gas engines is to jacket the cylinder *J*, that is, to construct a double-walled cylinder and circulate water between the two walls, through the jacket space. The base *U* supports the various parts of the engine; the flywheel *W* carries the engine through the idle strokes. Besides the above details, every gas engine is usually provided with lubricators *L* for the cylinder and bearings, and with a governor for keeping the speed constant at variable loads.

The majority of farm gas engines are of the single-acting type. This means the combustion (burning) of the fuel takes place at one end of the piston only.

The various parts of horizontal and vertical gasoline engines are illustrated and named in Figs. 72 and 73.

Carburetors for Gasoline Engines.—The function of a carburetor is to vaporize the gasoline, mix it with the correct proportion of air to form an explosive mixture and then deliver the mixture to the engine cylinder.

A mixture of fuel and air in the proper proportions is one of the most important factors essential to the economical and reliable operation of a gasoline engine. If too little air is present, or if the mixture is too rich, the fuel will not burn completely. This will result in loss of power, the exhaust from the engine will be darkened and odorous, and the unburned fuel may explode in the exhaust pipe, when it meets more air. If the mixture has too little gasoline, or is too lean, it will be slow-burning. In fact, it may still be burning when the inlet valve opens on the suction stroke, and the flame, flashing back through the inlet valve into the carburetor, may produce what is commonly called "back-firing." Faulty timing of valves, or a badly leaking valve, may also cause back-firing.

In some early forms of carburetors the air was passed over the surface of the gasoline on its way to the engine and became saturated with the fuel. In another type, called the bubbling carburetor, the air was made to bubble through the fuel. The objection to these types of carburetors is that the air combines with only the more volatile portion of the fuel, leaving the heavier constituents not vaporized.

The modern carburetors are of the spray or nozzle type, that is, the gasoline is injected into the entering air through a nozzle

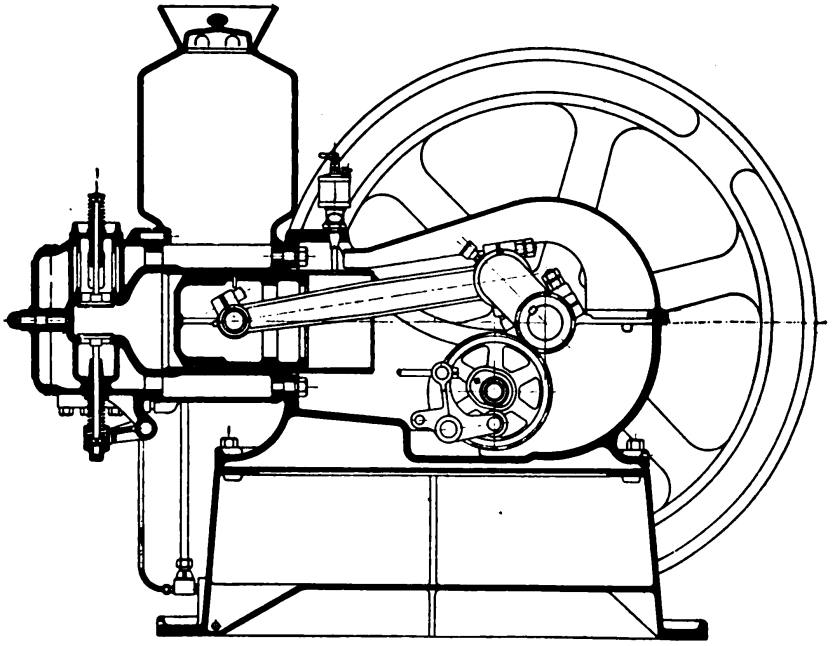

FIG. 72.—Hopper-cooled gasoline engine.

