No. 785,240. PATENTED MAR. 21, 1905

G. TRINKLER.

THERMIC MOTOR.

APPLICATION FILED SEPT. 29, 1899.

2 SHEETS—SHEET 1.

Fig. 1.

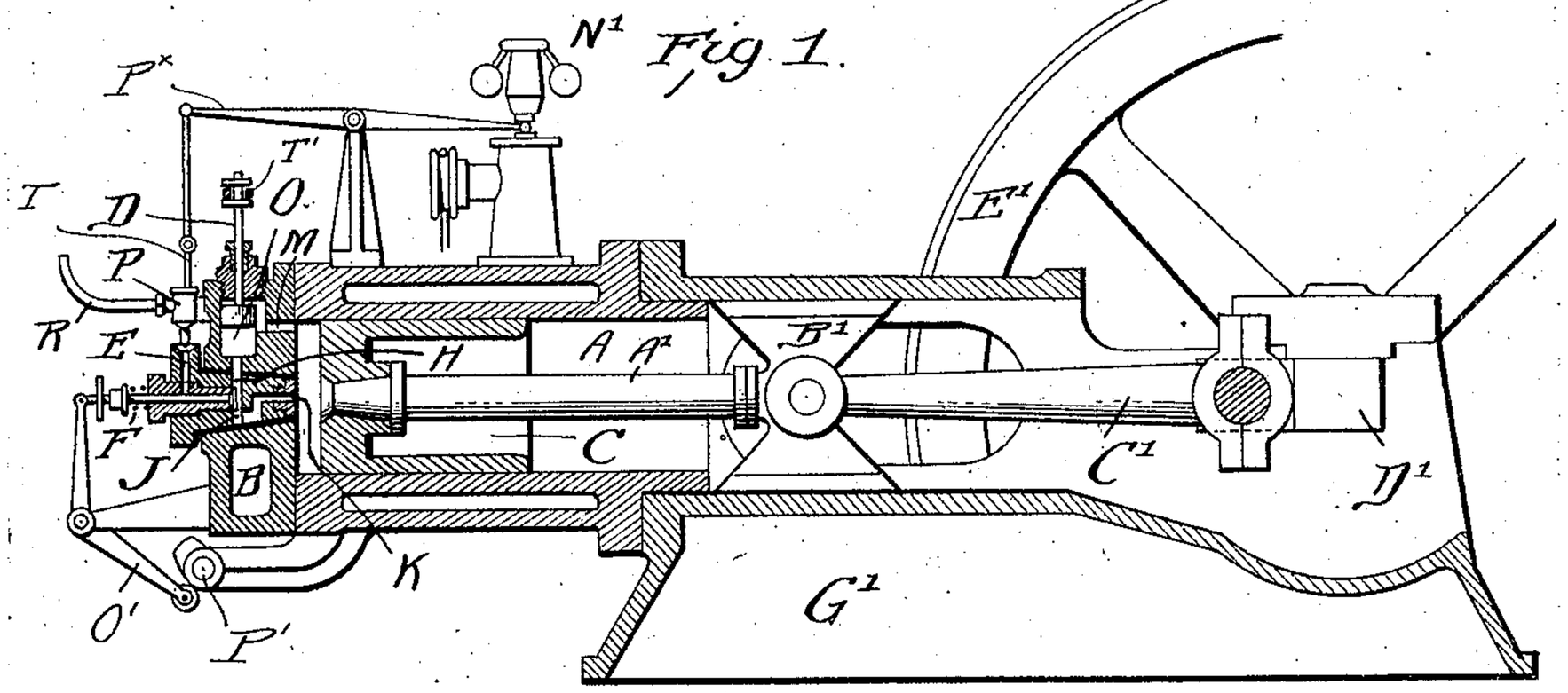



Fig. 2.

