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MOTOR ROAD TRANSPORT
FOR
COMMERCIAL
PURPOSES

PHILLIMORE

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MOTOR ROAD TRANSPORT FOR COMMERCIAL PURPOSES

JOHN PHILLIMORE

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MOTOR ROAD TRANSPORT

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COMMERCIAL PURPOSES

MOTOR ROAD TRANSPORT
FOR
COMMERCIAL PURPOSES

(LIQUID FUEL, STEAM, ELECTRICITY)

BY
JOHN PHILLIMORE
(*"Twin"*)

INTRODUCTION
BY
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PREFACE

The subject of Motor Road Transport for Commercial purposes is so extensive, and is one which can be treated from so many points of view, that it would seem desirable to state that the present book has been written as a guide for those who intend adopting mechanical traction for the first time, or who, although already possessing motor vehicles, have not a wide experience in their use. There has been no attempt to cover the whole of the subject.

With regard to the question of Running Costs, it is impossible at any time to give standard figures which will prove strictly accurate. Especially is this the case to-day when many transport fleets are only now being re-organized. Pre-war and war-time vehicles have suffered abnormally from the inevitable lack of spare parts and skilled labour; and on the other hand, post war machines only are being run by many firms, while prices of fuel, labour and material are constantly fluctuating.

Again, all costs are variable quantities, since the locality in which the service is usually run, the organization of the despatch, the nature of the work, the driver of the vehicle, and so on, all have their determining influence on the final figure of the cost per mile. The tables included in the chapters on costs will, however, give useful data upon which traders can base their own estimates of transportation charges.

It is not possible to give here a complete list of all who have very kindly helped me in the matter of supplying information, figures or photographs, but my special thanks are due to the Ministry of Transport, to the War Office, and to the Commissioners of Customs and Excise. Also to—

Messrs. Agricultural & General Engineers, Ltd.
,, Albion Motor Car Co., Ltd.
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,, The Super Engineering Co., Ltd.
,, Tilling - Stevens Motors, Ltd.
,, John Warwick & Co., Ltd.
,, Wm. Whiteley, Ltd.
,, The Yorkshire Commercial Motor Co.

I am also grateful to the Editors of *The Times*, *The Daily Mail*, *The Christian Science Monitor*, *Business Organisation and Management* and *Modern Transport* for allowing me to reproduce portions of articles of mine published in those journals. I am especially indebted to the Editor of the *Evening News* both for permitting me to reproduce the substance of many of my articles on Motor Transport which have appeared in that paper, and for the encouragement he has invariably given me in connection with this subject.

JOHN PHILLIMORE.

INTRODUCTION

The events of the past few years have focussed attention as it has never been focussed before on the commercial possibility, or rather necessity, of road haulage by mechanical transport.

The war, and the railway strike of 1919, demonstrated fully to the public the permanent character of motor traction in our national life. Let me quote but two examples, one of a military and the other of a civilian nature. When our forces made their advance after the Armistice towards the German frontier, the leading troops at one time had to be provisioned by mechanical transport at a distance of over 100 miles by road beyond the furthest point at which the railway could be repaired. At home during the strike, the fact that fleets of road vehicles carried out successfully the work of railways, as far as concerned the essential food supply of the community, must have convinced even the sceptics.

Complementary not Competitive.

It must not be assumed, however, from the above, that road transport can replace rail transport, especially where a ton mile basis is concerned. As Mr. Phillimore, with admirable broadmindedness, has pointed out, rail and road transport are not real competitors; rather is the one complementary to the other, and it is a nice appreciation of the possibilities and limitations of road haulage that will in the long run lead to success in its working.

Undoubtedly, one reason why traffic organization has received comparatively little attention in the past, is the fact that in this country practically no large road transportation companies existed with the exception of certain passenger carrying concerns, and the problem has consequently been neglected. Now, however, when many new users or companies are about to commence operations, and old users are extending their fleets, it behoves all those responsible for the operating side of the concern not merely to watch most closely the expenses incurred in their undertaking, but also to inquire how they can by modern methods so arrange their services as to utilize to the utmost the earning power of their vehicles.

Economy and Earning Power.

As is emphasized in this book, it is not sufficient to rest content with the knowledge that motor transport is cheaper in many cases than horse haulage. The methods in vogue require constant attention to see if further economies can be effected by improved organization. The earning power of the motor is represented by the product of the useful load and the number of miles it is carried.

Mr. Phillimore has evidently made a close study of this side of the question, for throughout his book the factor essential to success—economy in operation—is kept before the mind of the reader. As regards the class of vehicle to be employed, the respective advantages in using vehicles with internal combustion engines, steam engines and electric motors are set forth clearly in different chapters. The prospective user should therefore be able to obtain sound guidance as to the class of vehicle best suited to his particular type of work.

Costs : A Valuable Feature.

The figures of costs given are in most cases the results of actual working conditions, and although—

as is stated in the book—prices have changed so enormously during the past few years, the publication of results and not mere estimates should prove invaluable, not only to those about to embark upon mechanical transport, but also to those who are now running fleets of vehicles. The latter class of user may possibly find much that will help him to reduce appreciably his running expenses, or to supplement his existing fleets with vehicles of another type for handling economically certain of his loads which are now carried uneconomically.

The tables of charges for fleets actually in operation cover a large variety of conditions, and are plain unvarnished facts. Presented as they are without bias, they form a most useful contribution to the literature of road transportation.

The schedules are not reduced to one common basis for comparison. The accounts are set forth as kept by the owners, and as they stand it should be possible for most users to find some, at any rate, of the costing systems on a line with their own method of keeping accounts, and thus be able to check their figures.

The chapters on steam and electric vehicles should appeal particularly to those who, at the present time, fear the effect of the rapidly rising price of petrol.

Problem of the Roads.

In this short introduction I have dealt with one side of the question only, and that is the transport side. It must be remembered, however, that there is another side, *i.e.*, the roads. If there are no roads there is no road transport ; paucity of roads handicaps its development ; good roads and plenty of them lead to reduced running costs. But roads can neither be made nor maintained without considerable expenditure.

We have been familiar for so long with our very complete road system that we are apt to forget the large sums of money that have been expended on its initial construction and subsequent maintenance. The years of war have shown how continued abnormal traffic and neglect of upkeep lead to the destruction of road surfaces, and how road transport suffers from having to operate over bad or destroyed roads.

It is to the advantage, therefore, of the road user to see that money is available for the expense of upkeep of the roads, for the benefit of good road surface to him is inestimable, resulting as it does in reduced costs of vehicle operation.

The collection and tabulation of the data so ably set forth by the author in this volume represent a laborious task, the successful accomplishment of which places in our hands an instrument and guide of outstanding value.

In the growing stress of modern life such instruments are becoming every day more indispensable, and speaking for myself and hosts of fellow-students, I gladly and gratefully welcome Mr. Phillimore's contribution to the Library of Transport.

HENRY P. MAYBURY.

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FOR
COMMERCIAL PURPOSES

CHAPTER I

MOTOR ROAD TRANSPORT: PAST AND PRESENT

BEFORE August, 1914, the motor vehicle, whether for private or commercial use, was a great asset; now it is an absolute essential. At the outbreak of the war the days were not long past when it was wont to be looked upon as a luxury rather than a necessity; the horse, and more especially the railway, being formidable competitors in spite of their manifest limitations. All this has been changed, the three types of traction being now complementary to one another, and it is scarcely an exaggeration to say that the motor—either directly or indirectly—dominates to-day every phase of interior economy. The war has given a great impetus to mechanical transport as a whole, and practical experience has shown that it is now an indispensable factor of national life.

Without motor traction—and motor traction in the most up-to-date form—no country can hope to maintain a footing in the universal competitive reconstruction which is everywhere taking place.

European Road Mileages Compared.

Great Britain is eminently suited to road transport, as may be seen from the table appended, in the final column of which is shown the proportion—pre-war—of road mileage to area for several countries. It will be noticed that after England and Wales, France possesses the next greatest mileage of roads compared to the area of the country, while Austria, Spain, and Russia are the poorest off for road accommodation.

Country	Total Road mileage.	Area in Square miles.	Proportion Road Mileage to area.
England	133,651	50,328	2·6 to 1
Wales	18,484	8,012	2·3 to 1
Scotland	24,908	29,819	0·8 to 1
Ireland	59,150	31,762	1·8 to 1
Great Britain	236,193	119,921	1·9 to 1
Austria	80,176	240,456	0·3 to 1
France	429,464	207,076	2·0 to 1
Germany	175,000 (approx)	208,789	0·8 to 1
Italy	136,553	110,623	1·2 to 1
Japan	257,414	235,886	1·09 to 1
Russia	483,332	8,000,000	0·06 to 1
Spain	27,805	196,700	0·14 to 1

New Era for Mechanical Road Transport.

Mechanical road transport, owing to the increased development due to sounder views as regards rightful application and treatment, is entering upon a new era. The radius of its utility is continually being enlarged and appears to be almost unlimited, and the part that it will play in bettering the national welfare in years to come will, in the writer's opinion, prove to be immense.

That there are many difficult problems to be faced, and that much hard work will have to be done before really good results can be obtained, is not to be denied; but we have already gone so far along the road, and overcome so many serious obstacles, that there is little doubt but that we shall achieve success in time.

Some years ago the up-to-date trader began to adopt mechanical transport, his chief reason being the conviction that therein lay a distinct source of profit. One of his foremost ideas was the necessity

ONE-TIME LONDON OMNIBUSES IN FRANCE

(1889)—*bet. pp.* 2 *and* 3

of having a smart-looking van on account of the manifest advertisement gained thereby. This was natural and logical. Here was a travelling advertisement, and, if attractive, people who saw it would say, " That man must be doing well," with the result that fresh business would be gained. The truth of the saying that " nothing succeeds like success " is never better borne out than in this branch of business.

To-day it is no longer a question of profit only, but more often than not a question of existence.

Growth of Motor Haulage Companies.

Since the Armistice a great number of motor haulage contracting companies have sprung into existence, and undoubtedly this movement will expand to very considerable proportions all over the country. With the present uncertainty and fluctuation in the costs of material and labour, many commercial houses prefer to contract for their transport rather than to organize a fleet of vehicles of their own, more especially when their knowledge of the subject and actual experience are not extensive. This method, though unquestionably possessing certain advantages, can never, as a rule, compare in efficiency, economy, and independence with that of a fleet of motors run by a firm itself on well organized lines.

With all forms of transportation, reliability, elasticity, and economy are the features essential to success, and the system by which these qualities are gained to the greatest extent is the system to be adopted. Reliability is of primary importance, and that this can be secured was definitely proved in the war.

Triumph of Military Motor Traction.

There were demerits as well as merits in our mechanical road transportation in France, and the business man would not be able to run his motor service successfully on economic lines if similar to those adopted of necessity during time of war. But that it was not only a triumph of organization in regard to the handling of great numbers of machines and vast quantities of loads, but also a most convincing testimony to the motor itself, is not to be denied. As regards elasticity it is an established fact that motor road traction possesses this asset to a greater extent than any other form of transport; and the value of this was amply demonstrated during the war. The flexibility of our military transport and the lack of it on the part of the Germans was largely contributive to their defeat. Commercially, the value of being able to make extra detours on a delivery round or to change a route at a moment's notice speaks for itself. The matter of economy is dependent on several factors, notably upon the rightful application of the motor in respect of the nature of the work which is to be undertaken, and in the majority of cases, as may be seen from definite figures and facts in later chapters, the motor can be maintained at a cheaper rate than the horse when mileage is taken into consideration.

Enormous Development.

The following charts are illustrative of the enormous development of Military motor traction during the war.

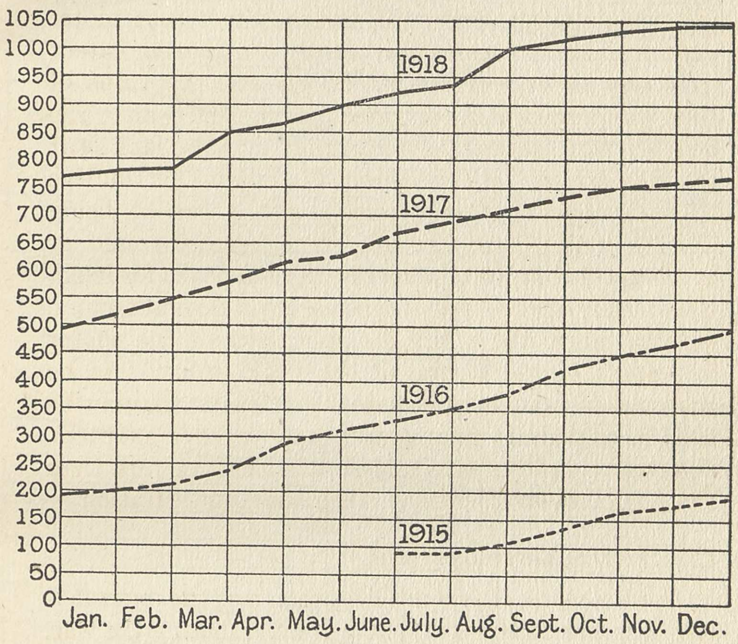
Taking the four classes of vehicle illustrated in Charts 1, 2, 3, and 4 (see pp. 5, 6, 7), it will be seen that the expansion in each case from September, 1915, to January, 1919, was as follows—

	Sept. 1915	Jan. 1919
Chart 1. Tractors	108	1,045
Chart 2. Steam Wagons . . .	235	835
Chart 3. Lorries	9,400	32,650
Chart 4. Cars, light pneumatic-tyred Vans, Ambulances .	3,900	13,300

And in Chart 5 (p. 7) of motor cycles, the increase from January, 1918, to January, 1919, was from 13,100 to 16,450.

The fall in the curves of charts 3 and 4 towards the end of 1917, was due to transference of vehicles to Italy.

CHART 1 : TRACTORS.



Reliability.

The immensity of the undertaking and the general reliability of the vehicles may be gauged by the facts that in 1918, nearly up to the time of the Armistice, 90 to 91 per cent. of the operating lorries were in running order, and that only about 600 lorries out of the total of over 30,000 that went over to France were condemned as being totally unfit for service.

CHART 2: STEAM WAGONS.

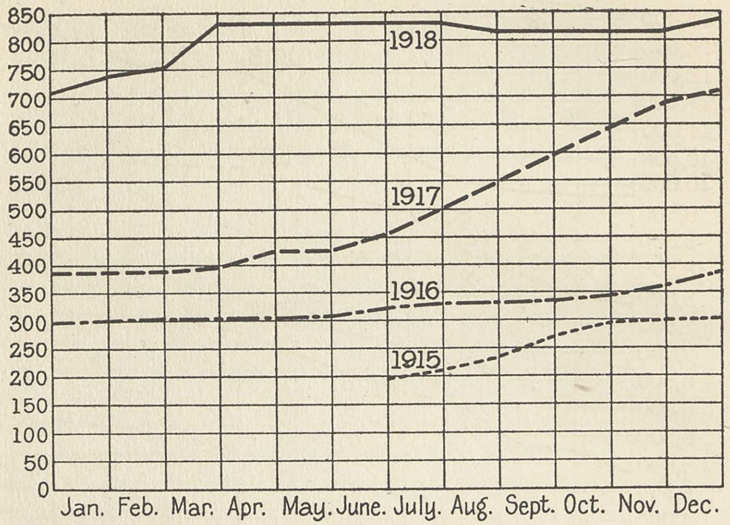


CHART 3: LORRIES.

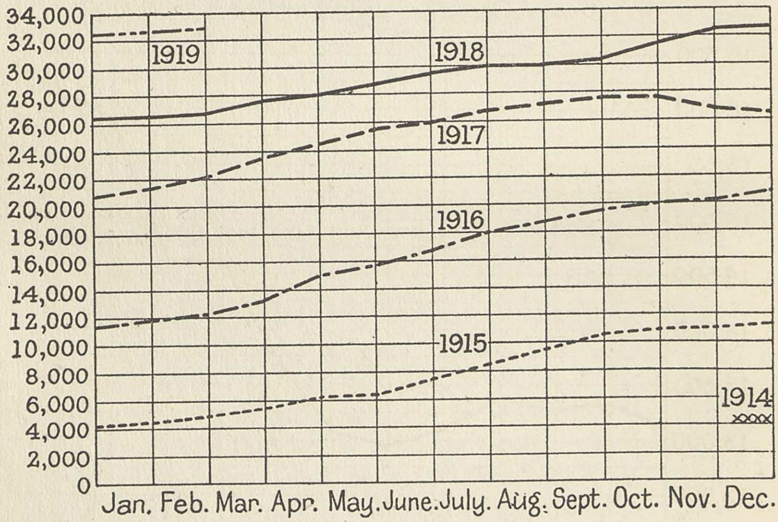


CHART 4: CARS, AMBULANCES, ETC.

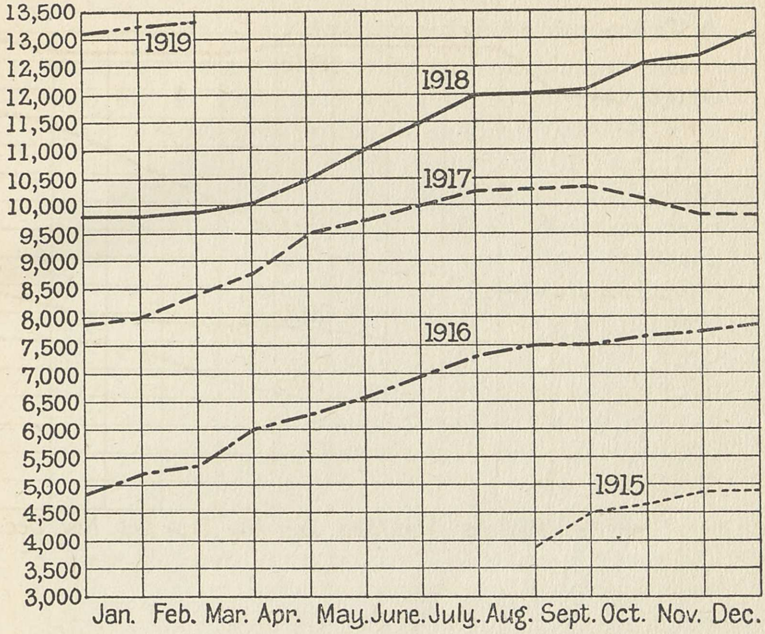
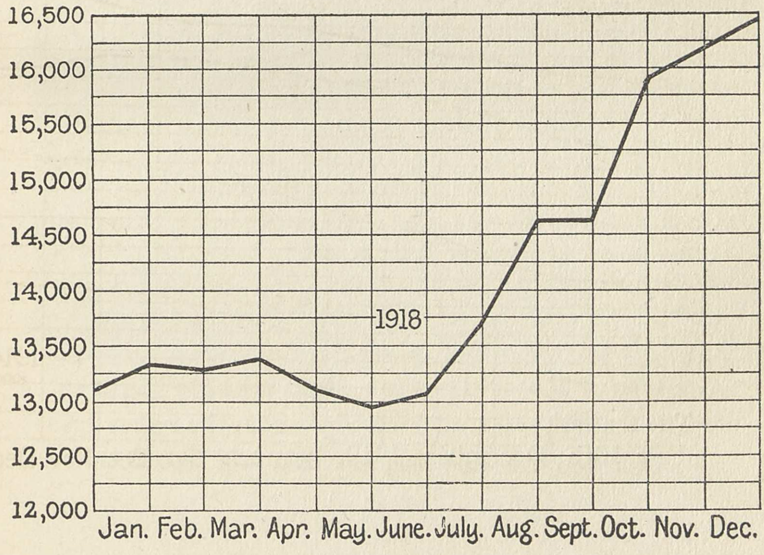


CHART 5: MOTOR CYCLES.



A Tremendous Achievement.

The organization included 88,000 men, operating 60,000 vehicles of all types, consuming in the year 1918, 80,000,000 gallons of petrol, over 400,000 tyres, and about 10,450 tons of spare parts. The territory covered was as large as half of England, and the food, munitions, guns, etc., supplied were for over 2,000,000 men. It was beyond question the greatest organization and employment of mechanical transport ever carried out under British control, yet people in Great Britain did not realize it. This was not unnatural, because those at home had no chance of seeing any but home transport, and also because many War Office details and figures could not be made public during the war.

The Lesson of the Railway Strike.

Business people in this country were, however, given plenty of opportunity of realizing the utility and scope of the motor vehicle during the tube strike of 1919, and later on, to a much greater extent, in the railway strike of the same year. There is little doubt but that during the latter mechanical traction received enormous impetus. The advantages were brought home to the trader who had not hitherto troubled to consider them, and having once weighed the matter thoroughly—taking into account the disadvantages which at that time were greatly emphasized—he determined to adopt motor haulage either for the first time, or to a greater extent than previously. The growth of mechanical transport has been remarkable, and, as an example of this, the figures given on the opposite page are interesting.

Growth of Motor Traffic : Remarkable Figures.

The statistics of traffic were taken on the seven days ending 13th December, 1919, between the hours of

LOADING UP A MILK LORRY IN HYDE PARK DURING THE RAILWAY STRIKE OF 1919

(1889)—*bet. pp.* 8 *and* 9

6 a.m. and 10 p.m., at a point near Fox Hill Farm, in the township of Barton Moss, on the Liverpool and Manchester main road.

The comparative figures were taken on the same road from 10th June to 16th June, 1912 (inclusive).

Mechanically Propelled Vehicles.	Total in 7 days, ending 13th Dec., 1919		Total in 7 days ending 16th June, 1912.	
	Number	Weight in tons	Number	Weight in tons
Motor Cycles	130	16·9	108	14·4
Motor Cars (including motor cabs, etc.)	366	585·6	128	204·8
Motor vans (covered) . .	206	315·0	39	97·5
Motor Omnibuses . . .	3	18·0	1	6·0
Motor Lorries (rubber tyres) .	2010	12060·0	94	564·0
Trailers to ditto . . .	336	1680·0	1	5·0
Motor Lorries (steel tyres) .	11	110·0	32	320·0
Trailers to ditto . .	4	20·0	18	90·0
Light Tractors . . .	3	15·0	4	20·0
Trailers to ditto . . .	3	15·0	4	20·0
Traction engines . . .	1	12·0	2	24·0
Trailers to ditto . . .	2	16·0	6	48·0
Total motor vehicles and trailers	3075	14863·5	437	1413·7
Horse Drawn Vehicles.				
Light vehicles (one horse) .	133	53·2	369	147·6
,, ,, (two or more horses	7	4·2	15	9·0
Heavy vehicles (one horse) .	561	701·2	551	688·7
,, ,, (two or more horses	92	230·2	128	320·0
Omnibuses (two or more horses)	—	——	26	78·0
	793	988·8	1089	1243·3

From the foregoing figures it will be seen that the increase in mechanically propelled traffic is 7 times in number and 10½ times in weight, as compared with 1912, while the decrease in horse-drawn traffic is 27 per cent. in number and 20 per cent. in weight.

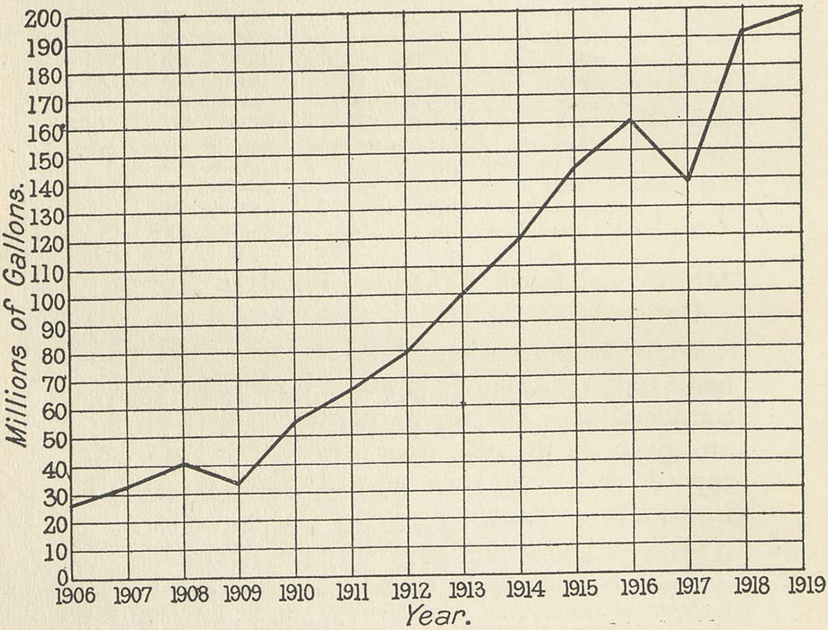
Further analysis will show that the number of the mechanically propelled vehicles of the commercial type (*i.e.*, motor wagons, traction engines and trailers), is 14½ times that of 1912, and rather over 13½ times the weight.

The assumed average weights contained in the Road Board's Summary of Statistics of Traffic were adopted in compiling these tables. It is interesting to note from these data the large increase in the number of rubber tyred, and the decrease of the steel tyred, commercial vehicles, the proportions of steel to rubber in 1912 being in the ratio of 1 to 2·9, and in 1919 of 1 to 182·7.

Rapid Rise in Motor Spirit Consumption.

Another method of illustrating the growth of motor transport, which is perhaps one of the best criterions

CHART 6: MOTOR SPIRIT.



as regards internal combustion engined vehicles—which after all, form a big majority of the total in this country—is by examining the quantity of motor spirit imported during the last few years.

Below will be found a return of the imports of oil petroleum, viz., motor spirit and fuel oil, respectively, into the United Kingdom during each of the years 1906 to 1919.

From these figures a rough chart has been made of the motor spirit imports in order to show at a glance the rapid rise in consumption (see p. 10).

Years	Motor Spirit Gallons.	Fuel Oil Gallons.
1906[1]	26,792,687	13,819,091
1907[1]	33,536,739	8,737,179
1908[1]	41,807,995	15,286,321
1909[1]	34,226,223	32,687,326
1910	55,049,210	34,363,276
1911	67,926,563	33,074,138
1912	79,590,155	48,135,845
1913	100,858,017	95,062,187
1914	119,030,155	212,675,855
1915	144,574,891	132,204,554
1916	161,410,824	22,556,004
1917[2]	139,270,181	440,582,168
1918[2]	192,959,054	842,405,536
1919[2]	198,767,221	265,405,203

Motor v. Horse Traffic: Relative Power of Control.

While making comparisons between motor and horse traffic the relative power of control is a point for consideration. The results in this connection which are given on the next page are of tests which were carried out some time ago at Sheffield, and are instructive.

[1] Includes " Spirit other than Motor Spirit " prior to 30th April, 1909.

[2] From 1st July, 1917, the figures include consignments which at the time of importation were known to be the property of His Majesty's Government or the Governments of the Allies.

	Total travelling time per mile. Min.	Sec.
HORSE AND CART.		
Stopping every 10 yards . . .	33	31
Stopping every 20 yards	32	24
PETROL WAGON.		
Stopping every 10 yards	14	48
Stopping every 20 yards	10	51
ELECTRIC VEHICLE.		
Stopping every 10 yards . . .	11	20
Stopping every 20 yards	9	20

The average time taken by each vehicle to cover distances of 10 yards and 20 yards from start to stop was—

	10 yds. Sec.	20 yds. Sec.
Horse and cart	11·4	22·1
Petrol Wagon	5	7·4
Electric Vehicle	3·8	6·3

CHAPTER II

ADVANTAGES OF MOTOR TRANSPORT USED COMMERCIALLY

A FEW years before the war it was almost impossible to discuss the relative advantages of mechanical and horse haulage on anything but the broadest lines, because the scope of utility of the mechanically-driven vehicle was too limited.

The motor van could, as a rule, only be run with economy on long distance service, where places of call were few and far between. With the advent of the lighter and speedier types of petrol-driven vans and also of the electric vehicle, all this was changed, and traders found that with suitable machines almost any kind of delivery service could be undertaken, and with a marked saving over the horse haulage system.

In these strenuous and unsettled days the success of most business firms depends largely on the efficiency of their delivery service.

An important point to be borne in mind by those who are hesitating over the change from horse to motor transport is, that it is to the firm which takes the initiative that the greatest benefits accrue.

There is no place to-day for the business man or firm who is not thoroughly up-to-date.

Quick Deliveries Ensured.

Quick and punctual collection and delivery are dependent on the most essential feature for despatch work, namely, reliability, and that this can now be attained, and in greater degree than with horses is too well recognized to-day to need further emphasis.

The motor is largely independent of weather, and the importance of this fact is sufficiently obvious to all connected with the delivery of goods.

For the transport of perishables, the motor is particularly well suited, since it conveys them from door to door, with only one handling at each end, while no delays occur as must be the case where frequent unloadings and reloadings have to be undertaken. In hot weather thousands of pounds worth of foodstuffs are wasted owing to the goods perishing on the journey, through slow and badly ventilated means of transport, most of which might be saved by the employment of motor vehicles.

Extension of Trading Radius.

Another great advantage is that, owing to the increased mileage which is possible with the motor, the trader's radius of business can be largely extended. By the use of motor-vans, outlying depôts, with all the expenses entailed by staffs, warehouses, stables, etc., rendered necessary by the limited capacity of the horse, can be dispensed with, thus effecting great economy.

Figures more Eloquent than Words.

A few general particulars relating to a large private despatch service engaged in the delivery of perishables, drapery, and general goods, may therefore be of interest. Seventy horse, and sixty motor vans are in use, while for the heavier class of goods steam wagons are employed. The total weekly mileage of the vans is approximately 25,000, or 1,300,000 miles per annum.

Some 13,000 parcels are despatched daily on six days in the week, and the number of weekly deliveries amount to 36,000.

The tonnage per week totals about 750 tons.

This firm originally had eight distributing depôts, situated at a certain distance from the central stores. It is a fact worthy of note that, owing to the increased scope of the motor van, all these eight depôts have been dispensed with, and the radius of distribution has in no way been curtailed. Moreover, deliveries are now undertaken which would in some cases have been impossible with horse transport, and in many others impracticable.

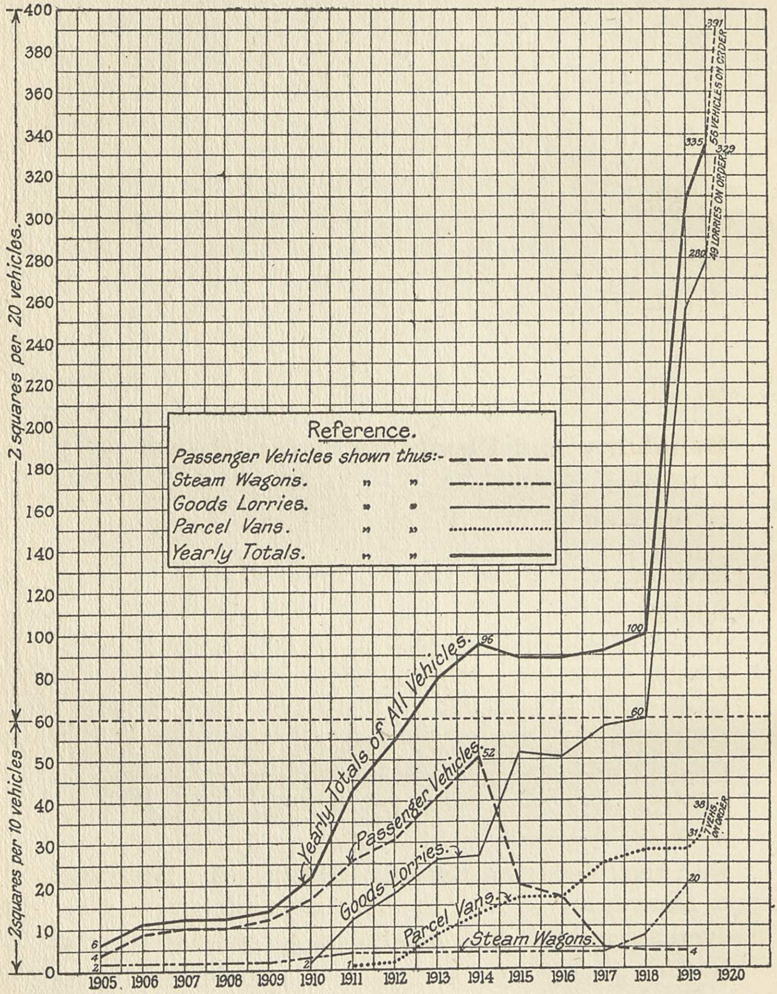
Under the new system goods are delivered within a radius of 50 miles, and in special cases up to 100 miles, direct from the central store, and in the case of perishables, this is of great importance, since foodstuffs can be purchased in the market and be delivered at their destination the same day, instead of being held up over night as was previously the case. A further point is that the firm finds that furniture delivery to Oxford from London, for instance, is far less costly in expenditure and time by motor than by rail, whereas with horses it would not prove practicable.

A comparison drawn between horse and motor haulage showed that the latter was capable of being worked at 40 per cent. less cost than the former.

As exemplifying how largely the motor can be used, and is being used in conjunction with railways, the chart on p. 16 showing the mechanical road transport employed by one of the railway companies in this country (whose commercial motor vehicles run approximately 1,563,000 miles per annum) from 1905 to 1920, is interesting.

Success for the Small Man: A Striking Example.

The following is a good example of what may be done in a small way, and the case is particularly interesting in view of the fact that the owner had little mechanical knowledge, but was most painstaking in looking after his van from the first day that he had it on the road. Some years ago this man, who was a



wholesale confectioner at Norbiton, bought a 16 h.p. 25 cwt. van and used it as a travelling shop, delivering to the small retail shops over a radius of 20 miles from Kingston-on-Thames. After eight years he retired from business, selling his van, which originally cost him £500, for the sum of £600. At the time of this sale the original chains supplied with the van were still in use, although the mileage covered during the period the vehicle had been in service was nearly 60,000 miles. In order to pay for the motor in the first instance, the owner mortgaged a little property which he had in Kingston, but owing to the van his business proved so successful that by the time he retired he had been able to make sufficient to keep himself in comfort during the rest of his life. The vehicle was, of course, of first-class make, but unless the owner had been conscientious and thorough in looking after it, this fine record would not have been achieved.

Reliability and Flexibility of the Motor.

In the busy season the motor is especially the friend of the business man, for since it knows no fatigue, it can be run when required day and night. An urgent order from a distance of six or seven miles can be fulfilled without disorganizing the daily round of deliveries, and any sudden rush of business such as is brought to certain trades, as, for example, mineral-water manufacturers, by an unexpected spell of hot weather, can be coped with, whereas with the employment of horse-haulage it would be utterly impossible, and the extra trade would go to the firm who could meet the demand. It must also be remembered that with the reliable modern chassis, it is usually possible to allow a stated time in the year in which it can be overhauled, and this should, of course, be at the trader's slackest season.

The horse is at a great disadvantage in this respect, since it is liable to physical disability at any season probably at the busiest time when the work is hardest, thus rendering it useless, and disorganizing with disastrous effects the delivery system.

One other point that is worthy of consideration is that in the case of an accident the motor can usually be repaired in a day or two—in urgent cases in a few hours—while the horse cannot be back at work for a considerable time.

The trader who has depended on railway transport during the war—and for that matter since then—knows full well how unreliable it can be; nor is he likely to find relief from his troubles in the near future, unless he is prepared to adopt mechanical transport if not wholly, at least in part. That motor traction has its limitations and drawbacks is not to be denied, but in the writer's opinion there are few cases in which these cannot be reduced to a minimum, if not eliminated, by the right choice of vehicle, proper handling, and efficient organization of the service.

These considerations are dealt with in later chapters.

MECHANICAL HAULAGE IN THE CORNFIELDS.

(1889)—*bet. pp.* 18 *and* 19

CHAPTER III

THE SCOPE OF THE MOTOR IN COUNTRY DISTRICTS

THE scope of the motor to-day may be said to be almost unlimited: for there are few trades which do not require rapid and efficient means of despatch and delivery, and in which mechanical haulage cannot be employed with advantage.

It is not possible in this book even to mention all the branches of trade in which there are still openings for the inauguration and development of motor traction, but no work on the subject could be considered at all complete without a brief reference to the broad and fertile field which exists for the motor to-day in the linking up of outlying districts with their centres, to the vast benefit of national life, both from the individual and the collective point of view.

If we are ever going to approach the desired end of being a self-supplying country, or at least to achieve this to any appreciable extent, it is essential that this much needed "linking up" in country districts should be begun as soon as possible.

Motor Delivery Contractor's Opportunity.

Country districts all over the British Isles are in crying need of quick, reliable, and mobile means of transportation, and there is a wide area of operation for the enterprising motor delivery contractor, whether he is able to start in a comparatively small way only, or with a fleet of motor vans or lorries.

To cite one example, the farmer is a man who is constantly requiring rapid and reliable means of transport, and many find that without it he cannot make the farm pay in any degree approaching the maximum.

The natural result is that a motor of some kind is bought, and, much against his will since it is not in his line, the farmer tries to run it himself. With luck and good management he may succeed to a limited extent, but he would infinitely prefer to have the whole thing run for him, and there is no reason why this should not be done to the advantage of the farmer and the transport owner.

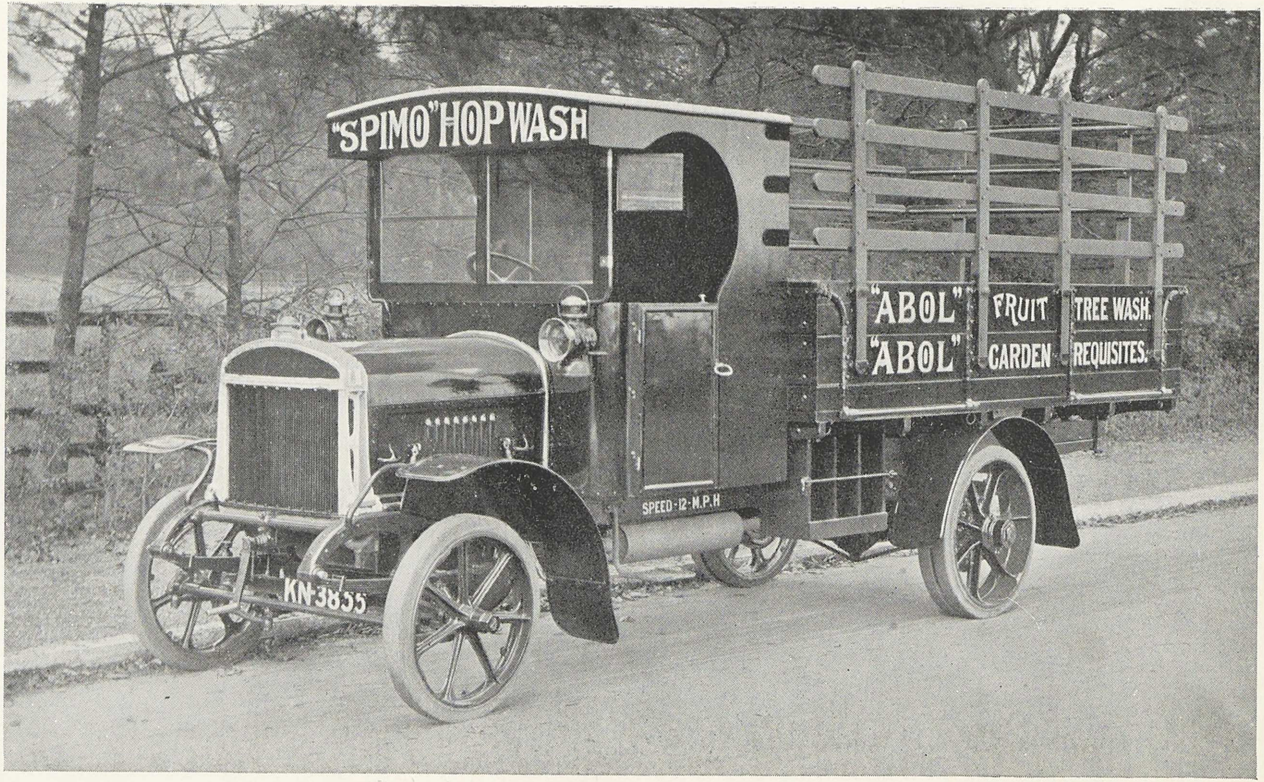
Milk conveyance is eminently suitable to be undertaken by motor, for the supplier can save his own transport to and from the railway station, can depend on door-to-door delivery with all its advantages, and can, while providing a certain return load for the contractor, receive his empty churns back with the least possible damage and delay.

The carrying of live stock to the market is also a line which might well be developed; while the conveyance of poultry, corn, hay, and market garden produce in large quantities—to quote only a few cases in point—contains obvious possibilities. Nor is this all, for the farmer needs a variety of goods brought to him, and these can be arranged to form return loads.

It must be remembered, however, that the agriculturist, as a rule, works on a scale of low profits, but against this can be set the fact that his requirements in the transport direction are fairly set and regular. This is a distinct asset. The carriage of coal and oil from the railhead is another branch which is well worthy of consideration by the prospective motor haulage contractor.

Motor Transport for the Carrier.

There are few trades which are more eminently suited to motor transport than that of the carrier,



A FARMER'S MULTI-PURPOSE BODY FITTED TO A $2\frac{1}{2}$-TON CHASSIS

for with the advent of the light and fast type of motor van he can combine the carrying of passengers and goods with a minimum of discomfort, delay, and inconvenience to those with whom he deals. He can deliver from door to door, and any small detour, such as may be necessary for the purchase of articles for his customers, can easily be made.

There is, too, the question of whether or not it would be worth allotting part of the body space with a view to utilizing it as a small travelling shop. In many cases it would. It could be run no doubt in conjunction with the carrying business, or if desired and circumstances permitted, as a separate concern. This is, however, too big a subject to be entered into here. It is sufficient to say that, with improved suspension—though this problem is far from being solved at present—employment of pneumatic tyres, of detachable wheels or rims, and possibly of a light trailer designed for fast travelling, this class of work can be undertaken with every prospect of success.

The speedy and comparatively light chassis, with a cleverly-designed body suitable for the purpose or purposes required, increases the carrier's radius enormously in comparison with that which horses can cover, assures him of the maximum of reliability for both purchasing and delivering his goods, and enables his passengers to be taken in comfort from door to door without wearisome delay.

There are in Great Britain many areas which lie at a distance of from six to ten miles from their supplying centre, and which are not served at the present time with any regular means of delivery.

At the best, a carrier with a horse van worked these districts before the war, and worked them inefficiently, but owing to the changing conditions—high price of fodder, uncertainty and difficulty of obtaining supplies, and so on—either it was found impossible to continue the work, or the prices charged were so excessive as to be almost prohibitive. The average distance of the various villages and houses from their nearest centre of supply is probably four miles. The small shops are dependent for their stocks on irregular visits from their suppliers, with the inevitable result that an appreciable part of their business is fast departing, owing to the residential houses obtaining supplies in larger quantities at a time, direct from London or the nearest large provincial town. This method does not overcome all the consumer's difficulties, for it does not apply to perishable goods, the demand for which is met only to a very limited extent by the shops in the nearest town which possess their own means of transport.

