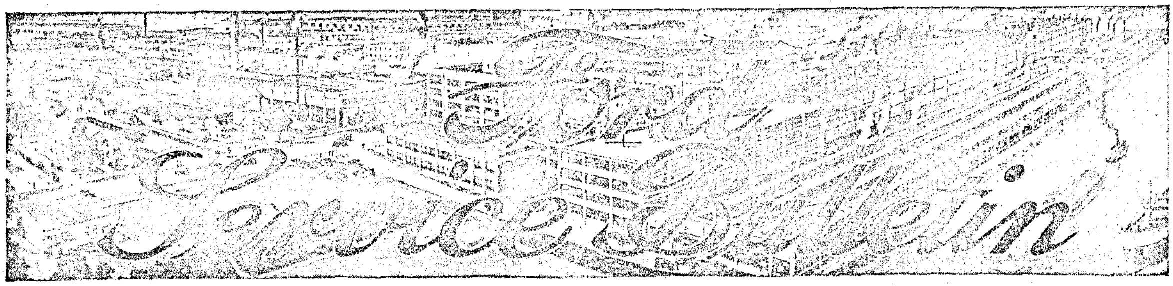

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Mechanics Should Endeavor to Improve Their Knowledge Along the Lines in Which They Work

Automobile Mechanics as a rule do not appear to care or take the trouble to improve their knowledge along the line of industry in which they are engaged. It is for this reason that we have so few first-class mechanics today. If it is the fault of the industry it is because of its rapid growth, tremendous expansion, that mechanics do not yet realize its paramount importance. It may be because the average standard of wages paid is too low, if this is the case, it is not the fault of the industry, but the fault of the mechanics. All things being equal, the average automobile repair mechanic is getting in proportion to what he is able to earn. In fact it almost seems in some cases as if the mechanic were being paid in excess of what he earned. A few ambitious and studious mechanics have raised themselves from the grease and mire to more desirable positions and salaries. It has only been accomplished however, through hard work and constant recreative thinking, and study. Men today are paid for thinking as well as doing. Today a "strong back and dormant mind" will not get one anywhere. If you exercise those brain cells a little bit every day, it will soon become a habit, and you will automatically endeavor to improve yourself and the conditions under which you are working. You will automatically turn out better work and in less time. Soon you will be receiving more money, and be ready for an opportunity for a better position. You can do this by constant study and reading. Read everything you can find on your work. Read the Ford Service Bulletin. Do not only read but remember what you read, and apply it to your work. Read big things, think big things, try to do big things, and even before you know it, you will be receiving an adequate renumeration for your efforts. Do not be afraid that the field will be overcrowded, as there will always be those who are content to use their backs.

Ford Mechanics' Section

(Continued from page 14, July, 1924, Service Bulletin)

Causes of Over Heating

The timing of the ignition has a noticeable effect upon the cooling of the motor. It is a well known fact that running a motor with spark retarded causes overheating. This is because the piston is already part way down in the cylinder when ignition occurs.

This means that a considerable part of the cylinder wall is exposed to the flame when it is at its hottest point. It can readily be understood that in this way after a short time, the cylinder walls have been considerably exposed to unusual heat, causing the cooling water to boil.

Also more gas—including more heat units—must be admitted into the cylinder to furnish the normal amount of power. This is necessary because the gas is expanding in a larger compartment, and its expansive effect is less than in a small one. From the above we may conclude that it is not economical to run continuously with a retarded spark.

Nearly every operator knows that a rich mixture of gasoline with air causes overheating in the motor. The primary cause for this excessive heat is the larger amount of heat units produced into the cylinder. One fact we must bear in mind is that it takes a certain definite length of time to burn a given amount of fuel; this is true no matter at what speed the motor may be running. If the mixture is rich it takes longer for it to burn, because there is more gasoline in it to be burned; also less oxygen in the mixture to form the combustion. At high speeds the spark should occur before the piston has entirely completed its compression stroke. The charge of gas, however, has not been completely ignited before the piston has reached top center, because, as before stated it takes a certain definite length of time to burn a given amount of fuel. Thus the heating effect of a rich mixture is the same as with a late spark. With the mixture very rich it still burns as it leaves the cylinder. This condition results in fouled spark plugs, making soot deposits on pistons and valves, and sometimes warps valves and valve stems. If the motor could be kept cool under these circumstances these results would not obtain; but because it cannot each makes the other worse.

