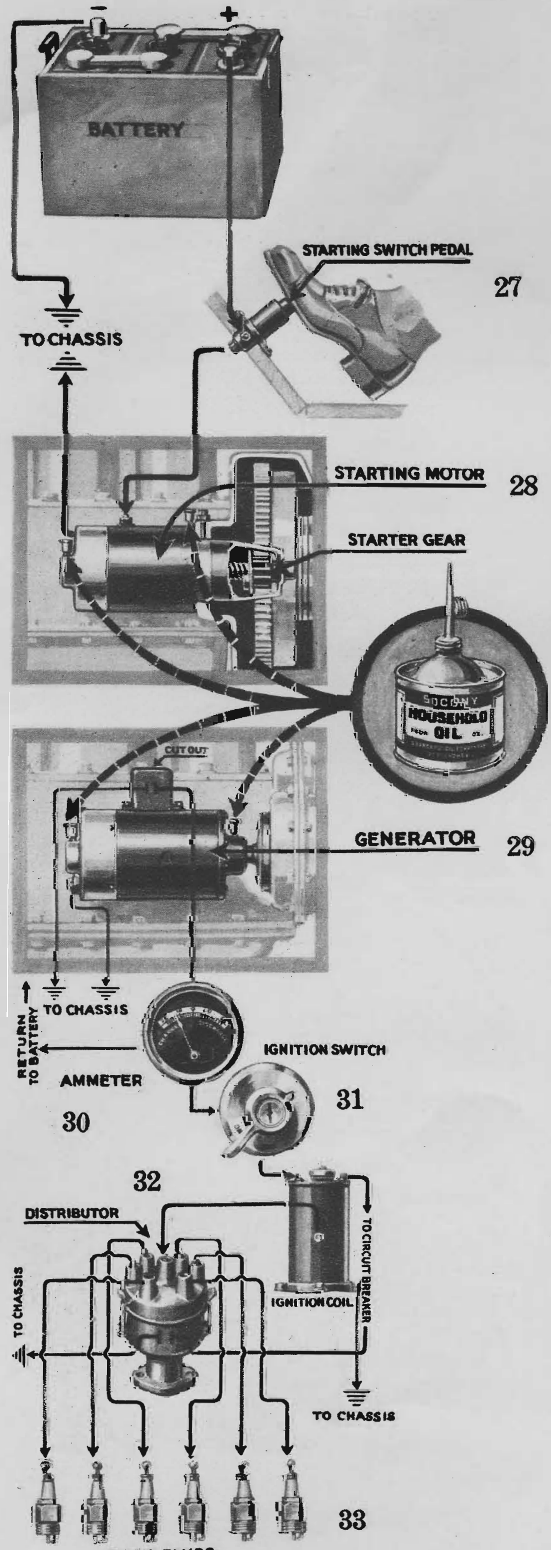


We Start and Run Our Engine

27. *The Starting Pedal*

When we step on the starting pedal, which is really a switch, we complete an electric circuit by joining two wires. With the completion of this circuit we draw current from our storage battery.

28. *The Starting Motor*

The current from our storage battery flows through wires to our starting motor. When the starter is operating, a small gear spins out on a shaft and meshes with the gear teeth on the flywheel. This gear springs back from the flywheel as soon as the engine starts.

Starting motor bearings demand a light oil. Socony Household Oil is an ideal lubricant.

29. *The Generator*

As our flywheel revolves, the generator "generates" electricity for our lights, supplies ignition and replenishes our storage battery.

Inasmuch as the generator revolves at high speed, it demands Socony Household Oil, the lubricant for generator bearings.

30. *The Ammeter*

The ammeter registers the "charging" rate of the generator, when running at sufficient speed to compensate for the current consumed by ignition and other circuits. While the generator is not running the ammeter registers the battery discharge.

31. *The Ignition Switch*

In starting our car, we close the ignition switch. The electricity from the generator or the battery flows through the switch into the ignition coil. In our automobile, the ignition coil transforms the low voltage current from the generator or battery, into high voltage current required for ignition.

32. *The Distributor*

From the ignition coil, our high voltage current flows to the distributor where it is "distributed" to the spark plugs. The low voltage current passes from the coil to the circuit breaker, in the distributor, where the circuit is "broken" at intervals as the distributor shaft revolves.

33. *The Spark Plugs*

Spark plugs are installed. They ignite the gasoline sucked into the cylinders.

How Our Spark Distributor Works

34.. *The Breaker Cam*

Our distributor is operated by a rotating shaft which is gear-driven from our crankshaft. On the upper end of this shaft is a piece of metal with as many sides as there are cylinders to our engine. This many-sided piece of metal is called the "breaker cam."

35. *The Breaker Arm*

The next item of importance in our distributor is the "breaker arm" which is pinned to our distribution casing at one end, permitting it to swing backward and forward for its entire length. In the center of this distributor arm is a piece of fibre. This fibre is held in contact with our breaker cam by a stiff spring.