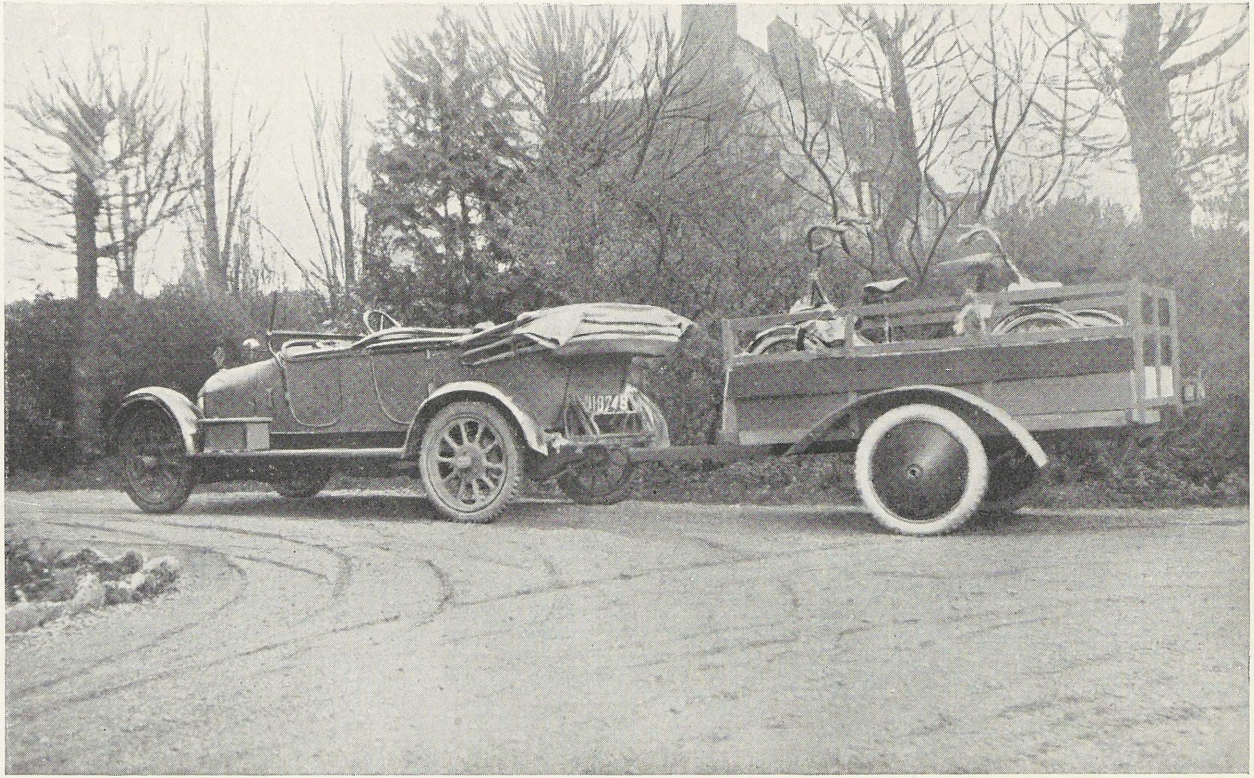
The ability to carry a few passengers with a reasonable degree of comfort in addition to goods is a valuable asset to the country carrier, and it is advisable for anyone who contemplates making a start in this line to arrange for proportionate seating accommodation in his van or vans. The seats may well take the form of padded benches, with a broad leather belt as a back rest—the latter will be found to be far more comfortable than a rigid rest—as detachability is, of course, necessary for those occasions when the load is composed of goods only.

Advice and Cautions.

Here a word of warning is not out of place to those who intend to go in for this class of work.

It is of the utmost importance to prospect the district thoroughly, and to do the necessary spade work before the van is bought.

This ought to be done because the type of country in which the business is to be created, and the nature



FAST-TRAVELLING LIGHT TRAILER

(1889)—*bet. pp.* 22 *and* 23

of the service, should be determining factors in the selection of a suitable vehicle.

It is well to bear in mind that charges should be based on a scale which will allow a reasonable profit to be made, and not on the short-sighted policy of excessive rates.

The man who prospects and canvasses his intended district thoroughly, buys sound and reliable vehicles, bases his charges on a reasonable scale of profits, adopts good organization, and who is reliable and accommodating, will run little risk from future competition of any sort once he has made a fair start. As he succeeds so he can extend his radius, until he finds that he is able to link up additional outlying areas.

Naturally, it will depend on the class of work undertaken whether the main quarters should be taken up at the centre or in some part of the outskirts of the district, and the question of return loads—always a difficult but most important one—should count much in arriving at a decision. For instance, in the case of the carrying of agricultural produce it would probably prove the wisest course to work from the country to the town, for the goods can then be collected more easily and taken to the market direct; while out-going loads can be arranged for, such as the delivery of supplies in comparatively large quantities to the country shops.

Where the work allows the organization to be on these lines, there is another advantage to the van-owner, namely, the lower cost in the country for rent of house and garage.

CHAPTER IV

SELECTION OF A VEHICLE

(1) NATURE OF SERVICE AND CHOICE OF POWER, AND THEIR RELATION TO GEARING

As surely as motor transport can, in most cases, be made not only to equal horse haulage in the matter of expense, but actually to effect a considerable financial saving and an increase of the business, so surely will the balance be on the wrong side if the vehicles chosen be unsuitable for the work which they have to do, or if the despatch organization be inefficient.

The writer has seen several cases in which a business firm has fallen into errors in connection with a motor delivery service which with ordinary foresight could easily have been avoided. For this reason it is desirable to put the case in such a way that others may avoid these pitfalls.

It is also only fair to the manufacturer to do this, for obviously the trader who employs his vans on unsuitable work or in an unreasonable way will not obtain the maximum advantage from this form of transport, and will not in consequence prove to be an enthusiastic owner.

Mistakes in Motor Management.

It is sometimes found that the manager of a business house is at loggerheads with the manufacturer who has supplied the vehicle. And why ?

For the sole reason that the firm, refusing to alter their system to conform with the more modern type of transport, is not running its service successfully.

Those in charge of the despatch department insist on conducting it on horse haulage lines, and among other fatal mistakes they constantly overload the vans. The inevitable result is that the anticipated success is not obtained, and the whole venture proves a source of worry rather than of satisfaction. There is no doubt that motor manufacturers and their vehicles have to contend with a good many difficulties. It must be remembered that if the motor vehicle is treated in a fair and reasonable way, its limitations are few and far between, but that if it is abused, the scope of its utility will be minimized, and the expenses of the service will be increased.

Continuous Service Represents Economy.

Ideal conditions are an impossibility, but with motor transport it is often possible to turn failure into success by making some small adjustment or alteration in the existing system. First and foremost it must be remembered that the motor van or lorry represents a considerable amount of capital, and, this being so, it should stand idle for as little time as possible.

To obtain the most economical results, the motor should be in service continually. Long journeys at a fair rate of speed, encountering a minimum of traffic, are the most desirable. Much also can be done to increase the efficiency of a delivery service by an ingenious and rapid system of loading, a subject dealt with hereafter. The van should not have to wait for any length of time at the firm's depôt from which the goods are being despatched. It should come in from one delivery and be out again on another without loss of time. In many cases this can be arranged for by means of a suitable body and loading platform.

An Unsuccessful Trial.

Here is the point where many fail, especially in the case of a business house which is trying motor transport for the first time, and which has hired one or more vans for a few weeks. Under these temporary conditions the manufacturer does not expect the firm to alter their organization to any great extent, but he does consider, and rightly so, that the house should take all the facts into account when arriving at a decision as to whether the motor shall wholly or in part replace the horse.

After a trial on these lines the firm finds that the vehicle has not done the work of four or six horses as it was supposed to do, and although they are pleased in many ways with the performance, and with the increased advertisement gained thereby, they decide to keep to the old policy, concluding that in their particular case horse haulage is still superior to mechanical transport.

Variety of Motor Vehicles.

Upon the right selection of the vehicle largely depends the success or failure of the delivery service.

One of the reasons that motor transport to-day is so successful in all branches of trade is the variety of types of car which can be employed.

Some years before the war, long-distance point-to-point delivery was one of the few kinds likely to be run at an actual profit. At the present time, with machines designed to carry maximum loads ranging from 2 cwt. to 6 tons, and more with the employment of a trailer, this restriction has been removed.

Pitfalls for the Trader.

The enlarged choice of power—liquid fuel, electricity, and steam—has also undoubtedly made it possible to employ mechanical transport on a much sounder and more economical basis. By this is meant that, owing to the wider range afforded for the selection of a suitable chassis and body, both depreciation and running costs may be kept lower than would otherwise have been possible. There are, of course, two sides to the question, and the dark one is that, by reason of this enlarged field of choice, there exists a greater possibility of a mistake being made in the selection. There is no wish to dishearten or to discourage the trader who is about to adopt the motor in place of the horse, but it is only right to mention the pitfalls in case they should be ignored. A van should not necessarily be chosen because it is inexpensive or because it is supplied with an attractive and commodious body, or again, because an exceptionally low fuel consumption is claimed for it, but rather because the motive power and the chassis design are eminently suited to the nature and conditions of the work which it is intended that the van shall undertake.

It is impossible to lay too much stress on the importance of this matter.

An Example.

No trader, for instance, who had bought an electric vehicle and a large or medium-sized petrol van, could put the former on long distance point-to-point despatch, and the latter on house-to-house deliveries, and yet obtain successful results. The obvious reason, of course, is that the electric vehicle, being comparatively slow in speed but economical in traffic and on short distances, is the more suitable for use in traffic and for house-to-house deliveries, owing to the smooth drive and the absence of energy-waste while standing idle.

The petrol car, however, with its capacity for long-distance work and higher rate of speed, is better adapted for the point-to-point system.

Determining Factor in Selection.

The peculiar conditions and nature of the trader's own particular service must be the determining factor in his selection of a suitable type of van. The maximum load and class of goods which it is desired to carry: the kind of body which is to be fitted to the chassis (with regard to bulk, advertisement, loading level, weather protection, etc.) : the amount of time during which the machine will be standing idle : the traffic to be encountered on the daily journeys : the gradients and state of the roads : the facilities for repairs and, in the case of an electric, for charging, or in that of a steam wagon, the opportunities for watering and so on—all these are points which must be thought out in order to arrive at a right decision.

Danger of Overloading.

With regard to capacity, it is well to make sure that both body and chassis are designed to take the maximum load that the trader requires to be carried, for though this seems an obvious consideration, it should be borne in mind that the weight of the body is sometimes included in the maker's estimate of the loading capacity of the van. This will also tend to obviate the evil and costly habit of overloading. It is surprising how often a body capable of carrying a net load of 30 cwt., is put on to a chassis designed for carrying 15 or 20 cwts. only.

This mistake will not be so likely to occur in the present day if intending owners deal direct with any of our firms well-known for reliable commercial vehicle construction. But in the case where the chassis is bought and then transferred to a body-builder who does not profess to be a consulting automobile engineer, the trader may give way to the temptation of over-loading.

Another instance in which this may happen is in dealing with a manufacturer who is in only a small way of business. Instead of informing the inquirer that, if it is wished to carry a net load of 30 cwt., a higher price must be paid for the chassis than for that built to carry 20 cwt. only, he short-sightedly agrees to put a body on the chassis which will result in its being constantly overburdened.

The Question of Power.

The next important point is that of power in its alliance with vehicle speed and gearing.

Different trades necessitate different rates of speed in their delivery service. There are in consequence several considerations which must be well weighed before the final selection of a van is made, in order to ensure that the choice will be a wise one.

It is not sufficient that the vehicle should be able to accomplish its journeys with punctuality, but it should also be run in the most economical way. It is astonishing how little attention is paid to this matter.

Great Economies Possible.

There are firms to-day owning fleets of commercial motor vehicles representing tens of thousands of pounds, who, with a little adjustment here and there in the organization of their despatch service, or with greater foresight in the selection of new vehicles, could save some hundreds of pounds in the year.

Careful observation shows that this occurs through want of experience or lack of interest, often coupled with inadequate record-keeping. The directors of the firm find that motor transport costs them much less proportionately than horse haulage, and there they rest content. They do not seem to consider whether there are any ways by which it can be made an even greater success. Yet by careful thought and thorough investigation, a small change in the policy either of the purchasing or of the maintenance department, may effect a very considerable saving in expenditure, besides augmenting the general efficiency of the service.

To return to the question of power and gearing, generally speaking, a van which is intended to run chiefly on short point-to-point deliveries will not require similar horse-power to that which will undertake long-distance runs.

The nature of the goods to be handled will be the determining factor in the rate of speed needed for delivery, and this will in its turn be affected by the bulk and the weight of the load to be carried.

Variety of Types for Different Services.

As an illustration, the firm which trades in perishable goods or in a light-weight, non-bulky article, obviously will not want the same class of vehicle as a dealer in furniture. The one will demand a light type of chassis, constructed for speedy and smooth running, with features such as power unit, suspension, and tyring, body floor level, etc., of very different design from the machine for transporting the heavier sort of merchandise. The type of country in which the car is usually to be worked must be borne in mind. If the roads are on an average good and level, comparatively low power and high gearing will prove suitable and economical; while for hilly districts, or those in which the road surfaces are habitually poor, the case is naturally the reverse. A point which it is imperative to remember is that the power unit must in every case be well up to its work, that is, not only should it be capable of conveying the maximum load at all times, but there should be, in addition, a reserve of power.

There is no surer way except by constant overloading, which has the same result, of making a delivery service a failure, than by the employment of vans which are under-powered for the transportation of the maximum load for which they are designed by the makers.

Power, Speed and Gear Ratio.

It is necessary to emphasize the fact that as power and speed in all forms of engineering are inversely proportional, the range of gear ratios provided on a chassis affects the question of power supply to a large extent. Broadly speaking, the greater number of gear ratios there are the better, since the wider variation afforded between engine and vehicle speeds enables the motor to be run more efficiently. The reason for this is that as far as the internal combustion engine is concerned it will, as a rule, give off its highest power within a certain small range of piston speeds. This range lies well above the minimum number of revolutions per minute at which the engine will run and pull, and is yet below the maximum at which it is possible to race it when running light. It will be clear then that the ideal condition would be that under which the driver, when ascending a hill, could keep the engine running at the maximum of efficiency by frequent changes of gear as the load on the engine tended to reduce its speed. This condition is, however, not realizable where gear wheels are employed, since the construction of such a gear box would be impracticable owing to cost, weight, and size. The above will, nevertheless, instance the advantage of a four-speed box over one fitted with only three, and the three-speed model over the two-speed pattern. This is particularly applicable to medium and heavy-weight vehicles.

The question of power and gearing enters all grades of motor transport, and will be found to influence the running cost sheets to a considerable degree. To take an example, a van which is fitted with a comparatively small-capacity engine, and a two or even three speed gear box, will often encounter a gradient for which there is really no suitable gear ratio. The slope will prove just too steep for the van to be driven up on top gear without the engine being put under excessive stress, while the next gear will be too low. This entails one of two things. Either the driver crawls because the engine is fitted with a governor (or if it is not, because he is conscientious and likes to treat his car well), or the engine is raced and a fair road speed is obtained. In the first case, valuable time is lost, and the engine is probably not run at its most efficient revolution rate ; in the second, unduly high maintenance charges will result.

This matter is of greater importance than many people apparently realize, and is worthy of thoughtful consideration by all who, possessing or intending to possess commercial motor vehicles, wish to obtain from them the greatest amount of work at the least possible cost.

CHAPTER V

SELECTION OF A VEHICLE (*continued*)

(2) DRIVERS AND DRIVING

THE question of driving plays a considerable part in the matter of selecting a commercial motor vehicle.

Is it the intention of the prospective owner to employ his late horse-driver, after the latter has been taught to drive safely? Will a moderate-waged mechanic-driver be employed? Or will the business man be prepared to pay a high wage to secure the services of a really skilled man?

These questions need to be answered beforehand, because not only does economy in operation depend to a considerable extent upon the class of driver engaged, but the organization of the inspection and repair department must be arranged accordingly.

When Non-Technical Drivers are Best.

The subject of driving is one which, if future success is to be ensured, cannot be overlooked even to-day when commercial motor chassis are so reliable.

The case of the business house which owns a large fleet of cars, and whose organization includes a repair branch, and that of the trader who runs one, two, or three machines, obviously differ in their requirements, as the method for repairs in each case will not be the same.

For the former, the best results will often be gained by the employment of men or women who have no real technical knowledge of the mechanism of a motor chassis, but who have been accustomed to the control of a horse-van.

3—(1889)

This sort of driver—if of a good class—is generally conscientious, and takes a pride in the reliability of his work.

Automatic Features.

There are types of petrol motor vehicles to-day which (provided as they are with automatic control of the engine speed, lubrication, ignition, and so on), are eminently suitable for being driven by a converted horse-driver. Any intelligent person who has had some experience of horse driving can handle such a van safely and satisfactorily after a few days' tuition.

There is no doubt, however, that definite advantages accrue to the firm who encourage this class of driver to acquire a certain kind of knowledge with regard to the running of a van. It must be remembered that it is not desirable that he should do repairs of any sort, or even any important adjustments, but it is an asset (since the foreman or inspection-mechanic will not be able to travel often on the van during its daily rounds), if the driver on his return to his depôt can report the commencement of a trouble, and perhaps locate it fairly accurately, thus saving both time and expense.

The Converted Horse-Driver.

Even if a firm is able to organize a weekly inspection of their vans, it is quite possible for a defect to start two or three days after the examination, and by the end of the week to have developed into a serious fault. In the case then of a firm which owns a fleet, the size of which warrants a regular inspection and repair department, the employment of converted horse-drivers —especially those who have previously served the house—may prove highly successful.

AN UP-TO-DATE TYPE OF 30-CWT. VAN WITH SIMPLE DRIVING CONTROL

(1889)—*bet. pp.* 34 *and* 35

Skilled Mechanic Drivers Best for Small Traders.

The converted horse driver, unless he or she has undergone an adequate training not only in the handling, but also in the mechanism and general running of a commercial motor vehicle, will not prove so successful for the small fleet owner as in the case of the man with a larger business. It is advisable for the trader working under limited conditions of service to employ skilled mechanic-drivers who are fully competent to carry out all running repairs, and even more serious work, such as taking up wear in a big end bearing or fitting a new ball-race to the gear box or rear axle.

The increased cost of the wages of a driver of this class will be more than repaid by the efficiency of the running of the van or vans, and by the reduced expenditure incurred on repair work.

The skilled man will be able to detect a fault at its commencement before it has time to develop seriously, and this, of course, saves labour.

He will be able to make the necessary adjustments or alterations himself, and, although a van may be kept off the road a few additional days in the year beyond the time which would be contracted for if the work were to be done by the makers, the advantage of the repairs being done by a man in the trader's own service is considerable.

The semi-skilled driver-mechanic who does not come into either of the previously mentioned classes is not likely to be found a great success in either case. He may be worth his wage where certain conditions prevail, but is often the cause of extravagance rather than one of economy.

Speed and Maintenance Costs.

The question of speed in the driving of a motor van plays one of the principal parts in the consideration of maintenance costs. This fact can be easily realized by the owner when he remembers that the driver is master of the van during the time that it is on the road. Where no recorders are fitted to the vehicle, or governors to the engine—and these latter can in many cases be easily disconnected unless sealed up—the drive can please himself as regards speed, provided he can complete his deliveries.

So much, therefore, will depend on the reliability and conscientiousness of the man, that if he is trustworthy and competent he can save his employer a very considerable sum of money in comparison with the careless driver.

It is tempting in hot or wet weather to push the van to its detriment, or when the load has been delivered, to hurry home, which is the worst time—as the van is running light—to drive with full throttle.

Such faults are more likely to be committed by the semi-skilled mechanic-driver.

The converted horse-driver is used to treating his means of conveyance with a certain amount of consideration—for Englishmen as a rule are born animal lovers—moreover, the type of man is more trustworthy, while the skilled class of man will be mechanically-minded and, therefore, a lover of machinery. Even if this is not sufficiently the case to prevent a vehicle being mishandled, he will understand fully the effect of any abuse in driving in its relation to maintenance and maintenance costs, especially if he works under a bonus system, and will be deterred on this account.

Ignition: Fixed or Variable ?

There are one or two means connected with driving by which substantial economy may be effected in the running of petrol vans. One is by employing variable spark control. The question has been much discussed from time to time, and because this system is capable of abuse by those who handle it without proper understanding, that of fixed type of ignition has become unwarrantably popular with both commercial motor designers and users.

It may be advisable before illustrating the advantages gained by the employment of the variable type of ignition over the fixed point pattern, to show in simple language for the benefit of those whose experience in this matter is not wide, what takes place in the engine when the spark control lever is moved.

Many men when they are being taught to drive a car are told to accelerate by opening the throttle and advancing the spark lever, and should knocking or thumping in the engine be heard, to retard the lever. This method is good as far as it goes, but unless both owner and driver are taught to understand something of the theory of the case, fixed type of ignition, with all its drawbacks, will appear, owing to the greater simplicity, to be the better method of the two.

Early Ignition Desirable.

With the ordinary four-stroke internal combustion engine, as even the novice will probably know, when the piston is near the top of the compression stroke a spark occurs at the plug and the " explosion " drives the piston downwards, so constituting the firing or power stroke in the cycle. The complete burning of the charge takes an appreciable period, and for this reason it is desirable to make the spark occur early, namely, while the piston is still on the upstroke. It will be easily realized that if the " explosion " strikes the piston head—the only movable part at the moment in a gas-tight chamber—while it is ascending, the effect will be far more severe than if the piston was already on the downward stroke.

If the crankshaft is turned over slowly so that the flywheel possesses only a minimum of stored energy, and the spark passes while the piston is on the up-stroke, it will not be allowed to finish its travel, but will be pushed down again owing to the increased heat and subsequent expansion of the gas on burning. The crankshaft will consequently be turned in the reverse direction ; this is what is implied by the term back-fire. When the shaft, however, is rotating at a higher revolution rate, a greater amount of energy is stored by the flywheel, and this will prove sufficient to overcome the resistance of the expansion until the dead centre is passed and the piston is ready to begin the downward path. With the engine running under a light load or at high revolution rate, it will readily be seen that if the spark is made to ignite the charge before the piston reaches the top of the stroke, the amount of power which will be given off by the engine will be in excess of the amount which would result with a later firing point.

The Fixed-point System.

Fixed-point ignition, as the name implies, does not allow the timing of the spark to be controlled from the driver's seat. It is set at an average point ; consequently, when the engine is running under a comparatively light load the ignition is too much retarded for efficiency, whereas inversely it is advanced in too great a degree, with the result that in order to avoid engine-knocking a change of gear ratio must be made. Obviously, the lighter the load on the engine when running under power, the earlier should the combustion of the vapour be begun, and *vice versa*, for in the latter case there will be considerable pressure on the piston head and resultant stress in the connecting rod, and if a bearing or the gudgeon pin is worn, a knock will make itself heard. This can, of course, be corrected to a large extent if the timing is regulated by the driver. Undoubtedly the reason why some manufacturers fit their chassis with fixed-point ignition is the fear that if the other type were supplied its application would be abused, causing undue wear in the engine. The argument is, however, weak, for the simple reason that misuse is equally possible with the fixed-point system.

Variable Ignition a Necessity for High Engine Efficiency.

In the opinion of the writer, the importance of simplicity in the design of a chassis throughout cannot be too strongly emphasized, but the few additional parts required for the variable type of ignition are an absolute necessity if high engine efficiency is called for. Imperative as simplicity in design is, there is yet a limit beyond which it cannot be carried unless some vital factor is sacrificed, and ignition is a case in point. With the carburettor as designed to-day, it is practically an impossibility to provide a correctly proportioned mixture for varying loads and engine speeds which will allow rapid and complete combustion to take place in the cylinder. It will be found that at some speeds the vapour will be too rich, and at others too weak, imperfect combustion resulting in both cases. The reason in the first instance is lack of oxygen, and in the second the slow rate of burning. These different mixtures will manifestly possess varied rates of flame circulation, and it is of great importance for maximum thermal efficiency to be able to alter the timing of the spark accordingly; for instance, to advance it for the burning of a weak mixture, and to retard it for that which is rich in proportion of fuel to air.

Another consideration is that as compression varies in relation to throttle opening so will the rate of combustion. For example, as the throttle is closed, the volume of the intake will be decreased, and, *ipso facto*, the subsequent compression. In this case, unless the firing can be advanced, the combustion will not have been completed before the exhaust valve is opened.

Flame Propagation.

The difficulty of obtaining purity of exhaust is already great, and because of this a considerable proportion of air in excess of that required theoretically for complete combustion must be admitted in order to secure good results. To employ fixed-point ignition is, therefore, to complicate a problem, the solution of which is already sufficiently difficult. The range within which petrol and air mixtures are explosive as opposed to quiet burning is comparatively small, and the need for ignition at the most favourable moment for rapid spread of the flame will thus be recognized without difficulty. The slower the propagation the greater the dissipation of heat, since energy is required to raise the temperature of the remaining gases or excess air, while owing to incomplete combustion a smaller quantity of heat is generated than would be the case with a correctly proportioned mixture. At low and high piston speeds the increase of power from an engine fitted with variable ignition over a similar one provided with the fixed type is very marked, and represents a considerable percentage of the total output.

How Expert Drivers Reduce Costs.

How does all this affect the van owner ? A driver who controls the spark and throttle with intelligence can reduce the maintenance cost of the car in an appreciable degree. It will be noticed that when entering upon a good straight length of road the expert driver will close his throttle little by little while advancing the ignition lever notch by notch until the former is, perhaps, only a third open, and the latter at the extreme limit. By this time the engine will have picked up her speed, and will be running with a true beat and strong clean pull.

The engine should be fed and her wants supplied primarily by spark-control, and secondly by the throttle. Once a car is under way the ignition should be gradually advanced and the gas reduced. It is largely a question of "sense"—"sense" as understood by the mechanically-minded. The good driver will know all about his engine from her "song," and will gauge exactly to what extent he can run on an early firing point and decreased gas supply, and *vice versa*.

Gear Changes Cause Strain and Wear.

There are, of course, occasions when the engine will be working under a heavy load, when ascending a hill for instance, and in these cases more gas must be supplied and the ignition point gradually retarded: but for all light work, such as running on the level or down a slope, the reverse method should be adopted.

There are many slopes and crests of hills which could be surmounted easily if the time of ignition was alterable, but which with a fixed point would necessitate a change of gear. This is clearly a factor which bears on the question of economy, and is of no small importance as regards the durability of a car, for changes of speed cause stress and wear in the mechanism of the chassis, especially when it is a matter of taking up the load on an up-gradient.

Advantages of Competent Control.

A controllable air valve fitted to the carburettor or induction pipe is another means by which the able driver can obtain good and economical effects from the engine. Here, too, the control should be the outcome of fine judgment and prompt but gradual manipulation.

In the handling of any machinery, roughness never pays but invariably takes toll.

The practical assets resulting from competent control of air, fuel, and ignition are, appreciably reduced consumption of fuel and lubricating oil, smoother and more efficient running, a cooler and cleaner engine, a saving in valve and plug renewals, and a considerably increased length of life of the power unit.

It will readily be seen, then, to what an extent the system of driving to be adopted may effect the selection of a van, and also how a particular class of driver will be suitable in the one case, but in the other may not tend to economy in operation.

CHAPTER VI

THE CHEAPEST FORMS OF MECHANICAL ROAD TRANSPORT

OWING to the increase of charges for transportation of all kinds since the war, there is little doubt that henceforth greater attention will be focussed, and rightly so, on the cheaper forms of mechanical transport. This branch—capable of far reaching development—comprises the handy, inexpensive light van, or motor cycle and sidecar, capable of carrying a load of from 2 to 5 cwt. at fair speed. This type of goods conveyance was only just beginning to be used as a practical proposition previous to the war, and it is a matter of surprise that it did not receive more consideration in England previously. The French Government realized earlier in the day the significance of this the cheapest form of mechanical traction, both in its bearing on national life, as affecting the cost of living, and also in the narrower but no less important aspect of individual business success. The " miniature van " appeals perhaps more widely to the business man than any other class of vehicle because, whether it is its owner's one and only means of transporting goods, or is supplementary to a fleet of 100 lorries, the part that it plays is of equal importance from an economical point of view.

Advantages of Light Motor Transport.

The advantages of these little vehicles are—

(1) Their cheapness to buy and to run.

(2) Their handiness, allowing them to be taken almost anywhere.

(3) The fact that they can be kept on the road

during a maximum number of working hours, due to loading and unloading facilities, and to the simplicity and accessibility of their mechanism.

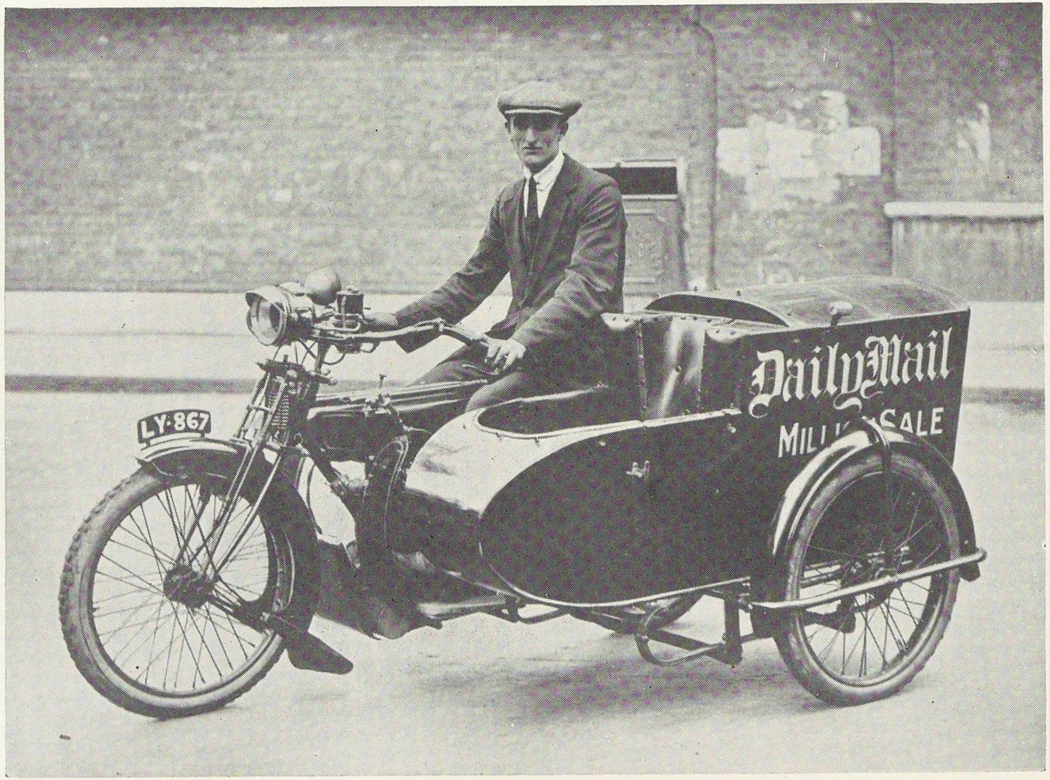
(4) The capability of comparatively high speed.

There are, naturally, many trades in which the 2 to 5 cwt. load capacity does not seem at first sight suitable for delivery purposes, but the writer is of opinion that, where circumstances permit, more might be done than is done to-day to increase the field of despatch service and decrease the cost proportionately, by the employment of two or three light machines in place of one heavier type of vehicle. It is a fact beyond dispute that a large percentage of the firms employing motor haulage do not get the full value from it, and this is because insufficient attention is paid to details in organization systems in which the cost of running might be reduced to an appreciable extent.

This kind of industrial motor is well suited for work in an area where thick traffic is encountered, and where the delivery entails frequent stopping and starting. This is so, partly on account of its comparatively low capital value, and also owing to its light weight; the wear and tear entailed by constant halts being proportionately far less than with the ordinary type of motor van.

The Box Van Tricycle.

The combined qualities of ease of handling, "slimness" and capacity for rapid "picking-up," allow these small machines to undertake successfully work which could not be done with efficiency, if at all, by any other class of motor vehicle. The form that combines practicability with the greatest economy is undoubtedly the pedal-assisted 2 to 3 cwt. box van



MOTOR CYCLE AND SIDE CARRIER

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tricycle. Such a machine is designed with simplicity as its aim, an aim which is the only true one where success, as regards motor transport from an economic point of view, is concerned.

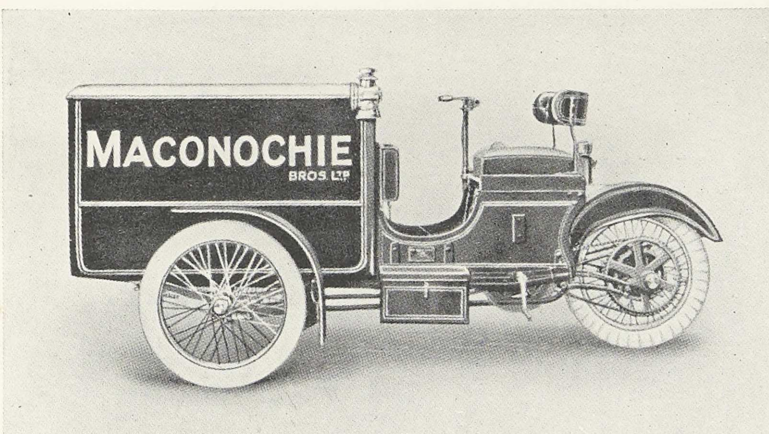
The Motor Cycle and Tradesman's Side Car.

The next example of light weight commercial traction, which is in an equally infantile stage as regards adoption and application, is the motor bicycle and tradesman's side car. A regular service for the conveyance of light goods can be run by means of a suitable combination at a very low figure, and the handicap of only being able to carry perhaps a couple of cwt. is made up for by the high rate of speed possible for delivery. The man who wishes to start a small carrier's business, but whose capital outlay is limited to a minimum figure, will be wise to consider this type, for it is possible to obtain a side car with a box body which is easily convertible to a passenger carrying model.

While touching on passenger conveyance it may be mentioned that, in the writer's opinion, there is a good future before the three wheeled taxi cab. Probably the best adaptation will prove to be the light three wheeled chassis the construction of which allows the single wheel to be placed in front, and to be both driven and steered. Such a design, with the driver's and passenger's seats arranged in tandem fashion, enables a closed body of practical dimensions to be fitted.

The Light Van.

There remains the three and four-wheeled types of light van. As regards the latter, the general lines of construction are sufficiently familiar in the miniature type of touring car to warrant but little further comment. Many of these are, on the whole, designed on too orthodox and complicated lines, for it must always be remembered that every additional working part means increased initial and maintenance costs. In making a selection from different reputable makes, it is a fairly safe rule to choose the chassis of the simplest construction.



EXAMPLES OF PETROL-DRIVEN THREE-WHEELED LIGHT VANS (1889)—*bet. pp.* 46 *and* 47

CHAPTER VII

PETROL VEHICLE COSTS OF OPERATION

THE difficulty, or rather the impossibility, of standardizing running cost figures at the present time for the different types of motor vehicles, owing to constant fluctuation in prices of material and labour, and the varying conditions of the roads throughout the country has already been referred to in the Preface. The lists of costs given in Chapters 7, 8, 9, 11 and 13 will, however, serve as a practical basis from which to work, and if the trader will analyse the various schedules, and adjust here and there, according to current prices, his own particular requirements and nature of the service, he will be able to gauge with a fair degree of accuracy what his motor ought to cost him in operation. In the case of "actual" (*i.e.*, not estimated) costs, the writer has made no attempt to bring them under one system.

Every firm has its own way of keeping costs, and it is considered the best plan to reproduce actual costs as they were supplied by the owners of the vehicles.

In order that there should be no misunderstanding, however, with regard to final figures, such as that of total vehicle cost per mile, the various tables are commented upon in an explanatory manner, and items which have not been included are mentioned. In some instances, costs taken over a pre-war period, during the war, and after, are given, and from these the rise in the cost of motor transport operation may be realized.

Weekly Mileage and Vehicle Costs.

It must always be remembered when studying registers of costs, that weekly mileage is an item which affects the vehicle cost per mile very largely.

The greater the mileage a van runs in the week, the smaller, proportionately, will be the final figure, for the reason that the standing charges remain the same in any case. Therefore, if the total weekly cost has to be divided by a large mileage figure, the total vehicle cost per mile will be relatively low, and *vice versa*.

Ton-Mile Costs.

Ton-mile costs can be very deceptive unless carefully studied, especially in regard to estimated charges. For example, it is of little real help to set out the cost per ton-mile of a 3 ton vehicle which operates at 2s. per mile as 8d., because this assumes that the vehicle always travels fully loaded, which is hardly likely to be the case in practice. The writer has, therefore, purposely omitted to show such figures except in the cases of "actual" costs, or in those where ton-mile figures are shown on a half loaded as well as a fully loaded basis.

Light Vans (2–5 cwt.) : Pre-war Costs.

The following costs refer to a 5 cwt. van fitted with a canopy type of body. The table has been compiled from records carefully kept day by day over a period of 12 months. The vehicle was employed in the delivery service of a leading wholesale drug company in London, and was at work from 8 a.m. to 6 p.m., and often much later. A night staff to do the necessary cleaning and adjustments was requisite, owing to the car being on the road all day. The average mileage per week worked out at 500.

It will be noticed that the driver's wages—in this particular case £1 per week—are not included.

The rate of depreciation is such that the total initial cost of the van is wiped off in less than three and a half years, which is a liberal basis provided repairs are carried out when required, and in a sound manner.

WEEKLY COST.

	£	s.	d.
Interest on capital of £120 at 5%	–	2	3
Depreciation at 30%	–	12	6
Insurance	–	2	3
Establishment and management charges . . .	–	5	–
Nineteen gallons of petrol at 1s. 5d. per gallon . .	1	6	11
Oil and grease	–	1	–
Tyres (three sets per year)	–	7	3
Cleaning	–	8	6
Painting car once a year	–	1	6
Mechanic's time, repairs, and adjustments . . .	–	6	8
Renewal parts	–	5	–
Lighting and lamp upkeep	–	–	11
500 miles for	£3	19	9
or 1·908 pence a mile.			

A Departmental Stores Fleet.

The following figures relate to a fleet of ten three-wheeled 2-4 cwt. machines employed in conjunction with a fleet of thirty-seven 15 cwt. petrol driven vans by a large London "Stores."

1ST MAY, 1915, TO 31ST JAN., 1916.

	£	s.	d.
Repairs including tyres	197	6	7
Expenses (petrol, oil, etc.)	160	–	–
Drivers' wages	360	–	–
Garage staff wages	56	8	–
Depreciation	200	–	–
Insurance	60	–	–
	£1033	14	7

The mileage run was 85,000 which gives vehicle cost per mile—exclusive of rent, rates and taxes, and interest on the capital—at 2·9 pence.

1919–1920 Costs.

The table on next page refers to a three-wheeled type of van of the 3-5 cwt. class, and gives the approximate average weekly cost on a 300 miles per week basis.

(1) *Standing Charges*—

		£	s.	d.
Interest on Capital of £192 18s. 9d. @ 6% per annum			4	5
Depreciation at 20% per annum			15	–
Insurance			4	–
Garage			6	–
Cleaning			4	–
Driver's wages	£2 15 – to	3	–	–
Total Weekly Standing Charges	£4 8 5 to	4	13	5

(2) *Running Costs*—

	£	s.	d.
Petrol @ 3s. 0½d. gallon	1	10	5
Oil and Grease		3	–
Tyres		15	6
Repairs and Renewals	1	5	–
	£3	13	11

Total Vehicle cost per mile, Standing Charges and Running costs included, 6½ to 6¾ pence.

Average consumption of Petrol	30-35 m.p.g.	
,, ,, Oil	800 ,,	
,, Tyre life Back	4,000-4,500	miles
,, Sides	5,000-6,000	,,

The succeeding figures are taken from actual practice, being those relating to light vans owned by a well-known London firm of outfitters.

The running costs per car are based on the first six months' running.

A liberal allowance has been made for depreciation, and the £25 per annum against the item "Mechanic" represents a form of contract wage.

The total cost per parcel is an interesting particular of considerable value, and many traders and firms

A THREE-WHEELER OF THE TYPE TO WHICH THE COSTS ON PAGE 49 REFER

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who do not keep this tally at the present time would be wise to follow this example. The vans are run practically only in London, which fact accounts largely for the comparatively high fuel consumption and low charges for repairs and tyres.

STANDING CHARGES.

Per Annum.

	£	s.	d.
Interest on Capital of £188 at 6% per annum	11	5	7
Depreciation at 20% per annum	37	12	–
Insurance, accidents, fire	10	7	6
Insurance, loss of parcels	2	10	–
Garage	11	–	–
Wages	125	–	–
Mechanic	25	–	–
	£222	15	1
Weekly charge per car	4	5	8

RUNNING COSTS.

For Six Months.

	£	s.	d.
Petrol, at 25 m.p.g.	42	–	–
Oil and grease	1	15	–
Tyres and tubes	7	18	8
Renewals, etc.	5	19	4
	£57	13	–

This gives a weekly charge per car for running expenses only of £2 4s. 4d., and, taking the mileage at 50 miles per day, or 300 per week, and the number of parcels delivered at 330 per week, the following results are obtained—

	£	s.	d.
Total vehicle weekly charges	6	10	–
,, cost per mile		–	$5\frac{1}{5}$
,, ,, ,, parcel		–	$4\frac{3}{4}$

10–15 cwt. Vans: Pre-war Costs.

The first costs of this series are pre-war, and pertain to the running of a 12 cwt. motor delivery van, and also to a half-ton horse van. Those for the motor were taken from experience gained after the van had been in service for over three years—

RUNNING COST, 12 CWT. MOTOR VAN.

Miles per week	200		300		400		500	
Miles per day	33		50		66		83	
Standing Charges—	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Interest on Capital of £250 @ 5%	5	–	5	–	5	–	5	–
Depreciation @ 20% of van at £250	20	–	20	–	20	–	20	–
Driver's wages . . .	25	–	25	–	25	–	25	–
Insurance	4	–	4	–	4	–	4	–
Garage	4	–	4	–	4	–	4	–
Running Charges—								
Fuel 22 miles per gal. @ 1s. 4d. per gal.)	12	1	18	2	24	3	30	3
Tyres at £40 per 10,000 miles .	16	0	24	–	32	–	40	–
Repairs at £20 per 10,000 miles .	8	–	12	–	16	–	20	–
Oil and grease. . . .	2	6	3	9	5	–	6	3
Total cost per week . .	96	7	115	11	135	3	154	6
Cost per mile (in pence) . .	5·8		4·6		4·0		3·7	

RUNNING COST HALF-TON HORSE VAN.

Miles per week	100	
Miles per day	16	
	s.	*d.*
Driver	25	–
Fodder	15	–
Shoeing and Vet.	2	6
Repairs, varnish, rent, stables, etc	7	–
Stable labour	4	6
Insurance	1	–
Depreciation (say one horse and van)	6	–
Interest on Capital of £50 at 5%	1	–
Total cost per week	62	–

One hundred miles per week is about the maximum for continuous work, therefore, 7·44 pence is the minimum cost per mile.

Summary of running costs expressed in pence per mile.

	Horse ½-ton van	12 cwt. motor van
100 miles per week	7.44d.	10·3d.
200 „ „ „	——	5·8d.
300 „ „ „	——	4·6d.
400 „ „ „	——	4·0d.
500 „ „ „	——	3·7d.

1st May, 1915, to 31st Jan., 1916

Running costs of 37 motor vans with average carrying capacity of 15 cwt.—

	£	s.	d.
Repairs (partly under contract) and tyres . .	1,379	11	2
Expenses (Petrol, oil, etc.)	2,192	3	8
Drivers' wages	1,880	4	9
Garage Staff wages	382	–	–
,, Rent at £150 per annum	112	–	–
Depreciation (5 years life)	1,500	–	–
Insurance	320	–	–
Washer's wages	150	–	–
	£7,915	19	7

The total mileage for the period was 346,585 miles, thus resulting in a vehicle cost per mile of 5·45 pence. Interest on capital is not included.

