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Front Wheel Wobble.

THE CAUSES, EFFECTS AND CURE OF FRONT WHEEL WOBBLE.

Front Wheel wobble is one of the commonest and most aggravating lapses from perfect performance that the steering system of an automobile is guilty of; yet, with all, it is probably the least understood, by car owners.

Wheel wobble can best be described as a tendency of the front wheels, to turn first, to the right, and then to the left at a definite frequency, without corresponding movement of the steering wheel. As a rule the amplitude of the vibration is not great, yet, in many cases it becomes sufficiently severe to cause loss of control of the car unless it is stopped.

> ***A Number** of engineers believe that many baffling cases of wheel wobble are due to the engine itself. On this point Mr. H. C. Dickinson, Research Manager, Society of Automotive Engineers, has the following to say.*
>
> *"Another possible source of wobble producing forces is the propulsive force driving the vehicle. There are several obscure ways in which some of the engine power may be absorbed in producing wheel wobble on a level road. An illustration of how this can occur is sometimes seen when towing a four-wheel vehicle such as an ordinary two-horse wagon or carriage from the end of the pole. Such a trailer will sometimes wobble from side to side in perfect synchronism. An analysis of the various forces and reactions involved in this performance, or in any of the possible conditions which may apply to an ordinary motor vehicle would occupy too much space. The point I wish to make is, that the forces which make the steering wheels wobble can come from the engine, but I doubt if they often do."*

Possibly, the reason why, wheel wobble is so little understood is because it can be caused by so many things. Probably, one of the most probable sources of this trouble is, lost motion in the steering mechanism, assuming that the steering system has been properly designed. The effect of lost motion can be likened to that of snapping a

link chain back and forward like whip. Just as all the links of the chain act as individual snappers, so also do the various points of lost motion in the steering system snap in turn when the wheels strike an obstruction, setting up the wheel vibration or wobble. Many times the engine is mounted rather flexibly in the frame and where this is the case or where the engine is somewaht loose on its mountings it acts in a manner similar to a weight on the end of a chain, increasing the shock.

Another source of wheel wobble can be found directly in the driver himself. Some drivers are habitually bothered with wheel wobble, yet, let some-one else drive the same car and the wobble disappears. Invariably these drivers will be found to grip the steering wheel tightly. When the front wheels are deflected slightly by some inequality in the road surface, the driver immediately attempts to turn them back to the straight ahead position rather than let them normally resume that position through the caster effect of the front axle. If, and this is usually the case, the torque which he applies to the steering wheel is consistently greater during the time when the front wheels are coming back to normal position than while they are turning away from the normal position, this difference in force will start the wobble and will maintain it. Drivers who consistently drive with a very loose hand upon the steering wheel seem to be almost free from this trouble.

Wheel wobble from this source was recently demonstarted by the purchaser of a new car who returned it to the service station with the report that the " front wheels wobbled all over the road " Tests by the service department disclosed no evidences of wheel wobble, although the owner continued to complain after the car was again delivered to him. Finally the service manager accompanied the owner in the car. Sure enough, when the owner was driving, quite perceptible wobble developed which disappeared when the service man took the wheel , the owner held the wheel in a tight nervous grip while the service man drove with a loose hold on the wheel. After this demonstration the owner realized the trouble lay in his own method of driving and adopted the looser grip.

A tight grip on the steering wheel will not only be apt to bring about wheel wobble, but it also causes much fatigue.

Another cause of wheel wobble, and one that is, in a way, related to the tight driving grip is the lack of caster to the front wheels. If the front wheels have the proper caster they will always tend to return to the straight-ahead position. Upon first thought, caster would seem to aggravate wobble. In one way its action is similar to that of force of gravity upon a pendulum, this force pulling the pendulum to the vertical position, past which it swings, again to return and continuing until stopped out by friction. If the wheels are castered too greatly, this action will probably take place, yet

rarely do we find a car with too much caster.

With too little caster, the usual condition, there is practically no tendency on the part of the front wheels to return to the straight-ahead position without the assistance of the steering gear. Thus, when the front wheels are deflected by a rough spot in the road the steering wheel must be brought into action, to keep the car on the road. This calls for a nicety of judgment, in determining just how much the steering wheel must be turned, that few drivers possess. Usually the wheel is thrown over too far, starting a see-saw that grows worse with every turn of the wheel, finally resulting in loss of control unless the car is slowed down.

So far, with the exception of improper caster, we have been dealing with properly designed steering systems. One point of design that is sometimes overlooked is the proper alignment of the drag link. On this point the Ross Gear and Tool Co., manufacturers of steering gears have the following to say:

" The drag link knuckle arm ball and front spring eye should constitute three points in a straight line and the more any one of these points deviates from this point line, the greater will be the wheel wobble on roads, and consequently increased the shock to the steering gear, which will also increase the hardness of steering. When the spring is deflected the axle moves in an arc upwards and backwards and the drag link moves backward as it rises, so that the wobble of the front wheels due to spring action is reduced to a minimum if this straight line realtionship is had. Shortening the drag link has a tendency to increase the shock transmitted to the gear, while lengthening will further reduce it" This, of course, is a condition over which the car owner has no control, the proper or improper relationship being determined by the car designer.

Wheel wobble may also be caused by front wheels out of balance. This out-of-balance condition creates an oscillatory force on the front wheels, that cause them to play through the entire steering system. One type of demountable rim had to be discontinued because of the large amount of metal used at the joint and the out-of-balance effect that this produced.

Apparently the character of the road has an effect on wheel wobble, although just what this is due to is not clearly understood. In one car in which " playing " was the result of faulty design this occured at twelve to twenty miles per hour on rough roads and at thirty miles per hour on smooth roads. Wheel wobble when caused by faulty design is a type of harmonic vibration, in which enters not only the wheels but the steering gear, frame and engine as well.

Thus the character of the road will be still another factor since this has at least some control on the vibration of the car as a whole.

Many cases of wheel wobble can be cured by the motorist himself. If he is having trouble from the source the first thing to consider is

himself and his method of driving. Does he find himself gripping the wheel tightly in an intense, nervous grip ? If he does, he should school himself to relax when at the wheel and drive with a loose hand. Of course this does not mean holding the wheel so loosely that it can be twisted out of his hands; may the proper grip be likened to that of shaking hands with his best girl, as contrasted with the grip given a male friend whom he is attempting to make wince with the strength of the hand clasp.

This will not only help to prevent wheel wobble, but it will also result in less fatigue while driving.

As stated before, "playing" may be due to improper caster. The car may not have had the proper amount when it left the factory or the front axle may never been bent later, so that proper caster no longer exists. In the majority of cases the caster must be increased and this can be accomplished rather easily by placing a small spacer between the rearward edges of the axle spring pads and the front springs. This tilts the axle slightly backward say that the center line of the steering knuckle intersects the road silghtly ahead of the point of contact between the tire and the road. A shim thickness from 1/16 inch to 1/8 inch is usually sufficient. The shim can be inserted by loosening the nuts on the U bolts clamping the spring to axle and lifting the car frame with a jack. The tapered end of an old spring leaf usually has just about the proper angle and this may take the place of the shim. A hole should be drilled torough the leaf to accomodate the center bolt, and the thicker portion should be towards the rear of the car.

Wheel wobble, due to looseness in the steering connections can be corrected, of course, by locating the points where play exists and removing this through proper adjustment. If the lost motion is due to worn bushings or ball joint sockets these should be replaced with new ones.

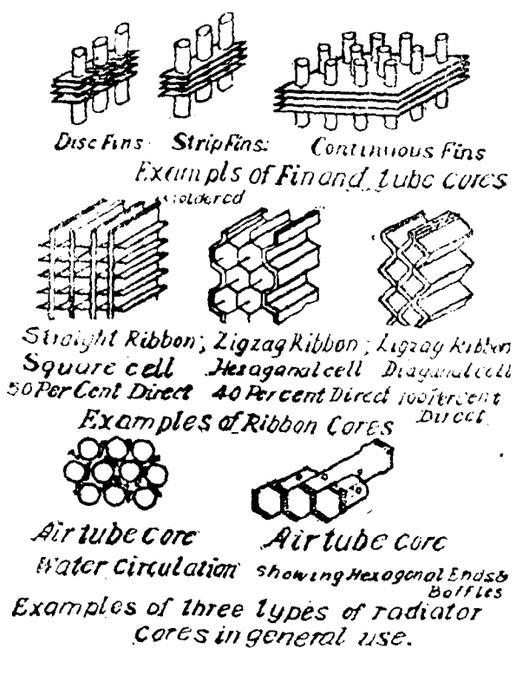
There is one infallible remedy for wheel wobble, unless the wobble is due entirely to the driver. This is to introduce enough friction somewhere in the steering system so that it will just over-balance all the forces, whatever they are, that tend to maintain the wobbling motion of the wheels. In some ways this cure may be worse than the ill, for not only will it make the car steer harder but it will induce rapid wear in the tightened steering connections. It will cure the wobble for a time, but eventually play will appear at the worn connections and the wobble will be even more severe than before.

Another article "How to adjust the front Wheels" will appear, watch for it.

Cooling from the Very Beginning.

DAIMLER INITIATED THE MODERN JACKET, RADIATOR AND FAN COMBINATION 25 YEARS AGO — FEATURES OF MODERN COOLING PRACTICE.

Twenty five years ago an English magazine, devoting a portion of its pages to the then new play thing, the "horseless carraige," carried the following item : "The arrival of a new German Daimler Car from Cannstatt, created quite a sensation. The most advanced item was the cooling. A device resembling the condensor of a marine engine was vertically mounted at the front of the Chassis and contained two and half gallons of water in small tubes. Behind this was a fan, carried direct on the crankshaft, and drawing a powerful draught through the tubes. Thanks to this design, the temperature of the water could never exceed 125 F., according to the inventors, and evaporation did not average more than one and half pints in eight hours running."



