

# THE AUTOMOTOR

AND

# HORSELESS VEHICLE JOURNAL

A RECORD AND REVIEW OF APPLIED AUTOMATIC LOCOMOTION.

Circulates amongst Makers and Users of Motor-Cars, Cycles, etc., in the United Kingdom, the Colonies and the Continent.

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## CONTENTS.

	PAGE
Roller Bearings and Their Applications ... ..	37
The Parsons' Motor ... ..	42
The "Scotte" System ... ..	44
Resistance of Vehicles in Rounding Curves ... ..	45
Report of the Manchester Deputation on Electric Traction ... ..	45
The Columbia Motor-Carriages ... ..	46
Motor-Cars and Maidstone ... ..	47
Nautical Automobilm ... ..	48
Maxim's Automotor ... ..	48
The use of Alcohol in Prime Movers ... ..	51
Doings of Public Companies ... ..	52
An Automobile House ... ..	56
Weights of French Light Petroleum Motors ... ..	56
The Heilmann Electric Locomotive... ..	57
Automobilism and the Fire Brigade of the Largest City of the World ... ..	57
Diary of Forthcoming Events ... ..	59
The Self-Propelled Traffic Association's Competitions... ..	59
Our Idea Entirely ... ..	60
Stables Fires ... ..	60
Racing on Roads and High Speed on Roads ... ..	61
The Thames Steamboat Service ... ..	61
Halstead and Horsburgh's Friction Clutch ... ..	62
Notes of the Month ... ..	63
Continental Notes ... ..	64
Self-Propelled Traffic Association ... ..	66
An Improved Differential Gear for Motor-Vehicles ... ..	68
Explosion of a Traction Engine ... ..	71
Correspondence ... ..	72
The Automobile Club of France and the Self-Propelled Traffic Association ... ..	74
Proceedings of Technical Societies... ..	75
New Inventions ... ..	79

### I.—The Advantages Arising from the Application of Roller Bearings.

The principal advantages arising from the application of roller bearings are the following :—

- Reduction in starting effort.
- Decreased tractive effort in the case of vehicles, whether running on ordinary roads, tramways, or railways.
- Decreased resistance to rotation in the case of shafts and other revolving mechanisms.
- Avoidance of hot bearings and economy in lubrication.

The vital importance of reducing starting effort and tractive force to the lowest possible point is well illustrated by the amount of labour and capital which has been expended with results generally satisfactory, from an economic point of view, upon the construction of the road, railway, and tramway systems of the world. The primary object of such systems is to reduce the force necessary to accomplish the transportation of people and merchandise, and, as a consequence, to effect such transportation at the least possible monetary cost.

It is interesting to note that very early in history the advantages of rolling motion were discovered. The ancient Greeks and Romans quickly appreciated the advantages of placing heavy loads upon rollers or wheels when desirous of moving them, rather than attempt to do so by sliding them over the surface of the ground. In other words, the advantages arising from the use of rolling, as compared with sliding friction, were so obvious as to ensure universal adoption of the principle.

Having obtained such good results from the adaptation of rollers or wheels for tractive purposes, it is strange that such a long period should have elapsed before any serious attempt was made to apply the same kind of motion between the wheels and their axles in the case of wheels revolving on fixed axles, or between the axle journals and their bearings, in the case of axles revolving in fixed bearings, as had been found so advantageous when acting between the rims of the wheels and the surfaces upon which they moved, the earliest of such attempts being so far as the author is aware of quite modern date.

The importance of reducing frictional assistance both in starting and running is now fully acknowledged, and is emphasised by the many anti-friction metals and special devices for improved lubrication of axles and shafts now on the market. Whatever degree of success the best of these devices may have attained they cannot approach such favourable results as are produced by the application of properly-constructed roller bearings. With reference to this part of the question, the following extract from a paper read at the Toronto meeting of the British Association in August last, by Mr. Bayley Marshall, M.Inst.C.E., is interesting :—

"Reduction in Starting Effort.—The reduction in the effort required to start vehicles or shafts fitted with roller bearings as compared with those fitted with ordinary bearings is of such importance that, if it were the only advantage, it would warrant the necessary additional monetary expenditure.

## ROLLER BEARINGS & THEIR APPLICATIONS.\*

As the application of rolling motion to bearings is at the present time exciting much attention, the author ventures to hope that the matter contained in the following paper will be acceptable to the members of this Association.

The subject may be divided into the following heads :—

- I. The advantages arising from the application of roller bearings.
- II. The requirements and details of construction of such bearings.
- III. The results already obtained from roller bearings which have been applied to railway vehicles, tramway cars, and other purposes.

\* Paper read at the Manchester Association of Engineers by Mr. THOMAS W. How, F.I.S.

"In the case of steam, electrical, or other mechanical traction, the reduction of starting effort allows of heavier trains or vehicles being controlled by the existing locomotives or other motors than can at present be dealt with, and in many cases would avoid the necessity of a second locomotive.

"In the case of electrical traction, the reduced starting effort is of almost vital importance, as not only does it effect a very considerable saving in electrical output, but also greatly reduces the serious

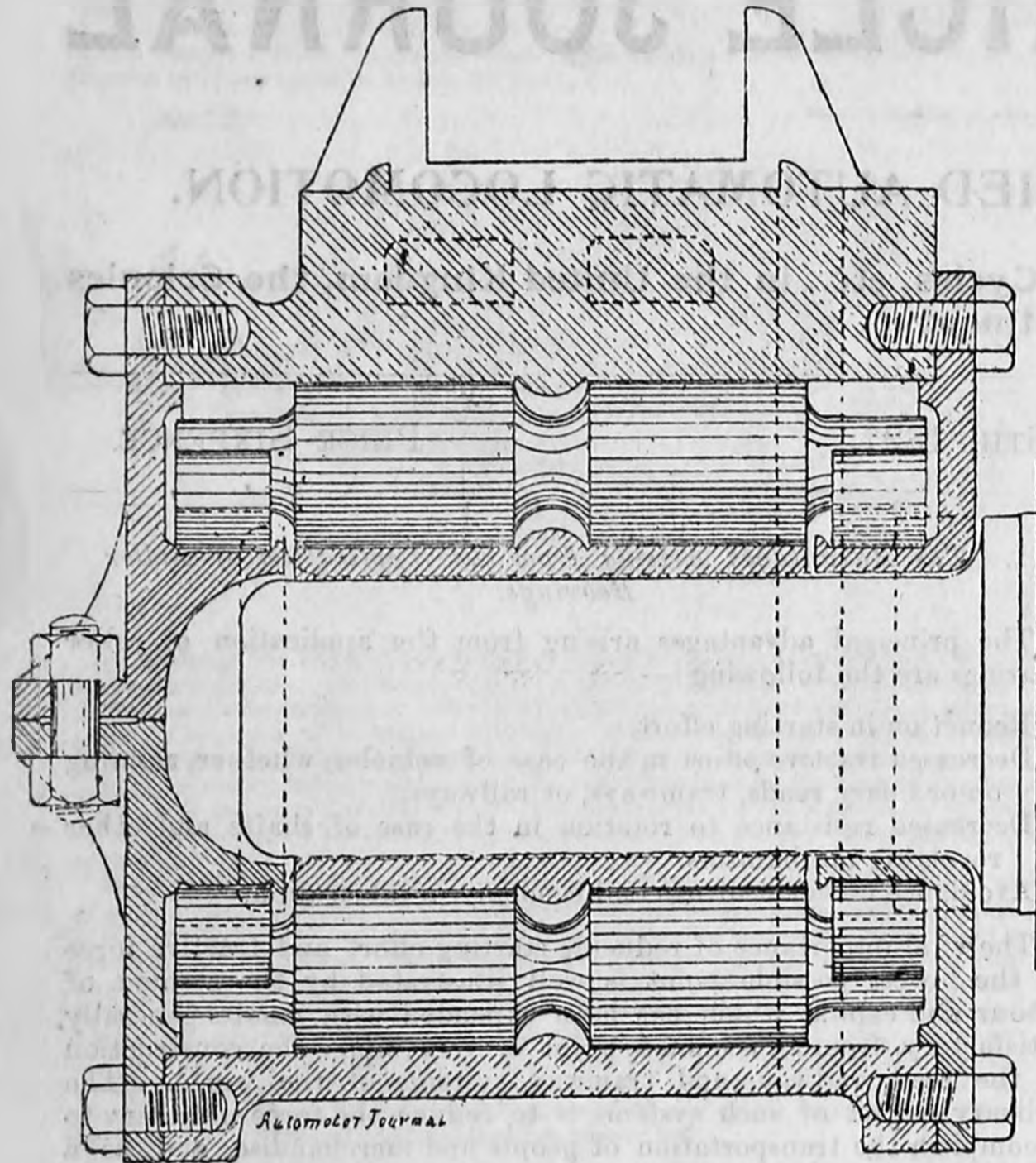


PLATE 1.

rush of current through the motors at the moment of starting, which rush is due to the fact that the motors and load have to be started at the same moment, with results most detrimental to the life of the motor. If the necessary effort can be materially reduced, there will be a large economy effected under the head of 'Maintenance of Motors.'

"In the case of horse traction, the starting of the load is, as in the case of electrical traction, the most trying part of the work, and the constant effort the horses have to make to overcome this resistance when employed on heavy draught work, such as omnibuses, trams, drays, railway carts, &c., &c., is the principal factor in reducing their lives to the present low average. Undoubtedly, where vehicles are fitted with roller bearings, horses can perform their duties with much less distress than with vehicles fitted with ordinary bearings, a result greatly to be desired from a humane as well as from an economical point of view.

"*Decreased Tractive Force.*—Although it is not claimed that the reduction in tractive force will be so large in proportion to that in starting effort, it must be remembered that this force is in application during the whole of the time a vehicle is running on level ground or ascending gradients; this point, therefore, becomes of great importance when the total amount of work done is calculated.

"*Decreased Revolving Effort.*—This is of great economical value in all cases of heavily-loaded shafting, as careful experiments have shown that the amount of power required to drive the main and counter shafts in workshops, all the tools being idle, amounts to as much as from 50 to 83 per cent. of the power required when all the tools are in full work; these figures show that there is ample room for improvement in shafting bearings.

"Another important field for the application of roller bearings is to the main and thrust bearings of propeller shafts. The author is not aware of any reliable data as to the percentage of engine power

absorbed in overcoming the friction of these bearings as now constructed; but, judging by analogy and from experiments on similar bearings, it must be very considerable.

"*Economy in Lubrication.*—This, though not of first importance, is a considerable item, seeing that a perfectly-constructed roller bearing does not require any lubrication, but only sufficient oil need be applied to prevent the rusting of the various parts."

The author thinks it is only right that he should state that Mr. Marshall's favourable opinions were chiefly founded on the results of experiments and trials made with roller bearings of the design and character hereinafter described.

## II.—The Requirements and Details of Construction of such Bearings.

The requirements of a satisfactory roller bearing may be stated as under:—

1st. The rollers must be provided with sufficient bearing in lineal inches and be of sufficient diameter to withstand the stresses imposed upon them, and must also be made of suitable material.

2nd. The rollers must not be allowed to touch each other; they must be controlled against lateral motion, and must remain exactly parallel with the axis of the journal throughout their revolutions thereon, as any deviation from the latter requirement reduces the contact between the rollers and journal to a point, and sets up a spiral movement of the whole series of rollers upon the journal. If such movement is allowed it is fatal to the good working of the bearing.

3rd. That the moving parts must be proportioned so that only rolling movement takes place between the engaged services.

4th. That the end thrust or tendency to lateral movement must be controlled not only in the case of the rollers themselves, but also of the axle or shaft in a fixed bearing, as, for instance, a railway axle, or of the bearing when revolving on a fixed axle, as does the ordinary road vehicle wheel.

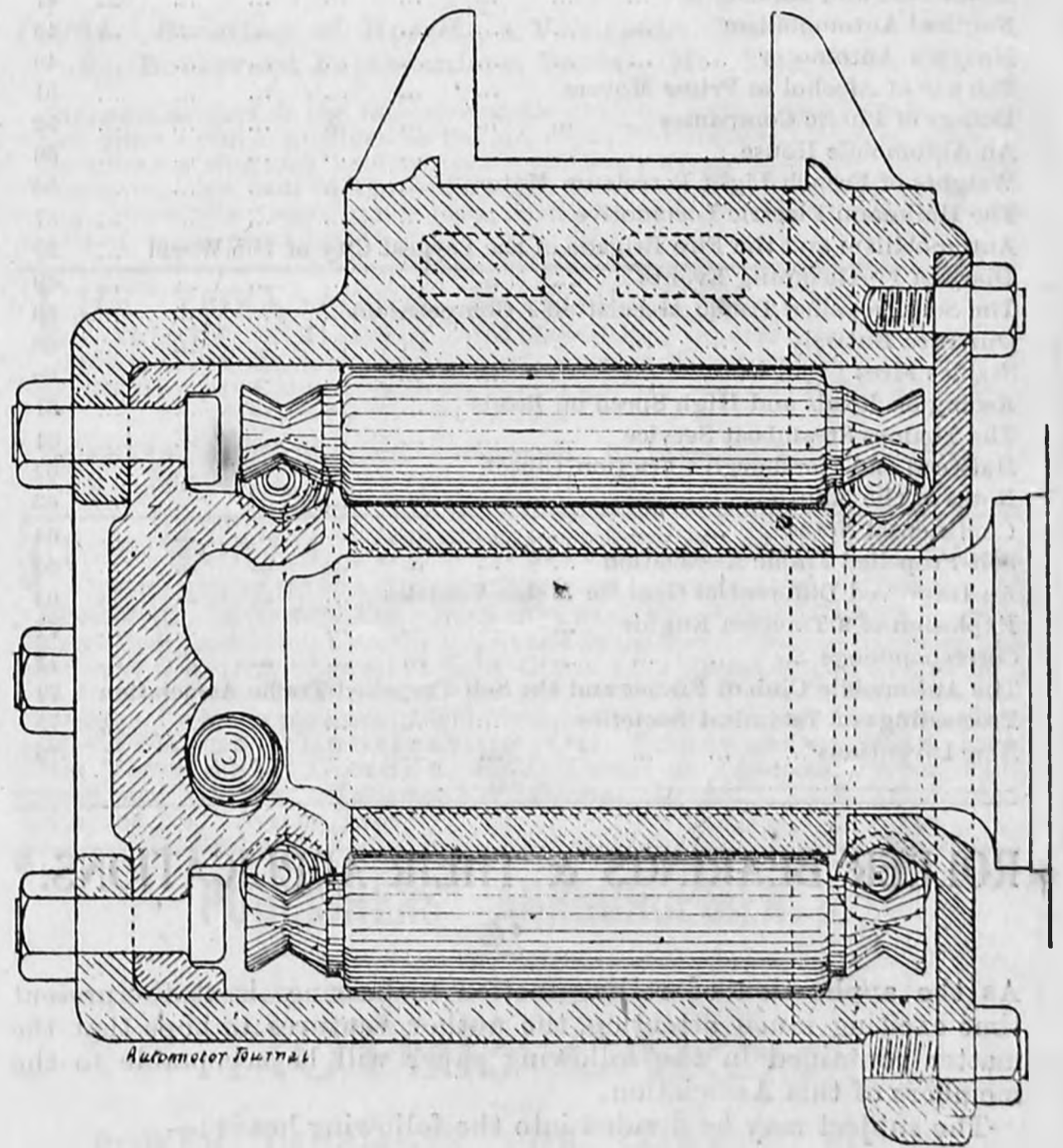


PLATE 2.

5th. That the bearing must be as simple and as free from complications as possible.

6th. Dust and dirt must, as far as possible, be excluded, though their presence is not so injurious to roller as it is to ordinary bearings.

7th. If it is desired to make a commercial as well as a mechanical success of such bearings, they must be so constructed that they can

be produced at reasonable cost; they must not require special attention, and must be capable of long service, with small cost for maintenance.

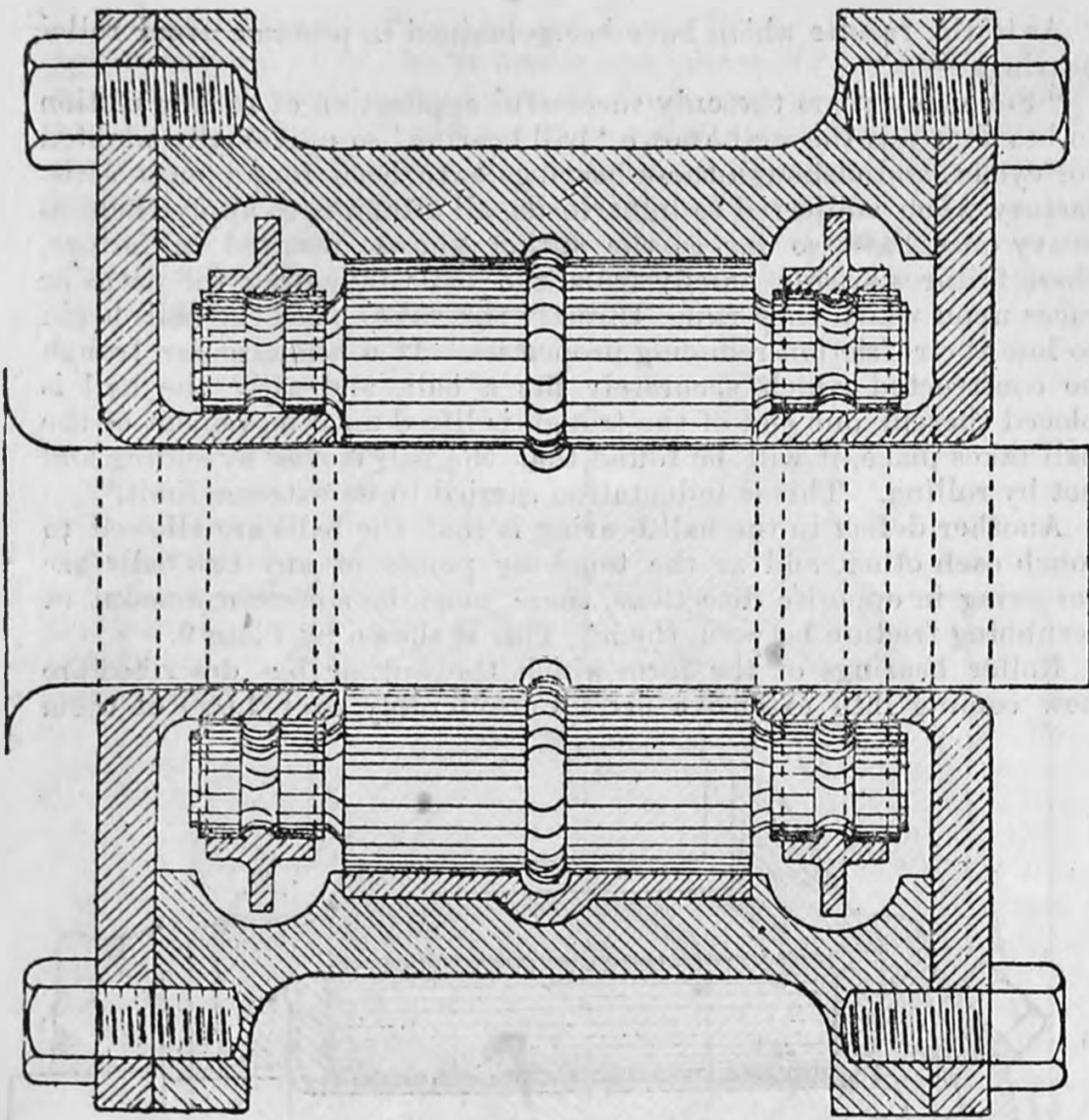


PLATE 3.

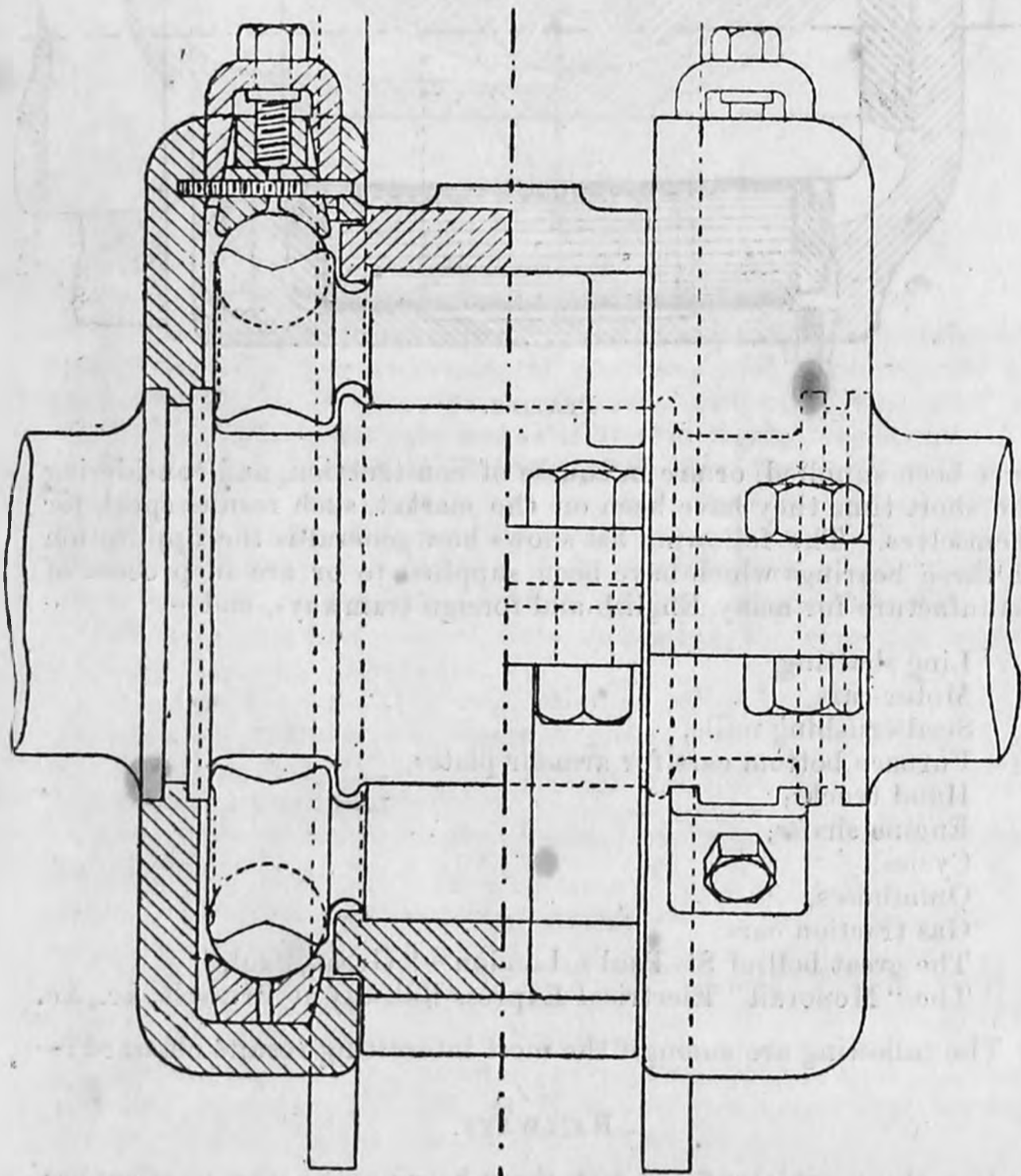


PLATE 4.

Simple as the above requirements may appear, the author believes that the only bearings at present which approach their fulfilment

are those he is about to describe, and it will be interesting to state shortly the steps by which the present design was reached.

In the first attempts the rollers were spaced by subsidiary rollers as shown in Plate 1, or by balls as shown in Plate 2; one such subsidiary roller or ball being placed at each end between each pair of rollers so that in any bearing there was twice the number of subsidiary rollers or balls than of main rollers. It was found, in the first place, impossible to keep these spacers in their proper position, as there was a strong tendency for them to fly outwards, and in the second place there was nothing to prevent the whole combination taking a spiral form.

To overcome the first difficulty, floating rings were introduced as shown in Plates 3 and 4, and the results proved that a great step in advance had been made, but that the spiral action still remained. The next step was to connect the spacing subsidiary rollers or balls, or, in other words, to form them on the ends of rods, thus compelling both ends to move at the same velocity. The arrangement then became as shown on Plate 5, a form of bearing which has given

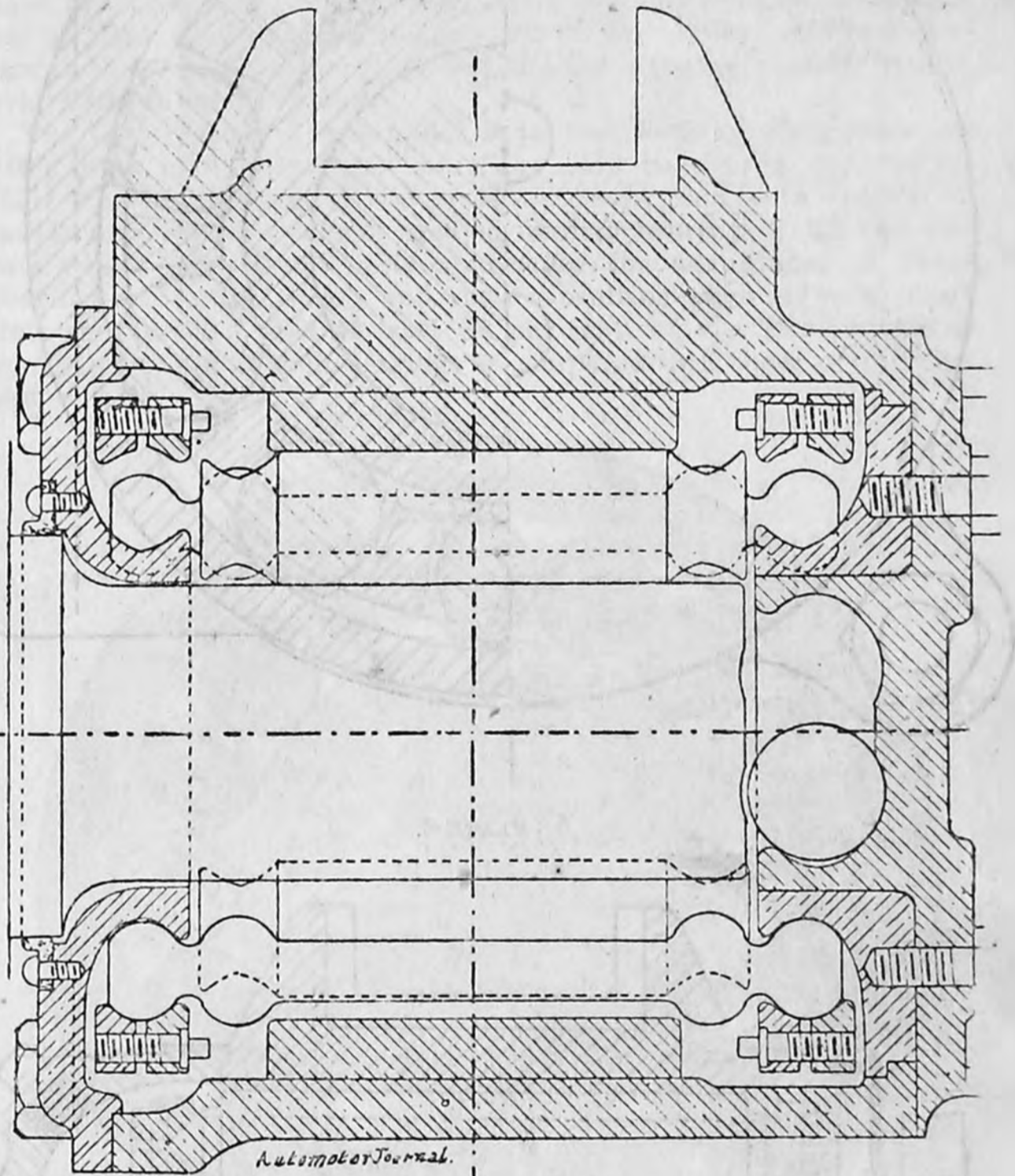


PLATE 5.

excellent results, its only fault being that it contains too many working parts, and is consequently too costly for general application. In this form of bearing, when the various moving parts are properly proportioned, there is nothing but true rolling movement. The next step was to do away with the subsidiary or spacing rollers, and to introduce a floating cage in their place, this cage being so designed that although it acts as a spacer for the rollers it does not carry any of the load. The general arrangement of the bearing then became as shown by Plate 6, and Fig. 1, Plate 7, of which Plate 6 is a cross section of the bearing, Plate 7 a longitudinal section, and Figs. 2 and 3, on Plate 7, details of the small bearing pieces which carry the ends of the rollers. This form of bearing has been applied, amongst other purposes, to "Great Paul," the big bell at St. Paul's Cathedral, London, with most satisfactory results. The next and final step was to do away with the conical points at ends of rollers and special bearing pieces in cage, and to make the rollers simple cylinders bearing on the spokes of the cage, as shown on Plate 8. This is the form of bearing recommended by the author, and is the one that has given the results set forth under heading III. It will be seen that there is only one moving part, namely, the cage, in

addition to the rollers, and the only sliding friction in the arrangement is that between the rollers and their bearings on the cage, this is of very small amount, as it has only to overcome the resistance of the cage to revolution.

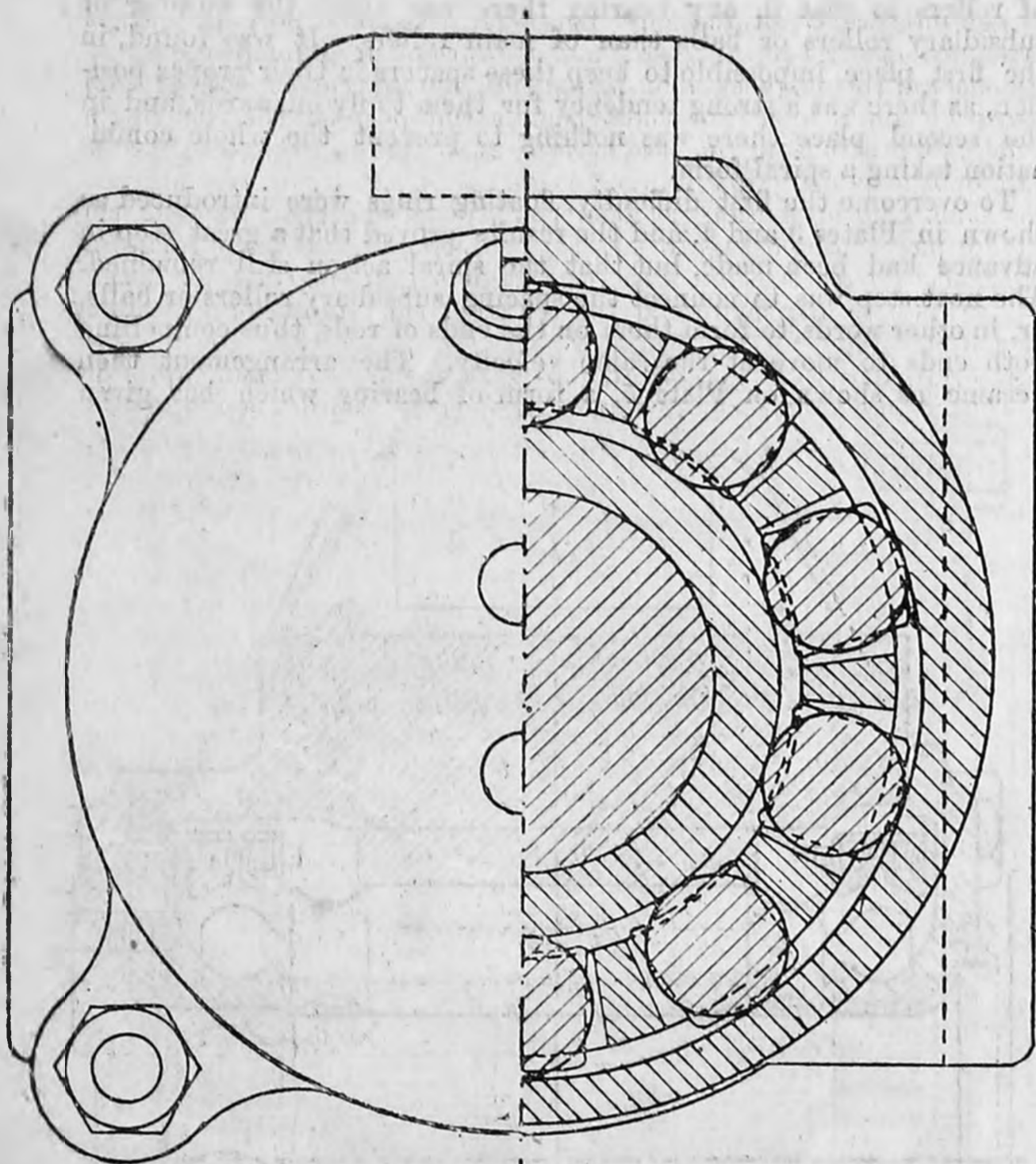


PLATE 6.

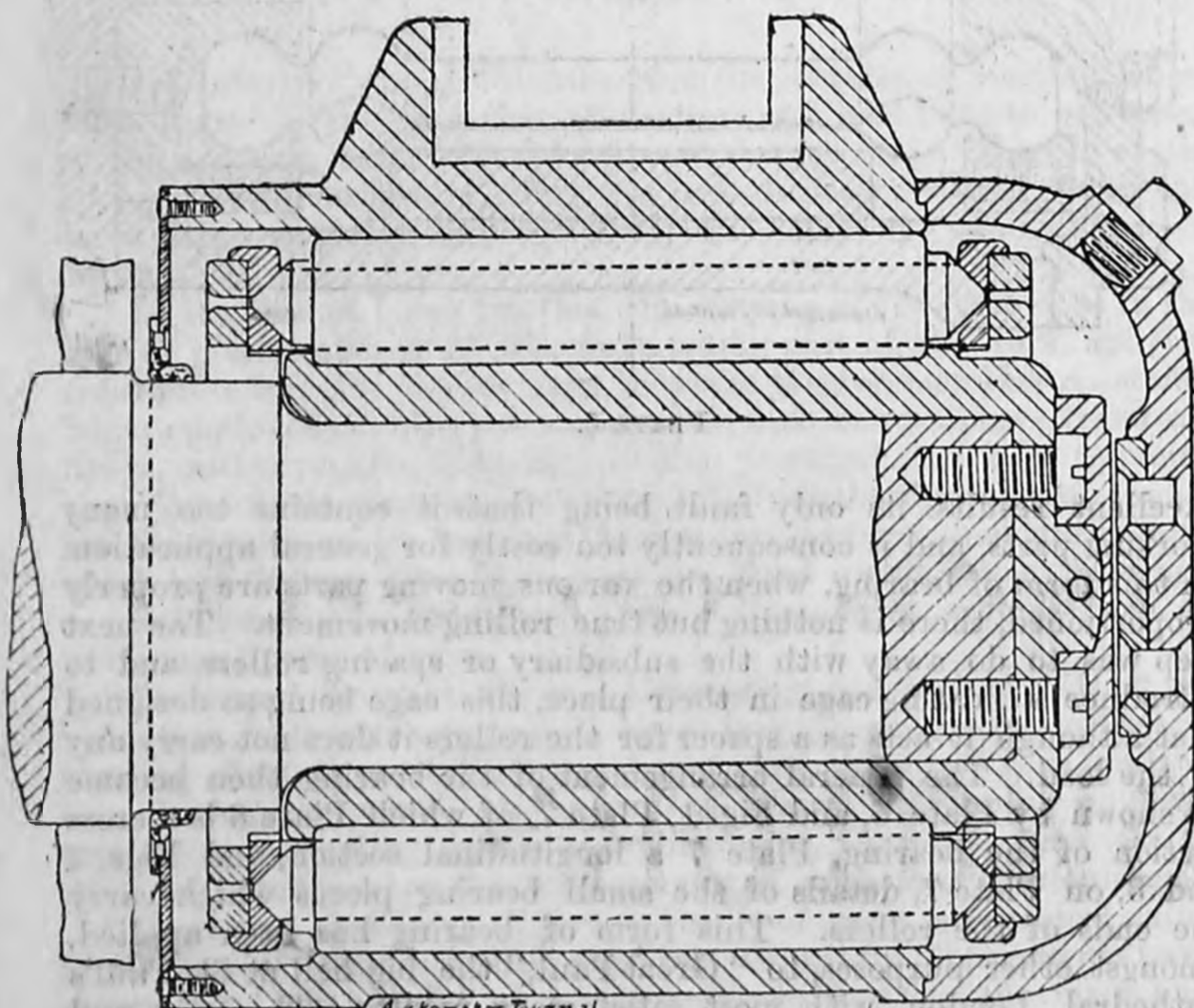


PLATE 7.

It is of interest to note that in this form of bearing the speed of revolution of the cage is only about one-third of that of the journal.

The above is a short description of the process of evolution of the latest form of roller bearing.

### III.—The Results already obtained from Roller Bearings which have been applied to Railway Vehicles, Tramway Cars, and other Purposes.

As to the results which have been obtained in practice from roller bearings:—

“For many years the only successful application of rolling motion to bearings was the well-known ‘ball bearing’ so universally adopted for cycles, and although these bearings have been found most satisfactory when subjected to light loads, all attempts to apply them to heavy ones have, so far as the author knows, resulted in failure, these failures arising chiefly from the balls indenting the paths or races upon which they run. Directly this takes place the balls begin to lose their friction-reducing properties. If a semicircular trough be constructed which accurately fits a ball, and after the ball is placed therein, one end of the trough is lifted until movement of the ball takes place, it will be found that the ball moves by sliding and not by rolling. This is indentation carried to its extreme limit.”

Another defect in the ball bearing is that the balls are allowed to touch each other, and as the touching points of any two balls are revolving in opposite directions, there must be a certain amount of scrubbing friction between them. This is shown by Plate 9.

Roller bearings of the form which the author has described are now coming into extensive use. Considerably over 1,000 of them

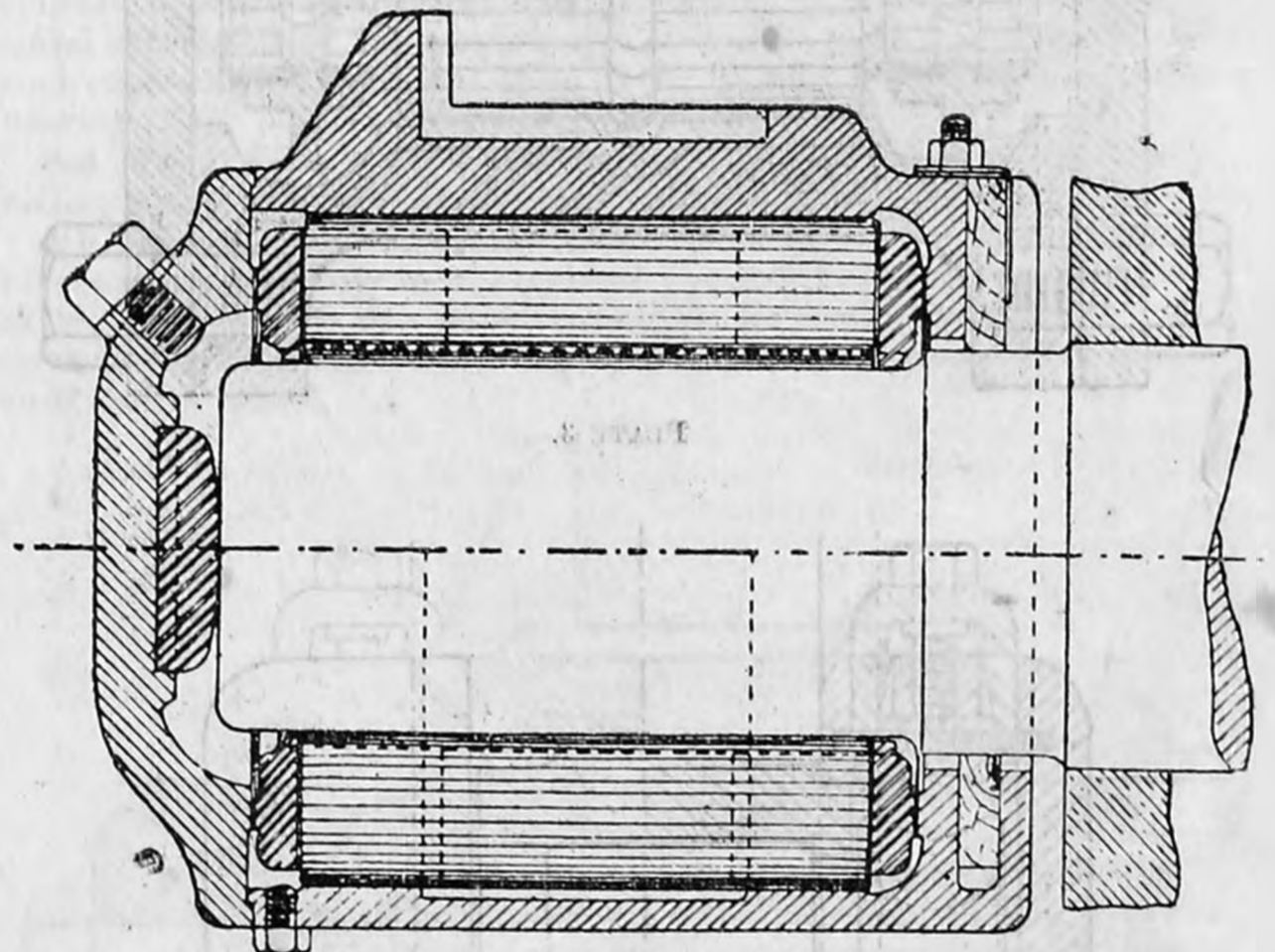


PLATE 8.

have been supplied, or are in course of construction, and considering the short time they have been on the market, such results speak for themselves. The following list shows how general is the application of these bearings which have been supplied to or are in process of manufacture for many English and foreign tramways, and—

- Line shafting,
- Motor-cars,
- Seed-crushing mills,
- Furnace bottom cars for armour plates,
- Hand trucks,
- Engine shafts,
- Cycles,
- Omnibuses,
- Gas traction cars,
- The great bell of St. Paul's, London—“Great Paul,”
- The “Monorail” Electrical Express Railway at Brussels, &c., &c.

The following are amongst the most interesting results obtained:—

#### RAILWAYS.

In railway vehicles fitted with these bearings the starting effort has, in many cases, been found to be as low as 3 lbs. per ton of load.

A passenger train of six carriages, fitted with roller bearings throughout, has been running for over two years between Brighton and Kemp Town, with a total mileage of over 70,000, and has shown a saving of from 12½ to 15 per cent. in the consumption of fuel,

which saving has been obtained under most disadvantageous circumstances, inasmuch as the engine has to be kept in steam for about 16 hours per diem, whilst its actual running time is under seven hours.

The road between Brighton and Kemp Town is also a most trying one on account of its almost continuous curves, its constant stoppages necessitating great expenditure of brake power, and the abnormal number of points and crossings in so short a run, added to which a great portion of the line is laid with guard rails, so that the fixed charges of traction are in this case very heavy.

