

Oct. 10, 1939.

I. P. HARING

2,175,463

INTERNAL COMBUSTION MOTOR

Filed Jan. 3, 1938

3 Sheets-Sheet 1

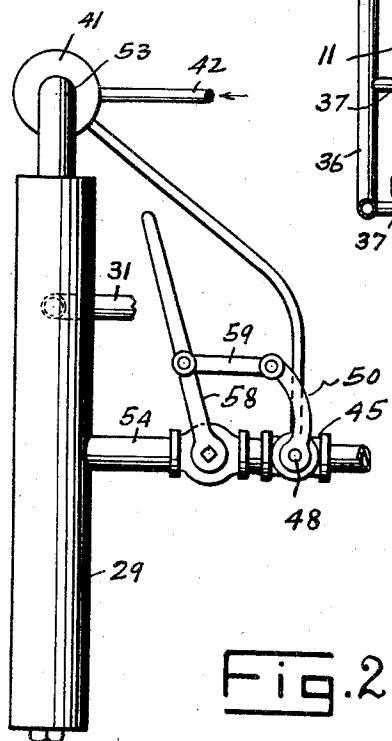
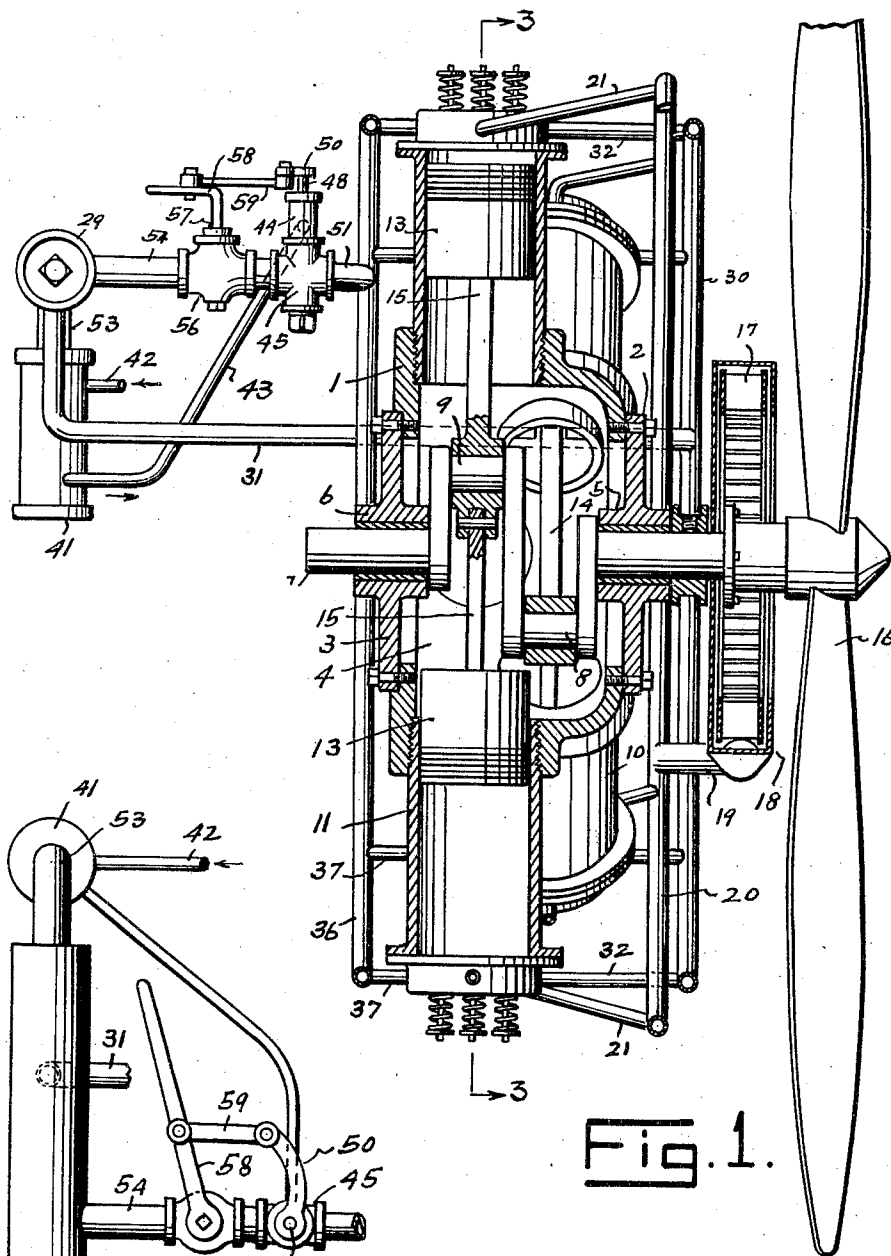


Fig. 1.