Fleet Running.

The results of the running of fleets of vehicles are as interesting and instructive as those of a single van, indeed, a sounder average cost figure will often be found where a fleet is concerned, and this in spite of the fact that fleet owners have certain advantages over the one, two, or three van trader.

The war naturally upset all commercial motor transport in England; nevertheless, this period and that after the Armistice are worthy of study with regard to mechanical haulage for the reason that great difficulties had to be contended with. Mileages had to be curtailed very considerably, and repairs were not easy to undertake.

The following lists contain the yearly mileages, from the date of purchase, of each van belonging to a fleet of forty-four petrol driven vehicles.

MOTOR VEHICLES.

Yearly Mileage from Date of Purchase.

No.	Bought :	Mileage to 31/1/15	31/1/16	31/1/17	31/1/18	31/1/19	31/1/20	Total.
86	Feb. 13	50,693	10,215	9,001	3,565	—	4,674	78,148
87	"	51,101	10,079	8,387	—	—	5,036	74,603
88	"	53,306	9,393	12,242	810	—	13,060	88,811
89	"	22,334	5,753	5,318	1,033	—	1,869	36,307
90	Apr. 14	10,842	11,119	11,364	4,938	7,303	5,238	50,804
91	June 14	7,190	7,712	18,818	11,126	5,055	9,385	59,286
92	"	9,198	12,113	11,964	9,751	5,253	—	48,279
93	Mar. 14	12,478	15,307	14,814	9,268	10,289	12,272	74,428
94	June 14	10,430	19,578	15,236	10,538	4,774	11,681	72,237
95	Apr. 14	8,788	19,005	12,177	7,212	7,155	7,690	62,027
96	June 14	11,591	11,071	13,372	10,515	5,821	10,399	62,769
97	Mar. 14	11,242	14,644	13,069	—	—	—	38,955
98	"	10,169	12,510	14,281	13,649	7,531	6,632	64,772
99	Apr. 14	10,765	12,241	13,966	11,322	10,206	4,864	63,364
101	July 14	8,969	14,559	14,296	10,626	12,486	11,359	72,295
102	"	11,058	10,000	15,543	2,143	11,092	16,101	65,937
103	"	5,817	8,471	10,458	13,207	11,040	14,498	63,491
104	"	9,511	14,721	15,858	8,549	4,810	13,432	66,881
105	"	9,310	15,150	16,443	15,103	8,361	11,109	75,476
106	"	8,875	10,518	15,504	15,702	4,560	11,133	66,292
107	Sept. 14	4,407	13,085	9,787	8,531	2,121	12,085	50,016
108	Nov. 14	3,075	15,153	18,027	—	—	2,874	39,129
109	"	3,142	14,399	14,139	1,005	—	—	32,685
114	"	1,925	17,322	14,519	8,727	8,230	13,077	63,800
115	"	1,996	17,911	14,814	12,851	11,343	16,002	74,917
116	"	3,570	10,654	4,605	—	—	5,984	24,813
117	"	2,978	8,918	18,046	11,628	14,831	16,603	73,004
118	"	2,482	19,128	14,380	—	—	—	35,990
119	"	3,095	17,867	19,652	13,458	4,911	5,736	64,719
120	Feb. 15	—	11,686	4,482	10,520	2,651	2,652	31,991
121	Mar. 15	—	5,030	17,710	9,355	8,522	11,395	52,012
122	June 15	—	8,730	12,822	10,790	7,730	12,465	52,537
123	July 19	—	—	—	—	—	6,952	6,952
124	"	—	—	—	—	—	4,059	4,059
125	Oct. 15	—	4,539	14,779	2,108	9,352	8,176	38,954
126	Nov. 15	—	2,750	24,016	4,110	—	557	31,433
128	" 16	—	—	1,200	12,211	25	—	13,436
129	"	—	—	1,200	5,175	9,546	9,207	25,128
130	"	—	—	400	13,650	—	—	14,050
131	"	—	—	1,400	12,250	595	8,147	22,392
132	"	—	—	1,200	10,135	11,880	9,654	32,869
133	"	—	—	1,200	890	260	11,805	14,155
137	Oct. 19	—	—	—	—	—	1,350	1,350
143	May 19	—	—	—	—	—	8,832	8,832

1920

The running expenses of these vans (four of which are 1 ton and the rest 12-15 cwt. machines) are taken from 1st Feb., 1919, to 31st Jan., 1920.

	£	s.	d.		d.	
Wages (Porters, Drivers & Garage)	5,338	–	–	or	3·80	per mile
Rent, Rates Lighting & Insurance	312	–	–	,,	·22	,, ,,
Spirit	3,703	–	–	,,	2·64	,, ,,
Insurance	558	–	–	,,	·39	,, ,,
Repairs (including body maintenance)	5,712	10	–	,,	4·07	,, ,,
Tyres	2,935	10	–	,,	2·09	,, ,,
Expenses (Oil and grease) . .	807	–	–	,,	·57	,, ,,
Total	19,366	–	–	,,	13·78	,, ,,

Notes.

The total mileage for the 12 months was 336,530. The total vehicle cost per mile, therefore, equals 13·8 pence. It will be noticed that neither Interest on Capital nor Depreciation is included in the above. The reason for this is that the vans are in their sixth year, and since a five year life only is allowed for in the case of these vans, Interest on Capital and Depreciation do not come in for calculation. It is interesting to note that during February, 1920, these vans were run—without carburettor adjustments—on Benzole. The average mileage per vehicle equalled 12·27 against the average, for three months prior, on petrol of 10·4.

The cost of tyres (all pneumatic) for an average number of twenty-five vans for 13 months ending July, 1919, was as follows—

Month.	Purchased. £	s.	d.	Credit. £	s.	d.	Miles ran.
July	424	7	–				45,085
August . . .	229	3	6	12	8	8	17,287
September . . .	151	9	9				17,094
October . . .	107	9	–				18,921
November . . .	92	5	10				18,613
December . . .	391	12	9	86	6	5	21,358

Month.	Purchased.	Credit.	Miles ran.
	£ s. d.	£ s. d,	
January . . .	214 11 3	78 4 9	20,731
February . . .	231 10 3		19,318
March . . .	133 16 6		22,435
April	311 5 3	9 10 –	22,231
May	296 16 9		26,751
June	240 5 2	41 11 6	21,714
July	368 13 10	10 7 3	25,534
	£3193 6 10	238 8 7	297,072

Stock in hand 1-8-19 .	220 8 3	
	£2972 18 7	
Less credit for Tyres transferred to Local Branches	238 8 7	
	£2734 10 –	
Credit for scrap . .	5 12 –	
	£2728 18 –	for 297072 miles equals 2·20d. per mile
Fitter's wages . .	180 – –	·14d.
	£2908 18 –	2·34d. per mile

20 CWT. COSTS.

Running Cost 1-ton Motor Van (pre-war).

Miles per week . .	200	300	400	500
Miles per day . . .	33	50	66	83
Standing Charges—	s. d.	s. d.	s. d.	s. d.
Interest on Capital of £315 at 5 per cent. . .	6 –	6 –	6 –	6 –
Depreciation at 20 per cent. of van at £315 . .	24 2	24 2	24 2	24 2
Driver's wages . .	25 –	25 –	25 –	25 –
Insurance . . .	4 –	4 –	4 –	4 –
Garage . . .	4 –	4 –	4 –	4 –
Running Charges—				
Fuel, 16 miles per gal. at 1s. 4d. per gal. . .	16 8	25 –	33 4	41 8
Tyres at £40 per 10,000 miles . . .	16 –	24 –	32 –	40 –
Repairs at £25 per 10,000 miles . . .	10 –	15 –	20 –	25 –
Oil and grease . .	2 6	3 9	5 –	6 3
Total cost per week .	108 4	130 11	153 6	176 1
Cost per mile (in pence) .	6·5d.	5·2d.	4·6d.	4·2d.

RUNNING COST: 1-TON HORSE VAN (PRE-WAR).

	s.	d.
Miles per week	100	
Miles per day	16	
Driver	25	–
Fodder, 15s. each	30	–
Shoeing and vet.	4	6
Repairs, varnish, paint	3	–
Rent, stables, etc.	4	–
Stable Labour	4	6
Insurance	1	–
Depreciation (say 2 horses and van £100) .	8	–
Interest on Capital of £100 at 5% . .	1	11
Total cost per week	81	11
Cost per mile in pence	9·8d.	

If only one horse is used, the extra cost of hiring a relief horse will in the end approximately balance the original extra cost, and since 100 miles per week is about the maximum for continuous work, the minimum cost per mile works out at 9·8 pence.

The summary of these costs expressed in pence per mile is therefore—

	1-ton Horse Van.	1-ton Motor Van.
100 miles per week . .	9·8 . .	10·29
200 „ „ „ . .	. .	6·5
300 „ „ „ . .	. .	5·2
400 „ „ „ . .	. .	4·6
500 „ „ „ . .	. .	4·2

1920.

The following are actual costs of a 1-ton delivery van, dating about 1913, which was fitted with a conversion set in 1919—

The work covering the period in question consisted mostly of "specials," though a certain number of regular rounds in North London were also done. Loads up to 30 cwt. were often carried.

A point—the importance of keeping a motor on the road as much as possible—is illustrated very clearly in the last week's entry, when, owing to the mileage amounting to only 15, the cost per mile is shown at the truly extravagant figure of 11s. 9½d.

7th February, 1920–1*st May*, 1920.

Week ending	7/2/20	14/2/20
	£ s. d.	£ s. d.
Wages	4 2 8	4 0 9½
Garage expenses	2 2 11	1 13 2
Petrol	2 4 2	2 1 11½
Oil and grease	0 7 7½	0 6 7½
Tyres	1 4 –	1 – 3
Sundries	1 5	13 2
Interest on Capital	8 1	8 1
Depreciation and insurance	1 3 2	1 3 2
	£11 14 0½	£11 7 2½
Mileage	288	243
Miles per gallon	14·4	12·7
Cost per mile	9½d.	11d.

Week ending	21/2/20	28/2/20
	£ s. d.	£ s. d.
Wages	4 4 –	4 4 4½
Garage expenses	1 16 11½	1 10 11½
Petrol	2 1 11½	1 13 1½
Oil and grease	7 7½	3 –
Tyres	17 9	1 1 6
Sundries	2 8	—
Interest on Capital	8 1	8 1
Depreciation and insurance	1 3 2	1 3 2
	£11 2 2½	£10 4 2½
Mileage	213	258
Miles per gallon	11·2	17·2
Cost per mile	1/0½	9½d.

During the next three weeks the car was in the workshops for overhaul, the respective charges under garage expenses being £6 14s. 9½d., £5 9s. 9d., and £1 12s. 8½d. ; while 9s. 4½d. is charged under "Sundries" for the week of 6th March and £3 10s. 10d. for that of the 13th.

Week ending	27/3/20	2/4/20
	£ s. d.	£ s. d.
Wages	3 17 7½	2 9 11
Garage expenses	1 14 9	1 18 –
Petrol	1 15 4	1 12 –
Oil and grease	0 4 9	2 9
Tyres	14 6	12 9
Sundries	4 6	—
Interest on Capital	8 1	8 1
Depreciation and insurance	1 3 2	1 3 2
	£10 2 10½	£8 6 8
Mileage	176	153
Miles per gallon	11	12·7
Cost per mile	1/5½	1/1

Week ending	10/4/20	16/4/20
	£ s. d.	£ s. d.
Wages	4 2 7½	4 6 6½
Garage expenses	1 3 9½	1 18 8½
Petrol	1 9 4	1 14 8
Oil and grease	5 –	5 6
Tyres	10 9	16 4
Sundries	1 1 –	—
Interest on Capital	8 1	8 1
Depreciation and insurance	1 3 2	1 3 2
	£10 3 9	£10 13 –
Mileage	129	196
Miles per gallon	11·7	15
Cost per mile	1/6½	1/1

Week ending	23/4/20	1/5/20
	£ s. d.	£ s. d.
Wages	2 1 3½	7 2½
Garage expenses	2 12 9½	5 10 –½
Petrol	18 8	16 –
Oil and grease	2 6	—
Tyres	9 2	1 3
Sundries	11 8	11 2
Interest on Capital	8 1	8 1
Depreciation and insurance	1 3 2	1 3 2
	£8 7 4	£8 16 11
Mileage	110	15
Miles per gallon	15·7	2·5
Cost per mile	1/6¼	11/9½

The high consumption of petrol shown in the last table is, of course, accounted for by the fact that the tank was left at the end of the week with a good supply.

CHAPTER VIII

PETROL VEHICLE RUNNING COSTS
25-50 CWT. LOADS

BEFORE giving present-day running costs for petrol vehicles of 30 cwt. loading capacity, it may prove helpful for purposes of comparison to outline briefly the work, together with schedules of operating costs in 1914, of a fleet of 25 cwt. vans run by a large London firm dealing in drapery, provisions, furniture, etc.

The annual mileage of the fleet at that time was 1,170,000 miles, the firm carried out all the necessary repairs to the vans, and the drivers were those who had previously driven the firm's horse vans. The first two vans were put into service in the beginning of October, 1905, and each of these vans by 1914 had run a distance of over 150,000 miles.

The firm had sixty-five vans, and the average annual mileage of each van worked out at 18,000 miles, or 63 miles every working day in the year. Some vans, of course, did less, while others did more ; a few running up to an annual mileage of 25,000 miles per van.

Long Distance Delivery.

The longest regular service which the firm undertook then was to Hindhead or Haslemere, this averaging 120 miles per day.

This service was started by an occasional single delivery to a house near Haslemere. It was then run once a month, and as people living in that part began to know and appreciate this feature of quick and door-to-door delivery, a regular service was established fortnightly, then weekly, then three days a week.

In the year of the war this delivery was carried out by three vans three times a week.

Many other long-distance deliveries were made weekly, and three days a week; and the firm found that on an average one motor van did the work of six horses. Some rounds would have taken eight horses, if it had been practicable to do them by horse haulage, but since there was not time enough in the day, these were not found possible.

These cases refer to perishable goods that were obtained from the Fish and Covent Garden Markets, and which required delivery the same day.

Average Petrol Bill.

The rise in the price of fuel from 1912 to 1914 was very marked, and, naturally, affected seriously the delivery expenses. However, this rise was fairly balanced by the reduction in the price of tyres. The following figures show the average petrol bill for each van—

	£	s.	d.
1912—Petrol at 7d. per gallon . . .	47	–	4
1913— „ 1s. „ „ . . .	80	12	–
1914— „ 1s. 1d. „ . . .	87	6	4

Cost of repairs—	£	s.	d.
Three vans for eight years	1,521	2	3
Eight vans for seven years	2,927	6	1
	£4,448	8	4

Cost of tyres—	£	s.	d.
Three vans for eight years	911	15	9
Eight vans for seven years	2,013	8	7
	£2,925	4	4

Dividing these two totals by 80, the cost of repairs and tyres per van per year is obtained as £55 12s. and £36 11s. 3d. respectively.

Cost per Mile.

So the cost per van per year running an average mileage of 18,000 miles was as follows—

	£	s.	d.
Petrol at 1s. 1d. 1,612 gals. . .	87	6	4
Wages average 31s.	80	12	–
Repairs	55	12	–
Tyres	36	11	3
Depreciation at ten years . . .	40	–	–
Oil, grease, carbide, washing, etc. .	13	–	–
Insurance	5	8	–
Total . .	£318	9	7

or cost per mile, 4½d.

The firm's equivalent horse haulage costs at that time worked out at 6½d. per mile.

In both the motor and horse running costs, no allowance for interest on capital or garage rent was made, as the firm's buildings were freehold. But while the interest would have brought out the motor costs higher in proportion to those of the horse, the former is less expensive in rent, since one motor van does not require the room that a van and six horses do. Engineers' salaries are charges in the repair account.

1920 Figures.

The following are the approximate average costs of running a good make of 30 cwt. lorry on a 400 mile per week basis. These figures, though based on the practice of a large number of vehicles operating on different classes of work over many years and brought up to date early in 1920, must be regarded as being more "average" than "actual" data, that is, as referring to vehicles running under reasonably favourable conditions.

1½ TON (APPROX. PRICE £800).

	Per Mile	Per Week £ s. d.
Standing Charges—		
Interest on Capital (at 6% per annum)		18 6
Depreciation on tyreless vehicle (at 15% per annum)		2 3 9
Wages of Driver (at 65s. a week).		3 5 –
Insurance and Garage (at £14 and £12 per annum)		10 –
Running Costs (400 *miles per week*)—		
Fuel at 2s. 10d. per gal. (11 m.p.g.)	3·09d.	5 3 –
Oils and grease	0·30d.	10 –
Repairs and Removals	1·41d.	2 7 –
Tyres (10,000 mile life)	1·01d.	1 13 8
	5·81d.	£16 10 11

Total vehicle cost per mile—9·9d.

The following table is also for a 1½ ton vehicle of another make. Interest on Capital outlay is taken at 6 per cent. as in the previous case—

Weekly Mileage.	250	300	350	400	450	500
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Tyres ·864d.	18 –	1 1 7	1 5 2	1 8 9	1 12 4	1 16 –
Petrol at 2s. 10d. per gal. 10 m.p.g. = 3·4d·	3 10 10	4 5 –	4 19 2	5 13 4	6 7 6	7 1 8
Lubricants ·2d.	4 2	5 –	5 10	6 8	7 6	8 4
Maintenance 1·56d.	1 12 6	1 19 –	2 5 6	2 12 –	2 18 6	3 5 –
Depreciation (less tyres) 1·27d.	1 6 5	1 11 9	1 17 –	2 2 4	2 7 7	2 12 11
Interest at £57 per annum.	1 1 11	1 1 11	1 1 11	1 1 11	1 1 11	1 1 11
Insurance	6 –	6 –	6 –	6 –	6 –	6 –
Storage	5 –	5 –	5 –	5 –	5 –	5 –
Drivers' Wages	3 – –	3 – –	3 – –	3 – –	3 – –	3 – –
Weekly cost	£12 4 10	£13 15 3	£15 5 7	£16 16 –	£18 6 4	£19 16 10
Per Car Mile	11·75d.	11·01d.	10·47d.	10·08d.	9·77d.	9·52d.

Weekly Running Reports.

In contrast to the above the succeeding tables are actual weekly running reports, extending over a quarter, of a 30 cwt. van, belonging to a business house in London. The van was in its first year of service, during the period covered by these records.

Under the heading of "wages" is included a van guard and overtime, and under "garage expenses," repairs, overhauls, adjustments, etc.

In addition, a proportion of the overhead charges of the garage is debited to each van of the fleet, as it comes up for overhaul or repair.

1st *November*, 1919–31st *Jan.*, 1920.

	Week ending			
	Nov. 1	Nov. 8	Nov. 15	Nov. 22
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Interest on Capital at 6% per annum . . .	19 7½	19 7½	19 7½	19 7½
Depreciation at 15% per annum and Insurance .	2 12 –	2 12 –	2 12 –	2 12 –
Wages	4 1 6	4 1 6	4 1 6	4 1 6
Garage Expenses . .	——	——	——	1 7½
Petrol	4 11 4½	3 14 4½	3 10 1½	3 1 7½
Oil and Grease . . .	5 4	3 8	3 10	4 6
Tyres	1 1 11	1 – 3	18 10	17 4
Sundries	5 3	7 10	3 4	——
	£13 17 –	£12 19 3	£12 9 3	£11 18 2½
Mileage	374	346	322	297
Miles per gallon . . .	8·7	9·9	9·8	10·2
Cost per mile . . .	9d.	9d.	9d.	9½d.

	Week ending			
	Nov. 29	Dec. 6	Dec. 13	Dec. 20
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Interest on Capital at 6% per annum	19 7½	19 7½	19 7½	19 7½
Depreciation at 15% per annum and Insurance .	2 12 –	2 12 –	2 12 –	2 12 –
Wages	4 11 6	5 2 1½	5 10 6	5 4 4½
Garage Expenses . .	1 7 4½	1 16 3	1 11 –	1 – 4
Petrol	3 3 9	4 6 3	4 3 11	4 1 8½
Oil and Grease . . .	6 2½	3 2½	5 –	2 10½
Tyres	19 9	1 1 7	1 2 4	1 4 8
Sundries	1 –	——	——	——
	£14 1 2½	£16 1 0½	£16 4 4½	£15 5 7
Mileage	338	369	381	421
Miles per gallon . . .	11·2	9·0	10·0	11·4
Cost per mile . . .	9½d.	10½d.	10d.	8½d.

	Week ending			
	Dec. 27	Jan. 3	Jan. 10	Jan. 17
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Interest on Capital at 6% per annum	19 7½	19 7½	19 7½	19 7½
Depreciation at 15% per annum and Insurance .	2 12 –	2 12 –	2 13 –	2 13 –
Wages	5 5 3½	4 1 6	4 1 6	4 11 7½
Garage Expenses . .	1 9 2	3 3 11½	4 5 2	1 1 10
Petrol	2 1 11½	11 0½	– 8 10	3 1 10
Oil and Grease . . .	1 8	– – 8	– – 9	3 2½
Tyres	10 5	– 2 9	– 6 3	19 11
Sundries	– – 1	– – 2	– 2 –	——
	£13 – 2½	£11 11 8½	£12 17 1½	£13 11 0½
Mileage	179	48	108	340
Miles per gallon . . .	9·4	9·6	9·8	12·1
Cost per mile . . .	1s. 5d.	4s. 9½d.	2s. 4½d.	9½d.

	Week ending	
	Jan. 24	Jan. 31
	£ s. d.	£ s. d.
Interest on Capital at 6% per annum	– 19 7½	– 19 7½
Depreciation at 15% per annum and Insurance	2 13 –	2 13 –
Wages	4 10 1½	4 3 11
Garage Expenses	1 10 9½	3 16 3
Petrol	1 15 4	2 19 7½
Oil and Grease	– 3 6	– 10 5½
Tyres	– 11 5	– 17 5
Sundries	– – –	– 3 –
	£12 3 9½	£16 3 3½
Mileage	195	298
Miles per gallon	12·1	11·0
Cost per mile	1s. 3d.	1s. 1d.

1920

The scale of charges for two 2½ ton vehicles (different makes), are based on similar lines to the "average" ones given previously for two 30 cwt. machines.

2½ TON (APPROX. PRICE £1,050).

		Per Week. £ s. d.
Standing Charges—		
Interest on Capital (at 6% per annum)		1 4 3
Depreciation on tyreless vehicle (at 15% per annum)		2 17 8
Wages of Driver (at 65s. per week)		3 5 –
Insurance and Garage (at £20 and £12 per annum)		12 4
Running Costs (400 *miles per week*)—	Per Mile.	
Fuel at 2s. 10d. per gal. (7·5 m.p.g.)	4·53d.	7 10 –
Oils and grease	0·37d.	0 12 4
Repairs and renewals	1·75d.	2 18 4
Tyres (10,000 mile life)	1·2d.	2 – –
	7·85d.	£20 19 11

Total vehicle cost per mile—1s. 0½d.

	Weekly Mileage					
	250	300	350	400	450	500
	£ s d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Tyres ·948d.	19 9	1 3 8	1 7 7	1 11 7	1 15 6	1 19 6
Petrol at 2s. 10d. per gal. 10 m.p.g. = 3·77d.	3 18 6	4 14 3	5 9 11	6 5 8	7 1 4	7 17 1
Lubricants ·37d.	7 8	9 3	10 9	12 4	13 10	15 5
Maintenance 1·63d.	1 13 11	2 – 9	2 7 6	2 14 4	3 1 1	3 7 11
Depreciation (less tyres) 1s. 4d.	1 9 2	1 15 –	2 – 10	2 6 8	2 12 6	2 18 4
Interest at £62 p. a.	1 3 10	1 3 10	1 3 10	1 3 10	1 3 10	1 3 10
Insurance	6 –	6 –	6 –	6 –	6 –	6 –
Storage	5 –	5 –	5 –	5 –	5 –	5 –
Drivers' Wages	3 10 –	3 10 –	3 10 –	3 10 –	3 10 –	3 10 –
	13 13 10	15 7 9	17 1 5	18 15 5	20 9 1	22 3 1
Per Car Mile	13·14d.	12·31d.	11·70d.	11·26d.	10·91d.	10·63d.

Estimated working costs of another make of 2½ ton lorry.

RUNNING EXPENSES PER WEEK.

	£ s. d.
Fuel at 12 miles to the gallon at 2s. 8d. per gallon	3 17 9
Lubricants	10 –
Tyre depreciation	2 – –
	£6 7 9

STANDING CHARGES.

	£	s.	d.
Depreciation 15% on cost of vehicle (without tyres) .	2	18	10
Insurance £20 per annum		7	8
Driver's Wages	3	15	–
Garage		10	–
Maintenance 2d. per mile	2	18	4
Interest on Capital Expenditure (say £1,070 at 6%) .	1	4	8
Cost per week	£18	2	3

Cost per car mile—1s. 0¼d.

The above scale of charges is based for a weekly mileage of 350 miles under good average conditions of running, but the author considers that the fuel item is underestimated.

CHAPTER IX

PETROL VEHICLE RUNNING COSTS
3-10 TON LOADS

WITH regard to the running costs of the heavier types of petrol vehicle, the first two lists contain approximate average weekly costs for two 3-ton lorries, of different make. The remark in Chapter VIII with reference to "average" costs applies equally to those given in this chapter also.

And the next record, which is actual data for a 3 tonner taken from 1st November, 1919, to 31st January, 1920, is particularly interesting as illustrative of the remarks at the beginning of Chapter VII, with reference to the cost per mile being largely influenced by the weekly mileage.

In this case, the lorry was used extensively for delivering goods to the various railway companies' yards in London. This sort of work involves a large amount of stopping and starting and slow running in queues.

APPROXIMATE AVERAGE RUNNING COST OF TWO DIFFERENT MAKES OF 3-TON LORRIES.

		Per Week.		
		£	s.	d.
Standing Charges—				
Interest on Capital (at 6% per annum)		1	5	5
Depreciation on tyreless vehicle (at 15% per annum)		3	–	5
Wages of Driver (at 65s. per week)		3	5	–
Insurance and garage (at £20 and £12 per annum)			12	4
Running Costs—(400 miles per week)	Per Mile			
Fuel at 2s. 10d. per gal. (7 m.p.g.)	4·86d.	8	2	–
Oils and Grease	0·37d.		12	4
Repairs and renewals	1·75d.	2	18	4
Tyres (10,000 mile life)	1·34d.	2	4	8
	8·32d.	£22	–	6

Total vehicle cost per mile—1s. 1d.

A USEFUL TYPE OF BREWER'S PETROL LORRY

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APPROXIMATE AVERAGE RUNNING COST OF TWO DIFFERENT MAKES OF 3-TON LORRIES—(*contd.*)

	Weekly Mileage					
	250	300	350	400	450	500
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Tyres 1·236d.	1 5 9	1 10 1	1 16 –	2 1 2	2 6 4	2 11 6
Petrol at 2s. 10d. per gal. 8 m.p.g. = 4·25d.	4 8 6	5 6 3	6 3 11	7 1 8	7 19 4	8 17 1
Lubricants ·52d.	10 10	13 –	15 2	17 4	19 6	1 1 8
Maintenance 1·88d.	1 19 2	2 7 –	2 14 10	3 2 8	3 10 6	3 18 4
Depreciation (less tyres) 1·6d.	1 13 4	2 – –	2 6 8	2 13 4	3 – –	3 6 8
Interest at £70 p. a.	1 6 11	1 6 11	1 6 11	1 6 11	1 6 11	1 6 11
Insurance	6 –	6 –	6 –	6 –	6 –	6 –
Storage	5 –	5 –	5 –	5 –	5 –	5 –
Drivers' Wages	3 10 –	3 10 –	3 10 –	3 10 –	3 10 –	3 10 –
Weekly cost	£15 5 6	£17 4 3	£19 4 6	£21 4 1	£23 3 7	£25 3 2
Per car Mile	14·66d.	13·77d.	13·19d.	12·72d.	12·36d.	12·07d.

ACTUAL RUNNING COST DETAILS OF 3-TON LORRY.

1*st November*, 1919–31*st Jan.*, 1920.

	Week ending			
	Nov. 1	Nov. 8	Nov. 15	Nov. 22
	£ s. d.	£ s. d	£ s. d.	£ s. d.
Interest on Capital	1 – 7½	1 – 7½	1 – 7½	1 – 7½
Depreciation and Insurance	2 4 2	2 4 2	2 4 2	2 4 2
Wages	4 16 6	4 16 6	4 16 6	4 16 6
Garage Expenses	– – –	– – –	1 10 5	13 10
Petrol	2 4 7½	3 5 8½	1 9 9	2 6 9
Oil and Grease	4 8	5 4	1 4	7 –
Tyres	7 10	1 1 2	7 3	13 3
Sundries	– – –	10 2	– – –	8 1
	£10 18 5	£13 3 8	£11 10 0½	£12 10 2½
Mileage	91	245	84	154
Miles per gallon	4·3	7·0	6·0	7·0
Cost per mile	2s. 4½d.	1s. 0½d.	2s. 9d.	1s. 7½d.

	Week ending			
	Nov. 29	Dec. 6	Dec. 13	Dec. 20
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Interest on Capital	1 – 7½	1 – 7½	1 – 7½	1 – 7½
Depreciation and Insurance	2 4 2	2 4 2	2 4 2	2 4 2
Wages	5 8 6	5 10 11	3 18 1½	3 17 –
Garage Expenses	1 9 –	1 16 3	1 11 –	1 3 7
Petrol	3 1 7½	2 8 10½	2 6 4½	1 17 6½
Oil and Grease	8 2½	3 2½	6 –	3 2½
Tyres	17 6	13 11	10 5	3 8
Sundries	4	– – –	– – –	– – –
	£14 8 5½	£13 11 0½	£11 16 8½	£10 9 9½
Mileage	203	161	121	63
Miles per gallon	7·0	7·0	5·7	3·7
Cost per mile	1s. 5d.	1s. 8d.	1s. 11½d.	3s. 3½d.

Actual Running Cost Details of 3-ton Lorry (*contd.*)

1st *November*, 1919–31st *January*, 1920.

	Week ending			
	Dec. 27	Jan. 3	Jan. 10	Jan. 17
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Interest on Capital	1 – 7½	1 – 7½	1 – 7½	1 – 7½
Depreciation and Insurance	2 4 2	2 4 2	2 4 2	2 4 2
Wages	4 2 3	4 16 6	4 10 6	4 16 6
Garage Expenses	18 11	1 11 4	1 3 5	18 5
Petrol	15 5½	2 1 11½	2 8 7	1 8 8½
Oil and Grease	1 8	4 6½	2 –	2 8½
Tyres	2 2	5 10	8 5	6 1
Sundries	– – –	– – –	– – –	– – –
	£9 5 3	£12 4 11½	£11 17 8½	£10 17 2½
Mileage	26	68	98	71
Miles per gallon	3·7	3·5	4·4	5.4
Cost per mile	7s. 1½d.	3s. 7d.	2s. 5d.	3s. 0½d.

	Week ending	
	Jan. 24	Jan. 31
	£ s. d.	£ s. d.
Interest on capital	1 – 7½	1 – 7½
Depreciation and Insurance	2 4 2	2 4 2
Wages	4 17 7½	4 9 –
Garage Expenses	1 15 4½	1 7 10½
Petrol	1 13 1½	1 13 1½
Oil and Grease	5 8½	3 5½
Tyres	9 7	8 1
Sundries	– – –	– – –
	£12 6 2½	£11 6 4
Mileage	111	94
Miles per gallon	7·4	6·2
Cost per mile	2s. 2½d.	2s. 4½d.

Approximate Average Running Costs of Two Different Makes of 4-ton Vehicles.

	Weekly Mileage					
	250	300	350	400	450	500
	£ s. d.	£ s. d.	£ s. d	£ s. d.	£ s. d.	£ s. d.
Tyres 1·41d.	1 9 4	1 15 3	2 1 1	2 7 –	2 12 10	2 18 9
Petrol at 2s. 10d. per gal. 7 m.p.g. 4·85d.	5 1 0	6 1 3	7 1 5	8 1 8	9 1 10	10 2 1
Lubricants ·52d	10 10	13 –	15 2	17 4	19 6	1 1 8
Maintenance 2·27d.	2 7 3	2 16 9	3 6 2	3 15 8	4 5 1	4 14 7
Depreciation (less tyres) 1·71d.	1 15 7	2 2 9	2 9 10	2 17 –	3 4 1	3 11 3
Interest at £74 p. a. on Capital	1 8 5	1 8 5	1 8 5	1 8 5	1 8 5	1 8 5
Insurance	6 –	6 –	6 –	6 –	6 –	6 –
Storage	5 –	5 –	5 –	5 –	5 –	5 –
Drivers' Wages	4 – –	4 – –	4 – –	4 – –	4 – –	4 – –
Weekly cost	£17 3 5	£19 8 5	£21 13 1	£23 18 1	£26 2 9	£28 7 9
Per Car Mile	16·48d.	15·53d.	14·85d.	14·34d.	13.94d.	13·62·d.

Year.	Number of PETROL LORRIES: County Council.	Rate of DEPRECIATION per Annum @ 15% on Current Value of Wagons purchased direct from MAKERS and @ 30% of Cost + Repairs necessary for putting into good order, Wagons purchased from WAR DEPARTMENT.	Average Cost of Repairs and Renewals per Lorry.	Average C of PETR per Lorr
		£ s. d.	£ s. d.	£ s.
1913–14 . . .	1	*90 – –*	1 19 6	67 8
1914–15 . . .	1	*92 5 –*	57 16 5	155 2
1915–16 . . .	2	*94 10 –*	12 10 –	105 4
1916–17 . . .	3	*100 10 –*	53 8 4	168 5
1917–18 . . .	3	*105 – –*	18 3 –	163 4
1918–19 . . .	3	*148 10 –*	75 7 1	283 9
1919–20 . . .	3	*180 – –*	172 13 4	261 2

(1889)—*bet. pp.* 70 *and* 71

machines are of similar make. The tables show the costs of the vehicles since they were first put on the road.

Actual Running Cost Details of 3-ton Lorry (*contd.*)

1*st November*, 1919–31*st January*, 1920.

	Week ending			
	Dec. 27	Jan. 3	Jan. 10	Jan. 17
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Interest on Capital	1 – 7½	1 – 7½	1 – 7½	1 – 7½
Depreciation and Insurance	2 4 2	2 4 2	2 4 2	2 4 2
Wages	4 2 3	4 16 6	4 10 6	4 16 6
Garage Expenses	18 11	1 11 4	1 3 5	18 5
Petrol	15 5½	2 1 11½	2 8 7	1 8 8½
Oil and Grease	1 8	4 6½	2 –	2 8½
Tyres	2 2	5 10	8 5	6 1
Sundries	– – –	– – –	– – –	– – –
	£9 5 3	£12 4 11½	£11 17 8½	£10 17 2½
Mileage	26	68	98	71
Miles per gallon	3·7	3·5	4·4	5.4
Cost per mile	7s. 1½d.	3s. 7d.	2s. 5d.	3s. 0½d.

	Week ending	
	Jan. 24	Jan. 31
	£ s. d.	£ s. d.
Interest on capital	1 – 7½	1 – 7½
Depreciation and Insurance	2 4 2	2 4 2
Wages	4 17 7½	4 9 –
Garage Expenses	1 15 4½	1 7 10½
Petrol	1 13 1½	1 13 1½
Oil and Grease	5 8½	3 5½
Tyres	9 7	8 1
Sundries	– – –	– – –
	£12 6 2½	£11 6 4
Mileage	111	94
Miles per gallon	7·4	6·2
Cost per mile	2s. 2½d.	2s. 4½d.

Approximate Average Running Costs of Two Different Makes of 4-ton Vehicles.

	Weekly Mileage					
	250	300	350	400	450	500
	£ s. d.	£ s. d.	£ s. d	£ s. d.	£ s. d.	£ s. d.
Tyres 1·41d.	1 9 4	1 15 3	2 1 1	2 7 –	2 12 10	2 18 9
Petrol at 2s. 10d. per gal. 7 m.p.g. 4·85d.	5 1 0	6 1 3	7 1 5	8 1 8	9 1 10	10 2 1
Lubricants ·52d	10 10	13 –	15 2	17 4	19 6	1 1 8
Maintenance 2·27d.	2 7 3	2 16 9	3 6 2	3 15 8	4 5 1	4 14 7
Depreciation (less tyres) 1·71d.	1 15 7	2 2 9	2 9 10	2 17 –	3 4 1	3 11 3
Interest at £74 p. a. on Capital	1 8 5	1 8 5	1 8 5	1 8 5	1 8 5	1 8 5
Insurance	6 –	6 –	6 –	6 –	6 –	6 –
Storage	5 –	5 –	5 –	5 –	5 –	5 –
Drivers' Wages	4 – –	4 – –	4 – –	4 – –	4 – –	4 – –
Weekly cost	£17 3 5	£19 8 5	£21 13 1	£23 18 1	£26 2 9	£28 7 9
Per Car Mile	16·48d.	15·53d.	14·85d.	14·34d.	13.94d.	13·62·d.

COUNTY COUNCIL MECHANICAL HAULAGE.

STATISTICS AND COSTS.

Year.	Number of Petrol Lorries: County Council.	Rate of **DEPRECIATION** *per Annum* @ 15% on *Current Value of Wagons purchased direct from MAKERS* and @ 30% of Cost + Repairs necessary for putting into good order, Wagons purchased from War Department.	Average Cost of **Repairs** and Renewals per Lorry.	Average Cost of **PETROL** per Lorry.	Average Amount of **Wages** per Lorry.	**Other Charges.** Amount per Lorry.	Average **Amount of DEPRECIATION** per Lorry.	Average **Total Costs** per Lorry.	**Average Cost per Ton-Mile.**	Average **Cost per DAY.**	Average Number **of Days worked** per Lorry.	Average **Ton-Mileage** per Day per Lorry.	Average **LOAD** Carried.	Average Cost of **HIRED VEHICLES** @ per DAY.	Appromixate **SAVING** of Costs of County Council Vehicles *over* Hired M.H Vehicles.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	Pence.	£ s. d.	Days.	Ton-Miles.	Tons.	£ s. d.	£
1913–14 . . .	1	*90 – –*	1 19 6	67 8 2	75 18 2	38 8 3½	35 – –	218 14 1½	4·98	1 17 8½	116	90·69	3¼	—	---
1914–15 . . .	1	*92 5 –*	57 16 5	155 2 1	150 14 3	121 18 5½	92 5 0	577 16 2½	6·29	2 – 10	283	77·87	3¼	—	—
1915–16 . . .	2	*94 10 –*	12 10 –	105 4 5	108 4 3	82 9 2½	66 19 0	375 6 10½	7·61	2 4 8	168	70·43	3⅜	3 – –	258
1916–17 . . .	3	*100 10 –*	53 8 4	168 5 10	115 1 4	100 1 5	90 9 8	527 6 7	8·40	2 6 5	213	70·75	3 7/12	3 5 0	595
1917–18 . . .	3	*105 – –*	18 3 –	163 4 8½	108 19 2	78 11 4	105 – –	473 18 2½	8·15	2 10 11½	186	75·04	3 7/12	3 10 –	531
1918–19 . . .	3	*148 10 –*	75 7 1	283 9 3	172 14 10	72 13 5	148 10 –	752 14 7	13·84	3 4 5	234	55·87	3 7/12	4 – –	545
1919–20 . . .	3	*180 – –*	172 13 4	261 2 1	252 2 5	92 1 –	180 – –	957 18 10	15·59	4 1 9½	234¼	62·96	3½	4 – –	—

(1889)—*bet. pp.* 70 *and* 71

machines are of similar make. The tables show the costs of the vehicles since they were first put on the road.

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Interest on C
Depreciation
Wages .
Garage Expen
Petrol .
Oil and Greas
Tyres .
Sundries

Mileage
Miles per gal
Cost per mile

Interest on c
Depreciation
Wages .
Garage Expe
Petrol .
Oil and Grea
Tyres .
Sundries

Mileage
Miles per gal
Cost per mile

APPROXI

Tyres 1·41d.
Petrol at 2s.
gal. 7 m.p.
Lubricants ·
Maintenance
Depreciation
tyres) 1·71
Interest at £
on Capital
Insurance
Storage
Drivers' Wag

Weekly cost

Per Car Mile . .	16·48d.	15·53d.	14·85d.	14·34d.	13.94d.	13·62·d.

4 Ton (Approx. Price £1,150).

	Per Mile	Per Week. £ s. d.
Standing Charges—		
Interest on Capital (at 6% per annum)		1 6 7
Depreciation on tyreless vehicle (at 15% per annum)		3 2 7
Wages of Driver (at 65s. per week)		3 5 –
Insurance and garage (at £20 and £12 per annum)		12 4
Running Costs (400 *miles per week*)—	Per Mile	
Fuel at 2s. 10d. per gal. (6 m.p.g.)	5·66d.	9 8 8
Oils and grease	0·37d.	12 4
Repairs and renewals	1·75d.	2 18 4
Tyres (10,000 mile life)	1·58d.	2 12 8
	9·36d.	£23 18 6

Total vehicle cost per mile—1s. 2½d.

Estimated Working Costs of a 4-Ton Lorry of a third make doing 350 Miles per Week.

	£ s. d.
Running Expenses per week—	
Fuel at 7 miles to the gallon at 2s. 8d. per gal.	6 13 4
Lubricants	15 –
Tyre Depreciation	2 – –
	£9 8 4

	£ s. d.
Standing Charges—	
Depreciation 15% on cost of vehicle (without tyres)	3 15 1
Insurance £20 per annum	7 8
Driver's Wages	3 15 –
Garage	10 –
Maintenance 2d. per mile	2 18 4
Interest on Capital Expenditure (say £1,385 at 6%)	1 12 –
Cost per week	£22 6 5

Cost per car mile—1s. 3¼d.

The statistics and costs (inset) refer to one 4-ton, one 3¼-ton, and one 3½-ton motor vehicles engaged on main road work by a county council. The first two are fitted with screw-end tipping bodies and the 3½ ton with a non-tipping body. The 3¼ and 3½-ton machines are of similar make. The tables show the costs of the vehicles since they were first put on the road.

County Council Work: 5-ton Lorries.

In the next schedule, relating to County Council work, it will be noticed that the cost per hour decreased in 1916 compared with that of 1915, by 2d., and the cost per ton-mile increased by 0·7d. The former was accounted for by the good running of the lorries, there being considerably less standing time for repairs than in the previous year, and as all the principal work upon which they were engaged, entailed only short distances from the Depôt, the consumption of petrol, oil, etc., was decreased. The increase in the cost per ton mile was entirely in consequence of these shorter journeys, the average mileage per journey being twelve as compared with fifteen in the previous year. All these lorries, purchased in September, 1912, are of the same make.

SCHEDULE SHOWING DETAIL COSTS OF 5-TON MOTOR LORRIES
Year ending December, 1916.

