In recognition of their services to the automobile industry during the first quarter century of its history, these men were decorated with silver medals at the Decoration of the Pioneers, January 6, 1925. Included in the picture is Charles Clifton, who as president of the National Automobile Chamber of Commerce, acted as host during the ceremony. Not in the picture, but decorated also, was R. E. Olds.
This book is dedicated to three men who have given counsel throughout its preparation:

Edwin F. Gay
Charles Clifton
William E. Metzger
PREFACE

This book attempts to trace the economic and commercial growth of the American automobile industry. Manufacturing methods and processes are discussed only as a background for the proper understanding of market and financial developments. A companion volume now in preparation will deal more fully with the history and problems of mechanical invention and factory organization.

Because of the recency of most automotive developments, there is little in print upon which one may draw. I have therefore obtained most of my data from the field—from companies, from individuals, and from trade associations. But in all cases, excepting where data were imparted to me in confidence, I have indicated my sources. The footnotes are all printed at the back of the book in order to free the text from a mass of details. The person who is interested, however, not merely in general conclusions and trends, but also in certain qualifications of statement and in the sources of various data, can readily find them either in the notes or in the appendices. The supporting data themselves, for all charts, appear likewise in an appendix.

It is here impossible specifically to express my thanks to each of the persons who have cooperated with me in gathering the materials for this book. A list of those who have contributed data, through interviews or
otherwise, is printed on pages 329 ff. But I have to thank especially, among the men of the industry, Mr. William E. Metzger, of Detroit, Colonel Charles Clifton, of Buffalo, Mr. Roy D. Chapin, of Detroit, Mr. J. Newton Gunn, of New York City, and Mr. W. A. Brush, of Detroit. Likewise, for their fullest cooperation, I am indebted to the members of the Board of Directors of the National Automobile Chamber of Commerce; to Mr. Alfred Reeves, the Chamber’s general manager; and to Messrs. O. P. Pearson, Robert A. Brannigan, John C. Long, W. I. Powlison, and G. C. Arvedson, also of that organization.

I wish also to record the courtesy of Mr. Howard E. Coffin, who opened to me his private library in Detroit.

Both to the Committee on Sheldon Traveling Fellowship, of Harvard University, and to the Committee on Aid to Research, of the American Council of Learned Societies, I am indebted for the award of grants which defrayed a considerable portion of the expense connected with obtaining data from the field.

Either for various sundry courtesies or for reading parts of the manuscript, I may also thank Professors F. W. Taussig and Homer B. Vanderblue, of Harvard, and Professor W. L. Crum, of Stanford University; Professor Lawrence H. Seltzer, of the College of the City of Detroit; my colleagues, Dean C. S. Marsh, Professor Oliver C. Lockhart, Professor Julius W. Pratt, and Mr. Barnet Nover; my friends, Messrs. S. A. Stephens and Volney Parker.

But most of all, I am grateful for the generous advice and guidance of Professor Edwin F. Gay, of Harvard University, and for the constant aid of my wife.

RALPH C. EPSTEIN

The University of Buffalo
September 19, 1927
CONTENTS

Preface ............................... V

I

An Epoch in Transportation .......... 3
1. The Significance of Automotive Transportation  3
2. Effects upon Rural Life ................. 7
3. Other Influences upon Rural Life .......... 12
4. Changes in Metropolitan Organization .......... 14
5. The Development of Post Roads .......... 17

II

The Evolution of Mass Production .......... 23
1. Manufacturing Proficiency and Commercial Development .......... 23
2. Invention and Early Construction .......... 24
3. Rapid Development of Manufacture .......... 28
4. Historical Basis of Present-Day Methods of Production .......... 33
5. Early Productive Organization .......... 37
6. Development of Standardization in Chassis Parts .......... 41
7. Development of Internal Plant Economies .......... 43
8. External versus Internal Economies .......... 50

III

Growth of the Market, 1903-1916 .......... 55
1. The Basis of Consumer Demand .......... 55
2. Consumer Demand and Price Determination .......... 62
3. General Growth in Market Demand .......... 65
4. Character of Market Demand .......... 71
APPENDICES

A. General Statistics of Automotive Manufacture, Market Distribution, and Finance
- 1. Production and Value of Product
- 2. Invested Capital, Employment, and Wages
- 3. Registration of Motor Vehicles
- 4. World Trade, World Production, and World Registration
- 5. Installment Sales: Financial Figures and Ratios
- 6. Financial and Other Statistics: Ford Motor Company and General Motors Corporation

B. Sources and Supporting Data
- 1. List of Acknowledgements to Individuals
- 2. Data of Charts and Tables

C. Historical Materials; Lists of Companies, Associations, and Trade Journals
- 1. Articles of Agreement of the Association of Licensed Automobile Manufacturers
- 2. Agreement Executed between the Electric Vehicle Company and the Winton Motor Carriage Company
- 3. Racing Records
- 4. List of Passenger Automobile Manufacturing Companies, 1895-1927
- 5. Lists of Truck, Bus, and Taxicab Manufacturers as of January 1, 1927
- 6. Trade and Technical Journals
- 7. List of Automotive Trade Associations, 1927

Index

ILLUSTRATIONS

The decoration of the pioneers, January 6, 1925, Frontispiece
1. Title page of the first number of the Horseless Age, November, 1895
2. Number of persons per passenger automobile, in the various states, as of January 1, 1927
3a. A main highway in New York State, near Buffalo, in 1912
3b. A typical New York State road, near Buffalo, in 1927
4. Four early gasoline automobiles of 1893-1899 and their builders
5. Assembly methods before and after 1912
6. The Olds Motor Works in 1903
7. Four of the leaders in the development of automotive standardization
8. Four years of machinery and manufacturing methods adopted since 1912
9. The difference of two decades
10. The celebrated curved-dash Oldsmobile
11. Four heavy cars of 1906-1908
12. Various mechanical designs of 1903-1907
13. William E. Metzger
14. The evolution of the closed car
15. A salesroom of 1899
16. A New York City automobile "salon," 1926
17. The first American automobile show held in Madison Square Garden, New York City, in 1900, and the
The Automobile Industry

Thirteenth annual exhibition held in the same building 12 years later

18. Henry Ford passing Alexander Winton in the seventh mile of a 10-mile race held at Grosse Point track, Detroit, in 1901

19. Some proud trade-marks of 1904

20. Four pioneer manufacturers who in 1908 discussed a possible merger of their companies

21. George B. Selden

22. A typical advertisement of the "Licensed Association" during its campaign to enforce the Selden Patent

23. Four leaders in automotive cooperation

24. Highland Park Plant of the Ford Motor Company

25. Automotive factories of today and yesterday

Charts

1. Motor vehicles and telephones in use in the United States

2. Production of wagons, carriages, and motor vehicles

3. Growth of surfaced road mileage in the United States

4. Passenger automobile production in the United States, 1903-1916

5. Passenger automobile production in the United States by three-year periods, 1903-1916

6. Factory sales of passenger cars by price classes, 1903-1916

7. Indexes of automobile production, physical volume of manufactures in general, and national income, 1909-1916

8. Retail prices of 30" x 3½" (Ford size) tires, 1909-1916

9. Factory sales of passenger cars by cylinder classes, 1903-1916

10. Factory sales of passenger cars by cylinder classes, Ford production excluded, 1903-1916

11. Production of low, medium, and high-priced cars, 1903-1916

12. Frequency distributions of factory sales according to price class, 1903, 1907, 1911

13. Passenger automobile production in the United States, 1903-1926

14. Consumer prices of cord and fabric tires, 30" x 3½" (Ford size), 1919-1923

15. Production of high-pressure tires and balloon tires
xviii  THE AUTOMOBILE INDUSTRY

48. National income and automobile production, 1919-1926 269

49. Quarterly exports of motor vehicles from the United States, from the first quarter of 1923 through the second quarter of 1927 272

50. Registration of passenger automobiles in leading countries of the world, 1926 273

51. Persons per motor vehicle in various countries of the world, 1926 274

52. Production of Ford and Chevrolet passenger cars, 1922-1926 282

THE AUTOMOBILE INDUSTRY
ITS ECONOMIC AND COMMERCIAL DEVELOPMENT

TABLE

1. Frequency distribution of firms retiring from passenger car manufacture in each year, 1903-1926, according to the number of years they were engaged in the industry 189
AN EPOCH IN TRANSPORTATION

1. The Significance of Automotive Transportation

In November, 1895, there came from the press of one E. P. Ingersoll, in New York City, the first number of a new periodical, the editorial page of which carried the following statement:

The appearance of a journal devoted to a branch of industry yet in an embryonic state may strike some as premature, and the somewhat desultory character of this number may provoke criticism in some quarters. But those who have taken the pains to search beneath the surface for the great tendencies of the age see what a giant industry is struggling into being there.

The editors called their new journal The Horseless Age, a title as daring as was the publication of the journal itself. For in the year 1895 but four automobiles were made in the whole United States. Yet the vision of the editors has been more than realized, and the subsequent product of that young and struggling industry of which they wrote has revolutionized road transportation both in America and, to a lesser extent, in many other parts of the world.

Thirty years ago, a horseless carriage consisted of three or four bicycle wheels and a light framework in which sputtered a noisy little single-cylinder engine. From the handful of such experimental “one-lung” con-
trivances built in this country by Charles E. Duryea, R. E. Olds, Elwood Haynes and others during the nineties, have come the 22,000,000 motor cars and trucks of today.

With but scant attention paid to it in many quarters, and distrusted and ridiculed in others, the infant automobile industry thus launched at the close of the century struggled on during the decade which followed, until in 1908 the then stupendous total of 60,000 cars was produced. In that year, W. C. Durant, then president of Buick, predicted that the time would come when a million automobiles a year would be made. He was laughed to scorn, even by his brother manufacturers. But eight years later, in 1916, more than a million cars were produced; and in every year since 1916 the production of motor vehicles has exceeded that figure. In 1920, more than two million vehicles were made in the United States; in 1923, well over three million; in 1925 and 1926, slightly over four million a year. Twenty-two million motor vehicles are now registered in this country. Incredible as it seems, there are actually more automobiles in America than telephones. In sheer rapidity and magnitude, the growth of automotive transportation in the United States constitutes one of the most amazing developments in all economic and commercial history.

The factories which make motor cars and motor trucks now employ more than 375,000 persons, while directly and indirectly over 3,700,000 wage earners are engaged in producing and distributing automobiles,
accessories, and parts. The capital invested in automobile factories in the year 1926 totaled over two billion dollars, while the yearly wages bill for the 375,000 workers well exceeded half a billion. Within a period of scarcely 30 years, the production of motor vehicles has become the largest of the country’s manufactures, if the importance of these be measured by the wholesale value of their products. As a result, Detroit, from a city of 285,000 people in 1900, has become an industrial center whose population numbers one and a quarter million; Lansing, a town of 16,000 in 1900, has a population of more than 70,000; while Flint, which a scant quarter of a century ago possessed 13,000, now has approximately 135,000 inhabitants. Many other cities, not themselves automobile manufacturing centers, have grown industrially because of the greater concentration of production made possible by the use of the motor car and truck.

Fundamentally, this development has taken place by virtue of the fact that the automobile offers an important type of transportation service for which a need has long existed. The motor car satisfies the desire not merely for transportation, but for transportation that is both swift and individualized. It goes without saying that the automobile is not the culmination of all efforts at transportation mechanisms. Nor is it even the swiftest which is now available; the airplane is coming into its own, and the railroad, for certain purposes, still affords somewhat faster transportation than does the motor car. But the automobile gives one thing that was not available before its advent: it gives "a quick, immediate, individual transportation service" with sufficient speed to reduce distances amazingly and to make possible a great multitude of activities which could not otherwise readily take place.

2. Effects upon Rural Life

Of the 22,000,000 motor vehicles now registered in the United States, about 4,500,000 are owned by farmers. A survey made by J. Newton Gunn several years ago showed that 33% of all cars then in use were in towns of 1,000 or under, while 55% of all cars were owned by inhabitants of communities of under 5,000 population. Later figures indicate roughly the same proportions. Together with the telephone and the electric light, the automobile has taken its place on the farm as one of the necessities of life. To the farmer it has meant increased effectiveness in raising and marketing his products, a wider range and greater ease of obtaining supplies for his farm and goods for his household, increased opportunity for social intercourse and recreation, quicker access to competent medical attention and hospital service, and centralized, better schooling for his children.

To travel twenty or thirty miles formerly took the farmer a whole day. Now the same distance can be covered by passenger car in an hour. With horses, twenty miles constituted a considerable haul. By motor truck, from half an hour to an hour and a half, depending upon the size of the truck, is all the running time
which such a trip requires. The result is that the radius of operation is extended from one of less than fifteen miles for the team and wagon to one of over fifty miles for the motor truck.

How this increase in hauling radius has widened market areas is evidenced by an investigation of the Department of Agriculture, which summarizes the experience of 831 Corn Belt farmers who own trucks. The average distance of these farmers from their markets, before acquiring trucks, was 8 miles. Since acquiring motor trucks, 215 of these men, or a little over one quarter of them, have changed markets for some or all of their products. For these 215 producers, the average distance now traveled to market is 18 miles. Fifty-one of the farmers included in the study now use markets 10 to 19 miles away, and twenty-two others truck their produce to markets 35 or more miles away.

This widening of selling areas has important economic consequences. One obvious result is the decrease in transportation cost which makes such an extension of the market possible. The report of the Joint Commission of Agricultural Inquiry indicated that the average cost of hauling wheat by horse, from farm to point of shipment, amounted to about 30 cents a ton mile. By truck, or by tractor, this amount was cut just in half. The expense of hauling corn, which formerly averaged 33 cents a ton mile to move to shipping points, was cut more than in half; while cotton, which had previously cost 48 cents a ton mile to transport, was carried at 18 cents.

It is not to be assumed from these figures that any large proportion of farmers, the country over, themselves own trucks. Only about 7% of them do. Some farmers not possessing trucks have their hauling done by neighbors who own them; about 40% of the Corn Belt farmers above mentioned reported that they had done custom hauling of this character. But a far bigger factor, in a number of states, is the operation of highway common carriers. There are now probably between two and three thousand motor express lines in the United States—in some individual states, a hundred or more. Many of these operate upon regular
routes, in some cases giving daily service to all points along them. For perishable commodities especially, this service has effected a revolution in modes of market distribution. To many cities, by far the major portion of the milk supply is brought by truck, in some instances from producing areas which lie 50 or even 70 miles distant. The length of such routes is commonly from 20 to 45 miles.

The farmers who are thus relieved, either wholly or partly, from the work of haulage are often enabled to devote themselves more fully to their work on the farm. In such instances, the motor truck not only lowers the expense and increases the speed of transportation, but serves to facilitate the division of labor. Freed from the responsibility of hauling his products to the point of rail or water shipment and with the market for them appreciably broadened, the farmer can now apply himself in a larger degree to the production of those things for which he is best fitted, or, at any rate, in which he is most experienced. For in agriculture, as elsewhere, specialization is promoted by improvements in transportation.

The ultimate result of the lower costs of production brought about by this increased geographical division of labor is, of course, to lower prices to the consumer. This conclusion, it is obvious, holds only in so far as competition operates. But the extension of marketing areas ordinarily tends to carry with it some intensification of competition. The speeding up of postal service and the reader delivery by motor of supplies on mail or telephone order all tend toward these same ends: the stimulation of competitive influences in both production and market distribution, the quickening of productive and distributive processes, and thus, ultimately, a greater abundance of consumable goods for the community at large.
3. Other Influences upon Rural Life

In other than strictly economic spheres, perhaps most important among the effects of the automobile has been the steady replacement of the old one-teacher "little red schoolhouse" by the modern consolidated school. Here again is seen the gain which results from the greater division of labor. In a one-teacher school, the pedagogue must needs be a jack-of-all-trades; he teaches all subjects and all grades of pupils. In the consolidated schools, however, students may be separated by grades. Furthermore, instead of instruction from one teacher in eight different subjects, students in vocational and other courses may often receive instruction from specialists in particular fields.

While the consolidation of schools began some thirty years before the advent of the automobile, the movement could never have attained its present proportions without the use of the motor car and motor bus. There are in the United States today well over 12,000 consolidated schools attended by 2,000,000 pupils. In the year 1924 alone, 1,424 new consolidations were effected; 200 of them are credited to the one state of North Carolina. Nearly half a million children are transported daily by motor vehicles; and of the 80,000 motor busses in the United States, about 30,000 are used by schools in rural sections. Often these busses carry crippled children who could not otherwise attend school at all.

No less striking than the improvement in systems of elementary education in rural districts are the strides that have been made in matters of health. The automobile has steadily forced higher standards upon the country physician. Again, with the market area broadened, competitive influences have become intensified. Many farmers will no longer accept poor or mediocre medical attention when by an hour's or a half-day's drive they can obtain the best. Operations, and often childbirths, are now undergone in urban hospitals instead of on the farm; X-ray diagnoses and special treatments of various kinds may be obtained far more easily than in former days. Thus some of the greatest disadvantages of rural as compared with urban life are for a number of persons largely removed by the presence of the motor.
4. Changes in Metropolitan Organization

Turn now to life in the city. It, too, has been affected. As in the country, the delivery of goods is speeded up, various kinds of services are brought within easier call, and social intercourse between different areas is promoted. Apart from the fact of its physically different appearance—the virtual disappearance of the horse-drawn vehicle upon most thoroughfares and the great congestion of traffic in the downtown center—the contrast between the city of today and the city of twenty years ago is perhaps not nearly so marked as is the case with the country district. None the less, substantial changes may be noted.

In commercial spheres within the city and its surrounding area, the automobile has effected a revolution in methods of market distribution. The motor truck, in particular, by complementing the work of the railroad, makes possible the handling of an immensely greater quantity of freight by single terminals. It may here be noted, in passing, that while the automobile provides essentially individual transportation of both passengers and merchandise, it is often not as an individual unit, but as a component of a coordinated transportation system that it accomplishes some of its most effective work. The truck is not to be regarded primarily as a competitor of the railroad, but mainly as an adjunct to it. The long-haul movement of freight can be accomplished far more cheaply in railroad cars drawn by a locomotive over smooth rails than in individual motor trucks or their trailers. Especially is this true if any attempt is made to consider the cost of highways in estimating total expense, as the railroads quite logically have contended, on economic grounds, ought to be done. But for short hauls, where the limited distance traveled does not spread the railroad's terminal and fixed expenses very thin per mile of carriageway, the more flexible motor truck can be used to advantage. And in deliveries to, from, and between railroad freight houses the truck finds one of its greatest fields of usefulness. Thirty different railroad companies now use trucks for terminal haulage in various cities, while the New York Central lines alone employ 600 trucks in 50 different uses.

By thus relieving freight congestion in the city, as well as by affording swift and economical delivery service within a radius of 50 to 60 miles, the motor truck enables the vast interchange of products necessary between the factories, wholesalers, jobbers, and retailers that serve the present great metropolitan areas. Together with the passenger car, the truck has promoted the cheaper, easier, cleaner living of thousands within a radius of 15 to 20 miles beyond the city's corporate limits. Indeed, in several cities, it has extended these limits to more than double 20 miles. A large department store in Chicago, for example, delivers packages to towns 42 miles away from the City Hall. Here a telephone call takes the place of a drive to town. One has only to recall the obstacles a 40-mile distance imposed a few decades ago to realize the great changes
that have occurred in the broadening of market areas, the specialization of business units, the concentration of huge populations about metropolitan centers.

But this increased massing of population about common commercial centers has meant a relative decentralization of urban population so far as the inhabited areas themselves are concerned. The city is no longer merely a thickly settled district where a great congregation of people all live and work and stay. Many who work there do not even live within its limits, and a number of those who live there remain within its borders but a part of the time when they are not at work. The countryside is not only brought nearer the city; the city itself becomes, in all but its corporate name, indeed a part of the surrounding country. New York is no longer merely Manhattan, Brooklyn, and the Bronx; it is also Long Island, Rye, New Rochelle, and indeed a part of Connecticut and New Jersey. The same is true of other cities, many of them communities much smaller than New York; as economic rather than corporate areas, they have expanded far beyond the narrower limits of a generation ago.

All this is not, of course, due wholly to the automobile. The street car, the elevated, the subway, the interurban, and the steam railroad had all contributed to this development and initiated it before the automobile came into use. In large measure, it is only in conjunction with these other modes of transportation that the motor car and motor truck have accelerated the expansion. But without the automobile, in many communities at least, the growth of urban areas could never have taken the same broad course.

5. The Development of Post Roads

The extent to which suburbs may grow or motorists may tour is conditioned largely by the character of a country’s highways. It is sometimes said that the automobile has caused good roads; sometimes, that the construction of good roads has caused the great development of the automobile industry. Both statements are true; here, as so often in economic matters, cause and effect have constantly interacted. The great strides which the country’s highway system has made in the last twenty years are seen in Chart 3. Through rapid and widespread local, state, and Federal activity, the United States within the last fifteen years has built a system of splendid highways which would delight the staunchest Jeffersonian advocate of internal improvements.

In 1916, Congress passed the Federal Aid Road Act, which appropriated $75,000,000 for the purpose of cooperating with all states that desired to build rural post roads. Towards the expense of such highway construction of a “substantial” character, the Federal government agreed to pay half, provided the states assumed responsibility for the expense of maintenance and provided that all roads constructed should be “free from tolls of all kinds.” The maximum amount per mile which the Federal government could contribute
was set at $10,000; this was later increased by amendment to $20,000 a mile. The total amount appropriated over a nine-year period ending in 1925 was $615,000,000; for the fiscal year ending June 30, 1925, alone, the sum of $75,000,000 was authorized.

In all, 184,000 miles of Federal Aid roads have to date been approved for construction, while 56,717 miles of highway have already been completed under the terms of the act. The United States now possesses, all told, a grand total of slightly over half a million miles of surfaced roads.

6. The Motor's General Social Influence

Finally, among the several effects of what might be termed the motorization of America, we have briefly to mention the more general influences which the motor car is exerting upon the country as a whole.

It is a commonplace of history that every means of communication which brings the inhabitants of different geographical areas more closely together inevitably tends, in time, to exercise a certain broadening influence upon the persons whom it thus affects. The automobile has not merely changed the physical appearance of our country, it has not only lined our rural areas with surfaced roads and crowded our city streets, but it is also doubtless altering the characters and the viewpoints of those who use it. Like the stagecoach, the railroad, and all other improvements in transportation, it enables the more ready observation and comparison of different places and practices; it greatly encourages social intercourse.

How substantial an effect will thus ultimately be exercised upon our social life can hardly now be told. It is still too early even to hazard a guess. Changes in social and political organization ordinarily lag behind
changes in industry. Secretary Herbert Hoover regards the fact that the automobile makes it possible for the business executive to supervise many activities which are geographically removed from the central establishment, and which previously would not have been essayed, as one of the most significant of the motor car's contributions to economic life. Possibly social or even political results no less important, but more subtle in their working, may well follow. The important fact to note, however, is that the common man in America has attained a mobility that was before unknown. The recent pilgrimage to Florida during the real estate boom of 1925-1926, for example, is a case in point; it could never have occurred, on anything like the same scale, in the absence of motor transportation of both passengers and freight.

The extent to which both ordinary and special travel may be still further stimulated is seen in the fact that the system of state and Federal highways now being built will, when completed in accordance with the plans already approved, "connect practically every city and town of 5,000 or more inhabitants in the United States. Practically 90% of the nation's population will live within ten miles of a Federal Aid road, and practically all the remaining 10% will be that close to a state road." It is estimated that even now approximately 40,000,000 people spend at least a part of their vacations in motor travel. Whatever the accuracy of this estimate, anyone who travels the highways even occasionally may himself see the reality of the fact.
Americans are seeing America. Like the railroad, the steamship, the telegraph, the bicycle, and the trolley car, which came before it, but upon a scale and with a rapidity never before known, the motor car during the past two decades, to use the language of Charles and Mary Beard, has “made travel and communication cheap and almost instantaneous . . . . drawing people of similar economic status and parallel opinions into cooperative activities.”

Such are some of the effects of the industry of which the following chapters of this book will treat. The social development just sketched is the result of a series of inventions, first developed principally by Europeans rather than Americans, which, about the beginning of this century, gave rise to a new product capable of being manufactured in quantities. But the consequences which have ensued involve also the remarkable growth of a new market, the organization of manufacturing enterprises, the devising of production methods, and the formulation of business policies. To these several matters we may now turn our attention.

II

THE EVOLUTION OF MASS PRODUCTION

1. Manufacturing Proficiency and Commercial Development

When James Watt, unable properly to bore the cylinder for his first steam engine, succeeded finally in hammering one out, he stated that “at the worst place the long diameter exceeded the short by three-eighths of an inch.” John Smeaton, who examined Watt’s engine and who had himself devised a boring machine in 1869 for the Carron Iron Works, declared that “neither the tools nor the workmen existed that could manufacture so complex a machine with sufficient precision.” Finally, after ten years of painful but determined effort, and aided by the mechanical genius of Wilkinson and the business genius of Boulton, Watt saw his engine a commercial success.

Today, in motor car factories, the extreme limit of inaccuracy which the inspection permits on several thousand dimensions of the product is set at one one-thousandth of an inch. Some inspections are for one-tenth of one-thousandth of an inch, or even less. It is truly a far cry from Watt’s three-eighths of an inch error to such modern precision. But these mechanical and metallurgical miracles did not come so rapidly as
the bare facts can be related; long years of trial and error, experiment and struggle, intervened. The detailed account of the development of modern methods of automotive manufacture will be reserved for another volume; but the evolution of mass production will here be sketched at sufficient length to enable a detailed analysis of the growth of the automobile market to be undertaken. For although the manufacture of a product depends upon the demands of the market, it is no less true—in the case of the automobile, perhaps more true—to say that the extent of the market rests upon the effectiveness with which the product can be manufactured.

2. Invention and Early Construction

If it be asked, "Who invented the automobile?" it is impossible to answer the question. The only accurate reply is, "No one." Far from being the product of a single mind, the motor car is not even the product of men within a single country, nor of a single generation of men within several countries. Its history gives no support whatever to any form of the "heroic" theory of invention, which attributes to one man the complete or practically complete credit for the development of a particular contrivance. In so far as prior credit for the mechanical development of the automobile can be distributed among individuals, however, it belongs to Europeans, not to Americans.

As early as the fifteenth century, Leonardo da Vinci glimpsed the possibility of power-driven vehicles. In 1680, Newton proposed a steam carriage to be propelled by a "rearwardly directed jet of steam." And Nicholas Joseph Cugnot, a captain in the French army, in the year 1769 actually built a steam carriage which is still housed in a Paris museum. In England, both Symington and Murdock, the latter an assistant of James Watt, and in America, Oliver Evans, all built experimental vehicles or models about the close of the eighteenth century. Richard Trevithick patented a steam vehicle in 1802 and a year later constructed one that actually ran. It steered with a handle bar, and was equipped with changes of gearing and with a differential device—a clutch on the axle which enabled one driving wheel to run faster than the other in making turns. 81

In succeeding years, principally between 1810 and 1830, Anderson, James, Gurney, Hancock, and Maceroni all built road carriages in England. By 1831, several steam coach lines were in operation, but they were soon abandoned. 82

After 1831 occurred a period of inactivity in steam road vehicle history. But meanwhile the attention of inventive minds was turned toward the development of the internal combustion engine. Here again may be seen the successive contributions which several generations often make in the development of an effective mechanism. Like the steam engine, which dates back to the Greeks, the gas engine "invented" by the Frenchman Lenoir in 1860 represented the culmination of a development which actually started several centuries before. Following Lenoir came the contributions of
Siemens, Hugon, Otto, and Brayton. And shortly Daimler, Benz, Maybach, and others added the fruit of their experiments. 

Thus by 1885 not only had the internal combustion engine been brought to a stage of working effectiveness, but an engine which could vaporize its own fuel had been developed. The internal combustion, hydrocarbon-type motor, the steam engine, and the electric motor and battery, which had been developed through much the same successive process of discovery and advance both by pure scientists and practical contrivers over a period of many decades, all were available, by 1875-1890, for incorporation into road carriages. In the various countries of Europe, notable among the several pioneers of this period were Daimler, Benz, Maybach, Krebs, Panhard, Levassor, Serpollet, DeDion, Bouton, Gibbon, and Roots. In America, the pioneers in experiment—steam, electric, or internal combustion—were Duryea, Olds, Haynes, Winton, Ford, King, Maxwell, Apperson, Riker, Clarke, Stanley, White, Franklin, and Selden. All these men actually constructed cars between 1886 and 1899, with the exception of Selden, who did not build a complete vehicle until later. Of his patent filed in 1879 and issued in 1895, however, something will be said in another chapter.

In this enumeration of “inventors” no pretense to anything that approaches completeness, or indeed proper emphasis, is made for countries other than the United States. The writer has not as yet examined the foreign development sufficiently to list accurately even those chiefly and directly responsible for the automobile in European countries. But experiment continued there during the late eighties, the nineties, and the early years of the twentieth century. Foreign experiment not only antedated all American production, but even for some years after the industry was here established, American designers copied foreign practice carefully and extensively. One of the American pioneers chuckles now as he relates how in the summer of 1900 he went to France, where he posed as an American capitalist who desired a vehicle for use on roads around his Newport estate. He ordered a small single cylinder DeDion-Bouton, which was shipped to Newport in accordance with his instructions; then it was brought to his factory, immediately taken apart, and carefully studied.

But the fascinating story of the successful struggles of those early years to build effective road vehicles belongs rather to the history of invention than to this brief chapter upon the evolution of mass production methods. Let it suffice here to say that both through the copying of foreign designs and through a great deal of more or less original work as well, a group of American experimenters—call them erroneously “inventors” if you will—drawing upon the mechanical, chemical, and electrical developments of decade piled upon decade, succeeded in building practical self-propelled road vehicles, chiefly of the internal combustion type. It must not, however, be thought that these men do not
deserve great credit for their achievements even though they all built upon the work of those who preceded them, and in some cases copied their contemporaries as well. The initial construction of the cars they built was incredibly difficult. Furthermore, they worked steadily to improve their designs; such experimenters as Olds and Duryea built one car after another. Although they were not inventors in the ordinary sense of the term, this great and steady improvement of design and construction involved the constant exercise of the “creative” faculties in a very real sense, that of the synthesis and skillful application of more or less well-known principles in order to produce results of an order higher than was known before.

3. Rapid Development of Manufacture

These early “horseless carriages” of the period 1886 to 1899 were not “manufactured” cars. They were the crude products of home or workshop experiment. Like Watt’s first steam engine, they were built with tools and machinery improvised for the occasion. Winton and Olds made many of the parts for these first cars themselves simply because factory-built automobile parts were then unknown. Ford made his first cylinder out of the exhaust pipe of a steam engine. He bought the iron work for the frame of the carriage; also the seat and springs. Both front and driving wheels were from bicycles. The flywheel he had cast from a pattern of his own design. The machine was air-cooled, or rather, “to be more accurate, the motor was simply not cooled at all.” Duryea’s car, which antedated Ford’s, was likewise crude; and an 1899 gasoline car, one of several that had been built by Olds, and styled an “improved model,” was controlled by a lever which connected, through rubber tubes, with pneumatic...
clutches and other devices so complicated in design and
type of operation that their fabrication upon a commercial scale
was not successful. This model was soon entirely aban-
doned in favor of a different type.

Thus, although there were perhaps 300 automobiles
built in the United States between 1886 and 1898,
there was no automobile manufacture. At best, as the
_Horseless Age_ had said in 1895, the industry was “in
an embryonic state.” It was not sufficiently important
even in 1899 to be listed in the census under a separate
heading. But by the end of 1926, it had attained such
a rank that the shipment of its products, together with
those of the other industrial activities to which it has
directly given rise, provided an annual total of 3,000,000
railroad carloads of freight.

Such an accomplishment has not, of course, taken
place under the virtual handicraft methods employed in
the early workshops of Duryea, Olds, Haynes, Winton,
Ford, and others. It is inconceivable that such a devel-
oped in so brief a span of years could have occurred
under any form of industrial organization other than
the factory system as we know it today.

Both the extent of this development and the rapidity
with which it has taken place are difficult to realize.
If Europeans chiefly “invented” the automobile, Ameri-
cans certainly developed the methods required for its
mass production. Automobile manufacturing, as dis-
tinguished from experimental building, commenced in
1900. Today, two and a half decades later, every

vestige of evidence that horseless carriages were once
constructed by individual mechanics, each working with
a fellow tinkerer in barn or early workshop, has disap-
peared from the industry. Nowhere has the division
of labor been carried further; nowhere has an almost
inconceivably complex task of manufacture come to be
executed with greater dispatch; nowhere have “thought,
skill, and intelligence” been transferred more com-
pletely from worker to machine.

It is something of an anomaly that the product which
represents one of the mechanically finest, the most cun-
ningly devised, and the most delicately fitted of all
contrivances which man has ever made is constructed
with the exercise of virtually no personal craftsmanship
whatever on the part of most workers engaged in its
manufacture. While this statement requires some
qualifications, it will in the main stand. The develop-
ment of those very methods which have made possible
the expansion of the industry has tended, and still is
tending, towards the reduction of human operations to
their simplest terms through the use of automatic and
semiautomatic machinery. All this is not, of course,
entirely new with the automobile industry. But as the
scale of production has increased, the extent to which
and the directions in which these tendencies have de-
veloped have greatly multiplied. With 10,000, 15,000,
now even 70,000 workers in a single factory, the rigor-
ous application of the division of labor, concomitant
with the development of special machinery for each
operation, knows virtually no limits.
What is, however, new with automobile manufacturing organization is the progressive assembly of parts, with the use of mechanical conveyors that carry materials past the men as they perform their work. This method of manufacture is now so well known that it hardly requires description. At one end of the factory building, an automobile frame is placed upon a track which is raised a foot or two above the floor. As the frame moves slowly past different groups of workmen, the axles, springs, engine, transmission, steering gear, wheels, truss rods, fenders, battery, body, radiator, gasoline tank, running boards, hood, and lamps are fastened to it; and “off the line” at the other end of the building thirty or forty minutes later, under its own power, comes a completed car. One man performs one operation, another man, or a set of men, another. Progressive assembly systems of this kind, which now prevail to a greater or lesser extent in all the largest factories, represent the extreme limit to which the extension of the management’s control over productive operations can be carried. Not only are the design, shape, size and quality of the work predetermined, but the rate at which each operation must be performed by the workers is rigidly controlled by a power machine, which even may be driven from another building. In some of the larger factories, conveyor systems are likewise used in the subassembling of various parts and units, such as the radiator and the complete motor.

4. **Historical Basis of Present-Day Methods of Production**

The great development of these more refined methods of power production has taken place only within about the past decade. Indeed, one of the most striking things about the automotive industry, and one of the greatest difficulties which still besets every automobile
manufacturer, is that production methods are constantly in process of alteration. Unpredictable changes have always been characteristic of modern machine production, but nowhere has the rate of change been more rapid than in this branch of manufacture. Yet though the various technical methods now in use are but recently developed, they are the product of an evolution begun over a century ago, and they admirably illustrate the cumulative nature of nearly all development in industrial technology.

The possibility of applying the present technique of motor vehicle production, in all its varying phases, rests fundamentally upon one great principle earlier applied in several other industries: the standardization and interchangeability of fabricated parts. In England, Samuel Bentham and Marc Isambard Brunel, father of I. K. Brunel, designer of the steamers “Great Western” and “Great Eastern,” developed, between 1800 and 1808, a group of machines to make ship blocks at Portsmouth. In collaboration with Henry Maudslay, these two men built 44 machines, “each performing its part in a definite series of operations.” With these machines, ten unskilled workers could produce as many blocks as 110 workmen. Although the blocks thus produced were identical, the activities of Bentham and Brunel did not aim primarily at attaining interchangeability of parts. There existed in the manufacture of wooden pulley blocks no need for a highly accurate turning of parts in order quickly to accomplish an assembly, and the substantial uniformity of their product was due simply to the employment of an excellent system of manufacture, developed in order to supplant skilled hand work by machine.

But in firearms manufacture, to avoid the careful reaming and fitting of the product when it was assembled, an extraordinary precision of parts was required. Whitney, Hall, and North began this development between 1798 and 1814, although the concept of interchangeable parts, and unsuccessful attempts to utilize them, date somewhat earlier. Albert Eames, Thomas Warner, and others improved upon their work before the middle of the century. Eames developed the manufacture of interchangeable parts in carbines and pistols and in 1842 began the manufacture of a new model percussion musket at Springfield. In 1853, in a demonstration before a British military commission, ten of these guns were dismantled, the parts mixed, and successfully reassembled. Exactly 50 years later, it may be noted, Henry M. Leland took three American-made Cadillac cars to the Brooklands race track, in England, ran them around the track, had them dismantled, withdrew 91 parts from the heap, substituted 91 identical stock parts, and had the cars reassembled with screw drivers and wrenches as the only tools employed. The cars were then immediately driven 500 miles around the course at an average speed of 35 to 40 miles per hour.

Between about 1850 and 1875, then, the interchangeable system of manufacture—making the separate parts of a product in quantities through the use of special tools, and next assembling the finished product from
identical sets of standard parts without any reaming, filing, or fitting of individual pieces—had been widely applied in factories making watches, agricultural implements, sewing machines, railroad cars, locomotives, and other products. The bicycle industry soon followed, and by 1900, this branch of mass manufacture could boast one establishment which employed 3,800 persons.

Meanwhile, between about 1800 and 1875, Maudsley, Clement, Whitworth, Nasmyth, and others, in England, and Lawrence, Howe, Stone, Gridley, Billings, Brown, Fellows, and many others, in America, had laid the basis for the more recent machine-tool developments of the late nineteenth and early twentieth centuries. The slide rest and screw cutting lathe, the planer, the steam hammer, the milling machine, the turret lathe, the gear shaper, and, of course, standard taps and dies, are only some of the present-day tools for which industry is obligated to these men.  

Upon this dual basis of an already developed system of interchangeable manufacture (the so-called “American system”) and the machine-tool development of a century in England and the United States, the automobile industry then built. But the difference between an automobile and a bicycle or a sewing machine is great. Not only has the one several thousand parts as compared with the other’s several hundred, but the many reciprocating parts of the automobile chassis travel at much greater speed than do those of other contrivances. Thus in many of its parts far higher standards both of precision and of tensile strength are requisite. These standards have been attained not through any greater skill in the labor applied directly to the parts tooled or machined, but through the development of highly specialized machine tools, better materials, and various calipers and gauges which can measure to within a thousandth of an inch or less. Coupled with the progressive system of assembly and its conveyor methods, such standards of precision permitted the rapid and cheap assembly of a multitude of parts into one finished product. Sold steadily at lower prices, this new product soon found a great market.

5. Early Productive Organization

The attempt to produce on a large scale was made by American entrepreneurs almost from the first, once the crudest experimental stages of the horseless carriage were past. The Olds Motor Works at Detroit and Lansing was the pioneer, making 1,400 vehicles in 1900, 2,100 in 1901, 2,500 in 1902, and about 4,000 in 1903. By 1904, this plant attained a production of as high as 40 complete vehicles a day. The Cadillac Company, likewise, came shortly to make 30 or 40 cars a day, and visitors at these two factories declared that their activities “passed belief in sober fact.”

There was expressed much skepticism as to whether production upon this huge scale could be maintained. Few persons were willing to buy stock in the motor industry even after its profitableness to several producers was evident. The industry was thus obliged to
finance itself almost entirely out of earnings. Each company started in a small way, turned over its capital as quickly as possible, and immediately reinvested whatever profits it received. While several companies by 1905-1906 thus came to produce upon a fairly large scale (2,000, 3,000, or 4,000 cars a year), they all did so by expanding their facilities through such reinvestment of earnings. There is on record during this early period no instance of a company's launching itself as a large producer during its first year of business; public confidence was so lacking that the requisite capital simply was not forthcoming. In 1904, even the oldest trade journal of the industry, the Horseless Age, warned prospective investors against succumbing to any "promoters' gilded dreams of 5,000 men in a single factory."

That there is often comparatively little investment of outside capital in new manufacturing industries has not generally been realized until recently. The economist is too accustomed to think of an industry as being launched and expanded as the result of capital saved by individuals and then "put into" that industry because it offers a higher rate of return, risks included, than do other industries. But in new industries no actuarial computation of risks is possible; and in the automobile industry the risks seemed to most outside investors too great to be undertaken. Thus the opportunity for profits did not immediately result in any considerable flow of productive resources toward motor manufacture. And certainly few funds elsewhere invested were "withdrawn" and thus diverted to the automobile industry. More will be said on this subject in other chapters.

But managerial and organizing ability did readily gravitate towards this new industry. The men who took advantage of this opportunity to pioneer were in the main young, and for the most part possessed little or no capital themselves. Their immediate capital needs they financed in two ways. Their initial fixed capital requirements were met by the relatively small sums which they and their few backers originally put into the enterprise. Their working capital requirements were met in part by the funds received from dealers as deposits upon orders, in part through buying parts and supplies on credit from various foundries, metal working and wood working establishments. For in the early days of automobile manufacturing, as distinguished from small-scale, experimental shop work, relatively few of the parts for the car were made within the plant of the "manufacturer." His business was primarily one of assembly. He bought on credit from the parts makers, and he sold for cash to his customers,
the automobile dealers and distributors. Thus a large part of his working capital was obtained through buying on 30-day or 60-day open accounts; his business was in effect financed by the parts makers. These latter for the most part exercised no degree of control whatever over the manufacturer to whom they thus advanced materials and supplies, although occasionally they obtained representation in the directorate of the automobile company.

These parts makers, the producers of iron castings, of steel tubings and shafts, of bearings, springs, bolts and nuts, of engine, axle, and transmission parts, and of radiators, lamps, tires, wheels, bodies, and the hundreds of other parts and accessories entering into the construction of a car, manufactured in most instances not to stock, but upon the order of the automobile maker. Most of these parts concerns were engaged in supplying other lines of business than automobile manufacturing. Some of them, however, came soon to cater principally to the new industry. The Timken-Detroit Axle Company, for example, though originally located in Canton, Ohio, moved to Detroit because the largest market for axles lay there. But while some of these firms made running gears and other parts and assemblies of their own design, most of them continued to make special parts for each manufacturer they supplied; and the parts thus fabricated for any particular automobile maker were absolutely unique in design, shape, size, and weight. During this early period, the automobile engineer's discretion, indeed often his mere whim in drawing up specifications for his car, was all that dictated the dimensions and quality of the parts thus made to order.

6. Development of Standardization in Chassis Parts

By 1910, conditions had become so bad in this respect that one parts maker fabricated 800 different sizes of lock washers, the various automobile manufacturers in the aggregate employed 1,600 different sizes of steel tubing, and 135 different analyses of steel, in all, were being specified. It was soon seen that manufacturing was far more difficult and costly than was necessary, and the automobile makers themselves took action. Under the leadership of Messrs. Howard E. Coffin, Henry Souther, Coker F. Clarkson, and others, the work of the Mechanical Branch of the Association of Licensed Automobile Manufacturers, followed by that of the Society of Automotive Engineers, eventually brought order out of chaos. Instead of 800 sizes of lock washers, 16 standard sizes were adopted. In place of 1,600 kinds of steel tubing, 210 types were specified. The number of alloy steels employed was reduced to less than 50.

The standardization of parts thus brought about, it is interesting to note, resulted in neither the stagnation of mechanical designs nor the stifling of individual initiative. Competition and variation in major features of design, and in special combinations of designs, continued. There was eliminated only the waste occasioned by the fact that each enterprise had gone its
HENRY M. LELAND
Famous for the application and refinement of the "American System" of interchangeable standard parts in automotive manufacture; general manager of the Cadillac Motor Car Company from 1904 to 1917; founder of the Lincoln Motor Company.

HENRY SOUTHER
Chairman of the first committee on standardization, Society of Automotive Engineers, 1910; later president of that body; initiator of S.A.E. standard steel and other metal specifications.

HOWARD E. COFFIN
President of the Society of Automotive Engineers in 1920, when the standardization work undertaken by that body was begun; vice-president, Hudson Motor Car Company.

COKER F. CLARKSON
Manager of the Mechanical Branch, Association of Licensed Automobile Manufacturers; secretary and general manager, Society of Automotive Engineers.

Figure 7: Four of the Leaders in the Development of Automotive Standardization.

EVOLUTION OF MASS PRODUCTION

own way in the specification of certain parts, the sizes or patterns of which were immaterial and which in any case were ordinarily out of sight in the completed chassis. Probably no more interesting example of the members of a competitive industry acting in concert to attain more orderly and less costly conditions of production for the industry as a whole has ever offered itself.

7. Development of Internal Plant Economies

Manufacturing expenses were steadily lowered in other directions as well, and along with this cheapening of process the quality of the product was constantly improved. The lower prices at which it became possible to sell the more serviceable vehicles greatly expanded the market for them, and each expansion of the market resulted in an enlargement of the scale of production, the discovery of better manufacturing methods, and again lower prices.

Soon, with the steady broadening of the market for medium-priced and low-priced cars and with the resultant increase in the scale of production in many plants, a number of companies began to make many of the more important parts of their chassis within their own factories. Striking among the causes of the constantly lowered production costs which they came to enjoy was the continuous development of new machinery. Hardly a year of the quarter of a century of automobile manufacture has gone by in which important new devices have not been developed. Some of these have been
designed by machine-tool building firms, which, about 1905 when the future of the industry seemed to most of them as being probably assured, came forward with new devices, while others have been invented within the automobile factories themselves.

In 1903, to cite a few examples, a multiple drill press was introduced to work cylinder blocks and heads; in the same year were developed also a machine to grind the cylinders themselves, a lathe to turn cam shafts, and a vertical turret lathe specially designed to turn flywheels. While all these devices increased production, figures for the rates of increase are not available. For more recent improvements upon these devices, however, there have been collected by Mortier W. LeFevre several records of accomplishment.

A newly developed automatic machine, for example, has supplanted the cam shaft turning lathe. It is equipped with either eight or twelve correctly shaped cams which move the cutting tool against the cam shaft to be shaped for either a four-cylinder or a six-cylinder engine. The machine turns all eight or twelve cams (which occupy different positions on the shaft, relative to one another) at one operation, and stops itself when the operation is finished. The resulting output is eight or twelve times greater per man employed in this work. That is, the output is eight or twelve times greater per man employed directly in automobile manufacturing, although this figure, of course, takes no account of the capital cost of the new machine itself, which is doubtless somewhat greater than that of the old one.
Likewise, the vertical turret lathe introduced in 1903 to turn flywheels has since been replaced by a much more effective unit. When first introduced, the latter machine, a lathe of the horizontal type, performed more than twice the work of the old. Still more recently, a new tooling of this lathe has greatly improved the quality of the product as well.

Many other similar instances might be adduced, the saving in labor within the factory often running higher than in the cases cited. Perhaps as important as the savings through the constant development of new machinery are those due to the devising of methods of material routing, machine layout, and assembling. The whole internal organization of the large factory, in this new industry, revolves around the concept of progressive performance through the decentralization of productive operations. What is meant by this is that the automobile industry was the first to apply the principle of scattering its machine equipment throughout the production process, regardless of the fact that similar machining operations are thus not performed by the same department of the establishment. In the fabrication of older mechanical products, the various machines of one general type were all arranged about a common center, and to this department was brought for execution all work which was to receive machining of this given character; all milling machines, for example, would be located in one department, and all milling operations would there be performed. But in the automobile industry, this centralized departmental organiza-

Evolution of Mass Production

zation of work is frequently split up; machines are located not according to kind, but according to their function in turning out the finished product. Thus the fabrication of individual parts, the making of sub-assemblies, and the work of final assembly proceed not only progressively but with the minimum of trucking and conveyance of materials.

The total net gain in productive effectiveness which has resulted from the rapid introduction and continuous improvement of these several radically new methods of production cannot be told with accuracy. Comparisons of total factory costs for identical units of product are not available. To compile a significant index number of automobile selling prices running over even a 10-year or 15-year period would be difficult in the extreme, for with the design and construction of nearly all cars having changed every year, no series of comparable units exists. One or two individual comparisons, in terms both of price and labor costs, may, however, be essayed to indicate very roughly the probable extent of the economies that have been effected.

In 1904, about four years after the industry really started, a five-passenger Packard touring car of 92-inch wheel base, weight 2,200 pounds, and carrying a four-cylinder, 24-horsepower engine, sold for $7,000, without top or windshield. Twenty years later the same company produced a five-passenger touring car of 126-inch wheel base, weight 3,650 pounds, carrying a six-cylinder, 27-horsepower motor, which sold for $2,585, with windshield, top, and full equipment. With allow-
The difference for the change in the purchasing power of money over this period, what this comparison indicates is that in 1924 a vehicle greatly improved in performance qualities and riding comfort, and enjoying markedly lower upkeep charges, sold for less than 25% of the price which a lesser vehicle of the same make commanded twenty years before. Similarly, to take an example in the low-priced field, in 1904 the Ford model F, advertised as "the most advanced type of automobile construction," weight 1,400 pounds, with a "matchless 2-cylinder motor," sold for $1,200. Two decades later, the Ford model T touring car, weight approximately 1,650 pounds, with a four-cylinder, 22-horsepower motor, and equipped with top and windshield, sold for $290. This was the advertised price, without demountable rims or self-starter, but the car of 1904 was not equipped with these features, either; with electric self-starter and demountable rims, the 1924 Ford touring car sold for $375. Again ignoring improvement in design and performance, but allowing for changes in money values, this represents a price reduction of about 85%. If it be assumed that the relative decrease in retail value represents relative gain in productive effectiveness, what this comparison shows is that in 1924 six better cars could be produced for the amount of labor and capital required to produce one poorer car in 1904.

For somewhat shorter periods, a comparison of labor hours, "man hours spent per car," though defective in that it ignores the increased mechanization of production which has steadily taken place over the entire period, gives results equally startling. These figures, for two establishments, are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Establishment A</th>
<th>Establishment B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1912</td>
<td>4,664</td>
<td>1,260</td>
</tr>
<tr>
<td>1915</td>
<td>3,241</td>
<td>533</td>
</tr>
<tr>
<td>1923</td>
<td>813</td>
<td>228</td>
</tr>
</tbody>
</table>
No effort should be made, of course, to compare these two establishments, since one clearly manufactures a different type of car than does the other. But the year-to-year decline in man hours in each case is astonishing; intermediate years above omitted show approximately the same proportional decreases; and while in certain respects man hours do not afford so good an index to productive efficiency as do selling prices, their comparison nevertheless affords positive proof of the highly dynamic character of conditions in such an industry as this, even a quarter of a century after its development began.

8. External versus Internal Economies

The chief reason for the great reductions in manufacturing costs which have obtained is that new machine tools of the sort just described were developed for use in the motor car factories themselves. But another reason, related although somewhat different, is that, merely because of the increase in the volume of automobile production, outside parts makers were steadily enabled to fabricate their products more cheaply. The development of such external economies raises an interesting, albeit complex, question of manufacturing policy, the more detailed discussion of which will be reserved for another volume: To what extent is it desirable for the manufacturer to buy his parts from outside parts makers, or, conversely, to what extent is the continued integration of processes within his enterprise desirable?

In the older days, that is, before 1906-1908, a distinct advertising advantage was thought to inhere in the fact that a company made nearly all the parts for its product. Some firms not only fabricated a number of their own parts, but made exaggerated claims as to the complete adoption of this policy. The Maxwell-Briscoe Company, in an advertisement in the Motor World in 1904, for example, declared that “the Maxwell plant . . . is not an assembly plant, but one where every part of the Maxwell automobile is actually made under the direct supervision of the designer, Mr. J. D. Maxwell.” Similarly, about the same time, the makers of the Rambler advertised that “excepting only the body, tires, and spark coil, every part of the Rambler touring car is made in our own factory.” But with the development of large and well-known parts making firms, such as the Continental Motor Corporation, the Brown-Lipe Gear Company, the Timken-Detroit Axle Company, the Hyatt Roller Bearing Company, and others, this pretense was dropped, and after about 1909-1910, motor manufacturers made no secret of the fact that they employed in their cars various units of assembly fabricated by favorably known outside parts makers. The extent to which cars were thus “assembled” varied with the different companies. In general, the producers of high-priced cars made more of their parts than did those of lower-priced cars. Between about 1908 and 1914, however, the cars of nearly all manufacturers were in large measure assembled, a few of even the leading makes being almost entirely so.
Since about 1914-1915, however, most of the larger companies have come to manufacture their own motors, axles, transmissions, and a number of other parts as well. Some now make even their own bodies. What has enabled this development to take place is, of course, the constant increase in the scale of production. The annual number of cars made by the average (median) producer over the period from 1903 to 1916 reflects this great increase. In 1903, this figure was 200 cars, in 1909, about 500, in 1916, approximately 2,000. By 1926, however, the figure had become 7,600. The arithmetic mean figures of annual production per plant, which reflect the development less accurately but emphasize the presence of the larger companies, are as follows: in 1916, about 18,000 cars; in 1922, over 25,000 cars; in 1926, 80,000 cars. By 1924, 8 makers produced over 100,000 cars each. The average (arithmetic mean) number of workers per factory was in that year 4,700. Excluding the Ford plants, this average figure is estimated at 3,100. These few figures are here cited merely to indicate the average scale of manufacturing operation. Further figures relating to the scale of production are given in another chapter in connection with the subjects of industrial concentration and combination.

But in spite of the great scale upon which production now takes place, the question whether a continually greater integration of processes is advisable upon the sole ground of cheapness of manufacture is a debatable one. The most frequent stimulus to make additional parts within the enterprise seems to have been a desire for certainty of supply so as to promote the continuity of plant operation, rather than primarily to lower production costs. But by 1918-1920, whatever the reasons, the day of the purely "assembled car" had passed. All the large makers now manufacture their own engines, this being regarded as the principal criterion in ascertaining whether or not a car is "assembled." A number of parts they still continue to buy, however; and the question of internal versus external economies as yet remains unsettled in a number of directions.

This chapter has omitted the discussion of many matters—events so large and problems so complex that their adequate treatment requires a book in itself. In particular, the problems of labor and the influence of automobile manufacturing development upon the internal organization of other industries have not even been touched upon. Their discussion, like that of other things, however, may here be dismissed as not strictly a prerequisite to the understanding of the market and commercial developments which are treated in the chapters which follow. One word, however, on the general history of automobile manufacturing which has just been sketched ought to be added: Will the future see as many rapid and radical changes in methods of automobile production as have occurred already? Doubtless it will not; it may well be that the motor industry, which is now expanding less rapidly than in the past, will witness no very great further changes in
productive technique. Yet prediction in such matters is always dangerous. For example, within the last two years it has been suggested that Diesel (oil burning) engines, already used abroad in motor trucks, may supplant gasoline motors in all vehicles for road transportation; and that then other alterations in design and construction may be introduced. It is not inconceivable that if such events should take place, the technique of production may again become markedly and rapidly altered. But even should no such further great development take place, the history of the automobile industry furnishes an instructive example to those who wondered, some twenty or thirty years ago, whether the day of all revolutionary improvements in productive processes was over. The cumulative character of economic development which any examination of the automobile industry discloses, the ramifications and interrelations of industrial technique which everywhere appear in such changes as have here merely been sketched, all support the thesis that the Industrial Revolution, so far from being merely a thing of the past, may yet look forward to continuous expansion.

III

GROWTH OF THE MARKET, 1903-1916

1. The Basis of Consumer Demand

The manufacture of automobiles has attained the unprecedented character and proportions sketched in the preceding chapter only because a surprisingly great demand developed for the product. It is the purpose of the present chapter to consider the nature of the demand for the motor car as a commodity purchased by the individual consumer, and to trace the steady growth of that demand throughout the period from 1903 to 1916.57

Fundamentally, the passenger automobile offers to the prospective purchaser a transportation service. But it offers much more than that, and the fact that it does offer more is important in explaining the great development of its market. Without any attempt to enumerate all the various actuating desires which may on occasion induce the purchase of a motor car, the purposes for which automobiles are bought may be classified under four main heads. These are: Transportation Service, Sport, Personal Possession, and Social Prestige. The four are in no sense separate; they are all supplied in the one object purchased. But overlap though they may, it is believed that in varying degrees they moti-
vate the acquisition of every passenger automobile purchased, be it a four hundred dollar car or a four thousand dollar one.

Take first the primary want which the automobile gratifies, the desire for transportation. Since the car he buys must supply such service, the purchaser is interested in its performing power. He wants carrying capacity, speed, power to "negotiate" hills or a stretch of poor road. Above all, he desires reliability, the capacity of sustained operation. In its early days, the motor car was an uncertain mechanism, and these several desired factors of performance were somewhat distrusted. Thus, for example, the advertisement in 1905, of the Pope Manufacturing Company, makers of the Pope-Hartford, a $3,200, 23-30 horsepower car, asserted, "Each car tested to a mile a minute flat." Similarly, the Waltham Manufacturing Company in 1904 declared of the Orient Surrey that it would "climb all grades and carry four people everywhere they wish to go"; while the makers of the famous curved-dash Oldsmobiles in the same year stated:

You see them wherever you go;
They go wherever you see them.

The innumerable races and contests of the period prior to 1910, which will be discussed later, also aimed at a similar end. Makers attempted to convince the public that their particular cars possessed superior qualities of performance in rapid and powerful transportation service. Even today, when no one doubts the ability of any car to make any reasonable grade, or to carry as many persons as can be crowded into it, makers continue to devote much advertising to descriptions of the performance of their cars. Smoothness, silence, acceleration—the ability to "throttle down" to low speed and then pick up in a flash—all are stressed.

