were driven. That this point has had an enormous effect upon the efficiency and economy of a service no one would deny. To fully realise what it meant one had only to look for a moment at the enormously increased subsidy that a steamship company would ask for an extra speed sufficient to save, perhaps, one day on a voyage from Europe. Again, one might consider the views expressed by Railway Commissioners in Australia to deputations that grumbled at the slow speed at which trains travelled. Now, the motor vehicle, being subjected to greater vibration than either steamships or railway trains, must necessarily be more sensitive to increased rates of speed than either.

Having now raised some comparisons to draw attention to the undoubted importance of this point, it was desirable to consider what rates of speed were most economical and this was a point that permitted of more definite adjustment than most others. In England, the speed of commercial vehicles was rather well regulated by law, and the author was of opinion that it would be in the interests of everybody—owners, drivers and the public—to say nothing of the supply companies, if similar or slightly more stringent regulations were enforced here. Motor vans and 'buses, weighing less than two tons unladen, were restricted to a maximum speed of 20 miles per hour; over two, and under four tons, to 12 miles per hour; and between four and five tons, to eight miles per hour, always providing that the wheels were shod with tyres of rubber, or other noiseless or resilient material. Failing this, the maximum speed allowed was five miles per hour. Vehicles over five tons in weight, unladen, were classed there, as here, as traction engines, and were subject to different regulations altogether.

Now, what speeds were exacted from these machines locally. Invariably, the utmost that could be got out of them; up to 30 and 35 miles per hour if they were suf-

ficiently powerful. Who hadn't seen a four- or five-ton lorry, careering along at 15 and 20 miles an hour, a danger to itself, its load, and every other road-user? Probably, too, in no single instance, did the load carried warrant the enormously increased cost of carrying it at such a speed. Petrol consumption was probably 50 per cent. greater than it need be; tyres 25 to 50 per cent., according to the adequacy, or otherwise, of their size, and repairs double; to which must be added a largely reduced useful life for the entire machine. The goods were probably carried formerly by teams, averaging between two and three miles per hour; why, then, must motors attain such high average speeds as 15 and 20 to do the same work? Vendors of these machines were doubtless responsible, to some extent, for impressing upon purchasers the maximum speed the vehicle could attain under favorable circumstances, thereby leading them to expect it under all conditions. Trial runs were then given, and loads carried at these ridiculous speeds. To such an extent were buyers influenced by this kind of thing, that they often ended up by purchasing the vehicle that carried its load at the greatest speed, although, actually, that particular machine might be the least suitable in every other way. The author had known this to occur in cases where people were in a position to know better. In conclusion, it might be stated that tyre companies based their calculations for sizes and loads on a maximum speed of 16 miles per hour for all weights.

## THE REPAIRING OF COMMERCIAL VEHICLES.

To many the crux of the whole question of commercially running a motor waggon lay in the important matter of repairs and maintenance. Various methods were adopted by different firms, such as sending the car for a periodic inspection to the firm from which it was purchased; garaging with them and leaving them to under-

take the maintenance; making the driver responsible for the car entirely; and lastly, keeping a mechanic to look after it, whose duties might be divided between the motor and other similar work. All such methods were bad and uneconomic.

Leaving the agent to periodically inspect it, except in one or two instances was thoroughly bad policy. Providing that the firm in question thoroughly understood its business, its inevitable aim would be to keep the vehicle running at its best so as to make it as good an advertisement as possible for itself. Such a policy would be uncommercial in that it would involve the machine being off the road for a longer period annually than was absolutely necessary. Again, keeping parts in the highest possible state of repair involved renewing wearing parts before it was necessary to keep the machine running commercially successfully. This only applied to those agents who thoroughly understood the needs of the commercial vehicle—and they were few. Most of them had taken up agencies for vans, additionally to touring cars, and expected to run them under the same organisation, which was "bad" from the user's point of view. Further, to quote from a paper read recently on the subject by Mr. David Smith, before the Institution of Automobile Engineers, London:—