So well satisfied is the Brighton Railway Company with the extended trials as above-named, that orders have now been placed for roller bearings for main-line traffic.

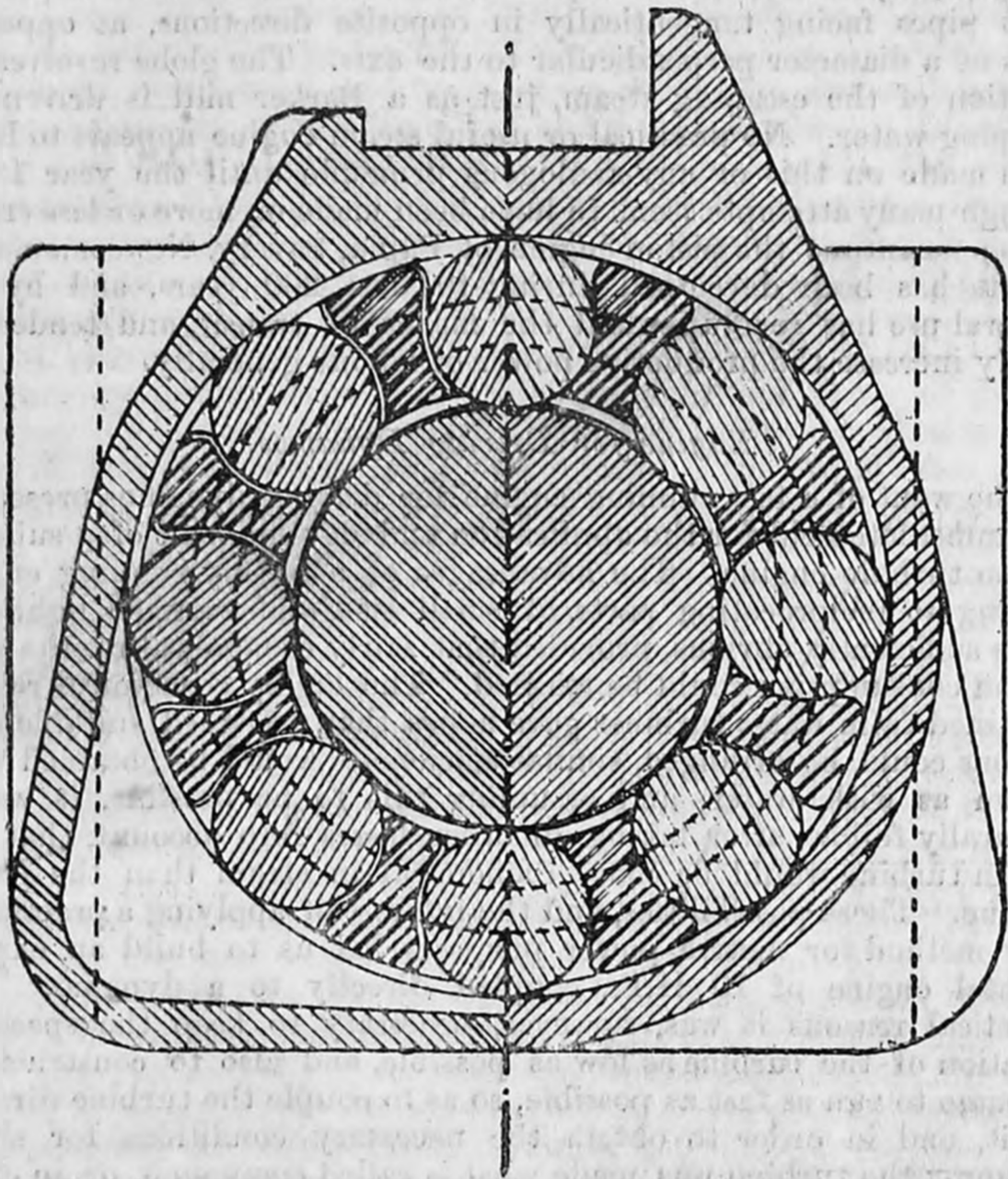


PLATE 8A.

The Western Railway of France are fitting a complete train with roller bearings for experimental purposes, and their report will undoubtedly be of great value, as investigations of this kind are carried out with great care and skill by Continental engineers.

The Liverpool Overhead Railway made their first trials with these roller bearings some two years ago, and are now gradually fitting them to the whole of their rolling stock, as they find that since their introduction they have, with a slight modification of their motors, been enabled to run three instead of two coach trains, the extra coach being without motors, thus increasing the carrying capacity of their trains by 50 per cent.

The contention that the application of roller bearings in the case of electrical traction will show a great economy under the head of "Maintenance of Motors," has been amply borne out by the experience gained at Liverpool.

The City and South London Railway are applying these bearings to their carriages.

TRAMWAYS.

The following are the results of careful experiments made to ascertain the relative starting effort and running friction of tramcars, fitted with ordinary and roller bearings.

*Starting Effort.*—Tramway cars, weighing 4 tons 15 cwt., ordinary bearings, 198 lbs. or 41.68 lbs. per ton; roller bearings, 30 lbs., or 6.53 lbs. per ton—a saving of 84 per cent.

RUNNING FRICTION—GRAVITY TEST.

A tramway car, fitted with ordinary bearings and weighing 2 tons 15 cwt., was let loose from a point 56 feet up an incline, with 1 foot 6½ inches rise. It ran down this incline and 57 feet along

the level line at foot of same, or a total distance of 113 feet. The force expended was, therefore, 6,160 lbs. falling through 1.521, &c., feet, or 9,364 foot lbs. The average frictional resistance was  $9,364 \div 113$ , or nearly 83 lbs., equal to 30.5 lbs. per ton. A similar car fitted with roller bearings being let loose from the same point, ran the full length of the level line available, namely, 320 feet, and had not then quite come to rest, the total distance traversed being 376 feet. The force expended was, again, 9,364 foot lbs. The average frictional resistance was  $9,364 \div 376 = 24.9$  lbs., or about 9 lbs. per ton of load, a saving of 70 per cent.

The following figures are of interest, and are founded on the results of actual experiments:—

Relative starting effort of a tramcar on a gradient of 1 in 20, ordinary bearings 100, roller bearings 77, saving 23 per cent.; ditto, ditto, on a gradient of 1 in 80, ordinary bearings 100, roller bearings 50, saving 50 per cent.; ditto, ditto, on a gradient of 1 in 140, ordinary bearings 100, roller bearings 39.6, saving 60.4 per cent.—results which require no comment.

Roller bearings have been fitted to many horse cars, with results most beneficial to the animals employed, and it is estimated that the use of them would so prolong the life of the horses that the reduction in their depreciation alone would show a saving of considerably over £10 per car per annum.

The Corporation of Blackpool have had some of their tramcars fitted with roller bearings, and these cars have been running on their electric tramway for over three years, and with results so satisfactory that they have applied similar bearings to all the new cars which have been constructed since the advantages of these bearings were established; and their consulting engineer some short time ago certified that at least 30 per cent. of electrical output is saved by the use of such bearings as compared with those in ordinary use.

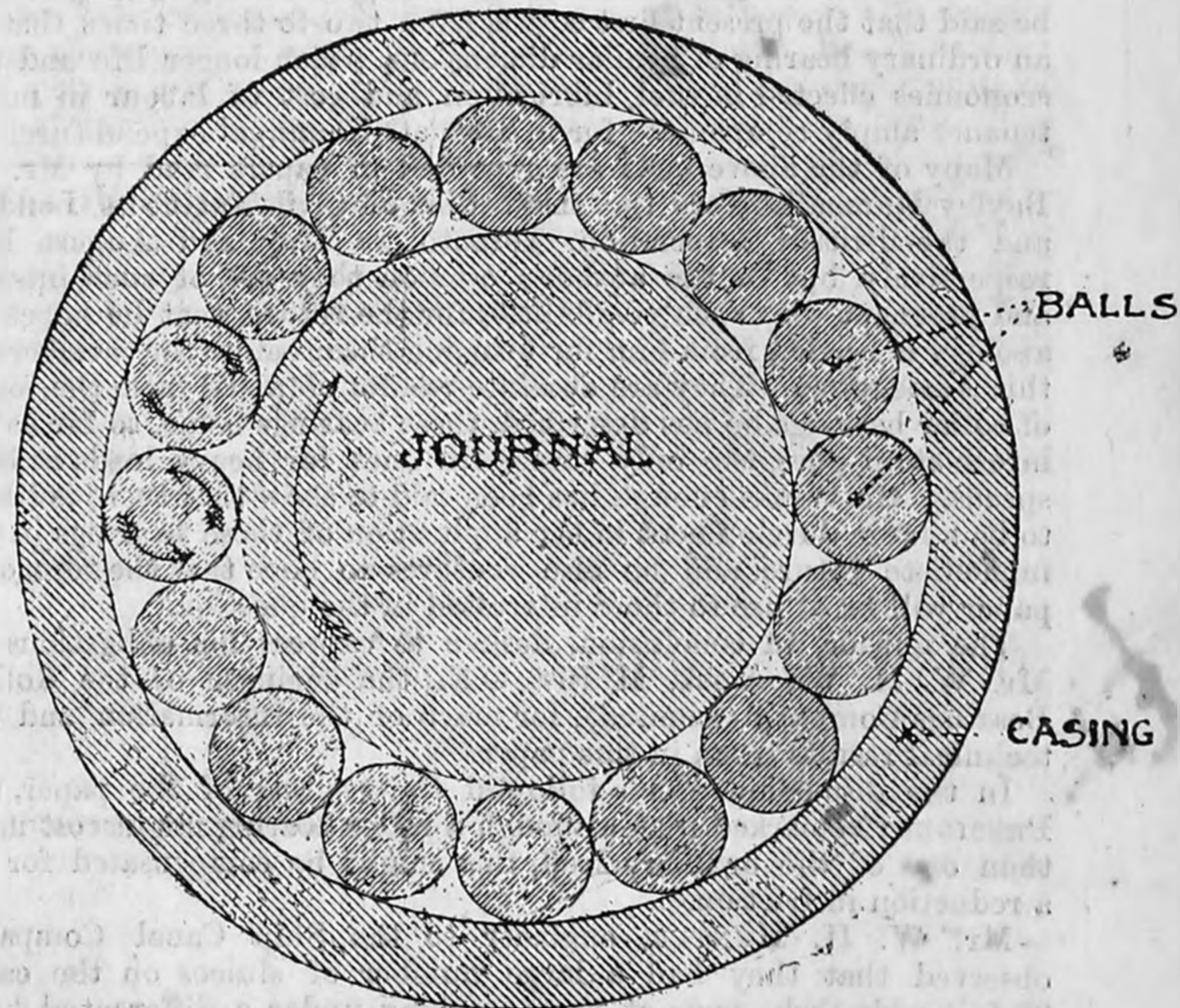


PLATE 9.

GENERAL APPLICATIONS.

Perhaps one of the most interesting amongst the general applications of these bearings is that of the big bell of St. Paul's Cathedral, "Great Paul," which, with its headstock and other moving parts, weighs nearly 25 tons, and which gave considerable trouble when mounted on ordinary bearings. The following results are instructive:—When mounted on the ordinary bearings the bell came to rest—after the swinging effort had been discontinued—within one minute, when on roller bearings in 6 minutes 55 seconds, showing that the frictional resistance of the latter was only about *one-seventh* of the former, a result remarkably in accordance with the starting effort tests given under the head of "Tramways."

An equally satisfactory result has been obtained from four bearings fitted to the main shaft of a heavy seed crushing mill at Hull, the actual saving, arising from the alteration from ordinary to roller bearings, being at the rate of no less than £120 per annum, a

saving that will repay the cost of such alteration in less than six months, and continue as an annuity for the remainder of the life of the bearings.

Two large bearings are now being manufactured for the main shaft of a large colliery ventilating fan for the North of England.

With reference to the question of heating, it is an interesting fact that there has not been a single case of a hot bearing in all the experience so far gained with roller bearings.

#### MAINTENANCE.

Although it is somewhat early to predict what the cost of maintaining these bearings will be, the results so far show that if they are constructed of suitable materials, it will be extremely low, 60,000 miles in railway work, and over three years in tramway work, with but very slight wear are most encouraging. It has been found that polished compressed steel is the best material for the rollers, cast steel for the cases in railway and heavy shafting bearings, and hard cast-iron for tramcar and other lightly loaded and slow-running bearings.

The demand for these roller bearings is steadily increasing, and the results obtained from their practical application in every-day use justify the author in his conviction that the experimental stage of roller bearings is now past, and that as the demonstration of their utility and economy becomes more generally known and appreciated, their success is already assured, and their universal adoption is only a question of gradual, if not of rapid, development.

With regard to cost. It is scarcely fair, perhaps, to make an absolute comparison with the ordinary axle-box bearing or plummer block at present in use, since the materials, workmanship, and working parts are essentially different. Moreover, economies in machinery and manufacture which follow a large and increasing demand, cannot fail to exercise a beneficial effect in this respect, but generally it may be said that the present first cost is from two to three times that of an ordinary bearing of similar dimensions, which longer life and the economies effected in fuel, lubrication, and cost of labour in maintenance amply compensate for in ultimate or annual expenditure.

Many of the above facts are recorded in papers read by Mr. W. Bayley Marshall before the Institution of Civil Engineers, London, and the British Association, Toronto, in May and August last, respectively, but in the author's opinion they are of such interest and pregnant with such possibilities for the future, that he hopes no apology is needed from him for bringing them before the members of this Association. They are absolute results obtained from the forms of roller bearings he has described, these bearings being, so far as his information goes, the only successful ones for heavy loads at high speeds. He thinks enough has been said to show that there is likely to be a large development in the application of these bearings in the immediate future, and he also ventures to hope that the foregoing paper will be of use to those interested in the question.

The author, in conclusion, desires to express his obligations to Mr. W. H. Woodcock, M. Inst. C.E., the engineer of the Roller-Bearings Company (Limited), for much of the information and the technical results given in this paper.

In the discussion which followed the reading of the paper, the PRESIDENT remarked that, although a roller bearing might cost more than one of the ordinary kind, this might be compensated for by a reduction in friction.

Mr. W. H. HUNTER, engineer to the Ship Canal Company, observed that they had a large number of sluices on the canal 30 feet wide each, some of them working under a differential head of 16 feet, and every one of which was worked on the roller principle with admirable results. The projectors of the Panama Canal had informed him they were going to adopt the principle of roller bearings for their sluices. Then they had on the canal a number of swing bridges, which were carried on the free roller principle. The whole secret of success in roller bearings was the avoidance of undue unit stress.

Mr. DANIELS said there was no disputing the advantages of roller bearings, and it was simply a question of getting special machinery to produce them more cheaply.

Mr. WOODCOCK, of the Roller Bearing Company, London, said the safe load depended, to a considerable extent, on the diameter of the roller. They might put a heavier load, per lineal inch, on a large roller than on a small one.

## THE PARSONS' MOTOR.

At a recent meeting of the Institute of Marine Engineers at Stratford the Hon. C. A. Parsons read a paper describing the motor which bears his name. This wonderful motor is destined to revolutionise existing practice, and those who are interested in road locomotion will find a study of this paper advantageous.

The Hon. C. A. Parsons in the course of his paper said:—The earliest notices of heat engines are found in the "Pneumatics" of Hero of Alexandria, which dates from the year 200 B.C. One of the steam or motive power engines there mentioned is the *Æolipiles*, a steam reaction engine consisting of a spherical boiler pivoted on a central axis, beneath which is placed a flame. The steam escapes by bent pipes facing tangentially in opposite directions, at opposite ends of a diameter perpendicular to the axis. The globe revolves by reaction of the escaping steam, just as a Barker mill is driven by escaping water. No practical or useful steam engine appears to have been made on this or any analogous principle until the year 1884, though many attempts seem to have been made on more or less crude lines; meantime the piston engine of Papin, Savery, Newcomen, and Watts has been developed during the last 200 years, and by its general use has revolutionised the means of transit, and tended to vastly increase the productive power of labour generally.

#### *Engine for Driving Dynamos.*

The want of a fast running engine for driving dynamos presented an immediate field for the application and development of a suitable steam turbine engine. The advantages of a steady running engine having no reciprocating parts, of small size and extreme lightness, were sufficiently obvious, provided that fairly economical results as to steam consumption could be realised. The highly economical results obtained from water turbines gave hopes that, provided suitable conditions could be arranged, similar efficiencies would be obtained with steam as with water, and assuming this to be possible, it would naturally follow, after taking all other losses into account, that the steam turbine would be more economical in steam than the piston engine. These possibilities, and the interest of applying a practically new method for motive power purposes, led us to build an experimental engine of 10 H.P., coupled directly to a dynamo. For practical reasons it was, however, necessary to keep the speed of rotation of the turbine as low as possible, and also to construct the dynamo to run as fast as possible, so as to couple the turbine directly to it, and in order to obtain the necessary conditions for steam economy the turbine was made what is called compound, or, in other words, a series of successive turbine wheels were set one after the other on the same spindle, so that the steam passing through them one after the other, the fall in pressure being spread over the series of turbines, should be gradual, and the velocity of the steam nowhere more than was desirable for obtaining a high efficiency for each turbine of the series.

#### *The Turbine Motor.*

The turbine motor consists of a cylindrical case with rings of inwardly projecting guide blades, within which revolves a concentric shaft with rings of outwardly projecting blades. The rings of blades on the cylinder nearly touch the shaft, and the rings of blades on the shaft lie between those on the case and nearly touch the case. There is left between the shaft and the case an annular space, which is fitted with alternate rings of fixed and moving blades. Steam passes first through a ring of fixed guide blades by which it is projected in a rotational direction upon the succeeding ring of moving blades, imparting to them a rotational force; it is then thrown back upon the succeeding ring of guide blades, and the reaction increases the rotational force. The same process takes place at each of the successive rings of guide and moving blades. The energy to give the steam its high rotational velocity at each successive ring is supplied by the drop in pressure, and the steam expands gradually by small increments. In a moderate size turbo-motor there may be from 30 to 80 successive rings, and when the steam arrives at the last ring the expansion has been completed. On the left side of the steam inlet are the dummy or rotating pistons, which are fixed to and rotate with the shaft. On their outsides are grooves and rings which project into corresponding grooves in the case. By means of the thrust bearing of the motor, the longitudinal position of the shaft is adjusted, and grooves and projecting rings kept nearly touching, so as to make a practically tight joint. The object of these pistons is to steam balance the shaft and relieve end pressure on the thrust

bearing. I give herewith a drawing\* of a 350 kw. Turbo Alternator, 13 of which size are now at work in the London stations. With compound condensing turbines a steam efficiency comparable with the best compound or triple expansion condensing engines was at length reached, and it was then resolved to test the application of the compound turbine to the propulsion of ships, for which purpose it seemed well suited, provided that as good an efficiency could be obtained from fast running screw propellers as with ordinary ones.

#### The "Turbinia."

In January, 1894, a syndicate was formed, and a boat was designed for this purpose. The "Turbinia," as the boat is named, is 100 feet in length, 9 feet beam, and 44½ tons displacement. The original turbine engine fitted in her was designed to develop upwards of 1,500 actual H.P., at a speed of 2,500 revs. per minute. The boiler is of the water-tube type for 225 lbs. per square inch working pressure, with large steam space, and large return water-legs, and with a total heating surface of 1,100 square feet, and a grate surface of 42 square feet. Two firing doors are provided, one at each end. The stokeholds are closed, and the draught furnished by a fan coupled directly to the engine shaft. The condenser is of large size, having 4,200 square feet of cooling surface. The circulating water is fed by scoops, which are hinged and reversible, so that a complete reversal of the flow of water can be obtained should the tubes become choked. The auxiliary machinery consists of main air pump and spare air pump, auxiliary circulating pump, main and spare feed pumps, main and spare oil pumps, also the usual bilge ejectors; the fresh-water tank and hotwell contain about 250 gallons. The hull is built of steel plate, of thickness varying from  $\frac{3}{16}$  inch in the bottom to  $\frac{1}{8}$  inch in the sides near the stern, and is divided into five spaces by watertight bulkheads. The deck is of steel plate,  $\frac{1}{8}$  to  $\frac{1}{4}$  inch in thickness. The approximate weights are:—Main engines, 3 tons 13 cwt.; total weight of machinery and boilers, screws and shafting, tanks, &c., 22 tons; weight of hull complete, 15 tons; coal and water, 7½ tons; and total displacement, 44½ tons. Trials were made with screws of various patterns, but the results were unsatisfactory, and it was apparent that a great loss of power was taking place in the screw. Owing to the cavitation of the water, the matter was then thoroughly investigated theoretically and experimentally, and it was finally determined (as the best course to overcome the difficulty) to subdivide the turbine motor into several separate compound turbines. Consequently the single compound turbine engine was removed from the boat and replaced by three separate compound turbines, directly coupled to three screw shafts, working in series on the steam, the turbines being the high pressure, intermediate, and low pressure, and designed for a complete expansion of the steam of hundredfold, each turbine exerting approximately one-third of the whole power developed, the three new screw shafts being of reduced scantling. By this change the power delivered to each screw shaft was reduced to one-third, while the division of the engine into three was favourable to the compactness and efficient working of the turbines. The total weight of engines and the speed of revolution remained the same as before. The effect on the screws was to reduce their scantling, and to bring their conditions of working closer to those of ordinary practice. The thrust of the propellers is balanced by steam pressure in the motors. At all speeds the boat travels with an almost complete absence of vibration, and the steady flow of steam to the motors appears to reduce the liability to priming; at any rate, no sign of this has yet occurred with ordinary Newcastle town water. No distilling apparatus has yet been fitted. The boat has been run at nearly full speed in rough water, and no evidence of gyroscopic action has been observable, though such a result would be anticipated from the known small amount of these forces under actual conditions; indeed, the "Turbinia" has so far proved herself an excellent sea-boat.

#### Advantages over Ordinary Engines.

The advantages claimed for the compound steam turbine over ordinary engines may be summarised as follows:—(1) increased speed; (2) increased economy of steam; (3) increased carrying power of vessel; (4) increased facilities for navigating shallow waters; (5) increased stability of vessel; (6) increased safety to machinery for war purposes; (7) reduced weight of machinery; (8) reduced space occupied by machinery; (9) reduced initial cost; (10) reduced cost of attendance on machinery; (11) diminished cost of upkeep of machinery; (12) largely reduced vibration; and

(13) reduced size and weight of screw propellers and shafting. For the purpose of going astern a small reverse turbine is used. This turbine has hitherto been of an inefficient form, and has constituted a part of the low-pressure motor; the power consequently that has been developed has been very small, and has given an astern speed of three knots. A powerful reversing motor is, however, now being fitted of similar construction to the ahead motors; its weight is three-quarters of a ton, and it is estimated that the astern speed will then exceed 10 knots. The turbine will be permanently connected to the central propeller shaft, and its casing will be connected to the condenser, and the amount of power spent in turning it when going ahead will be insignificant. In June last the "Turbinia" steamed from the Tyne to Harwich at the average speed of 12 knots, and from Harwich to Cowes at the average speed of 16 knots. During and after the week of the review she was run at speeds up to 34½ knots, estimated from the curve of steam pressure and speed, and ample steam is provided by the boiler at the highest speeds hitherto reached.

#### Results of Trials.

In April a series of trials were made by Professor J. A. Ewing, and the following paragraphs are extracts from his report, which comprises, I believe, the most complete set of investigations made on the working of a small fast vessel:—

"The mechanical friction of the turbines is particularly small, and the work spent on friction is not materially increased by increasing the range of expansion. This allows the steam to be profitably expanded much farther than would be useful or even practicable in an engine of the ordinary kind. Apart from questions of friction, the addition of weight and bulk to allow for this extended expansion would be enormous in the ordinary engine; in the turbine it is very moderate. Steam is expanded nearly two hundredfold in the "Turbinia," and this is accomplished with engines which are much lighter than reciprocating engines of the same power, although in these the expansion would be much less complete. Rough weather was met with in some of the trials, and I had the opportunity of seeing that the "Turbinia" is for her size a good sea boat. The machinery worked with perfect smoothness, the screws did not race, and the bearings remained perfectly cool throughout. From first to last during the whole of the trials there was no hitch whatever or difficulty of any kind in the action of the turbines. Some 20 trial runs in all were made under various conditions as to speed, the range of speeds tested extending from 6¾ knots to 32¾ knots. Full speed trials were made on 10th April, the boat having then been in the water for fully a fortnight. Two successive runs on the measured mile, in opposite directions, in smooth water and at the slack of the tide, gave the following data:—

Time on the mile .. .. .	1	2
Corresponding speed in knots .. .. .	103¼ secs.	110 secs.
Mean speed in knots .. .. .	32.79	32.73
Revs. per minute of high pressure and intermediate shafts .. .. .	.. .. .	32.76
Revs. per minute of low pressure shaft .. .. .	.. .. .	2,230
Steam pressure in boiler by gauge .. .. .	.. .. .	2,000
Steam pressure on admission to high pressure turbine .. .. .	.. .. .	210 lbs. per sq. in.
Greatest pressure in stokehole, by water gauge .. .. .	.. .. .	157 lbs. per sq. in.
	.. .. .	7¼ in.

"The speed reached during this trial, 32.76 knots in the mean, is, I believe, the highest recorded for any vessel. It is greatly in excess of the speed hitherto reached in boats so small as the "Turbinia." It is clear, then, that the exceptional speed developed in the "Turbinia" has been achieved without sacrifice of any economy, and that the substitution of turbines driving high speed screws in place of reciprocating engines driving screws of much more moderate speed is not attended with increased consumption of steam so far as fast running is concerned."

#### Turbines for Large Vessels.

In conclusion, the application of the steam turbine principle to fast ships in general, including passenger vessels, Atlantic liners, and ships of war, would appear to present no special difficulties. It may be said, generally speaking, that the larger the scale on which the engines are made the simpler is the construction and the higher the steam efficiency and the lower the speed of rotation. In the sizes hitherto constructed, the largest being the engines of the "Turbinia,"

\* We hope to reproduce this in our next issue.—ED.

this has been found to be the case. In applying turbine engines to a large passenger vessel or warship of, say, 30,000 I.H.P., probably four screw shafts with two screws on each shaft would be adopted; each of the four shafts would be driven by one compound turbine at a rate of between 400 and 700 revs. per minute, and the turbines would consist of the high pressure, the intermediate and two low pressure, each turbine developing approximately one-quarter of the total power. The screw propellers would be about one-half the diameter of ordinary twin-screw propellers, and the aggregate blade area would approximate closely to ordinary practice. With such engines the consumption of steam per propulsive horse-power would probably be less than that found in the mercantile marine, and considerably less than that found in war-vessels, where space and other conditions must necessarily be considered. There is also no limitation in steam pressure in the case of turbines other than those imposed by the boilers, and it is probable that in conjunction with water-tube boilers higher pressures than those at present usual would be generally adopted. With turbine engines in passenger vessels there would arise no questions of vibration from machinery or propellers, and in the event of one screw shaft or one motor becoming disabled, the one affected can be more readily taken out of action than is the case with ordinary engines, and the parts being lighter, can be more easily dealt with by the staff on board; thus the liability to serious breakdown is considerably reduced.

## THE "SCOTTE" SYSTEM.

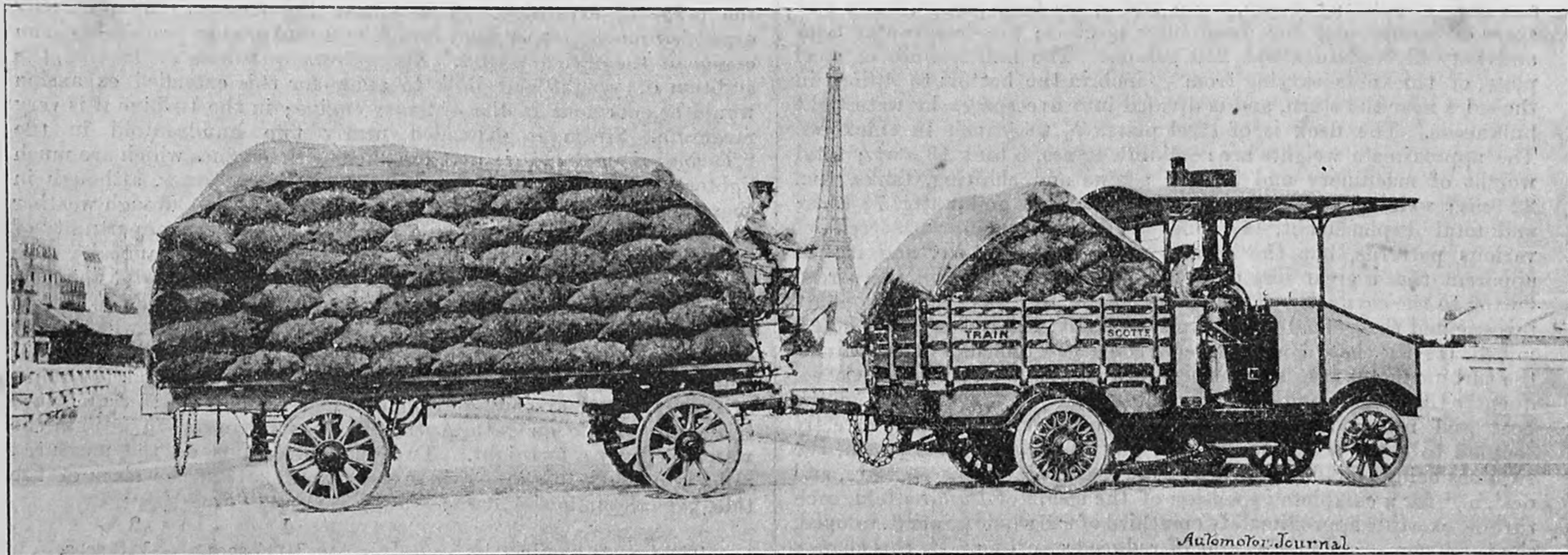
WE are in receipt of the following letter from the Director of the "Société des Chaudières et Voitures à Vapeur Système Scotte":—

*Monsieur le Directeur de L'AUTOMOTOR AND HORSELESS VEHICLE JOURNAL, 62, St. Martin's Lane, Londres, W.C.*

Je viens de recevoir le No. du 15 Octobre de votre Journal. Voulez vous me permettre de compléter les appréciations formulées par votre correspondant relativement au fonctionnement de notre train à marchandises pendant le Concours des Poids Lourds.

Étant donné le profil extrêmement accidenté des parcours ou l'on rencontrait des rampes de 14 per cent., nous n'avons transporté au maximum que 5½ tonnes de poids utile: mais il faut admettre que ce ne sont pas là les conditions normales du roulage.

Sur bonnes routes, en palier ou faibles rampes, c'est à dire ne dépassant par 4 per cent., nos machines peuvent convoyer à la vitesse de 7 à 8 kilomètres à l'heure de 10 à 12 tonnes de poids utile.



THE SCOTTE TRACTOR AND TRAILER.

**Death of a well-known Carriage Builder.**—*Le Guide du Carrossier* notes the death, at the early age of 55 years, of M. Basile Dimitri-Markoff, of Moscow, Russia. M. Markoff was well known and highly honoured in Moscow and Paris. He was wealthy, and the head of a great plant devoted to carriage building. He was urbane, genial, and his broad ideas led to the establishment of amicable relations between the members of the craft in these two cities. He was an admirer of France and of the French people. It was his habit to spend two or three months of each year in Paris or at French watering places. Lately he decided to remove to Paris to reside permanently, but after a return to Moscow recently he fell ill and died. He was the recipient of distinctive French honours. He carried the ensigns of the orders of St. Stanislaus and St. Vladimir, and was to have been decorated with the red ribbon, Legion d'Honneur, at the coming Paris exposition of 1900. Last year he was nominated a member of the jury at the Nijni-Novgorod Fair, where he rode in the Emperor's sleigh, which, in Russia, is regarded as a great honour. M. Markoff was a devoted Christian, and a member of the Russian (Greek) Church, and lived close to the Golden Rule, a tribute accorded him by all who knew him.

ALL interested in automotors should join the Self-Propelled Traffic Association. Prospectus and full particulars can be obtained of Mr. Andrew W. Barr, Secretary, No. 30, Moorgate Street, London, E.C.—(ADVT.)

Par ce même courrier et sous pli séparé je vous adresse deux phototypies représentant notre tracteur porteur avec sa charge réelle.

Dans vos "Notes du Continent" je relève qu'à la suite de nos essais dans le Luxembourg, la douane nous réclame 6000 francs pour la rentrée en France de nos machines. Permettez moi de vous faire remarquer que nos trains étant construits à Paris peuvent sortir de France et y rentrer absolument en franchise.

Veuillez agréer, Monsieur, mes salutations empressées.  
Paris, Octobre 18.

[We have pleasure in reproducing the photograph herewith.—ED.]

**A New Electric Motor Vehicle.**—Mr. T. Parker and several gentlemen connected with Messrs. Parker (Limited), of Wolverhampton, in addition to a number of distinguished visitors, attended the works in Wolverhampton, on October 27th, having been conveyed there from the station in Mr. Parker's new motor-car. The main object of the visit was to test the capabilities of this electric motor, which was in every way satisfactory. We understand that Mr. Parker, when on his motor-car trips, has had a good deal of trouble with small boys, who, not satisfied with hanging on behind, have thrown sticks and stones into the mechanism whilst the car has been running.

## RESISTANCE OF VEHICLES IN ROUNDING CURVES.

MR. HENRY SIMPSON, writing to *The Engineer* on "The Elements of Train Resistance," gives the subjoined formulæ, which, although representing what occurs on railroads, is equally applicable to steam-tractors on common roads hauling a string of wagons. In the course of his letter, Mr. Simpson says :—

"Most enginemen prefer to have the longest and heaviest vehicles near their engine, because, they say, the heavy wagons 'pull so hard' when near the break van. I cannot see that this can possibly be so on a straight road, and I will endeavour to show that even on a curved road the obliquity of the draw-bar pull cannot have a very material effect. Let us assume, for the sake of simplicity, that the vehicles of a train are all of the same weight, length, and resistance, and let—

T = Tractive force in pounds of engine in excess of that portion which is absorbed in overcoming the resistance of the engine itself ;

R = Resistance in pounds of each vehicle ;

$\theta$  = Supplement of angle contained by any two vehicles ;

n = Number of vehicles whose resistance is overcome by the tractive force, T ;

"Now, pull exerted on first draw-bar =  $T \cos \theta$ , and since R is absorbed in each vehicle, the pull exerted on—

$$\begin{aligned} \text{Second draw-bar} &= (T \cos \theta - R) \cos \theta = T \cos^2 \theta - R \cos \theta ; \\ \text{Third} &= (T \cos^2 \theta - R \cos \theta - R) \cos \theta = T \cos^3 \theta \\ &\quad - R (\cos^2 \theta + \cos \theta) ; \\ \text{Fourth} &= T \cos^4 \theta - R (\cos^3 \theta + \cos^2 \theta + \cos \theta) ; \\ \text{nth} &= T \cos^n \theta - R (\cos^{(n-1)} \theta + \cos^{(n-2)} \theta \\ &\quad + \dots + \cos^2 \theta + \cos \theta). \end{aligned}$$

"Since we have assumed that the engine is just capable of pulling the n coaches, it is obvious that the pull on the nth draw-bar must just equal the resistance :—

$$\begin{aligned} \therefore R &= T \cos^n \theta - R (\cos^{n-1} \theta + \cos^{n-2} \theta + \dots + \cos \theta) \\ \therefore T \cos^n \theta &= R (\cos^{n-1} \theta + \cos^{n-2} \theta + \dots + \cos \theta + 1) \\ \therefore T \cos^n \theta &= R \left( \frac{1 - \cos^n \theta}{1 - \cos \theta} \right) \\ \therefore T \cos^n \theta - T \cos^{n+1} \theta &= R - R \cos^n \theta \\ \therefore \cos^n \theta &= \frac{R}{R + T (1 - \cos \theta)} \end{aligned}$$

"It will be readily seen that on a straight road  $\theta = 0$  and  $\cos \theta = 1$ , and the geometrical progression would sum 'n,' and our equation would therefore stand  $T = R n$ . It will be found that in all cases  $\theta$  is so small as to make  $\cos \theta$  so nearly approach unity that the obliquity of the draw-bar pull may for all practical purposes be neglected. For instance, a train of 45 empty wagons is being hauled round a curve of 600 feet radius, the total resistance being 20 lbs. per ton. It will be found from the above formula that a draw-bar pull of 5,455 lbs. is necessary; whereas, if we neglect obliquity, a pull of 5,400 lbs. is necessary. The difference, 55 lbs., is so small as to be inappreciable; nevertheless, the length of a train and the position of the heaviest laden wagons are such important items in the eyes of most enginemen that I venture to draw attention to the matter, in the hope of a correct explanation being forthcoming."

**Leicester Invites Tenders for Motor Dust Carts.**—The Leicester Sanitary Committee invites designs and tenders for motor-vehicles for the collection of house refuse. The motive power capacity and all other particulars are to be described in a full specification, accompanied by drawings, and delivered at the office of Mr. E. George Mawbey, C.E., Borough Engineer and Surveyor, Town Hall, Leicester, addressed to the Chairman of the Sanitary Committee, by January 31st. The loaded wagons would have to ascend an incline of 1 in 20, turn in a limited space, back and tip over a beam about 14 inches high by 12 inches in width, and when empty descend a road having a gradient of 1 in 15. The committee do not bind themselves to accept any proposal, and firms tendering must do so at their own cost, no fees being allowed for the preparation of drawings, &c.

## REPORT OF THE MANCHESTER DEPUTATION ON ELECTRIC TRACTION.

THE following is a brief report of the deputation recently appointed to visit the Continent on the results of inspection of Continental stations :—

The object of the inspection was to ascertain the latest Continental practice in electric lighting, and to learn the extent to which electric traction was used, and the various methods by which it was applied, and especially, if possible, to ascertain how the problem of supplying current for both lighting and traction was dealt with.

One result of the investigation is to show that electric traction is fast superseding all other means of hauling trams. Wherever electric traction has been introduced on a small scale, the system is being largely extended, and the use of horses is being entirely abandoned. Electric traction is not only preferred to horse traction, but to all other forms of mechanical propulsion; even the Serpollet steam system in use in Paris, and which appeared so promising, is being abandoned in favour of the electric system. The essential elements common to every system of electric traction are an electric generator driven either by steam or water-power, and an electric motor fixed upon the tramcar geared to the axle of the wheels and causing them to revolve; the difference between the various systems of electric traction is comprised in the various ways of establishing the connection between the generator and the motor. The most direct and simplest method consists in connecting one pole of the generator to the tram lines, and the other to a wire suspended over the middle of each track, and carried on insulated supports. This system is known as the overhead trolley system. Next in order of simplicity and directness comes the underground conduit system. In this, each pole of the generator is connected to an insulated conductor carried in a concrete culvert beneath the roadway. Connection with both conductors is established by means of a contact-making device known as a "plough," which enters the culvert through a slot running longitudinally in the same direction as the tram lines. The third system is as simple as either of the two preceding ones, but it is less direct. It consists in charging secondary batteries or accumulators from the generator, which accumulators are fixed on the car, and afterwards give out current to the motor on the car. The electrical energy is thus stored in the accumulators, and no direct connection is necessary between the generator and the motor. The fourth system is that known as the closed conduit system. In this, one pole of the dynamo machine is connected to the rails, and the other is connected in succession to a series of metal plates between the tram lines, the connection being established automatically by the car as it moves onward. This system is as direct as the trolley or slot system, but it is much more complicated, and is very liable to become deranged.

All systems of electrical traction fall broadly under the four heads named above, but there are endless differences in detail. Thus with the trolley system, the overhead wire may be supported on posts fixed either in the middle of the roadway or at the side, arms projecting from the posts over the tracks; or it may be carried on wires, known as span wires, stretched across the track and attached either to the buildings or to two posts without arms. The wire may be fixed over the centre of the track or near one side, the latter being known as the side trolley system. Contact may be made with the wire either by means of a wheel, known as the trolley wheel, carried at the end of a long arm fixed on the roof of a car, or by means of a metal bow, also carried on the top of the car.

Again, in the underground slot system, the slot may either be at the side, one rail forming one side of the slot, or it may be midway between the two rails of each track, a third line of metal being thus necessary for each track.

In the accumulator system the batteries may be removed from the cars for charging, or they may be left in the cars. In certain cases, the accumulator system is combined with the trolley system, and the accumulators are charged from the overhead wires in those portions of the city where it is fixed, while the electrical energy so stored in the accumulators is used to run the cars over the lines in that portion of the city where overhead wires are not allowed.

Comparing the advantages of the various systems, there can be no question that the overhead trolley system is by far the cheapest to construct, costs less for maintenance than any other system, is the simplest to operate, and the most easily repaired. It is much less liable to interruption than either the underground slot system or the closed conduit system.

The accumulator system is extremely reliable, but the expense attendant on its introduction throughout the whole of the system of tramways is prohibitive, while if it be adopted for certain portions of the city, the working expenses are largely augmented on account of the great weight of the batteries having to be hauled over the whole of the lines, whether the accumulators are furnishing current or not.

The underground slot system, though as simple to work as the overhead trolley, is very much more expensive, and possesses the serious disadvantage that it entails an entire cessation of traffic over the portion of line being converted for at least three weeks during its construction. The closed conduit system, though very attractive in theory, is not at present sufficiently developed to admit of its adoption being recommended, as it is not capable of dealing with heavy traffic, is liable to fail, and may give rise to shocks fatal to animals, and unpleasant to human beings.

Inquiry and observation show conclusively that on the Continent, wherever possible, the overhead system with either trolley or bow is employed. Other systems are only resorted to when the overhead is forbidden from aesthetic considerations. These considerations doubtless have weight when streets such as the principal streets of towns like Paris or Berlin are in question; but in the case of a great commercial city like Manchester, where cheap transit is a paramount consideration, and where an interruption of the heavy traffic would be fraught with disastrous consequences, there appears no necessity to insist upon the streets being kept absolutely free from overhead wires.

Where the tram lines are laid, steel posts should be erected on each side of the street with arc lamps fixed on same.

That the steel posts should be prepared to receive cross span wires to carry the overhead trolley wires if the overhead system is adopted in Manchester.

In the streets where there are no tram lines, the arc lamps to be suspended in the centre of the streets and carried by span wires. These span wires to be fixed by rosettes to the sides of the buildings if permission can be obtained from the tenants and landlords, and if the permission cannot be obtained, steel side posts be erected, and the span wires be carried from them.

*Generating Stations and Installations.*—The deputation were much impressed with the manner in which the electric installations in the various cities had been carried out. The workmanship and design of the engines and electric appliances were extremely good, and silent working and steady running seemed to be the order of the day. It was evident that cleanliness of machinery and buildings were made a special object of the management.

THE AUTOMOTOR AND HORSELESS VEHICLE JOURNAL DIARY contains over 100 pages of information. Price 6d.; post free, 7d., of Messrs. F. King and Co., 62, St. Martin's Lane, London, W.C. See it for Notes on Motive Power generally and Electrical Batteries.