If we watch, we can see this breaker arm move in and out as our distributor shaft revolves. The corners on our breaker cam push it away from the distributor shaft and the stiff spring forces it back after the fibre has passed the high points of our cam.

The action of our breaker arm and cam is similar to holding a stick against the spokes of a revolving wheel. Our stick contacts each spoke and breaks away.

On the end of our breaker arm is a piece of metal called a "breaker point." And on the opposite side of our distributor is a fixed arm fitted with a similar "breaker point."

As our distributor shaft revolves, these points come together and "break," hence the name "breaker points." One of these breaker points is adjustable, but it is advisable to let your service station adjust it.

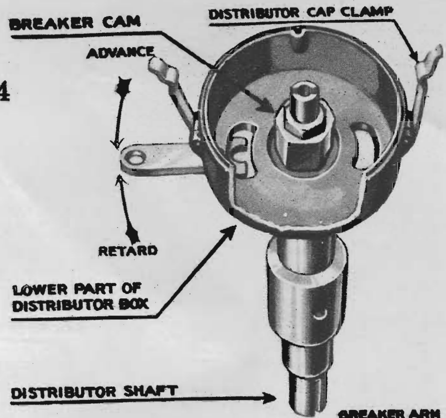
The function of our breaker points is to interrupt the flow of electricity to our spark plugs, for our spark must occur at just the right moment in our cylinders. The opening and closing of the points makes this possible.

36. *The Rotor*

The rotor, which fits in the slot in the top of our distributor shaft and rotates with it, distributes the sparks to the proper spark plugs. It makes electrical contact with the studs embedded in the distributor cup.

When we advance or retard our spark we move the breaker points backward or forward which makes the spark in our cylinders come earlier or later in the stroke.

34



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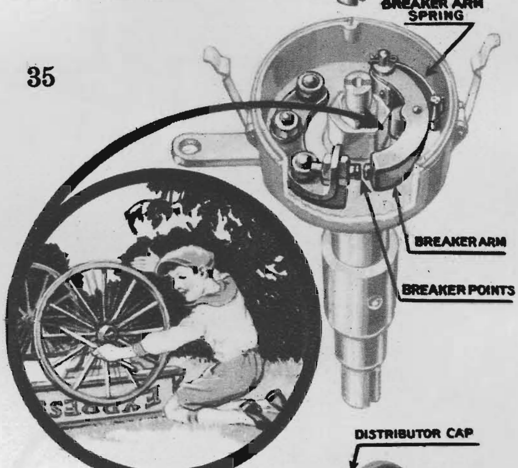

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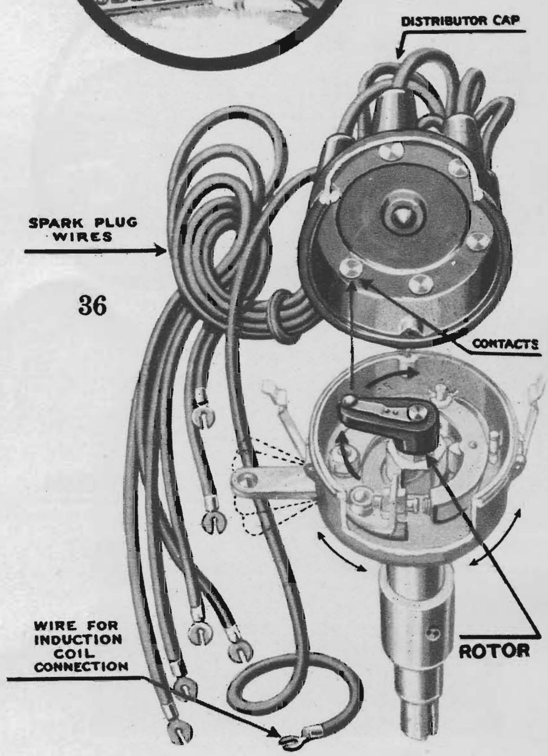