Thus we see the birth of the automobile radiator—probably very crude, as the description suggests, but in it all the elements of the modern cooling system, a reservoir of water, cooling tubes and a fan to supply a current of air while the car is not in motion.

It is hardly necessary to comment upon the need of some means of cooling the automobile engine. Without it the heat from the burning fuel would soon raise the temperature of the engine to a point where lubrication is impossible. In the very early days, before Daimler brought out his thn sensational device, engines were either air-cooled or water-cooled by "hopper," a non-circulating

system such as is still used for many farm type engines. Subsequent to this, all water-cooled Automobile engines, and these are in the large majority, have been provided with some type of radiator.

While there are many types of radiators, they are similar in their main details. A radiator contains tanks located at the top and at the bottom to receive and distribute the water. A cellular portion, usually called the core, occupies the space between the top and bottom tanks and serves to cool the water as it is circulated through it. The core is made up of numerous small passages through which the water flows while provision is made for air to circulate past and around the hot metal to remove the heat. These form the body of the radiator and around them is placed a protective casing which provides the means for supporting the unit on the chassis.

The core is usually made of rectangular outline and uniform thickness and while constructing in a variety of forms it always has the characteristic of thin walled water passages with free air circulating over their exteriors. Radiator cores in general use can be divided into three classes, fin and tube, ribbon and air tube.

In the first type, the fin and tube, the water passages consist of several tubes to which fins, about twice the diameter of the tube, are fastened. These fins increase the surface swept by the air and make possible a more rapid dissipation of the heat, in the same way that the fins on an air-cooled cylinder make possible this type of cooling. This method of construction is varied by using, instead of separate fins on each tube, a long strip punched to take a row of tubes. A still further modification is the continous fin construction, the individual fin being replaced by a plate taking all the tubes in the radiator. The Ford and Cadillac radiators are good examples of this type of construction. Regardless of whether the fins are separate or in the form of a continous fin they are equally spaced, with about 5 or 6 per inch. The tubes are usually from 1/4 to 3/8 inch in diameter.

In the ribbon type radiator the water passages are formed between parallel plates or ribbons, whence this type gets its name. Pairs of these plate are separated slightly either by crimping the edges or by a separating wire and soldering. The spaces thus enclosed form the water passage. The completed ribbon may be arranged in a number of ways. In some cases they extend straight from the top to the bottom of the core. In other cases they are zigzagged but whatever the type, they form communicating channels between the top and bottom radiator tank. The ribbons are separated at intervals by ribs or fins of flat metal that both stiffen the core and provide additional cooling surface. These are evenly spaced and give the completed radiator a cellular appearance, of squares, diamonds, or hexagons, according to the shape of ribbons. With this type of construction, two sides of each cellular opening consist of

water surfaces. The construction is sometimes modified in high efficiency radiators by joining the zigzagged ribbons directly to the other and omitting the fins. Thus water surrounds each cell and a much larger cooling effect is obtained. The water passages in the ribbons are from 0.05 to 0.06 inches wide and the air cells usually from 3/16 to 3/8 inch square.

The third form of radiator, the air tube, has a core made up of short tubes packed closely together in horizontal rows, with their ends flared and soldered to form the front and the back of the core. The air passes through the tubes while the water fills the space around the tubes and flows in any path from the top to the bottom of the core. In some cases dents are made in the tubes to increase the cooling effect. These dents do not add to the cooling surface but they set up a turbulance or swirling of the air as it passes through the core, thus preventing the air from passing through each cell, as a solid plug with only the outside layer drawing heat from the hot metal wall.

Air tube cores have much the same appearance as the ribbon core and both are true cellular types. Air-tube cores have been made with both round and square tubes, but neither type has been much used owing perhaps to the cost of manufacture. Furthermore such radiator cores have an enormous length of soldered joints and as a result are very delicate.

Naturally the core having inherently the greatest strength is the fin and tube type and for this reason is preferred on trucks and tractors where severe vibration has to be contended with.

Sketches showing various forms of these three types are shown in one of the attached illustrations.

From the standpoint of cooling efficiency, i.e., the amount of heat that a given size raditaor will dissipate, the aircore is the best although the zigzag ribbon type without fins is a close second. Next to this is the ordinary ribbon type and finally the tube and fin type. This does not necessarily mean that a car employing a tube and fin radiator will be inadequately cooled, for the capabilities of each type are known. Thus the engineer can select a radiator of the proper size for his engine regardless of type. Indeed many cars in the market have radiators that are too efficient, if such an expression can be used, and are over-cooled. This results in a lowered engine efficiency and usually an abnormally high fuel dilution of the lubricating oil, with the ills attending such dilution.

The amount of heat that a radiator must dispose of is seldom realised. Average figures taken from a great number of poppet valve-engines show that one third of the heat generated by the burning fuel is carried off by the circulating water. Since only about one-fifth of the energy in the fuel actually goes into driving the car, the radiator must dispose of half again as much energy as is used in moving the car. The amount of heat that a radiator can dispose of naturally varies directly as the

area of the core front and also as the depth of the core although for any type there is a definite depth beyond which little if any further increase in capacity will be obtained.

The speed with which the water flows through the core also effects the capacity of the radiator, the higher the velocity of the water, the greater will be the radiator capacity. Thus the type of circulating system, as well as the engine size, influences the size of the radiator. Of the two systems in use, pump and thermo-syphon, the latter demands the larger radiator because of the slower water circulation that it gives. As a rule the water passages are somewhat larger for radiators designed for the thermo-syphon system.

Such radiators are fitted also with extra large top tanks to give a large water capacity. Circulation of the water in this system depends upon the difference in weight of equal volumes of water at different temperatures. The cool water from the radiator enters the engine jacket and as it becomes heated its density decreases thus causing it to rise in the jackets, its place being taken by additional cool water from the radiator, This naturally sets up a circulation upward through the engine jackets and downward through the radiator. However, the difference between the hot and cold water is not great and unless the water in the system covers at least a portion of the upper inlet to the radiator the circulation will not take place ; the water cannot lift itself by its own bootstraps as it were. Thus to prevent a too rapid fall in water level due to evaporation, a large volume of water is required and this is supplied by the extra large top tank.

Pump circulation systems do not have this limitations and circulation will continue as long as sufficient water is present :to completely fill the engine jackets. This does not signify, however, that the water level in the radiator of an engine employing pump circulation should not be kept well up.

Even though the water be circuated at a low level, the temperature of the water entering the engine jackets will rise as the quantity of water becomes less. This results in boiling and a radiator being soon emptied. With engines employing the thermo-syphon system the matter of water level should be closely watched, for if this drops below the upper radiator connection, circulation immediately stops.

So far only the three major parts of the radiator have been touched upon, the upper and lower tanks and the core. Three other parts, that might be termed accessories, are the filler, overflow and drain. The latter is placed at the lowest point in the cooling system so that all the water may be drained from it, when occasion demands. The overflow consists of an open tube, the upper end extending into the filler, the lower end leading to the open air below the engine pan. This tube determines the upper water level and drains that rising above that level, thus preventing it from escaping out under the filler cap and staining the radiator surfaces. In

several cars, somewhat of a departure has been made in the arrangement of this overflow. The lower end instead of communicating with the open air is connected to a small tank carried on the chassis underneath the body. In addition the filler cap closes with an airtight seal. Thus when evaporation takes place the vapor is condensed and caught in this tank. As the radiator cools a suction is created that drains the condensed vapor from the tank back into the radiator. This overflow arrangement assures a proper water level at all times unless actual leakage takes place, and replenishment is necessary only at long intervals. Such an arrangement is of special value where water is scarce. It is also an advantage when alcohol anti-freeze solutions are used in as much as the alcohol that would otherwise evaporate and be lcst, is caught in the condensor tank.

In service the radiator gives little trouble and about the only things that can happen to it are clogging through the use of impure water, and leakage due to an open seam. The former can be guarded against by the use of clean water and by an occasional draining and cleaning, and the latter (usually the result of an accident), calls for repairs.

In cleaning the radiator it is advisable to run the engine with the radiator covered until the liquid in the cooling system is boiling hot.

Shut off the engine and immediately open the drains in the cylinder blocks and radiator.

If an alcohol anti-freezing solution is drawn off, part of it may be used again if the sediment is allowed to settle. In case it is used again its specific gravity should be tested with a hydrometer, after it has thoroughly cooled.

When the liquid has drained off, replace the drain plugs and fill the radiator with clean hot water. Then repeat the operations outlined above.

If in draining the second time, the water is very dirty, it may be desirable to repeat the flushing operations a third time, using a solution of sal-soda. If the sal-soda solution is used, be sure that it is drained out and the cooling system flushed again with clear water.

The sal-soda should not be allowed to get on the finish of the bonnet or radiator.

If this is done twice a season difficulties from clogged radiators will not arise.

Repairing radiators calls for considerable experience in handling a soldering iron and solder, so that the novice should not attempt the job even though he may be able to make acceptable connections. With a cellular radiator the motorist can make a temporary repair by closing the openings of the leaking cell with two rubber or leather washers held to the front and back of the core by a bolt or even wire twisted to press the washers tight against the metal.

Where a permanent repair is to be made the radiator should be

removed from the chassis and tested for leaks other than the one noted. To do so proceed as follows :—Plug the large hose connections on the radiator and screw on and tighten the radiator filler cap. Attach an air hose to the lower end of the radiator overflow pipe, immerse the radiator in water and turn on air under a pressure of approximately fifteen pounds. Leaks are indicated by air bubbles.

