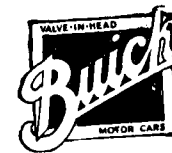
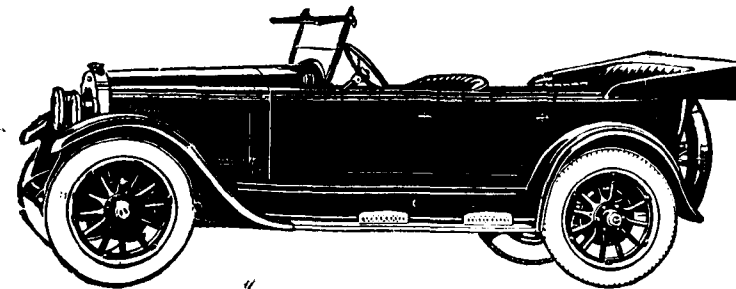


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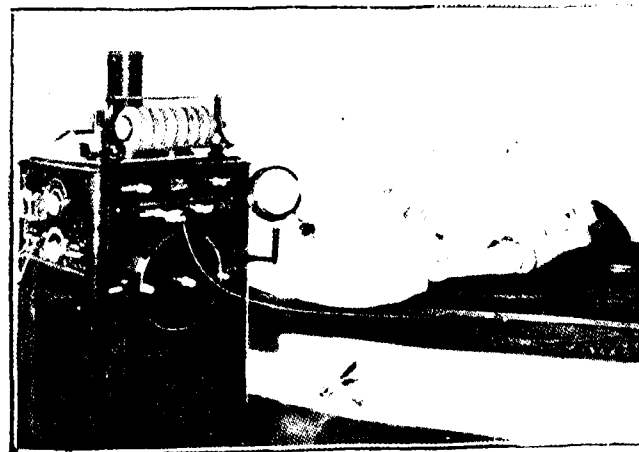
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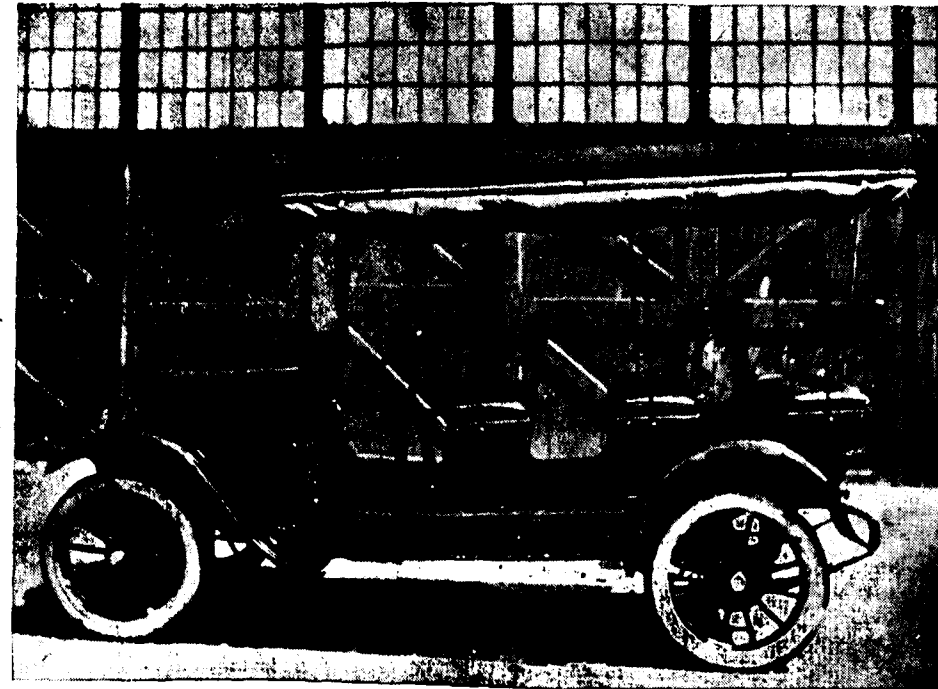
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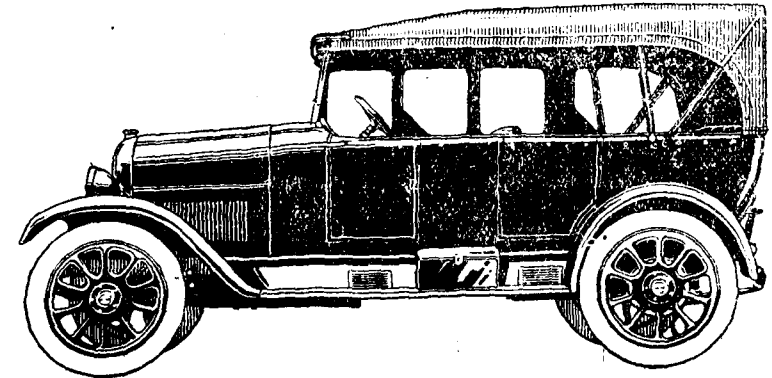
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Indian Motorist.

A Monthly Magazine of Motor Matters.

VOL. I

JULY 1925

NO. 3

A Motorist in the Making

REMEMBER THE FIRST TIME YOU SAT BEHIND THE WHEEL
AND CONTROLLED THE CAR YOURSELF?—WHAT A FEELING!
WHAT A THRILL! WHAT A RESPONSIBILITY!

WHEN taking possession of their first car, many people seem to be under the impression that, so long as they know which pedal to press to accelerate, and which applies the brake, all will run smoothly. It is only when their experience has ripened that they begin to realize that a full appreciation of the part played by each component of the machine is necessary to be able to enter into the full enjoyment of motoring; and so we find the novice, after having had an hour or so at the wheel, and without any previous knowledge of the working of a car, setting out on his first run as an owner-driver.

First Feeling of Responsibility.

Various members of his family occupy the passenger's seats and regard him with the deference due to so important a personage. As he makes his preparations for starting up, flattering remarks reach

him from his passengers as to the impossibility of their ever being able to acquire the necessary intelligence to know what to do with the numerous controls and instruments that make such an impressive display on the dashboard and steering wheel.

By this time the interpid driver is making rather nervous plunges at the starter button or pedal. Several of these having met with no very encouraging results, he silently decides that the switch button should be pulled out, and not pressed in, as he had previously thought. With an indifferent air he sets this matter right, and, offering up a short, but none the less fervent, prayer presses the button once again, having a sigh of relief as the engine comes to life.

Smilingly he takes his seat, and, remembering the words of the handbook, refrains from looking down as he engages low gear. Gently the clutch pedal is released until it is right back, but although the engine

roars at his touch, the car moves not. Glancing down he is surprised to find the change speed lever in the neutral position. Strange! he could have sworn he had engaged the gear. Perhaps it slipped out. However, making quite sure this time, he brings back the lever to first speed position. His manipulation of the clutch is as gentle as he can possibly make it, and his pressure on the accelerator pedal exactly as he has been taught. Despite these precautions, the engine stops with a jerk.

With a few mumbled remarks to his passengers about a heavy load and a cold engine, he starts up again, and on attempting to engage the gear he finds he had grasped the emergency brake lever. This proves to be hard on, and in a flash he realizes that this is the lever he must have grasped in his first attempt to engage the gear.

At last he gets the car under way, and although his "changes" are a trifle noisy, although the car almost stops before high gear is engaged, and although the subsequent temporary progression in a series of sharp jerks is a little uncomfortable, he is on the road in a car of his own; starting troubles are forgotten, and he is finding the world a very pleasant place.

Acquisition of road sense

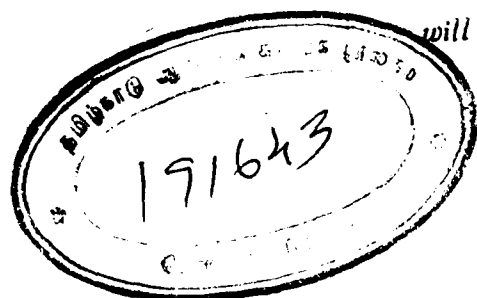
Speeding along, steering a somewhat wavy course, he suddenly finds himself approaching cross-roads. An emergency arises, and it is characteristic of his type that in a well-intentioned but misguided attempt to stop his car, he presses hard on the "accelerator" pedal. Fortunately he misses the other car by a fraction of an inch, and when he is able to steady both his nerve and his car he explains that if he hadn't simply piled on the speed the other car would have "had them."