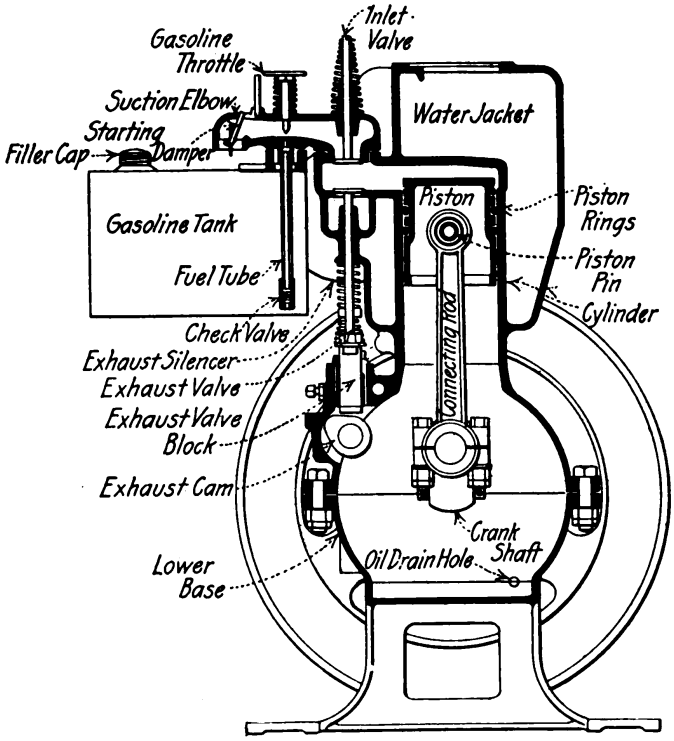

FIG. 73.—Vertical gasoline engine.

in the form of a finely divided spray. In the best forms of spray carburetors the fuel is delivered to the nozzle at constant pressure by maintaining the fuel at a constant level in the carburetor, either by means of an overflow pipe or by a float.

To the first type belong the mixer valves, or pump-feed carburetors, in which constant pressure is obtained by a pump and an overflow pipe keeping the height of the fuel at a constant level in a small reservoir. This type of carburetor is well suited for stationary and for semiportable engines. Pump-feed carburetors are also used to a limited extent on traction engines. This form of carburetor is well adapted for a fuel supply which is located in a tank underground and at a considerable distance.

For automobiles, boats, portable engines and for traction engines the float-feed type of carburetor is best-adapted. In this type of carburetor the gasoline is admitted to a float chamber, by gravity, from a tank placed above the carburetor. The gasoline flows out of the float chamber by a spray nozzle, the level of the fuel in the chamber being regulated by a copper or by a cork float which operates the gasoline valve. Most carburetors of the float-feed type are automatic in their action in that the quality of the mixture is regulated, by auxiliary air inlet valves, to suit the speed at which the motor is running.

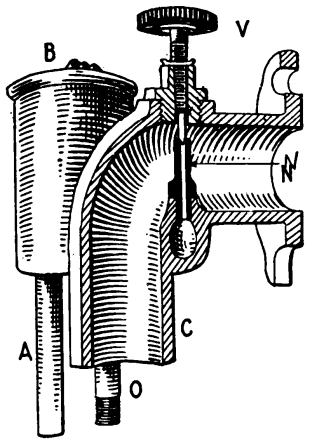

FIG. 74.—Pump-feed carburetor.

One form of mixer valve, or pump-feed carburetor, is illustrated in Fig. 74. A pump operated by the valve gear shaft of the engine forces the gasoline through the supply pipe *A* to the reservoir *B*. *O* is the overflow or return pipe which maintains the fuel at a constant level in the reservoir, and slightly below the point at which the needle valve *V* enters the gasoline nozzle *N*. When the piston of the engine starts on the suction stroke, a partial vacuum is created in the cylinder; the inlet valve is opened and a current of air is forced by the atmospheric pressure into the cylinder. This current of air enters through the air pipe *C*, attains a high velocity, and carries with it into the cylinder

a portion of the gasoline vapor. This is the reason why the air passage of a carburetor is so arranged, that the velocity of the air is increased as it passes around the gasoline spray nozzle. The greater the velocity of the air at the nozzle the more vapor

