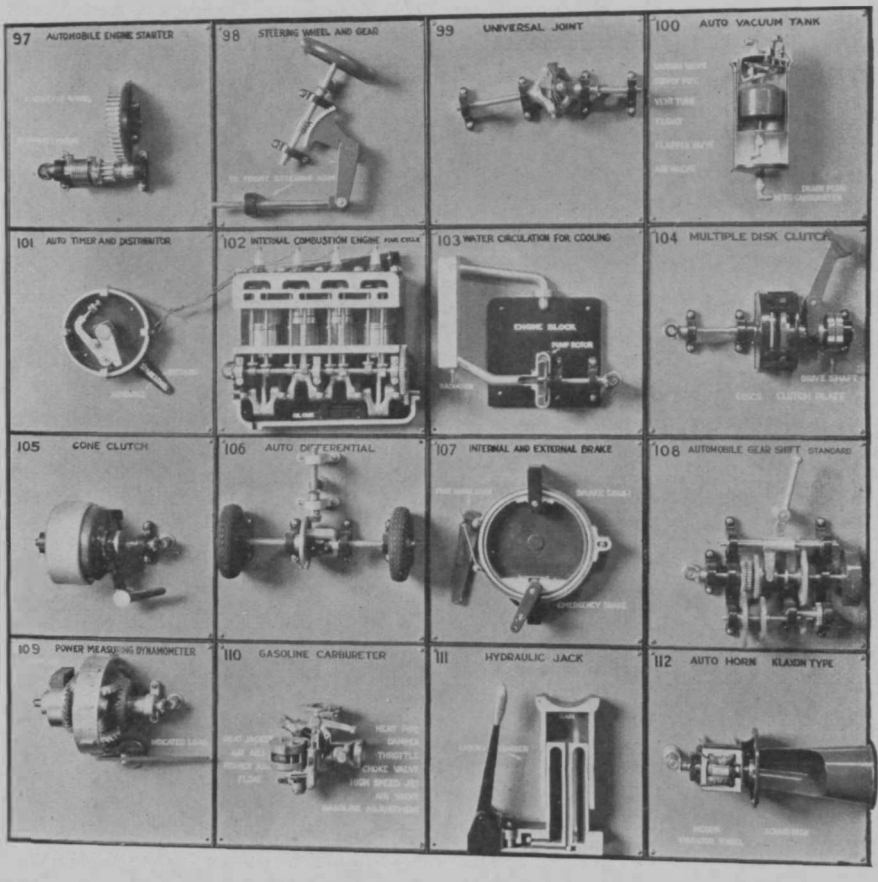

SECTION VII Nos. 97—112

Automobile section, showing different parts in detail. Hydraulic jack and miscellaneous devices.

Section VII

97. Automobile engine starter. This device known as the "Bendix drive" is the starter. The starting motor is attached to the left end of shaft. As the starting pedal is pushed, the motor starts the shaft at a high speed, sending the small gear in mesh with the teeth on the fly wheel. The spring absorbs the starting shock. This starts the engine (See No. **102**), which soon picks up speed so that the fly wheel revolves faster than the small gear. This action causes the small gear, still meshed with it, to rotate on the threads of the starting shaft, now slowing down, and throws it back to its first position and out of mesh with the fly wheel.

98. Steering wheel and gear. The steering mechanism in this model is known as the worm and gear type. The action of the worm and gear is very strong. Use is made of a bell crank drive (See No. **10**). The horizontal rod is connected to the steering arm on the front wheels.

99. Universal joint. There are many forms of universal joints (See Section II). The advantage of this form is that it is noiseless in its action. The leather disks are very flexible and keep changing position. It is necessary to use a universal joint as the engine shaft and drive shaft are always out of line and every vibration of car changes angle.

100. Auto vacuum tank. This shows a standard type of vacuum tank used to keep the carburetor supplied with liquid fuel all the time the engine is running, from the supply tank

which is at a lower level than the carburetor. When a vacuum is caused in the tank by the piston action of engine (See No. **102**), through supply tank, gasoline is sucked up from the supply tank, entering through vacuum valve. As the tank is filled, the float rises, causing the lever arms attached above it to operate. This closes vacuum valve and opens air valve in vent tube, allowing air to enter from outside. As the engine runs, the gasoline within the lower part of the vacuum tank is supplied to the carburetor, and as it does so, the float falls with the gasoline level. When the level falls sufficiently, the little springs and the float operate the valves again and the operation is automatically repeated.