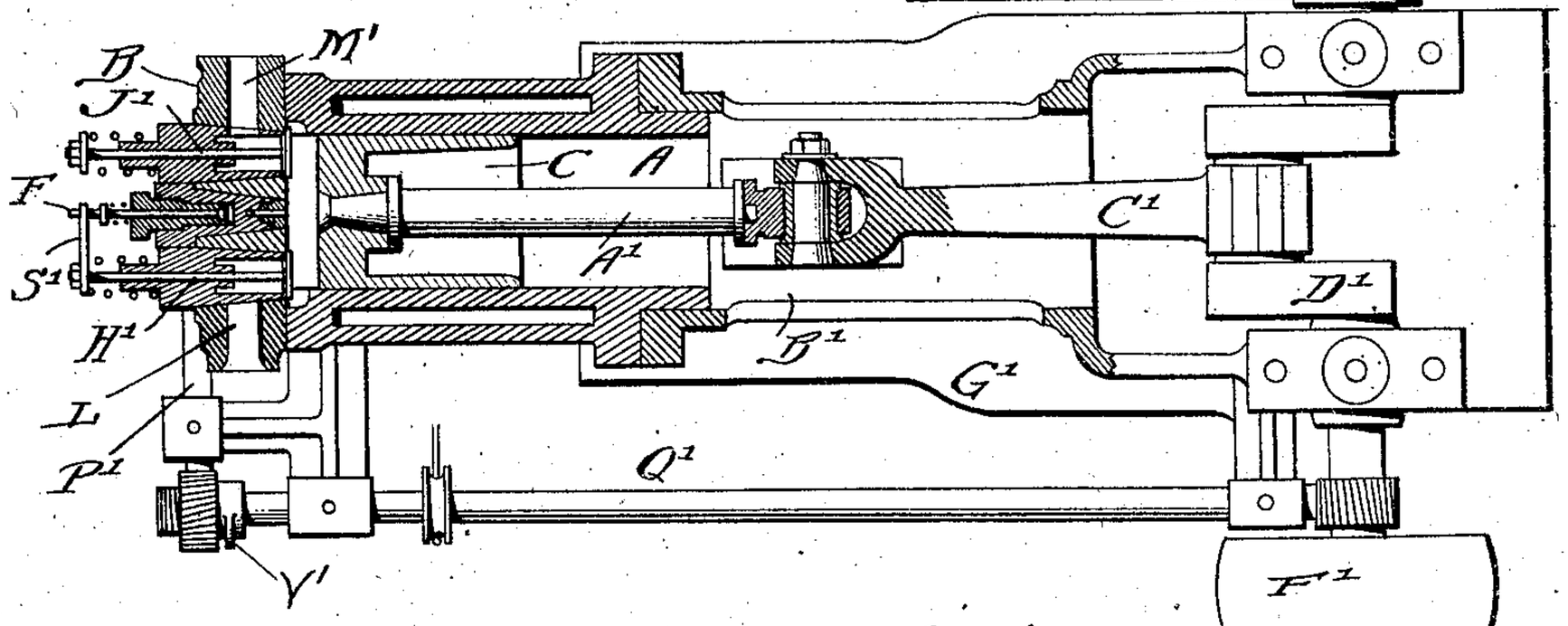



Fig. 4.

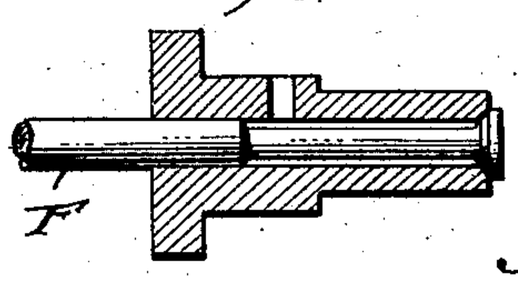



Fig. 3.

