

“Our contemporary advances the opinion that any considerable curtailment of existing capacity in the petrol vehicle would render it unprofitable to run, and states that the Vanguard Co. has actually converted some of its petrol-motor chassis to electrical driving, apparently on similar lines to the well-known Electrobus, and that vehicles have been privately tested with satisfactory results.

“If our contemporary is accurately informed—and we have no reason to suppose otherwise—there appears to be a good time ahead for the electric ’bus, which has everything to gain by a greatly extended use in the way of improved construction and efficiency. The subject brings others in its train, for the extensive use of battery vehicles would inevitably lead to the much-needed provision of charging facilities throughout the metropolitan area, and thus possibly remove one of the most serious objections at the present time to the adoption of electrically-driven vehicles generally for trade purposes. Judging by American contemporaries, the American station engineer has taken the battery-charging business more seriously than his British confreres, and special departments have been organised to look after this class of business, with good results.

“Of course, one has to admit that the electric vehicle is much more popular in the States than here—possibly due to the greater encouragement given by those interested in its progress—but, nevertheless, the matter seems, in view of possible developments in the metropolitan area, to be worth some concerted action on the part of London central station authorities.”

He was sure we all felt deeply grateful to the author for the very excellent and instructive paper that he had read, and we hope that, in the future, he will keep us posted on any improvements on this class of vehicle.

## THE AUTHOR'S REPLY.

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Mr. Boulton, in reply, said that when he wrote this paper he was under the impression that he was raising a new subject, and wrote it more with the idea of stimulating interest than with the expectation that intelligent criticism would be levelled at it. He had been very pleasantly surprised. He had listened to several papers on Motor Cars and Omnibuses in London, and he did not think he had heard such general and intelligent criticism as he had here in this room to-night.

The discussion had practically asked him to read papers on transmission, on steam, on electricity, on motor 'buses versus trams, on wheels and on oils, and he was afraid these things were impossible; but there were many points it was imperative should be dealt with.

In the first place, many people had raised this matter of fuel—i.e., petroleum, petro. spirits, and kerosenes. When he wrote this paper he stated that paraffin, such as was used in England, was not obtainable in this country. He had since had the pleasure of a chat with Mr. Wagstaff, who told him it was obtainable here. This paraffin had a specific gravity of 780 to 820. It was being largely used in motor lorries in England to-day, and he did not see why it should not be equally successful here; but the engine must be warmed before it could be used.

Then came the subject of petroleum spirits and why other fuels should not be used. He thought there were very few people that really knew anything about petroleums. In the first place, there was naphtha, 680-700; next there was benzine, 715-765; then came the petroleums. The use of these oils in motors depended en-

tirely on the range of boiling point. To go into that in detail was impossible at the present moment, but he might say that the range of boiling points rested between 80 degrees Fahr. and about 500 degrees: he meant the range from bottom to top.

Peculiarly enough, the lightest spirit had not the most satisfactory range of boiling points. That range was obtained in the 760 spirit when the commencement of evaporation took place at about 85 degrees and finished about 160 degrees Fahr. It was well known that petroleum evaporates in sections—i.e., 15 to 20 per cent. at one temperature, 15 to 20 per cent. at a temperature some 60 or 70 degrees higher, and the remainder at a still much higher temperature. Now, when the range of temperature was so great, the explosion could not be an even one, because it took place at different parts of the stroke. To get the greatest perfection, the explosion must take place when the compression was the greatest. The greatest efficiency was obtained from the 760 spirit, and any users of commercial vehicles would be well advised to employ it. If they did not believe him, he could only suggest that they should try them.

He had been asked questions on the subject of transmission gear. Mr. Selve had asked him particularly with regard to hydraulic gear. The Hall hydraulic gear was not the one that appeared in Sydney; that gear had two independent sets of cylinders—the one he would call pumps and the other cylinders. The engine drove three pumps set at an angle of 120 degrees; these pumps pumped the oil into three other cylinders of the same size. Now, when these pumps and cylinders were the same size direct transmission was obtained; the whole piece of mechanism locked itself and rotated as one body. The oil, being under pressure, provided a lubrication as near perfect as any lubrication could be, and the efficiency was as high as 97 per cent. When the

relation of the pumps to the cylinders was varied—i.e., the cylinders of a greater volume than the pumps—a certain amount of oil passed from the one to the other, but the oil that was flowing from the one to the other was only about a cupful.