Thus the novice generally survives much in the same way as a spider crawling across a crowded pavement narrowly escaped death from a hundred hurrying feet.

Gradually his knowledge increases and his road sense becomes better, so that his passengers begin to lose that feeling of anxiety, and other road users suffer less inconvenience. One must serve an apprenticeship somewhere, but the first duties of an owner-driver should be to learn as much as he possibly can about his car so as to be able to appreciate fully the work imposed, by his various actions, on the engine and other parts; also thoroughly to accustom himself to the positions of the various controls before venturing on to a public highway.

'How to Drive a Car'

will appear in our next issue



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How to Adjust the Frontwheels

ITS IMPORTANCE FROM THE PERFORMANCE AND EXPENSE STANDPOINT—MANIPULATION OF THE SEVERAL ADJUSTMENTS.

SOMEWHERE, between the front and rear covers of the instruction book that was in the tool-box or the door pocket of your car when you bought it, is a paragraph or paragraphs headed something like this, "Alignment of Front Wheels," or "Adjustment of Front Wheels." How many of us have read it over again since that first kaleidoscopic review of the "new book!" And if we have, have we checked the front wheels of our car to see if wear, a bump against the curb or some other mishap has destroyed the proper alignment as set at the factory?

Of course, wheels out of alignment is not as serious a condition as a steering gear out of adjustment, that is, it does not make a car dangerous to drive, but misali-



Tire wear that results with improperly aligned front wheels

gnment does take its toll in shortened tire life, and this in Rupees and annas makes well worth while the short time and small amount of effort required to rectify it.

To most of us the position of the front wheels of our car means little, so long as they remain upon the extremities of the axle and make steering of the car possible. But to the engineer who designed the car their position in relation to each other meant a great deal more. Before even the first experimental model was made the front

axle, the wheels, the distance rod, the steering spindle arms, in fact the entire front axle and steering mechanism, was laid out on the drafting board and the proper relationship between the front wheels determined. And why?

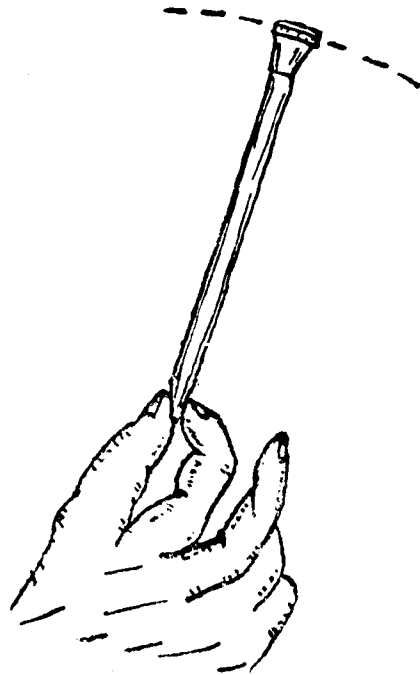
Set the wheels of your car straight ahead. They appear to be practically parallel. They should not be exactly parallel—of that we will speak later—yet they are nearly so. Now turn the wheels to the position of making a sharp turn. It will then be seen that they are no longer parallel but that the inside wheel appears to have turned through a greater angle than the outer. And that is actually the case; it is that effect that the designer of your car worked out on the drawing board, before even the first model was built. If the designer had not accurately determined these angles, front tire wear would be very rapid.

A wheel making a true rolling turn must pivot about some point, as a center, that lies upon the axis of the wheel—a line drawn through the hub. If this pivot point does not line upon this line, the wheel will slid bodily sideways, even though rolling. As a little example of this, grasp the point of a pencil between the thumb and forefinger allowing the other end to rest on a flat surface, say a table top. A metal pencil is good since the cap supplies a very acceptable wheel. Now, swing the pencil around the thumb and forefinger as a center, allowing the pencil to rotate as it swings, and it will be seen that the end of the pencil rolls over a true curve without any sideways. This is the case of the wheel swinging about the center located on the

wheel axis—the thumb and forefinger at the pencil point.

Now for the other case—Grasp the pencil in the same manner but place the second finger upon the table, and while rotating or whirling the pencil with the thumb and forefinger swing the hand about the second finger as a pivot. This time it will be seen that the end of the pencil—the wheel—no longer rolls smoothly but instead, it slides sidewise as it runs.

Now let us apply this to our car. To prevent the wheels from sliding sidewise when the car is turned, each must turn about some point lying upon its axis and since each wheel is turning at the same time, this point must be the same for all wheels. Inasmuch as the rear wheels



This illustrates how the wheel must roll in turning a corner.

are fixed to the rear axle this point must lie upon a line drawn along the rear axle as illustrated. The only way in which this can be accomplished is to have the front

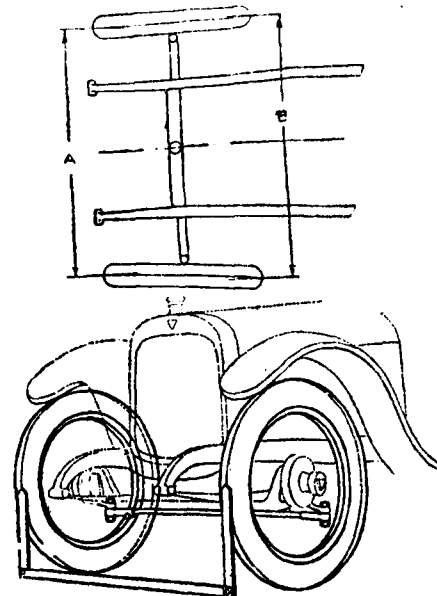
wheels gradually depart from the parallel relation as they are turned from straight ahead to the cramped position. This action is made possible by placing the left steering knuckle arm at a different angle than the right, the exact angles being obtained only after many trials. The designer of your car has gone to some length to determine proper wheel adjustment, has he not?

But he has gone even further than this. The fact that the front wheels were not exactly parallel, even when in the straight ahead position, was mentioned before and you will notice that the front wheels are wider apart at the top than at the bottom—if they are not they should be. These angles have been determined by your car manufacturer to give the easiest steering conditions and have been taken into consideration when designing the axle, and steering mechanism. If these proper alignments are not maintained, dragging of the tires will be had on the turns and even on the straight-away, with abnormal tire wear, such as illustrated, and naturally shortened tire life.

The wheels are *toed-in* slightly to give them somewhat of a *caster* action, that is, they tend to return to straight ahead position of their own accord, and thus making steering easier. However, if they are *toed-in* to too great an amount, we will get again tire sliding not only on the turns but even when driving straight ahead so that this adjustment should be checked and if wrong, corrected.

Again the wheels slant outwardly, that is, the distance between the tops of the wheels is greater than between the bottom. This serves two purposes—first, with the difference in the angles of the steering knuckles, it provides a true turning action and secondly, it brings the point of the tire in contact with the road, more nearly beneath the spindle bolt, thus reducing the *everage* of the wheel and making steering easier. Each of

these angles or wheel positions has been worked out by the manufacturer of your car and each must be right, in order, that the easiest steering coupled with minimum tire wear will be obtained.



Above—Proper "Toe-in" for front wheels.

Below—Aligning front wheels.

There are a number of methods by which alignment can be checked, several of which will be mentioned. Each accomplishes the same purpose and the method that seems the simplest to each of us can be used.

The alignment most likely to be disturbed is the "toe-in" of the wheels. One method of checking this is shown in accompanying illustrations.