Fig. 2.

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3 Sheets-Sheet 2

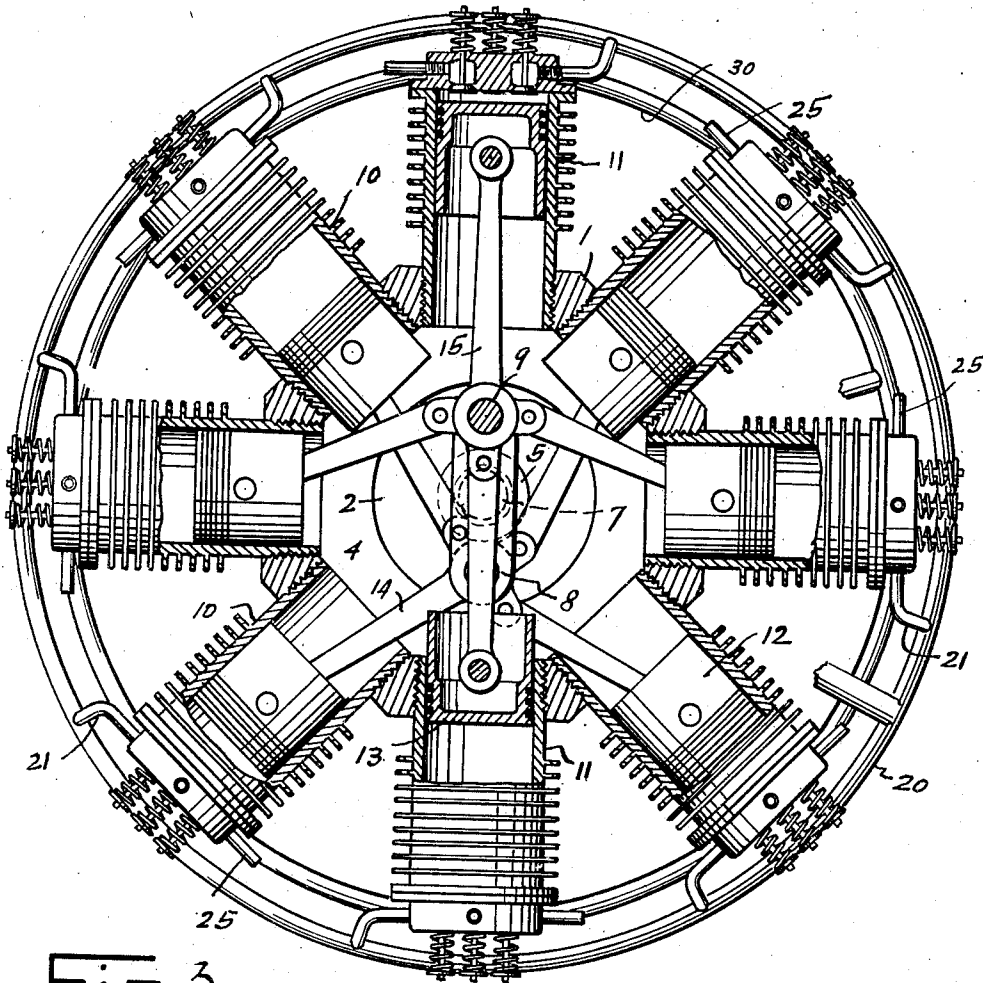


Fig. 3.

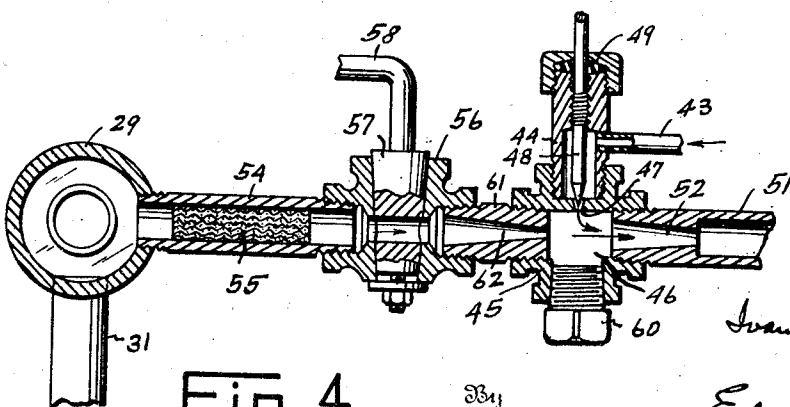


Fig. 4.