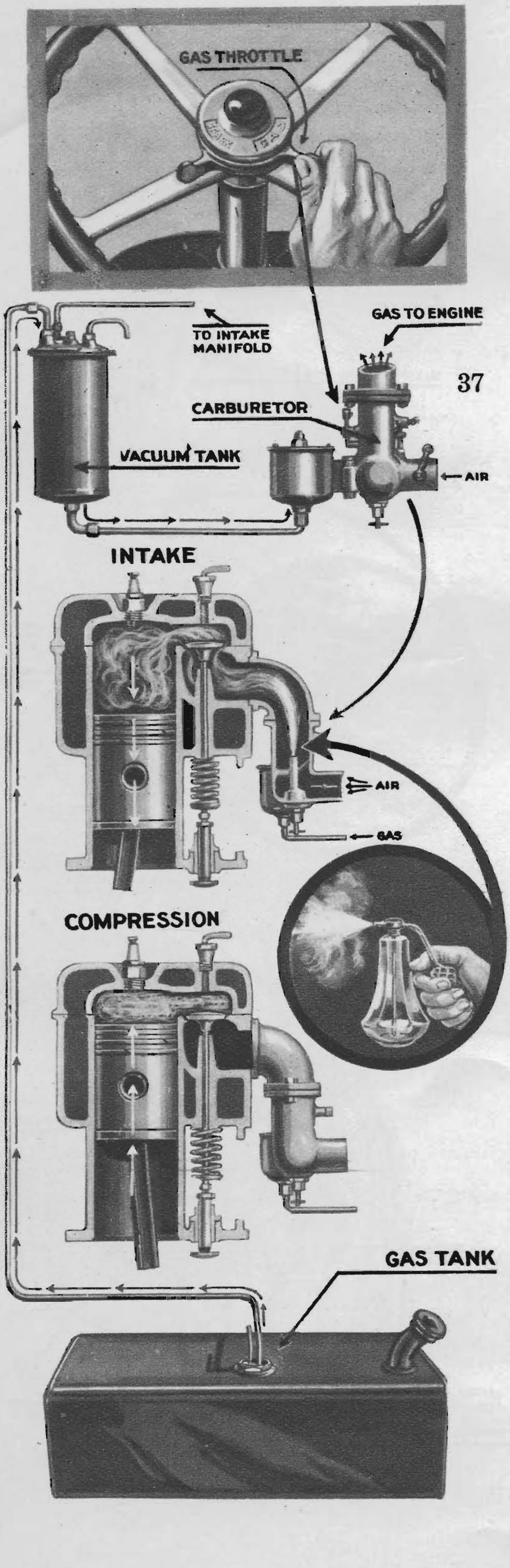

And This Is What Happens

37.

As the electric starting motor cranks our engine, liquid gasoline is sucked by vacuum from the gasoline tank, into the "vacuum tank" where it is strained and stored for use.

Most often the outlet of the main gasoline tank at the rear of our car is lower than the engine. The purpose of the vacuum tank is to insure a steady flow of gasoline to our engine regardless of the angle or position of our car.

The gasoline then flows from the vacuum tank into the carburetor where it is mixed with air before it is sucked into the cylinders in the form of a fog or vapor.

In some cars the gasoline is stored in a tank at a higher elevation than the carburetor. Thus it flows by gravity directly into the carburetor and not through a vacuum tank. In other cars the gasoline is fed to the carburetor by air pressure produced by a small compressor which forces air under pressure directly into the fuel tank.

Our foot accelerator operates a carburetor valve somewhat similar in principle to a stove-pipe damper. As we step on our accelerator we regulate the quantity of gasoline-air vapor sucked from the carburetor into the cylinders.

As the piston travels down in its cylinder, it creates a partial vacuum or suction and gasoline-air vapor is sucked from the carburetor to fill the space.

Our carburetor is a vaporizer or atomizer. It mixes air with gasoline in the form of an air-gasoline vapor. In principle, the carburetor is quite similar to the perfume atomizer.

The gasoline-air vapor, sucked into our cylinders, is now tightly squeezed or compressed by the upward stroke of the piston. This compressed charge will burn with great rapidity when ignited. The tremendous heat developed expands the gas and produces the power needed to drive the piston to the bottom of the cylinder.

The more gasoline-air vapor admitted into the cylinders, the greater the power and speed. Closing the carburetor valve reduces the speed of our motor.

The Vacuum Tank in Operation

38.

The purpose of our vacuum tank is to insure a steady flow of gasoline to our carburetor regardless of the angle or position of our car. Here is the way it does it.

Our vacuum tank consists of two tanks combined in one. An upper tank and a lower tank. The upper tank is the actual vacuum tank and the lower one a reservoir.

When we discussed the four-cycle principle, we saw that when the piston travels downward on its "intake" stroke it creates a suction or vacuum in a cylinder.

Ingeniously we take advantage of this vacuum and put it to work to suck the air from the upper chamber of our vacuum tank. This we accomplish through a copper tube which connects the upper chamber of the vacuum tank with our intake manifold. The intake manifold, we will recall, is the piping arrangement through which the gasoline vapor is sucked into our cylinders.

Nature abhors a vacuum. Hence the gasoline in our main gasoline tank rushes in to fill the vacuum. A copper tube connecting the main gasoline tank with the upper chamber of the vacuum tank acts as the vehicle through which our fuel is transported.

This process of sucking gasoline from the main gasoline tank continues until the fuel in the upper chamber reaches a level governed by a valve, which in turn is opened or closed by the rise or fall of a hollow metal can which floats in the gasoline.

When this metal float reaches a certain fixed level the suction or vacuum is automatically cut off, and air is allowed to enter this chamber through an air valve, thereby temporarily breaking the vacuum. The gasoline in this upper chamber now flows by gravity through a valve into the lower chamber or reservoir of our vacuum tank.