"As with all other new trades, there was a large influx of men into the motor trade, many of whom had had no mechanical training of any sort. It is only fair to state that many of these men had a natural aptitude for the work, and have become very good workmen indeed; but a large number have not done so, and the majority of the latter are, the author regrets to state, to be found in the motor repairing shops, some owning small repair works or garages of their own. These men, although possibly quite capable of taking down and erecting a car, do so by

rule of thumb only, and have often only the vaguest ideas as to the reason why a car will not run satisfactorily, and proceed by an expensive process of trial and error to locate the trouble." The same remarks, coupled with those made before regarding garaging, applied to placing the cars in the hands of the selling agents. It paid nobody. These cars blocked up the space of the agent and did not pay him unless he wanted one or two to gain experience in running costs, and it didn't pay the owner for reasons previously stated.

To place a car under the sole control of the driver naturally depended almost entirely on the personal element. Drivers had frequently complained to the author that they were expected to drive the cars all day, and then to clean and repair them during the night, which meant that they didn't, and were then blamed as careless, or useless. For a single car the author believed that this method of control was as satisfactory as any, unless some co-operative scheme of maintenance could be devised, in which case that was preferable. For a driver to control, and to be efficient, the duties should be strictly limited to driving, cleaning and effecting running repairs. The purchase of stores should be reserved by the proprietor, which prevented not only dishonesty by the driver, but also annoyance from the salesmen. The driver's work should be specified, and certain well-defined periods allowed for engine cleaning and inspection. His work, too, should be subject to supervision, say, twice yearly, by an independent engineer, who should specify repairs, leave them to the owner to have executed, and then pass them on completion. The examinations should be made by arrangement with an individual, and not a firm of motor engineers, who might send anybody, and who might be interested in the sale of some other make of car. The agents for the car itself, too, were liable to bias, and any

of these might easily make the driver's position an uncomfortable one, and prevent him from giving the best possible service.

The last mentioned calls for but little comment. It was sound, but liable to be expensive where single cars were concerned. Where two or three comprised the fleet the employment of a mechanic was imperative. In such cases the drivers need not be mechanic drivers, and would consequently earn less wages. Here again, the mechanic should be subject to the control of an inspecting engineer. In the author's opinion there was room for two or three highly-trained motor engineers, with both practical and theoretical knowledge, in Sydney. A mechanic's training was purely at the bench, and it was ridiculous to imagine him to be capable of the commercial repair and maintenance of motor vans, for he wasn't. Ask him to put into a fleet the most economic bearings, and he would probably put in solid phosphor bronze, because they would undoubtedly wear longer, but, oblivious to the fact that they would wear the crank shafts oval and consume more lubricating oil, etc., etc. Tell him to choose a white metal, and if his previous work had been with marine engines he would put in that metal which he had used at sea and wonder why on earth the big ends kept running hot. Ask him to choose a lubricating oil, and he would probably buy one from the man he liked best, or who flattered him most, not having been trained to understand, he was naturally no more able to do so than was a layman able to follow an engineer's description of a differential gear. Each man to his own trade, and such things were not within a mechanic's knowledge, and owners had no right to expect it of them; it wasn't fair to the men.

The marvellous part about it was that no employer would entrust his buying to an assistant behind the counter—he hadn't the experience or training—but that

same man would entrust a fleet of motor vehicles, worth perhaps thousands of pounds, to an untrained man, and treat anybody who questioned that man's ability as mad. The engineer was every bit as necessary in running commercial motors as in building ships and bridges. Supervising by engineers would probably work well enough in fleets up to, say, ten vehicles, but over that number an experienced engineer should be regarded as an economic necessity for the plant.

An amusing example of what a mechanic would do, and do in all good faith, came under the author's notice only a few weeks ago in another State. A five ton lorry had been burnt on the road owing to a backfire, through the carburetter, it was stated. The body was completely destroyed, and so were three of the wheels and tyres. The metal of the gear-box had fused in two or three places, as also had the male member of the clutch. The radiator was done for, and the engines seized. The frame, which was wood-armoured, had all the wood burnt out, and one of the back springs was broken, due, probably, to excessive expansion, caused by the heat. Add to that the fact that the car had already some eight or nine years' service to its credit, and one would think that the cheapest thing to do would have been to have let the insurance company have it and sell it for scrap. Not so our friend—he could repair it, and he would—there was no doubt about it. The car couldn't have been worth more than £200. He would spend that sum, or £250, on it, and run it. One wonders how the gears, engine, steering gear and frame would work after the heat they had been subjected to? Then perhaps his employers would believe that the scrap heap would have been the best place for it.