The element of sport, the factor of play or—there is no better word—of fun, is a further utility offered by the motor car. This is one of the things that have accounted in large part for the ready adoption of the motor by persons who could early afford its purchase, and it still accounts for a large part of the mileage which many cars run each season. For the automobile as a transportation mechanism is more than merely a means of carrying its passengers from one place to another. It is, to use a phrase now almost taboo in the automobile fraternity, a "pleasure car" as well. Orig-

Figure 10: THE CELEBRATED CURVED-DASH OLDSMOBILE.
The most popular car on the road in 1902-1903.
inally it was called just that, but within more recent years, yielding to certain criticisms, very likely first connected with the wartime restrictions of so-called "non-essential" processes and products in industry, the appellation has been dropped and the term "passenger car" substituted. But this is in one sense unfortunate, for the modern automobile affords not only "quick, immediate, individual transportation;" it gives users also, to use the striking phrase employed by the Packard Company in introducing its twelve-cylinder car in 1915, "the thrill of eager power under perfect control."

Always, this sensation of a surge of power has been sufficient to excite enthusiasm in those who have experienced it. Though the novelty of the sensation has for some worn off, there still remains for many drivers, and for many passengers as well, a constant source of satisfaction in the ride itself. From the very introduction of those early single-cylinder machines of Duryea, Haynes, Olds, King, Ford, and Winton to the present age of swiftly running fours, sixes, and eights, the purr of a motor or the exhilaration that comes from a burst of speed continues to awaken a pleasurable response.

Beyond its character as a transportation mechanism and as a means of pleasurable sport, however, the automobile is also a satisfactory personal possession. Like a handsome piece of furniture, a picture, or an artistic piece of jewelry, it not only is used but it reaches a deep-seated sense of ownership. Its purchase represents a larger unit expenditure than does almost any other article of consumption. But, unlike the house or the piano, the automobile was, until recently, nearly always sold for cash, not upon installment. The purchase of an automobile, therefore, has always been a family event of considerable magnitude. Though one name only appears upon the order, the family group is the unit to which, typically, the car is sold. In most families, each member is consulted; each member, from the twelve-year-old boy who has carefully read the catalogues dealing with engine specifications, to his mother who examines as carefully the vanity accessories, the upholstering, and the texture of the carpet in the tonneau, has some vote in the selection. The automobile is thus definitely a specialty and not a staple good. Conscious thought and interested attention are given to its purchase.

A recent writer on marketing classifies all consumers goods into three groups: convenience goods, shopping goods, specialty goods. He defines specialty goods as "those which have some attraction for the consumer, other than price, which induce him to put forth special effort to visit the store in which they are sold and to make the purchase without shopping;" and he quite properly lists the automobile as an example of a specialty good. But it is also in large measure a shopping good, since specifications are compared and performance qualities are checked. Automobile shopping is undertaken even more systematically than any other kind of retail shopping. It differs from shopping for other commodities in that not only prices are compared, but a host of other attributes as well. The automobile
buyer is purchasing a durable consumption good, one that is relatively costly to buy and entails expense to maintain, and one that satisfies a complex of wants. It is this latter characteristic which presents to both producer and retail dealer some of their greatest problems in marketing and advertising policy.

Midway between the fact that the motor car is something to own as well as to use, to tinker with and even in some cases to feel affection for, and the fact that it satisfies the desire for social prestige, is blended as a marketing consideration the factor of attractiveness of appearance. Here, as on the mechanical side, no two makes of car are alike. There are all kinds of touring body designs, all kinds of roadsters, coupés, sedans, and limousines; and of late years even the “coach” has made its appearance—a four- or five-passenger closed car with only a single door on either side. Take, however, any one of these body styles, and among the different makes of cars you find the utmost variation. Some have rounded radiators, some have squared; some have beveled, straight-line bodies, some have curved; some have hoods relatively high in proportion to their lengths, others, relatively low; some have one type of windshield, top, or door, others have different types. And besides the multiplicity of varieties in form, there is variety in color. Decidedly, the automobile, though a piece of machinery, is a “style product.” From year to year most manufacturers, and at least every few years all manufacturers, make either major or minor changes in both the appearance and mechanical design of their cars. From the inception of the industry, “new models” have constituted a unique and significant aspect of the business. In our discussion of commercial policies, this will be mentioned again; we have here only to point out the importance of these several variations from the marketing standpoint.

And important indeed they are. To say that many a car is sold upon its “looks” alone would be an overstatement, for the motives which actuate selection are always more complex than this. Yet often for short periods, when new makes of cars have been offered to the public and little save rumor was known concerning their mechanical merits, beauty of line or mere dash of appearance has sold the product in quantities. And even for long periods, if mechanical excellence and performance qualities are well established in addition, appearance may still be the decisive factor.

Last, but by no means least significant of the utilities which the automobile provides is the fact that its possession enhances the social prestige of its possessor. It not only is seen, like the furniture in the house, and unlike the furnace, but it is seen by others than the owner. The possession of any automobile denotes that a certain, albeit no longer necessarily a very advanced, stage of income has been reached; possession of some makes of automobiles indicates that greater heights have been attained; while ownership of certain other makes of cars suggests the pinnacle of financial achievement. As a personal possession which can be readily,
repeatedly, and unmistakably displayed to all, the automobile has no equal.

This is one of the reasons why the replacement demand for cars has been and will continue to be so large. "Once an owner, always an owner" is primarily, to be sure, a result of the transportation utility which the car supplies, and the pleasure and sport obtained from driving. But all automobile manufacturers and dealers recognize as well the existence of this appeal to social prestige. There is no doubt as to its presence, there can be question only as to its effect. Has it promoted extravagance in living, and thus caused "social waste," or has it acted as a spur, stimulating harder work and greater social production? These are debatable topics; they will be spoken of later.

2. Consumer Demand and Price Determination

It is social stratification, however, which both is catered to by various non-competing groups of cars and which in turn gives rise to them. From the beginning of the industry there have always been some cars selling below $800, some selling at $1,000, some at around $1,150, $1,200, $3,000, or $5,000 and over, and at prices intermediate between those figures. Within each group there has developed competition between different makes; between the several groups there exists competition mainly at the fringes, so to speak. How large an area constitutes these fringes is, however, important. The $1,000 car does not compete with the $5,000 car; it does compete, not merely with other

$1,000 cars, but with $800, $850, and $900 cars and with $1,050, $1,100, $1,150, and perhaps even with $1,200 and $1,300 cars. Similarly, the $3,000 car competes with $2,500 cars and perhaps with $3,700 or $3,800 cars. Just where to demarcate these limits is an interesting problem in consumer demand and price policies. In fact, the entire question of price determination in automobile manufacture is one which not only raises some most interesting questions connected with the industry, but goes to the heart of the assumptions underlying the economic doctrines of market and normal value. Whether in this matter (to use the language of economic theory) the Marshallian view or the Austrian position primarily be taken, the assumption is always either that homogeneous units of product are offered by competing sellers, or else that one producer has virtually a monopoly in the industry. Yet in the vast majority of actual instances in industry and commerce today, neither condition is present; there is severe competition between somewhat similar products, supplied by a number of competing sellers. No one of their products may properly be regarded, as is the alternative to the purchase of a really monopolized commodity, merely as a substitute for the other; it is the same general kind of product, but made or finished differently in one or a number of respects. The alternative which the consumer has is not what kind of article he may buy to satisfy his wants, but which brand or make of article he purchases.

Such a product, par excellence, is the automobile.
Any car one may select supplies a clear illustration of an article midway between the orthodox assumption of perfect competition on the one hand, quasi-monopoly upon the other. Yet there is no doubt that it is sold competitively, and that “competitive influences” have a great deal to do with establishing prices.

Not only is there competition between the cars within each group, but also, as has just been suggested, between the several groups of cars themselves. One of the most generally noted occurrences in the social life of any neighborhood is that car owners “graduate” from one class to another; the automotive social ladder is an important one. Yet in many cases this upward movement is attended by considerable doubt on the purchaser’s part and is carried through only after much hesitancy and calculation.

Prices here, therefore, are not determined “competitively” in the usual sense, because the products offered for sale are not completely standardized. The automotive manufacturer actually can “put” a price upon his product, and get that price, so long as it is not inordinately above the average price of other cars of equal weight, size, and power (that is, does not show a differential of, say, more than $50, $100, or $200). But although the price thus set may not be “inordinately” above any other producer’s price, it may vary substantially from it. And the number of cars sold, whatever price is set, depends largely upon the particular combination of the several elements of construction, design, and appearance that is offered. The appeal which these several combinations of elements make to the consumer probably determines his choice of a car selling within the limits of any price group, somewhat irrespective of the precise price at which it sells.

Whatever the exact mechanism of the price fixing process, there can be no doubt that every producer of motor cars has this fraction of monopoly power: within rather broad limits he can set his price where he pleases and still sell cars. Very probably, however, the severest competition in the industry occurs not among the producers habitually selling within any given or established price class, but takes place when one producer lowers his price so drastically as to enter another price group. If then his product presents a combination of elements such as clearly surpasses that offered by any producer in the group he has just entered, the others must all lower their prices or else suffer a serious falling off in sales. The events of the last two and a half years, when several producers have invaded the $500-$750 field in this manner, seemingly corroborate the hypothesis here suggested. It accounts for the recent decline in Ford sales and the expansion of Chevrolet, Essex, and other makers’ outputs which are discussed in later pages.

3. General Growth in Market Demand

The growth of the market for cars from 1903 to 1916 is depicted in Chart 4 on the next page. From a production of about 11,000 cars in 1903 to one of 1,500,000 in 1916 is the accomplishment recorded in these
fourteen years. The total output for the entire period is approximately 4,400,000 cars. The figures in this and in a number of the charts which follow are plotted upon a logarithmic scale, on which equal vertical distances represent equal percentage changes in the data as plotted from year to year. Changes in the slope of the curve, from year to year, therefore indicate accurately the comparative rates of production growth during the period in question.

A glance at this chart serves to show the remarkable steadiness with which this growth has taken place. To be sure, there is a variation in the rate of growth for any one year as compared with another, but this variation is explicable, in the main, on cyclical grounds. Take any three or four consecutive years together, and you find almost precisely the same rate of increase as for any other such set of years. Thus observed, the slope of the line changes hardly at all. It indicates a steady expansion, with each year's output averaging about a 45% increase over that of the preceding year.

Before inquiring into the reasons for this steadiness in the rate of growth in general, we may examine the detail of the curve more closely and note such divergences as do exist. One is at once struck with the great rates of increase from 1903 to 1904, from 1908 to 1909, from 1911 to 1912, and from 1915 to 1916. One notes, conversely, the relatively slight rates of growth from 1904 to 1905 and from 1910 to 1911.

The 100% increase in production from 1903 to 1904 is somewhat surprising in view of the fact that 1904
was a year of general depression. It was not so bad a year, to be sure, as some others have been, but it nevertheless was characterized by a level of trade distinctly low. Automobile manufacture, however, was a new and growing industry. The demand for its product came in these early years chiefly from the well-to-do, and the consumer demand for goods exerted by this class of persons falls off only slightly during depressions. On the production side, the increased capacity afforded by the great expansion of the Olds Motor Works, together with the fact that the success of this company in 1903 served to stimulate production at the hands of the other manufacturers, accounts in large measure for the relatively large output of the industry in 1904.

The next great rate of increase, as shown by the year-to-year progress of the curve in Chart 4, came between 1908 and 1909. Production in 1909 increased 101% over that in the year preceding. This undoubtedly is due chiefly to the fact that there was a panic in 1907. The year which followed (the panic occurred in the fall) was marked by a level of trade ranging from 7% to 19% below normal. Production in the automobile industry showed a substantial increase in this year (1908); but the increase registered would undoubtedly have been a greater one had not a general depression of business occurred. The year 1909, with its doubling of the production of the preceding year, represents a normal secular increase combined with full recovery from the cyclical restraint of 1908.

So also with the relatively large increase—a 79% gain—from 1911 to 1912. The cyclical factor is here, however, much less important; the year 1911 was not one of real depression, but only of recession. General business activity receded at worst about 4% from the normal line. But combined with the difficulties in which the General Motors Corporation (then called General Motors Company) had found itself in 1910, this slackening of general business in 1911 served to put an effectual damper upon the expanding automobile industry. The years 1908, 1909, and 1910—in particular, 1909—had all shown goodly increases in the rate of expansion (47%, 101%, 43% over each preceding year, respectively). What more likely, then, that a temporary falling off ensue, just as took place in 1905 after the striking increase of production in 1903? So far as can be made out, this is just what happened. The successful years of 1908, 1909, and in part of 1910, led manufacturers to wax optimistic, to undertake commitments which could not be financed out of sales later in 1910; the result was the necessity of curtailing operations drastically in 1911. Several automotive factories were shut down for one or more quarters of this year. In the terminology of the business cycle, the automobile industry underwent a crisis in its manufacturing history.

Since it is not our purpose here to treat at any length of the question of extremely short-time oscillations of production, we shall not pursue this matter further. But the economic investigator concerned with the re-
lation of the cycle of an individual industry to the business cycle at large would have in the year 1911 an interesting item for analysis. Detailed study of that year would doubtless throw important light upon the manner in which a new and rapidly developing industry meets its short-time financial and other vicissitudes. The market for a new product, such as the motor car, can grow only as more consumers come to desire the article, or as more consumers receive such incomes as enable its purchase. (We may waive here the possibility of the same consumer's buying several units of the product; so-called dual ownership of automobiles was, until recently, restricted to those at the top of the income scale.) But arrangements for production are made by manufacturers in anticipation, and on estimate, of the market. Production plans in 1911 over-rated what the growth of that market was to be. If the average rate of increase for production and sales through the years 1908 and 1909 could have been maintained, the line of secular trend for the output of the industry up to 1916 would show a decidedly sharper slope. Just what this slant would have been can be observed by again examining Chart 4.

Finally, just as the great increase of production in the year 1912 represents a recovery from the extreme low level of 1911, so the 51% and 86% increases of 1915 and 1916, respectively, over the years immediately preceding, represent a recovery from the general business depression of 1914. We need not analyze conditions in detail during these years. The outbreak of war in Europe occasioned a sharp drop in business activity in this country, the extreme low point being almost 18% below normal. Recovery commenced about the beginning of 1915, but trade did not become normal again until the end of that year.

Though in no year prior to 1917 did the production of automobiles ever show an absolute decrease as compared with the production of the preceding year, we see, nevertheless, that changes in the rates of increase during the years 1903-1917 corresponded roughly with changes in general business conditions. Except for the year 1904, each marked recession in general business was accompanied by a relative decline in the expansion of automobile production.

4. Character of Market Demand

We may now turn our attention to the factors which have made for that great and surprisingly steady rate of growth in general from 1903 to 1916. If we plot passenger car production, not by single years but by the accumulations of three-year periods, we get a line such as is shown in Chart 5. Expansion has taken place, not literally by leaps and bounds, but by a prodigious climb, a climb steadily maintained throughout the entire period. In the three years 1901 to 1904, there were made 49,000 cars; in 1905 to 1908, 166,000; in 1909 to 1912, 864,000; in 1913 to 1916, approximately 3,300,000. We may examine first the causes of the magnitude of this growth, then the causes of its steady character.
At the outset there was skepticism. The automobile was a horseless carriage; it was not only new but dangerous. But once the opposition upon grounds such as this died down, the desire of most Americans for motor cars became a fact. Why should people want automobiles? To many, the question today seems one too idle to answer. The several satisfactions which the automobile yields the consumer have already been analyzed: transportation service, recreation, social prestige. Once the utility of the motor car in these respects was demonstrated, the desire for ownership on the part of millions of persons followed. The American, in particular, desired the motor because it satisfied his love of activity, of rapid movement from place to place, of independence to go and come as he pleased. Much emphasis is often placed upon national character in explaining the economic development of particular countries; often this may be overdone. But in the case of the automobile, there can be little doubt that we as a people were peculiarly fit, by habit and tradition, for its widespread adoption.

All this, however, explains only the desire which persons have for motor cars. The demand which they can effectively exercise must rest on something more; to explain how each year an increasingly great group of consumers came to buy them necessitates some examination of that group's willingness and ability to pay the purchase price. Since during the entire period which we are here considering (1903 to 1916) cars were bought by consumers only for cash, and since the average (arithmetic mean) price of the 4,400,000 cars sold through this whole period was about $825, the readiness and ability of consumers to purchase seem indeed remarkable.

We can best examine these several matters by analyzing the growth of the market in terms of price classes of cars sold. While during the period prior to 1917 the rate of growth for production in toto has been approximately constant, sales in particular price classes of product have not grown in the same manner. There has, in short, been a shifting of sales (and of production) as between the several qualities and sizes of product. The course of this development is seen in Chart 6, shown below on page 75. This chart, prepared from a practically complete enumeration of the production figures for all companies which engaged in manufacture, shows, for each year from 1903 to 1916, the sales of American companies, classified according to nine different price groups. Before examining the chart, however, a few remarks must be made concerning the compilation which underlies it.

The division into price classes is arbitrary, as any
such division must be. It attempts, however, to embrace what might be termed "non-competing groups of cars." Thus the price ranges between the several division points are not uniform, but increase as price ascends. Five hundred dollars difference in the price of a car of one make as compared with one of another make may be considered as meaning no more to a buyer of a car in the $1,775-$2,275 class than does perhaps $200 to a buyer of a car in the $675-$875 class. Similarly, a thousand dollars more or less spent by the buyer of a $5,000 car may mean no more than does $100 to the buyer of a $675 car.

One further point is to be noted before we proceed to an examination of the results of this compilation. No allowance has been made for changes in the purchasing power of money over the period 1903-1916. The reason that this has not been done is that relative to one another a thousand dollar car and a four thousand dollar car in 1916 represented about the same types of vehicle, broadly speaking, as in 1903, 1904, 1905, and the other intervening years. In any price class, the car of 1916 was a far better automobile than the car of 1910, just as the car of 1910 had been a better machine than that of 1903. But in comparative size, design, and workmanship, a six-cylinder, 60-horsepower, 138-inch wheel base car of 1916 stood to a four-cylinder, 30-horsepower, 116-inch wheel base car of the same year about as a heavy four-cylinder car of 1904 or 1905 stood to a light two-cylinder vehicle of the same vintage. And though each—the $1,000 car and the $4,000 car—had indeed become a vastly better vehicle by 1916, its price had not risen in accordance with the general level of commodity prices because of increasing output, improved manufacturing methods, and lower costs of production.

These preliminaries disposed of, examine now Chart

Chart 6: Factory sales of passenger cars by price-classes, 1903-16.
In 1903, cars selling at $1,375, or under, constituted about two-thirds of the total production. In the years immediately following, this proportion of low-priced cars (cars below $1,375) steadily decreased, until in 1907 the situation was reversed, only about a third of the cars in that year selling at or below $1,375. Then, with our attention still upon this large grouping of cars above and below $1,375, in 1908 came a swing back; and in all the years following the higher-priced cars became proportionately less important, and the lower-priced ones relatively more so, until in 1916 the latter constituted about 90% of the total. One might suspect that this latter movement is due merely to Ford, but this is by no means the case. If one takes the Ford figures out, there still remain, in 1912, 1913, 1914, 1915, and 1916, the following percentages of the total to the credit of the cars under $1,375: 43%, 38%, 64%, 57%, 84%.

In like manner one may trace on this chart the movement of any class or combination of classes indicated. Note, for example, the relatively insignificant part that has been played throughout the entire period by the $5,000 cars—those selling at $4,775 or above. Never has its proportion of sales been more than a small percentage of the total. Such is not, however, true of the $4,000 car (the class selling between $3,775 and $4,775), nor of the $3,000 car (selling between $2,775 and $3,775), nor of the $2,500 car ($2,275 to $2,775). At one time, these three groups ($2,275 to $4,775) comprised nearly half of the entire total—in 1906, 45%. But by 1916, they came to less than 2%.

Conversely, the lowest-priced group of cars, that under $675, for a long time played a proportionately small part in the expansion of the industry, rising above 7.5% in one year only, prior to 1911. Yet in every year from then on, sales in this class amounted to more than 25% of the total, until in 1916 they constituted 51.1%. Note, too, how cars selling around $1,000 ($875 to $1,375) formed for years a far larger group than did those selling either around $800 or around $600; yet in 1916 these $1,000 cars came to hardly more than did the $800 cars, and only to about one-third as much as the $600 cars. One now notes the influence of the Ford company; this latter displacement is due chiefly to its policy of having gradually lowered prices.

Additional details may be obtained through such further study of the chart as the reader may wish to make. A similar diagram for the period 1917-1926 will be found in the following chapter. The tables of percentages underlying both charts are given in Appendix B, pages 335-337 and page 345.

5. The Underlying Causes of Demand Changes

The explanation of these several shifts in market demand lies in several directions. Many of the cars made up to about 1904 were single- and two-cylinder vehicles. They were relatively light affairs, the chassis in some ways suggesting buggy, carriage, and bicycle practice rather than automotive design of present-day
character. Then came the steadily wider adoption of the four-cylinder motor. This involved making heavier and more powerful cars, which cost more to manufacture. The high-speed motor, of small bore but great power, had not yet made its appearance, and added size and weight were called upon to furnish the desired performance. As will be pointed out in a moment, however, consumption still came chiefly from the well-to-do classes in the community; a market for the higher-priced, more powerful cars, therefore, existed. This market was served, and served upon a scale large both absolutely and proportionately, from about 1904 to about 1910.

The demand for powerful, heavy cars ran to extremes, and some monstrosities of shapes and sizes appeared. An interview with the sales manager of the Packard Company by a representative of a trade paper, in 1905, is reported as follows:

Of the tendencies of the times, Mr. Waldon said it was unmistakably for higher-powered cars, incidentally letting fall the information that his company probably would be forced next year to build some 60- and 90-horsepower machines in response to it, but predicting at the same time a reaction to normal power and weights when the user got tired of colossal tire bills and the natural expense incidental to the operating of giant cars. The "disease," as Mr. Waldon termed it, had in his opinion, about eighteen months yet to run."

It would seem that this prediction was not far wrong. Just about two years later, the trend in question began to reverse itself, although it took about six years all told before there was seen something like a definite return
to the proportion which obtained between cars selling above and below $1,375 in 1903-1904. An additional cause which may have contributed to this relative plethora of higher-priced cars during the period 1905-1910 was the depression of general business which, we have already noted, was felt in certain of these years.

The year 1904 was a bad one, a part of 1907 was bad, 1908 was extremely bad. These years of depression did not cause any appreciable curtailment of automobile purchases on the part of the middle and lower classes in the income scale, for such persons had not bought cars previously. But the years of depressed business may have checked any tendency of this character which might otherwise have developed.

It was partly to counteract the then prevalent, and all too frequently well-founded, impression that most automobiles were luxuries which could properly be owned only by the very wealthy, that the 1907 Buick catalogue stated of the "Model D", "It has not been our purpose to build a high-powered car . . . . rather . . . to build a car that combines economy in operation with a minimum expenditure for maintenance." The model thus described was a four-cylinder car of 102-inch wheel base, weight 2,250 pounds, of 24 horsepower. But even this small car, paraded as an economical machine to purchase and run, sold for $2,000, minus headlights, top, and headlight gas tank! These three appurtenances added $210 to the price, which was, of course, quoted f.o.b. factory.

After 1909-1910, however, the four-cylinder car came firmly to be established as the standard type. Lighter ones were then made by many producers. The development of new designs and better methods of production enabled good four-cylinder vehicles to be turned out at lower costs, and thus, just as the demand for expensive cars became (as we shall soon see) temporarily saturated, there came a great growth in the market for low-priced cars.

In part, this growth doubtless resulted from the general increase in material well-being which took place; the income of the country as a whole did increase substantially. But an examination of the rate of this growth in the country's income throws only slight light upon the problem; it was not so marked an increase as to indicate that any widespread purchase of cars, due to this cause alone, became much more possible on the part of the middle and lower classes of income receivers after the years 1910-1911 than before. Nevertheless, the great growth in the demand for cars of all types in this country is often explained solely upon grounds of our large and constantly increasing national income. To suggest that our large per capita income, as compared with that of other countries, is in part responsible for our adoption of the motor is one thing; but to say that the rate at which it has increased explains in any large measure the growth of the automobile market is quite another. This can be seen by a glance at Chart 7, which indicates the comparative levels of automobile production, the production of manufactures in general, and national income (for such years as data
are obtainable), with allowance for price changes, during the period 1903-1916. The arithmetic average of figures for the years 1903-1913 is taken as the base for all three curves. Curve A is automobiles, Curve B is manufactures in general, Curve C is national income.

Little need be said in the way of analysis of this chart; it speaks for itself. The vastly more rapid rate of increase in automobile production (once the year 1908 was passed) over the rates of increase in both manufactures in general and national income in the aggregate suggests that, up to 1916 at least, the growth of the market for automobiles was not caused solely by any general increase in wealth, but in large measure must have diverted income and resources from the purchase and production of certain other commodities. This implies neither that automobile consumption has been "wasteful," nor that it has not contributed to increase production on the part of the nation at large. But it is apparent that the rates of increase in automobile production and in goods in general did not keep pace during the period we are here considering. The country's annual income in 1916 as compared with 1912 had increased by about 25%. But the annual production of automobiles increased by about 475%. Automobiles were bought instead of other things; not always things which actually were being bought, but probably, in many cases, things which would have been bought in somewhat larger quantities as the country's aggregate income rose.

For a community to be able to consume in one year, say, twice as many automobiles as in some earlier year, without actually giving up the consumption of any other articles, obviously does not require that its income be doubled. But in the absence of such a doubling of total income it does necessitate that the consumption of certain other things fall short of being doubled. Here, however, automobile consumption increased by about twenty times as much as did national income. This, to repeat, does not mean that the automobile did not contribute vastly towards that very increase of national income which in some measure, of course, made its purchase possible. It did. But it was bought also by many persons who gave up the purchase of certain quantities of other goods because they felt that the automobile had more to offer them than did the total of these other articles.

It is impossible to say just what other things were given up either wholly or in part, or of which things purchases were postponed; probably, in part, pianos, certain kinds of clothing, certain types of furniture; doubtless certain services. But no quantity of statistics which one could compile for clothing or for furniture would indicate anything at all conclusive, unless figures were available for each and every one of the other
items which enter into consumers' budgets. We can be certain that not 475% more of everything was annually consumed between 1912-1916. We know, in terms of the only universal measuring unit we have, the dollar (corrected, of course, for changes in purchasing power), that the increased consumption of all things could not have averaged more than a 25% advance. But comparison of changes in the rate of consumption in any two, three, or four commodities would not indicate any causal relationship as existing between them; for when the proportion of a person's income spent upon one item in his budget is altered, probably that spent not only upon some other single item, or even a few items, but upon nearly all other individual items is also altered.

Thus to ascertain with any degree of certitude what even the chief shifts in demand were, attendant upon the diversion of income to the purchase of automobiles, would be difficult in the extreme. Could an investigator, however, give sufficient time and attention to the question, even a partial answer might afford a remarkable study in the economics of consumption. A number of bankers and other business men for many years attempted, through public utterances and printed articles, to discourage the infant automobile industry, upon grounds of danger both to the bond market and to the solvency of the consumer. Yet the bond market has survived, and the consumer has prospered as well. How he has done it—what other things he has had, and has not had, to give up—would constitute an interest-

ing chapter in the history of the American standard of living if it could be written.

The chief causes of the increased purchase of automobiles by the middle and lower classes are thus not to be found in any great increase of general prosperity. They are rather to be found in the character of the product itself. During the earlier years of its history, the automobile was a very expensive possession to maintain. The now well-worn statement to the effect that it is not the original cost but the upkeep which counts was certainly most pertinent. Cars are not entirely trouble-proof today; but the annual expenses of operation, chiefly gasoline, oil, tires, insurance, garage rent, and depreciation, constitute a far larger total than does the outlay for repairs and parts. During the period of 1903-1910, however, the expense occasioned by the rapid breaking and wearing out of parts and by the necessity for frequent overhauling and adjusting of engines, axles, or transmissions, often either equaled or exceeded the annual cost of operation. Neither the design of parts nor the quality of materials from which they were made had progressed far enough to insure low repair expense to the consumer. The factory warranty, then as now, was only for a ninety-day period. If, after that time, axle shafts crystallized, universal joints snapped, crankshafts broke, pistons cracked, springs gave way, valve stems warped, clutches seized, gears stripped, cylinder walls wore rapidly, or flywheels loosened, it was up to the purchaser to pay the bills. And not only did these and myriad other
ailments occur frequently and new parts have to be bought, but the cost of these new parts was high, because of small-scale production and the virtual absence of standardization in design. The treatment of this matter here may seem to the reader somewhat exaggerated. But in 1906, the effective life of many springs was but little over 1,200 to 2,000 miles, and tires were seldom warranted for more than 2,000 to 3,000 miles. When tires wore out, their replacement was indeed expensive. A 30 by 3 inch (Ford size) tire as late as 1910 cost $30, a 4-inch tire for a medium-sized car cost $50, while a 5-inch tire for a large car sold for over $80.88

Even if parts broke within the ninety-day warranty period, as they often did, the factory's guaranty, however, applied only to replacement of the parts themselves and did not cover the labor cost of installation. In some cases, the dealer would absorb this labor cost when the breakage occurred before expiration of the warranty period, but more often he did not. This item of labor in making repairs to the vehicle came high in deed, often amounting to several times the value of the parts replaced. Not only this; it often was inefficient labor. If not downright dishonest, much of it was incompetent; and the average customer, knowing but little about the mechanism of the car, was at the mercy of the repair men. I recall one occasion, during those days, on which my father's car had just been completely overhauled at a cost of nearly $300. It had not been functioning properly, and this overhauling was all, he was told, that was required to put it in condition. The car was in the shop two weeks. Within a day or two after it came out, the engine began again to "miss" and to heat up. In despair, my father called upon a friend who was in the automobile business and asked him if he would send a mechanic to look the machine over. The man came out, examined the car carefully, and then gravely announced, "Nothing is fundamentally wrong with this car; all it needs is a good overhauling."

Facts of this character were fairly generally known. They definitely dissuaded purchase on the part of many persons who might have been able to afford the initial investment, but who hesitated to commit themselves to the possession of an article which might well cause them to live beyond their means. Coupled with this hesitancy was grave doubt on the part of those persons who did half decide to buy, as to what particular make they ought to purchase. The multiplicity of types, the great variety in design and specifications, which persisted until about 1910, tended literally to bewilder the prospective purchaser. Nothing was certain, all was in process of experiment. There were offered cars with engines of one, two, three, four, or even six cylinders. The engine could be of either the four-cycle or two-cycle type. The cylinders could be parallel or opposed;
they could be set in the chassis either horizontally or vertically; they could be mounted under the body, under the hood, or at the rear of the car near the axle. The engine might be either air-cooled or water-cooled. Steering could be by bar, tiller, or wheel. The drive might be by shaft, through bevel gears, or by chain. If by chain, it might be either double or single. The transmission could be either planetary or sliding gear; it might have either 2, 3, or 4 speeds forward. Finally, to exhaust merely the list of major specifications, the ignition might be by either battery or magneto; if batteries were employed, they could be either dry or storage; if magneto, this might be of either high or low tension.

All the diversity—and at first much of this variety in offering appeared within each price class of product offered—confused the layman. If the engineers themselves differed, how was he to tell which type, or which combination of specifications, was the most satisfactory? There can be little doubt that questions of this character led in many cases to the postponement of purchases. And in the minds of persons of moderate means they doubtless often strengthened the conviction that ownership of the automobile, in its experimental stages, was not for them.

But by 1910-1911, this confusion of type had largely disappeared. After that date, in cars selling below $3,000, the shaft-driven, magneto-equipped, water-cooled car with a four-cylinder vertical engine and three-speed, sliding-gear transmission became the well-
nigh universal type of vehicle. The Ford, which retained the two-speed planetary transmission, and the Franklin, which remained air-cooled, were almost the sole exceptions; but both the Ford and the Franklin conformed to the general run of vehicles in respect to the other specifications mentioned.

Chart 9 shows the production of cars classified by cylinders from 1903 to 1916. It will be noted that at the start of this period, in 1903, 66% of all the vehicles made were of the single-cylinder type, while fours constituted only 14.5% of the total output. Two years later, in 1905, single-cylinder and two-cylinder cars together equaled only half the total production; the four-cylinder cars, plus a few three-cylinder machines, made up the other half. But after then, the fours continued to gain heavily, until by 1912 they made over 90% of all the cars sold. Chart 10 shows the same development, the Ford output not counted. Without the Ford production, the percentage of fours in 1912 is slightly smaller, but is still over 85%. After 1914, the six-cylinder begins, comparatively speaking, to cut into the market for fours; but the great development of the six belongs to the period to be considered in the next chapter.

Between 1907 and 1911-1912, then, the four-cylinder car came into its own. Standard practice in its design made for lower prices of parts and for more efficient repair service. Far better construction also reduced the necessity for such extensive and frequent repairing as was before required. After 1910-1911, trips of 100 miles and more per day, without the virtual certainty of serious trouble to the average owner, became practicable. No longer did manufacturers have to advertise as did the Cadillac Company in 1903, "When you buy
a Cadillac, you buy a round trip.” Better roads also made repairs *en route* less essential and mitigated also the dreaded detour. By 1915-1916, with the introduc-

6. Saturation of the High-Priced Car Market

The results of all this development are reflected in Chart 11, which shows the course of absolute sales figures for three broad price classes of cars—in other words, lumps into three main groups the actual figures in the nine classes for which successive percentage variations were given in Chart 6 above.®

GROWTH OF THE MARKET, 1903-1916

93
The three curves of Chart 11 represent factory sales of low-priced, medium-priced, and high-priced cars for the period 1903-1916. Curve A is for low-priced cars, or those retailing at or below $1,375; Curve B is for medium-priced vehicles, or cars selling between $1,376 and $2,775; Curve C represents high-priced cars, those selling at or over $2,776. Here, as in previous charts, there is no correction made for changes in the general price level from 1903 to 1916. It is worthy of note, however, that an expenditure of $2,000 in 1903 or 1905 was equivalent to the expenditure of successively larger sums in subsequent years; by 1916, to about $3,000.

That sums of $2,000, $3,000, $5,000, which in 1903-1905 meant $3,000, $4,500, or $7,500 in terms of the price level of 1916 (and also, roughly, in terms of the price level today), were freely spent for motor cars can mean only that their consumption was mainly indulged in, up to about 1910-1911, by the relatively wealthy. But the relative tapering off of Curves B and C, especially Curve C, after about 1909, points to the saturation (or to use a word now in greater favor, the stabilization) of the high-priced car market between 1912 and 1916, and to the slowing down in the rate of increase which took place in the market for medium-priced cars. Of the short straight line drawn to the right, through Curve C, we shall speak shortly.

These inferences as to the character of consumption prior to 1910-1911 are borne out by some actual facts which have been collected: the lists of the first twenty buyers of Steam Mobile, Waverly Electric, Winton, Cadillac, and E.M.F. cars, in the years 1898, 1903, and 1907. In the case of Winton, these figures are for the twenty cars produced at the Cleveland factory. Sales of the other makes are for the first score of cars sold, in each case in the Detroit territory.

Of the first twenty Steam Mobiles disposed of by William E. Metzger in 1898-1899 at his store in Detroit, which was one of the first retail automobile establishments in the country, there were sold:

- 4 to "capitalists"
- 4 to physicians
- 2 to manufacturers
- 3 to "general business men"
- 1 to a broker
- 1 to a printer
- 1 to a plumber
- 3 to merchants

For the Wintons sold in 1898, the list is much the same except that no plumber or printer appears. Summarized, it shows thirteen buyers designated either as manufacturers or capitalists, four as engineers or physicians, and three as merchants. The first commercial sale of a Winton car was to Robert Allison, a mechanical engineer of Port Carbon, Pennsylvania, on April 1, 1898. This was not, however, the first sale of an American automobile; the first sale of any American mo-
The first twenty Waverly Electrics sold in Detroit, also in 1898, were bought by about the same class of persons that purchased the Steam Mobiles, except that here six cars were sold to "ladies—wives of the above class, including two wives of bankers." The Oldsmobiles sold in 1903 show about the same distribution, except that no "capitalists" nor manufacturers are listed; merchants and physicians predominate. This is probably due to the fact that the little curved-dash Oldsmobile sold for only $650, while the Winton, which sold in 1898 for $1,000, was selling in 1903 for $2,500 and, in common with many other medium-priced and high-priced makes, was the type which manufacturers and "capitalists" continued to buy.

For neither the Cadillacs sold in 1903 nor for the E.M.F.'s sold in 1907 can the complete details be supplied, but I am told that the situation was essentially the same as with the cars already enumerated. Sales were to manufacturers, capitalists, merchants, and physicians; not to salesmen, small shopkeepers, clerks, mechanics, or artisans. The only exception is an occasional plumber or steam fitter, and such men were in a sense proprietors; they were masters, not journeymen.

I have endeavored, but without avail, to obtain similar figures for companies whose first cars were marketed in years later than 1907. But the fact that by 1907, when the E.M.F., a $1,250 car, was put on the market, the situation had not substantially changed, together with the appearance of the three curves of Chart 11, leads one to believe that it did not, in fact, become greatly altered until 1910-1911.

Returning now to Chart 11, note again the movement of Curve C, representing the sale of high-priced cars, after the year 1911. It runs roughly parallel to the base line of the chart, indicating virtually no rate of increase whatever. The market for high-priced cars, in other words, was completely stabilized for the years 1912-1916. Market stabilization may be defined as that point at which the demand for the product is such
as to call forth only sufficient units to maintain the number already in use. More simply, after stabilization has set in, the only demand for cars is a replacement demand. Numerically, such a demand is equal annually to the number of cars in use divided by their average length of life in years.

The average annual demand for automobiles of the class represented by Curve C, between 1912 and 1916, in round numbers according to that curve, was 17,400 cars. I have calculated what the normal replacement demand would have been during these years, on the basis of the number of cars in service at the end of 1911 and each subsequent year through 1915. The results are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Theoretical Replacement Demand</th>
<th>Actual Market Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>1912</td>
<td>21,000</td>
<td>17,500</td>
</tr>
<tr>
<td>1913</td>
<td>18,500</td>
<td>20,000</td>
</tr>
<tr>
<td>1914</td>
<td>18,500</td>
<td>18,000</td>
</tr>
<tr>
<td>1915</td>
<td>17,700</td>
<td>15,000</td>
</tr>
<tr>
<td>1916</td>
<td>17,500</td>
<td>16,500</td>
</tr>
</tbody>
</table>

Curve R of Chart II, the short straight line running across the ordinates for the years 1912-1916, indicates the average theoretical replacement demand during these five years—approximately 18,500 cars per year (arithmetic mean). The actual average market demand annually during this period for automobiles of the class here considered, was, as stated, approximately 17,400 cars (arithmetic mean).88

7. Summary: Market Development through 1916

Stated in general terms, the facts and reasoning presented in this chapter indicate, first, that in the introduction of a new product, the purchase of which entails any considerable expenditure, demand comes initially from persons in the upper range of the income scale. Particularly is this the case if the acquisition of the article involves a substantial subsequent charge for maintenance.

Secondly, the price at which the bulk of the product is sold may or may not, for the time being, bear any close correspondence to cost of production; but these prices from year to year vary in a manner which correlates with changes in the technique of production as well as with those factors which relate primarily to market conditions.

Thirdly, whatever the interplay of these two sets of factors, eventually there is reached a stage during which further units of product cannot be sold to consumers located in the upper range of the income scale except in approximately constant quantities per unit of time (a replacement demand). When this point is reached, the extension of the market as a whole may, however, still take place either through an enlargement of the country's income or through a downward price movement which permits persons located in the lower ranges of the income scale, and previously not buyers of the product, to become consumers. This "downward price movement" may be one of retail selling price, or may
largely take the form of lower maintenance expense resulting from improvement in the product. In automobiles, both methods of lowering cost to the consumer have operated. By way of qualification, it should, however, be remarked that an aggressive individual pro-

ducer can sometimes further extend his own market by encroaching on the sales of other producers. But frequently he attempts not so much to do this as to enter the field of the lower-priced product also. This has often been the case in the automobile industry, notably within the last five years. Something more will be said of this type of competition in later pages.

These three stages in the course of automobile prices and sales are illustrated graphically again in Chart 12. The three diagrams of this chart are based on a part of the data which went into the year-to-year price class chart before discussed (Chart 6). The first of these three diagrams, that for 1903, indicates how large a proportion of cars sold at or below $1,375; but a sum of $1,375 then was equivalent to about $2,000 now; consumption was indulged in only by the well-to-do. The middle frequency curve shows how much more predominant became the higher-priced types by 1907, because of technical changes in design. The distribution of frequencies here is such that the drawing of a smooth curve has not been attempted. Finally, the diagram for 1911 shows the full result of the strong movement toward very low-priced cars which began after 1907 and gained headway after 1910. Technical knowledge, increased standardization of parts, constant progress in manufacturing methods, and the temporary saturation of the high-priced market were both the causes and the accompaniments of this great movement.
MARKET DEVELOPMENT, 1917-1926

1. General Characteristics of the Period

For the great middle class to buy motor cars after 1912, and for not merely the "middle" but the so-called "lower" classes in the income scale increasingly to become owners from 1916 on, required not merely that the selling prices of automobiles be steadily lowered and that their general quality be improved, but that other developments contributing to the ease of both acquisition and operation take place. These new developments may be grouped under four main heads: the introduction of the self-starter, the advent of the cord tire, the manufacture of low-priced closed cars, and the establishment of installment sales. Coupled with these events occurred a marked expansion of the export market; but this, while important especially during the last few years, constituted only a comparatively slight part of the total market expansion of the period 1917-1926.  

Although one of these four factors, the electric self-starter, was first offered and more or less widely introduced by 1913-1914, the others all came after 1915-1916. Of course, any single year which is taken to mark off "periods" in an industry's history must in a
period. It was about the last year during which the "straight-line" rate of growth in passenger car production, described and charted in the last chapter, was in evidence; since then, production has continued to grow, but at a somewhat slower rate. Chart 13 on the preceding page shows this plainly. The 1903-1916 figures are here charted again, and to the diagram is added the curve for 1917-1926, which is dotted in order to differentiate it readily. The recent course of this production curve will be discussed in later pages; it may here be noted merely that the rate at which the industry expanded began to slacken somewhat after 1917. That its absolute growth, however, continued as astonishingly as it did is largely because of the factors just suggested: the self-starter; the cord tire; the coming of the closed car, and with it good roads; and the development of time payments. The steadily growing prosperity of the country, too, has played a part, especially during the last few years, in somewhat the same way as it did in earlier years from 1910 to 1916—as a contributing but not the solely responsible factor. In part, the country's prosperity has enabled it to buy automobiles; in part also, the presence of more motor vehicles has promoted prosperity.

The period 1900-1910, then (the dates are arbitrary and only approximate), saw the automobile industry entirely out of the workshop stage and successfully established as an important branch of American manufacture; the period 1911-1916 saw the comparative perfection of its product and the extension of its market to more than merely the well-to-do classes of society; while the period 1917-1926 has witnessed not so sharp a rate of increase, but nevertheless a continuous expansion of that market through steady refinement in the design and construction of the product and through important newly developed methods of market distribution.

2. The Self-Starter, the Cord Tire, and Other Refinements

More than any other single thing, the development of the electric self-starter served to extend the automobile's scope of usefulness as a family vehicle. To crank many a car was none too easy a task even for strong men, while in cold weather it sometimes became a chore of long duration. In the very early days of the industry, about 1905, one of the trade papers relates the case of an owner who himself always drove his car, but being a man of rather slight build, invariably carried along a chauffeur "solely to swing the crank past compression." But although by 1912 ignition devices and carburetors had reached the stage where under favorable weather conditions most cars could always be started without "spinning," even a quarter turn or two of the engine was too laborious, too dirty, and with some motors, if one neglected properly to retard the spark, too dangerous an act to be undertaken by a woman.

There had been some attempt at self-starting devices almost since the beginning of the industry. Alexander
Winton, about 1907, invented a pneumatic device, principally because a large six-cylinder engine which the Winton factory brought out in that year was thought too heavy to be turned by hand. Others had invented both air, spring, and even electric devices, but seemingly none of these possessed the capacity both to “spin” the engine continuously and, after the car was running, infallibly again to store up a sufficient supply of energy to repeat the operation as soon as necessary. Finally, Henry M. Leland, then president of Cadillac, whose own technical contributions to the industry have been many, encouraged a young engineer, Charles F. Kettering, to develop an electric starting system for that company’s cars.

Here was a case neither of “accidental” nor of “inspired” invention—the sort of thing which inventors’ biographers so often glibly write about—but of a deliberate, calculated attempt to bring forth a definite device. Building upon the work of others who had preceded him (in this particular case, Clyde J. Coleman had earlier patented several engine starters, features of which were later purchased by the owners of the Kettering patents), Kettering finally succeeded in producing his starter, and the Cadillac for 1912 came out with complete electrical equipment. Other cars soon followed: the next year, 48 manufacturers provided starters on their machines, and by 1914 there remained only five companies, or about 8% of all makers, who did not offer this feature. Thus what would have been regarded as a luxury before 1912 became a necessity by 1914. A little later, electric starting was offered even on the Ford, although for some years only at an extra charge.

While after 1912 the four-cylinder open touring car continued to be the standard type of vehicle, it was a greatly improved car, in comfort and performance, compared with what it had been a few years previous. Reliability came to be taken more or less for granted, and refinement began to be stressed. The Studebaker catalogue for 1913, for example, said proudly of the new model which it announced: “The convenience of the ‘35’ is a noteworthy characteristic. A pull of a lever on the steering column starts the motor . . . . gear shift levers operate handily, and both front doors open . . . . Press a button, and the brilliant electric headlights illuminate the road.”

Both the demountable rim, which came into wide use about a year after the self-starter, and the cord tire, which was developed just previous to 1916 but not used at all widely, except on expensive cars, until several years later, served also to remove much of the irksomeness and the expense connected with both city and country driving. The demountable rim made changing a tire child’s play compared with the earlier practice of removing the entire casing and tube and repairing the puncture on the road, or, at best, substituting a new tube. The letters patent connected with demountable rims, removable wheels, and similar devices are several; to whom the principal credit for the development belongs it is difficult to state.
The cord tire, which provided both easier riding and longer wearing qualities than did the less flexible fabric casing, both lengthened car life and conduced towards the greater comfort of the motorist. Although the cord at first cost more to purchase than did the fabric type, the greater mileage which it afforded caused both manufacturers and the public soon to adopt it widely. With its widespread use its price, relative to that of the fabric, was greatly lowered. Chart 14 illustrates this decline in the price spread between the two types. Chart 15 shows the more recent tendency towards the use of the resilient, low-pressure balloon tire, another great refinement which, together with four-wheel brakes, has made rapid headway since 1923-1924.

Charts 16 and 17 illustrate the rapidity with which important new improvements are adopted by all makers, under competitive conditions, once one or more makers have introduced it. The one chart shows the percentage of makers offering a self-starter as standard equipment on any of their cars in the years 1912, 1913, 1919, 1921, 1922, and 1924. The other chart is similarly constructed, but is for four-wheel brakes in 1923, 1925, and 1927. The pressure of competition to sell stimulates the progressive manufacturers constantly to seek better devices or designs, while the same pressure of competition then forces others to follow or be left behind in the race. In spite of the many checks upon what the economist calls “free” or “perfect” competition—checks which undoubtedly do exist in many quarters of the industrial world—no better proof of the fact that the force of competition is not merely an abstraction, but does really operate, is to be found than in the automobile industry. Fortunately, however, by virtue of an enlightened and unusual patent agreement to be described in another chapter, automotive competition has been in a sense
"cooperative" in its character; in the main, new devices and refinements of construction have become available to whichever firms wish to make use of them.

3. The Rise of the Closed Car

In 1916, "the car of the American family," to use a phrase which must be credited to Hupmobile, was the open touring car. True, a folding top was supplied as standard equipment in all cases; one did not have to pay from $85 to $150 extra for this adjunct as in former years. Further, it had just become a "one-man" top. Side curtains also were furnished, although they were difficult to adjust and greatly impaired the driver's vision of the road when they were all in place.

Closed cars, of course, existed. But they were tremendously expensive in comparison with the open ones; they cost from about 30% to 50% more. They were chiefly limousines and coupés, rather than sedans, and they were owned principally by the wealthy who either employed chauffeurs or owned two or more cars, or by physicians or others whose duties necessitated an all-weather vehicle the year round. The total number of closed cars made in 1916 came to less than 2% of the total automobile production.

After 1917, this figure gradually rose, as Chart 18 indicates. But not until 1921 did closed car production amount to more than one-fifth of the total. Today it stands at nearly three-fourths (72.0% in 1926) of the entire motor car output.

In part, good streets and highways have made this possible. Closed cars were not, in earlier years, well suited for country touring. Rough roads and relatively
poor body construction shook them to pieces; windows loosened, sashes cracked, the whole body rattled. But well-paved roads enabled closed cars to be used more frequently for long trips, and the increased demand for closed vehicles caused manufacturers to give more attention to their design and construction. Quantity production again brought down prices, and lower prices again extended the market for the product. To fit better the pocketbooks of those who wanted closed cars but felt that they could not afford to pay so great a differential as then prevailed, the Hudson company in

Figure 14: The Evolution of the Closed Car.
The Oldsmobile model for 1902 shown above was announced as a car to which "all roads and seasons look alike." The Velie is the first closed car made by that company. The Hudson model is the first coach, produced in 1922. The three Franklins represent an evolution of body type begun in 1902 and culminating in the company's "25th Anniversary Sedan" two and one-half decades later. The middle Franklin picture is the first sedan marketed by the company.
1922 introduced the "coach," a five-passenger two-door closed model which sold at only $50 to $100 more (a differential of from 3% to 6%) than did the open cars on the same chassis. This example was followed within a year or two by nearly all other manufacturers, and the year 1925 saw more closed cars sold than open ones. Again, like so many other things which have occurred in the automobile industry, had this development been predicted by anyone a few years before it actually took place, it would not have been believed possible. And

![Chart showing index numbers for average spread between closed- and open-car prices, 1922-26.](Image)

Chart 19: Index numbers showing the average spread between closed- and open-car prices, 1922-26. (Open-car prices in each year taken as 100.)

Once again, like the self-starter and various other improvements in design and construction, the closed body, by virtue of its year-round availability, promoted the purchase and use of cars, through lowering the "per mile" expense of their operation to the consumer.

Chart 19 shows the marked recent decline in the "spread" between the prices for closed cars and those for open cars from 1922 to 1926. The figures plotted are the average prices of six makes of open cars and of the corresponding closed cars, of the same makes, offered in each year on the corresponding chassis, the open car prices being expressed as 100 and the closed car prices as indexes of each year's open car prices. Low-, medium-, and high-priced cars are included; the six makes are Ford, Chevrolet, Hudson, Paige, Packard, and Cadillac. It will be noted that a closed car can now be bought for approximately the same price as an open one.

4. Introduction of Installment Sales

About 1913, at the Chicago Automobile Show, one of the exhibitors distributed as souvenirs small enameled buttons, which were pinned on one's coat lapel like campaign buttons during election times. These buttons bore the somewhat inelegant but emphatic declaration, "It's Hell to be Poor." The implication was, of course, that the great advantage of being more or less wealthy was that it enabled one to own an automobile.

That was about 1913; in that year 460,000 cars were produced. Ten years later, in 1923, one could buy a
brand-new automobile by paying as little as $300 or $400 "down," and the balance in from eight to ten monthly installments; in that year, 3,500,000 cars were sold. By 1925, 75.5% of all cars, both new and used, were sold on the installment plan; a total of $2,642,000,000 worth of new automobiles were marketed "on time," and the average volume of installment paper outstanding was approximately $1,049,000,000. Today, 64% of the new cars, and probably a somewhat larger proportion of used cars, are bought on time.

Such a huge volume of installment operations brought forth severe criticism when first the facts became known. Yet the economics of installment selling are neither so complicated nor so novel as to occasion any great alarm provided that reasonable discretion is employed in the exercise of this important marketing device. Time payments long have been known, and have operated successfully, in the sale of sewing machines, pianos, and other durable goods. Houses have always been built and sold with first and second mortgages, the principals of which in many cases have been amortized by the buyer through monthly, semiannual, or annual payments. Between about 1915 and 1917, several finance companies which had for some years purchased receivables in other trades began to experiment with automobile installment paper. The early operators in this new field of commercial credit seem to have been the firms of John L. Little (now the National Bond and Investment Company), Henry Iltleson (Commercial Investment Trust), and A. E. Duncan (Commercial Credit Company). From the comparatively small amount of retail automobile financing started by these companies in 1915-1917 has grown the annual $2,500,000,000 volume of installment sales of today.

That the time payment plan came widely to be applied in automobiles by about 1923 means merely that the motor industry had by that time come to maturity and that its product had been perfected. It was this maturity of its product which made possible the successful inauguration of time payments. Installment selling of motor cars would have developed long before had not the mechanical construction of the product, prior to about 1912-1916, been so imperfect that too great a risk would have been involved.

As a matter of fact, as early as 1912-1914, sporadic cases of "time payment" did appear, although they were not known by that name. Occasionally, sales were made on the basis of a 66% to 75% down payment, with the balance represented by one or two promissory notes given the dealer directly by the customer and maturing, say, one in three months and the other in six months from the date of purchase. The privilege of making such a purchase was, however, limited to persons of some financial standing in the community, who merely preferred to buy their cars "out of income instead of capital," as the current phrase goes, and whom the local dealer thus obliged if his own financial condition permitted him to do so. Today, however, the financing of automotive installment sales is carried on almost entirely by financial specialists, the "finance
companies,” of which there are several hundred in the United States.

The economic effects of such installment selling are alleged to be many and various. It is not proposed here to undertake any very extended discussion of this subject. To say that the time payment plan enables persons to live “extravagantly” depends entirely upon one’s definition of extravagance; it may mean merely that the extravagance consists in the other person’s buying something that the critic chooses not to buy himself and therefore condemns. If, however, it be declared that time payments promote one’s “living beyond his income,” a somewhat clearer statement is then put forward for discussion. Admittedly, the installment plan may do this for a time, but only temporarily. In all cases, the day for settlement eventually arrives; unless the debtor keeps constantly on the move to avoid his creditors, he can hardly continue to live much beyond his means for an indefinite period.

But although installment credit may tempt some buyers to try to live beyond their incomes, there can be no doubt that for other persons it has promoted increased thrift and stimulated productive efforts. Most individuals work harder when the spur of ambition prods them, and the ownership of a motor car is something to which almost every wage earner in America has within recent years aspired. Time payments have made it possible for many to realize this longing, and arranging to liquidate the obligation has doubtless given many persons their first lessons in successful famil-
down payment was set at 40%, with the balance in no more than twelve months. These requirements, known in the industry as “standard terms,” are now followed by most finance companies and dealers.

Like all other large new developments, automotive installment selling has had problems to solve and abuses to correct. But the marvel is not that these difficulties have appeared, but that, in the aggregate, they have really been so few in number and seem to be so rapidly approaching correction. The grave fears entertained two or three years ago that the continued motorization of the country, through the machinery of time payments, meant its demoralization and spelled economic and financial chaos are already proved as groundless as many “grave fears” of new movements often are. The same things were said in 1912-1914, before the days of installment selling: it was feared by many that the “continued diversion of capital” to the automobile industry would result in either economic stagnation or industrial crisis. Yet both our national income and automobile registrations have since those years greatly increased, and they both continue to grow.

The experience of several hundred finance companies seems to have demonstrated that there are but two fundamental principles which need to be followed to insure safety. These have been briefly stated by Mr. C. C. Hanch as follows:

1. The down payment made by the purchaser must be large enough to make him feel that he has a real equity in the purchase and is not merely a renter.

2. The maximum time of deferred payments must be short enough [to ensure] that the depreciation of the article will not absorb the equity of the purchaser or security of the lienholder before the last note matures.

When these two principles are held to, the “soundness” of automobile sales on time seems clear beyond reasonable doubt. The following figures for repossessions of new cars (cars seized under the mortgage or lien because of the failure of the purchaser to meet the payments) show how relatively few are the instances in which the consumer is unable to meet his obligation when the sale is made on standard terms:

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage of time sales repossessed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage of time sales repossessed where down payment was 30% of the time selling price</td>
</tr>
<tr>
<td>1925</td>
<td>1.72%</td>
</tr>
<tr>
<td>1926</td>
<td>2.09%</td>
</tr>
</tbody>
</table>

But note how these slight proportions increase when the standard terms are departed from:

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage of sales repossessed where down payment was less than 25% of the time selling price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage of sales repossessed where down payment was 25% of the selling price</td>
</tr>
<tr>
<td>1925</td>
<td>3.81%</td>
</tr>
<tr>
<td>1926</td>
<td>4.02%</td>
</tr>
</tbody>
</table>

Where the down payment was less than 25% of the time selling price.

10.96% | 11.52%

These percentages, which are totals or averages representing the composite experience of 150 finance companies, all increased somewhat from 1925 to 1926 because of the tendency on the part of some companies to depart from sound credit terms in the latter part of 1925, a tendency which continued until corrective measures were taken towards the end of 1926.
The extent to which this corrective work, sponsored by the two associations just mentioned, has proceeded is shown in the fact that whereas in November, 1925, the average percentage of automobile paper calling for thirteen or more monthly payments was 18.3%, such paper amounted in November, 1926, to only 13.2%.