The motor valves must be properly ground and seated to insure proper cooling. When they leak the throttle must be opened wider and the mixture in the carburetor made richer in order that explosions have sufficient force to do the work required. The result is overheating and a waste of fuel.

By pre-ignition, this is an ignition before the proper time. It is caused by hot particles of carbon on the top of the piston. These become hot enough to ignite the mixture under compression before the spark occurs at the spark plug. In fact, when hot enough will keep the motor running for a short time when the ignition switch has been shut off. The detrimental effect is loss of power and overheating. The early explosion of the gases result in negative work, or back pressure on the piston. A rich mixture is often made to make the explosion strong enough to do useful work, i. e. to keep the motor running. But the rich mixture together with the long exposure of the cylinder walls to the hot gases make the motor overheat.

Other causes of overheating are, i. e. low supply of oil or water, broken or loose fan belt, improper passages, heavy carbon deposit, etc.

Cleaning Solutions

Lye Solutions—Into five gallons of water dissolve a quarter of a pound of lye, strain through a cloth and pour in radiator, start the engine and let it run about five minutes, then drain the radiator, refill with clean water and start the engine for a few minutes, then draw off the water and fill again with clean water.

Second Solution—Mix a quarter of a pound of washing soda in two gallons of hot water, fill the radiator. If the radiator is very dirty it is a good idea to run the soda solution through several times to remove all the scale.

In winter a water cooled engine must be guarded against freezing, for if water freezes in any part of the system, it will cause the breaking of the radiator, or crack a water jacket. While the engine is running the water is kept warm and there is little danger of freezing but when the engine is stopped care must be taken. To prevent the water from freezing an anti-freeze solution should be used, such as denatured alcohol, wood alcohol or glycerine mixed with water.

Ignition, Starting and Lighting

Ignition—Lighting

Before you can understand the action of electricity, you must be able to distinguish electricity and magnetism. While they are two separate and distinct forms of energy, they are so very closely related that if we have electricity we can produce magnetism, or if we have magnetism we can produce electricity. While magnetism is not in any way (that we know of) connected with electricity it does, however, play a most important part in electrical operations and because of its importance we are going to spend considerable time with it in our discussion.

You are all familiar with a horse shoe magnet and have from time to time conducted little experiments with it. Perhaps these experiments have been conducted more for one's own amusement than for anything else, yet you have become familiar with its action. A magnet has properties which cause it to attract like substances. For instance, we have a magnet similar to the one used in the Ford magneto, by placing a piece of iron or steel near it the steel or iron is attracted toward the magnet. Another peculiarity is that this magnet has a north or positive pole and a south or negative pole. This can be determined by placing the two like poles of a magnet together, in which case they will repel each other, or by placing the two opposite poles together they will strongly attract each other. We can also determine this with a compass.

What is a magnet?

In the first place a Ford magnet is a bar of steel. It is first pressed into 'V' shape and then hardened. However, upon inspection it will be found just like any other piece of steel, possessing no apparent magnetic qualities. Next it is placed in a very strongly magnetized field, one end at the north and the other at the south, for a fraction of a minute and it immediately becomes a permanent magnet, having a north and south pole.

We have just described how permanent magnet was made. We have also what is known as a temporary magnet. A temporary magnet is a piece of soft steel or iron and is a magnet only while coming in contact with a magnetic field and will lose this magnetism as soon as the magnetic influence is taken away. For instance, take a common soft bolt. We will place the bolt in a magnetic field, which will be explained later, made from winding a number of turns of insulated wire around it, then we will cause electricity to flow into the wire by attaching a battery. The result is that the bolt becomes a magnet and will attract like substances. Now let us break the magnetic field by disconnecting the battery from the coil and the bolt becomes just a common bolt again, possessing no magnetic power. This illustrates a temporary magnet.

A temporary magnet is similar to a permanent magnet, except that the material is soft and it loses its magnetic power as soon as the magnetic influence is taken away from it. The softer the iron or steel, the better temporary magnet is makes. There have been a number of theories advanced as to just what makes a permanent or temporary magnet and while these theories do not help us much, we will take this one as an example, as it appeared to be the most feasible.