Number of Lorry	Working Hours					Mileage covered	No. of of loads carted	Weight of loads carted.
	Loading	Outward Journeys	Unloading	Inward Journeys	Total			Tons Cwts.
1	972	549	475	426	2422	10,365	972	4917 9
2	876	522	430	485	2313	9,936	870	4365 12
3	836	586	454	458	2334	11,123	816	4108 15
Total	2684	1657	1359	1369	7069	31,424	2658	13391 16
Year 1915	2169	1796	996	1465	6426	35,272	2379	11868 10

Number of Lorry	Material.									
	Petrol	Motor Engine Oil.	Gear Oil.	Waste.	Cloths.	Common Oil.	Paraffin Oil.	Grease.	Carbide	Single Tyres.
	Gals.	Gals.	Gals.	lbs.	lbs.	Gals.	Gals.	lbs.	lbs.	
1	1875	88	22	3	11	2	2	231	14	—
2	1896	101	45	13	16	2	3	231	13	—
3	1802	76	21	10	4	1	8	232	14	—
Total	5573	265	88	26	31	5	13	694	41	18
Year 1915	6098	362	86	19	29	8	14	741	32	13

SCHEDULE SHOWING DETAIL COSTS OF 5-TON MOTOR LORRIES

Year ending December, 1916

(*continued*)

Number of Lorry.	Total cost of Labour, Materials, Tyres, Spares, etc.	Depreciation of Capital.	Total.	Cost per ton mile.	Cost per working hour.
	£ s. d.	£ s. d.	£ s. d.	pence.	pence.
1	405 19 10	103 3 4	509 3 2	4·66	50·4
2	418 16 –	103 3 4	521 19 4	5·02	54·1
3	407 17 5	103 3 4	511 – 9	4·38	52·5
Total	1232 13 3	309 10 –	1542 3 3	4·68	52·4
Year 1915	1142 17 6	314 7 3	1457 4 9	3·97	54·4

Year ending December, 1917.

Number of Lorry.	Working Hours.				Total.	Mileage covered.	No. of loads carted.	Weight of loads carted.
	Loading.	Outward Journeys	Unloading.	Inward Journeys				
								Tons Cwts.
1	587	454	302	357	1700	9802	557	2823 13
2	838	733	388	567	2526	13430	675	3335 10
3	860	545	424	436	2265	10471	891	4479 15
Total	2285	1732	1114	1360	6491	33703	2123	10638 18
Year 1916	684	1657	1359	1369	7069	31424	2658	13391 16

Number of Lorry.	Material.									
	Petrol.	Motor Engine Oil.	Gear Oil.	Waste.	Cloths.	Common Oil.	Parafin Oil.	Grease.	Carbide.	Single Tyres.
	Gals.	Gals.	Gals.	lbs.	lbs.	Gals.	Gals.	lbs.	lbs.	
1	1670	91	35	16	9	—	2	153	10	—
2	2310	103	36	12	8	—	4	153	10	—
3	1752	99	37	14	11	—	2	153	10	—
Total	5732	293	108	42	28	—	8	459	30	6
Year 1916	5573	265	88	26	31	5	13	694	41	18

Schedule Showing Detail Costs of 5-Ton Motor Lorries

Year ending December, 1917.

(*continued*)

Number of Lorry.	Total Cost of Labour, Materials, Tyres, Spares, etc.	Depreciation of Capital.	Total.	Cost per ton mile.	Cost per working hour.
	£ s. d.	£ s. d.	£ s. d.	pence.	pence.
1	409 2 3	103 3 4	512 5 7	4·95	72·3
2	514 19 2	103 3 4	618 2 6	4·47	58·7
3	433 12 9	103 3 4	536 16 1	4·89	56·9
Total	1357 14 2	309 10 0	1667 4 2	4·74	61·6
Year 1916	1232 13 3	309 10 0	1542 3 3	4·68	52.4

Year ending December, 1918.

Number of Lorry.	Working Hours. Loading.	Outward Journeys	Unloading.	Inward Journeys	Total.	Mileage Covered.	Number of Loads Carted.	Weight of Loads Carted.
								Tons. Cwts.
1	699	532	334	442	2,007	11,962	685	3,421 —
2	415	321	227	251	1,214	5,979	368	1,801 19
3	812	679	445	592	2,528	15,078	790	4,055 17
Total 1918	**1,926**	**1,532**	**1,006**	**1,285**	**5,749**	**33,019**	**1,843**	**9,278 16**
Total 1917	2,285	1,732	1,114	1,360	6,491	33,703	2,123	10,638 18
Total 1916	2,684	1,657	1,359	1,369	7,069	31,424	2,658	13,391 16

Number of Lorry.	Materials. Petrol.	Motor Engine Oil.	Gear Oil.	Waste.	Cloths.	Common Oil.	Paraffin Oil.	Grease.	Carbide.	Single Tyres.
	Gals.	Gals.	Gals.	lbs.	lbs.	Gals.	Gals.	lbs.	lbs.	
1	2,000	86	32	19	54	—	4	260	8	—
2	1,028	60	27	17	—	3	4	220	5	—
3	2,316	138	32	24	12	—	6	260	8	—
Total 1918	**5,344**	**284**	**91**	**60**	**66**	**3**	**14**	**740**	**21**	—
Total 1917	5,732	293	108	42	28	—	8	459	30	6
Total 1916	5,573	265	88	26	31	5	13	694	41	18

Year ending December, 1918—(contd).

Number of Lorry.	Total Cost of Labour, Materials, Tyres, Spares, Etc.	Depreciation of Capital.	Total.	Cost per Ton-Mile.	Cost per Working Hour.
	£ s. d.	£ s. d.	£ s. d.	pence.	pence.
1	622 12 6	103 3 4	725 15 10	5·83	86·8
2	383 12 3	103 3 4	486 15 7	7·98	96·2
3	672 9 3	103 3 4	775 12 7	4·81	73·6
Total **1918**	**1,678 14 –**	**309 10 –**	**1,988 4 –**	**5·74**	**83·0**
Total 1917	1,357 14 2	309 10 –	1,667 4 2	4·74	61·6
Total 1916	1,232 13 3	309 10 –	1,542 3 3	4·68	52·4

The Estimated Life of each Lorry, for the purpose of Depreciation, has been taken at 7 years; and Depreciation of Capital has been charged to each Lorry per year at one-seventh of its purchase price.

Approximate Average Running Costs of a 5-Ton Vehicle of Good Make.

Weekly Mileage.	250	300	350	400	450	500
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Tyres 1·59d.	1 13 1	1 19 9	2 6 4	2 13 –	2 19 7	3 6 3
Petrol at 2s. 10d. per gal. 6 m.p.g. = 5·66d.	5 17 11	7 1 6	8 5 1	9 8 8	10 12 3	11 15 10
Lubricants ·55d.	11 5	13 9	16 –	18 4	1 – 7	1 2 11
Depreciation (less tyres) 1·87d.	1 18 11	2 6 9	2 14 6	3 2 4	3 10 1	3 17 11
Maintenance 2·3d.	2 7 11	2 17 6	3 7 1	3 16 8	4 6 3	4 15 10
Interest at £80 per annum.	1 10 9	1 10 9	1 10 9	1 10 9	1 10 9	1 10 9
Insurance (6s. weekly)	6 –	6 –	6 –	6 –	6 –	6 –
Storage (5s. weekly)	5 –	5 –	5 –	5 –	5 –	5 –
Drivers' Wages	4 – –	4 – –	4 – –	4 – –	4 – –	4 – 0
Weekly cost	18 11 –	21 1 –	23 10 9	26 – 9	28 10 6	31 – 6
Per car mile	17·81d.	16·84d.	16·14d.	15·62d.	15·21d.	14·89d.

Estimated Working Costs of 3–4-Ton Petrol-Electric Lorry doing 350 Miles per Week.

Standing Charges—	£ s. d.
Interest on Capital Expenditure (say £1,435 at 6%)	1 13 1
Depreciation 15% on cost of vehicle (without tyres)	3 18 11
Driver's Wages	3 15 –
Insurance £20 per annum	7 8
Garage	10 –
	£10 4 8

Running Expenses per Week—	£	s.	d.
Fuel at 7 miles to the gal. at 2s. 8d. per gal.	6	13	4
Lubricants		15	–
Tyre depreciation	2	–	–
Maintenance 2d. per mile	2	18	4
Cost per week	£22	11	4

Cost per vehicle mile—1s. 3½d.

Approximate Tractor Costs.

The last table in this chapter relates to a tractor lorry—all four road wheels of which are driven—capable of carrying a load of 3 tons, and drawing a trailer with 5 tons.

The figures supplied to the author and reproduced here are approximate ones, and Interest on Capital has not been included.

INITIAL COST.

	£	s.	d.
Cost of Chassis	1,150	–	–
War Department Type Body	100	–	–
Trailer	200	–	–
	£1,450	–	–

Cost per Annum	£	s.	d.	*Cost per mile run.* d.
Depreciation 20% on £1,450 worked on a basis of purchase in 5 years	290	–	–	9¼
Petrol 8½d. per mile 250 days per annum at 30 miles per day—7,500 miles per annum.	265	12	6	8½
Tyres for Chassis (average life 15,000 miles) 4 tyres approx. £16 each—£64 per annum 7,500 miles	32	–	–	1
Tyres for Trailer 1/3 of allowance for Chassis	10	13	4	¼
Labour say Driver £4 per week Vanman £3 per week	364	–	–	12
Garage, Insurance, License, say	37	–	–	1
Lubrication	20	–	–	½
Repairs say	75	–	–	2½
Total	£1094	5	10	2s. 11d.

A TRACTOR LORRY PULLING OVER A 15-INCH TREE STUMP

(1889)—*bet. pp.* 76 *and* 77

In looking at the costs on the previous page the allowance of £75 per annum for repairs may appear small at first sight, but when the comparatively high figure for depreciation is taken into account and the relatively low annual mileage, the item need not be considered as unreasonable. Tyre allowance, however, is probably on the low side.

Before concluding this chapter, mention should be made of a new class of vehicle, namely, the six-wheeler. It is likely that this type will be recognized legally as a six-wheeled vehicle and not as a lorry and trailer, and if this proves to be the case so that a maximum load of, say, 7 tons can be transported at a legal rate of 12 miles per hour, this type should have a good future before it.

CHAPTER X

ELECTRIC VEHICLES

THE electric vehicle for commercial purposes has undoubtedly come to stay, but until the time is ripe for the installation of charging stations along our main roads, making it possible to link up services—both passenger and goods carrying—from town to town, the electric car is unlikely to supplant that driven by means of liquid fuel. At the present time the scope of the former is limited to short distance deliveries in which frequent halts have to be made. For such a sphere the electric chassis has been found in practice to be superior to any other form of transport.

Advantages of Electric Transport.

The chief advantages of the electric system are—

(1) Ease of manipulation.

(2) Economy in operation and maintenance.

(3) Simplicity of construction, thereby requiring a minimum of attention for successful upkeep.

(4) Elimination of energy-waste while the vehicle is at rest.

(5) Smoothness of drive, and elimination of vibration from the mechanism.

(6) Absence of exhaust gases,—an important consideration in many classes of delivery.

(7) Self-starting quality of the vehicle, coupled with instantaneous up-take of the load and rapid acceleration.

(8) Minimized danger of fire, thus enabling a vehicle to be loaded or unloaded in a building which a petrol van would not be allowed to enter.

(9) Comparatively slow rate of depreciation generally.

(10) Good weight distribution.

(11) Reliability due to simplicity of design.

ELECTRIC LORRIES SUPPLEMENTING RAILWAY TRANSPORT

(1889)—*bet. pp.* 78 *and* 79

As mentioned above, the electric car is only suitable to-day for work in a comparatively short radius of despatch, and from this fact the disadvantages can be gauged.

(1) Limited operation.

(2) Radius affected to a considerable extent by nature of roads and road surface.

(3) Weight of battery, although this is largely compensated for by the elimination of such parts in a petrol chassis as the gear-box.

(4) Time needed for charging, when it is not possible to do this while the vehicle is being loaded or unloaded.

(5) Relatively low rate of speed.

(6) Possible difficulty of charging easily and at a reasonable figure, though much has been done to facilitate this item during late years.

Future Prospects of Electric Conveyances.

The restrictions placed upon petrol-driven vehicles during the war, entailing the complete laying-up of many thousands of these machines, brought the advantages of electric conveyances prominently before traders and firms interested in mechanical road transport, and invaluable service was rendered by the electrically-driven chassis owing to its independence of these restrictions.

Thus the utility of this class of van was fully established, and the writer considers that not only will the electric transport vehicle hold its own, but that its use for short-distance frequent-stop delivery work, will in the future become greatly extended.

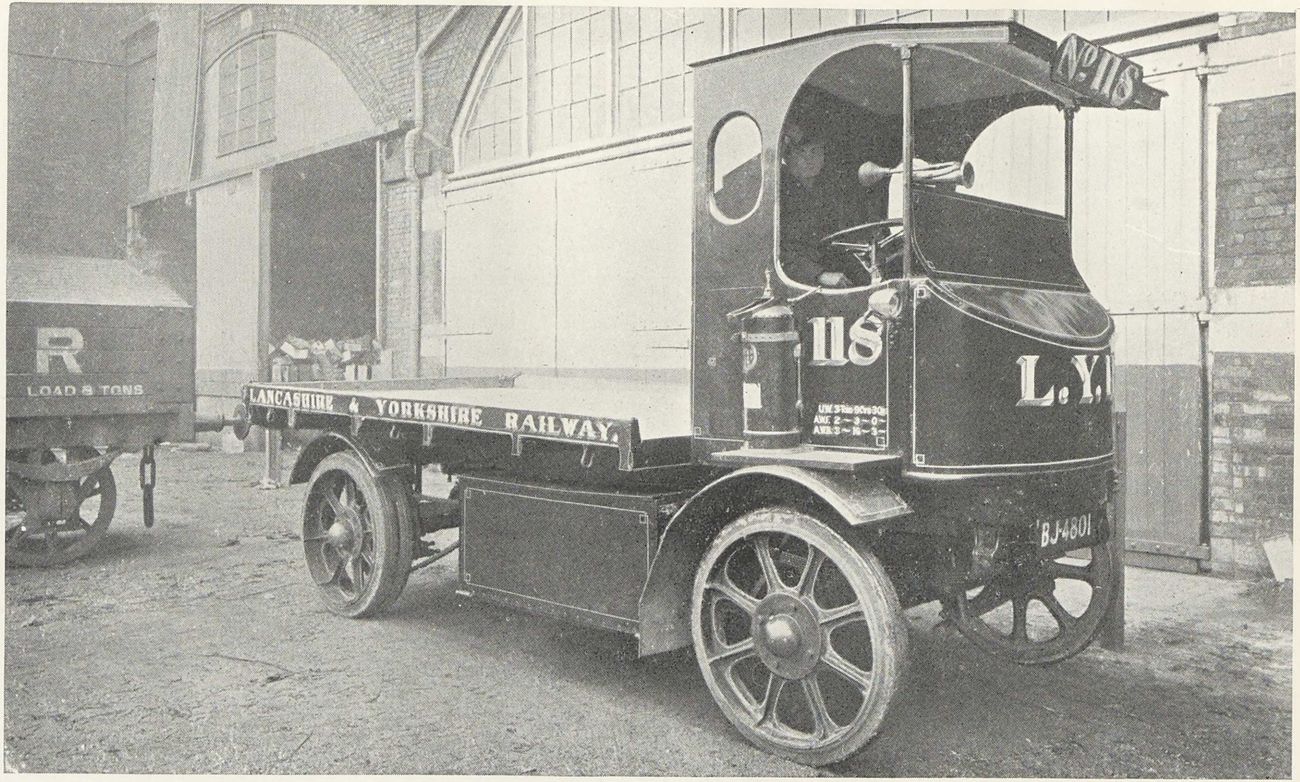
Principal Constructional Features.

The lay-out of the electric vehicle chassis is very much simpler than that of those driven by means of liquid fuel or steam, and as this type is so much less known and yet has probably the greatest future before it, a brief summary of the chief constructional features may be useful. The principal parts of the chassis as differing from the petrol vehicle are three in number; namely, the controller, the battery, and the motors. The electrical energy is conveyed from the battery to the controller, and thence to the motors, and thus transformed into mechanical energy. The heart of the chassis—the battery—is usually carried by a sub-frame which is slung from the side members of the main frame. This design has been found to be the most practical method, since it affords good weight distribution, accessibility, and the maximum of flat surface for floor space.

Battery Types.

The two types of battery which are most generally used in this country are a nickel-iron-oxide-alkali-accumulator, and the Ironclad-Exide pattern, which is a lead-plate cell. There are, of course, other makes and types of accumulators, but these two are the best known in Great Britain. Each kind has its own particular advantages and disadvantages, and in practice is found to give satisfactory results with no great difference in regard to combined reliability and maintenance.

The controller is fitted near the driver's feet, either above or below the floor-boards, and this position allows for the simplest form of handling in operation—*i.e.*, one lever. The design of the driving mechanism is dependent upon whether one motor or two are to be incorporated, and whether the drive is to be delivered to the front or back road wheels. If a single motor is fitted, a differential gear will be necessary. The drive from the motor to the countershaft is conveyed by an enclosed silent chain, and thence from the



THE RAILWAY COMPANIES FAVOUR THE ELECTRICALLY-DRIVEN LORRY

1889)—*bet. pp.* 80 *and* 81

differential gear to the road wheels through the medium of side chains.

Another system is by means of gearing in place of the chain drive from motor spindle to counter-shaft.

If two motors are fitted, they may either be placed in the wheel hubs or connected by spur-gearing. In the former case the chief disadvantages are that large-size hubs are required and slow-running motors, and this means increased weight and direct contact with road wheel shocks. The advantages are that owing to the elimination of gearing, efficiency is increased and weight is saved : thus the total weight of the two designs probably would not differ to any great extent.

When front wheel drive is adopted, the motors are, as a rule, connected to the driving wheels, as in the case of the spur gearing pattern mentioned above, through some spring attachment in order to ensure correct meshing of the wheels under running conditions.

The uses to which the electric vehicle is being put are constantly increasing, and a very good example of this is to be found in the almost universal adoption of the electrically-driven chassis by municipalities and other public bodies.

CHAPTER XI

ELECTRIC VEHICLES—RUNNING COSTS

THE electrically-driven vehicle is very extensively used in municipal work, as may be judged by the facts given in this chapter. This class of work seldom favours economical operation in respect of the returns which mechanical haulage can show when employed commercially. Nevertheless, accounts of municipal traction are always of interest for, as a rule, fuller and more accurate details of the service are kept than is the case with many commercial firms, and the motor is in no way favoured by being run under ideal conditions.

Municipal Corporation's 1 Ton Electric Lorry.

The particulars below relate to a 1 ton electric lorry belonging to a corporation. The details of the whole service have been most carefully kept and compiled, and cover a period of one year's running during the war—

	Week-days	Sundays	Total.
Number of Miles run . .	10,376	110	10,486
Number of Hours in commission	2,988	48·5	3,036·5
Number of Days in commission.	305	7	312

Days out of commission for the twelve months, other than Sundays and public holidays—none.

Total costs for the year are—

	£	s.	d.
Capital charges, insurance, etc.	124	9	–
Wages	115	14	11
Material	24	16	3
Current	23	11	10
Tyres	21	16	11
	£310	8	11

The wages charge includes, in addition to the driver's wages, the cost of the labour spent on maintenance and repairs.

The cost of material appears to be rather high, but it includes £6 10s. for a duplicate set of chains which, strictly speaking, should be a capital charge.

Other outstanding items are—

	£	s.	d.
Lubricants	6	7	11
Paraffin	1	3	–
Rags	1	5	11
"Ferodo" brake lining	2	13	2
Water, distilled	1	7	11

The average current consumption for the twelve months including motor-generator losses, worked out at 1·08 units per mile, which, at 0·5d. per unit, equals 0·54d. per mile.

The tyres cost £25 the set at that time, and carried a guarantee of 12,000 miles, and the cost per mile was therefore 0·5d. Thus the total costs per mile run were—

Wages and Capital charges, etc.	6·07d.
Current	0·54d.
Tyres	0·50d.
	7·11d.

Average Mileage and Maintenance.

The average miles per hour maintained during the year, based on the total hours in commission, and including all loading and unloading time in addition to the actual hours on the road, is given, of course, by dividing the total number of miles run by the total number of hours in commission, and equals 3·45 m.p.h. For the period in question the average rate of pay to the driver was approximately 7½d. an hour, therefore the cost of driving equals 2·17d. per mile.

The cost of maintenance which was included in the wages figure of £115 14s. 11d. may be arrived at by dividing the capital charges by the total mileage, adding the driving, tyre and current costs, and subtracting this total from 7·11d.

The complete analysis will be as follows—

	Cost per Mile.
Capital charges, insurance, and driver's licences	2·85d.
Driver's Wages	2·17d.
Maintenance of vehicle and battery, including lubricants (material 0·57d., labour 0·48d.)	1·05d.
Current	0·54d.
Tyres	0·50d.
	7·11d.

These figures are based on interest at 4½ per cent., and current at 0·5d. per unit.

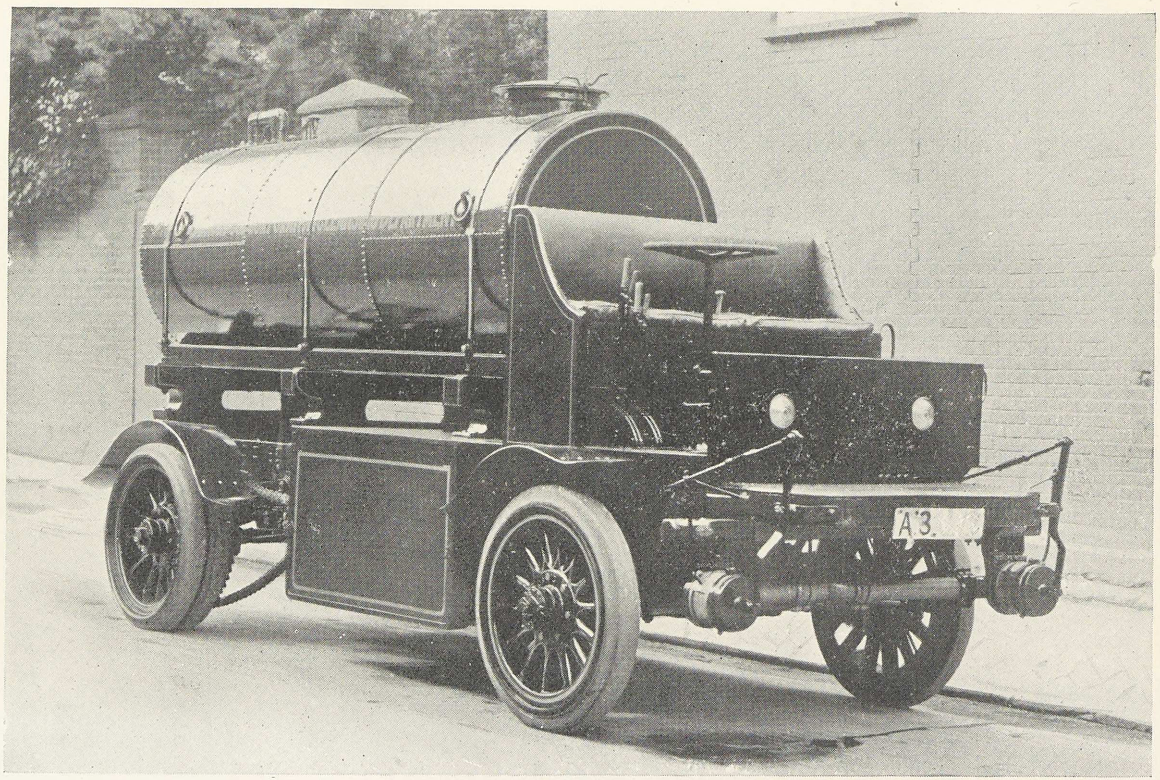
If, however, as an alternative, 5 per cent. for interest and 1d. per unit for current be taken, the cost per mile will be 7·73d., a figure which, at the time these tables were drawn up, compared favourably with the cost of petrol vehicles. The latter figure of 7·73d. is based on annual capital charges amounting to £127 16s. 7d., which, including as it does £10 for insurance and 10s. for driver's licences, is equal to 17·4 per cent. of the cost of the vehicle, as regards interest and repayment charges.

At 4½ per cent. interest, the percentage of the purchase price is 16·86.

All cleaning, overhauling and repairing was done as a rule on Saturday afternoons, and occasionally at night and on Sundays. The consequent overtime naturally increased the maintenance costs.

Another Municipal Example.

In another case of the electric vehicle working on municipal work, a saving over horse haulage amounting



A MUNICIPAL ELECTRIC VEHICLE

(1889)—*bet. pp.* 84 *and* 85

to £1,650 3s. 2d. per annum (in dealing with 13,425 tons of material carried and refuse collected) was effected between 24th September, 1917 and 30th September, 1918. Three vehicles were employed, and electricity worked out at 2·80 units per mile. The charge for the current was 1½d., 1½d. plus 10 per cent., and 1½d. plus 20 per cent. per unit. Tyres were guaranteed for 10,000 miles, and renewals were provided for by an allowance of 1d. per mile. The following particulars show the inclusive costs of the vehicles—

ANNUAL VEHICLE COSTS.

	£	s.	d.
3 vehicles at £1,020 each = £3,060.			
Interest and repayment of loan, 10 years at 6%	420	–	–
Insurance	22	10	–
Repairs, renewals, maintenance, and cleaning	292	1	7½
	£734	11	7½

Inclusive Costs, Sept., 1917, to Sept., 1918—

	£	s.	d.	£	s.	d.
Wages including War Bonus and Overtime				1,155	10	2
Vehicle Costs, as above				734	11	7½
Electricity—						
11,379 units at 1½d.	71	2	4			
28,047 units at 1½d., plus 10% and meter rent	193	2	6			
17,487 units at 1½d., plus 20% and meter rent	131	6	1			
				395	10	11
Tyres 20,309·1 miles at 1d.				84	12	5
				£2,370	5	1½

The material carried and the refuse collected and carried amounted to 13,425 tons. The cost per ton of the electric thus works out at 3s. 6½d. as against 5s. 9d. to 6s. 3d., or an average of 6s. per ton for horse haulage, and thereby saves 2s. 5½d. per ton.

The costs of a 3½ ton electric lorry, owned by a County Borough, during the early part of 1918 were as follows—

	Jan. 1918 £ s. d.	*Feb.* 1918. £ s. d.
Current at ½d.	1 4 2	1 13 4½
Repairs	1 10 9	2 12 11
Garage Labour	16 8½	
Driver's Wages	7 3 10½	12 3 10
Loader's Wages	5 1 –	15 5 5½
Sundries	– – –	1 4 6
	£15 16 6	£33 – 1

	Jan. 1918	*Feb.* 1918.
Miles run	195	322
Tons of Fuel carted	190	497
Working Expenditure	£15 16 6	£33 – 1

This gives the costs per mile run as 1s. 7½d. and 2s. 0½d., and the costs per ton carted as 1s. 8½d. and 1s. 4d. respectively.

This vehicle was delivered on 12th December, 1917, and both the costs above and below are exclusive of the interest and depreciation on the capital sum represented by the vehicle. Under normal conditions, this may be taken at about 1s. per ton. The summary of results for the months of March and April were—

	March 1918 £ s. d.	*April* 1918 £ s. d.
Current at ½d.	1 14 4	1 11 10
Repairs	2 7 5	2 7 9
Driver's Wages	12 2 11	11 15 9
Loader's Wages	13 4 2	12 – 9
Battery Repairs	1 18 10½	1 8 10
Oils	– – 2½	2 16 –
	£30 19 11	£32 – 11

	March 1918	*April* 1918
Miles run	381	358
Tons of Fuel carted	556	509
Working Expenditure	£30 19 11	£32 – 11

Thus the cost per mile run works out at 1s. 7d. and 1s. 9d. respectively for the two months, and the cost per ton carted at 1s. 1d. and 1s. 3d.

In comparing costs of electric vehicles, it is important to take into consideration the price of current per unit, which varies considerably.

Electrically Driven Fleet Work.

In connection with the running of fleets of motor vehicles, a brief description of the organization and costs of the electrically driven vans of one of the largest transport owners in the Kingdom is of interest.

The first of the fleet was put on the road in March, 1914, and when war broke out so many horses were commandeered that the company took immediate steps to obtain other electric vehicles.

From time to time new cars were acquired, and at present the company has as many in service as the charging stations can accommodate.

The nature of the service consists in the distribution of supplies from the factory to the various depôts of the company, and in this work the electric cars have proved most reliable and economical.

The fleet consists of twenty-seven vans, comprising 5 ton, 3½ ton, 2 ton, 1 ton, and ½ ton types.

The average daily mileage is about thirty, and charging is done on the premises.

In the great majority of cases no boosting charge is given, as the company find that the abolition of the boosting charge not only simplifies matters but increases the general efficiency of the cars.

The charging is done while the vehicles are at rest in the loading bay, by means of plugs, which are arranged at convenient intervals along the wall. As each car comes in it is inspected, and any slight repair or adjustment is made at once.

A house-type meter placed on the wall above the charging plug is read when the vehicles come in for charging, and again when the batteries are fully charged. In all there are twenty-five charging plugs, and each is on a separate circuit. By means of speaking tubes, communication is afforded between the stations and the engineer in charge of the power plant situated in the basement of the building.

Detailed records are kept of the performance of each vehicle on forms drawn up with the following headings over vertical columns—

Date.	Hours worked.
Journey to.	Rate.
Miles (out and in).	Cost of labour.
Total miles.	Topped up.
Meter Readings before and after charge.	Materials used.
Total charge.	Cost of materials.
Tyres renewed.	General remarks.
Repairs and renewals.	Summary of costs.
Mechanic's name.	Total costs.

Detailed Records.

In the following records current is taken at 1d. per unit. In each case the figures are for six months' running of $3\frac{1}{2}$ ton vans.

	I.	II.
Total miles travelled . . .	4,161·8	3,590
D.C. units consumed . . .	6,031	3,851
Cost at 1d. per unit	£25 2 7	£16 – 11
Labour and material for repairs . .	£8 – 5	£4 – $9\frac{1}{2}$
Cost per mile current only . . .	1·4d.	1·07d.

The cars were new on the road when the above records were commenced.

The cost does not include depreciation, insurance, or any over-head charge.

It is interesting to note that the first electric vehicle which the company bought was kept at work continually (owing to the exigencies of the service in 1914) until the battery had been practically run to death. The total mileage completed before this occurred was 25,435 miles. In the 5 ton and 2 ton costs, current is taken at 1d. per unit.

Two 5-ton Vehicles.

	I.	II.
Miles run in six months . . .	4,656	4,882
Units consumed	9,110	8,098
Maintenance	£16 19 5	£10 17 3
Wages	£131 12 –	£131 12 –
Cost of current per mile . . .	1·95d.	1·66d.

Two 2-ton Vehicles.

	I.	II.
Miles run in six months . . .	4,139·7	4,457
Units consumed	5,756·2	4,457
Maintenance	£15 12 –	£12 10 6
Wages	£131 12 –	£131 12 –
Cost of current per mile . . .	1·35d.	1d.

The wages will be found to be unusually high, as two assistants were required in addition to the driver on the particular service upon which the vehicles were engaged.

As the last column includes an unexpected coincidence between the number of units and the number of miles run, it may be advisable to state that the figures have been carefully checked.

Two different types of battery were in use with the fleet, but it was found in practice that there was no great difference when durability, economy in operation, and attention for maintenance were all taken into account. Tyres lasted on an average for 8,000 miles, and driving chains, if kept in continual daily use, stood approximately for 18 months.

Fleet of Electric Half-Tonners.

Running cost of six electric ½ ton vans from 1st February, 1919 to 31st January, 1920. These machines were run in and around London.

	£	s.	d.		d.	
Wages (porters and Drivers): .	1500	–	–	or	6·99	per mile.
Garage and maintenance . .	572	–	–	,,	2·665	,,
Car Insurance	100	–	–	,,	·466	,,
Repairs	188	10	–	,,	·878	,,
Tyres	75	10	–	,,	·351	,,
	£2436	–	–	,,	11·35	,,

The total mileage for the year was 51,500 giving a vehicle cost per mile of 11·35 pence. Depreciation (ten years life) and Interest at 6 per cent. on capital brings this total up to 15·06 pence per mile.

The item " maintenance " includes contract charging and vehicle inspection, and battery upkeep comes under " repairs."

JULY 1919–JAN. 1920.

COSTS OF RUNNING 1-TON VANS IN LONDON.

Standing Charges—	£	s.	d.
Interest at 6% per annum on £600		13	10
Depreciation (10 years life) at rate of £100 per annum .	1	18	5
Driver's Wages at 60s. per week	3	–	–
Assistant at 55s. per week	2	15	–
Insurance at £16 per annum		6	1
Garage, etc.		3	6
Total weekly standing charges	£8	16	10

	Per Mile.
Running Costs—	pence
Current at 1d. per unit	·72
Tyres	·7
Cost of Engineers attendance per van	1·78
Material used for general maintenance, repairs and overhauls,	1·88
Total Running Cost per Mile	5·08
Total Vehicle Cost per Mile	15·33

Fleet of Eighty Electrically Driven Vans.

The above costs are derived from actual data relating to a fleet of vans running on delivery service in London. A portion of the whole electrically-driven fleet of eighty vans has been taken, and the cost per vehicle has been arrived at by averaging the charges for thirty machines over the stated period. The mean age of the vans in question is four years, and Interest on Capital together with Depreciation have been taken at current vehicle prices.

It will be noticed that a liberal allowance of Assistant's wages has been included. The vans run six days in the week, are fully charged at night, boosted at mid-day, and average in the year about 10,000 miles.

In the case of this particular firm the garage where the vehicles are both charged and stored forms the despatch yard, which undoubtedly tends to economy in the organization costs, for even if the vans were run on a maintenance contract the yard would be required. Galleries carrying the charging cables and plugs are conveniently arranged throughout the building. The firm generate their own electricity, hence the comparatively low charge of 1d. per unit.

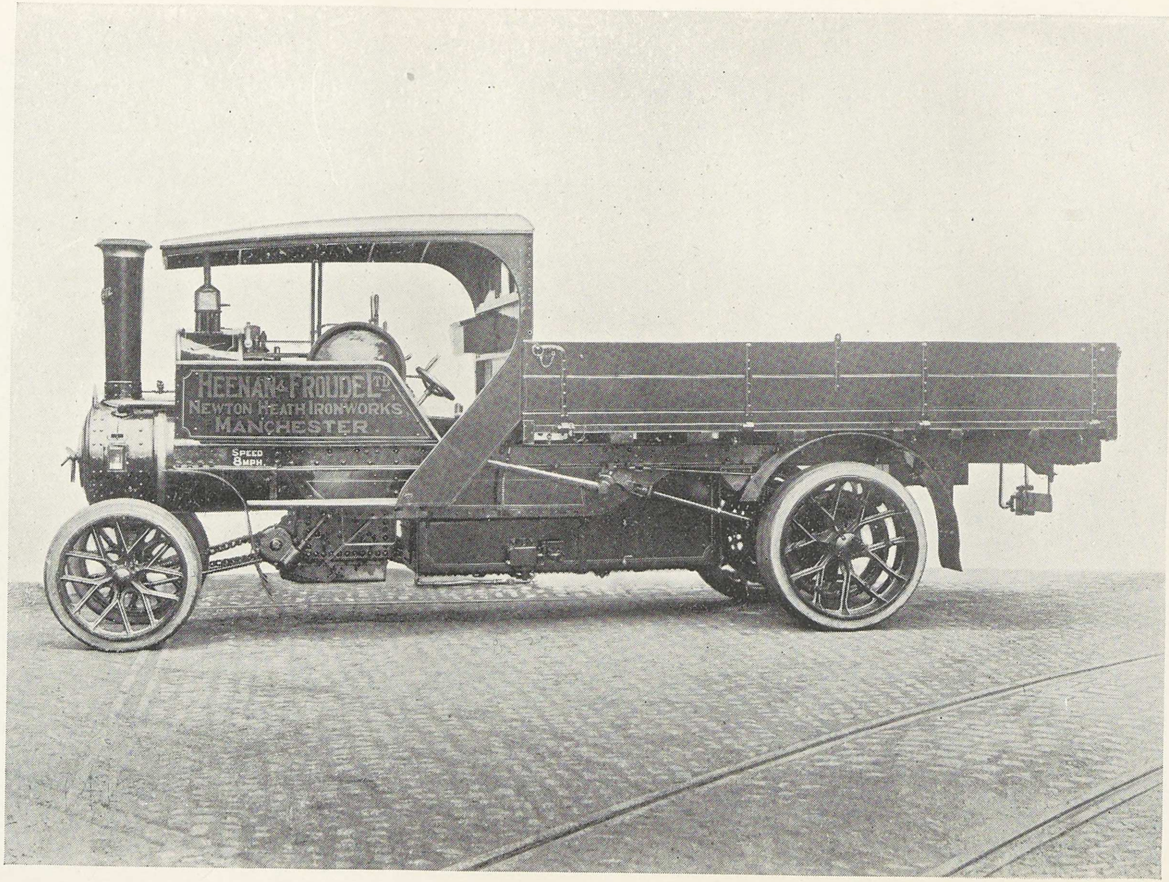
Basis of Different Load Capacity.

On the following page will be found approximate "average" weekly running costs—made up in Jan., 1920, and based on experience—for three vans of the same make, but of different load capacity, covering a daily mileage of between 20 and 25 miles.

The charge for garage especially requires adjustment for each individual case, because in some this item can be set down at a nominal figure, while in others it will prove a more serious expense.

CAPITAL EXPENDITURE.

	$1\frac{1}{2}$ ton.	$2\frac{1}{2}$ ton.	$3\frac{1}{2}$ ton.
	£ s. d.	£ s. d.	£ s. d.
Chassis, with standard body and usual accessories	761 – –	816 – –	934 – –
Solid rubber tyres to all wheels .	41 – –	46 – –	54 – –
Appropriate battery equipment .	258 – –	258 – –	322 – –
	£1,060 – –	£1,120 – –	£1,310 – –
Drivers' Wages	3 – –	3 – –	3 – –
Assistants' Wages	2 5 –	2 5 –	2 5 –
Cost of current at $1\frac{1}{2}$d. per unit on an average weekly mileage of 130	14 7	16 3	19 6
Oil and waste at £3 per annum .	1 2	1 2	1 2
Repairs, including topping up the battery (but exclusive of tyre and battery renewals)	5 9	5 9	5 9
Depreciation at $7\frac{1}{2}$% per annum (exclusive of tyres or battery) .	1 1 11	1 3 6	1 6 11
Interest on Capital at 6% per annum	1 4 6	1 5 10	1 10 3
Cost of battery based on a life of 20,000 miles	1 13 6	1 13 6	2 1 10
Cost of tyres based on a life of 10,000 miles	10 7	11 11	14 –
Insurance and Garage	10 –	10 –	10 –
Estimated total weekly runinng cost	£11 7 –	£11 12 11	£12 14 5
	pence.	pence.	pence.
Consequent cost per vehicle mile .	20·95	21·5	23·49
Cost per net ton mile loaded, throughout journey	13·97	8·6	6·71
Cost per net ton mile loaded on half the journey only	27·94	17·2	13·42



A 5-TON WAGON WITH OVER-TYPE ENGINE.

CHAPTER XII

STEAM WAGONS AND TRACTORS

STEAM traction has its own sphere of utility in the general scheme of mechanically propelled road transport, and, as in the case of the electric vehicle, its field of activity is not only being maintained, but is even increasing. The steam wagon has long since ceased to be the unwieldy and unreliable vehicle which it was in the earlier days of motor transport, nor does it now require a great deal of attention to keep it in running order, even when employed on hard and continuous service.

Legal Regulations for Heavy Vehicles.

To those who are proposing to adopt this method of delivery, and who are not acquainted with the law relating to heavy machines, a word of warning should be given. The Heavy Motor Car Act of 1904 defines a heavy motor-car as a self-propelled vehicle weighing over 2 tons and under 5 tons unladen, and one which is not used for the purpose of drawing more than one trailer or vehicle, such trailer and its locomotive not exceeding 6½ tons weight unladen. The above weights exclude water, fuel, and any special body or fittings which are not essential for the running of the machine.

The speed is fixed at the following limits—

With rubber tyres—if rear axle weight fully loaded does not exceed 6 tons, 12 miles per hour ; if weight does not exceed 8 tons, 8 miles per hour.

With steel tyres—8 miles per hour where hind axle weight does not exceed 6 tons, and if not over 8 tons, 5 miles per hour is allowed as a maximum.

An Important Detail.

It will readily be seen that it is important for the purchaser to ascertain beforehand from the maker whether the catalogued weight of the vehicle is given inclusive of the "running" load or not, for if it is not the owner may put his wagon on to the road with a total load which is illegal, owing to the additional weight of loaded tanks and bunkers not having been taken into account.

If a firm advertises a wagon as a 4 ton machine, it should be able to carry a load of goods weighing 4 tons, and to be yet within the legal limits.

The total weight of the car and its load must not exceed 12 tons; the maximum figure for the rear axle being 8 tons, and that for the front 4 tons.

Other items for consideration include tyres, width, brakes, attendant, lamps, springs and trailers.

Tyre Points.

A steel tyre must be at least 5 inches in width, and any increase is in proportion of wheel diameter to axle weight.

It must be smooth and flat where it touches the ground; or if supplied with strakers or shoes, the space between these must not exceed one-eighth of the width of the tyre when measured straight across in an axial direction.

The extreme overall width of a heavy motor-car or trailer must not be in excess of 7 ft. 6 in., and the car must possess two independent brakes; the reversing gear can be counted as one. Only one attendant—the driver—is required by law for every heavy motor-car. As regards lamps, one must be carried on the off side in front, showing a white light ahead, and one, which sheds a white light on to the back number plate and a red light to the rear, must be carried at the tail of the vehicle.

Suitable springs must be fitted between the frame and the axles. The following particulars must be plainly marked in figures not less than 1 inch in height—on the offside of a trailer—

The Trailer.

(1) The weight of the trailer unladen (which must not be more than 1½ tons).

(2) The loaded axle weight of each axle if the trailer exceeds 1 ton unladen.

The registered number of the car must be fitted at the rear in a conspicuous place. A brake, capable of operation either from the driver's foot-plate or by a competent person carried on the trailer, must be supplied on the latter.

With reference to licensing none is needed for a motor car which carries goods, but the driver must, of course, have his license which costs 5s. a year.

Registration.

The wagon must be registered (the fee being £1), with a county council or borough, and the following particulars must be supplied—

(1) Weight unladen.

(2) Axle weight of each axle.

(3) Diameter and width of each wheel.

And on every heavy motor car, in letters not less than 1 inch in height, must be painted conspicuously—

(1) The registered weight unladen.

(2) The registered axle weight of each axle.

(3) The highest speed.

The first two items denoted by U.W. tons and A.W. tons, must be painted on the off side of the vehicle, and the third item (M.P.H.) on the near side.

The registered number must be shown clearly both at the front and back of the machine, or in the case where a trailer is attached, at the rear of the latter.

Development of Steam Wagon.

In former years there existed a definite boundary—formed by load tonnage—between the scope of useful service of the steam wagon and that of the petrol driven vehicle.

It is true that there were some of the latter class—especially on the Continent—which were capable of hauling a load of over 3 tons, but, generally speaking, the field of the commercial motor driven by liquid fuel was confined to loads of that weight and under, while the steam wagon and tractor were employed exclusively on work where the net load was in excess of this figure.

This border line has undergone some change, by reason of steam vehicle manufacturers setting themselves the task of producing a lighter type of chassis, which would be able to transport 3 tons weight of goods on an economic basis, which would compare favourably with the oil-driven van or lorry.