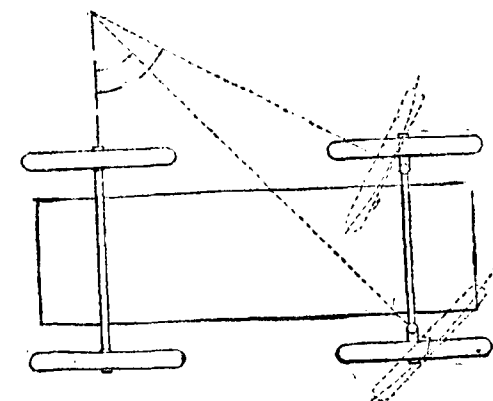
Jack up the front of the car from the center of the axle so that the distance rod is not interfered with. With both wheels free to revolve, a centre line may be marked on each tire by holding a soft lead pencil against it when spinning. The wheel must be held steady or the result will not be a straight line.

Next, measure with a tape or stick the distance between these lines at a point opposite the hub; turn the wheels half a revolution and measure again. The distance between the two results is the average, allowing for a slight wobble, and should be 5/16" to 3/8" less than the distance measured in the same way at the rear.

The handiest way to check this alignment is with a distance stick as shown in the illustration, and if much of this work is to be done a measuring device of this kind will be found very convenient. Its construction is very simple and is clearly shown in the illustration.

A second method, probably a little more accurate than that just described, is illustrated by a diagram. Jack up the front axle until both wheels are clear of the floor and true up the demountable rims on the wheels. Move the steering wheel to bring the left front wheel "A" parallel with the frame "B." This may be determined by taking measurements "C" from the rim of the wheel to the frame.

Tie a string to a rear spoke of each front wheel directly back of



Illustrating the position of the front wheels when making a turn.

the center of the wheel. Carry the strings inward between the spokes, back around the tires and then forward to points "D" as shown. Use string that will extend exactly twelve

feet in front of the tires. Bring the strings in until they just touch the forward edges of the tires at "E." The strings must be slightly above or below the hubs so as to clear them.

If the wheels are in proper adjustment the distance "G" will be from $1\frac{1}{2}$ " to $1\frac{3}{4}$ " less than the distance "F," this giving an actual toe-in at the wheels of $5/6$ " to $3/8$ ".

Other methods can be devised, the one and only object being to determine the difference in the distance between the front wheels at their front and rear edges.



Two methods of testing the front axle for alignment.

If the difference in measurements is within the limits given -- all well and good. If not, the adjustment should be changed until the proper measurements are had. This adjustment is made by lengthening or shortening the distance rod located usually just behind the axle and connecting the two steering knuckle arms. This arm carries at each end a clevis, one of which, usually at the right hand end, is threaded on to the rod. In making the adjustment, first take out the bolt that fastens this side of the rod to the steering spindle. Relieve the lock nut at the side of yoke. Turning the yoke to the left lengthens the distance rod, while turning it to the right shortens the rod. Lengthening the rod decreases the distance between the wheels at the front and increases the distance at the rear. The opposite condition is, of course, obtained by shortening the rod. After the proper adjustment is procured, drawing up tightly on the clamp bolt at the side of yoke should not be forgotten. It is also advisable to check the alignment of the wheels after they have been let down on the ground with the weight of the car on them. This is especially

ally true if the car has been much usage and has developed considerable play in the steering mechanism.

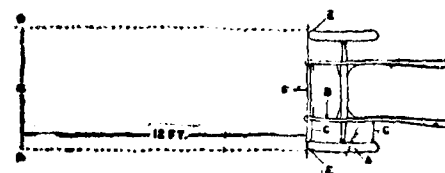
The camber of the front wheels -- the greater distance between them at the top than at the bottom -- fortunately does not change unless one of the wheels has received a very hard blow from a collision or a bad skid into the curb. The difference in the measurement between top and bottom of the wheels should be between $1\frac{1}{2}$ and 3 inches, this varying with different cars. The exact figure for your individual car had best

be obtained from your instruction book. Moreover, the camber should be the same for each wheel, i.e., each wheel should slant the same amount when the front axle is horizontal. The actual amount of camber can be easily determined in a manner similar to that in which the amount of toe-in was measured.

The only way in which this can change from the original adjustment is through bending of the front wheel spindle or the front axle. If the former, the bent spindle should be discarded and a new one installed, as any attempt to bend it back to its original position may weaken the metal, leaving a point of weakness at a very critical place. If the axle has been bent it can be straightened and then tested for alignment in the following manner. Place the axle upside down, the spring saddles resting upon parallel bars or blocks. When in this position the centre lines of the bores in the axle yokes should be parallel to each other, and in the same plane. These same lines should either be vertical or inclined only a small amount when viewed from the end of the axle. This can be determined with

a square as shown. The measurements "A" and "B" should not differ by more than $1/8$ inch. If any difference at all is present this should be in such a direction that the upper ends of the spindle bolts slant backward when the axle is in place on the car.

Possibly even after the wheels have been adjusted, the tires may still show evidences of misalignment, if this is the case the cause is a bent steering knuckle arm, this changing the angle so carefully determined by the car designer to give true rolling of the wheels on a turn. Fortunately again, this does not occur very frequently, for



Another method of aligning wheels.

usually the distance rod will bend before the steering knuckle arm. If it has occurred, however, the only remedy is to compare the suspected knuckle arm with a new one and if only slightly bent, straighten it, using the new knuckle as a guide.

If badly bent, the installation of a new spindle is advisable.

Straightening bent parts is unquestionably Repair shop work, for frequently such parts must be heated during the straightening process. Modern automobile construction demands the use of the highest grades of alloy steels. A great advantage of such steels is that by proper heating and cooling, great strength and durability are obtained. However, heat treatment must be given with a full and accurate knowledge of the particular steel being dealt with. Thus, if a piece is heated without such knowledge, it immediately loses the advantage which the original heat treatment gave it.

The other adjustments, particularly that for toe-in, can be made by the car owner himself and the front tires show any evidences of wear from misalignment, this should be checked immediately and rectified if found incorrect. Indeed it will pay to check up on the front wheels occasionally even if tire wear has not developed to a point where misalignment is recognizable; it does not take long nor is it difficult and it may result in the front tires giving several thousand miles more service before they must be discarded than they otherwise would.



Motoring in Travancore.

BY E. W.

THE States of Travancore and Cochin, especially the latter, a good record in roadmaking in the past fifty years and the motorist who wants to enjoy a run on excellent roads through some of the most beautiful scenery in South India, cannot do better than plan a trip in these two States. Until 1860 there was scarcely a road of any importance at all, and all the travelling had to be done, either on rough

been lost sight of, for the Government has erected a series of good Travellers' Bungalows along the route. In most of them the provision is better than in the British Indian ones, and the traveller need never fear he will be in difficulties with regards to accommodation or commissariat. Our experiences in these countries have been of the happiest, for everywhere we stopped we found the bungalow servants able and willing



Trivandrum Summer Palace.

roads or by the backwaters. Of course, in these days, travelling on the backwaters is much quicker than it used to be, but as a rule the journey is circuitous, and roads are necessary for the great proportion of the traffic. The roads of these States, even though it is difficult to procure the materials necessary for metalling, compare very favourably with those in British India, and in many places they are distinctly better. Add to this the fact that the comfort of the traveller has not

to do anything required of them. For the most part the bungalows were kept clean, as also the necessary linen for the table and the beds. This means a good deal to the motorist who has to cut down his saamaan to the minimum when he is taking a long trip. As one passes over the Travancore roads one readily acknowledges that the engineers who prepared them were men of skill, and the present day motorist owes to them much gratitude.

Our trip in the Travancore coun-

try took us from the very north of the State, in fact, part of Cochin as well, down to the very south of the country, Cape Comorin. There was a choice of roads at several points, but the great main road running from Cochin to the south was the one followed, though some of the others are very good and lead through interesting districts. There are several roads which have not yet been completely bridged, but for the most part, they are now passable at all seasons of the year, by motor cars. Though we are unacquainted with the country on the west coast, we will be

we pass to the south crossing by means of a ferry, the wide river, Tannipuzha Periyar, and after a few miles Perumpavur is reached. A short run of eleven miles more brings us to another river which is crossed by another ferry. This river is the Muvattupuzha, and in the monsoon season it is a strong flowing river. Then on again through beautiful country, palms on every side, we have a run of nearly three miles till we reach the small village of Ettumanur, which is the headquarters of the Taluk and is chiefly inhabited by foreign people who are



Waiting at the Ferry.

surprised to find how densely populated it is. Sometimes we ran for miles, and could scarcely tell where one village ended and another began.