Science has discovered that steel or iron is composed of molecules (which is the smallest known substance that can be maintained in itself separately) and that each molecule is a permanent magnet having a north and south pole. Now in an ordinary piece of iron or steel these molecules are placed in every direction, working against each other, hence the iron is not magnetized. However, when we place this steel in a magnetic field these molecules change their position and all pull in one direction, but as soon as the magnetic influence is taken away, they resume their former positions. However, after steel has been hardened the molecules change their position and are not able to resume their former position on account of the hardness of the material hence it becomes a permanent magnet.

When a current of electricity is sent through a coil of wire, there is a magnetic field built up about the coil, whether the wire is insulated or not, **because magnetism cannot be insulated.** When a pebble is dropped into a pool of still water, rings are started where the pebble struck the water and they spread out until they come to the edge of the water. The magnetic field which is built up about the coil acts much in the same way, except that it revolves around the coil in a clockwise direction when the current is flowing away from the observer and in a counterclockwise direction when the current is flowing toward the observer. When more than one loop of wire is used and the insulation of successive turns touch each other and the turns are wound in layers, the field does not surround each wire but surrounds the whole coil as though it were one wire. If a soft iron core be placed through the loop the magnetic influence is collected in the core and magnetizes it with a north pole at one end and a south pole at the other. If the coil is held up before the observer broadside so that the current is flowing away from him, the left hand end will be the north pole. A magnet of this kind is an electro magnet and will only retain magnetism while the electrical current is flowing.

Producing Electric Energy

As the current is sent through the coil the core will be magnetized with a certain polarity, as the current is reversed through the coil the polarity of the coil will be changed. In the previous chapters we explained how a magnet was formed, bringing it in contact with a magnetic field composed of a coil of wire through which electric current was made to pass.

It has also been discovered that the action works in an opposite way, for instance, let us break the lines of magnetic force between the north and south pole with a coil of wire when we break these magnetic lines of force that we have caused a current to flow temporarily through the wire.

The faster these lines of force are cut the more current will be generated in the coil. This is the principle of all mechanical electric generators. The adoption may differ slightly in different generators, yet the principle remains the same. When this coil is passed through the magnetic field in one direction it will cause a current to flow through the coil in a certain direction but if the coil is passed through the field in the opposite direction the current will flow the other way through the coil. This is just what happens in the Ford magneto and produces what is known as alternating current. Direct current flows in one direction, as from a storage battery or a direct current generator. Alternating current pulsates or flows first one way, then the other.

60 cycle alternating current reverses 120 times per second. As before stated, the Ford magneto produces alternating current and at an engine speed of 1000 R. P. M. it reverses 16,000 times per minute or about 267 times per second. While it is a fact that we know very little about electrical current, we do need to know what it will do.

Electrical Terms

First, in order to get any benefit or use from electricity we must put it in motion. While electricity is not in motion it is of practically no value. There is a force which causes electricity to be put in motion, known as ELECTRO MOTIVE FORCE or VOLTAGE. When we have an electric pressure or voltage and the circuit is closed between the positive and the negative of batteries, for instance, current flows. The term or name of this unit of current flow is AMPERE. The amount of current that will flow depends upon the voltage and resistance offered by the line. The resistance of a line depends upon four things—first the material used (copper is the most practicable), the diameter of the conductor, the length of the conductor and the termperature. The name of this unit of resistance is the OHMS. Electricity can produce power and is capable of doing work. The name of the unit of power is the WATT. In general use of electricity the four terms mentioned above are all that is necessary for the mechanic to know.

The following are formulatives of finding the quantity of unknown terms when others are given—One volt of pressure will force one ampere of current through one OHMS resistance and in doing so, one WATT of power is produced. The amount of current that will flow through a circuit is directly proportional to the voltage or E M F and inverse proportional to the resistance on OHMS, therefore—

Volts —Amperes x Ohms
6 — 3 x 2

Amperes—$\dfrac{\text{Volts}}{\text{Ohms}}$
3 — $\dfrac{6}{2}$

Ohms —$\dfrac{\text{Volts}}{\text{Amperes}}$
2 — $\dfrac{6}{3}$

Watts —Volts x Amperes
18 — 6 x 3
55 —110 x ½
746 —110 x 6.7818
746 Watts—1 Electrical horse power.