## THE COLUMBIA MOTOR-CARRIAGES.

THIS vehicle is manufactured by the Pope Company, of Hartford, U.S., and its general appearance is shown in Fig. 1. As will be seen, it is an electrically-propelled four-wheeled carriage, having seating capacity for two persons.

The body consists of a box in which is carried the battery of accumulators, the front part of the box forming the seat, and protection is given by fitting a light hood. The wheels are of the bicycle pneumatic-tyred type, with ball bearings. The body is carried by an ingenious and elaborate system of springs, while the front axletree is made something like a bowstring girder of light tubing, and forms a very rigid, strong, yet light support. The rear axletree, together with the motor, differential gear, &c., is shown in Fig. 3. The motor is of the Lundell type, and is of two H.P. rated, but can be overloaded to twice this without appreciable heating.

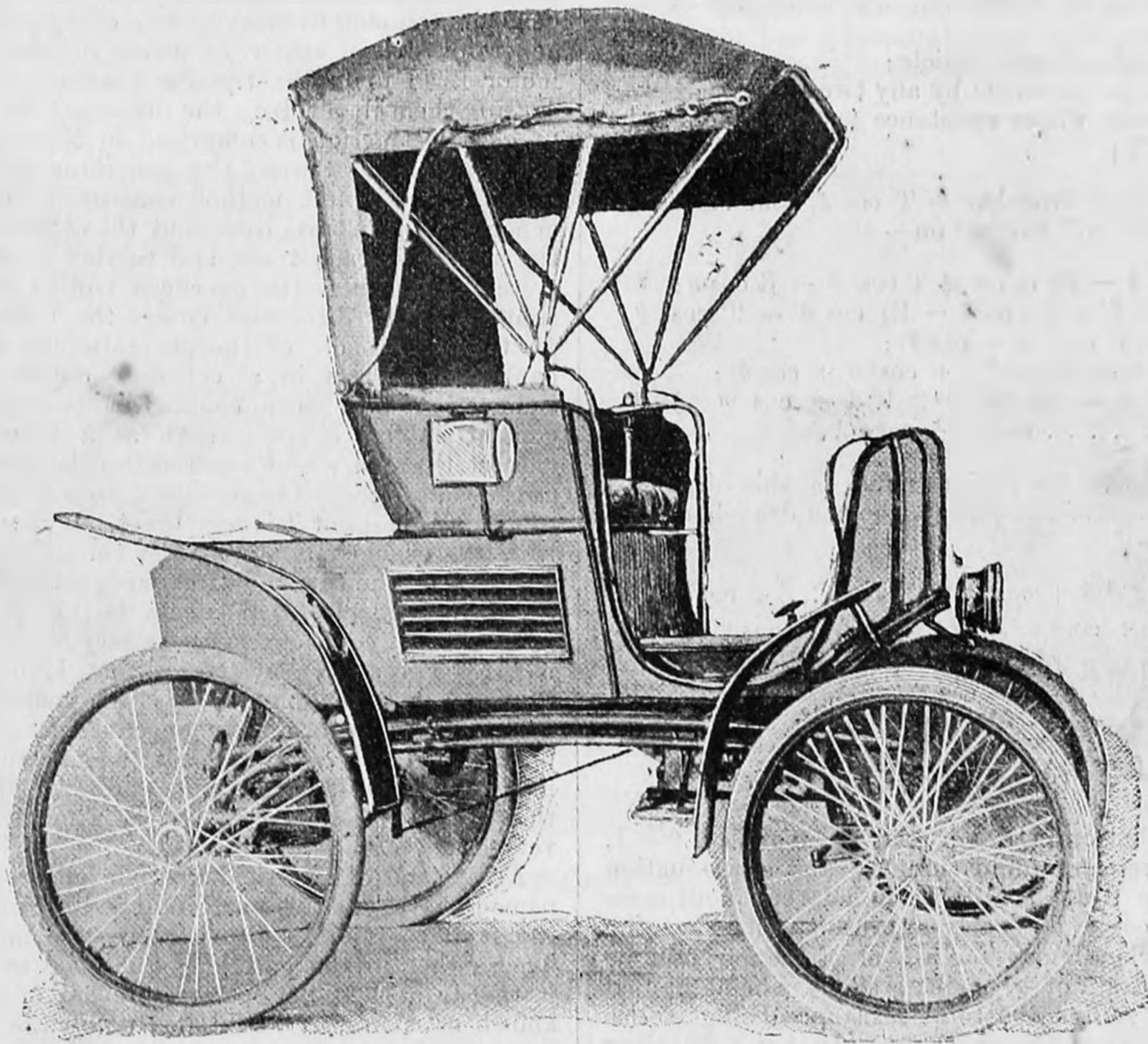


FIG. 1.—THE COLUMBIA ELECTRIC CAB.

Fig. 4 shows the battery and system of driving and controlling. The battery consists of 40 cells contained in four groups, 10 in each. Its capacity is 70 ampère hours, with a maximum discharge of 35 ampères. Under ordinary conditions of city traffic, running on asphalt, a speed of 12½ miles can be obtained with a discharge rate of 18 ampères. The efficiency of the system is stated to be 72 per cent., that is when discharging at the rate stated, 1½ H.P. are developed on the wheel rim. The connections are so arranged with a watt meter that when the charging current enters the "full" position on the dial it indicates that slightly more energy has gone into the battery than was taken out. Two small contacts, after the manner of the

ordinary electric alarm clock, are provided at the "full" position, so that when the finger reaches this point the circuit is completed through the electromagnet on the cut-out which actuates the armature and permits of the main switch of the carriage being thrown out. Thus, by simply inserting the charging plug in the carriage and closing the main switch, no attention whatever is required until it is desired to next use the carriage. The recording watt meter is of a special type made by the General Electric Company.

The reversing switch shown is not put in the controller on Columbia carriages, for the reason that in some cases it is possible for an excited person during an emergency to quickly draw the controller from full speed ahead to backing. This would be liable to cause serious results, and in the Columbia carriages a special reversing switch is provided which is operated by the foot, and which makes it practically impossible for an unthinking or careless person to reverse the current in the motor when the carriage is going at full speed ahead.

The emergency switch is a small plug placed conveniently near the seat; an operator can always pull it out in case of any accident to the motor, which would prevent its being stopped.

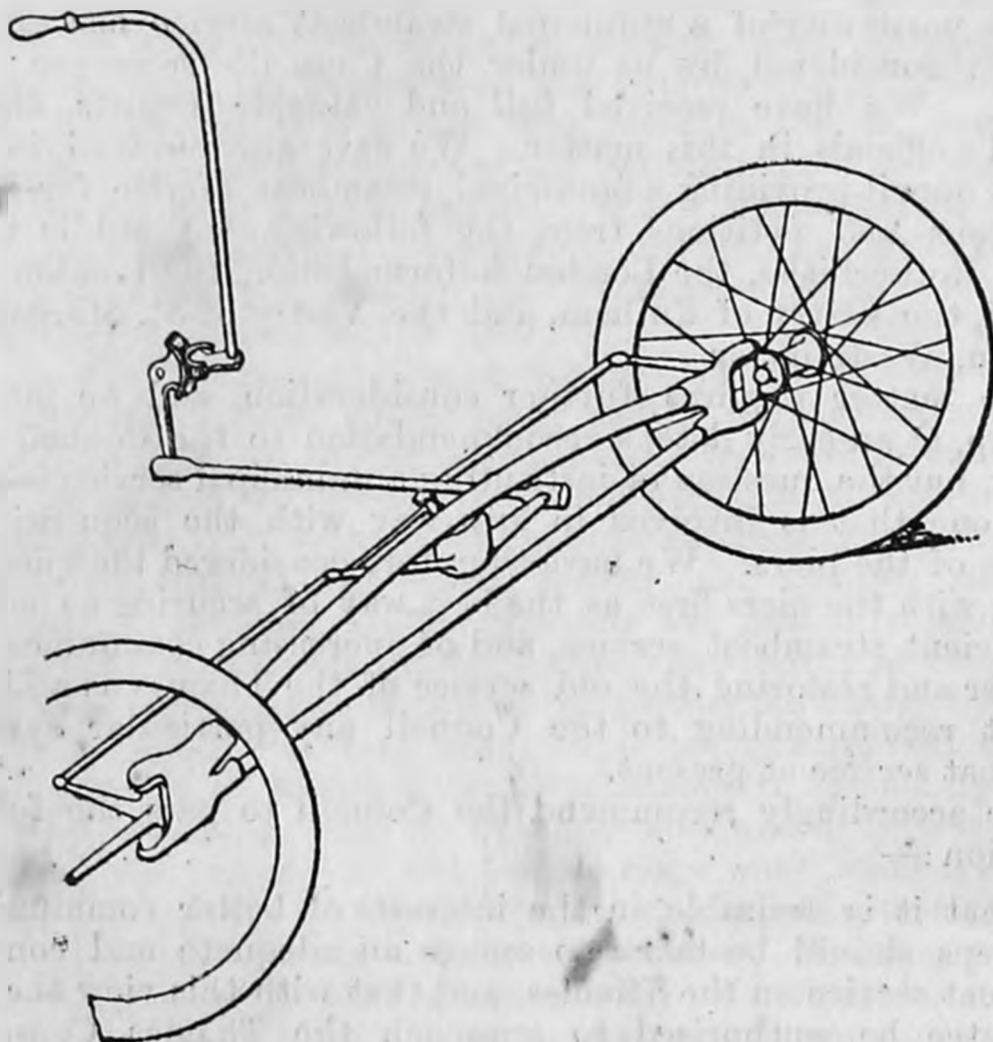


FIG. 2.

All battery connections, and, for that matter, all connections throughout the carriage which have to be manipulated in any way, are made of two different sized holes, all of the positive

The carriage weighs about 1,700 lbs., of which 850 lbs. are accounted for by the battery. The cost of recharging is about 50 cents., and the energy suffices for a run of 30 miles on good roads at a speed of 12½ to 15 miles per hour. The cells are stated to stand wear remarkably well, one set having run 2,300 miles without deterioration. In design, appearance, and finish the Columbia motor-car is all that can be desired, and reflects credit upon the Pope Company.

MOTOR-CARS AND MAIDSTONE.

MAIDSTONE and some other towns have lately been "afflicted"—this is, we think, the orthodox word—with typhoid. In plain English, Maidstone is, like so many county towns, rather indifferently governed, and hence the people have dilute sewage given them to drink, and thereby suffer from the existence of typhoid and other filth diseases. For the sufferers we have every sympathy; and we trust that after this lesson the electorate will do their duty, and free themselves from the government of those whose first duty, in many cases, consists in maintaining abuses and privileges, and who steadily set their faces against progress, whether this takes the form of new waterworks, electric lighting, or motor-vehicles. Few other counties are so backward as Kent. With no manufactures to speak of, it is a county in which the influence of the Squire and the Parson is supreme, and hence, it is not surprising that bad sanitation should prevail in the houses, and that the water supply should be contaminated with sewage, and that motor-vehicles should be regarded with disfavour by the local bumbles and beadles. There are, unfortunately, many other towns like unto Maidstone, both in the quality of their water and in their local administration. It is, however, only when an epidemic breaks out that the public learns how very backward and reactionary a local governing body can be, and how very ridiculous the proposals emanating from such bodies can be. Thus, the Warwickshire County Council has, as is well known, a strong antipathy to motor-vehicles. At a recent meeting of this body, as we learn from the *Birmingham Argus*, it was stated that complaints had been received of motor-vehicles proceeding along Coventry Road, between the city of the three spires and Birmingham, at a high speed and refusing to stop, infringing the Light Locomotives on Highways Order, 1896. The Council decided to make a representation to the Local Government Board that such an alteration of the Order was necessary as would ensure the registration of all motor-cars; that each car should carry in some conspicuous place a number corresponding with the number on the register, and that the registered proprietors of the car should be made responsible for any breaches of the Act. It is clear, says our contemporary, that the carriage

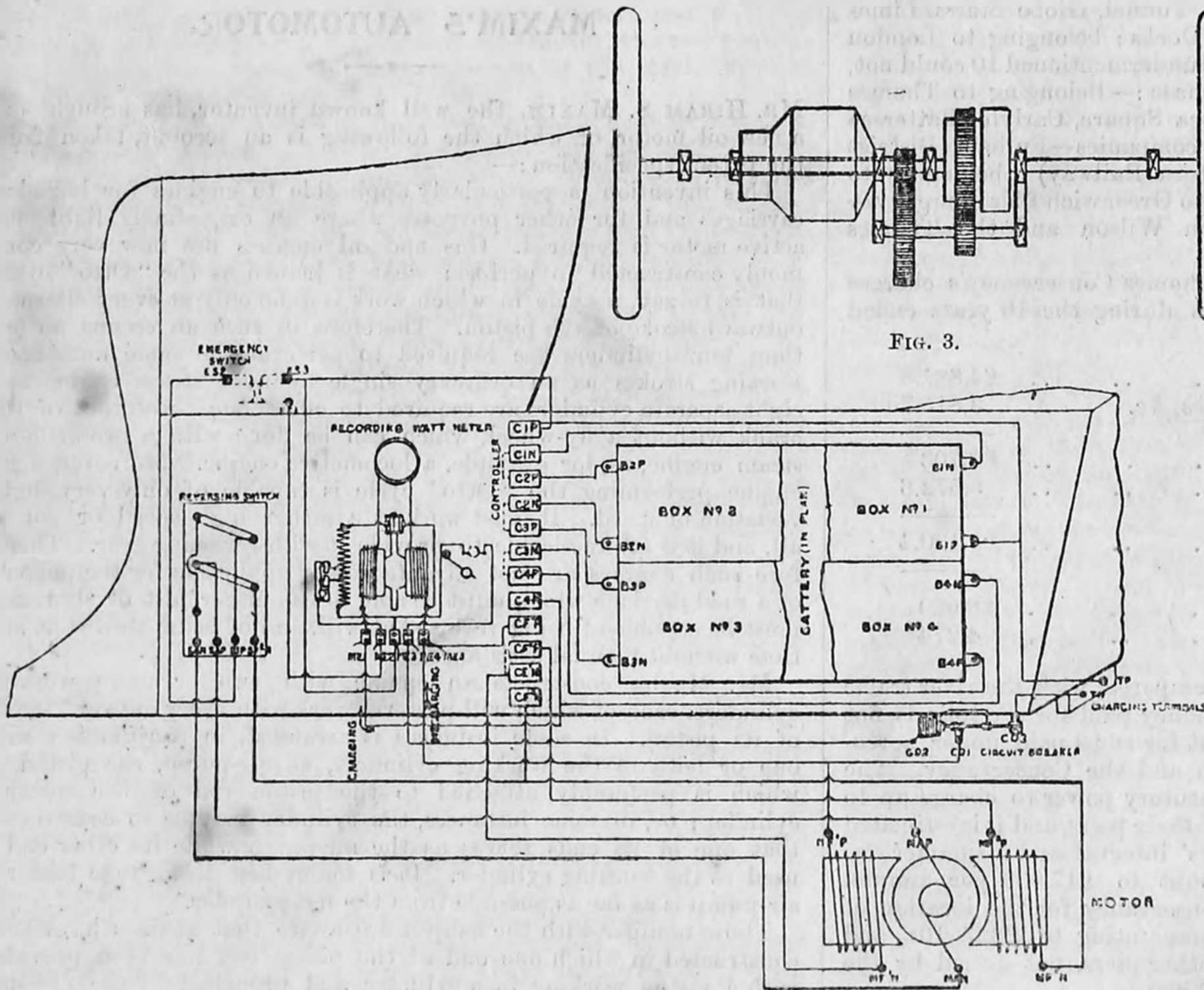


FIG. 4.

holes being the larger. Thus no negative plug can be entered in a positive hole, nor any positive plug entered in a negative hole; by this means it is almost impossible to make any mistakes in forming up connections.

people on the Council do not intend to part with their horseflesh or they would not suggest these restrictions, which will give a plying-for-hire appearance to a gentleman's private motor-car.

We do not object to the principle of registration, although we see no necessity for adopting it, and if it is necessary for motor-vehicles, it is also equally necessary for horse-drawn vehicles. We can assure the Warwickshire County Council that Acts of Parliament and Local Government Board Orders are not altered because a few selfish persons desire it, and before the alteration was made people of much more importance than those who compose a provincial county council would have to be heard. If our worthy friends in Warwickshire will mind their own business and look after their local water supply, they will exhibit a capacity for local self-government which at present they evidently lack, or they would not pass such childish resolutions, which are framed in no spirit of anxiety or desire for the public weal, but merely to gratify the selfish wishes of what are known as "carriage folk."

## NAUTICAL AUTOMOBILISM.

### THE THAMES RIVER SERVICE.

SOME time ago the Rivers Committee of the London County Council was instructed to consider what steps, if any, should be taken to provide London with an efficient steamboat service, and to free from toll the piers or landing-stages on the Thames in the county of London. The Committee have considered this and other references on the same subject, and the result appears in their report, in which they state that the first step to be taken "is to acquire and work the piers," a view which is in accordance with the one taken by the local authorities who have approached the Council. It is believed that the following 18 piers can be acquired without involving capital expenditure:—Belonging to Thames Conservancy—Wandsworth, Chelsea, Pimlico, Lambeth, Westminster, Waterloo, Temple, Blackfriars, Allhallows, London Bridge (Old Swan), London Bridge (Surrey side), Cherry Gardens, Tunnel, Globe Stairs, Limehouse, West India Docks, Commercial Docks; belonging to London County Council—Hammersmith. The undermentioned 10 could not, it is thought, be obtained without purchase:—Belonging to Thames Steamboat Company—Putney, Battersea Square, Carlyle, Battersea Park, Nine Elms; belonging to railway companies—Fulham (District Railway), Charing Cross (South Eastern Railway); belonging to dock companies—Blackwall; belonging to Greenwich Pier Company—Greenwich; belonging to Sir Maryon Wilson and the Thames Steamboat Company—Woolwich.

The following particulars show the Thames Conservancy's charges for the use of about 20 of their piers during the 10 years ended 1893:—

Expenditure on wages and staff .. ..	£4,887.3
Expenditure on repairs, rates, stores, &c. ..	3,815.7
<b>Total .. ..</b>	<b>£8,703</b>
Receipts for pier dues .. ..	5,572.6
<b>Loss by the Thames Conservancy .. ..</b>	<b>£3,130.4</b>
Maximum receipts (1884) .. ..	£8,029
Minimum receipts (1889) .. ..	4,274

The apparent smallness of receipts compared with the river traffic is accounted for in this way, that the money paid for the tolls is not the statutory charge for actual calls but for sums paid under agreement between the steamboat companies and the Conservancy. The Conservancy, it is pointed out, have statutory power to charge up to sixpence per call of each boat at each of their piers, and it is estimated that for a winter service of 15 minutes' interval and a summer one of 10 minutes, this toll would amount to £17,000 per annum. Additional charges are made by the Conservancy for the location of piers which do not belong to them, amounting to £327 10s., and there are charges for annual rental at other piers, not owned by the Conservancy, which reach a total of £3,850.

It is explained that there is reason to believe that the Thames Conservancy are willing "to arrange with the Council to facilitate the traffic on the Thames by transferring to the Council the charge, regulation, and maintenance of the existing piers belonging to them, but this concession, to be of practical utility, would need to be accompanied by the right on the part of the Council to remove them,

where necessary, from their present positions to such others as might be deemed more suitable for the river passenger traffic; and perhaps would require to be supplemented by the right to acquire such piers as are owned by others which may be found necessary for the Council's purposes.

"The possibility of a municipal steamboat service has also been carefully considered by us under the Council's reference on this subject. We have received full and valuable reports from the Council's officials in this matter. We have also received, in favour of the Council providing a municipal steamboat service for London, resolutions and petitions from the following:—A public meeting held at Rotherhithe, the London Reform Union, the London Trades Council, the Vestry of Fulham, and the Vestry of St. Margaret and St. John, Westminster.

"The matter requires further consideration, and we intend to bring up, at an early date, a recommendation to the Council on this subject, but the question of instituting a municipal service is not, we think, one that is involved in any way with the acquisition and working of the piers. We have therefore considered the question of dealing with the piers first as the best way of securing an adequate and efficient steamboat service, and of increasing communication on the river and restoring the old service of the Thames as a highway, without recommending to the Council any particular system of steamboat service at present.

"We accordingly recommend the Council to pass the following resolution:—

"That it is desirable, in the interests of better communication, that steps should be taken to secure an adequate and convenient steamboat service on the Thames, and that with this view the Rivers Committee be authorised to approach the Thames Conservancy Board and others concerned in order to ascertain on what terms and conditions the Council could acquire the piers."

At the last meeting of the Council this resolution was adopted by a large majority.

## MAXIM'S AUTOMOTOR.

MR. HIRAM S. MAXIM, the well known inventor, has brought out a new oil motor, of which the following is an account, taken from the patent specification:—

This invention is particularly applicable to engines for horseless carriages and for other purposes where an exceedingly light and active motor is required. Gas and oil engines are now very commonly constructed to perform what is known as the "Otto" cycle, that is to say, a cycle in which work is done only at every alternate outward stroke of the piston. Therefore in such an engine no less than four cylinders are required to perform the same number of working strokes as an ordinary single cylinder steam engine and eight separate cylinders are required to effect one revolution of the crank without a fly-wheel, which can be done with a two-cylinder steam engine, as, for example, a locomotive engine. Moreover, a gas engine performing the "Otto" cycle is capable of only very slight variation of speed. It must work at a rather high speed or not at all, and it is impracticable to provide it with reversing gear. Therefore such engines are not advantageously applicable for the purpose of a road carriage which must be able to run either fast or slow, and must be capable of being reversed at will, and of being started at any time without manual assistance.

Mr. Maxim constructs an engine with two or more working cylinders, each of which will perform work with every outward stroke of its piston. In some instances is arranged, in conjunction with one or both of the working cylinders, an air-pump, the piston of which is preferably attached to the piston rod of the working cylinder; or, in some instances, the cylinder may be so constructed that one of its ends serves as the air-pump while its other end is used as the working cylinder. It is found best to arrange that the air-pump is as far as possible from the hot cylinder.

Those familiar with the subject are aware that engines have been constructed in which one end of the piston rod has been provided with a piston working in a cylinder and propelled by the pressure of hot air or gas, while another piston on the rod has been employed for compressing the air, but in such engines the pressure in the working cylinder never exceeds the maximum pressure in the air reservoir, consequently these engines are not as economical as those using the "Otto" cycle, in which the pressure exceeds that of the compressed air in the air reservoir.

In Mr. Maxim's engine the connecting rod may be attached directly to the pump-piston so that the cross-head pin or pivot will be situated in a cool place, and consequently the piston will work better than if the said pivot were at the other end. The crank pins are set at angles of  $90^\circ$  from each other, and are arranged in such a manner to balance the engine as nearly as possible.

The engine works in the following manner, viz.:—Suppose it is ready for starting, the compressed air tank having a pressure of about 45 lbs. to the square inch, the valve in the air passage is opened, the compressed air enters the cylinder, and the piston is pushed forward as in a steam engine. When the piston has moved through about one-fourth of its stroke it uncovers the ignition tube, or otherwise causes the ignition of the charge of gas or vapour that has been admitted to the cylinder. At this instant a valve operates to close the communication between the compressed-air tank and the cylinder, and the charge being ignited the pressure suddenly rises to about 100 lbs. to the square inch. In some instances the cylinder is allowed to become very hot, especially where heavy petroleum is used. Its temperature may be sufficiently high to ignite the gas or oil without any special igniter, and in such cases the desired result is obtained by not injecting the gas or vapour until after the piston has travelled through about one-fourth of its stroke, thereby obtaining the same results as by igniting the charge by means of a special igniter. If very heavy oil is to be employed and the cylinder kept hot as stated, it is advantageous to use a long piston provided with packing rings at its outer end, and to keep cool only that part of the cylinder in which these rings work, while the inner end of the piston may be loosely fitted in the cylinder, and made of material which will endure a high temperature. For instance, the piston may be covered with asbestos, with or without an external covering of "platinoid," which is a mixture of wrought-iron and nickel. The end of the cylinder may also be made of the same or similar material, and heated with a Bunsen burner to a temperature sufficient to ignite the oil. But where a light petroleum is used the cylinder need not be kept at a high temperature. It can be jacketed throughout its entire length, and the charge may be ignited at about one quarter of the piston's stroke either by an ignition tube or an electric spark. As the piston moves outward it performs work on the crank and at the same time compresses the air, the two pistons being brought to a state of rest at the end of the stroke by the compressed air in the air-pump.

In an engine of this kind it is necessary that a definite quantity of inflammable material shall be introduced into the cylinder at each stroke, and apparatus is provided which so operates that the admission valve, when opened at any particular part of the stroke, will not remain open. For this purpose a device is employed, which first raises a weight, and then, by means of a tappet, releases it, so that the weight in falling strikes the valve, and by its impact opens the same, but allows it to close again immediately. In this case the oil, which should be under a pressure greater than that of the compressed air, enters the cylinder in a fine spray; or it may be volatilised, and enter the cylinder in the condition of vapour. The quantity of fluid admitted may be varied by varying the force of the blow, the length of the stroke, the force of the spring, the action of the tappet, or the size or shape of the valve. The pressure on the oil should be at least 100 lbs. to the square inch, so that it may enter with great force into the cylinder. The oil may be contained in a strong tank subject to the pressure of compressed air; or a small pump may be arranged to pump a larger quantity of liquid than is required, the superfluous oil being blown through a bye-pass at a pressure in excess of the pressure of the compressed air in the tank.

When four cylinders are employed upon the same crank shaft the engine may run either at a high or a low speed. Suppose that the engine is required to run slowly on a slight downward grade, the liquid may be shut off, and then, if the cylinder is hot, the apparatus will work as a hot-air engine, the only power developed being due to the increased volume of the air entering the hot cylinder, and whenever more power is required a larger or smaller quantity of oil can be admitted as required. The speed of the engine may be reduced by closing a valve in the compressed air passage.

If an automatic regulator or governor is required, one constructed in the following manner is employed; that is to say, a diaphragm is connected with the compressed air tank and with the oil-supply in such a manner that if the pressure in the air tank rises above the pre-determined pressure it diminishes the quantity of oil or gas introduced into the chamber, whereas if the pressure shall fall below this point an increased quantity of oil will be introduced and the heat will be correspondingly increased. In this way the quantity of

oil burned can be automatically regulated according to the amount of work being performed. If the load is light the engine may work simply as a hot-air engine, whereas if the load is heavy it will work as a gas or oil engine.

Reversing the engine is effected as follows:—There are two sets of cams on one shaft arranged to actuate the induction and exhaust valves, and capable of the required adjustments; or if preferred, two shafts can be used, each one having its own special cams. When a single shaft is employed the shaft may be arranged to be pushed inwards to reverse the engine, whereas if two shafts are used they may be arranged to be turned about a common centre so that one or the other will come into its operative position according as the engine is to run forward or backward.

This engine, according to Mr. Maxim, will work at any desired speed, and under very different loads, and will work as well with a heavy as with a light load. It therefore requires very much less gearing than other forms of gas or oil engines, and may in fact be geared directly to the axle of the carriage or vehicle on which it is used. The engine may be arranged to permit one or more cylinders to be used as may be required, and can be adapted to the various conditions which affect the working of a road carriage which not only has to run on the level but also has to mount and descend steep inclines. In some instances arrangements can be made for employing the engine as an air pump and thereby retarding the vehicle in descending an incline.

The air reservoir may be of any convenient shape or size, but preferably it is constructed of strong tubing completely surrounding the engine and serving as its foundation, and in some cases as the framework of the carriage. The oil reservoir may be located at any convenient part of the carriage, and the water tanks may be arranged in such a manner that the water can be fed into the parts to be cooled and can only escape as steam, the water being employed for cooling the cylinder or the exhaust valve or both as may be required.

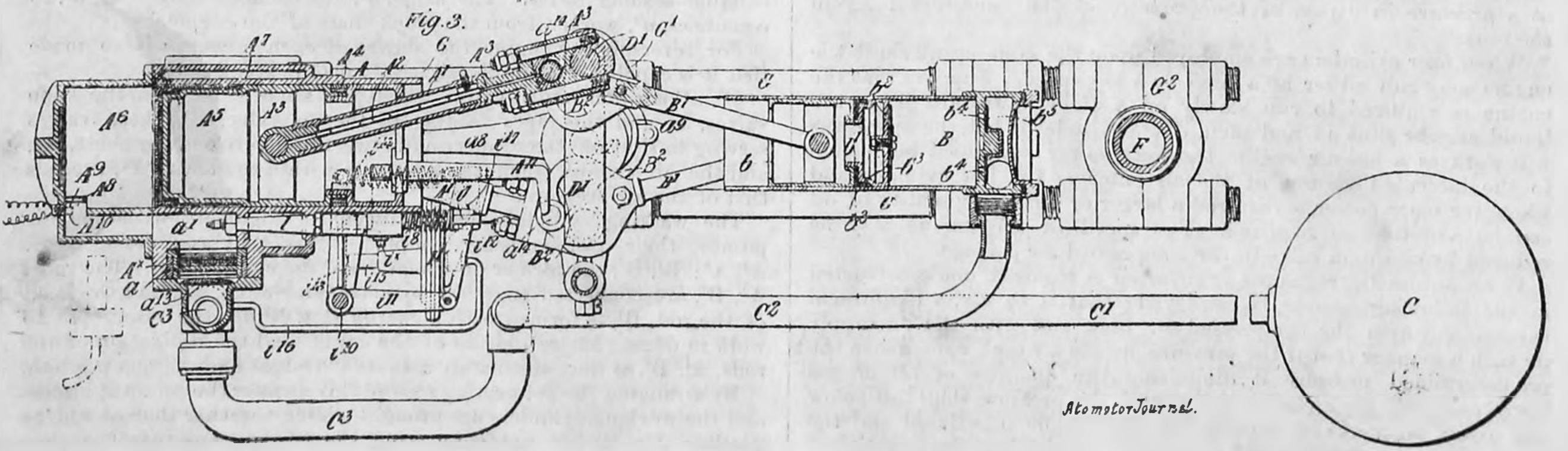
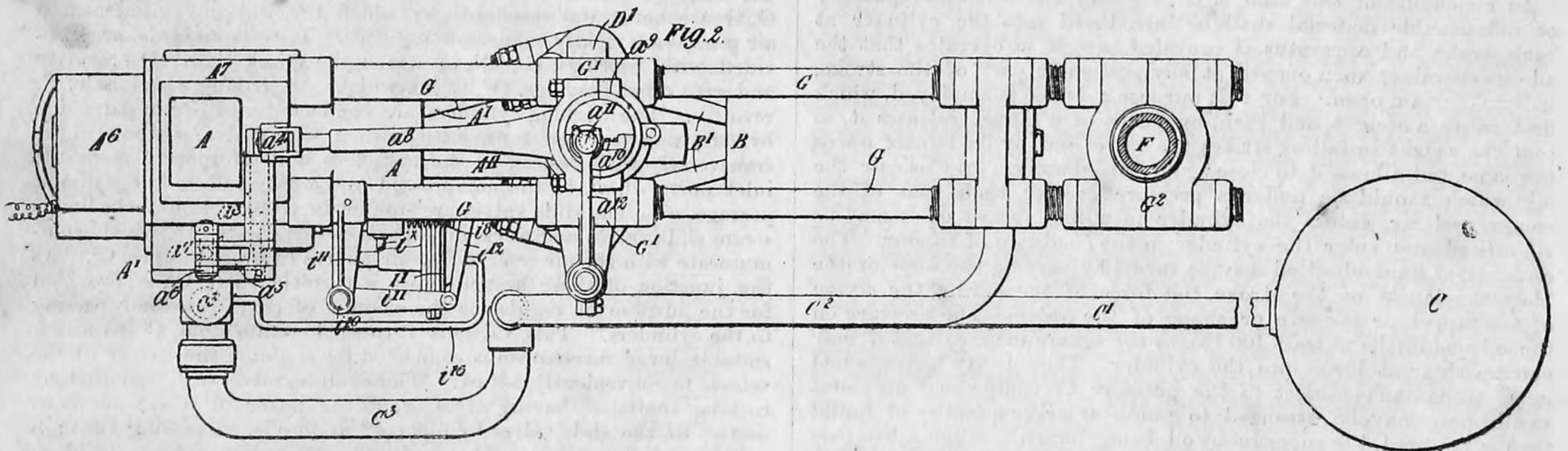
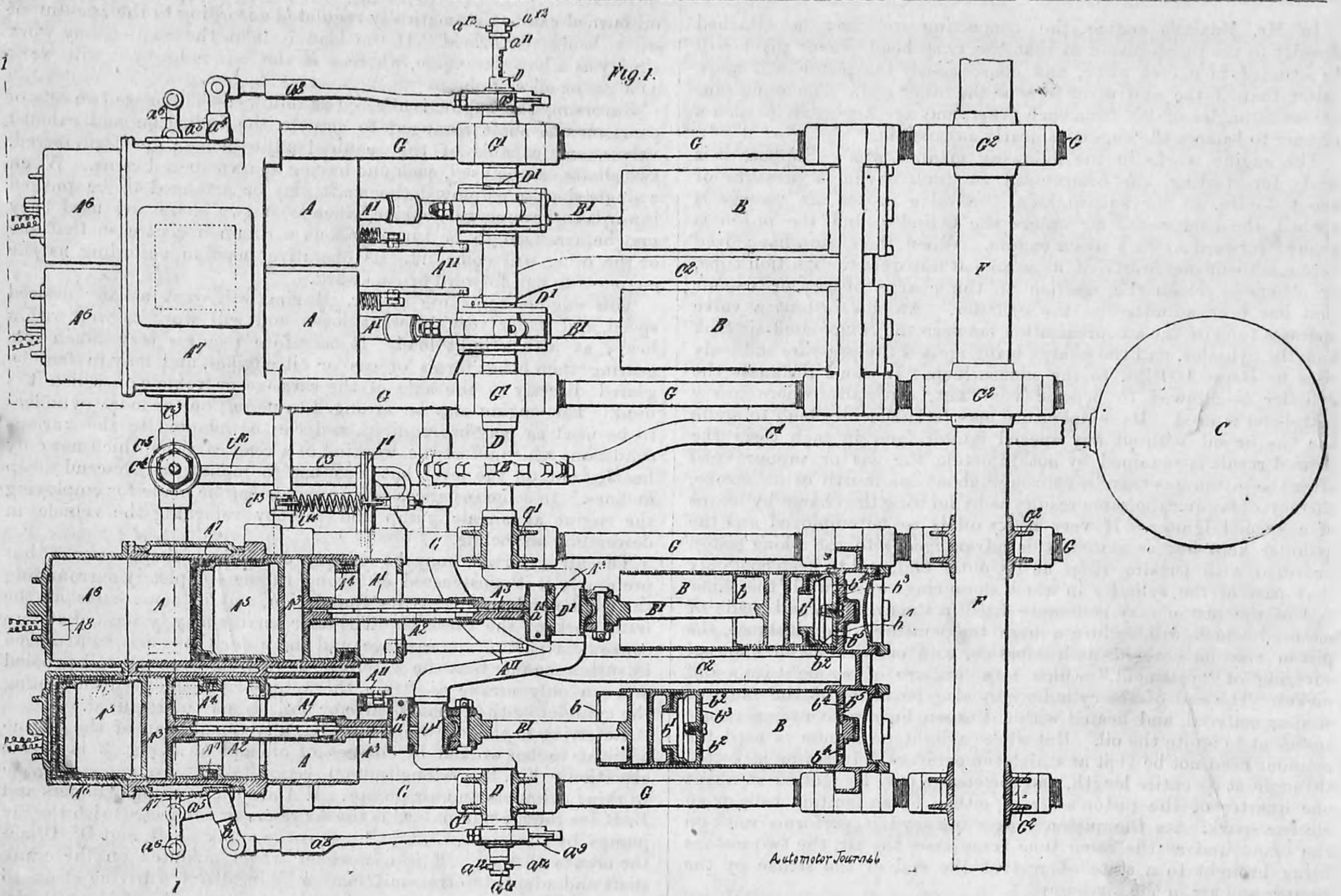
Referring to the drawings, Fig. 1 is a sectional plan of the engine adapted to be worked by charges of oil and air. Fig. 2 is a side elevation. Fig. 3 is a longitudinal section taken through one of the working cylinders and air pumps. A, A are the working cylinders and B, B are the air pumps. C is the air reservoir connected with the air pumps by the pipes, C<sup>1</sup>, C<sup>2</sup>, C<sup>3</sup>. D is the crank shaft, and D<sup>1</sup>, D<sup>2</sup> are the cranks thereon. E is a sprocket wheel mounted on the crank shaft and adapted to transmit motion by means of a driving chain to the axle, F, which may be the driving wheel axle of the vehicle. G, G are horizontal standards by which the working cylinders and air pumps are rigidly connected together. These standards are provided with bearings, G<sup>1</sup>, G<sup>2</sup>, in which the crank shaft, D, revolves and with other bearings, G<sup>3</sup>, G<sup>4</sup>, in which the driving wheel axle, F, revolves. The working cylinders are connected together in pairs side by side, each pair being provided with a slide valve, a, that works transversely with respect to the cylinders, and alternately opens the inlet ports, a<sup>1</sup>, a<sup>2</sup>, to the compressed air supply and to the exhaust passage, a<sup>3</sup>. The slide valves are similar in construction to ordinary steam slide valves and work in valve boxes or chests, A<sup>x</sup>, which communicate with the air reservoir or air pumps by branch pipes, C<sup>3</sup>. At the junction of these branch pipes a throttle valve, C<sup>4</sup>, is provided for the purpose of regulating the amount of compressed air passing to the cylinders. This valve is furnished with a stem, C<sup>5</sup>, to which suitable lever mechanism is connected for enabling the driver of the vehicle to conveniently adjust. These slide valves are actuated by rocking shafts, a<sup>4</sup>, having arms, a<sup>5</sup>, the latter of which are connected to the slide valves by links, a<sup>6</sup>, and rods, a<sup>7</sup>, passing through suitable stuffing boxes. The arms, a<sup>4</sup>, are connected by rods, a<sup>8</sup>, to eccentrics, a<sup>9</sup>, worked from the crank shaft of the engine.

For reversing the engine the sheave of each eccentric is so made that it is capable of sliding transversely on the crank shaft.

a<sup>12</sup>, a<sup>13</sup> are non-return valves which are situated between the slide valves, a, and the pipes leading to the air valve, C<sup>1</sup>, these valves serving to shut off the connection between the valve box or chest, A<sup>x</sup>, and the air pumps when the pressure within the chest, A<sup>x</sup>, exceeds that of the air pressure.

The working cylinders are arranged in alignment with the air pumps, their pistons being coupled together by connecting rods, A<sup>1</sup>, A<sup>2</sup>; B<sup>1</sup>, B<sup>2</sup>, the former of which drive the crank shaft. The rods, A<sup>1</sup>, B<sup>1</sup>, are connected together by a transverse pin, a<sup>14</sup>, and the head of the rod, B<sup>1</sup>, is formed with a curved slot, B<sup>2</sup>, for the crank pin to work in during the revolution of the cranks and the oscillation of the rods, A<sup>1</sup>, B<sup>1</sup>, as they alternately assume a straight and oblique position.

By arranging the connecting rods in this manner the pump cylinders and the working cylinders are brought closer together than would be possible if a simple rod connecting the two pistons together were



employed, and yet the air pumps are kept a sufficient distance from the working cylinders to ensure the former being kept cool.

The connecting rod, A<sup>1</sup>, is made hollow as shown, so as to contain lubricant which can flow to the crank pin. At every outward stroke of each of the air pump pistons air enters the pump from the atmosphere through the openings, b, b<sup>1</sup>, b<sup>2</sup>, in the piston. During the inward stroke of the pump piston the openings, b<sup>2</sup>, are kept closed by a flexible disc valve, b<sup>3</sup>, and the air within the pump is forced into the air reservoir through the openings, b<sup>4</sup>, which are kept closed against the return of the air by a flexible disc valve, b<sup>5</sup>.

The end of the working cylinder is closed by a cap or cover, A<sup>6</sup>, which constitutes the explosion or combustion chamber. The explosive mixture of oil and air enters the chamber, A<sup>6</sup>, through the ports, A<sup>8</sup>. A<sup>9</sup>, A<sup>10</sup> are electric igniters which, at the required portion of the stroke of the piston, are caused to "spark" by any suitable contact device. An externally arranged lamp for heating an ignition tube, to effect the explosions, may be used if necessary. This lamp may also be used to raise the temperature of the cylinders sufficiently to cause the vaporisation of the oil charges prior to ignition.

I, I, are the oil inlet valves, each of which is arranged to be actuated by a finger or tappet, A<sup>11</sup>, on the pistons of the working cylinders as the pistons reciprocate. The oil inlet valve is of the plunger type, and comprises an outer casing formed with a central passage, to which the oil gains access from the inlet by transverse holes. Within the passage are two valves, one being the outlet valve, and the other a non-return valve.

Extending transversely across the engine is a rocking shaft, i<sup>10</sup>, having arms, i<sup>11</sup>, to whose outer ends are pivotally connected levers, i<sup>12</sup>. The free ends of these pivoted levers engage with the slotted heads of the plunger pump. Situated about midway of the length of this transverse rocking shaft is another arm, i<sup>13</sup>, acted upon by a spring, i<sup>14</sup>, which keeps the said arm, i<sup>13</sup>, constantly pressed against a plunger, i<sup>15</sup>, forming part of the regulator, I<sup>1</sup>. This regulator consists of a box or casing within which is a flexible diaphragm, upon one side of which the inner end of the plunger, i<sup>15</sup>, is located. The other side of the diaphragm communicates by means of a pipe, i<sup>16</sup>, with the compressed air pipe, C<sup>3</sup>, so as to be acted upon by the pressure of the air supplied to the engine as such air passes the throttle valve, C<sup>4</sup>. The free ends of the pivoted levers, i<sup>12</sup>, are formed with lateral inclines, i<sup>17</sup>, against which the fingers, A<sup>11</sup>, on the pistons act to open the oil inlet valves.

It will be seen that the arm, i<sup>13</sup>, is subjected to two opposed pressures—that is to say, a pressure due to the spring, i<sup>14</sup>, and a pressure due to the compressed air within the regulator, I<sup>1</sup>. Thus the rocking shaft, i<sup>10</sup>, will be shifted angularly in a direction depending on which of the pressures predominates. By such angular movement the outer ends of the arms, i<sup>11</sup>, will be moved up or down, and by correspondingly shifting the pivoted levers, i<sup>12</sup>, will thereby vary the extent to which the inclines, i<sup>17</sup>, on the pivoted levers protrude into the path of the fingers, A<sup>11</sup>, so regulating the extent and the duration of the opening of the oil inlet valves. Thus the amount of the oil charges supplied to the cylinders by the oil inlet valves will be automatically regulated or varied by the amount or pressure of the compressed air passing the valve, C<sup>4</sup>, from the compressed air reservoir, or pumps. By means of this governor or regulator the driver of the vehicle can, by altering the air valve, C<sup>4</sup>, regulate the speed of the engine.

Mr. Maxim makes no less than 22 claims in connection with this motor, but the first two seem to be the more important. They are:—

1. An engine in which the first portion of the piston's stroke is effected by the pressure of air compressed before admission to the cylinder, and the remainder by pressure due to the combustion of oil or gas in such compressed air.