He had also been asked to give some explanation of the electric drives, of which there were several. The low pressure direct current one was supposed to be put on the market, and a number of persons were invited to try it: the usual thing was that the motor got burnt out before they reached home. It could not be employed for passengers. Then the Thomson-Houston electric transmission was fitted to a Wolseley 'bus and ran fairly satisfactorily. He had not any details of them, but had particulars of one known as "Hallford." In this case a petrol motor drove the dynamo direct. The dynamo drove through two direct current motors on to the chains, but why chain transmission was chosen he did not quite know. They worked satisfactorily, but had a vulgar way of burning out when they were not wanted to. Up to the present moment no further 'buses of that type had appeared, although he noticed that the makers were now advertising them.

With regard to the weight of engines with relation to brake horse-power, such figures were not used amongst motor engineers, for the simple reason that it was of little moment to them. The motor engineer cared more about having a substantial thing than the saving of weight. He considered that the weight of a touring car engine per brake horse-power was 15 to 20 lbs., and of a commercial motor engine 20 to 30 lbs. Of course, the weight per b.h.p. must vary according to the number of cylinders in the engine.

He had been asked to give the formula for determining the horse-power of engine. Every maker now practically used the R.A.C., which was  $\frac{D^2 N}{2.5}$ . A great deal of criticism was levelled at it, but no one could

provide a formula that would more nearly arrive at the horse-power: in one or two cases this formula was found to fail, but in most cases it struck the horse-power very nearly indeed.

Mr. Arnot raised the point that he (the speaker) was hoping to get out of—viz., trams—and he quoted the marvellous figures of 4.8d. per mile, including everything. If he remembered rightly, Reading found out that they had omitted, when estimating the cost, to allow for rails and other expenses. In other cities it had been found that the cost came out from 7d. to 8½d., and he did not think that any practical engineer would contend that he could work his cars for less than 7d. Mr. Arnot went on to say that he did not think motor 'buses could compete with trams. When he read a paper before the Institute of C. Engineers in London, he referred to the competition between the London General Omnibus Co. and the London United Tramways. The latter drove the 'buses off the road in West London, and they set to work to try and recover the roads they had lost; and he happened to know that they had been very successful and they were not only holding the roads, but were extending them. The result of this competition had been that the London Tramways found that their receipts for the twelve months, notwithstanding an extra twelve miles of track, had been reduced by £21,375; their shares, which stood at 4 (£5 shares), stood to-day at nothing. He thought that rather significant. He had been in West London himself, and he had noticed that people invariably waited for the motor 'bus in preference to the tram—they never knew if they were going to get to their destination in the tram, but if a 'bus got stuck up they got into the next. He did not think himself that electric trams had a particle of a chance against motor 'buses in the future, and he had no hesitation in saying that within the next ten years there would be fewer trams in the world than there were



to-day. Trams congested the traffic, they were costly to put down, and were a danger to everybody; further, they could not be depended upon to complete their journey. When a dirigible road vehicle was hung up you had only to get into the next and go on.

Leaving the tram question, he came to the subject of the petrol engine. This subject had been dealt with by steam engineers largely, who naturally have a preference for their particular kind. He did not think the steam engineers in Australia had given petrol the attention it deserved. He did not know whether the gentleman was present who recommended steam to the N.S.W. Government, but he (the speaker) would say that—that he was responsible to a very great extent for retarding the use of the commercial motor vehicle in this and the other States. The Government of Victoria imported four steam motor 'buses and two petrol ones; their engineer did not like the look of the petrol vehicles, so retained the steam ones and sold the petrol for what they would fetch. Six months later the steam 'buses were broken up for scrap iron, but the petrol ones are running to-day. The steam 'bus was unsuccessful in London. He granted they were fitted with flash boilers, but were any of you gentlemen prepared to provide him with a locomotive type boiler that would run at a speed of 12 to 14 miles an hour? He did not think you would succeed in doing it. A few years ago there were three firms in England manufacturing steam lorries. Could any of you offer to supply him with a Thornycroft motor to-day? Two of the firms mentioned had given up making the steam lorry; Leylands were still in a position to supply steam, but recommended petrol. He had a letter from them the other day with reference to steam or petrol for a certain district in N.S.W., and they strongly recommended petrol. He thought, of the 30 municipalities in England using motor waggons, 28 are using Leylands'. One firm used eight of Leylands'