Conductors

All materials are conductors of electricity. Some, however, are much better conductors than others. The materials are classified as to their resistance. The ones having the least resistance being the best conductors. Silver has the least resistance, but its scarcity and expense make it impracticable. Copper is next to silver in conductiveness. It is much cheaper and more plentiful, therefore copper is almost universally used as an electrical conductor.

Insulation

Electricity is conducted from its source, which is a battery or generator, to whatever piece of equipment is to be driven, through copper wire, which is called the LEAD and from this it returns to the battery or generator through a return wire or ground. It might be well to mention here that it is absolutely necessary that we have a complete circuit from and to the generator in order to produce power. As electrical energy will follow the path of least resistance, it is absolutely necessary that we insulate the wire or the LEAD if we expect to control its direction. It is because of this that the wires are covered with rubber or cloth called insulation. Whenever this insulation becomes broken or worn through and the LEAD wire touches the return wire, a short circuit is caused which will allow some of the current to pass back to the generator without performing its duty.

In the Ford car we use only LEAD wires as the frame of the car returns the current to the generator or battery. This insulation applies only to electric conductors and does not apply in any way to magnetism as there is no matter known to us that will insulate magnetism and it is because of this that magnetism can be induced through an insulated wire.

Induction

It has been discovered that by passing a current of electricity through a coil of insulated wire and quickly making and breaking the current, that another current will be made to flow (while this current is being broken) into a second coil of insulated wire which has been previously wrapped around the primary coil, but having no electrical connection to it. This is called INDUCTION.

Condenser

THE CONDENSER is composed of two pieces of tinfoil seven feet long and 3½ inches wide. The two strips of tinfoil are insulated from one another by two pieces of glassine paper. The two strips of tinfoil have no electrical connection within the condenser. They are, however, connected in the primary circuit to each side of the contact point. A condenser is used to absorb the self induced or reactionary current of the primary winding at the time of breaking of the contact points and thus prevent it from opposing the rapid fall of the primary current. Its action is very similar to an air cushion in a water pipe which will prevent the water from hammering when a tap is suddenly turned off. The more rapid the fall of the primary current the greater the force of the induced current into secondary winding.

(To be continued)

Lug for Jack on Lincoln Rear Axle

One of the small items for the convenience of the driver which have been provided throughout the Lincoln car is the provision which has been made for placing the jack under the rear axle for removing or applying a tire.

This is a lug extending from the rear bracket on the brake drum (see Fig. 6), which is in a very convenient position for placing the jack and is keenly appreciated by Lincoln owners who have had previous experience with other cars in the usual difficulties encountered when endeavoring to place jacks under the rear axle.

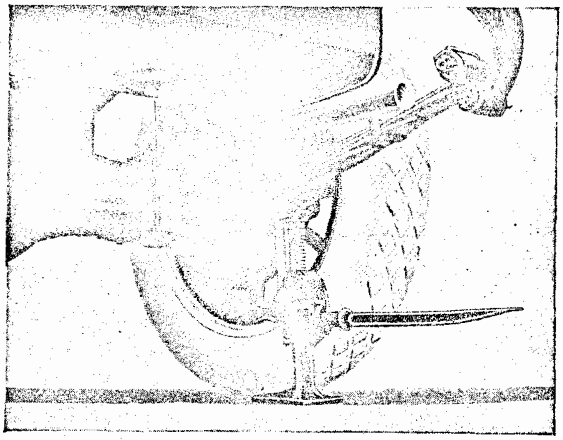

Fig. 6

Our Service on Parts Shipments

We endeavor at all times to maintain a good service on parts shipments from Branches to dealers and are continually trying to improve our methods. If dealers, who are not now doing so, have orders for parts listed in numerical order on the regular parts order blank, a great deal of time will be saved in our Branches and consequently will assist in bettering our service to you.

This method of ordering will also facilitate your checking of parts from the packing slips or invoices, as they would be invoiced in the same rotation as on your order blank.

Dash Lamp

Fig. 7 illustrates a dash lamp now standard equipment in Fordor Sedans. The hole on the instrument panel is located 3¾″ up from the bottom of the instrument panel and midway between the priming rod and switch. The insulated wire is attached to the ammeter terminal next to the switch.