In a fin and tube pipe radiator leaks generally occur where a tube is soldered to the upper or lower tank or header. In making such a repair the tube should be re-soldered on the inside of the header. This may be done after removing the radiator casing, and removing the tank by unsoldering. If it is necessary to replace a tube, remove both tanks by unsoldering, lay the radiator down flat, and with a blow torch melt the solder the entire length of the tube to be removed. The tube can then be pulled out. Before putting in a new tube, tin it its entire length. After the tube is in place and the fins are lined up, solder the tube to the fins, using a blow torch. With a soldering iron, solder the ends to the headers.

Whenever radiator tanks are removed for any purpose, it is a good plan to test all the tubes. Test each tube separately by plugging one end and forcing air under approximately fifteen pounds pressure into the open end, while the radiator is immersed in water.

Inspect the radiator fins. They should be parallel to each other and equally distant from each other. To insure maximum radiator efficiency, each fin must be soldered to each tube.

Repairs to the cellular type should be carried out in much the same manner as that described for the fin and tube type. If the leak is at the junction of the ribbons and one of the headers this should be soldered inside the header. Leaks in the ribbons are always at either the front or back of the core and solder can be run on the edges with a hot iron.

There are a number of precautions to be observed in caring for the radiator, other than the periodic flushing referred to before. Keep the cellular openings clean. Never allow mud to remain in them as it cuts down the radiation and prevents proper cooling.

Never—and be sure about this —put cold water into the radiator while the motor is hot. By "hot" we mean any temperature which is uncomfortable to the hand when held against the cylinder head.

When a motor gets "hot" the cylinder walls and especially the cylinder head around the exhaust ports are thoroughly heated up. The danger of cracking these parts cannot be over estimated: so, make it a point, should you stop for water after the motor has been running for some time, to test the temperature of the motor by raising the bonnet and placing your hand on the cylinder head. If you can hold it there with comfort, water can be placeed in the radiator, if not wait until you can. It will only take a few minutes for the motor to cool off, and the repair bill saved will more than offset the slight loss of time and inconvenience.

And finally it is not a good plan to put cornmeal, bran or other substances in a radiator to stop a leak. It clogs up the tubes, thereby decreasing the radiating efficiency. Make a permanent repair at the first opportunity.

The Interesting Gazda Sectional Axle.

The Gazda sectional axle is a new construction of swinging half axles for motor cars (rear driving axles), each wheel on the axle is furnished with individual springs; the half axle is connected by a new type of ball and socket joints to the centre part, driven by a gear flange. It consists of three concentric spherical calottes. The second of these is built on to the end of one-half axle and can play between inner and outer calotte around the common centres. For the transmission of the rotary movement the middle calotte is connected by a moveable coupling with the innermost one. The inner one has four depressions into which gear four balls embedded in the middle calotte. These depressions must lie in meridianal planes, which also go through the axis of the whole system. Therefore the half axle can swing out of the axis of the whole system into two meridianal planes, thereby taking any position inside a cone, although the rotation is transmitted quite satisfactorily.

The joints of the two halves are connected in such a way, that the two inner spherical segments are cast with a circular flange in one piece. The two outer spherical calottes also carry flanges, which are screwed to the middle flange. In this way the outer and inner spherical calottes are combined and in the thus formed spherical cavity, the middle part of the joint can move. The outer spherical calottes carry the bevel wheel and have big circular openings through which the half axles protrude. The rims of these openings are enlarged and drawn out, the outside is turned on the lathe and forms the surface for the bearing. The whole complex is encased and apart from that a sort of leather (or other flexible material) pipe which is fixed to the case and encloses the protruding axle, and makes the whole joint dust and water-proof.

The advantages of the Gazda sectional axle is that the weights which are not provided with springs, are reduced to a minimum. The case is fastened to the chassis, and therefore no longer follows the vibrations of the wheels. The wheels hold the road at highest speed, as each of the hind wheels passes over obstacles independently of the other one, and therefore will not lose contact with the road.

Motoring in Ceylon.

(A RUN FROM COLOMBO TO KANDY) BY A CORRESPONDENT.

Let it be said in the very beginning that there is no finer place in the East for the motorist than Ceylon. For the most part the roads are in a beautiful condition, even the long roads that run across the island through the jungle. And everything is done in the way of providing well furnished rest houses so that the traveller requires only the minimum amount of luggage. There may be better places but the writer has not seen them, and from what he has been able to gather of those who have travelled far afield, it is doubtful if there is any part where the motorist can be so assured of a fine time. There are seasons of the year when it is perhaps not advisable to make the tour of the island but in the early parts of the year, from January to May he can be assured of good runs, though he may expect occasional showers. With only a limited time at my disposal I determined to see some of the interesting places of the island, and though I might easily be scamping the places visited, have made a much wider tour. I was content to make a few trips, leaving the other places to be visited at a later time.

The port of Colombo is well known to many who come to India, as this from England is becoming popular, and each boat brings a fair contingent of passengers who cross by the new line. If they stay any length of time in the port they are certain to be struck by

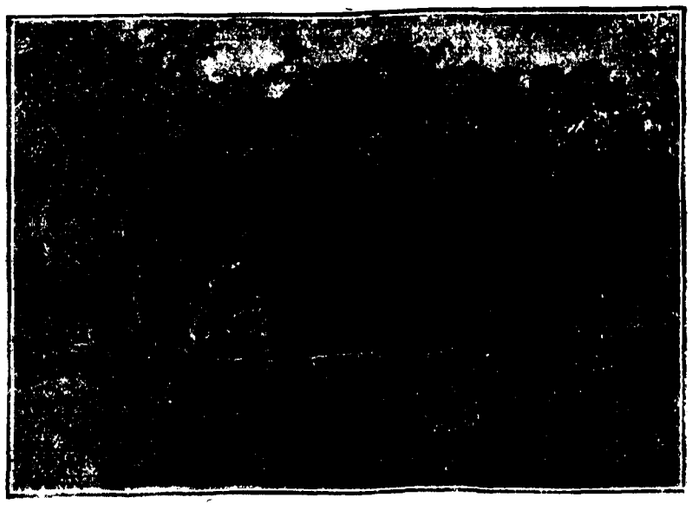
A CEYLON ROAD.

the large number of motor cars rushing about the place. Let the visitor stand at one or the other end of the Galle Face in the morning or evening and he will be surprised at the almost endless stream of motor vehicles which will pass him. No wonder the people of Ceylon and Colombo especially, are keen on motoring for conditions are almost ideal. I did not think it worth while, for the limited time I was intending to be in the island, to take my own car across, as I was informed that there would be no difficulty in hiring a car at moderate rates to visit practically any part of the island. This is true, but unless one forms a party of 3 or 4 motoring can prove a very expensive business when you begin to hire at one rupee and eight annas a mile, which was my lot on several occasions. Given a small party travelling by motor. It is not unreasonably expensive but if one has to pay the whole cost, it takes away some what from the pleasure. There are many motor services in the island, and some of the best trips can be done in this way. In addition to the motor busses, which are most uncomfortable, there are ordinary motors running, and it is possible to get a seat, the rate of which varies from six to ten annas a mile. Bnt I was fortunate in having a friend who kindly offered to give me a run on his motor cycle over one part of the prejected trip. When I say that this included a run from Colombo to Kandy, and thence to Newara Eliya, those who know Ceylon, will agree that the finest part of the country was done in this way. In this article I wish to give a brief account of the ride from Colombo to Kandy in the centre of island.

PASSING THROUGH A FINE AVENUE.

The town of Kandy is some eighty odd miles from Colombo, and after some fifty miles the ascent into the Kandyan hill

begins and continues till Kandy is reached at a height a little above 2,000 feet, The first part of the journey is through level country. and very typical of Ceylon. On every side will be seen the countless cocoanut trees, and evidences of paddy tea and cinamon cultivation. But most important of all, the rubber cultivation which has become so important a part of the industrial life of Ceylon. The first place of the real interest is Heneratgoda,

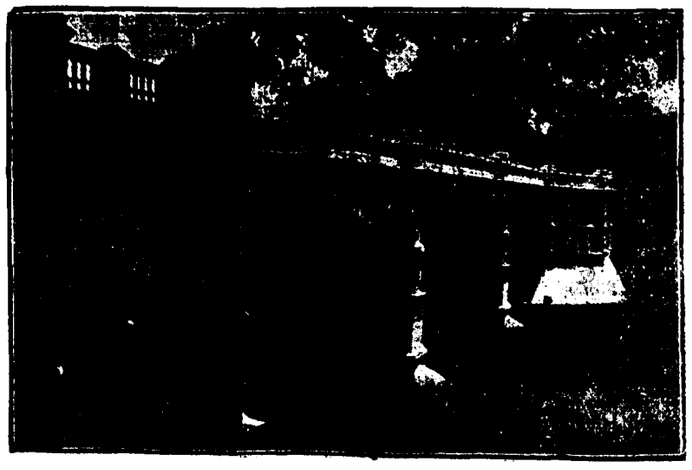


PICTURESQUE VIEW ON PEREDENYIA GARDENS.

a busy little town of about five thousand inhabitants. The chief interest is the Botanic Garden where some of the finest para rubber trees in the island are grown. This is one of a number of such institutions. which the Government has established in connection with the famous Peredeniya Gardens which we visited later, and a large number of experiments are carried on throughout the year by the staff appointed by the staff of the Department. The work done in these gardens has been of inestimable value to the companies engaged in the cultivation of rubber, as well of other products. We passed through a country full of interest, on every hand signs of rich cultivation and active husbandry. It is impossible to escape from the cocoanut, and the motorist can be assured that so long as he is passing along this stretch of country he need never fear suffering from thirst for he will be able to get, at all times, a plentiful supply of the cooling water from the fresh cocoanut, and this is truly hard to beat in a hot country.