101. Auto timer and distributor. In an internal combustion engine, it is very necessary that the igniting spark occur only in the cylinder that is ready to be fired and at the right time in the cycle of operations. The timer and distributor is the device which regulates this action. The revolving arm is rotated by cam shaft of the engine (See No. **102**). As it revolves, it closes contact with the four terminals on the shell of timer, causing current to go to spark plugs on the engine and fire them in regular order. In this model the firing order is 1, 3, 4, 2. The other arm, called the breaker arm breaks the current at each contact point as revolving arm travels against cam attached to it.

102. Internal combustion engine, four cycle. This is called a four cycle, four cyclinder motor because of the four steps in the process, repeating themselves in each one of the four cylinders. It is also called a combustion engine because the

power is obtained by the rapid burning or combustion of a liquid, forming a gas which expands and exerts great pressure. The four steps in the process are the loading, compressing, firing, and exhausting or clearing. As the action is the same in all cylinders, the one on the right will serve as a good example.

Step 1. As the engine is started by the starting device (See No. **97**), the piston head starts downward and sucks a charge of vaporized gasoline in through the inlet valve from the carburetor (See No. **100** and No. **110**). The piston is attached to the lower shaft, called the crank shaft, by the connecting rod. Connected to the crank shaft by means of gears is the cam shaft. The upper gear is four times larger than the lower, therefore the upper or cam shaft rotates only once while the lower rotates four times. This regulates the next step.

Step 2. As the piston starts back, the inlet and exhaust valves are both closed by the action of the cam on the cam shaft, and the gas is compressed above the piston head.

Step 3. At the end of the up stroke, the timer delivers current to the spark plug, making a spark which fires or explodes the compressed gas at the proper time causing the piston to go down. This is called the power stroke for it transmits a rotary motion through the crank shaft to the drive shaft of the car.

Step 4. At the end of the power stroke, the exhaust valve is opened and the piston returning upward forces the used gas out through the valve into the muffler and into the air. Beginning at the right, the order of firing of the cylinders is

1, 3, 4, 2. The continuous explosion of gas causes the engine to heat up. Therefore a cooling system is needed, as shown in No. **103.**

103. Water circulation for cooling. The circulating pump system shown in this model is most generally used today. As the water is heated it rises to the top of the water jacket and travels through this pipe into the top of the radiator. A cooling fan draws cold air in through the openings of the radiator and cools the water. The cool water is then drawn down through the radiator by gravity and by the pump rotor and enters the lower part of the water jacket to repeat its cooling action.

104. Multiple disk clutch. Clutches were explained in No. **32.** This type is a friction clutch. The shaft on the left is connected to the crank shaft of the engine (See No. **102**). The two driving disks are mounted one on the crank shaft end, being the clutch plate, and one on the drive shaft end. The clutch plate is fixed on a sleeve and slides on the crank shaft. The red and white disk on the right connects with the transmission (see No. **108**). In front of the clutch plate are several disks mounted loosely on the crank shaft. When clutch pedal is pressed down, clutch plate and loosely mounted disks are parted, thereby breaking connection with the engine. When the clutch pedal is left in place the clutch plate gradually engages with the multiple disks, thereby starting the car. Multiple disks afford a smooth starting and less wear, because the friction is distributed in all disks.

105. Cone clutch. This is one of the earliest

types of clutch used in automobiles. It is no longer used because the shock at starting was too great and the wear excessive.

106. Auto differential. The differential in this model is the set of four miter gears in a bracket, connected with the shafts of the rear wheels. The purpose of this device is to allow one wheel to rotate with a different speed than the other if necessary, for example, in turning a corner. The small miter gears of the differential do not revolve when both wheels are running at the same speed but simply act as a lock between the driving sections of the two wheels. When there is a difference in speed, the two horizontal gears revolve on their own pinions and compensate for the difference. At the same time they keep the driving contact between the two sections of the axle.