The outcome of this step has without doubt added greatly to the popularity of the steam-driven machine, and has enlarged its radius to a very appreciable extent. It must be remembered that in service where frequent stopping and starting are encountered—as when transporting heavy goods in areas where crowded traffic is continually met with—the steam wagon is superior in many respects to that propelled by oil by reason of the nature of the fuel and the construction of the chassis.

Special Advantages of Steam Transport.

Perhaps the greatest disadvantage of the former class is the comparatively low rate of speed allowed

A 5-6 TON WAGON FITTED WITH A TRANSVERSE BOILER, THREE-SPEED GEAR, AND LORRY BODY WITH DETACHABLE SIDES

(1889)—*bet. pp.* 96 *and* 97

by law, but in such a case as that given above this drawback is hardly calculable. In addition to this kind of delivery the steamer is eminently suitable for transporting heavy loads at low speed on long-distance runs. There is little doubt that the petrol chassis is not really adapted for use with iron tyres, although the writer has seen good work done by such machines abroad; this is, however, the exception, and the trader who wishes to employ a hard-tyred vehicle will be wise to use one driven by steam. In making a choice of power between steam and oil, the real determining factor is annual mileage.

If the required figure is high, the slower type of vehicle will not be able to undertake the work, because, although it can run long-distance journeys and economically, the limiting rate of speed will prevent it from doing a big yearly mileage.

In any district where coal or coke is comparatively cheap it will probably pay the trader to run steam wagons in preference to petrol lorries; moreover, the former can be so designed that they can be fired on wood if necessary, and for colonial use this may be a decided asset.

Steam Tractors.

Concerning the steam tractor as distinct from the steam wagon, the chief point to bear in mind in making a choice between the two is that, as a rule, where the load to be transported is of a weight which cannot be carried on a single trailer the tractor—which bears no useful load itself—will not prove the best investment. To conform with the Heavy Motor Car Act, it must weigh not more than 5 tons unloaded, and unless it is brought under the traction engine regulations it cannot draw more than one trailer—with a load of about 5 tons—at a time, and this at the rate of 5 miles per hour. It will therefore be seen that the scope of the tractor is limited.

Practical Considerations.

On the other hand, one very distinct advantage can be gained when it is possible to work separately three trailers per tractor, for a system can then be adopted whereby the capital (represented by the steam driven vehicle) will bring in its greatest return. With all mechanical road transport, the greater the number of working hours spent on the road the greater will be the efficiency of the service. In the case where, for instance, three trailers can be run between two depôts, it is possible to keep the tractor on the road the whole time, because the delay at a depôt is confined merely to the slipping of the one trailer and to the attachment of the fresh one. This high interest-bearing method of transportation can, of course, be attained to some extent by means of a petrol or steam-driven wagon and trailers, and a greater total load can be carried; but unless some sound quick-loading and unloading device is supplied to cope with the wagon tonnage, the time spent in depôt delays will be far greater than with the tractor.

One other point to be borne in mind when weighing the advantages and disadvantages of a tractor is that it can be used as a stationary power unit, like the ordinary traction engine, although in a more limited capacity. This is a feature which should not be overlooked, especially with regard to work in an agricultural area.

CHAPTER XIII

STEAM WAGON AND STEAM TRACTOR.—RUNNING COSTS (3-10 TONS)

DESIGNS of steam-driven chassis vary in the arrangement of the position of the units, and it stands to reason that each firm of manufacturers has its own ideas on boiler and engine construction. The prospective buyer, however, need not be greatly bewildered with regard to his choice of vehicle on the score of reliability, because although some makes may be more suitable than others for a particular class of work, the majority of British-built steam wagons are constructed on sound engineering lines. For this reason it will not be found that any wide disparity exists in the running costs of similar types—but of different make—when employed on work of a uniform nature.

The two Types of Steam Lorry.

The chief point to be borne in mind is that there are two distinct types of steam lorry, one which has an overtype engine, and the other in which the engine power plant is arranged to allow of more even load tonnage distribution.

In view of the law restricting axle weights, the latter class may prove the more economical of the two in ton-mile calculations in certain cases of haulage.

The two following tables of average costs (see next page)—based on experience, and made up in 1919—relate to two different makes of steam wagon of the class which does not employ an overtype engine.

Fuel Consumption—	5–6 Ton	4 Ton	3 Ton
Raising Steam	45 lbs.	45 lbs.	45 lbs.
Running per mile	12·5 ,,	11·5 ,,	9 ,,
Water Consumption, gallons per mile .	7·5 gal.	7·25 gal.	7·00 gl.
Running Costs in Pence per Mile—	5-6 Ton	4 Ton	3 Ton
Fuel (coke at £2 per ton) . . .	3·00	2·27	2·00
Lubrication (oil at 4s. per gal.) . .	0·36	0·36	0·3
Tyres	2·00	1·75	1·5
Maintenance	1·00	1·00	1·00
	6·36	5·38	4·80
Standing Charges in Pence per Week—	5-6 Ton	4 Ton	4 Ton
Driver's Wages, £3 10s. per week .	840	840	840
Mate's ,, £2 15s. ,, .	660	660	660
Rent, Rates and Taxes £30 per annum	144	144	144
Insurance, £14 per annum . . .	67	67	60
Deposit £100 per annum for Depreciation	480	480	480
	2191	2191	2184
Total Working Costs in Pence per Mile—	5-6 Ton	4 Ton	3 Ton
Running Costs	6·36	5·38	4·80
Standing Charges	10·95	8·76	7·28
Total . . .	17·31	14·14	12·08

5–6 Ton based upon 200 miles per week.
4 ,, ,, ,, 250 ,, ,,
3 ,, ,, ,, 300 ,, ,,

STANDING CHARGE

(in pence per week).

	4-ton	6-ton	10-ton
Driver, at £3 5s. per week . .	780	780	780
Helper, at £2 ,, ,, ...	480	480	480
Rent and Rates at £31 4s. per annum	144	144	144
Insurance at £26	120	120	120
Interest at 5% on cost of vehicle .	276	290	350
Total standing charge in pence per week	1800	1814	1874

RUNNING COSTS
(in pence per mile).

	4-ton	6-ton	10-ton.
Fuel	1·68 15 miles per cwt. at 1s. 9d. plus 20% for firing and waiting.	2·3 11 miles per cwt. at 1s. 9d. plus 20% for firing and waiting.	2·8 9 miles per cwt. at 1s. 9d. plus 20% for firing and waiting.
Lubricants	·27 2½ gals. oil at 4s. and 2 lb. grease at 8d. for 500 miles.	·34 2½ gals. oil at 4s. and 2lb. grease at 8d. for 400 miles.	·36 2½ gals. oil at 4s. and 3 lb. grease at 8d. for 400 miles.
Tyres	1·5	1·8	3·4
Maintenance	1·0	1·0	1·5
Depreciation	1·8 150,000 mile life.	1·84 150,000 mile life	2·7 120,000 mile life.
Total Running costs in pence per mile	6·25	7·28	10·76

(Depreciation is based on cost of wagon without tyres, spread over useful life.)

This will give the total cost per mile—on a 200-mile week basis—at 15·25, 16·35, and 20·13 pence respectively.

Taking a 400-mile week basis, the costs are, of course, proportionately lower, and are as follows—

	4-ton	4-ton	10-ton.
Total cost per mile	10·75	11·81	15·44

APPROXIMATE AVERAGE WEEKLY RUNNING COSTS OF STEAM MOTOR WAGONS

	Heavy type on solid rubber tyres to carry approximately 5 tons on body at a legal speed of 8 miles per hour.	Light type on solid rubber tyres to carry approximately 3 tons on body at a legal speed of 12 miles per hour.
Capital Expenditure.		
Chassis complete with standard wooden body and mounted on solid rubber tyres . . .	£ s. d. 1253 – –	£ s. d. 1106 – –
Approximate weekly Running Costs.		
Nixons navigation coal at 52s. 6d. per ton, with an approximate consumption of 7 lbs. per mile and an estimated run of 64 miles per day for 5 days per week = 320 miles per week on a coal consumption of 1 ton	2 12 6	

Approximate Average Weekly Running Costs of Steam Motor Wagons (*contd.*).

Ditto—5 lbs. per mile at 96 miles per day for 5 days per week = 480 miles on a consumption of 21 cwts.		2 15 1
Driver's wages	3 – –	3 – –
Assistant's wages	2 5 –	2 5 –
Oil, waste and firewood	14 4	14 4
Repairs at £60 per annum	1 3 –	1 3 –
Depreciation at the rate of 10% per annum (exclusive of tyres)	2 4 8	2 2 6
Depreciation of rubber tyres (based on a life of 10,000 miles at £90 per set) 320 miles per week at 2·1d. per mile	2 16 –	
Ditto (at £80 per set) 480 miles per week at 1·9d. per mile		3 16 –
Interest on capital outlay at 6% per annum . .	1 8 11	1 7 4
Estimated Total weekly running cost . . .	£16 4 5	£17 3 3
Consequent cost per Vehicle mile . . .	12·2d.	8·5d.
Cost per net ton mile loaded throughout journey .	2·4d.	2·8d.
Cost per net ton mile loaded on half the journey only	4·8d.	5·6d.

A charge for insurance and garage should be added according to individual cases.

Detailed Estimate of the Cost of Running a 5-Ton Hydraulic Tipping Steam Wagon, Carrying a Legal Load of 3½ tons only.

The following figures refer to vehicles engaged on road maintenance haulage.

The ton mileage per annum—14,000—is based on the assumption that the wagon covers 8,000 miles in the year and runs half that distance carrying the full legal load, and the other half empty.

The final figures may appear rather high to the commercial user of a steam wagon, but it should be remembered that county haulage is considerably more costly than that of the ordinary business firm owing to the nature of the work.

It will be noticed that although the lorry is of the 5-ton class the maximum load allowed by law is—largely owing to the tipping mechanism—only 3½ tons. This matter is commented on in the chapter on bodies.

The initial capital expenditure on a new wagon is taken at £1,320, and the cost of tyres included at £120.

Coal consumption is estimated at the rate of 1 cwt. for 12 miles, and the yearly amount consumed at 33½ tons.

Interest on capital expenditure has not been included, as lorries are purchased out of revenue.

	£	s.	d.
Depreciation: 15 per cent. p.a. on £1,200	180	–	–
Insurance, registration, and licenses	16	–	–
Rent of stores	15	–	–
Average cost of repairs and renewals, p.a.	50	–	–
Average cost of tyres, p.a.	80	–	–
Fuel	96	14	6
Oil for all purposes at 6 qts. per 100 miles	33	–	–
Waste, 1¼ cwt. p.a.	2	10	–
Wages: Driver and mate at 21s. per day, including non-breakdown bonus	262	10	–
Costs per annum	£735	14	6
Administration: Add 5 p.c.	36	15	9
Total per annum	£772	10	3

Number of Working Days.

Total days in year		365
Less—Bank Holidays	4½ days	
Annual holidays	7½ ,,	
Saturdays and Sundays	78 ,,	
Washing out	20 ,,	
Compulsory loss of time for repairs, etc.	5 ,,	
		115
Total number of working days per annum		250

Cost per day = £3 1s. 9½d.

Assuming 4,000 miles with full legal load; assuming 4,000 miles empty; cost per ton mile equals 13·25 pence.

See also statistics on the next page.

Steam Wagons and Trailers.

The tables on pp. 105 to 107 relate to steam wagons engaged on County Council work, and are worthy of study. In this class of haulage the number of working days in the year and the amount of idle running, that is, without the net load, or any load at all, are often considerable, and this should be borne in mind when viewing the final figures.

Early in 1915, owing to the shortage of labour and

COUNTY COUNCIL MECHANICAL HAULAGE.

Statistics and Costs of a Fleet of Steam Wagons from 1917-1920.

Year.	*Number* of Steam Wagons owned by County Council.	*Rate of Depreciation* per annum at 15% on current value of wagons purchased direct from makers, and at 30% of cost and repairs necessary for putting into good order wagons purchased from War Dept.			Average Cost of *Repairs* and Renewals per Lorry.			Average Cost of *Coal* per Lorry.			Average amount of *Wages* per Lorry.			*Other Charges.* Amount per Lorry.			Average *amount of Depreciation* per Lorry.			Average *Total Costs* per Lorry.			Average *Cost per Ton-Mile.*	Average *Cost per Day.*			Average number of *Days worked* per Lorry.	Average *Ton-Mileage* per day per Lorry.	Average *Load* carried.	Average cost of *Hired Vehicles* at per day.			Approximate *Saving* of Costs of C.C. Vehicles over Hired M.H. Vehicles.
		£	s.	d	£	s	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	Pence	£	s.	d	Days.	Ton-Miles.	Tons.	£	s.	d.	£
1917–18	2	**105**	-	-		7	9	55	9	5	71	4	6	86	17	–	39	7	6	253	6	2	11.35	2	8	3	105	51.00	5	3	10	–	228
1918–19	5	**148**	**10**	-	28	4	4	89	13	10	144	4	7	12	3	1	113	-	6	496	6	4	13·41	2	12	11	187½	47.36	5	4	–	–	1,270
1919–20	12	**187**	**8**	**4**	16	3	8	91	18	7	165	16	7	103	17	10	116	17	4	494	14	–	11.62	3	–	10	162½	62.82	4	4	–	–	1,870

Of the wagons referred to during the period 1919–1920, ten are of the same make and fitted with overtype engines, while the remaining two are of another make and type.

With the exception of two vehicles, all are supplied with tipping mechanism, and the makers' nominal load capacity is 5 tons in every case.

horses, and the high prices charged for mechanical haulage, the question of transportation of material became somewhat acute. In one county it was agreed to purchase a steam tipping wagon and two trailers at a cost of £800. These were delivered in October, 1915. The short period that this wagon worked up to the end of the financial year could hardly be taken as a basis for arriving at a definite statement of cost, but after allowing for depreciation at the rate of 12½ per cent., and including the whole of the working expenses, the cost of hauling the material dealt with was only 3½d. per ton per mile.

It was not expected that this low rate would be maintained, and the figure of 5d. per ton per mile was estimated for the coming year.

The initial experiment proved so satisfactory that another wagon and two trailers were purchased at the cost of £850.

1916–1917.

	No. 1.	No. 2.
Date purchased	Nov. 1915	July, 1916
Cost with two trailers	£800	£850
Working period, up to 31st March, 1917	12 months	8 months
Working Costs—	£ s. d.	£ s. d.
Wages	144 7 9	123 – 8
Coal	80 4 1	60 9 –
Oil	8 16 9	6 – 10
Repairs, Tyres, etc.	103 10 9	33 7 2
	336 19 4	222 17 8
Add Depreciation at 12½ per cent.	100 – –	70 16 8
	£436 19 4	£293 14 4
No. of days worked	257	207
„ „ loads hauled	847	744
„ „ tons carried	7,513	6,602
„ „ miles travelled	5,080	3,357
„ „ „ „ loaded	2,540	1,678
„ „ tons hauled per journey	8·87	8·86
Cost per day	£1 14 0	£1 8 4½
„ „ mile	3 5¼	3 6
„ „ ton per mile	4·65d.	4·75d.

1917–1918.

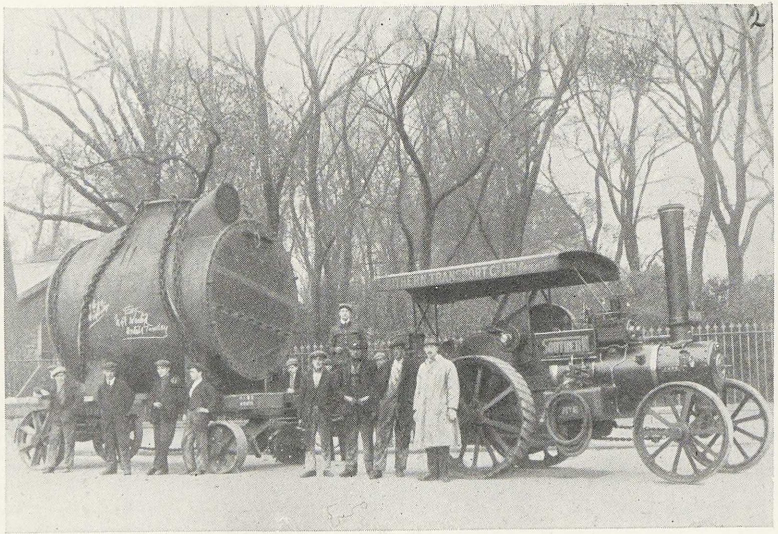
	No. 1.	No. 2.
Date purchased	Nov., 1915.	July, 1916.
Cost with two trailers	£800	£850
Working period, up to 31st March, 1918.	12 months.	12 months
Working Costs—	£ s. d.	£ s. d.
Wages	156 15 7	149 9 3
Coal	83 17 4	98 14 9
Oil	12 17 6	15 9 6
Repairs, Tyres, etc.	86 2 8	79 8 7
	339 13 1	343 2 1
Add Depreciation at 12½ %	100 – –	106 5 –
	£439 13 1	£449 7 1
No. of days worked	246	252
,, ,, loads hauled	754	1,029
,, ,, tons carried	6,827	8,783
,, ,, miles travelled	4,574	4,386
,, ,, ,, ,, loaded . . .	2,287	2,193
,, ,, tons hauled per journey . .	9·05	8·53
Cost per day	£1 15 9	£1 15 8
,, ,, mile	3 10	4 1
,, ,, ton per mile	5·09d.	5·76d.

1918–1919.

	£ s. d.
No. 1 with two trailers, purchased Nov., 1915 .	800 – –
No. 2 ,, ,, ,, ,, July, 1916 .	850 – –
No. 3 ,, ,, ,, ,, Nov., 1918 .	926 10 –
	£ s. d.
Working Expenses for 1918-19, including wages, repairs, coal, oil, etc.	1,144 19 4
Add Depreciation at 12½ % per annum	244 17 –
	£1,389 16 4

No. of days worked	595	
,, ,, loads hauled	1,637	
,, ,, tons carried	12,649	
,, ,, miles travelled . . .	11,674	
,, ,, ,, ,, loaded . .	5,837	
,, ,, Tons hauled per journey . .	7·72	
		£ s. d.
Cost per day		2 9 8½
,, mile		– 4 9
,, ton per mile		7·4d.

Wagons Nos. 2 and 3 were of the same make but different to No. 1.



HAULAGE OF HEAVY LOAD

This Condensor—weighing just over 12 tons, which, with the 4 ton weight of the carriage, made a total load of approximately 16 tons—was hauled from the Goods Depôt at Brighton to the Corporation Power House at Southwick.

(1889)—*bet. pp.* 106 *and* 107.

1919–1920.	£ s. d.
No. 1 with two trailers, purchased Nov., 1915 .	800 – –
No. 2 „ „ „ „ July, 1916 .	850 – –
No. 3 „ „ „ „ Nov., 1918 .	926 10 –
No. 4 (of a third make) purchased second hand from Government, May, 1919	500 – –

	£ s. d.
Working expenses for 1919–20, including wages, repairs, coal, oil, etc. . . .	1,837 8 1
Add Depreciation at 12½ per cent. p.a. .	374 2 11
	£2,211 11 –

No. of days worked	860
„ „ loads hauled	2,742
„ „ tons carried	17,956
„ „ miles travelled	15,770
„ „ „ „ loaded	7,885
„ „ tons hauled per journey . . .	6·54

	£ s. d.
Cost per day	2 11 5
„ „ mile	5 7
„ „ ton per mile	10·2d.

In Chapter XVII, on "What Records to Keep," will be found reproductions of specimen costing sheets, filled in, in respect of 5-ton steam wagons.

Approximate Average Weekly Running Costs of Steam Motor Tractor.

Capital Outlay.

Capital cost of Tractor designed for an approximate net haulage capacity of 10 tons £1,149 10 6

Approximate Weekly Running Costs.

	£ s. d.
Driver's wages	3 – –
Assistant's wages	2 5 –
Good steam coal at 39s. 6d. per ton, with an approximate consumption of 17 lbs. per mile, and an estimated run of 40 miles per day for 5 days per week = 200 miles per week on a coal consumption of 30 cwts.	2 19 3
Oil, waste and firewood	14 4
Repairs at £75 per annum	1 8 10
Depreciation at 7½% per annum	1 13 2
Interest on capital outlay at 6% per annum . .	1 6 6
Estimated Total weekly running cost	£13 7 1

Consequent cost per vehicle mile	16d.
Cost per net ton mile, loaded throughout journey .	1·6d.
Cost per net ton mile, loaded on half the journey only	3·2d.

These figures are exclusive of initial and maintenance costs of two 5-ton trailers, the purchase price of which could be taken, at the time this estimate was made, as approximately £300.

Tractor Haulage v. Team Labour.

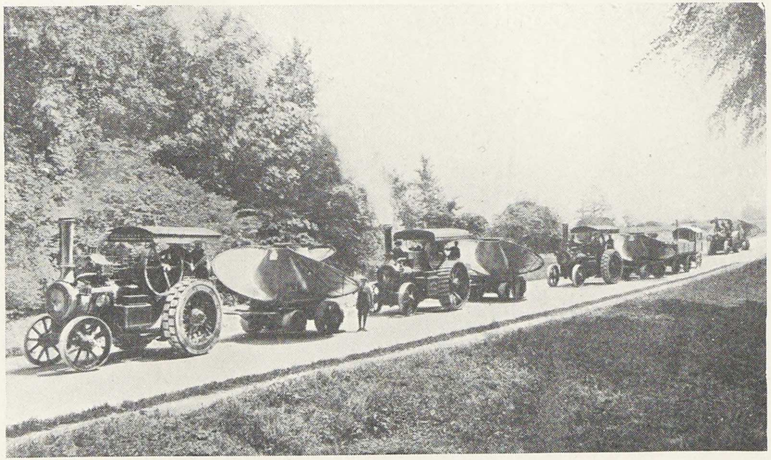
The particulars given below relate to County Council haulage, and are interesting both on account of the length of period which the statements cover, and also because of the comparison between Tractor Haulage and Team Labour.

No. 1 statement shows details of the working and costs of a 3-ton tractor and wagons for 8½ years. This tractor plant—which originally cost £517 in 1904—was the first of its kind in Scotland, and was sold in 1913 for £150.

No. 2 statement gives the costs of a 5-ton tractor—convertible to a steam road roller—for a period of 11 years; and No. 3 statement of a 5-ton tractor for a period of 5 years.

The final table shows the daily working costs of the tractors at 1919 rates, together with detailed costs per mile of working the tractor only and the tractor and wagons combined. Depreciation in both cases of the 5-ton machines has been based on the original capital sum of approximately £650 per tractor and wagons. One of the most important factors in the use of mechanical traction in this class of work is that the stone is taken direct from the source of supply to the road rolling operations, thus obviating the need for roadside depots, and the additional cost of handling entailed by them.

The figures quoted against Team Labour in the statements are based on Carting Contractors rates operating in the District during the periods to which they refer.



TRANSPORTING PROPELLERS BY ROAD

(1889)—*bet. pp.* 108 *and* 109

STATEMENT OF ANALYSIS OF WORKING AND COSTS OF NO. 1 TRACTOR —3 TONS—FOR 8½ YEARS ENDING 15TH MAY, 1913.

No. of days at work in 8½ years	1,934
Quantity of material hauled in 8½ years . .	41,254 tons
Average quantity hauled per day . . .	21·91 ,,
Total distance travelled in 8½ years . . .	42,390 miles
Average distance travelled per day . . .	23·20 ,,
Average cost per day including filling wagons and washing out, etc., including 15% for depreciation wear and tear for 7½ years and 22% for year 1913	19s. 7¾d.
Average cost per ton per mile including filling wagons, etc.	5·52d.
Average quantity of Fuel consumed per day .	2 cwts. 1 qr.

COMPARATIVE STATEMENT OF STEAM TRACTOR HAULAGE *v.* TEAM LABOUR FOR 8½ YEARS.

	£	*s.*	*d.*
Horse Haulage 41,254 tons carted 2 miles including filling at 2s. per ton . . . . (average cost per mile, 1s.)	4,125	–	–
Steam Tractor and Wagons, 41,254 tons hauled 2 miles including filling at 11d. per ton	1,896	–	–
Estimated saving in favour of Steam Tractor Haulage	2,229	–	–
Deduct initial cost of Tractor and Wagons . .	517	–	–
	1,712	–	–
Add produce of sale of Tractor Plant in May, 1913	150	–	–
Total estimated saving in cost for 8½ years . .	£1,862	–	–

STATEMENT OF ANALYSIS OF WORKING AND COSTS OF NO. 2 TRACTOR —5 TONS—FOR 11 YEARS ENDING 15TH MAY, 1919.

(This Tractor is convertible to Road Roller).

No. of days at work hauling in 11 years . .	1,468 days
No. of days rolling in 11 years	1,366 ,,
Quantity of material hauled in 11 years . .	34,482 tons
Average quantity hauled per day . . .	23·45 ,,
Total distance travelled in 11 years . . .	33,471 miles
Average distance travelled per day . . .	24·01 ,,
Average cost per day hauling including filling wagons and washing out, etc., depreciation wear and tear included at the rate of 20%	28s. 9d.
Average cost per day rolling	22s. 6½d.
Average cost per ton per mile	7¼d.
Quantity of fuel consumed per day . . .	3¾ cwts.

COMPARATIVE STATEMENT OF STEAM TRACTOR HAULAGE *v.* TEAM LABOUR FOR 11 YEARS.

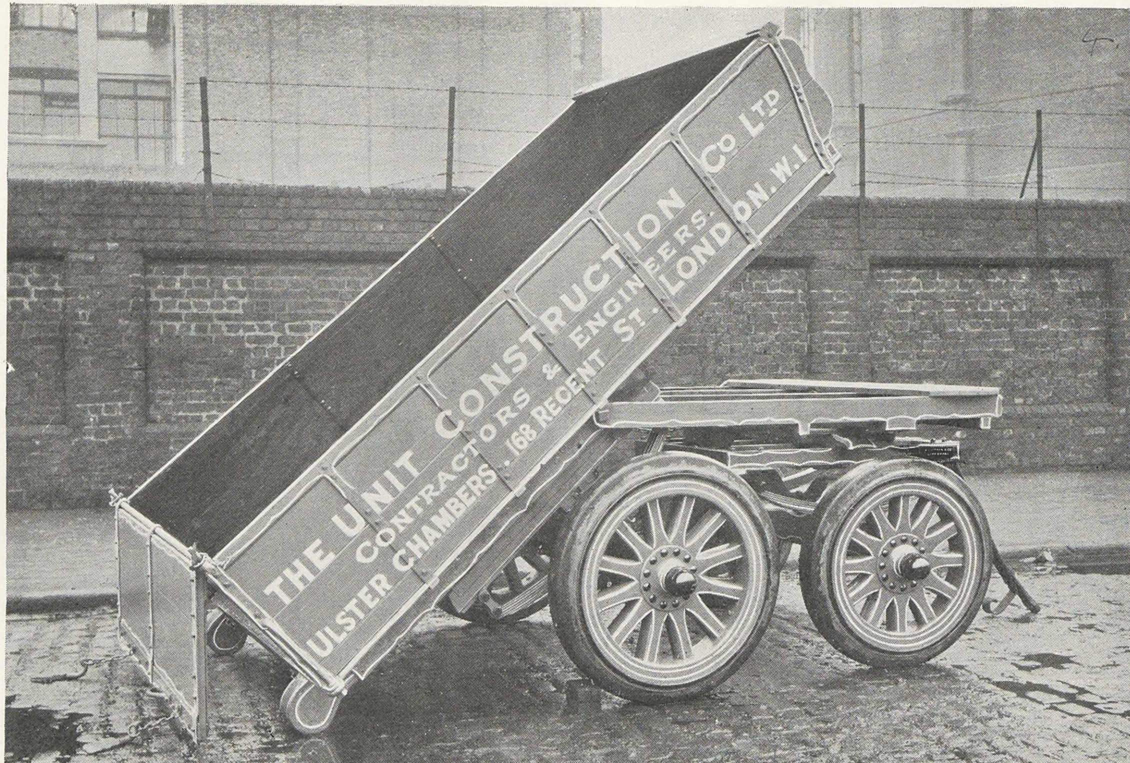
	£	s.	d.
Horse Haulage 34,482 tons carting 2 miles including filling at 2s. 11d. per ton	5,025	–	–
(average cost per ton per mile 1s. 5½d.)			
Steam Tractor and Wagons, 34,482 tons hauled 2 miles including filling at 1s. 2½d.	2,083	–	–
(average cost per ton per mile 7¼d.)			
Estimated saving in favour o Steam Tractor Haulage	2,942	–	–
Deduct initial cost of Tractor Wagons and rolling gear	750	–	–
	2,192	–	–
Add present estimated value of plant	500	–	–
Total estimated saving in cost for 11 years . .	£2,692	–	–

STATEMENT OF ANALYSIS OF WORKING AND COSTS OF NO. 3 TRACTOR —5 TONS—FOR 5 YEARS ENDING 15TH MAY, 1919.

No. of days at work in 5 years	675
Quantity of material hauled in 5 years . .	11,600 tons
Quant ty of material hauled per day . . .	17·18 „
Total distance travelled in 675 days . . .	14,040 miles
Average distance travelled per day . . .	20·80 „
Average cost per day including filling wagons, washing out, etc. (Depreciation, wear and tear included at the rate of 20%)	50s. 8d.
Average cost per ton per mile	11d
Quantity of fuel consumed per day . . .	3½ cwts.

COMPARATIVE STATEMENT OF STEAM TRACTOR HAULAGE *v.* TEAM LABOUR FOR 5 YEARS.

	£	s.	d.
Horse Haulage, 11,600 tons carting 3 m les including filling at 6s. 3d. per ton	3,625	–	–
(average cost per ton per mile 2s. 1d.)			
Steam Tractor and Wagons, 11,600 tons hauled 3 miles including filling at 2s. 11d.	1,691	–	–
(average cost per ton per mile 11d)			
Estimated saving in favour of Steam Tractor Haulage.	1,934	–	–
Deduct initial cost of tractor and wagons . .	650	–	–
	1,284	–	–
Add estimated present value of plant . . .	500	–	–
Total estimated saving in cost for 5 years . .	£1,784	–	–



A USEFUL TYPE OF RUBBER-TYRED END-TIPPING TRAILER

(1889)—*bet. pp.* 110 *and* 111

Detailed Cost Per Day of Working 5 Ton Steam Tractor and Wagons for Year 1919.

	s.	d
Driver	10	–
Coals, Oils, Waste, etc.	9	–
Depreciation, wear and tear, and Interest on Capital based on cost of plant (viz. £650) working 270 days per annum . .	12	–
3 Fillers	21	–
Sundries	1	–
Total . .	53	–

(*a*) Detailed Cost Per Mile for Tractor Only.

	s.	d.
Driver		$5\frac{1}{4}$
Coals, etc.		$4\frac{3}{4}$
Depreciation, wear and tear, and Interest on Capital (25%), based on cost of plant (viz., £500), working 270 days per annum . .		5
Insurance, rents, etc.		$\frac{1}{4}$
Sundries		$\frac{1}{2}$
Per mile . .	1	$3\frac{3}{4}$

Tractor working cost per mile: 1*s*. $3\frac{3}{4}$*d*.

(*b*) Detailed Cost Per Mile for Tractor and Wagons Combined.

	s.	d.
Driver		$5\frac{1}{4}$
Coals, etc.		$4\frac{3}{4}$
Depreciation, wear and tear, and Interest on Capital (25%), based on cost of plant (viz., £650), working 270 days per annum . .		$6\frac{3}{4}$
Insurance, rents, etc.		$\frac{1}{4}$
Sundries		$\frac{1}{2}$
	1	$5\frac{1}{2}$

Tractor and Wagons working cost per mile: 1*s*. $5\frac{1}{2}$*d*.

The overhead charges in the foregoing have been based on pre-war cost of steam tractor and wagons.

CHAPTER XIV

TRAILERS

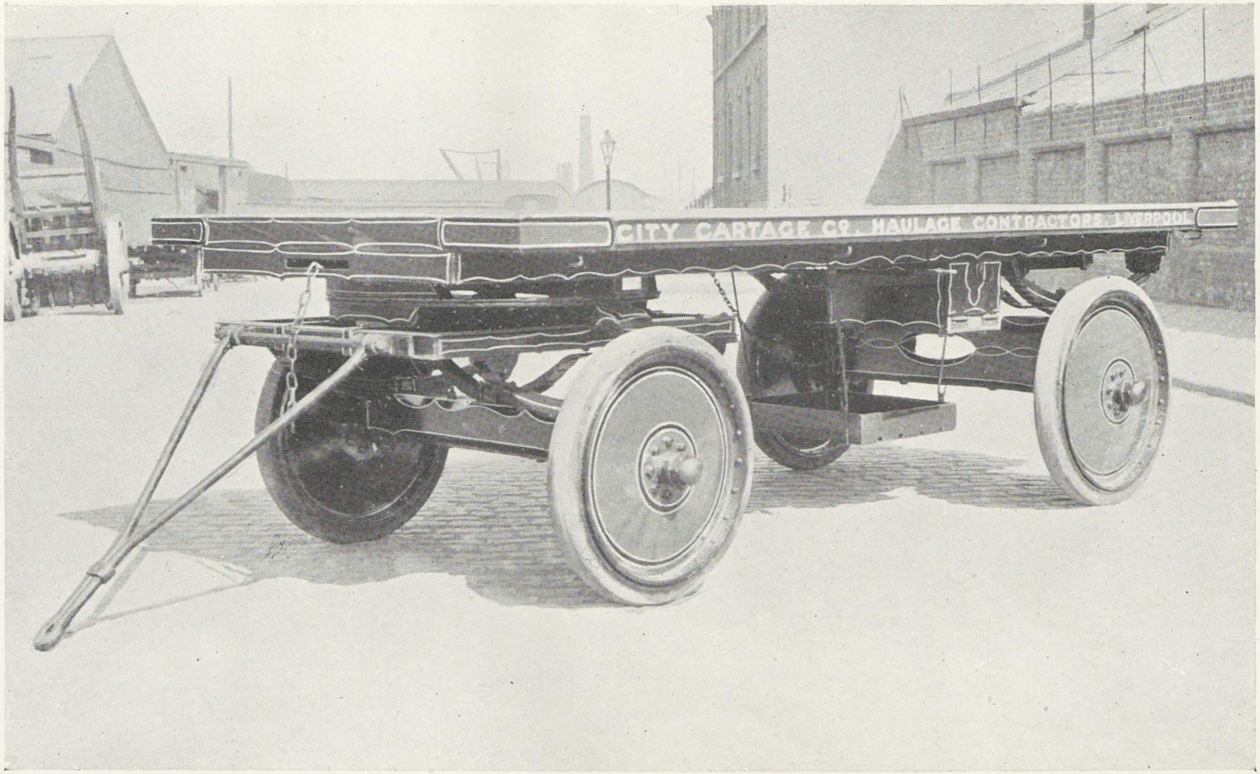
It is a matter of surprise that the use to which trailers are applied in Great Britain, in connection with mechanical transport propelled by means of liquid fuel, is so limited.

Many owners of commercial motors fitted with internal combustion engines connect the use of trailers with steam driven vehicles only, yet there is no reason—as was demonstrated in many countries during the war—why the trailer should not, in many cases, be employed successfully with the petrol-driven van. One of the chief disadvantages is that the clutch of the internal combustion engined chassis is subjected to severe stress when hauling a loaded trailer. The taking-up load is naturally much greater ; and there is no doubt that before the war many van-owners, although enterprising, gave up the idea of using trailers after a trial, chiefly on account of clutch trouble.

To Obviate Clutch Trouble.

There is, however, no practical reason why such trouble should be experienced if the chassis is designed with a view to withstand the extra loads. This point should be fully grasped before any experiment is tried, for it is courting disaster to expect a feature built to transmit a definite maximum amount of power in order to overcome a stated maximum resistance, to work successfully under conditions of greater severity.

A detriment to the employment of a trailer of the heavy type is the reduced maximum legal speed, but with many classes of goods the increased period of



AN UP-TO-DATE TRAILER OF USEFUL DESIGN

(1889)—*bet. pp.* 112 *and* 113

time taken for the deliveries would be more than compensated for by the extra loading capacity available.

Disadvantages.

There are two other disadvantages which will at once strike the trader—first, the possible necessity of having to employ a second man to travel on the trailer; and, secondly, the difficulty of manoeuvring when loading and unloading. Many firms already send out two men on each van, so that in these cases no additional expense need be incurred, while provided that brakes, controllable from the driver's seat, are fitted to the trailer, it can be run as a rule unattended. With regard to the question of ease of manipulation, there are trailers designed so that they can be steered when run in a reverse direction; thus their use need not be discounted on the score of difficulty in manoeuvring.

With some trades the limiting factor is the working hours of labour. If a man's full day is taken up with the delivery of goods which can be carried without overloading on his van alone, there is little to be gained by the use of a trailer.

Advantages.

The most important of the advantages is obviously the extra load which can be carried, which means that the van can earn considerably more money for a comparatively small additional expenditure. As can easily be seen, the variation between the minimum and maximum paying loads of a van is greatly increased by the use of a trailer. For instance, in the case of a man owning a 3-ton vehicle, the minimum paying load will probably be about 1 ton. The variation between his minimum and maximum paying loads is therefore from 1 to 3, but with a trailer capable of carrying a load of, say, 2 tons, it will be widened from 1 to 5.

Again, the employment of trailers may in many cases solve a difficulty which could not be got over in any other way, for while the van is travelling with a loaded trailer, the loading or unloading of another can be proceeded with against the return of the van. Much time, and consequently money, may be saved in this way, for it must never be forgotten that a motor represents a certain amount of capital, and in order to get the highest return it should be kept doing useful work as far as is consistent with proper organization of the despatch service.

Commercial Utility of Trailers.

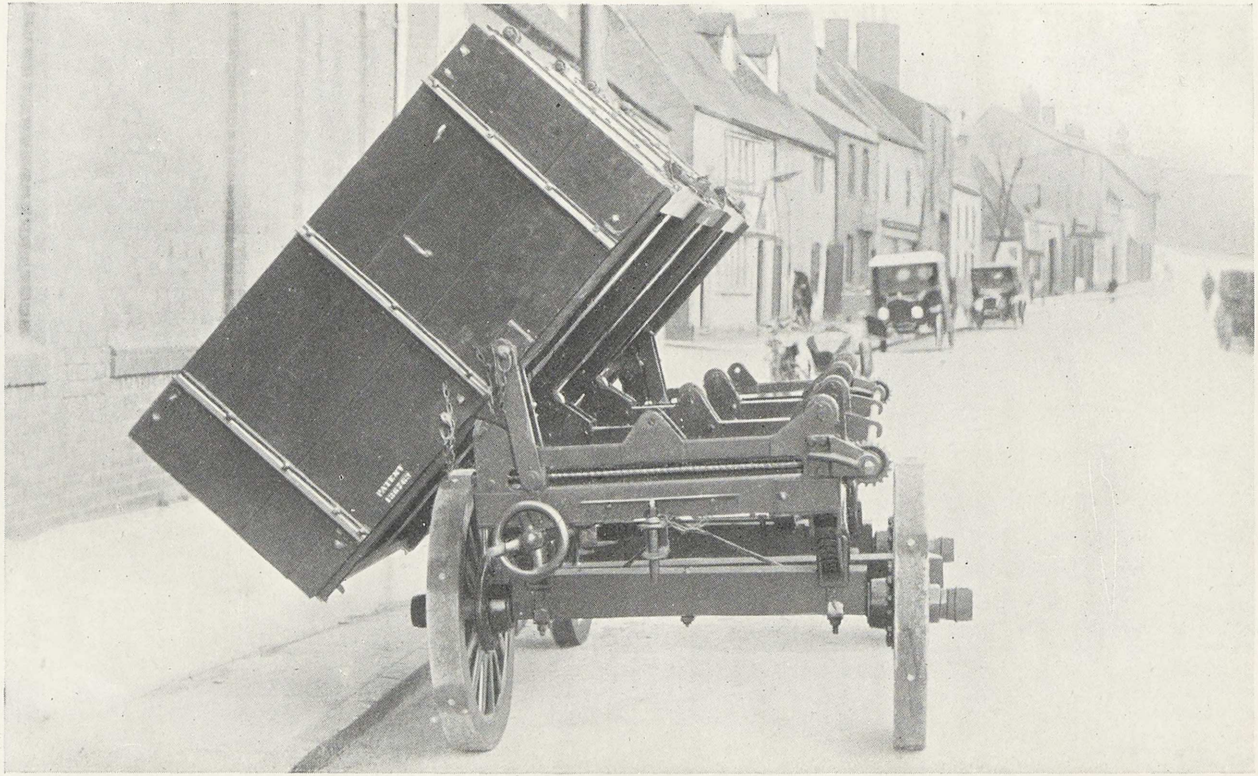
A point to be considered when adopting trailers is that in order to obtain the best and most economical results, it is essential that the trailer should be of suitable and substantial build. The use of old wagons and carts, which were not designed for fast travelling, is to be deprecated, and is undoubtedly one of the causes—leading as it has done to failure—which has made many shy of employing trailers to any extent.

Trailers are now made to suit almost every requirement varying in load capacity from a few hundredweights up to 5 tons.

The lighter types are supplied with pneumatic tyres, and when drawn by light vans possess the great advantage of being able to travel at a higher legal maximum speed than the solid-tyred vehicles.

The following list of some of the trades which employ trailers gives an idea of their utility.

Shopfitters, Haulage Contractors, Oil Refiners, Fruit Growers, Lard Importers, Removers, Motor Repair



A GOOD EXAMPLE OF THE SIDE-TIPPING TRAILER

(1889)—*bet. pp.* 114 *and* 115

Works, Coal Merchants, Millers, Grocers, Brewers, Furnishers, Tar Refiners, Cement Manufacturers, House and Estate Agents, Machinery Makers, Electrical Engineers, Wholesale Chemists and Druggists, Confectioners, Building Contractors, Wool Merchants, Drapers, Circus Proprietors, and so on. The question of labour saving bodies is dealt with in another chapter.

CHAPTER XV

PASSENGER CARRYING—TYPES OF VEHICLES

One of the best paying and the least risky branches of motor transport is that of passenger carrying, especially as regards the larger types of public service vehicles.

The man who is likely to obtain the best results is the one who purchases his vehicles after ascertaining the class of work to which they are to be put, and the importance of suitability can hardly be too much insisted upon.