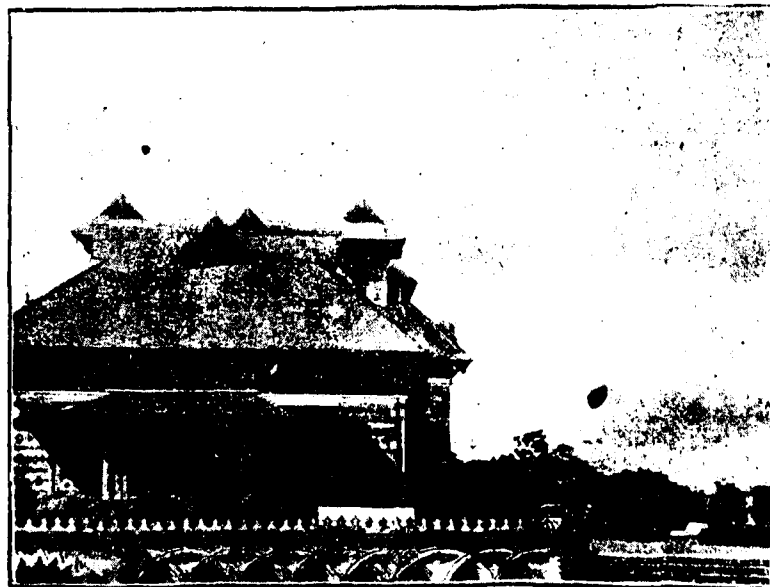
There is endless life along these roads, especially in the journey from Trivandrum to Nagercoil. The first part of our journey is from Cochin to Trivandrum, a run of 155 miles. Leaving the port of Cochin we pass along the main road via Angalalia, where the main road through Travancore meets it. From this junction

engaged in trade. In this place there is also a famous temple dedicated to Siva, and which is highly honoured throughout the State. Kottayam is not very far away and here we enter into some wonderfully picturesque country. Before entering the town we must cross over the two rivers, after which we have completed our first part of the journey, a distance of over sixty miles. We propose to stay here; for Kottayam has many places of interest for us to see, and

moreover it is a most beautiful district, and well worth giving a little time to it.

Kottayam is at the head of a large navigable stream which is connected with the backwaters. There is a considerable amount of traffic along this river from Alleppey and other places, and it is not without interest to walk down to the landing stage where the small steamers and *wallams* arrive with their passengers and cargo. It is worth while to take a short trip along the river in one of the boats,

fine college which has been most successful, in the past, in turning out large numbers of students for the university. Another interesting feature of Kottayam is the place it holds in regard to the indigenous systems of medicine which are practised by a considerable number of able men. We are able to stay in the fine Rest House which is here established by the Government for the convenience of travellers. The scenery both on water and land around Kottayam is very pictures-



Trivandrum the Museum.

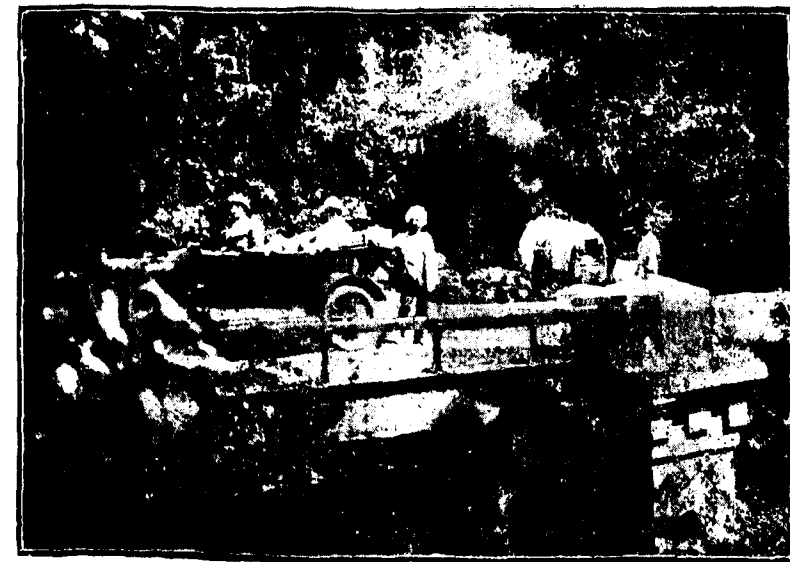
for the scenery is certainly as fine as anything you will find along the coast. Kottayam, being on the main road to Peermade attracts a lot of trade, and is a great commercial centre. It is the centre of strong Christian church belonging to the Church Missionary Society, and for many years has been one of the chief seats of the Syrian Church. There are several very fine Anglican and Syrian churches in the town and neighbourhood. In addition to its ordinary mission agencies the Church Missionary Society also conducts a

que indeed and we shall not regret staying here even a few days.

But we are aiming for Trivandrum and we must continue our journey to the South. We shall have many rivers to cross: some of them by ferry, but these are well arranged, and, as a rule there is not a great deal of time wasted. A short run brings us to Changanacherry, a town with a population of over fifteen thousand, and the headquarters of the Tashildar. There are several canals connected with the backwaters so that it is possible if we so desire

to go by boat to Alleppey or Quilon the two main ports on the coast. It is still the seat of a family of Koil Tampurans allied to the Travancore Royal House, but the town itself has steadily declined in importance. There is a large Christian community, and there are very fine Syrian churches in the neighbourhood. There is a large fair held here at certain times of the year, and during that week large numbers come from all over North Travancore. But we need not stop here, for we have still some eighty miles to run before we reach the town of Trivandrum. And

longer run without coming to a river, but it is all very interesting, and unless you are in a hurry to get to the end of the journey, one does not mind very much. We have seventy four miles to complete before we get to the end of our journey. We cross the Kallada River some four miles from Adur where we may stop for a while to take lunch if we so desire. Then on again, every part of the road providing something of interest in the way of natural beauty, until we reach Kottarakara, a small town was formerly the capital of the Elayadathu Swarupum. The scenery



On the Roads.

there are several rivers to be negotiated by the ferries. It will be a great relief to motorists when these rivers are bridged over, but bridges are expensive luxuries, and the State can only gradually undertake the heavy expense to be involved. The rivers Ranni, Varrayyam and Manimala are crossed before Chengunnur is reached. We are passing through very fine scenery all the way, and the surface of the roads, for the most part, is good. One sometimes wishes it was possible to take a

around this town is very picturesque and it is worth while to have a look at the pagoda, the palace and the ancient Syrian church. At this point we cross the railway that was built at great expense by the Travancore government from Quilon to Shençottah, a fine piece of railway engineering. The rest of the journey is along a good road, and the three rivers that have to be crossed have been bridged, so that the motorist has no difficulty in doing this part of the road. All the country is typical of North Tra-

vancore, innumerable cocoanut palms on all sides, and rich foliage and scenery along the roads which have fine trees along them for some parts of the distance. The man with the camera has a great chance of snapping many interesting pictures, though he must be warned to give long exposures if he attempts to take the shady places. At last the town of Trivandrum is reached, after a journey of three or four days for we have not hurried, partly on account of the ferries, and partly because we have chosen to make many stops to see the lovely scenery through which we have passed. Trivandrum is the capi-

tal of the State and is one of the most progressive towns in the Madras Presidency. In recent years it has undergone considerable developments, and there is now a fine collection of modern buildings which are the necessary adjuncts of modern government. As we have passed over the roads we have realised the progressiveness of the State, as a whole, and especially with regard to its communications. It is surprising that more do not trouble to visit this interesting country, for it certainly does provide a most excellent district for those who love to see nature at its very best.