Rear View Mirror

We are now installing a rear view mirror, Fig. 8, on all Fordor Sedans. This mirror is located 2½ inches to the right of centre for left hand control cars and 2½ inches to the left of centre on right hand control cars.

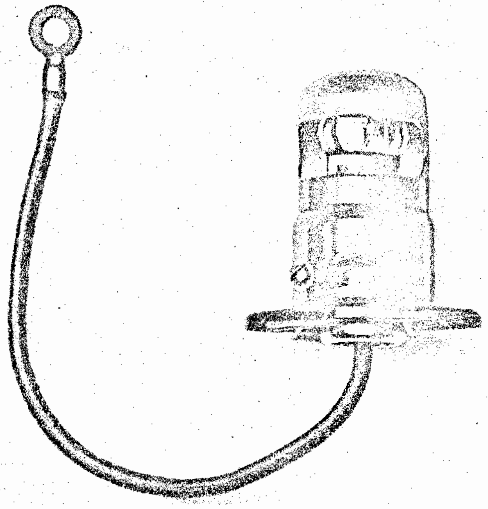

Fig. 7

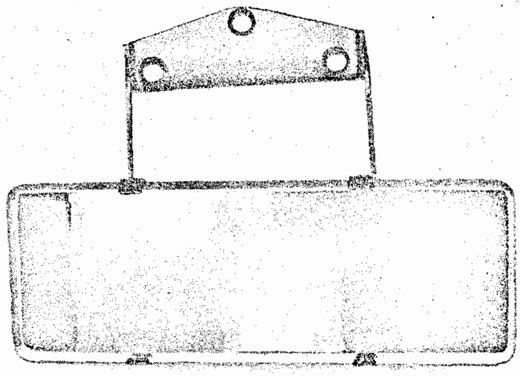

Fig. 8

Windshield Wiper

Windshield wipers illustrated by Fig. 9 are now standard equipment on Fordor Sedans. The hole for installing this wiper if drilled 8½ inches to the left of centre of windshield frame on left control cars and 8½ inches right of centre on right hand control cars.

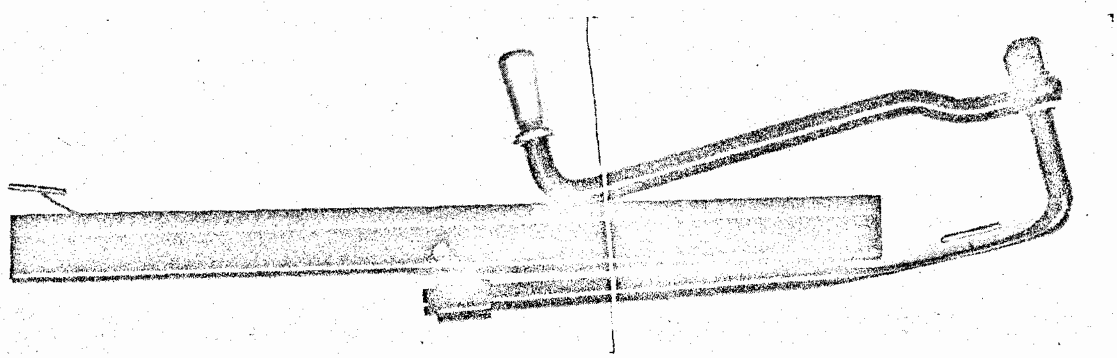

Fig. 9

Balloon Tires

We are now installing Balloon Tires as optional equipment on all Ford closed models at an additional price of $50.00.

This equipment includes the following parts:

		Four tires, size 29″ x 4.40″.
2	No. 2801K	front wheels demountable.
2	No. 2814K	rear wheels demountable.
16	No. 2847K	demountable wheel rim bolts.
16	No. 2848	demountable wheel rim bolt nuts.
16	No. 2846K	demountable wheel rim bolt clamps.
5	No. 2845K	demountable wheel rims.
1	No. 2849K	spare rim carrier assembly.