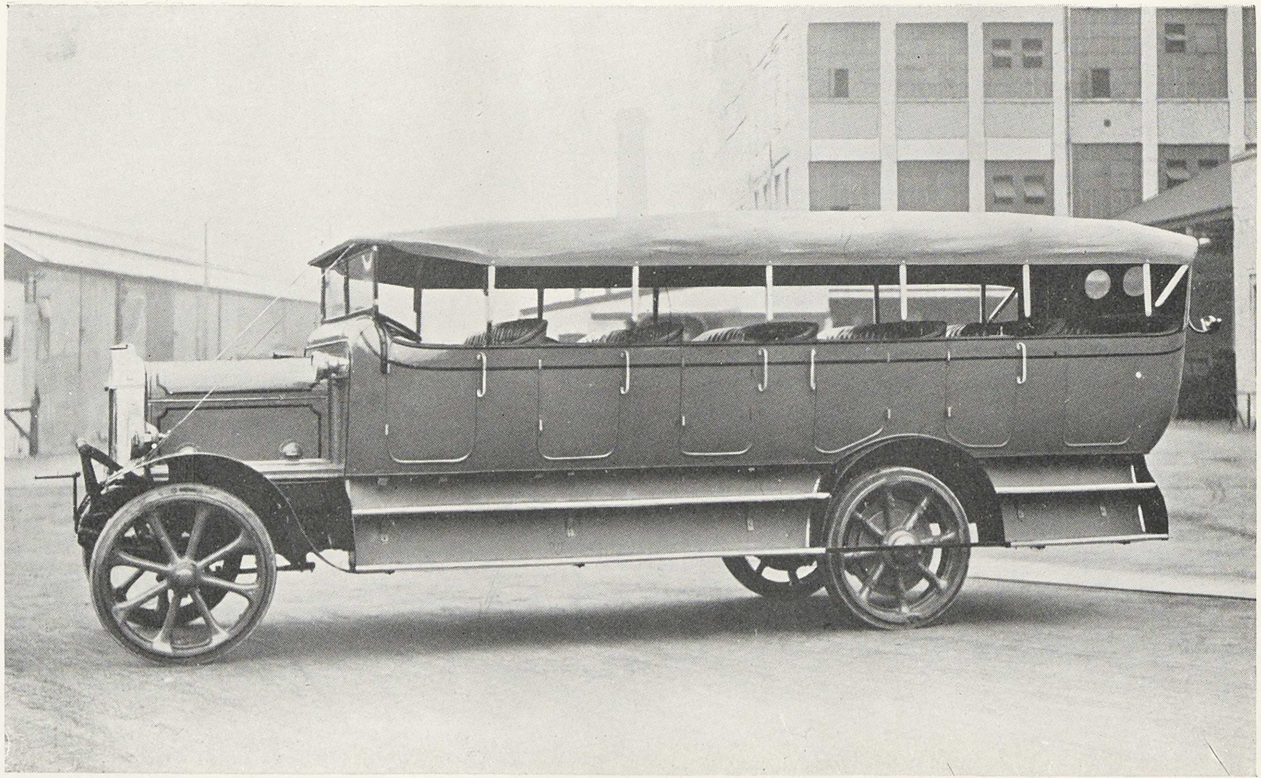
This is so in every branch of mechanical transport, and passenger carrying is no exception.

The Question of Suitability.

To take two exaggerated examples, no trader organizing such a service where long, or comparatively long distances, are to be run would choose an externally-fired steam chassis, or a vehicle with an all-electric drive. According to such conditions of the service as—

(1) The average number of passengers,
(2) Town or Country work or a combination,
(3) Condition and contour of roads,

so must the type of chassis and body be determined, if real success is to be gained. Cases vary so widely, and there is such a broad range in the choice of a suitable chassis, that it is impossible to lay down any definite rules on the matter. There are, however, one or two points which might be mentioned as likely to prove of help to those who do not possess much knowledge of the subject, and who naturally wish to avoid the disastrous pitfall of buying the wrong machine.



A 45-H.P. CHAR-À-BANC WITH A SEATING CAPACITY OF THIRTY

(1889)—*bet. pp.* 116 *and* 117

Essential Points.

The size and power of the vehicle should be relative to the number of passengers which it is estimated are, as a rule, to be carried. An adequate degree of comfort should be provided, especially now that road surface is not so good as it was in pre-war days.

Provision should be made, if possible, without detracting materially from the seating accommodation, for light luggage; or in the case of a locality being chosen which is dependent on fine-weather visitors, a double purpose body in which the seats are removable may well repay any extra initial cost. In this way during the winter months a combined passenger and goods service, or one for goods only, may be maintained. A trial run and common sense will prove the best guides in connection with such chassis requirements as engine and brake powers, suitable gearing, etc.

Roughly speaking, it may be stated that the heavier the load to be carried and the more hilly the district, the lower should be the gearing of the chassis.

For work in traffic it is imperative for economic reasons that the engine should be capable of flexibility and slow and even running under load, also that the transmission should be smooth in the uptake.

The question of pneumatic tyres for commercial motor vehicles is especially important with regard to those of the passenger carrying type, and is dealt with under "Tyres" in Chapter XXI.

As to the cost of the service, much will depend on how the vehicle or vehicles are handled and looked after. It is sufficient to say that this point must in no wise be overlooked, for many a service has been converted from a failure to a success simply by the adoption of good inspection and overhaul organization, and by the employment of drivers who had consideration not only for their passengers, but also for their machines.

In considering the different types of passenger-carrying vehicle, the chassis which is driven by means of a petrol engine with power transmitted by clutch and gear box to a rear live axle is the best known, and consequently the most widely used. At the same time there are two other kinds of chassis which deserve attention.

The Petrol-Electric Chassis.

One of these is the petrol-electric, and the other the automatically-fired steam car.

Both of these systems are suitable for passenger transportation, and especially on services where many stops and starts occur, for the reason that machines of these descriptions are smooth and quick at taking up the load from rest.

In the petrol-electric car the power is supplied by means of an ordinary liquid fuel engine, which drives a dynamo. Current is generated by the latter, and in turn drives an electric motor. The final transmission is obtained by the employment of a propeller shaft and live rear axle.

If two electric motors are used, they may be arranged to drive the rear road wheels direct through suitable gearing, and thus the need for a differential gear is eliminated. The most customary practice, however, is to adopt the former design. The driver has no clutch or gear lever to manipulate, but merely the controller and speed regulator. In the best-known system—which has stood the test of a number of years—these are carried in separate aluminium cases, the controller being of the tramway type, with screw adjustment to the contact fingers, and the speed regulator of the multiple contact make.

A SINGLE-DECK OMNIBUS IN THE CONSTRUCTION OF WHICH THE COMFORT OF THE PASSENGERS HAS BEEN STUDIED

(1889)—*bet. pp.* 118 *and* 119

This operates by varying the resistence in the shunt field of the generator, and by shunting the series field of the motor.

The chief disadvantage of the petrol-electric chassis is that owing to the necessity for running the engine at comparatively high speed, fuel consumption is apt to be heavy.

It would seem, however, that great possibilities lie in a magnetic form of transmission, for any system which can combine simplicity with reliability and yet prove economical would obviously have a great future before it.

The Automatically-fired Steam Car.

Although not quite so simple in the handling as the petrol-electric, this car possesses great power of rapid yet smooth acceleration, and this quality is a distinct asset, for the reason that a better schedule can be kept than with a machine which is slow at starting and stopping.

As regards means of effecting economy in the operation of passenger-carrying vehicles, the remarks in Chapters XXI, XXII, and XXIII apply.

CHAPTER XVI

CONSIDERATIONS IN THE ORGANIZATION OF A MOTOR SERVICE, AND THE NEED OF KEEPING RECORDS

CONSIDERATIONS which affect the economy of the running of a motor service are touched upon in other chapters, but it is intended here to lay stress on one or two points which, if not entirely overlooked, are often given insufficient attention in the matter of successful organization of Motor Delivery Services.

Road Surface.

The first point to be mentioned is that of road surface. The bearing which this has upon the economical results of mechanical road transport is great, and it is essential for success that it should receive due regard from time to time as conditions change. Wherever it is possible, the routes of a despatch system should be made out over roads which are in a good or fair state of repair, and this should be arranged for especially on return journeys, when the van will probably be running light or with a small portion only of its maximum load. This is not, of course, an easy matter, but it should be remembered that a few additional miles on a comparatively good road are not only run in the same amount of time as will be taken on a shorter but bad route, but will make ample return by reduction in the cost of maintenance.

The very great stress and consequent strain, and the alternating stresses producing fatigue of the metal and subsequent fracture caused to all parts of the mechanism when the van is run at speed over a potholed or corrugated road, are accountable for much undue wear and tear. If van owners saw their

A RECENT TYPE OF LONDON OMNIBUS

(1839)—*bet. pp.* 120 *and* 121

machines slogging along bad roads, bumping, swaying and groaning, as may be seen any day, they would undoubtedly be surprised that the machinery stands up to its work, year in, year out, in the way that it does.

The wise despatch manager will be he who keeps his eye on the changing condition of the roads, and who, when one gets badly worn, and the deliveries allow, changes the route for one of which the surface is in better repair.

A great deal necessarily depends upon the driver of the van, but this has been discussed in the Chapter headed " Drivers and Driving."

Overloading Courts Disaster.

One of the commonest mistakes made in the working of commercial motor transport, and one of the chief sources of unnecessarily high upkeep expenditure, is overloading. Invariably to load a van in excess of the maximum weight for which it was designed and built, is to court disaster. The temptation to put on board an extra quantity of goods when the space is available is great, but those responsible for the van must remember that by doing this constantly they are, without a shadow of doubt, increasing their running expenses disproportionately, and laying up for themselves trouble in the future. A chassis is designed throughout for a given maximum load, and if this is exceeded the extra stress caused to all parts of the mechanism becomes too great, and deformation or shear occurs, or, put untechnically, wear takes place long before it is legitimately due. This entails lengthy workshop repairs, even if breakdowns on the road are avoided.

It is difficult to bring this point home without figures or without becoming too technical, but let those who are interested in the matter remember the fact that any benefit derived from the extra amount of goods delivered in this way will not nearly balance the loss caused by the increased period of time during which the van has to be laid up for the overhaul, apart from the augmented cost in money for labour and materials.

The ideal condition for the running of a motor delivery van is obviously that whereby the maximum load can be carried throughout the whole journey, but unfortunately such a state of things is generally unattainable in practice.

Wherever possible, however, the service should be arranged so that the motor can transport a useful load on its return journey, and thus reduce the cost of the delivery service per ton mile.

Keep Accurate Records of Despatch Service.

Whether a man is the owner of one commercial motor vehicle only, or of several hundred, it is of the greatest importance to his interests that full and accurate records of everything in connection with the Despatch Service should be kept.

This point cannot be emphasized too strongly, because so many traders and business houses fail to realize the absolute necessity of keeping adequate records if really satisfactory results are to be attained. Manufacturers of industrial motors are constantly drawing the attention of the writer to this neglect.

The majority of them would infinitely prefer that a proper tally were kept of the van's behaviour, because not only would this be a help to them in remedying any defects in design, but, in the case of a well thought out and soundly constructed vehicle, it would demonstrate its true value. The man who stands to gain most from the keeping of records, however, is the owner ; yet the number of commercial motor vehicle users who treat this matter seriously are few and far between.

Motor accounts may be kept simply and accurately, so that while a minimum of time and labour is taken up in their keeping, all useful information which is likely to be required at any time, may be obtained at a glance. Such records will more than pay their way. On the other hand, the writer has occasionally come across the man who loses sight of the real object in view, and who in an excess of enthusiasm (since the keeping of records can prove quite an absorbing work) runs his account with such a wealth of unnecessary detail and complication, that he incurs considerable expense, and can seldom lay his hand on the particular information which is wanted. Simplicity and accuracy are the two essentials.

What Information is Required.

The registering of a precise yet simple log can be greatly facilitated by the use of a recording instrument. These machines register automatically on specially designed paper discs—

(1) The hour of departure.

(2) The time and duration of each stop. (A most useful record, since it is difficult to obtain accurately without an automatic instrument.)

(3) The distance covered.

(4) The speed.

(5) The hour of arrival.

From these it can be seen at a glance if the driver has made use of excessive speed to make up for any unauthorized halt. The reading of these discs is not a difficult matter considering the size of the scale, and accuracy is obtained within a practical degree.

Value of Proper Records.

If an owner keeps no records, or insufficient ones, he can never run his delivery service at its best. No two services are necessarily alike, and all have their weak spot. Without sound knowledge of the ins and outs of the despatch, it is impossible to locate and remedy the weak points, nor can any control be kept over the driver when he is on his rounds.

As an illustration, a vehicle may be employed on a service for which it is unsuited. In the case of a proper log being kept this will be detected within a week or two, whereas without means of observation it might be six months or even a year before the owner discovered that the motor was not bringing in the best return of which it was capable.

It is no easy matter for the trader who has little or no experience of motor delivery to obtain the best results from his van from the outset. The cautious man will, therefore, put the vehicle on the service which he considers likely to prove the most suitable, and will let his book of records confirm or alter his decision.

A suggestion of what items should be recorded will be found in the next chapter.

CHAPTER XVII

WHAT RECORDS TO KEEP

For the benefit of those who have not had any experience of motor despatch work on which to base their system of record keeping, a list of the various items which it is considered are useful to form the foundation of a log are given below.

The following list may look formidable at first sight, but will be found in practice to be perfectly simple in the keeping if done day by day; and since several of the items can be deduced from others, the number should not impose an onerous task either upon the driver or the book-keeper.

A Log for Every Car.

A separate book should be kept for each car, and the designating number of a van should be noted on its own book to prevent any possible error occurring where more than one vehicle is in service. Every day of the month should have its own space, as in this way any days on which the machine was not in commission can easily be ascertained.

Each of the following items should have its own column, and should be entered daily, and space for the weekly summaries should be allowed for—

(1) Date.

(2) Time of departure for loading depôt.

(3) Time of return to garage.

(4) Places of delivery.

(5) Times of arrival and departure, when possible.

(6) Total day's mileage.

(7) Total time (given by difference between items 2 and 3).

(8) Total time taken in delivery (given by sum of times of item 5).

(9) Running time, including involuntary stops (given by difference between items 7 and 8, minus stops for meals).

(10) Involuntary stops, reason and duration.

(11) Miles per hour of day's journey (given by dividing item 6 by item 7).

(12) Miles per hour of running time (given by dividing item 6 by item 9).

(13) Weight of load (*a*) out and (*b*) home.

(14) Nature of load (*a*) out and (*b*) home.

(15) Total distance load carried.

(16) Ton-miles out and home.

To obtain item 16 multiply load in tons by distance carried in miles. Where deliveries and collections are made en route the loads will have to be " average " loads.

Running Costs.

The next list of records should be of the quantities and cost of fuel and lubricants, and any charges connected with the running of the vehicle, as for instance, for a petrol van, gallons of spirits, pints of engine oil, pounds of grease, gallons of gear oil, material used, labour on car, and by whom done—this last entry forms a useful check.

Tyres, carbide, paraffin, waste, etc., and petty cash expenses on the road should also be entered.

Successful Operation Assured.

From the record of these items in conjunction with the "standing charges" enumerated in a subsequent chapter, the weekly, quarterly and yearly costs can easily be calculated, and will show sufficient detail of the running and the cost of the service, to ensure successful operation, provided, of course, other conditions, such as the employment of a van suitable to its work, are fulfilled.

With such records as those of cost per ton-mile, miles per hour when running, and miles per hour including all stops, the owner can by comparison tell at a glance how each van—of whatever type and size—and each driver, is working.

No doubt everyone has his own ideas about an arrangement or a system of record-keeping, but if the above is taken as a basis and carefully and accurately observed, it will be found to be well worth the trouble involved, and the owner will gain the maximum of usefulness with the minimum of cost from his mechanical transport.

As a concrete example of a full costing scheme inaugurated by a County Council, specimen sheets (partly filled in, with the exception of the yearly one) are reproduced hereafter. (*See* inset.)

Interest on capital is not taken into account, because the purchase money comes out of revenue.

The County Surveyor was not satisfied, at the time that these statistics were got out, with the Standard Ton-Mileage system. Therefore, this heading has been disregarded. It was hoped that a more reliable method for this item, based on the actual work each lorry has carried out in the past, would be arrived at shortly.

With reference to the bonus system, each driver is allowed—in addition to his wage—" running money " amounting to 20s. per month; provided he has no mechanical breakdown during the month.

A mechanical breakdown is defined as " any form of breakdown which prevents the steam wagon or petrol lorry being used."

Upon the completion of the month, the Divisional Surveyor's certificate form is filled in and forwarded to the County Surveyor, stating whether or not a driver is entitled to his " running money."

The County Council possess sixteen self-propelled vehicles for work upon main roads. Three are petrol lorries and thirteen are steam wagons. In order to ensure that economy and efficiency are regularly maintained in the running and working of this mechanical transport, the following scheme has recently been commenced for costing and analysing the daily, weekly, monthly and yearly work done by each vehicle.

The driver of each vehicle fills in every day a daily work sheet showing the number of journeys and mileage made by his vehicle, loads carried, fuel, lubricating oil, etc., consumed. These particulars are checked by the foreman and sent in weekly to the Divisional Surveyor, who examines them and forwards them to the County Surveyor.

A weekly sheet is then issued by return to the Divisional Surveyor, showing the fuel, oil, and waste consumption and running cost per ton mile. Any excessive consumption of coal, petrol, and oils or undue empty mileage is by this means at once noted and inquired into, and immediate improvement is the required result.

At the end of the month, a monthly summary of cost is made out, and this includes in addition to the fuel, oils, etc. (mentioned in the weekly report sent to the Divisional Surveyor), the cost of repairs, renewals, and wages (including bonus).

This monthly summary is sent to each Divisional Surveyor accompanied by a letter emphasizing any points in connection with ton mileage, repairs, etc., or general management that call for attention.

A yearly summary of work done and the total expenditure for the year under the various headings, including depreciation, insurance, fuel, wages, running costs and other charges, is kept for each vehicle.

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M.H. 1.

MAIN ROADS. MECHANICAL HAULAGE. DAILY SHEET.

MOTOR LORRY / STEAM WAGON } No....................................... MAKER..............*Steam Wagon*........... *12th*.......day of........*April*,...........1920.

Journey No. (1)	Place where Standing. (2)	Place of Loading. (3)	Place of Delivery. (4)	Road No. (5)	Miles Covered. Full. (6)	Miles Covered. Empty. (7)	Material Hauled. Description. (8)	Material Hauled. Actual Weight Carried in Tons.	Enter below all Stores received or Repairs done, giving Particulars and Name of Tradesman. Also Quantity of Coal or Petrol, and Oil, etc., used. (9)	State here if any Stoppage of Work, amount of time lost and reason for same. (10)
1	—	—	—	44	7		*Men & Tools*	3¾	**Stores received.**	
2		—	—			3				
3		—	—		11½		*Road Sand*	3¾	**Repairs done.**	
4		—	—			11½				
5		—	—		11½			3¾		
6		—	—			1½				
7									**Coal** ....4....Cwts.	
8									**Petrol** ....Galls.	
9									**Cylinder Oil** ....1 Qts.	
10									**Engine Oil** .... Qts.	
11									**Grease** ....lbs.	
12									**Waste** .... 2 ....lbs.	
Totals to be filled in at Headquarters.					30	16		11¼	Ton-Mileage........112½.........	

Commencement of Day's Running. Time....6........a.m. **Standing Time.**
Termination ,, ,, ,, ,, ...5.30....p.m. Total Hours....*Nil.*
Total Hours run........*10h. 10m.*......................................

I hereby certify the above particulars to be correct (*Signed*)...................Driver.
Examined (*Signed*)..Foreman.

At the conclusion of the Day's Work this Duplicate Sheet to be sent to the Foreman in charge. The Foreman will check and sign each sheet. The Foreman will forward the DUPLICATES to the Divisional Surveyor as required.

M.H. 2.

MAIN ROADS. MECHANICAL HAULAGE. WEEKLY REPORT.

MOTOR LORRY / STEAM WAGON } No....................................... MAKER............*Steam Wagon, Hydraulic End Tipping.* DRIVER'S NAME..

EXACT TARE WEIGHT OF VEHICLE T........7........ C....1............ Q........0.......

WEEK ENDING.......................*17th April*,..........................1920

Day of week (1)	Day of Month. (2)	Petrol used. Galls. (3)	Coal used. Cwts. (4)	Oil used. Qts. (5)	Waste used. lbs. (6)	Grease used. lbs. (7)	Running* Costs. £ s. d. (8)	Ton—Mileage. (9)	Cost per Ton—*—Mile. Pence. (10)	Average Length of Journeys in Miles. Full. (11)	Miles Covered. Full. (12)	Miles Covered. Empty. (13)	Total Vehicle Mileage. (14)	Ton—Mileage. (15)	Total Tare Weight in Ton—Miles (16)	Ton—Vehicle—Mileage. (17)	Tonnage Hauled. (18)	OBERVATIONS. (19)
MON.	12		4	1	2			112½		10·00	30	16	46	112½			11¼	
TUES.	13		4	1				105½		9·83	29½	16	45½	105½			10¼	
WED.	14		3½	1				66		9·50	19	15	34	66			6¾	
THUR.	15		2	1½				22½		1·50	6	20	26	22½			15	*Hauling Tar-macadam*
FRI.	16		2	1				48¼		4·75	14¼	14¼	28½	48¼			9½	
SAT.	17		1½	¾				30		2·75	11	10	21	30			13¼	
TOTALS	5½ *Dys.*	—	17	6¼	2			384¾		5·78	109¾	91¼	201	384¾	1,417	1,801¾	66¼	
COSTS	—	2	11	1	—	— 8	2 11 9											
							2 11 9	384¾	1·61									

Petrol. ....Miles per Gallon.
Oil. ....3·10....Quarts per 100 miles.
Coal. ....11·82....Miles per Cwt.

* The Costs given on this report are not the total Running Costs, and do not include Wages, Repairs, Tyres, etc., which are given in the Monthly Report.

M.H. 3.

MAIN ROADS. MECHANICAL HAULAGE.

MONTHLY STATEMENT OF RUNNING COSTS AND PARTICULARS OF PETROL MOTOR LORRIES AND STEAM WAGONS.

MONTH ENDING............*30th April*,...........1920.

Registered Number of Motor Lorry or Steam Wagon. (1)	Division. (2)	Petrol or Steam. (3)	Tonnage Hauled. Tons. (4)	Ton—Mileage. (5)	Running Costs from Weekly Sheets. £ s. d. (6)	Repairs & Renewals for Month. £ s. d. (7)	Tyres. £ s. d. (8)	Wages (Driver & Mate). £ s. d. (9)	Bonus (Driver). £ s. d. (10)	Total Running Costs. £ s. d. (11)	Cost per Ton—Mile. Pence. (12)	Average Length of Journeys in Miles. (13)	Ton—Mileage Standard. (14)	Difference between Columns 5 & 14. Above T.M.S. (15)	Difference between Columns 5 & 14. Below T.M.S. (15)	Vehicle Mileage. (16)	Ton—Vehicle—Mileage. (17)
—	N.W.	STEAM.	324	1,275½	8 16 8½	1 19 10	7 9 6	25 6 11	1 – –	44 12 11½	8·40	4·00	—	—	—	769	6,697
—	N.W.		249¾	794½	8 6 1		4 4 1	24 4 2	1 – –	37 14 4	11·39	3·19	—	—	—	432¼	3,674
—	N.W.		292	1,312	10 5 7		6 7 5	24 3 5	1 – –	41 16 5	7·65	4·53	—	—	—	655¼	5,956
—	N.E.		236¼	1,482½	8 5 9½		8 3 10	27 14 2	1 – –	45 3 9½	7·32	6·50	—	—	—	842½	7,748½
—	N.E.		112½	528¾	5 – 11		2 14 10	10 2 9	1 – –	18 18 6	8·59	4·70	—	—	—	282	2,601½
—	N.E.		278½	1,052	10 17 11		6 2 1	25 3 3	1 – –	43 3 3	9·85	3·80	—	—	—	628	5,094
—	S.E.		325¾	1,094¼	7 2 2½	10 10	5 11 10	18 4 11	1 – –	32 9 9½	7·13	3·36	—	—	—	575	5,356½
—	S.E.		220½	871½	7 5 5	1 8 6	4 17 5	17 13 1	1 – –	32 4 5	8·87	3·95	—	—	—	501	4,566½
—	S.W.		174	1,069	8 10 9	12 – 10	6 14 3	21 9 11	2 – –	50 15 9	11·40	6·08	—	—	—	690¼	6,108
—	S.W.		251¾	1,628¾	9 18 5½	4 8 3	7 3 9	20 9 5	2 – –	43 19 10½	6·48	6·39	—	—	—	739¼	6,951½
—	S.W.		295½	1,607½	11 3 6	6 – 2	6 19 3	21 19 7	1 – –	47 2 6	7·04	5·45	—	—	—	716¼	7,051
—	S.W.		Under	Repairs.													
—	S.W.			do.													
									(Commenced	work in May, 1920.)							
—	N.E.	PETROL	194¾	1,414	33 9 10½		5 4 7	23 3 8	1 – –	62 18 1½	10·68	7·04	—	—	—	836½	4,645
—	S.E.		Under	Repairs.													
—	S.E.		358¼	1,777¾	30 18 1½	1 6	7 6 2	24 9 10	1 – –	63 15 7½	8·61	5·05	—	—	—	1,169¼	6,747

JMMAR
Y

Registere Number Lorry o Steam Wa (1)	Total £ s. (14)	te per Ton Mile. Year.	Since Commencement. (23)	Average Cost per Day for the year. £	s. (24)	d.

(18

M.H. 4.

SUMMARY.

YEAR ENDING MARCH 31ST,..............................

EXPENDITURE.

Registered Number of Lorry or Steam Wagon (1)	Petrol or Steam. (2)	Depreciation. £ s. d. (3)	Insurance. £ s. d. (4)	Rents. £ s. d. (5)	Fuel. £ s. d. (6)	Oil and Waste. £ s. d. (7)	Wages. £ s. d. (8)	Bonuses, Allowances Expenses. £ s. d. (9)	Tools. £ s. d (10)	Repairs and Renewals. £ s. d. (11)	Tyres. £ s. d. (12)	Miscellaneous. £ s. d. (13)	TOTAL £ s. d. (14)

WORK DONE, ETC.

Lorry or Wagon No. (15)	No. of Days Worked. (16)	Total Tonnage Hauled. (17)	MILES COVERED. Full. (18)	MILES COVERED. Empty. (18)	—Total —Vehicle— —Mileage. (19)	Ton— —Miles. (20)	Ton— —Vehicle— —Miles. (21)	RATE PER TON MILE. For the Year. (22)	RATE PER TON MILE. Since Commencement. (23)	Average Cost per Day for the year. £ s. d. (24)

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This summary also includes the yearly average costs at (*a*) per day, and (*b*) per ton mile.

The system described above has not been working sufficiently long to make it possible to give all details as to costs under all heads in connection with the County Council Mechanical Transport.

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CHAPTER XVIII

HOW TO KEEP ACCOUNT OF COSTS

THE subject of records which affect the organization of a service, as distinct from actual operating charges, has already been touched upon. As has been intimated, the question of keeping the accurate costs of a service is a highly important one, and should never be neglected. The percentage of industrial motor users who keep precise details of the expenditure on their vehicles is extremely small, many firms not troubling to keep costs at all, others noting merely the running expenses, while others again record a conglomeration of standing and running charges.

Strict Economy Essential.

The increase in the cost of motor road transport during late years is bringing this subject of costs much to the fore, and owners should realize that strict economy must be practised, and will find that unless due care has been paid to the matter of keeping proper tally of all the items connected with the running of the vans, it is impossible to locate and remedy the weak points which are the cause of unnecessary expense.

A Simple System of Costing.

Costs should be divided under two heads—

(1) Standing charges.

(2) Running charges.

Standing charges are those items which are fixed at certain rates, and are not influenced by mileage.

The addition of the two weekly totals will give the total cost of the vehicle per week.

The various items, especially those of the standing charges, require careful consideration and analysis in order to determine a sound basis on which to work, and these will be entered into subsequently. To make clear, however, what the items are which it is desirable to record, skeleton tables, suitable for use with petrol, steam or electric vehicles, are given below.

PETROL VAN

Standing Charges—	Per Week. £ s. d.
Interest on capital of £— at— per cent. . . .	
Depreciation at £— per annum on vehicle without tyres	
Drivers' wages at — per week – . . .	
Helpers' wages at — per week (if required) . .	
Insurance at £— per annum	
Rent, rates and taxes at £— per annum . .	
Total standing charge (per week) .	£

Running Costs—	Per Week. £ s. d.
Petrol; — gallons at — per gallon	
Tyres ; at £— per — miles	
Renewals and repairs	
Oil, grease, paraffin, washing, etc	
Total running costs (per week) . .	£

	Per Week. £ s. d.
Standing Charges	
Running Costs	
Total cost of vehicle (per week) . .	£

STEAM WAGON.

Standing Charges—	Per Week. £ s. d.
Interest on capital of £— at — per cent. . . .	
Depreciation at £— per annum (on vehicle) without tyres	
Drivers' wages at £— per week	
Helpers' wages at £— per week (if required) . .	
Insurance at £— per annum	
Rent, rates and taxes at £— per annum . . .	
Total standing charge (per week) .	£

Running Costs—	Per Week. £ s. d.
Fuel ; — cwts. at — per cwt.	
Tyres ; at £— per — miles	
Renewals and repairs	
Oil, grease, paraffin, waste firewood, washing, etc. .	
Total running costs (per week) . .	£

	Per Week. £ s. d.
Standing Charges	
Running Costs	
Total cost of vehicle (per week) . .	£

ELECTRIC VEHICLE

Standing Charges—	Per Week. £ s. d.
Interest on capital of £— at — per cent. . . .	
Depreciation at £— per annum on vehicle (less battery and tyres)	
Drivers' wages at £— per week	
Helpers' wages at £— per week (if required) . .	
Insurance at £— per annum	
Rent, rates and taxes at £— per annum . . .	
Total standing charge (per week) .	£

Running Costs—	Per Week. £ s. d.
Current—units at — per unit	
Tyres at £— per — mile	
Battery upkeep (at — years' life)	
Chassis renewals and repairs	
Oil, grease, washing etc.	
Total running costs (per week) . .	£

	Per Week. £ s. d.
Standing Charges	
Running Costs	
Total cost of vehicle (per week) . .	£

In each of the foregoing cases the total vehicle cost per mile is obtained by dividing the total cost per week by the weekly mileage, and the total cost per ton-mile is arrived at by dividing the total cost per mile by the average tonnage carried. Fuel or electrical consumption can be ascertained by dividing the weekly mileage by the number of units consumed.

CHAPTER XIX

INTEREST ON CAPITAL EXPENDITURE AND DEPRECIATION—SPECIMEN TABLES

In continuance of the subject of motor road transport, it should be pointed out that before a schedule of charges can be kept it is necessary to examine the various items of expenditure, and to settle upon a system which will afford a sound basis on which to make future calculations.

This remark, of course, refers especially to standing charges, and it is proposed to mention here such matters as Interest, Depreciation, Insurance, and the like.

Calculation of Standing Charges.

The first matters for present consideration are Interest on the capital outlay and Depreciation of the vehicle. These two naturally come under the head of standing charges.

There are two different methods of calculating these amounts; the first to be dealt with is that whereby a fixed percentage of the initial capital figure is taken annually over a term of years.

Thus suppose a vehicle—whether driven by petrol or steam or electricity—cost £1,000 when new, and that the life of the machine be taken at eight years (which is not unduly optimistic since there are vans running to-day with more than ten years' service behind them), the charge for interest on capital of £1,000 at 6 per cent. will be £60 per annum. Depreciation at 12½ per cent. will be £125 per annum. (As a matter of fact, it should be taken less tyres, and also battery in the case of an electric.)

It will be seen that at the end of eight years the cost of the vehicle will have been completely wiped off, and any further service will, therefore, be at greatly reduced cost, or in the event of a sale, the price will be to the good.

This method is not strictly accurate, because at the end of the eighth year the trader will possess an asset which will not appear in his books, but nevertheless it is one which is largely used at the present time.

The Compound Basis System.

The alternative and less crude, though more complicated, method is that in which interest and depreciation are taken on a compound basis. The method of taking a fixed percentage of the initial capital outlay every year over a term of years is obviously not very correct. It is a safe process provided the life of the vehicle is not over estimated, but will not show so accurately, as will the compound basis system, what the value of the van is at any time. For this a comparatively high rate of interest must be taken, and this will show adversely in the accounts during the first few years. It cuts both ways however, and, as far as it goes in practice, is as broad as it is long. The total vehicle cost per mile will work out perhaps rather high for the initial years, but will diminish very considerably later on.

Long Life of Commercial Motors.

The question of depreciation is a vexed one ; some like to take a high figure for it and a low one for repairs, and others a low rate of depreciation and a heavy estimate for repairs, the two items being very closely allied. The writer favours the latter as being the more logical plan of the two with commercial motor vehicles, because fashion does not play any appreciable part in the matter, as it does with touring cars. An industrial motor is only scrapped when the type becomes almost obsolete for useful service, and not on account of wear and tear. There are motor vehicles running to-day, and doing good service, which have been in commission for a number of years.

Many, no doubt, possess but few of the original parts, perhaps only the frame, axles, crank chamber, and gearbox casing, but the condition and the running of the van may be as good as when it was new.

This is accounted for under the item of repairs and renewals, and the life of the vehicle is only ended by its becoming obsolete as a type of mechanical conveyance.

Thus it can be seen that the trader who buys a first class machine and is prepared to look after it, need not hesitate to consider its life as being of considerable length.

Depreciation.

There is a point which may strike the business man as being one which should be accounted for, and that is the heavy rate at which any vehicle depreciates in value directly it has been used. In normal times it is obvious that when a new van has been in use for a week only, the depreciation in the event of a sale is out of all proportion to wear and tear. It is doubtful if the owner would be able to sell at a reduction of a sixth on the original price. It is, of course, possible for the trader to write off some such fall in value at the commencement of the vehicle's service, but in practice this is never done, for the simple reason that commercial motors are bought for investment and not for amusement or speculation.

Interest on Capital.

The matter of interest on the capital outlay is closely connected with that of depreciation, and should be taken in conjunction with it. Thus, suppose a vehicle cost £1,000, the life be taken at twelve years, depreciation be fixed at 15 per cent—thus giving on a compound basis a scrap value only for the van at the end of twelve years—and interest at 6 per cent., the following result is obtained—

FIRST YEAR.	
Depreciation on £1,000	£150
Interest on £1,000	£60
SECOND YEAR.	
Depreciation on £850	£127
Interest on £850	£51

and so on.

In this way the depreciation and interest are taken on the constantly diminishing value of the machine, which will give its correct worth at any time.

Illustrative Tables.

Below will be found some tables which have been worked out for vans of an initial price of £1,000. These lists show the value of the van each year of its life, together with the annual charges for depreciation and interest. These can be split up easily into weekly charges.

It is a simple matter to make from these tables, others based on initial prices such as £1,250, £500, £750, £250, and so on.

The figures are expressed in pounds only.

Fractions exceeding a half have been counted as one pound.

5 YEARS' LIFE: $32\frac{1}{2}$ PER CENT. DEPRECIATION

Value of Vehicle at end of:		Depreciation $32\frac{1}{2}\%$	Interest at 6%
	£ £	£	£
1st	1,000–325 = 675	325	60
2nd	675–219 = 456	219	40
3rd	456–148 = 308	148	27
4th	308–100 = 208	100	18
5th	208– 68 = 140	68	12
	£140 = "scrap" price at end of 5 years.		

7 Years' Life: 25 per cent. Depreciation

Value of Vehicle at end of:			Depreciation at 25%	Interest at 6%
	£	£	£	£
1st	1,000–250	= 750	250	60
2nd	750–187	= 563	187	45
3rd	563–141	= 422	141	34
4th	422–105	= 317	105	25
5th	317– 79	= 238	79	19
6th	238– 59	= 179	59	14
7th	179– 45	= 134	45	11

£134 = " scrap " price at end of 7 years.

9 Years' Life: 20 per cent. Depreciation

Value of Vehicle at end of:			Depreciation at 20%	Interest at 6%
	£	£	£	£
1st	1,000–200	= 800	200	60
2nd	800–160	= 640	160	48
3rd	640–128	= 512	128	38
4th	512–102	= 410	102	31
5th	410– 82	= 328	82	25
6th	328– 66	= 262	66	20
7th	262– 52	= 210	52	16
8th	210– 42	= 168	42	13
9th	168– 34	= 134	34	10

£134 = " scrap " price at end of 9 years.

12 Years' Life: 15 per cent. Depreciation

Value of Vehicle at end of:			Depreciation at 15%	Interest at 6%
	£	£	£	£
1st	1,000–150	= 850	150	60
2nd	850–127	= 723	127	51
3rd	723–108	= 615	108	43
4th	615– 92	= 523	92	37
5th	523– 78	= 445	78	31
6th	445– 67	= 378	67	27
7th	378– 57	= 321	57	23
8th	321– 48	= 273	48	19
9th	273– 41	= 232	41	16
10th	232– 35	= 197	35	14
11th	197– 30	= 167	30	12
12th	167– 25	= 142	25	10

£142 = " scrap " price at end of 12 years.

15 YEARS: $12\frac{1}{2}$ PER CENT. DEPRECIATION

Value of vehicle at end of:			Depreciation at $12\frac{1}{2}\%$	Interest at 6%
	£	£	£	£
1st	1,000–125 =	875	125	60
2nd	875–109 =	766	109	52
3rd	766– 96 =	670	96	46
4th	670– 84 =	586	84	40
5th	586– 73 =	513	73	35
6th	513– 64 =	449	64	31
7th	449– 56 =	393	56	27
8th	393– 49 =	344	49	24
9th	344– 43 =	301	43	21
10th	301– 38 =	263	38	18
11th	263– 33 =	230	33	16
12th	230– 29 =	201	29	14
13th	201– 25 =	176	25	12
14th	176– 22 =	154	22	11
15th	154– 19 =	135	19	9
	£135 = " scrap " price at end of 15 years.			

The above scrap prices need not be considered unduly optimistic, since the life of a vehicle is almost entirely determined, not by mechanical condition, which is accounted for under repair and renewal charges, but by out-of-dateness.

It has not, therefore, been considered necessary to depreciate below that rate in any case.

CHAPTER XX

INSURANCE AND ITS COSTS

THE question of insurance with regard to motor vehicles is a wide one, and consequently a matter which it is wise to study if the most satisfactory results from the van owner's point of view are to be obtained.

It is possible to over insure, just as it is possible to take out a policy which does not cover owner or vehicle sufficiently.

The Three Chief Risks.

The three risks against which it is essential to insure are—

Accident,
Fire,
Third Party.

Before illustrating these with a concrete example of an up-to-date policy, it is as well to mention insurance against mechanical breakdown.

Premiums are high and of limited scope, and the modern well-built commercial motor vehicle is sufficiently reliable if cared for—even with our bad roads—to render such an insurance an outlay which will seldom be found to give an adequate return.

Scope of Ordinary Policies.

To consider then, the two risks—accident and fire. It will be found in practice that most of the companies or corporations which grant insurance policies for motor vehicles are prepared to guard the owner against these two risks on the following terms.

Up to full value is usually paid in respect of loss of, or damage to, the insured motor vehicle (including necessary lamps, tyres, and accessories thereon) caused by—

(*a*) Accidental external means.

(*b*) Malicious means.

(*c*) Fire, lightning, explosion or self-ignition.

(*d*) Theft.

(*e*) Transit (including loading and unloading by road, rail, or inland waterway).

The cost of removing the damaged motor vehicle from the scene of the accident to the nearest competent repairer's will also be paid, and repairs up to £10 in value may be proceeded with immediately, provided that a detailed estimate has been previously obtained and forwarded to the corporation. There are certain items which are excluded, such as wear and tear, depreciation, mechanical breakdowns, bursts and punctures of tyres, damage to tyres unless caused by accidental collision, injury, loss or damage arising through earthquake, war, invasion, riot, excessive loading, and so on, and it is only reasonable to expect that such particulars would not be covered.

Other Risks.

By the payment of additional premiums the following risks may also be guarded against—

(*a*) Injury, loss or damage caused by sparks or ashes from any insured motor vehicle.

(*b*) Boiler explosion.

(*c*) Liability in respect of personal injuries sustained by passengers in any insured motor vehicle.

(*a*) and (*b*) are, of course, of special interest to owners of steam-driven vehicles.

" Third Party " Risks.

The third great risk against which the motor owner will be wise to guard himself is that of " Third Party."

If a policy does not include unlimited indemnity in this respect, it is essential that the limiting figure should be at least a high one, and the policy should be comprehensive.

In continuation of the concrete example of an up-to-date policy, the third party section, together with prices showing what was the approximate cost of such insurance in July, 1920, is given below.

(1) (*a*) Unlimited indemnity for the motor owner's legal liabilities will be paid in respect of claims by the public for injury to anyone not in the assured's service who is injured by the insured motor vehicle ; and

(*b*) Up to £10,000 each accident, in respect of claims by the public for damage caused by the use of the insured motor to property and injury to animals other than property or animals connected with the assured.

(2) The above (*a*) and (*b*) include the periods of loading or unloading the insured motor vehicle.

(3) Law costs of any claimant and all law costs, charges, and expenses incurred with the written consent of the corporation or company in defending the assured in respect of any third party claim are covered.

(4) All legal expenses of defending the assured or his paid driver at police court proceedings in connection with any accident covered under the policy, will be met.

It is, of course, possible to insure against accident only, or fire only, or third party only, but in the long run the policy which includes all three risks will be found to give the best return. Third party risks at least should be covered in every case.

Most policies carry a bonus of about 10 per cent. off a renewal premium, if no claim has been made by the assured during the preceding twelve months.

Light Goods Vehicles. (Full Insurance.)

Not exceeding 3 tons when fully laden.

Example 1.—10 h.p., and not exceeding £500 value. £13 per annum.

Example 2.—20 h.p., and not exceeding £700 value, £17 per annum.

For London and Glasgow add approximately 33⅓ per cent.

For Provinces and certain large towns add approximately 12½ per cent. 5 per cent. to 15 per cent. extra is chargeable on all the above for certain "heavy" trades.

For "Fords" there are specially reduced rates, namely, £11 13s. 4d. for a valuation of £275, and in excess of this figure 14s. per cent. must be added.

"Heavy" Trades.

The "heavy" trades rated at an increase of 5 per cent. include the following—

Cartage contractors, general goods and parcel carriers, mail and parcel post contractors, motor trade (including body builders, dealers, engineers, garage proprietors and vehicle makers—excluding maker's testing risks), railway and canal companies and road making contractors.

And those at 15 per cent. increase are—

Brewers, mineral water manufacturers, factors or agents, newsagents and newspaper proprietors—collection and delivery of newspapers.

The "Provinces" may be specified as the appended map areas—

Birmingham	Leeds
Bristol	Newcastle
Lancashire	Sheffield

while the " certain large towns " include such places as

Bath	Lincoln
Bournemouth	Reading
Burton-on-Trent	Southend-on-Sea
Darlington	Southsea
Hove	West Hartlepool
Ipswich	York

Scotland comprises

Aberdeen	Kilmarnock
Dundee	Kirkaldy
Edinburgh	Leith
Falkirk	

The whole of Ireland and Wales come under this class also.

Heavy Goods Vehicles.

Exceeding 3 tons when fully laden.

This premium is approximately £20, and is irrespective of horse power, etc. The same increase for London, Glasgow, the provinces and certain large towns apply to this case also, together with those for " heavy trades."

If a trailer is employed 28s. must be added to the above, and 14s. for each additional trailer hauled.

Char-a-bancs.

The approximate yearly premium (according to use, *e.g.*, hotel or plying for hire) is from £29 10s. to £33, to which must be added 20 per cent. if garaged in the London or Glasgow areas, and 10 per cent. if kept in the provinces, etc. If it is desired to insure liability to passengers carried, this can be covered by an addition of 7s. to 15s. per seat, according to the indemnity required.

This also applies to

Cars used for Private Hire Purposes.

Three examples of this class of insurance are—

(1) 10 h.p., not exceeding £350 value, £16 10s. per annum.

(2) 20 h.p. not exceeding £600 value, £22 per annum.

(3) 30 h.p. not exceeding £800 value, £24 per annum.

Provinces and certain large towns plus 5 per cent.