107. Internal and external brake. The working of foot and emergency brakes is shown in this model. When the foot brake lever is pressed down it operates the lever on the left and by toggle action (See No. **92**), tightens the brake bands on outside of brake drum, retarding it according to the pressure exerted on the foot pedal. When the emergency lever is operated the same action on bottom of lever turns the eccentric cam, with powerful action, expanding the brake band on the inside of the drum with the same result.

108. Automobile gear shift, standard. The upper revolving shaft is connected on the left end to the engine through the clutch. The right end of shaft is connected to the drive shaft

of the car which runs to the rear axle. This shaft is cut in two between the yellow and blue gears, each part revolves separately. The small or intermediate shaft carries reversing gear. The lower revolving or jack shaft carries four gears, all fixed. These mesh with upper gears to give the three speeds forward (low, intermediate, and high) and reverse. On the left, the two yellow gears always mesh. The upper shaft drives the lower, getting its power from the engine, reducing the speed of the lower shaft because the driving gear is smaller than the driven gear. On the right, the two lower red gears always mesh. When in **reverse** position, all red gears on right are in mesh. Follow motion of yellow gears and red gears to understand reverse action. When in **low** or **first** position, the green and red gears on the right mesh. The speed is low because a large gear on the upper shaft meshes with a much smaller one on the lower shaft, the lower gear now being the driver. In **second** or **intermediate** position, the two blue gears mesh, the speed of the upper shaft being the same as the lower, both gears being the same diameter. This speed is greater however, than when in low. In **third** position or **high**, the yellow gear on the left locks inside of the blue gear. Now the speed transmitted is high because the driven gear is locked with the drive gear which runs at engine speed.

109. Power measuring dynamometer. The purpose of this device is to measure the power required to drive a particular mechanism. It depends principally upon the action of a train of four bevel gears and a hoop-shaped frame. The two horizontal gears and the frame in which they

are arranged revolve freely on the middle of the horizontal shaft, on which there are two vertical gears, the one on the right stationary, the other loose on the shaft. The vertical gears mesh with the horizontal gears. If a load is put on the gear loose on shaft at left, the power required to hold the hoop stationary is the power required to carry the load. This is measured by any device made to stop rotation of hoop which is attached to a recording arm which registers on scale.

110. Gasoline carburetor. The duty of the carburetor is to mix the fuel and air and insure the proper proportion of each before it is sent to the cylinder to be burned. Gasoline is supplied to the carburetor from the main supply tank by means of the vacuum tank (See No. **100**). The carburetor converts the fuel into a vapor by mixing it with air.

Gasoline enters float chamber from vacuum tank (See No. **100**), through needle valve attached by a lever on the float. When a sufficient supply is in, the float rises and valve closes. This float automatically keeps gasoline at proper level as in vacuum tank. Gasoline is then sucked into the mixing chamber in center by the action of engine pistons (See No. **102**). It is mixed with air, admitted through air valve, which vaporizes it as it passes into distributor pipe or manifold for entrance into cylinders (See No. **102**). When engine is running at a very high speed and additional gasoline is needed, it is drawn through the high speed jet. The throttle valve at top regulates the gas flow to the engine, thereby controlling its speed. The choke is used in starting when the motor is cold

and the mixture will not explode properly. The air inlet is closed so that more gas enters the mixing chamber giving a richer mixture. The heat pipe leads from the exhaust manifold. Heat is drawn into the heat jacket around the carburetor which aids in vaporizing the gasoline, particularly in cold weather.

111. Hydraulic jack. A hydraulic jack is very powerful. A small force will exert a tremendous lifting power. Pressure applied to the lever causes the valve A at opening of liquid chamber to open so that liquid is drawn from it and flows toward center cylinder. The lever returning in the opposite direction opens valve B into cylinder below ram allowing the liquid to rise in it and raise the ram. The great lifting power depends on the length of the lever and the size of the plunger attached to it. The longer the lever and smaller the plunger, the greater the force.

112. Auto horn, Klaxon type. This is the usual type automobile horn. The motor causes the vibrator or cam wheel to revolve against the button mounted on sound disk, causing it to vibrate. The greater the number of vibrations, the higher the pitch or tone. The horn or resonator amplifies the sound.