2. A gas or oil engine adapted to work either as a hot air and explosion engine or as a hot air or explosion engine.

The specification is numbered 9,525 of 1896.

NÄMN denna tidskrift "THE AUTOMOTOR AND HORSELESS VEHICLE JOURNAL" när ni tillskrifver annonsörerne.

FOR the Regulations respecting Automotor-Carriages and the Carriage of Petroleum, see THE AUTOMOTOR AND HORSELESS VEHICLE DIARY AND POCKET-BOOK for 1897, which contains over 100 pages of information. Price 6d.; post free, 7d., of Messrs. F. King and Co., 62, St. Martin's Lane, London, W.C.

## THE USE OF ALCOHOL IN PRIME MOVERS.

M. L. LÉVY, professor of distillery at Douai, has recently published in the *Distillerie Française* an interesting article in which he investigates the thermo-dynamics of alcohol and other hydrocarbons when employed as the source of motive power in an ideal motor, following the Beau de Rochas Cycle. One of the principal advantages of the use of alcohol is the total absence of that disagreeable smell that accompanies the use of petrol and other petroleum compounds in motors.

Number of Horse-power Hours theoretically produced by the Combustion of one kilogramme from the Agent.

Nature of the Agent.	Explosion in presence of the least volume of air absolutely necessary.	Explosion in presence of a volume of air double that strictly necessary.
Alcohol at 90° .. .. .	3.235 .. .. .	3.05
Petrol .. .. .	6.75 .. .. .	6.12
Amylic alcohol (C <sup>5</sup> H <sup>12</sup> O + H <sup>2</sup> O), 83 per cent. of alcohol.. .. .	4.28 .. .. .	3.92
Butylic alcohol (C <sup>5</sup> H <sup>10</sup> O + 2H <sup>2</sup> O), 67.3 per cent. of alcohol.. .. .	3.2 .. .. .	2.93
Distillery oil, 0.75 of amylic alcohol, 0.25 of butylic alcohol .. .. .	4 .. .. .	6.73

From this it will be seen that from the thermo-dynamic point of view petrol has a great superiority. Coming now to the economical aspect of the question, in which one seeks to obtain the greatest amount of work at the least cost of material, the results obtained in the following table show how much work can be obtained from the combustion of one franc's worth of each of the various agents named. In the calculation the following prices obtain:—Alcohol at 90°, 30 francs per hectolitre (in bond); petrol, 0.45 franc per kilogramme; distillery oil, 0.133 franc per kilogramme:—

Number of Horse-power Hours obtained by the Combustion of one franc's worth of each substance.

Nature of the Agent.	Explosion in presence of a volume of air strictly necessary.	Explosion in presence of a volume of air double that strictly necessary.
Alcohol .. .. .	9.00 .. .. .	8.50
Petrol .. .. .	15.00 .. .. .	13.60
Distillery oil .. .. .	30.00 .. .. .	27.50

From this it will be seen that it is impossible to think of replacing petrol by alcohol in small motors; pure alcohol is 60 per cent. dearer than petrol, but its use presents certain advantages, taking into consideration the cleanness and convenience resulting from a complete combustion. If, on the contrary, leaving out economy, distillery oil and alcohol are mixed, they are more easily burnt than petrol, and also they do not, like the latter, infect the air, and are capable of producing as much work, under certain conditions, as economically as petrol.

**The Underground Railway and Electric Traction.**—We recently commented upon the supineness of the directors of this and the District Company in adhering to steam locomotives when, as it appears to us, compressed air locomotives would offer so many advantages. Since then, a *Daily Mail* representative has interviewed an official of the Metropolitan Railway on the subject of electric traction, for the purpose of ascertaining what are the difficulties mentioned by Mr. Bell before the Board of Trade Commission, whose report was recently issued. The official interviewed said the point referred to by Mr. Bell was, he imagined, the question of finding the initial energy for starting a large number of trains simultaneously on the same section. "There are 27 stations on the circle," he said, "and to start trains from several of these at the same time would require a considerable power from the source of supply. This difficulty will, of course, be overcome eventually; but electrical traction will not be utilised on the Metropolitan system for some little time. The subject is receiving the continuous attention of the directors, but it is naturally one that demands serious consideration. As soon as a decision is arrived at a definite announcement will be made." Why does not Mr. Bell try compressed air locomotives?

## DOINGS OF PUBLIC COMPANIES.

THE capital of Headland's Patent Electric Storage Battery Company (Limited) has been increased from £15,000 to £20,000 by the creation of 5,000 new shares of £1 each.

A GENERAL meeting of the Universal Electric Carriage Syndicate will be held at the London Tavern, Fenchurch Street, E.C., on December 2nd, at two o'clock, to receive a report by the liquidator (Mr. W. O. Attree) of the winding-up operations.

"SMIDDY, LONDON," is the telegraphic address of Messrs. J. W. and T. Connolly, King's Cross, manufacturers of the well-known "Ideal" rubber tyre. In this firm's advertisement in our last issue it was inadvertently printed "Smidoly." Business firms please note and alter accordingly.

THE report and accounts of the British Motor Syndicate, to be submitted at the general meeting to be held on the 18th instant, are just issued, and are published in this number. The figures are of a most remarkable nature, and as the report is only to hand as we go to press, we reserve our criticism of this extraordinary document for our next issue.

AT the meeting of the Colonial Assets and Investment Company (Limited), held on the 10th inst., reference was made to the London Electric Omnibus Company, to the effect that the former owned a one-sixth interest in the Ward accumulator, and it was stated that the London Electric Omnibus Company, which has been formed for the purpose of working this accumulator, has completed the construction of three omnibuses, but its directors have decided that until the Company has a sufficient number to run on the streets it will not commence a regular service of electric omnibuses.

A DIVIDEND of 10 per cent. has been declared by the directors of the Caledonian Motor-Car and Cycle Company (Limited), of Aberdeen. The called-up capital of the Company is just over £2,300, and the net profit from all sources from December 24th, 1896, to September 30th, 1897, being nine months and four days' trading, amount, as per profit and loss account, to £548 10s. 11d.; depreciation on the plant, machinery, fittings, &c., being 10 per cent. written off, £65 12s. 10d.; leaving a balance for division of £482 18s. 1d. This sum the directors propose to deal with as follows:—Write off the total amount of preliminary expenses, £124 12s. 4d.; pay a dividend of 10 per cent., free of income tax, on the paid-up capital of the Company, £233 19s.; directors' and auditors' fees, £38 8s.; to carry forward to next year £85 18s. 9d.

THE shareholders in Mr. Pennington's Irish Motor and Cycle Company have reason to be satisfied with the result of the liquidation which was wisely determined upon. A second cheque has been forwarded to them giving a further refund of 1s. 6d. a share to the holders of ordinary shares, leaving only 1s. a share of the amount which they subscribed still due. The preference shareholders have received back the entire amount, and we understand the directors are making arrangements by which, in a short time, Mr. Robert Gardner, the liquidator, will be enabled to remit the last shilling to the original shareholders. Whatever mistakes the directors made in connection with the inception of the Company, their worst enemies cannot but render them praise for the satisfactory manner in which they have seen that those who subscribed their money to the concern, upon the faith of the high characters of the members of the Board, have been properly protected, and will not be losers by their confidence.

THERE appears to have been a great number of hard words thrown about recently in regard to the affairs of the Britannia Motor-Carriage Company (Limited), resulting in the calling, on the 4th inst., at the Holborn Restaurant, of an extraordinary general meeting in compliance with the requisition of certain members holding in the aggregate 5,825 shares, or a trifle over one-tenth of the issued capital of the Company. Whether the accusations put forth against those concerned with the launching of the Company have any measure of truth in them or no, it is not for us to say, but it certainly seems to us that all the matters which this meeting was

specially called to discuss would have been better left until after the ordinary general meeting of the Company, to be held on December 15th next. When this meeting has taken place and the accounts have been presented, and the progress of the concern reported upon, it should be time enough to raise questions likely to wreck the Company in the event of the reports being of the nature foreshadowed by the malcontents. At the meeting, the directors made a very good stand against the attacks of their traducers, the Chairman's proposal for the adjournment of the meeting until immediately after the annual meeting, on December 15th, being ultimately carried unanimously. We trust the directors will be able to follow up their advantage by demonstrating beyond doubt at the December meeting that the affairs of the Company are in a flourishing condition and likely to result in substantial dividends being paid speedily to the shareholders. The President, the Hon J. H. H. Berkeley, must be congratulated upon the admirable manner in which he ruled the meeting, which at first gave promise of such unpleasant developments.

THE meeting of the shareholders of the New Beeston Cycle Company (Limited), was held at Coventry on the 14th of last month, to consider the scheme of reconstruction set forth in our October issue. Mr. Rowland Hill presided, and stated that the directors had decided to take the shareholders entirely into their confidence, and had therefore given the fullest information possible. He stated that, as the meeting was aware, the vendors handed over to this Company the business assets of the successful Quinton Cycle Company, which they had previously purchased for £55,000. By the prospectus the promoters were able to legally claim a large number of vendors' shares, which established, in the Chairman's opinion, a crushing load, from which, unless relieved, it would never hold up its head. It was not long after the flotation before Dr. Iliffe and himself saw the necessity of finding some way of relieving the shareholders of this crushing weight of vendors' shares. Their endeavours had culminated in the scheme now placed before them. It was a better scheme than they ever dreamt it was possible to get, and was the result of months of anxiety and negotiation. They anticipated satisfactory results from it, and by that he meant dividends to the shareholders. They knew that their cycle business was a good one, and if fairly capitalised there should be good dividends. They had one of the finest factories in the trade, and if there was one-half the demand in England that there was in France for motor-cycles that business should pay a large dividend, even out-doing eventually the Cycle Company. The directors had been told that the present scheme was above criticism. The separation of the cycle from the motor business was considered absolutely necessary, and it was also absolutely necessary to have more working capital. On the cycle side the Company had done a large trade, and their plans for next year were for a greater trade. He moved that the scheme be approved. Dr. Iliffe, seconded, and stated that the new share capital would be called up at lengthened periods. After some discussion the scheme was put to the meeting and unanimously approved. The Chairman then stated that it was a matter of satisfaction that £450,000 of proxies had been received in favour of the scheme, and over £100,000 were ordinary shares. The Chairman and Dr. Iliffe were thanked by the meeting, Mr. Stevens remarking that they had the courage to stick to the firm when the other directors were afraid to meet the shareholders. In accordance with the resolution, the Beeston Motor Company (Limited) has now been registered, with a capital of £110,000 in £1 shares.

### G. R. Blot and Co. (Limited).

UNDER the above title a Company has been registered with a capital of £75,000, in shares of £1 each, for the purpose of manufacturing electrical and other apparatus and plant, and especially accumulators of the kind manufactured by Mr. G. R. Blot. The invention is patented practically all over the world, and the English Company acquires the patents of Great Britain, Canada, and several of the colonies, together with the right of taking out patents in all countries in which patents or protections do not already exist. We understand that the whole of the capital has been privately subscribed, and that the Company will at once get to work to place their accumulators upon the market in a commercial form. The directors are Mr. Thomas Parker, J.P., M.I.C.E., &c., of Thomas Parker (Limited), Wolverhampton; Mr. F. Hall Kirby, M.I.C.E.; Mr. Ernest Honey, of the Elswick Cycle Company (Limited); and Mr. G. R. Blot, the inventor. The offices of the Company are at 33, St. Swithin's Lane, London, E.C.

### New and Mayne (Limited).

FOLLOWING the appointment of a receiver and manager upon the application of Mr. Rucker, a debenture-holder, made on September 15th last, in the above matter, two meetings have been held of the creditors of the Company at the Westminster Palace Hotel, the first being adjourned until the 10th inst. to enable a report to be drawn up for the creditors by a Committee appointed at the first meeting. The following gentlemen constituted the Committee:—Messrs. Reuben Hunt (R. Hunt and Co.), J. Strong (Henderson and Spalding), J. Hoyle (Dicks' Asbestos Company), and W. L. Gray (Dunlop Company). At the adjourned meeting, Mr. A. L. Basden, the receiver appointed by the Court, read the report drawn up by the creditors' Committee, which, after giving particulars of their investigations into the Company's affairs, the method of keeping the books, the proper issue of debentures, &c., pointed out that Mr. Rucker had from time to time advanced very large sums of money to the Company for the purpose of carrying on the business, amounting in the aggregate to close on £80,000, against which Mr. Rucker held some £53,000 of first debentures. After several interviews and a good deal of negotiation, the Committee had arranged with Mr. Rucker, subject to the creditors consenting to the reconstruction of the Company upon the lines indicated in the scheme set forth in the original circular, to accept in the reconstructed Company £25,000 in first mortgage debentures, and for the balance of his debentures he was willing to accept second mortgage debentures *pro rata* with the rest of the unsecured creditors, who would also receive a similar security in the reconstructed Company for the full amount of their debts. The Committee in their report then unanimously and strongly recommended the full acceptance of the amended reconstruction scheme, and a resolution to that effect being put to the meeting was carried with only one dissentient, viz., a representative of Messrs. J. K. and R. Lord, who recently filed a petition in the Companies' Winding-Up Court for the compulsory winding-up of New and Mayne (Limited). The resolution was then declared carried, and the necessary creditors' signatures obtained to enable the receiver and manager to obtain the consent of the High Court to the reconstruction scheme agreed upon by the creditors.

The Committee appear to have done their work admirably, and the unsecured creditors have to thank Mr. Rucker for the extremely generous way in which he has dealt with his claims upon the entire assets of the Company. There is no question in our mind that the creditors have a very substantial chance of obtaining their money back ultimately, as there is little doubt that New and Mayne (Limited) have valuable assets, which, if properly worked, should, under the coming condition of affairs in the automotor industry, result in the building up of a very valuable business.

### Leather-Shod Wheel Company.

A LARGE company of shareholders met at the works of the Leather-Shod Wheel Company (Limited), at Bow Road, E., last month, for the purpose of witnessing a demonstration of the process by which the Company manufactures leather tyres and applies them to wheels of all kinds. It is claimed for the leather tyre invented by Messrs. Pierrou and Klein in 1895—the patent rights of which for the United Kingdom the Leather-Shod Wheel Company (Limited) was formed to take over—that it is at once elastic, durable, quiet, cheap, and light running. In the year mentioned works were started in Vienna, and the Austrian Government very soon began to use the wheels in several of their departments.

Upon the formation of the English Company, among the first orders given was one for wheels for the trolleys in the House of Commons. Then the Secretary of State for War gave an order for wheels for military carriages, and another came from the Director of Clothing of the Royal Army Clothing Department. Instructions were also received before many weeks had passed to prepare trial sets of wheels for the General Post Office, the London Road-Car Company, the Maxim-Nordenfelt Guns and Ammunition Company, Messrs. Merryweather and Sons for fire-engines, and a set of wheels for use on one of the London Tramways. In all these cases it is said the trials made have proved satisfactory, and orders have been sent in for wheels, not only for ordinary carriages, cars, and vans, but also for trucks, trolleys, machine pulleys, roller skates, friction wheels for transmitting power, rollers for bridges and gates, seed crushers, &c.

It is stated that, in addition to the quiet running, it is so elastic that a wheel dropped on a wooden floor will rebound about one-fifth

of the distance. In Vienna it is found that the leather tyres last nearly as long as iron tyres, and three to four times as long as tyres made of rubber. As to cost, a whole wheel fitted with the leather tyre can be supplied at the same price as a rubber tyre alone. It is further claimed that considerable economy is effected in repairs of vehicles using these tyres, it being found that vehicles using elastic tyres last much longer than others. Moreover, it is contended that the tyre will stand such heavy weights that a tread as narrow as two inches can, if desired, be used for vehicles carrying loads of five tons upon each wheel, and in support of this statement are instanced the leather-shod wheels used for artillery purposes by the well-known firm of Fried. Krupp, gun-makers, of Essen. Any existing wheel can have the tyre attached rapidly and cheaply.

The process of manufacture, as explained to the shareholders by Mr. H. S. Fearon, the Company's engineer, is as follows:—Strips of leather are first passed into a machine and stamped into dies, which, having also been glued in the operation, are pressed into a cylinder and then delivered into racks in long segments. A whole tyre is made up and placed into a frame, which holds it tightly, and it is then several inches in diameter larger than the wheel for which it is intended. Upon being placed around the wheel, to the rim of which a vertical channel has already been attached, it undergoes a very great circumferential hydraulic pressure, and is contracted into the channel, the edges of which are subsequently turned in upon the leather, thus holding the whole firmly in position. A large factory is in course of construction, and in a few weeks it is expected that the Company will be manufacturing wheels in considerable quantities. The tyreing machines are capable of turning out 300 wheels per day, three feet in diameter, with only 60 workmen.

### British Motor Syndicate.

THE report of the directors of the British Motor Syndicate (Limited), with balance-sheet and profit and loss account from the date of incorporation to 30th September, 1897, to be submitted to the general meeting to be held at Coventry on the 18th inst., states that the gross profits, before charging directors' fees, amount to £446,285. Dividends and bonuses have been paid absorbing £217,173, and the Board have thought it wise at this time to utilise a considerable portion of the balance of profits in writing liberal sums off the cost of patents, freehold property, furniture, &c., as shown in the accounts. The cost of patents amounts to no less than £413,682, whereas the capital issued to the same date is £250,000, so that nearly half the cost of the patents has been paid out of the profits, and not out of the capital. Last year the Board's efforts were principally directed towards obtaining the necessary funds for purchasing controlling patents—the motor-car as now used being quite a modern invention. This year attention has been given to the manufacture of motor-cars in this country, and the industry has now been thoroughly established. The progress made is seen by the fact that, whereas last November no British-made motor car was in existence, to-day upwards of 200 motors and motor-cars have already been turned out by the Company's various licensees at Coventry, and motor-cars are being delivered weekly. So far all attempts to excel the patents and inventions belonging to this Syndicate have signally failed, and all tests, public and private, indicate that their Systems are the only practical ones of any value, and will be found the controlling powers in the industry for years to come. All the international competitions and races have again this year been won by motors in accordance with the patents held by the Syndicate. The directors further report the continued success of their litigation. All points hitherto contested in the Law Courts have been won by the syndicate. It has been deemed prudent to restrict the issue of new licences for the present, in view of the rapid developments now taking place. With reference to the Syndicate's electrical patents, no better evidence could be given than the electrical cabs now running in the streets of London under the Company's licence. The able management of the London Electrical Cab Company has silenced misrepresentations with reference to electrical motors. The oil-motors have a long list of records for the year in speed. In certain Government departments they are being submitted to severe tests, and the reports to date are in every way favourable. It is a matter for congratulation that in less than two years this Syndicate has obtained the premier position in this country. More progress is shown here than even in America or Germany. Only in France has this been exceeded, where, after the most thorough testing, the motor is being adopted by the railway companies, the post office, the army, and is rapidly coming into general use for large establishments,

as effecting great economy in time and money. The state of the share market and the Jubilee year have deferred the launching of any new enterprise this year. Time is, however, in the Company's favour, as the motor is each day gaining ground, and the position is strengthening. The directors are now preparing plans for extensive developments next year.

With the report is issued a circular announcing that an extraordinary meeting of the Syndicate is to be held at the close of the ordinary meeting for the purpose of passing certain resolutions to

alter the articles of association (which alterations are rendered necessary in order that the Syndicate may apply for a Stock Exchange quotation, and by reason of the extension of the Syndicate's business which is now transpiring), and to divide the existing capital of the Syndicate into two classes of shares—preference and ordinary. The meetings will be held at Coventry in order that shareholders may inspect the motor-mills there situated, which are proposed to be taken over.

PROFIT AND LOSS ACCOUNT, FROM 21ST NOVEMBER, 1895, TO 30TH SEPTEMBER, 1896.

Dr.	£	s.	d.	Cr.	£	s.	d.	£	s.	d.
To expenses connected with exploitation of patents and licences and agents' and renewal fees ..	134,227	7	7	By sale of licences—						
Office salaries, experts' fees, rent, rates, taxes, insurance, gas and water, postage, law costs, travelling expenses, carriage, repairs and renewals, and petty expenses .. .. .	12,319	4	7	For cash .. .. .	301,000	0	0			
Purchase of motors, cars, tools, &c., including working models and patterns .. .. .	19,030	19	4	For shares .. .. .	290,000	0	0			
Printing, advertising, demonstrations, exhibition show and preliminary expenses.. .. .	14,578	9	7					591,000	0	0
Bank charges and interest .. .. .	173	7	10	Motors, bicycles, tricycles, &c., sold, and sundry profits .. .. .				24,527	12	4
Directors' fees .. .. .	625	0	0	Stock of motors, cars, bicycles, tricycles, tools, &c., on hand September 30th, 1897, as valued by the manager .. .. .				11,087	6	8
Amounts written off—										
Patents and licences .. .. .	150,000	0	0							
Shares .. .. .	46,777	10	0							
Furniture, fixtures, and fittings.. .. .	215	4	9							
Freehold premises .. .. .	139	8	4							
	197,132	3	1							
Balance carried to balance-sheet .. .. .	248,528	7	0							
	£626,614	19	0					£626,614	19	0

BALANCE SHEET, 30TH SEPTEMBER, 1897.

Dr.	£	s.	d.	Cr.	£	s.	d.	£	s.	d.
To nominal capital—				By patents and licenses acquired—						
1,000,000 shares of £1 each .. .. .	£1,000,000	0	0	For cash .. .. .	136,688	11	5			
Capital issued and paid—				For shares (see Note under heading of capital) .. .. .	276,993	0	0			
250,000 shares of £1 each .. .. .	250,000	0	0	Less amount written off .. .. .	150,000	0	0			
NOTE.—By an agreement dated 21st October, 1896, the Syndicate became liable for the issue of 750,000 shares in respect of patents therein referred to; 650,000 of the above shares still remain to be issued under such agreement.								263,681	11	5
Sundry creditors—				Shares in kindred companies—						
On open account .. .. .	£29,267	13	3	At cost or nominal value .. .. .	62,370	0	0			
On bills payable .. .. .	2,600	0	0	Less 75 per cent. written off .. .. .	46,777	10	0			
	31,867	13	3					15,592	10	0
Profit and loss account—				Freehold property .. .. .	2,788	6	9			
Balance per account .. .. .	£248,528	7	0	Less 5 per cent. written off .. .. .	139	8	4			
Less dividends and bonus paid—					2,648	18	5			
In cash .. .. .	£52,652	14	7	Less mortgage .. .. .	1,500	0	0			
In shares .. .. .	164,520	0	0					1,148	18	5
	217,172	14	7	Furniture, fixtures, and fittings .. .. .	1,434	18	2			
	31,355	12	5	Less 15 per cent. written off .. .. .	215	4	9			
	£313,223	5	8					1,219	13	5
				Sundry debtors .. .. .				7,772	6	1
				Cost of registration of companies now in process of formation .. .. .				1,649	1	4
				Stock of motors, cars, bicycles, tricycles, tools, &c., on hand, as valued by the manager .. .. .				11,087	6	8
				Cash and bills (since matured and honoured) at bankers and in hand .. .. .				11,071	18	4
								£313,223	5	8

I have examined the books of the British Motor Syndicate (Limited) from November 21st, 1895, the date of incorporation, to September 30th, 1897. Payments in relation to the Motor-Car Club, amounting to £4,378 8s. 2d., have been charged in the accounts as an expense. A sum of £1,664 13s. 4d. has been paid in respect of income-tax, but no reserve has been made for the balance

payable, as yet unascertained. Subject to the foregoing remarks I am of opinion that the balance-sheet, which is in accordance with the books of the Syndicate, correctly exhibits the position of the Syndicate's affairs.

ERNEST BOOTHROYD, Chartered Accountant,  
London, November 1st, 1897. Auditor.

### Roller-Bearings Company.

THE ordinary general meeting of shareholders of the Roller-Bearings Company (Limited), was held on 28th October. Major-General Hutchinson, C.B., in the chair, during his speech said:—

The accounts of the Company relate, as will be observed from the balance sheet and profit and loss account, to a period of 15 months, from 2nd July, 1896, to 30th September, 1897, and, bearing in mind that the Company started to build up an absolutely new business, and had not the advantage of taking over a working concern, it will, we trust, be allowed that the results obtained during that period are not unsatisfactory. With reference to that paragraph in the report dealing with the number of bearings supplied, it may be interesting to state the various uses to which the bearings manufactured by this Company are being put.

For railway work considerable progress has been made during the last 12 months with the railway companies, both in this country and on the Continent. The London, Brighton, and South Coast Company, after experimenting themselves with these bearings for upwards of two years with satisfactory results, have now decided to adopt them for main line passenger traffic, and they, it is hoped, will shortly be fitted to their bogie stock. The South Eastern Railway have also determined to give them an extensive trial. The North Eastern Railway have been supplied with these bearings, and the Lynton and Barnstaple Railway, now approaching completion, have fitted the whole of their rolling stock with these bearings. With regard to electrical railways, the City and South London (King William Street to Stockwell) have fitted trains with them, and the directors are glad to announce that they have secured the contract for the whole of the rolling stock of the Waterloo and City Railway, and the whole of the carriages upon the Liverpool Overhead Railway are being gradually fitted with their bearings. The Mono-Rail Lightning Express Train at the Brussels Exhibition was fitted throughout with these bearings, and the directors have reason to believe that the results were satisfactory. The Company was awarded a silver medal diploma at the Exhibition for their exhibits. With respect to tramway works, the bearings have been supplied to gas, traction, and electrically worked cars for Blackpool, for cable cars at Edinburgh, and for horse tramways at Burnley, Worcester, Deptford, and Northampton. For motor-car work the bearings have already been supplied to Scarborough and Queensland; and bearings for shafting, furnace-cars, trollies, cranes, and ventilating fans for machinery have also been supplied by this Company, and negotiations are now in progress for fitting up electrical cabs, omnibuses, and other vehicles. Space has been taken at the Crystal Palace, where two loaded wagons are on view, one fitted with ordinary axle-boxes and the other with roller bearings. In conclusion, the demand for these roller bearings is steadily increasing, and the results obtained from their practical application in every-day use justify the directors in believing that the experimental stage of roller bearings is now passed, and that as their many advantages become more widely known and appreciated their success is assured, and their general adoption is only a question of gradual, if not of rapid, development. I now beg to move the adoption of the report and accounts.

Mr. W. SHELFORD seconded the motion, which was agreed to unanimously.

### The Daimler Motor Company.

#### WORK ACCOMPLISHED—OUTLOOK FOR THE INDUSTRY AND DIVIDEND PROSPECTS.

THE second ordinary general meeting of the Daimler Motor Company (Limited) was held last month, under the presidency of Mr. H. J. Sturmev (the Chairman of the Company).

The Secretary (Mr. E. M. C. Instone) read the notice convening the meeting.

The CHAIRMAN said when he had the pleasure of meeting the shareholders at Coventry the Company was on the point of commencing actual deliveries of motors. That was in May, and although this balance-sheet took them very little into the actual period of production, he was inclined to congratulate the shareholders upon what he considered was a very successful result for their first year's working, in view of the fact of the long time necessary to organise the works. Remembering that they had undertaken the manufacture of an entirely new article, and that practically no one in this country was acquainted with it, he thought the time had not been wasted in any way upon it, and that the progress made had really been rapid. As would be seen from the balance-sheet (which was published in the October number of THE AUTOMOTOR AND HORSELESS

VEHICLE JOURNAL), the whole of their capital was subscribed. In regard to the item, plant and machinery, £17,752, if any of the shareholders were engineers, the directors most cordially invited them to make the most careful inspection of the works; whilst if they were not engineers, the Board would welcome the visit of any trained practical engineer in whom they might have faith and like to send. He thought that an inspection would show that for "up-to-dateness," completeness, and suitability for the work in hand they had the finest installation of plant and machinery in the trade, either in this country or abroad. For many months the work was that of preparation, and he need not tell the veriest novice at mechanical work that they could not make a complete article until they had every part—motor-gear, wheels, tyres, chains, and everything else. At the same time the work of producing those parts in quantity had been going on, so that although they had very few carriages actually finished, they had the parts ready for a very large number. When they had every part finished and ready to the hand of the builders it took something like a fortnight to erect the motor, and then various times, from a fortnight to as much as five weeks, for the motor to go through the testing shops for its many little adjustments and putting through tests in such a way that the Company could be satisfied that the motor was of the highest efficiency, and he need scarcely say that no motor was allowed to leave the shops until the Company's experts were thoroughly satisfied on that point. Then when the motor was finished there was quite as much work in the frame, gearing, &c., as in the motor itself. It took about three weeks to put the motor into its frame, and then there was the carriage builder's work, which was necessarily slow, paints and varnishes having to be used. The highest class of carriage took 16 coats of varnish, every one of which had to dry and then be rubbed perfectly smooth before the next coat was applied.

The Company had now 24 carriages going through the shops; they were finishing them now at the rate of four a week, and hoped before many weeks had passed to increase the number to six. With regard to the item leasehold land and buildings, £9,686, plus £3,894 spent on additions, he should explain that the first amount was entirely a profit transaction. The directors were fortunate in securing at Coventry a fine property of 13 acres of leasehold land with a double factory upon it. It had been built as a cotton factory, but had been burnt out, and was rebuilt by the insurance company: but the cotton company being wound up, it had not been occupied since. It came into the market at an absurd price—less than what the factory alone cost to build—and the directors lost no time in securing it, especially as at that time the British Motor Syndicate was floating the Great Horseless Carriage Company and searching for works in which to install it. They agreed to pay a fair price to the Daimler Company for one of the factories, that price being a sum which gave them a cash profit on the transaction as well as leaving them with the second factory and the surrounding land. The valuation of the land and buildings had been taken at the insurance value. The only portion of the report which at first sight might appear not at all satisfactory to shareholders, was the fact that although they had made a substantial profit they did not recommend the payment of a dividend. But it must be remembered that the profit he had shown was not a cash profit. The £9,686 was entirely in land and buildings, and not a trading profit in the ordinary sense of the term, so that it could not be distributed. Then, although upon the balance-sheet they had £10,000 on deposit, the directors had since had to pay for additional plant, and erect new workshops for building purposes, which had taken a considerable amount. It would have considerably hampered the future operations of the Company to have paid a dividend; but the directors were hoping that next year they would be able to do so, and that it would be the first of a very long series of highly-satisfactory dividends. It was important for this object that the public should purchase motor-cars in the same way in which they were purchasing in France, and he was glad to say that all signs pointed at the present time to an excellent business in the future for the Company. The chief enemy of the motor industry was a certain section of the press. At first they had nothing too good or too hopeful to say of them. They knew nothing about it, but from their writings gave the public the idea that the motor-car was a sort of thing that could be purchased for a small amount, cost nothing to keep, and that they had only to press a button and the motor would do all the rest. Since then many French and German carriages, many of them worn out before they got to this country, had appeared on our streets, and had not been altogether a success, with the result that a section of the press had turned right round and represented the motor-car as a crude thing which ran for five miles and then

stopped and was at any time liable to explosion. However, a great many people were having the cars, and he was pleased to say that everyone who had been supplied had been entirely satisfied with the result. With regard to their cars he could say positively that there was absolutely no smell which reached the occupants, and no vibration which would be noticed unless it were specially looked for, while with the exercise of ordinary care, such as had to be used in regard to gas, an explosion was practically impossible. There was absolutely no danger of the car running away; for they had no less than eight means of stopping it, and they could not very well all fail. He, personally, had a car delivered on September 9th, and up to the present he had driven it 1,029 miles. He had driven it from John o'Groats house and came right through the centre of Scotland, and not a single hill, up or down, had given him any trouble whatever. In future the directors' fees would be some £200 less, because they had received a letter that morning from Mr. Harry J. Lawson, stating that he found his time fully taken up with the work of the British Motor Syndicate, and felt obliged to resign his seat on this board, but he added that he should be happy always to afford the Company any help in his power. The Chairman then concluded by formally moving the adoption of the report and accounts.

Mr. JAMES A. BRADSHAW seconded the motion, and said he had put his car to an exceedingly severe test, having taken seven passengers, including luggage and a reserve of oil, from Coventry to Liverpool at an average speed of 12 miles an hour, up hill and down dale. He thought that spoke volumes for the possibilities of the Daimler motor. The car was, as far as it was possible to judge at the present moment, almost perfect.

After a short discussion, the motion was unanimously carried.

### New Companies Registered.

[Under this heading we give a full list of new Companies registered which take power to make, deal, or become interested in any manner in automotor vehicles.]

	Capital.
Beeston Motor Co., Ltd. .. .. .	£110,000
Blenheim Cycle Co., Ltd. .. .. .	100
Craven Cycle Co., Ltd. .. .. .	2,000
Cyclists' Chalet Co., Ltd. (Coaston, Somerset) .. .. .	30,000
Davidson's Air-Car Construction Syndicate, Ltd. .. .. .	20,000
Dunlop Motor Co., Ltd. (14, Regent Street, W.) .. .. .	25,000
Edward Foster & Sons, Ltd. (Halifax and Bradford) .. .. .	50,000
Edwin Clark & Co., Ltd. (Banscombe, Rodborough, Gloucestershire) .. .. .	3,500
G. R. Blot & Co., Ltd. (33 St. Swithin's Lane, E.C.) .. .. .	75,000
Kodak Cycle Co., Ltd. .. .. .	100
Licensed Tyre Syndicate, Ltd. .. .. .	10,000
Perambulator and Manufacturing Co., Ltd. .. .. .	10,000
Power and Traction, Ltd. .. .. .	10,000
Scottish Motor-Omnibus and Car Co., Ltd. (66, Calzow Street, Hamilton, N.B.) .. .. .	5,000
Self-Generating Electric Vehicle Light Syndicate, Ltd. (3 and 4, Crooked Lane, E.C.) .. .. .	5,000
Shakespeare, Kirkland, & Frost, Ltd. (274, Stratford Road, Birmingham) .. .. .	15,000
Starleys, Ltd. (Aitken Chambers, Cannon Street, Birmingham) .. .. .	1,000
Thames Rubber Co., Ltd. (14, Coventry Street, W.) .. .. .	35,000

### AN AUTOMOBILE HOUSE.

M. RENODIER, of Paris, sends us an account and a drawing of a house on wheels, which owing to the pressure on our space we are unable to reproduce, which has been constructed by M. Jentaud, the well-known French carriage-builder, and purchased by the former gentleman. It was originally intended to have been entered for Les Poids Lourds Competition, but could not be completed in time. The carriage, which in some respects resembles a large railway omnibus, is divided into two bedrooms—each containing two beds, a dressing room, bath room and lavatory, a kitchen, and sundry cupboards. The various apartments are entered from a corridor on the port or left-hand side of the carriage. The bedroom can be transformed at will into a dining or day room. There are two

entrances, one on the side and the other at the rear end opening into the kitchen. All the rooms are tastefully furnished and well lighted by windows with lifting panes, as in railway carriages. The beds are 1.80 metre by 0.70 metre. The carriage is 7.70 metres long, 2.50 metres wide, and 2.40 metres high inside. The two bedrooms are each 2.0 metres by 1.80 metre; and the kitchen, 1.50 metre by 2.40 metres. The water supply for the kitchen, &c., consists of a tank which holds 200 litres. On the imperial are seats for 12 persons, and space for their provisions and baggage for a run of 400 to 500 kilometres. The carriage is supported by two wheels, and the fore end rests upon the tail of the tractor, which is by De Dion et Bouton, and is rated at 30 H.P., and which can carry water and fuel sufficient for a run of 500 kilometres. This tractor can haul a load of eight tons at a speed of 16 kilometres, and can easily take 10 per cent. gradients. The cost of fuel coke runs out at about 15 centimes per kilometre.

### WEIGHTS OF FRENCH LIGHT PETROLEUM MOTORS.

Name of Maker.	Horse-power.	Revs. per min.	Weight. Kilos.
Audibert et Lavirotte .. .. .	3	—	70
" .. .. .	6	—	180
" .. .. .	8	—	200
" .. .. .	10	—	350
Dalifol .. .. .	3	—	300
Dion et Bouton .. .. .	1½	1,600	35
Chastel et David .. .. .	12	—	250
Crouan et Cie. .. .. .	10	—	200
Landry et Beyroux .. .. .	5	400	160
" .. .. .	10-12	400	180
Panhard et Levassor .. .. .	4	700	75
" .. .. .	6	700	130
" .. .. .	8	700	160
" .. .. .	12	700	250
" .. .. .	5.2	1,000	75
" .. .. .	8	1,000	130
" .. .. .	10.4	1,000	160
" .. .. .	16	1,000	250
Pygmée .. .. .	1	—	30
Benz .. .. .	1½	—	105
" .. .. .	3	—	160
" .. .. .	5	—	198
" .. .. .	8	—	261
Peugeot .. .. .	4	—	90
" .. .. .	5	—	110
" .. .. .	6	—	135

John o'Groat's to Land's End on a Motor Vehicle.—We congratulate Mr. Henry Sturmev, of the *Autocar*, on the successful completion of what we think is the longest continuous tour yet made in the British Isles in an automotor vehicle. He started from John o'Groat's House on the 2nd ult., and after travelling by easy stages, varying from 36 to 86 miles per day, arrived at Land's End at 4.35 p.m. on the 13th ult., having accomplished the journey of 929 miles at an average speed of just under 10 miles per hour all through, notwithstanding the fact that such elevations were crossed as the Ord of Caithness, the Grampian Mountains, the Pass of Killiekrankie, Kirkstone Pass into Ambleside, and the extremely hilly country between Exeter and Bodmin. Throughout the journey no breakdowns occurred, and all roads were traversed without trouble of any kind. Mr. Sturmev was accompanied by one servant, and carried between 200 and 300 lbs. of baggage, including a sufficiency of oil for the journey. The car used was of English manufacture, having been built by the Daimler Motor Company, and was fitted with a 4 H.P. motor propelled by benzoline. Part of the object of the tour was to prove the capabilities of the new mode of conveyance to surmount all hills which a capable bicyclist can master, and to travel successfully and without failure upon any high road in the kingdom, and in this Mr. Sturmev claims to have succeeded. Mr. Sturmev has since returned to Coventry, via London, on his automotor vehicle, which is none the worse for its long journey of over 1,500 miles.

## THE HEILMANN ELECTRIC LOCOMOTIVE.

THE following are some particulars of the automotor which is being tried with great success on the Western Railway of France. The net weight is about 124 tons, the locomotive proper weighing 75 and the tender 49 tons; the latter can carry 19.6 tons, or 4,386 gallons of water. In appearance the locomotive is massive, but without being clumsy, it gives one the idea of concentrated energy. The design is well worked out. In working order the total weight of the engine, tender, coal water, &c., is 200 tons. There are eight pairs of wheels, each pair being driven by a 100 H.P. motor. These motors receive current from two dynamos of 1,000 ampères at 450 volts, but this output can be easily increased. These electric generators are mounted one at each end of vertical engines, which are divided in two groups, each with three cylinders working on the compound system. These engines have been constructed by Willans and Robinson, and with them there has been overcome one of the difficulties experienced with the experimental engine, whereby excessive vibration was set up; the arrangement of the six cylinders gives effective balancing. The motor gives off 1,400 H.P., and at this power it can haul a train of not less than 588 tons weight at a speed of 37 miles per hour, or at a speed of 68 miles per hour it can haul a train of 245 tons weight. The heating surface of the boiler is slightly under 2,000 square feet, while the steam pressure is 200 lbs. The locomotive is 93 feet long over all, 9 feet wide; the chimney is 13 feet 9 inches above the rail level. Whether the comparatively light permanent way adopted in France will stand such heavy traffic is, however, doubtful; our own opinion is, that before the undoubted advantages of the Heilmann locomotive can be enjoyed rails of much heavier section, closer spaced sleepers, &c., must be employed. The first public trial trip took place on the 12th and was most successful. It may be mentioned that the famous McIntosh engine for the Caledonian Company, known as the Dunalistair, is 53 feet 4 inches long, including the tender, and weighs 86 tons. The corridor train taken by her weighs 354 tons, so that the Dunalistair's performance, especially over Beattock, is almost as good as the Heilmann.

## AUTOMOBILISM AND THE FIRE BRIGADE OF THE LARGEST CITY OF THE WORLD.

ACCORDING to the report of the Fire Brigade Committee of the London County Council for the year ending March 31st last, issued a few days ago, the staff of the Brigade numbers 963. Firemen employed on watch by day at the stations throughout London number 140, and at the engine and escape stations by night 375, making a total of 515 in every 24 hours. The authorised strength of the Brigade includes 963 officers and men, comprising coachmen, pilots, and men under instruction; 58 land fire engine stations, 3 sub-stations, 16 permanent street stations, with fire-extinguishing and life-saving appliances, 204 fire-escape stations, 60 hose-cart stations, 11 hose and ladder truck stations, 5 river stations, 8 steam tugs, 13 barges, 9 carrying engines (4 being used as store barges), 9 steam fire engines on barges, 58 land steam fire engines, 66 6-inch manual fire engines called "curricles," 35 miles of hose, 115 hose carts and hose reels, 14 hose and ladder trucks, 7 horse tenders and fire-escapes combined, 12 vans for carrying hose, coal, fire-escapes, and stores, 4 wagons for street stations, 7 vehicles for use of officers when inspecting stations, &c., 226 fire escapes (inclusive of 11 small fire-escapes kept at police stations), 5 long fire-ladders, and 9 vans to carry the same, and 139 horses. The actual disbursements during 1896-7 on maintenance, including pensions, were £164,728, and on capital £75,031 2s. 7d.

Speaking generally, it must be said that most of this enormous plant is antiquated and obsolete in design, and generally inefficient: there is not a single steam motor which works at anything more than 150 lbs.—a comparatively low pressure. There is not a single electric pump. Flexible metal section hoses are things utterly unknown to the Fire Brigade, as are water towers and other improved means for dealing with fires. Lastly, *there is not a single automotor fire engine in the first city of the world.* Can it be wondered at that London fires are so frightfully destructive and so costly? Little or no improvement has been made in the plant of the Fire Brigade since the days of the old Metropolitan Board of Works.

## LECTURES ON PATENT LAW.

A VERY important course of six lectures is now being delivered by J. Fletcher Moulton, Esq., Q.C., on "Patent Law," under the auspices of the Council of Legal Education, in the Middle Temple Hall. The first lecture was delivered on Tuesday, November 2nd, at 7.45 p.m., and the lectures will be continued at the same hour on subsequent Tuesdays. The following is a syllabus of the lectures:—

Lecture I.—Nature of Grant by Letters Patent.—Their Legal Status prior to Act of Monopolies.—Effect of that Act.—Practice and Procedure in the Sixteenth and Seventeenth Centuries.—Modern Developments.—Legal Status of Letters Patent under Existing Law.

Lecture II.—The Invention.—Difficulty of Definition of the word "Invention."—Essential Characteristics of a Patentable Invention.—Negative Canons Derivable from Judicial Decisions.—Delimitation of the Invention in the Specification.—Origin and Function of Claims.—Their Interpretation.—Colourable Imitation.

Lecture III.—Conditions of Validity.—(1) Novelty:—Prior User.—Secret User.—Experimental User.—Prior Publication.—Its Sufficiency.—Conflicting Decisions.—Distinction between Public Knowledge and Common Knowledge.—Publication by the Inventor Himself.