When we run out of gasoline it is necessary to prime our vacuum tank. Fuel poured into the upper tank flows through the valve into the lower tank and supplies the carburetor.

As our engine starts, the vacuum again operates and the flow of gasoline from the main tank is resumed.

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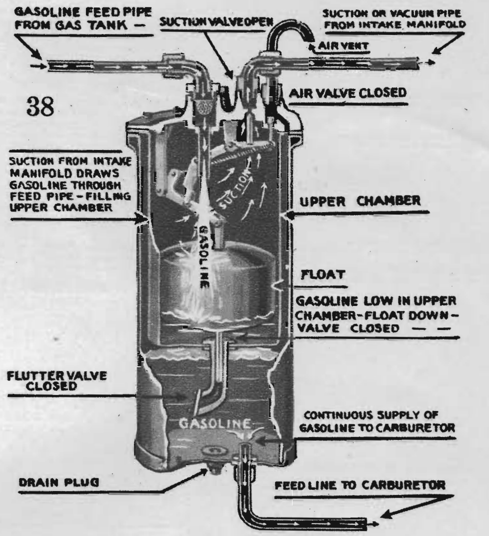

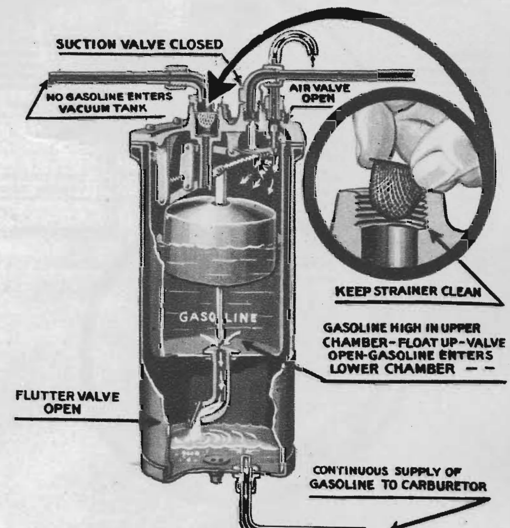

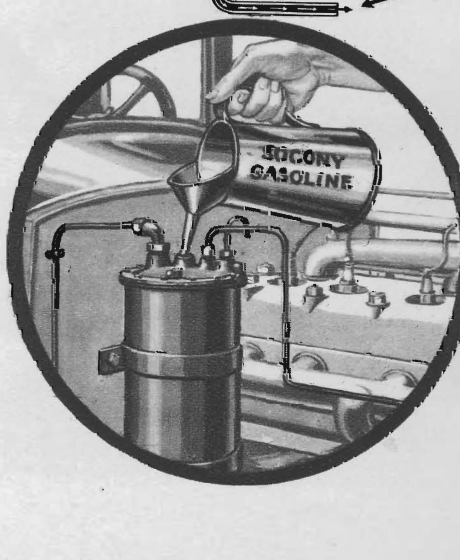

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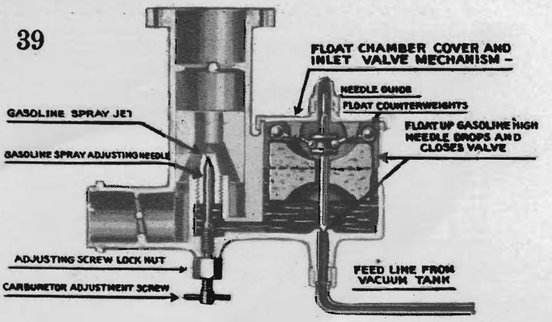
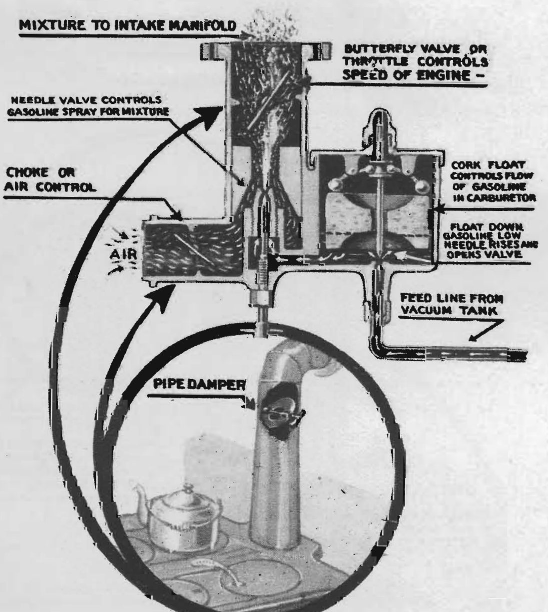
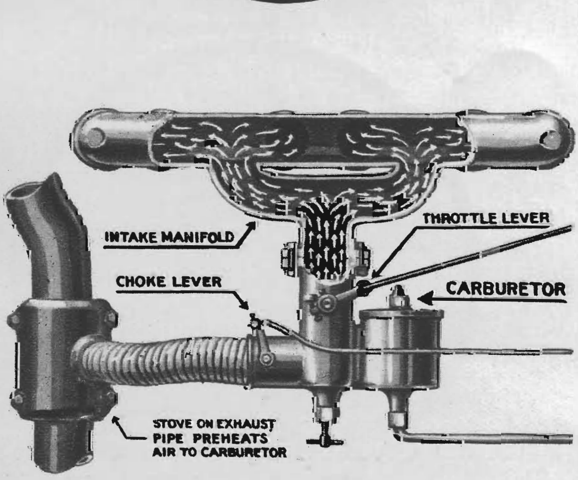