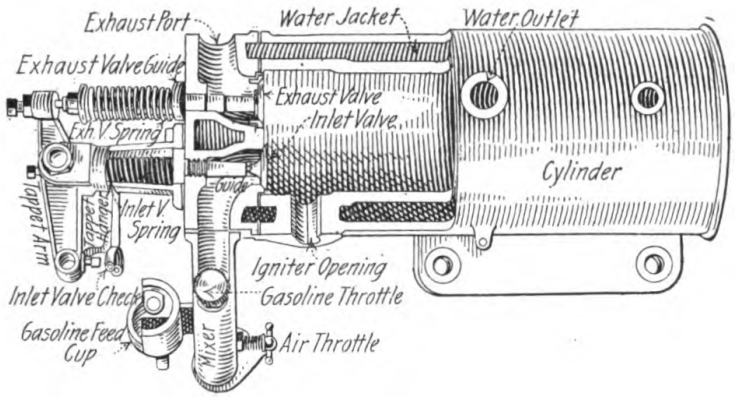

FIG. 75.—Pump-feed carburetor and engine cylinder.

is carried into the engine cylinder. When starting an engine by hand with this form of carburetor, a damper or throttle in the air pipe is closed, so that the velocity of the air is increased sufficiently to admit the fuel to the cylinder. The relative positions of the air throttle and mixer are illustrated in Fig. 75.

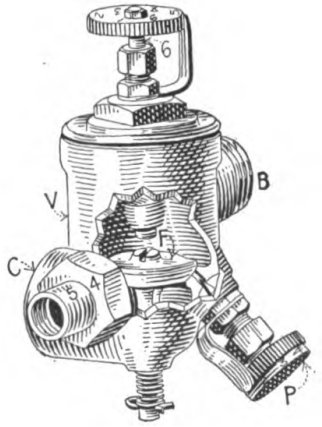

FIG. 76.—Gravity carburetor.

Another form of spray nozzle carburetors is illustrated in Fig. 76. Air enters at the lower opening *C*, gasoline flows in at (5), and the mixture of the air and fuel leaves the mixer valve at *B*. The amount of gasoline fed is regulated by adjusting the needle valve at *P*. When the engine piston moves on its outward stroke, the disc *F* is raised by suction, drawing in a charge of air, through the seat opening and past the gasoline port, into the mixing chamber above *F*. The lift and movement of the valve *F*, and consequently the quantity of the mixture to the cylinder, is regulated by the stem (6). The gasoline is supplied from a tank above the carburetor. This form of carbureter is much used for two-stroke cycle engines, as it facilitates easy starting,

but is somewhat dangerous on account of the possibility of gasoline leakage.

In small stationary engines the form shown in Fig. 77 is often used. This carburetor consists essentially of a needle valve N, which regulates the fuel, and a check ball valve B which maintains the level of the fuel.

Automatic or float-feed carburetors are provided with two chambers, one a float chamber in which a constant level of the fuel is maintained by means of a float, the other a mixing chamber through which the air passes and mixes with the fuel. The float and mixing valves may be placed side by side, or the two chambers may be constructed concentric; that is, the float is placed around the spray nozzle. The concentric type keeps the fuel at the predetermined level much better than the carburetor with the chambers side by side.

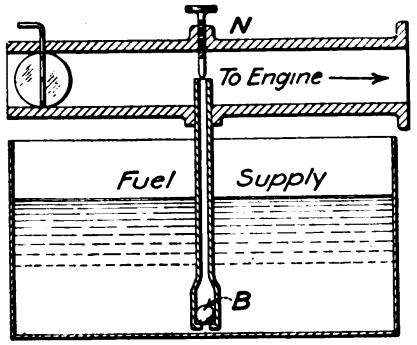

FIG. 77.—Suction-feed carburetor.