steam lorries for nine years, but now buy the firm's petrol waggons. With regard to the question of running costs, these referred to vehicles loaded nearly or quite to their full capacity. The steam paid best, and would continue to pay best when you could light up your fire in the morning, get ready for the road, load up, go to your destination, unload, pick up another load, and so on, doing about forty miles a day with a full load. Petrol never would be able to touch steam under those conditions, but where were they to be found? How often was it that if you got a full load out you had an empty run home? How often was it that you did not have regular work? With petrol the costs only go on so long as the engine is running, and it was for that reason that petrol was taking the place of steam. The petrol was the vehicle of the near future, and he would therefore suggest that steam engineers study the petrol vehicle and find out what it was. They would like it more as they got used to it, and it would save them and their clients a lot of money. Some argued that steam was the thing of the future. Why was it that the traction engine was not supreme to-day, with its lowest costs of all? There was only one answer, and that was you could not get the loads to justify it. The same thing applied to the steam lorry. The petrol vehicle, too, was faster, and people were always willing to pay for increased speed.

There had been a number of questions asked with regard to wheels and tyres. He did not propose to deal with these, because the subject was such a lengthy one.

Mr. Nelson gave a very interesting contribution to the discussion—more particularly as he represented the Chamber of Manufacturers. In reply to a question he thought was suggested, he would say that the motor van or lorry would replace from  $2\frac{1}{2}$  to 5 horses, according to the use to which it was put.

Another question in regard to steam in this coun-

try was in regard to times of drought. Where were you going to obtain an unlimited supply of water from?

One gentleman mentioned that there were 108 things to go wrong with the petrol engine. Motor 'buses and vans were invariably put in the hands of most ignorant men after a week or a fortnight's training; they ran six or twelve months, or even two years, without a hitch of any kind. The London 'buses complete 99 per cent. of their time-table journeys. Did your trams do as much? He was sure they did not.

The President had referred to electric vehicles, also to a vehicle in England that could run 60 miles on its accumulators, and wanted to know why it was that the electric vehicle could not succeed because the accumulators must be re-charged in two or three minutes. In a large town you could not be certain of getting back after a specified number of miles. If you wanted to take a long run you had either got to put a shed at each end of the trip for changing the accumulators or use some other type of vehicle to run these long stretches. The London Electrobus Co. had been running on that system, and after every second journey on their short run of three miles the vehicles had to go into the garage to change the accumulators, which was done in five minutes. They had not earned any money. Probably the vehicle to which the President referred was the electrobus, and, if so, he (the speaker) would be inclined to take the "60 miles" with a grain of salt.

He had been asked to deal with the side slip. If you wanted to understand what side slip was, obtain a toy motor car and drive a nail through the front of it into the floor, then wind the spring and set the back wheels moving; the result would be that the back wheels would describe a circle round the front wheels. If you want to do away with this skidding you would have to provide waterproof dressing for the streets, which would do away with grease and afford better clutching for the



wheels. This matter deserved the better attention of our road engineers, and in this connection he would say that from statistics he had received in the last fortnight he found that motor vehicles constituted 60 per cent. of the traffic of the principal London streets on a week day, and 70 per cent. on a Sunday, and this percentage was increasing.

Mr. Shirra referred to the cheap oils being bad. He might say that in the early days oils costing 4s. per gallon were used, and one or two companies went bankrupt through it; they then came on to the cheaper oils, which had proved satisfactory. For himself he would use the most expensive oil he could buy, because he knew how to work it; but when you put a heavy car in the hands of a driver who has to go through traffic and pay more attention to the piloting of his car than to watching his lubrication, etc., you must use a cheap oil on account of the large amount he would waste.

Generally speaking, he was convinced that the future did lie with petrol. Steam would never go altogether; it would have its uses, but they would be in isolated places. Petrol was absolutely proved to the greatest experts in England in 1907 to be supreme with loads up to three tons, petrol or steam with loads from three to five, steam for loads over five tons. Since then petrol had advanced by leaps and bounds. When he left England in February last the demand was for petrol engines, the demand for steam vehicles being practically dead. Of the three leading manufacturers of steam, two had given it up, and the third was doing very little. He did not think he could bring greater proof of the supremacy of the petrol waggons, and to all who were interested he would suggest that they procure a copy of "The Commercial Motor" of 9th September.

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