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3 Sheets-Sheet 3

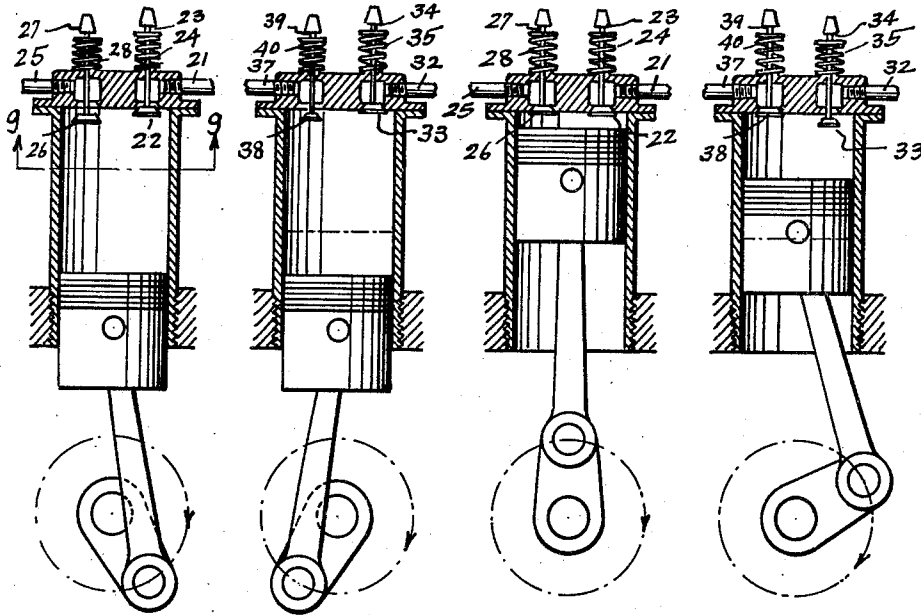


Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

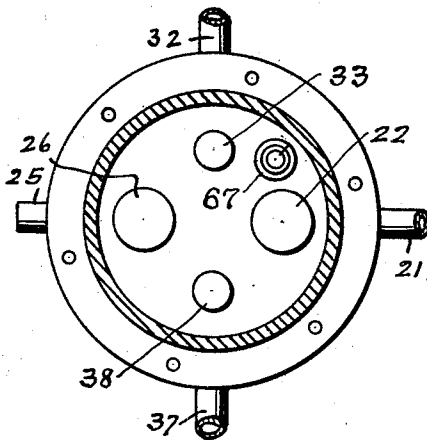


Fig. 9.

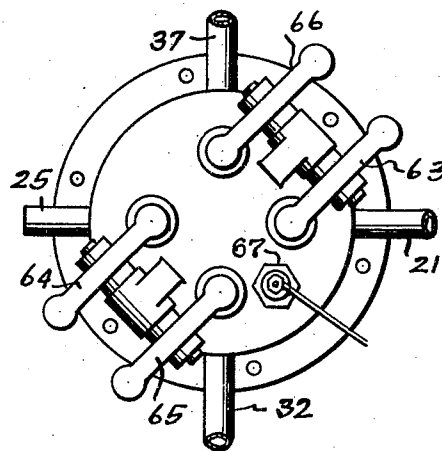


Fig. 10.

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UNITED STATES PATENT OFFICE

2,175,463

INTERNAL COMBUSTION MOTOR

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Application January 3, 1938, Serial No. 182,939

6 Claims. (Cl. 123—75)

This invention relates to an internal combustion motor.

The invention embodies certain improvements over that type of motor disclosed in co-pending application, Serial No. 107,791, filed October 27, 1936, which matured to Patent No. 2,134,786, granted November 1, 1938.

An object of the invention is to provide novel means for supplying the motive fluid to the motor cylinders whereby the motive fluid will be thoroughly broken up and vaporized and delivered to the motor cylinders in a high combustible state.

It is another object of the invention to provide an auxiliary compression drum or similar receptacle which is connected with the combustion chambers of the motor and in which a portion of the pressure from the chambers is stored under compression with means for connecting said pressure receptacle or drum into the fuel feed tank whereby pressure is applied to the fuel in the tank to effect the feeding of the fuel and with means for connecting said pressure receptacle with the carburetor device to the end that the fuel, as fed to the carburetor device, will be subjected to a blast of the hot compressed vapors delivered from the pressure receptacle or drum.

A further object resides in the provision of novel means for scavenging the cylinders.