There is a fair amount of variety in the journey but when the road begins to ascend then new vistas

open before one. One the road one passes through great avenues of the Talipet palms, certainly one of the most striking trees of the island. The writer was not so fortunate as to see them in flower, but this is not to be wondered at, as the flower bursts forth only once is a lifetime of the tree when it is approaching its hundredth year. But those who have seen it say that the Botanical world offers no more beautiful sight than this. It happens sometimes that scores



FINE BRIDGE NEAR KANDY.

may be in flower at the same time while at another not one may be seen.

The ascent is full of interest, and one is able to get splendid views of the plains. As we entered the Kandyan country we felt that we had reached quite a new Ceylon the part which is so definitely associated with the Buddhist faith. The railway runs parallel to the road in several places, so that there is a similarity of view obtained from both.

The delightful run through the Kandyan country where we may see many Buddhist temples brings us to Peredeniya Gardens which are 1,500 feet above sea level. Who has not heard of these famous Botanical Gardens, probably the finest in the world? Here is a situation perfectly ideal from whatever point of view it is regarded, and it is a wonderful collection of tropical plants the motorist may see if he turns into these gardens. They were organised to foster and assist agricultural enterprise and while this primary object is not lost sight of, the gardens are visited for their wonderful flower displays etc. One may spend many hours here, and in the fact the motorist will be tempted to take more than one run out from Kandy., the next stopping place. only about four miles distant. From one point to the

other the motor may pass. along beautifully kept roads and he will continually be catching sight of exquisite views. Along the river there is a road, and here he will find endless joy. But this is not a place merely to motor through and to pass on, for if the motorist has not altogether lost pleasure in leisurely walking with a view to investigation and observation, he will not miss the opportunity of strolling along the flower paths and on to the forbery and the orchid house.

in the garage for the rest of the time he is in Kandy, for the scenery around the lake is too exquisite to be seen from a car going even fifteen an hour. Unfortunately Kandy has a hot climate though not so trying as Colombo, and there is not very much pleasure in walking. But to see Kandy at its best, one must forego the car and take walks on the higher levels from which one can get glorious views of the lake, the distant hills are richly wooded. There are several places of interest

LAKE AT KANDY.

But our object was Kandy, and much as we desired to remain in these beautiful gardens, we had to move on to Kandy. Here we found much to interest us. The lake is exquisite, and though some say it is somewhat artificial, there is something so beautiful about the whole scheme that this idea is completely lost. Perhaps the motorist ought to put his car

worth visiting but the most important is the temple of the Tooth the home of that relic of Buddah which is worshipped by millions. Near by is the art Museum where brass articles made by the Kandyans are on sale. If a corner can be spared in the car, one is inclined to invest some spare cash here for the work is very fine. Our journey was done very com-

fortably and the motor cycle responded perfectly to all demands made on it, and we have confidence that it will not fail us in the more difficult part of the journey we next intend to make, that is through the great tea districts on the Newara Eliya the hill station of Ceylon.

Restoring Leaky Valves

SOMETIMES THEY ARE DONE BEYOND THE GRINDING STAGE—WHAT TO DO AND HOW TO DO IT

Valve grinding is a simple and straightforward operation, depending on the condition of the valves and valve seats Where the valves and valve seats have been burned, or distorted, through valve stems sticking in their guides, where they are badly fitted, or have become ridged, it is a waste of time to resort to grinding.

Under any of these circumstances, the seats should be re-cut and the valve faces skimmed until the surfaces of both are completely regular and clear all round. Should the seats require cutting, short of a suitable cutting tool or a mushroom cutter, the best plan is to go to the expense of a new valve, having the one it replaces toned up and fashioned into a mushroom cutter. Then suitably hardened for re-cutting work, and in re-cutting the seats, take a light cut and rotate the cutter at one speed until the job is finished. A heavy cut at uncertain or varying speed will cause the tool to "chatter" and make a sorry mess of the seat.

The driver is not advised to undertake, and will not undertake, these jobs unless he is sure of himself, but he is advised to make certain they are done, if they need doing, before attempting to get good results by grinding while the valves or seats are in the condition stated.

If these conditions are not evident, or, having got rid of them, should they have been present, grinding may be proceeded with, and, if properly done, it should not be at all an irksome job. The method of bearing down on the brace, or whatever tool is used, and turning round and round in one direction is one very frequently adopted; but the more energy expended in this way the more distant is the prospect of cutting an efficient valve seating.

A very common misconception about a seat is that it should be as broad as the level surfaces of both valve and seat and the ideal way to get rid of these mistakenly sought results is by the afore-mentioned method of grinding. What actually happens is this. By turning the valve round and round without intermission in this way,

the particles of emery, or whatever grinding compound is employed, are carried down in a circular path, cutting a series of furrows, making a kind of amphi-theatre of ridges, which the misguided operator fondly regards as a gas-tight seating. In appearance, it is dark instead of bright, as surfaces should be if they bear hard against one another.

What is necessary, and what alone constitutes an efficient seat, is to have quite a narrow, glittering, and continuous ring showing up on both valve and seat, from which it is at once apparent that the valve is bearing down on the seat, and is touching hard the whole way round.

To get this result, the operation should be proceeded with in the manner now to be described. First obtain a piece of spring of sufficient length and having sufficient recoil when placed round the stem, to lift the valve clear of the seat when downward pressure is withdrawn. The use of the spring makes the operation speedier. It is necessary to lift the valve clear of the seat at frequent intervals as the operation speeds, and the use of the spring saves lifting the valve clear by hand, doing it automatically, and doing it quicker.

Having smeared the valve, with a thin coating of grinding paste, slap it smartly down on the seat, and rotate it to and fro within a third of circumference for about a minute. On withdrawing pressure from the valve, turn it round a little each time, so that when grinding is renewed, there will be a fresh disposition of the grinding material. Each time the valve is brought in contact with the seat, it should be done with a vigorous slap. This, with the method of grinding indicated, soon brings up a bearing.

After proceeding in this manner for some time, wipe the paste from the valve only, and grind again. Now examine your markings; If they are continous, the paste may be wiped from both valve and seat, and, on grinding the clean surfaces together, the narrow, glittering ring which constitutes the seat should be apparent. If the ring shows the least dull at any point, a fresh application of paste and renewed grinding are necessary.

Fun from here and there

How to Stop Her ?

The owner of a a racing car was driving along a country road, when he overtook an old man and being of a kindly disposition, offered to give him a lift. His passenger was tremendously impressed by the speed and luxury of the car, and to humour the old fellow the driver put on the accelerator, until they were travelling at about sixty miles an hour. Suddenly, however, they came upon a grassy patch of road ; the car skidded and crashed into a tree. By good luck, neither was injured. The old man pulled himself out of the ruins, filled his pipe, and then remarked, thoughtfully, " That sartinly was fine, sir, but there's one thing that baffles me. How do you stop her when there ain't no trees about ?"

⁂

Two men were having a chat together, the subject being wireless. "Yes my friend," said one, "Wireless is a wonderful thing. Only last night, I even heard the wife singing in America, and mine is only a crystal set."

" Oh, that is nothing," replied his companion, this morning, "I heard my wife stirring her tea in " China," and mine is only a tea-set."

⁂

As a rich man was motoring through a country district he noticed an old man seated outside a cottage with all his furniture around him.

" Poor old soul " the visitor said, stopping his car and giving the old gentleman a banknote. " What's your trouble ?—evicted, I suppose ?"

" No, sir," was the mournful reply ; " it's just my old woman white-washing."

⁂

It was early spring, when a gentleman out motoring with a friend noticed that they were crawling along a thoroughfare where previously they had been accustomed to go at full speed. He asked why the car was moving so slowly. " Why," explained the driver of the car, "everybody's carrying home garden tools now, and you can't run over a man without risking a puncture."

⁂

A certain motor-car manufacturer, who advertised that he had put one of his cars together in just seven minutes, was rung up on the telephone and asked if it were true.

" Yes," was his answer. " Why,"

" Oh! nothing. Only I believe I have that car."

⁂

The motorist walked into the local antique shop.

" I want something funny and grotesque to go on the front of my motor car," he said to the girl in charge.

The girl retreated to the back of the shop. " father," she shouted: " You're wanted!"

⁂

It was a very wet night, and the last omnibus was full inside, when the conductor asked: " Will any gentleman go on top to oblige a lady?"

There was no response, so the enquiry was repeated, but still there was no reply.

At last one male passenger remarked :

"Are you sure that she is a lady and not a poor woman?"

"Oh, yes," said the conductor, without hesitation, "she is a lady, alright." "A well-dressed lady?" presisted the passenger. " Yes, a thoroughly well-dressed, fashionable lady," the conductor assured him.

" Then," said the passenger, setting himself more comfortably in his seat, " she can afford to take a cab home."

⁂

Mrs. Fusser: "Men sure do change a terrible lot after they get married."

Mrs. Dusser: "What's the trouble now?."

Mrs. Fusser: " Before, we were married my husband said he would give me all the world; now he won't sell some of his property to buy me an automobile ".

⁂

A smartly dressed woman was sitting in an omnibus, when a quiet looking young man, in getting in, accidentally trod on her dress. She talked to him for ten minutes, and wound up by saying, "A gentleman would have apologised."

The young man bowed, and calmly said; "A lady would have given me a chance."

⁂

He had been dining too well, and hailing a taxicab, he crawled gingerly inside, after falteringly giving the driver his destination.

It happened that the opposite door had been left unlatched by the previous fare, and stumbling against it, the inebriated one fell outside. He picked himself up with great difficulty, and accosted the driver.

" Thatsh pretty quick work," he said, "how much do I owe you?"

Thro' the Motor Show Rooms.

AT FIAT'S.