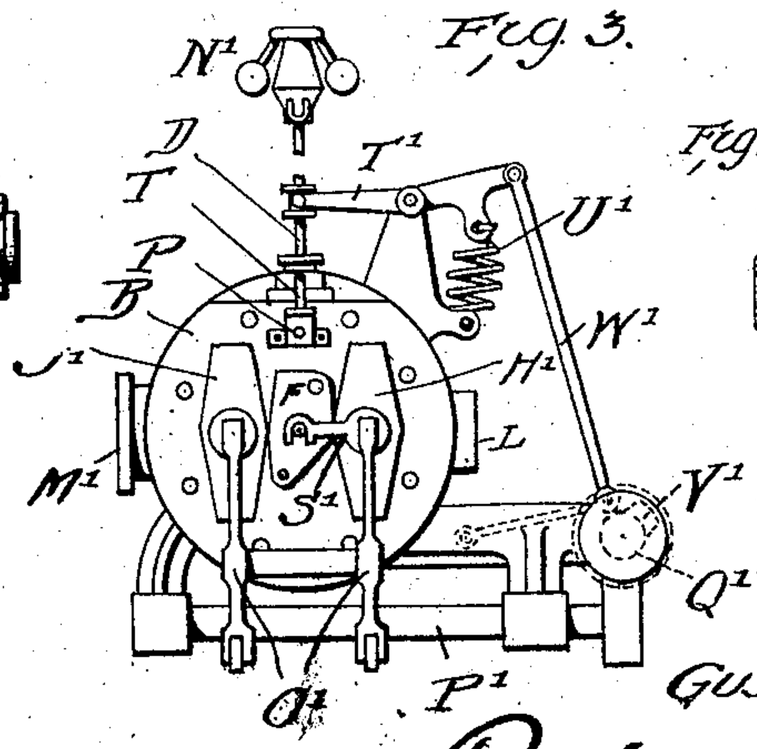
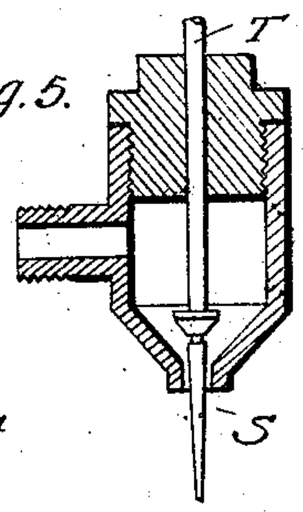



Fig. 5.

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2 SHEETS—SHEET 2.

Fig. 6.

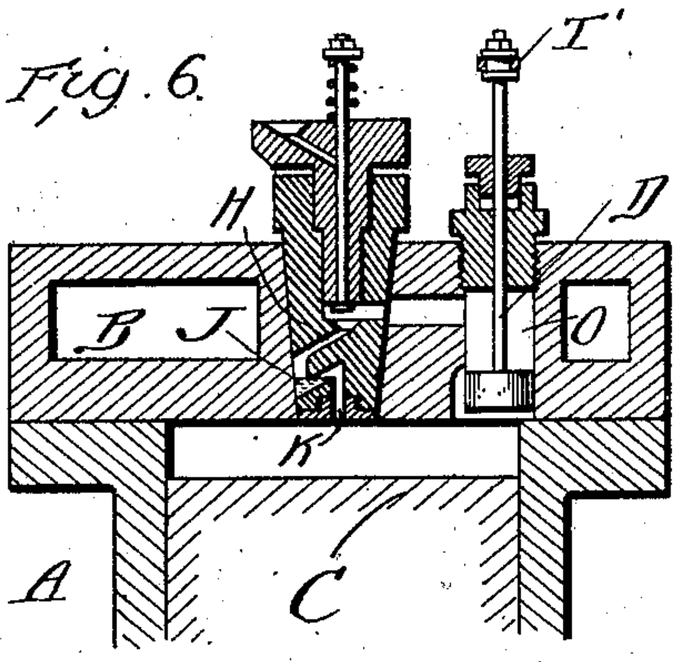



Fig. 7.