Lecture IV.—Conditions of Validity (*continued*).—(2) Sufficiency of Specification:—Double Duty of the Patentee.—Difficulties arising therefrom.—Examples.—(3) Utility:—Origin and Nature of the Condition.—Meaning of the Term in Patent Law.—Commercial Utility.—(4) Conformity:—Origin and Nature of the Condition.—Fair Development.

Lecture V.—Procedure.—Mode of Obtaining the Grant.—Amendment of Grant.—Revocation of Grant.—Rights and Remedies of Patentee.—Rights and Remedies of Public.—Action for Threats.—Compulsory Licences.

Lecture VI.—Defects of English Patent Law.—Foreign Systems.—Relative Advantages.—Possible Improvements.—International Rights.

The lectures will be open to all members of the Inns of Court free, and to gentlemen non-members on payment of a fee of one guinea for the course. Tickets to be obtained at the office of the Council, Lincoln's Inn Hall, W.C.

**Automotor Vehicles in Berlin.**—A society has just been started in Berlin to promote the introduction of motor-cars on the Continent. In discussing this enterprise, the *Elektrotechnische Zeitschrift* brings forward certain statistics to show that the electric car, with accumulators, is not so very far behind the petroleum motor-car in weight and speed, and that for certain purposes, such as for cabs and parcel vans, the electric car has the advantage. A comparison is made between a Daimler benzine car and an electric car made by Kühlstein. Both these cars are capable of carrying five persons. If five persons are taken as weighing 400 kilogrammes, the comparison between the two cars is shown in the following table, using the figures given by the manufacturers:—

	Daimler.	Kühlstein.
Weight, fully loaded..	1,550 kg.	2,000 kg.
Average speed per hour ..	12 miles.	8.4 miles.
Maximum speed per hour ..	15.6 miles.	12.8 miles.

The electric car contains 30 Correns cells, with a capacity of 250 ampère-hours. According to experiments by Correns, the Lundell motor on this car required 35 ampères on good stone pavement, 42 ampères on asphalt, and 60 ampères on the ordinary roads. One charge is sufficient to run 42 miles. The battery weighs 750 kilogrammes, and gives, with an average discharge current of 46 ampères, 14 kilowatt-hours, or 1 kilowatt hour per 53 kilogrammes of battery. The London electric cab, carrying three persons, weighs 1,500 kilogrammes, and has an average speed of 9.6 miles per hour. Its horse-power, compared with Kühlstein's car, is as 24 to 28, and the weight of the batteries as 70 to 75. Since the London cabs run 41 miles with one charge, the product of weight × run is 72 mile-tons, while with the Kühlstein car it is 84 mile-tons. Our German contemporary concludes, from these figures, that Kühlstein's car is 9 per cent. better than the London cab in power developed per unit weight of battery.

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CORPORATION OF LEICESTER.

The SANITARY COMMITTEE of the Leicester Corporation invite DESIGNS and TENDERS for MOTOR VEHICLES for the collection of House Refuse.

The motive power, capacity, and all other particulars are to be described in a full Specification, accompanied by Drawings, and delivered at my office, addressed to the "Chairman of the Sanitary Committee," not later than MONDAY, January 31st, 1898.

The loaded wagons would have to ascend an incline of 1 in 20, turn in a limited space, back and tip over a beam about 14 inches high by 12 inches in width, and when empty descend a road having a gradient of 1 in 15.

The Committee do not bind themselves to accept any proposal, and firms tendering must do so at their own cost, no fees being allowed for the preparation of drawings, &c.

E. GEORGE MAWBAY, C.E.,  
Borough Engineer and Surveyor.

Town Hall, Leicester,  
4th November, 1897.

The Automotor and Horseless Vehicle Journal.

A RECORD AND REVIEW OF APPLIED AUTOMATIC LOCOMOTION.

NOVEMBER 16TH, 1897.

DIARY OF FORTHCOMING EVENTS.

Notices to be included under this heading should reach the Office not later than the 12th of each month.

- 1897.
- Nov. 19-27 .. Motor-Vehicles at the Stanley Show, Agricultural Hall, London.
- Nov. 26 .. Opening Session of Self-Propelled Traffic Association (Liverpool Centre). Address, with lantern illustrations: "Self-Propelled Vehicles, 1896-7," by Worby Beaumont, M.I.C.E., &c.  
Motor-Car Club Annual Meet. Hôtel Métropole, London, 11 a.m. Drive to Sheen House Club, Richmond Park. Returning at 4 p.m.
- Dec. 13 .. Yorkshire College Engineering Society—"The Daimler Motor and its Application to Auto-Cars" (illustrated), by J. Sidney Critchley (Daimler Motor Co.).
- 1898.
- Jan. .. .. Exhibition of Locomotion and Engineering, Rifle Barracks, Belle Vue, Bradford.
- Jan. 11 .. Liverpool Cycle and Motor-Car Exhibition, Liverpool.
- Jan. 20-29 .. Midland Cycle and Motor-Car Exhibition, Bingley Hall, Birmingham.
- Feb. 3-12 .. Sheffield Cycle, Motor-Car, and Accessories Exhibition, Drill Hall, Sheffield.
- Feb. 14 .. Yorkshire College Engineering Society—"The Steam Turbine Engine and its Applications," by John D. Bailie (C. A. Parsons and Co., Newcastle).
- May 2, 9, 16, 23 Society of Arts Cantor Lectures—"Electric Traction," by Prof. Carus Wilson.
- May 24 .. Self-Propelled Traffic Association (Liverpool Centre) Heavy Vehicle Trials.
- June .. .. Motor-Vehicle Exhibition, Paris. Automobile Club of France. Sections—(a) Automotor vehicles which have given proof of their practical efficiency; (b) Industries connected with automobilism; (c) Motors adapted for automotors; (d) Vehicles adapted for automotors.

- 1898.
- July 5 .. .. Race from Paris to Amsterdam, under the auspices of the Automobile Club of France.
- 1899 .. .. Race from Paris to St. Petersburg, under the auspices of the Automobile Club of France.
- 1900 .. .. Paris International Exhibition—Great Display of Automotor-Vehicles and Allied Trades.

ANSWERS TO CORRESPONDENTS.

- G. A. (Sheffield).—Copy sent as desired. We thank you for your expressions of appreciation.
- J. G. (Carnoustie).—We have sent your letter on as desired. For future guidance, however, you might note the postage is 2½d. The address is 13, Boulevard Malesherbes, Paris.
- H. EVANS (Worcester).—We thank you for returning the paper. The address of Mr. J. S. Bickford is Camborne.
- J. P. HITCHIN (Rochdale).—A Company is in formation for working the English patents, and will shortly be carried through. A lorry upon this principle has already been constructed in England, and the Company hold the patent rights for Great Britain. The registered offices of the Company are 7, Poultry, London, E.C.
- W. B. B. (Hayward's Heath).—The only bath-chair motor attachment which we know is one supplied by the Britannia Motor-Carriage Company, of Woodstock Road, Shepherd's Bush. Mr. John Ward, of 246, Tottenham Court Road, has, we believe, one on view at his premises. The motor is electric. You might try New and Mayne, Woking.
- A. A. C. (Bedford), R. C. F. (Gloucester), J. B. (Kenilworth), J. E. (Invicta).—We regret it is impossible to supply you with No. 1, Vol. I. The only form in which you can procure it, we are afraid, is in a bound volume at one guinea, which price is likely to increase. Practically all the rest of the numbers can be obtained at the ordinary price.
- J. E. F. J. W. (Llandudno).—You did not send your change of address. Hence the reason of your not receiving the paper. We are now forwarding back numbers as desired.
- J. W. (Southend-on-Sea).—The address of M. Peugeot is Mandeure, Doubs, France.

THE SELF-PROPELLED TRAFFIC ASSOCIATION'S COMPETITIONS.

ELSEWHERE in the present issue we publish the rules drawn up by the Self-Propelled Traffic Association for the conduct of the competition to be held next year in Liverpool. As will be seen, considerable care has been taken in framing them so as to not only secure the object that the Association has in view, but also to give designers the widest possible latitude. In order to ensure the former the judges will be selected from the Council of the Association, and no difficulty should be experienced in finding suitable men for this purpose. Inasmuch as the S.P.T.A. was largely, we had almost said entirely, formed to develop motor traffic in goods on commercial lines between large towns, the nature of the problem to be solved is not altogether the same as that which existed in *The Engineer* and Les Poids Lourds Competition. In these a more catholic idea was sought to be achieved. In the S.P.T.A. the problem is more definite. The loads to be carried, the work the vehicles will have to do, the routes to be traversed, are all known, and hence judges conversant with the Liverpool and Manchester trade will no doubt be able to make a more suitable choice—that is for their own local conditions. In the district named much produce is carted to and from the docks in large "floats." These are

easily laden, the "lift" being not more than a foot or so. The cotton, Jaggary, hides, &c., are usually carted away on four-wheeled open-sided wagons, whose platform is about 3 feet 6 inches or 4 feet from the ground. We mention these things as being possibly serviceable hints to intending competitors. Indeed, we should strongly recommend the latter to study the local conditions on the spot, because it is certain, as can be gathered from the rules, that the competition will be a drastic one. The Liverpool merchants are quite prepared to place a large order with the maker of a vehicle that meets their views, but they won't spend sixpence on an experiment; and competitors will do well to remember that a motor-vehicle which might suit London traffic might not be acceptable in Liverpool. As will be seen, money prizes will be offered, but we do not think this an inducement. The problem, although, as we say, a definite one, is yet a difficult one. The desired motor-van is to have a net carrying capacity of 10 tons, a platform area of 110 square feet, and a mean speed of four miles per hour. It must also of necessity comply with the Locomotives on Highways Act, that is, its weight must not exceed (tare) three tons. If one runs out the salient features of a design (as we have) it will be seen that in order to get within the Act a very special design is called for. It was, we think, the difficulty of complying with the conditions laid down by *The Engineer* and the Act of Parliament that rendered the competition of our contemporary so nugatory. One cannot study the Locomotives on Highways Act without concluding that it appears to have been drawn with the evident intention of delaying the introduction of heavy automotor vehicles as long as possible. It is well known that both in the Lords and Commons there was an influential opposition to the measure, and this had to be so far placated as to render the Act partially inoperative by this limit of three tons, and also by insisting upon a low speed. We are not at all sure that the S.P.T.A. will not be well advised if it directs its energies towards obtaining an amendment to the Act in the next Parliament.

When we remember, too, that in and around Liverpool the gradients are often such that ample motive and braking power are absolutely essential, it will be realised that the problem is, as we say, a most difficult one. One of the conditions that we do not quite see the reason of, is that the mechanism shall be below the platform. Considering that the loading brows in the docks are not more than 2 feet 6 inches or 3 feet high, and that the platform must hardly be higher than this, we think this condition unnecessary. It will be noticed, too, that while the length of the vehicle is determined it is permissible to make it articulated, that is, it can consist of a long "float," the forepart of which rests on a motor-vehicle. We do not think this design will commend itself owing to the additional weight involved in the extra pair of wheels.

We have not the slightest doubt that both the conditions of the S.P.T.A. competition and the Act of Parliament can be amply fulfilled. What we do hesitate about is, whether there will be a sufficiency of competitors. One might produce a successful vehicle, but it might fail in some minor point, and even a prize or certificate of merit would not compensate the manufacturers for time and materials expended. There is, however, no doubt that the S.P.T.A. is making every effort to solve the problem of heavy automobilism, and we sincerely trust that it will be successful.

In conclusion, we would point out that the subject of automotor vehicles capable of carrying loads of 5-10 tons has now been before the engineering community for twelve months. Ample time has been afforded for the elaboration of designs, and we would ask English engineers—Is this problem of heavy automobilism to be solved on this side of the channel, or will it be left for the highly-trained and technically-educated French or German engineers to show us how it's done?

Owing to the pressure on our space this month we are obliged to hold over much important matter relating to the proceedings of the engineering societies dealing with automobilism.—ED.

## OUR IDEA ENTIRELY.

IN the July number of the AUTOMOTOR, on p. 415, we propounded, in an article entitled "The Automotor Industry, and How to Foster It," the idea of establishing an exchange. We wrote:—"We propose that in London and the large provincial cities, such as Liverpool, Glasgow, Manchester, Birmingham, &c., there should be formed Automotor Exchanges—that is, manufacturers and designers of automotors should form a parent Association, with branches in these towns. At each branch there would be a depôt, with examples of each type of motor. A would-be purchaser would thus be able to inspect the whole industry at a glance, and obtain the fullest technical information. Trials could be arranged, and purchases effected with the least trouble, and with the best possible guarantee that the purchaser had obtained what he required. A trial might well be made of this idea in London to start with. It is, of course, not intended to have anything in the nature of, or savouring of, an 'Exhibition.' Our idea is that of a purely business Exchange, where one could see samples of motors and obtain quotations exactly in the same way as one can go into the Corn or Wool Exchange and obtain samples and prices of these articles."

We, of course, are only too pleased that our contemporaries should adopt this idea, but, without wishing to claim any credit for it as a brilliant inspiration, we think that inasmuch as such Exchanges as we mentioned will undoubtedly be established, and as a matter of historical accuracy for the guidance of future writers on the history of automobilism, not to mention such minor considerations as journalistic etiquette, it should be clearly understood that the idea in question was first promulgated by this journal. We mention this because we see *La Locomotion Automobile* lays claim to the inception of the idea, and the *Autocar*, in its issue of October 16th, says with charming naïveté:—"Our contemporary, the *Locomotion Automobile*, has suggested that the difficulty could be overcome by establishing a permanent exhibition of autocars, and of industries attaching thereto. Such a show has become so indispensable that one wonders why it was not thought of before." Really! It has been thought of before.

## STABLE FIRES.

ONE of the many evils attending the housing and accommodation of horses is that the risk of fire is always present, and cannot well be eliminated. As the number of horses is increased, so does the risk of fire become greater, and the Fire Insurance Companies regard stables with well-founded dislike. In London where space is so costly, it has become the practice to house the horses in flats, and when it is considered what a large amount of dry hay and straw is required to feed even a moderate stable of 50 horses, and how this dry and easily-ignited material is scattered about, it will be seen that the risk is a serious one. That it is so is from time to time demonstrated by the fires which take place in connection with stables. Quite recently the well-known carriers, Messrs. Carter, Paterson, and Co., had their stables in the Goswell Road burnt out. Fortunately, owing to the prompt assistance of the Fire Brigade, nearly all the horses were saved, but the damage done to plant, goods, &c., was very great. The firm in question had a very complete and well-arranged block of stables, and it is difficult to account for the fire, unless it be attributed to carelessness or malice. Inasmuch, however, as some explanation had to be given, it occurred to certain scribes to attribute it to the motor-car. The chain of reasoning by which this conclusion is reached is not very strong, but it will serve the purpose of those newspapers which—sticklers for the old order—seek to discredit automobilism. It seems that Messrs. Carter, Paterson, and Co. use motor-vehicles for their business, and hence what more likely than that these new-fangled things caught fire or exploded? As David might say to Acres, "I suppose there ain't been so

merciless a beast in the world as your loaded—motor." At any rate this is the idea that not a few writers on the Press—whether from knowledge, which we doubt, or silly prejudice, which we think—entertain. Thus the *Globe* in an inconsequential paragraph said:—

"The pros and cons of motor-car *versus* horse continue to oscillate with nicety, and a large con was registered yesterday when a conflagration broke out in Messrs. Carter, Paterson's depôt through, it is believed, an explosion of stored gas for the Company's motor-cars. It is true that your motor-car needs no oats; but, on the other hand, your horse never spontaneously combusts himself and his surroundings. If the horses which were rescued with difficulty from yesterday's fire could have given their opinions of motor-cars, we might have obtained something more interesting than printable."

On seeing this we immediately communicated with the firm in question, and these gentlemen informed us that there was absolutely no evidence to connect the fire with the motor-vehicles. It is easy to see that the writer of the above precious paragraph knows nothing whatever of motor-vehicles or he would not talk about "an explosion of stored gas." If he and others after his kind would store their brains with a few elementary facts of engineering science they would do their papers more credit and their profession also. The ignorance of a large section of the daily Press on this and similar subjects is truly pitiable. However, here is another lie exposed.

### RACING ON ROADS AND HIGH SPEED ON ROADS.

THE National Cyclists' Union has at length, we are glad to say, prohibited road racing or pacing, and the reason is that such locomotion may be dangerous to the public. No sane person will, we think, dispute or deny this danger, and, for our part, we think that all persons who "scorch" on any kind of vehicle, and who thereby lessen the safety of the public to any degree whatever, ought to be severely punished; much more severely, in fact, than has been customary. While saying this it must be distinctly understood that driving a vehicle other than an automotor-vehicle at a high speed is not *per se* unlawful, it is only so when danger to the public is caused, or is likely to result. This view of the law was recently laid down by the Lord Sheriff Brown in the Aberdeen Court (*vide* AUTOMOTOR for October). The learned Judge said:—"If a bicycle was a carriage, and so declared by statute, the prosecutor had never yet succeeded in obtaining a conviction against a driver of a carriage for furious driving, except on proof that in point of fact danger to the public had emerged."

So far as cycles and horse-drawn vehicles are concerned, high speeds may be lawfully indulged in within this limitation. It is, however, because cyclists have shown such a disregard for the rights of pedestrians that they have now to take united action against those of their own body who would use the road for racing purposes. Racing is an unlawful act, as the highway is not, and never has been, recognised as a racing track. It is very necessary that all who use the road in any way, and especially those who administer the law as to vehicles and highways, should have clear ideas on the subject. At present convictions for furious driving are based not upon whether there was or was not danger to the public, but upon the evidence of some illiterate policeman and the personal predilection of some magistrate, who in too many cases is a distinctly prejudiced party. Police evidence is naturally and of necessity biassed. We must remember that the policeman is keenly and personally interested in obtaining a list of convictions with as little personal risk to himself as possible, because the more convictions he obtains the quicker his promotion. It is to his manifest interest to secure a conviction, and cyclists afford an easy and grateful prey.

British law is rarely logical, and the term "furious driving" well exemplifies this. It is not the actual velocity of a mass

which does harm, but it is the amount of kinetic energy contained in it which determines the results. A swallow, weighing a few ounces, will fly at a speed of 30 miles per hour against the glass of a lighthouse, and the kinetic energy it develops, while harmless to the glass, is taken up by the bird with the result that it fractures its limbs. A cycle and its rider, weighing 180 lbs. and travelling at 12 miles per hour, will develop 765 foot lbs. of energy. This is, of course, more than sufficient to capsize any pedestrian, but if instead of a human body, it is a wall with which the cyclist collides, the chances are that he will be maimed for life and his machine will be past repair. It is a very common sight to see in London a van drawn by a pair of fresh horses being driven at a rate of eight or nine miles per hour, but it is very uncommon to see proceedings taken against the drivers. The weight of the van (empty) and horses will be certainly not less than 3½ tons and at 8 miles the kinetic energy will be 16,660 foot lbs., yet a motor-van, weighing (empty) 26 cwt., would have to go at a speed of over 13 miles per hour to develop this amount of kinetic energy. Notwithstanding that the motor-van could be stopped in one-fourth to one-third of the distance that the horse-drawn van could be, and could be manœuvred so much more easily, the intelligent policeman and the sapient magistrate would undoubtedly convict the driver of the motor of "furious driving," utterly oblivious of the fact that it could not possibly do more damage than a van weighing nearly three times as much, but only going about two-thirds the speed. It is this failure to recognise the science and the law of the thing which makes many of these prosecutions for furious driving so unjust, not to say ridiculous. Defendants in these cases would do well to consider this view of the question. It, of course, may be urged that it is easier to get out of the way of a heavy brewer's dray than it is to get out of the way of a "scorching" cyclist. It is; but the mere fact that it is necessary to get out of the latter's way establishes "furious driving" on his part and the law provides for this.

G. H. L.

### THE THAMES STEAMBOAT SERVICE.

As will be seen from a report that we publish elsewhere, there is every likelihood that the great problem of the congestion of the streets of London will be partially solved by the establishment of an efficient service of river automotors. That London in this particular matter should be so far behind other capital cities is to many people inexplicable, but if we remember that for many centuries the banks of the river, say, from Westminster to Blackwall, have been occupied by private owners, and that access to the river can even now only be obtained at certain points, and that by traversing dark and devious passages not always free from danger, the gradual diminution of the popularity of the river as a means of passenger transport is easily accounted for. Take, for instance, the approaches to Wapping Stairs or Cherry Gardens Pier. No one having valuables upon them would care to seek out these piers after dark. As will be seen, the first step is to acquire the piers, at present owned by the Thames Conservancy; and if the Council succeeds in this the next thing will be to sell them again to the "knacker." These piers are, for the most part, "dummy" lighters, with no proper accommodation or protection against the weather, they are all very old, rickety things, not worth repairing or reconstructing, and fit only for "scrap." Larger and more commodious pontoon piers, with glazed and warmed waiting-rooms, should be built; these should be moored at more convenient stations than are the present ones. The approaches to the piers should be wide and well lighted, and the connecting bridges should be covered in and glazed. As regards the vessels, considering that the Council will eventually acquire them, as they have the trams, there will be no excuse for not providing much better boats than those in use at present. These vessels are utterly obsolete in every way. Their design is wretched, and their accommodation as bad as can be; there is no efficient subdivision, and no adequate protection for

buoyancy. In fact, there has been little or no substantial improvement in these river vessels ever since the "Princess Alice" disaster. The Council will, we trust, insist upon the Company that proposes to work the traffic complying with a pretty tight specification as regards hull, machinery, &c. A mean speed of not less than 15 knots should be insisted upon. The machinery should consist of oil-fired water-tube boilers supplying steam to horizontal three-stage compound engines driving dynamos which, by means of electro motors, would drive the twin screws; or perhaps a better arrangement would be to use Parsons's turbines; the object in each case being to get all the machinery below the main-deck, and to have absolutely no vibration. The modern but obsolete torpedo-catcher engine-room practice should be avoided. As regards the design on deck, this should be a radical departure from the existing open-deck arrangement. American river boat practice might be to a certain extent followed.

Lastly, but of equal importance, is the question of *personnel*. The boats must be properly manned; the public will not trust themselves to rough, uncouth, uncertificated watermen; at least, no one cares to do so. The Council should insist that all the mates and masters should at least have home trade certificates, while the engineers should be required to hold, at any rate, a second's ticket. We have thrown out these few suggestions as the result of our own experience with vessels in various parts of the world, and in the hope that they may serve to guide those concerned, and of others desirous, as we are, of seeing the Thames become the favourite route. We congratulate the Rivers Committee and the Council on their efforts so far, and we feel assured that the ratepayers will cheerfully lend their aid to further this scheme of municipal and nautical automobilism.

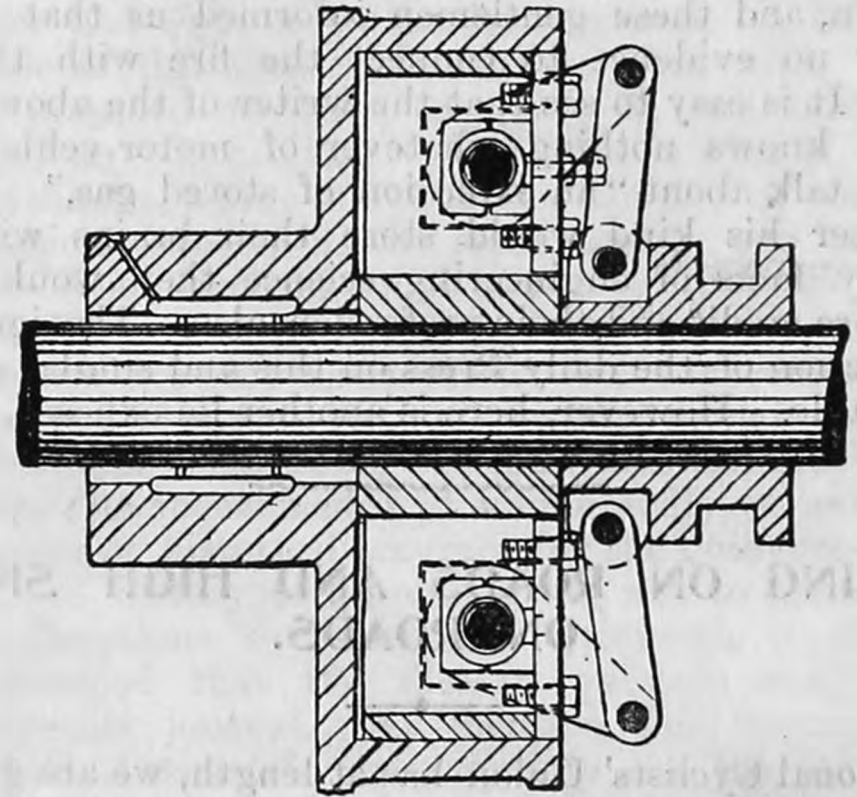
G. H. L.

**Curious Collision between Motor Vehicles.**—In the afternoon of October 13th a curious accident occurred in Charing Cross Road. A motor-van, belonging to a parcels delivery company, was crossing from Shaftesbury Avenue in the direction of the Palace Theatre, when two omnibuses drove across in front of the van, the drivers making disparaging remarks to the motor man. Behind the omnibuses was a second motor-van, belonging to a patent medicine company, and the driver of the first motor vehicle, turning, it is said, to answer the omnibus drivers, did not see the second motor, with which his own came into collision. The wheels of the two became locked and remained so for some time, the crowd laughing, and cabmen and omnibus drivers jeering. One of the motors could not start again for ten minutes, and when it did move (with the aid of boys pushing) the crowd cheered lustily. Beyond the damage to the paint the motors seemed to be none the worse for the accident. It is to be regretted that steps are not taken by the owners of motor vehicles to check the vulgar and offensive abuse of omnibus and cab drivers. The Police Regulations are quite clear as to the offence in question.

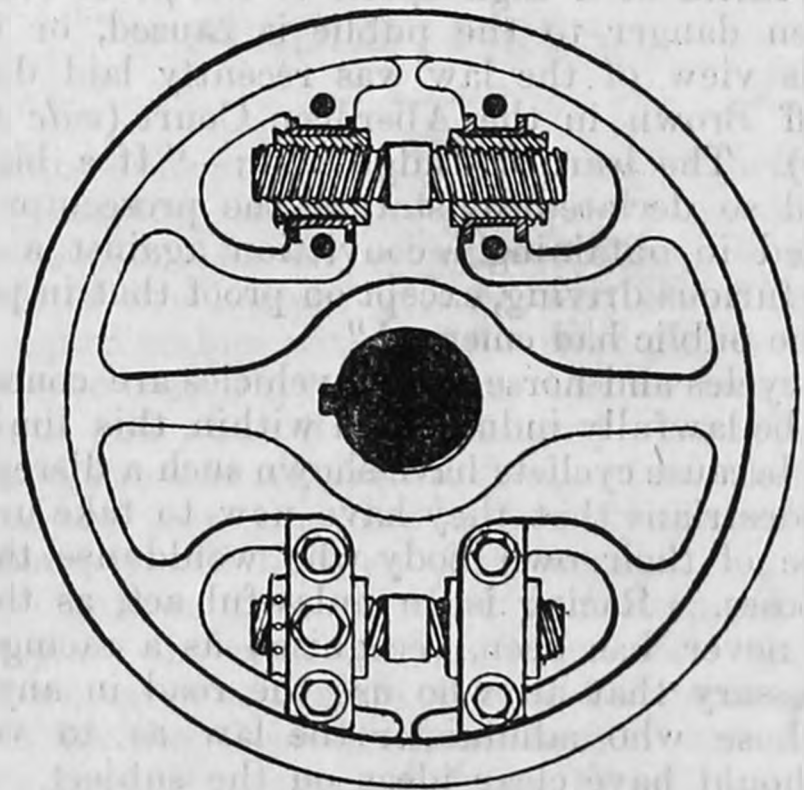
**A New Motor-Car and Cycle Club.**—Mr. Howard Fenney, a director of Messrs. Hearl and Tonks, is about to establish a club in Birmingham, where those interested in automobilism can meet. The building is a new one, and is rapidly approaching completion; the cost is said to be £12,000, which has been found entirely by Mr. Fenney. When finished, it is intended to let the building, furnished complete, to a limited liability club, at an annual rental to be fixed by an independent valuer. The accommodation will be of the very best, and will comprise in the basement a show-room, where cases containing samples of the goods manufactured by each member may be on view, as also stalls for the sale of all the chief cycle and trade newspapers. The ground floor will be formed into a kind of cycle exchange, where members may meet their customers and transact business, discuss the market quotations, and effect "deals" in cycle shares, &c. Further ahead will be reading, writing, smoking, and general reception rooms, as also a large dining-room, where meals can be obtained at any time of the day. Then, of course, there will be the necessary recreation and billiard rooms, all furnished in the most luxurious style. It is intended to conduct the club on the soundest lines, the membership being limited to principals only, and already a number of the most influential gentlemen connected with the trade have promised to take an active part in the management.

## HALSTEAD AND HORSBURGH'S FRICTION CLUTCH.

FOR those automotor vehicles in which oil-motors are employed, a clutch which permits of rapid engagement and disengagement without shock is an essential fitting. As is well-known, oil-motors have to be run at practically a constant speed, and any variation in the speed is best effected by means of a good clutch which enables the various gears to be quietly thrown in and out of gear. The accompanying illustrations show the clutch invented and manufactured by Messrs. Halstead and Horsburgh. It consists of a split ring which, by means of two right and left-handed screws and toggle levers, can be expanded so as to grip the internal periphery of a shell pulley. As will be seen, provision is made for adjusting two of the nuts



with which the screws engage, so that the effects of wear may be readily compensated for. When correctly adjusted the toggle levers assume the position shown in the sectional view when the clutch is in gear, thus relieving the brasses or starting levers of any pressure, and rendering the clutch self-locking. A further advantage is that the clutch, being perfectly symmetrical, is naturally balanced, and can therefore be used at the highest speeds.



Messrs. Halstead and Horsburgh claim the following advantages for this clutch:—It transmits more power than any other friction clutch of equal diameter. There are no parts liable to get out of order or lock; and any required adjustment may be made whilst engine is running; all parts are interchangeable. It is also self-locking when in gear, and there is no end thrust on brasses or starting levers; it also works vertically or horizontally.

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## NOTES OF THE MONTH.

A CYCLE, motor-car, and accessories exhibition will be held at the Sheffield Drill Hall, from February 3rd to February 12th, 1898.

THE Kensington Vestry is going to try an automotor vehicle instead of horses, to see if there will be any saving to the ratepayers.

WITH due appreciation of the fitness of things, the members of the Hammersmith Vestry, on the occasion of the recent inauguration of their New Central Electric Light Station, drove to the scene of the function in electric cabs.

THE De Dion Tricycle which the Hon. C. S. Rolls recently acquired is, we understand, turning out a great success. It is particularly suitable for racing, Mr. Rolls having recently paced a cycling friend for 100 miles, which was accomplished in 5 hours 4½ minutes.

THERE will again be a gathering of motor-cars during the Stanley Show this month at the Agricultural Hall. They will be on view in the King Edward's Hall, the exhibiting firms being Humber and Co., Daimler Motor Company, and the Great Horseless Carriage Company.

THE Dunlop Company have decided to embark upon the manufacture of motor-vehicles, and have recently started a subsidiary company with a capital of £25,000 for this purpose. Mr. A. Herschmann is their chief draughtsman, and their works will be situated at Bournbrook, near Birmingham.

WE hear that it is proposed to establish a service of motor-vehicles from Lincoln to Brigg and back, a distance of 42 miles, and passing no less than 29 villages *en route*. We should think that the scheme has every promise of success in it. Mr. E. Daubney, of 9, Chaplin Street, Lincoln, is the Secretary *pro tem*.

WE regret to chronicle the death of Mr. W. Arnold, of the firm of Messrs. Arnold and Sons, engineers, of East Peckham, at the age of 78 years. The deceased gentleman had devoted much time and thought to automobilism, and was the inventor of the very successful type of motor-vehicle which bears his name.

The G.P.O. Authorities are using an electric motor van for the conveyance of mails, parcels, &c., between St. Martin's-le-Grand and Victoria. It makes five journeys per day. So far it has proved itself to be a distinct success in every way, and we hear that the G.P.O. contemplates the use of such vans in the larger provincial cities.

No less than 400 patents have been granted for acetylene gas; and 12 companies, having over half a million of capital, have been formed, and yet only one factory is producing calcium carbide. Although there are 16 works elsewhere, several of them are on a small scale, and the production is due to the inflated price obtained for the carbide. The only British factory is at Foyers, N.B.

*Animals' Friend*, in speaking of the automotor, says:—"Patronise the motor-cab and car. It will abolish the tired and broken-down horse from the street and highway, the public thoroughfares will be more sanitary, and there will be no more equine suffering in the wet and cold of wintry nights when masters and mistresses are pleasuring." Our humane contemporary adds that "the horrors of the midnight cab rank have yet to be told."

THE Yorkshire Motor-Car Company, of Albert Buildings, Bradford, has arranged for an exhibition of motor-cars, motor-wagons, motor-cycles, accessories, &c., to be held during December or January, at the Rifle Barracks, Belle Vue, Bradford. Mr. J. E. Tuke, with his usual energy, is the moving spirit in this exhibition, which we wish every success. The Company over which this gentleman presides is thoroughly up-to-date, and prepared to supply all the best forms of motor-cars and tricycles at moderate prices, ranging from £75 upwards. At the latter figure the price list includes a vehicle capable of running 100 miles at the stupendous cost of 1s. for fuel!

ON the 25th of last month the Scottish Motor, Omnibus, and Car Company (Limited) started the running of motor-cars between Hamilton and Larkhall and Hamilton and Blantyre; a service for Hamilton, Bothwell, and Uddingston being also started on the 26th. The cars run every hour, at moderate rates. They are elegant and light, and are seated for six outside, with accommodation for one or two more beside the driver. From reports to hand they are being well patronised, numerous groups watching their departure and arrival. The crowd of would-be riders increases every day, and is far beyond the power of the Company to cope with. No doubt by next year arrangements will be made to increase the number of motor-cars upon the route.

THE Lord Mayor's Show was characterised by the presence of a couple of vehicles—the one representing the uncomfortable lumbering, gaudy, stuffy, jerky, and dilatory stage coach, and the other a motor-vehicle which was capable of carrying more for a greater distance at a higher speed, and with less cost, and with greater care, safety, and comfort than any stage coach ever built. It is, of course, too much to expect that the next Lord Mayor will discard that awfully hideous, lumbering vehicle, called the State carriage, but as the schoolmaster continues to make his influence felt in the coming generation we hope the time is not far distant when carriages in all State processions will be propelled by mechanical means, and that in future Lord Mayors' processions the present State carriage will be exhibited as an example of the kind of State vehicle in use in the unenlightened period of the nineteenth century. However, we must not be ungrateful for the recognition that has been bestowed upon automobilism by the city fathers.

THE *Westminster Gazette* is remarkable for two things—an unreasoning and silly dislike of the Right Hon. Mr. Joseph Chamberlain, the Colonial Secretary, and motor-vehicles. We could understand such an attitude on the part of a professed Tory organ, but it seems just a trifle inconsistent to see a so-called "Liberal" journal adopting it. In a note in a recent number the *Westminster Gazette* says:—"If the arrival of the motor-car and the increase of the cyclists in crowded streets has given the Commissioner of Police in London some anxious moments, the state of the traffic in Paris would be enough to break down Sir Edward Bradford altogether. There the motor-car is daily responsible for a growing list of accidents, for the Paris *cocher* is not at the best a careful driver compared with our London cabby, and when his animal sees one of the monstrous motor-vans bearing down on it, with a noise like a siren, and in a cloud of smoke, its rickety form is galvanised into a wild desire to get into the nearest place of refuge, which may happen to be a shop window or the side of a house. Such pranks are extremely disconcerting, not to say alarming, for the man in the street. The Englishman in Paris who has learnt the terrors of the street will be glad to hear, for the sake of his less experienced fellow-travellers, that the Municipal Council has determined to make inquiries into the question of unrestricted motor-car traffic."

WE are absolutely certain that the arrival of the motor-car has not in the slightest degree caused the Chief Commissioner

to have any "anxious moments." Indeed, the suggestion is so childish that it needs no refutation. What, may we ask, is a "monstrous motor-van"? Does this refer to size or to some immoral trait in its character? Were the *Westminster Gazette* even tolerably well informed, it would know that the size of motor-vans is strictly regulated by the Police in Paris, and nothing monstrous is permitted; hence a motor-van that made a "noise like a siren" and in a "cloud of smoke," would be promptly seized and the driver rather heavily fined. We might enlarge upon the matter, but our time and space are too valuable to be unduly occupied in refuting every absurd and mendacious statement concerning motor-vehicles that appears in a section of the London Press.

THE Paris correspondent of the *Morning Advertiser* writes:—"If M. Paul Mayan's public statements respecting the almost stationary condition of the automobile car industry here are based upon sound information, the reason for the slow production of those vehicles in France must be sought in the paucity of workmen possessing the requisite mechanical skill. M. Mayan says that the builders have provided themselves with the factories and the necessary machinery, but that a year or two must elapse before the technical training has been disseminated among French artisans to an extent empowering the manufacturers here to meet the active demand for motor-carriages. The French artisan, nevertheless, has been the first in the field, and was engaged in the construction of motor-cars long before the latter were seen in England. A more probable explanation would seem to be that while the French workman is perfectly competent and ready for the work, the French manufacturers themselves are not altogether satisfied with the types of the motor-car yet evolved, and are holding back. An instance of the ingenuity with which this idea of the automobile has been elaborated by the Paris designers and makers has just been furnished by a firm in the Avenue Victor Hugo. The finishing touches are being put in the workshop there to an auto-mobile cottage. The movable habitation thus constructed contains two bedrooms, a dining-room, a bath-room, and a kitchen, with a balcony on the first floor."

OUR contemporary, the *Graphic*, has shown a commendable enterprise in obtaining an electric cab for the use of its staff. Instead of its reporters having to rush hither and thither in noisy and dangerous "hansoms," they now proceed on their business in the swift and secure automotor. Needless to say, the appearance of this cab in Fleet Street has evoked feelings of the most intense jealousy among the journalists. It has been said—we know not with what truth—that since the acquisition of this cab, the *Graphic* men refuse to recognise common journalists who ride in vulgar hansoms. While counselling humility to the scribes of our contemporary, we would suggest that other newspapers might also purchase automotors, and thus remove any chance for what the servant girls call "stuckupness." As regards the performances of the new vehicle, the *Graphic* men speak highly of it. One man writes: "I had the advantage of a long trial of the new vehicle on the occasion to which I refer, and I had experience of its capabilities in crowded thoroughfares, in open roadways, up hill and down dale, and I must say that I was perfectly surprised with the result. The driver seemed to have the most perfect control over his vehicle; the ease with which it could be turned, and the small space it could turn in, the way in which its pace could be moderated, and the quickness with which it could be brought to a full stop, was in the highest degree commendable. One of the drawbacks—which I am told, in time, will be got rid of—is the burr of the machinery. Another is that a different bell should be provided; the present bell is too much like that of the cycle, and when foot-passengers turn round expecting to see a bike and find instead a horseless cab they are naturally somewhat startled. When these two defects have been remedied, one will be able to thoroughly enjoy the ease and the gondola-like movement of the new invention, which ought to achieve a tremendous success."

## CONTINENTAL NOTES.

THE De Dion firm has started a line of tractor omnibuses between Melun and Meaux.

A COMPANY is being formed to take over the business of M. Delahaye, the well-known automotor manufacturer. The capital will be 6,000,000 francs.

AN association of automobilists for Central Europe has been formed at Berlin, and it rejoices in the name of *Mitteleuropäischer Motorwagen-Verein*.

THE municipality of Bordeaux has decided to establish lines of automotor-omnibuses. The London County Council does not know what these things are—apparently.

THE Self-Propelled Traffic Association has become affiliated with the Automobile Club of Paris, and membership of the one carries honorary membership of the other.

HERR THIEN, a Berlin electrician, has built an electric drosky, which will go 42 miles, on one charge, at a speed of 13 miles an hour. The accumulators are of the Correns type.

IT is said that an English firm has taken premises at Puteaux for the manufacture of electric automobiles, capable of going 120 miles without recharging. We should like to see that cell. By the way, Puteaux has been christened by *Les Sports Automobilopolis*.

SINCE the French Government has decided to tax motor-vehicles on the pretence that they are articles of luxury, why, it is asked, should not yachts be taxed? The answer is simple, the French Government is extremely desirous of doing all it can to increase its naval strength, and actually gives bounties to shipbuilders and shipowners.

THE French military authorities have recently put the "Scotte" tractors through some very severe trials in hauling baggage, wagons, cannons, &c. The experiences have been most satisfactory; the military men are loud in their praises of this new adjunct to warlike operations, and it is certain that automotor vehicles will ere long form an indispensable part of the equipment of every modern army.

LES POIDS LOURDS.—After a somewhat lengthy delay the commission appointed by the Automobile Club to conduct Les Poids Lourds trials has issued its report. The report is a compendious volume of 55 pages, and it contains a large amount of useful matter. We shall deal fully with it in our next issue. M. le Comte de Chasseloup-Laubat is to read a paper on the trials at one of the meetings of the *Société des Ingénieurs Civils*.

IT will be remembered that on the occasion of the Paris-Dieppe race the special train broke down, and the intention was expressed of claiming an indemnity. That there was a good cause for action is apparent when it is remembered that the special train arrived after the race had been run, and thereby defeating the very object for which the "special" was chartered. The indemnity agreed upon was 10,000 francs, which has been paid to the Automobile Club.

M. MICHELIN has furnished some particulars to *La Genie Civile* as to the cost of running a steam brake, using coke as fuel and carrying six persons. The weight of the brake is 2,050 kilos. = 4,510 lbs. tare. It has journeyed over 7,700 kilometres, or 4,774 miles, and the cost works out at—for coke, '0616 franc per kilometre, oil for lubrication, '0346 franc per kilometre, and total cost of running, '1065 franc per kilometre. The mean speed was 16 kilometres, or 9.6 miles per hour. The repairs are put at 50 francs per month.

ALEXANDRIA, which was the home of a high civilisation when London was an uncouth collection of mud huts, and which boasted of fleets and libraries when British naval architecture was represented by coracles made of wattles sheathed with skins, still maintains its ancient reputation. It has a modern and fully equipped electric tramway system. London is content with a wretched system of horse-drawn tramcars. We would suggest that a deputation of members of the London County Council should visit the ancient seaport of the Pharaohs and see how it's done.

MR. PENNINGTON is, perhaps, hardly sufficiently appreciated on this side, but in France he has at any rate succeeded in arousing the enthusiasm of *Les Sports*, which paper thus pours itself out:—"Pennington the great, the illustrious Pennington, he who has invented the war automobile," and so on, and so on. *Les Sports* then goes into raptures about the magnificent apartment which this distinguished gentleman occupies at the Grand Hotel, and loses itself over the contemplation of the boxes of cigars and the bottles of champagne produced.