Likewise, in 1925 the paper written with a down payment of 25% or less on new cars made up 19.3% of the total, while by November, 1926, this figure had been reduced to 9%. Due to this substantial stiffening in the terms of purchase, the repossession figures for 1927, when they become available, may show somewhat reduced ratios as compared with 1926. Further figures in connection with repossession, as well as statistics upon other phases of time payments, may be found in Appendix A, page 322.

5. Production by Cylinder and Price Classes

Quite as marked as the adoption of the closed car during the latter part of the period 1917-1926 has been the shift from the four-cylinder to the six-cylinder type of engine. In 1917, 80% of the cars made were fours and less than 20% sixes. By 1926, only about 60% were fours and nearly 40% were sixes.

The shift, however, becomes far more striking if the percentages are calculated exclusive of the Ford. The 1917 figures are roughly the same as before, but the 1926 figures show only slightly more than 40% of the cars to be fours, and 55% to be sixes. In other words, the six-cylinder automobile, which previous to 1916 was re-
garded as more or less of a luxury, has now become the standard type in cars selling at $1,000 or over. There are even several popular makes of cars selling between $700 and $900 which have six-cylinder motors, but in total volume the six does not yet dominate this field as it does the higher price classes. It may, however, soon do so, if the present trend in any way forecasts future developments in this direction.

Of the other cylinder types marketed between 1917 and 1926, little need here be said. The twelve-cylinder engines introduced in 1916 were mainly limited to comparatively high-priced cars and were not long continued save by Packard, which first offered the “twin six” in this country. Even this company, however, abandoned its twelve in 1922 in favor of the “straight” or “line” eight type—an example which several other makers have followed. But although either the “V” type of eight introduced by the Cadillac Company in 1914 or the more recent line eight is now made by a number of manufacturers, the aggregate production of eight-cylinder cars is not yet large relative to the entire automotive output. It will be noted, however, that from 1923 to 1926 the figure for eight-cylindered production has increased from 1.0% to 2.2% (or without including the Ford production, from 2.1% to 3.3%), of the total output. Further details connected with the trends of production by cylinder classes may be seen in Charts 20 and 21.

The growth of the market by price classes of cars, over the period 1917-1926, evidences no changes of
such striking character as does the shift in cylinder types during the same period. Except for the war years and the period of postwar inflation, followed by the readjustments of 1921-1923, the percentages of total production in the price groups below $1,375 does not become markedly altered. Before examining the exact course of these percentage relationships, however, let us note the actual sales figures for low-, medium- and high-priced cars as shown in Chart 22.

The three curves of this chart continue for the period 1917-1926 those shown in the previous chapter (in Chart 11, page 93) for 1903-1916. The general rate of increase for the two upper curves is somewhat less for this period than that which obtained prior to 1916, although the top curve, that for low-priced cars ($1,375 or under), is still climbing upward.

It is of exceptional interest to note that Curve C (high-priced cars) mounted rapidly from 1917 to 1920. It will be recalled that in Chart II, Curve C had become approximately stabilized; during the years 1912-1916 it averaged but little more than a replacement demand, which was estimated at about 17,000 cars a year. An observer in 1915 might well have said that the absolute market for high-priced cars would grow no further. Yet see what took place. In 1919, the curve began to mount sharply. In that year over 35,000 cars of this class were sold, and in 1920, over 100,000 were marketed. Since 1920, the sale of high-priced cars has declined, but it still stands at a level from two to three times as high as that to which it seemed firmly anchored in the years 1912-1916. That this increase in sales from 1918 to 1920 was due partly to the change in the general purchasing power of the dollar is, of course, true; but that it was by no means due solely to that cause seems borne out by the fact that the curve continues upon such a high level even after the period of deflation has taken place. Prices for cars of every class are now lower than in 1912.

To summarize: The present situation with regard to sales in these three broad classes of cars is that the market for high-priced cars, after growing greatly since 1917, fell off somewhat since 1920, but stood in 1926
at a level nearly four-fifths as high as that of 1920. The market for medium-priced cars from 1917 to 1920 continued its expansion at about the same rate as that which it had enjoyed from 1910 to 1917, but since 1920 it has slightly tapered off. Its rate of growth has not slowed down so markedly, however, as has the curve for high-priced cars. Between 1925 and 1926, this curve for medium-priced cars, alone of the three curves, underwent an absolute decline; but this decline is doubtless attributable to recent reductions in the prices of closed cars which brought a number of $1,400 and $1,500 cars within the "$1,375 or under" class. The top curve, that for low-priced cars, has risen most steadily of all, although its rate of growth from 1917 to 1926 has been less than for the period prior to 1916. However, for the years 1924-1926 it is still on the increase, more sharply so than either of the two lower curves.

Return now to the percentage figures for the various price classes as shown in Chart 23. The increase in the proportions of the cars selling at above $675 is due principally to the higher prices which automobiles, in common with all commodities, enjoyed during the period 1916-1920 and is in no way connected with any developments peculiar to the automotive industry. The reversal of this trend from 1921 to 1924 in part represents merely the opposite situation, one of a generally declining commodity price level. In part it also represents, as do even more largely the shifts from 1924 to 1926, the increased effectiveness of the automobile
industry in making and marketing its product at lower
costs and prices, plus the presence of the time payment
plan, which brought into the market vast numbers of
new buyers whose comparatively low incomes led them
to buy the Ford, Chevrolet, Essex, Star, and other low-
priced cars in tremendous quantities. That the pro-
portion of cars selling under $1,375 is in 1926 only
85%, as against 91% in 1916, does not mean that the
automobile is any less "the average man's" vehicle, but
only that the "average man" now buys a closed car
instead of an open one. The difference of $100 or $150
which still obtains, between the closed and open models,
in some makes selling at around $1,375 probably now
brings many older buyers of, say, $1,200 or $1,300 cars
barely into the "$1,375 or over" class. It may also be
true that the decline of the 91% figure to 85% is to
be explained partly by the fact that the institution of
time payments has permitted some persons who would
otherwise have bought low-priced cars to purchase
medium-priced ones.

It should not be assumed, however, that sales on
time are confined to low-priced or even to medium-
priced vehicles. In spite of the common impression
that a far greater proportion of the higher-priced cars
is sold for cash than of the lower ones, such is in fact
not the case. No complete figures on this point are
available, but sample investigations among dealers
handling various classes of cars indicate that in this
respect there is very little difference between classes
of buyers.\textsuperscript{95} That a number of the leading makers of

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\textsuperscript{96}
METHODS OF MARKET DISTRIBUTION

1. Retail and Wholesale Distributive Channels

With the geographically wide market for cars which has existed from the start, and with the pronounced localization of the industry which occurred fairly early in its history, particularly around Detroit and Cleveland, it was practically impossible for any manufacturer to sell his product direct to the consumer. Instead, the typical procedure was to dispose of his output by selling to dealers in each community, who in turn sold the cars to the public. Sometimes but one set of middlemen was employed—the retail dealers. But more often, especially after a factory had been in operation a year or two, wholesalers in certain centers were also appointed, a large dealer becoming the distributor for an entire territory. Not merely a town or city, but a whole state or even several states, was allotted to such a distributor, who then sold to local retail dealers of his own appointment. As a third possibility for disposing of a part of the product, the manufacturing company itself sometimes established branches in one or several centers, instead of appointing distributors there.

There are thus three main channels through which cars may be distributed: factory to retail dealer, factory to distributor (wholesaler), factory to branch. Actually, no one of these three possible systems seems ever to have been employed as an exclusive method, except in one remarkable instance in which all the retail dealers had a direct contact with the factory. Most manufacturers have utilized both factory branches and wholesale distributors, or both wholesale distributors and retail dealers, some of whom may enjoy a direct contact with the factory, or other similar combinations of these three types of intermediary between factory and final buyer.

Five such schemes of market distribution which have actually been employed by manufacturers are depicted in Chart 24. System A, in which branches, wholesalers, and retail dealers are all used, has been one most frequently essayed; systems B and D next most frequently; C next; and E, where the manufacturer disposes of his entire output through local retail dealers, hardly ever.

Though a large number of factories today operate no branch houses whatever, or else operate but one or two such branches, most of them at one time or another have tried the branch system. A questionnaire which the writer circulated in 1926 in order to obtain information regarding marketing practices called for the checking of each year in the history of the company during which it had employed branches, distributors, direct dealers, and requested that in the event that branches had once been employed but later discontinued, the
Chart 24: Distributing systems in use by automobile manufacturers.

reasons for such action be stated, if the company cared to confide them.
A number of firms complied with this request, and the reply which predominates is interesting. It is simply that it was extremely difficult to find branch managers who proved as competent as did the wholesale distributors who had their own funds invested in their establishments. One would naturally expect the manufacturing company to operate branches if it can; it is a more direct method; it maintains factory contacts with both local dealers and consumers.99 Further, the simultaneous operation of several branches ought presumably to reduce sales expense. Yet so great is the single obstacle just mentioned in the way of successful branch operation that comparatively few manufacturers have developed branches at all widely. This is true of passenger cars. In the sale of trucks, certain service and other factors make branch house operation more essential, and there the system enjoys a much wider vogue.

It is worth while to quote from several of the replies, just to indicate the unanimity of experience which prevails. The following excerpts are from separate answers received from executives of five different companies:

The fact is that passenger cars sold by branches have not been generally a success. It is hard to get a manager . . . . to handle the company's money, make trades, and so on . . . . to compete with a dealer who has to work upon his own investment and protect it. . . . .

The retail motor car business has many leaks, and we find it extremely difficult to find managers who do not waste considerable money. . . . .

It is difficult to get good managers who have no money invested. . . . . If a dealer has a financial interest in his own company,
he is found to be much more satisfactory than a branch manager, who has practically no financial interest in the branch.

... We find in a general way that even a man who makes a "fair to middling" dealer lies down and quits completely when put in charge of a factory branch—where the urge of actual, personal incentive is less strong.

2. Characteristics of Distribution Through Dealers

Where the branch house system is not employed, four characteristics of automobile marketing through distributors and dealers are to be noted. The first of these is that the product is never shipped on consignment, but is sold outright. The second is that all factory sales are made for cash. The third is that those intermediaries who are wholesalers invariably sell at retail also. And the fourth is that, though the product is sold outright, the factory may and usually does exercise a large degree of supervision and control over the businesses of both dealers and distributors.

From the beginning, both consumers and members of the trade have often spoken of the automobile dealer's place of business as the "agency" for the particular make of car there handled. But it has in fact never been an agency at all. Though the factory assists the dealer in his sales through advertising, thus assuming some of the responsibility for the "demand creation" function, it entirely gives up title to the product when it puts it in the dealer's hands. The retail dealer (and the wholesale distributor also) stores the goods, assumes the risks involved in carrying them, and finances the transaction. He is not a representative of the manufacturer, in the

legal sense, at all, but a wholly independent merchandiser who purchases automobiles from the factory at the wholesale price and sells them to his customers at the retail price. Though he buys the product outright, however, he does so under contract. He may agree each year to take a predetermined number of cars. In consideration of this, he is ordinarily given exclusive territory, that is, he is the only one to whom the factory will sell in his town or neighborhood. But ordinarily the contract is terminable at the option of either party upon thirty days notice.

The second characteristic of these distributive arrangements is the striking fact that from the very beginning all sales made by the factory have been strictly for cash. Not only are sales to dealer and distributor upon a strictly cash basis, but these purchasers have actually often put up deposits, paying 2%, 5%, or 10% of the purchase price in advance of delivery. Such stringent cash arrangements and such a system of deposits are to be found, as customary usages, in the history of no other industry of which I have knowledge. How are they to be accounted for?

The answer seems to lie in the character of the product and the conditions of the demand for it. As has been pointed out above, the purchase of an automobile entails a large outlay by the consumer. It was felt that unless the dealer discouraged the practice, the consumer would request the privilege of making payments over a considerable period. But in the early days of the industry, such installment selling could not
well have succeeded. As has been suggested already, the automobile in its early days was both a new and an uncertain mechanism. It gave trouble to the best drivers and to the most mechanically minded persons; how much greater and more numerous the annoyances which its complex construction could offer to the inexperienced and to those not mechanically inclined! If the factory had sold on open book account to the dealer, many dealers, it was feared, would have sold cars on three months' or six months' time to the consumers. And many consumers, manufacturers well knew, would never have paid. The risks of mechanical or other accidents to the car were too great, the market for used cars was restricted, and the dealer's equity in a car sold on time would have been subject to an extremely rapid depreciation. By thus selling to the dealer only for cash, the manufacturer made it practically impossible for him to sell to the consumer other than for cash, for local banks would not then finance him. When the first curved-dash Oldsmobile was marketed in 1900, R. E. Olds announced to his dealers that cash was the only basis upon which production and sales could satisfactorily take place, and that hence the Oldsmobile would be sold only in that manner. This inaugurated the policy; the example was followed by all the other manufacturers who swung into quantity production after Oldsmobile had pointed the way.

Dealers' deposits, however, were not at first demanded by manufacturers. Strange as it may appear, they were voluntarily offered by the dealers themselves. The reason was that under the strictly cash arrangements in force, the automobile factory has always shipped cars with sight drafts attached. Certain dealers objected to this. Few other merchants in their town were drawn against in this manner, and the procedure seemed to cast a doubt upon their credit standing. Hence arose the practice of depositing a certain fund with the factory, of having this fund debited whenever cars were shipped, and then renewing it again.

Later, the factory insisted upon such deposits from dealers, though often in varying amounts per car, according to the caliber and business standing of the merchant. Frequently, such dealer deposits constituted an important source of working capital for the manufacturing company. The fact that the demand for cars rapidly expanded, that during many years deal-
ers at certain seasons "stood in line and begged for cars," facilitated the requirement of deposits.

Another reason for demanding that business be done on a cash basis, apart from the character of the automobile as a complicated mechanical product liable to disorder and accident, was the very limited financial responsibility of many of the dealers. Most of the men available for "franchises" were small merchants—bicycle dealers or repair men, hardware dealers, locksmiths, or electricians. They were the logical persons to handle motor cars in their communities, for few others could arrange readily to give the mechanical service which the consumer required. Thus with few exceptions (John Wanamaker in New York and Philadelphia was a notable one) the retailer of automobiles was a man against whom an action at law would avail little, for he was possessed of few assets. This is the reason, also, thinks one of the pioneers of the industry, for the inclusion in the dealer contract of a more or less standard thirty-day termination clause; it was essential for the factory not to be bound to continue disposing of its valuable product through a dealer who might not fulfill his contract—one who, through incompetent salesmanship or poor service, might not be able to take his agreed quota of cars.

But even today, with the industry's product perfected, with about two-thirds of all cars retailed on credit, and with substantial types of business men as dealers whose assets in some cases may amount to several hundred thousands of dollars, the factory invariably continues to ship its cars "Sight Draft against Bill of Lading." The wholesaler or the retailer, when he needs credit, obtains it elsewhere, ordinarily from his bank or from an automobile finance company.

The amount of these wholesale operations (what, in short, may be termed "dealer financing" in contrast with "consumer" or installment financing) which the automobile finance companies now carry on is not at all large in comparison with the volume of retail installment paper which they carry. This is due to the fact that the advent of the closed car has greatly reduced the extreme seasonal fluctuations which formerly prevailed. About 1915-1917, when wholesale or dealer financing together with retail or installment financing first developed, the dealer often had great difficulty in meeting the sight drafts, bill-of-lading attached, which covered the shipments of the manufacturer during the dull winter months.

Through the services of the finance company, however, under either the "warehouse plan" (where the cars are stored by the dealer under a
trust receipt or other instrument given to the finance company) or the "floor plan" (where the dealer holds the cars in his display room or elsewhere), the dealer at once obtained from 80% to 90% of the invoice price of the cars\(^{100}\) and was enabled in this manner to accept the shipments of the manufacturer the year round. The more continuous operation of the latter's factory was thus promoted, and production costs were kept down in consequence. Since about 1921, the great vogue attained by the closed car has both conduced to the further stabilization of factory operations and has reduced the necessity for dealer assistance from the finance companies on the wholesale side of the marketing process. On the retail or installment side, of course, the year-round importance of the finance company is now greater than ever, although the dealer still pays cash to the factory for every car which is shipped to him.

The third characteristic of automotive distribution through the several market channels depicted in Chart 24 is that when wholesale units (either factory branches or independent distributors) are employed as intermediaries between factory and dealers, such wholesalers invariably carry on a retail business as well. For a long time, in the immediate territory in which the branch or the distributor was located, no dealers at all were appointed; it is only within the last two or three years that several automobile showrooms retailing the same make of car within a city have sprung up. But even now, with one or more independent retail dealers selling a given make in the same city, the distributor in that city invariably, and the branch in most cases, continues to retail.

One reason for the fact that the wholesaler of cars is also a retailer is, of course, that usually he started as a retail dealer and then later took on the wholesaling function. More important, however, is the fact that the automobile business is one which easily lends itself to the combination of wholesale and retail activities. The product is not packaged; it does not come in hundreds or by the gross. The individual car is always the unit of sale, and wholesale transactions are merely relatively small multiples of retail transactions. Since cars must be carried in stock for delivery to dealers as they call for them, it is always possible to sell out of this stock at retail. Further, the distributor must carry a large stock of replacement parts, in order that dealers may readily replenish the stocks of parts which they keep on hand locally. Thus the distributor would be in a position to give service on cars, whether he sold at retail or not.

Not only are certain overhead expenses saved by using the same establishment for both wholesale and retail operations, but an additional advantage which accrues is that the distributor keeps his touch on the public pulse in the matter of car performance. Through giving service and handling complaints himself, he is in a better position than he would otherwise be to make suggestions to the factory, to appreciate the dealers' problems, and to offer them advice.
3. Marketing Cooperation and Control by the Factory

To be a satisfactory dealer, it is not enough that one buy cars and sell them. They must be sold in a manner which will reflect credit upon the factory, and after being sold, they must be so "serviced" that the reputation of the car shall not suffer in comparison with that of other makes. Short-sighted policies of service, no less than ineffective methods of sale, have caused the downfall of many a retail distributive organization. The factory, therefore, is vitally interested in the manner in which the retailer and distributor conduct their businesses. Few manufacturers feel that the methods the dealer employs, the equipment he uses, the place of business he occupies, are wholly or even largely the dealer's own concern. The extent to which the factory organization can dictate to the dealers in these matters depends principally upon how strategically intrenched its product is in the public favor. If the make of car is a popular one, the dealer "franchise" is worth a great deal. There is then little to check the manufacturer's control. He may not only prescribe what quantities of replacement parts must be carried, but also the exact prices at which repairs must be made. The factory may not only require that all replacement parts be bought from it and not from outsiders, but may, as do, for example, the Ford Motor Company and Dodge Brothers, even send around traveling representatives to inventory and inspect any dealer's stock of parts without advance warning. Thus the manufacturer un-

dertakes to insure that the ultimate consumers of his product, the car owners, receive genuine factory parts and adequate, reliable service.

On the selling side, control is likewise exercised. All companies cooperate with the dealer in assisting him with his local newspaper advertising; ordinarily, the expense is shared evenly. Most companies attempt to prescribe the general style which the advertising shall take; many even provide the copy itself, which, except for the insertion of the dealer's name, must be employed verbatim. Similarly, some factories prescribe the style of lettering to be used on display signs and show windows; and some even attempt to make mandatory the adoption of a particular arrangement in the layout and design of the showroom.

But along with this prescription of local advertising and sales methods, the larger companies attempt to give the dealer another powerful aid in marketing his cars: each year the motor manufacturers spend several hundreds of thousands, if not millions, of dollars in national advertising. In magazine advertising alone, Chrysler, Willys-Overland, Dodge, Buick, and Chevrolet spent in 1926 well over three quarters of a million dollars each. The magazine advertising of all passenger car companies in 1926 amounted to $11,427,000. Substantial as this sum seems, it averaged, however, only 0.4% of sales (wholesale value). The expenditures of twelve leading companies for magazine advertising in 1926 are shown in Chart 25. The growth in the annual automotive expenditure for magazine ad-
vertising by all motor car, motor truck, tire, and accessory makers, as well as the figures for passenger cars separately, over the period 1914-1926, is shown in Chart 26. The automotive grand total in 1926 was nearly $25,000,000 in magazines alone; including the other media used it is, of course, much higher.

Beyond specifying what the amount and nature of the dealer's own advertising shall be, a few companies have at times even specified what the dealer's sales should be; they have, in other words, told him how much business he should do. In spite of the fact that the dealer is no employee of the manufacturer at all, nor even an agent, certain companies have on occasions surveyed dealers' territories, set sales quotas for the season, and threatened to deprive the dealers of their franchises if these quotas were not reached.

But it is greatly to be doubted if such a policy is a wise one, even from the standpoint of the factory which practices it. Like all other ambitious merchandisers, the motor vehicle dealer desires and appreciates sales help and, frequently, he is even willing to accept many marketing suggestions which partake more of the nature of orders than suggestions; but he does not ordi-
narily enjoy being told the amount of business that he must do in his own establishment. Such a mandate savors more of the "hired man" relationship than of market distribution through independent jobbers and dealers who have their own capital invested in their enterprises. When scientific management was introduced by F. W. Taylor and practiced by his disciples some years ago, it may be recalled that labor objected to it strenuously upon the ground that while it might have meant higher pay, it also tended to "drive" the worker. So now it may be with "scientific distribution" in the automobile industry—it may mean prosperity for the dealer, but it ought not to be so overdone as to arouse his antagonism. A factory sales policy that aims merely to make the dealer dispose of a certain number of cars over a given period, whether economic conditions in his territory warrant it or not, is shortsighted. Dealer good will, in the long run, is as important to the manufacturer as consumer good will. Neither can be permanently maintained by sales policies and practices which are too rigid to be reasonable, for the attainment of the one makes possible the other.

Somewhat less striking among the controls exercised by the factory over the dealer is the matter of price. But this control is less striking only because it has seldom been objected to and is more or less customary in other trades. The factory advertises its car at a certain stated price, or, when it makes more than one model, at certain stated prices. The dealer likewise always advertises the cars at this same price; in the vast majority of instances, he actually sells them at this advertised price. That this has been so universally the case is somewhat at variance with what one might expect to find in an industry of this kind. The retail automobile business is subject to marked seasonal fluctuation. The demand for cars is at its peak in the spring, when often twice as many cars are called for as during some winter months; it falls off somewhat in the summer months, declines still further in the fall, and is at its lowest ebb again in winter. A retail automobile establishment, moreover, is subject to much the same expenses, excluding those for salesmen who are paid on commission, all the year around, although the proportion of fixed or overhead charges to total expenses is, of course, less than is the case in manufacturing. Nevertheless, the fixed expense connected with the rental of quarters, the administration of sales and service, and the cost of demonstrators runs high. The distributor's gross profit, that is, the factory's discount from the advertised list price, runs normally from 20% to 30%; that of the local dealer from 15% to 25%. If the list price to the consumer were occasionally cut 5% or even 10%, there would still remain something in the way of a surplus to be set against seasonal "carrying charges."

Yet, in spite of the fact that one might expect that these cuts often would be made, and in spite of the fact that the manufacturer is legally powerless to prevent it, such price cuts have been made, on the whole,
rather infrequently. The influence of the manufacturer
in discouraging them, the feeling of many dealers that
it is not “reputable” to engage in such practices, above
all, the custom of a standard price and the acceptance
of the advertised price by most consumers without
question, all have led to a system of price maintenance
equaled in few other industries. To these should be
added, of course, the consideration that because of the
thirty-day or other short-time termination clause in all
dealer contracts, the manufacturer has always pos-
sessed the power to cut loose from any dealer at will;
and, the dealer “franchise” being an exclusive one, the
factory is not legally compelled to sell at wholesale to
anyone with whom it does not choose to do business.

Of late years, however, the maintenance of retail
prices is in some cases more apparent than real. The
allowance by the dealer upon the used car which he
often accepts “in trade” on the new machine affords
a much practiced means of disguised price cutting. If
any used car of any make be offered to different dealers
in the same city, the valuations made may vary greatly.
The practice of granting an allowance on a used car that
is more than the price at which it can be resold is, how-
ever, frowned upon by the factory and is probably
becoming less rather than more frequent. It has its
dangers for the dealer, in that he may easily go too
far. The used cars ordinarily must be repainted or
reconditioned before they are sold. Too high allow-
ances on cars, or too many used cars taken in trade
over a short period, not only tie up his working capital,
but may mean serious loss if conditions in the used
car market a month or two ahead should not meet
expectations. Indeed, some factories not only discour-
age the making of deliberate price cuts in this manner,
but advise the dealer as to just what allowances ought
to be made on particular makes and models of cars of
other makes.110

Price control, as well as controls of the other sorts
just mentioned, is, of course, exercised over dealers by
some manufacturers in other industries: in machinery,
in toilet articles, in retail clothing, to cite three exam-
examples. But in no other industry does the tendency to-
wards dealer control as a whole appear to have devel-
oped quite so extensively as in automobiles. Probably
the reason this control of marketing activities has been
so widely attempted by motor manufacturers is that,
as has been earlier pointed out, the product is a valu-
able one and is marketed through exclusive retailers
in the various territories. The factory might suffer
substantial losses on inventories, work-in-process, and
finished stores should the dealer, through having injured
the machine’s reputation in his locality by reason of
poor service or improper sales methods, be unable to
dispose of his quota of cars. Another reason why con-
trol over dealers can be effectively exercised in the
automobile industry is that commonly only one, or
at most two, intermediaries handle the product before
it reaches the consumer; to keep one or two intermedi-
aries “in line” is much easier than to control three or
four.
None the less, that such a rigorous system of control has been maintained is of interest. In so far as it can be shown to have conduced towards the advantage of manufacturer, dealer, and consumer alike, its thorough and successful trial here may lead other trades to follow it in several respects. The market distribution of automobiles is competitive, but the conditions of competition are tempered by a definite and customary—and therefore well-known and expected—set of practices which does much to avert that blind or cut-throat rivalry to sell which has been characteristic, at various times, of several other industries. And so long as conditions remain sufficiently “competitive” to protect the consumer against extortionate prices, there can be little doubt that such a tempered competition, with the rules of the game understood by all, is of more benefit to the community than “wild” production and market distribution unaccompanied by any checks at all upon the sellers. This concept of a “tempered set of competitive conditions” raises interesting and important problems of economic theory—problems which again go to the heart of the various theories of value and price.  

4. Speed Competitions and Reliability Contests

There remain to be noted, as a marketing feature during the industry’s history from 1913 to 1916, the numerous reliability trials and competitions which were held. A number of races and exhibitions had been conducted prior to 1900, but it was only after that
year that such performances came into full swing. It is not necessary here to chronicle the march of these many events from year to year, but a few may be noted as illustrative of what these contests accomplished.

On the one hand were automobile exhibitions and parades, upon the other, road and speedway races. In between these extremes of sport and daring ranged various hill-climbing contests and reliability tours. Some of these were national, some local in scope. Some contributed virtually nothing to the technical development of the automobile, while others contributed a great deal. Of the latter class, reliability tours and races were the most important. All the contests, however, had this much in common: they were competitive tests designed to show prospective purchasers which make of car was best. Thus they may be regarded primarily as marketing devices. Had it not been for the favorable publicity which manufacturers hoped to achieve, it is probable that few would have entered their cars in these contests. And because some manufacturers participated, others felt that they could not afford to remain out. Mr. Ford, for example, remarks that he was opposed to racing, but that, "As the others were doing it, I, too, had to do it."

Of the dozen or more reliability contests held each year, easily the most important was the Glidden Tour. A Bostonian, Charles J. Glidden, in 1903 offered a cup, to be competed for annually in a tour of not less than 1,000 miles. The first competition was to be held in the summer of 1905. It was open to all members of the American Automobile Association or "any club in the world recognized by them." It was evidently the donor's purpose to promote private touring and automobiling in general, and not primarily to found a competitive publicity contest for manufacturers; hence the stipulation that each car entered must be driven by its owner. But while some lay owners did enter, most of the contestants were manufacturing executives, many of whom themselves drove their cars.

Thirty-three cars started the first tour, run through New England. Twenty-eight of them finished. Scoring of performance was based on the frequency and seriousness of the troubles which each car encountered. The best score was made, and the cup won, by Percy Pierce, driving a Pierce-Arrow. Certificates of performance were awarded to the 28 entrants who finished the tour. Among the manufacturing executives who received such certificates were J. D. Maxwell (Maxwell), Walter C. White (White), R. E. Olds (Reo), Charles E. Walker (Pope-Hartford).

Of this tour a participant wrote enthusiastically:

The tour has proved that the automobile is now almost foolproof. It has proved that American cars are durable and efficient. It has shown the few who took part how delightful their short vacation may be, and it has strengthened our belief in the permanence of the motor car.

When this was written, cars had been produced commercially for about seven years. While production in the preceding year (1904) was 22,000 cars, the total
number produced since 1898 amounted to only about 68,000,\textsuperscript{118} of which probably not more than 40,000 were in use. It is thus easy to see why the permanence of the motor car was still doubted in many quarters. We rather smile today at the assertion that in 1905 the automobile was “almost foolproof,” bearing in mind that 5 of the 33 entrants did not even complete the run. For those days, however, 1,000 miles over country roads was indeed a severe test of a car’s endurance; it could be traversed far less easily than could twice that distance five or six years later.

The tours in the years which followed were held in various parts of the country, in the East, the West, and the South. That of 1906 was noteworthy for the defects in the car design to which it pointed, that of 1907 was marked by a seemingly feverish excitement on the part of the contestants and by several accidents, that of 1908 by dissension among the tourists and by protests against the scoring of the award. By 1909, the number of entrants (which had been 46 in 1907) had dwindled to 21. The reason for the decline, given by F. B. Hower, one of the officials, was that the manufacturers “were enjoying too much prosperity. They said, why should we enter this contest when we are unable to supply the demand now? The advertising will do us no good.”\textsuperscript{119} The year 1909 was one in which production, be it noted, had increased about 100\% over the preceding year. It was one of several years in which the automobile industry has seen “dealers come to the factory, stand in line, and beg for cars.”

5. Technical Contributions from the Early Tours

Immediately after the tour of 1906 had been held, a technical observer, Albert L. Clough,\textsuperscript{120} stated that the contest showed conclusively how imperative was the need of improvement in front axle construction. Both better design and materials were needed. Even those high-priced cars which were equipped with axles of the tubular type could not traverse 1,200 miles without the axles becoming bent. The tubular axle was then still made of material of the same quality as had been used in bicycle stock and could not stand the strain of country travel.

The same writer further pointed out that springs, as a rule, were woefully weak spots in the chassis and that if breakage were to be avoided in the future, either the long semielliptic type must be abandoned, or else better material must be employed.\textsuperscript{121} Tires also were punctured upon innumerable occasions during this journey of 1,200 miles, and brakes wore out rapidly whenever a mountainous stretch was encountered. The part of the car which gave the least trouble was the engine; relative to other parts, its performance was striking. It possessed enough power to “stress the running gear to the point of destruction in a few thousand miles of country running without itself being injured to any serious extent.”\textsuperscript{122}

This was in part because of the poor roads of the period. Paved roads in the country districts were virtually unknown. The dirt and sand roads, while often en-
durable for horse and wagon, were too full of ruts and holes to permit high rates of speed with either comfort or safety. Even as late as the 1909 Glidden contest, instances of the following character were reported:

After leaving Baraboo, 42 miles out [between Madison and La Crosse, Wisconsin] . . . . the road became exceedingly sandy . . . . at 79 miles we had to leave the main road and go through a grass-grown lane. At the end of this lane came a hill which was so steep that many contestants doubted whether they could have climbed it . . . . Luckily, they only had to descend it.128

A day's run during the 1909 Glidden Tour averaged 175 miles, but it was far from being a comfortable day's travel. Driven alone for pleasure, and not in a contest, it is doubtful if the ordinary car in the hands of the average owner-driver at that time could make more than 75 to 100 miles in a day of eight hours' travel.

There are available no transcontinental figures for the year 1909, but figures for the earliest of such trips on record, made in 1903, may be compared with one made 21 years later. The contrast between the two will illustrate the progress in engine and running gear construction which has gradually taken place from year to year.

What seems to have been the first transcontinental trip successfully completed was made by a non-professional driver in his own car. Dr. H. N. Jackson, a Vermont physician, drove his Winton from San Francisco to New York in 63 days.124 Finishing just a few weeks later, a Packard car sent out by the factory made the same journey in 61 days, averaging about fifty miles daily.125 In the summer of 1925, an eight-cylinder Cadillac sedan, under the auspices of American Automobile Association officials, left Washington, D. C. and four and three-quarters days later arrived in San Francisco. The 3,127 miles were covered in a total elapsed time of 4 days, 18 hours, and 30 minutes. The car was, of course, driven day and night and was equipped so that the passengers might sleep. The fact, however, that the passengers have attested they could sleep comfortably speaks volumes for the present condition of the country's highways as contrasted with that of earlier years. Another recent exploit of similar character, two years ago, was the trip of the Army flyer, Lieutenant Leigh Wade. With a companion, he crossed the continent in a Packard car without once stopping either the engine or the car itself. Gasoline was taken on, and the necessary lubrication performed automatically by the driver pressing a plunger, while the car was in motion.

Still more recently, several faster transcontinental trips have been made, the two latest ones at this writing being those of a Chrysler six-cylinder car which was driven from San Francisco to New York City in 3 days and 8 hours, and a Studebaker sedan which still more recently has made the same trip, but in the reverse direction, in 3 days, 5¾ hours.

Racing proper may be said to have begun in this country in 1895, when the Chicago Times-Herald staged a 54-mile contest around the city. This event was not exactly, however, a breathless affair. The 54
miles were covered in 8 hours and 23 minutes, the winner being Charles E. Duryea, who alone of the 31 entrants managed to finish. The American Automobile Association, however, held a 50-mile road race on Long Island five years later, which is by that organization regarded as the first real American speed contest. The winner, A. L. Riker, did the 50 miles in 2 hours, 3½ minutes. Dirt track, sand beach, and finally speedway racing followed. The first Indianapolis speedway race, run in 1911, was won by Ray Harroun, in a Marmon, which covered the 500 miles at an average speed of 74.6 miles an hour, a contrast with the 1900 record which tells its own story. More recent records are considerably higher; detailed tables will be found in Appendix A. Since about 1920, however, both the public and the manufacturers’ interest in racing has greatly declined. Because of the visible perfection of the motor car, manufacturers need no longer direct any great efforts towards proving the ability of their cars to show speed and to withstand “punishment.” Spectacular accomplishments are not longer necessary; good will towards a particular make of car is promoted both by magazine and newspaper advertising and by the daily service which the car gives in the hands of its owners, whose number is now so great that information from them may be obtained quite readily by prospective purchasers.
VI

THE ENTRANCE AND EXIT OF FIRMS,
1903-1926

1. The Shifting Personnel of Particular Industries

"At any particular moment in any branch of manufacture," wrote Alfred Marshall, "some businesses will be rising and others falling; some doubting whether to start new factories, others whether to enlarge existing factories, and to provide themselves with better appliances; while others again, feeling themselves behind the age, finding by experience that the equipment and internal organization of their factories will hardly enable them to sell at current prices and make a profit, will be tending to diminish their average output, or perhaps breaking down altogether."

If such is indeed the case in any trade, it will be of especial interest to inquire into the conditions of commercial mortality and survival in an industry during the first few decades of its existence. In the two and a half decades of its history which have elapsed, the automobile industry has grown from the workshop stage to such maturity as to give it first rank among the manufactures of the country. To analyze this amazing growth in terms of the rise and fall, the fortunes and misfortunes, of the individual firms which have played a part in it, is the primary purpose of this chapter and the two chapters which follow.

Between 1903 and 1926, inclusive, a total of 181 companies engaged in the manufacture of automobiles. That is, the 24 companies found actually to have been in production at the beginning of 1903, plus the companies which entered subsequently, made a total of 181 producers who, up to and through the year 1926, had built and sold passenger cars upon a commercial scale.

This figure, in comparison with estimates often made, and with one list which has already been published, seems very low. I doubt, however, whether the correct number of companies which have actually engaged in automobile production over the period 1903-1926, if it could be ascertained with the utmost accuracy, would run much over 200 to 225. The count here made of 181 includes the total number of firms for which I either have actual production data, or have good reason to believe actually produced and commercially sold cars. Undoubtedly there were during these years a number of other companies, some of which probably engaged in fabricating automobiles. Most of them, however, were business units, either incorporated or otherwise, which existed only in the minds of the men who organized them. Those which did make cars turned out only a few, often only a sample car or two. A number were "active," in this sense, for one year only, or even a shorter time. Any estimate which included these "paper" firms would run high indeed. To count them might throw light upon the number of
aspirants to automobile manufacture, but it would hardly afford a picture of the rise and fall of actual manufacturing establishments. In calculating total entrants and exits, therefore, I have included only such firms as seem actually to have produced and sold cars in a commercial way, firms which sold cars to customers other than merely their few principal stockholders or promoters, and which operated plants for more than merely two or three weeks or a month.

Of the 181 companies which, in this strict sense, engaged in passenger car manufacturing over this 24-year period, 137 have retired from the field. Forty-four now remain. These figures do not include three companies which have recently entered and build only taxicabs; nor, as will appear shortly, do they include newly incorporated subsidiaries of old companies.128

Of these 44, only 11 have been in business for the entire period. Some of the 44 entered only a year or two ago, while many others have been in the field for a decade or more. The average (arithmetic mean) length of life, for all 181 companies, has been 9.4 years. The median length of life has been 7.0 years.

The distribution of these companies according to the number of years they have remained in business is given in Chart 27 on page 169. But before proceeding to an examination of these frequencies, it is doubtless advisable to define more exactly what is here meant by the terms “length of life,” “entrance,” and “exit.” The length of a concern’s life is not taken to mean its continued corporate existence under one name, but the number of years during which it or a direct successor continued to produce motor cars constituting essentially the same line of vehicles. For example, in 1903 Thomas B. Jeffery and Company engaged in the manufacture of the “Rambler” automobile. This is counted as an entrance into the passenger car field. About 1912, following the death of Thomas B. Jeffery, the name of the car was changed to “Jeffery,” and the name of the company to The Thomas B. Jeffery Company. Then, in 1916, the Jeffery interests sold their properties to a group, headed by James J. Storrow and C. W. Nash, which had just organized the Nash Motors Company. But the Jeffery establishment was taken over as a going concern; the plant continued to operate as before; the distributing organization remained much the same. Though the Jeffery Company, as a corporate entity, completely disappeared, this is not considered as constituting an “exit” from the field of automobile manufacturing. The enterprise, an effective business at the time of its sale, continued in operation; its ownership merely changed hands. Thus the Nash car and the Nash Motors Company are not to be regarded as newcomers from the point of view of the rise and fall of firms, but as lineal descendants of the Rambler car and Thomas B. Jeffery and Company. Not only was the number of concerns in the industry left unaltered by this change in ownership, but no new capital was invested, nor old capital withdrawn, as its direct result. There did occur, to be sure, an expansion of the business under the new régime; but this
was financed largely out of earnings and might possibly have taken place in some measure anyhow.

There are in this compilation several such cases of changes in names, either wholly capricious or else the result of a complete transfer of ownership such as in the instance just cited. In all these cases, such changes are not considered to constitute either "entrances" or "exits." Combinations of existing companies have been similarly treated when the lines of cars manufactured were continued. Thus in the case of General Motors, the Cadillac, Oldsmobile, Oakland, Buick, and Chevrolet companies are not regarded as disappearing with their absorption into the holding company, but are counted as continuing in business. General Motors, now, happens actually to own the physical assets of its five car manufacturing divisions. But they are still separately operated and are generally still regarded by the trade as individual manufacturing and marketing units. They did not fail; they merely combined. Nor is General Motors, the holding company that was formed in consolidating them, counted as an "entrance." But when Cartercar, Welch, Scripps-Booth, and Sheridan (other one-time General Motor's units) were discontinued by the holding company and their plants liquidated, their disappearances are then counted as "exits" from the industry in the years in which liquidation took place.

Whenever a concern has been consolidated with, or purchased by, another already existing concern, and one line of cars has been discontinued as a result of the consolidation, this is considered as an "exit" from the field. While in the few instances in which this has taken place no great amount of capital may have been withdrawn, the effect has been, however, to reduce the number of producing units.

In the instance of an already established company merely adding a car to its line, but giving it a new trade name, the new "subsidiary" is not treated as a new concern, although it may be separately incorporated. Thus, for example, Essex Motors, Inc., building the Essex car, which was merely a low-priced car produced largely in the Hudson plant and marketed as a part of the Hudson line, is not counted as a new company as of the date of its organization. A different name was given this model primarily as a matter of marketing strategy.

It remains, in final explanation of the terms "entrance" and "exit," to mention the participation in automobile manufacture by firms already engaged in other manufacturing fields. Often these continued making sewing machines, wagons, plows, or locomotives after entering upon the manufacture of motor vehicles. In spite of the fact that no new corporation may have been created when this occurred, this should be regarded as the "entrance" of a new automobile firm. The withdrawals of such companies from passenger production (and it is an interesting fact that most of them have withdrawn) are "exits" in the tabulation of rise and fall, although there may have been no failure of any corporate unit at all. Instances of the various sorts
above mentioned do not, however, predominate among the concerns here tabulated; and except for such cases the term “entrance” means the organization and actual operation of a new concern; “exit” means failure and, ordinarily, liquidation; “length of life” means the elapsed time between the two.

2. The Length of Life of Companies and the Causes of Failure

It will be seen from Chart 27 that 48 of the 181 companies have enjoyed a life of only 1, 2, or at most 3 years. A life of 4 to 6 years is found for 40 other companies, while a duration of 7 to 9 years characterizes 26 other firms. The falling curve of the chart indicates that as the length of life increases, the number of companies enjoying it steadily shrinks. Only eight companies have remained in business 22 to 24 years, and only five have survived 28 to 30 years.

This distribution, expressed in terms of certain percentages, gives the following frequencies:

- 28% have lasted 3 years or less
- 49% have lasted 6 years or less
- 36% have lasted 10 years or more
- 19% have lasted 16 years or more

Put otherwise, the median length of life is 7 years; the first quartile is 3; the third quartile, 13.

How, it may be asked, do these lengths of life compare with those for firms in other industries? Unfortunately, there are no comprehensive figures available for other important individual trades or manufacturing pursuits, although something will be said shortly as to certain general percentages of failure which have been compiled by R. G. Dun and Company for all businesses taken together. But, even in the absence of satisfactory comparable data for other separate industries, it
seems evident that the mortality in automobile manufacture is high; only 33% of the firms which actually started at any time during this 24-year period still survive.

Upon second thought, however, that there have been relatively so many automotive failures is not so surprising. One would expect the hazards to be greater in a new industry, especially one making a complex fabricated product, subject to constant change and improvement in design and construction. This recurrent necessity of making innovations both in the character of the product and in methods of manufacture, if the place of a firm in the industry is to be maintained, probably serves to explain in large measure the complete disappearance of many automotive names that were once highly respected. Coupled with this imperative necessity of making alterations in the character of the product has always existed the danger of making them too readily or too drastically. For if insufficient change of practice means stagnation, so also do frequent and complete shifts of production policy spell manufacturing and marketing confusion.

Similarly, in the automobile industry, a delicate balance had always (and still has) to be struck between a policy of making too few models or "chassis types" to satisfy the demands of the market and one of simultaneously making too many types to permit a sufficiently economical production and a satisfactory control over manufacturing processes. As in other trades, the dealer ordinarily desires a complete, or fairly complete, line. He welcomes the production of an additional model which will sell in another price class, for then he can sell against the competition of a greater number of other makes of cars. But the experienced manufacturer knows that by the development of standard practice in plant operation, the more readily attainable through a policy of concentration upon one or two popular chassis types, he can markedly lower factory costs. Thus viewed, the greatest degree of economy in production at times seems to be incompatible with the fullest measure of success in market competition. But since a firm's net earnings are always a result (or, in mathematical language, a function) of both sales volume and production costs, the most profitable policy for a firm to pursue is seldom to increase sales alone, or to lower production costs alone, but always to find the proper point of balance between

Figure 19: Some Proud Trade-Marks of 1904.
these two variables. This point, for any particular product at any given time, being largely a matter of guesswork, of shrewd judgment coupled with trial and error, some firms have tended towards the one pole, some towards the other. Willys-Overland throughout most of its history, Studebaker in recent years, and Buick for a considerable time, furnish examples of concerns which have attempted to meet the demand of the dealer for a comparatively large line of products. On the other hand, Ford, Dodge, and Hudson offer three admirable illustrations of firms which, over periods running from 8 to 16 years each, not only made very slight changes in design from year to year, but also leaned strongly in the direction of simplifying production during any given period by concentrating upon a relatively narrow line of products.

The compromise policy which Hudson initiated in 1919 and which several other firms have adopted, namely, that of producing a second car under another trade name at the hands of a subsidiary company, will not here be discussed. In general, the extent to which it pays to diversify the line, even when another name is given the new car, depends upon the same considerations which obtain if the new model is not thus differentiated. This whole matter, however, raises some extremely interesting and significant questions of general business policy which I hope to consider at length in another volume. The proper number of models for a firm to make is not, of course, completely settled, nor would any standard which might be set up, however

sound it might seem, necessarily obtain either for all companies or for all periods. The trend of the last few years seems in the direction of increasing the line. Manifestly, the conditions of market competition here constantly interact with, and significantly influence, considerations of production.

It is clear, however, that in past years those firms which have leaned too far one way or the other in these two matters of supplying the dealer with either too large or too small a number of models, or in changing the design and construction of cars either too drastically or insufficiently at certain intervals, have fallen by the wayside. It is not, of course, here meant to imply that errors of judgment in connection with these several policies have been the only causes of business failure in this and other industries. There can be little doubt, however, that these have acted as important causes. Financial incompetence, lack of selling ability, pure administrative ineptitude, all have counted here, as elsewhere. But, allowing for all such individual ineptitudes in particular cases, the high general level of failures in automobile manufacture remains in large measure due to the great difficulties present in striking a proper balance between sales and manufacturing policies.

Likewise, the fact that the automobile industry has emphatically been one of "increasing return" wherein any increase of output brings with it, within very broad limits, a lowering of unit costs\(^\text{30}\) may also account in large part for the presence of this high rate of mor-
tality. In particular, the great savings made possible by internal plant economies place a premium upon large-scale production. The manufacturer who can materially lower his costs by the development of standard practice in manufacturing operations, possibly through concentration upon one or two popular chassis types, is often enabled to offer his product in a lower price class than the one in which he has been previously selling; and may thus drive many of the producers already in that price class to cover. Some of them may succeed in remaining there despite the newly offered competition, but others will have to attempt to serve a lower price class of buyers. If they cannot do this successfully, they are then driven out of business entirely. The causes of any particular failure may sometimes be understood through an analysis of the internal management factors involved in the particular enterprise, but frequently they can be arrived at adequately only through study of the practices and policies of competing firms as well. The rapid march of events in the automobile industry simply left behind those firms which could not keep in step.

3. Failures Year by Year

So much as to the causes underlying certain broad factors in automotive failures throughout the period 1903-1926 in general. What, now, of the specific course of failures from year to year? Both in absolute number and in the proportion of failures, has there been any marked variation?

A glance at Chart 28 will show that the answer is distinctly in the affirmative. The curves of this chart show the absolute number of entrances into and exits from the industry during each year from 1903 to 1926. The table below the chart gives the supporting data and, in addition, the number of firms left in business at the end of each year or at the very beginning of the year following. The solid curve represents entrances; the broken one, exits.

In tracing the relation between these two curves, it will be noted that they seldom rise or fall together in the same year. That is, they correlate inversely. A year in which many firms entered is, as might be expected, seldom a year in which many failures occurred. Conversely, in those years marked by a large number of failures, relatively few concerns essayed to enter the industry. For example, in 1909, with 18 entrances, there is but 1 failure, while in 1910, with 18 failures, there is only 1 entrance. In 1924 also, there are 15 exits and only 2 entrances.

This inverse correlation is, as the chart indicates, far from perfect. But in the main the figures justify the not startling conclusion that new firms choose "good years" in which to enter business, while "bad years" dissuade those with intentions of doing so. Certainly the 18 failures of 1910 served to cast an effectual damper on entrances in 1910-1911, and again, seemingly, the large casualties of 1922-1924 discouraged attempts to start in those years. The great number of companies which entered the field in 1912-
1913 is probably due to the launching of many plans which were postponed in 1910-1911. What caused the great number of entrances in the period of 1908-1909 itself is difficult to say. In some measure it may represent a recovery from the poor conditions of general business in 1907-1908; in some measure, a mere rush-
The entrance and exit of firms, 1903-1926

for other individual industries, there are available certain annual figures of general business mortality; first, for all business concerns in the United States, secondly, for all manufacturing firms in the United States in certain years. Messrs. R. G. Dun and Company present, in the various January issues of their Review, a record of general business insolvencies running over a period of 60 years and calculate the proportions for the period 1903-1926 for all concerns to be as shown in the following table:

<table>
<thead>
<tr>
<th>Year</th>
<th>Per Cent</th>
<th>Year</th>
<th>Per Cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1903</td>
<td>0.9</td>
<td>1915</td>
<td>1.0</td>
</tr>
<tr>
<td>1904</td>
<td>0.9</td>
<td>1916</td>
<td>0.9</td>
</tr>
<tr>
<td>1905</td>
<td>0.8</td>
<td>1917</td>
<td>0.8</td>
</tr>
<tr>
<td>1906</td>
<td>0.7</td>
<td>1918</td>
<td>0.6</td>
</tr>
<tr>
<td>1907</td>
<td>0.8</td>
<td>1919</td>
<td>0.4</td>
</tr>
<tr>
<td>1908</td>
<td>1.1</td>
<td>1920</td>
<td>0.5</td>
</tr>
<tr>
<td>1909</td>
<td>0.8</td>
<td>1921</td>
<td>1.0</td>
</tr>
<tr>
<td>1910</td>
<td>0.8</td>
<td>1922</td>
<td>1.2</td>
</tr>
<tr>
<td>1911</td>
<td>0.8</td>
<td>1923</td>
<td>0.9</td>
</tr>
<tr>
<td>1912</td>
<td>0.9</td>
<td>1924</td>
<td>1.0</td>
</tr>
<tr>
<td>1913</td>
<td>0.9</td>
<td>1925</td>
<td>1.0</td>
</tr>
<tr>
<td>1914</td>
<td>1.0</td>
<td>1926</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Thus in no year did failures much exceed 1% of all concerns engaged in manufacturing, trading, and other commercial pursuits. For manufacturing alone, Dun and Company do not give percentage figures, but they list the absolute number of failures in all manufacturing fields for the years 1910-1926. Such of these figures as can be related to the total number of establishments given for certain years in the Census of Manufactures are as follows:
These figures of approximately 2%, 1%, and 2% are to be compared with figures for automobile manufacturing, for the same years, of 7%, 5% and 1%. The last automobile manufacturing figure (1% for 1921), however, was abnormally low; it rose to ten times as much the year following, and still higher the year after that.

While the automobile "failure" figures here discussed are really "exits" and not in all cases insolvencies, the insolvency rate is clearly much higher than in general business. Of the 137 firms which have retired from automobile manufacture, at least 65, it has been ascertained, actually went into bankruptcy. The list is given in detail in Appendix C, pages 377-382.

4. Causes of Changing Rates of Failure

How, now, account for the great fluctuations in the year-to-year percentage of failures over the period indicated by Chart 29? For the slight fall in the percentage of failures from 1903 to 1907, it may merely be suggested that the relatively small number of companies in the field, together with an unusual prosperity enjoyed by the new industry in 1903, made the conditions of existence fairly easy during those years. But the succeeding period, 1908-1912, offers a fruitful field for analysis. If we ignore the 26% peak in the single year 1910, for which special factors account, a question first arises concerning the marked general increase in the percentage of exits during the year 1907-1912.

This rise seems to be due both to the rapidly changing techniques of design and production and to a great "tapering off" in the demand for high-priced cars. Between 1907 and 1910, single- and two-cylinder cars were practically abandoned. Four-cylinder machines were made, and many manufacturers found them more difficult to build. The transition to higher powers and weights involved the necessity of redesigning not only the engine, but often also the axles, transmission, and the rest of the running gear. If, for example, a firm attempted to utilize on a heavier model the same rear axle it had employed on a lighter, the results were often disastrous. The car would come to have a bad reputation; it was known to consumers, and especially to dealers, as a "lemon," or, perhaps at best, as a good car with poor rear axle shafts or axle housing. If any great quantity of such cars had been shipped, "making good" in a market sense often involved the prompt replacement, free of charge, of all parts already in consumers' hands. Unless this was done, both dealer morale and consumer demand fell off.

On the other hand, extensive redesigning of models meant incurring heavy expenses for new dies, jigs, templets, or even new machinery. It might also involve losses on certain items of inventory.
industrial field was the attainment of a nice balance between means and ends more necessary or more difficult than in automobile manufacture with its highly unstable conditions. What to make and how to make it, when to change and how much to change, to which class of consumer the product is to go and how to get it there, when to be bold and when to be conservative—these were indeed anxious problems calling for manufacturing, sales, and financial ability of the highest caliber. And, as in all business enterprise, chance has played a part. It is easy now to see the revolution in the demand for cars of several price classes which occurred after about 1907; but the manufacturer who obstinately stuck to their manufacture in 1909 had no chart to warn him. In retrospect, the lack of "progressiveness" is obvious in those concerns which retained a two-cycle engine or a chain drive; but the shrewdest men in the industry were often in doubt as to which course they ought to pursue. Even so clear-visioned and brilliant a leader as W. C. Durant at that time stated that one reason for amalgamating, into the General Motors Company in 1909-1910, concerns making so many widely varying products was that there was no certainty as to what would happen:

"They say I shouldn't have bought Cartercar," he said. "Well, how was anyone to know that Cartercar wasn't to be the thing? It had the friction drive and no other car had it. How could I tell what these engineers would say next? Maybe friction drive would be the thing. And then there's Elmore, with its two-cycle engine. That's the kind they were using on motor boats; maybe two-cycles were going to be the thing for automobiles. I was for

Conditions such as these probably explain the rising proportion of failures between 1907-1912. Constant uncertainty as to what the progress of the industrial arts would next bring forth was coupled with doubt as to the extent of the market and the preference of the public for particular types of vehicle. Not only did the demand for high-priced cars shrink relatively during these years; for a time it fell off absolutely as well. The extraordinary exit figure in 1910, of 26% of all firms engaged in the field, is probably due, above all, to the absolute falling off in the demand for high-priced cars which occurred in that year. Many manufacturers who could not, or did not, successfully adapt their facilities to the production of lighter-weight, four-cylinder vehicles during that and the two years which immediately followed, were obliged to retire from business. They were, in Marshall's words, the firms already "feeling themselves behind the age." The one producer who preeminently was ahead of his time in this respect was Ford. His company made a heavy 6-cylinder machine in 1907, but discontinued it in the following year and ever since, until 1927, stuck to the now ubiquitous light car introduced in 1908.

Following the year 1912, the percentage of failures fell almost steadily. It had been 12% in 1912; it became 7% in 1918, 6% in 1920, 1% in 1921. How explain a decline as great as had been the general ascent during the period 1907-1912?
In the first place, there was an increased ease of manufacturing. Not only were fundamental changes in design less frequent in this period, but the general growth of the industry had made the purchase and employment of good materials and standard parts a fairly simple matter. The establishment in 1906 of the Mechanical Branch of the Association of Licensed Automobile Manufacturers marked the beginning of a program of general technical research. The movement towards the standardization of materials and parts received a fresh impetus in 1910 when, upon the breaking up of the Association of Licensed Automobile Manufacturers, the Standards Committee of the Society of Automotive Engineers was formed. "The apparently easy path [of standardization] was strewn with pitfalls, which it took years of study and continuous effort to learn to overcome. All the records of the Mechanical Branch were turned over to the Society, thus combining the resources of both organizations and advancing the work at one step as could not otherwise have been done during a period of years."

Some details of this procedure have been mentioned in an earlier chapter, but its importance for the survival of many firms, especially the small ones, warrants further discussion. In 1907-1911, because of the absence of standardization (and thus the lack of interchangeability) in carburetors or ignition apparatus, "major alterations in engine construction were required to change sources of supply." Subsequent to 1912, however, conditions such as these disappeared. Not only were the specifications of fabricated parts standardized, but those of materials as well. The steel maker was no longer "enabled to get around a bad corner" by unloading an inferior lot of material upon an unwary automobile manufacturer; he had to meet the stringent engineering specifications available to all car designers and purchasing agents in the Society of Automotive Engineer's Handbook.

Not only did the purchase of standardized parts and materials become much easier between 1913 and 1921, but their cost became much lower. Production on a steadily growing scale resulted in both external and internal economies; lower cost enabled manufacturers to sell their products at lower relative prices, and each lowering of price increased the quantity sold. The number of entrances into the industry between 1913 and 1921 could greatly exceed the number of exits and the proportion of failures could be comparatively low, because most companies in the period produced inexpensive cars, and the market for low-priced cars kept on expanding at a remarkable rate.

The shift in number of producers serving these several markets, the low-, medium-, and high-priced car, is shown in Chart 30. The total figures of these frequency distributions are not, however, to be compared with the total numbers of companies in business each year as shown in preceding charts and tables, since some producers manufactured cars of several sizes and prices.