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What is a Storage Battery?

CHEMICAL RATHER THAN ELECTRICAL ENERGY STORED IN CELL.—SIMPLE STATEMENT OF COMPLEX REACTIONS.—WHAT THE STORAGE CELL WILL AND WILL NOT STAND.

CORRECTLY speaking, the term storage battery is a misnomer in the sense that absolutely no electrical energy is stored in a cell. What does take place is a chemical change while the current is entering the battery, which so affects the elements of the cell that they are in a position to change back again when the cell is being discharged, and in thus reverting to their original form, they give rise to an electric current in the same manner as an ordinary primary cell gives rise to its electromotive force.

In its simplest form the storage cell comprises two lead plates, immersed in dilute sulphuric acid. When these plates are connected to the terminals of a dynamo, the current passing through the plates and through the liquid changes the character of the surfaces in contact with the acid. The plate which is connected to the positive terminal of the dynamo becomes gradually coated with a film of lead peroxide, while the negative plate assumes a covering of spongy lead. Spongy lead is not ordinary metallic lead, although its chemical symbol (Pb) is the same, but is some allotropic form of the metal itself, even as graphite is nothing but carbon in allotropic form.

As the charging current is continued, the chemicals conversion on the surfaces of the plates eats deeper and deeper within certain limits. It will be seen, that with the battery charged, we have in reality two dissimilar electrodes immersed in an electrolyte, and from what was said before on the chemical production of the electric current it can be readily expected that such a combination will give rise to an electromotive

force. As the battery is discharged, the lead peroxide on the positive element is reduced to lead oxide, while the spongy lead on the negative element also is changed into lead oxide.

Such at least is the popular explanation of the working of the storage cell. On the surface of it, it appears perfectly simple and at the same time simply perfect, but the storage battery is far more complicated than it appears on the surface. As a matter of fact, while the explanation given is practically what happens, the chemical processes which give rise to the changes in the character of the plates under charge and discharge, are extremely complex, so much so in fact, that while chemists have been looking into the working of such cells for years and years, even at the present time the full chemical actions and reactions have not been fathomed.

The full explanation of the chemical changes which are effected in the battery is as follows :-

When the battery discharges, the electric current passing through it decomposes the water in the electrolyte, liberating hydrogen and oxygen, the first being given off at the negative or spongy lead plate. The gases at the instant of liberation are chemically more active than in their fixed or ordinary state; to use the lingo of the chemist they are "nascent." The hydrogen in this nascent or highly active state combines with certain molecules of oxygen in the lead peroxide, forming water, and the abstraction of those molecules of oxygen gradually changes the lead peroxide into lead oxide (Pbo). At the other plate the following is taking

place. The oxygen liberated combines with the spongy lead, and likewise forms lead oxide (Pbo.) Therefore a complete discharge of the cell would change both the negative and positive into lead oxide, and since two identical compounds in an electrolyte do not exhibit a potential difference, the flow of current would cease.

If, however, a charging current be sent through the battery in a direction opposite to that in which current flowed on discharge, the gases of decomposition are liberated also oppositely, the oxygen being formed at the positive and the hydrogen at the negative plates. In this case, the oxygen at the positive pole combines with the lead oxide, adding a molecule of oxygen and changing the element to lead prooxide, while the hydrogen combines with the molecules of oxygen in the negative element to form water, and thus abstracts the oxygen from the negative plate, turning it back to lead. The battery is, then, when full charged, exactly in the same state as before, and becomes again an active battery possessed of two dissimilar plates immersed in electrolyte.

There is one important chemical change which takes place which is not accounted for in the above explanation. It is the fact that lead oxide (Pbo) is incapable of existing as such in the presence of sulphuric acid (H₂SO₄). The (SO₄) radical of the acid immediately replaces the oxygen molecule in the lead oxide, forming lead sulphate (PbSO₄), while the oxygen molecule of the lead oxide combines with the hydrogen molecule of the sulphuric acid to form water (H₂O). As lead sulphate is possessed of very high resistance to the passage of electric current, and moreover, as it is very hard to change it back again to lead oxide or lead peroxide, it is quite obvious that continued discharge of the battery past a certain minimum point will be highly injurious, since it will result in the formation of such a quantity of lead

sulphate as to materially affect the efficiency of the cell.

There are two general types of storage batteries, the Plante type, in which the lead plates, which are roughened or corrugated to increase the surface which is subjected to the action of the electrolyte, are immersed in the electrolyte and "formed" by constant charging and discharging; and the Faure type, in which the plates comprise grids made of porous lead, the interstices being filled with the active material introduced in the form of a paste.

Because of its weight and the trouble incidental to forming the plates, the Plante type is not used in Automobile Work. The Faure type can be made with comparatively light lead grids, which are packed full of the active material forming a plate which is considerably lighter than can be obtained by the Plante process. Storage batteries, especially when used where vibration is excessive, as on the automobile, unless they are especially made for service of this sort, are likely to shed the active material from the plates, which, of course, in time results in their deterioration. This process is hastened by the fact that the material on the plates changes in bulk.

When a battery is fully discharged, it can absorb current at the highest rate. As the charge progresses, the plates can no longer absorb current at the same rate and the excess current goes to form gas. In a battery which is charged or nearly charged, the plates can absorb current without excessive gassing only at low rate, and high charge rate will be almost entirely used in forming gas, resulting in high temperature and wear on the plates.

In starting and lighting systems, the aim is to provide sufficient current under average running conditions so that the battery will not be "starved" and yet the charge will be at a rate which will not cause injurious gassing.

The sulphating which takes place during an ordinary discharge is entirely normal. If, however, charging is insufficient, the sulphate increases and becomes hard and the plates become lighter in color, lose their porosity and are not easily charged; this is the abnormal condition usually referred to as "sulphated". This condition is usually the result of "starvation" of the battery.

A very general misapprehension has existed in the past as to the effect on a lead storage battery of discharging at very high rates. The fact that a starting battery will spin one of the big modern engines which a strong man can scarcely turn over shows what its capabilities are; and the length of time it will with proper charging and care continue to do this heavy work without giving out shows that it is not injured thereby.

It is not discharge at any rate which injures a battery, but overdischarge, or, what in time amounts to the same thing, undercharge or "Starvation."

Persistent overcharging not only tends to wash out the positive active material, but also acts on the positive grids, giving them a scaly appearance.

Temperature has quite a marked effect on a battery. Low temperature temporarily both lessens the ampere hour capacity which can be taken out of the battery and lowers the discharge voltage. It is as if the battery were numbed by the cold and unable to make the same effort as at normal temperature.

It is just as well, however, to bear in mind the effect of cold weather and to aim to keep the battery usually well charged in winter and not expose it unnecessarily to low temperatures. This is no danger of the electrolyte freezing in a charged cell; but in one which is overdischarged or has had water added without subsequent charging this is likely to occur.

High temperature is to be avoided from the standpoint of life; 110 degrees Fahrenheit is usually given as the limiting temperature and even this would be harmful if maintained

steadily. Heating is ordinarily the result of charging at too high current rate. If the temperature of the electrolyte in a battery is found to run consistently high, the system should be inspected; it may be out of adjustment and be charging the battery at too high a rate.

The effects of continued high temperature are to distort and buckle the plates, to char and weaken the wood separators, to soften and sometime injuriously distort the jars and covers.

If starting motor is used unnecessarily for cranking engine or for propelling car, rapid discharge takes place. Avoid this whenever possible, as under this condition dynamo must be operated a long time to replace in battery the amount of current taken by the starting motor.

Do not let this happen to your battery.

Be sure to add distilled water to the battery every week.

The electrolyte consists of a mixture of pure sulphuric acid and distilled or other pure water.

Concentrated sulphuric acid is a heavy, oily liquid having a specific gravity of about 1.835. A battery will not operate if the acid is too strong, and it is, therefore, diluted with sufficient pure water to bring it to a gravity of 1.270 to 1.300 for a fully charged battery. Stronger electrolyte than this is injurious.