How Our Carburetor Works

39.

The gasoline flowing from our vacuum tank to our carburetor is first stored in a float chamber. As the gasoline rises in this chamber, the float rises. When the gasoline has reached the proper level further flow is stopped by a lever which closes a needle valve at the bottom.

At this point the level of the gasoline in the float chamber is even with the top of the spray jet in the mixing chamber. Now the suction, in our various cylinders, draws air through the air intake pipe and on through the mixing chamber.

As the air rushes past the spray jet it sucks from this jet a small amount of gasoline which is vaporized and mixed with the rapidly moving air in the proportion of approximately 15 parts of air to 1 of gasoline.

The gasoline-air vapor is now drawn through the manifold to our various cylinders as it is needed. The proportion of air and gasoline mixed in our carburetor is controlled by a needle valve which opens or closes the spray jet.

The amount of gasoline-air vapor which is fed to our cylinders is controlled by the movement of a "butterfly" valve which is operated by our foot accelerator or the throttle lever. The butterfly valve closes or opens the passage to the intake manifold just as the damper closes or opens the smoke pipe on a stove.

In starting, it is sometimes necessary to use a very rich mixture. We secure this rich mixture by use of a "choke" which reduces the quantity of air sucked into the mixing chamber. Approximately 8 parts of air to 1 of gasoline is considered a rich mixture.

The "choke" is a valve which opens or closes the opening to the air intake pipe and is similar in operation to our stove damper. Be cautious with the use of the choke as a too-rich mixture will flood our engine and dilute the oil in the crankcase.

Many carburetors are fitted with "hot-stoves," attached to the exhaust pipe, which pre-heat the air before it is drawn into the mixing chamber. This is especially desirable for winter driving as it helps to vaporize the gasoline drawn into the mixing chamber.

And This Is What Happens Next

40.

Now comes the electric spark from the spark plug. The highly inflammable, highly compressed gasoline-air vapor ignites in our cylinder. Great heat is quickly developed. The gas which has been trapped in the combustion chamber of our cylinders expands almost instantly. The pressure thus produced forces the piston downward with the speed of a bullet.

This procedure is similar to that of a big gun. The spark plug is the fuse, the gasoline is the powder, the cylinder is the gun barrel and the piston is the bullet.

The pistons in our engine move with great rapidity. When an engine with a 4½-inch stroke turns over at 1,200 revolutions per minute, a car speed of approximately 25 to 30 miles per hour, the piston speed is 900 feet per minute—a distance 108 feet greater than the height of the Woolworth Tower, in New York, one of America's tallest buildings.

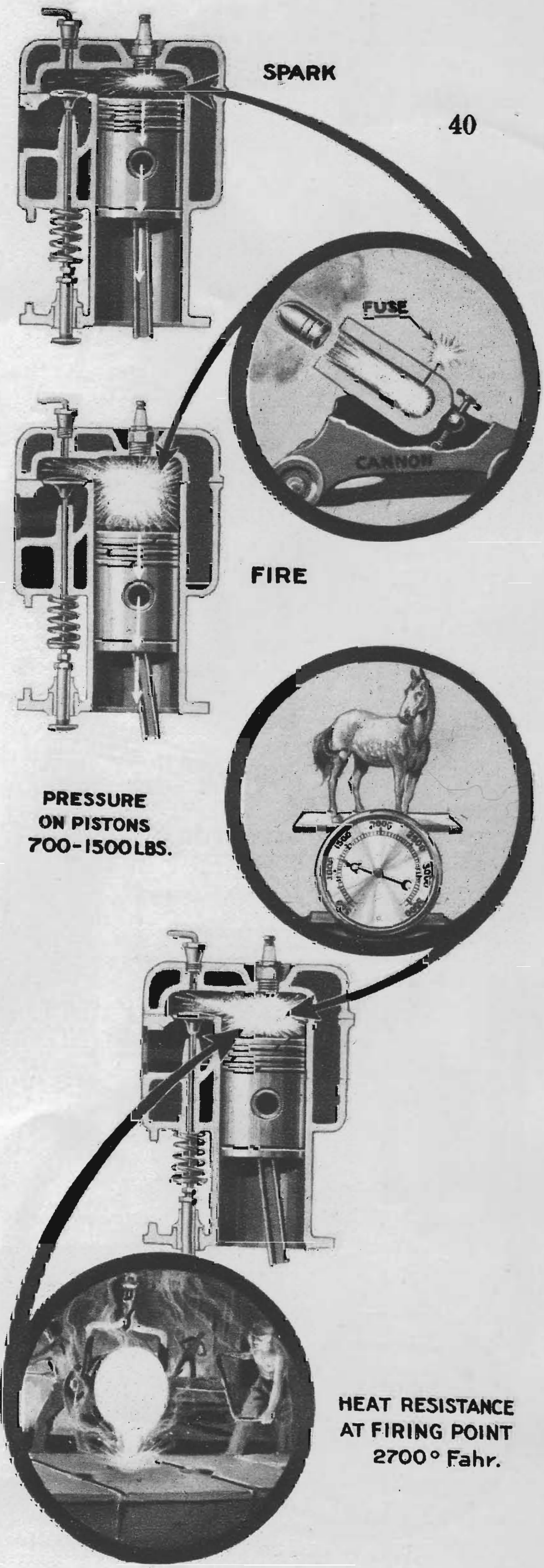
The pressure is transmitted from the piston through the connecting rod to a crankarm. As a result, the crankshaft whirls around and around like the handle on a coffee grinder or an ice-cream freezer, thereby developing the power necessary to drive our car.