A further cause of the falling proportion of failures
between 1913 and 1921 probably lies in the fact that this period was one of rapidly rising general prices. Except for the year 1914 and a part of 1915, the country enjoyed general "prosperity"; money conditions were easy, full employment prevailed, large numbers of the working class received higher money wages than ever before. In accordance with the common difficulty of distinguishing real purchasing power from money income, many workers spent their wages more freely than ever; and the purchase of automobiles was a popular form of expenditure.

But with the crisis of 1920 and the depression of 1921-1922 came a sharp reversal of general business conditions. Twenty-two firms had entered the industry in 1919-1920; 23 withdrew in 1922-1923. Fifteen more exits were made in 1924. The proportion of failures steadily rose from 1% in 1921 to 21% in 1924.

Since 1924, however, failures have declined. Not as yet have the forebodings which the 1924 failure rate once suggested been realized. That rate, combined with the fact that 1924 was the first year, other than one of war or of deep general business depression, in which the total number of automobiles produced (in all price classes taken together) showed an absolute decrease from that of the year immediately preceding, raised some doubts, a year or two ago, as to the safety of a number of firms in 1925 and 1926. But such grave doubts the years 1925 and 1926 soon dispelled. The 1925 production figure was 3,855,000 cars (if automobile trucks are included, the number of motor vehicles produced totaled 4,300,000). This represented a slight increase over both the 1924 figure and the former high-water mark of 3,650,000 cars in 1923. The 1926 figures stood even somewhat higher still—3,900,000 cars, or 4,400,000 cars and trucks together.
(These figures include the Canadian production, which comes almost exclusively from American-owned factories.) In consequence, failures in 1925 fell from the 21% level of 1924 to but 14% in 1925, and to 12% in 1926.

5. Average Life of Firms Leaving the Industry

There remains one more tabulation. The length of life has been computed for all firms throughout the period 1903-1926. A final question which this computation ought to answer is: Did the average life of those firms which have each year failed become altered over this period? The figures on the average length of life presented above (9.4 years, arithmetic mean; 7.0 years, median) were for the entire group of 181 companies which engaged in business between 1903 and 1926. Thus there were included those firms which remain in business at present. If, however, these, the 44 companies now remaining in business, be eliminated, the averages that hold for the 137 firms which over a 24-year period have come and gone are slightly different: the arithmetic mean is 7.2 years, the median, 5.0 years.

The distribution of the mortalities of each year, based upon the individual lengths of life of the outgoing companies, is shown in Table 1 on the opposite page. The averages for each year, for quicker examination, are shown in Chart 31.

Both these arithmetic means and the median yearly figures for the life of outgoing firms fluctuated first
Enter the automobile industry, 1903-1926. (In 1907, none left.)

one way and then the other between 1903 and 1916. Neither figure had risen above 7.5 years by 1916, and both averages stood then about as they had in 1906, at 4 years as compared with 3.4 years in the case of the earlier year. But between 1916 and 1924 a marked and almost steady rise in both figures occurred, until by 1926 the median stood at 11.5 years, while the arithmetic mean (affected by the exit of several extremely old companies, each of which had lasted over 20 years) reached the slightly higher figure of 11.8 years. The reasons for the general increase of the median figure, which is not affected by these extreme cases, during the period subsequent to 1916 are doubtless the same as those which accounted for the marked decline in the percentage of failures from 1912 to 1920: increased ease in manufacturing and great expansion of the low-priced car market, with a growing recognition on the part of many companies that this was the profitable market. It was undoubtedly the stabilization in conditions of productive technique which chiefly caused this rise in length of life. Had there prevailed the same necessity for frequent radical changes in design and construction and the same difficulties in the way of making these required alterations as existed in the period before 1910-1912, many concerns would have been forced out sooner than they were.

What the future will bring in the way of exits from the field, now that the conditions of production have become relatively stabilized, will depend primarily upon the demands of the market. There is, of course, an interrelation between the prices of products and the ability of producers to offer given supplies of goods. But while the interaction of supply and demand may be held to determine the “normal” price of a competitive product over a long period, this “normal” or “long-run” price, in the economist’s sense of the term, is an elusive if not wholly nonexistent category in a rapidly developing industry where constant change is the order of the march. In automobile manufacture before about 1912, it was, speaking loosely, easier to sell cars than to make them. Since 1912, because of great technical strides, it has become much easier to make them. Now, with the annual aggregate demand for cars growing at a less rapid rate than in former years, it may shortly
prove to be easier to make automobiles than to sell them. What is here meant, however, should be made perfectly clear. Cessation of demand is in no way indicated and is, indeed, utterly unthinkable. But an apparent tendency towards stabilization, as evidenced by a marked tapering off of the curve showing the rate of production increase, is to be recognized. This means merely that the industry has come to maturity. How much higher its annual output (which, be it repeated, is still growing) can climb still remains an unsettled question. It will be touched upon briefly in the concluding chapter.

VII

THE RISE AND FALL OF FIRMS, 1903-1926

1. *The Relative Movements of Specific Firms*

The last chapter gave an outline of the rise and fall of all firms over the period 1903-1926. Figures were presented for both total and year-by-year entrances into, and withdrawals from, the industry. The purpose of the present chapter is somewhat different. Not failures in general, but the rise and fall of individual producers will be discussed; not mortality rates for the industry as a whole, but the progress of particular firms, each compared with the other, will be traced.

This analysis of the rise and fall of companies in terms of their comparative leadership in the industry divides into two parts. The first portion, which discusses in some detail the period 1903-1916, constitutes an examination of each company's history in order to see whether or not that firm ever was counted among the first 25% of all firms in the industry and, whether or not it could at one time be so counted, to ascertain what its fate was subsequently. The second part of the study undertakes a still more detailed examination of the exact positions of a smaller group of producers—those firms which have, at one time or another, definitively stood in the very forefront of the industry. The
2. Movements between Production Groups, 1903-1916

To trace the movements of specific firms in a comprehensive manner, all companies engaged in the manufacture of passenger cars at any time between 1903 and 1916 are ranked for every year according to the number of cars which each produced. The largest producer in any one year heads the list for that year, the others follow in order of rank. Thus arrayed, the list for each year is divided into three sections. The first or top grouping contains the highest one-fourth of the companies listed. The second or middle grouping then constitutes the central half, or the middle 50%, of all the companies arrayed in that year, according to their positions in production. The third or bottom grouping includes the lowest one-fourth of the roll of firms for the year. In the language of statistics, the first and third quartiles, and thus the interquartile ranges, are found for each series.

These division points ascertained, all firms which enjoyed a minimum life of five years or over during the period 1903-1916 may be specifically classified according to their positions above, below, or between these points in various years. If in such a classification the positions of specific firms are followed, the results will indicate how many of the firms remained in the first division, or above the first quartile, for each year throughout the entire period of their five years or more of existence; how many at one time standing above the first quartile sooner or later dropped to the interquartile range (the middle group), or even lower; or how many that were for a time below the third quartile (in the lowest group) ever rose to positions of leadership (the highest group).

The reasons for limiting the firms included in this count to those which have enjoyed a five-year life or more are fairly obvious. A firm which is in business but one year exhibits no rise or fall at all; while one that lasts but one or two years may evidence by its position nothing more than birth and death pangs. It rarely, if ever, rises to any substantial position, and its history belongs to the subject of entrances and exits, considered in the preceding chapter, rather than to that of rise and fall in the sense now meant. In ascertaining the movement of each firm, moreover, neither the first year's production figure nor the figures of the last two years of its existence (if it went out of business during the period here considered) have been counted. This latter procedure has been followed because it often took from 12 to 18 months after the occurrence of a crisis in a concern's life, or after a decision to retire, finally to wind up affairs. Thus, five years has seemed to be the minimum length of life which could well be established for the purpose in mind.

There were 63 firms which enjoyed this minimum life between 1903 and 1916. Many of these firms, of course, had lives much longer than this; a number lasted 8 years or more, and an occasional one lasted 12 or 14.
A number continued in business beyond 1916, and many of these still remain in the field. The average life which the 63 firms had enjoyed up to and including 1916 was: arithmetic mean, 10.8 years; median, 10 years.

Over this period of 14 years, then, we may note the rise and fall of these companies as depicted in Chart 32. From the preceding discussion, the construction of this rather unconventional-looking diagram should be fairly clear. Its top "box" or rectangle represents the group of firms standing above the first quartile, occupying positions of leadership; the bottom "box," those standing below the third quartile, in the lowest positions; while the middle "box" represents the interquartile range,

The 63 curves, or lines, of the diagram represent the 63 companies. The diagram covers no particular year between 1903 and 1916, but the period in general; those several curves which run straight across the diagram, for example, lines a and b in the top box, indicate that the companies they represent never changed their positions as between the upper, lower, and middle groupings throughout the entire period. Those curves which move, however, from one rectangle into another—which cross either or both of the two heavy black bands denoting the first and third quartiles—indicate that the companies they represent, at one time or another, shifted their positions to the locations indicated, remaining in the new positions either temporarily or permanently. The companies represented by curves h and i, for example, which start in the top box of the diagram, at one time during the period 1903-1916 produced suf-
icient automobiles to place each of them among the highest fourth of the companies in the industry. But at some later time both these companies dropped out of this class.

Examine now the movements of the 63 companies as shown in this diagram. Nearly half of them maintained their position within their respective ranges throughout the entire period: 28 curves run straight across the diagram. It should, of course, be clear that the parallelism of those curves which move together does not indicate parallelism of individual firms relative to one another within any one group or rectangle, but only that the firms represented remained in similar positions with respect to being above, below, or between quartiles.

Somewhat over half the total number, or 35 companies, in some year either rose or fell. Five of these 35 rose and remained permanently on the high level (curves $q$, $r$, $ccc$, $ddd$, $iii$). Nine fell and remained permanently on the lower level (curves $h$ to $p$, $aaa$, $bbb$). Of the other 21, all save one oscillated; they either rose and then fell again, or else fell, then rose again. The one which did not oscillate dropped twice—it fell steadily (curve $p$).

Now as to the detail; for here, as often, it is from an analysis of details that conclusions best come.

There were 7 firms which, so long as they remained in business, held in every year their positions in the first division (curves $a$ to $g$). Not all these firms, it is true, continued in business throughout the whole of the period, but the percentage of withdrawals among the firms which have at any time stood above the first quartile is in general quite small. Only in years prior to 1906 did any large proportion of leading producers undergo vicissitude. That these 7 firms retained their positions would seem to indicate that leadership in a new industry can be maintained, for 14 years at least, by a large proportion of the companies in the vanguard.

But leadership can also easily be lost. Nine other producers, each of whom in some year or other stood proudly in the first division, fell, in some other year or years, below it (curves $h$ to $p$). Seven of them sank to the middle group and there remained (curves $h$ to $n$). One of them fell to this middle division and later rose again to leadership (curve $o$). The ninth one remained in the middle division for a time, then dropped permanently to the bottom group below the third quartile.

Conversely, an almost identical number of producers, 8 to be exact, who were once members of the middle group, managed to rise for a time to positions in the first division, but before the close of the period rejoined the interquartile range (curves $s$ to $z$). Seven other members of this middle group fell at one time or another to positions below the third quartile; but in time they all returned to the range from which they came (curves $tt$ to $zz$).

3. Summary of Movements from Group to Group; Exceptional Cases.

The outstanding features of the progress of these firms between divisions may be summarized as follows:
Movements out of the middle range, made in either an upward or a downward direction, are decidedly temporary—they tend in time to reverse themselves; similarly, although to a lesser extent, upward movements from the bottom group into the middle group tend also to be temporary; but downward movements out of the first group tend to be permanent. To put it more vigorously, mediocrity, once surmounted, is soon reverted to; incompetence surmounted is also soon reverted to; but leadership, once lost, is hardly ever seized again. That only one of the 9 firms leaving their positions in the first division ever returned is somewhat startling.

A further feature connected with the rise and fall of these firms is that most of the movement has been between immediately adjacent groups; that is, from the top division (or from the bottom division) into the middle division or vice versa; not often from bottom to top, or from top to bottom. There are only 3 instances among all 63 companies in which movements of this more extreme type have occurred (curves $p$, $ccc$, $ddd$). These three firms have been investigated in order to ascertain what special circumstances, if any, were present.

The two cases in which there have occurred climbs from below the third quartile to above the first quartile are quite different in character. One (curve $ccc$) is that of a wagon works which engaged for some years in the production of automobiles, making a high-priced car. During the period here under consideration, this company, large and well financed, discontinued its high-priced line and purchased the business of another automobile firm, a successful maker of low-priced cars. With the excellent manufacturing organization thus acquired, the company had little difficulty in reaping the great gains attendant, after 1912, upon cultivation of the market for low-priced automobiles.

The second firm which successfully lifted itself out of a position below the third quartile (curve $ddd$) did so chiefly because of engineering skill. It, too, made an expensive car, but about 1907 it pioneered in the combination of several features which other makers were soon to follow and which only comparatively recently, among large cars, have been generally discarded. This company introduced the first car with a six-cylinder engine, four-speed selective type sliding gear transmission, and double ignition system employing a high-tension magneto. It was not only a well designed but an exceptionally well constructed machine, and immediately came into public favor throughout the country.

The third exceptional instance (curve $p$), also of a high-priced machine, is that of a firm which fell from above the first quartile to below the third. This decline involved a gradual loss of sales over a period of more than half a dozen years. The firm remained in business for 13 years all told. Its cars, especially in the latter years of its history, were handsome vehicles and enjoyed a good reputation. Except for the fact that the factory was located in New England, where conditions do not seem generally to have been favorable for
automobile manufacture, no good explanation for its decline has yet been found. It continued throughout its life to make high-priced cars—one model was exceptionally high-priced—and this may have contributed to its difficulties after 1911-1912, the market for high-priced cars, as has elsewhere been pointed out, having become temporarily "saturated" between 1912 and 1916.

The analysis of the movement of these 63 firms may be concluded by the following summary figures:

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
<th>of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number that neither rose nor fell</td>
<td>28</td>
<td>45%</td>
</tr>
<tr>
<td>Number that rose and remained on higher level</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Number that fell and remained on lower level</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>Number that either oscillated or else fell twice</td>
<td>21</td>
<td>33</td>
</tr>
</tbody>
</table>


If a similar analysis of the rise and fall of firms between quartiles be made for the period 1917-1926, what are the results, and how do they differ from those just obtained for the earlier period?

Eighty-four companies, each of which was in business for at least five years during the period 1917-1926, are included in this new diagram, Chart 33. While the facts of the analysis for the earlier period are fresh in our minds, we may at once summarize the situation for this later period as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
<th>of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number that neither rose nor fell</td>
<td>50</td>
<td>59%</td>
</tr>
<tr>
<td>Number that rose and remained on higher level</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Number that fell and remained on lower level</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Number that either oscillated or else fell twice</td>
<td>21</td>
<td>25</td>
</tr>
</tbody>
</table>

Chart 33: Movement of 84 automobile firms over the period 1917-1926.
It will thus be seen that, while a considerable movement between groups took place during this later period of the industry's history, the percentage of firms which "stayed put," that is, remained within the same group over the period, is substantially higher than before. The percentage of firms which oscillated is, conversely, somewhat smaller. The percentage of firms which fell and remained on the lower level is little different than during the earlier period. But the percentage which rose and remained on the higher level is distinctly lower (4.0% as compared with 8.0%).

Of the 10 firms which fell from above the first quartile, it will be noted that only two ever returned. Both of these, however, again dropped back. Of the seven firms which succeeded in rising to the top group from lower positions, only two remained there. One of these is now out of business, but the other still stands in the first division.

5. Movements of Conspicuous Leaders Relative to Each Other, 1903-1924.

The discussion of the preceding sections has dealt with the movement of firms from one broad group to another. The data to be presented in this and the section to follow concern the fortunes of certain conspicuously successful producers, each compared with the other.

Twenty-eight companies are included in this more detailed study. Most of them have tasted generously of success. Some attained the heights a score or more years ago and have subsequently fallen. Others have remained on a high level, while still others have only recently climbed upwards. All, however, at one time or another in their history, have ranked among the first 10 makers of passenger cars in point of the number of vehicles produced. As in the study of exits and entrances undertaken in the preceding chapter, the term "firm" or "company" here designates a producing unit rather than a corporate entity. Thus, the companies which now comprise the five divisions of the present General Motors Corporation—Buick, Cadillac, Chevrolet, Oakland, Oldsmobile—are counted as separate producers. It happens, however, that the more recently organized Durant group of companies, because of the form in which figures were available, is counted as a unit. This one anomaly in treatment occurs only in the last year which the study covers, and is therefore not serious.

The position of the 28 producers who in one or more years managed to qualify as members of the "first 10" are shown in Chart 34. Their positions relative to one another are given at three-year intervals. Curves A, B, C, to curve J, inclusive, represent the 10 producers who in 1903 led the industry in their individual volumes of production. Producer A was first; B, second; J, tenth. Follow their fortunes in the years that follow. Producer A is never again first. Producer B eventually stands in a position below tenth place and there remains. Producer G, once sixth, is likewise now in the "under tenth" category. And producers C, E, F, I, and
J are out of business entirely. Producer D alone has risen; he now heads the industry, a position which he has held for over half the period.

If there had been no rise or fall of leading firms at all, relative to one another, the several curves of the diagram would never cross. As it is, however, the chart looks almost like a field of battle. Only five firms other than Producer D have ever occupied the same relative positions at any two successive three-year intervals; only one, other than Producer D, has ever occupied the same relative position at three successive intervals, except, perhaps, for those which fell below tenth place. There is in the mêlée, it would seem evident, no such thing as the "representative firm" depicted in economic theory as "holding its position year by year," typifying the bulk of the establishments in an industry or trade. Whatever the validity of the concept for certain well-matured and more or less staple trades, clearly the "representative producer" is hardly yet to be found in automobile manufacture, not even over a period of 22 years of its history.

But while virtually no firms have retained exactly the same ranks from one time to another, some companies have maintained, for considerable periods of time, a much greater relative stability of position than have others. Observe, for example, producers D and M. But examine also the extreme oscillations of producers Q, R, and V, and the brilliant climb made by producer Y, within a ten-year period. And note that such producers as N and W, who both entered after
1903, occupied high places in 1906 and 1912, respectively, and now for many years have been members of the "under tenth" group.

Mark also the total number of quondam above-tenth-place producers continuing in production, as compared with the number who have gone out of business entirely. Nine have withdrawn or failed; 8 remain, but in the "under tenth" category.

6. Causes of Changes in Leadership

Of the 10 original leaders in 1903, only one remains a leader in 1924. What percentages of those who were leaders at one or more of the several three-year intervals subsequent to 1903 are to be found in this group in 1924?

As the gap towards the year 1924 narrows, there is a steady increase in this percentage. Of those who occupied tenth place or above in

<table>
<thead>
<tr>
<th>Year</th>
<th>Fraction Remaining</th>
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<tr>
<td>1903</td>
<td>1/10</td>
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<td>1906</td>
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<td>1909</td>
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<td>1912</td>
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<tr>
<td>1915</td>
<td>7/10</td>
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<tr>
<td>1918</td>
<td>8/10</td>
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Of the 10 leading firms in 1924, only two have been in the industry less than 10 years. But while nearly all these leading firms are seasoned producers in the sense of being a decade old or more, only three of them started before 1908-1909. In other words, although few firms organized within the last decade have sprung into the forefront, most of the present leaders are not strictly pioneer companies; they date back only about a decade and a half.

The history of these leading companies which are not "pioneer" organizations in the sense of having been started by 1903, or even by 1906, reveals, however, the fact that every one of them was organized by men who had earlier been engaged in the automobile business. And, with but one exception, all the men who headed these concerns had enjoyed not only automobile experience, but automobile manufacturing experience before they started their own ventures. Many of them—a surprisingly large number—had been associated with that pioneer exponent of quantity production, R. E. Olds, in the Olds Motor Works, between 1898 and 1903, at Detroit and Lansing. Howard Coffin, R. D. Chapin, and R. B. Jackson, all officials of the present Hudson Company; C. D. Hastings, of Hupp; A. Z. Mitchell, of Dodge Brothers; William E. Metzger and B. F. Everitt, of Everitt-Metzger-Flanders; Charles B. King, of the King Company; John D. Maxwell, of Maxwell-Briscoe; C. B. Wilson, of Willys-Overland—these are some of the men who early were connected in one manner or another with the Olds organization.

Others of the 1924 leaders were also once connected with pioneer firms. Thus, the Dodge brothers had made parts for Olds and motors for Ford since about 1900 and 1909, respectively. Indeed, they already not only possessed a well-equipped plant, but had acquired such a reputation in the trade by 1914 that, following the
announcement in that year of their plan to build and market a car of their own, over a thousand dealers throughout the country actually applied for the sales franchise before even a sample car was ready for display. W. C. Durant and some associates, who started the Chevrolet Motor Company in 1913, had previously been executives of the General Motors and other companies. W. P. Chrysler, before producing his own car in 1923, had been an official of both Buick and Willys-Overland. Similarly, the present Nash concern is not only the descendant of the old Jeffery company, but its head was at one time president of the Buick company and later of General Motors. It is thus important to note that all the most successful units organized since 1908-1909, while not pioneer organizations, have been piloted by pioneer manufacturers.

This helps to explain the success of many of the present leaders of the industry, but how explain the demise of those who led in 1903? On a priori grounds, it may perhaps be said that the producers who are the first in an industry will not all succeed, because the qualities required for innovation differ from those required for continued commercial success. Those men who are first to sense the significance of new mechanical devices, like the inventors of the new contrivances themselves, may often not be possessed of "practical" ability. Certain of those who pioneer in any field, though of great service in their day, may, through having become accustomed to methods and tactics which they themselves have developed, be loath to give up those once successful ideas in favor of methods later devised by newer and bolder minds.

There is doubtless truth in this generalization. But it is possible to point out a more specific application of this general reasoning. Most of the 1903 leaders who either went out of business or fell below tenth place in later years failed to sense the changes in market demand which took place. Their products were quite well made and often striking in appearance. But of these 10 leading firms, 8 either made or commenced to make heavy cars after 1904-1905. The craze for stupendous weights and powers, however, lasted only a few years. Yet all these 8 producers except one continued the manufacture of large models.

Four of the eight firms made large models which were excessively heavy and cumbersome. All four soon dropped from their leading positions. Eventually, three of them withdrew from the field. The fourth firm still continues to produce with substantial success, but has, of late, concentrated its energies upon a lighter type of chassis.

Only 3 of these 8 producers ever once attempted to market any model which sold under $2,500, and the lighter models which they did bring out about 1913-1914 constituted quite subsidiary parts of their lines. Thus these 8 producers all faced the relative decline which took place in the market for medium- and high-priced cars and took no advantage whatever of the great expansion of the low-priced field which began to develop in 1910-1911. Yet, it should be repeated,
nearly all of these 8 firms manufactured quite excellent products, as standards in those days went. Their failure to sense market currents, rather than any lack of technical or manufacturing ability, accounts for their displacement as leaders.

VIII

CONCENTRATION AND COMBINATION; MANUFACTURERS' ASSOCIATIONS.

1. The Scale of Production

In 1903, the largest plant in the automobile industry, the Olds Motor Works, made 3,922 cars. Today, the average annual (arithmetic mean) production per factory is 81,000 cars, while several of the larger factories make nearly as many vehicles daily as did the Olds Works in an entire year.

This growth in the size of production units may be seen in Chart 35. As in previous production charts, the curves are here plotted on a logarithmic scale in order to show accurately the percentage changes in each item. Curve A represents the production of the largest firm, Curve B that of the firm standing exactly at the first quartile, Curve C the median firm, and Curve D, the firm at the third or lowest quartile. The detailed data of this chart are given in Appendix B (page 348). Only the outstanding features of the growth will here be discussed.

The largest producer in 1903 made slightly fewer than 4,000 cars. This number gradually rose until in 1908 it stood at about 8,500 cars. Then, in the next year, this figure of 8,500 more than doubled. A differ-
ent producer than in 1903 occupied first place in 1909, but not yet the one who henceforth was to lead.

This doubling in the output of the largest firm between 1908 and 1909 (it happened that the same firm was first both years) was a part of the general exceptional rise in output (a 100% increase) which took place between those two years.151 Following 1910, the scale of the largest firm's production, the Ford output, regularly increased at a rate varying from 30% to 100% a year, until in 1916 it reached the then prodigious figure of well over half a million cars.

The range between this figure for Ford and that for the producer standing at the first quartile, always large, became steadily greater during this period. The size of the firm standing at the third quartile, and also the range between it and the lowest firm, likewise show increases as the industry grows. But the change here is not nearly so pronounced as with firms at the first quartile. The figures for the firms at the lowest extreme of each year's series are so small that they have not been charted. They oscillate throughout the period, never running up to 100 cars and often being below 20. They represent, in the main, companies which went out of business in the course of each year.

The interquartile ranges are wide. Since 1904, the firm represented by the first quartile has never been less than about 4 1/2 times the size of that standing at the third quartile, and in 1926 is roughly 50 times as large.

The median and the arithmetic mean production fig-
ures per plant,\textsuperscript{162} given in Chart 36, also show great variation. The great discrepancy between the two, both of which increase as the industry expands, is due largely to Ford, but in part also to the growth of a number of other producers standing above the first quartile. In 1913, for example, the first five producers together made 213,000 cars, while the total output of the industry was only 462,000 cars. Similarly in 1916, the first five companies together made about a million cars out of the 1,525,000 that were produced in that year.

A considerable concentration, then, has always ex-

listed. Even before 1910, the firms standing above the upper quartile seem to have produced from about 70\% to 90\% of the product. In 1926, the proportion was 88\%. Chart 37 shows the degree of concentration which has prevailed from 1903 to 1926, all producers included.

Chart 38 shows the same thing, but excludes Ford figures. It is worthy of notice that the degree of concentration has remained approximately constant over this period of 24 years; it is even slightly less now than it was in 1903, a fact which, as regards the automobile
industry at least thus far in its history, hardly supports the Marxian doctrine.

2. Combinations in the Industry's History.

Unlike the course of events in certain other industries, the concentration which has existed in automobile production has not been accompanied by any great amount of combination. Apart from the Ford Motor Company, which is in reality merely a highly integrated enterprise and in no sense a combination of the horizontal type, there have been only two notable attempts to amalgamate competing companies.\(^1\) One succeeded; the other failed.

The General Motors Company, organized by William Crapo Durant towards the end of the year 1908, started with assets of $18,000,000 and a net worth of about $9,000,000. It nearly met disaster in 1910, but with the aid of eastern banking interests was successfully refinanced. At the end of 1926, its listed assets totaled over $900,000,000 and its net worth amounted to about $640,000,000, exclusive of good will and patents. The rate at which the growth of the General Motors Com-
pany, or Corporation as it has been called since 1916, has taken place is evidenced by Chart 39, which shows its net worth as of the beginning of each year from the time of its organization in 1908. Besides controlling, either through ownership of their physical assets or through large stock interests, the Buick, Cadillac, Chevrolet, and Oakland companies, the Olds Motor Works, the Fisher Body Company, and the Yellow Truck and Coach Manufacturing Company, the corporation counts among either its owned or affiliated companies 16 different parts and accessory firms, 18 export and overseas companies, and the General Motors Acceptance Corporation, a company organized in 1919 to finance the installment sale of General Motors products. As with other automobile companies, the present net worth of the corporation has grown in considerable measure from reinvested profits. Of the $576,000,000 which has been earned on its common stock during the period 1909-1926, $313,000,000 has been paid out in dividends; $263,000,000, or 47% of the total earnings available for the common stock, has thus been reinvested in the business. But although like its competitor, the Ford Motor Company, the General Motors Corporation stands head and shoulders above the other automotive firms in point of size, it has in no sense ever attained a monopolistic or even dominating position in the industry, as did virtually, for example, the United States Steel Corporation in the iron and steel or the Standard Oil Company in the petroleum field. The percentage of the total motor vehicle output which General Motors has produced in each year from 1909 to 1926 is shown in Chart 40. The recent increase during 1925 and 1926 is due principally to the great success of its Chevrolet car in competing with the Ford, an episode which will be discussed in a later chapter. Further figures relating to the corporation are given in Appendix A, pages 325-328.

The other large combination in the history of the industry was the United States Motor Company, formed in February, 1910, under the leadership of Benjamin Briscoe, head of the Maxwell-Briscoe Company. It acquired a 99% ownership (or more) of the capital stock of eight companies, among which were the
Maxwell firm, the Columbia Motor Car Company, the Dayton Motor Car Company, and the Brush Runabout Company. It failed two and a half years later, with total assets of about $17,000,000 (exclusive of $12,000,000 of "good will"). The reasons for its failure are several, but the situation may be summarized by saying that the combination of companies was a remarkably haphazard one. Geographically, they were widely scattered; New York, Connecticut, Rhode Island, Massachusetts, Michigan, and Ohio were states represented. Two of the firms included were avowedly unprofitable in the period preceding combination and were taken in largely on the basis of the trade names of their cars. Out of the debris of this failure, the Maxwell Motor Company, Inc., was organized, and continued to make the Maxwell car. It alone remained, until very recently, of all the cars which had been brought within the United States Motor Company.

The reason that consolidations in this industry have been so few probably lies partly in the character of the product, partly in the conditions of demand during the early days of the industry, and partly in the attitude of the public towards it during this formative period.

Automobiles, however, are distinctly specialty products. Thus monopoly, in the sense of an all-exclusive control of the market in general, is almost unthinkable. Each producer has indeed a monopoly of his particular brand and design of car, and one producer may for a time enjoy a virtual monopoly in his price class, as did Ford for some years. But other makes of cars soon come to compete. Consumers have different tastes; they will pick and choose between different cars if these are offered. Even a reasonably large and powerful combination could not well hope to drive all competing cars off the market so long as these cars presented features, or combinations of features, not possessed by the products of the larger company. So long as room remains for innovations in design and construction, room remains for the "smaller fellow." It is to be doubted if genuine monopoly ambitions, aiming primarily at the fixing of price through substantial control over the conditions of supply, have ever seriously prevailed in the mind of any large producer.

But most manufacturers gave not a thought to the kind of reasoning here suggested. They were much too busy. And in this probably lies the chief reason why no combinations other than General Motors and United States Motor were formed. Throughout most of the history of industry, the demand for cars has been such that the successful producers have had almost all the business they could handle. Facilities, in many years, could not be expanded fast enough to meet the demand for the product; why then worry about combination with other firms? It is the unsuccessful producer—the manufacturer saddled with a fixed overhead and not enough business to "absorb" it—who has a strong motive to combine. He hopes to improve his condition thereby. Mr. Briscoe has stated the motives which, to his mind, stimulated combinations, in language as follows:
... There was always the thought that if we ... should ever drop so far behind competition as to make it difficult to sell our product "off the fire," we ... would find ourselves in a very unfortunate financial situation. ... I believe that at the bottom of every combination, either accomplished or attempted, there is the belief that through the proposed combination will be an opportunity for recapitalization, for securing more money to place the project in a better financial condition. It is often the claim that ... economies will be effected, sales effort concentrated, etc., etc., but I believe the history of almost every combination will show that the principal motive comes from being hard up. 

A third reason that so few combinations were effected was that little money was available for the automobile industry in its early years other than what was earned and put back into the business. Most automobile companies have been built up principally from reinvested profits. Of the $61,000,000 net worth of the Ford Company in 1916, only $28,000 was ever obtained from outside sources; of the Hudson Motor Car Company's $7,000,000 net worth in 1916, only $59,000 had come from elsewhere; of the Reo Motor Car Company's $9,000,000 net worth, only $144,000. With other companies, the situation was similar—in the vast majority of cases they have had to finance themselves. Thus it was not possible to offer much in the way of financial inducement to firms when one firm wished to purchase or to merge with another. The stocks of automobile firms, whether consolidations or otherwise, could not readily be sold to the public.

Mr. Briscoe puts well the skepticism which prevailed. The capitalists upon whom he at one time called, in attempting to finance his first automobile manufacturing concern, feared greatly that the industry was rapidly becoming overexpanded. This was a year (1904) in which production was 22,000 cars. They pointed out that the Olds Motor Works was making nearly 5,000 cars a year, the Cadillac firm planning a production of 6,000 cars, the Ford Company just recently organized and already swinging into production. "'How and where,' they asked, 'could all these cars be sold?'" Few bankers, especially outside of Detroit, were willing to risk capital in the industry. On the one occasion when eastern bankers did participate in an automobile transaction of magnitude, the refinancing of General Motors in 1910, they exacted the most stringent terms. An attempted combination between Ford, Buick, Maxwell, and Reo, four of the leading companies in 1908, fell through simply because Messrs. Durant and Briscoe (representing Buick and Maxwell, respectively) saw little possibility of obtaining sufficient cash to satisfy Messrs. Ford and Olds. The two latter were willing to combine, but demanded payments of at least $3,000,000 each in cash for their concerns instead of the stock of the combination which was offered to them. This is the only attempt which I have been able to discover of a serious effort at combination, other than the subsequent instances of General Motors and United States Motor, promoted, respectively, by the same two men, Durant and Briscoe, who but a short time before had hoped to combine their companies with Ford and Reo.
Figure 20: Four Pioneer Manufacturers Who in 1908 Discussed a Possible Merger of Their Companies.

WILLIAM CRAPO DURANT
Formerly president, Buick Motor Company; organizer and formerly president, General Motors Corporation; president, Durant Motors, Incorporated.

RANSOM E. OLDS
Builder of the curved-dash Oldsmobile and formerly vice-president, Olds Motor Works; chairman, Reo Motor Car Company.

BENJAMIN BRISCOE
Formerly president, Maxwell-Briscoe Company; organizer and formerly president, United States Motor Company.

HENRY FORD
Formerly chief engineer, Detroit Automobile Company; organizer and formerly president, Ford Motor Company; majority stockholder, Ford Motor Company.

3. The Association of Licensed Automobile Manufacturers.

But while combinations have been few, the formations of patent and trade associations in the industry have been important. Both the present National Automobile Chamber of Commerce and the Society of Automotive Engineers are outgrowths of a “License Association” formed in 1903 and not disbanded until 1911. The influence upon the industry of this organization—the Association of Licensed Automobile Manufacturers, or the “A. L. A. M.” as it was called, has, in several directions, often been both exaggerated and misunderstood. Its history may therefore here be outlined.

About 1877, George B. Selden, a patent attorney of Rochester, New York, and a graduate of the Sheffield Scientific School at Yale University, began directing his attention towards the development of a “road engine.” Two years later, in 1879, he filed an application for a patent upon this device, which existed as yet upon paper only. By shrewd, but quite legal, methods he succeeded in keeping his patent from being granted for sixteen years: that is, he constantly withdrew, modified, and reworded the claims of his application. In the language of Hough, District Judge, whose opinion was delivered in 1909, Selden “usually, after a rejection made or criticism offered by the examiner . . . . did nothing by way of amendment for about two years—the extreme limit of inactivity then permitted by the
rules of Patent Office practice. By these means he received in 1895 a patent for an invention of 1879, and in the meantime had never built a motor car, and never succeeded in getting anyone sufficiently interested in his theories to experimentally try them out.”

Meanwhile, the infant automobile industry developed quite independently of Selden and his patent, and the small factories of Duryea, Olds, Winton, and others began to turn out cars. In 1889, however, Selden assigned to the Electric Vehicle Company, a concern in which Messrs. George H. Day, W. C. Whitney, Anthony F. Brady, Thomas F. Ryan, and P. A. B. Widener chiefly seem to have been interested, exclusive rights to his patent with power to grant sublicenses. The storm was not long in brewing. The Electric Vehicle Company soon announced its intention of enforcing the “basic” Selden patent, and in 1900 brought suit against the Winton Motor Carriage Company. The latter, in its demurrer, asserted that the patent was invalid, contending that Selden’s plans, which covered “a road locomotive, provided with suitable running gear including a propelling wheel and steering mechanism, [and] a liquid hydro-

Figure 21: George B. Selden, who on November 5, 1895, received Letters Patent No. 549,160.

CONCENTRATION AND COMBINATION carbon gas engine of the compression type,” were not patentable at all because they constituted merely a combination of known and existing elements.

Coxe, District Judge, at once overruled this demurrer. Litigation continued; and on March 5, 1903, the Association of Licensed Automobile Manufacturers was formed by the Electric Vehicle Company and 18 other manufacturers, including the Winton Motor Carriage Company. A list of these charter members is appended to the association’s Articles of Agreement, which appear in Appendix C. In consideration of being granted a license to make cars, each manufacturer paid to the association a royalty of 1 1⁄4% of the catalogue (retail) price of all vehicles which he sold. Of this 1 1⁄4%, three-fifths was retained by the Electric Vehicle Company, the owner of the patent, and the other two-fifths went into the association’s treasury, any or all of which amount, at the direction of the executive committee, might be employed for legal expenses in enforcing the patent. Any residue remaining upon the termination of the agreement or “the dissolution of the association for any cause” was to be distributed to the members pro rata in accordance with their original contributions.

The association lasted eight years. Litigation was continuous; a number of manufacturers who refused to join organized a rival association, the American Motor Car Manufacturers’ Association. But in September, 1902, Judge Hough, of the Circuit Court, after probably the most exhaustive legal and technical considera-
tion of the details of any letters patent which has ever been undertaken, gave a decision upholding Selden's claims. The opinion was delivered after dozens of technical experts, some of them brought over from England and France, had testified, and scores of exhibits, including even a car which was built to order in accordance with the original Selden plans, had been presented. It constituted a smashing triumph for the Licensed Association, and by the end of 1910 nearly every recalcitrant manufacturer except Ford and Thomas B. Jeffery, another pioneer whose opposition was most determined, had either joined or taken out a license.

The proportion of the automobile industry's output upon which royalties were thus paid may be seen in Chart 41, which shows the percentage of total production by members and licensees, from 1903 to 1911. These figures are shown both excluding and including the Ford Company. Taken either way, the production of the Licensed Manufacturers amounted to approximately 70% to 80% of the total between 1903 and 1906. Then, due doubtless to the fact that, while litigation over the patent dragged on, no dire consequences to the non-licensed makers occurred and therefore few new entrants into the field joined the association, its percentage of production fell off by 1908 to only about 45% to 50% of the total. Following the court decision in 1909, however, the unlicensed manufacturers at once capitulated, and the association's percentage of output amounted, in 1910 and 1911, to practically 100% of the total, excluding the Ford production. Including Ford, the figure came to about 85% in 1910 and 70% in 1911.

The influence of the Selden association upon the development of the industry, although most important from the point of view of standardization and technical research, was neither so dominant nor so oppressive,
upon the purely commercial side of things, as might perhaps be imagined from these figures. The royalties, although large in the aggregate, were fixed at a more or less nominal percentage so far as the individual car maker was concerned: first $1\frac{1}{4}\%$, later, in 1907, at only $\frac{8}{10}$ of $1\%$. Thus, whatever the merits of the patent, no very enormous burden was placed upon the manufacturer. The total of all royalties, I have estimated, came to approximately $5,800,000$. Three-fifths of this sum went to the Electric Vehicle Company (and out of this share, an unknown amount to George B. Selden); while the remaining two-fifths was used by the association largely for legal fees.

Furthermore, the association in no way attempted to restrict the manufacture of cars. In the market, its members competed with one another vigorously. Whatever may have been the original intentions of the organizers of the Electric Vehicle Company, the Selden association was thus in no sense a monopoly. Membership in the association—or at all events, a license to manufacture—was open to anyone who could demonstrate that he was actually engaged in the production of gasoline automobiles and was not merely a “fly-by-night” seller of stock certificates or of a hastily assembled experimental vehicle. Both the size of the membership and the evidence given during the trial seem to establish this fact clearly. The association never attempted either to set any figures for the production of cars nor to place any limit upon the number of firms that could make them, save, of course, that it sought to restrain those manufacturers who would not join its ranks. It is true that after 1909, when more than 60 companies applied for membership, not all were admitted, but most of these, though not admitted to membership with the privilege of voting or attending the association’s meetings, were nevertheless granted licenses to manufacture. By limiting both membership and licenses, however, to concerns who were held to be “good and reliable manufacturers,” the association doubtless protected both the automotive industry and its customers, to some degree, from unscrupulous exploitation, and this, apart from whatever actual unsettling effects its various lawsuits may have occasioned, probably stabilized somewhat the general conditions of production and market competition. That consumers were in some cases actually intimidated from buying the products of perfectly “good and reliable” but unlicensed manufacturers is, however, quite probable; certainly the advertisements of the A. L. A. M. attempted to accomplish this result. In response to the association’s repeated warning “Do Not Buy a Lawsuit with Your Automobile,” the Ford Company offered to give each purchaser a bond protecting him against any damages that might arise from this quarter.

Such, then, was the situation at the beginning of 1911. The patent had been sustained—although in the language of Judge Hough, “a patent fit only for tribute”—and virtually all manufacturers except Ford and Jeffery had joined the association. But following Judge Hough’s 1909 decision, the case had been carried
Gasoline Automobiles and Selden Patent

Figure 22: A Typical Advertisement of the "Licensed Association" During Its Campaign to Enforce the Selden Patent.

To the Circuit Court of Appeals, and the decision which that court announced on January 9, 1911, spelled the end of the Licensed Association.

The patent, after eight long years of litigation and the accumulation of 26 volumes of testimony, was still sustained. But—it was held that the Ford Company had not infringed it. The technical basis for this conclusion need not here detain us; the difference between compression and noncompression, between constant volume and constant pressure hydrocarbon engines, concerning which the lawyers and technical experts had wrangled for so many years, will not here be discussed. It will suffice to state that the Selden patent was held to cover only road vehicles propelled by the Brayton type of engine, in which the charge was compressed by an outside device before being introduced into the cylinder; whereas the Ford car, in common with every other motor vehicle of American manufacture, was propelled by an engine of the Otto type in which the reverse of this was true. If Ford had not infringed, then no one had ever infringed; and the Association of Licensed Automobile Manufacturers was dissolved.

4. The National Automobile Chamber of Commerce

In its stead, arose the Automobile Board of Trade, and then, succeeding it in 1913, the National Automobile Chamber of Commerce. The Society of Automotive Engineers continued the technical research begun by the Mechanical Branch of the old Licensed Associa-
tion, while the National Automobile Chamber of Commerce, in which now were included all firms save the Ford Motor Company, became the automotive makers' trade association. To this day, the Ford Company has not joined the chamber, although the Lincoln Motor Company, now a Ford subsidiary, is a member.

The most significant aspect of the activity of the National Automobile Chamber of Commerce is that while, like the association which preceded, it has no monopoly power, it substantially alters the character of automotive competition. For one thing, each company reports its production to the chamber monthly, and each company receives monthly, in confidence, both the combined and the individual reports of every other member. Thus each firm knows exactly what the state of his competitors' business is; there are no secrets as regards either the volume of sales in units or their value in dollars. Such a cooperative interchange of information—until recently upon a quarterly rather than a monthly basis—has existed since 1903.

More unusual and important, however, is the arrangement by which members of the National Automobile Chamber of Commerce "cross-license" all patents. This unique co-operative arrangement, adopted in 1915 largely under the leadership of C. C. Hanch, now embraces 300 separate patents which relate to various parts of an automobile. Each member of the chamber permits any other member to use, without the payment of any royalty, any patent which his firm owns; and he in turn, is privileged to use freely any or all of the
patents now owned or newly developed by his competitors. The tremendous importance of this unusual system of cross-licensing becomes at once apparent if it be reflected that in the absence of such a scheme, an individual or a firm which developed one new automotive device would, if it sought to manufacture cars, have to obtain licenses and pay royalties to use several hundreds of other patents, or else infringe on them. Excessive legal entanglements which might thus have resulted have been avoided by the cross-licensing agreement. During the twelve years in which it has been in force, not a single lawsuit between chamber members relating to any patent covered by the agreement has taken place. "Revolutionary" patents, for example, entirely new types of engine such as the Knight motor, or an entirely new type of transmission, are not included in the agreement, nor are external body shapes or other "design patents." To date, however, no mechanical or electrical patents have developed which have constituted such radical departures from present practices.  

This cross-licensing agreement, as it was adopted in 1915 and continued in force until 1925, thus included not alone patents which members owned in 1915, but also all patents which might be taken out up to the year 1925. In 1925, the agreement was renewed for a five-year period. The renewal, however, includes only the patents taken out previous to 1925, not new patents which are obtained now. The reason for not including currently obtained patents in the new agreement is that certain of the larger companies now spend such huge sums in the deliberate development of new designs that it was not considered fair to ask them to contribute the results of this research gratis to the entire industry. Technical improvements formerly came from many different quarters, and came almost inevitably, one might say. Now, with the industry having reached maturity and the motor car a comparatively perfected product, the bulk of the new devices and designs seemingly arise chiefly through a process of deliberate and organized research—a program which is undertaken principally by the larger concerns; hence the alteration in the patent agreement.
THE FORTUNES OF LEADING PRODUCERS

1. The Net Incomes of Ford, Reo, and Packard, 1905-1926

The firms that have engaged successfully in the automotive industry for a number of years have enjoyed prosperity in varying measure. It will be of interest to examine their gains, first individually, then collectively.\textsuperscript{174}

Incorporated June 16, 1903, the Ford Motor Company started with $28,000 paid into its treasury.\textsuperscript{175} Not a dollar additional has been invested in this business apart from earnings.\textsuperscript{176} Its gross assets in 1926 totaled $784,000,000; its net worth was approximately $700,000,000. All the stock of the company is owned by Mr. Henry Ford, his wife, and his son, Mr. Edsel B. Ford, its present chief executive. At the outset, Mr. Henry Ford owned but 25\% of the stock; but in 1906 and shortly thereafter he purchased a sufficient number of shares from other stockholders to raise his holdings to 58\%.\textsuperscript{177} In 1919, Mr. Edsel Ford bought from the Dodge Brothers, James Couzens, and others, the entire remaining 41\% of stock. The price paid for these shares was approximately $75,000,000, or $12,500 for each share of $100 par value.\textsuperscript{178} The company earned in net profits in that year $69,000,000;\textsuperscript{179} in each of the two years immediately following, it earned roughly about the same, and in 1922, 1923, and 1924, about $100,000,000 or over each year.\textsuperscript{180}

The present plant capacity of the Ford Company is probably about 2,000,000 or more cars and trucks a year. Though the company by no means makes all the parts for its cars, it is the most highly integrated concern in the industry. It operates not only blast furnaces, foundries, and coke ovens, but also saw mills, steel freighters and lake steamers, a railroad, and maintains a daily airplane service between Dearborn, Michigan, and its Chicago plant. It has 32 establishments scattered over the United States and employed in 1925, exclusive of foreign branches and plants, over 161,000 persons. In the year 1921 it made over half of all the automobiles produced in the United States. What its percentage of the total output of cars and trucks has
been in other years before and since 1921 can be seen in Chart 42.

The yearly rates of profit which, from 1905 to 1926, have financed the Ford Company's remarkable expansion are shown in Chart 43. Never below 45% until 1917, its annual net earnings have several times equaled over 100% upon net worth. The rates of profit for the year 1907 and 1910 are not shown in the chart because the vertical scale does not run high enough. They were 378% and 215% respectively. Also, the chart does not show the earnings for the 15½ months' fiscal period ending in 1904—283% upon net worth.

Commencing with the year 1917, however, the company's rate of earnings underwent a marked decline. Only in two years of the 8-year period 1921-1924 did earnings reach 40% or higher. Always, however, they
exceeded 20%, except in 1924, 1925, and 1926, when they fell to new low points of 18.3%, 12.1% and 9.2% respectively. The profits figured for the years 1922-1926, however, are merely estimated (the Ford Company has not made public its earnings for those years) and may not be nearly so accurate as for the earlier period. The basis of these estimates is explained in Appendix B, pages 352-354.

This remarkable record of rate and amount of profits over a 20-year period (only after 1923 did the rate fall below 20%) has probably never been equaled by any manufacturing enterprise. The reasons for it seem to center about the recognition, on the part of Mr. Ford and his aides, of two fundamental economic principles. In the first place, they have fully appreciated the fact that larger quantities of any useful article can be sold as the price is lowered, and that the sales of some articles may thus be increased far more than in proportion to the decrease in price. In the automobile business, the application of this simple principle of elasticity of demand was of vital concern. Coupled with it was the concept of cost to the consumer as embracing more than original outlay. Thus, the Ford car was light and was simply made and, in comparison with other cars up to about 1916-1918, cost little to operate.

The other principle so firmly grasped by Ford is nothing more nor less than that of the division of labor. The enormous gain in productive effectiveness which ensues from specialization in production is primarily what has enabled the steady price reductions which
detailed history of this organization has been published. The few short works which have been written are for the most part either eulogistic or condemnatory.

The two other highly successful producers whose history stretches over a 20-year period or longer, apart from those firms now included in the General Motors Corporation, are the Reo Motor Car Company and the Packard Motor Car Company. The Reo Company was organized at Lansing in 1904; the Packard firm originated at Warren, Ohio, in 1900, but was moved to Detroit in 1903. The one engaged at the beginning in the production of fairly low-priced cars; the other has always made an expensive product, although of recent years it has made medium-priced cars also. Both concerns, like most other automobile companies, have been built up chiefly out of income. The Reo Company started with less than $100,000. No additional funds have ever been invested, other than earnings. Its net worth in 1926 was nearly $50,000,000. The Packard firm sold additional shares some years after it was organized; nevertheless, 81% of its $45,000,000 net worth in 1924 represented reinvested profits.186

The rates of profits which these two firms have enjoyed from 1905-1924 are shown in Chart 43 also. The Reo curve in general runs higher than the Packard one; but both set of figures, prior to 1910, stand well above 40% each year. Both curves in general follow the Ford curve, but stand well below it at nearly all times prior to 1917. On several occasions, Reo's annual rate of profits has reached 60% or higher.
noted, have earned somewhat higher profits in several recent years than have most of the producers already mentioned, but their rates of return have oscillated somewhat sharply. The Studebaker earnings evidence a general rise during the period for which they are shown. They are charted only from 1921 on because of the fact that prior to that date they included the profits of that firm's wagon business, which was liquidated in 1920.
The average measure of success attained by four of these companies, together with another firm, the Pierce-Arrow Motor Car Company, whose earnings have not been charted here, is reflected in the annual price ranges of their shares on the New York Stock Exchange from 1917 to 1926, presented in Chart 46. These averages, unlike many compilations of stock prices, have been computed so as to make proper allowance for stock dividends and new stock issues. They show that the figures at which the common stocks of these five companies, Willys-Overland, General Motors, Packard, Pierce-Arrow, and Reo, sold in 1926 averaged a low of 214 and a high of 344, as compared with figures of 44 and 71, respectively, in 1917. The 1926 low and high figures represent increases of 382% and 385%, respectively, over the 1917 prices. For comparative purposes, the ranges of 50 industrials and rails are charted also. Their 1926 low and high, respectively, average only a 74% and a 51% increase over the 1917 figures.

The enormous gains reaped by the few fortunate persons who early committed their funds to that "visionary" branch of manufacture, the automobile industry, may again be stated in a still more striking manner. To take four examples: $10,000 invested in the common stock of the Reo Motor Car Company at its organization in 1904, with no further contribution of funds or purchases of stock, would have amounted to an equity of approximately $2,000,000 as of the end of 1926. The same sum invested in the Hudson Motor Car Company in 1909 would, by the end of 1926, have amounted to approximately $4,500,000. Had $10,000 worth of the General Motors Company's stock been bought in 1908, the holder would have had an equity of approximately $650,000 in 1926; while the market value of his shares, at the high quotation of that year (225/4) would have been well over $1,000,000. This assumes that no rights to purchase new stock issued by the General Motors Corporation had been exercised. But had all such right been taken advantage of, the total cash outlay would have amounted, by August, 1927, to $99,500; the total market value of the shares held, to about $1,675,000; the total market value of
the holdings plus the cumulative total of cash dividends received, to slightly over $2,000,000. 187

Finally comes the fourth illustration, that of the greatest "money-maker" of all time. Had $10,000 been invested in the Ford Motor Company in 1903, this sum would have constituted nearly one-third of its entire paid-in capital. With no further cash investment whatever, this sum would, by the end of 1926, have amounted to the unbelievable equity of $275,000,000 (two hundred and seventy-five millions of dollars). 188

3. The Level of Profits as Represented by Nine to Fifteen Large Concerns

If the capitals and the earnings of these several producers are now surveyed as a whole, it may be possible to draw some tentative conclusions as to profits in a new industry. In order to ascertain earnings for the entire industry, it would be necessary, according to Marshall, to subtract "from the aggregate profits of the successful . . . . the aggregate losses of those who have failed . . . . then divide the remainder by the sum of the numbers who have succeeded and those who have failed." 189 Although this counsel of perfection cannot be followed in this case, nor, perhaps, with exactitude in any industry, it is nevertheless worth while to plot, as in Chart 47 on page 256, the annual earnings, or losses, over the period 1910-1926, of all companies for which the individual profits figures have already been given. To these, to make the picture as complete as possible, are added the earnings of the Pierce-Arrow Company, for which data have been obtained running back to 1916.

There are included in this compilation, then, 10 enterprises which are separately controlled as of 1926 (counting General Motors as only one company), but the number of separate producing units ranges from 9 to 15 throughout the period. As of 1926, the number of such producing units included is 14; the capitals of the following are included: Cadillac, Chevrolet, Buick, Dodge, Ford, Hudson, Lincoln, Nash, Oakland, Oldsmobile, Pierce-Arrow, Reo, Packard, Studebaker, and Willys-Overland.

Though this figure (9, 12, or 15 companies) represents in no year more than about one-quarter of the total number of companies engaged in the industry, it includes, especially in recent years, a very considerable proportion of the industry's invested capital, in 1926, 88%. The extent to which these figures are indicative at various intervals of the industry as a whole (cars and trucks combined) 190 can be seen from the table on page 254.

Total capital figures for intermediate years prior to 1919 are not available. It is probably true, however, that in the years prior to 1915 the net worth of the firms here included constitutes somewhat less than one-third of the capital of the whole industry; from 1915 to 1918, probably, on an average, about one-half the total; while from 1919 on, it represents by far the larger proportion of the industry.

The earnings here listed, therefore, do not indicate
THE AUTOMOBILE INDUSTRY

Capital Invested
(Millions of dollars)

<table>
<thead>
<tr>
<th>Year</th>
<th>Whole Industry*</th>
<th>Producers Here Included</th>
<th>Percent of Total Capital Here Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>1910</td>
<td>174**</td>
<td>35</td>
<td>20%</td>
</tr>
<tr>
<td>1914</td>
<td>407</td>
<td>107</td>
<td>26%</td>
</tr>
<tr>
<td>1919</td>
<td>1,015</td>
<td>606</td>
<td>60%</td>
</tr>
<tr>
<td>1923</td>
<td>1,571</td>
<td>1,200</td>
<td>77%</td>
</tr>
<tr>
<td>1924</td>
<td>1,601</td>
<td>1,374</td>
<td>81%</td>
</tr>
<tr>
<td>1925</td>
<td>1,888</td>
<td>1,600</td>
<td>85%</td>
</tr>
<tr>
<td>1926</td>
<td>2,089</td>
<td>1,838</td>
<td>88%</td>
</tr>
</tbody>
</table>

* Net tangible assets.
** This is the 1909 census figure; no estimate for 1910 is available.

"the general level of profits," or "average profits," at all accurately. Undoubtedly, the average level of these figures is consistently somewhat higher than would be the case if all the companies that ever engaged in automobile manufacture were included. But it is probable that if a curve representing all producers could be drawn, it would, in its general contour, follow the curve for the successful producers, though at some unknown lower level. It is permissible to doubt whether the losses of the unsuccessful, which Marshall suggests are to be subtracted from the gains of the successful, though perhaps substantial absolutely, would be large relatively in this industry. As has been pointed out, very little of capital in the industry, proportionately, ever came through outside investment. The only way in which any relatively large amount of the total capital which came to be invested in automobile manufacture between 1903 and 1926 could have been dissipated would have been for a number of one-time prosperous concerns to have lost a large part of the earnings which they had reinvested. But this occurred very infrequently; for, as has already been pointed out, few firms that were markedly successful subsequent to 1906 ever met with misfortune, while those producers who were successful prior to 1906 and later lost money, had invested, under the scale of production which then obtained, a relatively small amount even in the aggregate, that is, a sum small in comparison with the huge total of all the capital that was invested in automobile manufacture over the entire period 1903-1926.

Chart 47, then, indicates the average earnings in the industry, as represented by most of the leading companies, between 1910 and 1926. The solid curve is for all companies; the broken curve, for all companies excluding Ford.

In most years prior to 1917, this group of leading companies earned 30% or over upon net worth, falling under 20% in only one year (the bad year, 1911). In three of these years earnings amounted to 50% or more upon capital. And never except in 1921 have net earnings fallen below 15%; never, even in 1921, has there occurred a net loss for the industry as a whole. Excluding the Ford figures, the record runs somewhat lower, but, except for the deficit of 1921 (caused chiefly by a General Motors Corporation loss of $38,000,000), the contour of the two curves is about the same.

That contour is interesting. Ignoring year-to-year fluctuations, the level of profits for all producers rose
markedly from 1911 to 1916, then fell off substantially. In the years before 1917, though oscillating greatly, earnings averaged annually about 40%; from 1917 on, though oscillating somewhat, they have averaged only about 20%. In the last year for which data are available (1926), they stand at 19.8%. Profits for 1927, and perhaps for a few years to follow, may again possibly be as high if not even somewhat higher than for 1926; but it is greatly to be doubted if they will ever again reach the 40% to 50% level of the period which ended in 1916.