It was a pity that some genuine attempt hadn't been made earlier to run an independent repair shop. Agents

tell them, and rightly, that repairs didn't pay, and they did not, but an agent suffered from disabilities that an independent man didn't. It was not necessary to specify the causes that led up to this, but some of an agent's limitations must be obvious. Needless to say a proper repair shop needed to be a highly organised establishment with a qualified engineer in a leading position. By dealing scientifically with the maintenance and repair of commercial vehicles it would be possible for him to keep them in just that state of commercial efficiency that would give the best results and reduce the cost of running to an absolute minimum. It would follow, naturally, that if such a shop succeeded, work would be pressed upon it until it had all it could possibly undertake, and two or three more trained men would become necessary.

One of the most awkward questions in the motor repair world was that of spare parts. The cost of them was enormous, and it was freely asserted that manufacturers earned more from the sale of spare parts than they did from complete cars. Again, it was suggested that a manufacturer priced his spare parts with a view to preventing people from purchasing complete sets and erecting cars themselves. Let them see what Mr. Smith said on the subject, in his paper before the Institution of Automobile Engineers, last year:—

"Manufacturers, in bringing out a new model, must make a certain number of extra parts to be kept in stock as spare parts for replacement, the extra parts being in such numbers as experience dictates. The course sometimes adopted is to spread the cost of these spare parts over the whole output of the particular model when fixing the selling price of the cars.

"If the whole of the spare parts were sold it would show a reasonable profit, but against this is to be set the

expense of storing and looking after these parts, probably for a good many years. Also, it must be considered that many of the spare parts made will possibly never be sold, and will have to be scrapped in the end.

"To make the parts of old models as the orders are received is not to be thought of in any works running under paying conditions. It means the stopping of machines from their regular work, and if this is done, no price that could be asked in reason would make the work profitable. It would be far better to say at once that the part was out of stock, and had better be made by the repairer, if it is anything but a casting needing an expensive pattern, and, thanks to the acetylene blowpipe, very few new castings are now required."

"It is certainly advisable that the parts used in repairing any car should be those made by the makers of the car. The repairer has not the advantage of the special tools and jigs, and the knowledge of the quality of the material used, that the maker has, and no matter how carefully the part is made, it is reasonable to suppose that it cannot be quite so accurately finished as the parts produced by the maker, while the repairer, not knowing the exact material used by the makers, may inadvertently use one of inferior strength."

This was, in the author's opinion, most important. Users should insist, where possible, on parts made by the manufacturer being used, even if costing more. The repairer would not object, as his profit would be as great. The author had discussed the question of spare parts with many local agents, and it was one that caused much worry. The cost of stocking an adequate amount of spare parts was almost prohibitive, and to manufacture was not very satisfactory, for the reasons stated above, and because the same grades of steel were not obtainable here

that were used in Europe and America. Again, some agents did not stock spares, and the buyer only found that out when he needed them. The most reputable firms, however, did carry comparatively large stocks.

In the two tables which would be found at the conclusion of the paper, are given some prices respecting the cost of spare parts. In table I. were given the relative costs of spare parts, as shown in the catalogues of two different makers, from which would be seen the enormous discrepancy that existed between the two methods of pricing. In Table 2 was given a miscellaneous collection of makers' prices, and the actual cost of manufacture. These two tables, it was thought, would give some adequate idea of the indiscriminate manner in which manufacturers priced their spares.