The pressure pushing against each of our pistons at the instant of explosion totals many thousands of pounds, depending upon the size of our cylinders.

No wonder our pistons travel downward at such terrific velocity! No wonder the automobile engine can develop amazing horsepower with these pressures!

This great pressure in our cylinders is caused by the expansion of the rapidly burning gasoline-air vapor. The temperature developed in the burning process reaches approximately 2,700 degrees Fahrenheit at the core of the explosion.

This is above the melting point of cast iron or steel and at this temperature our pistons and cylinders would quickly melt like wax if steps were not taken to cool them.



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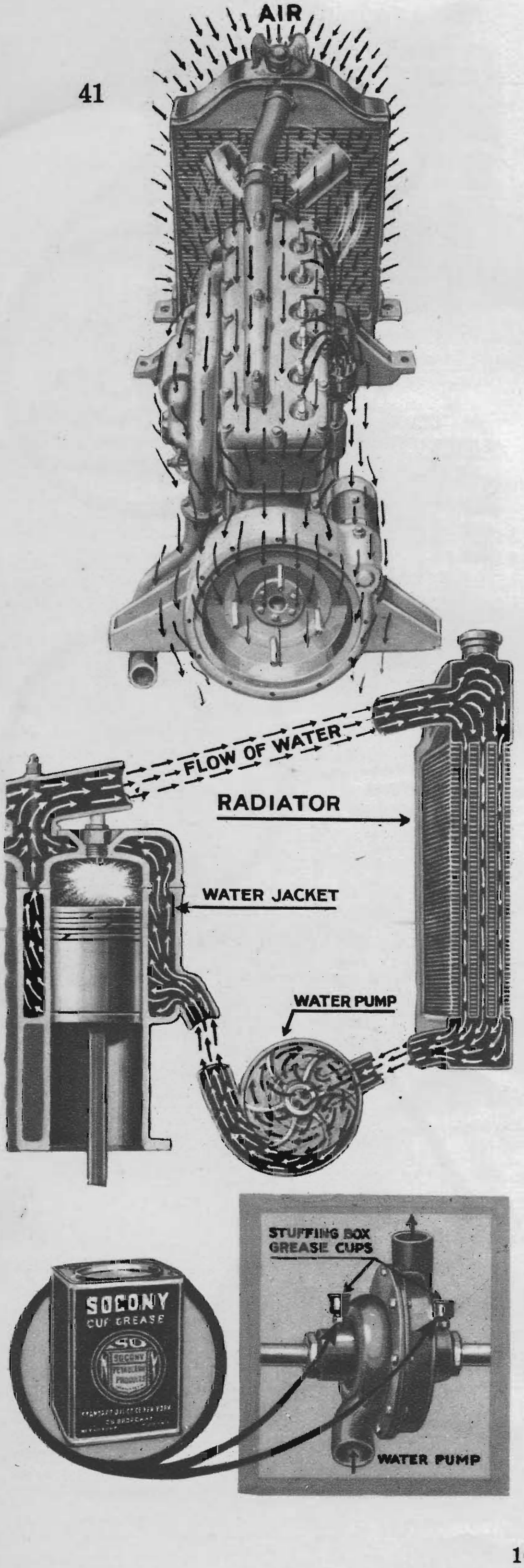


And So We Must Cool Our Motor

41.

We reduce the terrific heat developed in our motor usually by means of water. The most generally used water cooling system consists of a radiator for cooling the water, water jackets which encase the cylinders and other parts to be cooled, and a pump for forcing cool water through the heated areas.