To prepare electrolyte from sulphuric acid of 1.835 specific gravity, mix with water in the proportions for the desired specific gravity, taking the following precautions:

Use a glass or earthenware vessel, never metallic. Carefully pour the acid into the water, never water into acid.

Stir thoroughly with wooden paddle and allow to cool before reading the gravity.

Both the water and the sulphuric acid used in making electrolyte should be chemically pure to a certain standard. This is the same standard of purity as is used in drug stores

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as "CP" (chemically pure) or by the chemical manufacturers as "battery acid."

In this connection, the expression "chemically pure" acid is often confused with acid of "full strength." Acid may be of full strength (approximately 1.835 sp. gr.) and at the same time chemically pure. If this chemically pure acid of full strength be mixed with chemically pure water, the mixture would still be chemically pure, but not of full strength. On the other hand, if a small quantity of some impurity be introduced into chemically pure acid, it would not materially reduce the strength, but would make it impure.

The usual method of determining the strength of electrolyte is taking by its specific gravity. The method is possible on account of the fact that sulphuric acid is heavier than water. Therefore the greater the proportion of acid contained in the electrolyte the heavier the solution or the higher its specific gravity.

By specific gravity is meant the relative weight of any substance compared with water as a basis. Pure water, therefore, is considered to have a specific gravity of 1, usually written 1.000 and spoken of as "ten hundred" One pound of water is approximately one pint. An equal volume of concentrated sulphuric acid (oil of Vitrol) weighs 1.834 pounds. It, therefore, has a specific gravity of 1.835 and is spoken of as "eighteen thirty five."

Since electrolyte, like most substances, expands when heated, its specific gravity is affected by a change in temperature. If electrolyte has a certain gravity at a temperature of 20 degrees Fahrenheit and is then heated the heat will cause the electrolyte to expand, and, although the actual strength of the solution will remain the same as before heating, yet the expansion will cause it to have a lower gravity, of approximately one point (.100.) for each three degree rise in temperature. For instance, if electrolyte has a gravity of 1.244 at 40 degrees Fahrenheit and the tempe-

rature be raised to 43 degrees Fahrenheit, this increase in temperature will cause the electrolyte to expand and the gravity to drop from 1.275 to 1.274. On the other hand, if the temperature has been lowered from 70 degrees to 67 degrees, this would cause the gravity to rise from 1.275 to 1.276. Since the change of temperature does not alter the actual strength of the electrolyte, changing its gravity only, the gravity reading should be corrected one point for each three degrees change in temperature. For convenience, 70 degrees Fahrenheit is considered as normal, from which point the corrections are made.

When the temperature is considerably above below normal, the hydrometer readings should be corrected as explained above.

The specific gravity or density of the electrolyte is measured by an instrument called the "hydrometer."

This consists of a closed glass tube in the form of a short barrel with a longer stem of small diameter. Inside of the stem is a graduated scale. The hydrometer floats upright in the liquid and the point on the scale at the surface of the liquid shows the specific gravity, usually called "gravity."

For greater convenience, the hydrometer is usually placed inside of a larger glass barrel provided with a rubber bulb on top and a suitable nozzle on the lower end. This combination is known as the hydrometer Syringe.

By squeezing the bulb, inserting the nozzle into the electrolyte and releasing the bulb, electrolyte is drawn up into the glass barrel. Sufficient electrolyte should be drawn up to float the hydrometer clear of the rubber plug in the bottom.

To prevent the hydrometer from sticking to the side of the barrel, it is necessary that the syringe be held in a vertical position. The reading is taken at the surface of the electrolyte and when there is no compression on the bulb.

In recording the gravity of the different cells, it is customary to begin with the cell at the positive end.

When the readings have been taken, be careful to put the electrolyte back into the same cell from which it was taken. Failure to do this often leads to trouble; that is, electrolyte is often taken out of one cell, the gravity noted and the

electrolyte put back into another cell.

The result is that the amount of electrolyte taken out of the first cell is eventually replaced with water, leaving the electrolyte weaker; whereas the electrolyte which was taken out and put into another cell would make the electrolyte of that cell stronger, resulting in irregularity in the different cells.

General Instructions for Battery Care will appear in our next issue.



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Fun from here and there

AS an experienced motorist was crawling carefully through a well-known "trap" in Kent, the village constable made imperative signs to stop. "Look here," said the driver tartly, "I wasn't exceeding the speed limit." "I know that, sir," said the policeman with a diffident cough, "but you see I've got three chaps in the jail for reckless driving, and they sent me out to look for a fourth for a game of bridge."

A CERTAIN wealthy Scotsman had just purchased a second-hand motor-car, and the first time he was out in it the chauffeur seemed to have great difficulties with it. "Ye're going awfu' fast," the owner remarked. "Yes," sir, "gasped the man, "something's gone wrong. . . . I can't stop her." "Then, for heaven's sake, laddie," cried the other, "run into something cheap."

FAIR MOTORIST: "Really, I didn't hit you intentionally."

Irate Victim: "What have you got that bumper on your car for, if you aren't aiming to hit some one?"

"THE AUTOMOBILE certainly is replacing the horse," remarked the man, when he found a piece of a tyre in the sausage.

AN English motorist who was lost in the Lowlands of Scotland slowed his car up as he saw a girl approaching. "Mother-well?" he inquired, jerking his finger in the direction in which he was travelling. "Yes, thankee," said the girl, "how's yer own?"

"IT only takes me twenty minutes to get to my office," said Mr. Chuggins. "But you didn't arrive until an hour after you telephoned that you were leaving home." "Yes it took me the other forty minutes to get the car started."

AN Englishman who was engaged on a motoring tour in Ireland stayed one night at a little inn in County Galway. The visitor was much struck by the physique of his host's five strapping sons, and congratulated the father upon his family. "Sure, sor," said the Irishman proudly, "they're fine bhoys. I've never had to lift me hand to wan of them, excipt in self-defence."

BANDAGES used at a Surrey Hospital in the past year amounted to over 24 miles in length. Motorists, however, declare that they get very little credit for providing employment for bandage-manufacturers.

"HAVE you seen Johnson lately?" enquired one motoring speed-merchant of another.

"Unfortunately," remarked the latter, "I ran across him last night!"

A MOTORING correspondent writes on "How to Avoid Skids." He doesn't say anything about emulating Felix, which is really the best way.

A VIPER held up the traffic on Kesnton Common recently. "Cars pulled up lest they should run over it." It is safer to be a snake than to be a pedestrian nowadays.

The following statute taken from the byelaws of Kansas City adds another to America's host of world's records:—"When two cars approach one another at a crossing they shall both come to a full-stop, and neither shall start up until the other has gone."

THE Motor-car was whizzing up the narrow main street of a country village at much more than the legal limit. The constable on duty had

no hesitation in stopping the car "Sorry, sir," he said as he produced his black book and wetted his pencil, "I shall have to report you. Will you give me your name and address?" "Certainly," said the young man, "I'm the Honourable Aubrey Fitzwilliam Marmaduke Gascoigne-Blood, worth....." "Ere.....re," said the limb of the law faintly as he scratched the nape of his neck, "Perhaps you'd better push on sir.....and don't do it again."



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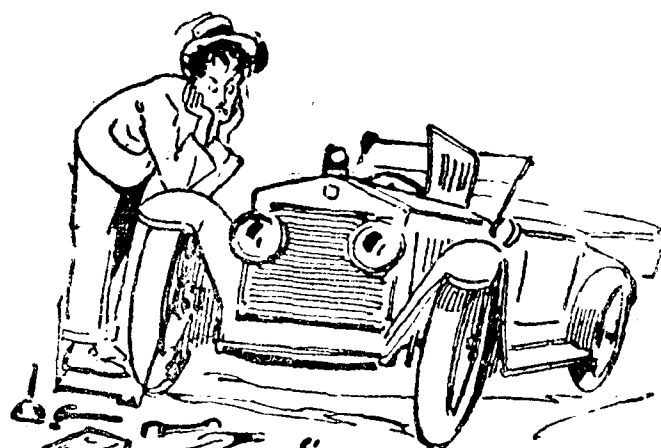
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The Madras News Agency

Free Specimen.