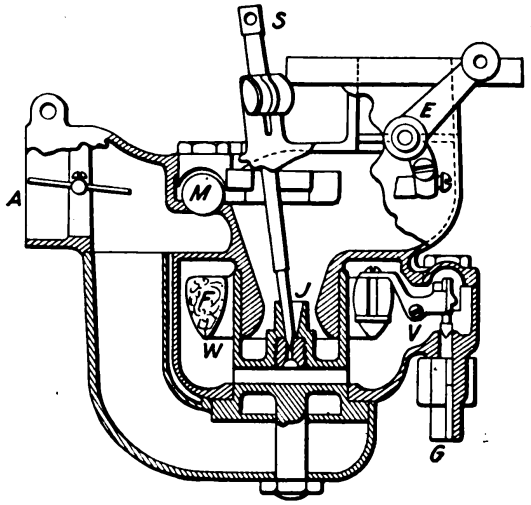

FIG. 78.—Kingston carburetor.

The concentric float-feed type of carburetor is illustrated in Fig. 78. F represents the float, which operates the float valve V and regulates the amount of gasoline entering the float chamber W through fuel inlet at G. The air inlet to the carburetor is

at *A*. *S* is the gasoline-adjusting screw which regulates the needle valve. The mixing chamber around the top of the spraying nozzle *J* is constructed so as to increase the velocity of the air at that point. This part is called the throat or Venturi tube of the carburetor. The amount of mixture which is allowed to pass to the engine cylinder is regulated by the throttle *E*. As the throttle *E* is opened and the speed of the motor increases, the velocity of the air at the Venturi passage becomes great and too much fuel is pulled in by the air. To overcome this, carburetors

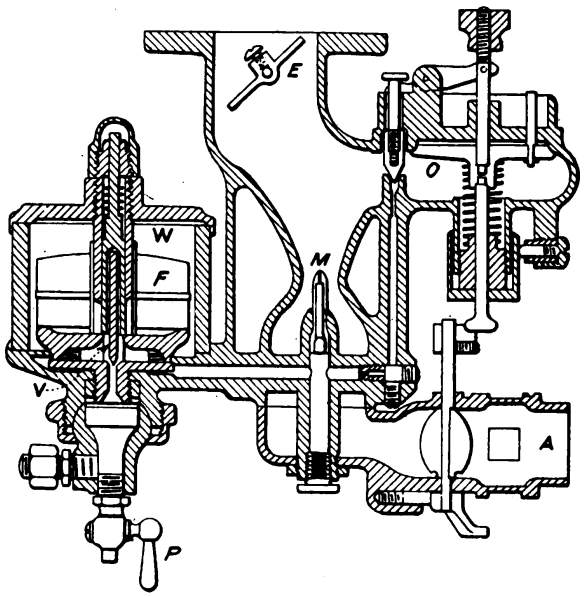

FIG. 79.—Stromberg carburetor.

of this type are arranged with auxiliary valves which are controlled by the balls *M*. These auxiliary valves admit more air as the speed of the motor increases, diluting the mixture before it is allowed to enter the engine cylinder.

A float-feed carburetor with the two chambers side by side is illustrated in Fig. 79. In the float chamber is placed a float *F* which operates the float valve *V* and regulates the amount of fuel entering the float chamber *W*. The main air inlet is at *A*. When the float chamber becomes filled with gasoline to a certain level, the float closes the needle valve *V*, and the flow of fuel is stopped. The fuel from the float chamber enters the mixing chamber *M*, at the right, and is picked up by the air entering at *A*. The mixture passes to the engine cylinder through the throttle *E*.