Another water cooling arrangement, known as the thermo-syphon system, depends upon the difference in density of hot and cold water for its circulation.

The water, heated in the jackets surrounding the engine, flows continually upward and into the top of the radiator. The cooler water at the bottom of the radiator flows by gravity to the bottom of the water jackets, to be heated in turn and thus to complete the cycle of circulation.

In yet another system, a large volume of air is drawn through the front of the hood, past flanges attached to the cylinder walls, and, after doing its work of air-cooling the air is sucked out at the back of the engine by means of a suction fan.

The water in the water-cooling system passes through the engine jackets at a rapid speed. In most cases all of the water makes a complete circuit of the cooling system every minute we drive our car twenty-five miles per hour.

Note:—Since the water pump is such an important unit in our cooling system it should be lubricated with the best of grease. Socony Cup Grease will make your pump last longer and leak less.

To maintain the proper temperature in our cooling system we require a flow of air through the radiator at all car speeds. For this purpose we install a fan, driven by the motor, and placed directly behind the radiator.

There is hardly a revolving mechanism in our entire automobile engine which approaches the rotating speed of the fan.

A noisy fan bearing is annoying. Noise and waste of power at this point, caused by a poorly lubricated fan bearing, is reduced by regular use of the correct Socony lubricant.

We Silence Our Engine

42.

We have described the terrific heat and pressure under which our engine operates. If we allow these exhaust gases to blow directly out of our engine, with no attempt to silence them, the noise would be deafening.

The cause of this noise is a peculiar one. As the hot exhaust gas leaves the engine it pushes away the air outside very rapidly —just as the gases from a cannon expand at the cannon mouth. Thus we may say that, for an instant, we have a large bubble of hot exhaust gas outside our exhaust port which is pressing strongly against the air surrounding it.

However, at the next instant, this pressure drops. The volume occupied by the bubble of exhaust gas is greatly decreased. The surrounding air, which a moment ago had been pushed away, rushes back to fill this space. As the opposite layers of air come together a sharp report is heard.

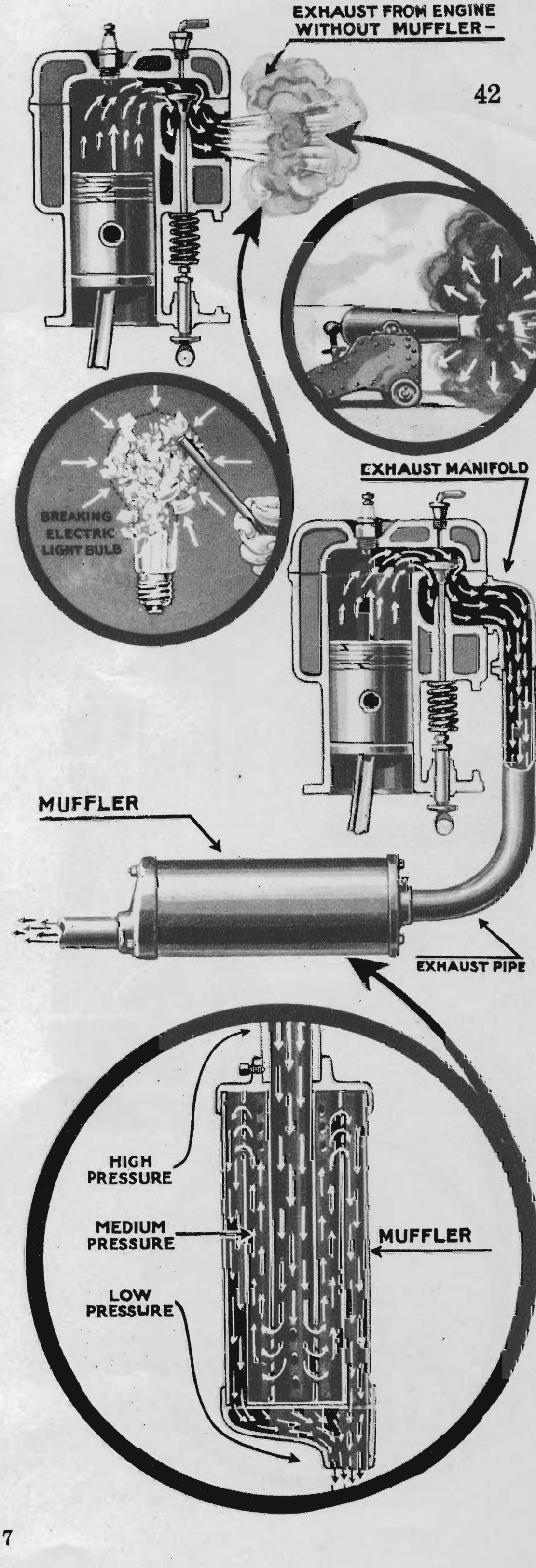
This action may be compared to breaking an electric light bulb. At the moment of breaking, the outside air rushes in to fill the vacuum inside. The opposite layers of air strike each other with a bang, just as in the case of the air surrounding the exhaust gas as it is expelled from the engine.