You are a motorist and get a half hour for yourself very occasionally. But you cannot better spend it than at Fiat's. May be you are a bit unhappy with your car, and you would like to buy a new one—a non-nuisance one. Or, you are tired of your present one and long for a change. Neither the one, nor the other; you have heard about Fiat's reputation and you wish to see them for yourself. You step into Fiat's show room and you behold "The Cars on which the Sun never Sets," for they daily run in the sun all the world over.

You are no stranger to cars, you have seen thousands of them of all kinds running about. You have ceased getting sentimental over it. All the same, when you are in the midst of Fiat Family of swift wheeled children, you feel that you are in the presence of one of the highest achievement of Science and Capital. Fiat makes a peculiar impression on your mind, You cannot explain it because you are not responsible for it. But you feel you hadn't done justice to yourself because you hadn't acquainted with Fiat earlier, though it was there in your midst.

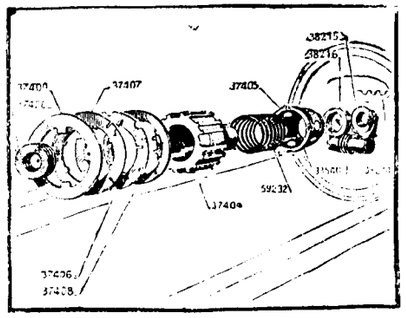
Your first impression is that you are in the midst of cars built for " All-Weather." The very look gives you that assurance. The cars look fit for work and weather. Each car has that quiet, sober strength about it, which does not escape your eye.

The Fiat people are not strangers. One of the oldest and largest in Calcutta, they have now for sometime settled in Madras. As you look round, you see in Fiat's the latest models which the world-famous factory of Fiat's builds at Tourino. The views of Fiat's give you an excellent idea of the gigantic organization.

Just look at the four cylinder groups. There is 501 All-weather, 501 Normal Torpedo, DeLuxe special sliding seat, spider 2-seater, saloon and sports Torpedo. You have also the 502 Coupe de Ville and Touring de Luke ; besides the 505 model de Luxe 7-seater, 15-20 H. P. 505 Coupe. Among the six cylinder group, you have the 510 Torpedo de Luxe and 519 Torpedo de Luxe. To see these models with a timely word of explanation from the Fiat's people is to believe. In fact, you begin to have a faith in these machines because the kindly guide in the showroom claims for Fiat's

car no more than what they deserve. For, if it were not for its solid and sound value, you can't explain how the 501 model has come to be known throughout the world as " the car that never goes wrong."

Take the 10-15 (501) model. The Engine is a four cylinder cast *en block* with side by side valve, detachable cylinder head, the bore and stroke being 55 mm. and 110 giving a cubic capacity



Fiat Clutch in parts.

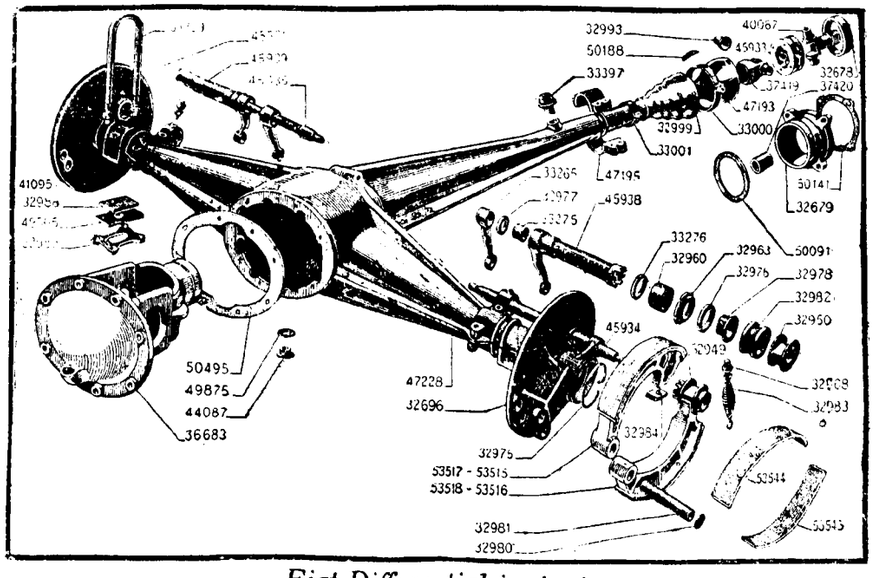
of 1400 cc. The Engine is the Universal single unit construction job and has incorporated a multiple disc type of clutch totally enclosed in a dust and water proof cover though absolutely accessible to get at for the purpose of adjustment or cleaning by removing a small cover over the gear box which is held in place by two screws. The gearbox speed selective, type four speeds forward and one reverse, is also incorporated immediately behind the clutch and forms a whole unit with the engine. Transmission from gearbox to differential is by cardan shaft with one Universal joint only encased in a dust and water-proof cover this being automatically oiled from the gearbox. The crown wheel and the tail shaft pinion is of the spiral type giving extremely long life and absolute silence under all conditions.

The steering gear is of worm and gear type mounted on the right hand side of it to begin. The ignition lever is mounted on the steering wheel but the throttle arrangment is somewhat novel and is worked with a knurled sleeve mounted on the steering mast. The corburettor is of a FIAT patent and follows very closely in principle that of the Zenith. This little instrument has a novel arrangement attached to it by which the driver can cut down his petrol consumption by merely turning a small lever on the dash board. Brakes both sets operating on rear wheel one pair by pedal and the other by a lever situated in a very convenient place inside the body. Wheels are of the Sankey steel artillery type detchable from the hub fitted with 765 x 90 mm tyres.

Lubrication is of the full pressure type worked by a gear pump and ensures absolutely reliable flow of oil under all conditions. The cooling is by a centrifugal water pump assisted with a large fan driven by whittle Belt. Petrol tank is placed inside the scuttle and feed the carburettor by gravity. A 12-volt electric lighting and starting system is fitted to the car with 2 very powerful 50 c. p. Half watt. Head lamps, side lamps, rear lamp etc., Starting is by electric motor which engages on an enclosed gear on the flywheel.

The FIAT Factory by building this model have absolutely excelled themselves in every respect and have satisfactorily met the needs of those discriminating buyers who wish to have a small, light and an absolutely realiable yet not too expensive a car.

A far greater number of people will now be able to own FIATs than has been the case in the past. Every part of the FIAT car is made in the FACTORY with the only exception of the Magneto



Fiat Differential in parts.

which is a "MERELLI" it willl therefore be seen that the FIAT could by no means ever be classed as a construction job and we feel sure in stating that this is a very strong point in its favour of being one of the very best cars in the market today obtainable at an exceptionally low figure.

But we should get along. We shall step up to the *501 Torpedo De Luxe with adjustable front seats*. This mode differs only from the Normal type by having the front seats sliding on rails, de Luxe upholstery in antique leather, wider and more comfortable front and rear seats, a vertical windscreen and external door handles. The advantage of having an adjustable front seats are obvious to anybody who is undertaking a long tour.

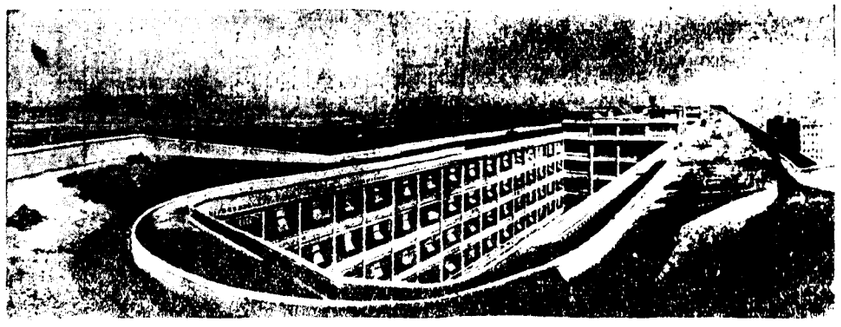
We come to the " SPUDER."

Curved line 2-seater body with streamline Bonnet and scuttle. The front seat is large enough to accommodate 3 people and the folding Dickey for two. The Dickey when closed is covered with lin-rubber for carrying luggage. Double adjustable windscreen, Celluloid side curtains and water-proof canvas with cellu-

loid rear light, Hood envelope in black water-proof canvas, are also incorporated in this car. Doors have external and internal handles. Pockets are also fitted. Upholstery is in antique leather. The floor boards are covered in lin-rubber. The FIAT Cars are finished most exquisitively having inlaid mahogany woodwork, carpet on the floors, robe rails and all metal parts heavily nickel plated.

The speed range of the FIAT Cars for 1925 extend up to 47 miles per hour. The car is exceedingly comfortable and type new springs having been fitted with a greater number of leaves.

It is the belief of the FIAT organisation that with its 1925 series of cars which includes 2 six



Fiat Cars individually tested before leaving—Factory—on their own Aerial way.

cylinder models they are in a position to meet every need of the buyer who wants the luxury and satisfaction of a real first class car with an international reputation of being one of the most economical and reliable in the world. Certainly the great beauty embodied in this car combined with the numerous mechanical advancements will undoubtedly place them in a position of becoming ever so more popular in the Southern India, than they have been hitherto. It is admitted by all concerned that the engine is flexible to a fault and is ideal in every way. The FIAT has given convincing proofs of its faith in the dominance over other and it will not be out of place to mention that the world's flying mile record at a speed of 147·69 miles per hour is held by one of these famous cars. It is probably not known that the FIAT Factory is the largest in Europe with the largest capital and resources behind it and every chassis before it leaves its works, is thoroughly tested in all its various departments and then on aerial tract, on the roof of their Factory before same is ready for handing over to the Exporting Agents. The Local FIAT Agents are in an excellent position to supplying the various models of

cars that may be required. A thoroughly up-to-date service department is now under construction with up-to-date machinery etc., which is being put down, their showrooms situated in Mount Road, are pretty and customers are ensured of a courteous reception and can have full particulars, and expert advice can be always had without obligation.