OUR French friends have a genius for taxation. Is there any single article of commerce in France which is not taxed in some way? We think not. So long as motor-vehicles were in the experimental stage they escaped taxation, but a vigilant Minister of Finance had got his eye upon them, and when he saw that they were articles of regular manufacture and employed for commercial purposes, he, worthy gentleman, issued his decree, and in future automotor-vehicles with two places will pay 60 francs, and the others 100 francs; in communes of more than 40,000 inhabitants they will pay 40 francs and 75 francs respectively; in communes of from 20,000 to 40,000 inhabitants, 30 francs and 60 francs; in communes of 10,000 to 20,000 inhabitants, 25 francs and 50 francs; in communes of 5,000 to 10,000 inhabitants, 20 francs and 40 francs; in communes of less than 5,000 inhabitants, 10 francs and 20 francs.

THE reason for the imposition of the tax is that the Finance Minister is 30,000,000 francs to the bad in his Budget, and hence there is some excuse for it. At the same time, we fail to see why the residents of large towns or districts should be discriminated against in favour of those who reside in the small ones.

SOME time ago the French Minister of Public Works appointed a Commission to discuss the condition under which services of public motor-vehicles should be subsidised by the State. The Commission has reported that the State is authorised by law regulating public transport to pay subsidies to automotor companies subject to an engagement not exceeding a period of 10 years. Subsidies, however, can only be granted to companies possessing sufficient rolling stock to be able to carry daily over the whole length of the system at least 10 tons of merchandise at an average speed of four miles per hour, and of 60 passengers with two tons of luggage at an average speed of seven miles. The subsidy for each year is calculated according to the total distance covered by the vehicles, and their capacity for carrying passengers, luggage, merchandise, and the like. The amount cannot exceed 250 francs for every kilometre of road comprised in the daily service, or be more than half of the total subsidy allowed by the departments or the communes. Nevertheless, it can attain 300 francs and 350 francs per kilometre, and the three-fifths and two-thirds of the total subsidy respectively in departments where the amount received in taxation does not exceed a certain figure, that is to say, districts which are only poorly or sparsely inhabited. The report is very generally approved in Parliament.

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ALL interested in automotors should join the Self-Propelled Traffic Association. Prospectus and full particulars can be obtained of Mr. Andrew W. Barr, Secretary, No. 30, Moorgate Street, London, E.C.—(ADVT.)

**Automotor Cabs in Paris.**—The Paris correspondent of the *Daily Telegraph* writes:—The London electric cab that was recently sent over to Paris has been tested with success. It has been taken up the steepest hills, has made the round of Paris, has created no little sensation among the promenaders in the Bois de Boulogne, and has exceeded the 70 kilometres agreed upon with a run of 80 kilometres, after which its motive powers were moreover not exhausted. Representatives of some of the principal companies and a number of engineers have followed these experiments with equal interest and delight, and the problem of ways and means is being attentively studied. It is believed that something can be done towards reducing the weight of the vehicles, nor will the entire cab system be revolutionized at once. A certain number of these cabs will be started as an experiment, and if the public, as is expected, takes kindly to them, they will be rapidly increased. It is affirmed, by the way, that the reason why more horseless vehicles have not been brought out in Paris is that the manufacturers have great difficulty in procuring the requisite amount of skilled labour, so that all the local builders together do not produce between them at the rate of more than one horseless carriage a day.

**An Electric Delivery Wagon.**—Our American contemporary, the *Electrical Age*, gives an illustrated description of an electrically-propelled delivery wagon constructed by a Chicago firm. The electrical equipment consists of 44 storage batteries, having an individual capacity of 100 ampères per hour, weighing only 13 lbs. each, and connected with a 3½ H.P. motor, iron-clad and waterproof, of the four-pole pattern. The charging apparatus consists of an automatic stationary rheostat, which is equipped with meters indicating the proper volume of current and the number of ampères stored in the vehicle batteries. These have an apparatus which automatically disconnects them from the charging circuit when fully charged. The plugs of the connections, the binding posts of the batteries, and the rheostat are correspondingly marked positive (+) and negative (−), so that no possible error can be made in placing them. The guiding lever is at the driver's left hand, and a smaller lever at the seat on the right reverses the machinery. The wheels bear on frictionless ball-bearing axles, and have three-inch pneumatic tyres. One of the wheels carries an odometer, and this has proved that as great a distance as 64 miles has, under favourable circumstances, been run with one charging of the batteries. The batteries occupy very little space, and they can, therefore, be so placed as not to injure the appearance of the vehicle. It is stated that from the odometer record it has been found that the electricity costs about one halfpenny per mile. The wagons register from 30 to 42 miles a day each, and even then the batteries are not half empty at night.

**Military Automotor Vehicles.**—The Paris correspondent of the *Daily Telegraph*, writes:—"Military authorities in this country cannot be accused of neglecting to turn recent inventions to profitable account. Cycling has been encouraged in the army to a considerable extent, and now it is the motor-car which is claiming its share of attention. With a view to ascertaining how it could be utilized for the transmission of communications at a rapid rate and over long distances, Général Billot, Minister of War, has just got up a very practical experiment, which has been duly carried out by a committee of officers, under the direction of Colonel Feldmann. Two hundred kilometers were to be covered between dawn of day and night, with an hour's interval for rest. Such was the programme, and the worst roads that could be pitched upon were expressly selected for the purpose. The start was effected from the Place St. Thomas d'Aquin, between 6 and 6.30 a.m. Eight vehicles were pressed into the service, and the majority of them conveyed specially appointed delegates, among whom may be mentioned Captain Mangin, Commandant Sainte Claire-Deville, Captain Barisier, and Captain Parra. With the exception of one, all the cars were provided with motors of six-horse power. Each vehicle followed a separate road, there being three equidistant convergent points: to wit, Dreux, Fontainebleau, and Villers-Cotterets. Among the drivers of the cars were M. René de Knyff, Mr. Archdeacon, and Mr. Morse, and all were delighted with the expedition, which, moreover, gave the officers complete satisfaction. The roads were as bad as could possibly have been wished, and any amount of skill was needed to deal effectively with the obstacles which presented themselves on the various routes. The military committee has since visited the establishments of the chief constructors, in order to study the different types of vehicles under the superintendence of Colonel Feldmann.



## SELF-PROPELLED TRAFFIC ASSOCIATION (INCORPORATED).

LIVERPOOL AND DISTRICT CENTRE.

President of the Association: Sir DAVID SALOMONS, Bart.

LIVERPOOL CENTRE.

President:

The Right Honourable The EARL OF DERBY, K.G., G.C.B.

Vice-Presidents:

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LYSTER, M. Inst. C.E.; ARTHUR MUSKER; G. FREDK. RANSOME;  
HENRY H. WEST, M. Inst. C.E., M. Inst. N.A.; JOHN WILSON;  
JOHN T. WOOD, M. Inst. C.E.

Honorary Solicitor:

LAWRENCE JONES, 6, Water Street, Liverpool.

Honorary Secretary:

E. SHRAPNELL SMITH, Royal Institution, Colquitt Street, Liverpool.

### Trials of Motor Vehicles for Heavy Traffic, May, 1898.

#### PARTICULARS OF COMPETITION.

(Issued by the Liverpool Centre and approved at Head Centre.)

*Objects of Trials.*—The chief object of the trials is to arrive at a type of heavy motor-wagon suitable for trade requirements in Liverpool and neighbourhood, which shall be capable of economically taking the place of horse haulage and of competing with the existing railway rates, in the transport of heavy loads of goods over considerable distances.

*Nature of Trials.*—Trial runs will be made from Liverpool, over minimum distances of 30 miles, on four successive days. All vehicles will be required to traverse the prescribed routes, without alternative, and to perform such manœuvres as are hereinafter specified. No route longer than 40 miles will be selected.

Route-maps will be issued for each course on the mornings of the respective runs.

*Date of Trials.*—The trials will begin on the morning of Tuesday, May 24th, 1898, and will conclude on the afternoon or evening of the Friday following.

*Judges.*—Three members of the Liverpool Council and two members of the General Council will be chosen by their respective Councils to act as judges. As soon as these gentlemen have been appointed their names will be published.

*Awards.*—Money prizes of £100, £75, and £50, also certificates of merit, will be given at the discretion of the judges.

A full and exhaustive report on the trials will be issued by the judges and circulated by the Association.

Intending competitors are also referred to the special notice below.

#### GENERAL REGULATIONS APPLICABLE TO ALL VEHICLES.

(I.) The vehicle shall be self-propelled. The part carrying the generator or motor, or both, may be articulated and detachable, but the propulsion shall be effected by utilising the load for adhesion.

(II.) The vehicle shall be propelled by mechanical power alone, but (with the reservation that the judges may disqualify and prohibit from competition any vehicle or motor which, in their opinion, is faultily constructed or dangerous from any cause whatever) there shall be no restriction on the source of such power or the nature of the agents used.

(III.) The vehicle shall be capable of going anywhere that a horse-drawn vehicle carrying the same load can go, and of being placed in the same positions and withdrawn therefrom without external assistance.

The particular manœuvre most generally called for is to work into and out of a loading berth when "cramped" for room. This requirement arises in the case of embayments, or of confined spaces between other vehicles in a line receiving or discharging goods. Carters usually back into such positions obliquely, and bring the vehicle into line by turning the leading wheels at right angles to the rear wheels and again backing.

(IV.) The vehicle shall be capable of working into and out of an embayment of one-and-a-half times its own length.

(V.) The vehicle shall conform in all respects to the requirements of the Locomotives on Highways Act, 1896, and, in the case of its being oil-propelled, of the "Regulations as to Petroleum," issued by the Home Secretary under Section 5 of this Act.

(VI.) All working parts shall be properly encased.

(VII.) The tare of the vehicle shall be recorded, both inclusive and exclusive of any water, fuel, or accumulators used for the purpose of propulsion.

#### VEHICLES ELIGIBLE FOR COMPETITION.

Class I.—Vehicles capable of carrying a minimum load of two tons of goods. (Vehicles entered in this class may be open or covered.)

Class II.—Vehicles capable of carrying a minimum load of five tons of goods. (Vehicles entered in this class shall have level platforms only without any covers.)

#### REGULATIONS APPLICABLE TO VEHICLES ACCORDING TO CLASS.

(I.) The average speed during the trial runs, inclusive of stoppages, shall reach—

- (a) In Class I, six miles per hour.
- (b) In Class II, four miles per hour.

(II.) The vehicle shall have a level platform area of not less than—

- (a) In Class I, 60 square feet.
- (b) In Class II, 110 square feet.

(III.) In Class II the height of the floor line from the ground shall be not less than 3 feet 9 inches, and shall not exceed 4 feet 3 inches.

#### RULES AND CONDITIONS.

(I.) The vehicle shall carry at least the minimum weight of goods, or any weight in excess declared by the competitor, throughout the continuance of the trials. Suitable ballast will be provided by the Association.

(II.) Each competitor shall himself make all arrangements for the necessary staff and appliances to work his vehicle or vehicles. Accommodation for the vehicles, in Liverpool, will be provided by the

Association. Vehicles intended for trial shall be registered as "arrived," at this depôt, not later than 3 p.m. on Monday, May 23rd, 1898.

(III.) An official observer will accompany each vehicle during the trial runs, to take notes of behaviour, fuel and water consumption, &c., and no repairs will be permitted without his knowledge and consent.

(IV.) Any vehicle withdrawn from competition during the trials, except under the written authority of the judges, shall not be eligible for a prize or for commendation.

(V.) Six photographs of each vehicle, together with one perfect negative, shall be furnished by the competitor, not later than May 16th, 1898.

These must be delivered in good order at the Liverpool Royal Institution, addressed to the Honorary Secretary, Self-Propelled Traffic Association.

(VI.) Full drawings of any vehicle shall be submitted to the judges in confidence, if required by them, prior to the final adjudication.

(VII.) Entries shall be made on printed forms (to be obtained from the Honorary Secretary) at any time prior to 12 noon on the last day of March, 1898, and shall be accompanied by an entrance fee as under:—

	£	s.	d.
For one vehicle .. .. .	5	5	0
For each additional vehicle by the same competitor .. .. .	1	1	0

Entries shall be addressed, under cover of a registered letter, to the Honorary Secretary, Self-Propelled Traffic Association, The Royal Institution, Colquitt Street, Liverpool.

(VIII.) A complete list of particulars shall be lodged with the Honorary Secretary not later than May 16th, 1898.

The description must be type-written or printed, and six copies must be furnished. The tare weight of the vehicle, both exclusive of any water or fuel and in complete running order, must be given, also, as briefly as possible, any peculiarities of construction or of working to which the competitor desires to draw the attention of the judges.

(IX.) Each competitor shall arrange to have his vehicle or vehicles ready for inspection by the judges at 9 a.m. on the morning of Tuesday, May 24th, 1898, in the depôt that shall be used as headquarters during the trials.

(X.) All vehicles shall be stored over-night at the depôt or depôts provided by the Association.

(XI.) Lots will be drawn to determine the order of starting. It is intended to begin the runs shortly after 9 a.m. on each of the four days, the vehicles following one another at intervals of about 10 minutes.

(XII.) At the conclusion of the trials, any vehicle, or motor, or part thereof, shall be opened up, in confidence, for inspection by the judges, if required.

The judges reserve to themselves the right of absolutely disqualifying any competitor for any infraction of these rules.

While obeying in all respects the instructions of the judges and the conditions of the competition generally, it is to be fully understood and agreed by every competitor that no responsibility, legal or otherwise, is to attach either to the judges or to the Self-Propelled Traffic Association, in respect of anything, or for any damage or injury caused to any person or thing, but that all responsibility of every sort and kind, whether pecuniary or otherwise, is to attach to the competitor, and is to be borne by him.

THE FOLLOWING ARE THE POINTS WHICH WILL BE TAKEN INTO CONSIDERATION BY THE JUDGES IN MAKING THE AWARDS.

- (a) *Cost.*—Economy of working, including attendants.
- (b) *Control.*—Stopping, starting, changing speed, steering and reversing, particularly under adverse conditions, such as on inclines or in confined spaces.
- (c) *Working.*—Noise, smell, visible vapour, dust, or other nuisance when travelling; number of mechanical operations requiring attention from the driver; efficiency of brakes; time occupied in preparing the vehicle for service on the road; ability to start from rest on an incline of 1 in 16; speed—within legal limits; distance run without taking or receiving supplies of fuel, oil, gas, electrical or chemical materials or electrical current, water, or of any agent employed for actuating the motor or assisting its working; ability to complete the course without stopping to effect

repairs, adjust parts, apply lubricants, or for any other purpose or cause not provided for in the itinerary; freedom from a break-down of any nature.

(d) *Construction.*—Strength of frame and working parts; quality of workmanship; efficiency of springs; freedom from complicated or over-refined parts; facility with which repairs can be effected; capacity of bunkers, oil and water tanks; ratio of available to total platform area—preference will be given, as regards vehicles entered in Class II, to a system that gives the entire platform, from end to end, free for goods; ratio of tare to power of motor; ratio of tare to weight of freight carried during the trials.

(e) *Steam-propelled Vehicles.*—Action of feed-pumps or injector; ample supply of steam; consumption of fuel and water per mile; leakage of steam or water; arrangements for stoking.

(f) *Oil-propelled Vehicles.*—Efficiency of ignition; regularity of carburation and explosions; range and gradation of speed of vehicle, and smoothness with which changes of gear are effected; circulation and weight of cooling water; consumption of oil per mile; leakage of pipes or tanks.

The decision of the judges, expressed in writing on any point, shall be final and binding on all parties, and they may withhold any award, or any portion thereof.

Three printed copies of these rules will be issued with each form of entry, one of which, signed by the competitor, must accompany each entry when forwarded to the Honorary Secretary. In signing and returning this copy of the rules, the competitor shall accept all the conditions herein imposed upon him, and shall agree to be bound in all respects by them.

Each vehicle will be allotted an official number which must be displayed during the continuance of the trials.

LAWRENCE JONES, Honorary Solicitor.  
E. SHRAPNELL SMITH, Honorary Secretary.

Royal Institution, Liverpool,  
November 16th, 1897.

SPECIAL NOTICE TO COMPETITORS.

A prominent member of the Association has intimated to the Honorary Secretary that he is willing to receive, on the recommendation of the judges, one or more vehicles to work in the heavy goods traffic of Liverpool and neighbourhood, on trial, during a period of one month, and, further, that he is prepared to purchase fifty vehicles in all.

Provided—

- (a) That the vehicle shall carry five tons of goods during the official trial runs, and that it is capable of carrying up to ten tons when required.
- (b) That the vehicle shall comply with the regulations applicable to Class II.
- (c) That during the month's trial, the vehicle shall work generally to his satisfaction.
- (d) That during the month's trial, the cost of working shall not exceed 3.5d. per net ton-mile, calculated on the basis set forth below.

During the continuance of these additional practical trials, the expenses of working, up to 3.5d. per net ton-mile, will be borne by the member in question.

This offer is not to be taken in any sense as a contract of a binding nature at law.

SCHEME [referred to in Provision (d)] FOR ASCERTAINING THE COST OF WORKING.

The cost of working per net ton-mile, inclusive of interest at 5 per cent. per annum, depreciation at 15 per cent. per annum, maintenance, attendance, and all other charges shall not exceed 3.5d. This cost shall be calculated on the basis of 60 per cent. of maximum load (10 tons) being carried 15 miles per day, and the same distance being traversed "light" (i.e., without load), on 260 days per annum. An example of the method of calculating this figure is appended:—

Load designed for .. .. .	5 to 10 tons.
Active work per annum .. .. .	260 days.
Distance traversed with 60 per cent. of load (6 tons) .. .. .	3,900 miles.
Distance traversed light .. .. .	3,900 miles.
Prime cost, say .. .. .	£600.

## Assumed Expenditure.

	£	s.	d.
Interest at 5 per cent. per annum, say .. ..	30	0	0
Depreciation at 15 per cent. per annum, say .. ..	90	0	0
	<hr/>		
	120	0	0
*Fuel—13 lbs. of furnace coke per vehicle-mile, 13 lbs. $\times$ 30 $\times$ 260 = 45 tons at 15s. per ton .. ..	33	15	0
*Oil, grease, and waste .. ..	10	0	0
*Wages—Driver at 30s. per week .. ..	78	0	0
Boy at 7s. 6d. per week .. ..	19	10	0
Stabling—Proportion .. ..	5	0	0
*Water .. ..	10	0	0
Licence .. ..	5	5	0
*Repairs .. ..	20	10	0
	<hr/>		
	182	0	0
	<hr/>		
Total per annum .. ..	£302	0	0

## TRAFFIC—

6  $\times$  3,900 = 23,400 net ton-miles.  
Cost = 3.10d. per net ton-mile.

\* Cost determinable during the month's trial.

THE Second Session of the Self-Propelled Traffic Association (Liverpool Centre) will be opened at 8 p.m. on Friday, November 26th, when the President of the Association, the Right Hon. the Earl of Derby, K.G., G.C.B., is expected to take the chair. The meeting will be held at the Royal Institution, Colquitt Street, Liverpool. The inaugural address—"Self-Propelled Vehicles, 1896-7" (with lantern illustrations)—will be delivered by Mr. W. Worby Beaumont, M. Inst. C.E., M. Inst. Mech. E., Cantor Lecturer on Modern Road Vehicles, and Member of the General Council of the Self-Propelled Traffic Association. The hon. President during his visit upon this occasion will be the guest of Mr. Alfred L. Jones.

**London Cab Fares.**—A writer in the *Daily Telegraph*, discussing the question why cabs are dear, says:—"But the great recommendation of the omnibus is its cheapness; and the great drawback to the cab is its admitted dearness. Moreover, taking the cab system of the metropolis and contrasting it with the facilities obtainable abroad, or even in our own provincial cities, the deficiencies of London are at once apparent. The real trouble rests in the difficulty of adjusting fares, and herein lies the whole secret of the failing tendencies of the cab trade. It wants a person having the courage of his convictions to pay a cabman no more than his legal fare, and it is only a man who knows his London well who would dare to dispute, at the risk of being publicly insulted in the streets, cabby's dictum as to distances. Many men, rather than incur odium of the kind, wilfully pay the driver much more than his due, and thus encourage him to expect the next fare to be equally liberal; whilst many ladies, rather than pay more than is just, avoid the cabman altogether, and thus it happens that his custom diminishes and his prospects tend to grow more gloomy, with the keener omnibus competition, and that of the network of underground railways already in existence, or now in course of construction. It may also be recollected that the new electric cabs have come to stay. In the view of competent judges they are doing very well, and it is expected that as the winter approaches these weather-protected coaches will be preferred to hansoms. The advent of the electric cab, it is no secret, is necessitating an entire revision of the regulations applying to licensed public carriages, but the Secretary of State and the police have no power whatever to revise fares, and only a magistrate can settle a dispute as to any hiring. Recent alterations in the law, by what is called the Bilking Act, no longer oblige a cabman to drive his fare to a police-station, should any quarrel arise between them. But in the interests of the public, and if cabs are to continue to exist as licensed vehicles, reform is demanded; and it is argued that the electric cab proprietors, as they become firmly established, instead of falling into the old rut and letting out their cabs, as though they were hansoms or 'growlers,' at a daily charge, might take steps to obtain the Parliamentary revision of cab fares. In the best informed quarters motor-cabs are expected to bring about a reduction of fares, and it is also thought that the four-mile radius must shortly be extended to five. If cabs could be run as 'buses or trams' on a charge by distance, as recorded by the cab itself, could be made."

## AN IMPROVED DIFFERENTIAL GEAR FOR MOTOR-VEHICLES.

MR. R. JAS. URQUHART, C.E., of Liverpool, has effected several improvements in ordinary differential or "Jack-in-the-box" gear, which we herewith illustrate and describe.

His invention relates to differential reducing gearing for the high-speed engines of automobile vehicles, and consists in improvements in the construction and arrangement of such gearing which embodies an epicycloidal train, the object being to produce a compact gearing from which can be obtained several reduced speeds in both directions without reversing the direction of the primary shaft. In the arrangement illustrated the primary shaft drives the secondary or low-speed shaft through an epicycloidal train, which may gear directly with the primary shaft or indirectly by means of intermediate gearing. One element of the epicycloidal train is fixed so as to drive the low-speed shaft; this is the carrier which carries the intermediate or planet pinion or pinions. The other two elements of the train are so arranged that they can be driven from the primary shaft in both directions.

Each of the two elements driven from the primary shaft is provided with a brake drum and band or equivalent friction clutch, by which it can be fixed or allowed to slip at will. When it is required that the primary shaft shall continue to rotate without the epicycloidal train, the primary shaft is provided with a suitable clutch or clutches by which such train may be driven or not as desired. The elements of the train are the two differential wheels and the planet wheel.

The accompanying drawings illustrate the best method of construction of the improved arrangement of gearing. Fig. 1 illustrates an elevation of the gearing showing the upper half or so in section. Fig. 2 shows the method adopted of securing or fixing the two elements of the epicycloidal train to prevent their rotation and checking their rotation. In the arrangement illustrated, bevel gearing is employed to rotate the two elements of the epicycloidal train, the latter being preferably formed with spur wheel teeth. The arrangement is also shown as applied to the axle of two driving wheels of a road vehicle, and as driving through a differential or balance gear to allow of one wheel over-running the other when the vehicle is passing round a curved path.

Referring now to Fig 1, *a* is the high-speed shaft, and it may be the motor-shaft or a shaft in direct gear with the motor-shaft. In many cases it will only rotate in one direction, but in some cases it will be required to rotate in either direction. When it is required to rotate in either direction the motor is provided with reversing gear or the shaft, *a*, is driven from the motor through a reversing clutch arrangement. The bevel pinion, *b*, is keyed to the shaft, *a*. The travelling or driving wheels' axle is in two parts, *c* and *c'*; to each part is keyed one of the travelling wheels. To the part *c* is keyed the element, *d*, of the differential or balance gear, which is preferably formed with spur teeth. To the part *c'* of the axle is keyed the spur pinion, *e*, and freely on the axle is mounted a carrier or disc, *f*, upon which are mounted a stud or studs. Each stud carries a spur pinion which gears with the teeth, *d'*, of the element, *d*, and the teeth, *e'*, of the element, *e*, at the same time.

The element, *d*, of the balance gear is provided with a flanged rim, *d''*, fitted with a band brake, *x*, of ordinary construction, the band of which is fixed at one end, *x'*, Fig. 2, to the structure carrying the gearing, and at the other end is attached to any suitable lever arrangement by which it can be drawn tightly round the flanged rim. By so gripping this part of the balance gear, the travelling wheel fixed to the part, *c*, of the wheel axle can be braked. The part, *c'*, of the axle to which is fixed the second travelling wheel, is also provided with a flanged rim or pulley, *g*, fitted with a brake band, *x*, operated in a similar manner. The two brake bands are preferably so coupled together by rods and levers that they operate in unison.

The elements of the epicycloidal train are arranged that the angular speed of the last or driven element, *f*, has the lowest value. The element, *f*, forms the carrier for the planet wheel, *h*. Preferably three planet wheels are arranged round the disc, *f*. Each planet wheel, *h*, is carried upon a stud, *h'*, fixed to the disc, *f*, preferably by a screwed nut, *h''*. The element, *i*, or sun wheel of the epicycloidal train is mounted free upon the part, *c'*, of the axle and has a long sleeve, *e''*, at the end of which is keyed a flanged brake pulley, *j*, fitted with a suitable band brake, *x*, similar to those fitted on the flanged rims, *d''*, and *g''*, or other suitable known form of clutch, and by which it may

be prevented from rotating or checked to the desired extent. The element, *k*, of the epicycloidal train is preferably mounted upon the sleeve, *c*<sup>2</sup>, so as to revolve freely thereon. It is also provided with a flanged rim, *k*<sup>1</sup>, and a band or other friction brake by which it may be held stationary or allowed to revolve at will. The internally cut teeth, *k*<sup>2</sup>, are in gear with the pinion or planet wheels, *h*. A clutch box, *l*, is also formed on the element, *k*, by which it is rotated. A sleeve, *m*, provided with clutches, *m*<sup>1</sup> and *m*<sup>2</sup>, is mounted upon the sleeve, *c*<sup>2</sup>, and is provided with a shipping collar, *m*<sup>3</sup>, and forked shipping lever, *m*<sup>4</sup>. The sleeve, *m*, is fixed so as to rotate with the sleeve, *c*<sup>2</sup>, by the key or feather, *m*<sup>5</sup>, but is capable of a sliding movement in the line of the axle or shaft, *c*<sup>1</sup>, spaces, *m*<sup>6</sup> and *m*<sup>7</sup>, being provided as clearance. Upon the sleeve, *m*, are loosely mounted two toothed bevel wheels, *n* and *o*, in gear with the toothed bevel pinion, *b*. Each of these bevel wheels is provided with clutch boxes, *n*<sup>4</sup> and *o*<sup>1</sup>. A clutch, *n*<sup>1</sup>, is also keyed to the boss of the wheel, *n*, to rotate therewith but free to slide lengthwise thereon. This clutch is provided or formed with a shipping collar, *n*<sup>2</sup>, and shipping forked lever, *n*<sup>3</sup>. In order to keep the bevel wheel, *o*, in gear with the pinion, *b*, a collar, *p*, is fitted loosely upon the end of the boss of the bevel wheel, *o*. A similar loose collar, *j*<sup>3</sup>, is also fitted upon the boss, *j*<sup>1</sup>, of the pulley, *j*, the two collars are fixed together by rods, *p*<sup>1</sup>, passing through openings formed in the collar, *m*<sup>3</sup>. The shipping levers, *n*<sup>3</sup> and *m*<sup>4</sup>, are fixed to rods, *q*, which are moved by hand levers or

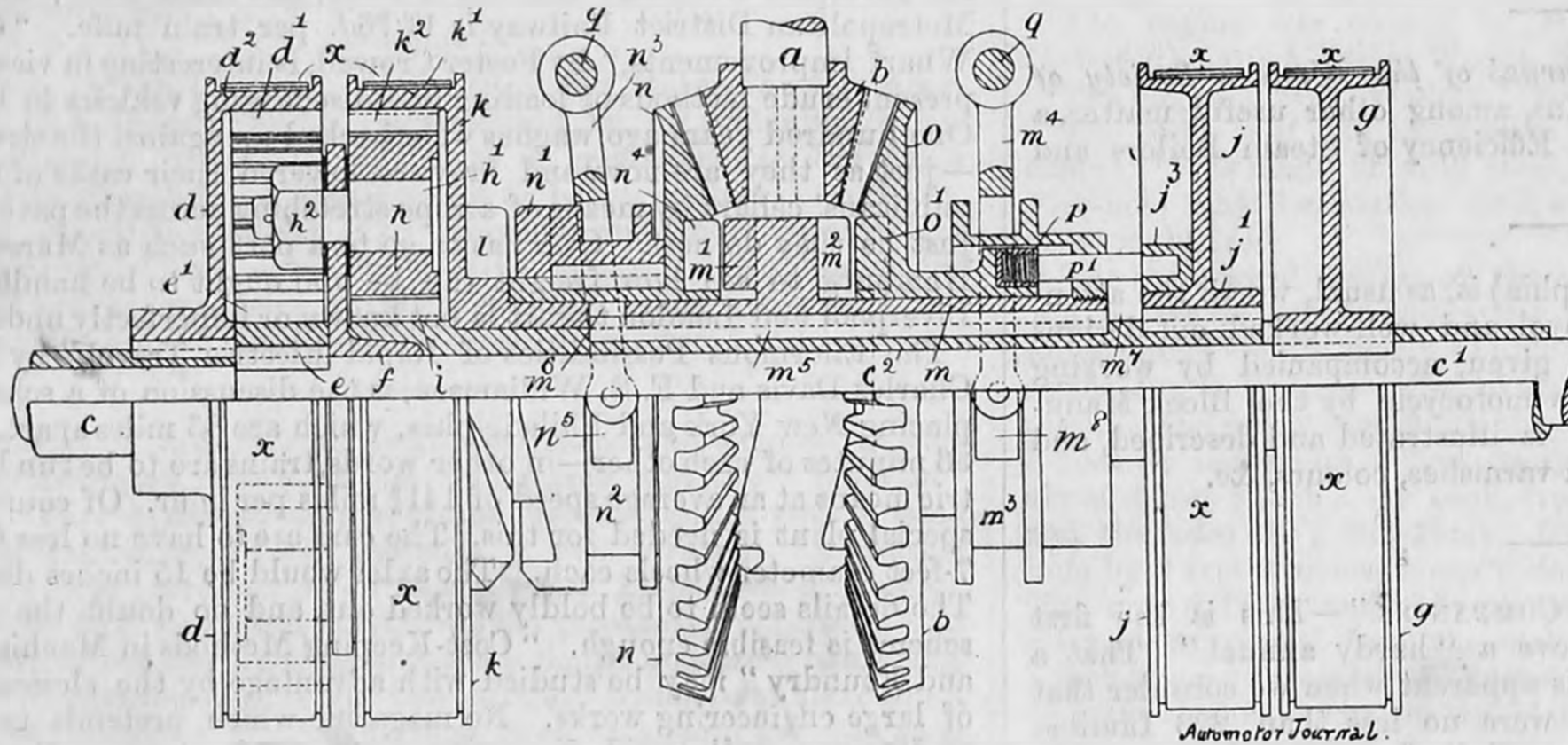
angular speed to produce certain reduced angular speeds in the travelling wheel or wheels of a vehicle in both directions substantially as described and illustrated in the drawing.

The specification is numbered 19,559 of 1896.

## LAW REPORTS.

J. R. FREEMAN, of J. R. Freeman and Sons, cigar manufacturers, Hoxton, was, at the City Summons Court, on November 5th, fined 10s., including costs, for causing a motor-van to be used without having the name and address of the owner painted on it according to law.

ON the 10th inst., before Mr. Justice Wright, sitting as an additional Judge of the Chancery Division for the purpose of hearing petitions for the winding-up of companies, a petition was presented by Mr. E. R. Evans, a shareholder, for a compulsory order to wind up the Ward Electrical Car Company (Limited). The Company was formed in 1888. It had, said counsel, never done any business, never owned any omnibuses, nor had any commercial existence.



IMPROVED DIFFERENTIAL GEAR.—FIG. 1.

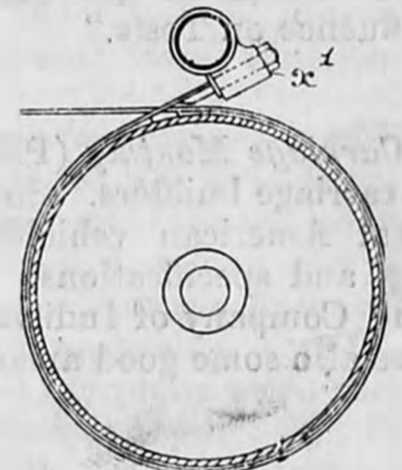


FIG. 2.

equivalent means. The clutches, *n*<sup>1</sup>, *m*<sup>2</sup>, and *m*<sup>1</sup>, and the corresponding clutch boxes, *l*, *n*<sup>4</sup>, and *o*<sup>1</sup>, are formed in the case illustrated to drive each in one direction only, but in other cases when the same speeds are required when travelling in either direction the clutches and clutch boxes are formed accordingly. Sliding boxes, *m*<sup>8</sup> and *n*<sup>5</sup>, are disposed in the grooves of the shipping collars, *m*<sup>3</sup> and *n*<sup>2</sup>, and the forked ends of the shipping levers, *m*<sup>4</sup> and *n*<sup>3</sup>, are pivoted to them. Also when the element, *k*, is free to rotate through its brake drum, *k*<sup>1</sup>, not being clutched and the element, *i*, is driven through the clutch, *m*<sup>1</sup> or *m*<sup>2</sup>, being in gear with the bevel wheel, *n* or *o*, or when the element, *k*, is driven through its clutch, *n*<sup>1</sup>, and the element, *i*, is free to rotate through its brake drum, *j*, not being clutched, the gearing may rotate without communicating motion to the shaft or axle, *c*<sup>1</sup>. If, however, the elements, *k* and *i*, be clutched to the bevel wheel, *n*, so as to rotate therewith an aggregate speed in the disc, *f*, or the same as that of the bevel wheel, *n*, is obtained; but by clutching the element, *i*, to the bevel wheel, *o*, so as to rotate therewith a certain differential speed of the disc, *f*, is obtained. According to this arrangement of gearing two further different speeds of the disc, *f*, in one direction can be obtained, first by clutching the element, *k*, to the bevel wheel, *n*, and fixing the element, *i*, by its brake drum, *j*, and, secondly, by clutching the element, *i*, to the bevel wheel, *n*, through the clutch, *m*<sup>2</sup>, and fixing the element, *k*. Also the disc, *f*, can be made to rotate in the opposite direction by fixing the element, *k*, and clutching the element, *i*, to the bevel wheel, *o*. It is obvious that in some cases the balance gear can be dispensed with, as when one travelling wheel only is driven, in which case the element, *f*, is fixed directly to the hub or axle.

The claim made by the inventor is the improved construction of gear for transmitting the motion of a shaft rotating at a uniform

There was no opposition, and his lordship made the necessary order for winding up the Company.

THE petition of Messrs. J. K. and R. Lord for an order for the compulsory winding-up of New and Mayne (Limited), of London, electrical engineers, was before Lord Justice Vaughan Williams recently, in the Companies' Winding-up Court. Mr. Baker appeared for the petitioners, and explained that they were judgment creditors for £159 11s. He had received support for the petition from eight other creditors, but no notice of opposition, except from the liquidator and the debenture-holders. Mr. Hamilton, who appeared for the liquidator, asked that the petition should stand over until there had been held a meeting of the creditors to consider a scheme of arrangement. The liquidator would show that if there was a forced sale of the property, the unsecured creditors and the shareholders would receive nothing; whereas if the scheme of reconstruction were entered upon, not only the creditors would be paid, but the shareholders would also benefit. The further hearing of the petition was then adjourned until the first petition day after November 10th.

ON the 8th inst., at Highgate Police Court, Bernard Boverton Redwood, residing at Slewathen, Ballard's Lane, Finchley, was charged on a summons with driving a light locomotive—viz., a motor-tricycle—and refusing to stop when called upon to do so by Police-constable Coe, 101 S. Mr. Paterson, solicitor, defended. Coe deposed that at 12.30 p.m. on Sunday, October 24th, he was on duty in Ballard's Lane, Finchley, when his attention was called to a horse attached to a landau which had bolted down the lane. He succeeded in bringing it to a standstill, and was trying to quiet the

animal down when the defendant approached from behind on a motor-tricycle. Witness held up his hand and called on defendant to stop, but he took no notice, and, in passing the horse, frightened it again. Jonathan Hunt, a coachman, said that he was engaged to take a customer home from chapel on the day in question. He was waiting outside the chapel when defendant passed him on a motor-tricycle. His horse was frightened, but, notwithstanding that, he passed him four times. The fourth time the motor-car caused the horse to bolt. The policeman and a man named Bell stopped the horse, after the horse had smashed the fore-carriage of the landau. Whilst the horse was being held by Coe the defendant rushed by again, and refused to pull up when called upon to do so by the policeman. Dr. Orton told defendant that the full penalty was £10, but, as this was the first case of the kind brought before the Court, the defendant would be fined 20s. and costs only.

## REVIEWS OF BOOKS.

WE have received No. 1 of Vol. XVII of *The Indiarubber World*, which abounds in well-written matter of great interest to trade readers.

WE have also received the *Journal of the Western Society of Engineers of Chicago*, which contains, among other useful matter, a paper on "Causes of the Variable Efficiency of Steam Boilers and their influence on Tests."

*The Carriage Monthly* (Philadelphia) is, as usual, worth the attention of carriage builders. Some novel and well-worked out designs of typical American vehicles are given, accompanied by working drawings and specifications. A new motorcycle by the Block Manufacturing Company of Indianapolis is illustrated and described, and there are also some good articles on varnishes, colours, &c.

"BIRCH'S MANUAL OF CYCLE COMPANIES."—This is the first edition of what will doubtless prove a "hardy annual." That a good work of this kind is needed is apparent when we consider that at the time of publication there were no less than 223 Limited Companies, having an authorised capital of £30,000,000, engaged in the cycle industry. At the present time this amount has been largely increased by the formation of other Companies. The work before us comprises a list of companies, giving the names of directors, officers, capital, dividend, &c. This is accompanied by an index, so as to facilitate reference. There is also a chronological list of registrations, and a directory of directors' officials. A chapter is devoted to the law of cycles and motor-vehicles, and another to patents. The imports and exports of, and duties levied on, cycles and their component parts follows, and a copious index concludes the volume. The work is well arranged, and the printing, &c., excellent; but the list of motor companies is sadly deficient.

*The Thames Ironworks Quarterly Gazette*.—This quarterly is to hand, and, as usual, it abounds with instructive matter for all connected with nautical automobilism, but is more interesting to those connected with the great shipbuilding works on the Thames. There is a good account of the career of the unfortunate H.M.S. "Captain," contributed by that veteran naval designer, Mr. G. Mackrow, who has, next to Sir W. H. White, designed more warships than any other man living, and remarkably good ships they have proved themselves to be. This gentleman also describes the final departure of his latest creation, the Japanese battleship "Fuji," and excellent photographs of this vessel and the "Captain" are given. A good picture is that of the Queen reviewing the Baltic Fleet in 1854 from the yacht "Fairy," also built at this historical shipyard. It is not generally known that this Company, the "Thames (Limited)," as it is usually designated, is a centre of light in the East End. Mr. A. Hills, the chairman, is a model employer, and strikes are unknown under his rule. There are science classes and cricket and football clubs in connection with the works, while the encouragement of thrift is a great feature. Savings-bank, medical, and other clubs,

are established, to which all have to belong. We have only one wish for the "Thames (Limited)," and that is, may its yard be full of work!

*The Engineering Magazine* for October contains no less than ten original articles on subjects which are just now largely occupying the attention of the capitalist, the engineer, and the general public. Professor Geo. Forbes discusses the problem of electric power for trunk-line railways. After referring to some early American lines, the professor says:—"It can be proved that if the railway companies of Scotland were to combine to work their trunk lines by means of electric locomotives, the electric current being developed by the water power which exists in that country, then the whole of that service might be carried on without the use of steam locomotives." This is a direct statement, and no doubt Professor Forbes has not made it without due consideration. If we accept it, then it follows that the Scottish railway directors are neither studying the interests of their shareholders nor the public. Few people are more conservative than railway and tramway directors, and they really seem to think that a locomotive and a two-horse tramcar represent the most perfect means of locomotion. As showing the advantages of electric traction, Professor Forbes gives the following particulars:—The cost of running the City and South London Electric Railway is 6.48d. per train mile; that of running the Liverpool Overhead Railway is 3.84d. per train mile; while the Metropolitan District Railway is 11.76d. per train mile. "Modern Wharf Improvements," by Foster Crowell, is interesting in view of the present crude methods of loading and discharging vehicles in London. One hundred years ago wagons were backed up against the street kerb—just as they are now, and brewers lowered their casks of ale into publicans' cellars by means of a rope stretching across the pavement—just as they do now. One has to go to a port such as Marseilles or Hamburg to see how freight can be and ought to be handled. In Liverpool and London the art is not known or imperfectly understood. "The Enormous Possibilities of Rapid Electric Travel," by Messrs. Charles Davis and F. S. Williamson, is the discussion of a scheme for placing New York and Philadelphia, which are 85 miles apart, within 36 minutes of each other—in other words, trains are to be run by electric means at an average speed of 141½ miles per hour. Of course, very special plant is needed for this. The cars are to have no less than 12 7-foot diameter wheels each. The axles would be 15 inches diameter. The details seem to be boldly worked out, and no doubt the general scheme is feasible enough. "Cost-Keeping Methods in Machine Shop and Foundry" may be studied with advantage by the clerical staffs of large engineering works. No magazine which pretends to be up to date can well avoid discussing Klondyke, and under the title of "Exploring and Exploiting a Gold Country," this new El Dorado is described by Mr. Albert Williams. From this we learn that gold mining is by no means the easy digging that many imagine. "Progress in the Perfection of the Rock Railway," by Mr. E. L. Cortholl, gives a succinct account of the various mountain railways in existence, principally in Central Europe. "The District Distribution of Energy," by Mr. Chas. Emery, is an account of the steam supply to the public in New York, but no new developments are mentioned. "The Esthetic (sic) Treatment of Engineering Work," by H. Heathcote Statham, has already been criticised in the engineering Press. The author's ideas may be gathered from his opinion of the Tower Bridge:—"It is the most terrible and monstrous piece of sham ever erected." As our readers know, this bridge is really a steel cantilever and suspension structure clothed in a masonry garb. If, as Ruskin, Carlyle, and other teachers have it, truth is the basis of all art then, and we agree with Mr. Statham, his strictures are merited. The Forth Bridge, in its naked simplicity, is a noble thing. Clothe the central towers in masonry as was proposed so as to make it harmonise with its environment (to use the spurious art jargon), and it would be, as Carlyle would say, a sham. We are glad that Mr. Statham has entered his protest against this kind of thing—it is badly needed at present, when it is deemed necessary that the latest railway coaches on the London and North-Western Railway and Great Western Railway shall resemble as much as possible the obsolete mail coach of 50 years ago. A very different subject is "Ericsson's First Monitor and the Later Turret Ships," by Geo. L. Fowler. This is a readable and well-illustrated article, but the writer, with pardonable patriotism, makes the common mistake of attributing the invention of the turret to Ericsson, whereas it was that of Captain Cowper Cowles who practically demonstrated the advantages of the turret in the Crimean War of 1854, whereas Ericsson's "Monitor" did not appear till 10 years later.