From Manager,

DOODLE, MADRAS.



*only "Indian Motorist"
Can solve this mess*

Questions and Answers.

ENGINE KNOCK.

Q.—My engine has been knocking for over a year. Have put in new piston rings and recently put in camshaft and bearings and tightened up all the crankshaft bearings, yet the knock is still there. It is more noticeable on a hard pull on high. Sometimes do not hear it at all. At times can be heard with only engine running. What would you advise?

A.—As you disposed of the crankshaft and camshaft and probably inspected the connecting rods, the only thing remaining is piston slap. This occurs when cylinders and pistons are badly worn and can only be removed by having cylinders ground and new pistons and rings fitted. Doubtless you have cleaned the combustion space of all carbon deposits.

CRACKED AXLE HOUSING.

Q.—Without apparent cause I have, within a very short time,

broken three right-hand rear axles on my car. Can you suggest the cause and remedy?

A.—Yes. Undoubtedly you will find the axle housing cracked on that side near the point where the spring is anchored. This will cause an additional strain on the shaft at every turn and cause it to break. Would suggest that you have a new tube riveted in place. When the axle housing and bearings are in good repair and proper alignment you should have no further trouble.

BATTERY CONNECTIONS.

Q.—What troubles originate in battery connections and what attention should they have?

A.—The principle troubles are loose connection or corroded terminals. If the battery is not kept clean and prevented from slopping over, corrosion is bound to occur, which will eventually cause an interruption of current. Corrosion is due to fumes which are constantly passing off from

the cells. A little ammonia or washing soda dissolved in water applied to the terminals and connections with a cloth, will usually remove any corrosion that may have taken place. Corrosion should be prevented by coating the terminals and connectors with vaseline or grease.

SHORT-CIRCUITING BATTERY.

Q.—Please advise if a short-circuit will discharge a battery?

A.—It certainly will. Any battery will be rapidly exhausted if it is allowed to stand on short-circuit for any length of time. For this reason care should be taken not to place any tools, etc., on the battery where they might short-circuit it.

CONSTRUCTION OF STORAGE BATTERY.

Q.—What is the function of a storage battery in an electrical system? Please show how they are constructed.

A.—The battery is the heart, or centre of the system. The current generated by the generator is stored in the battery, and is used by the starting motor for cranking the engine and burn the lamps at low car speeds and when the engine is at rest. In a six-volt system it has three compartments or cells and in a twelve-volt system, six cells. Within each cell are two elements; one positive, the other negative. Each element consists of a number of plates contained in a hard rubber jar and are immersed in a solution known as electrolyte. The plates of one element are known as positive plates and consist of grids or frames of specially prepared lead, the interstices in which are filled with lead peroxide. The plates of the other element are known as negative plates and are lead grids filled with spongy lead.

FITTING PISTON RINGS.

Q.—(1) In fitting Ford piston rings which side is the top? And how much clearance should be allowed in the joints? (2) In oversize pistons, say a .0250, could a .03125 ring be cut down to fit properly?

A.—(1) The side with the punchmarks, on the rod "Ford" in script. The ring slot clearances are as follows: Ring compressed in cylinder, top ring .003", second ring .035", and the third ring .008".

(2) Yes, this can be done on a grinder, or by lapping if care is taken to keep the ring of equal thickness at all points.

EXPLOSION IN CARBURETOR.

Q.—Occasionally I hear a popping noise in my carburetor. As I am told that it is dangerous I should like to know what remedy to apply.

A.—Popping back at the carburetor is exceedingly dangerous if the carburetor has just been primed or there is much of a leak. It is caused by lean mixture, leaky inlet valve or electrical troubles in distributor, which cause an explosion in cylinder when inlet valve is open. Look over these parts carefully, as occasionally, a car burns and is a total loss from this cause alone.

FLUSHING RADIATOR.

Q.—My car heats up very badly after a few miles. The radiator does not leak, the hose connections are perfect, the pump works properly. The water runs through the radiator, but slowly. Can you advise me if radiator can be clogged and how to clean same without injuring the interior?

A.—The sluggish circulation suggests clogging of radiator at some place. It may be sediment and slime from the water or rust and scale. Dissolve two pound washing soda in hot water sufficient to fill radiator

system. Use car as usual for several hours. Then drain thoroughly and fill with clean water. If circulation is still sluggish, remove radiator and run water under pressure from bottom to top to force out sediment. Steam pressure would be better. If this fails to remedy trouble, have radiator attended to by expert repair man.

LOW SPEED GEAR.

Q.—Please tell me if I can be troubled with a slipping clutch or not. When I put gears in low speed and let in the clutch the car does not always move. I do not have this trouble with the other speeds.

A.—From the fact that the other gears work correctly it would seem that the clutch is not at fault. The trouble is probably in the control of the low-speed gear. The control must be adjusted. Have it examined by an experienced mechanic.

MAXIMUM SPEED OF FORD.

Q.—What is the maximum speed

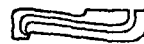
that a standard built Ford touring car or Roadster can go on a level road, if pushed to the limit? And what is the maximum speed that one should drive it from a standpoint of service and preservation?

A.—The maximum speed is about forty miles an hour; some go a little higher and others a little lower. The most efficient speed is between twenty and thirty miles an hour.

LOCATING AN OPEN CIRCUIT.

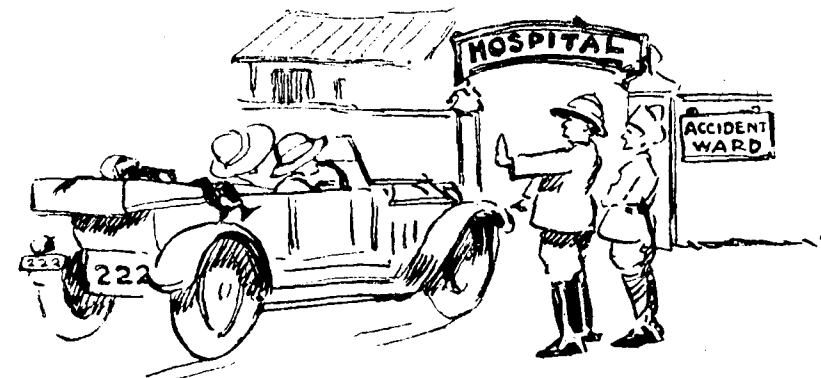
Q.—Please describe how to locate an open circuit in a wiring system.

A.—This may be readily accomplished with test points, by placing a point at each end of the circuit in question. The points are connected with a test lamp which will light if the circuit is open, as the points form another circuit for the current and thus complete that circuit which was previously open.



The Amusing Adventures OF Mr. and Mrs. Spinround, Tourists in the East.

Continued from the Last Issue.



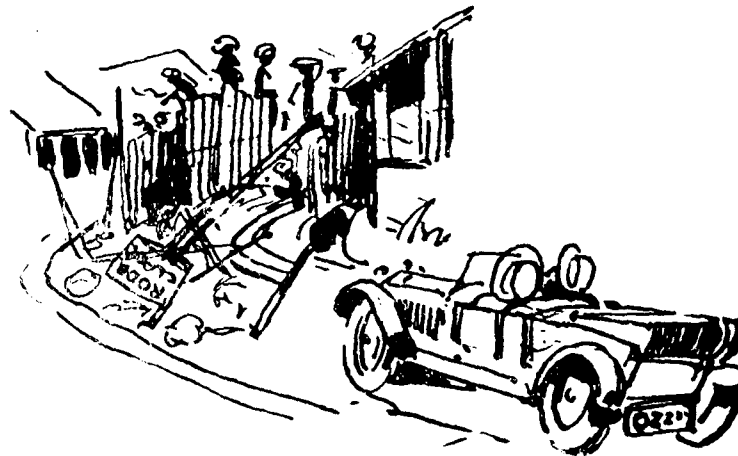
They put him in the car;
To the Police at Hospital gate
They leave the boy to his fate.