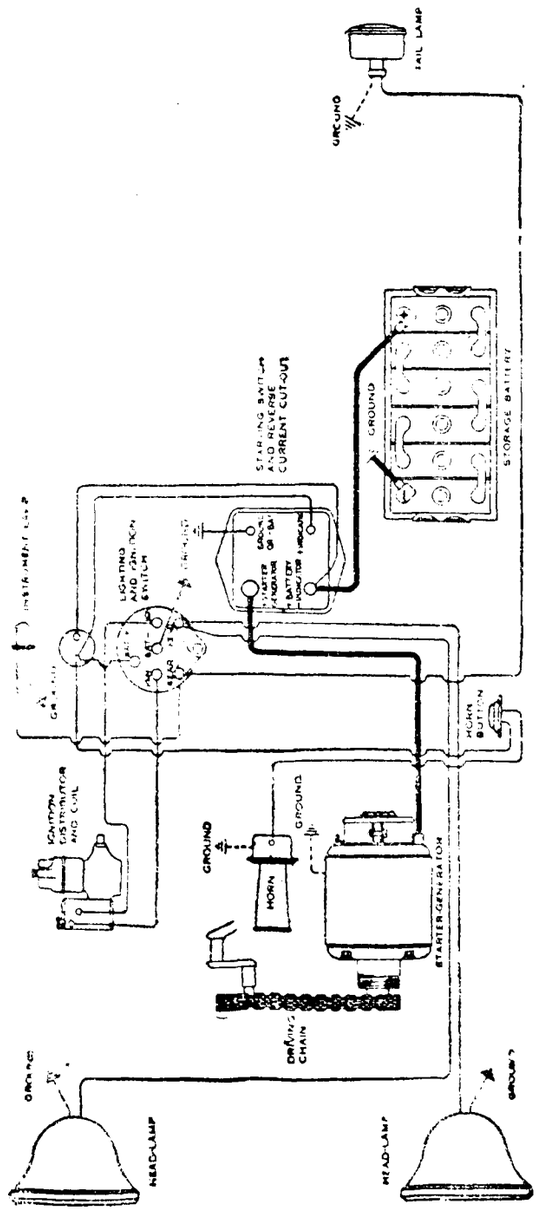
The Dodge Electric System.

COMPLETE INSTRUCTIONS FOR CARE OF NORTH EAST 12 VOLT SYSTEM

The complete starting and lighting system of the Dodge consists of the single unit North East starter-generator located on the front left hand side of the engine ; the North East combined starting switch and reverse current cut-out attached to the upper floor board ; the 12 volt storage battery contained in the battery box ; the charging indicator and the combination ignition and lighting switch, both located on the instrument board, the head, tail and dash lamps, and the necessary wiring to connect the several electrical units. The starter-generator is driven by means of a silent chain running over a sprocket keyed on the front end of the crankshaft and another sprocket on the armature shaft on the starter-generator. The ratio of the armature shaft to the crankshaft revolution is three to one.

STARTER-GENERATOR.—The starter-generator is of the 12 volts single unit type, having but one armature and one set of field windings, and operating both as a starter and generator. The aramature shaft is supported at both ends by ball bearings packed in grease. The sprocket end bearing is lubricated by the splash of oil from the timing gear case. The commutator and bearing is lubricated by oil introduced through the hole located in the center of the end cap on the starter generator. A few drops of oil should be applied to this bearing every 2000 miles. All repairs and adjustments on the starter-generator and the starting switch should be made by the nearest North East Electric Company service station.

WIRING.—Referring to the wiring diagram (as shown), it will be seen that the connection between the several elements of the system are arranged as follows : The negative terminal of the storage battery is connected directly to the car frame. The positive terminal of the battery is connected to the smaller of the two large binding posts on the starting switch. The positive terminal of the starter-generator is connected to the larger of the two large binding posts on the starting switch. The nagative terminal of the starter generator is connected to the car frame through the grounding strap and the starter-generator field ring. This comprises the starting circuit, the wires of which are all of large cross-section to carry the heavy starting current without appreciable loss. In addition to the above mentioned heavy wires there are the following connections for the charging circuit ; The positive terminal on the indicator is connected to the small starting switch binding post marked " Indicator." The negative terminal on the indicator is connected to the smaller of the two large starting switch binding posts. The small



Dodge Starting and Lighting Systems.

starting switch binding post marked " Ground " is connected to the car frame.

It is very important that all of these connections be made exactly as shown in the wiring diagram, because any alteration of this arrangement will impair the operation of the starter-generator and probably injure the apparatus. In case it is necessary to make any repairs on any part of the electrical system, disconnect the battery, to prevent a possible short circuit.

STARTING.—After the ignition switch has been turned on, press down the starting switch pedal. This operation closes the circuit between the battery and the starter-generator, thereby causing the latter to act as a starter and turn over the crankshaft of the engine by means of a silent chain drive. As soon as the engine begins to run under its own power the starting switch should be released. This breaks the circuit between the battery and the starter-generator through the starting switch.

GENERATING.—As soon as the car attains a speed of 9 to 10 miles per hour the reverse current cut-out, located in the starting-switch housing, automatically closes the circuit between the starter-generator and the battery, thus allowing a charging current to be conducted from the starter-generator to the battery. Whenever the car speed falls below 9 to 10 miles per hour the cut-out automatically opens the generating circuit and prevents the battery from discharging through the starter-generator except, of course, when the starting-switch is operated. The output from the starter-generator is maintained at a correct value by a combined action of a regulating device known as the third brush system, and the differential effect of the series field upon the shunt field, commonly known as a bucking field. In this way the battery is kept in a properly charged state under normal usage of the car. In cases, however, where the car is subjected to abnormal service, such as continuous day driving with infrequent use of the starter, it is advisable occasionally to allow the lights to burn dim over night. This will compensate for the abnormal charge given the battery. The same results may be obtained by allowing the starter-generator to run the engine, with the ignition turned off, for a period of five to ten minutes. Under extreme conditions it may be necessary to have the charging rate of the starter-generator changed slightly so as either to decrease or increase the charge given the battery to meet special requirements of the case. This alteration of the charging rate can be quickly made by adjusting the third brush system. The car owner should, in all such cases, have the adjustment made for him by North East Electric Company, or one of its branches, or service stations, or by a Dodge Brothers dealer. Under no circumstaces should he attempt to make this adjustment himself.

SHUNT FIELD FUSE.—The fuse located on the outside of the commutaor and housing of the starter-generator is inserted in the shunt field circuit; and is designed to blow if the battery circuit is opened, this protecting the system by rendering the starter-generator inoperative. Therefore, if the machine fails to charge the battery at any time, inspect the fuse first of all; and, in case it is found blown, replace it with a new one. If the new fuse in turn blows as soon as the machine is started up, make a careful search for the cause of the trouble and see that the necessary conditions ensure before allowing the equipment to go into service again

ADJUSTMENT OF STARTER-GENERATOR POSITION.—To insure the quiet operation of the silent chain which drives the starter-generator, the starter-generator must be located in correct alignment with reference to the crankshaft sprocket, and the chain must be so adjusted that there is a slight amount of play in it. An eccentric adjusting ring in the front flange of the cylinder block goes on over the forward end of the starter-generator and provides for an adjustment of the chain tension, The starter-generator is supported by two adjustable " V " blocks and is held in position by a steel strap thus making its installation absolutely rigid in position. The proper alignment is obtained by locking the starter generator slightly up against the front flange of the cylinder block by means of the castellated binding nut. This alignment can be checked up by removing the chain inspection cover and by placing a straight-edge against the front of the crankshaft sprocket. The front face of the starter-generator sprocket should lie flat along this straight-edge. It is impossible for the starter-generator to get out of alignment unless the binding nut comes loose. The adjustment to obtain the proper tension on the starter-generater chain can be made as follows; Loosen the set-screw and lock-nut on the edge of the front flange on the cylinder block and back of the castellated binding nut on the starter just enough to remove the pressure from the adjusting ring. Loosen the " V " blocks and clamping strap to allow the starter-generator to move. This will permit the eccentric adjusting ring to be turned until the required play of the chain is obtained. The chain, when properly adjusted, should have an up and down movement of approximately one half inch in the portion midway between the sprockets. After the correct adjustment has been obtained, make sure that the set-screw the lock-nut and the castellated binding nut are all screwed up tightly. See that the chain tension has not been disturbed while performing this operation. Next: carefully adjust the "V" blocks up snug between the cylinder block and the starting–generator. When this has been done tighten the steel clamping strap. After the inspection cover has been replaced the chain should now run without perceptible noise. It is lubricated by dipping into the oil in the bottom of the front gear compartment, and therefore requires no further

attention after it has been properly adjusted.

STARTING SWITCH AND REVERSE CURRENT CUT-OUT.—The combined starting switch and reverse current cut-out is attached to the upper toe board. The starting switch is operated by a plunger pedal which extends through the top of the switch case. The switch is always held open by means of a strong coil spring while not in use. Whenever the plunger pedal is depressed it closes the switch and thus allows current to flow from the battery to the starter generator. This causes the Starter-generator to operate as a motor and crank to the engine. When operating the switch make sure always to press the pedal down firmly to the Limit of its stroke; also note that the pedal rises at once to its normal position as soon as the foot pressure has been removed. If the engine is cold pull out the carburetor dash control on the instrument board so as to supply it with richer mixture of gas for starting.

STORAGE BATTERY.—A 12 Volt six-cell storage battery is used with this system. It is enclosed in a steel box which is riveted to the left-hand side of the car frame. It is held securely in place in this box by means of a cover plate and is thus protected from injury from road shocks. The battery furnishes current for the ignition and the lighting systems as well as for starting the engine.