If, instead of allowing our exhaust gas to expand and contract instantly in the surrounding air, we conducted it through a long pipe where it could expand more slowly, we would be able to reduce this noise materially. This is just what our muffler does for us.

Of course, we do not use a long pipe, but we obtain the same result by passing our gases through a series of short pipes, each one larger than the other as pictured.

With our car running at 25 miles per hour, the exhaust gas leaves our cylinders at a pressure of about 25 pounds per square inch. It passes into the exhaust manifold attached to our engine and is conducted through the exhaust pipe into the muffler.

By passing the gas through our muffler, we reduce the pressure from 25 pounds per square inch at our engine to a pressure so low that it is practically noiseless.



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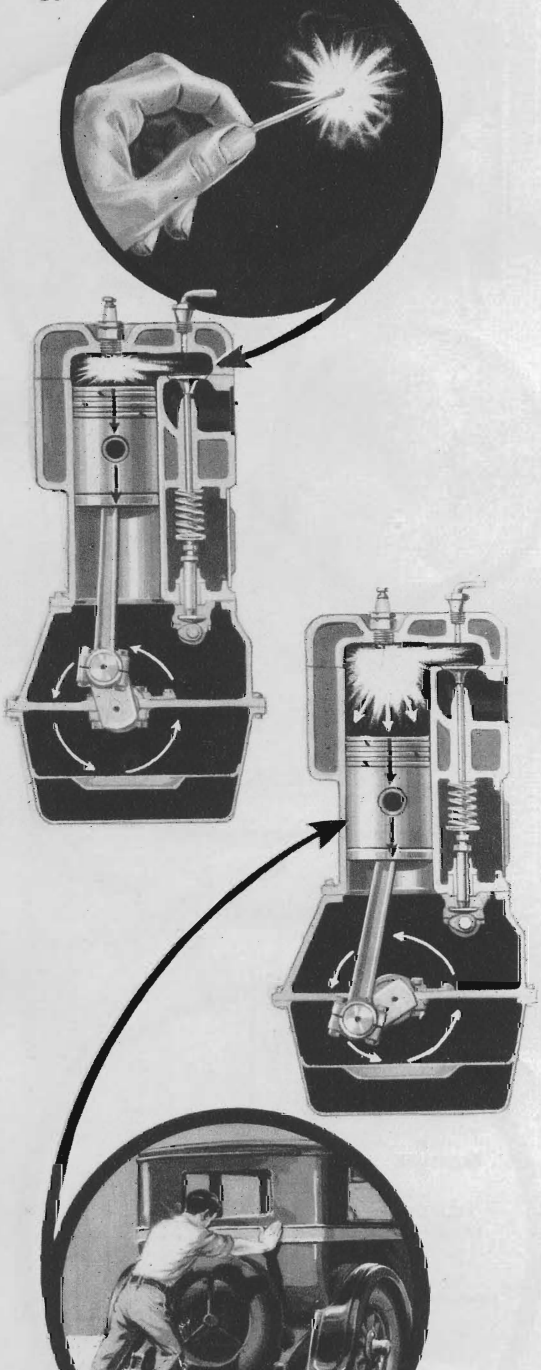

How Gasoline Supplies the Power to Our Engine

43.

Gasoline does not explode—it *burns* in our cylinders. The difference is that an explosion is instantaneous while the burning of gasoline-air vapor, though swift, is not instantaneous. If we wish to push our car we know it would be useless to run up and hit it, for the instantaneous shock would hardly move the car. We get behind the car and push with all our weight and force—and the car moves.

The burning of gasoline in our cylinders is similar to the burning of a match. Every substance has a different burning point. The highly inflammable match tip has a lower burning point than the wood stick of the match.

We raise the highly inflammable match tip to its burning point by rubbing the tip on a rough surface. When ignited, the match tip flares up and produces the heat necessary to raise the wood stick to its burning point.

Figuratively, gasoline passes through a similar process of combustion in our cylinders. The flame from the spark plug swiftly ignites the inflammable tips or parts of the gasoline, and the heat developed ignites the slower burning, but more powerful remainder of our fuel.

When a compressed mixture of gasoline-air vapor is completely ignited in our cylinders, it burns with great speed and produces intense heat. As a result of the heat, the burning gases quickly expand and develop terrific pressures which exert their force upon the top of our pistons.

Gasoline must be balanced in its make-up. It should contain just enough highly inflammable ends to ignite readily for quick starting. It should contain just enough less inflammable but more powerful ends to produce the necessary heat and pressure to drive the pistons.

Socony Gasoline is properly balanced, and, because it burns cleanly, it leaves little or no carbon. Every gallon of Socony Gasoline is of uniformly fine quality because of the careful attention it receives at every stage of the refining process.