With the above and other objects in view the invention has particular relation to certain novel features of construction, operation and arrangement of parts, an example of which is given in this specification and illustrated in the accompanying drawings, wherein—

Figure 1 shows a longitudinal, sectional view of the motor.

Figure 2 shows a plan view of the pressure drum and auxiliary supply tank showing the valve controlling means associated therewith.

Figure 3 shows a front, elevational view, partly in section, taken on the line 3—3 of Figure 1.

Figure 4 shows a cross-sectional view of the pressure drum and the control valves associated therewith.

Figure 5 shows a sectional view of a cylinder with the piston approaching the end of its back stroke, showing the exhaust valve fully opened and the initial opening of the air valve.

Figure 6 shows a sectional view of the cylinder taken at right angles to the view shown in Figure 5 showing the piston at the beginning of compression stroke at which time the exhaust valve and air valve are both closed and showing the fuel valve open and the pressure valve closed.

Figure 7 shows a sectional view of the piston as shown in Figure 5 with the piston at the end of compression stroke and all valves closed for firing.

Figure 8 shows a sectional view of the cylinder as shown in Figure 6 with the piston on power stroke with the pressure valve open to admit air, or the products of combustion, into the pressure receptacle.

Figure 9 shows a cross-sectional view taken on the line 9—9 of Figure 5, and

Figure 10 shows an outer end view of a cylinder.

Referring now more particularly to the drawings wherein like numerals of reference designate similar parts in each of the figures, the numeral 1 designates an approximately circular casing having the circular front and rear end plates 2 and 3 secured thereon and enclosing the crank chamber 4. The front and rear plates 2 and 3 have suitable aligned bearings 5 and 6 wherein the crankshaft 7 is mounted to rotate. This crankshaft has the oppositely arranged eccentric wrists 8 and 9 and mounted on the casing are the front and rear series of cylinders 10 and 10, respectively.

In the respective cylinders are the series of pistons 12, 13 which are connected to the corresponding wrists by the connecting rods 14, 15 as shown.

In the present illustration a radial type of motor is shown and on the forward end of the crankshaft is a propeller 16 and between the propeller and the casing and fixed on the crankshaft there is an air current generator 17 which is enclosed by a suitable housing 18. This housing has a discharge pipe 19 which is connected into a circular air manifold 20. This manifold has the branches 21 which are connected into the heads of the respective cylinders and which are controlled by the inwardly opening air valves 22 mounted in the cylinder heads on the stems 23 and the conventional springs 24 are provided to normally maintain the air valves closed. Leading outwardly from the cylinder heads are the exhaust pipes 25 which are controlled by the inwardly opening exhaust valves 26 mounted on the stems 27 and normally held closed by the springs 28. These exhaust valves are shown as exhausting into the free atmosphere separately but it is obvious that they may be connected, if desired, into a common exhaust manifold. The numeral 29 designates a pressure receptacle. In the present instance this is shown in the form of a drum. The numeral 30 designates a pressure

manifold and leading from it and entering the drum there is a pipe 31. The pressure manifold 30 is connected with the outer ends of the respective branches 32 leading out from the cylinder heads. Upon starting of the motor a portion of the air in the cylinders will be forced out through the branches 32 into the manifold 30 and thence through the pipe 31 into the pressure drum 29 and after the motor has started a portion of the gases on back stroke, under pressure, will be forced out through said branches into the manifold 30 and thence through the pipe 31 and into said drum to maintain the required pressure in the drum. The branches 32 are controlled by the inwardly opening exhaust valves 33 in each cylinder head, said valves being fixed on the outwardly extended stems 34 and normally held closed by the pressure springs 35.

There is an intake manifold 36 which is connected into the respective cylinders through the intake pipes 37 which are controlled by the inwardly opening intake valves 38 in the cylinder. These valves are mounted on the outwardly extended stems 39 and are normally held closed by the pressure springs 40.

The numeral 41 designates an auxiliary fuel supply tank into which motive fluid is fed from a main supply tank, not shown, through the supply pipe 42. A conventional pump may be employed for feeding the motive fluid into the auxiliary tank 41, if desired. A delivery pipe 43 leads from the auxiliary supply tank 41 and is connected into the valve casing 44 and this valve casing is connected to the cross-connection 45 as more clearly shown in Figures 1 and 4. This cross-connection 45 encloses a mixing chamber 46 and leading from the valve casing 44 into the mixing chamber there is a tapered valve seat 47 which is controlled by a needle valve 48 having a threaded connection with the outer end of the casing 44 and having a surrounding stuffing box 49 as shown. A controlling arm 50 is attached to the outer end of the needle valve 48 as more clearly shown in Figures 1 and 2.