London and Glasgow plus 15 per cent.

A reduction of 10 per cent. is generally given if the vehicle is driven by the owner only, while there is a special rating for " Fords," *i.e.*, £13 6s., up to a value of £275. Passenger risk is the same as in the case of a char-a-banc.

Most policies allow of a reduction of premium if the first amount on each claim is borne by the assured.

10 per cent. if assured bears the first £2 10s. of claim, 20 per cent. if assured bears the first £5 of claim, and so on.

A point to bear in mind is the due appreciation of any alteration in the market value of the motor. The replacement value of a machine naturally varies with the condition of the market at any particular time; and unless adjustment is made for this occasionally, the trader may find that he is either over-insuring, or paying an annual premium which in the event of the total loss of a vehicle would in no way allow of its being replaced.

CHAPTER XXI

FUEL—SPARE PARTS—TYRES—LUBRICANTS—GARAGE ORGANIZATION

THE cost of running a motor is a subject which, in view of the increased charges for all materials and labour to-day, is of even wider interest and worthy of greater consideration than it was a few years ago.

In a previous chapter a skeleton table has been given, showing the various items the expenditure on which should be recorded, so that the motor owner may be able to arrive at an accurate figure of the total cost of running his vehicle. Such knowledge is becoming more and more necessary every day if economy in transportation is to be attained, and many big fleet owners now calculate their vehicle costs per mile to a thousandth part of a penny. As an illustration of the importance of such accuracy it may be stated that the reduction of a penny per mile in the operating costs of the omnibuses in London means the saving of about half a million pounds annually.

The different particulars under the heading of Standing Charges, such as Depreciation, have also been considered, and the next details for comment are those which come under the title of Running Costs.

Fuel Costs.

The first of these is Fuel.

Separate accounts of the quantity and the current price per unit should be kept, as also of grease and lubricating oil. By adopting this system, the van-owner will be able to compare the various records of both drivers and vans, which he could not do so well if the running charges were lumped together and not separated under their various heads. This matter is of considerable importance and affects the efficiency of a service very much.

Economy may be effected in fuel consumption in the case of internal combustion engined vehicles by divers means, such as the fitting of an extra air or spraying device ; by the mixture of benzole with the petrol ; or by the employment of some soundly designed atomizer or paraffin carburettor, such as is hereafter described.

The author would like to add a word of warning in connection with this subject, namely, that those responsible for the service should make sure that the vans are not run habitually on too rich a mixture. Not only is this wasteful in fuel, but its evil effect on the engine is great, and increased expenditure will not be confined to the fuel item alone, but will extend to those of lubricating oil and repairs. Care should be taken to prevent waste in the storage of fuel and in the filling up of the tanks on the vans.

With the steam wagon and electric vehicle, the number of cwts. of fuel or of units of electricity used per working day, and their costs, should also be recorded in detail.

In the case of the steamer, coke will very often prove a more economical fuel than coal. Generally speaking, the former is cheaper and—even in comparison to best Welsh steam coal—considerably cleaner.

Since the quality of coke varies to a considerable extent the steam wagon owner will be wise if he experiments until he finds a kind suitable to his machine.

One disadvantage—which may in some cases prove a determining factor against the use of the cheaper fuel—is that it is more bulky than coal.

Spare Parts.

As regards spare parts, the transport owner will be well advised to keep a reasonable number in hand. It is here especially a question of the happy mean, for it is almost as expensive to keep a large and over-stocked spare part depôt as to be understocked and to have to rely on the manufacturer in time of need.

If the van-owner is running a class or type of vehicle of which he has not had previous experience, the best plan is to get from the maker a list of those parts which from the latter's experience are most likely to give trouble and to keep a corresponding supply of these.

To depend on the manufacturer to supply a correct spare part at a moment's notice, is, in many cases, to court unnecessary expense, for the reason that there will probably be delay in the business, during which time the van must lie idle, and in addition cost money.

Tyres.

The bulk of commercial motor transport in this country to-day is undertaken by vehicles running on solid tyres; nevertheless, there appears to be a tendency on the part of traders whose transport is of the fast type, to favour the pneumatic tyre. This question of pneumatic tyres for the heavier types of mechanical road transport is a large and important one, for the reason that it contains the possibility not only of widely increasing the scope of the road motor, but also of effecting a considerable decrease in the cost of operation. Two of the greatest obstacles in the past to the employment of big air-filled tyres for lorries were overcome by making the covers with cord instead of fabric, and by using the straight-side bead in place of the clincher type. With these improvements it was found possible to produce a reliable tyre, and one which could be fitted to a wheel rim without undue difficulty.

It is only necessary to realize the fact that the earning power of a motor vehicle is represented by the product of the useful load and the number of miles it is carried, in order to see the enormous possibilities which lie in the air-filled tyre for commercial vehicle purposes.

Advantages.

Before studying the effects which such a change-over is likely to have on road transport as a whole, it is advisable to consider the advantages and disadvantages of the system. That drawbacks do exist is not to be denied; moreover, they are far from being trivial. So much progress has already been made, however, in the matter that in the opinion of the writer the giant pneumatic, suitable to all forms of mechanical road traction except that of the heaviest kind, is more than likely to come into favour. The advantages may be summed up as follows—

(1) The possibility of increased vehicle speed. This immediately widens and extends the radius of the motor, and thereby improves its earning capacity.

(2) An appreciable decrease in fuel and oil consumption over that obtained from a vehicle running on solid tyres can be effected, owing to higher gearing, greater tyre resilience, and reduced road resistance.

(3) The cushioning action of an air-filled tyre is obviously very much greater than that of a solid, and for this reason vibration and road shock are minimized to a large extent. The direct outcome of such an advantage is (*a*) lower rate of depreciation; (*b*) a diminution of repair charges; (*c*) improved transportation of the goods or passengers; and, most important of all in its far-reaching

effects, (*d*) the increased load capacity for a given horse-power.

It is probable that the extensive use of pneumatic tyres, to the exclusion of the solid type, would result in less road wear and tear, and consequently in lighter taxation. The writer is not so optimistic, however, on this score as some would seem to be, for the reason that speed is a factor in road damage which counts for a good deal, while not only would the aggregate annual mileage of motor vehicles in Great Britain be vastly increased, but owing to higher road speeds many of our highways would require reconstruction. It is unlikely that any beneficial effect would accrue as regards this particular matter of road surface for a number of years. Nevertheless, if we pave the way for the next generation for more efficient road transport we shall have progressed.

Disadvantages.

Following are the disadvantages in the use of large pneumatic tyres—

(1) The most serious handicap is the likelihood when the covers get worn of a puncture or burst. Therein lies a possible source of unreliability, the greatest enemy of industrial traction. To-day there are in this country some hundreds of vehicles operating on giant pneumatics, but because the movement is still in its infancy there is little data of value with regard to the period when the tyres get worn down. Such questions as (*a*) when to retread in order to get the most out of a cover and yet save a burst; (*b*) the significance of any unreliability in running due to tyre troubles; and (*c*) the amount of danger attendant on a burst when the vehicle is being driven fast—especially with reference to public service motors—have yet to be answered satisfactorily.

(2) Another detriment is the present inability to protect adequately the walls of the cover from damage due to running against street kerbs.

(3) A point which is not so serious, but which must not be overlooked, is that a mechanically or electrically operated pump must be used for inflation.

Considerations of weight and price in contrast to existing types of solid tyres are of importance. In order to get a comparison that is a true one, it is necessary to contrast the respective weights of the fitted wheels, because not only should the weights of the tyres themselves come into the calculation, but also those of the various attachment fittings. Moreover, the diameter of the actual wheels for the pneumatic is not equivalent to that for the solid tyre.

Taking, as an example, fitted wheels suitable for a 3-ton lorry—

SOLID.

No. of tyres: 6. Size: 1010 × 120 mm. Weight: 850 lbs. Weight of 4 wheels: 750 lbs. Total weight: 1,600 lbs. (approx.).

PNEUMATIC.

No. of tyres: 4. Size: 38 × 7 ins., front; 44 × 10 ins., rear. Weight: 680 lbs. Weight of 4 wheels: 550 lbs. Total weight: 1,230 lbs.

It will be seen that, on the score of weight, the pneumatic is superior.

The respective prices for sets of tyres are as follows—

SOLID.	PNEUMATIC.
6 tyres, 860 × 90 = £36	4 covers, 36 × 6 ins. 4 tubes, 36 × 6 ins. = £146
6 tyres, 900 × 100 = £42	2 covers, 36 × 6 ins. 2 tubes, 36 × 6 ins. 2 covers, 40 × 8 ins. 2 tubes, 40 × 8 ins. = £206
6 tyres, 1010 × 120 = £56	2 covers, 38 × 7 ins. 2 tubes, 38 × 7 ins. 2 covers, 42 × 9 ins. 2 tubes, 42 × 9 ins. = £278

The prices for the solid tyres are of necessity approximate, as the cost of different makes varies widely.

From these figures it will be seen that the price of the air-filled tyre is greatly in excess of that of the solid.

Nevertheless, initial cost, as any wise business man knows, is by no means necessarily a deciding factor.

The points for consideration are—

(1) How much fuel and oil will be saved in the year by running on pneumatics, compared to solids ?

(2) How much lower will be the annual charges for depreciation and repairs ?

(3) How much more business will be gained by the improved transportation of goods or passengers ?

(4) How much more business will be gained by the possibly extended radius, due to increased vehicle speed ?

To-day we have not a sufficiently wide and varied experience in the extensive running of commercial motor vehicles of the heavy kind on big pneumatics to enable us to set out statistics on these various items. What particulars we have, however, point with no uncertain finger towards achieving a definite success in substantially reducing the operation costs of motor vehicles when run on giant pneumatics.

Were the pneumatic tyre widely adopted commercial motor vehicle design would be revolutionized, and instead of building heavier and heavier chassis in order to stand up to roads which the same chassis destroy, and destroy increasingly, we should get the lighter class of motor, with consequent reduction of taxation and operation costs, and the product of the useful load and the number of miles it is carried would be increased beyond the standards existing to-day.

The following remarks on how to effect economy in the annual tyre bill apply both to pneumatic and solid tyres.

The high price of tyres, the condition of the roads, and the vanishing system of tyre maintenance contracts and guarantees, make it imperative for the van owner to keep a strict watch over this item in the running costs.

One of the greatest sources of tyre extravagance is lack of care as regards inspection.

This should be done on shed-day without fail. The whole operation is simple in the extreme, and takes but very little time. The wheels should be jacked up, and all cuts in the tyres should be freed from grit or stones.

With the pneumatic cover this is of special importance. Small stones if left embedded in the cuts, will work their way in, and in the case of a pneumatic will eventually cut the fabric and cause a burst tube and cover, and once the canvas has been cut the previous reliability cannot be expected.

In the case of the solid tyre, stones will very often enter so deeply that the tread is split, and finally strips of rubber come away. Inspection is more than ever necessary in very dry weather, or if the van has been running where top road surface is loose or scratched up.

A great deal as regards tyre wear depends on the driver of the vehicle, and on the state of the mechanism. A fierce clutch, fierce brakes, or the careless operation of these will prove very destructive to the life of the tyres. If the van is out of commission for any time—even if only for a few days—it is advisable to take the weight off the tyres by jacking up and blocking the chassis.

All tyres should be kept free from oil, and spares must be kept in a moderate temperature, and in the dark.

Vans may often be seen running with their wheels out of line. This may have occurred as the result of a slight accident : from striking the kerb sharply either from a side-slip or from careless driving ; from a weak axle ; or again, from strained or worn steering connections.

The tyres of a van running with the wheels out of alignment are subjected to a continuous and severe scraping action. This fault is easy to detect, either by lining up the wheels with a string or a piece of wood, or by examining the surface of the tyres.

The defect should be remedied at once, for excessive and entirely unnecessary wear will take place so long as the wheels do not run truly. Lastly, if overloading and excessive speed are permitted, the life of the tyres will, without the shadow of a doubt, be short.

Lubricants.

It may seem absurd to think of lubricating oil as being a definite component part in the construction of a motor chassis, nevertheless, it is so in practice.

Without an insulating film of lubricant between two bearing surfaces, it is not possible to have continuous relative motion for any length of time, nor even occasional movement, without wear. This film, therefore, in effect becomes a constructional member.

It can be readily seen that the life of a bearing depends almost entirely upon the quality of the lubricating substance, and upon its presence where and when it is most wanted. There is probably no machinery in the world which is subjected to such neglect in this matter as the motor car. Any liquid, so long as it resembles oil—and very often the refiners are to blame for the deficiency—is poured into a motor engine, quite irrespective of whether the grade is suitable to the piston speed, the working temperature of the engine, the lubrication system, and the season of the year. A considerable difference in the yearly charges for lubricating oil and engine repairs will result according to whether or not a right choice has been made.

Economy in Oil.

Oil, like most other things, has risen in price lately, and it is more than ever necesary to reduce the consumption per vehicle mile as much as is consistent with efficiency. Over lubrication is a costly habit, but one which is often indulged in. Extravagant in oil, it impairs the mixture, and tends to carbon the cylinder heads, pistons, plugs, and valves. The modern type of engine is generally provided with some means—whether it be an overflow tap or a tell-tale—of obviating this evil, but the man who fills up often thinks he knows better than the designer.

The oil should, without exception, be carefully strained before being poured into the engine, and just the right amount, *and no more*, put in. In connection with the gear-box, and—where chain drive is not employed—the differential case, the same rule as regards quantity applies.

It is seldom that the bearings, except when newly fitted, are absolutely oil-tight, and if the box contains an excess, the lubricant will only work out, make a mess in the undershield, and be lost for any useful purpose.

Moreover, where a casing is filled, or nearly so, with a heavy type of lubricant, power is absorbed unnecessarily when the wheels are in motion.

Value of Proper Drainage.

An important consideration—which sounds in opposition to economy, but in reality is not so—is that of draining the engine-base and gear-box, washing out, and replenishing from time to time.

The gear-box does not, of course, require this attention very often, but it is surprising what an amount of " deposit " will be found after some months of hard work. This gets churned up, and mixing with the whole is greatly destructive of bearing surfaces.

In the engine itself, the matter is of even greater importance. Small quantities of fresh oil are always being added to the old, and the impression often exists that that is sufficient for good lubrication.

The writer has known cases where engines have been run for a year without the oil in the base chamber being changed. The state of the bearings at the end of that time was deplorable. The principal part of the oil had long since lost its body, with the consequence that it had little resistance to offer in the form of cushioning.

Pump and sump filters should be kept clean at all costs, for if not, the oil supply to the various parts may be decreased. With regard to the general lubrication of any machinery, it should be remembered that " little and often " is the golden rule.

Shed-Day.

The need of keeping a commercial motor vehicle in good mechanical order is obviously great, for if this be not done, reliability, the essence of successful haulage, will not be obtained.

The annual cost of maintenance with regard to the mechanism may vary widely, and for this reason it is essential for traders who possess motor vans or lorries to adopt a good system of garage organization.

The practice of running a van to destruction may pay under certain exceptional circumstances, and with a certain type of car; but where British-built vehicles are used, it will seldom, if ever, be found to give the best return, because they are not designed to be run on those lines.

The care of the machine is therefore of great importance, and the figure for repairs and renewals will work out in proportion to the amount of attention that is paid to this matter.

Weekly Inspection Essential.

Where the nature of the service allows, a van should not be on the road for more than five days a week. The sixth day should be shed-day when the weekly overhaul can be done. In addition, a fortnight—in the trader's slackest season of the year—should be set aside for the annual overhaul.

Such a method has been found to be the most economical of any.

In some trades six working days are essential for delivery purposes, in which case one of two courses should be taken.

Either a sufficient number of vans must be kept in order to allow the necessary "spare" machines to fill up the gaps on "sixth days," or an overhauling staff must be kept who will do the work on Sundays. A weekly inspection is of the utmost importance for the general efficiency of the service, and this should be done by a skilled man.

Details that Require Attention.

Greasing and oiling should be carried out thoroughly throughout the chassis; all the bolts and nuts tightened where required; also all adjustments which are necessary, such as taking up slack in the driving chains, cleaning and dressing the clutch, correcting play in steering joints, etc.

Tuning-up the engine should be done as a matter of course. Details such as cleaning the petrol filter and float chamber, scraping and setting the sparking plug points, overlooking all the electrical wires and connections, fan belt, and so on, will well repay the time spent on them.

Unless the driver is a really skilled man, the inspection should be done by an engineer, although in most cases the van driver will be able to undertake the actual work.

This weekly examination is in the nature of "a stitch in time," and its importance cannot be emphasized too strongly.

It is advisable to keep a chart for each vehicle, as this will show at a glance what has been done and when it was done.

After definite periods the engine and gear-box should be washed out and fresh lubricant put in.

The period will depend on the mileage which is being done and on the quality of the lubricant, and can be best determined by experience. It should be borne in mind that it is false economy to continue to run any piece of mechanism with oil which has been in use for so long that it has practically lost its lubricating properties.

The Annual Overhaul.

The annual overhaul is naturally the most serious operation, and it is well to spare no trouble or expense over it. Both chassis and body should be brought up to new standard, for they have a fresh year's work in front of them.

A point, seemingly trivial, but in reality by no means so, in favour of good work being put into the yearly overhaul, is that of advertisement.

It is quite extraordinary how additional business comes to the firm whose vans are attractive, smart, and quiet in operation.

The matter is not sufficiently realized in this country as a whole ; there are signs, however, that business houses are awakening to this fact.

Motor traction is one of the finest mediums for advertisement, and this should never be forgotten if the full value is to be secured for such means of transport.

CHAPTER XXII

BONUS SYSTEMS

THE human element in connection with mechanical road transport is a factor which, owing to its bearing on the costs of operation, calls for careful and serious consideration.

Unless a "clock" is fitted to a van, the motor owner must place himself entirely in the driver's hands when the latter is on his rounds. A trustworthy and conscientious man may save his employer pounds in the year as compared with the driver who has no feeling for his machine or sense of loyalty to those for whom he works.

Careless operation of the drive control, together with overspeeding on bad road surface, may well add 25 per cent. or even 50 per cent. to the running expenses in the year, and this point is too often overlooked by employers.

There are, of course, drivers who do not require encouragement in order for them to give of their best, but the majority do, and the policy which does not attempt to get the men interested in their work is a short-sighted one.

Economy of Bonus Systems.

If bonus systems were more generally adopted, there is little doubt but that motor transport would be run on more economical lines.

It is in the handling of vehicles that the greatest source of extravagance lies, yet it is the most neglected and least considered factor in their operation in this country.

To take a concrete example, particulars of a bonus system in a big despatch service in London are given here.

Fuel Saving.

A mileage is set for the different types of machine, and all miles run in excess of the fixed mileage are paid for as a bonus at the rate of 25 per cent. of the value of the fuel saved.

Tyre Saving.

When it was decided to offer a bonus for pneumatic tyre saving, all wheels were fitted with detachable contractable rims, in order to encourage drivers to study tyre economy. The result is that when a driver thinks a tyre has run long enough on a back wheel, he changes it to a front wheel, and thus gets a greater total mileage out of it than if it had been left on a driving wheel until it gave out. The tyre bonus consists of 2s. 6d. on all tyres reaching 4,000 miles, and 1d. for every additional 100 miles run.

Van Appearance.

In order to encourage drivers to take a real interest in the appearance of their vans, three prizes (of five, three, and one guineas) are given every six months.

The competition between the men is very keen, and the judges—who are independent—usually have some difficulty in making the awards.

Two or three ties for the different places often result. In the event of ties the full prize is given to each man.

Sinking Fund.

A sum of 2s. a week is set aside for each driver, and he is only allowed to draw this every six months.

Any fines for exceeding legal speed limit or for lights out incurred during the period are deducted from the total of 52s. In most cases the men draw the full sum. The firm are members of the C.M.U.A., which entitles the men to compete in any competitions which the Association put up. To any man or team winning a prize, the House gives a like amount.

No overtime is paid to the men. What is considered a fair day's work—based on careful calculation and experience—is set for each driver and van, and if the round is finished at 3 o'clock in the afternoon, so much the better for the driver. Such a method would probably not be practical were no bonus system in force, and if the van engines were not, as a rule, governed, because it would lead to overspeeding. With the drivers interested in their work, however, and with an eye fixed on economical running, the scheme appears to work out well in practice.

CHAPTER XXIII

ECONOMIES : FUEL

There are many ways by which the cost of motor maintenance may be reduced, and one of the most effectual and obvious is by cutting down the fuel consumption, or by obtaining satisfactory running with the use of a fuel cheaper than that used heretofore. It should be realized that where a large number of machines are employed, the saving of 1d. per mile will result in the saving of thousands of pounds a year. This is a fact, which, though so well known, is often disregarded.

Fuel-Saving Devices.

There have been during the past few years a large number of fuel-saving devices, such as extra air and spraying contrivances, placed upon the market, many of which have been submitted to the author for practical test. Broadly speaking the net gain obtained from the fitting of any of these devices is not very marked. They undoubtedly tend towards economy, but are in many cases crude both in theory and in practice, and consequently fall short as regards the issue. Nevertheless, in the writer's opinion, there are one or two exceptions, one of which is briefly described below.

An atomizer—the invention of an Australian—consists of a truncated cone, constructed of a metal having high heat conductivity, and containing a series of gauze screens. A metal casing surrounds this cone, and into the intervening space exhaust gas is passed. A special type of air valve, which is mechanical in action, and controlled entirely by the carburettor throttle, is fitted into the induction pipe immediately above the atomizer. The aim of the contrivance is, of course, to try and improve the carburation by getting a dryer and better mixed gas than would be obtained with a standard carburettor alone.

A practical test of the invention was made on an "average" Ford car. One journey was made without the atomizer, and one journey with it. The conditions of each run were as similar as it was possible to obtain, and the distance—from a fixed point out and back—in each case was 24 miles.

Consumption of Fuel Results.

Without Atomizer . .	25·4 miles per gallon.
With ,, . .	42·7 ,, ,,
Increase in mileage per gallon	66·77 per cent.

It will be noticed that these figures are considerably in excess of those of some official tests given below. The latter taken during the war by the Royal Air Force, the War Office, and the Australian Motor Transport Service, are average figures based on observations of fleets of vehicles.

The second reason for the disparity is that the conditions throughout the writer's test were more "normal," and consequently a good deal more favourable to the Atomizer.

RESULTS OF COMPARATIVE TESTS.

Make of car.	No. of tests.	Mileage.	Average without Atomizer. m.p.g.	Average with Atomizer. m.p.g.	Average increase in mileage per gallon with Atomizer.
Ford cars and vans[1].	60	2,023	21·55	29·04	34·75%
Ford cars (under R.A.S.C.) . .	—	13,858	14·049	19·68	40·80%
Crossley cars and tenders . .	84	1,375	14·25	18·17	27·5%
Leyland 3-ton lorries	92	1,515	6·54	8·37	27·98%

[1] Under R.A.F., W.O. and A.M.T.S., May, 1917, to April, 1919.

The Carburati on Problem.

The problem of carburetting air with the heavier forms of liquid fuel, such as paraffin, in order to produce a homogeneous and dry gas for burning in an internal combustion engine, is one which is difficult of solution, and the obstacles which have to be faced can only be fully appreciated by those who have gone into the question thoroughly.

For the marine or stationary engine the matter is not easy, nevertheless, it has not a tithe of the complication which the motor lorry or car presents, for the reason that the loads and pistons speeds do not vary so widely in ratio to time, nor do atmospheric pressure and temperature differ in the same degree. With the average modern petrol carburettor the efficiency is not high, and when the amount of useful work obtained from any given quantity of spirit in relation to its latent energy is considered, it is easily realizable how far short of perfection is even the light fuel carburettor of to-day. The present day design of the internal combustion engine is accountable for a large amount of heat wastage, but that only seems to point direct to the utilization of surplus heat in order to volatilize the heavier forms of liquid fuel.

The typical car or van carburettor is not capable of self regulation even with regard to such comparatively small variations as are met with when using different grades of petrol and benzol. The seat of the trouble lies in the fact that the mixing is inadequate, and temperature is not sufficiently studied; and without these two factors being taken into serious consideration, a homogeneous and dry gas will not be obtained.

The consequence of this is loss of power through condensation, unevenness in burning, and incomplete combustion.

Many inventors before the war tried to produce a carburettor that would allow a motor vehicle engine to run on the heavier kind of liquid fuel, and the writer examined and tested on the road several makes of paraffin carburettors. Most of them died a natural death, though some were undoubtedly good in idea to a limited extent.

The trouble in most cases was that little real flexibility was obtainable—although paraffin as a fuel is extremely sensitive—owing to the charge not being sufficiently and correctly mixed for varying loads and speeds, and under any sudden change of condition combustion was not complete. Another grave objection was that these carburettors were anything but self-regulating.

A Successful New Invention.

One of the most interesting and progressive inventions for the improvement of carburation hitherto produced was examined by the author not very long ago, and claimed to be a carburettor designed to run any car on paraffin; while, by the fractional movement of one small externally placed screw, different grades of petrol, benzol, and even alcohol could be used, the adjustments of weight, of fuel and air, and degrees of temperature being entirely automatic.

The device is the outcome of twenty-five years of research and practical test by the inventor, and in its latest form is simple and compact, the carburettor taking up no more room than does the ordinary type of petrol carburettor.

The heating apparatus merely consists of tubes surrounded by the exhaust gas, the air being drawn through these, and an ordinary type of ball and spring float chamber is used.

The fuel is fed from the float chamber through an automatically-controlled passage, to a jet nozzle which is placed within a primary and movable mixing cone.

Concentrically mounted within this cone is a short upright tube which surrounds the upper end of the jet and extends above it, enabling part of the hot air supply to pass up inside the tube and impinge on the fuel as it emerges from the top of the nozzle.

The other part of the supply goes up through the annular space between the inside wall of the movable mixing cone and the outside of the tube, and mingles with the mixture of fuel and air as it leaves the top of the tube inside the cone.

This mixture then emerges through the opening in the top of the cone into the main atomizing and mixing chamber. Here lateral ports—self-regulated—admit cold air in such a way that the first currents may meet the mixture in a direction normal to it, and the second in a reverse direction. In this way, while dilution is permitted, direct contact of the liquid fuel with the walls of the chamber—a most important point—is greatly minimized until the condition of a substantially permanent gas has been attained.

A sleeve adapted to reciprocate vertically in the casing of the chamber, and carrying a central circular baffle, is controlled in one direction by the suction of the engine, and in the opposite way by gravity or by action of a spring. By means of this sleeve automatic regulation of the cold air ports, the fuel supply from the float chamber to the nozzle, and also variation of temperature are obtained.

The normal number of degrees used in the case in point when running on paraffin was about 800 degrees F.

Result of a Practical Test.

A road test was undertaken with this device fitted to a car of American make, and supplied with a four cylinder engine. The total weight, with driver and passenger, was about 17 cwts.

The only priming required when the engine was cold in order to enable it to take up on paraffin was one or two table-spoonfuls of petrol, and a small cup conveniently placed outside the bonnet allowed this to be done without inconvenience.

The disadvantages of the priming and the initial "smoking" cannot easily be overcome, but are not really serious drawbacks. The success of the design lies in the fact that a proper gas is apparently made under all the varying conditions that occur in practice. The running of the car was considered to be equal in many respects to that on petrol, while it was possible to put the engine through tests which could not have been so successfully borne if it had been run on petrol with the ordinary light fuel carburettor.

An instance of this was the engine's power of hanging on at low speed under a heavy load. The car was driven on the high gear up a slope almost to a standstill, yet the firing was perfectly even, and although the engine was by no means new there was no knocking or pinking of any sort, and the power given off was exceptionally high. After a change of speed, whether made early or late, the engine answered the throttle lever immediately, and no fuss or popping was experienced at any time during the test, nor did the exhaust indicate incomplete combustion by smoking. At the bottom of a hill down which the car had been allowed to drive the engine with the electric current switched off, the same conditions were maintained.

In order to arrive at some idea of the consumption of fuel under everyday road conditions, and without special tuning for a low figure, the car was stopped en route at a village shop and the main fuel tank tap turned off.

A pint of paraffin was bought for 2½d., and put into an empty auxiliary tank, and on this supply the car ran over a give-and-take road for 4¾ miles, or at a rate of 38 miles to the gallon.

It is understood that the inventor of this carburettor has tried it on a number of different makes of engine—the various data with regard to fuel consumption being given below—though not on a sleeve-valve type. Since a higher temperature of exhaust would be obtainable with this make, the results might be even better. No difficulty was experienced in making the engine run at high revolution rate with evenness of power output. The designer states that he has run on all kinds of fuel, including 75 per cent. pure wood and grain alcohol, with no change in regard to engine cosntruction or compression pressure.

FUEL CONSUMPTIONS.

Car.	Original Carburettor	With Inventor's Carburettor.	
	On Petrol	On Petrol.	On Paraffin.
Ford with Kingston carburettor . .	28–m.p.g.	53–m.p.g.	48–m.p.g.
17–h.p. Maudsley .	22–m.p.g.	32–m.p.g.	30–m.p.g.
75–h.p. Mercedes .	8–9–m.p.g.	———	22–m.p.g. (average)
Winton "Model C"[1].	22–m.p.g.	———	33–m.p.g.
14–15–h.p. S.P.A. .	30–m.p.g.	———	42–m.p.g.

On a 10-h.p. two-seater fitted with a Trier and Martin three-jet carburettor 4¾ pints of petrol were used for 15 miles.

With the new device 15 miles were run on 3 pints, 8 oz., and on 3 pints 10 oz. of paraffin oil.

Power Alcohol.

The subject of Industrial Alcohol is manifestly a very extensive one, comprising as it does the consideration—*inter alia*—of the creation of an Empire industry ;

[1] (On 75 per cent. alcohol this car did 25–m.p.g., but the compression was much too low for this fuel.)

development of land tillage throughout Great Britain and especially in Ireland ; the possibility of reducing freightage both by water and by railroad ; and the likelihood of increasing the productive qualities of the nation and decreasing the cost of living—both natural outcomes of cheaper transportation.

The question is undoubtedly full of pitfalls, but is equally full of allurement, and is intricate in its technicalities. Nevertheless, it is not difficult to follow the general outline of the advantages and disadvantages of Power Alcohol as a fuel for motor road transport.

As most people know, alcohol can be procured by distillation from any vegetable matter containing starch or sugar, and also from wood; the possible supply, therefore, may be taken as practically unlimited. The most profitable source in Europe has generally been found to be either potatoes or beetroot, by reason of the proportion of spirit obtainable per acre. In France, Germany, and the U.S.A. experiments in connection with the use of Power Alcohol have been carried out over a number of years, and satisfactory results have been obtained, not only in the laboratory, but under practical working conditions. This has been made possible owing to the fact that the Governments of those countries have realized the national importance of developing this industry, and have granted considerable freedom for the production of Industrial Alcohol on a commercial basis.

England Lags Behind.

Why is it that hitherto we of all people—far removed as we are from the world's oil fields—have lagged behind in this matter ? Is it not due in the first place to the restrictions placed by the Government on the production of a fuel of this kind ? Secondly, is it not also owing to our lack of thrift which—notwithstanding the chances which we have of creating an immense home and empire industry, of keeping the money in our own country, of obtaining cheap light, heat, and power, and of being independent of foreign supply—compels us nevertheless to pay year after year enormous and ever increasing sums of money to other countries for our oil imports ?

Many people would have us believe that it is merely necessary to get the Excise regulations altered in order to have at once a national and limitless source of cheap power, and all that this would stand for. Such a revolutionary change-over is a dream. The national employment of Industrial Alcohol can only come about by broad minded encouragement on the part of the authorities, by hard work such as is entailed in the building up of any industry, and by the progress of years.

Advantages of Power Alcohol.

To take first the advantages which are offered by such a fuel, for use in internal combustion engines—

(1) It is more homogeneous than petrol, and will mix with water.

(2) Being a much less inflammable spirit than petrol, it is safer to handle, a feature which affects insurance.

(3) An engine operating on this fuel is quieter in running.

(4) With the engine under load, the exhaust is purer than with most liquid fuels, such as petrol, benzole, etc.

(5) Greater thermal efficiency is obtainable with alcohol, owing to the fact that a higher compression pressure can be used.

(6) For this reason it will stand a higher degree of temperature without self-ignition ; it is admirably

adapted for use with air-cooled engines, and this fact alone is sufficient to claim attention.

(7) The explosive range of alcohol and air is very much wider than that of petrol and air, and a more uniform effort is exerted on the crankshaft owing to the slower rate of flame propagation.

Disadvantages.

The most obvious disadvantage of the use of Industrial Alcohol in this country to-day is the price. This is a matter which lies entirely with the Government, connected as it is with various regulations and restrictions. It may be added that the difficulty of rendering the spirit non-potable can be overcome as it has been in other countries. Other drawbacks are largely connected with present day design of the internal combustion engine, and here is the point on which stress should be laid.

Engine Design Alterations Required.

The ordinary type of motor vehicle engine will run on Power Alcohol, but in order to obtain anything approaching efficient results radical alteration in design is needed, as may be judged from the following facts—

(1) Alcohol being a less volatile and ignitible spirit than petrol, easy starting of an engine is not obtained.

This fault, in common with most fuels except petrol, is serious, but is surmountable without much difficulty.

(2) Since combustion takes place at a lower rate with alcohol than with petrol, it is necessary to employ lower piston speeds, otherwise the exhaust gases will not be pure, and deposits, detrimental to the engine metals, will remain.

(3) To obtain power output from an alcohol engine equivalent to that derived from one run on petrol,

THE ELECTRIC VEHICLE IS WELL SUITED FOR THE TRANSPORT OF BREAD

(1889)—*bet. pp.* 172 *and* 173

it is essential to raise the compression pressure considerably, and to pass a greater quantity of fuel into the cylinder. The net result of this is that a heavier type of engine is required for use with Power Alcohol.

Government's Hampering Restrictions.

Manufacturers are not going to alter their designs of engine on the off-chance that the Government will free Alcohol for industrial purposes from the present hampering restrictions. Nor if the regulations should be altered to-day, could they reconstruct their plans by to-morrow. Some years must elapse before alcohol is available in sufficiently large quantities to enable our transportation to be independent of foreign oil supplies, and some years must elapse before motor vehicles, as a whole, are built suitable for running on alcohol.

But though we are confronted with these difficulties it should be realized that they are not insuperable, and that, therefore, Industrial Alcohol—containing as it does, so long as sunshine is untaxed, an inexhaustible supply of energy transmutable into cheap light, heat and power—is bound to become a practical reality.

Whether it be foreign imported or produced in the Empire is a matter which rests with ourselves. In the meantime, the change-over should be taken in hand without delay. The first essential step is for the Government to remove the restrictions and to offer practical encouragement for the distillation of Commercial Alcohol throughout the Empire. Designers will then get to work.

In the interval, the thin end of the wedge could be inserted by the extensive use of alcohol in conjunction with other home produced fuels, such as benzole, with which it will mix in any proportion. Incidentally, it may be mentioned that this quality is one of the chief assets of benzole. It was in this way, by mixing 80 per cent. of alcohol with 20 per cent. of benzole, with the addition of a little napthalene, that Germany made herself independent of foreign imports.

Cheap Motor Fuel of the Future.

By using a mixture, motor transport could be run with the minimum of alteration in engine construction; and this would not only tide over the years while the re-designing of engines and the creation of the alcohol industry were in progress, but would prepare the way for the more complete and general use of alcohol as a fuel, and would once and for all relegate the prevailing high level price of motor fuel to the realms of the past.

CHAPTER XXIV

BODIES—RAPID LOADING AND UNLOADING DEVICES

THE question of bodies for commercial motor vehicles is one of extreme importance, and it is only comparatively recently that the matter has begun to receive the consideration which it deserves. When it is remembered that the body affords one of the main assets of motor road transport—*i.e.*, advertisement—and is one of the chief sources either of extravagance or of economy—according to its suitability—the significance of body-build is easily recognizable.

To deal specifically with different types of body suitable for divers trades would entail filling several volumes. It is therefore proposed in the present book to treat the subject on general lines only, with special reference to the labour saving and economic side of the question.

One of the essential requisites of a commercial motor body is that it should be as light as possible consistent with strength. Many vans are fitted with bodies which are unnecessarily large and heavy, and this means waste of fuel, oil and tyres, and extra wear of the machinery throughout, besides causing increased damage to road surface. It is not an uncommon sight to see a van setting out on a journey carrying only half the net load, or with but a small portion of the available cubic capacity in use. This is obviously an extravagant method of transporting goods.

The problem of return loads is quite difficult enough as it is, without the handicap of carrying additional dead or non-remunerative weight. However, attention is at last being focussed on this very important matter, owing to the high cost of transportation which has forced increased economical efficiency on all who employ mechanical haulage. It is probable that co-operation resulting in a system of clearing-houses throughout the country will before very long solve this problem to a great extent.

Mechanical transport—because it can easily show a marked improvement in return over horse haulage in many instances—is far too often run with inadequate organization, and those responsible for the system rest content with comparatively poor results, whereas, with a little consideration, forethought and enterprise, a marked increase in efficiency could be obtained.

Wind Resistance.

A point, the importance of which is seldom realized and which applies to most types of bodies, is wind resistance. Both builders and buyers of bodies are apt to assume that because the average van is not driven at 40 miles an hour, the matter of windage area is immaterial. But this is far from being the case. A van with a high broad fronted body driven against a head or a partially head wind runs as though a brake was kept permanently applied. Wind-resisting surface means increased running costs, and much of this could be avoided. Bodies both in front and at the rear should be shaped as much as is practical with reference to reducing resistance from air currents. Many vehicles, such as large furniture vans, must of necessity present a good deal of "dead" surface, but by the use of the smallest and lightest shaped body compatible with the average load required to be carried, much extra weight and wind-resisting surface may be saved, with consequent return in the earning capacity of the van.

A FRONT-WHEEL-DRIVE ELECTRIC DELIVERY VAN

(1889)—*bet. pp.* 176 *and* 177

Detachable Bodies.

Every business man will readily understand that, as a commercial motor vehicle represents a comparatively large amount of capital, the longer the time during which it is kept on the road with a paying load, the greater the profit.

In order to arrive at any approach to the ideal it is consequently essential that the loading and unloading should be arranged in such a way as to ensure the minimum of time being expended on these operations. Wherever it is feasible, two or more bodies of differing type and carrying capacity should be obtained for the one chassis. These detachable bodies can be built in different models according to requirement. In this way a single chassis may be made to serve more than one requirement. Such bodies must be constructed so that they can be moved easily and without much labour being entailed. If they are designed small and light they can be arranged to slide on the chassis from the loading platform, or if of the heavy and bulky order they can be lifted and dropped into place by some simple form of crane, or by means of a winding drum worked off the gear box of the van.

The advantage of having two or more bodies for each chassis—apart from the question of size varying according to the load—is obviously that the machine may be kept on the road as much as possible, the only time during which the capital is bearing interest. Where spare bodies can be loaded or unloaded independently of the chassis and ready for its return, the best results are easily attained.

For some classes of goods the most efficient method may prove to be that in which an ordinary open sided platform body is fitted to the chassis, as on this can be slid or dropped two, four, or even six separate box bodies. In this way the owner can always start his van on its journey with the proper load, and need not handicap himself by carrying dead weight in addition.

On the occasions when the maximum load is to be carried the total weight of the detachable bodies will, of course, be in excess of that of the ordinary type of body, and it is for the trader to determine whether his van will be usually run fully loaded or only partially so. If the former, the multiple box body system may not help, but for the firm whose delivery loads vary, presuming the nature of the goods carried allows of it, a reduction in the annual maintenance bills will be effected by the adoption of this arrangement.

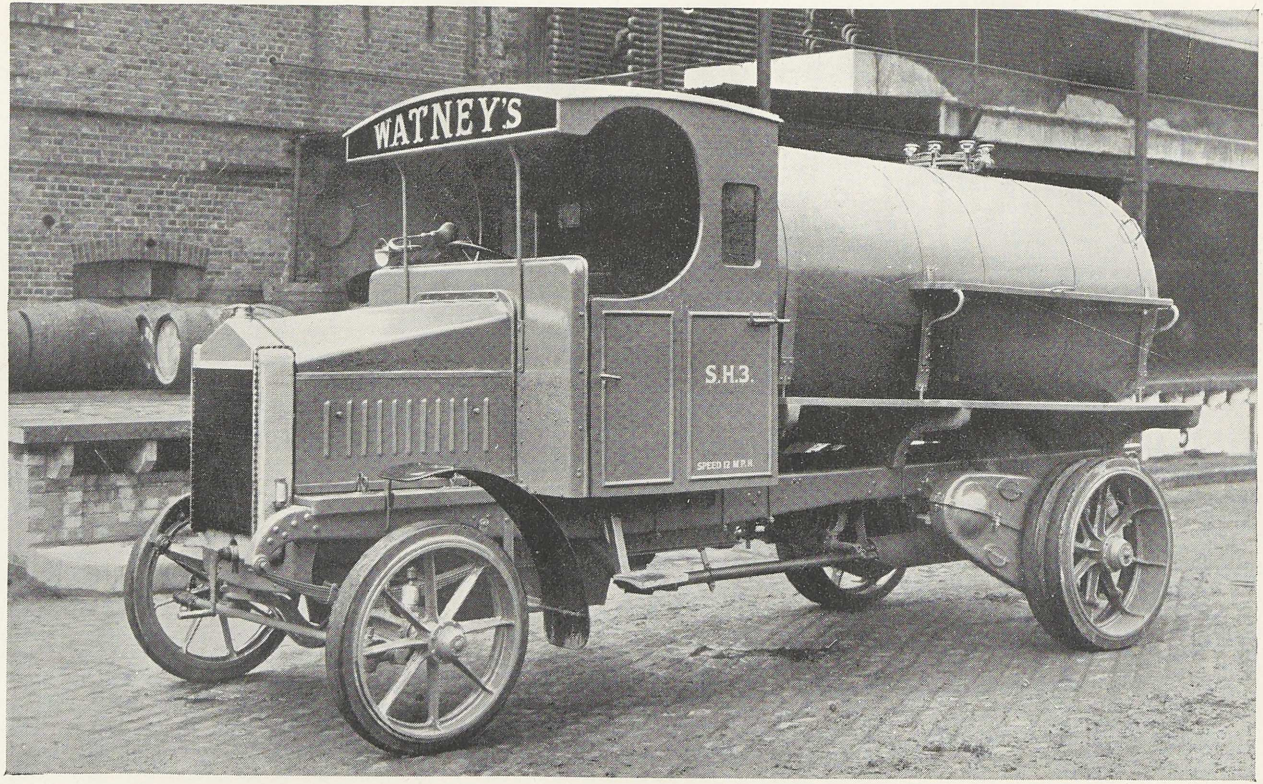
Semi-Automatic Loading and Unloading.

In addition to tipping bodies—dealt with hereafter—there are two kinds of apparatus specially designed for time and labour saving which are worthy of description.

The first of these consists of a detachable body mounted on a truck. The latter is of a four-wheeled skeleton design, and can be manoeuvred by hand, horse, or motor by means of a draw bar, the front wheels being steerable.

The motor chassis is backed up to the truck, connection is made by a special method, and with the help of cables and rollers the detachable body is run off the truck on to the lorry. The whole operation can be done by one man in less than a quarter of an hour; in fact, it is claimed that a load of 3 tons has been transferred single-handed in six minutes.