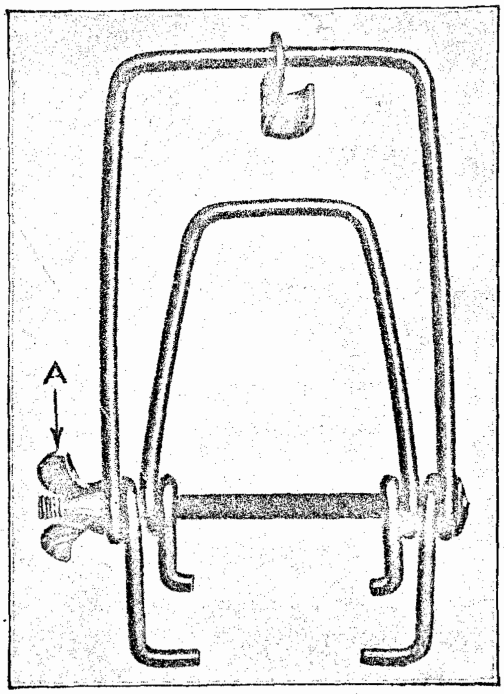

Fig. 10

The Balloon Tire itself is only an enlarged cord tire with a larger air capacity with a thinner carcass and a reduced pressure. It is designed to give greater flexibility and better riding qualities.

The tire is a straight wall type and uses a split rim, similar to that used on the truck with the exception that the rim is held together by a pin.

It will be necessary to remove the pin with a 3/16″ punch and pull the rim apart to remove and replace tires. The rims, as are now being used have four holes drilled into the flange, two on each flange near the break on the rim. These holes are so placed for the use of a special split rim tool, Fig. 10.

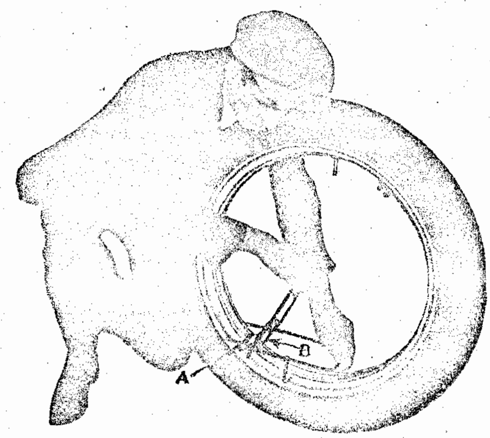

Fig. 11

These tools will be supplied by us and listed in our regular parts catalogue at $1.00.

The following instructions cover the complete use of the tool in both removing and replacing the tire.

Remove pin from hinge lock. Insert ends of both handles in holes on back of rim. IMPORTANT. See that ends of short handle are in holes nearest split of rim marked "B", Fig. 11. Hold tool in place with left hand, turn wing nut marked "A" with right hand until the other two ends of handles are tight against rim.

To break rim at split separate tool handles as shown in Fig. 11, raising end of rim attached to short handle over the other end of rim, as shown in Fig. 12.

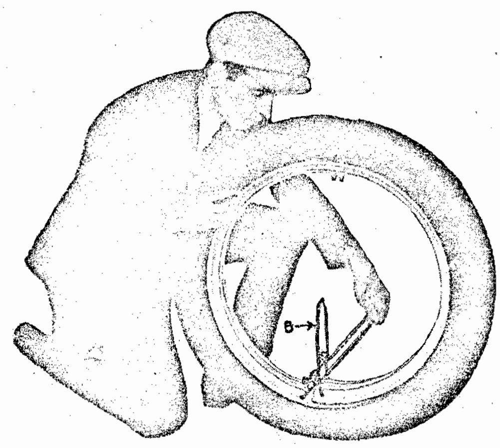

Fig. 12

With one end of the rim over the other, pull along handle of tool toward you until it touches the rim.