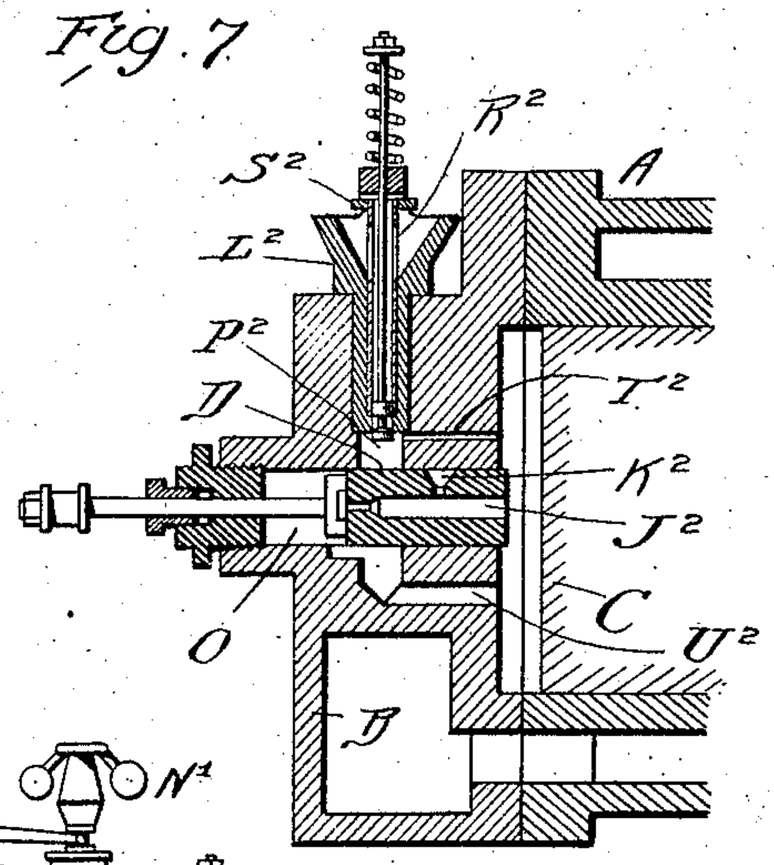



Fig. 9.