4. The Nature of Profits in a New Industry

If it is to be assumed that these 9 to 15 leading firms are typical of the industry as a whole, the contour of this curve in a measure accords with certain accepted tenets of economic theory. It is not to be supposed that the earnings of a competitive trade could remain permanently at an unusually high level without additional producers being attracted to the field and offering substantially similar products at prices so low as to reduce the average percentage of net return. As Marshall again remarks, "the average rates of profit in a trade cannot rise or fall much without general attention being attracted to the change before long."104 Even though demand continues to increase in both the schedule and the market sense,103 an assumed flexibility in supply presupposes something in the way of rough adjustment of price to cost "before long."

But the question of how long is of interest and im-
portance. Often the shifting of productive energies and resources cannot be accomplished, in several months or even in several years, in sufficient measure to satisfy a new and rapidly increasing demand. Not only is much capital fixed, much organization relatively immobile, but what free capital does seek investment is often timid. The risks of manufacture in the automobile industry were readily assumed by men with entrepreneurial abilities, but few capitalists were found willing to venture their funds. There seems to have existed sufficient organizing and managerial talent, but not mobility of capital in the traditional sense. Professor Lawrence H. Seltzer holds that capital was mobile with respect to its diversion to the purposes of automobile manufacture because the parts makers sold on credit to the motor car manufacturers and thus gave the latter considerable indirect command of productive resources. But though this suggestion throws interesting light on the processes by which production in a new industry is attained, it does not corroborate the traditional view that capital is mobile in the other sense—that of readily flowing for direct investment towards new enterprises which promise substantially higher returns than the general run of businesses.

In this new industry business profits thus appear principally as wages of management and as compensation for risk, rather than as a high interest or dividend return upon capital invested. There was little or no outside capital invested in the automobile industry; there was only capital reinvested by men who started with hardly any capital at all. And the returns on this reinvested capital are inextricably mixed with the returns to the managerial ability of the men who decided to expand the businesses which they operated. These managers themselves owned most of the stock, and thus most of the invested capital, for there was in these concerns seldom any bonded indebtedness. In striking contrast with most modern large-scale enterprises, the executives in the automobile industry were actually owner-managers; they were entrepreneurs in the older sense of the word. The return they received thus constituted primarily the result of their labor in organization, of their current decisions as to what to make and on how large a scale to make it, of their willingness to devote themselves to a new and as yet risky profit making enterprise.

Their judgment as to the future of the industry happening to be sound beyond their fondest hopes, some of them made huge profits. But even after it had been demonstrated, over a half-dozen years and more, that great profits might be made in automobile manufacture, capitalists hesitated to invest their money. The funds to finance expansion still had to come, as before, out of the industry’s earnings. Thus it took about a decade for the average earnings of successful automobile firms to fall much below 35%. Though the series of figures here presented does not go further back than 1910, there is evidence of high earnings on the part of several companies established between 1900 and 1910, and while such earnings may not have generally pre-
vailed for a ten-year period prior to 1916, they did for at least an eight- or nine-year period.

By 1916-1917, however, not only had a great deal of capital come to be invested in the automobile industry through this constant process of “ploughing back” earnings, but risks had greatly diminished; in part through the general acceptance of the automobile by consumers, but especially because of a much greater ease of manufacturing brought about by the development of standard methods and practices and improved machine-tool technique. Yet automobile manufacturing still appears to offer sufficient obstacles in the way of “free competition” to enable earnings, a quarter of a century after the industry began, to continue upon a somewhat higher level than that of the general run of industries. It may be that this fact is due, in part, to the “quasi-monopolistic character” of each automobile manufacturer’s product, which was suggested in an earlier chapter. But the automobile industry ranks, nevertheless, as a competitive industry; it is as competitive as most industries and certainly far more competitive than many.

That there is clearly a tendency, however, for the differentials existing between producers in this field to become narrower is shown by Charts 43 and 44. In 1926, the rate of Ford profits (although this rate, to be sure, is merely estimated) was even lower than that earned by the balance of the industry; while in 1924, 1925, and 1926 the percentage profits of that concern, of Reo, Packard, Dodge, Nash, and Willys-Overland

(none of which, however, are estimated) in general all corresponded much more closely than during the earlier period.

The fact of this correspondence hardly squares with the “rent theory” of business profits. If, as Francis A. Walker once asserted, men’s differential abilities are primarily responsible for their differential gains, then one would not expect to see such wide differentials as existed in the automobile industry prior to 1917 so largely disappear in the period which follows. Even with due allowance for the years 1916-1918, when the country was at war and passenger car production was curtailed, there should occur no such equalization of the rate of profits as between producers if differential abilities constitute the whole or even the greater part of the explanation of such earnings.

Differences in ability, of course, exist. In so far as personal qualities determine the degree of success attained, probably courage in undertaking the risks of production on a large scale is what marked off the highly successful from the slightly successful, or unsuccessful, producers. Those who had the courage to put into practice certain policies before their success was assured, those who dared to discontinue the manufacture, wholly or in part, of one kind of product while that product was still going well and paying profits, in favor of another type because they thought the latter would pay better, often made great fortunes. Others, once shown what to do, often could learn to do it just as well. But they did it only two, three, or four years
later, after it had proved to be commercially profitable.

But the largely conjunctural character of the great profits made by those who led the way in this industry seems absolutely clear. The stage was all set for their making. For decades, other men and other industries had laid the foundation stones. On the production side, the whole machine-tool development mentioned in a previous chapter was available. On the market side, the industrial revolution which began a century and a quarter before 1890-1900 had steadily swung the tastes, the desires, the habits of thousands of people towards a higher standard of living. Especially was this true in America, where every workman might aspire to any consumption level upon which he observed others.

Had an R. E. Olds, a Henry Ford, or a W. C. Durant been born in the early eighteenth century, what would have been his lot? Obviously, no positive answer is possible. But we do know that none of these men would have been an automobile manufacturer, nor would any one of them have attained preeminence in machinery manufacture upon a large scale. The requisite basis upon which such production could take place simply had not then been developed.

"We hardly realize," says Roe, "the crudity of the tools available in the eighteenth century. In all machinery the principal members were of wood. . . . The fastenings and smaller parts only were of metal, and consisted of castings and forgings fitted by hand. There were some lathes of the very simple type. . . . Such lathes were almost useless for metal cutting. . . . The slide-rest . . . had not been put into practical form. . . . There were a few rude drilling and boring machines, but no planing machines. . . . The tool equipment of the machinist . . . consisted chiefly of a hammer, chisel, and file . . . the appliances for cutting metal were little better than those of the Middle Ages."

Industrial development always proceeds cumulatively, but with regard to any particular phase of its unfolding there is little telling when the chrysalis will break. The chief preparatory stages in the evolution of a given industrial situation may spread over long years. But the technical and market basis once laid, the development which follows may be rapid beyond belief. By 1890-1900, virtually all the basic machine tools now in use were at hand, precision instruments and limit gauges of various sorts had appeared, and the interchangeable system of manufacture was well developed. Some extraordinarily able and some less able men stepped in and utilized them, and then developed them much further. That these pioneer motor manufacturers made profits is due to the correctness of their decisions as to the practicability of the automobile; but that they made profits as large as they did is due primarily to a conjuncture of their abilities and time, place, and circumstances. The public wanted cars; that these men knew or suspected. Cars could be manufactured; of that they felt sure. But of the extent to which the public would demand cars, and of the extent to which manufacturing costs would be lowered
as the volume of production increased, and of the extent to which these two factors would interact, they had no realization.

Conjoined with the circumstances that have been mentioned is also the important fact that the period from 1900 to 1920 was one of generally rising prices. The profitable conduct of business enterprise was therefore greatly facilitated. Expansion might have been far more difficult, and automotive failures perhaps more frequent and serious, had the general movement of prices been a downward one such as occurred from 1866 to 1897.

To conclude, the profits of any producer in an industry are the result of both his ability and his opportunities. What is the exact proportion in which these combine cannot be told. But in the automobile industry, it appears that conjunctural gains have bulked very large indeed. Like the miner who is confident gold will be struck, the pioneers in motor manufacture expected large profits. In so far as the lure of these gains stimulated the assumption of production risks, they formed a part of "supply-price." But as in mining the vein actually tapped may run far deeper than anyone ever imagined, so in motor manufacture the extent of the market reached outran all expectation.

To sum up the discussion of these three chapters, the data here available, though for some years very incomplete, suggest several things. First, that in a new and rapidly developing industry such as this, many of the firms which at the outset attained prominence disappeared entirely in a decade's time or less. Secondly, that many of the firms which soon came to be continuously successful entered the field shortly after the industry was established. They earned profits at a rate averaging six or seven times "normal interest" over at least a seven- or eight-year, perhaps over a ten-year, period. Thirdly, that after this eight- or ten-year bonanza period was over, rates of profit fell off somewhat, but, on the greater part of the capital invested in the industry, remained for another seven- or eight-year period at a level averaging approximately five times a "normal interest" rate. And, finally, since the recipients of these returns, for the first fifteen or sixteen years of the industry's history, were for the most part "owner-managers" and not merely investors, these largely conjunctural gains seem, in spite of regular salaries drawn by these officials, to have constituted a mixed return upon both capital and business ability. That the same small group of persons undertook both the investment and the active managerial functions in building up this new industry indicates that the entrepreneur type of the Industrial Revolution was still functioning at the dawn of the twentieth century.
MARKET STABILIZATION AND INDUSTRIAL MATURITY

1. Stabilization of Demand and the Replacement Market

If one examines the curve for automobile production over the entire period from 1903 to 1926, plotted as it has been shown throughout this book, upon a logarithmic scale or "ratio chart," he finds three distinct periods of growth. There is, first of all, the sharp upward climb from 1903 through 1916. Next is the great but proportionately lesser gain from 1917 through 1923. Finally are seen the very slight increases which have resulted between 1924 and 1926. Since 1923, production has more than tapered off—the new records that have been made represent only comparatively slight increases over the 1923 figure. Production has, in other words, become almost stabilized at a trifle under 4,000,000 passenger cars a year.

With this apparent stabilization of demand, in the minds of many persons has come the fear of a falling off. Yet it is difficult to find a logical basis upon which any marked permanent decline is to be looked for. Even a temporary decline of any great proportion is by no means necessarily to be expected, although some curtailment of present production may possibly take place. Yet even such a curtailment, if it did occur, would probably be only temporary. The grounds upon which these assertions rest may briefly be examined.

Should no more "new" buyers whatever of automobiles appear—assuming for the moment what is probably not at all true, that absolutely everyone in the United States who will own a car during the next few years now possesses one already—then, excepting for possible developments in the export market, the demand for cars would, of course, consist solely of purchases to replace existing vehicles as they wear out. It is thus sometimes said that, were such now to be the case, next year's replacement demand would be equal to present registration divided by the average number of years which a car lasts; for example, if over 20,000,000 cars are now registered and the average life of the cars now in use is, say, seven years, then there exists an annual replacement demand for nearly 3,000,000 cars. This, however, is not true—not as yet. For by far the greater number of the approximately 20,000,000 cars now in use are of quite recent vintage; that is, they have been put into service just one, two, three or four years ago. Eventually, replacement needs will call for 3,000,000 or more cars annually, but not for at least another year or two. By an ingenious method which is here described in a note, Mr. Oscar P. Pearson, the statistician of the National Automobile Chamber of Commerce, has calculated what the number of cars scrapped during the last several years has been
and his results, for 1923, 1924, 1925, and 1926 (the latter, in the absence of the complete 1927 registration figure, is estimated), respectively, are in round numbers as follows: 878,000, 1,146,000, 1,669,000, 1,900,000. Replacement needs, then, simply on this basis, amount in 1926 to almost 2,000,000 cars a year, and are, of course, constantly growing.

2. Relation between the New Car and Used Car Markets.

But if to estimate present replacement demand merely by dividing present registration by a car's average length of life is too optimistic a procedure, to limit it to vehicles actually scrapped might, for the next few years at least, be somewhat too conservative a method. Even though no "new" buyers of new cars should appear, many present owners of cars who have newly acquired them during the past two or three years will "trade in" these cars during the next year or two, long before they are worn out. Here, then, is a "replacement" demand, but one which is not reflected in the figures for "cars scrapped"; it constitutes a clear addition for the time being to that figure. In this case, the "new" owner may be the purchaser of the used car, who, to play on words, is none the less a "new" buyer, though the "old" owner is the one who gets the new car. It is only in consequence of thus extending the market for cars "downward" through the used car market that so many buyers of new cars are induced to purchase before their cars are worn out.

Thus to say just how many new cars will be called for during the next few years is difficult if not impossible. Much depends upon the country's income, upon prosperity in general. Whatever the country's prosperity, it remains true that the number of new car owners will not increase nearly so rapidly as it has in the past. But that no more cars will be sold to "new" owners—new in either of the two legitimate senses—is inconceivable. Exact figures in this matter cannot be essayed because of the absence of information as to the distribution of current income and consumers' budgets. But while no figures upon this distribution

![Chart 48: National income and automobile production, 1919-1926. (Income in 1913 dollars per person gainfully employed.)](chart.png)
of the country's income in the years 1922-1926 are as yet available, there have just been prepared by a reliable research body estimates as to the total amount of such income in each of these years. These figures, the preliminary estimates recently disclosed by the National Bureau of Economic Research, are plotted in Chart 48 along with the curve of automobile production for the years 1919-1926.

Reduced to dollars of 1913 purchasing power, the figures indicate a growth in the country's productive (and therefore consumptive) capacity that is as startling as it is gratifying. The current income per person gainfully employed increased from $1,586 in 1922 to $2,010 in 1926, which, when deflated so as to put both figures into dollars of 1913 purchasing power, indicates an increase in real income of 21% over just this four-year period. Granted the rough accuracy of these preliminary estimates by Dr. W. I. King and his colleagues, the general upswing in economic welfare which the Bureau's earlier studies of income show to have taken place from 1910 to 1919 has not only continued but has greatly increased its rate.

It may be asked, just how does this affect the automobile industry? Without necessarily subscribing to Messrs. Foster and Catching's dictum that the automobile industry holds the one and the only key to prosperity, it may be said that there can be no doubt as to the fact that prosperity supports the automobile industry quite as much as the motor industry, in turn, contributes to the country's welfare. And by prosperity is not meant rising prices, rampant speculation in commodities, and "paper profits," but real increases in the physical volume of production together with reasonably satisfactory employment conditions such as have prevailed during the past several years. That great strides in actual economic welfare have continued during a period of comparatively stabilized prices—indeed, during the last eighteen months, of actually slowly declining prices—only indicates that progress in new mechanical and other inventions, better productive organization, and improved methods of market distribution is in general not yet over. To the extent that this progress continues the country will be able to "afford" automobiles; a substantial number of persons in the lower ranks of the income scale may perhaps become buyers; a much slighter but continually increasing number of persons in the middle and upper ranges of the income scale may become "dual owners"; and virtually no one will have to give up his possession of a car, whether bought on the installment plan or for cash.

3. The Export Market

An additional factor in the demand for American motor vehicles over the period of the next few years may be the sales of cars and trucks abroad. Although still constituting a relatively small proportion of total sales, exports are growing rapidly. Chart 49 shows quarterly exports of motor vehicles from 1923 through the second quarter of 1927. While the 1926 export
figure includes only 6.5% of the total American production, that percentage is nearly twice as large as that for 1923. This, however, includes only the export of completed cars from factories located in the United States. If to the exports of motor vehicles proper there be added both the outputs of American-owned factories in Canada and foreign assemblies of American cars in other countries, the total foreign consumption of American vehicles in 1926 becomes 13.7% of our total output. It amounts, in absolute numbers, to 618,713 cars and trucks.

The extent to which American automobile exports will further grow depends largely upon the economic development of foreign countries. That there would seem to exist a vast potential market, at least, for motor vehicles throughout the rest of the world is evidenced by Charts 50 and 51, which show respectively the comparative registration of passenger cars and the number of persons per motor vehicle in the United States and in various other countries. One factor limiting exports at present, however, is the tariff wall which most foreign countries have endeavored to erect against the importation of American cars. On a car selling for $1,000 f.o.b. Detroit, this tax often amounts to several hundred dollars; in Argentina, Japan, Italy, Germany, and France it is $300 or over; in New Zealand and in Czecho-Slovakia it is $500 or more, while in Austria it is $850, or 85% of the original price. Added to this are the high internal taxes which the purchaser of a car abroad must pay. Thus
the total cost of acquiring a $1,000 American car, plus
the first year's registration and other fees in the for-
eign country, ranges from the low points of about
$1,400 to $1,500 in Sweden, India, South Africa, and
China, to the high points of about $2,000 to $2,500 in
New Zealand, Japan, France, Germany, and Austria.
That American cars are able to find sale in many of
these countries in competition with the foreign (there,
the "home") product is indeed a striking evidence of
the great productive effectiveness of the American mo-
tor industry.

Another limiting factor is the price of gasoline
abroad, which ranges from 27 to 70 cents a gallon.
Finally, and most important, is the lack of any great
highway development in many countries. This is evi-
denced by the figures for "square miles of area to miles
of road" in various parts of the world. While in the
United States and in several European countries this
ratio averages about 1, it runs as high as 150 and even
over 300 in many Central American and South Ameri-
can regions. If once the ability to purchase motor
vehicles on the part of these various lands develops,
however, widespread highway construction will doubt-
less follow—thus further stimulating motorization.

But the rapidity with which this motorization may
take place is, to repeat, yet unknown. It is, however,
to be noted that skepticism as to the further motori-
zation of America itself was continually expressed
throughout the years of the automobile's development
in this country. As recently as 1922, when only 10,-
000,000 cars were here registered, Mr. Alfred Reeves,
general manager of the National Automobile Chamber
of Commerce, stated in a public address that this coun-
try doubtless possessed the capacity to absorb as many
as 15,000,000 cars, and in making this statement he
believed that he was reasonably optimistic. Yet in the
five years that have elapsed since then, the addition to
the 1922 registration figure has been just double that
estimate. That events abroad will take a similar course
is highly doubtful; yet one dare make no sweeping
statement.
4. The Importance of Marketing Policy

In spite of these favoring conditions, however, it seems clear that with the general maturity of the industry which has now come about, the bonanza days of huge profits have disappeared save for a very few producers. But it seems equally patent that wholesale disaster in no way confronts the industry as is often alleged in newspaper stories and elsewhere. Competition will probably increase; doubtless prices, both through some curtailment of profits and through the attainment of a still greater productive effectiveness, may be further lowered; and perhaps a somewhat smaller number of producers will remain in business; but that a mere handful of companies will soon come to occupy the field seems quite improbable. Nor is the industry, in the writer's judgment, nearly so "overcapacitated" as many fear is the case. Its capacity is merely somewhat more than ample to supply a large demand, the exact extent of which, over the period of the coming few years, is undetermined. Such theoretical estimates of a capacity of 6,000,000 to 7,500,000 cars as have sometimes been made seem to be gross exaggerations. If one takes even the largest actual monthly output which has ever been registered (that of 394,096 cars in October, 1925) or the largest combined car and truck output ever attained (that of the same month) and multiplies either figure by 12, he arrives at an annual approximation of only 4,729,152 cars, or 5,261,028 cars and trucks combined. Proper
allowance for the plant capacity which was added by several large producers during 1926 would probably not increase those totals by more than from 300,000 to 500,000 units. All these figures, it should be borne in mind, are the maximum theoretically possible outputs. None of them represent the production that is practically possible, which is a somewhat smaller figure, for no industry can be expected to operate constantly at peak load. Such “excess” capacity as the automobile industry now possesses probably constitutes no greater percentage of the actual demand for its product than in the case of many other industries. The view that “cut-throat” competition and thus widespread failures lie ahead therefore seems quite unfounded.

Yet with the total market demand not growing nearly so rapidly as was the case prior to 1923, sales and profits for all concerns in the industry can hardly continue to increase as has been the case in the past. But progressive producers will not tamely submit to even a falling off of their growth. Previously, nearly all companies could grow; although they did not all grow at the same rate, they grew simultaneously. Now, the one may possibly be able to continue his growth only at the expense of the other. Which firms, it may be asked, will thus continue, relatively speaking, to rise and which to fall?

Those firms will survive which best preserve an intelligent balance between production and marketing conditions. Automobile manufacture, as has been shown in previous chapters, has always been at best a difficult business. The product is a complicated one to fabricate, and considerations both of quality and cost under mass production conditions are equally important. Furthermore, constant changes in both the technique of manufacturing methods on the one hand and the demands of the market on the other have been here the rule rather than the exception. What type of automobile to manufacture and when to commence its production, in what price class to sell and how to distribute the product, and when to alter either the design of the car or the price range in which sales are desired, have always been difficult questions for manufacturers to determine.

Coupled with these problems always was, and still is, that of having to decide how many different chassis types should be made and marketed. Just as a proper balance has to be sought between a policy of making changes in the product either so drastically as to invite manufacturing chaos and high production costs on the one hand, and that of improving the product so slowly, on the other hand, that sales lag—so likewise must the right balance be struck between making too few and making too many chassis types and body styles. Those manufacturers who have succeeded, and who will further succeed, are those who have best approximated these two sets of “balance points” and have taken cognizance of changing conditions without allowing themselves to be overcome by them.

Now that the expansion of one firm, if it occurs upon any very considerable scale, must come largely at the
expense of another or several others, a particular producer can continue to enlarge his annual production only in two ways. He may, through much experimental work and superior engineering and designing skill, produce a car that clearly eclipses in both performance and appearance the products of his competitors, or he may endeavor to cut into their market by bringing out additional models to compete with producers in other price ranges than his traditional class.

The first thing—to produce a surpassingly better car—is now the more difficult to accomplish. It has been done by two or three companies in the past few years, but only by these two or three. Productive conditions have become so relatively standardized, the technique of car manufacture is so well understood, engine and running gear construction are now comparatively so far advanced, that it takes little short of genius to produce a car that is clearly the superior of others in its price class by a margin much more tangible than may exist in the minds of the writers of advertising copy.

To make the second effort—to try to expand sales—is far easier. No order of genius is now required to build a smaller or larger model and add it to an existing line, and this any number of producers have done within the last two years. It is, logically, merely an expression of the coming struggle to keep total sales volume growing. But though easy to inaugurate, this policy, too, has its dangers. Every experienced manufacturer knows that to make more models in the same plant means higher unit costs, and unless total volume can be increased in such a ratio as to cause compensation for the loss of certain productive economies by the attainment of others, a net loss rather than a gain may result. The evidence of a past period points to an overemphasis upon productive economies and the neglect of market factors by many leading producers, while the present situation apparently points to just the reverse situation, a frenzied pursuit of the market to the apparent neglect of productive considerations.

This has not, however, been true of the Ford Company. It recently went to the other extreme. For 15 years, from 1908 to 1923, the Ford Motor Company was undisputed champion of the automotive field. During these 15 years it succeeded in retaining its preeminence without making any basic change in the character of its product. But between 1923 and 1926, the Chevrolet, Overland, Star, and Essex companies succeeded in supplying cars which, while also small and sturdy in construction, were of a different design in several important respects; and to these producers the market soon turned. The Ford production still remained an enormous one, measured in absolute figures, but during the five or six years ending in 1926 the curve denoting its annual growth virtually "flattened out," and in 1924 and 1926 the Ford sales figures registered absolute decreases as compared with those of 1923 and 1925, respectively. The figure for 1926 stood at a lower level than that of any year since 1922.

Chart 52 shows annual Ford and Chevrolet produc-
tion for the years 1922-1926. In a measure, both the comparative and the absolute loss of sales by the Ford company over the past few years is due to factors other than merely those involving the design of its product. As has been previously pointed out, the curve of total passenger car production—for all makes taken together—has shown a general "tapering off" tendency as regards the rate of its growth, since about 1916. From one point of view, the much larger relative decline in Ford sales for the last few years may constitute merely one reflex of this general slackening in the rate of expansion. Also, and as a corollary of the general situation, the greatly increased number of used cars of all makes now on the market undoubtedly affected Ford sales in substantial degree. Instead of buying Fords, many persons with $350 to $600 to spend within the past two or three years have purchased the other types of used cars which have been available in large numbers, and in serviceable condition, at these low prices. Lastly, in the list of extenuating circumstances affecting Ford sales in 1925 and 1926 is the fact that the last two years have been a period of such pronounced general prosperity that a number of otherwise potential buyers of new Fords decided to spend an additional $150 or $200 and purchase the products of Chevrolet, Essex, Star, and other companies instead.

Yet while all these three factors—the general stabilization of the industry, the comparative plethora of used cars, and the recent high level of general prosperity—are important, they account for the Ford decline only in part. Clearly coupled with these external contracting factors has operated an internal cause—the design and construction of the Ford car itself. From 1908 to 1927 hardly an improvement in design was made. Except for a vastly better quality of materials (which all makes of cars have enjoyed as the result of great advances in metallurgical science), the fifteen-millionth Model T Ford chassis, produced in 1927, was identically the same type of chassis as that which rolled out of the Piquette Street plant in 1908 when this model was first announced.

It is true that this very policy underlies the astonishing success that has been Ford's; it is irrefutable
that a policy of never changing design but ever lowering selling price resulted in productive economies of the greatest magnitude. But, like any single principle of action alone followed, such a policy can remain too fixed, can become too rigid and unyielding a part of a business creed. To make cars at low cost is one thing; to make cars that consumers want is another. While in the Ford case, certain other factors just mentioned have operated, there can be no doubt in the minds of most observers that many of the buyers of second-hand cars, and some of the buyers of the Chevrolet and the Essex, during the last two or three years would have bought the Ford instead, had only its design been different. Another type of transmission, other springs, other lesser details of construction—all these things, it has been well known for several years, were desired by an increasingly large proportion of the automotive public. Yet, until now, the Ford company paid no heed. Like the eight leaders of 1903 whose history was above discussed, it persistently clung to a type of product from which consumers were turning away. With all willingness to grant credit for splendid and prolonged earlier achievements, one cannot but affirm that the all-important principle of balance between marketing and productive considerations has here been disregarded. For manufacturing proficiency, though both essential to success and difficult of attainment, is of little avail unless accompanied by sagacious market analysis. Supplying a product is but one side of manufacture in its full economic sense; suiting that product to the demands of the mass of its consumers is the complementary necessity without which industrial leadership cannot be long maintained. In no industry may the principle of balance, to employ Mr. A. W. Shaw's apt phrase, be ignored with impunity, and the history of the automobile industry has often afforded a striking illustration of the consequences which attend its neglect. The Ford company constitutes only the latest instance which offers itself. Whether or not the error can yet be corrected in this case, whether or not the new model which is now being brought out will regain for the Ford company its proud position as the undisputed leader of the automotive field, is, however, a matter which, like many other things in a world of constantly changing economic conditions, must remain for future observation.
NOTES

The abbreviation N.A.C.C. refers to the annual statistical publication of the National Automobile Chamber of Commerce entitled *Facts and Figures of the Automobile Industry*.

A proper name cited as a source of information, e.g., "Olds," or "Willys," refers to an interview with one of the several individuals whose full names and positions are given in the list which appears in Appendix B (pages 329-333).

CHAPTER I

1. *N.A.C.C.*, 1925, p. 4. The figure rests upon an examination of census and other data by Mr. O. P. Pearson.

2. Duryea, Olds, and Haynes seem to have been first; Alexander Winton, Charles B. King, and Henry Ford soon followed; George B. Selden, though famous for his patent first filed in 1879, never built a car until 1905, and did so then only for purposes of exhibiting in court the subject of his patent. For further reference to Selden and the results of his patent see Chapter VIII.


4. *N.A.C.C.*, 1927, p. 11, gives $3,371,855,805 as the 1925 wholesale value of the automobile industry’s product, the source for this figure being the Census of Manufactures for that year.

5. *N.A.C.C.*, 1927, p. 36, gives the figure 4,528,422 as of December 31, 1926.

6. The Gunn figures (under the name of the United States Rubber Company stated as the source of the data) are cited in *N.A.C.C.*, 1921, p. 16. They are as of 1921. *N.A.C.C.*, 1927, p. 15, cites later figures compiled by R. L. Polk Company which show that as of December 31, 1926, 28% of total passenger car registration was in towns of under 1,000 and 47% of the total in towns of under 5,000. The registration of trucks, based on data compiled by the same company but not reprinted in the source mentioned, shows, as of December 31, 1926, 24% in towns of under 1,000 and 42% in towns of under 5,000.

7. H. R. Tolley and L. M. Church, *Corn-Belt Farmers’ Experience*
288 THE AUTOMOBILE INDUSTRY

with Motor Trucks, United States Department of Agriculture, Bulletin No. 931, February 25, 1921.

8. Compiled from the frequency distribution given on page 19 of the Department of Agriculture Bulletin No. 931, previously cited.


10. There are about 6,500,000 farmers in the United States, and in 1926 there were 499,782 farm-owned trucks. The distribution of farm-owned trucks by states is given in N.A.C.C., 1927, p. 36, in a table for which figures are taken from the Farm Journal.

11. A total of 984 motor express companies is actually listed in the files of the National Automobile Chamber of Commerce. In 1922, that organization estimated the total number in existence to be 1,500. As of 1927, the number is undoubtedly 2,000 and perhaps as high as 3,000.


14. The Massachusetts legislature, in 1867, authorized the consolidation of district schools, and in 1869 authorized school trustees to meet the cost of transportation of pupils. The towns of Greenfield, Quincy, Montague, and Concord all effected at least a partial consolidation by 1887. See Consolidation of Schools and Transportation of Pupils at Public Expense, Bulletin No. 6, Department of Education of Massachusetts, 1920; cited in LeRoy A. King, Annals of the American Academy of Political and Social Science, November, 1924, p. 66.

15. J. F. Abel, Consolidation of Schools and Transportation of Pupils, Bulletin No. 41, United States Bureau of Education, 1923. Cited by King, op. cit., p. 73. The number 12,000 as of 1923 has since then increased substantially.

16. N.A.C.C., 1924, p. 32.

17. N.A.C.C., 1927, p. 78. Most of the “school busses” enumerated are in use in rural districts and in small towns.

NOTES

18. It is doubtless true, however, that in some instances the cost of medical attention still deters the rural population from using the physician’s services as frequently as does the city dweller.

19. N.A.C.C., 1924, pp. 26-27. For a statement of the rôle of the truck in terminal areas, November 2, 1923, see Relation of Highways and Motor Transport to Other Transportation Agencies, Report of Special Committee VI of Chamber of Commerce of the United States.


23. Public, No. 244, 67th Congress, approved June 19, 1922. Printed in Circular No. 161, Office of the Secretary, Department of Agriculture.


CHAPTER II


30. Samuel Smiles, Boulton and Watt, p. 186; quoted in Roe, op. cit.


32. One coach actually carried as many as 3,000 passengers before the service was discontinued. But because of the opposition of vested
interests and the popular fear that the roads would be damaged and horses annoyed, these early steam carriages were quickly legislated out of existence by the imposition of high taxes. There is, however, some evidence that they were mechanically and commercially practical. Telford and other engineers testified, before a Select Committee in 1831, that their weight would not result in harm to road surfaces. See William T. Jackman, *The Development of Transportation in Modern England*, New York: G. P. Putnam's Sons, 1916.

33. The various names and statements made in this section are derived from a number of different sources; all these authorities are cited in an article by the present writer, "Industrial Invention: Heroic or Systematic?" *Quarterly Journal of Economics*, February, 1926.

34. Apparently because of both the dangers of operation and the difficulties of maintenance, steam vehicles soon lost in public favor and their manufacture was discontinued by all but a few firms; one firm only remained for any length of time in the field of steam-car manufacture after about 1908-10. Electric passenger cars remained in slight favor for a considerable time, but of recent years have disappeared from the road almost entirely; none are any longer being manufactured.

35. This is probably the only sense in which the word "invention" ordinarily means much anyhow. In a volume to follow the present work, I hope to be able to carry this discussion much farther. With respect to the general theory of invention, see the above mentioned paper in the *Quarterly Journal of Economics*, February, 1926.


37. The evidence which I have thus obtained indicates that Duryea's vehicle probably was the first American car employing an internal combustion motor.


41. Their various works are described in detail in Roe, *op. cit.*

42. England led in developing machine tools from 1775 to 1850; America has led since about that date.

43. See especially Chapter IX, section 4.

44. See Chapter V, section 2.

45. On the "mobility" of capital in this connection see a University of Michigan doctoral thesis by Lawrence H. Seltzer entitled "Capital in the Automobile Industry," p. 49, an excellent monograph which has just been awarded the Hart, Schaffner and Marx prize and will soon be published in book form by Houghton, Mifflin and Company. Though the automobile manufacturer obtained command of the resources necessary for production of vehicles in this manner—through having the parts makers devote their facilities to the turning out of engine parts, axles, and so on—there was no substantial actual investment of outside capital in the automobile industry proper. While I have not yet investigated the situation so thoroughly and in so many quarters as I should like, I am convinced that there was virtually no mobility of funds in the sense of their having been withdrawn from one industry and put into another.

46. Often of these complete assemblies; for example, a whole engine, rear axle, or gear set.


48. See the various articles in the "Standardization Number" of the *Journal of the Society of Automotive Engineers*, December, 1921; also, an excellent popular article by J. K. Barnes, "The Men Who 'Standardized' Automobile Parts," *World's Work*, June, 1921.

49. See below, Chapter III, section 5.

50. It is not here implied that in most cases any close correspondence between price and cost existed or that all producers shared alike in the cost reductions; only that prices and costs, through affecting the scale of production, reacted upon each other and that, in general, greatly lowered costs of manufacture did result in substantially lower prices to the consumer.


52. I am indebted to Mr. Howard Einstein, a consulting industrial engineer of Detroit, for the elaboration of this explanation.

53. "Man hour" figures, for any one establishment, include only "present labor," not, in the phraseology of economic theory, "past and present labor combined." Furthermore, along with the increased use
of machinery has come, also, the production of a greater number of chassis parts within the individual establishment. Thus the recent reduction of "man hours" which the mechanization of processes within all automobile manufacturing enterprises would have entailed has been somewhat offset by the employment of more men for the internal fabrication of parts. But whatever the net resultant of the several factors at work, the effectiveness of labor has clearly here been multiplied enormously.

54. La Fevre, op. cit., pp. 3-4. "Establishment B," shown here, is designated in La Fevre as "Establishment C."

55. Issue of November 24, 1904.

56. Motor World, February 12, 1903.

CHAPTER III

57. The motor truck will not be treated specifically in this chapter. The real development of truck manufacture began after that of the passenger car industry, of which the truck was, technically speaking, an outgrowth; and the rapid extension of the market for trucks has taken place upon much the same basis as that which has characterized the introduction of several other important labor-saving devices in industry or commerce.


59. See Chapter V, section 4.


61. By "the Marshallian view" I mean that theory, most fully formulated by Alfred Marshall in his Principles of Economics (1st edition, London: Macmillan and Company, 1890), which holds that normal price (value) depends upon the interaction of utility and cost (marginal cost, if present) of production. By the Austrian view, I mean the several doctrines of Menger, Wieser, and Jevons, succinctly stated more recently by Böhmf-Bawerk in his Positive Theory of Capital (1923 reprint, G. E. Stechert and Company, New York), that price (value) depends predominantly upon final (marginal) degree of utility.

62. There is, of course, a gradation in the prices of different makes if these be arranged in a series, and mathematically there may seem no good basis for selecting one range in this series rather than another. But the trade has recognized from time to time the existence of various price groups, and during any year there are points about which the cars of similar size and quality cluster; there is now, for example, clearly a $600-800 class, a $2,500 class, and so on.

63. See Chapter X, section 4.

64. "Averaging" in the sense of seldom diverging from a smooth line of trend which could be drawn, for the period as a whole, through the curve actually plotted.

65. See Chapter II, above.

66. These are the percentage deviations of the Harvard Index of Trade, which for the years 1903-15 is composed of figures for the following items: bank clearings outside New York City, merchandise imports, gross earnings of leading railroads, pig iron production, and volume of industrial employment. The index is given in the Review of Economic Statistics, preliminary volume V, p. 75.

67. This was in April, according to the Harvard Index of Trade in the Review of Economic Statistics, just cited. The American Telegraph and Telephone Index of General Business Activity shows a maximum decline of only 3%. The figures for this latter index I have taken from the table reprinted in Homer B. Vanderblue, Problems in Business Economics (Chicago: A. W. Shaw Company, 1924), p. 603.

68. The financial problems which one concern, the General Motors Company, faced and met are admirably treated in Seltzer, op. cit. (Note 45).

69. I have drawn no distinction between production and sales figures. There is, of course, some "carry over" of cars each year, but over a period of years the two figures coincide.

70. Harvard Index of Trade, previously cited (Note 66).

71. Ibid.

72. For production growth from 1917-26, See Chart 13, p. 103.

73. In the following discussion we may neglect, for the most part, year-to-year "carry over" and employ the terms "production" and "sales" synonymously.

74. Cf. Chapter VI, section 1; also Note 127, below.
75. The data upon which this study is based include the production figures of virtually every concern which has ever engaged in automobile production in this country, nearly 200 in all. Because many of the figures were furnished to me in confidence, I am unable to give individual figures, but here chart, and present in the appendix, only the percentages. For some years, however, there exist certain discrepancies between the total number of cars which I have classified and the total published production for the entire industry. I do not believe, however, that these discrepancies, if they could be corrected, would at all affect the trends which are disclosed, and Mr. O. P. Pearson, statistician of the National Automobile Chamber of Commerce, and several other friends who have examined the figures share this belief. For the nature of these discrepancies, as well as for an explanation of the method of compilation, see Appendix B, pages 335-337.

76. This chart, as well as several charts which follow, differs somewhat from the charts covering similar data which I presented in the Harvard Business Review, January, 1927. The reasons for the discrepancies are several, but chief among them is the fact that the Ford calendar year (instead of fiscal year) figures have come into my possession since that time. All charts have been redrawn so as to incorporate these and other lesser corrections which it has been found possible to make.

77. The exact percentage figures for the data here considered are given in Appendix B, page 336.

81. In 1914, our per capita income was $335, in contrast with the following figures for other countries: $243, United Kingdom; $146, Germany; $185, France; $112, Italy. National Bureau of Economic Research, Income in the United States, by Wesley C. Mitchell and others, p. 85.

83. From data charted by Leonard P. Ayres in the Cleveland Trust Company Business Bulletin, October 15, 1924, and from additional data furnished by him relating to Firestone casings.

84. Page 75.

85. See above, page 74.

86. As indicated by Dun's, Bradstreet's and the Bureau of Labor Statistics' index numbers.

87. I have also calculated replacement demand by starting with the number of cars put into service prior to and during the year 1912; the result comes to about the same thing. For a fuller explanation of replacement demand and the method of computation, see Leonard P. Ayres, The Automobile Industry and Its Future, Cleveland Trust Company pamphlet, 1921. The assumption I have here made is that a high-priced car was, on the average, replaced by a new car after four years of service at the hands of its original owner. Thus a car that was produced in 1908 is assumed to have been replaced (traded in or otherwise disposed of in favor of a new vehicle of the same general price class) at the end of 1911. The table finally arrived at upon this basis (see Colonel Ayres' monograph for a detailed description of the method) is as follows.

<table>
<thead>
<tr>
<th>Year</th>
<th>Carried Over</th>
<th>Produced During Year</th>
<th>Eliminated During Year</th>
<th>In Use at End of Year</th>
<th>Replacement Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>1912</td>
<td>73,913</td>
<td>17,533</td>
<td>7,471</td>
<td>83,975</td>
<td>24,000</td>
</tr>
<tr>
<td>1913</td>
<td>83,075</td>
<td>20,080</td>
<td>20,030</td>
<td>74,122</td>
<td>18,500</td>
</tr>
<tr>
<td>1914</td>
<td>74,122</td>
<td>17,997</td>
<td>17,997</td>
<td>74,122</td>
<td>18,500</td>
</tr>
<tr>
<td>1915</td>
<td>74,122</td>
<td>15,287</td>
<td>16,506</td>
<td>70,903</td>
<td>17,700</td>
</tr>
<tr>
<td>1916</td>
<td>72,993</td>
<td>16,438</td>
<td>17,533</td>
<td>70,903</td>
<td>17,700</td>
</tr>
</tbody>
</table>

88. Though certain qualifications may attach to some parts of the data presented in these pages (see Appendix B), the sales figures for the years here in question are believed to be quite reliable. Total production for the years 1912-1916 inclusive was 3,703,000 cars, while our total sales figure for all price classes of cars during the same period was 3,668,000 cars.
CHAPTER IV

90. The expansion of the export market is discussed in Chapter X, section 3.

91. Coleman's patents are many. The earlier applications include one for an air starter, filed in 1903 (Serial No. 176,156) and one for a spring starter, filed in 1904 (Serial No. 216,013). On Kettering's work, the popular article by W. A. P. John in Motor for August, 1921, is of interest.

92. All figures cited in this section are taken, unless otherwise noted, from information and bulletins furnished the writer by C. C. Hanch, secretary and general manager of the National Association of Finance Companies, and from a paper by Milan V. Ayres, analyst of that organization, "Installment Selling and Its Financing," Third Automotive Financing Conference, National Association of Finance Companies, Chicago, November 15-16, 1926.

93. The new car figure is for the year 1926; the exact used car figure is not available.


95. Such is the conclusion of a prominent finance company official who has personally investigated the situation rather widely.

96. The Cadillac Company, in advertising its new LaSalle car, priced at about $2,500-$3,000, even calls attention to the exact amounts of the down payments needed to give the buyer delivery of its various models.

CHAPTER V

97. The reasons for this localization are not entirely clear. In the very early days—from 1900 to 1905 or 1906—a number of automobile factories were in New England. But most of them disappeared soon afterwards—nearly all of them by about 1912-14. The reasons for the marked localization around Detroit as usually given are the proximity of raw materials, the fact that some of the early experimenters were located there, and also that Detroit has always been "an open-shop town." None of these reasons alone, however, serves as an adequate explanation, although combined they of course have a certain weight. The entire matter will be discussed further in another volume.

NOTES

98. These statements are based primarily upon the results of a questionnaire sent in 1926 to all manufacturers by the writer with the cooperation of the National Automobile Chamber of Commerce.

99. As will appear shortly in the discussion, both wholesalers and branch houses always sell cars at retail also, in some portion of the local market.

100. Olds.

101. Everitt.

102. Chapin.

103. Olds, Willys.

104. Metzger.

105. See William A. Grimes, Financing Automobile Sales (Chicago Trust Company Prize Monograph; Chicago: A. W. Shaw Company, 1927), p. 22. The details of wholesale financing operations are well discussed in that book.


107. I am indebted to Mr. Charles C. Parlin, of the Curtis Publishing Company, for furnishing me with these, as well as some earlier figures. All the figures are drawn from issues of that company's publication, Leading Advertisers, for various years.

108. The only exception I know to this statement is a brief advertisement which I once saw in a newspaper in a small city; the dealer had given up his franchise and was attempting quickly to dispose of cars he still had on hand.

109. The chief exceptions to this statement are certain instances in which particular makes or models of car have been discontinued, and it was desired to close out the stock on hand.

110. Of late, however, the stringency of such control and advice has been much relaxed by certain companies, one or two of which have even subsidized the dealer on "trade-ins" to help him make the sales.

111. In either the companion volume to this book or in some other publication, I hope possibly to discuss them. As to how much can be done with these problems I am not at all certain. The matter is, of course, a complex one; it relates also to the considerations that were raised, but, again, not fully discussed, here in Chapter III, Section 2. Briefly, the thought which I have in mind is the by no means wholly original one that neither "free competition" (whatever the economic theorist
may ordinarily mean by that phrase) nor "monopoly" obtains over
the greater part of the industrial field today. But what I have fur-
ther in mind is that the actual state of affairs cannot be accurately
described by saying either that "competition is merely checked" or
that "monopoly is incomplete." What really prevails in many if not
most industries is a (now) quite normal state of "tempered" or even
"cooperative" competition—the production of more or less similar
goods and services by several producers, sold against each other at
not quite uniform prices, which prices are sometimes subject to more
or less rapid alteration, but with modifications, both of price and of
production schedules, often accompanied by notice to competitors,
and often with some regard for the "ethics" of the situation as among
members of the dealer organization. How much or how little the
careful study of commercial practices and conditions such as these in
particular industries would contribute towards a modification (either
the verification or the disproof) of certain parts of the theory of
value and price is an open question. But it would seem that some
such examinations of these matters might at least be undertaken,
admittedly difficult as is the task if it really aims at more than the
mere description of business practices.

112. An outline of racing history is to be found in C. G. Sinsabaugh,
"The Melting Pot of Design," *Automobile Trade Journal*, December
1, 1924, pp. 225-232. Details of both races and reliability contests
may be obtained from contemporary accounts in most of the trade
journals.


114. The *Horseless Age* for the half-year July-December, 1904, lists
six reliability, endurance, or hill-climbing contests, and twelve racing
events, and its subsequent volumes list still larger numbers.

115. A national federation of local motor clubs.


117. George Otis Draper, in the *Horseless Age*, July 26, 1905, p.
153.

118. Including half of the 1905 production. The time we are con-
idering is July, 1905.


120. "Technical Contributions from the Contests," *Horseless Age*,
August 1, 1906, p. 143.
130. There have been wide variations in expenses as between producers, but for all producers the growth of the industry has been accompanied by both external and internal economies. In the terminology of the current value theory, returns have been neither constant nor diminishing; as of any given time they have varied; but in the long run, decreasing cost has prevailed in striking fashion.

131. It will be recalled that this Census, from 1899-1919, was issued only quinquennially, not biennially as at present.

132. The Olds Motor Works notably, making a $650 car, the famous "Curved-dash" Oldsmobile, had just convinced several thousand purchasers that the horseless carriage was a practicable road vehicle, and in 1904, largely as a result of the Olds success, a greatly increased number of purchasers seem to have entered the market.

133. The near failure of the General Motors Company in that year, following a too great expansion of production in 1909 and 1910, led to serious difficulties of a cyclical character (loosely, "cyclical" in the special sense of a particular industry's own "business cycle") on the part of most producers in 1910 and 1911. In addition, the demand for high-priced cars in those years underwent a decline, which will be discussed below.

134. See Chapter III.


136. See Chapter V, section 5.

137. Seltzer, op. cit., p. 153, citing Mr. A. B. C. Hardy, formerly president of the Olds Motor Works and one-time assistant to Mr. Durant. The citation of Durant's remarks rests upon the quotation of them by Mr. Hardy, which is substantially, although not exactly, verbatim.


140. See Chapter II, section 6.


142. B. B. Bachman, loc. cit.

143. Eighty entrances as compared with 49 exits.

CHAPTER VII

144. See section 5, below.

145. During and since the World War.

146. At least, the first American car.

147. As in preceding sections, this method of measuring the standing of manufacturers makes no allowance for variations in the size, price, or quality of vehicle produced, but it is the simplest and perhaps the best single measure that can be employed. It is also obvious that to be one of the first 10 producers in 1903 meant something less than to be one now. This is true both absolutely and relatively. The median producer in 1903 made barely 200 cars a year; the leading producer made only 4,000. The tenth producer in that year, in a list totaling 24 firms, stood only slightly above the median of the series.

In the years that followed, however, the number of firms increased. In 1910, the tenth producer stood at about the first quartile; in the years 1909-1916, in general, roughly midway between the top firm and the first quartile; in 1921, at about the first decile; and in 1924 somewhat higher still. Because of the character of the data for the years since 1916, however, only the first 10 firms in any year have been here considered.

148. See Chapter III.

149. As has been elsewhere stated, the Ford Company made a heavy six-cylinder car in 1907 and discontinued it the following year.

CHAPTER VIII

150. The number of cars produced is here again utilized as the index to a firm's size, even though it takes no cognizance of the quality of product made, nor of its value. There are, however, great difficulties in the way of weighting production figures in accordance with variations in size and types of cars. See Note 147.

151. See Chart 4, page 66.

152. More accurately in some cases, per company, though up to 1916 nearly all the companies operated but one main works.

153. Durant Motors, Inc., recently formed, did not combine competing producers, but initiated several entirely new lines of cars.

154. Figures from 1909 to 1924 are taken from Seltzer, op. cit., Table 50, who had them compiled from the books of the company;
those for 1925 and 1926 are computed from the corporation's annual reports. By "net worth" here and in discussions which follow I mean the total of assets (excluding good will and patents) minus all liabilities to other than security holders. Surplus, undivided profits, and contingent reserves are thus considered, along with all stock equities and, where they occur, with bonded debts, as constituting a part of the invested capital and, in our sense of the term, of the net worth of the concern as a business enterprise. Cf. what is said in Appendix B in connection with the sources of Charts 42-45, below.

155. From an unpublished History of Maxwell Organization, 1904-1921, by J. C. Holmes. This manuscript is placed in my hands by the courtesy of Mr. Holmes, who is assistant comptroller of the Chrysler Corporation, the company which has inherited the Maxwell records.

156. Following the crisis of 1920, the Maxwell Company merged with the Chalmers Motor Company and more recently has become the present successful Chrysler Corporation.

157. It no longer remains, strictly speaking. In 1925, the Maxwell name was completely dropped, and the name Chrysler "Four" been given to the car marketed in its place. See Note 128.

158. The Selden patent association (the "Association of Licensed Automobile Manufacturers") was a pool of quite different character; each manufacturer, as its Handbook stated, really did "conduct his business entirely independent of the other, and ... in open competition." Handbook, 1903, p. 5. Cf., however, what is said of the organization and history of this patent association on pages 227-235.


160. See Seltzer, op. cit.; the original investment amounts for the Hudson and Reo Companies check with what Mr. Coffin and Mr. Olds have told me. That for the Ford Company is well known and is authentic; it is given also by Ford and Crowther, op. cit., p. 51. The various net worth figures cited in this paragraph were compiled by Seltzer from company reports and corporation records.


163. Briscoe.
A. We signed the license agreement believing it to be the best interests of our company, also believing the Selden patent good and binding.

Answer objected to as not responsive and question repeated.

A. We have done, we believe, the largest business during the past three years of any automobile manufacturer in the United States. This fact would prove that the Selden patent had not restricted our business.

133. Q. I don't think you understand my question. In view of the statements in your last answer, did it ever at any time occur to your Board of Directors that by virtue of this provision in Article II three-quarters of the members of the Board of Managers might say that you were doing too much business and adopt a rule that no one member should make over five hundred vehicles a year and that they might adopt another rule fixing the prices for them at which they should be sold?

(Page 1022.) A. Such a thing never occurred to our Board of Directors and inasmuch as I have personally attended I believe every meeting of the Board of Managers of the Association that has been held, I can say that no action has ever been taken or considered which would in any way place any limitation on what could be done by any individual member.

170. See the testimony cited in Note 169, answer to Question 94.

171. 172 Federal 937.

172. Summaries are to be found in the decisions of Hough, 172 Federal 924, and Noyes, 184 Federal 894, and a fuller discussion, upon which the attorneys drew, in Dugald Clerk, The Gas Engine, New York: John Wiley and Sons, 1886.

173. A somewhat fuller, and popular, discussion of the original cross-license agreement is found in John K. Barnes, "The Men Who Created Cooperative Competition." World's Work, May, 1921.

CHAPTER IX

174. The figures from which the following compilations and charts have been made are taken from three sets of sources: tables in Seltzer, op. cit., corporation reports, and Poor's Manual and Moody's Manual of Industrials. Seltzer gives the individual figures through 1924 for 8 of the 15 concerns (counting General Motors as one company) which are discussed, but does not summarize them so as to arrive at the profits of these producers taken together. The individual figures he discusses in relation to their bearing upon the question of what portions of their 1924 net worths came out of earnings, not particularly in relation to their significance for the theory of business profits. The Ford net worth figures for 1922-1926 I have estimated on a somewhat hazardous basis; this is explained in Appendix B. Net worth is here defined as the gross assets minus all liabilities to others than stockholders and bondholders, but excludes good will and includes reserves for contingencies; it is thus roughly the equivalent of the economist's term "invested capital." For a more complete explanation of these and other details of the method of compilation, see Appendix B, pages 352-354.

175. Ford and Crowther, op. cit., p. 51; also Poor's Manual, 1925, p. 1283.


178. Ibid.

179. Fiscal year ended July 31.

180. See Appendix B, p. 353.

181. I am told by Mr. Metzger that Mr. Ford in the early days once drew for him a diagram illustrating this by an isosceles triangle, in which selling price was measured along an imaginary perpendicular running from apex to base and the total volume of sales by the area between the apex and any horizontal lines which one might draw through points in this perpendicular, at right angles to it. Each reduction in price was calculated to cause more than a proportional increase in sales. Mr. Metzger believes that the success of the Cosmopolitan, Munsey's, and McClure's magazines in greatly expanding their circulations upon reducing prices to ten cents, about this time, perhaps stimulated Mr. Ford's thought in the matter.

182. Cf. the saturation of the high-priced car market, and lesser expansion of the medium-priced as compared with the low-priced market, page 97, above.

183. The Ford truck, a one-ton vehicle made in the same plant as the passenger car, has practically the same chassis as the passenger car, except for a heavier frame, heavier springs, and different wheels and rear axle; its motor, transmission, and front axle assembly are identical with those of the passenger vehicle.

184. The Model T was announced in 1908, and only in 1925 were any but trifling changes made in its chassis. Even then, the alterations were not substantial.

185. Mr. Ford in his book (Ford and Crowther, op. cit., pp. 19-20; repeated on pp. 273-274) puts the explanation in somewhat different terms. He attributes his success to the facts that his institution has
eliminated waste and greed, and is performing a service. "The principles of the service," he says, "are these:
1. An absence of fear of the future and of veneration for the past.
2. A disregard of competition.
3. The putting of service before profit.
4. The realization that manufacturing is not buying low and selling high."

186. Seltzer, op. cit., p. 263.

187. The figures for General Motors which rest on the assumption that rights have been exercised I take from an article in the Wall Street Journal for August 16, 1927, entitled "Large Profits in General Motors." The following table is an abridgement of the one there given:

<table>
<thead>
<tr>
<th>Year</th>
<th>Shares Owned</th>
<th>Cumulative Cash Investment</th>
<th>Total Market Value of Holdings and Cumulative Cash Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>1927</td>
<td>7,250</td>
<td>$90,500</td>
<td>$25,628,539</td>
</tr>
<tr>
<td>1926</td>
<td>4,840</td>
<td>1,424,303</td>
<td>785,237</td>
</tr>
<tr>
<td>1925</td>
<td>2,424,303</td>
<td>476,305</td>
<td>395,850</td>
</tr>
<tr>
<td>1924</td>
<td>785,237</td>
<td>424,937</td>
<td>295,654</td>
</tr>
<tr>
<td>1923</td>
<td>424,937</td>
<td>785,237</td>
<td>395,850</td>
</tr>
<tr>
<td>1922</td>
<td>295,654</td>
<td>395,850</td>
<td>295,654</td>
</tr>
<tr>
<td>1921</td>
<td>169,063</td>
<td>355,650</td>
<td>224,937</td>
</tr>
<tr>
<td>1920</td>
<td>169,063</td>
<td>355,650</td>
<td>224,937</td>
</tr>
<tr>
<td>1919</td>
<td>160,663</td>
<td>355,650</td>
<td>224,937</td>
</tr>
<tr>
<td>1918</td>
<td>140,781</td>
<td>355,650</td>
<td>224,937</td>
</tr>
<tr>
<td>1917</td>
<td>111,688</td>
<td>355,650</td>
<td>224,937</td>
</tr>
<tr>
<td>1916</td>
<td>8,000</td>
<td>355,650</td>
<td>224,937</td>
</tr>
<tr>
<td>1915</td>
<td>8,000</td>
<td>355,650</td>
<td>224,937</td>
</tr>
<tr>
<td>1914</td>
<td>8,000</td>
<td>355,650</td>
<td>224,937</td>
</tr>
<tr>
<td>1913</td>
<td>8,000</td>
<td>355,650</td>
<td>224,937</td>
</tr>
<tr>
<td>1912</td>
<td>8,000</td>
<td>355,650</td>
<td>224,937</td>
</tr>
<tr>
<td>1911</td>
<td>8,000</td>
<td>355,650</td>
<td>224,937</td>
</tr>
<tr>
<td>1910</td>
<td>8,000</td>
<td>355,650</td>
<td>224,937</td>
</tr>
<tr>
<td>1909</td>
<td>8,000</td>
<td>355,650</td>
<td>224,937</td>
</tr>
</tbody>
</table>

* Six months to June 30.  † Twelve months to July.  ‡ Five months to December 31.  ‡ Twelve months to September 30.

201. Only in comparatively recent years have shares of most of these corporations come to be owned by the general public. Packard was listed on the New York Stock Exchange in 1923, Hudson in 1923, and Dodge Brothers in 1925, while Reo and Ford have never been there listed. The stocks of certain automotive firms not listed on the New York Exchange have, however, for some years been traded on the Detroit and Chicago stock exchanges, and on the New York Curb; Reo is listed on the Curb, and so is the Canadian Ford company. The American Ford company, however, has never been listed.

CHAPTER X

202. The method is to add to the registration of a given year the production of the following year; from this figure, subtract the "following" year's exports; from the result, subtract the "following" year's registration; divide this figure by 2, which gives the number of vehicles scrapped during the last half of the given year. Then to this, add the number of vehicles scrapped during the first half of the "following" year, similarly computed; the resulting total is the vehicles scrapped during the given year itself. A table giving the results thus computed for each year over the period 1913-1926 is given in Appendix A, page 316.