While the body is on the motor it is locked by a cam movement against motion, vertical, lateral and longitudinal. A point to be observed is that the weight



A NEW TYPE OF BEER-CARRYING BODY

(1889)—*bet. pp.* 178 *and* 179

of the load coming on to the chassis is taken gradually, and does not depend on the goodwill or the delicate touch of the loader.

The other device is a rapid-loading or unloading contrivance, and consists of a movable floor, which is made up of jointed plates. These can be moved backwards and forwards, and when unloading, the plates as they move on to the tail board—thus dumping their load—fold up. The reverse process is gone through for loading. These operations are done by means of a cable and winding drum.

Where " blocks " of load are to be dumped at different points, an arrangement by which the body is divided into sections or compartments by means of vertical boards used in conjunction with a movable floor may well add efficiency to the service.

Tipping Bodies.

With regard to tipping bodies both for chassis and trailer great advance has been made. This mode of unloading is by no means new, but it is in the application of the principle that progress lies. In addition to the usual hand method of operation there are several other forms worked electrically, mechanically, and hydraulically.

Electrical Tipping.

To take an example of the tipping gear on an electric vehicle: the design arranges for a motor—driven from the main batteries of the car—which turns a central screw running parallel to the chassis. The current is automatically switched off at the highest tipping position, and also when the body is returned to the normal position, thus avoiding over-running.

Mechanical Tipping.

An instance of a mechanically operated end tipping apparatus is that fitted to a certain make of steam wagon. The process is effected by a drive from the end of a crankshaft through bevel gears to a pair of vertical screwed shafts with swivel nuts, these working in brackets attached to the body. The movement is controlled by the driver from the cab of the wagon.

In another example—on a petrol-driven lorry—a drive is taken from the gear box and through suitable gearing to the telescopic screws on either side of the main frame. A special arrangement, whereby adjustable stops cause an arm to free the bevel driving gear at the top and bottom body position, is provided, and, although the body is trunnioned in such a way that it is tipped from its extreme end, it is claimed that a load of 3 to 4 tons can be dumped in twenty seconds. The body, raised to its maximum position, however, lies at an angle of 60 degrees, which in certain cases may tend to limit the utility of the method.

An ingeniously designed patent mechanically operated " run-back " on a steam wagon offers the third example of this class. The whole of the operation of raising or lowering the body is performed by the engine, all that it is necessary for the driver to do is to work a friction-clutch pedal. Spigots, attached to the front and to the back of the body, engage automatically with recessed brackets so that rigidity when travelling may be assured. On the underside of the body are fitted brackets, carrying rollers, which run in guide-channels, fitted upon the top of the chassis frame. Between the top channels is placed a horizontal screw, fitted with a nut, to which is attached two levers, and the other ends of these hold the underside of the body. From this it will be seen how the movement is obtained, and stops are provided for controlling the motion.

The most interesting point is that, owing to inclines fitted on the top of the chassis at a certain part, the body is practically in equilibrium just before the end of its horizontal travel is finished. Any further revolutions of the screw, therefore, tend to tip it, and thus to discharge the load. To revert to the running position it is only necessary to reverse the engine.

Hydraulic Tipping.

The hydraulic is perhaps the most used of any automatic system—because it is the most suitable for petrol-driven lorries which form a majority of the commercial motor vehicles in this country—and one or two illustrations of this are given below.

In one make of tipping mechanism, a body with about 4 tons load can be raised into position in 20 seconds. Two cylinders are employed, and are fitted to the body about midway, and just in front of the rear axle.

The duplicate cylinder method lacks simplicity, but provides a very steady lift.

One cylinder types are, of course, somewhat slower in operation, the time taken being, as a rule, about $1\frac{1}{4}$ mins. to tip completely a load of $3\frac{1}{2}$ tons, and about $\frac{3}{4}$ mins. for return to the horizontal position. A good design will possess a very simple control, and afford a nicety of adjustment in such a way that the motion can be arrested, or altered, with rapid response to the handling of the controlling lever. A case of the hydraulic system being applied to a steam driven vehicle is that in which the tipping-gear is operated by a telescopic hydraulic ram—worked from the boiler pump—and by this means an efficient tipping angle is obtained.

A Necessary Consideration.

A word of warning in connection with the adoption of tipping mechanism is, however, necessary, and this is illustrated by the table on next page which relates to vehicles employed on County Council work.

It must not be assumed from the statement that the system as a whole is at fault : it is the writer's opinion that more could be done than is at the present time in this country towards increasing haulage efficiency in several trades by the rightful application of the tipping body and trailer ; but the example shows that care should always be taken to weigh the pros and cons of any new method before adoption.

It will be seen that in the following instances the maximum load allowed by law on these two particular types of steam tipping wagon falls short of the maker's nominal loads, and this naturally affects appreciably the ton-mile costs.

The moot point—which the motor user must decide for himself according to his own conditions of service—is whether or not the saving of time effected during loading or unloading operations will repay him for the reduced load capacity due to the extra weight of the tipping gear.

In the accompanying schedule the back axles of all the lorries were put over weighbridges when the vehicles were ready for the road, that is, carrying water, fuel, oil, tools, and accessories. In the first column is given the maker's nominal capacity of the vehicle, in the second the actual rear axle weight unloaded but ready for the road, and in the third the legal load which could be properly put upon the lorry.

The last two sets of figures show a better load proportion, which is accounted for by the fact that these vehicles are not supplied with an overtype engine.

STEAM WAGONS.

Description of Tipping gear.	Load to be carried according to maker.		Actual Rear Axle-weight Unloaded, but ready for road.		Legal load to be Carried.		Registered Rear Axle-weight Loaded.		Actual Front Axle-Weight Unloaded, but ready for road.		Registered Front Axle Weight Loaded.	
	tns.	cwts.	tns.	cwts.	tns.	cwts.	tns.	cwts.	tns.	cwts.	tns.	cwts.
Screw, end .	5	0	4	4½	3	15½	8	0	3	4¼	4	0
Screw, side .	5	0	4	16	3	4	8	0	2	17	4	0
Hydraulic, end	5	0	4	4	3	16	8	0	2	17	4	0
Hydraulic, end	5	0	4	11	3	9	8	0	2	17¼	4	0
Hydraulic, end	5	0	4	10	3	10	8	0	2	17½	4	0
Screw, end .	5	0	4	4	3	16	8	0	3	3	4	0
Screw, end .	5	0	4	9¾	3	10¼	8	0	2	5	4	0
Screw, end .	5	0	4	4	3	16	8	0	3	3	4	0
Hydraulic, end	5	0	3	0¼	4	14¼	7	14½	4	5½	4	5½
Hydraulic, end	5	0	3	3¾	4	7¾	7	11½	4	8½	4	8½

Trailer Bodies.

Trailer bodies are made which tip endways or sideways, and from which the discharge can be made in about 1½ mins. Some designs are so arranged that, when the body is tipped, either the side door or the end door is released, and remains in its normal position. In this way, the load can be dumped—clear of the vehicle—with great ease.

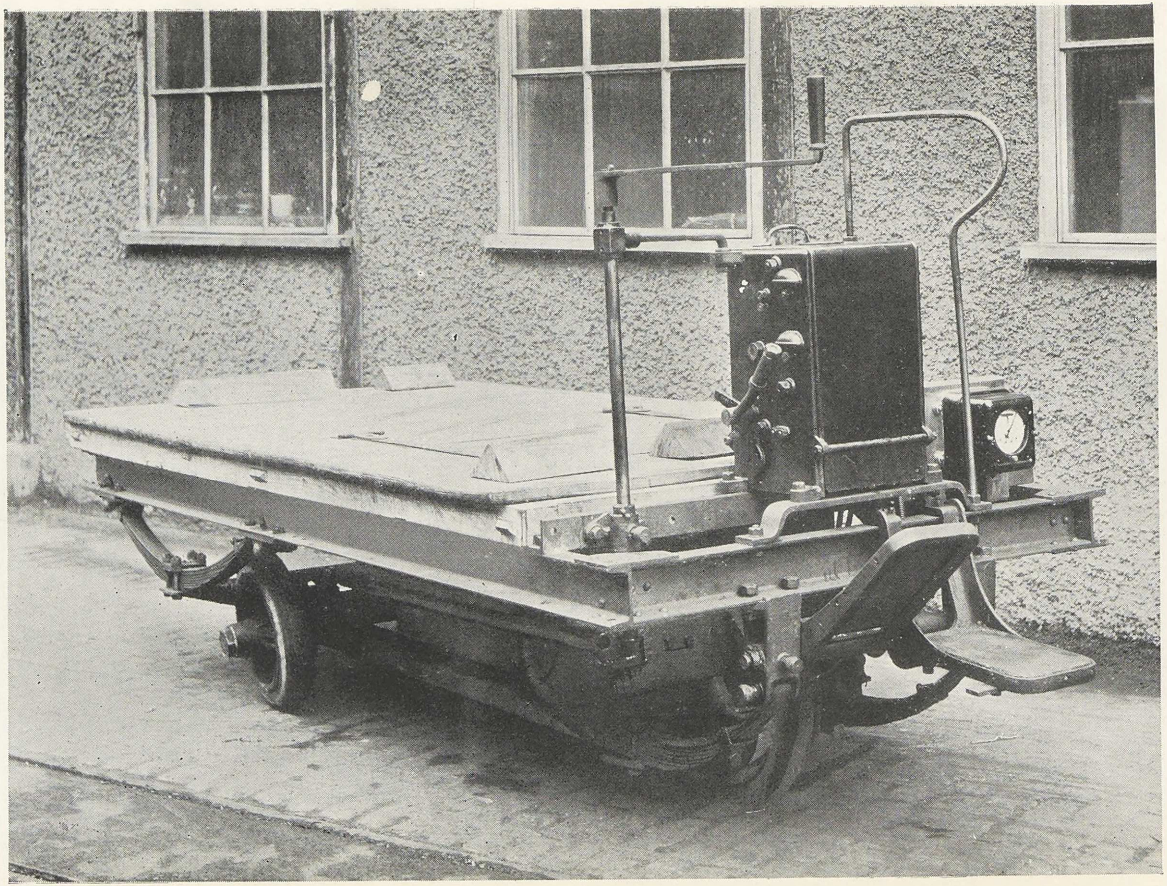
Body Sizes.

The size of a body naturally varies with the type of chassis to which it is to be fitted, also in relation to loading heights. The latter is a consideration which must be well weighed before the purchase of any vehicle, because, in the event of adequate loading accommodation not being provided, much valuable time and labour may be lost in the yard.

To obtain low floor height it is often necessary to box in the rear wheels of the van, and if this is the case, the trader must remember that these form projections inside the body, curtailing the body space, and this may well render loading or unloading more difficult with certain classes of goods.

Economy may be effected to an appreciable extent in a despatch service by the use of shutes, cranes, endless chains or belts, turntables, quick-loading and unloading hand and mechanically propelled trucks, and so on, for any sound method whereby the time occupied in loading or unloading can be reduced minimizes the cost of transport operation.

It cannot be too often insisted upon that a motor van lying idle represents capital bringing in no interest.



A THREE-WHEELED TYPE OF ELECTRIC TRUCK

(1889)—*bet. pp.* 184 *and* 185

CHAPTER XXV

ELECTRIC TRUCKS, AND THE COST OF RUNNING

In spite of the attention which is being given to motor road transport to-day throughout Great Britain—in fact, throughout the world—the problem of "first" handling of material and goods in factories and loading yards does not receive as much study as it might. It can easily be seen that a business house which changes over from horse to motor vehicle for the delivery and collection of goods may effect a great saving in expenditure; but that if the lorries are kept waiting about unnecessarily in the yards, or if there is congestion in the factory itself, owing to lack of adequate means for the handling of material, the transport system will not show the best return.

Loading Economy.

The effectiveness of a motor fleet, however finely run, will be hampered if out of date and wasteful means are employed for the conveyance of the goods to the loading bays. In many classes of trade, wheel-barrows and hand propelled trucks are used where conditions would readily allow the use of mechanically propelled trucks; and this in an age when production is of primary importance, and the price of labour is high.

Labour Saving Trucks.

Without doubt there is great scope for soundly constructed "initial-conveyance" vehicles. The electric truck—which can be handled by unskilled labour—is capable of replacing five or six men with hand barrows, thus saving the wages of at least four men. It may be mentioned, in addition, that the efficiency of the machines themselves may often be increased by making variations in the design, or by the fitting of auxiliary devices, such as tipping bodies, traction attachments, cranes, etc. Even with these small machines it is necessary to remember that time spent standing idle is time wasted. This is, of course, the fundamental point for attack in the solution of every transport problem.

The Elevating Platform.

An appliance which is worthy of note, therefore, in connection with these trucks is the elevating platform, which enables the machine to be run under ready loaded tables and to pick them up in a few moments, thus saving the loading time. It should be remembered that the greater the annual mileage during which a motor vehicle is run laden, the lower will be the cost per mile proportionately.

The control of all electrically driven conveyances is so simple, requiring a minimum of skill, that it is not proposed to go into the driving or the details of construction of these trucks, but merely to outline briefly the specification of two representative types, which will show at a glance the chief characteristics and capabilities of the electric truck.

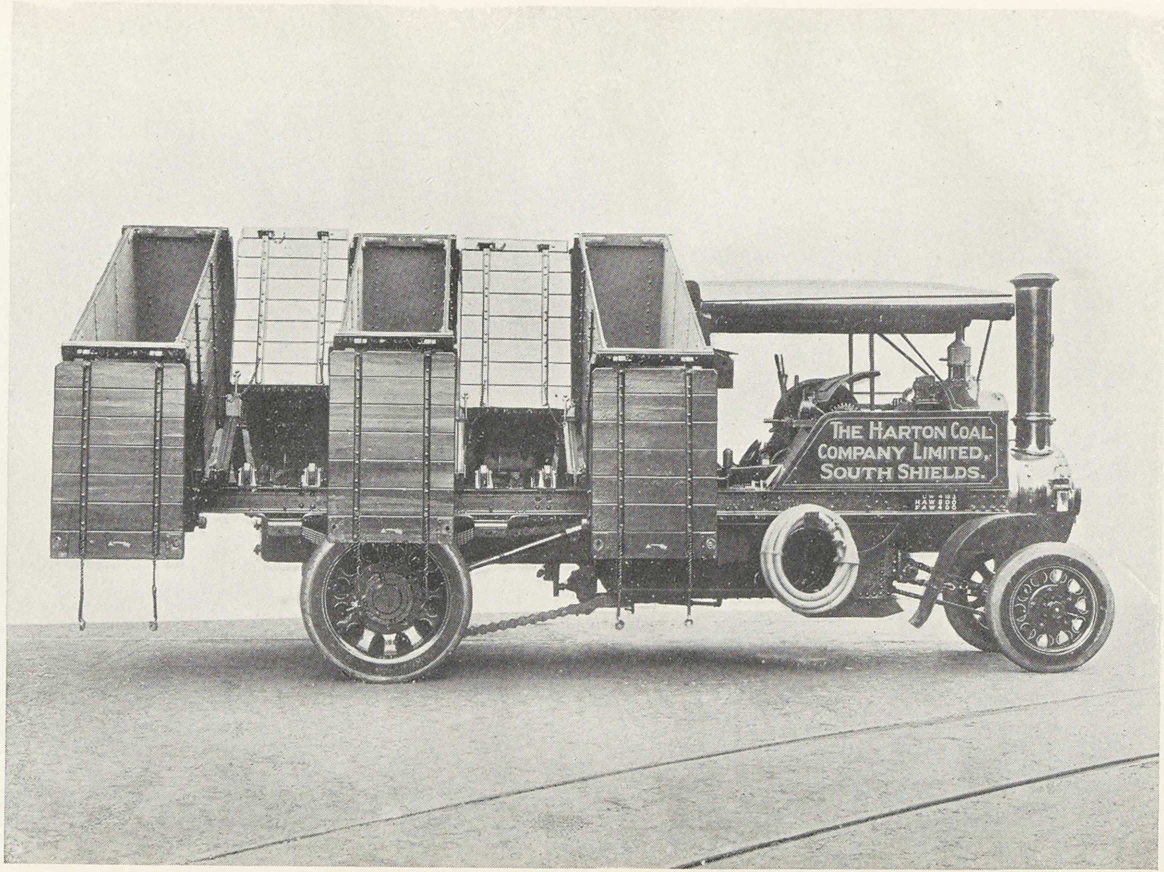
The three wheeled model is designed particularly for operation on uneven road surfaces, and in places where space restrictions demand a small turning radius.

THREE WHEELER.

Motor.—Series wound, totally enclosed, $1\frac{1}{2}$ h.p. normal rating.

Loading Capacity.—3,000 lb.

Battery.—20 cells, 129 ampere-hours capacity; normal charging current 24 amperes.



A STEAM WAGON WITH A COMPARTMENTED SIDE-TIPPING BODY

(1889)—*bet. pp.* 186 *and* 187

Tyres.—Solid rubber. Driving wheel 20 in. by 3½ in. Other wheels 16 in. by 3½ in.

Speed.—4½ m.p.h. loaded ; 5 m.p.h. unloaded.

Gradients.—Up to 1 in 7 loaded.

Turning Radius.—8 ft.

Weight of truck.—11 cwt.

Weight of truck with battery.—17 cwt.

Load hauled.—3 tons on level.

Clearance.—3 in.

The four-wheeled truck is built especially to facilitate the loading of heavy goods, and for this reason has a lower platform height than that of the three-wheeler. The loading area is moreover larger, and more bulky material can therefore be handled.

Four-Wheeler.

Motors.—Series wound, totally enclosed, each ¾ h.p.

Tyres.—Solid rubber, steering wheels 16 in. by 3½ in.; other wheels 10 in. by 3 in.

Speed.—5 m.p.h. loaded, 6 to 7 m.p.h. unloaded.

Weight of truck.—15 cwt.

Weight of truck with battery.—22 cwt.

Turning radius.—10 ft.

The other items are the same as in the first specification. The platform area of the three-wheeler is 6 ft. 1 in. by 3 ft. 9 in., and that of the four-wheeled type 7 ft. by 3 ft. 4 in.

Schedule of Costs.

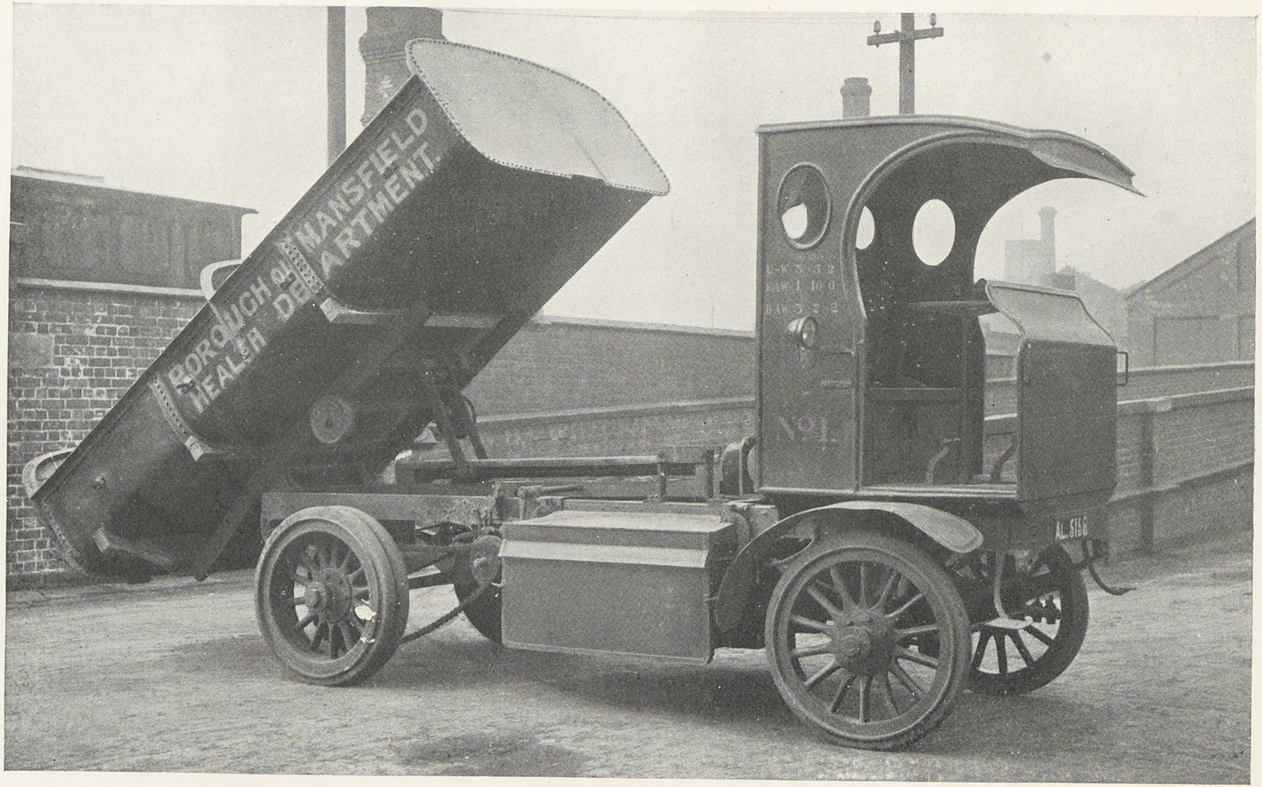
	£
Interest on capital at 6 per cent. per annum	25
Depreciation on truck (less battery and tyres) at 10 per cent. per annum	34
Drivers' Wages	150
Insurances, etc.	15
Current (2,000 miles per annum) at 1½d. a unit	6
Battery renewal (two years' life)	34
Tyres, ditto	8
Cost of running truck 2,000 miles per annum	£272

Tyre Life and Battery Renewal.

When the saving in wages, due to the fact that the one truck replaces five or six handbarrows, is taken into account, it will be seen that a very appreciable reduction in transport charges can be made in trades where the nature of the goods and the conditions of service allow the use of such a vehicle.

It is, moreover, only fair to the makers of these machines to point out that the figures, in order that they may prove the more reliable guide to the uninitiated, are founded upon a decidedly conservative basis.

Tyre life, for instance, is taken at 4,000 miles, which should be on the safe side, while battery renewal is reckoned for at the end of two years, though accumulators often last considerably longer.



AN ELECTRICAL TIPPER

(1889)—*bet. pp.* 188 *and* 189

CHAPTER XXVI

AN EXAMPLE OF BIG FLEET ORGANIZATION

A 300 Vehicle Fleet and its Costing System.

It is not difficult to realize that a transport firm whose vehicles daily cover 5,000 miles collecting and delivering 120,000 gallons of milk must require extremely good organization throughout the service, also that the records of costs must be of exceptional interest. Some particulars of the working of such a firm, which is really a big combine comprising as it does some fifty odd companies, are given here.

About 300 vehicles (mostly of the 3-ton type) are employed and standardization is being arrived at as much as possible, the latest additions to the fleet comprising 130 new three-ton chassis all of the one make, and thirty 30-cwt. machines of another make.

The average petrol consumption for the new 3-ton lorries is from 6 to 7 miles per gallon, and for the 30-cwt. 10 miles per gallon.

The principal work is to collect milk from the farmers, take it to the firm's factories, and deliver it wherever required.

A very complete system of record-keeping is used, whereby it is possible to find the cost per gallon per day for any lorry in the fleet.

Three forms are filed for each lorry —

No. 1 gives the financial history ;

No. 2 gives the running costs ;

No. 3 gives the mechanical history.

Specimens of the forms used are reproduced here and, as in the case of others shown later, are self-explanatory.

MOTOR RECORD.

(Financial History)

No.

Make of Car or Lorry.. H.P............................ Date Sold..

Date Purchased .... Sold to..

Body Built by...

Cost Chassis £.................... Body £........................... Total £...........Amount £........................... L.F...............................

Registered No................. Engine No.. Chassis No. ....

VALUE AND DEPRECIATION RECORD.

Year.											
Value @ January 1st . £											
Depreciation for Year . £											
Value @ December 31st . £											

Remarks

INSPECTOR'S REPORTS.

(Mechanical History)

No.

Date.	Substance of Report.	Action Taken.

MOTOR
(Running

Month.	Location.	Driver's Name.	Mileage.	Milk Collected (Galls.)	Petrol or Coal used Galls. or cwts.	Miles Per Gall. or Cwt.	Fuel. £	Fuel. s.	Labour. £	Labour. s.	Repairs (except tyres). £	Repairs (except tyres). s.
JAN.			1704	31620	255	6·68	36	12/3	20	9/9	—	—
FEB.			1450	29070	203	7·14	29	12/-	20	9/9	—	—
MAR.			1714	27026	247	6·93	41	3/4	20	9/9	—	9/–
APR.			2490	33042	368	6·76	61	6/8	17	17/6	—	—
MAY			2730	31111	389	7·01	64	16/8	20	5/–	17	7/8
JUNE												
JULY												
AUG.												
SEPT.												
OCT.												
NOV.												
DEC.												
TOTAL Year												
,, To Date												

RECORD.

Costs)

No. SHEET No.

13—(1889) 20 pp

Tyres. £	Tyres. s.	Insurance Depreciation. and Interest £	Insurance Depreciation. and Interest s.	TOTAL. £	TOTAL. s.	Average Cost per Mile.	Average Cost per Gallon.	No. of days at work.	Average Miles.	DETAILS OF REPAIRS.	Initials Manager.	Initials Board.
—	—	17	13/4	74	15/4	10·53	·56	31	55·00			
—	—	17	13/4	67	15/1	11.21	·55	29	50·00			
—	—	17	13/4	79	15/5	11.16	·70	31	55·29			
—	—	17	13/4	96	17/6	9·34	·70	30	83·00			
—	—	20	5/–	122	14/4	10·78	·94	31	88·06			

In addition a detailed mechanical history of the lorry is kept in a card index, one card for each lorry, and everything connected with the vehicle is put down, even to the mileage of the sparking plugs. The aim of these statistics is to get at the cost per mile of running the vehicles, and the cost per gallon for collecting the milk, also, as it is an easy matter to convert gallons of milk into tons, the cost per ton-mile can be ascertained.

The maintenance of such a fleet is naturally a big item, but the firm have inspectors travelling certain definite zones, who daily report to the manager the condition of the vehicles, and who order them in for repairs to the various depôts immediately anything appears faulty.

For the purpose of control, the country is divided into two by a line from London to Aberystwyth, all south of that line coming under a main repairing depôt in Dorsetshire, and all north under one in Derbyshire. In addition, there are minor repairing depôts situated at various specially selected places.

The whole of the buying for the transport is done through one office—the chief office in the north—and therefore many economies are effected.

The average cost per gallon for collection is a figure under 1d., and the average cost per vehicle mile works out at 15.95d.

Besides the forms 1, 2, and 3, a fourth one is used as Inspector's daily report, and a fifth as Works Manager's bi-weekly report.

In addition, a Road Motor Fuel Record (*a*) and a Record of Motor Vehicles (*b*) are employed, specimens of which are given here.

The latter (*b*) gives the information necessary to complete No. 2, and is issued to the subsidiary companies for return each month.

INSPECTOR'S DAILY REPORT.

FACTORY.. Date of Last Visit................................ *Date*.................................

U.D. No.	General Appearance of Vehicle.	Running Condition.	State of Engine.	Lubrication.	Condition of Tyres.	Repairs required.	Recommendations.	Manager's Remarks and Action Taken.

Spares—List of Stock.

Condition.

Petrol and Benzole—Stock. galls.

Method of Storage.

Oil—Stock. galls.

Method of Storage.

Records

Are records properly up-to-date } Fuel / Motor Vehicles

GENERAL REMARKS. (Garage and Conveniences.)

Signature..

WORKS MANAGER'S REPORT.

DEPOT.. *Date*..

Job No.	Date rec'd.	Owning Coy. and Factory.	U.D. No.	Progress.	Remarks including cause of delay if any.	Probable date of Completion.

General Remarks

NOTE.—This return must include all vehicles at the works from their arrival to their despatch.

Signature...

To be made up Wednesday and Saturday evenings.

ROAD MOTOR FUEL RECORD SHEET. ....Branch. Week ending..............................192

	RECEIVED.					ISSUED—COAL.					
	Petrol.	Benzole.	Oil	Bought From.	Price per gal.	Coal.	Signature.	Coal.	Signature.	Coal.	Signature.
Monday . .											
Tuesday . .											
Wednesday .											
Thursday . .											
Friday . .											
Saturday . .											
Sunday . .											
Total . .											

ISSUED—PETROL, BENZOLE.

Vehicle . . .												
	Petrol.	Benzole.	Signature.	Petrol.	Benzole.	Signature.	Petrol.	Benzole.	Signature.	Petrol.	Benzole.	Signature.
Monday . .												
Tuesday . .												
Wednesday .												
Thursday . .												
Friday . .												
Saturday . .												
Sunday . .												
Totals . .												

Certified at the Branch.	Entered on Milk Collection Sheets }	Stock from last week and all calculations. }	Stock at end of Week }	Vised by Manager ....
At C.O.	Checked with Milk Collection Sheets }	Stocks from last week and all calculations }	A/c's passed for all purchases of Petrol & Benzole. }	Vised ....

NOTE.—To be kept by all Depots where one or more Motor Vehicle is used. Daily entries and Signatures. To be forwarded to the Chief Office, where it will be checked and filed.

DEPOT......

RECORD OF MOTOR VEHICLE.

....DRIVER

MAKE.. U.D. No.........30............... MONTH...........*March*.......................1920

Journeys.	1st		2nd		3rd		4th		5th		PETROL.	BENZOLE.
	Miles.	Galls.	Miles.	Galls.	Miles.	Galls.	Miles.	Galls.	Miles.	Galls.		
1	45	529									8	
2	45	526									8	
3	45	528									8	
4	45	529									7	
5	45	526									8	
6	45	524									8	
7	45	519									8	
8	45	534									7	
9	45	527									8	
10	45	525									8	
11	45	529									8	
12	45	530									8	
13	45	528									8	
14	45	526									8	
15	45	527									8	
16	45	530									8	
17	45	529									7	
18	45	531									8	
19	45	530									8	
20	45	533									8	
21	45	520									8	
22	48	742									8	
23	48	742									8	

Mechanic's Remarks.

Date Signature

Inspector's Remarks and Instructions.

O.K.
Greasers require attention, specially rear spring slippers.

Date 31 3 20
Signature

Manager's Remarks.

24	48	744									8		
25	48	748									7		
26	48	743									8		
27	48	748									8		
28	48	732									8		
29	48	750									8		
30	48	746									8		
31	48	746									8		Date
Totals	1425	18519									244		Signature

Grand Totals	**Miles** 1425	**Galls.** 18519	**Petrol** 244	**Coal or Benzole**

To be filled up at Factory.

	£	s.	d.	£	s.	d.
Labour Driver . 4 *weeks and* 3 *days*						
Home Repairs .	16	0	0			
Petrol 244 Gallons at 3/4						
Benzole " " .	40	13	4			
Coal Cwts. at .						
Repairs a/c of £7 10 – / 3 6						
	7	13	6			
Total Carried Forward .	64	6	10			

Includes all Expenditure under headings specified. Remarks on back.

___*March* 31*st*____1920 Factory Manager.

To be filled up at C.O.

	£	s.	d.
Brought forward	64	6	10
Insurance	1	–	–
Depreciation	16	13	4
Interest			
Total Cost .	82	0	2

Cost per Mile	13.81	Average Miles per Journey	46
" " Gall. Milk	1.06	" Galls. Milk "	597
		Miles per Gall. or Cwt.	5.84

Petrol records and expenses checked and certified correct.

__*March* 31*st*__1920 ____________________Director.

NOTE.—The Manager of every Depot where one or more Motor vehicles are in use is to forward one of these forms properly made out for each Vehicle, with the fuel record sheets, to his Chief Office on the 2nd of every month. It will be checked there and forwarded to Headquarters, where it is to arrive not later than the 10th of each month. For blank forms apply to Headquarters.

CHAPTER XXVII

CLEARING HOUSES

THE subject of clearing houses or transport exchanges for motor road vehicles is of great importance because, with the adoption of an efficient system throughout the country, ton-mile charges could be reduced. Owing to the relatively high costs of all fuel, materials, and labour in connection with the running of motor vehicles, traders have been forced to consider seriously the question of return loads.

Clearing houses for motor vehicles were originated during the war by the Government in an attempt to save transport. Several of the larger municipalities followed the example and created organizations for this purpose. In August, 1920, there existed some twenty or so clearing houses for road transport under either the direct supervision of local municipalities or Chambers of Commerce, or, at any rate, with their official encouragement and support. These exchanges were instituted primarily to deal with traffic between large main centres, such as between Leeds and Manchester, Manchester and Liverpool, Birmingham and Manchester, and so on.

The experience gained from these pioneer clearing houses shows that while they undoubtedly did much good work, they did not really attempt to solve local difficulties. Obviously what is required in addition to connecting main centres is that outlying districts should be linked up also. One of the greatest obstacles to a complete clearing house system is expense. The cost which would be entailed in setting up offices in all small towns and villages simply to deal with this one phase of motor road transport would be prohibitive at the present time.

A Definite Scheme.

The Industrial Vehicle Section of the Automobile Association formed a scheme in the summer of 1920, whereby use was made of its existing organization of recognized agents and repairers to form an exchange system. The Association appointed between 500 and 600 agents throughout the country to keep registers showing on the one hand the goods, produce, machinery, etc., requiring transportation in their own area, and on the other hand a record of the motor transport running from their own locality to other districts. Arrangements were made whereby existing recognised clearing houses should act on behalf of the Automobile Association and its agents, thus linking up large centres where facilities already existed with the outlying and intermediate points which otherwise could not have hoped either to have had their quota of road transport or to have contributed their proportion to the traffic requiring intermediate or return loads. (See Appendix II.)

In addition to the existing individual organizations referred to above, close touch is kept with the Association of Road Transport Clearing Houses, which Association embraces all recognized clearing houses of any importance.

A national network of exchanges which will serve the whole kingdom is urgently required, for there is little doubt that mechanical road transport must be rendered more efficient than it is to-day—the cost per ton-mile must be reduced. One of the obvious ways of achieving success is to keep the vehicle loaded as near as possible to its maximum tonnage capacity the whole time it is on the road.

There is much to be learned yet with regard to this matter, but now that a start has been made, energy guided by experience should assuredly lead us towards the goal.

APPENDIX I

CLASSIFICATION OF HIGHWAYS

It is unnecessary to-day to dwell on the importance of road reconstruction. The vast increase in the number of vehicles during late years, and especially during 1920, is obvious to all who travel by road, as is also the fact that not only are the transported loads augmented in tonnage but they are carried at higher rates of speed. Such conditions call urgently for change and progress. The need for the classification of our highways throughout the country is imperative, for without a definite and comprehensive road system we cannot hope to cope with the motor road transport of to-day, let alone that of to-morrow.

The road problem is of widespread interest because it affects everyone either directly or indirectly, and a short statement of what is proposed by the present Government with regard to classification does not seem to be out of place here.

Memorandum on the Classification of Roads

Under the provisions of Section 17 of the Ministry of Transport Act, 1919, the Minister may, subject to the approval of the Treasury, make advances out of the moneys provided by Parliament to any authority, company or person, either by way of grant or by way of loan, or partly in one way and partly in another, and upon such terms and conditions as he thinks fit, for the construction, improvement or maintenance of roads, bridges, or ferries. For the purpose of such advances, the Minister may, after consultation with the Roads Committee appointed under this Act and the local authorities affected, classify roads in such manner as he thinks fit.

The Roads Department of the Ministry is at present engaged on the preparation of a scheme for the classification of all roads in Great Britain and Ireland, and it is intended that a complete scheme shall be submitted to the Minister before the end of the present year (1920), in order that advances may be made to highway authorities towards the cost of the maintenance of roads during the financial year commencing 1st April, 1921.

Roads will be divided into three classes: (1) first class, (2) second class, (3) all other roads. The classification is to be made on the basis of the relative importance of the various highways for general traffic purposes, and regard will be had to the consideration whether a road proposed to be classified is an important route for through traffic, or possesses more than local importance, and especially whether the cost of maintenance is considered to be materially affected by the through traffic forming a substantial percentage of the total traffic on the roads.

It is intended that advances shall be made by the Minister of Transport out of the Roads Funds derived from the taxation of vehicles towards the maintenance of roads included in Classes 1 and 2, and it is hoped that the moneys forthcoming will enable contributions to be made on the basis of 50 per cent. of the cost of maintenance of first-class roads and 25 per cent. of the cost of second-class roads. Before any decision can, however, be arrived at as to basis of these contributions, an estimate of the cost of maintenance of roads included in Classes 1 and 2 must be arrived at by the Roads Department of the Ministry from information to be obtained from the many highway authorities responsible for the maintenance of the roads.

When this classification has been determined it is intended that a system of numbering shall be laid down by the Ministry for all roads included in Classes 1 and 2. The sign-posting of these roads will then be put in hand in order to remedy the present inadequate provision. The new sign posts will conform to a certain standard to be laid down by the Ministry, and will indicate the number of the route in addition to the distance to the nearest village, nearest important town, and the terminal town on the route.

The question of adequate and standard forms of caution signs and the provision of signs giving the names of towns and villages on the main approaches will also be dealt with.

APPENDIX II

LIST OF TOWNS

IN WHICH THERE ARE

CLEARING HOUSES FOR RETURN LOADS

Aberdeen
Aberdovey
Aberfeldy
Abergele
Abingdon
Accrington
Alcester
Alderley Edge
Aldeburgh
Alford
Alnwick
Alresford
Alton
Alveston
Ambleside
Appleby
Arundel
Ashburton
Ascot
Ash
Attleborough
Aylesbury
Ayr
Baldock
Balmachllan
Banbury
Banchory
Barnstaple
Barrow-in-Furness
Basingstoke
Batley
Battle
Bawtry
Beaconsfield
Bedford
Berkhamsted
Berwick-on-Tweed
Bideford
Bingham
Birchington
Birkenhead
Birmingham
Bishop Auckland
Bishop's Waltham
Blackburn
Blackpool
Blackwater
Blairgowrie
Bletchley
Bognor
Bolton
Boro Bridge
Borough Green
Boscombe
Boston
Bournemouth
Bovey Tracey
Bradford
Braunton
Brechin
Brecon
Bridgend
Bridgnorth
Bridgwater
Bridlington
Brigg
Brighton
Bristol
Broadway
Bromley
Bromsgrove
Broughton Astley
Broughty Ferry
Buckden
Buckfastleigh
Bude
Burnham
Burnley
Burton-on-Trent
Bury
Bushey Heath
Buxton
Callander
Calne
Cambridge
Cambourne
Canterbury
Cardigan
Carmarthen
Carlisle
Castle Douglas
Caterham Valley
Charlbery
Chatham
Cheddar
Cheltenham
Chelmsford
Chepstow
Chesham
Chester
Chester-le-Street
Chippenham
Chipping Norton
Chislehurst
Christchurch
Chudleigh
Chulmleigh
Church Stretton
Cirencester
Cleckheaton
Clevedon
Cleveleys
Cobham
Cockermouth
Colchester
Coleford

Colne
Comrie
Cranbrook
Cranleigh
Crawley
Crewe
Crieff
Cromer
Crook
Crowborough
Croydon
Cuckfield
Cupar
Daventry
Dartford
Deal
Denton
Derby
Dereham
Devizes
Dingwall
Doncaster
Dorchester
Dorking
Dover
Dovercourt
Downton
Dulverton
Dumbarton
Dunfermline
Dunstable
Durham
Ecclesfield
Eccleshall
Edgware
Edinburgh
Egham
Ellesmere
Ellesmere Port
Ely
Enfield
Epping
Epsom
Evesham
Exeter
Exmouth
Fakenham
Falkirk
Falmouth
Fareham
Faringdon
Farnborough
Faversham
Felixstowe
Fleetwood
Flint
Folkestone
Fordingbridge
Forfar
Fowey
Framlingham
Frinton-on-Sea
Frome
Gailey
Gainsborough
Gateshead-on-Tyne
Gerrards Cross
Gillingham
Girvan
Glasgow
Glastonbury
Glossop
Gloucester
Godalming
Gourock
Grange-over-Sands
Grantham
Grimsby
Guildford
Hale
Halifax
Handsworth
Hanley
Hartley Wintney
Harwich
Hatfield
Hawick
Heathfield
Hemel Hempstead
Henley-on-Thames
Hexham-on-Tyne
Highbridge
Highcliffe-on-Sea
Highworth
High Wycombe
Hindhead
Hoddesdon
Holmes Chapel
Holt
Holyhead
Horsham
Hounslow
Hove
Hull
Hungerford
Huntley
Hythe
Ilkeston
Ilminster
Inverness
Ipswich
Ironbridge
Keighley
Kelvedon
Kendal
Keswick
Kidderminster
Kilmarnock
Kingsclere
Kingsbridge
Kings-Lynn
Kingston-on Thames
Kirby Moorside
Kirkby Stephen
Kirkcaldy
Kirkham
Knaresborough
Knutsford
Lanark
Lancaster
Langport
Largs
Leamington Spa
Ledbury
Leeds
Leicester
Leiston
Leominster
Lewes
Lincoln
Lou Port
Liphook
Littlehampton
Liverpool
Llandovery
Llandudno
Llanfair
Loughborough
Lowestoft
Ludlow
Luton
Lutterworth
Lydney
Lymington
Lynton
Lytham
Macclesfield

Maldon
Malton
Malvern
Manchester
Mansfield
Margate
Market Deeping
Market Drayton
Market Harborough
Marlborough
Marlow
Melksham
Melton Mowbray
Mere
Merstham
Middlesbrough
Midsomer Norton
Milnthorpe
Moffat
Morecambe
Morpeth
Nairn
Nantwich
Neath
Newark
Newbridge
Newbury
Newcastle
Newcastle-on-Tyne
Newhaven
New Malden
Newport
Newquay
New Romney
Newtown
Northallerton
Northampton
North Berwick
Northfield
Northwich
Norwich
Nottingham
Nuneaton
Oakham
Ongar
Ormskirk
Orpington
Oswestry
Oxford
Padstow
Paignton
Paisley
Pangbourne
Pelham Street
Penicuik
Penistone
Penrith
Penzance
Pershore
Perth
Peterborough
Petersfield
Pewsey
Pickering
Pitlochry
Pocklington
Pontefract
Pontypool
Poole
Port Isaac
Porth
Porthcawl
Portobello
Portslade
Poynton
Prestatyn
Prestwich (Lancs)
Prestwich (Ayr)
Pulborough
Purley
Pwllheli
Rainham
Reading
Redbourn
Retford
Rhayader
Rhosneigr
Rhyl
Richmond (Surrey)
Richmond (Yorks)
Ripley
Ripon
Rochdale
Rochester
Romford
Romsey
Rugby
Rugeley
St. Albans
St. Andrews
St. Blazey
St. Columb
St. Ives
Saffron Walden
Salcombe
Salisbury
Sandgate
Sandwich
Saxmundham
Scarborough
Scole
Seaford
Sevenoaks
Seaton
Shaftesbury
Sheerness
Sheffield
Shenfield
Shepton Mallet
Sherborne
Sheringham
Shoreham-by-Sea
Shrewsbury
Sidmouth
Sittingbourne
Skipton
Slough
Snettisham
Southam
Southampton
Southbourne
South Brent
Southend-on-Sea
Southport
Southsea
South Shields
Southwell
Southwold
Spalding
Spilsby
Stafford
Stamford
Stevenage
Stilton
Stirling
Stone
Stony Stratford
Stourbridge
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Stranraer
Stratford-on-Avon
Studley
Sturry
Sunderland
Sunbury Common
Sutton
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