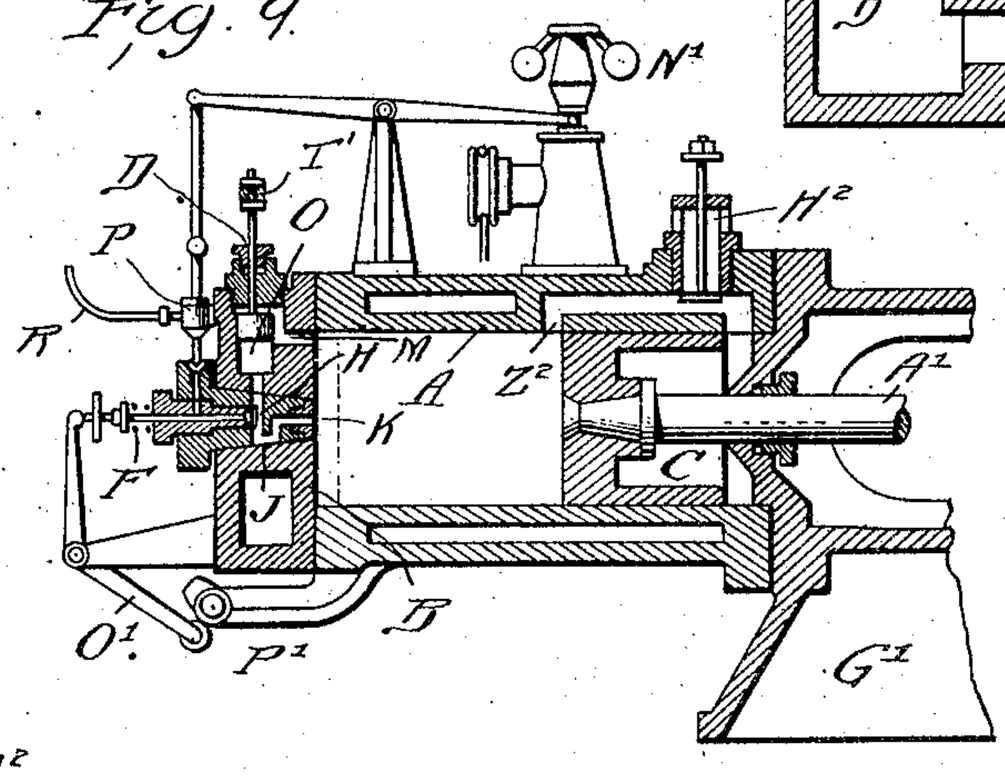



Fig. 8.

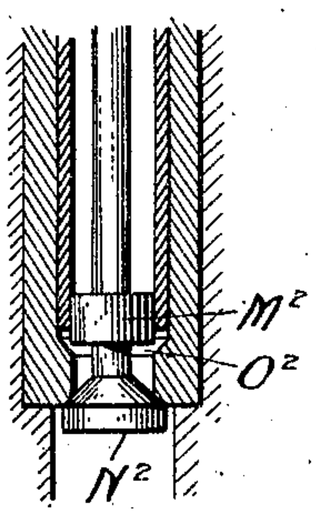
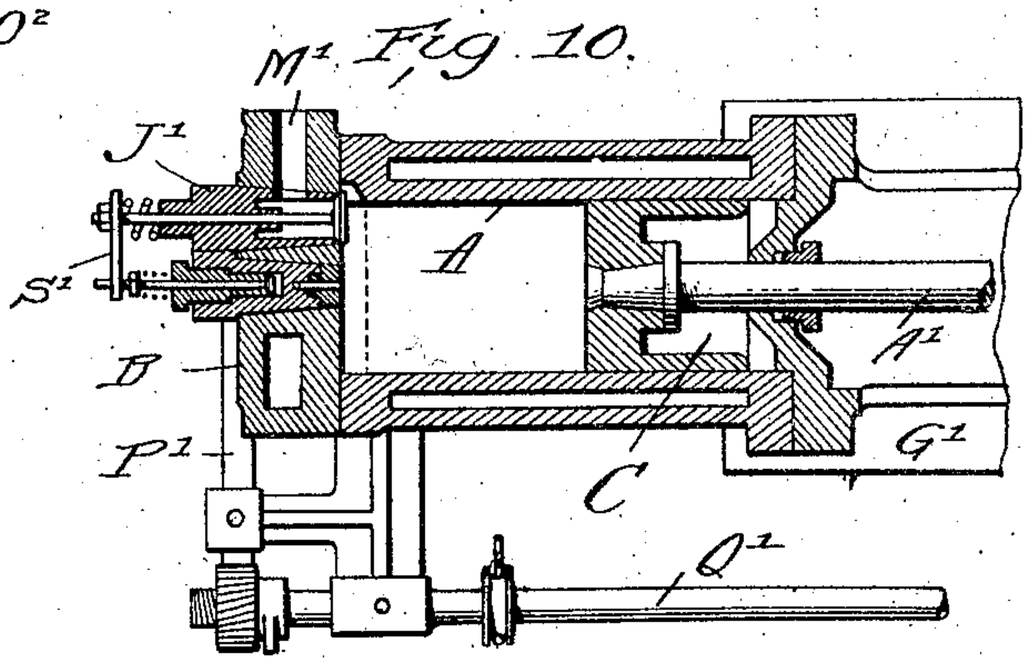



Fig. 10.

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# UNITED STATES PATENT OFFICE.

GUSTAF TRINKLER, OF ST. PETERSBURG, RUSSIA.

## THERMIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 785,240, dated March 21, 1905.

Application filed September 29, 1899. Serial No. 732,107.