204. N.A.C.C. Foreign Trade Bulletin No. FT 256, March 10, 1927.

205. The figures which follow in this and the next paragraph are taken from the N.A.C.C. Bulletin just cited.

206. That is, with equipment as of October, 1925. The industry's investment (as of 1927) has increased by only about 5% or possibly
APPENDIX A

GENERAL STATISTICS OF AUTOMOTIVE MANUFACTURE, MARKET DISTRIBUTION, AND FINANCE

The figures which follow are compiled from tables in the various editions of Facts and Figures of the Automobile Industry, the annual publication of the National Automobile Chamber of Commerce, 366 Madison Avenue, New York City, or from information obtained from the staff of that organization, unless otherwise stated.
## APPENDIX A

### Truck Production

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Trucks</th>
<th>Wholesale Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1903-1910</td>
<td>10,374</td>
<td>$20,485,500</td>
</tr>
<tr>
<td>1911</td>
<td>10,555</td>
<td>22,722,521</td>
</tr>
<tr>
<td>1912</td>
<td>22,000</td>
<td>43,000,000</td>
</tr>
<tr>
<td>1913</td>
<td>23,500</td>
<td>44,000,000</td>
</tr>
<tr>
<td>1914*</td>
<td>25,375</td>
<td>45,098,464</td>
</tr>
<tr>
<td>1915</td>
<td>74,000</td>
<td>125,800,000</td>
</tr>
<tr>
<td>1916</td>
<td>92,130</td>
<td>166,650,723</td>
</tr>
<tr>
<td>1917</td>
<td>128,157</td>
<td>220,966,665</td>
</tr>
<tr>
<td>1918</td>
<td>227,790</td>
<td>434,155,992</td>
</tr>
<tr>
<td>1919</td>
<td>275,043</td>
<td>423,316,021</td>
</tr>
<tr>
<td>1920</td>
<td>321,789</td>
<td>423,240,410</td>
</tr>
<tr>
<td>1921†</td>
<td>148,065</td>
<td>164,858,850</td>
</tr>
<tr>
<td>1922‡</td>
<td>240,228</td>
<td>220,114,667</td>
</tr>
<tr>
<td>1923‡</td>
<td>386,755</td>
<td>305,900,066</td>
</tr>
<tr>
<td>1924‡</td>
<td>403,530</td>
<td>307,211,444</td>
</tr>
<tr>
<td>1925‡</td>
<td>473,154</td>
<td>433,744,079</td>
</tr>
<tr>
<td>1926‡</td>
<td>401,353</td>
<td>433,371,189</td>
</tr>
</tbody>
</table>

* From United States Census Reports.
† Canadian production included.
‡ Canadian production included.

### Canadian Production

<table>
<thead>
<tr>
<th>Year</th>
<th>Cars*</th>
<th>Trucks</th>
<th>Year</th>
<th>Cars*</th>
<th>Trucks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1919</td>
<td>70,036</td>
<td>7,800</td>
<td>1923</td>
<td>127,976</td>
<td>19,226</td>
</tr>
<tr>
<td>1920</td>
<td>81,636</td>
<td>10,588</td>
<td>1924</td>
<td>98,365</td>
<td>18,043</td>
</tr>
<tr>
<td>1921</td>
<td>61,098</td>
<td>5,148</td>
<td>1925</td>
<td>136,409</td>
<td>25,812</td>
</tr>
<tr>
<td>1922</td>
<td>92,838</td>
<td>8,169</td>
<td>1926</td>
<td>168,302</td>
<td>36,814</td>
</tr>
</tbody>
</table>

* Including special chassis.

### Passenger Car Production, United States Only, 1921-1926

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Passenger Cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1921</td>
<td>1,452,002</td>
</tr>
<tr>
<td>1922</td>
<td>2,302,003</td>
</tr>
<tr>
<td>1923</td>
<td>3,589,036</td>
</tr>
</tbody>
</table>
### Motor Vehicles Scrapped Annually in United States, 1913-1926*

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Vehicles Scrapped</th>
<th>Year</th>
<th>Number of Vehicles Scrapped</th>
</tr>
</thead>
<tbody>
<tr>
<td>1913</td>
<td>117,424</td>
<td>1920</td>
<td>357,355</td>
</tr>
<tr>
<td>1914</td>
<td>131,087</td>
<td>1921</td>
<td>507,759</td>
</tr>
<tr>
<td>1915</td>
<td>371,045</td>
<td>1922</td>
<td>815,200</td>
</tr>
<tr>
<td>1916</td>
<td>397,206</td>
<td>1923</td>
<td>877,010</td>
</tr>
<tr>
<td>1917</td>
<td>141,841</td>
<td>1924</td>
<td>1,145,820</td>
</tr>
<tr>
<td>1918</td>
<td>164,105</td>
<td>1925</td>
<td>1,668,016</td>
</tr>
<tr>
<td>1919</td>
<td>411,141</td>
<td>1926</td>
<td>1,900,000</td>
</tr>
</tbody>
</table>

*Computation by O. P. Pearson according to method described in Note 202, page 308.

Preliminary estimate.

### Invested Capital, Employment, and Wages

#### Invested Capital

<table>
<thead>
<tr>
<th>Year</th>
<th>Passenger Cars</th>
<th>Trucks</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1899 *</td>
<td>$284,660,151</td>
<td>$230,789,377</td>
<td>$5,560,000</td>
</tr>
<tr>
<td>1904 *</td>
<td>$867,053,600</td>
<td>306,425,000</td>
<td>3,200,000</td>
</tr>
<tr>
<td>1909 *</td>
<td>$1,344,166,000</td>
<td>289,334,000</td>
<td>1,233,871,000</td>
</tr>
<tr>
<td>1914 *</td>
<td>$1,554,103,325</td>
<td>302,546,620</td>
<td>1,425,649,952</td>
</tr>
<tr>
<td>1919</td>
<td>320,000</td>
<td>290,358,100</td>
<td>1,233,871,000</td>
</tr>
<tr>
<td>1921</td>
<td>3,177,377,419</td>
<td>317,077,088</td>
<td>3,091,205,112</td>
</tr>
<tr>
<td>1925</td>
<td>1,203,790,002</td>
<td>384,788,748</td>
<td>3,088,028,800</td>
</tr>
<tr>
<td>1930</td>
<td>1,000,000</td>
<td>444,000,000</td>
<td>2,088,000,000</td>
</tr>
</tbody>
</table>

* From 1919 edition of Facts and Figures.

† Includes body and parts plants.

‡ Tangible assets, United States factories. Does not include parts, accessory, body, and tire manufacturers.

### Registration of Motor Vehicles

#### By Years, for Entire United States*

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
<th>Year</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1895</td>
<td>4</td>
<td>1911</td>
<td>619,500</td>
</tr>
<tr>
<td>1896</td>
<td>15</td>
<td>1912</td>
<td>944,000</td>
</tr>
<tr>
<td>1897</td>
<td>90</td>
<td>1913</td>
<td>1,298,000</td>
</tr>
<tr>
<td>1898</td>
<td>800</td>
<td>1914</td>
<td>1,711,330</td>
</tr>
<tr>
<td>1899</td>
<td>3,200</td>
<td>1915</td>
<td>2,445,000</td>
</tr>
<tr>
<td>1900</td>
<td>8,000</td>
<td>1916</td>
<td>3,512,000</td>
</tr>
<tr>
<td>1901</td>
<td>14,800</td>
<td>1917</td>
<td>4,083,140</td>
</tr>
<tr>
<td>1902</td>
<td>23,000</td>
<td>1918</td>
<td>6,146,017</td>
</tr>
<tr>
<td>1903</td>
<td>32,070</td>
<td>1919</td>
<td>7,595,446</td>
</tr>
<tr>
<td>1904</td>
<td>55,000</td>
<td>1920</td>
<td>9,321,304</td>
</tr>
<tr>
<td>1905</td>
<td>75,000</td>
<td>1921</td>
<td>10,403,395</td>
</tr>
<tr>
<td>1906</td>
<td>107,000</td>
<td>1922</td>
<td>12,215,175</td>
</tr>
<tr>
<td>1907</td>
<td>142,000</td>
<td>1923</td>
<td>15,092,177</td>
</tr>
<tr>
<td>1908</td>
<td>197,500</td>
<td>1924</td>
<td>17,591,681</td>
</tr>
<tr>
<td>1909</td>
<td>312,000</td>
<td>1925</td>
<td>19,054,347</td>
</tr>
<tr>
<td>1910</td>
<td>408,500</td>
<td>1926</td>
<td>22,101,303</td>
</tr>
</tbody>
</table>

* As of the end of each year.
### 4. World Trade, World Production, and World Registration

#### United States Exports of Passenger Cars

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Number</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1919</td>
<td>67,145</td>
<td>$73,700,027</td>
</tr>
<tr>
<td>1920</td>
<td>122,308</td>
<td>$135,525,921</td>
</tr>
<tr>
<td>1921</td>
<td>59,050</td>
<td>$63,533,775</td>
</tr>
<tr>
<td>1922</td>
<td>66,790</td>
<td>$51,499,816</td>
</tr>
<tr>
<td>1923</td>
<td>127,035</td>
<td>$90,692,272</td>
</tr>
<tr>
<td>1924</td>
<td>151,379</td>
<td>$112,531,154</td>
</tr>
<tr>
<td>1925</td>
<td>252,124</td>
<td>$190,869,665</td>
</tr>
<tr>
<td>1926</td>
<td>245,443</td>
<td>$182,094,181</td>
</tr>
</tbody>
</table>

#### United States Exports of Motor Trucks and Automobile Parts

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Number of Trucks</th>
<th>Value of Trucks</th>
<th>Value of Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1919</td>
<td>15,585</td>
<td>$15,475,437</td>
<td>$42,562,186</td>
</tr>
<tr>
<td>1920</td>
<td>20,136</td>
<td>46,577,381</td>
<td>86,198,613</td>
</tr>
<tr>
<td>1921</td>
<td>7,480</td>
<td>10,315,803</td>
<td>30,058,729</td>
</tr>
<tr>
<td>1922</td>
<td>11,443</td>
<td>8,270,908</td>
<td>32,288,032</td>
</tr>
<tr>
<td>1923</td>
<td>14,881</td>
<td>13,138,028</td>
<td>59,027,407</td>
</tr>
<tr>
<td>1924</td>
<td>27,551</td>
<td>19,109,370</td>
<td>75,370,466</td>
</tr>
<tr>
<td>1925</td>
<td>60,116</td>
<td>30,096,447</td>
<td>86,043,013</td>
</tr>
<tr>
<td>1926</td>
<td>68,174</td>
<td>48,577,618</td>
<td>105,128,015</td>
</tr>
</tbody>
</table>

#### By States, as of December 31, 1926

<table>
<thead>
<tr>
<th>State</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>225,930</td>
</tr>
<tr>
<td>Arizona</td>
<td>23,685</td>
</tr>
<tr>
<td>Arkansas</td>
<td>200,419</td>
</tr>
<tr>
<td>California</td>
<td>1,000,478</td>
</tr>
<tr>
<td>Colorado</td>
<td>248,011</td>
</tr>
<tr>
<td>Connecticut</td>
<td>291,235</td>
</tr>
<tr>
<td>Delaware</td>
<td>44,734</td>
</tr>
<tr>
<td>Florida</td>
<td>401,562</td>
</tr>
<tr>
<td>Georgia</td>
<td>277,468</td>
</tr>
<tr>
<td>Idaho</td>
<td>94,760</td>
</tr>
<tr>
<td>Illinois</td>
<td>1,370,503</td>
</tr>
<tr>
<td>Indiana</td>
<td>772,520</td>
</tr>
<tr>
<td>Iowa</td>
<td>608,098</td>
</tr>
<tr>
<td>Kansas</td>
<td>491,270</td>
</tr>
<tr>
<td>Kentucky</td>
<td>281,557</td>
</tr>
<tr>
<td>Louisiana</td>
<td>330,500</td>
</tr>
<tr>
<td>Maine</td>
<td>154,480</td>
</tr>
<tr>
<td>Maryland</td>
<td>254,843</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>990,120</td>
</tr>
<tr>
<td>Michigan</td>
<td>1,188,786</td>
</tr>
<tr>
<td>Minnesota</td>
<td>630,285</td>
</tr>
<tr>
<td>Mississippi</td>
<td>205,200</td>
</tr>
<tr>
<td>Missouri</td>
<td>654,854</td>
</tr>
<tr>
<td>Montana</td>
<td>193,038</td>
</tr>
<tr>
<td>Nebraska</td>
<td>366,773</td>
</tr>
<tr>
<td>Nevada</td>
<td>24,014</td>
</tr>
</tbody>
</table>
### Exports and Imports of Motor Vehicles (Passenger Cars and Trucks)

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Exports</th>
<th>Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Value</td>
</tr>
<tr>
<td>1919</td>
<td>83,000</td>
<td>$109,000,000</td>
</tr>
<tr>
<td>1920</td>
<td>173,000</td>
<td>212,000,000</td>
</tr>
<tr>
<td>1921</td>
<td>38,000</td>
<td>43,000,000</td>
</tr>
<tr>
<td>1922</td>
<td>78,000</td>
<td>59,000,000</td>
</tr>
<tr>
<td>1923</td>
<td>152,000</td>
<td>106,000,000</td>
</tr>
<tr>
<td>1924</td>
<td>178,000</td>
<td>132,000,000</td>
</tr>
<tr>
<td>1925</td>
<td>312,240</td>
<td>270,968,212</td>
</tr>
<tr>
<td>1926</td>
<td>313,617</td>
<td>230,671,799</td>
</tr>
</tbody>
</table>

*Completed vehicles; excludes foreign assemblies of American units. Total vehicles exported, counting these assemblies, were: 1925, 451,590; 1926, 412,965.*

### World Production of Motor Vehicles

(Passenger Cars and Trucks), 1926

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of Motor Vehicles</th>
<th>Number of Persons per Motor Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>4,318,461†</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>205,116</td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>200,000</td>
<td></td>
</tr>
<tr>
<td>England</td>
<td>198,099</td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>64,760</td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>54,500</td>
<td></td>
</tr>
<tr>
<td>Czecho-Slovakia</td>
<td>7,500</td>
<td></td>
</tr>
<tr>
<td>Belgium</td>
<td>6,000</td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>5,000</td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>1,050</td>
<td></td>
</tr>
<tr>
<td>Total World Production</td>
<td>5,061,584</td>
<td></td>
</tr>
</tbody>
</table>

Proportion of U. S. output to world production: .85%

*Figures prepared by Automotive Division, United States Department of Commerce; reprinted in Facts and Figures, 1927.*

† Includes American cars assembled abroad.
5. Installment Sales: Financial Figures and Ratios.

AVERAGE OR COMPOSITE EXPERIENCE OF ABOUT 150 REPRESENTATIVE FINANCE COMPANIES, BASED UPON INDIVIDUAL AVERAGES FOR ONE YEAR, AS OF NOVEMBER 1.

Abridged from a compilation by the National Association of Finance Companies, Chicago.

<table>
<thead>
<tr>
<th></th>
<th>1925</th>
<th>1926</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of cars sold on the installment plan:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All cars</td>
<td>75.5%</td>
<td></td>
</tr>
<tr>
<td>New cars</td>
<td>64%</td>
<td></td>
</tr>
<tr>
<td>Automobile retail paper:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage calling for 13 or more monthly payments</td>
<td>18.32%</td>
<td>13.24%</td>
</tr>
<tr>
<td>Percentage with down payment of 35% or less on used cars and 25% or less on new cars</td>
<td>19.36%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Average amount of purchase money note (total of installments per car):

<table>
<thead>
<tr>
<th></th>
<th>1925</th>
<th>1926</th>
</tr>
</thead>
<tbody>
<tr>
<td>New cars</td>
<td>$550</td>
<td>$595</td>
</tr>
<tr>
<td>Used cars</td>
<td>$280</td>
<td>$277</td>
</tr>
<tr>
<td>Average loss per repossessed car:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 equal monthly payments or fewer</td>
<td>$50</td>
<td>$65</td>
</tr>
<tr>
<td>13 to 18 equal monthly payments</td>
<td>$78</td>
<td>$94</td>
</tr>
<tr>
<td>More than 18 equal monthly payments (or &quot;balloon&quot; note)</td>
<td>$220</td>
<td>$158</td>
</tr>
</tbody>
</table>

NEW CARS

Percentage of repossessions:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Down payment 35 1/2% of cash price or 30% of time selling price</td>
<td>1.72%</td>
<td>2.00%</td>
</tr>
<tr>
<td>Down payment 25% of time selling price</td>
<td>3.81%</td>
<td>4.03%</td>
</tr>
<tr>
<td>Down payment less than 25% of time selling price</td>
<td>10.96%</td>
<td>11.52%</td>
</tr>
</tbody>
</table>

USED CARS

Percentage of repossessions:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Down payment 40% of cash price or 37% of time selling price</td>
<td>3.01%</td>
<td>4.27%</td>
</tr>
<tr>
<td>Down payment less than 37% of time selling price</td>
<td>6.16%</td>
<td>8.57%</td>
</tr>
</tbody>
</table>

APPENDIX A

6. Financial and Other Statistics: Ford Motor Company and General Motors Corporation

FORD MOTOR COMPANY

BALANCE SHEETS AS OF DECEMBER 31, 1925 AND 1926

<table>
<thead>
<tr>
<th></th>
<th>Dec. 31, 1926</th>
<th>Dec. 31, 1925</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash, Accounts and Notes Receivable</td>
<td>$413,709,351</td>
<td>$1,177,105,078</td>
</tr>
<tr>
<td>Investments, Patents, Furniture and Fixtures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real Estate</td>
<td>143,203,082</td>
<td>132,107,028</td>
</tr>
<tr>
<td>Machinery and Equipment</td>
<td>137,615,082</td>
<td>134,445,000</td>
</tr>
<tr>
<td>Deferred Charges</td>
<td>1,514,067</td>
<td>1,624,236</td>
</tr>
<tr>
<td>Merchandise</td>
<td>88,074,088</td>
<td>107,831,138</td>
</tr>
<tr>
<td><strong>Total Assets</strong></td>
<td>$784,208,080</td>
<td>$742,913,568</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Dec. 31, 1926</th>
<th>Dec. 31, 1925</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Liabilities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital Stock</td>
<td>$17,264,500</td>
<td>$17,264,500</td>
</tr>
<tr>
<td>Accounts Payable</td>
<td>50,294,734</td>
<td>76,633,613</td>
</tr>
<tr>
<td>Reserve for Taxes</td>
<td>18,886,028</td>
<td>26,593,562</td>
</tr>
<tr>
<td>Mortgage Payable</td>
<td>145,000</td>
<td>145,000</td>
</tr>
<tr>
<td>Surplus</td>
<td>607,637,788</td>
<td>622,466,893</td>
</tr>
<tr>
<td><strong>Total Liabilities</strong></td>
<td>$784,208,080</td>
<td>$742,913,568</td>
</tr>
</tbody>
</table>

*These assets are all lumped together in the Ford Company's balance sheet. The data have been drawn from Moody's Manual of Industrials, 1926.
### Production of Ford Cars and Trucks, Calendar Years 1903-1926

(United States only)

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Cars</th>
<th>Number of Trucks</th>
<th>Year</th>
<th>Number of Cars</th>
<th>Number of Trucks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1903</td>
<td>708</td>
<td></td>
<td>1915</td>
<td>367,416</td>
<td></td>
</tr>
<tr>
<td>1904</td>
<td>1,000</td>
<td></td>
<td>1916</td>
<td>597,056</td>
<td></td>
</tr>
<tr>
<td>1905</td>
<td>1,695</td>
<td></td>
<td>1917</td>
<td>858,590</td>
<td>7,341</td>
</tr>
<tr>
<td>1906</td>
<td>1,599</td>
<td></td>
<td>1918</td>
<td>350,673</td>
<td>54,354</td>
</tr>
<tr>
<td>1907</td>
<td>8,423</td>
<td></td>
<td>1919</td>
<td>695,482</td>
<td>104,508</td>
</tr>
<tr>
<td>1908</td>
<td>6,158</td>
<td></td>
<td>1920</td>
<td>843,621</td>
<td>133,011</td>
</tr>
<tr>
<td>1909</td>
<td>12,292</td>
<td></td>
<td>1921</td>
<td>871,886</td>
<td>66,130</td>
</tr>
<tr>
<td>1910</td>
<td>19,293</td>
<td></td>
<td>1922</td>
<td>1,111,715</td>
<td>139,359</td>
</tr>
<tr>
<td>1911</td>
<td>40,402</td>
<td></td>
<td>1923</td>
<td>1,099,984</td>
<td>214,740</td>
</tr>
<tr>
<td>1912</td>
<td>78,611</td>
<td></td>
<td>1924</td>
<td>1,385,427</td>
<td>204,851</td>
</tr>
<tr>
<td>1913</td>
<td>182,799</td>
<td></td>
<td>1925</td>
<td>1,525,039</td>
<td>249,760</td>
</tr>
<tr>
<td>1914</td>
<td>258,356</td>
<td></td>
<td>1926</td>
<td>1,771,882</td>
<td>171,020</td>
</tr>
</tbody>
</table>

### Canadian Production of Ford Passenger Cars

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Cars</th>
<th>Year</th>
<th>Number of Cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1922</td>
<td>46,068</td>
<td>1925</td>
<td>61,882</td>
</tr>
<tr>
<td>1923</td>
<td>65,010</td>
<td>1926</td>
<td>81,361</td>
</tr>
<tr>
<td>1924</td>
<td>77,805</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Assets

#### Current and Working Assets

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash in banks and on hand</th>
<th>United States Government securities</th>
<th>Other marketable securities including temporary loans in 1925</th>
<th>Sight drafts with bills of lading attached, and c.o.d. items</th>
<th>Notes receivable</th>
<th>Accounts receivable and trade acceptances, less reserve for doubtful accounts</th>
<th>Inventories at cost or market</th>
<th>Prepaid expenses</th>
<th>Total Current and Working Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1925</td>
<td>$117,825,372.05</td>
<td>$12,840,580.65</td>
<td>$12,073,433.68</td>
<td>$4,733,433.44</td>
<td>$1,895,576.92</td>
<td>$27,701,286.38</td>
<td>$156,203,663.15</td>
<td>$3,050,866.96</td>
<td>$336,338,713.73</td>
</tr>
<tr>
<td>1924</td>
<td>$108,290,770.02</td>
<td>$25,141,317.68</td>
<td>$8,195,347.90</td>
<td>$2,704,005.41</td>
<td>$112,091,659.13</td>
<td>$20,817,493.47</td>
<td>$189,869,088.04</td>
<td>$1,858,584.43</td>
<td>$290,869,088.04</td>
</tr>
</tbody>
</table>

#### Fixed Assets

<table>
<thead>
<tr>
<th>Year</th>
<th>Investment in affiliated and miscellaneous companies</th>
<th>General Motors Corporation stocks held in treasury</th>
<th>Real estate, plants, and equipment</th>
<th>Deferred expenses</th>
<th>Good will, patents, etc.</th>
<th>Total Fixed Assets</th>
<th>Total Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1925</td>
<td>$79,715,822.88</td>
<td>$19,497,728.97</td>
<td>$434,973,003.49</td>
<td>$7,494,472.37</td>
<td>$43,579,000.95</td>
<td>$84,555,822.66</td>
<td>$920,894,105.89</td>
</tr>
<tr>
<td>1924</td>
<td>$86,183,747.60</td>
<td>$11,963,578.18</td>
<td>$287,268,286.41</td>
<td>$5,110,337.95</td>
<td>$22,382,127.00</td>
<td>$121,712,562.81</td>
<td>$703,786,584.85</td>
</tr>
</tbody>
</table>

### Total Assets

<table>
<thead>
<tr>
<th>Year</th>
<th>December 31, 1926</th>
<th>December 31, 1925</th>
</tr>
</thead>
<tbody>
<tr>
<td>1926</td>
<td>$290,869,088.04</td>
<td>$189,869,088.04</td>
</tr>
<tr>
<td>1925</td>
<td>$336,338,713.73</td>
<td>$290,869,088.04</td>
</tr>
</tbody>
</table>
### General Motors Corporation

**Condensed Consolidated Income Accounts, 1925 and 1926**

*(Abridged from 1926 Annual Report)*

<table>
<thead>
<tr>
<th>Year Ended</th>
<th>December 31, 1925</th>
<th>December 31, 1926</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Profit from operations and investments</strong></td>
<td>$243,441,474.63</td>
<td>$249,296,409.43</td>
</tr>
<tr>
<td><strong>Provision for depreciation</strong></td>
<td>20,259,973.51</td>
<td>17,366,506.84</td>
</tr>
<tr>
<td><strong>Net profit from operations and investments</strong></td>
<td>$222,181,501.12</td>
<td>$231,932,902.59</td>
</tr>
<tr>
<td><strong>Less: Provision for miscellaneous items</strong></td>
<td>$20,387,409.07</td>
<td>$11,077,460.70</td>
</tr>
<tr>
<td><strong>Less: Provision for United States and foreign income taxes</strong></td>
<td>$201,794,092.05</td>
<td>$220,855,441.89</td>
</tr>
<tr>
<td><strong>Net income</strong></td>
<td>$171,598,710.06</td>
<td>$107,070,531.89</td>
</tr>
<tr>
<td><strong>General Motors Corporation proportion of net income</strong></td>
<td>$174,085,743.04</td>
<td>$106,484,756.18</td>
</tr>
<tr>
<td><strong>Seven per cent preferred stock dividends</strong></td>
<td>$3,352,206.74</td>
<td>$3,315,222.21</td>
</tr>
<tr>
<td><strong>Six per cent preferred stock dividends</strong></td>
<td>$116,928.00</td>
<td>$115,540.50</td>
</tr>
<tr>
<td><strong>Six per cent debenture stock dividends</strong></td>
<td>$176,068.50</td>
<td>$189,228.50</td>
</tr>
<tr>
<td><strong>Earned on common stock</strong></td>
<td>$68,439,857.31</td>
<td>$98,844,764.97</td>
</tr>
<tr>
<td><strong>Plus: Equity in the undivided profits of General Motors Acceptance Corporation, Yellow Truck and Coach Manufacturing Company, Ethyl Gasoline Corporation, and Fisher Body Corporation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total earnings on common stock</strong></td>
<td>$178,585,855.00</td>
<td>$108,376,286.44</td>
</tr>
</tbody>
</table>

### Liabilities, Reserves, and Capital

<table>
<thead>
<tr>
<th></th>
<th>December 31, 1925</th>
<th>December 31, 1926</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current Liabilities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accounts payable</td>
<td>$48,221,294.10</td>
<td>$44,829,843.16</td>
</tr>
<tr>
<td>Taxes, pay rolls, and sundries accrued, not due</td>
<td>29,723,522.81</td>
<td>23,687,818.70</td>
</tr>
<tr>
<td>United States and foreign income taxes</td>
<td>30,324,466.79</td>
<td>13,012,000.00</td>
</tr>
<tr>
<td>Accrued dividends on preferred and debenture stock</td>
<td>1,274,714.65</td>
<td>1,214,872.84</td>
</tr>
<tr>
<td>Extra dividend on common stock, payable January</td>
<td>34,788,557.67</td>
<td>25,427,072.50</td>
</tr>
<tr>
<td><strong>Total Current Liabilities</strong></td>
<td>$144,337,506.00</td>
<td>$109,043,207.20</td>
</tr>
<tr>
<td><strong>Total Reserves (Depreciation and other items)</strong></td>
<td>$139,883,066.21</td>
<td>$105,766,217.16</td>
</tr>
<tr>
<td><strong>Capital Stock</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seven per cent preferred stock</td>
<td>$105,333,200.00</td>
<td>$104,619,200.00</td>
</tr>
<tr>
<td>Six per cent preferred stock (outstanding and authorized)</td>
<td>1,795,000.00</td>
<td>2,175,700.00</td>
</tr>
<tr>
<td>Six per cent debenture stock (outstanding and authorized)</td>
<td>2,786,900.00</td>
<td>3,121,100.00</td>
</tr>
<tr>
<td>Common stock no par value (Issued, 8,700,000 shares; in 1925, 5,161,599 shares)</td>
<td>435,000,000.00</td>
<td>258,079,050.00</td>
</tr>
<tr>
<td><strong>Total Capital Stock</strong></td>
<td>$544,916,000.00</td>
<td>$367,995,050.00</td>
</tr>
<tr>
<td><strong>Interest of minority stockholders in subsidiary companies</strong></td>
<td>2,420,688.21</td>
<td>1,061,844.65</td>
</tr>
<tr>
<td><strong>Surplus</strong></td>
<td>$80,341,318.47</td>
<td>$110,020,472.84</td>
</tr>
<tr>
<td><strong>Total Capital Stock and Surplus</strong></td>
<td>$636,678,003.68</td>
<td>$488,978,740.49</td>
</tr>
<tr>
<td><strong>Total Liabilities, Reserves, and Capital</strong></td>
<td>$920,804,105.89</td>
<td>$703,876,664.85</td>
</tr>
</tbody>
</table>
### General Motors Corporation Factory Sales, 1919-1926

(From 1926 Annual Report)

<table>
<thead>
<tr>
<th>Passenger Cars*</th>
<th>1926</th>
<th>1925</th>
<th>1924</th>
<th>1923</th>
<th>1922</th>
<th>1921</th>
<th>1920</th>
<th>1919</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buick</td>
<td>250,000</td>
<td>208,575</td>
<td>166,952</td>
<td>218,886</td>
<td>138,502</td>
<td>83,888</td>
<td>116,213</td>
<td>119,853</td>
</tr>
<tr>
<td>Cadillac</td>
<td>27,139</td>
<td>22,717</td>
<td>17,005</td>
<td>21,201</td>
<td>22,021</td>
<td>17,159</td>
<td>19,790</td>
<td>19,851</td>
</tr>
<tr>
<td>Chevrolet</td>
<td>610,246</td>
<td>486,485</td>
<td>315,456</td>
<td>464,800</td>
<td>240,390</td>
<td>75,657</td>
<td>144,502</td>
<td>132,210</td>
</tr>
<tr>
<td>Oakland</td>
<td>58,537</td>
<td>47,380</td>
<td>36,512</td>
<td>35,074</td>
<td>26,853</td>
<td>12,661</td>
<td>37,444</td>
<td>54,451</td>
</tr>
<tr>
<td>Pontiac</td>
<td>75,836</td>
<td>65,385</td>
<td>45,728</td>
<td>33,336</td>
<td>21,216</td>
<td>12,645</td>
<td>26,241</td>
<td>33,345</td>
</tr>
<tr>
<td>Oldsmobile</td>
<td>59,536</td>
<td>43,935</td>
<td>45,728</td>
<td>33,336</td>
<td>21,216</td>
<td>12,645</td>
<td>26,241</td>
<td>33,345</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Passenger</strong></td>
<td>1,221,771</td>
<td>787,148</td>
<td>566,553</td>
<td>774,017</td>
<td>442,981</td>
<td>203,191</td>
<td>343,990</td>
<td>350,210</td>
</tr>
<tr>
<td><strong>Commercial</strong></td>
<td>113,079</td>
<td>45,824</td>
<td>19,277</td>
<td>15,326</td>
<td>2,932</td>
<td>1,489</td>
<td>4,938</td>
<td>2,682</td>
</tr>
<tr>
<td><strong>Miscellaneous</strong></td>
<td>1,138</td>
<td>552</td>
<td>351</td>
<td>2,037</td>
<td>5,11</td>
<td>10,450</td>
<td>44,477</td>
<td>28,846</td>
</tr>
<tr>
<td><strong>GRAND TOTAL</strong></td>
<td>1,234,980</td>
<td>835,902</td>
<td>587,341</td>
<td>798,559</td>
<td>456,763</td>
<td>214,799</td>
<td>393,075</td>
<td>391,738</td>
</tr>
</tbody>
</table>

* Includes Canadian plants.  
† Miscellaneous includes GMC Trucks to end of April, 1925.

### Sources and Supporting Data

This following is a list of the principal persons to whom the writer is indebted for aid in the collection of data.

- Robert A. Basner, manager, Patent Department, National Automobile Chamber of Commerce, New York City.
- W. H. Benne, manager, Patent Department, National Automobile Chamber of Commerce, New York City.
- John P. Ayers, vice-president, Cleveland Trust Company.
- Robert S. Burnett, manager, Standards Department, Society of Automotive Engineers, New York City.
- A. B. Brandwain, manager, Patent Department, United States Motor Association, Detroit.
- R. B. Bate, executive secretary, American Automobile Association, Cleveland, Ohio.
- Robert A. Basner, manager, Patent Department, National Automobile Chamber of Commerce, New York City.
- Robert S. Burnett, manager, Standards Department, Society of Automotive Engineers, New York City.
- W. H. Benne, manager, Patent Department, National Automobile Chamber of Commerce, New York City.
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- W. H. Benne, manager, Patent Department, National Automobile Chamber of Commerce, New York City.
- John P. Ayers, vice-president, Cleveland Trust Company.
- Robert S. Burnett, manager, Standards Department, Society of Automotive Engineers, New York City.
ROY D. CHAPIN, chairman of the board, Hudson Motor Car Company, Detroit; president, National Automobile Chamber of Commerce, New York City.

COKER F. CLARKSON, secretary, Society of Automotive Engineers, New York City.

CHARLES CLIFTON, chairman of the board, Pierce-Arrow Motor Car Company, Buffalo; honorary president, National Automobile Chamber of Commerce, New York City.

HOWARD E. COFFIN, vice-president, Hudson Motor Car Company; formerly president, Society of Automotive Engineers.

JOSEPH P. COTTON, attorney-at-law, New York City; director, Willys-Overland Company, Toledo.

EDMUND E. DAY, dean, School of Business Administration, University of Michigan, Ann Arbor.

HOWARD EINSTEIN, consulting engineer, Detroit.

A. R. ERSKINE, president, The Studebaker Corporation, South Bend, Indiana.

F. LESLIE HAYFORD, economic statistician, General Motors Corporation, New York City.

FREDERICK J. HAYNES, chairman of the board, Dodge Brothers, Inc., Detroit.

MARCH HAYNES, Kokomo, Indiana.

J. C. HOLMES, assistant comptroller, Chrysler Corporation, Detroit.

HERBERT HOOVER, Secretary of Commerce, Washington.

J. WILLIAM JAMES, manager of publicity, Cadillac Motor Car Company, Detroit.

W. A. P. JOHN, Campbell-Ewald Company, Detroit.

CHARLES B. KING, Larchmont, New York; formerly president, King Motor Car Company.

JULIUS KLEIN, director, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington.

FRANK KOLBE, assistant treasurer, General Motors Corporation, Detroit.

EDWARD F. KORBEL, Korbel and Colwell, New York City.

JOHN R. LEE, assistant to the president, Dodge Brothers, Inc., Detroit. Formerly production manager, Ford Motor Company.


JOHN C. LONG, manager, Educational Department, National Automobile Chamber of Commerce, New York City.

ALVAN MACAULEY, president, Packard Motor Car Company, Detroit.

THOMAS H. MACDONALD, chief of Bureau of Public Roads, Department of Agriculture, Washington.
JAMES S. MARVIN, assistant general manager, National Automobile Chamber of Commerce, New York City.


S. A. MILES, manager, Passenger Car Show Committee, National Automobile Chamber of Commerce, New York City.


R. E. OLDS, chairman of the board, Reo Motor Car Company, Lansing; formerly vice-president, Olds Motor Works.

CHARLES COOLIDGE PARLIN, manager, Division of Commercial Research, Curtis Publishing Company, Philadelphia.


OSCAR P. PEARSON, statistician, National Automobile Chamber of Commerce, New York City.

E. LeROY PELLETIER, advertising manager, Rickenbacker Motor Company, Detroit; formerly advertising manager, Everitt-Metzger-Flanders Company.

W. L. POWLISON, librarian, National Automobile Chamber of Commerce, New York City.

A. B. QUALE, secretary, Willys-Overland Company, Toledo.

ALFRED REEVES, general manager, National Automobile Chamber of Commerce, New York City; formerly sales manager, United States Motor Company.

FRANK W. ROCHE, president, Motor Trades Publishing Company (Automobile Topics), New York City.

M. H. ROMIG, advertising manager, Velie Motors Corporation, Moline, Illinois.


JOSEPH A. SCHULTE, general manager, Detroit Branch, Cadillac Motor Car Company, Detroit.

JOHN W. SCOVILLE, statistician, Chrysler Corporation, Detroit.

GEORGE B. SELDEN, Jr., 13 Grove Place, Rochester, New York.

LAWRENCE H. SELTZER, associate professor of economics, College of the City of Detroit, Detroit.

H. O. SMITH, chief of Automotive Division, Department of Commerce, Washington.

FRANZ SNIDER, financial editor, New York Sun.


I. H. TAYLOR, assistant chief of Automotive Division, Department of Commerce, Washington.

C. A. VANE, general manager, National Automobile Dealers' Association, Chicago.

F. S. VORN, assistant advertising manager, The Studebaker Corporation of America, South Bend, Indiana.

J. B. WAGSTAFF, sales promotion division, Willys-Overland, Inc., Toledo.

HENRY G. WEAVER, director of sales research, General Motors Corporation, Detroit.

JOHN N. WILLYS, president, Willys-Overland Company, Toledo.

ALEXANDER WINTON, president, Winton Engine Company, Cleveland; formerly president, Winton Motor Car Company.
THE AUTOMOBILE INDUSTRY

2. Data of Charts and Tables

CHART 1

**SOURCE:** Facts and Figures of the Automobile Industry, published by the National Automobile Chamber of Commerce, New York City, 1924 and 1927 editions, hereinafter referred to as N.A.C.C.; also data compiled by American Telephone and Telegraph Company.

<table>
<thead>
<tr>
<th>Year</th>
<th>Motor Vehicle Registration</th>
<th>Number of Telegraphs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1902</td>
<td>28,755</td>
<td>2,377,644</td>
</tr>
<tr>
<td>1907</td>
<td>142,061</td>
<td>8,726,592</td>
</tr>
<tr>
<td>1912</td>
<td>944,000</td>
<td>11,756,520</td>
</tr>
<tr>
<td>1917</td>
<td>6,146,617</td>
<td>14,345,751</td>
</tr>
<tr>
<td>1923</td>
<td>12,238,575</td>
<td>17,746,168</td>
</tr>
</tbody>
</table>

CHART 2

**SOURCE:** N.A.C.C., 1927; United States Census of Manufactures, 1920 and 1921.

<table>
<thead>
<tr>
<th>Year</th>
<th>Wagons</th>
<th>Carriages</th>
<th>Motor Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1904</td>
<td>648,755</td>
<td>937,490</td>
<td>22,830</td>
</tr>
<tr>
<td>1909</td>
<td>587,685</td>
<td>828,422</td>
<td>130,986</td>
</tr>
<tr>
<td>1914</td>
<td>557,472</td>
<td>550,401</td>
<td>589,054</td>
</tr>
<tr>
<td>1919</td>
<td>414,909</td>
<td>244,386</td>
<td>1,035,594</td>
</tr>
</tbody>
</table>

CHART 3

**SOURCE:** Department of Agriculture, Bulletin No. 1279; also, N.A.C.C., 1927.

<table>
<thead>
<tr>
<th>Year</th>
<th>Miles Surfaced</th>
</tr>
</thead>
<tbody>
<tr>
<td>1904</td>
<td>153,520.40</td>
</tr>
<tr>
<td>1909</td>
<td>199,476.32</td>
</tr>
<tr>
<td>1914</td>
<td>257,207.54</td>
</tr>
<tr>
<td>1919</td>
<td>387,260.00</td>
</tr>
<tr>
<td>1924</td>
<td>591,945.00</td>
</tr>
</tbody>
</table>

APPENDIX B

**CHART 4**

**SOURCE:** N.A.C.C., 1925.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Passenger Cars</th>
<th>Year</th>
<th>No. of Passenger Cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1901</td>
<td>11,735</td>
<td>1910</td>
<td>181,000</td>
</tr>
<tr>
<td>1904</td>
<td>21,419</td>
<td>1911</td>
<td>199,319</td>
</tr>
<tr>
<td>1906</td>
<td>24,559</td>
<td>1912</td>
<td>350,000</td>
</tr>
<tr>
<td>1908</td>
<td>33,500</td>
<td>1913</td>
<td>461,500</td>
</tr>
<tr>
<td>1910</td>
<td>43,300</td>
<td>1914</td>
<td>543,579</td>
</tr>
<tr>
<td>1912</td>
<td>63,500</td>
<td>1915</td>
<td>818,618</td>
</tr>
<tr>
<td>1914</td>
<td>127,731</td>
<td>1916</td>
<td>1,525,578</td>
</tr>
</tbody>
</table>

**CHART 5**

**SOURCE:** These data are compiled from the same source as those of Chart 4.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Passenger Cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1901-1904</td>
<td>49,000</td>
</tr>
<tr>
<td>1905-1908</td>
<td>166,000</td>
</tr>
<tr>
<td>1909-1912</td>
<td>864,000</td>
</tr>
<tr>
<td>1913-1916</td>
<td>3,351,000</td>
</tr>
</tbody>
</table>

**CHART 6**

**SOURCE:** The data for this chart were obtained by classifying and adding together individual company production figures, which in nearly all cases were obtained from confidential sources. The method of compilation was as follows. The Handbook of Gasoline Automobiles, company catalogues, and the files of trade journals for each year from 1904 to 1917 were consulted to ascertain the number of models made by each producer and the price of each model. The price of the standard touring car was taken in every case where a touring car was made, except for the years 1920-1926, when the production of each maker was divided into closed and open cars; the closed car taken was either the coach or the 5-passenger standard sedan. The proportions assigned to the closed models in these years, except in individual cases where the exact ratio was known to vary greatly from these figures, were as follows:

- 1920-1926, 1/6
- 1922, 1/3
- 1924, 1/5
- 1926, 2/3
- 1921, 1/5
- 1923, 1/3
- 1925, 2/3
When more than one type of chassis was made by the same company and the proportion of production in each model could not be ascertained, the output of the maker was counted as being evenly divided between the two or more types of chassis sold during the year in question. Though this division was in some cases quite arbitrary, in other cases there existed reason to suspect that production actually was approximately so divided. It is, however, quite likely that errors thus made in one direction were largely compensated for by errors made in the other direction. For example, some company whose production was arbitrarily split between two models, a $1,200 car and a $1,500 car, may have sold more $1,200 cars than $1,500 ones; but some other company, making two products about similarly priced and whose production was likewise evenly divided in this count may well have sold more $1,500 cars than $1,200 ones. In the cases of nearly all of the larger companies, however, either the actual or the approximate proportions were ascertained within fairly close limits.

There were, furthermore, for some years substantial differences between the totals of cars in all classes and the total production figures estimated by the Census Bureau and by the National Automobile Chamber of Commerce. In part, these are explicable in that the "production" figures I have utilized are, as stated in the text of Chapter III, really factory sales figures. While over a long period the two sets of figures coincide, for short periods they may not; that is to say, they neglect annual "carryover" of finished car inventories. But these discrepancies are great in only two or three of the years under discussion; as stated in Note 75, I do not believe that they affect the percentage relationships involved; several friends in the industry, to whom I have shown the data, share this opinion. For most of the years in question, however, my totals roughly coincided with (came to within 90% to 100% of) the published production figures for the industry. The absolute detailed figures are not here given; but the proportions of cars in each price class, as depicted in Chart 6, are as given in the above tables.

### APPENDIX B

<table>
<thead>
<tr>
<th>Price Class</th>
<th>1910 %</th>
<th>1911 %</th>
<th>1912 %</th>
<th>1913 %</th>
<th>1914 %</th>
<th>1915 %</th>
<th>1916 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>$675 or under</td>
<td>7.0</td>
<td>15.9</td>
<td>46.0</td>
<td>46.6</td>
<td>49.3</td>
<td>43.9</td>
<td>51.1</td>
</tr>
<tr>
<td>676-875</td>
<td>5.9</td>
<td>30.2</td>
<td>3.2</td>
<td>0.5</td>
<td>5.0</td>
<td>15.5</td>
<td>19.8</td>
</tr>
<tr>
<td>876-1375</td>
<td>39.4</td>
<td>12.8</td>
<td>23.7</td>
<td>10.9</td>
<td>27.0</td>
<td>15.3</td>
<td>20.1</td>
</tr>
<tr>
<td>1376-1775</td>
<td>58.6</td>
<td>23.8</td>
<td>13.7</td>
<td>8.1</td>
<td>17.8</td>
<td>17.8</td>
<td>5.2</td>
</tr>
<tr>
<td>1776-2275</td>
<td>3.7</td>
<td>5.1</td>
<td>16.0</td>
<td>10.2</td>
<td>5.7</td>
<td>3.4</td>
<td>2.2</td>
</tr>
<tr>
<td>2276-2775</td>
<td>5.1</td>
<td>0.8</td>
<td>0.9</td>
<td>3.9</td>
<td>1.5</td>
<td>2.3</td>
<td>0.5</td>
</tr>
<tr>
<td>2776-3775</td>
<td>5.3</td>
<td>7.2</td>
<td>3.3</td>
<td>2.6</td>
<td>2.3</td>
<td>1.1</td>
<td>0.9</td>
</tr>
<tr>
<td>3776-4775</td>
<td>3.3</td>
<td>4.9</td>
<td>1.9</td>
<td>1.9</td>
<td>0.5</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>4776 and over</td>
<td>3.3</td>
<td>4.9</td>
<td>1.9</td>
<td>1.9</td>
<td>0.5</td>
<td>0.2</td>
<td>0.1</td>
</tr>
</tbody>
</table>
THE AUTOMOBILE INDUSTRY

APPENDIX B

CHART 9
Source: Same as Chart 6. The method employed is analogous to that used in computing the data for that chart.

### Curve B. Volume of Manufactures

<table>
<thead>
<tr>
<th>Year</th>
<th>Index Number</th>
</tr>
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<tbody>
<tr>
<td>1903</td>
<td>73.3</td>
</tr>
<tr>
<td>1904</td>
<td>71.9</td>
</tr>
<tr>
<td>1905</td>
<td>84.3</td>
</tr>
<tr>
<td>1906</td>
<td>90.5</td>
</tr>
<tr>
<td>1907</td>
<td>91.3</td>
</tr>
<tr>
<td>1908</td>
<td>77.5</td>
</tr>
<tr>
<td>1909</td>
<td>95.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Index Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1910</td>
<td>96.9</td>
</tr>
<tr>
<td>1911</td>
<td>92.4</td>
</tr>
<tr>
<td>1912</td>
<td>105.0</td>
</tr>
<tr>
<td>1913</td>
<td>100.2</td>
</tr>
<tr>
<td>1914</td>
<td>100.1</td>
</tr>
<tr>
<td>1915</td>
<td>100.3</td>
</tr>
<tr>
<td>1916</td>
<td>127.7</td>
</tr>
</tbody>
</table>

### Curve C. National Income

<table>
<thead>
<tr>
<th>Year</th>
<th>Index Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1909</td>
<td>94</td>
</tr>
<tr>
<td>1910</td>
<td>100</td>
</tr>
<tr>
<td>1911</td>
<td>98</td>
</tr>
<tr>
<td>1912</td>
<td>103</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Index Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1913</td>
<td>106</td>
</tr>
<tr>
<td>1914</td>
<td>102</td>
</tr>
<tr>
<td>1915</td>
<td>106</td>
</tr>
<tr>
<td>1916</td>
<td>125</td>
</tr>
</tbody>
</table>

### Chart 8
Source: Data through courtesy of Colonel Leonard P. Ayres. The casings are Firestone non-skid fabrics.

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage for Each Cylinder Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1903</td>
<td>18.8</td>
</tr>
<tr>
<td>1904</td>
<td>18.9</td>
</tr>
<tr>
<td>1905</td>
<td>18.1</td>
</tr>
<tr>
<td>1906</td>
<td>18.1</td>
</tr>
<tr>
<td>1907</td>
<td>18.0</td>
</tr>
<tr>
<td>1908</td>
<td>18.0</td>
</tr>
<tr>
<td>1909</td>
<td>18.0</td>
</tr>
<tr>
<td>1910</td>
<td>18.0</td>
</tr>
<tr>
<td>1911</td>
<td>18.0</td>
</tr>
<tr>
<td>1912</td>
<td>18.0</td>
</tr>
<tr>
<td>1913</td>
<td>18.0</td>
</tr>
<tr>
<td>1914</td>
<td>18.0</td>
</tr>
<tr>
<td>1915</td>
<td>18.0</td>
</tr>
<tr>
<td>1916</td>
<td>18.0</td>
</tr>
</tbody>
</table>

### Chart 10
Source: Same as Chart 9.

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage for Each Cylinder Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1903</td>
<td>18.0</td>
</tr>
<tr>
<td>1904</td>
<td>18.0</td>
</tr>
<tr>
<td>1905</td>
<td>18.0</td>
</tr>
<tr>
<td>1906</td>
<td>18.0</td>
</tr>
<tr>
<td>1907</td>
<td>18.0</td>
</tr>
<tr>
<td>1908</td>
<td>18.0</td>
</tr>
<tr>
<td>1909</td>
<td>18.0</td>
</tr>
<tr>
<td>1910</td>
<td>18.0</td>
</tr>
<tr>
<td>1911</td>
<td>18.0</td>
</tr>
<tr>
<td>1912</td>
<td>18.0</td>
</tr>
<tr>
<td>1913</td>
<td>18.0</td>
</tr>
<tr>
<td>1914</td>
<td>18.0</td>
</tr>
<tr>
<td>1915</td>
<td>18.0</td>
</tr>
<tr>
<td>1916</td>
<td>18.0</td>
</tr>
</tbody>
</table>
### Chart II

**Source:** Same as Chart 6.

#### Curve A. Low-Priced Cars

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Cars</th>
<th>Year</th>
<th>No. of Cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1903</td>
<td>7,253</td>
<td>1910</td>
<td>80,113</td>
</tr>
<tr>
<td>1904</td>
<td>9,440</td>
<td>1911</td>
<td>95,536</td>
</tr>
<tr>
<td>1905</td>
<td>11,215</td>
<td>1912</td>
<td>136,615</td>
</tr>
<tr>
<td>1906</td>
<td>11,951</td>
<td>1913</td>
<td>262,867</td>
</tr>
<tr>
<td>1907</td>
<td>13,285</td>
<td>1914</td>
<td>437,661</td>
</tr>
<tr>
<td>1908</td>
<td>19,072</td>
<td>1915</td>
<td>657,605</td>
</tr>
<tr>
<td>1909</td>
<td>56,284</td>
<td>1916</td>
<td>1,299,206</td>
</tr>
</tbody>
</table>

#### Curve B. Medium-Priced Cars

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Cars</th>
<th>Year</th>
<th>No. of Cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1903</td>
<td>1,916</td>
<td>1910</td>
<td>63,113</td>
</tr>
<tr>
<td>1904</td>
<td>2,872</td>
<td>1911</td>
<td>64,809</td>
</tr>
<tr>
<td>1905</td>
<td>6,293</td>
<td>1912</td>
<td>100,251</td>
</tr>
<tr>
<td>1906</td>
<td>9,405</td>
<td>1913</td>
<td>82,872</td>
</tr>
<tr>
<td>1907</td>
<td>14,427</td>
<td>1914</td>
<td>207,507</td>
</tr>
<tr>
<td>1908</td>
<td>16,618</td>
<td>1915</td>
<td>113,558</td>
</tr>
<tr>
<td>1909</td>
<td>38,625</td>
<td>1916</td>
<td>207,507</td>
</tr>
</tbody>
</table>

#### Curve C. High-Priced Cars

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Cars</th>
<th>Year</th>
<th>No. of Cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1903</td>
<td>1,206</td>
<td>1910</td>
<td>17,097</td>
</tr>
<tr>
<td>1904</td>
<td>1,688</td>
<td>1911</td>
<td>18,960</td>
</tr>
<tr>
<td>1905</td>
<td>5,842</td>
<td>1912</td>
<td>17,533</td>
</tr>
<tr>
<td>1906</td>
<td>7,735</td>
<td>1913</td>
<td>20,086</td>
</tr>
<tr>
<td>1907</td>
<td>8,672</td>
<td>1914</td>
<td>17,997</td>
</tr>
<tr>
<td>1908</td>
<td>7,427</td>
<td>1915</td>
<td>15,940</td>
</tr>
<tr>
<td>1909</td>
<td>20,039</td>
<td>1916</td>
<td>16,488</td>
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</table>

### Appendix B

#### Curve R. Replacements: High-Priced Cars

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1912</td>
<td>18,500</td>
</tr>
<tr>
<td>1913</td>
<td>18,600</td>
</tr>
<tr>
<td>1914</td>
<td>18,600</td>
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<tr>
<td>1915</td>
<td>18,600</td>
</tr>
<tr>
<td>1916</td>
<td>18,600</td>
</tr>
</tbody>
</table>

#### Chart 12

**Source:** The compilation mentioned in the discussion of Chart 6 in this appendix; the figures for Chart 12 are there listed.

#### Chart 13

**Source:** Same as Chart 4, but 1927 edition; Canadian production, however, is subtracted from figures asterisked in source.
CHART 14

**Source:** Data through courtesy of Mr. George W. Sawin, manager, B. F. Goodrich Rubber Company, and Mr. O. P. Pearson, statistician, National Automobile Chamber of Commerce. All figures are for casings of Goodrich make.

<table>
<thead>
<tr>
<th>Year</th>
<th>Per cent</th>
<th>Year</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1915</td>
<td>1.5</td>
<td>1921</td>
<td>22.1</td>
</tr>
<tr>
<td>1916</td>
<td>1.5</td>
<td>1922</td>
<td>30.0</td>
</tr>
<tr>
<td>1917</td>
<td>4.0</td>
<td>1923</td>
<td>34.0</td>
</tr>
<tr>
<td>1918</td>
<td>7.0</td>
<td>1924</td>
<td>43.0</td>
</tr>
<tr>
<td>1919</td>
<td>10.3</td>
<td>1925</td>
<td>56.5</td>
</tr>
<tr>
<td>1920</td>
<td>17.0</td>
<td>1926</td>
<td>72.0</td>
</tr>
</tbody>
</table>

CHART 15

**Source:** *N.A.C.C., 1925 and 1926.*

<table>
<thead>
<tr>
<th>Type</th>
<th>1924</th>
<th>1925</th>
<th>1926</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High pressure casings</strong></td>
<td>46,000,000</td>
<td>40,087,529</td>
<td>38,373,049</td>
</tr>
<tr>
<td><strong>Balloon casings</strong></td>
<td>5,633,000</td>
<td>20,756,883</td>
<td>20,099,318</td>
</tr>
</tbody>
</table>

CHART 16

**Source:** The *Handbooks of Gasoline Automobiles* and information received from individuals.

<table>
<thead>
<tr>
<th>Year</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1912</td>
<td>1.7</td>
</tr>
<tr>
<td>1913</td>
<td>8.7</td>
</tr>
<tr>
<td>1914</td>
<td>92.4</td>
</tr>
</tbody>
</table>

CHART 17

**Source:** Same as Chart 15.

<table>
<thead>
<tr>
<th>Year</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1923</td>
<td>2.4</td>
</tr>
<tr>
<td>1925</td>
<td>36.2</td>
</tr>
<tr>
<td>1927</td>
<td>90.5</td>
</tr>
</tbody>
</table>

APPENDIX B

CHART 18

**Source:** *N.A.C.C., 1927 and 1928.*

<table>
<thead>
<tr>
<th>Year</th>
<th>Per cent</th>
<th>Year</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1925</td>
<td>1.5</td>
<td>1921</td>
<td>22.1</td>
</tr>
<tr>
<td>1926</td>
<td>2.5</td>
<td>1922</td>
<td>30.0</td>
</tr>
<tr>
<td>1927</td>
<td>4.0</td>
<td>1923</td>
<td>34.0</td>
</tr>
<tr>
<td>1928</td>
<td>7.0</td>
<td>1924</td>
<td>43.0</td>
</tr>
<tr>
<td>1929</td>
<td>10.3</td>
<td>1925</td>
<td>56.5</td>
</tr>
<tr>
<td>1930</td>
<td>17.0</td>
<td>1926</td>
<td>72.0</td>
</tr>
</tbody>
</table>

CHART 19

**Source:** Compiled from the *Handbooks of Gasoline Automobiles* and from other automobile price lists and bulletins. The base is shifted each year, as explained in the text.

<table>
<thead>
<tr>
<th>Year</th>
<th>Index</th>
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<tbody>
<tr>
<td>1922</td>
<td>144.45</td>
</tr>
<tr>
<td>1923</td>
<td>136.59</td>
</tr>
<tr>
<td>1924</td>
<td>127.79</td>
</tr>
<tr>
<td>1925</td>
<td>114.23</td>
</tr>
<tr>
<td>1926</td>
<td>105.77</td>
</tr>
</tbody>
</table>

CHART 20

**Source:** Same as Chart 9.

<table>
<thead>
<tr>
<th>Year</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1917</td>
<td>80.0%</td>
<td>17.8%</td>
<td>1.7%</td>
<td>2.5%</td>
</tr>
<tr>
<td>1918</td>
<td>73.0%</td>
<td>23.0%</td>
<td>3.6%</td>
<td>4.0%</td>
</tr>
<tr>
<td>1919</td>
<td>71.5%</td>
<td>26.0%</td>
<td>2.7%</td>
<td>3.1%</td>
</tr>
<tr>
<td>1920</td>
<td>72.7%</td>
<td>24.6%</td>
<td>2.4%</td>
<td>2.3%</td>
</tr>
<tr>
<td>1921</td>
<td>78.1%</td>
<td>19.5%</td>
<td>2.0%</td>
<td>0.4%</td>
</tr>
<tr>
<td>1922</td>
<td>70.7%</td>
<td>18.3%</td>
<td>2.0%</td>
<td></td>
</tr>
<tr>
<td>1923</td>
<td>81.6%</td>
<td>17.4%</td>
<td>1.0%</td>
<td></td>
</tr>
<tr>
<td>1924</td>
<td>70.5%</td>
<td>20.4%</td>
<td>1.1%</td>
<td></td>
</tr>
<tr>
<td>1925</td>
<td>59.0%</td>
<td>29.3%</td>
<td>1.7%</td>
<td></td>
</tr>
<tr>
<td>1926</td>
<td>61.0%</td>
<td>36.8%</td>
<td>2.2%</td>
<td></td>
</tr>
</tbody>
</table>
## Chart 21
**Source:** Same as Chart 9.