In order to obtain satisfactory service from the battery, pure water must be added to the battery solution at frequent intervals, so that this solution will always be up to the proper height. The battery should be inspected and filled regularly, once every week in warm weather, and once every two weeks in cold weather. Use only distilled water for filling the battery, never acid or electrolite. When filling the battery, add water to each cell until the solution is approximately one-half inch above the top of the plate, or level with the bottom of the vent-hole. The best way to ascertain the condition of the storage battery is to test the specific gravity of the solution in each cell by means of a battery hydro-meter. This should be done regularly so as to keep an accurate check on the whole electrical system. The failure of any part to function properly can be detected readily in this way. If both the starter-generator and the charging indicator are operating normally and the battery, on the other hand, is in a run down condition, inspect the wiring system carefully for a short-circuit which is probably causing a drain on the battery.

CARE.—The starter-generator and the cut-out and starting switch are so constructed that they require practically no attention other than to be kept free from dirt and water. In case any part of the electrical system fails to work satisfactorily, test the battery with a hydro-meter, and if it is found to be in a discharged condition, inspect the entire system for short-circuits or loose connections. If

in so doing the ground wire of the starter switch or the indicator wires are removed, care should be taken to replace wires properly before again starting the engine.

LIGHTING SYSTEM.—All the electric lamps derive their current from the storage battery through wires leading from the ignition and lighting switch. Current from the positive terminal of the storage battery flows through the heavy wire to the smaller of the two large starting switch terminals and thence to the charging indicator negative terminal. From this point it is conducted to the ignition and lighting switch. The lighting system is of the ground-return type, the car frame serving as a return path for the current from the lamps to the negative terminal of the battery.

There are two head lamps, and a tail lamp. The lamps used are as follows :

Head lamps—15 candle power —12—16 Volts—single contact—Bayonet Base.

Tail lamp—2 candle power—12-16 volts — single contact—Bayonet Base.

Dash lamp—2 candle power—12-16 volts — single contact—Bayonet Base.

All the lighting wire is armoured as well as insulated, thus practically eliminating the possiblity of a short-circuit. Both head lamps are connected to one terminal of the lighting switch by means of separate wires. This is done so that, even if a short-circuit should develop in one of the wires, the other lamp would still be burning. The tail lamp and dash lamp have also separate wires, both leading to another one of the lighting switch terminals. The lighting switch has three positions — " Off," " Dim," ' 'ON." In the " DIM " position the tail lamp, the dash lamp, and the head lamps " DIM " are turned on. In the " ON " position the tail lamp, the dash lamp and the headlamps " BRIGHT " are turned on. All of the lamps are connected in parallel so that the burning out or removal of any one of them will not effect the other. On the back of the combination ignition and lighting switch are five binding post terminals. Starting with the terminal at the top of the switch and considering them in clockwise direction the terminals are marked and connections made to them as follows: " HEAD," two headlight wires; " TAIL," tail lamp and dash lamp wires; " IGN," Magneto switch wire; " BAT," current indicator to switch wire; To the back of this switch is connected also a dimmer resistance coil through which the current for the head lamps flows when the lighting switch handle is turned to the " DIM " position. The starting and lighting—wiring system are shown complete in the diagram.

CHARGING INDICATOR. —The charging indicator is located on the left hand side of the instrument board and is inserted in the charging circuit between the reverse current cut.—out and the

positive battery connection of the starting switch. To the positive terminal on the current indicator are connected the wires which conduct the current for the ignition and lighting switch and for the horn. This indicator registers " CHARGE " when the starter-generator is charging the battery, and " DISCHARGE" when the battery is supplying current for the lighting systems. Even when the starter-generator is supplying normal current to the battery, the indicator will show "CHARGE", with all the lamps are burning. " DISCHARGE " will appear on the indicator whenever the lights are being used while the car is standing or running on direct drive at a speed of less than nine to ten miles per hour. If at any time the charging indicator fails to register properly, inspect its terminal posts to see that the wires leading thereto are tightly attached. Also, make sure that there are no short-circuits in the wiring system. The showing of " DISCHARGE " instead of "CHARGE" when the latter should be indicated is an almost certain sign that a short-circuit has developed in the wiring system, unless, of course, the wires attached to the charging indicator have been connected to its terminals in such a way as to reverse the direction of flow of the current through the indicator. If no short-circuit in the car wiring is to be found, remove the charging indicator and examine it for internal troubles. Be sure to replace properly all connections before running the engine again. Should the charging indicator be removed from the circuit, connect together all the leads which are normally attached to its terminals. Failure to do this will injure the equipment when the engine is operated.

Why should not Ladies Drive ?

We don't see any reason why they should not. On the other hand, ladies should, that is what *" Indian Motorist "* will always fight for tooth and nail, wheel and speed. Cars are chick movie homes. And who has the better right to lead and guide the movie home than the Lady of the Home ?

Woman's Instinctive Safety :

Women are always " Safety First " people. That is their instinct. At the wheel or in the verandah she always steers safely for safety. Every man with a car *must* teach his Lady driving. He can't entrust his car or self in safer hands.

A Lady Motorist Acquitted.

Mrs. Banubai Furdunji, Bombay, was charged with rash driving. The learned magistrate acquitted her. We congratulate both. In acquitting her, the learned magistrate remarked that ladies ought not to drive cars in crowded parts of busy cities.

But the Magistrate forgets :

We are sorry the learned magistrate forgets or errs. For, may we ask whether the learned magistrate knows that women have been driving taxis in Berlin for years now ? They drive in other European cities as well. Is Bombay more busy than some of those cities ? What about men who cause accidents ? Why discourage Ladies ? Why deny them their right ?

Are Policemen Living Speedometers ?

We are funny without knowing it. Our traffic police are empowered to arrest a car or bus exceeding the speed limit. But how is the Police Officer to guage the speed as he stands like sphinx rooted to a spot ? Is he a living speedometer ?

What's The Remedy ?

You need not invent the remedy. Just look at Bombay and Calcutta. Sluggard Madras, and be wise. Give your officers motor cycles. Let them follow up. They can lay by the heels those that exceed speed limit, thus save many lives.

More Footpaths ; less deaths :

Give footpaths all over Madras. That means you provide a track for high speed vehicles. We want less rules, regulations and orders.

We want more footpaths to put in the pedestrian.

A Funny Compliment!

Men of light and status are addressed—thank God they are very few—our first number of "*Indian Motorist.*" And they refuse it, though it is complimentary!

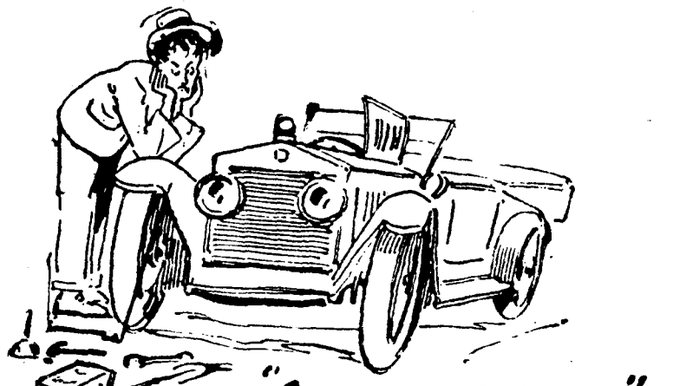
Not Interested!

Is it because they are not interested? For, who can afford to be not interested in motoring. What a contrast between our public men and British leaders of thought and rank! Or, are they too busy?

And who are they!

1 Maharajah of Bobblii.
2 D. B. M. Krishna Nair, M.L.C
3 K. R. Menon Esq.
4 H. H. Maharaja Sir Bahadur V. S. Ranga Rao.

& a few more.



Questions and Answers.

Won't Mesh Properly.

Q.—What would be the cause of the Bendix Drive on the starter not meshing properly and jumping out of mesh when it does engage?

A.—The Bendix starter trouble may be due to oil or dirt on the screw shaft.

Sideplay.

Q.—What sideplay should connecting rods have? Also, what side play should crankshafts have?

A.—The amount of side play permissible for either main or connecting rod bearings depends upon the oiling system. With pressure-feed systems this is generally limited to about ·005 inch, while splash systems permit a greater clearance for the connecting rods and about ·008 inch for the main bearing that takes the end thrust.

Chevrolet Overhauling Information

Q.—I have a Chevrolet Superior touring car which I am overhauling and am confronted with several problems. First, after cleaning and oiling clutch band leather, I am having difficulty in compressing the clutch spring. What is an easy way to do this? Second, the flyweel seems to be loose, to have considerable end play, that is, when I depress the clutch pedal it jerks the flywheel slightly towards me. Should this be? If not what is the cause and remedy? Third, after grinding valves and replacing piston rings, I turned the engine over and found although the head was on tight,

the valve tappets were not placed on yet and spark plug were on tight that the air compressed by pistons blew down into the engine oilpan with a whistling noise. Is this a sign that the rings leak and will lose compression, or will this be eliminated as soon as the oil starts splashing on cylinder walls?

A.—The clutch spring cannot be compressed without the use of tools. A slotted piece of pipe to fit inside of the clutch hub will be necessary and a bar of steel with holes drilled to fit the spacing of holes in the clutch hub. Place the pipe over the clutch shaft with the slot in line with the hole in the hub and the bar over the end of the pipe. Next place bolts through the bar and the clutch hub and draw up on these until the spring is compressed far enough to permit inserting the retaining pin.

There should not be any end play in the crankshaft. It is due to the wear of the main bearing flanges and to eliminate this it will be necessary to replace the bearing which takes the end thrust.

The whistling noise indicates a loss of compression and the rings no doubt fail to seal the cylinders. It is doubtful whether the oil will seal this, as whistling indicates a considerable leakage.