The buyer would best protect his own interests if he insisted on seeing the spares kept, and bargain before purchasing his car, as to the sum he would be asked to pay for those he was most likely to need. The question then arose as to what he was most likely to require, and that must depend on the size of his fleet. If he owned six vehicles of one make and size he should work on the complete spare principle and keep a complete spare engine, gear box, radiator, front and back wheel. When any repair became necessary it was merely needful to change the individual part and repair the one removed, at leisure. With a smaller fleet down to one vehicle it was desirable to lock up the least possible amount of capital in spares. Where one vehicle was concerned it was well to ascertain that the agent had ample spares and to merely stock an adequate collection of bolts, and nuts, and similar parts, in addition to those that everybody kept with every car, such as sparking plugs, springs, etc. Greatest attention should be paid to the adequate stocking of spare pins for the wearing parts of the steering gear, change speed gear,

brakes, and torque rods. All of these were called upon to do hard and severe work, which had probably been adequately allowed for by the manufacturer. Again, the wearing parts were made to an exact (usually metric) standard, and unless the replacement fitted exactly it was liable to give continual trouble. The author had an experience once, where the driving shaft of the car in question was divided into two pieces coupled together and bolted by means of eight bolts. These were adequate, but in renewing, three-eighth bolts were employed, with the result that about a fortnight later they all broke, first on one car and then on another. Serious accident might have resulted, too, owing to the foot brake becoming inoperative. Careful examination showed that the bolts had stretched and broken. An original bolt was taken from another car and a careful comparison made, when it was found that it was of 10 mm. pattern, and of special steel; the three-eighth bolt had seemed right to the foreman until the experience was gained and those provided by the manufacturer employed afterwards. The author had often marvelled at the increasing number of motor accidents that were taking place in Australia to-day, when the steering-gear was alleged to have given way, and had wondered whether in some cases something similar wasn't the true cause! The question was a small one, but one worthy of most careful attention. The renewal of bolts and pins should not hang a car up, and was liable to become necessary at any time, whilst the breaking of a cylinder or crank-shaft was not likely to happen, and would take a day or more to remedy at the best.

## RUNNING COSTS.

The only remaining question that was likely to prove of considerable interest to members was that of running costs, and it was hoped that the ensuing discussion would provide some interesting figures of the

cost of work actually accomplished by different makes of car under actual load conditions in New South Wales. In the hope that this might be the case and some valuable data added, in the discussion on this paper the author did not propose to provide any estimated costs, which could be of no real value. Thanks to the courtesy of Mr. Joe Hamer, the engineer in charge of the fleet of waggons run by the City Council, he was in a position to give some actual figures gathered by Mr. Hamer in the course of his conduct of the transport of this department.

TABLE "A."

**Working and Expenses of No. 3 Motor Waggon from August 15th, 1911, to August 17th, 1912.**

| | |
|---|---|
| Total working period .. .. .. | 292 working days; 21 days in garage. |
| Mileage .. .. .. .. .. .. | 6,832 miles. |
| Total amount carried .. .. .. | 5,824 tons, exclusive of body. |
| Petrol used .. .. .. .. .. | 302 cases @ 8 galls. per case. |
| Lubricating oil, gear oil, and kerosene used .. .. .. .. .. | 60 galls. |
| Repairs through accidents .. .. | £8 10s. |
| Repairs and renewals (wear and tear) .. .. .. .. .. .. | £5 6s. 8d. |

NOTE.—This motor has been used exclusively in the cartage of gullies, except in the case of a week or two.

TABLE "B."

**Actual Costs and Work done by Street Watering Waggon, Sydney.**

| | |
|---|---|
| Petrol .. .. .. .. .. .. | £3 10s. per week. |
| Oil .. .. .. .. .. .. .. | 1s. 7½d. per week. |
| Tyres .. .. .. .. .. .. | £4 10s. per week. |

Ten hours a day. 180/000 galls. per week. 296 miles per week.

From the above it would be seen that information might be given to show that a cart with horse and man cost 13/9 per day, whilst one motor does the work of 10 carts and costs £2 9s. 2d. per day, including labour. The motor accordingly removed 20 tons per day at 6s. per ton, or at one-third of the cost with horses. What applied for municipal work certainly applied for ordinary cartage where firms might be called upon to cart many miles into the country at short notice.