## CATALOGUES.

WE have received from the Pope Manufacturing Company, of Hartford, U.S.A., a handbook containing directions for the care and advantageous operation of their motor carriages. This contains many useful hints to those who own or operate any kind of electric automotor vehicle. The value of the work would be enhanced if it were accompanied by drawings showing the connections, &c.

AMONG the more successful designs of gas-engines the "Forward" occupies a deservedly high place both for excellence in construction and economy in consumption. Messrs. T. Barker and Co., of Birmingham, have sent us their catalogue, which gives full particulars of this motor, the indicator diagrams being specially interesting. We note the consumption is as low as 21.9 cubic feet per B.H.P.

M. Th. CAMBIER, of Lille-Saint-Maurice, a well-known manufacturer of automotor vehicles and launches, sends us his catalogue of motors, &c. He makes six distinct types of vehicles, ranging from the "Duc à two places" to the "Diligence à 18 places," all operated by horizontal petrol motors. The information given is, however, of a very general kind, and hardly sufficient to decide an intending purchaser.

JUDGING by the price list to hand of the Motor-Car Company, 15, Red Lion Square, W.C., there should be no difficulty in the public obtaining practically any type of motor-vehicle for which they may be in search. There appears to be every class of machine, new and second-hand, from £30 upwards, and the Company are also prepared to deal upon the "Hire System." No doubt the Company are endeavouring to fill the usual "long-felt want," and their example should speedily find a host of imitators.

THE names of Edison and Swan are inseparably connected with the practical introduction of electric lighting, and the "Ediswan" Company have taken advantage of the present Jubilee year to issue a special catalogue, which includes a well written "Historical Review of the Introduction of the Electric Light into England," prefaced by an "Historical Review of the Company." There is also an interesting chapter upon incandescent lamps and their use. The Ediswan Company claim to be the only one which manufactures a lamp right through. From the prices given we should say that good incandescent lamps are now within everyone's reach.

WE have received from Messrs. Measures Brothers, the well-known iron and steel merchants of Southwark, a large sheet containing full-sized sections and dimensions of angle, tee-iron, channel, and other bars; also a handsome little pocket book, forming a useful catalogue of iron and steel work in general. Steel is now largely employed in situations in which a few years ago it was unknown; for instance, in building construction, steel girders and cast-iron columns have entirely replaced masonry and timber. Similarly, for railway carriages, trucks, and carriage work generally, steel is replacing timber. For motor-wagons it seems to us a *sine qua non* to use steel channels or angles for the frames.

THE Electrical Power Storage Company's latest catalogue is of special interest just now, having regard to the large use of secondary batteries for motor-vehicle propulsion. This Company has succeeded in producing a cell which, so far, has given every satisfaction for this purpose. This cell is, we learn, the joint production of M. Faure, the original inventor of the secondary cell, and Mr. F. King, the Company's manager. It is fully described in the catalogue, as are the other cells made by the Company. The business in secondary batteries is really a very large one. Central stations can hardly be said to be properly equipped without a large amount of current stored in cells. And now that electric vehicles are becoming common, the E.P.S. Company will, we are sure, have a prosperous career. This catalogue is excellently got up, and printed on very superior paper.

MESSRS. ROBESY AND CO., of Lincoln, made a reputation very many years ago as manufacturers of high-class motors, and have steadily

increased this by keeping well abreast of every modern improvement. In their latest catalogue, which by the way is a fairly thick, well printed, and copiously illustrated book of 150 pages, is an interesting account of their vast works. We note that Messrs. Robey make everything about their engines except the iron ore, and no doubt they would make this if they could, and so be quite independent. As regards their various types of motors, these are so well known and appreciated both by farmers and central station engineers—to mention two extreme classes of customers—that it is not necessary to say anything of them. We note that Messrs. Robey do not manufacture traction engines, and that they rate their boilers by nominal horse-power—a vague and meaningless term. On the other hand, the principal point of excellence about this catalogue is that dimensions, weights, &c., are given not only in British units but also in metric units, a great convenience to the foreign buyer. Manufacturers would do well to imitate Messrs. Robey in this respect.

## EXPLOSION OF A TRACTION ENGINE.

THE following is an excerpt from the official report of an inquiry held under the Boiler Explosions Acts, as to the cause of an explosion of the boiler of a traction engine that occurred on June 14th, while the engine was going from Netherton to Halesowen.

The engine was owned by Messrs. H. and T. Danks and Co. (Limited), Crown Boiler Works, Netherton.

The engine driver, William Thomas, was scalded.

The boiler is of the locomotive type, and forms part of a traction engine. It is made of mild steel, with the following exceptions:—Fire-hole ring, foundation ring, and internal stays, which are made of wrought iron.

The cylindrical portion of the shell is 2 feet 6 $\frac{3}{4}$  inches in diameter and 5 feet 5 $\frac{1}{2}$  inches long; the shell plates are  $\frac{3}{8}$  inch thick, the longitudinal joints being double riveted and the circumferential seams single riveted. The rivets are  $\frac{3}{8}$  inch diameter and 1 $\frac{1}{2}$  inches pitch. The mean length of the outer shell of the firebox is about 3 feet 4 $\frac{1}{2}$  inches by 2 feet 8 $\frac{1}{2}$  inches mean width, and its height about 4 feet  $\frac{3}{4}$  inch; the back, front, and top plates are  $\frac{3}{8}$  inch thick, and the sides are  $\frac{1}{2}$  inch thick. The firebox is about 2 feet 11 inches long by 2 feet 3 inches mean width, and it is about 3 feet in height. The crown, front, and side plates are about  $\frac{3}{8}$  inch thick, and the sides are supported from the shell by 42 screwed and riveted stays,  $\frac{7}{8}$  inch diameter, made of Yorkshire iron, and pitched 4 inches by 4 $\frac{1}{4}$  inches apart. The crown plate is supported by 35 stays about  $\frac{7}{8}$  inch diameter, which are screwed into the plate and fitted with nuts. The ends of the boiler are supported in the steam space by longitudinal stays attached to tee-iron brackets. The tube plates are  $\frac{9}{16}$  inch thick; the one at the smoke-box end of the boiler is flanged to meet the shell, the other is also flanged and forms the back plate of the firebox; 41 tubes, 2 inches diameter and 12 B.W.G. thick, made of wrought iron, are fitted. The barrel is connected to the firebox "throat plate" by a single riveted joint. The mountings of the boiler consist of:—One pressure gauge, one glass water gauge, two test cocks, three blow-off cocks, four mud doors, one manhole door, two feed check valves, one filling plug, one fusible plug, two safety valves, 1 $\frac{1}{2}$  inches diameter, loaded by springs to 140 lbs. per square inch.

The traction engine was built in 1892 by Messrs. John Fowler and Co., Leeds. No big repairs have been necessary, but a new internal feed pipe was fitted about six months previous to the explosion. The boiler was not insured; it was inspected periodically by Mr. Joseph Jewkes, foreman fitter to the owners of the engine, Messrs. H. and T. Danks and Co., and the last inspection was made on the 1st July, 1897.

The cause of the explosion was that the thread on the feed pipe gave way, and the check valve was blown off, steam and water escaping with great force through the orifice, and this was brought about by the defective condition of the thread upon the feed pipe.

### General Remarks.

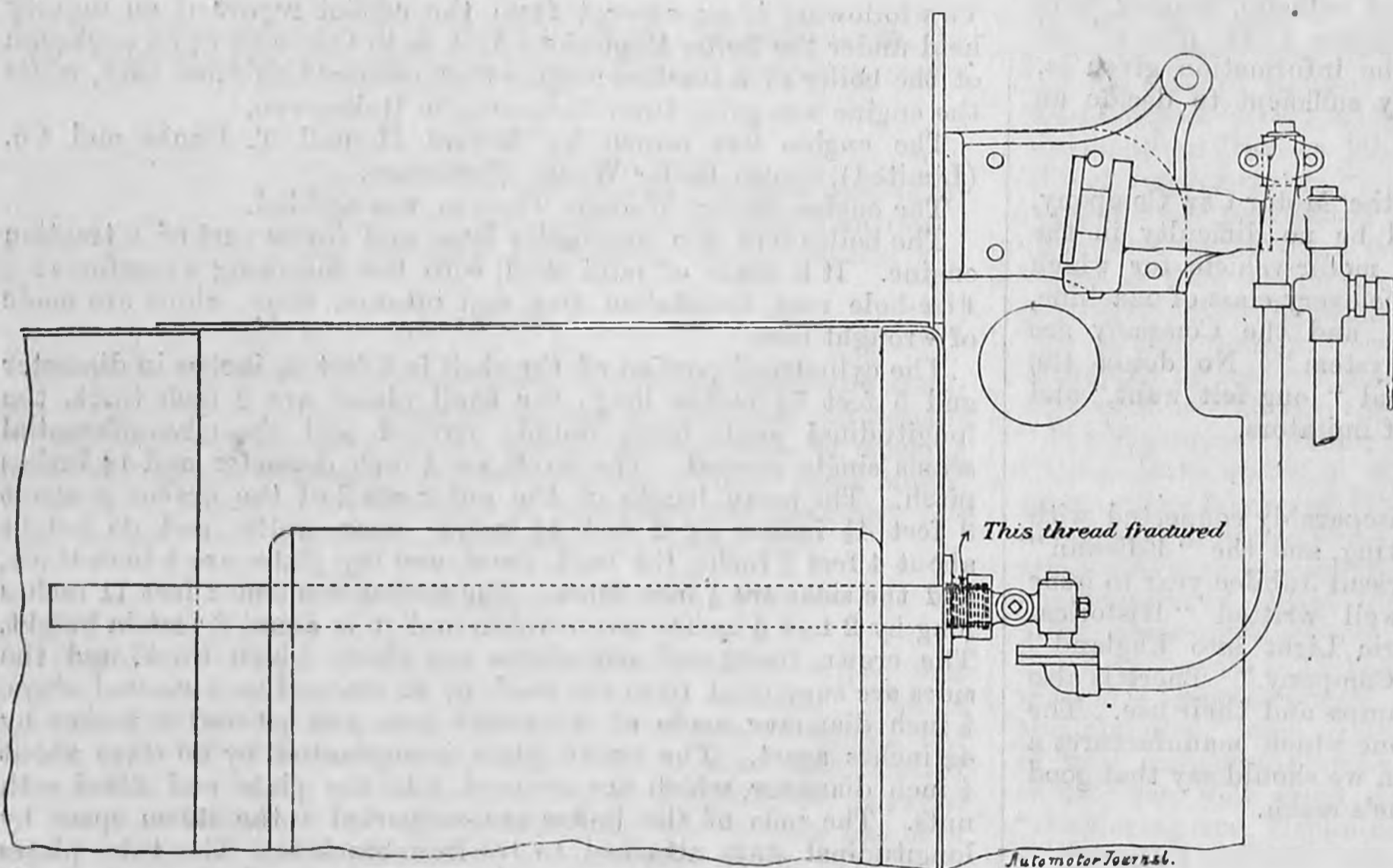
The pipe which gave way was fitted to the boiler six months previous to the explosion on account of the internal part of the old pipe being split, the screwed part, it is said, being in good condition; the new pipe was made of iron, and was 2 $\frac{3}{8}$  inches outside diameter, and  $\frac{3}{16}$  inch thick, screwed at one end for a length of 2 $\frac{1}{2}$  inches, with 11 threads to the inch; this end is screwed through an iron plate riveted to the boiler front, and projects 1 inch; to this projecting

part the check valve is screwed, and a joint is made between the nut on the valve chest and the plate on the boiler front; the remainder of the pipe, 3 feet 6 inches long, acts as an internal feed pipe.

The rough work that these engines do, and the vibration set up by their passage over bad roads, necessitates the constant overhauling of the machinery. Messrs. H. and T. Danks and Co. give instructions to their drivers that in case of any repairs becoming necessary, a report is at once to be made to the foreman fitter, who is responsible for doing what is required.

#### Observations of the Engineer Surveyor-in-Chief.

This explosion appears to have been caused by the failure of the thread of the feed pipe to which the check valve was attached. The joint of the valve was reported to be leaking, and was remade on the morning of the explosion, when the thread in question was observed to be defective, and it is said to have been arranged that a new pipe should be fitted, although no immediate danger was apprehended. The thread on the pipe appears, however, to have been in a worse condition than was thought, and its holding power proved to be insufficient to resist the vibration caused by the engine passing over rough roads.



Unfortunately one man was injured, and the case furnishes another illustration of the importance of insuring that the means by which all such fittings are attached to a boiler are in good condition.

THE electric tramway system of Montreal comprises 75 miles of track, traversed by from 170 to 200 motor-cars per diem; these cars run about 7,000,000 car-miles per annum, and carry in round numbers 30,000,000 passengers. The speed at which they travel through the streets is  $7\frac{1}{2}$  miles an hour, and the service is kept up, according to the requirements of the town, from 5 a.m. until 2 o'clock the next morning. The averages of some three years' operations of the power station are appended:—

Coal consumed per car-mile	....	....	7 lbs.
Coal consumed per ton-mile	....	....	1 lb.
Coal consumed per electrical horse-power	....	....	2.75 lbs.
Power consumed per motor-car mile	....	....	2,000 watt-hours.
Power consumed per ton-mile	....	....	293 "
Resistance to haulage per ton (draw-bar pull)	....	....	147 lbs.

ALL interested in automotors should join the Self-Propelled Traffic Association. Prospectus and full particulars can be obtained of Mr. Andrew W. Barr, Secretary, No. 30, Moorgate Street, London, E.C.—(ADVT.)

## CORRESPONDENCE.

\* \* \* We do not hold ourselves responsible for opinions expressed by our Correspondents.

\* \* \* The name and address of the writer (not necessarily for publication) MUST in all cases accompany letters intended for insertion or containing queries.

### THE ENFIELD STEAM CARRIAGE.

To the Editor of THE AUTOMOTOR AND HORSELESS VEHICLE JOURNAL.

DEAR SIR,—I have had great pleasure in reading your very able report upon the heavy self-propelled vehicles in France. It proves one thing: that an omnibus of four tons tare, carrying 20 persons, can be propelled 14.7 miles at the cost of 8d. for fuel, and if we say water and oil at one halfpenny, total 8½d.; it is therefore a little over one halfpenny per mile. The tanks hold 100 gallons, which would be sufficient for a journey of 23 miles.

Please compare the above with the vaunted economy of the spirit motor. Coventry Bollée, weight 3½ cwt., carrying two persons and a portmanteau, cost per mile said to be one halfpenny; Sterling motor, carrying three persons and 100 lbs. of baggage 100 miles, 4s. 7d., which is over one halfpenny per mile.

I wish to bring to your notice the splendid performance of the Enfield Steam Carriage which ran in the year 1849. Number of passengers on carriage, 50; average speed, 37 miles per hour; average consumption of coke per mile, 11.48 lbs., or under 1d. per mile. We must not forget our worthy friends, Messrs. Merryweather and Shand and Mason, who, I think, in the year 1862 stood a very severe trial at the Crystal Palace with their fire engines, 100 lbs. pressure of steam from cold water in 10 minutes 25 seconds in the one case, and 10 minutes 51 seconds in the other.

What a lot we have learned since the above periods when we are obliged to fit our warships with a French boiler.

That the De Dion and Bouton omnibus gave every satisfaction is a great credit to the designers, but to me there are some very grave errors in the construction, both in the vehicle and the boiler.—Yours faithfully,  
HENRY SPORTON.  
Enfield.

[Our correspondent must not forget that the more important advances in engineering science during the last 30 years have with few exceptions been of French or German origin. French boilers, viz., the "Belleville," Du Temple, Nielausse, and others are fitted in British warships simply because of their practical advantages. The De Dion boiler is in our opinion one of the most suitable boilers for road locomotion, as it provides the maximum of heating surface with the minimum of weight.—ED.]

### A WORD FOR ELECTRICITY.

To the Editor of THE AUTOMOTOR AND HORSELESS VEHICLE JOURNAL.

SIR,—Though it is not to be doubted that for heavy, long-distance traffic on common roads, steam-power will eventually be employed in some form or other, it must be admitted that for lighter work it is totally unsuitable. For steam machinery, with its numerous complications, skilled attendance is a necessity, and two responsible officials will always be required on a steam vehicle: one to drive and the other to attend to the boiler and engines; and for a small private vehicle this is quite out of the question. Where steam fails, however, there electricity may perhaps step in. Storage batteries

are terribly heavy, no doubt, and not suitable for extended journeys into remote wilds (at least, not at present), but against this manifest weakness on their part may be set the following theoretical advantages that are perhaps not impossible of practical attainment:—

1. The employment of wind and water power in country districts to charge cells automatically—a most important economy not involving great outlay.

2. The possibility of converting the motor into a dynamo while descending hills (instead of using a brake) and charging the cells, thus regaining some of the energy expended before in going up hill.

Then of course there are the admitted advantages of non-vibration, cleanness, absence of noisome products, and ease of manipulation. If, as suggested before, we suppose *three* pairs of wheels to be provided, we obtain double battery space with the same steering facility as in shorter vehicles, and the weight of the cells disposed symmetrically on both sides of the central driving axle. There is no reason, surely, why we should not make our "horseless" vehicles quite as long as the horse and cart which now dominate our roads.—I am, &c.,

A. J. A.

November 3rd.

[There is no reason why three pairs of wheels should not be employed. We have always maintained that the effective length of a horse-drawn vehicle is the distance between the nose of the beast and the tail board, and motor-vehicles should be at least as long as this.—ED.]

#### MOTOR-CARS AND THE LORD MAYOR'S SHOW.

To the Editor of THE AUTOMOTOR AND HORSELESS VEHICLE JOURNAL.

SIR,—My directors will feel obliged by your inserting the following correspondence, which has taken place between us and the Lord Mayor and Sheriffs Company. My directors naturally feel they have been treated unfairly.—Yours faithfully,

THE ELIESON LAMINA ACCUMULATOR CO. (Ltd.).

W. S. NAYLOR, Secretary.

4, Greenland Place, Camden Town, N.W.,

November 8th, 1897.

Lord Mayor and Sheriffs Committee, Guildhall, E.C.,  
October 21st, 1897.

DEAR SIR,

I am desired by Mr. Pannell to thank you very much for your letter and the photograph, and to inform you that upon full consideration the Committee do not see their way on the present occasion to include a motor-car of any description in the procession.

Yours faithfully,

W. S. Naylor, Esq.,

J. W. SANDY, Asst. Secretary.

Elieson Lamina Accumulator Co. (Ltd.).

On November 5th a printed circular to the following effect was received:—

Lord Mayor and Sheriffs Committee, Guildhall, E.C.,  
November 4th, 1897.

DEAR SIR,

I herewith enclose the Police instructions as to the time and place for your electric carriage to join the procession. Be kind enough to acknowledge the receipt, in order that I may be assured that all arrangements are completed, so far as you are concerned

Yours faithfully,

J. W. SANDY, Asst. Secretary.

The previous circular was acknowledged on the 5th instant, and the following letter was received on the 6th instant:—

Lord Mayor and Sheriffs Committee, Guildhall, E.C.,  
November 5th, 1897.

DEAR SIR,

A letter intended for someone else was posted to you last night in error. The letter contained a direction for an electric carriage to be in Coleman Street, on Tuesday next, to take part in the procession.

Please to understand that this letter was intended for someone other than yourself, and that, as you have been already informed, the Committee cannot use your motor-car on this occasion.

Yours faithfully,

The Secretary,

WM. H. PANNELL, Hon. Sec.

Elieson's Patent Electric Motor-Car Co.

#### THE BERLIN FIRE BRIGADE STEAM TRICYCLES.

To the Editor of THE AUTOMOTOR AND HORSELESS VEHICLE JOURNAL.

DEAR SIR,—In your October, 1897, issue, you say, on p. 15, that in Berlin the fire brigade employs steam tricycles. Will you be good enough to get us particulars of these to carry one and two persons, along with best cash prices to trade and illustrations, as we are open to buy if satisfactory, and take up agency to sell? Your kind attention will be much esteemed and oblige.

HARRISON AND CO.

Pocklington, October 29th, 1897.

[We would suggest to our correspondents that they write to the Berlin Municipal Authorities, and to the British Embassy, at Berlin. In both cases they will, we are sure, be given every information. They might also place themselves in communication with the nearest German Consul. Or again, they might communicate through their local Chamber of Commerce, or through the London Chamber of Commerce. We ourselves can hardly be expected to act as commercial agents for individual firms.—ED.]

#### LOAN OF LECTURE SLIDES.

To the Editor of THE AUTOMOTOR AND HORSELESS VEHICLE JOURNAL.

SIR,—Will you allow me to say that I shall be happy to lend my series of lantern slides of motor-carriages to any responsible individual for lecture purposes.

There is so much ignorance in some localities as regards this new means of locomotion that I hope lectures on the subject may be of some use.

My slides now number about 60, some unfortunately are rather thick, so a good light is necessary.

JOHN HENRY KNIGHT.

[We have much pleasure in giving publicity to our correspondent's offer, and quite agree that lectures such as he himself gave recently at the Camera Club would be of distinct educational value in the country districts.—ED.]

#### DESIGN OF STEAM MOTOR.

To the Editor of THE AUTOMOTOR AND HORSELESS VEHICLE JOURNAL.

DEAR SIR.—As a constant reader of your interesting paper, I should be pleased to hear if you could help me with a steam motor-car I am having built here.

1. Can you give me address of maker of oil (paraffin) burners?

2. Is there any suitable condenser made for steam cars, and who should I apply to for design?

3. The car I am building is to have four wheels—ought the power be applied to the front or the back pair? which would give the most hill-climbing power?

Any information you can give me will be gratefully received.—Yours truly,

LOUIS KNOHLAUCH.

Leith, November 2nd, 1897.

[(1) and (2). Apply Liquid Fuel Engineering Company, Cowes, Isle of Wight; also to Thorneycroft's, Chiswick. (3) The power should be applied to the after-wheels.—ED.]

#### WANTS AUTOMOTOR VEHICLES.

To the Editor of THE AUTOMOTOR AND HORSELESS VEHICLE JOURNAL.

DEAR SIR.—I am badly wanting to find the very best motor carriages for a foreign country, to carry two, three, or more tons slowly. Also light motor-cars and tricycles of the very best kind. I have heard of a foreign motor tricycle, said to be perfect, and of which there are some half-dozen in England, or coming, but I cannot trace them.

If you can help me by advising me where to apply please do so, or by sending me any copy or copies—back numbers of JOURNAL—which give the requisite information please send them, and I will send the money for them by return of post.—Yours faithfully,

Bexley, November 2nd, 1897.

F. I. COOKE.

[We could not advise as to the "best" or "very best" motor vehicle. Most of the better-known makes of motor vehicles advertise

in our columns, or, if our correspondent can wait till our Diary for 1898 is issued, he will find therein a very complete directory of makers, &c. Copies have been sent as requested.—ED.]

#### THE VALUE OF ADVERTISEMENTS IN "THE AUTOMOTOR JOURNAL."

To the Editor of THE AUTOMOTOR AND HORSELESS VEHICLE JOURNAL.

DEAR SIR,—Please continue my advertisement this month and until further notice.

I am pleased to inform you I have received 165 answers up to now from the last advertisement, some of them from important business people whom I had previously no idea were in any way interested in motor-cars.

Wishing your much-appreciated journal continued success, I remain, yours sincerely,  
F. FRENZEL.  
November 10th, 1897.

#### FLASHING BOILERS.

To the Editor of THE AUTOMOTOR AND HORSELESS VEHICLE JOURNAL.

SIR,—I duly received No. 1, Vol. II, of the AUTOMOTOR, &c., JOURNAL, and sent P.O. and stamps (6s. 6d.) in payment of the remaining numbers, and 7d. for a copy of the "A. and H. V. Handbook."

Can you give me any information about flash boilers?—Yours truly,  
ALEX. DOUGLAS.

Stranraer Foundry, Stranraer, N.B.

[The flash boiler, which is an old English invention dating from 1736, depends upon the principle of supplying a large excess of sensible heat to a very small quantity of water enclosed in a very strong chamber whereby the evaporation is instantaneous. In practice very thick tubes, 39-inch to 45-inch thick, are flattened or curved to a U section till the internal space is about 125 inch in width. The tube is heated to about 800° to 900° C. (a red heat). Water is injected into the thin lamina-like space, and is instantaneously converted or flashed into steam. The pressure depends upon the heat supplied directly, and upon the quantity of water injected inversely. The best-known form of flash boiler is the Serpollet. This system has often been described in the technical journals, and a good account of it will be found in "Farman's Auto-Cars" (Whittaker and Co.). We shall in a near issue describe the Serpollet tramway system as used in Paris.—ED.]

#### A VARIABLE SPEED GEAR.

To the Editor of THE AUTOMOTOR AND HORSELESS VEHICLE JOURNAL.

SIR,—If I can produce a variable ratio and reversing gearing capable of reversing or varying the ratio from maximum to minimum in either direction from a motor running constantly in one direction, are you open, or can you tell me of anyone who would be, to negotiate for the patent rights in the same?

The variation is positive, and is not affected by the uncertain slip of a brake (although adaptable to that).

The whole of the operations of starting, stopping, reversing, or varying the ratio are controlled by one handle.

The gearing may be adapted to serve as anti-friction bearings for the shaft or wheel to which it is applied; and it is almost impossible for the motor to stop through being overloaded, as in one form the ratio is altered by the load itself when too great. There is scarcely any loss by friction in the gearing; I should say about as much in the entire gear as there is in a ball bearing.

It may be used either as tooth or friction gearing, or both. It will transmit a good power as friction gearing, because of the large number of contact points we are able to provide by this arrangement.

An exhaustive search has not found any anticipation.

Several cycle makers and engineers who have seen it pronounce it to be just what is wanted, and are negotiating for licences at varying royalties, but I want to get an influential gentleman who could put the thing on the market properly to take it up before accepting their offers of 5s. per gear.

The chief objection to all friction gears has been that the whole of the power has to be transmitted through one, or at most two, points of contact. I can use 20 or 30, or more.

Another fault is, so much pressure must be put on the bearings to give sufficient grip that the metal crushes, and also a lot of power is lost through friction in the bearings, due to the excessive pressure. Mine has none of these objections.—Yours respectfully,  
5, Strand, Southampton. W. WOOLIDGE.

[A good variable speed gear has undoubtedly a large field for employment. We could not take steps to negotiate any business matter, but no doubt the publication of your letter will cause some of those interested to communicate with you.—ED.]

#### THE DURYEY MOTOR.

To the Editor of THE AUTOMOTOR AND HORSELESS VEHICLE JOURNAL.

SIR,—Can you tell your readers what has become of the Duryea motor-car? After seeing the excellent running of these American cars on the trip to Brighton last year, one is surprised not to see them more in evidence here.

A report has been whispered that the inventor was bribed by another firm or rival company to take his ingenious vehicle back to the States. Perhaps you can tell me if there is any truth in the report. I enclose my card.  
N. Y. T.

November 2nd.

[We have no knowledge of the "bribery" mentioned by our correspondent. The Duryea motor-car was temporarily in the hands of Mr. McKim, of Cannon Street, who was adjudicated bankrupt some little time back, since which this car seems to have dropped quietly away. We believe, however, that a personal representative of the Duryea Company has for some months past been in England in connection with introducing the car to the British public, and no doubt he has carried on active negotiations with various people to that end, the result of which we shall probably see presently.—ED.]

#### THE AUTOMOBILE CLUB OF FRANCE AND THE SELF-PROPELLED TRAFFIC ASSOCIATION.

THE following letter has been received from Mr. Andrew W. Barr, the Secretary of the Self-Propelled Traffic Association, and we have very much pleasure in giving it publicity in our columns:—

To SIR DAVID SALOMONS, BART., President of the Self-Propelled Traffic Association.

November 4th, 1897.

DEAR SIR,—I have the pleasure to inform you that at a meeting held yesterday, the Committee have finally appointed the Self-Propelled Traffic Association to represent the Automobile Club de France in Great Britain.

This step has been taken both as an acknowledgment of the interest of which you have given us so many proofs, and as a mark of sympathy with the Association over which you preside, and whose members include so many distinguished elements with whom we are happy to be identified.

As a result of this decision the members of your club when staying in Paris may, upon the written request of the President of the Self-Propelled Traffic Association, have extended to them for the time being all the advantages enjoyed by our colleagues of the Automobile Club of France.

Such members will receive for the purpose a personal card of invitation, signed either by myself or by a member of the Council of Administration.

Yours, &c.,

BARON DE ZUYLEN DE NYEVELT.

HA hirdetök irják kérünk a "THE AUTOMOTOR AND HORSELESS VEHICLE JOURNAL" gondolni.

FOR the Irish and Scotch Regulations of Motors, see THE AUTOMOTOR AND HORSELESS VEHICLE DIARY AND POCKET-BOOK for 1897, which contains over 100 pages of information. Price 6d.; post free, 7d., of Messrs. F. King and Co., 62, St. Martin's Lane, London, W.C.

PROCEEDINGS OF TECHNICAL SOCIETIES.

Mechanical Propulsion on Canals.\*—(continued.)

It is important to know how the resistance of the same boat, loaded to the same draught, alters in passing from a canal of one section to a canal of another. Some experiments upon this point were made in 1894, of which the following is a brief account. It may be premised that the ratio  $n = \frac{\Omega}{\omega}$ , which the wetted section  $\Omega$  of the canal bears to the immersed midship section  $\omega$  of the boat, obviously cannot sink below unity; and also that, the more nearly the ideal conditions of smooth water are approached, the more nearly does the ratio  $n = \frac{\Omega}{\omega}$  approach infinity. As a limit, therefore, it may roughly be said in a general way that, when  $n = \frac{\Omega}{\omega} = 1$ ,  $\frac{R}{r} = \infty$ ; and when  $n = \frac{\Omega}{\omega} = \infty$ ,  $\frac{R}{r} = 1$ . In Table 7 is given the values of the ratio of sections  $n = \frac{\Omega}{\omega}$  and of the ratio of resistances  $\frac{R}{r}$ , obtained from experiments made with the "Jeanne," a boat of the "Flûte" class, 99 feet long and 16.44 feet wide, towed in the River Seine and in four different canals, with draughts of 3.28 and 4.27 and 5.25 feet, and at speeds of 0.82 to 4.10 feet per second or 0.56 to 2.80 miles per hour. In the River Seine, where the minimum value of the ratio  $n = \frac{\Omega}{\omega}$  was not less than 72.5, the ratio  $\frac{R}{r}$  which the resistance  $R$  in a canal bears to the resistance  $r$  in a river, can without appreciable error be taken as 1.00. From Table 7 it will be seen that, with a draught of 4.27 feet and at a speed of 2.46 feet per second or 1.68 mile per hour, the ratio  $\frac{R}{r}$  of the resistances of the "Jeanne" is only 1.38 in the Dérivation de Joigny, where the ratio  $n$  of sections attains a value of 6.39; while in the Canal du Nivernais, where the ratio  $n$  of sections falls to 2.94, the ratio  $\frac{R}{r}$  of resistances rises to 3.82: that is, for a reduction to a little less than half in the ratio of the sections, the ratio of the resistances is nearly tripled. This example shows how great an influence the ratio of the sections has upon the resistance. The figures given in Table 7 are purely experimental, and not arrived at by any mathematical calculation. At the speed of 0.82 feet per second it will be noticed that the resistances in the River Seine are the same at draughts of 3.28 and 4.27 feet; this is probably due to the fact that the resistances were measured to the nearest kilogramme, and therefore a difference of less than 2 lbs. would not be noticed in converting the readings from French into English measure.

Formula.—The foregoing results obtained by M. de Mas afford a means of checking the formulæ usually adopted for the resistance of boats to traction upon canals. The two following are believed by the author to be the formulæ most generally employed, in which  $n = \frac{\Omega}{\omega}$  :—

$$R = K\omega V^2 \frac{1}{n+2} \dots \dots \dots (1)$$

$$R = K\omega V^2 \left(\frac{n}{n-1}\right)^2 \dots \dots \dots (2)$$

The first formula was propounded by Du Buat in the last century, and has been applied by D'Aubuisson to the resistance of boats upon the Midi Canal. The second is deduced from the formula used for an open expanse of water—namely,  $R = K\omega V^2$ —by substituting for the absolute speed of the boat in open water its relative speed in relation to the water flowing backwards past it, on the assumption that the water would pass back from bow to stern at a uniform speed through the narrowed section  $\Omega - \omega$ . From the results now obtained by M. de Mas are deduced the three following conclusions:—First, for a boat hauled at a given speed,  $V$ , the resistance to traction is not proportional either to  $\frac{\omega}{n+2}$  or to  $\frac{\omega n^2}{(n-1)^2}$ ; second, for a boat kept at a constant draught the resistance to traction is not proportional

to  $V^2$ ; and, third, for a given boat the proportions  $\frac{R(n+2)}{\omega V^2}$  and  $\frac{R(n-1)^2}{\omega V^2 n^2}$  are neither of them independent of the speed. Hence it will be seen that the two above formulæ can give only wrong results. Recently M. de Mas has been engaged on experiments with a view to determine the variation of resistance offered to a boat when the area of cross-section of a canal is kept the same, while its width and depth are altered; his results, however, have not yet appeared.

TABLE 7.—Ratios of Sections  $\frac{\Omega}{\omega}$  and of Resistances  $\frac{R}{r}$  of boat "Jeanne" in different Waterways.

$R$  = resistance to traction in canal;  $r$  = resistance to traction in river.

Draught.	Waterway.	0.82 ft. per sec.		1.64 ft. per sec.		2.46 ft. per sec.		3.28 ft. per sec.		4.10 ft. per sec.		
		$\frac{\Omega}{\omega}$	$\frac{R}{r}$	$\frac{\Omega}{\omega}$	$\frac{R}{r}$	$\frac{\Omega}{\omega}$	$\frac{R}{r}$	$\frac{\Omega}{\omega}$	$\frac{R}{r}$	$\frac{\Omega}{\omega}$	$\frac{R}{r}$	
3.23 feet	River Seine	116.04	1.00	83.8	1.00	145.5	1.00	244.7	1.00	383.6	1.00	
	Dérivation de Joigny	8.31	1.00	28.7	1.00	149.9	1.03	271.2	1.11	458.6	1.20	
	Canal de Bourgogne	5.39	1.33	103.3	1.42	227.1	1.56	407.8	1.67	692.2	1.33	
	Canal de la Cure	4.64	1.41	108.2	1.48	233.1	1.63	452.0	1.85	795.9	2.07	
	Canal du Nivernais	3.82	1.50	123.5	1.70	254.4	1.95	557.8	2.28	1018.3	2.66	
	4.27 feet	River Seine	89.30	1.00	83.8	1.00	172.0	1.00	295.4	1.00	474.0	1.00
		Dérivation de Joigny	6.39	1.17	105.3	1.26	233.1	1.38	440.9	1.49	756.2	1.60
		Canal de Bourgogne	4.54	1.74	154.3	1.84	341.7	1.98	621.7	2.10	1073.7	2.26
		Canal de la Cure	3.57	1.92	178.5	2.13	410.0	2.38	813.5	2.75	1501.4	3.17
		Canal du Nivernais	2.94	2.67	255.7	3.05	657.0	3.82	1389.0	4.70	2345.6	5.58
		5.25 feet	River Seine	72.49	1.00	90.4	1.00	187.4	1.00	319.7	1.00	511.4
	Dérivation de Joigny		5.19	1.42	141.1	1.56	326.3	1.74	619.5	1.94	1124.4	2.20
Canal de Bourgogne	3.68		2.45	244.7	2.71	562.2	3.00	1047.0	3.28	1838.3	3.79	
Canal de la Cure	2.90		2.56	261.6	2.93	637.9	3.67	1532.0	4.79	2965.2	5.80	

It has been found over and over again that, as the depth of a canal is augmented, the ease with which a boat can be towed is increased. In the discussion upon the late Mr. F. R. Conder's paper upon "Speed on Canals" ("Proceedings Inst. C.E.," 1884, vol. lxxvi, p. 160), it was stated by Mr. Robert Gordon (p. 198) that within the limits of his experience retardation of speed and deficient steering power "were much more strikingly developed in shoal water, with only a few feet between the bottom of the vessel and the bed of the canal, whatever the breadth of the stream might be, than in a restricted narrower section of greater depth." On the Forth and Clyde Canal, on which there is steam navigation, and where,

\* Abstract of paper read by Mr. LESLIE ROBINSON at the Institution of Mechanical Engineers.

according to Sir Arthur Cotton, the ratio of wetted section  $\Omega$  of canal to immersed cross-section  $\omega$  of boat amounts to 3 : 1, it is found that a higher speed than five miles per hour cannot be adopted, because above this speed the water is not delivered quickly enough at the stern to admit of effective steering. In the discussion upon Messrs. Clegram and Healy's papers in 1866 ("Proceedings Inst. C.E.," 1866, vol. xxvi, p. 1) the two following conclusions were drawn by Mr. William Beardmore (p. 43):—"Firstly, that with any flat-bottomed vessel propelled by a screw, immersed to its full diameter in a canal where the sectional area of the vessel was less than one-seventh part of that of the whole waterway, the speed was sensibly affected (independently of the laws of motion of bodies through narrow canals) wherever the depth below the vessel's bottom did not exceed two-thirds of the diameter of the screw. Secondly, that when the sectional area and depth of canal were less than the above proportions, the velocity at which the screw could be worked with advantage was limited by the speed with which the water could pass beneath the boat so as to feed the screw. In other words, if a speed were obtained beyond that at which the water would pass to the screw, the engine power was wasted in churning the bottom water."

*Speed.*—The speed attainable upon a canal must necessarily be limited by the consideration of the preservation of the banks. Up to a speed of three miles per hour it was found by Dr. Pole that no waves were formed which had an injurious effect on the sides of the canal; but above that speed breaking waves became developed, and had a most destructive effect upon the banks. At moderate speeds it has been found that the wasting of the banks extends only about 1 foot above and below the water level. The difficulty of preserving the banks was one of the great hindrances to the use of steam power upon canals. When it was first determined about 1860 to try towing by steam upon the Ashby-de-la-Zouch Canal, the railway owning the canal objected; and the matter was referred to Dr. Pole, who tried a boat propelled by a screw at different speeds, with the result already mentioned, namely, that no damage was done up to three miles per hour, but that above this speed breaking waves were formed. The highest speed allowed in France is from six to eight kilometres, or about  $3\frac{3}{4}$  to 5 miles per hour, while in England three miles per hour is the usual speed. In narrow canals, and in tunnels such as that on the Canal de Saint-Quentin, the speed has to be further reduced, owing to the heaping up of the water in front of the boat. An instance is cited by Lermoyez in 1863, in which the last of a train of barges was left on a dry keel, owing to the water not being able to flow backwards past the boats quickly enough to supply the void caused by their passage. They acted indeed like the plunger of a pump, forcing the water before them: and the only way in which they could be moved along was by waiting for intervals of 20 minutes until the water had returned to its normal level in the canal. Even in a moderately wide canal, by keeping the traffic moving continuously in the same direction over a distance of 30 miles for a whole day, Scott Russell found the water raised 18 inches higher at one end of the canal and lowered 18 inches at the other, making a total difference of level of three feet.

With regard to altering the shape of the boat in order to gain increased ease of traction, the experiments of M. de Mas may be again referred to. He has experimented with two builds of boat already mentioned, which are known locally as a "Péniche" and a "Toue" (ferry-boat), having the same length of water line and the same width amidships. The "Péniche" is but slightly rounded at each end, and the bottom is only slightly cut away at the stem and the stern; the boat is therefore full-bodied, the coefficient of fineness being 99 per cent., that is, the ratio which the volume of the displacement bears to the parallelepiped circumscribing the immersed hull is 99 per cent. The "Toue" is square at the stern, but rather more cut away at the bow than the "Péniche," and its coefficient of fineness is consequently reduced to 97 per cent. Both these builds of boat have flat bottom and parallel sides. With a draught of 4.27 feet and at a speed of 1.68 miles per hour the resistance of the "Toue" is 232 lbs. less than of the "Péniche," while with a draught of 5.25 feet and at the same speed the decrease is 366 lbs. The loss of carrying capacity in the "Toue" consequent on the difference in shape, is 5.9 tons; so that for this small reduction in carrying capacity there is a considerable diminution of resistance to traction, and a consequent increase in speed might be obtained. The resistance of boats to traction is also increased in going round curves; and M. Flamant ("Annales des Ponts et Chaussées," 1881, vol. i, p. 214) has shown that the power required to tow a boat round a curve of 328 feet radius is just double that required on a straight stretch of canal having the same cross section as the curve. French canals, however, are usually made of extra width in curves; and it is then

found that a curve of 328 feet radius does not materially increase the resistance to traction on a canal intended to carry boats of 125 to 128 feet length and  $16\frac{1}{2}$  feet width.

*Mechanical Propulsion.*—There are four different methods in use for the mechanical traction or propulsion of boats upon canals, which will be taken in the following order:—(1) propulsion by screws worked either by steam, by petroleum motors, or by electricity; (2) hauling upon a submerged chain or wire rope lying along the bed of the canal; (3) attachment to an endless running rope working along the canal bank; (4) towing by a locomotive running along the canal path. These the author believes are the only plans at present in use on canals, or passing through the experimental stage. Upon the Continent a few stern-wheel steamers are in existence on rivers; but they are seldom used on canals, because they occupy so much room in the locks, and the stern wheel takes up a good deal of valuable space that might be occupied by cargo.

(To be continued.)

#### Some Points in Cycle Construction.\*

THE rapid development of the modern bicycle is mainly if not entirely due to the influence of the racing track in securing the extinction of the least fit. The advance has been made by a lengthy and expensive process of trial and error; but this process would have been far more tedious and expensive, if it had been left to the judgment of the average rider to decide what constituted fitness. It is in the final struggle at the end of a well-contested race that the fine shades of difference in the speed of machines have been discriminated. This method of experiment may eventually give place to others more scientific and more exact; but the latter are hardly likely to be so popular. It is now generally understood that the property of speed, possessed in such various degrees by cycles, is mainly a negative property; that is, it is the absence of any means of dissipating the energy transmitted through the mechanism; in fine, the whole question is one of efficiency. The best machine both for racing and for ordinary riding is that which is most efficient. The principal causes of inefficiency in a cycle are—want of rigidity, and friction:—A cycle which should be absolutely rigid and entirely without friction would have an efficiency of 100 per cent.; that is to say, it represents an ideal perfection which cannot be exceeded, and cannot actually be attained.