The auxiliary air valve *O* is operated by a spring and regulates the quality of the mixture in proportion to the speed of the

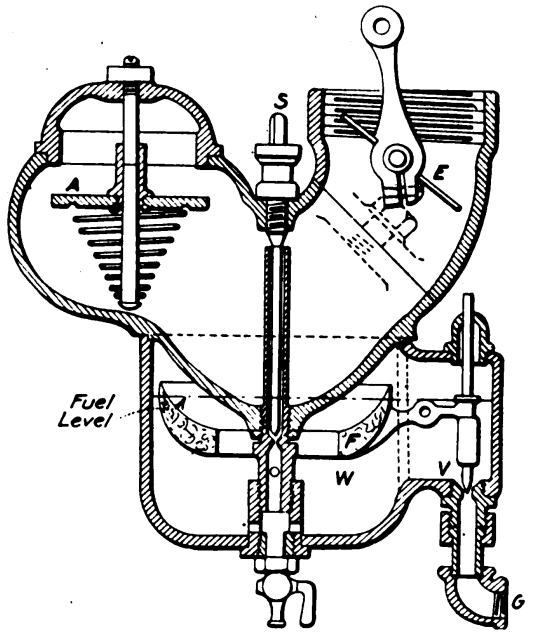

FIG. 80.—Bennett carburetor.

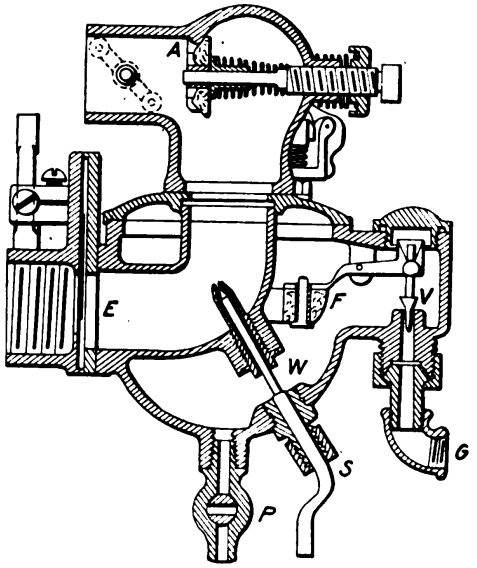

FIG. 81.—Schebler carburetor.

engine and in a manner similar to the ball valves in the carburetor of Fig. 78. In some forms of carburetors an enlarged main air inlet takes the place of the auxiliary valve. In others, the con-

nection to the throttle regulates the fuel needle valve, or the air inlet, to suit the speed of the engine and the load on the engine. Two other forms of float-feed carburetors are shown in Figs. 80 and 81. The parts of these carburetors are designated by the same letters as the similar parts in Figs. 78 and 79.

The concentric type of carburetor is usually preferred on account of the fact that the pressure on the spray nozzle can be kept more nearly constant in this type than in the carbureter where the float and mixing chambers are placed side by side.

Floats for carburetors are made either of cork or of metal. The hollow metal float is more expensive and is more liable to leak. Cork floats, when covered thoroughly with shellac, will not lose their buoyancy, but there is some danger that particles may become detached from the cork and clog the passages leading to the spray nozzle.

The carburetor float chamber is usually provided with a petcock at its lowest point (*P* in Fig. 79), for drawing off poorer grades of gasoline and also water.

In automobile practice, multiple-jet carburetors are sometimes used. The multiple-jet carburetor has two or more spray nozzles and this enables the engine to draw the correct proportion of fuel and air at high speeds.

The action of the carburetor, Fig. 80, is that of a multiple-jet type. In starting, this form operates as a surface carburetor, but the mixture becomes diluted as the engine speeds up.

Most float-feed carburetors are provided with some hand-operated method for priming the carburetor. This is accomplished by depressing the float, so that an excess of gasoline may be allowed to enter the mixing chamber. Another method is by throttling the air.

To overcome carburetor troubles on account of climatic conditions, or where low-grade gasoline is used, the carburetor should be jacketed by hot water. A hot-air connection to the carburetor will also overcome this difficulty. In automobiles in which the thermo-syphon system of water circulation is employed, exhaust gases from the engine are used for jacketing the carburetor, instead of hot water. Hot jackets are also advantageous in cold weather and prevent the use of rich mixtures and the consequent low fuel economy.