Let one compare the convenience in carting from Sydney to near, say, Picton. The distance would be approximately 50 miles. To cart by horses was prohibitive, hence it becomes a choice between motor and rail. The former loaded up at the store and unloaded at the destination some five hours later. The latter loaded up at the store, unloaded at the railway, loaded on to truck, unloaded again at terminal station, loaded on to carts, and thence to destination; time occupied, two or three days, and the condition of the load might well be imagined, unless it was manure or some indestructible commodity.

## CONCLUSION.

In the foregoing the author had endeavoured to put forward some of the factors facing the owner of commercial motor vehicles to-day, and suggested some means for economising working expenses. He devoutly hoped that the discussion would be productive of some actual working experiences locally and costs of running; also that users would not be backward in giving particulars of their problems and difficulties. That many were in urgent need of solution left no possible room for doubt, and if the development of the country districts was to proceed on the lines alone made possible by the use of the commercial motor, it was imperative that a solution be found for several at least of the difficulties outlined in the foregoing paper.

TABLE I.

| Name of Part. | A. £ | s. | d. | B. £ | s. | d. |
|---|---|---|---|---|---|---|
| Connecting rod, complete .. | 4 | 5 | 0 | 1 | 3 | 6 |
| Bronze crank shaft bearing .. | 2 | 4 | 0 | 0 | 10 | 0 |
| Rear brake shoes .. .. .. | 1 | 15 | 0 | 0 | 17 | 6 |
| Rear brake drums .. .. .. | 1 | 17 | 9 | 0 | 17 | 6 |
| Piston, complete .. .. .. | 3 | 12 | 0 | 1 | 15 | 0 |
| Valves .. .. .. .. .. | 0 | 16 | 6 | 0 | 3 | 6 |
| Bevel pinion and shaft .. .. | 5 | 0 | 0 | 2 | 7 | 0 |
| Bevel crown wheel .. .. .. | 5 | 10 | 0 | 2 | 12 | 0 |
| Crank shaft, four-throw .. .. | 24 | 15 | 0 | 8 | 17 | 0 |
| Cylinders, complete, per pair .. | 20 | 0 | 0 | 8 | 8 | 0 |
| Half-axle shafts .. .. .. | 3 | 12 | 0 | 1 | 4 | 0 |
| Large differential pinion .. .. | 2 | 10 | 0 | 0 | 18 | 6 |

TABLE II.

| Name of Part. | Makers' Quoted Price. £ | s. | d. | Cost of Manufacture. £ | s. | d. |
|---|---|---|---|---|---|---|
| *Piston, with rings .. .. .. | 2 | 5 | 0 | 0 | 18 | 6 |
| Crank shaft, four-throw .. .. | 22 | 10 | 0 | 9 | 5 | 0 |
| Main crank-shaft bearings .. | 1 | 10 | 0 | 0 | 8 | 6 |
| Piston rings .. .. .. .. | 0 | 2 | 7 | 0 | 0 | 10 |
| Front wheel cones .. .. .. | 0 | 5 | 7 | 0 | 2 | 4 |
| Half-axle shaft .. .. .. | 2 | 4 | 6 | 0 | 15 | 0 |
| Large crown wheel .. .. .. | 4 | 12 | 6 | 1 | 17 | 6 |
| Small bevel pinion and shaft .. | 2 | 15 | 0 | 0 | 18 | 0 |
| *Rear brake shoes, lined .. .. | 2 | 16 | 6 | 1 | 2 | 0 |
| *Rear brake drums .. .. .. | 1 | 15 | 6 | 0 | 17 | 0 |
| Valves .. .. .. .. .. | 0 | 10 | 6 | 0 | 3 | 9 |
| Connecting rod, complete .. | 3 | 12 | 0 | 1 | 14 | 0 |
| Connecting rod, big end bush . | 1 | 3 | 6 | 0 | 7 | 0 |
| Connecting rod, small end bush | 0 | 3 | 6 | 0 | 1 | 7 |

* One-twelfth cost of pattern charged in these items.