*Rigidity.*—Of these two sources of inefficiency, it is probable that want of rigidity is the most important. It is in this particular that cycles differ far more than in friction; and it is invariably found that the more rigid machine is also the faster. The cause is twofold. Firstly, the work done in springing the frame out of shape at each stroke of the foot is not spent in driving at the end of the downstroke, but only in lifting the foot at the beginning of the upstroke. The amount of exertion wasted in this way may be fairly estimated by sitting on a machine with the wheels fixed, and alternately applying and relieving the pressure of the foot on the pedal; the more springy the machine, the greater will be the fatigue experienced. Secondly, the springing of the frame causes a general condition of instability, due partly to the alteration of the balance through lateral movement of the pedals, and partly to the wheels being forced out of line, thereby causing the machine to swerve from side to side, instead of running a true course. Although the loss of efficiency from this cause may seem slight, the sense of instability has a disastrous effect in marring a sudden effort or in aggravating a steep hill.

*Friction.*—In a machine with well-constructed bearings, friction is mainly due to the chain. The consequent loss has been variously estimated, as low as 1 per cent. of the total power has been recently given. If this were correct, chain driving would be the most efficient means of transmitting power at present known. Probably, however, the loss was measured when the chain was not doing any work, which would make the test fallacious. About 5 per cent. seems nearer the truth. The means of avoiding these various sources of inefficiency may be considered in detail; and at the same time the means by which the ordinary stresses in a vertical plane may be met with the minimum of material.

*Factor of Safety.*—It has been said that the factor of safety for a cycle frame is about  $1\frac{1}{4}$ . If this is understood to mean that a machine designed for a 12-stone rider should not be ridden by one exceeding 15 stone, it is probably not far out in most cases; yet

\* Paper read by Mr. F. J. Osmond, of Birmingham, at the Institution of Mechanical Engineers.

a well-built frame will carry a steady load of at least 10 times this weight without injury. The difference between these two statements is due to the fact that the front part of the frame is exposed to shocks which must cause bending stresses near the head; for if the two front tubes are arranged so that their axes intersect vertically above the axle of the front wheel, the stresses are only pure tension and compression, so long as the force acting through the front axle is purely vertical. It is evident that this is not the case when the front wheel meets a brick or other obstacle which represents a force acting obliquely; whilst when the wheel drops on the other side of the obstacle there is a shock which is vertical. It is thus impossible to avoid bending; and the best compromise is obtained by making the axes of the two tubes meet some distance behind the perpendicular through the front axle. This consideration is sufficient to justify the present shape of frame with short head and horizontal top-tube. Any considerable obstacle surmounted by the front wheel causes two distinct shocks, the first oblique and the second vertical; and these shocks will in general tend to bend the front tubes first in one direction and then in the other. The bending moments are greatest close to the head, just where the tubes have been weakened by brazing; it is, therefore, necessary to provide some local strengthening. This, the author gives by shrinking a reinforcement about 4 inches long upon the outside of the tube ends; the tubes are brazed together at the ends, tapered in a lathe, and the whole then brazed into the lug. By this means the part weakened by the brazing is kept within the reinforcement, and breakage is practically impossible.

*Large Tubes.*—Although there is an evident advantage in increasing the diameter of tubes subjected to bending and tension, yet, as the thickness must be reduced in order to retain the same weight, a limiting ratio of diameter to thickness is soon reached, which cannot be exceeded without danger of the tube failing through buckling induced by some small local stress due to dents, &c. This ratio is much smaller when the tubes are curved, as in handle-bars, which, if made of too thin metal, will fail at the bend, and not at the junction with the stem, where they ought to fail first if their strength is calculated from the bending moment only. In multicycles, where heavier tubes are necessary, the diameters may be considerably increased with great advantage to the general strength and rigidity. For tandem and triplet cycles the author makes tubes 25 per cent. larger in diameter than for single machines, which gives about 50 per cent. more rigidity for the same weight.

*Aluminium Frames.*—The advantages of aluminium and its alloys, as compared with steel, have been so often urged that a few facts may be interesting. The best aluminium alloys have about 16 per cent. less strength and rigidity when drawn into tube than a steel tube of the same weight and outside diameter; but owing to its much greater thickness the aluminium tube can be made of larger diameter without danger of buckling. For handle-bars aluminium has greater advantages, and if it could be readily plated it would be really valuable for this purpose. The difficulty of jointing is much against it in most cases. For the comparison of strength and rigidity the tubes tested were both 1 inch outside diameter, and practically of the same weight per foot; the steel tube was 20 gauge or 0.036 inch thick, and the aluminium alloy 12 gauge or 0.110 inch thick. The superiority of the steel tube was due to its greater mean diameter; making allowance for this, the strengths and stiffnesses of the two materials are nearly equal. The maximum stress in the steel tube was 52 tons per square inch, and in the aluminium alloy 18.7 tons per square inch. The effect of a brazing heat was to reduce the strength of the steel by 45 per cent., thus bringing down its maximum stress to 28.6 tons per square inch; the stiffness was unaffected.

*Testing of Tubes.*—In testing tubes it is necessary to take special precautions in order to avoid buckling by local stress. For example, if the tube is supported at the ends and loaded at the centre, it should be of considerable length, say 3 feet for 1 inch diameter, and the load should be suspended by a broad leather strap, so as to distribute the pressure over a large surface. Through the neglect of these precautions the results of many published tests have been rendered entirely misleading. The advantages so often claimed for "webbed" tubes are apparent only when the tube is tested in short lengths and loaded in the centre. Under these conditions a plain tube is crushed in at the point where the load is applied, which is also the point of maximum compression stress due to the bending. It therefore fails prematurely from a local stress, which has no counterpart in the working stresses of a cycle. When tested with proper precautions, webbed tubes are both weaker and less rigid, weight for weight, than plain tubes, a result which accords with theory. The same may be said of various other sections. It is in

many cases better to test by brazing a solid plug into one end of the tube, and having clamped this end, to load the other end; in this way all unfair stress is avoided. Corrugated tubes have the advantage of resisting local stress better than plain tubes; but they are less rigid, weight for weight, and present difficulties in jointing. Nickel steel is as rigid as carbon steel, and has the advantage of a higher elastic limit; it is therefore well suited for the two front tubes of a cycle, which are the most subject to vibration. In other parts, where the elastic limit is not so nearly approached, it has no advantage over ordinary steel. It is a mistake to suppose that the mildest steel is the safest under vibration; owing to its low elastic limit it is more liable to break off short from vibration than harder steel containing up to 0.8 per cent. of carbon.

*Means of Securing Rigidity.*—In considering the design of a safety bicycle frame, too little attention is generally paid to what may be called the driving stresses; that is, those set up by the pressure of the foot upon the pedal, which causes lateral distortion of the frame. There are two distinct cases to be considered—first, when the pressure of the foot is balanced by a pull at the handle on the same side; and second, when there is no pull at the handle. In the first case, when the pressure of the foot is balanced by a pull at the handle on the same side, the distortion is confined mainly to the front part of the frame, consisting of the head tube, the upper and lower front tubes, and the seat-socket tube. Each member of this quadrilateral is subjected to both torsion and bending. If any one of these members is so strengthened that its bending and twisting are diminished, then the strength of the adjacent members is also increased, so that much greater forces are required to produce a given distortion. Now the head tube being short compared with the other members, an increase in its thickness is accompanied by an increase in the stiffness of the frame out of all proportion to the increase of weight. This stiffness is also increased up to a certain point by shortening the head tube. The long heads in vogue a few years ago rendered the frame more springy, while the present pattern of frame, with horizontal top tube and comparatively short head, is much better in this respect. The torsion of the seat-socket tube is greatly diminished if the rear part of the frame is rigidly connected, instead of being merely bolted together. When the torsion of the head tube and seat-socket tube is thus minimised, rigidity is secured by providing top and bottom front tubes of suitable diameter and thickness. In the second case, when the pressure of the foot is not balanced by a pull on the handle, the distortion is not confined to the front part of the frame, but every member is twisted and bent simultaneously. The rigidity thus depends mainly on the joints throughout the frame. In a machine wanting in rigidity, the wheels and the frame are no longer in the same plane; the wheel inclines to one side of the vertical and the frame to the other, and the direction of the inclination alters at each stroke of the foot. The stresses thus set up are much the same as if the wheels were fixed, and the frame twisted by means of the seat pillar. If the joints are made merely by flattening the ends of the tubes and then bolting up, the frame is liable to be rickety, because under bending and twisting stresses such joints will give more than the whole length of the tube. This source of weakness is avoided in the author's practice by brazing the back forks and chain stays together, without any flattening or weakening of section, and by reinforcing the joint with a wrapping of sheet steel. At the junction of the seat-socket tube the back forks are also brazed on, and the solid end-piece, after brazing in, is recessed to take the seat-pillar bolt. This connection is so rigid as to permit of dispensing with the usual bridge above the back wheel. In the same way the ends of the front fork are stiffened so as to increase the lateral rigidity greatly, as compared with the usual make of flattened-tube fork-end. In the fork crown the weakest feature of the ordinary double-plate pattern is the smallness of the brazing surface, which sometimes results in the tearing apart of the joint. This is remedied by fitting the fork blades into a practically continuous socket joining the crown plates, thereby so greatly increasing the brazing surface as to reduce the maximum stress on the solder, and to eliminate all chance of breakage.

*Chain Stays.*—The chain stays are perhaps the most important part of the frame of a cycle; they are certainly the part about which the greatest difference of opinion exists. Before the extreme importance was realised of a narrow tread for constituting a straight-running machine, round chain stays of  $\frac{3}{4}$  inch diameter were often used, which gave ample stiffness; but now that there is a premium on every  $\frac{1}{8}$  inch under 5 inches clear width between the pedals, it is necessary to reduce this diameter to about  $\frac{5}{8}$  inch. Now a tube of

round section  $\frac{5}{8}$  inch diameter is only about half as stiff as one  $\frac{7}{8}$  inch diameter of the same weight, and has only about 70 per cent. of the strength. It therefore becomes necessary to use a section giving greater rigidity and strength than the ordinary round tube. The choice lies between oval, rectangular, and D sections. The last of these has been chosen by the author as the most suitable, in consideration of the nature of the stresses to be met. The weight of the rider puts the chain stays in tension; but this tension is small compared with that produced when the foot is exerting its maximum pressure on the pedal. The nature of the deformation produced by the chain tension may be investigated by tightening up the chain, and then squeezing its upper and lower spans together. It will be seen that both of the chain stays are thereby bent towards the chain side, because, being connected by the back axle, one cannot move without the other; and the final result is a bending in four places, two on each side, namely, close to the bridge and close to the back axle. The chain stays designed by the author are shaped with a slight bend in the middle, so as to clear the crank end. This construction has been criticised as causing a bending moment at that point, tending to buckle inwards the stay on the chain side; but experiment shows that the total bending moment is not a maximum at that point, and that consequently the slight inward bend does no harm. On the other hand a sharp bend near the bridge is a source of weakness, which is best guarded against by using a steel casting at this point, instead of merely bending the tube. The bending moment, which is due to the back axle not being exactly in line with the back forks in some portions of the "chain adjustment," amounts in extreme cases to about 70 inch-pounds, which means only a small stress on the D tubes that are used. The stress, moreover, is perfectly symmetrical, and causes no lateral distortion of the frame. The advantage claimed for the radial or swinging adjustment—namely, that the axle is always in the centre line of the back forks—is thus of small account, and is far more than counterbalanced by the want of lateral stiffness in that adjustment. By the "chain adjustment" is meant the path of the back axle along the slot provided for the purpose of adjusting the tension of the chain; when the back forks are bolted to the axle, the weight of the rider is taken direct by the axle; but when the frame is brazed together at this point, the axle moves away from the point where the centre lines intersect.

*D Tubes.*—On the subject of D tubes for chain stays there exists some amount of misapprehension. They were introduced by the author partly because the flat inner surface is convenient for the nut on the back axle to be locked against, and partly because, for the same width and weight, they are more rigid than either round or oval tubes. It must be borne in mind that, in order to attain the requisite rigidity, it is necessary in general to increase the section of chain stays beyond what is required for mere strength; it is therefore the rigidity of the different sections that has to be compared, and not their strength. It has been argued by a recent writer on cycle construction that, weight for weight, a tube of semicircular section is only 1 per cent. stronger than a tube of circular section, if both are of infinitesimal thickness. Now the D tubes employed by the author are not of semicircular section, and they are at least 20 gauge or 0.036 inch thick. A semicircular tube is about 16 per cent. stiffer than a circular tube, weight for weight, if both are of infinitesimal thickness; and when the thickness becomes finite, the advantage is still greater. A  $\frac{5}{8}$  inch semicircular tube of 20 gauge or 0.036 inch thickness is about 25 per cent. stiffer than a  $\frac{5}{8}$  inch circular tube of the same weight, since the thickness of the latter must be about 17 gauge or 0.054 inch, and its mean diameter is therefore less. The section used by the author, however, is not semicircular, but much more resembles the shape of the letter from which it takes its name. Theoretically, a rectangular section is the best possible; but its appearance on a cycle is so hideous as to be out of the question. If for equal weight the relative stiffness of a tube of circular section,  $\frac{5}{8}$  inch diameter and about 17 gauge thickness, be represented by 100, then the results of tests of oval and D and rectangular sections, all three rolled from a round tube of  $\frac{5}{16}$  inch diameter, will compare as follows:—

Round tube, 0.65 diameter × 0.054 thickness, relative stiffness,	100.
Oval " 0.65 wide × 1.125 deep × 0.036 thick, " "	110.
D " 0.65 " 1.070 " 0.036 " " "	136½.
Rectangular 0.65 " 0.825 " 0.036 " " "	146½.

It will thus be seen that the D section now adopted is only about 7 per cent. less stiff than the rectangular, which is the best that can be rolled out of a round tube of the same diameter and to the same width.

Various webbed sections have from time to time been proposed and advantages have been claimed for them on the strength of tests which mainly show resistance to local crushing in one particular direction, and give no indication whatever of the value of the section when made up into a cycle. Tests made on webbed D tube, by brazing a plug into one end and loading the other, show that it is 6 per cent. less strong and 15 per cent. less stiff than plain D tube of the same weight and external size. It is important to realise that the material of a tube should be kept as far away from the neutral axis as possible.

*Multicycles.*—The necessity for lateral rigidity is even more apparent in multicycles than in single machines. It is found that any want of unison in the efforts of the riders has a disconcerting effect, which greatly detracts from the pace and from the power of going up hills. It is only by the employment of tubes of larger diameter that the increased distorting stresses can be properly met. The form of frame now generally adopted was first used by the author in 1895, and has for its principal feature a horizontal tube running from the bottom of the head, parallel with the top tube which starts from the top of the head; the lower line of tube is braced by means of light diagonals to a single bottom tube of  $1\frac{3}{4}$  inches diameter. This form of frame, whilst not superior in strength or rigidity to that having diagonals running from the top tube to the bottom without an intermediate tube, possesses a great commercial advantage in the fact that frames can be built of different heights without altering the angles of the lugs simply by raising the top tube. It is advisable to unite the rear end of the intermediate tube to the back forks by a short fork, which increases the lateral rigidity. There seems to be a general tendency to duplicate the back fork in multicycles; but greater rigidity can be secured by means of a single fork of large section, provided that it is properly connected to the top of the rear seat-pillar lug. In the same way a single tube of  $1\frac{3}{4}$  inches diameter connecting the various crank-brackets gives greater rigidity than the more usual arrangement of two 1-inch tubes, placed either side by side or one above the other. The method devised by the author of fixing the back axle by nuts locking against the inner surface of the chain stays, gives a rather wider spread to the back forks than is usual, which is an advantage in improving the bracing between the axle and the seat-pillar lug.

*Chains.*—The great advantage of a roller chain, when exposed to mud or dust, led the author to consider why the block chain was so generally admitted to be the faster of the two; and the conclusion he came to was that it is a question of smoothness of running. The roller-chain links were at least 1 inch long from centre to centre of eyes, whilst those of the block chain were alternately 0.4 inch and 0.6 inch. By shortening the links, therefore, to half an inch, he concluded that the roller chain would run more smoothly, and consequently be faster than the block chain. It was found indeed that roller chains of  $\frac{3}{8}$ -inch pitch were already contemplated by the chain makers; but as this length is slightly in excess of the longer of the block-chain links, there is no advantage in smoothness or speed. It was questioned whether the chain and wheel of  $\frac{1}{2}$ -inch pitch could be made a success in practice, but experience has fully justified the expectations on this point. The smoothness of running with gearing of this pitch is remarkable, whilst its excellent behaviour when covered with mud or dust renders a casing almost superfluous.

*Gear and Crank Length.*—The question of gear is so closely connected with that of crank length that they cannot properly be considered separately. For it is evident that a gear of 60 inches does not represent the same conditions with a 6-inch crank as when one of 7 inches is used; and similarly it would not be reasonable to expect that a leg 36 inches long will be suited by a length of crank which suits a leg 32 inches long. The length of crank must be decided by the rider's natural length of stride, and the ratio of multiplication of gear to length of crank must depend upon his muscular development, both of which data may be approximately ascertained by measurement. The gear is then the product of the two factors so determined. The maximum ratio of multiplication for road riding is about 12 times, and the minimum about nine times. The maximum length of crank may be taken as about  $7\frac{1}{2}$  inches, and the minimum 6 inches. Hence the gear may vary from 90 inches down to 54 inches.

Om De maatte reflectere ovenstaaende Avertissement, behag da ta novne "THE AUTOMOTOR AND HORSELESS VEHICLE JOURNAL."

NEW INVENTIONS.

Claiming particularly to apply directly or indirectly to Motor Vehicles, &c.

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At the request of a number of subscribers we are pleased to announce that for the future we have arranged to more thoroughly cover the field of completed Patents referring to the Motor-Car Industry, by producing the latest Specifications and Diagrams.

Patents Applied For.

Abbreviations: Impts., Improvements in; Relg., Relating to.

- 1897.
- Oct. 1. 22,565. J. HARPER. Impts. tractors for vehicles and motor-cars.
  - .. 2. 22,578. R. F. MOORE. Speed alarm and recorder.
  - .. 2. 22,590. J. J. SLACK and W. HOUGHTON. Impts. saddles for motor-cars, &c.
  - .. 5. 22,785. A. ECKFORD. Impts. re'g. motor street-sweeping machines.
  - .. 5. 22,795. A. JORDON and J. G. H. BROWNE. Application of three-cylinder engines to vehicles.
  - .. 6. 22,932. E. H. HODGKINSON. Impts. velocipedes and automotor-carriages.
  - .. 8. 23,067. F. WOODCOCK. Chains for cycles and motor-cars.
  - .. 8. 23,094. BOWDEN, HOYLE, and URQUIHART. Impts. motor-propelled vehicles.
  - .. 11. 23,280. C. LEE. Impts. motor-cars.
  - .. 11. 23,357. W. E. SIMPSON. Impts. motors and motor-driven vehicles.
  - .. 11. 23,367. W. KLIEMT and A. HEINEMANN. Impts. driving gear.
  - .. 11. 23,368. KLIEMT and HEINEMANN. Impts. motor-cars, &c.
  - .. 13. 23,502. W. H. TYE. Spring wheel for road vehicles.
  - .. 13. 23,528. H. C. L. HOLDEN. Controlling and regulating motors.
  - .. 15. 23,723. W. HOUGHTON. Impts. saddles for cycles, motor-cars, &c.
  - .. 15. 23,792. F. W. SCHNEIDER. Impts. relg. electric propulsion of vehicles.
  - .. 15. 23,803. DELEGEON et CIE. Mechanism for varying the speed of automotor-vehicles.
  - .. 16. 23,822. E. C. BLECHYNDEN and R. Y. MCINTOSH. Impts. self-propelled vehicles.
  - .. 18. 23,974. J. N. CAREY. Variable speed driving gear.
  - .. 19. 24,032. C. TENNETT, W. AMBLER, and A. J. RILEY. Impts. self-propelled vehicles.
  - .. 19. 24,066. A. S. BOWLEY. Frame fittings for auto-vehicles, &c.
  - .. 19. 24,076. H. O'REILLY. Impts. cycles, motor-cars, &c.
  - .. 21. 24,295. J. B. HEAL and S. H. HEAL. Acetylene gas generator for road vehicles, &c.
  - .. 21. 24,355. C. H. HALL, Junr. Impts. mudguard bridges.
  - .. 22. 24,473. W. C. PLAYER and J. PEARSON. Impts. joints of cycle and motor-car frames.
  - .. 22. 24,494. H. J. LAWSON. Impts. relg. motor-vehicles.
  - .. 23. 24,597. W. S. SMITH and H. T. ROBERT. Multiple speed gear and driving mechanism.
  - .. 25. 24,656. T. MOODY. Impts. driving gear.
  - .. 25. 24,712. P. E. DOOLITTLE (W. J. STILL and T. BENGOUGH). Motor apparatus for propelling vehicles.
  - .. 25. 24,813. C. H. BARROWS. Impts. motor road vehicles.
  - .. 29. 25,062. A. HODGKINSON and F. REDFORD. Impts. relg. to handle-bars.
  - .. 29. 25,066. J. B. MORGAN. Impts. driving gear.
  - .. 30. 25,168. G. A. J. SCHOTT. Safety guard for motor-vehicles.
  - .. 30. 25,189. E. S. BOND. Acetylene gas apparatus for motor-vehicles, &c.
  - .. 30. 25,235. The Hon. R. T. D. BROUGHAM. Roller bearing locking or under carriage for electrical vehicles.

Specifications Published.

14,756. Oil Engines for Propelling Carriages, &c. James Roots, 100, Westminster Bridge Road, London. July 3rd, 1896.

Fig. 1 shows the method of connecting the valve and power countershaft to the motor.

Fig. 2, the plan of a portion of the frame of an oil motor vehicle, showing the friction discs and rollers.

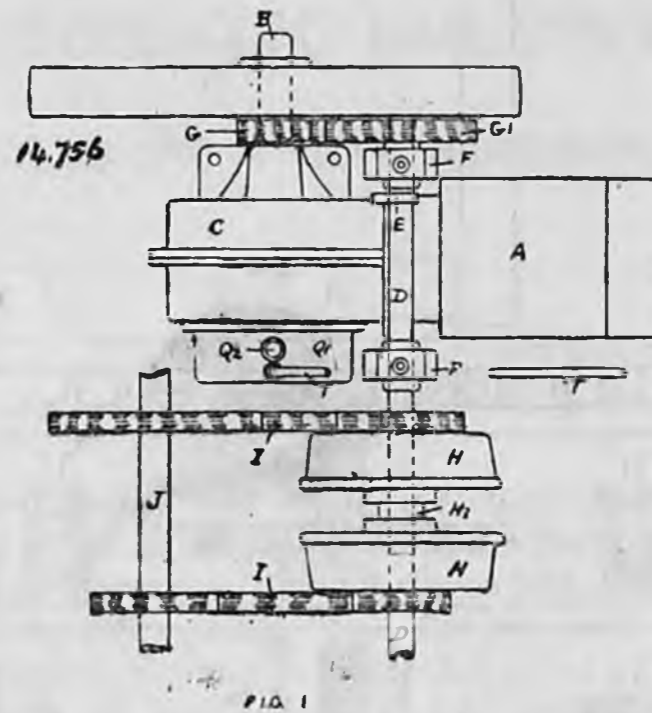
Fig. 4 is an elevation of a portion of an engine, showing the arrangement of the starting and automatic burners.

In Fig. 1, A is the cylinder, B the crank shaft, C the enclosed and airtight crank pit, D the half speed shaft, E the cam for operating the exhaust valve, F the bearings carrying the half speed shaft, which are fixed to the motor, a third bearing not shown is fixed to the vehicle frame, G, the chain wheel on the crank shaft, having half the number of teeth of the chain wheel, G 1; H, H, are friction clutches operated by a fork lever not shown, fitting in the groove, H<sup>1</sup>, by which either of the chains, I, I, are thrown into gear to drive the axle or shaft, J.

The exhaust valve and the method of operating it by the cam, E, are not shown, and may be of the usual construction.

The bearings, F, are fixed to brackets which are bolted to the motor. The countershaft, D, is parallel to the crank shaft, and is driven by the chain and chain wheels, G and G 1, at half the speed of the crank shaft. It carries the cam, E, for operating the exhaust valve, and transmits the power of the motor to the shaft or axle, J. The countershaft, D, thus serves the double purpose, it is conveniently placed parallel with the other, and runs more silently, being driven by a chain.

In Fig. 2, K is the frame of the vehicle. L L the vehicle wheels, rigidly fixed to the portions of the axle, L 1 and L 2; M, M<sup>1</sup>, are the friction discs fixed to the other ends of the axle shafts, L 1 and L 2; N, N<sup>1</sup>, are the friction rollers, O is a toothed wheel keyed to the shaft, P, which is driven by the motor, it gears with the wheel, O<sup>1</sup>, which is fixed to the shaft, P<sup>1</sup>. The gear wheel, O<sup>1</sup>, has the same number of teeth as the wheel, O, the shaft, P<sup>1</sup>, therefore rotates at the same speed as the shaft, P, but in the opposite direction. The rollers, N, N<sup>1</sup>, slide on feathers on the shafts, P, P<sup>1</sup>, and are simultaneously operated by a lever (not shown) from the seat of the carriage. In the position of the friction rollers, N, N<sup>1</sup>, shown, if they are moved nearer the bearings, P 4 and P 5, they cease to drive as the pressure lessens at the peripheries owing

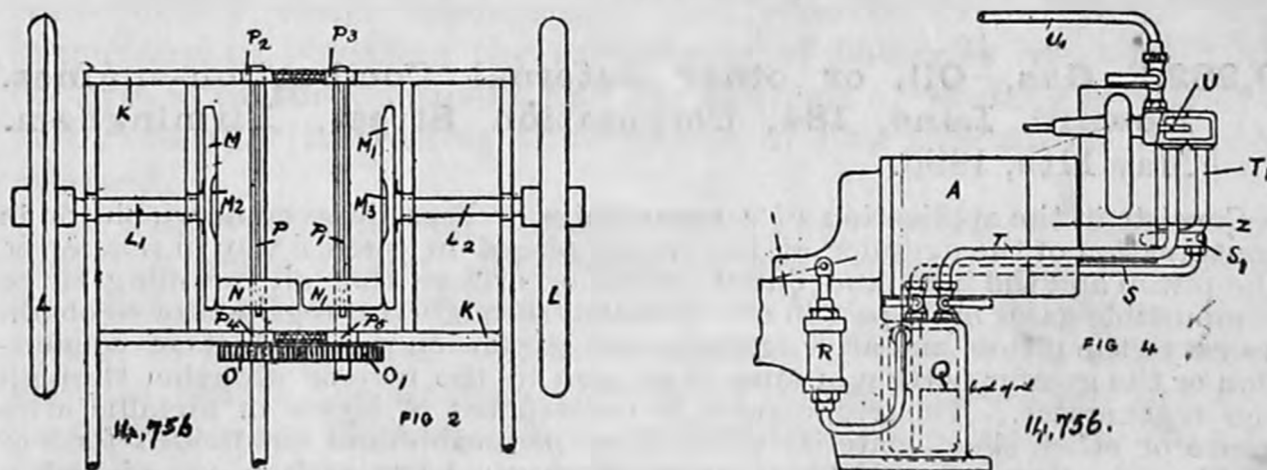


to the turned away edges of the discs, M, M<sup>1</sup>. If the rollers, N, N<sup>1</sup>, are moved toward the centre of the discs, they increase the speed of the vehicle until they reach the hollowed out centres, M<sup>2</sup>, M<sup>3</sup>, when they again cease to drive, if the movement be continued toward the bearings, P 2, P 3, then the vehicle is reversed. Means may be provided (not shown) for compressing the shafts, P and P<sup>1</sup>, together when it is desired to reverse or to place the rollers at a different position on the discs.

The shaft bearings are fitted in a guide and pressed apart by a spring, but prevented from exceeding a certain adjusted distance by set screws, so that the shafts need not be out of the parallel by more than 1/32 inch. One shaft may be the counter shaft of the motor, or may be driven by the motor in any convenient manner such as a chain and chain wheels, or flexible coupling.

A ratchet and pawl may be fitted, if desired, in some intermediate position between the wheels.

In Fig. 4, Q is the lamp reservoir which is not more than half filled, so as to allow room for compressed air at the top of the reservoir. R is the air pump operated by means of a bell crank lever connected to the side shaft of the engine (not shown). S is the pipe conveying the oil under pressure to the burner, S 1, a pressure burner of usual construction. T is the pipe conveying the air blast from the reservoir, Q, to the oil feeder, U (U 1 is the oil supply pipe). In the space round the oil feeder, U, which is operated in the usual manner, described in my former specifications, may be fitted cotton or other absorbent material.



From U the blast of air carries the oil fed thereto, by means of the pipe, T 1, to the pipe or channel surrounding the flame and ignition tube within a casing. The pipe or channel terminates in a nozzle which directs the air blast flame upon the ignition tube. In starting the engine, Fig. 4, the cock on the pipe, T, is closed, air is pumped to a pressure of a few pounds per square inch in the reservoir, Q, the cock on the pipe, S, is opened and the burner, S 1, started in the usual manner.

After the engine is started, to obviate the uncertainty of the type of burner, such as S 1, the automatic burner is brought into action, by closing the cock on the pipe, S, and opening the cock on the pipe, T.

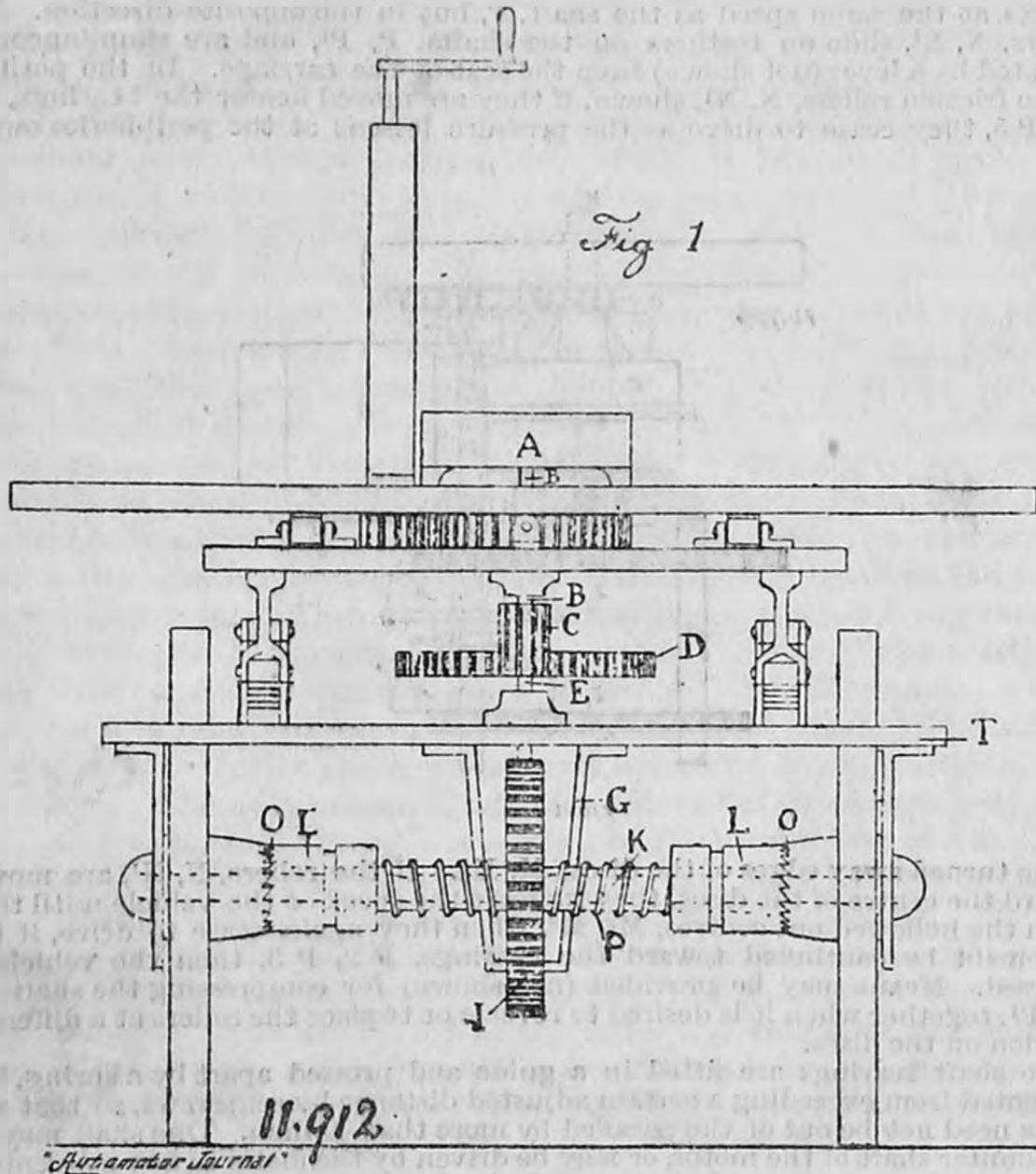
The engine continues to pump air by the pump, R into Q, which is conveyed by the pipe, T, and sweeps off the oil fed by the feeder, U, and both are conveyed by the pipe, T 1, to the coil, V.

In Fig. 1, the motor is started by the usual starting lamp with a separate reservoir. The air chamber, Q 1, is used as a cushion chamber only for the air blast, to prevent variation and intermittence in the air supply, and no oil is placed in it. Q 2 is the cap of the suction and delivery valves of the air pump formed by the front face of the working piston and the enclosed air-tight crank pit chamber, C. Air is delivered from the crank pit, C, to the chamber, Q 1, by the delivery valve under the cap, Q 2, and conveyed by the pipe, T, to the oil feeder of the same construction as U, in Fig. 4. The rest of the automatic burner is of the same construction as in Fig. 4.

**11,912. Autocars, or Self-propelling Vehicles.** Charles Casman, 4, Chaussée d'Aerschot, Louvain, Belgium. June 1st, 1896.

This invention has reference to autocars, or self-propelling vehicles, with a turbine as the motor.

A is the turbine (for instance, a steam turbine) for imparting motion to the vehicle. B is a vertical shaft, on which is a fluted or toothed pinion, C, by means of which it transmits the motion of the turbine to a fluted or toothed wheel, D, keyed on the upper part of a vertical shaft, E, which extends through the frame, T, of the vehicle, and whose lower end is mounted in a



hanger, G, in such a manner as to rotate freely therein. The vertical shaft, E, is, on a level with the axle of the vehicle, provided with an endless screw or worm, which gears with the teeth of a toothed wheel, I, keyed on a hollow shaft, K, in which or through which passes the axle of the vehicle. The hollow shaft is square in cross section, and each of its ends is provided with a clutch adapted to slide freely along the said shaft, and to engage with a toothed rim or ring of teeth, O, on the boss or hub of the adjacent wheel of the vehicle. Springs, P, arranged preferably around the hollow shaft, K, act to constantly press the clutches, L, into gear with the toothed rings, O.

The motion of the toothed wheel, I, is thus transmitted to the wheels of the vehicle by means of the shaft, K, and the clutch mechanism or coupling, L, O.

**9,982. Gas, Oil, or other Internal Combustion-engines.** Howard Lane, 184, Corporation Street, Birmingham. May 11th, 1896.

Consists in the application of a regenerator or heat interceptor within or in continuation of the cylinder of the motor placed in such a way in relation to the piston and the inlet and outlet orifice or orifices that all incoming air or combustible gases must pass in one direction through the regenerator to obtain access to the piston, and after ignition and expansion the products of combustion or the greater portion of same must pass in the reverse direction through the regenerator. The regenerator is constructed of layers of metallic wire gauze or other sheet material or of other permeable and subdivided form of rapid conducting and absorbing power offering a large surface, yet of such a structure that although individual portions of the fabric will quickly receive heat yet they will not readily impart that heat from one portion of the structure to another. Metallic gauze is suitable in that the points of contact formed by the places where the wires cross each other offer very small surfaces of contact between the sheets.

To intercept the heat that would otherwise be lost in the exhaust or discharge of the motor cylinder and by connection through its end, the regenerator in size and shape may coincide with the cross section of the cylinder and cover the end.

**15,832. Motors for Road Carriages, &c.** William Henry Dugard, Vulcan Mills, Bridge Street West, Birmingham. July 17th, 1896.

The motor consists of a turbine actuated by steam or other fluid pressure, the bucket disc of which turbine is arranged on a vertical spindle or shaft.

The invention also consists of providing the vertical spindle or shaft of the bucket disc with loosely-fitting bearings so as to permit the bucket disc and shaft to partake of a slight radial sliding or lateral motion under the centrifugal force of the rotating bucket disc, the space between the ends of the spindle or shaft and its bearings being occupied by steel springs for limiting and controlling the radial sliding motion or lateral movement of the spindle or shaft;

the addition to or combination with the turbine of one, two, or more supplementary nozzles, the communications between which and the steam passage of the turbine are opened and closed by valves controlled by the pressure of the steam; the use of the variable speed belt gear consisting essentially of a series of pairs of pulleys on which loose bands are situated, one or other of the said pairs of pulleys being put into gear by the pressure on the band of a tightening or jockey pulley; and, lastly, of arranging the bottom bearing for the driving pulley shaft in a lever capable of being turned in the direction proper for bringing the periphery or acting surface of one of the driving pulleys in direct contact with the periphery or acting surface of the corresponding pulley on the driven shaft so as to obtain a reverse motion of the said shaft and effect the backing of the vehicle.

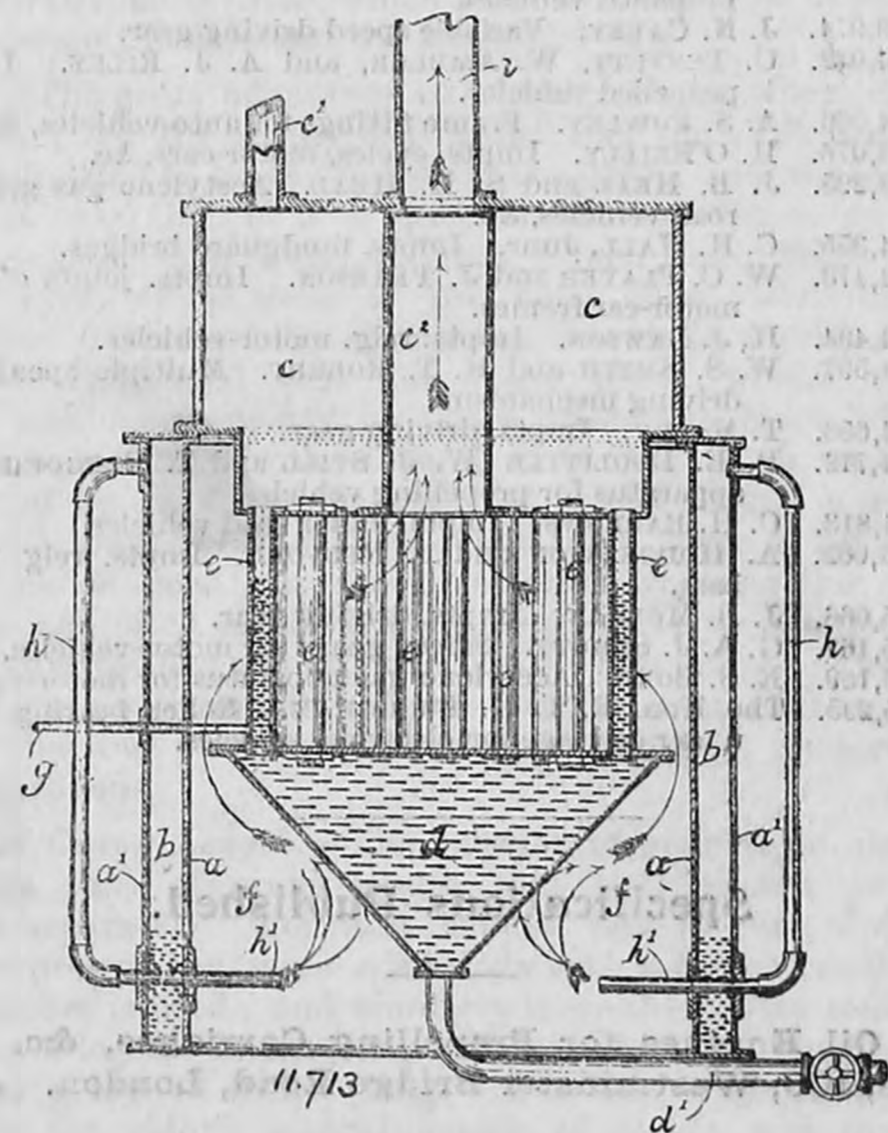
**4,284. Cycles and Motor Cars.** Laurence Redmond, 126, Sandford Road, Ranelagh, Dublin. February 11th, 1897; Accepted, May 29th, 1897.

This invention relates to improvements in cycles and motor-cars, and has for its object the application of leverage for the purpose of applying pressure to break rods.

It consists of the combination with a preferably curved handle pivoted to transverse handle bar with ball bearing joints or with loose, adjustable, detachable collars, or other joints, which are free to move on said transverse handle bar of a central lever also pivoted to transverse handle bar with ball bearing joints, or with loose, adjustable, detachable collars, or other joints, which are free to move on said transverse handle bar and engaging in said preferably curved handle. The depression of said preferably curved handle causes central lever to be also depressed, the lugs of central lever pressing against vertical piece of an inverted T-shaped crank, thus causing the other arms of said crank to rise and fall respectively, thereby applying pressure to break rods.

**11,713. Steam Generators and Furnaces for Road Carriages, &c.** Preston Davies, Spencer House, West Hill Road, Southfields, Surrey. May 29th, 1896.

A cylindrical or other casing, *a*, has a second casing or jacket, *a*<sup>1</sup>, at a certain distance therefrom, so as to form an annular space, *b*, wherein is placed the naphtha or other volatile liquid intended for fuel. Upon or at the upper end of this annular space is fixed a hollow ring, *c*, which communicates with a conical-shaped vessel, *d*, placed centrally and apex downwards, within the space contained by the casing, *a*, and which vessel, *d*, is suspended by and communicates through a set or series of tubes, *e*, with the above-mentioned hollow ring. The ring, *c*, is intended to form a steam space or dome, the tubes, *e*, and conical vessel, *d*, form the water or liquid space of the boiler, and the space, *f*, contained or enclosed by the annular casing, *a*, forms the furnace or combustion chamber of the generator; *c*<sup>1</sup> is the steam pipe for conducting the steam from



the steam space or dome, *c*, to the engine or the like; *d*<sup>1</sup> is a blow-off pipe, fitted with a suitable stop-valve for blowing off sediment or dirt from the conical vessel, *d*. The feed-water or other liquid is preferably introduced into the water or liquid space through one or more tubes, *g*, entering the lower extremities of one or more of the tubes, *e*, and the normal water level in the latter might advantageously be situated at a point about three-quarters of their length, as shown.

To introduce the vaporised liquid fuel into the furnace or combustion chamber, pipes, *h*, lead from near the upper part of the annular casing, *a*<sup>1</sup>, at two or more points opposite each other; their free extremities terminate in nozzles, *h*<sup>1</sup>, so situated as to impel the blow-pipe flames that would result from the burning vapour against the conical-shaped vessel, *d*, after impinging against which they take an upward course, and having passed between and enveloped the tubes, *e*, connecting the said conical vessel with the hollow steam ring or space, *c*, would finally pass away to the uptake, *i*, through the central aperture, *c*<sup>2</sup>, in the said hollow steam ring, *c*.