<table>
<thead>
<tr>
<th>Year</th>
<th>Cylinder Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
</tr>
<tr>
<td>1917</td>
<td>62.7%</td>
</tr>
<tr>
<td>1918</td>
<td>49.6%</td>
</tr>
<tr>
<td>1919</td>
<td>48.0%</td>
</tr>
<tr>
<td>1920</td>
<td>45.1%</td>
</tr>
<tr>
<td>1921</td>
<td>65.3%</td>
</tr>
<tr>
<td>1922</td>
<td>67.7%</td>
</tr>
<tr>
<td>1923</td>
<td>47.4%</td>
</tr>
<tr>
<td>1924</td>
<td>47.8%</td>
</tr>
</tbody>
</table>

## Chart 22
**Source:** Same as Chart 10.

### Curve A. Low-Priced Cars

<table>
<thead>
<tr>
<th>Price Class</th>
<th>1917</th>
<th>1918</th>
<th>1919</th>
<th>1920</th>
<th>1921</th>
</tr>
</thead>
<tbody>
<tr>
<td>$675 and under</td>
<td>55.3</td>
<td>41.6</td>
<td>43.5</td>
<td>39.6</td>
<td>48.1</td>
</tr>
<tr>
<td>676-875</td>
<td>15.1</td>
<td>11.6</td>
<td>4.0</td>
<td>2.8</td>
<td>13.9</td>
</tr>
<tr>
<td>876-1375</td>
<td>19.6</td>
<td>11.6</td>
<td>4.0</td>
<td>2.8</td>
<td>13.9</td>
</tr>
<tr>
<td>1376-1775</td>
<td>15.5</td>
<td>11.6</td>
<td>4.0</td>
<td>2.8</td>
<td>13.9</td>
</tr>
<tr>
<td>1776-2275</td>
<td>3.1</td>
<td>3.0</td>
<td>8.5</td>
<td>10.6</td>
<td>11.3</td>
</tr>
<tr>
<td>2276-2775</td>
<td>0.3</td>
<td>1.1</td>
<td>1.9</td>
<td>4.0</td>
<td>2.3</td>
</tr>
<tr>
<td>2776-3775</td>
<td>0.9</td>
<td>1.7</td>
<td>1.6</td>
<td>3.0</td>
<td>4.7</td>
</tr>
<tr>
<td>3776-4775</td>
<td>0.1</td>
<td>0.4</td>
<td>0.3</td>
<td>1.7</td>
<td>1.1</td>
</tr>
<tr>
<td>4776 and over</td>
<td>0.1</td>
<td>0.2</td>
<td>0.4</td>
<td>0.7</td>
<td>0.9</td>
</tr>
</tbody>
</table>

### Curve B. Medium-Priced Cars

<table>
<thead>
<tr>
<th>Price Class</th>
<th>1917</th>
<th>1918</th>
<th>1919</th>
<th>1920</th>
<th>1921</th>
</tr>
</thead>
<tbody>
<tr>
<td>$675 and under</td>
<td>56.2</td>
<td>62.2</td>
<td>59.4</td>
<td>51.2</td>
<td>51.6</td>
</tr>
<tr>
<td>676-875</td>
<td>0.1</td>
<td>7.5</td>
<td>11.0</td>
<td>8.5</td>
<td>8.5</td>
</tr>
<tr>
<td>876-1375</td>
<td>20.4</td>
<td>13.7</td>
<td>13.8</td>
<td>19.8</td>
<td>24.7</td>
</tr>
<tr>
<td>1376-1775</td>
<td>11.7</td>
<td>8.8</td>
<td>9.6</td>
<td>11.5</td>
<td>7.5</td>
</tr>
<tr>
<td>1776-2275</td>
<td>3.7</td>
<td>5.2</td>
<td>2.7</td>
<td>5.8</td>
<td>3.2</td>
</tr>
<tr>
<td>2276-2775</td>
<td>4.5</td>
<td>1.4</td>
<td>1.1</td>
<td>1.3</td>
<td>2.4</td>
</tr>
<tr>
<td>2776-3775</td>
<td>1.3</td>
<td>1.3</td>
<td>0.8</td>
<td>1.0</td>
<td>1.3</td>
</tr>
<tr>
<td>3776-4775</td>
<td>0.9</td>
<td>0.4</td>
<td>0.6</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>4776 and over</td>
<td>0.7</td>
<td>0.1</td>
<td>0.1</td>
<td>0.4</td>
<td>0.3</td>
</tr>
</tbody>
</table>
APPENDIX B

CHART 27

SOURCE: These data are based upon both the materials mentioned in the discussion of Chart 6 and upon a study of the Handbooks of Automobiles and trade journal sources.

<table>
<thead>
<tr>
<th>Length of Life in Years</th>
<th>No. of Firms</th>
<th>Length of Life in Years</th>
<th>No. of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>.49</td>
<td>16-18</td>
<td>.7</td>
</tr>
<tr>
<td>4-6</td>
<td>.40</td>
<td>19-21</td>
<td>.11</td>
</tr>
<tr>
<td>7-9</td>
<td>.26</td>
<td>22-24</td>
<td>.8</td>
</tr>
<tr>
<td>10-12</td>
<td>.18</td>
<td>25-27</td>
<td>.4</td>
</tr>
<tr>
<td>13-15</td>
<td>.13</td>
<td>28-30</td>
<td>.5</td>
</tr>
</tbody>
</table>

CHART 28

SOURCE: The same as for Chart 27.

CHART 29

SOURCE: Same as for Chart 27, and R. G. Dun and Company.

CHART 30

SOURCE: Same as Chart 6.

CHART 31

SOURCE: Same as Chart 6.

CHART 32

SOURCE: Same as Chart 6.

CHART 33

SOURCE: Same as Chart 6.

CHART 34

SOURCE: Same as Chart 6.
### Chart 35

**Source:** These figures have been computed from the data utilized in the preparation of Chart 6.

<table>
<thead>
<tr>
<th>Year</th>
<th>Highest Firm</th>
<th>Firm at First Quartile</th>
<th>Median Firm</th>
<th>Firm at Third Quartile</th>
<th>Lowest Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1903</td>
<td>3,022</td>
<td>290</td>
<td>173</td>
<td>84</td>
<td>1</td>
</tr>
<tr>
<td>1904</td>
<td>3,502</td>
<td>310</td>
<td>172</td>
<td>83</td>
<td>1</td>
</tr>
<tr>
<td>1905</td>
<td>3,010</td>
<td>290</td>
<td>301</td>
<td>90</td>
<td>1</td>
</tr>
<tr>
<td>1906</td>
<td>4,045</td>
<td>1,073</td>
<td>310</td>
<td>129</td>
<td>4</td>
</tr>
<tr>
<td>1907</td>
<td>8,455</td>
<td>1,204</td>
<td>587</td>
<td>216</td>
<td>15</td>
</tr>
<tr>
<td>1908</td>
<td>8,847</td>
<td>900</td>
<td>278</td>
<td>119</td>
<td>18</td>
</tr>
<tr>
<td>1909</td>
<td>18,177</td>
<td>2,755</td>
<td>750</td>
<td>245</td>
<td>8</td>
</tr>
<tr>
<td>1910</td>
<td>30,957</td>
<td>1,175</td>
<td>750</td>
<td>245</td>
<td>8</td>
</tr>
<tr>
<td>1911</td>
<td>40,402</td>
<td>1,414</td>
<td>930</td>
<td>162</td>
<td>36</td>
</tr>
<tr>
<td>1912</td>
<td>29,512</td>
<td>1,617</td>
<td>911</td>
<td>186</td>
<td>15</td>
</tr>
<tr>
<td>1913</td>
<td>182,799</td>
<td>2,455</td>
<td>855</td>
<td>240</td>
<td>6</td>
</tr>
<tr>
<td>1914</td>
<td>128,256</td>
<td>2,194</td>
<td>904</td>
<td>248</td>
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<tr>
<td>1915</td>
<td>307,145</td>
<td>3,068</td>
<td>1,407</td>
<td>262</td>
<td>7</td>
</tr>
<tr>
<td>1916</td>
<td>507,920</td>
<td>6,486</td>
<td>1,026</td>
<td>700</td>
<td>7</td>
</tr>
<tr>
<td>1917</td>
<td>608,590</td>
<td>8,356</td>
<td>1,343</td>
<td>734</td>
<td>15</td>
</tr>
<tr>
<td>1918</td>
<td>501,613</td>
<td>7,186</td>
<td>1,082</td>
<td>556</td>
<td>10</td>
</tr>
<tr>
<td>1919</td>
<td>606,481</td>
<td>11,573</td>
<td>1,379</td>
<td>776</td>
<td>2</td>
</tr>
<tr>
<td>1920</td>
<td>550,011</td>
<td>10,753</td>
<td>1,099</td>
<td>185</td>
<td>7</td>
</tr>
<tr>
<td>1921</td>
<td>871,886</td>
<td>5,521</td>
<td>1,060</td>
<td>333</td>
<td>10</td>
</tr>
<tr>
<td>1922</td>
<td>1,355,053</td>
<td>8,164</td>
<td>1,337</td>
<td>537</td>
<td>10</td>
</tr>
<tr>
<td>1923</td>
<td>1,702,587</td>
<td>18,690</td>
<td>2,210</td>
<td>733</td>
<td>5</td>
</tr>
<tr>
<td>1924</td>
<td>1,985,417</td>
<td>20,310</td>
<td>2,732</td>
<td>572</td>
<td>21</td>
</tr>
<tr>
<td>1925</td>
<td>1,535,039</td>
<td>19,050</td>
<td>2,620</td>
<td>1,053</td>
<td>2</td>
</tr>
<tr>
<td>1926</td>
<td>1,271,882</td>
<td>60,392</td>
<td>7,615</td>
<td>1,302</td>
<td>13</td>
</tr>
</tbody>
</table>

### Chart 36

**Source:** The same as Chart 6. The median figures listed above in the data for Chart 35. The arithmetic mean figures follow:

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Cars Per Plant</th>
<th>Year</th>
<th>Number of Cars Per Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1903</td>
<td>439</td>
<td>1915</td>
<td>11,388</td>
</tr>
<tr>
<td>1904</td>
<td>379</td>
<td>1916</td>
<td>18,005</td>
</tr>
<tr>
<td>1905</td>
<td>632</td>
<td>1917</td>
<td>21,021</td>
</tr>
<tr>
<td>1906</td>
<td>695</td>
<td>1918</td>
<td>12,554</td>
</tr>
<tr>
<td>1907</td>
<td>1,079</td>
<td>1919</td>
<td>30,494</td>
</tr>
<tr>
<td>1908</td>
<td>833</td>
<td>1920</td>
<td>21,845</td>
</tr>
<tr>
<td>1909</td>
<td>1,281</td>
<td>1921</td>
<td>16,018</td>
</tr>
<tr>
<td>1910</td>
<td>2,467</td>
<td>1922</td>
<td>25,629</td>
</tr>
<tr>
<td>1911</td>
<td>2,171</td>
<td>1923</td>
<td>46,486</td>
</tr>
<tr>
<td>1912</td>
<td>3,505</td>
<td>1924</td>
<td>49,597</td>
</tr>
<tr>
<td>1913</td>
<td>5,003</td>
<td>1925</td>
<td>71,002</td>
</tr>
<tr>
<td>1914</td>
<td>6,648</td>
<td>1926</td>
<td>81,720</td>
</tr>
</tbody>
</table>

### Chart 37

**Source:** Same as Chart 6.

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage</th>
<th>Year</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1903</td>
<td>91.9</td>
<td>1915</td>
<td>94.7</td>
</tr>
<tr>
<td>1904</td>
<td>96.8</td>
<td>1916</td>
<td>94.1</td>
</tr>
<tr>
<td>1905</td>
<td>68.5</td>
<td>1917</td>
<td>91.7</td>
</tr>
<tr>
<td>1906</td>
<td>84.5</td>
<td>1918</td>
<td>90.0</td>
</tr>
<tr>
<td>1907</td>
<td>85.5</td>
<td>1919</td>
<td>87.5</td>
</tr>
<tr>
<td>1908</td>
<td>86.0</td>
<td>1920</td>
<td>92.6</td>
</tr>
<tr>
<td>1909</td>
<td>79.4</td>
<td>1921</td>
<td>95.1</td>
</tr>
<tr>
<td>1910</td>
<td>93.3</td>
<td>1922</td>
<td>95.0</td>
</tr>
<tr>
<td>1911</td>
<td>72.0</td>
<td>1923</td>
<td>95.1</td>
</tr>
<tr>
<td>1912</td>
<td>91.0</td>
<td>1924</td>
<td>93.3</td>
</tr>
<tr>
<td>1913</td>
<td>93.6</td>
<td>1925</td>
<td>91.8</td>
</tr>
<tr>
<td>1914</td>
<td>92.4</td>
<td>1926</td>
<td>88.4</td>
</tr>
</tbody>
</table>
THE AUTOMOBILE INDUSTRY

CHART 38

SOURCE: Same as Chart 6.

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1903</td>
<td>90.3</td>
</tr>
<tr>
<td>1904</td>
<td>85.3</td>
</tr>
<tr>
<td>1905</td>
<td>65.6</td>
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<td>1906</td>
<td>85.6</td>
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<tr>
<td>1907</td>
<td>81.0</td>
</tr>
<tr>
<td>1908</td>
<td>85.1</td>
</tr>
<tr>
<td>1909</td>
<td>77.1</td>
</tr>
<tr>
<td>1910</td>
<td>93.3</td>
</tr>
<tr>
<td>1911</td>
<td>93.1</td>
</tr>
<tr>
<td>1912</td>
<td>88.1</td>
</tr>
<tr>
<td>1913</td>
<td>88.0</td>
</tr>
<tr>
<td>1914</td>
<td>94.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1915</td>
<td>90.8</td>
</tr>
<tr>
<td>1916</td>
<td>90.7</td>
</tr>
<tr>
<td>1917</td>
<td>84.6</td>
</tr>
<tr>
<td>1918</td>
<td>85.1</td>
</tr>
<tr>
<td>1919</td>
<td>77.8</td>
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<tr>
<td>1920</td>
<td>85.9</td>
</tr>
<tr>
<td>1921</td>
<td>88.3</td>
</tr>
<tr>
<td>1922</td>
<td>91.5</td>
</tr>
<tr>
<td>1923</td>
<td>90.8</td>
</tr>
<tr>
<td>1924</td>
<td>86.8</td>
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<tr>
<td>1925</td>
<td>86.3</td>
</tr>
<tr>
<td>1926</td>
<td>82.4</td>
</tr>
</tbody>
</table>

CHART 39

SOURCE: Figures from Seltzer, op. cit., through 1924; 1925-1927 computed from General Motors Corporation annual reports. All figures are as of the beginning of each year.

<table>
<thead>
<tr>
<th>Year</th>
<th>Net Worth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1909</td>
<td>$9,684,401</td>
</tr>
<tr>
<td>1910</td>
<td>17,826,303</td>
</tr>
<tr>
<td>1911</td>
<td>33,510,119</td>
</tr>
<tr>
<td>1912</td>
<td>31,456,005</td>
</tr>
<tr>
<td>1913</td>
<td>33,570,578</td>
</tr>
<tr>
<td>1914</td>
<td>34,402,392</td>
</tr>
<tr>
<td>1915</td>
<td>38,176,411</td>
</tr>
<tr>
<td>1916</td>
<td>41,477,143</td>
</tr>
<tr>
<td>1917</td>
<td>68,058,493</td>
</tr>
<tr>
<td>1918</td>
<td>88,058,493</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Net Worth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1919</td>
<td>$237,525,137</td>
</tr>
<tr>
<td>1920</td>
<td>317,340,107</td>
</tr>
<tr>
<td>1921</td>
<td>424,669,092</td>
</tr>
<tr>
<td>1922</td>
<td>356,104,136</td>
</tr>
<tr>
<td>1923</td>
<td>404,084,093</td>
</tr>
<tr>
<td>1924</td>
<td>437,070,370</td>
</tr>
<tr>
<td>1925</td>
<td>486,885,309</td>
</tr>
<tr>
<td>1926</td>
<td>497,884,186</td>
</tr>
<tr>
<td>1927</td>
<td>641,297,924</td>
</tr>
</tbody>
</table>

APPENDIX B

CHART 40

SOURCE: United States output figures from N. A. C. C., 1927; General Motors figures through 1918 from Seltzer, op. cit.; 1928-1926 from annual reports of the General Motors Corporation.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total U. S. Output</th>
<th>General Motors Output</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1909</td>
<td>130,086</td>
<td>30,981</td>
<td>23.7</td>
</tr>
<tr>
<td>1910</td>
<td>187,000</td>
<td>35,752</td>
<td>19.0</td>
</tr>
<tr>
<td>1911</td>
<td>210,000</td>
<td>46,719</td>
<td>11.3</td>
</tr>
<tr>
<td>1912</td>
<td>378,000</td>
<td>53,068</td>
<td>7.8</td>
</tr>
<tr>
<td>1913</td>
<td>485,000</td>
<td>39,120</td>
<td>8.0</td>
</tr>
<tr>
<td>1914</td>
<td>369,054</td>
<td>53,068</td>
<td>9.5</td>
</tr>
<tr>
<td>1915</td>
<td>366,050</td>
<td>76,068</td>
<td>21.1</td>
</tr>
<tr>
<td>1916</td>
<td>1,687,708</td>
<td>312,088</td>
<td>18.4</td>
</tr>
<tr>
<td>1917</td>
<td>1,868,049</td>
<td>312,088</td>
<td>17.4</td>
</tr>
<tr>
<td>1918</td>
<td>1,792,686</td>
<td>246,834</td>
<td>14.2</td>
</tr>
<tr>
<td>1919</td>
<td>1,974,016</td>
<td>391,738</td>
<td>19.9</td>
</tr>
<tr>
<td>1920</td>
<td>1,904,047</td>
<td>203,075</td>
<td>10.7</td>
</tr>
<tr>
<td>1921</td>
<td>1,660,082</td>
<td>214,769</td>
<td>13.0</td>
</tr>
<tr>
<td>1922</td>
<td>2,055,624</td>
<td>450,703</td>
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</tr>
<tr>
<td>1923</td>
<td>2,079,992</td>
<td>709,555</td>
<td>34.9</td>
</tr>
<tr>
<td>1924</td>
<td>2,006,815</td>
<td>587,341</td>
<td>29.2</td>
</tr>
<tr>
<td>1925</td>
<td>3,122,456</td>
<td>793,907</td>
<td>25.2</td>
</tr>
<tr>
<td>1926</td>
<td>4,428,286</td>
<td>1,594,820</td>
<td>35.2</td>
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</table>

CHART 41

SOURCE: Same as Chart 6.

INCLUDING FORD

<table>
<thead>
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<th>Year</th>
<th>Percentage</th>
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<tbody>
<tr>
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<td>1904</td>
<td>73.4</td>
</tr>
<tr>
<td>1905</td>
<td>72.5</td>
</tr>
<tr>
<td>1906</td>
<td>65.5</td>
</tr>
<tr>
<td>1907</td>
<td>53.4</td>
</tr>
</tbody>
</table>

<table>
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<th>Percentage</th>
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</tr>
<tr>
<td>1909</td>
<td>67.2</td>
</tr>
<tr>
<td>1910</td>
<td>87.5</td>
</tr>
<tr>
<td>1911</td>
<td>71.4</td>
</tr>
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</table>
THE AUTOMOBILE INDUSTRY

EXCLUDING FORD

<table>
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<th>Per Cent</th>
<th>Year</th>
<th>Per Cent</th>
</tr>
</thead>
<tbody>
<tr>
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<td>54.7</td>
</tr>
<tr>
<td>1904</td>
<td>70.3</td>
<td>1909</td>
<td>74.8</td>
</tr>
<tr>
<td>1905</td>
<td>70.0</td>
<td>1910</td>
<td>99.8</td>
</tr>
<tr>
<td>1906</td>
<td>69.6</td>
<td>1911</td>
<td>98.3</td>
</tr>
<tr>
<td>1907</td>
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<td></td>
</tr>
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</table>

CHART 42

SOURCE: Same as Chart 6.

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<th>Year</th>
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<th>Year</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
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<td>1915</td>
<td>41.5</td>
</tr>
<tr>
<td>1904</td>
<td>7.6</td>
<td>1916</td>
<td>41.8</td>
</tr>
<tr>
<td>1905</td>
<td>5.4</td>
<td>1917</td>
<td>46.4</td>
</tr>
<tr>
<td>1906</td>
<td>5.5</td>
<td>1918</td>
<td>69.0</td>
</tr>
<tr>
<td>1907</td>
<td>13.6</td>
<td>1919</td>
<td>69.8</td>
</tr>
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<td>10.0</td>
<td>1920</td>
<td>48.5</td>
</tr>
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<td>11.3</td>
<td>1921</td>
<td>60.0</td>
</tr>
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<td>1923</td>
<td>46.5</td>
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<tr>
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<td>34.9</td>
<td>1924</td>
<td>49.1</td>
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<tr>
<td>1913</td>
<td>40.2</td>
<td>1925</td>
<td>40.5</td>
</tr>
<tr>
<td>1914</td>
<td>48.4</td>
<td>1926</td>
<td>33.0</td>
</tr>
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</table>

CHARTS 43, 44, 45

SOURCE: See Note 174. The figures are based either on Lawrence H. Seltzer, Some Chapters on Capital in the Automobile Industry, Tables 28, 29, 50, 54, 57, 61, 62, an unnumbered table on p. 255; Poor's Manual, issues of 1923 and 1925, analyses of the Ford Motor Company; Moody's Manual of Investments for various years, or the annual reports of the several corporations included. The Ford net worth figures which I have computed from the balance sheets shown in Poor's and Moody's are gross assets less good will, minus all liabilities of the corporation to all others than those to shareholders. Seltzer's figures for the various net worths in some instances include patents and good will, but these items are in all those cases insignificant. I have excluded good will and patents in my computation, but have included all other assets, less liabilities to all others than stockholders and bondholders. Thus the net worth figures, with allowance for some variation in accounting methods as between companies, are practically the equivalent of "invested capital," at least, are sufficiently so for the purposes at hand. The Ford profits figures for the years 1922, 1923, 1924, 1925, and 1926 not being available, I have estimated by taking the difference between the net worth of each year and that of the year preceding. This procedure may, of course, understate the Ford earnings, for it ignores entirely whatever may have been withdrawn as dividends by the Ford family; it is, however, all that one can do by way of estimate. So far as the general public is aware, no very large sums seem to have been invested by the Fords in other firms or industries during these last few years; but one does not know, of

FORD MOTOR COMPANY*

<table>
<thead>
<tr>
<th>Year Ending</th>
<th>Receipts</th>
<th>Net Worth</th>
<th>Net Profits</th>
<th>Percentages of Net Profits to Net Worth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept. 30, 1904</td>
<td>$1,336,800</td>
<td>$100,000</td>
<td>$283,037</td>
<td>283.0</td>
</tr>
<tr>
<td>* 30, 1905</td>
<td>1,914,905</td>
<td>220,758</td>
<td>290,194</td>
<td>131.5</td>
</tr>
<tr>
<td>* 30, 1906</td>
<td>1,491,626</td>
<td>231,807</td>
<td>1,038,928</td>
<td>44.2</td>
</tr>
<tr>
<td>* 30, 1907</td>
<td>2,723,851</td>
<td>207,863</td>
<td>1,279,308</td>
<td>46.2</td>
</tr>
<tr>
<td>* 30, 1908</td>
<td>2,041,921</td>
<td>908,552</td>
<td>2,322,876</td>
<td>122.8</td>
</tr>
<tr>
<td>* 30, 1909</td>
<td>1,521,299</td>
<td>701,172</td>
<td>4,271,510</td>
<td>287.6</td>
</tr>
<tr>
<td>* 30, 1910</td>
<td>1,740,268</td>
<td>1,008,791</td>
<td>1,370,808</td>
<td>208.2</td>
</tr>
<tr>
<td>* 30, 1911</td>
<td>2,400,961</td>
<td>994,085</td>
<td>2,275,021</td>
<td>140.5</td>
</tr>
<tr>
<td>* 30, 1912</td>
<td>4,747,677</td>
<td>906,543</td>
<td>1,253,332</td>
<td>132.1</td>
</tr>
<tr>
<td>* 30, 1913</td>
<td>5,610,883</td>
<td>1,097,386</td>
<td>2,045,767</td>
<td>128.5</td>
</tr>
<tr>
<td>* 30, 1914</td>
<td>1,104,847</td>
<td>602,354</td>
<td>2,323,455</td>
<td>100.3</td>
</tr>
<tr>
<td>July 31, 1915</td>
<td>1,317,586</td>
<td>53,875,226</td>
<td>2,641,432</td>
<td>45.7</td>
</tr>
<tr>
<td>* 31, 1916</td>
<td>2,068,057</td>
<td>91,353,771</td>
<td>30,049,018</td>
<td>100.1</td>
</tr>
<tr>
<td>* 31, 1917</td>
<td>2,747,503</td>
<td>114,060,908</td>
<td>26,314,057</td>
<td>112.4</td>
</tr>
<tr>
<td>* 31, 1918</td>
<td>3,005,324</td>
<td>133,604,007</td>
<td>36,341,657</td>
<td>27.7</td>
</tr>
<tr>
<td>* 31, 1919</td>
<td>3,025,125</td>
<td>120,186,721</td>
<td>69,916,487</td>
<td>23.7</td>
</tr>
<tr>
<td>April 30, 1920</td>
<td>4,706,865</td>
<td>202,135,296</td>
<td>53,448,480</td>
<td>26.3</td>
</tr>
<tr>
<td>* 31, 1921</td>
<td>5,610,430</td>
<td>1,253,579,647</td>
<td>75,790,390</td>
<td>55.7</td>
</tr>
<tr>
<td>April 30, 1922</td>
<td>4,057,596</td>
<td>330,000,000</td>
<td>181,200,000</td>
<td>57.5</td>
</tr>
<tr>
<td>* 31, 1922</td>
<td>4,600,000</td>
<td>197,800,000</td>
<td>29.0</td>
<td></td>
</tr>
<tr>
<td>* 31, 1923</td>
<td>4,645,000</td>
<td>1,253,579,647</td>
<td>99,000,000</td>
<td>18.3</td>
</tr>
<tr>
<td>* 31, 1924</td>
<td>4,066,750</td>
<td>73,012,055</td>
<td>84,050,000</td>
<td>117.1</td>
</tr>
</tbody>
</table>

*Profits figure for 1922, 1923, 1924, 1925 and 1926 are estimated by the present writer. Those for 1909 and 1920 are estimated by Seltzer. His footnotes explaining his estimates and the several shifts in fiscal periods are here omitted, as well as a note to the 1919 net worth figure.

†Includes Lincoln Motor Company, 1922-1926.

‡Estimated as explained above.

§Four-month period ending April 30, 1922.

April 30, 1923-1928.

Twenty-month period ending December 31, 1923.
THE AUTOMOBILE INDUSTRY

As has been employed in private investments or in personal expenditure.
The absolute figures are not given except for the Ford Motor Company. The percentages which I have either taken or computed from the various sources above mentioned, however, follow. For most years, the Ford Company’s volume of sales also is shown.

PERCENTAGE OF NET PROFITS TO NET WORTH

<table>
<thead>
<tr>
<th>Year</th>
<th>Reo Motor Car Company</th>
<th>Packard Motor Car Company</th>
<th>General Motors Corporation*</th>
<th>Willys-Overland Company</th>
<th>Hudson Motor Car Company</th>
<th>Studebaker Corporation</th>
<th>Nash Motors Company</th>
<th>Dodge Brothers, Inc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1905</td>
<td>48.7</td>
<td>63.7</td>
<td></td>
<td></td>
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<td>1906</td>
<td>43.9</td>
<td>77.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1907</td>
<td>63.0</td>
<td>64.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>1908</td>
<td>68.6</td>
<td>43.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1909</td>
<td>67.0</td>
<td>62.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1910</td>
<td>22.2</td>
<td>57.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1911</td>
<td>10.7</td>
<td>10.48</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1912</td>
<td>16.1</td>
<td>13.39</td>
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<tr>
<td>1913</td>
<td>20.9</td>
<td>16.5</td>
<td></td>
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<td></td>
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<td>1914</td>
<td>49.1</td>
<td>8.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1915</td>
<td>38.2</td>
<td>17.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>1916</td>
<td>34.0</td>
<td>34.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1917</td>
<td>15.4</td>
<td>18.6</td>
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<td>14.0</td>
<td>10.8</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1919</td>
<td>17.2</td>
<td>12.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1920</td>
<td>15.0</td>
<td>14.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1921</td>
<td>16.9</td>
<td>31.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1922</td>
<td>23.2</td>
<td>23.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1923</td>
<td>38.1</td>
<td>15.33</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1924</td>
<td>15.0</td>
<td>10.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1925</td>
<td>15.0</td>
<td>10.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1926</td>
<td>20.3</td>
<td>26.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Includes, throughout either all or a part of the period, the following passenger car companies, in addition to several truck and parts making firms: Buick Motor Company, Cadillac Motor Company, Olds Motor Works, Oakland Motor Company, Marquette Motor Car Company, Cartercar Company, Elmore Manufacturing Company, Ewing Automobile Company (all acquired 1908-1910), Scripps-Booth Corporation (acquired 1915), Chevrolet Motor Company (acquired 1917), and Sheridan Motor Car Company (organized and acquired 1920).

† Net loss.
THE AUTOMOBILE INDUSTRY

CHART 47

SOURCE: The data for this chart are those of Charts 43, 44, and 45, plus data for the Pierce-Arrow Motor Car Company. The net worths and net profits, respectively, of all companies included in those three charts were added together for each year and the percentages of aggregate profits upon aggregate net worths then computed. Both the absolute figures and the percentages obtained here follow. Also, there is given the number of companies included each year, counting each producing unit of General Motors as a separate company.

ALL COMPANIES, FORD INCLUDED

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Companies</th>
<th>Total Net Worth</th>
<th>Total Income</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1910</td>
<td>12</td>
<td>$34,582,275</td>
<td>$19,614,072</td>
<td>56.4</td>
</tr>
<tr>
<td>1911</td>
<td>11</td>
<td>$32,875,329</td>
<td>$11,992,636</td>
<td>22.6</td>
</tr>
<tr>
<td>1912</td>
<td>9</td>
<td>$57,109,396</td>
<td>$20,411,718</td>
<td>33.9</td>
</tr>
<tr>
<td>1913</td>
<td>10</td>
<td>$82,755,479</td>
<td>$42,456,370</td>
<td>51.3</td>
</tr>
<tr>
<td>1914</td>
<td>10</td>
<td>$106,298,122</td>
<td>$57,444,197</td>
<td>38.9</td>
</tr>
<tr>
<td>1915</td>
<td>11</td>
<td>$147,797,504</td>
<td>$77,354,190</td>
<td>51.3</td>
</tr>
<tr>
<td>1916</td>
<td>10</td>
<td>$237,339,695</td>
<td>$113,537,604</td>
<td>49.4</td>
</tr>
<tr>
<td>1917</td>
<td>12</td>
<td>$336,590,406</td>
<td>$88,255,086</td>
<td>26.6</td>
</tr>
<tr>
<td>1918</td>
<td>12</td>
<td>$400,121,222</td>
<td>$66,330,824</td>
<td>16.5</td>
</tr>
<tr>
<td>1919</td>
<td>13</td>
<td>$606,844,479</td>
<td>$105,622,503</td>
<td>17.0</td>
</tr>
<tr>
<td>1920</td>
<td>14</td>
<td>$779,379,712</td>
<td>$117,280,788</td>
<td>15.0</td>
</tr>
<tr>
<td>1921</td>
<td>15</td>
<td>$856,468,916</td>
<td>$123,644,413</td>
<td>14.4</td>
</tr>
<tr>
<td>1922</td>
<td>15</td>
<td>$966,516,484</td>
<td>$260,608,204</td>
<td>26.9</td>
</tr>
<tr>
<td>1923</td>
<td>14</td>
<td>$1,209,884,596</td>
<td>$265,338,444</td>
<td>21.9</td>
</tr>
<tr>
<td>1924</td>
<td>14</td>
<td>$1,374,325,197</td>
<td>$208,335,106</td>
<td>15.2</td>
</tr>
<tr>
<td>1925</td>
<td>14</td>
<td>$1,600,139,907</td>
<td>$317,615,340</td>
<td>19.8</td>
</tr>
<tr>
<td>1926</td>
<td>14</td>
<td>$1,838,094,988</td>
<td>$304,175,417</td>
<td>10.8</td>
</tr>
</tbody>
</table>

APPENDIX B

ALL COMPANIES, FORD EXCLUDED

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Net Worth</th>
<th>Total Income</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1910</td>
<td>$32,480,552</td>
<td>$15,092,562</td>
<td>46.5</td>
</tr>
<tr>
<td>1911</td>
<td>$48,468,368</td>
<td>$5,717,605</td>
<td>11.8</td>
</tr>
<tr>
<td>1912</td>
<td>$47,122,861</td>
<td>$7,354,406</td>
<td>15.6</td>
</tr>
<tr>
<td>1913</td>
<td>$66,888,093</td>
<td>$4,409,603</td>
<td>26.4</td>
</tr>
<tr>
<td>1914</td>
<td>$76,038,068</td>
<td>$18,048,005</td>
<td>23.7</td>
</tr>
<tr>
<td>1915</td>
<td>$93,022,976</td>
<td>$32,802,774</td>
<td>34.0</td>
</tr>
<tr>
<td>1916</td>
<td>$176,200,924</td>
<td>$50,425,868</td>
<td>29.3</td>
</tr>
<tr>
<td>1917</td>
<td>$212,579,498</td>
<td>$61,041,029</td>
<td>29.1</td>
</tr>
<tr>
<td>1918</td>
<td>$267,516,315</td>
<td>$36,025,767</td>
<td>13.5</td>
</tr>
<tr>
<td>1919</td>
<td>$450,555,758</td>
<td>$125,698,092</td>
<td>27.9</td>
</tr>
<tr>
<td>1920</td>
<td>$577,194,416</td>
<td>$63,832,308</td>
<td>11.0</td>
</tr>
<tr>
<td>1921</td>
<td>$744,039,725</td>
<td>$52,550,095*</td>
<td>-0.7*</td>
</tr>
<tr>
<td>1922</td>
<td>$728,510,648</td>
<td>$79,406,004</td>
<td>10.9</td>
</tr>
<tr>
<td>1923</td>
<td>$766,845,960</td>
<td>$137,538,444</td>
<td>17.9</td>
</tr>
<tr>
<td>1924</td>
<td>$835,375,197</td>
<td>$109,335,100</td>
<td>13.1</td>
</tr>
<tr>
<td>1925</td>
<td>$916,111,052</td>
<td>$235,520,245</td>
<td>25.2</td>
</tr>
<tr>
<td>1926</td>
<td>$1,024,181,642</td>
<td>$206,520,025</td>
<td>26.9</td>
</tr>
</tbody>
</table>

* Deficit.

CHART 48

SOURCES: Automobile production figures are those given for Chart 43. Income figures are from National Bureau of Economic Research, News-Bulletin No. 23, February 21, 1927, and here follow.

INCOME PER PERSON GAINFULLY EMPLOYED

<table>
<thead>
<tr>
<th>Year</th>
<th>1913 Dollars</th>
<th>Year</th>
<th>1913 Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1910</td>
<td>.934</td>
<td>1923</td>
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</tr>
<tr>
<td>1920</td>
<td>.907</td>
<td>1924</td>
<td>!121</td>
</tr>
<tr>
<td>1921</td>
<td>.887</td>
<td>1925</td>
<td>1165</td>
</tr>
<tr>
<td>1922</td>
<td>.979</td>
<td>1926</td>
<td>1186</td>
</tr>
</tbody>
</table>
### Chart 40

**Source:** Figures furnished by Automotive Division, United States Department of Commerce.

<table>
<thead>
<tr>
<th>Year</th>
<th>Quarter</th>
<th>No. of Vehicles Exported</th>
<th>Year</th>
<th>Quarter</th>
<th>No. of Vehicles Exported</th>
</tr>
</thead>
<tbody>
<tr>
<td>1922</td>
<td>First</td>
<td>31,316</td>
<td>1926</td>
<td>First</td>
<td>82,496</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>45,205</td>
<td></td>
<td>Second</td>
<td>78,987</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>36,670</td>
<td></td>
<td>Third</td>
<td>69,759</td>
</tr>
<tr>
<td></td>
<td>Fourth</td>
<td>38,705</td>
<td></td>
<td>Fourth</td>
<td>73,931</td>
</tr>
<tr>
<td>1924</td>
<td>First</td>
<td>46,858</td>
<td>1927</td>
<td>First</td>
<td>98,941</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>48,007</td>
<td></td>
<td>Second</td>
<td>115,494</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>40,433</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Fourth</td>
<td>43,610</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1925</td>
<td>First</td>
<td>62,558</td>
<td></td>
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</tr>
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<td></td>
<td>Second</td>
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<td>Third</td>
<td>76,913</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>Fourth</td>
<td>84,554</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Chart 50

**Source:** Automotive Division, United States Department of Commerce.

<table>
<thead>
<tr>
<th>Country</th>
<th>Passenger Car Registration as of December 31, 1925</th>
<th>Percentage of World’s Total Registration of 20,837,126 Cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>17,442,638</td>
<td>83.7</td>
</tr>
<tr>
<td>Canada</td>
<td>639,695</td>
<td>3.1</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>506,000</td>
<td>2.7</td>
</tr>
<tr>
<td>France</td>
<td>450,000</td>
<td>2.2</td>
</tr>
<tr>
<td>Australia</td>
<td>243,055</td>
<td>1.2</td>
</tr>
<tr>
<td>Germany</td>
<td>215,150</td>
<td>1.0</td>
</tr>
<tr>
<td>Argentina</td>
<td>165,000</td>
<td>.8</td>
</tr>
<tr>
<td>Balance of World</td>
<td>1,415,608</td>
<td>5.3</td>
</tr>
</tbody>
</table>

### Appendix B

**Chart 51**

**Source:** N.A.C.C., Foreign Trade Bulletin, No. FT 256.

<table>
<thead>
<tr>
<th>Country</th>
<th>Persons per Motor Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>5.3</td>
</tr>
<tr>
<td>New Zealand</td>
<td>11</td>
</tr>
<tr>
<td>Australia</td>
<td>16</td>
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<tr>
<td>Argentina</td>
<td>43</td>
</tr>
<tr>
<td>Uruguay</td>
<td>59</td>
</tr>
<tr>
<td>Holland</td>
<td>196</td>
</tr>
<tr>
<td>Germany</td>
<td>196</td>
</tr>
<tr>
<td>Spain</td>
<td>256</td>
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<tr>
<td>Brazil</td>
<td>293</td>
</tr>
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<td>Egypt</td>
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<td>Japan</td>
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<tr>
<td>India</td>
<td>2,470</td>
</tr>
<tr>
<td>China</td>
<td>25,500</td>
</tr>
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</table>

**Chart 52**

**Sources:** Ford figures from same source as Chart 6; Chevrolet figures from 1926 annual report of General Motors Corporation. Both series include Canadian production.

<table>
<thead>
<tr>
<th>Year</th>
<th>Ford Production Number of Passenger Cars</th>
<th>Chevrolet Production Number of Passenger Cars</th>
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<tbody>
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<td>1922</td>
<td>1,157,783</td>
<td>740,300</td>
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<td>1923</td>
<td>1,764,994</td>
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<tr>
<td>1924</td>
<td>1,643,292</td>
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<tr>
<td>1925</td>
<td>1,587,821</td>
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<tr>
<td>1926</td>
<td>1,353,743</td>
<td>620,364</td>
</tr>
</tbody>
</table>

**Table 1**

**Sources:** The figures presented in this table have been prepared from the materials mentioned in the discussion of Chart 6 in this appendix, and through a checking of the Handbook of Gasoline Automobiles, the files of trade journals, and the consultation of miscellaneous other sources.
APPENDIX C

HISTORICAL MATERIALS; LISTS OF COMPANIES, ASSOCIATIONS, AND TRADE JOURNALS

1. Articles of Agreement of the Association of Licensed Automobile Manufacturers

ARTICLES OF AGREEMENT

Whereas, several of the parties hereto own Letters Patent of the United States for improvements in automobiles, and parts used on or in connection with the construction thereof, and all of said parties are actively engaged in the manufacture and sale of automobiles; and

Whereas, it is mutually desired to protect the rights of each party hereto under said Letters Patent against infringements thereof and against attacks upon the validity thereof, and also to protect each of the parties hereto in the right to manufacture and sell automobiles embodying inventions owned or controlled by the parties hereto, which inventions, in construction or design, are patented or otherwise; and

Whereas, the Electric Vehicle Company, hereinafter known as the "Vehicle Company," a New Jersey corporation, is the exclusive Licensee under Letters Patent No. 549,160, granted November 5, 1895, to George B. Selden with rights to sublicense thereunder:

Now Therefore, in consideration of your mutual promises and undertakings herein set forth, and of the granting by the Vehicle Company of a license under said Letters Patent No. 549,160 to each of the signators hereto, and of the sum of one dollar each to the other paid, the receipt whereof is hereby acknowledged, it is agreed as follows:

361
That the parties hereto, including in said terms all parties who may be hereafter admitted as parties hereto, do hereby and under this agreement associate themselves together on the terms and conditions hereinafter set forth, as the “Association of Licensed Automobile Manufacturers.”

That the parties hereto, and those hereafter admitted as parties, shall create a Board of Managers composed of a representative of each of the parties hereto, which Board shall be known as the “Board of Managers of Licensed Automobile Manufacturers,” and hereafter called the “Board,” which shall have the powers and perform the duties hereunder mentioned.

It shall also have power by a three-fourths ($\frac{3}{4}$) vote of all of its members, to make any rules or regulations which may in its judgment be necessary for carrying on business under the licenses, and generally for promoting the purpose of the Association, and may also by like vote provide penalties for any violation of such rules or regulations, and in case by such vote a cancellation of the license of any offending party shall be requested, then and in that event the Vehicle Company will cancel such license, but the Vehicle Company shall not be required, without its consent, to cancel more than one such license in the course of any one calendar year.

Each of the parties hereto shall annually appoint from its officers or stockholders one (1) person who shall be its representative on said Board, who shall hold office for the period of one (1) year, or until his successor is elected. Said Association Board shall hold its first meeting at New York, in the State of New York, on the fifth day of March, 1903, and the term of office of the first members of said Board shall date from such first meeting; each and any of the parties hereto, or who shall become parties hereto, shall fill any vacancy arising from the death, resignation, or otherwise of its members on said Board; each member may appear and vote in person or by proxy, and such proxy shall be by some officer or stockholder or the party thereby represented by said member, and the vote of such substitute shall be binding on the party he represents. Meetings of said Board may be called at any time by the president, and shall be called by him on the request of five members in writing, on at least ten days notice in advance by mail.

Said Board shall elect from its members the following to be officers and known to be officers of the Association, and fix the compensation thereof. A president, vice-president, secretary and treasurer, and if the Board shall so decide, the offices of secretary and treasurer may be held by one and the same person, and may provide for the appointment or election of other officers, as it may from time to time designate. All matters which may come before said Board shall be decided by a two-thirds ($\frac{2}{3}$) vote of all the members thereof, except as herein otherwise provided. Said Board shall have an office in the City of New York, State of New York, and shall hold its regular meetings at such office, or at such other place as shall be previously designated by said Board or its officers or committees, or as may hereafter be more specifically prescribed. Said Board shall make such by-laws as shall be deemed necessary in order to carry out the powers conferred upon it in and by this contract.

Said Board is authorized and hereby empowered to employ a General Manager, and all necessary clerical assistance to carry on the work entrusted to it, and perform its obligations hereunder, and may require from its officers, their assistants and agents, sufficient and proper security for the performance of the duties to be severally performed by them.

Said Board shall keep accurate records of its proceedings and books of account, and shall make reports to the parties hereto of all acts and doings under this contract, and of all receipts and disbursements, at least every six months during the continuance hereof.
364 THE AUTOMOBILE INDUSTRY

7. Said Board is hereby authorized and empowered to appoint from its members an executive committee of five (5), of whom the Vehicle Company shall always be entitled to appoint one, a majority of whom shall constitute a quorum, which executive committee may be authorized to exercise the powers and duties of said Board, as herein determined, to such extent and on such occasions and under such circumstances as may from time to time be delegated to it by said Board.

8. Nothing herein contained shall be construed as operating to deprive any of the parties hereto of the full right, title and interest in any and all inventions or Letters Patent now owned or controlled, or which may hereafter be acquired by them, or estopping or preventing them from enforcing such rights against any other party hereto, nor shall anything herein contained be held to be acknowledgment by any party hereto of the validity of any patents of any other party hereto, excepting the aforesaid Selden patent No. 549,160.

9. Each member of the Association (including Electric Vehicle Company) shall pay a royalty under the Selden Patent of one and one-quarter (1¼) per cent on the catalogue price of all vehicles manufactured by it under said patent, as provided in its form of license, a copy of which is hereto annexed, said royalty to be paid to the Electric Vehicle Company, and that Company is to retain for its own use three-fifths (3⁄5) thereof, and to pay over to the Association two-fifths (2⁄5) thereof, within ten days after its receipt by Electric Vehicle Company, as provided in said license.

10. The parties hereto, as an Association, do all and severally agree, in consideration of the covenants and terms of license agreement of even date granted by Vehicle Company to them, that they will and hereby assume and pledge themselves to the extent of the funds received by said Association as its share of royalties under the Selden patent, to pay all future charges for litigation under Letters Patent No. 549,160, retainers and services of counsel and experts, and other expenses of the Association, the Vehicle Company, as an individual, to be relieved of all such expenses in view of its joint contribution to this Association of Licensed Automobile Manufacturers. The funds for this purpose to be dispensed under the order of the executive committee.

11. The Vehicle Company hereby agrees with the other parties hereto, and it is mutually covenanted and agreed between all the parties hereto, that the executive committee shall and is hereby empowered to determine to whom licenses from Vehicle Company under said patent No. 549,160 are or are not to be granted, and the rates of royalty upon which they shall be granted. No license shall be granted by said Vehicle Company under said Letters Patent without the unanimous consent in writing of the executive committee, nor at a less royalty rate than one and one-quarter (1¼) per cent of the catalogue price of completed vehicles, as provided in Article 4 of the license. The executive committee may furthermore determine and prescribe a limitation of future license to any particular type or types of vehicle which the licensee shall have the right to manufacture under said Letters Patent. Upon the grant of any such licenses under the Selden patent No. 549,160, the Licensees shall be entitled to become members of this Association, upon signing this agreement and upon making the payment required by Article 16 hereof. If the executive committee shall determine that a license is not to be granted to any party, such license may, notwithstanding, be granted on the written consent of two-thirds of the Board of Managers.

12. The executive committee shall and is hereby authorized to determine what infringements of said patent No. 549,160 shall be prosecuted, and shall generally, subject to advice of counsel, control the policy, scope and expenses of such litigation, so long as the Association defrays all the expenses thereof, and under
the conditions that all suits are to be prosecuted in the name of the Vehicle Company and by attorneys, solicitors, and counsel named by it, but the Committee may employ additional associate counsel.

13.

The executive committee is hereby authorized and empowered in its discretion, and upon the request or consent of any party hereto, to cause to be commenced and prosecuted any and all suits under any Letters Patent, except the Selden patent No. 549,160, owned and controlled by such party for the infringement thereof by any person or corporation not a party hereto, and shall have the exclusive control and management of such actions, suits, and proceedings, except in the matter of damages or compromise for past infringement, or amounts, rates or terms of license for further use, which latter shall be subject to consent and approval by the party or parties hereto owning or controlling such patent rights; and, on request of any party hereto, to defend any suit, action or proceeding, except one under Selden patent No. 549,160, which may be commenced or threatened against any party hereto by any person, firm, or corporation not a party hereto for the infringement of any Letters Patent, except one under Selden patent No. 549,160; and shall have exclusive control and management of said suit, action, or proceeding instituted or defended by it under the powers herein conferred, and to pay all legal and other expenses of such litigation out of the funds of the Association so far as is hereinafter provided.

14.

Bringing or defending of any such suits as provided in above Articles 12 and 13 is to be subject to the approval of the Board. In suits provided for in Article 13, the Board shall determine in advance the proportion of all expenses thereby incurred or to be incurred which shall be paid by the individual party or parties who own or control the patent rights involved and the proportion thereof that shall be paid from the common funds of the Associated Licensees, which determination shall be final, and the share to be borne by such party or parties hereto when so determined shall be paid to said Association, as it shall from time to time require, to meet the portion of actual expenses from time to time incurred.

15.

It is mutually agreed, between the Vehicle Company and the other parties hereto that the litigation between the Vehicle Company and the Winton Motor Carriage Company now pending, is to be terminated by the latter accepting a license at the rate and under the terms and conditions hereinbefore prescribed, and in accordance with form of license hereto attached; provided, however, that out of the royalties payable to the Vehicle Company under such license for its own use it may rebate from time to time, as such royalties become due, the expenses incurred by said Winton Company in said litigation, and such Vehicle Company shall also accord like treatment to any and all parties hereto who have contributed any moneys toward the defense by the Winton Company of such litigation.

16.

Each of the parties hereto shall deposit in the treasury of this Association, immediately upon becoming a party hereto, the sum of Two Thousand Five Hundred Dollars ($2,500) for the general expenses of the Association. If any party hereto shall fail to perform its agreements and undertakings hereunder, then said monies so deposited by it or any balance thereof remaining and any other monies or assets which may be held by the Association in trust or for the mutual benefit of said party with all the other parties hereto, shall be forfeited to said Association; but before any such forfeiture shall be declared said party shall be cited to appear before said Board, or a committee thereof composed of not less than five members, at a certain time and place, and show cause why its said money and interests should not be forfeited, and the action of said Board or of such committee, approved by a vote of the Board after such hearing, shall be in all things final and conclusive.

17.

It is furthermore mutually agreed that if any party shall cease
to be a Licensee under Letters Patent No. 549,160 by reason of
the forfeiture of its license under the terms and conditions thereof,
or for good and sufficient reason, as more specially provided for
in the license agreement, a copy of which is hereto attached,
such party shall forthwith cease to be a party hereto, and with
the cancellation and termination of said license agreement all its
rights, benefits, and privileges hereunder shall cease, and all its
interests as an Associated Licensed Manufacturer in the assets
of such Association of Licensed Automobile Manufacturers shall
cease.

18.

A declaration of forfeiture, as above provided in Articles 16
and 17, shall terminate all rights, benefits, and privileges of said
offending party under this agreement, and all its interest in the
Association and the assets thereof, and shall relieve each and all
of the other parties hereto from duties, liabilities, or obligations
hereunder to said offending party, and the several parties hereto
then remaining shall stand to said offending party in the same
position, and shall have the same rights as against said offending
party as if this contract had not been made, and said offending
party had at no time been a party hereto; but such termination
shall not operate as to said offending party to in any manner
affect any obligations under these presents as between the parties
remaining, and as between them it shall continue in force as if
said offending party had at no time been a party hereto.

19.

This agreement and mutual covenants and agreements herein
shall continue in force until the fifth day of November, 1912,
unless sooner terminated. This contract may be terminated, and
the parties hereto shall be relieved of all obligations hereunder,
upon a vote of a majority of the parties hereto at any time after
said Letters Patent No. 549,160 shall have expired or have ceased
to be effective in view of a decree of any court of last resort.

Upon the termination of this agreement and dissolution of said
Association for any cause, the monies and assets of any kind
remaining after the payment of all obligations contracted in be-
half of the parties hereto by their duly appointed Board or execu-
tive committee or officers, shall be distributed pro rata with the
amount contributed by each party hereto then represented in
said Association, and any suits, actions, proceedings, or any
litigation then remaining shall be transferred and surrendered to
the particular parties hereof therein interested, and who hereby
obligate themselves to thereafter assume the entire control of
expenses or other obligations.

20.

The executive committee shall have power from time to time
to distribute pro rata among the then members, in proportion to
their contributions, any funds in the treasury in excess of the
obligations and needs of the Association.

In Witness Whereof, the several parties hereto have hereunto
affixed the signatures of their corporations, by their officers, there-
unto duly authorized, or by their duly accredited representative,
this fifth day of March, 1903.

Electric Vehicle Co.
Olds Motor Works
by Fred L. Smith, Sec. & Treas.
The Auto-car Company
by John S. Clark, Sec. & Treas.
The George N. Pierce Co.
by Charles Clifton, Treas.
Packard Motor Car Co.
by Henry B. Joy, Vice Pres.
Apperson Bros. Automobile Co.
by Elmer Apperson
Larchmont Automobile Co.
Barclay H. Warburton, Chair. Ex. Com.
Knox Automobile Co.
E. H. Cutler, Pres.
Locomobile Company of America
by S. T. Davis, Jr. President.
APPENDIX C

Buffalo Gasoline Motor Co.
A. Snyder, Sec'y.
Pope Manufacturing Co.
by Albert A. Pope, President.
Sandusky Automobile Co.
Jas. J. Huicle, Pres.
Crest Manufacturing Co.
by Henry W. Lamb, President.

July 2, 1904.
Studebaker Automobile Co.
by Geo. W. Studebaker, Pres.
Worthington Automobile Co.
by W. J. P. Moore, Vice Pres.
Buick Motor Co.
by Hart O. Berg, Prest.

(Endorsed.)

2. Agreement Executed between the Electric Vehicle Company and the Winton Motor Carriage Company

LICENSE AGREEMENT

WHEREAS, The Electric Vehicle Company, a New Jersey corporation, party of the first part, is exclusive licensee under Letters Patent of George B. Selden, dated November 5, 1895, No. 549,160, for an improved road engine, and has also exclusive power to grant sub-licenses under the same; and

WHEREAS, The Winton Motor Carriage Co., a corporation of the State of Ohio having its principal office at Cleveland, Ohio, party of the second part, is desirous of acquiring a license under said Letters Patent; and

WHEREAS, an Association of Licensed Manufacturers under said patent has been formed by an agreement, a copy of which is hereto annexed, to which the party of the second part is or is to be a party;

Now, therefore, it is agreed as follows:

THE AUTOMOBILE INDUSTRY

The Haynes-Apperson Co.
by Elwood Haynes, Pres.
The Peerless Motor Car Co.
by L. H. Kittredge, Sec'y & Treas.
The Winton Motor Carriage Co.
Geo. H. Brown, Sec'y.
U. S. Long Distance Automobile Co.
Lewis Nixon, Prest.
Waltham Mfg. Co.
Harrison Williams, Prest.
International Motor Car Co.
Albert A. Pope, Prest.
The J. Stevens Arms & Tool Co.
I. H. Page, Pres. & Treas.
H. H. Franklin, M'f'g. Co.
H. H. Franklin, Treas.
Charran Girardot & Voigt Co. of America
A. D. Proctor Smith, Vice Prest.

April 24, 1903. The Commercial Motor Company
James E. Woodbridge, Prest.

April 28, 1903. Berg Automobile Co.
by Hart O. Berg, Prest.
Cadillac Automobile Company
by Lem. W. Bowen, Secretary.
Northern Manufacturing Co.
by W. T. Barbour, President.
Pope-Robinson Co.
by John T. Robinson, Prest.
Elmore M'f'g Co.
J. H. Becker, Sec'y & Mgr.
E. R. Thomas Motor Co.
by E. R. Thomas, Prest.
The Kirk Manufacturing Co.
Ezra E. Kirk, President.
1. The Electric Vehicle Company, in consideration of the due performance of all of the agreements herein on the part of the party of the second part, hereby grants to the party of the second part a license to manufacture vehicles under said Letters Patent, at Cleveland, Ohio and not elsewhere without the written consent of the licensor, to the full end of the term for which said patent has been or may be granted, unless terminated as herein provided for.

2. Nothing herein contained shall be construed as involving a license by implication, estoppel, or otherwise under any other Letters Patent now or hereafter owned or controlled by the party of the first part.

3. The party of the second part is to pay the sum of One Thousand Dollars, in advance, on account of royalties specified herein.

4. The party of the second part is to pay a license fee on each and every vehicle manufactured under this license at the rate of one and one-fourth ($\frac{1}{4}$) per cent of the catalogue price of the same, as completed, including running gear, frame, motor, connections, body, trimmings and cushions, all in finished condition ready for use; three-fifths ($\frac{3}{5}$) of said license fees or royalties shall be retained by said licensor for its own use and the remaining two-fifths ($\frac{2}{5}$) thereof shall be paid over to said Association of Licensed Manufacturers by said licensor within ten days after receipt thereof by said licensor, for the purposes of said Association, as set forth in the agreement hereto annexed, or any amendments thereof that may from time to time be made by the parties thereto. No incomplete vehicles nor running gears are to be sold hereunder without the previous written permission of the party of the first part, and on payment of royalty, based on selling price of vehicle when completed. But this provision shall not prevent the bona fide replacement or repair of parts of vehicles on which royalty has been paid.