*To all whom it may concern:*

Be it known that I, GUSTAF TRINKLER, a subject of the Emperor of Russia, and a resident of St. Petersburg, Russia, have invented certain new and useful Improvements in Thermic Motors, of which the following is a specification.

The devices forming the subject-matter of my invention may be applied to engines of any kind, as four-cycle, two-cycle, horizontal, or vertical engines. Figures 1, 2, and 3 of the accompanying drawings show the application of parts of my invention to a four-cycle engine for liquid fuel.

Fig. 1 is a vertical sectional view. Fig. 2 is a horizontal sectional view. Fig. 3 is a rear view of the cylinder. Figs. 4 and 5 are detail views. Fig. 6 is a view of a vertical engine. Fig. 7 is a view of an engine for powdered fuel. Fig. 8 is a detail view. Figs. 9 and 10 are views of a two-cycle engine.

A is a cylinder in which the piston or plunger C works.

A′ is the piston-rod, and B′ the sliding cross-head.

C′ is the connecting-rod; D′, the crank-shaft; E′, the fly-wheel; F′, the pulley; G′, the frame serving to support the engine.

B is the cylinder-head, containing the inlet-valve H′ and the exhaust-valve J′.

Air enters into the engine through the port L. The products of combustion escape through the port M′.

The valves H′ and J′ are controlled by levers O O, acted upon by cams on the distributing-shaft P′, which makes a half number of revolutions as the driving-shaft D. The shaft P′ is driven by this shaft D by means of a gear and by the intermediate shaft Q′.

N′ is the usual governor, (regulator,) acting upon the controlling device P by means of the connections P×.

The liquid fuel is supplied by the feeding-conduit R and runs through the device P into the port E, accumulating there until the valve F is opened. The valve F opens during the suction period simultaneously with the air-valve H, which latter actuates the former by means of a lateral arm S′. The liquid accumulated in the port E is at once sucked in through the valve F and flows into the sinuous conduit H J K. This valve F is shown on a larger scale on Fig. 4. At the compression period the atmospheric air introduced into the engine by the valve H′ penetrates through the equilibrating-port M into the chamber O above and below the piston D, which remains stationary. Thus the chamber O constitutes a part of the compression-chamber of the cylinder A, and at the end of the compression the pressure therein is equal to the pressure in the cylinder A. For instance, when the air in the cylinder has been compressed to thirty atmospheres the pressure in the chamber O will be also equal to thirty atmospheres and the liquid in the conduit H J K will remain in equilibrium; but at the same time the piston D, actuated by the lever T′, Fig. 3, sinks down, shuts the equilibrating-port M, and produces in the chamber O an excess of pressure, which forces the liquid from the conduit H J K into the combustion-chamber of the cylinder. The ignition in this engine is spontaneous, owing to the adiabatically-compressed air.

The lever T is actuated by a cam V by means of a link W. A spring U′ returns the lever to its normal position. One can give the cam V such a construction as to start the movement of the lever T and the piston D with a great speed. In this case the feeding of the liquid fuel is very quickly performed, and the combustion will be instantaneous and practically an explosion. However, one can give the cam another construction, so as to regulate the feeding of fuel in order to cause the combustion to proceed gradually, thus preventing a sudden rise of pressure.

The liquid-controlling device P is shown on the separate detail Fig. 5. The liquid is caused to flow therein through a supply-pipe R, Fig. 1, from an elevated tank and runs therefrom through an outlet S, whose cross-section may be modified by means of a conical spindle T, upon which acts the speed-regulator N′, Fig. 1, of the engine through the connections P×. The higher is lifted this spindle T the more liquid flows through the opening S, controlled by this spindle, and

vice versa. The liquid may be also supplied to the aperture E by means of a pipe connected therewith and leading from a small pump of ordinary construction.