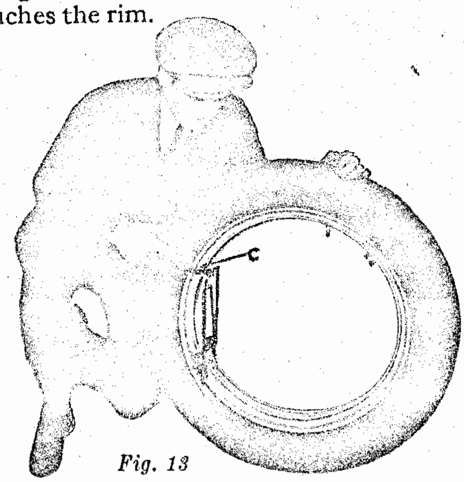

Fig. 13

The long handle of tool can be held in place, by hooking latch marked "C", Fig. 13,

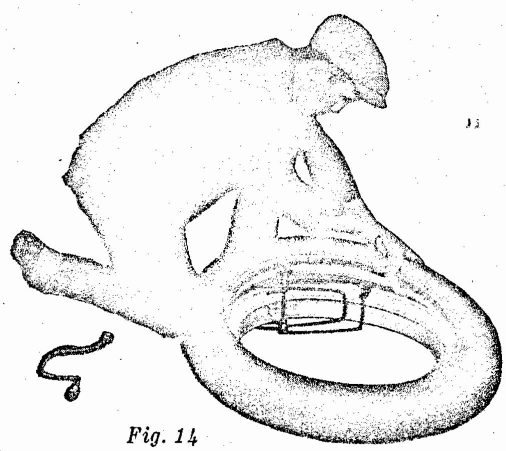

Fig. 14

over side wall of rim. Be sure to have this latch on same side of rim as the wing nut. Fig. 13.

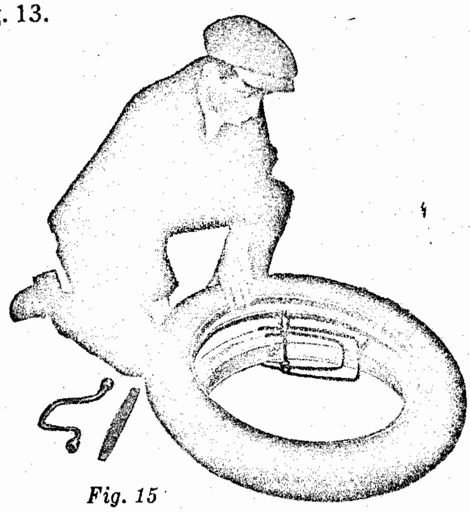

Fig. 15

Lay tire and rim on ground with wing nut face up, and tire can be easily removed with tire iron.

To replace tire on rim, insert valve stem in valve hole, see that bead of tire is forced well in place about ten inches each side of valve.

By walking on tire you can easily force tire over on rim, then force tire iron between the two beads of tire and rim, pulling tire iron with your hands on both sides of tire six

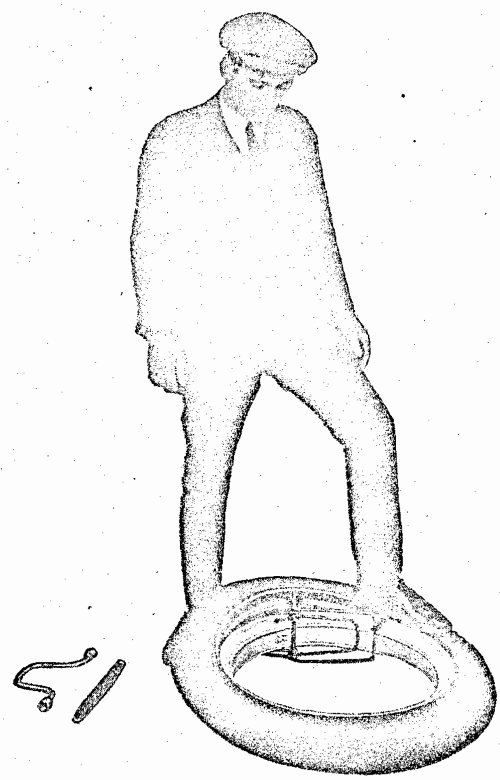

Fig. 16

inches at a time until you make complete circle of rim, giving you an opportunity to place flap with your fingers properly in tire before closing rim.

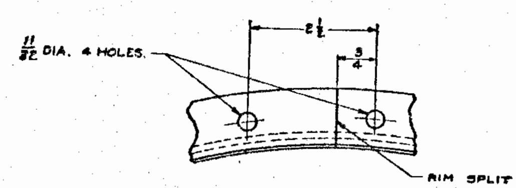

Fig. 17