'Now hurry up dear
We are late, late, I fear'
Shouts he to her and she to him.
But of what avail?
For turning a corner,
Plump they meet a horner
It was Bull's horn against car's horn.

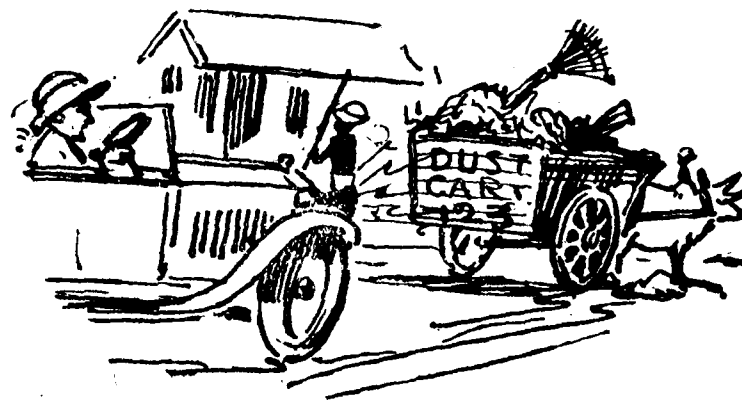


Man, brute and a buffalo
A passage unwillingly allow

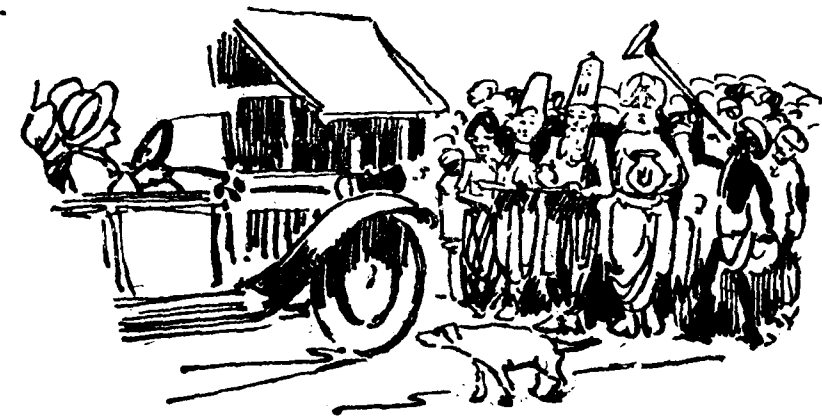
The Spinrounds start
Determined like an arrow to dart,
But against them was the Corporation
Of a slow Eastern Civilization.



With roads cut up for repair
And "Road closed" board lying unfair
Hammer, pick-axe, coolies and bricks
Right across the Car 222 Y.
'Back, back, my friends'
Shout the coolies.
Back they go
And again, there's 'Dust Cart'



That too patience helps to pass
What is this?
Tom-tom and *mumum*
Bands and bugles
Bells and *bangles*.



Your Eastern wonders never cease
As varied as it's multi-millions!
Thank Goodness!
Spinrounds reach the broad road.
"Lo! Who is the Spinround, he or we?"



Asks Spinround when they see the policeman
Swinging his arms like Windmill's arms,

Fed up with the East,
Unable to stand the feast,
The Spinrounds leave for Home
For there is nothing better than Home.





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FOR SALE.

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

3½ H. P. Sunbeam combination Rs. 1300 Tyres etc. Perfectly new.
Apply Box No. 107, c/o Indian Motorist.

Ford touring-1923 model with Battery & self starter recently over hauled thoroughly run only 10,000 miles Entirely owner driven. Rs. 2000.

Apply Box No. 108, c/o Indian Motorist.

Fiat 15-20 H. P. Limousine practically new Elec. Lights, Purchased for Rs. 13000 in 1922 hardly ever used, Overhauled and Painted recently Rs. 6500, or near offer.

Apply Box No. 109, c/o Indian Motorist.

A new chevrolet purchase February 1925, run only 1500, miles. In perfect condition. Rs. 2500.

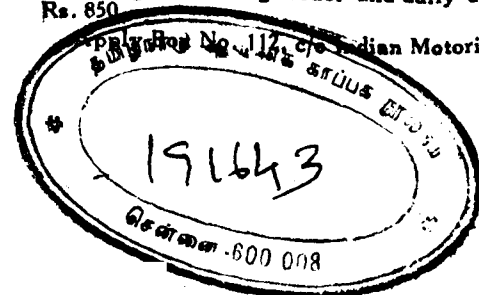
Apply Box No. 110, c/o Indian Motorist.

One Overland 83 Model five seater painted even and chocolate cushion covers to match—What offer.

Apply Box No. 111, c/o Indian Motorist.

One 6-8 H. P. Twin cylinder Enfield Motor Cycle combination Coach Built Side car in good running order and daily use. Rs. 850.

Apply Box No. 112, c/o Indian Motorist.



WANTED.

One Second hand Ford with or without self starter—

Apply with particulars.

Box No. 106 c/o Indian Motorist.

A Lens seater car in good condition—Two State Maker & Price.

Apply Box No. 113, c/o Indian Motorist.

One B. S. A. Motor Cycle—1913. Model recently over hauled and painted—in perfect running order Rs. 300, or near offer.

Apply Box No. 114, c/o Indian Motorist.

A Ford Touring car 1923 or 24 model. In good running order Can invest Rs. 900.

Apply Box No. 115, c/o Indian Motorist.

Esset. Two seater double dicky—just over hauled and Painted Tyres almost new—entirely owner driven, Rs. 2200, What offer?

Apply Box No. 116, c/o Indian Motorist.

Handwritten notes:
DS 112
112
113
114
115
116

Have You a Car to Sell?

Somebody wants to
Buy it.

Do You Want to Buy a Car?

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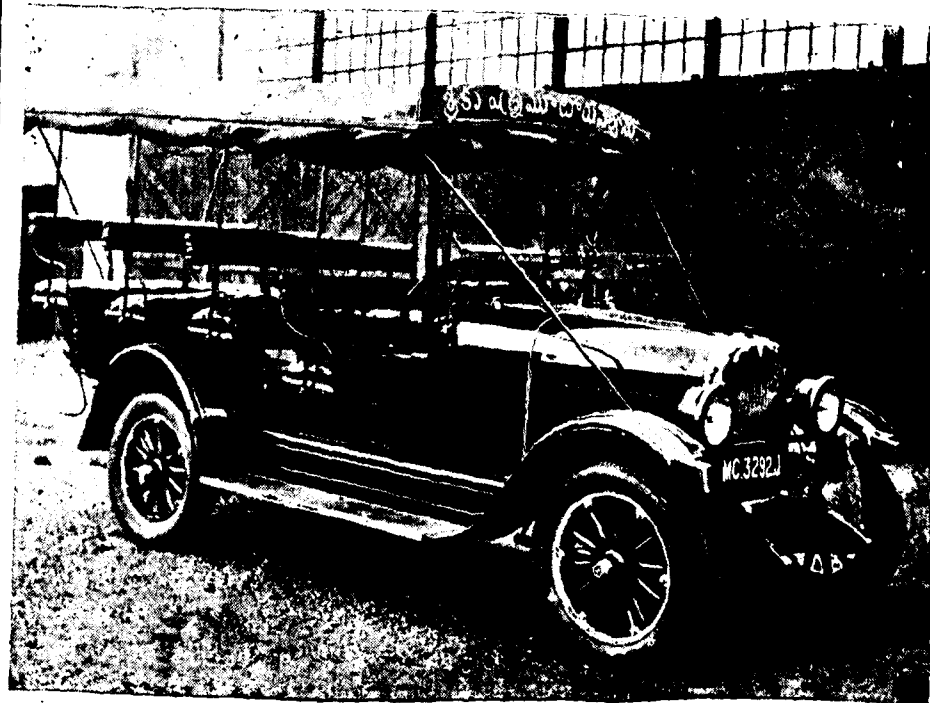
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