Lubricated by Crankcase Oil.

Q.—Please advise me if you put gear compound in the transmission of the Overland, or does the engine furnish the oil for it?

A.—The Overland Four Engine clutch, transmission and the universal joint are all lubricated by the engine oil in the crankcase.

Rugby Carburettor Adjustment.

Q.—What adjustment can be made on the Rugby Carburetor? By whom is it made?

A.—The carburetor used on the Rugby Four is made by the Tilotson Carburettor Co., of Ooledo, Ohio. This carburetor is especially designed for the Rugby engine, and due to this design, no adjustment is necessary. The claim being that standard nozzles are suited to all gravity changes and atmospheric conditions.

Good carburetor action cannot be expected until the engine warms up. When starting, especially in cool weather, it requires a little richer mixture, which is obtained by pulling out the choke rod on the instrument board. Should the engine miss or spit when starting, although it operated properly when last used, it is reasonable to believe that the carburetor is not at fault, but the trouble is with another part. Therefore, before tampering with the carburetor, first try to locate the trouble elsewhere.

All nozzles can be taken out and cleaned by removing nuts on the bottom of carburetor body, and screwing out the nozzles with a small screw driver. Threads of the nut and nozzle are the same and can easily be removed. Once every two or three months, it is well to remove the intake assembly by unscrewing the nut holding it to the carburetor body and clean

the carburetor filter screen. If the engine does not run evenly at low speeds or when idling, turn the low speed screw located just above the float chamber. Screwing this screw in, cuts down the air and makes the mixture richer. If screwed out, more air is allowed to enter, making the mixture lean. This adjustment should not be attempted until the engine warms up thoroughly.

Mounting the Ford Ball Thrust Bearing.

Q.—Will you please inform me how the drive shaft ball thrust collar (2591. Ford part number) is put on the drive shaft? It has a 1 inch hole and the drive shaft is 1-3, 32 inch in diameter.

A.—The drive shaft bearing has an inner sleeve which must be removed This will permit mounting the ball thrust bearing, after which the sleeve is again mounted on the shaft. This is necessary as the thrust bearing must resist end movement while the roller bearing is not designed to take such stress.

Installing New Brushes.

Q.—Will you please tell me how to overhaul and install new brushes in an Autolite generator used on the 1922 Overland Four? A new battery was put on this car and in one week it was so run down, that it was impossible to start the engine with the starter. The generator does not seem to charge very much when running along moderately, but will show about 20 amperes when raced.

A.—The Autolite generator follows conventional practice, the brushes being held in position by screws mounted in the cover of the commutator. When the new brushes have been installed it will, of course, be necessary to seat them to the commutator.

Chevrolet Differential.

Q.—Will you please tell me how the differential of a 1920 model Chevrolet 490 is assembled?

A.—The Chevrolet differential consists of bevel pinions which mesh with master gears that are mounted on the axle shafts. The pinions are supported by a spider which is prevented from turning by the two halves of the differential housing, but the pinions are free to turn on the spider. The pinions are in turn in mesh with the master gears, while the ring gear is riveted to the differential housing.

Ignition Coil Failed.

Q.—I have a Chevrolet car in which the ignition coil failed. I had a new coil put on and now the motor sometimes has a tendency to backfire, especially when starting. The motor did not backfire before with the old coil on. Have tried two or three different coils, with the same trouble.

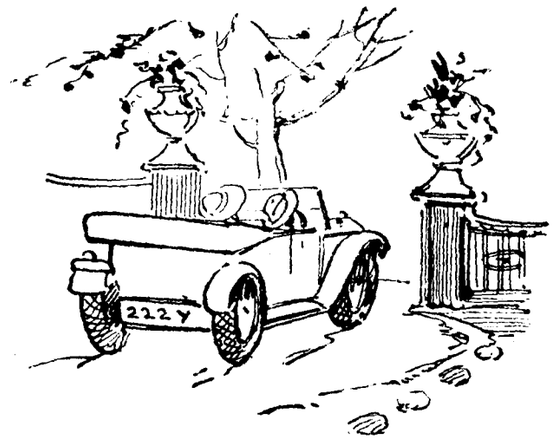
A.—When replacing the coil, the engine timing may have been changed, while it is also possible that the new coil has had strength enough to cause pitting of the breaker points and thus making ignition rather sluggish.

The Amusing Adventures

OF

Mr. and Mrs. Spinround, Tourists in the East.

Mr. and Mrs. Spinround
Just arrived from Home
Make up their curious mind
To spend round a half hour
To see funny peoples
Of sunny places.



They start,
Pass Hotel Gates.
There may be
Much to see,
Thought she
And so too thought he.
Of high palms
And Shapeless Elephants,
Of striped tigers
And spotted pards
Of the rivers longer than
Thames

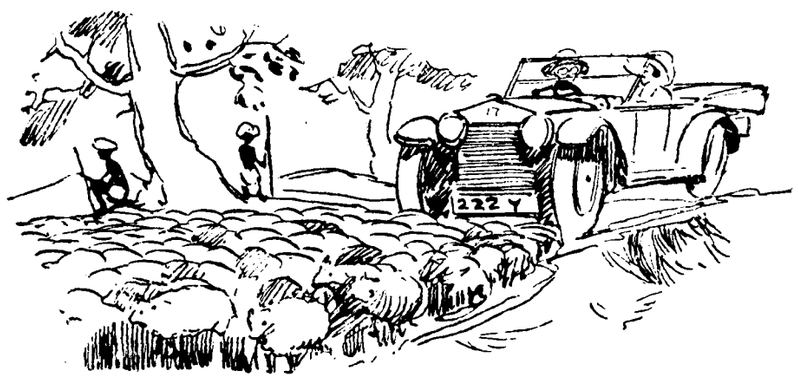
Of crocodiles with skins like your wallet
Of the Taj
To which the World makes haj
Of the Peacock
With its tail studded of gems
Of its parrots
More talkative than Burkes or Pitts
Of its Minas and bulbuls
Singing more sweetly than Sarojini.
Any many wonders
And their memories
The Tourists wished to gather
In their Spin of half an hour.

They ran through a narrow street,
Narrow, small huts lining, The sun full shining.

Right in the middle
Like a cork in the bottle
Stands a hillock of straw.

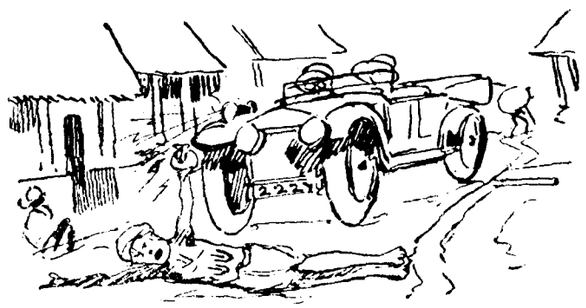
Hooting and horning, stamping and swearing,
The straw heap moved a mile an hour;
For, no quicker could the cart move.

Mr. Spinround swore,
The Lady felt it bore ;
And at last at a turn of the road
The Tourists escaped.



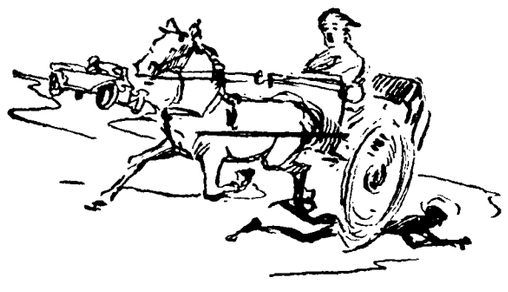
Only to find their car 222 Y
Get wedged in a flock of sheep.

Mr. Spinround swore
The Lady felt it bore.
Hooting and horning, stamping and swearing,
The Shepherds left the sheep
And the car to shift for themselves,
" The charming East, they say
I wish I met them and had my say,"
Spinround muttered and somehow got thro'.
But of what avail ?
There lay stretched right across.



The pious beggar of the East.
The fiery sunwas his feast.
He was the Sun sage
To move him would enrage.
Mr. Spinround swore
The Lady felt it bore
At a turn of the road
The Tourists escaped,
For a time they breathed easy
They felt they must get along.
They promised their " Boy " at Hotel,
" We shall be back in half an hour ,
Give us a cool bath of shower
And ready be the cover."

But at a distance
What do they see.



Coward ! to run over a boy,
And to bolt as fast
As whip wheels could carry.
We are late,
But can't leave him to his fate.
As carmen true
We shall our duty do."

So they say ;
Pick up the boy ;

(To be Continued.)

Buy or Sell.

FOR SALE.

One Harley-Davidson, combination. 7-9-H. P. Owner driven, new. Hood and side curtains, thoroughly overhauled, owner leaving station Rs. 1000.
Apply Box No. 100
c/o Indian Motorist.

One Chandler Car six cylinder seven seater M. C. 3347—Elec. Lights, and self starter in good order. Rs. 2000 or near offer.
Apply Box No. 101,
c/o Indian Motorist.

One Royal Enfield Car. M. C. No. 1212 fitted with wire wheels, zenith carburetor Bosch magneto, in running condition. Rs. 1250 what offer.
Apply Box No. 102
c/o Indian Motorist.

One Paige Car M. C. 3397 with wire wheels in running order. Zenith carburretor. Rs. 2000 near offer.
Apply Box No. 103,
c/o Indian Motorist.

WANTED.

One decent two seater. English make.
Apply with particulars. Box No. 104, c/o Indian Motorist.

One Second Hand Rugby Car, 1924 Model preferred—
Apply with particulars.
Box No. 105 c/o Indian Motorist.

One Second Hand Ford with or without self starter—
Apply with particulars.
Box No. 106 c/o Indian Motorist.

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