5. The party of the second part within the first ten days of January, April, July, and October in every year is to furnish the party of the first part and also the Association written statements under oath, showing the number and kinds of vehicles made, sold or otherwise disposed of, not included in any previous account, and the catalogue price of the same, and shall within ten days thereafter pay to the party of the first part all of the royalties due therefor to the party of the first part, as aforesaid, which shall not have been prepaid; and the first of such statements shall include all vehicles sold or otherwise disposed of from January 1, 1903.

6. The party of the second part is to keep books of account, giving full particulars of the licensed business, and permit the party of the first part, at all reasonable times, to inspect the same and the premises where the licensed business is carried on.

7. The party of the second part admits the novelty of the invention of George B. Selden claimed in said patent No. 549,160 and the validity of the claims thereof and the exclusive rights of the party of the first part thereunder, and will not while this license remains in force, directly or indirectly contest the same or aid others in so doing.

8. The party of the second part will mark all vehicles made by it with the date and number of said Letters Patent and with the fact that it is licensed thereunder.

9. If the party of the second part shall fail to comply with any of its agreements herein contained or shall fail in any calendar year commencing from the first quarter day after the date hereof to pay royalties to the amount of One Thousand Dollars ($1,000), the party of the first part may cancel all the rights of the licensee hereunder by giving thirty days' written notice to that effect; but the party of the second part shall not be thereby relieved from any obligations which has arisen before the giving of such notice.

10. This license shall not be assigned, divided, or shared with any person or persons whatsoever without the written consent of the party of the first part.

11. The licensor will, while this license is in force, in conjunction with the Association of Manufacturing Licensees under said agreement, as therein provided, use all reasonable and proper means to prevent infringement of said Letters Patent, and bring and diligently prosecute such suits or proceedings as may be
advised by counsel employed, as specified in said agreement.

If in any such suit it shall be adjudged by any Circuit Court of Appeals of the United States, after a final hearing on testimony, that said Letters Patent are invalid, or so limited in scope that vehicles substantially like those which have been manufactured and sold by the licensee hereunder may thereafter be made and sold without infringing any valid claim of said Letters Patent, or in case any like decree should be made in any court of the United States by a decision not appealed from within the time allowed by law, then and thereafter the licensee may, at its option, cancel all its future rights and obligations under this license by serving thirty days' written notice to that effect, but such notice shall not impair the obligation of the licensee hereunder up to the time of the expiration of said notice.

12. This license is granted subject to the provisions of the agreement of the Association of Licensed Manufacturers, a copy of which is hereto annexed (or any amendments thereof which may from time to time be made by the parties thereto), and any violation by the licensee of any obligations arising out of said agreement or from its having become a party thereto, or any disobedience of or failure to comply with any regulation or requirement duly adopted by said Association, or the Executive Committee thereof, or any failure of the licensee at any time to be a member in good standing, as duly determined by said Association, shall entitle the licensor to cancel all rights of the licensee hereunder, by giving thirty days' written notice to that effect, but the licensee shall not thereby be released from any obligations hereunder to the licensor.

In Witness Whereof, the parties hereto have caused their names and seals to be hereunto affixed this fifth day of March, 1903.

THE WINTON MOTOR CARRIAGE CO.
By ALEXANDER WINTON,
President.

Geo. H. Brown,
Secy.

ELECTRIC VEHICLE CO.
Geo. H. Day Prest.

3. Racing Records
(From Automobile Trade Journal, December 1, 1924)

VANDERBILT CUP

First race, Long Island, N. Y., October 8, 1904; distance, 284.4 miles. Won by Heath, Panhard; time, 5:26.45; average, 52.2 m.p.h.

Second race, Long Island, N. Y., October 4, 1905; distance, 283 miles. Won by Hemery, Darracq; time, 4:36.08; average, 61.49 m.p.h.

Third race, Long Island, N. Y., October 6, 1906; distance, 297 miles. Won by Wagner, Darracq; time, 4:50.16; average, 61.43 m.p.h.

Fourth race, Long Island, N. Y., October 24, 1908; distance, 258.06 miles. Won by Robertson, Locomobile; time, 4:00.48; average, 64.38 m.p.h.

Fifth race, Long Island, N. Y., October 30, 1909; distance, 278.08 miles. Won by Grant, Alco; time, 4:25.42; average, 62.77 m.p.h.

Sixth race, Long Island, N. Y., October 1, 1910; distance, 278.08 miles. Won by Grant, Alco; time, 4:15.58; average, 65.18 m.p.h.

Seventh race, Savannah, Ga., November 27, 1911; distance, 291.38 miles. Won by Mulford, Lozier; time, 3:56.00; average, 74.07 m.p.h.

Eighth race, Milwaukee, Wis., October 2, 1912; distance, 299.54 miles. Won by De Palma, Mercedes; time, 4:20.31; average, 68.97 m.p.h.

Ninth race, Santa Monica, Cal., February 26, 1914; distance, 403.24 miles. Won by De Palma, Mercedes; time, 4:53.41; average, 73.49 m.p.h.

Tenth race, San Francisco, Cal., March 6, 1915; distance, 300.3 miles. Won by Resta, Peugeot; time, 4:27.37; average, 67.2 m.p.h.

Eleventh race, Santa Monica, Cal., November 18, 1916; distance, 294.03 miles. Won by Resta, Peugeot; time, 3:22.48; average, 86.90 m.p.h.
GRAND PRIZE

First race, Savannah, Ga., November 26, 1908; distance, 402.08 miles. Won by Wagner, Fiat; time, 6.10.31; average, 65.08 m.p.h.

Second race, Savannah, Ga., November 12, 1910; distance, 415.2 miles. Won by Bruce-Brown, Benz; time, 6.03.05; average, 70.55 m.p.h.

Third race, Savannah, Ga., November 30, 1911; distance, 411.36 miles. Won by Bruce-Brown, Fiat; time, 5.13.50; average, 74.45 m.p.h.

Fourth race, Milwaukee, Wis., October 5, 1912; distance, 409 miles. Won by Bragg, Fiat; time, 5.59.27; average, 69.3 m.p.h.

Fifth race, Santa Monica, Cal., Feb. 23, 1914; distance, 403.248 miles. Won by Pullen, Mercer; time, 5.13.30; average, 77.2 m.p.h.

Sixth race, San Francisco, Cal., February 27, 1915; distance, 400.28 miles. Won by Resta, Peugeot; time, 7.07.57; average, 57.5 m.p.h.

Seventh race, Santa Monica, Cal., November 18, 1916; distance, 403.248 miles. Won by Wilcox-Aitken, Peugeot; time, 4.42.57; average, 85.59 m.p.h.

INDIANAPOLIS SPEEDWAY

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<td>H.C.S. Special, Milton</td>
<td>5.20.50</td>
<td>90.05</td>
</tr>
<tr>
<td>1924</td>
<td>Duesenberg, Corum-Boyer</td>
<td>5.05.23</td>
<td>98.24</td>
</tr>
<tr>
<td>1925</td>
<td>Duesenberg, de Paola</td>
<td>4.56.39</td>
<td>101.13</td>
</tr>
<tr>
<td>1926</td>
<td>Miller Special, Lockhart</td>
<td>4.13.37</td>
<td>94.63</td>
</tr>
<tr>
<td>1927</td>
<td>Duesenberg Special, Souders</td>
<td>5.07.33</td>
<td>97.54</td>
</tr>
</tbody>
</table>

*1916 distance, 300 miles; 1917 distance, 500 miles; all others 500 miles. No races were run in 1917 and 1918 because of the war.

4. List of Passenger Automobile Manufacturing Companies, 1895-1927

The following list includes the principal American companies known actually to have engaged in the production and sale of passenger automobiles upon a commercial scale over the period 1895-1927. When a company's name has been changed one or more times, the last name employed is the one given. Holding companies are designated by asterisks, and the makes of cars which they control are given in footnotes. When the company name does not include the name by which its car is, or was, known, the latter is shown in parentheses. The letter "B" following the year of exit indicates known bankruptcy or court proceedings. Some of the companies not so marked may also have failed in the technical sense, but the fact of bankruptcy in some of these cases has not been satisfactorily checked and no "B" is therefore appended. I am indebted to Mr. W. L. Powelson and Mr. G. C. Arvedson for aid in checking the list for this purpose.

Allen Motor Company, Columbus, Ohio, 1914-1922. B.
American Locomotive Company (Alco), New York City, 1909-1914.
American Motor Car Company, Cleveland, Ohio, 1908-1910.
American Motors Company, Indianapolis, Indiana, 1913. B.
Anderson Motor Company, Rock Hill, South Carolina, 1910-1925. B.
Apperson Brothers Automobile Company, Kokomo, Indiana., 1903-1925. B.
Auburn Automobile Company, Auburn, Indiana, 1912-1922.
Austen Automobile Company, Grand Rapids, Michigan, 1913-1919.
Baker R & L Company, Cleveland, Ohio, 1899-1924.
Bartholomew Company (Glide), Peoria, Illinois, 1901-1920.
Briggs Detroitor Company, Detroit, Michigan, 1915-1917. B.
Briscoe Motor Corporation, Jackson, Michigan, 1914-1921.
Brog Electric Vehicle Company, Cleveland, Ohio, 1913-1915.
Brush Runabout Company, Detroit, Michigan, 1909-1912.
THE AUTOMOBILE INDUSTRY

APPENDIX C

Buick Motor Company, Flint, Michigan, 1904-. B.
Cadillac Motor Car Company (Cadillac, La Salle), Detroit, Michigan, 1907-. B.
J. T. Case T. M. Company, Racine, Wisconsin, 1912-. B.
Cartercar Company, Pontiac, Michigan, 1906-1915. B.
Chalmers Motor Company, Detroit, Michigan, 1907-1924. B.
Chandler Motor Car Company, Cleveland, Ohio, 1914-. B.
Chevrolet Motor Company, Flint, Michigan, 1914-. B.
Chrysler Corporation, Detroit, Michigan, 1923-. B.
Cleveland Automobile Company, Cleveland, Ohio, 1910-. B.
Cole Motor Car Company, Indianapolis, Indiana, 1912-1925. B.
Columbia Motors Company, Detroit, Michigan, 1916-1925. B.
Commonwealth Motors Company, Chicago, Illinois, 1920-1922. B.
Consolidated Car Company (Abbott-Detroit), Detroit, Michigan, 1909-1915. B.
Corbin Motor Vehicle Corporation, New Britain, Connecticut, 1903-1912. B.
Courier Car Company, Dayton, Ohio, 1909-1910. B.
Crest Manufacturing Company, Cambridge, Massachusetts, 1903-1905. B.
Crow-Elkhart Motor Corporation, Elkhart, Indiana, 1915-1915. B.
James Cunningham Son & Company, Rochester, New York, 1911-1912. B.
Daniels Motor Company, Reading, Pennsylvania, 1910-1924. B.
George W. Davis Motor Car Company, Richmond, Indiana, 1916-. B.
Dayton Motor Car Company (Stoddard-Dayton), Dayton, Ohio, 1905-1912. B.
Detroit Electric Car Company, Detroit, Michigan, 1906-1923. B.
Dodge Brothers, Detroit, Michigan, 1914-. B.
Dorris Motor Car Company, St. Louis, Missouri, 1906-1926. B.
Dort Motor Car Company, Flint, Michigan, 1915-1924. B.
Durant Motor Company, Inc., New York City, 1922-. B.
Dort-company of Michigan, Lansing, Michigan, 1922-1926. B.
Durant Motor Company of New Jersey (Star), Elizabeth, New Jersey, 1922-. B.
Durant Motor Company of Indiana (Princeton), Muncie, Indiana, 1924-1925. B.
Earl Motors Manufacturing Company, Jackson, Michigan, 1921-1924. B.
Elkhart Motor Company (Elcar), Elkhart, Indiana, 1915-. B.
Electric Vehicle Company (Columbia, Pope-Hartford, etc.), Hartford, Connecticut, 1897-1900. B.

Elmore Manufacturing Company, Clyde, Ohio, 1902-1912. B.
Empire Automobile Company, Indianapolis, Indiana, 1915-1918. B.
Everett-Metzger-Flanders Company (E.M.F.), Detroit, Michigan, 1908-1912. B.
Ewing Auto Company, Geneva, Ohio, 1900-1910. B.
Falcon Motors Corporation (Falcon-Knight), Detroit, Michigan, 1927-. B.
Flanders Motor Company, Detroit, Michigan, 1910-. B.
Flint Motor Company, Flint, Michigan, 1923-. B.
Ford Motor Company, 1903-1915. B.
H. H. Franklin Manufacturing Company, Syracuse, New York, 1902-. B.
Gardner Motor Company, St. Louis, Missouri, 1909-. B.
Garford Company, Eleryia, Ohio, 1909-1914. B.
*General Motors Corporation, Detroit, Michigan, 1908-1912. B.
Grant Motor Car Corporation, Cleveland, Ohio, 1915-1923. B.
Gray Motor Corporation, Detroit, Michigan, 1922-1926. B.
Great Western Auto Company, Peru, Indiana, 1913-1915. B.
H. C. S. Motor Car Company, Indianapolis, Indiana, 1910-1912. B.
Hal Motor Car Company, Cleveland, Ohio, 1917-1928. B.
Hanson Motor Company, Inc., Atalanta, Georgia, 1920-1924. B.
Handley-Knight Company, Kalamazoo, Michigan, 1921-1923. B.
Haynes Automobile Co., Kokomo, Indiana, 1895-1923. B.
Henderson Motor Car Company, Indianapolis, Indiana, 1913-1914. B.
Herreshoff Motor Company, Detroit, Michigan, 1912-1913. B.
Holmes Automobile Company, Canton, Ohio, 1920-1923. B.
Hudson Motor Car Company (Hudson, Essex), Detroit, Michigan, 1909-. B.
Hupp Motor Car Corporation, Detroit, Michigan, 1909-. B.
Imperial Automobile Company, Jackson, Michigan, 1913-1914. B.
Inter-State Motor Company, Muncie, Indiana, 1908-1919. B.
Jackson Motors Corporation, Jackson, Michigan, 1904-1923. B.
Jones Motor Car Company, Wichita, Kansas, 1919-1920. B.
Jordan Motor Car Company, Cleveland, Ohio, 1917-. B.
Kentucky Wagon Manufacturing Company, Louisville, Kentucky, 1920-1923. B.
King Motor Car Company, Detroit, Michigan, 1914-1924. B.
Kirk Manufacturing Company (Yale), Toledo, Ohio, 1903-1906. B.
Kissel Motor Car Company, Hartford, Wisconsin, 1903-. B.
Kleiber Motor Company, San Francisco, California, 1926-. B.
Kline Car Corporation, Richmond, Virginia, 1913-1923. B.
Knox Automobile Company, Springfield, Massachusetts, 1900-1914. B.

* Owns Cadillac, Buick, Chevrolet, Oakland, and Oldsmobile.
THE AUTOMOBILE INDUSTRY

Krit Motor Car Company, Detroit, Michigan, 1913-1914. B.
Lafayette Motors Corporation, Milwaukee, Wisconsin, 1920-1924. B.
Lewis Spring & Axle Company (Hollier), Chelsea, Michigan, 1915-1920. B.
Lexington Motor Company, Connersville, Indiana, 1915-1926. B.
Liberty Motor Car Company, Detroit, Michigan, 1917-1923. B.
Lincoln Motor Company, Detroit, Michigan, 1920-
Locomobile Company of America, Bridgeport, Connecticut, 1899-.
Lorraine Motors Corporation, Grand Rapids, Michigan, 1919-1922. B.
Lozier Motor Company, Plattsburg, New York, 1905-1917. B.
McFarlan Motor Corporation, Connersville, Indiana, 1913-
W. H. McIntyre Company, Auburn, Indiana, 1908-1910. B.
Maibohm Motors Company, Sandusky, Ohio, 1920-1922. B.
Marquette Company, Detroit, Michigan, 1909-1911. B.
Matheson Motor Car Company, New York City, 1906-1913. B.
Maxwell Motor Company, Inc., Detroit, Michigan, 1904-1924. B.
Mercer Motors Company, Trenton, New Jersey, 1909-1926. B.
Metzger Motor Car Company (Everitt), Detroit, Michigan, 1910-1917. B.
Milburn Wagon Company, Toledo, Ohio, 1915-1916.
Mitchell Motors, Inc., Racine, Wisconsin, 1903-1903. B.
Moon Motor Car Company (Moon, Diana), St. Louis, Missouri, 1908-.
Mora Motor Car Company, Newark, New Jersey, 1906-1910. B.
Mutual Motor Car Company (Marion), Indianapolis, Indiana, 1915-1916. B.
Nash Motors Company, Kenosha, Wisconsin, 1916-.
National Motor Car and Vehicle Corporation, Indianapolis, Indiana, 1904-1924. B.
Nordyke and Marmon Company (Marmon), Indianapolis, Indiana, 1904-.
Northern Manufacturing Company, Detroit, Michigan, 1903-1908.
Oakland Motor Company (Oakland, Pontiac), Pontiac, Michigan, 1908-.
Ohio Electric Car Company, Toledo, Ohio, 1910-1918.
Ohio Motor Car Company, Cincinnati, Ohio, 1909-1910. B.
Olds Motor Works, Lansing, Michigan, 1899-.
Packard Motor Car Company, Detroit, Michigan, 1900-.
Paige-Detroit Motor Car Company, Detroit, Michigan, 1912-

APPENDIX C

Pathfinder Motor Car Manufacturing Company, Indianapolis, Indiana, 1913-1917. B.
Peerless Motor Car Company, Cleveland, Ohio, 1909-.
Fiehrnly-Motor Car Company, Lynchburg, Virginia, 1920-1922. B.
Fierce-Arrow Motor Car Company, Buffalo, New York, 1901-.
Pilot Motor Car Company, Richmond, Indiana, 1918-1924. B.
Pope Motor Car Company (Pope-Toledo), Toledo, Ohio, 1903-1910.
Premier Motors, Inc., Indianapolis, Indiana, 1904-.
Pullman Motor Car Company, York, Pennsylvania, 1906-1917. B.
Regal Motor Car Company, Detroit, Michigan, 1908-1918. B.
Reo Motor Company (Reo, Wolverine), Lansing, Michigan, 1904-.
Rickenbacker Motor Company, Detroit, Michigan, 1922-1927. B.
Roamer Motor Car Company, Kalamazoo, Michigan, 1917-.
Rollin Motors Company, Cleveland, Ohio, 1924-1925.
Royal Motor Car Company, Cleveland, Ohio, 1904-1908.
S. G. V. Company, Reading, Pennsylvania, 1908-1916. B.
Sandusky Auto Company, Sandusky, Ohio, 1904-
Saxon Motor Car Company, Detroit, Michigan, 1914-1922. B.
The Sayers and Scovill Company, Cincinnati, Ohio, 1919-1924.
Scripps-Booth Corporation, Detroit, Michigan, 1915-1922.
Simplex Automobile Company, New York City, 1907-1910.
Simplex Motor Car Company (Amplex), Mishawaka, Indiana, 1908-1910.
Smith Auto Company, Topeka, Kansas, 1908-1910. B.
F. B. Stearns Company, Cleveland, Ohio, 1898-.
Stevens-Duryea, Inc., Chicopee Falls, Massachusetts, 1906-1924. B.
Studebaker Corporation, South Bend, Indiana, 1904-.
Stutz Motor Company of America, Indianapolis, Indiana, 1913-.
Templar Motor Car Company, Cleveland, Ohio, 1919-1924. B.
5. Lists of Truck, Bus, and Taxicab Manufacturers as of January 1, 1927

These lists are not complete, but contain the names of the principal companies only.

**Motor Trucks**

- Chevrolet Motor Company (Chevrolet). Detroit, Michigan.
- Denby Motor Truck Corporation (Denby). Los Angeles, California.
- Duplex Truck Company (Duplex). Lansing, Michigan.
- Ford Motor Company (Ford). Detroit, Michigan.
- Four Wheel Drive Auto Company (F-W-D). Clintonville, Wisconsin.
- Garford Motor Truck Company (Garford). Lima, Ohio.
- Gotfredson Truck Corporation (Gotfredson). Detroit, Michigan.
- Graham Brothers (Graham). Detroit, Michigan.
- Harvey Motor Truck Works (Harvey). Harvey, Illinois.
- Indiana Truck Corporation (Indiana). Marion, Indiana.
- Kelly-Springfield Truck and Bus Corporation (Kelly). Springfield, Ohio.
- Kissel Motor Car Company (Kissel). Hartford, Wisconsin.
- Kleiber Motor Truck Company (Kleiber). San Francisco, California.
- LeBlond-Schacht Motor Truck Company (Schacht). Cincinnati, Ohio.
- Mack Brothers Motor Car Company (Mack, Big Brute). New York City.
- Master Motor Truck Manufacturing Company (Master). Middleboro, Massachusetts.
- Moreland Motor Truck Company (Moreland). Los Angeles, California.
- Oneida Manufacturing Company (Oneida). Green Bay, Wisconsin.
- Rauch and Lang, Inc. (R and L). Chicopee Falls, Massachusetts.
- Reo Motor Car Company (Reo). Lansing, Michigan.
- Sanford Motor Truck Company (Sanford). Syracuse, New York.
- Standard Motor Truck Company (Standard). Detroit, Michigan.
- Sterling Motor Truck Company (Sterling). Milwaukee, Wisconsin.
- Stewart Motor Corporation (Stewart). Buffalo, New York.
- Walter Motor Truck Company (Walter). New York City.
- White Motor Company (White). Cleveland, Ohio.

* Controlled Maxwell, Columbia, Stoddard-Dayton, Brush, and other manufacturers.
Willys-Overland Company (Overland), Toledo, Ohio.
Yellow Truck and Coach Manufacturing Company (Yellow), Chicago.

MOTOR BUSES

Acme Motor Truck Company (Acme), Cadillac, Michigan.
American La France Fire Engine Company (American-La France), New York City.
Atterbury Motor Car Company (Atterbury), Buffalo, New York.
Corbitt Motor Truck Company (Corbitt), Henderson, North Carolina.
Denby Motor Truck Corporation (Denby), Detroit, Michigan.
Fageol Motors Company (Fageol), Oakland, California.
Federal Motor Truck Company (Federal), Detroit, Michigan.
Garford Motor Truck Company (Garford), Lima, Ohio.
General Motors Truck Company (GMC), Pontiac, Michigan.
Graham Brothers (Graham), Detroit, Michigan.
International Harvester Company (International), Chicago, Illinois.
Kissel Motor Car Company (Kissel), Hartford, Wisconsin.
Larrabee-Deyo Motor Truck Company (Larrabee-Deyo), Binghamton, New York.
Maccar Truck Company (Maccar), Scranton, Pennsylvania.
Mack Brothers Motor Car Company (Mack), New York City.
Moreland Motor Truck Company (Moreland), Los Angeles, California.
Pierce-Arrow Motor Car Company (Pierce-Arrow), Buffalo, New York.
Reo Motor Car Company (Reo), Lansing, Michigan.
Republic Motor Truck Company (Republic), Alma, Michigan.
Sanford Motor Truck Company (Sanford), Syracuse, New York.
G. A. Schacht Motor Truck Company (Schacht), Cincinnati, Ohio.
Selden Truck Corporation (Selden), Rochester, New York.
Standard Motor Truck Company (Standard), Detroit, Michigan.
Sterling Motor Truck Company (Sterling), Milwaukee, Wisconsin.
Stewart Motor Corporation (Stewart), Buffalo, New York.
Studebaker Corporation (Studebaker), South Bend, Indiana.
White Motor Company (White), Cleveland, Ohio.
Yellow Truck and Coach Manufacturing Company (Yellow), Chicago, Illinois.

TAXICABS

Checker Cab Manufacturing Corporation (Checker), Kalamazoo, Michigan.
Dodge Brothers, Inc. (Dodge), Detroit, Michigan.
Elcar Motor Company (Elcar), Elkhart, Indiana.

APPENDIX C

Larrabee-Deyo Motor Truck Company (Majestic), Binghamton, New York.
Moon Motor Car Company (Moon), St. Louis, Missouri.
National Cab and Truck Company (Premier), Indianapolis, Indiana.
Oakland Motor Car Company (Oakland), Pontiac, Michigan.
Peerless Motor Car Corporation (Peerless), Cleveland, Ohio.
Reo Motor Car Company (Reo), Lansing, Michigan.
Roamer Motor Car Company (Pennant), Kalamazoo, Michigan.
Willys-Overland Company (Willys-Knight), Toledo, Ohio.
Yellow Truck and Coach Manufacturing Company (Yellow Cab), Chicago, Illinois.

6. Trade and Technical Journals

Automobile Topics. New York, 1901-.
The Automobile. New York, 1901-1917. In 1917, name changed to Automotive Industries and The Automobile.
Motor Age. Chicago, 1922-.
Automobile Trade Journal. Philadelphia, 1905-.
Automotive Industries. Philadelphia, 1917-.
Formerly called The Automobile.
Motor. New York, 1905-.
Journal of the Society of Automotive Engineers. New York, 1917-.

7. List of Automotive Trade Associations, 1927

NATIONAL AUTOMOBILE CHAMBER OF COMMERCE

General Offices: Marlin-Rockwell Building, 366 Madison Avenue, at 46th Street, New York City.
Honorary President: Charles Clifton, Chairman of the Board, Pierce-Arrow Motor Company.
President: Roy D. Chapin, Chairman of the Board, Hudson Motor Car Company.
General Manager: Alfred Reeves.

MOTOR AND ACCESSORY MANUFACTURERS ASSOCIATION

General Offices: Fisk Building, 250 West 57th Street, New York City.
Branch Office: Credit Department, First National Bank Building, Detroit, Michigan.
General Manager: M. L. Heminway.

Rubber Association of America
General Offices: 250 West 57th street, New York City.
President: J. C. Weston.
Secretary and General Manager: A. L. Viles.

American Automobile Association
National Headquarters: Pennsylvania Avenue at 17th Street, N. W., Washington, D. C.
President: Thomas P. Henry, 41 Burroughs Avenue, Detroit, Michigan.
Treasurer: Kane S. Green, 23 South 23rd Street, Philadelphia, Pennsylvania.
Secretary: Charles C. Janes, Southern Hotel, Columbus, Ohio.
General Manager: Ernest N. Smith, Washington, D. C.

National Automobile Dealers Association
President: W. L. Hughson, San Francisco, California.
Secretary and General Manager: C. A. Vane.

Society of Automotive Engineers
General Offices: 29 West 30th Street, New York City.
President: J. H. Hunt, Detroit, Michigan.
Secretary and General Manager: Coker F. Clarkson.

National Association of Finance Companies
General Offices: First National Bank Building, 33 South Clark Street, Chicago, Illinois.
President: E. M. Morris, South Bend, Indiana.
Secretary and General Manager: C. C. Hanch.

National Standard Parts Association
General Offices: 608-609 Empire Building, Detroit, Michigan.

APPENDIX C

President: W. C. Stetlinius, American Hammered Piston Ring Company, Baltimore, Maryland.
First Vice-President: W. T. Mills, Auto Parts Company, St. Louis, Missouri.
Executive Vice-President: E. P. Chalfant, 608-609 Empire Building, Detroit, Michigan.
Secretary: Robert Macfee.

Automotive Equipment Association
General Offices: 18th Floor, City Hall Square Building, Chicago, Illinois.
President: E. V. Hennecke, Long Island City, New York.
Vice-President: A. C. Storz, Omaha, Nebraska.

Automobile Body Builders Association
General Offices: 1819 Broadway at 59th Street, New York City.
Secretary-Treasurer: Frederick D. Mitchell.

National Association of Taxicab Owners
Headquarters: 500 North Dearborn Street, Chicago, Illinois.
President: W. W. Cloud, Baltimore, Maryland.
Vice-President: Russell Reel, Des Moines, Iowa.
Treasurer: Walter S. Laird, Pittsburgh, Pennsylvania.
Secretary: J. G. Williams, Chicago, Illinois.

Trailer Manufacturer's Association of America
Headquarters: 1133 Broadway, New York City.
President: H. C. Fruehauf.
First Vice-President: S. A. Griggs.
Second Vice-President: H. W. Raymond.
Secretary-Treasurer: Henry M. Wood.
Manager: Allan P. Ames.

Motor Vehicle Conference Committee
Offices: Marlin-Rockwell Building, 366 Madison Avenue at 46th Street, New York City.
INDEX

<table>
<thead>
<tr>
<th>A</th>
<th>Abel, J. F.</th>
<th>288</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability</td>
<td>263, 265</td>
<td>201</td>
</tr>
<tr>
<td>Acceleration</td>
<td>57</td>
<td>146</td>
</tr>
<tr>
<td>Accident</td>
<td>263, 265</td>
<td>156</td>
</tr>
<tr>
<td>Acknowledgements to individuals</td>
<td>329</td>
<td>380</td>
</tr>
<tr>
<td>Active firms</td>
<td>163</td>
<td>280</td>
</tr>
<tr>
<td>Actuarial computation of risks</td>
<td>39</td>
<td>146</td>
</tr>
<tr>
<td>Additional models</td>
<td>280</td>
<td>146</td>
</tr>
<tr>
<td>Advertising</td>
<td>146</td>
<td>146</td>
</tr>
<tr>
<td>expenditure by entire industry (chart)</td>
<td>146</td>
<td>146</td>
</tr>
<tr>
<td>expenditure by various companies (chart)</td>
<td>146</td>
<td>146</td>
</tr>
<tr>
<td>Aggregate profits</td>
<td>252</td>
<td>252</td>
</tr>
<tr>
<td>Agreement to cross-license patents</td>
<td>239</td>
<td>239</td>
</tr>
<tr>
<td>Agriculture</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Agricultural implements</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Air-cooling</td>
<td>89</td>
<td>89</td>
</tr>
<tr>
<td>Airplane</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Air starters</td>
<td>106</td>
<td>106</td>
</tr>
<tr>
<td>Alloy steels</td>
<td>41</td>
<td>41</td>
</tr>
<tr>
<td>American Automobile Association</td>
<td>155, 159-160</td>
<td>155, 159-160</td>
</tr>
<tr>
<td>A.L.A.M. mechanical branch</td>
<td>235</td>
<td>235</td>
</tr>
<tr>
<td>Allison, Robert</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>American Committee on Highway Transport</td>
<td>288</td>
<td>288</td>
</tr>
<tr>
<td>American Academy of Political and Social Science, Annals of</td>
<td>288</td>
<td>288</td>
</tr>
<tr>
<td>American Motor Car Manufacturers' Association</td>
<td>229</td>
<td>229</td>
</tr>
<tr>
<td>American system</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>American Telephone and Telegraph Company</td>
<td>334</td>
<td>334</td>
</tr>
<tr>
<td>Anderson</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Annual income</td>
<td>82</td>
<td>82</td>
</tr>
<tr>
<td>Annals of the American Academy of Political and Social Science</td>
<td>288</td>
<td>288</td>
</tr>
<tr>
<td>Appearance</td>
<td>60-61</td>
<td>60-61</td>
</tr>
<tr>
<td>Apperson</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Argentina</td>
<td>273</td>
<td>273</td>
</tr>
<tr>
<td>Articles of Agreement of the &quot;A.L.A.M.&quot;</td>
<td>229, 361</td>
<td>229, 361</td>
</tr>
<tr>
<td>Arvedson, G. C.</td>
<td>377</td>
<td>377</td>
</tr>
<tr>
<td>Assembled cars</td>
<td>51, 53</td>
<td>51, 53</td>
</tr>
<tr>
<td>Assemblies, foreign</td>
<td>272</td>
<td>272</td>
</tr>
<tr>
<td>Assembly methods</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Association of Licensed Automobile Manufacturers, Mechanical Branch</td>
<td>41, 184, 227, 229, 235, 305, 361</td>
<td>41, 184, 227, 229, 235, 305, 361</td>
</tr>
<tr>
<td>Associations, list of</td>
<td>385</td>
<td>385</td>
</tr>
<tr>
<td>Austin, trade-mark</td>
<td>170</td>
<td>170</td>
</tr>
<tr>
<td>Austria</td>
<td>273-274</td>
<td>273-274</td>
</tr>
<tr>
<td>Austrian view</td>
<td>292</td>
<td>292</td>
</tr>
<tr>
<td>Automatic machinery</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>Automobile Board of Trade</td>
<td>235</td>
<td>235</td>
</tr>
<tr>
<td>Automobile manufacturing development</td>
<td>53</td>
<td>53</td>
</tr>
<tr>
<td>Automobile prices</td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td>Automobile salon</td>
<td>147</td>
<td>147</td>
</tr>
<tr>
<td>Automobile shopping</td>
<td>59</td>
<td>59</td>
</tr>
<tr>
<td>Automobile show, Chicago</td>
<td>115</td>
<td>115</td>
</tr>
<tr>
<td>Automobile Trade Journal</td>
<td>298</td>
<td>298</td>
</tr>
<tr>
<td>Automotive cooperation, leaders in</td>
<td>237</td>
<td>237</td>
</tr>
<tr>
<td>Automotive journals, list of</td>
<td>385</td>
<td>385</td>
</tr>
<tr>
<td>Automotive stocks</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Average length of life of firms retiring</td>
<td>190</td>
<td>190</td>
</tr>
<tr>
<td>Average life of firms</td>
<td>184</td>
<td>184</td>
</tr>
<tr>
<td>Average life of firms leaving the industry</td>
<td>188</td>
<td>188</td>
</tr>
<tr>
<td>Average price of cars, 1903-1916</td>
<td>73</td>
<td>73</td>
</tr>
<tr>
<td>Axles</td>
<td>85, 157, 181</td>
<td>85, 157, 181</td>
</tr>
</tbody>
</table>
INDEX

Parts makers 39, 40, 50
Passenger cars, number of firms making 103-104
Passenger car companies, list of 277
Passenger car production, figures for 314
Patent agreement 109, 319
Patent, Selden 227-228, 304
See also Selden Patent
Patents 26, 106-107, 238
cross-licensing of 236
Paved roads 157
Pay roll, figures for 317
Peak load 278
Pearson, Oscar P. 267, 287, 329, 332, 342
Per capita income in various countries 81
Percentage of failures after 1912 169
chart of 177
fluctuations in 178
Performing powers 16
Permanence of the automobile, doubt concerning 150
Periodicals, list of 185
Period of growth 102
Periods in automobile industry's development 104
Perishable commodities 10
Personal possession 55
Persons per motor vehicle in various countries (chart) 214
Persons per passenger automobile 13
Persons per passenger automobile 13
Permit sales in various countries 104
Post roads 17
Post war inflation 128
Postponement of purchases 89
Poor's Manual 304-305, 307
Pope-Hartford 56
Pope-Toledo, trade-mark 56
Pope Manufacturing Company 56
Population of cities 6
proximity of, to highways 20
Port Carbon, Pennsylvania 95
Portsmouth 34
Possession 55, 56
Postal service 11
Postal service 11
Postwar inflation 128
Postponement of purchases 89
Premier, trade-mark 170
Present labor 201
Prestige 55
Price 101-102, 127, 222
average, during 1903-1910 73
determination of 61-65
during period 1913-1921 186-187
increase of, during war 277
maintenance of 178-179
of automotive and other stocks 290
of closed cars 114-115

THE AUTOMOBILE INDUSTRY

National Bond and Investment Company 116
National Bureau of Economic Research 270, 294, 337
National character 77
National income 83
Net income of various companies 240
Net profits 240
in entire industry 252
chart of 256
Net worth definition of 353-354
growth of, from earnings 224
of General Motors (chart) 220
New buyers 267
New England 155, 201, 296
New industries, profits in 257
New Jersey 16
New Rochelle 16
Newspaper advertising 144
New York 14, 140, 158, 222
New York Central Railroad 15, 280
New York City 141, 153-155
New Zealand 173-174
Non-competing groups of cars 267, 297
Non-compression engines 235
Normal interest 285
Normal price 191, 292
North 37
North Carolina 12
Northern, trade-mark 170
Noyes, Judge 304

Olds, R. E. 4, 66, 139, 155, 220, 236, 262, 267, 302
Oldsmobile 97, 113, 139, 156, 205, 247, 253, 260-260

Olds, R. E. 4, 66, 139, 155, 220, 236, 262, 267, 302

Overland 136, 150, 155, 156, 159, 160, 253, 260, 265, 308
Packard 47, 58, 79, 115, 124, 131, 138-139, 238
Packard Motor Car Company 216
Packard, J. W. 96
Packard, R. E. 4, 139, 155, 20
Pancardi, Charles C. 207
Panic of 1907 68
Paper, installment, figures upon 372
Paper profits 271
Paradel 154
Parlin, Charles C. 207
Patent Selden 227-228, 304
Patents 26, 106-107, 238
Cross-licensing of 236
Patent agreement 109, 319
Pay roll, figures for 317
Peak load 278
Pearson, Oscar P. 267, 287, 329, 332, 342
Per capita income in various countries 81
Percentage of failures after 1912 169
chart of 177
fluctuations in 178
Performing powers 16
Permanence of the automobile, doubt concerning 150
Periodicals, list of 185
Period of growth 102
Periods in automobile industry's development 104
Perishable commodities 10
Personal possession 55
Persons per motor vehicle in various countries (chart) 214
Persons per passenger automobile 13
Persons per passenger automobile 13
Permit sales in various countries 104
Post roads 17
Post war inflation 128
Postponement of purchases 89
Poor's Manual 304-305, 307
Pope-Hartford 56
Pope-Toledo, trade-mark 170
Pope Manufacturing Company 56
Population of cities 6
proximity of, to highways 20
Port Carbon, Pennsylvania 95
Portsmouth 34
Possession 55, 56
Postal service 11
Postal service 11
Postwar inflation 128
Postponement of purchases 89
Premier, trade-mark 170
Present labor 201
Prestige 55
Price 101-102, 127, 222
average, during 1903-1910 73
determination of 61-65
during period 1913-1921 186-187
increase of, during war 277
maintenance of 178-179
of automotive and other stocks 290
of closed cars 114-115
Price (continued)

of cord and fabric tires 107
of gasoline 275
of tires 86
spread of, between closed and open cars 115

Price classes 65, 73-77
changes in, during 1907-1919 182
production by, 1917-1926 124, 128
chart of 179
production and factory sales by, 1903-1916 75
shift in number of producers among 185
Price control 151
Price cutting 140
Printer 95

Production
and value of product, figures for
as a measure of leadership 104-195
by cylinder classes 114
by cylinder classes, 1917-1926 122-123
by cylinder classes, 1917-1926, Ford excluded 124
by price classes, 1917-1926 (chart) 129
by price classes, 1917-1926 124, 128
capacity 276-277
compared with income and goods in general (chart) 82
cost 52
during period 1917-1926 102-105
figures by years 314
growth, rate of 1917-1926 104
periods in 266
in 1895 3
in 1903-1916 65-71
in 1903-1916 (chart) 66
in 1903-1916, by 3-year periods 72
in 1903-1926 (chart) 103
in 1908 4

in 1916 4, 103
in 1920 and other years 4
in various countries 370
large-scale
of cars compared with goods in general 81-85
of closed cars 111
of high-priced cars, 1917-1926 126-127
of licensed manufacturers (chart) 230
of low, medium, and high-priced cars, 1917-1926 (chart) 126
of low-priced cars, 1917-1926 126
of medium-priced cars, 1917-1926 126
of three broad price classes of cars (chart) 93
per factory 213
periods of growth in policy 266
rate since 1923 266
reports by members to N. A. C. C. 236
resources, shifting of scale of 258
total world 320
Productive effectiveness 274
Prosperity 85
Production groups, movement between 194
Profits 30, 265, 276
average rate of 257
conjunctural character of 163-264
difference in 260
for entire industry (chart) 256
general level of 252
in 1917 307
nature of 157
of Ford, Reo, and Packard (chart) 743
of Nash, Dodge, and Studebaker (chart) 249
of various producers 240-252
of Willys-Overland, General Motors, and Hudson (chart) 248

Price in 1908 4
in 1903-1916, by 3-year periods 65-71
in 1903-1916 (chart) 66
in 1903-1916, by 3-year periods 72
in 1903-1926 (chart) 103

INDEX

Prices of
in 1903-1916 (chart) 66
in 1903-1926 (chart) 103

Production growth
in 1903-1926 126-127
in 1917-1926 124, 128

Quarterly Journal of Economics 200, 207
Quarterly exports (chart) 272
Quarterly Journal of
Economics

Q

Quantity production 200
Quarterly exports (chart) 272

Quartiles 194, 197, 199, 209
movement of firms between, 1903-1916 194
production of firms at first and third 213
Quasi-monopoly character of automotive products 260
Questionnaire on distributing practices 133
Quickness of transportation 7
Quincy 288
Quota, sales of 140, 147
Quotations

R

Races 57, 152, 154, 159-160
Racing records 375-376
Radiators 60
Railroad 6, 14, 16, 22, 36
Rambler 250
trade-mark 51, 165
Range of stock prices (chart) 251
Rate of failures 173
1903-1907 150
1908-1912 181

Reinvestment of earnings 59
Reliability 56, 107
contests 153
tours 154
Reo 225, 250, 253, 256, 260, 302, 307
Reo Motor Car Company 224, 246
earnings of 246, 250
Reo, trade-mark 170
Repair expense 85
Repair men 87
Repairs 85-86
Repetitive production 245

of production growth 104
periods in 256
of profits 257
Ratio chart 266
Ratios, for repossession 122
Real estate boom in Florida 20
Reaming of parts 55
Rear axle 181
Receivables 116
Reciprocating parts 36
Recommended terms, in installment selling 120
Records 375-376
racing 375-376
transcontinental 158-159
Recourse, in installment sales 322
Redesigning of models 181
Reduction of costs 375-376
Reduction of distances 7
Reeves, Alfred 123, 124
Refinancing of General Motors 225
Refinement of designs 107
Registration 266
by sizes of community 7
density by states 13
figures by states 318
figures by years 317
in leading countries (chart) 273
in various countries 321
Reinvested capital 258-259
Reinvested profits 244
of production growth 104
periods in 256
of profits 257
Ratio chart 266
Ratios, for repossession 122
Real estate boom in Florida 20
Reaming of parts 55
Rear axle 181
Receivables 116
Reciprocating parts 36
Recommended terms, in installment selling 120
Records 375-376
racing 375-376
transcontinental 158-159
Recourse, in installment sales 322
Redesigning of models 181
Reduction of costs 375-376
Reduction of distances 7
Reeves, Alfred 123, 124
Refinancing of General Motors 225
Refinement of designs 107
Registration 266
by sizes of community 7
density by states 13
figures by states 318
figures by years 317
in leading countries (chart) 273
in various countries 321
Reinvested capital 258-259
Reinvested profits 244
of production growth 104
periods in 256
of profits 257
Ratio chart 266
Ratios, for repossession 122
Real estate boom in Florida 20
Reaming of parts 55
Rear axle 181
Receivables 116
Reciprocating parts 36
Recommended terms, in installment selling 120
Records 375-376
racing 375-376
transcontinental 158-159
Recourse, in installment sales 322
Redesigning of models 181
Reduction of costs 375-376
Reduction of distances 7
Reeves, Alfred 123, 124
Refinancing of General Motors 225
Refinement of designs 107
Registration 266
by sizes of community 7
density by states 13
figures by states 318
figures by years 317
in leading countries (chart) 273
in various countries 321
Reinvested capital 258-259
Reinvested profits 244
INDEX

Service policies 144
Shaft drive 180
Shaw, A. W. 284
Sheffield Scientific School 227
Ship blocks 34
Shopping for automobiles 59
Shopping goods 59
Show, automobile 157
first one in 1900, picture of 153
Square miles of area to miles of road 175
figures for 321
Stabilization 98
Stages in automobile industry's development 104
Stages in growth 102
Standardization 104, 261
of parts 41
Reduction of failure because of parts 184-185
Standards Committee of the Society of Automotive Engineers 184
Standard methods 260
Standard of living 262
Standard Oil Company 220
Standard practice in manufacturing 174
Standard terms in installment sales 120-121
Stankey 26
Stanks, trade-mark 170
Steel maker 185
Stevens-Duryea, trade-mark 170

S
Sales 58
See Distributing; Installment
Sales, by years, price, and cylinder classes. See Production
Sales figures, General Motors Corporation 328
Sales policy See also Marketing
Sales quota 140, 147
Sarsfield of 1899, illustration of 138
San Francisco 158-159
Saturation of the high-priced car market 81, 93, 94, 101
Sawin, George W. 342
Schools 12
"Scientific distribution" 148
Scientific management 148
Scraped cars 267
Scrapes-Booth 166
Seasonal fluctuation 149
Second-hand cars 284
Secular trend 70
Selected, George B. 26, 227, 232, 287
Selden Case Record 303
Selden case testimony in 303
final decision in 235
Selden patent 26, 227, 232, 302, 304
A.L.A.M. advertisement in support of royalties under 234
Self-starter 102, 103, 105
Selkurt, Lawrence H. 258, 291,
293, 300, 301, 302,
Seventy
Semi-elliptic springs 157
Sewing machines 36, 116, 167
Sewer distribution 313
Sheffield Scientific School 227
Sheet metal 34
Shaw, A. W. 284
Shaw, W. H. 227
Shaw, W. 227
Sheffield Scientific School 227
Ship blocks 34
Shopping for automobiles 59
Shopping goods 59
Show, automobile 157
first one in 1900, picture of 153
Square miles of area to miles of road 175
figures for 321
Stabilization 98
Stages in automobile industry's development 104
Stages in growth 102
Standardization 34, 86, 101
Stages in automobile industry's development 104
Stages in growth 102
Standardization 34, 86, 101
of parts 41
Reduction of failure because of parts 184-185
Standards Committee of the Society of Automotive Engineers 184
Standard methods 260
Standard of living 262
Standard Oil Company 220
Standard practice in manufacturing 174
Standard terms in installment sales 120-121
Stankey 26
Stanks, trade-mark 170
Steel maker 185
Stevens-Duryea, trade-mark 170

S
Sales 58
See Distributing; Installment
Sales, by years, price, and cylinder classes. See Production
Sales figures, General Motors Corporation 328
Sales policy See also Marketing
Sales quota 140, 147
Sarsfield of 1899, illustration of 138
San Francisco 158-159
Saturation of the high-priced car market 81, 93, 94, 101
Sawin, George W. 342
Schools 12
"Scientific distribution" 148
Scientific management 148
Scraped cars 267
Scrapes-Booth 166
Seasonal fluctuation 149
Second-hand cars 284
Secular trend 70
Selected, George B. 26, 227, 232, 287
Selden Case Record 303
Selden case testimony in 303
final decision in 235
Selden patent 26, 227, 232, 302, 304
A.L.A.M. advertisement in support of royalties under 234
Self-starter 102, 103, 105
Selkurt, Lawrence H. 258, 291,
293, 300, 301, 302,
Seventy
Semi-elliptic springs 157
Sewing machines 36, 116, 167
Sewer distribution 313
Sheffield Scientific School 227
Ship blocks 34
Shopping for automobiles 59
Shopping goods 59
Show, automobile 157
first one in 1900, picture of 153
Square miles of area to miles of road 175
figures for 321
Stabilization 98
Stages in automobile industry's development 104
Stages in growth 102
Standardization 34, 86, 101
Stages in automobile industry's development 104
Stages in growth 102
Standardization 34, 86, 101
of parts 41
Reduction of failure because of parts 184-185
Standards Committee of the Society of Automotive Engineers 184
Standard methods 260
Standard of living 262
Standard Oil Company 220
Standard practice in manufacturing 174
Standard terms in installment sales 120-121
Stankey 26
Stanks, trade-mark 170
Steel maker 185
Stevens-Duryea, trade-mark 170
THE AUTOMOBILE INDUSTRY

INDEX

Trailers 15
Transcontinental trip, first 158
Transit 85, 181, 213, 284
Transportation 6

V
Vacations 20
Value of product, figures for 314

Studebaker 107, 150, 171, 249, 253, 256
Studebaker Corporation 247, 277
Studebaker plant 45
Street car 16
Subsidiary companies 167
Subway 16
Summary of market development 116
Tires 85, 146, 157

Taps 36
Tariff 273
Taxes 273
Taxicab manufacturers, list of 384-385
Taussig, F. W. 307
Tayler, F. W. 148
Technical improvements 230
Technical journals, list of 236
Technique, stabilization in 191
Telephones 4, 7, 15
number in use 8

Technical journals, list of 384-385
Technical improvements 230
Technical journals, list of 236
Technique, stabilization in 191
Telephones 4, 7, 15
number in use 8

Studebaker 107, 150, 171, 249, 253, 256
Studebaker Corporation 247, 277
Studebaker plant 45
Subsidiary companies 167
Subway 16
Summary of market development 116
Tires 85, 146, 157

Taps 36
Tariff 273
Taxes 273
Taxicab manufacturers, list of 384-385
Taussig, F. W. 307
Tayler, F. W. 148
Technical improvements 230
Technical journals, list of 236
Technique, stabilization in 191
Telephones 4, 7, 15
number in use 8

Steel tubing 41
STEELS, ALLOY 41
Steering 80
Stock Exchange 308
Stocks 224
automotive 250
of General Motors Corporation 306
obstacles to sale of 37-39
prices of 250
Stockholders 164
net equity of 307
Stoddard-Dayton, trade-mark 170
Stone 36
Storrow, James J. 165
Street car 16
Straight eight 124
Straight-line rate of growth 104
Stratification, social 62
Subway 16
Summary of market development 116
through 1916 99
Supply price 264
Surfaced roads 18, 19
Sweden 274
Symington 25
Systems of distribution, diagram of 134

T
Taps 36
Tariff 273
Taxes 273
Taxicab manufacturers, list of 384-385
Taussig, F. W. 307
Tayler, F. W. 148
Technical improvements 230
Technical journals, list of 236
Technique, stabilization in 191
Telephones 4, 7, 15
number in use 8

Steel tubing 41
STEELS, ALLOY 41
Steering 80
Stock Exchange 308
Stocks 224
automotive 250
of General Motors Corporation 306
obstacles to sale of 37-39
prices of 250
Stockholders 164
net equity of 307
Stoddard-Dayton, trade-mark 170
Stone 36
Storrow, James J. 165
Street car 16
Straight eight 124
Straight-line rate of growth 104
Stratification, social 62
Subway 16
Summary of market development 116
through 1916 99
Supply price 264
Surfaced roads 18, 19
Sweden 274
Symington 25
Systems of distribution, diagram of 134

T
Taps 36
Tariff 273
Taxes 273
Taxicab manufacturers, list of 384-385
Taussig, F. W. 307
Tayler, F. W. 148
Technical improvements 230
Technical journals, list of 236
Technique, stabilization in 191
Telephones 4, 7, 15
number in use 8

Steel tubing 41
STEELS, ALLOY 41
Steering 80
Stock Exchange 308
Stocks 224
automotive 250
of General Motors Corporation 306
obstacles to sale of 37-39
prices of 250
Stockholders 164
net equity of 307
Stoddard-Dayton, trade-mark 170
Stone 36
Storrow, James J. 165
Street car 16
Straight eight 124
Straight-line rate of growth 104
Stratification, social 62
Subway 16
Summary of market development 116
through 1916 99
Supply price 264
Surfaced roads 18, 19
Sweden 274
Symington 25
Systems of distribution, diagram of 134

T
Taps 36
Tariff 273
Taxes 273
Taxicab manufacturers, list of 384-385
Taussig, F. W. 307
Tayler, F. W. 148
Technical improvements 230
Technical journals, list of 236
Technique, stabilization in 191
Telephones 4, 7, 15
number in use 8

Steels, alloy 41
Steel tubing 41
Steering 80
Stock Exchange 308
Stocks 224
automotive 250
of General Motors Corporation 306
obstacles to sale of 37-39
prices of 250
Stockholders 164
net equity of 307
Stoddard-Dayton, trade-mark 170
Stone 36
Storrow, James J. 165
Street car 16
Straight eight 124
Straight-line rate of growth 104
Stratification, social 62
Subway 16
Summary of market development 116
through 1916 99
Supply price 264
Surfaced roads 18, 19
Sweden 274
Symington 25
Systems of distribution, diagram of 134

T
Taps 36
Tariff 273
Taxes 273
Taxicab manufacturers, list of 384-385
Taussig, F. W. 307
Tayler, F. W. 148
Technical improvements 230
Technical journals, list of 236
Technique, stabilization in 191
Telephones 4, 7, 15
number in use 8

Telegraph 22
Tempered competition 152, 268
Temples 181
Tensile strength 37
Terminal haulage 15
Termination clause in contracts 150
Theory of free competition 207
of value 63, 152, 268
Thomas, trade-mark 170
"Thought, skill, and intelligence," 49, 253, 256
transfer of 31
Three-cylinder cars 90-92
Time payment 104, 116-117, 120, 122, 130
by price classes 130-133
down payment in 110
economics of 118
losses in 322
soundness of 121
statistics of 322
See also Installment Sales
Timken-Detroit Axle Company 40, 51
Times, Francis, Company 95
Times-Herald, Chicago 159
balloon 85, 146, 157
cord 107
cord and fabric, price of 107
prices (chart) 86, 108
Tolley, H. R. 287
Tooling 46
Tools 36
See also Machinery, Machine Tools
Touring car 60
tours, technical contribution from 157
See also Glidden Tours
Trade associations, list of 385
Trade-ins 150, 208
Trade journals, list of 385
Trade-marks of 1904, illustrations of 170
Trade, taking cars in 150
Traffic 14

Trend of production growth, 1903-1916 67
Trevithick, Richard 25
Trolley car 22
Trust receipt 242
Trust, anti° 11
Truth, skill, and intelligence," 49, 253, 256
Transfer of 31
Two-cylinder cars 74, 77, 87, 120, 122, 130, 181-182
Type, diversity of 60, 80

U
United Kingdom 294
United States Motor Company 221-223, 225
United States Rubber Company 287
United States Steel Corporation 220
Universal joint 85
Upkeep, cost of 85
Urban life 13
Utilities offered by auto-

value, market and normal 63
Value theory 63, 152, 268
Valve stems 85
Vanderlip, Hon. B. 291
Variety, in design 87
illustration of 88
in specifications 41
in style 60
of type 60
V type eight 124
Velie 113

W
Wade, Lieutenant Leigh 159
Wages, figures for 317
of management 258
Wagons 10, 167, 200, 240
Walden, Sidney 70
Walker, Charles E. 155
Walker, Francis A. 261
Wall Street Journal 306
Waltham Manufacturing Company 57
Wanamaker, John 140
Wants, for automobile as a consumption good 56
War 71, 112
Warhouse plan 141
Warner, Thomas 35
Warranty 85, 86
Warren, Ohio 90, 246
Washington, D. C. 159
Waste 61
Water-cooling 89
Watt, James 23, 35, 58
Waverley Electric 94
first twenty buyers of 96
Wells 166
trade-mark 170
Welfare, economic 271
Weath 9
White 26
White, Walter C. 155
Whitney 35
<table>
<thead>
<tr>
<th>Name</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whitney, W. C.</td>
<td>228</td>
</tr>
<tr>
<td>Whitworth</td>
<td>36</td>
</tr>
<tr>
<td>Wholesale distribution</td>
<td>132-135</td>
</tr>
<tr>
<td>Wholesalers</td>
<td>142, 143</td>
</tr>
<tr>
<td>Widener, P. A. B.</td>
<td>228</td>
</tr>
<tr>
<td>Wieser</td>
<td>292</td>
</tr>
<tr>
<td>Wilkinson</td>
<td>23</td>
</tr>
<tr>
<td>Wilson, C. B.</td>
<td>209</td>
</tr>
<tr>
<td>Willys, J. N.</td>
<td>297</td>
</tr>
<tr>
<td>Willys-Overland</td>
<td>209, 210, 250, 253, 256</td>
</tr>
<tr>
<td>earnings of</td>
<td>247</td>
</tr>
<tr>
<td>Winton</td>
<td>26, 28, 30, 94, 95, 96, 97, 106, 158, 228</td>
</tr>
<tr>
<td>first twenty buyers of</td>
<td>96</td>
</tr>
<tr>
<td>Winton, Alexander</td>
<td>96, 160, 287</td>
</tr>
<tr>
<td>Winton, trade-mark</td>
<td>170</td>
</tr>
<tr>
<td>Winton Motor Carriage Company</td>
<td>228, 229</td>
</tr>
<tr>
<td>agreement of, with Electric Vehicle Company</td>
<td>371</td>
</tr>
<tr>
<td>Wood</td>
<td>262</td>
</tr>
<tr>
<td>Woodward, G. C.</td>
<td>289</td>
</tr>
<tr>
<td>Working capital</td>
<td>30, 139</td>
</tr>
<tr>
<td>of dealer</td>
<td>150</td>
</tr>
<tr>
<td>Work-in-process</td>
<td>151</td>
</tr>
<tr>
<td>Workshop stage</td>
<td>104</td>
</tr>
<tr>
<td>World markets for motor</td>
<td>271-275</td>
</tr>
<tr>
<td>vehicles</td>
<td></td>
</tr>
<tr>
<td>World production, figures for</td>
<td>320</td>
</tr>
<tr>
<td>World registration, figures for</td>
<td>321</td>
</tr>
<tr>
<td>World trade, figures for</td>
<td>319</td>
</tr>
<tr>
<td>World's Work</td>
<td>308</td>
</tr>
<tr>
<td>Yale, trade-mark</td>
<td>170</td>
</tr>
<tr>
<td>Yale University</td>
<td>227</td>
</tr>
</tbody>
</table>