Fig. 6 shows a construction analogous to the construction that is shown on Fig. 1, but applied to a vertical cylinder. A B C are respectively the cylinder, the cylinder-head, and the piston; H J K, the sinuous conduit, and D the depressible piston. An analogous depressible piston D may be also applied to the insufflation of solid finely-pulverized fuel—for instance, coal-dust. On Fig. 7 A B C are over again, respectively, the cylinder, the cylinder-head, and the piston. The small piston or plunger D is provided with two bores, an axial bore $J^2$ and a cross-bore $K^2$. The coal-dust is supplied to the funnel $L^2$. It drops down and is retained by the small piston $M^2$ on the rod above the valve $N^2$, Fig. 8. When this latter is pressed down the piston $M^2$ opens to the coal-dust a free passage into the annular space $O^2$, closing at the same time the lower issue of this space, so as to prevent the dropping down of this charge of coal-dust. When the valve is lifted, the lower edge of the piston $M^2$ discovers the space $O^2$, and the coal-dust strews out, resting on the upper face of the valve $N^2$ until the valve is depressed again, when it drops into the chamber $P^2$, Fig. 7, closed from below by the plunger D. The charge of coal-dust is controlled by the pipe $R^2$, which is lifted or lowered by suitable connections leading to the speed-regulator of the engine acting on the small trunnions or pins $S^2$, Fig. 7, and thus varying the height of the chamber $O^2$ and the dimension of the slot formed at the lower stroke of the piston $M^2$. The opening of the valve takes place at the suction period when the pressure in the working cylinder surpasses not the pressure of the outer atmosphere or, generally, the pressure upon the coal-dust in the funnel $L^2$. At the compression period the coal-dust in the chamber $P^2$ is subjected to no variation. The gases compressed in the driving-cylinder penetrate through the conduits $T^2$ $U^2$ $J^2$ into the chambers $P^2$ and O

To cause the coal-dust to be blown into the driving-cylinder, the small piston D is moved from the right to the left, closes the passage $U^2$, puts the channel $K^2$ under the chamber $P^2$, compresses the air in the chamber O, and causes this air to rush through the bore $J^2$ to catch the coal spilling through the bore $K^2$ from the chamber $P^2$, and to carry this dust out into the driving-cylinder.

From foregoing it may be easily understood that the above-described construction of the injecting devices can be applied without any modification to two-cycle motors. This is, for example, illustrated on Figs. 9 and 10. The cylinder A is closed at the right-hand end and serves as a pump for the air, which when the piston moves to the left is sucked through the valve $H^2$ and fills the right-hand chamber of the cylinder. Simultaneously compression is produced in the left-hand chamber, and when the piston reaches the left dead-point the combustion begins. Then the piston moves back to the right. In the left cylinder-chamber an effective expansion of gases is performed, and in the right chamber a slight compression, about 0.3 atmosphere. When the piston has reached the right dead-point, the lever O and shaft P′ cause the valve J′ to open, and the spent gases are exhausted through the port M. At the same time the piston C opens the communication-port $Z^2$, and the pure air from the right cylinder passes rapidly to the left chamber and fills it. Consequently by the next left-hand stroke of the piston C a compression of the pure air will begin again in the left cylinder-chamber—that is, the engine will work as a two-cycle one. The liquid fuel enters, as above described, through the valve F; but this latter is actuated by the exhaust-valve J′ by means of a lateral arm S′, acting upon the spindle of the valve F. The engine has no suction period. The valve F has a different construction than the valve on Fig. 4.

I claim—

In combination in an internal-combustion engine, the cylinder and piston, a chamber connected with the cylinder by a pair of ports means for supplying fuel to the chamber, and a piston controlling one of the ports and means for actuating said piston at the end of the compression-stroke to create a pressure in the chamber in excess of that in the cylinder and force the fuel through the remaining port into the cylinder.

In witness whereof I have hereunto set my hand in presence of two witnesses.

GUSTAF TRINKLER.

Witnesses:
N. THEKALOFF,
Y. BLACK.