The mixing chamber 46 is connected into the intake manifold 36 through a tubular connection 51 which has a Venturi passageway 52 leading outwardly from said chamber.

One end of the pressure drum 29 is connected into the top of the auxiliary fuel tank 41 by means of a tubular elbow 53. Leading from the pressure drum 29 there is a nozzle pipe 54 containing a screening element 55, as shown in Figure 4. This nozzle pipe terminates in the valve casing 56 in which the turnable valve 57 is seated. The upper end of the valve 57 has an overturned arm 58 which is connected with the arm 50 by means of a cross-link 59, pivoted to said respective arms. Any suitable valve controlling device, accessible to the operator, may be employed for shifting the arm 58 and thereby controlling the valves 48, 57. The outer end of the cross-connection 35 may be closed by a suitable, removable plug 60. The valve casing 56 is connected into the mixing chamber 46 by means of a tubular connecting nipple 61. This nipple 61 has a tapering nozzle passageway 62 therethrough thus forming a blast nozzle whereby the pressure vapor will be discharged at high velocity into the mixing chamber 46.

The numerals 63, 64, 65 and 66 designate, respectively, the rocker arms for operating the valves in a conventional manner. The cycle of operation of a cylinder is illustrated in Figures 5 to 8, inclusive. With the motor turning in a

clockwise direction the firing order of the series of cylinders 10 is one, three, five and seven and the firing order of the series of cylinders 11 is six, eight, two and four. Upon starting of the motor there will be sufficient air under pressure stored up in the drum 29 to force the fuel into the cylinders and thereupon the motor starts firing. Conventional ignition means as 67 are provided for igniting the charges. Thereafter a portion of the gases, on power stroke, will be conducted from the combustion chambers of the cylinders into the drum 29 to maintain the required pressure therein. The fuel in the auxiliary tank 41 will accordingly be subjected to the pressure contained in the tank 29 and will be thereby forced through the said pipe 43 and through the valve seat 47 into the mixing chamber 46 and the mixture will pass thence through the Venturi passageway 52 into the intake manifold 36 and thence to the cylinder but after the air intake and exhaust valve have been closed. When the motor is stopped and the valves 48, 57 are actuated to closed position the pressure fluid in the drum 29 will be trapped and maintained under pressure, the valve 48 preventing the feed of the motive fluid from the fuel tank 41. Upon starting the motor the valves 48, 57 should be actuated to open position to permit a resumption of the feed of the motive fluid. Should the pressure in the drum 29 be reduced on account of leakage, the pressure will be restored in the drum 29 while starting the motor, the pistons 12, 13 acting as a pump for that purpose. As the motive fluid is fed through the mixing chamber 46 it will be constantly subjected to a blast of the hot pressure vapor from the drum 29 through the connecting nipple which connects the valve casing 56 with the cross-connection 45, the fluid passing through the tapering nozzle passageway 62 being discharged at high velocity through the mixing chamber. The motive fuel will also be fed under pressure and the fuel vaporized in the chamber 46 will be forced through the Venturi passageway 52 and will thereby be further vaporized forming a mixture which will enter the intake pipe 36 and will be delivered into the motor cylinders in a highly combustible state and after the cylinders have been scavenged and filled with clean air.

The cylinders will be thoroughly scavenged by the air forced inwardly through the branches 21 and discharged outwardly through the exhaust pipes 25 and clean air will be supplied to each cylinder after each explosion.

When the piston is near the end of its back stroke the exhaust valve 26 is fully opened and the air inlet valve 22 begins to open and is fully open when the piston reaches the end of power stroke, as shown in Figure 5. As the piston begins compression stroke the air valve and exhaust valve both close and the fuel mixture valve 33 opens and again closes when the piston reaches approximately the position shown in dotted lines in Figure 6. The valve 33 is at this time closed. Thereafter all valves close and the piston continues to move to the limit of its compression stroke as shown in Figure 7. After the compression stroke and as the cylinder moves backwardly, as shown in Figure 8, the pressure valve 33 opens and air under compression, upon original starting of the motor, and thereafter a portion of the hot vapors, the products of combustion, pass through the branch line 32 to the pressure drum 29.

What I claim is:

1. A motor comprising a cylinder, a piston therein, a pressure container, a conduit leading from the cylinder to the container, a mixing chamber, fuel feeding means adapted to discharge into said chamber, an intake conduit leading from the mixing chamber into the cylinder, valves controlling the respective conduits, means for igniting a charge in the cylinder, a conduit leading from the container to the mixing chamber, means for controlling the valves whereby, upon firing of the charge in the cylinder, upon power stroke, a portion of the pressure fluid will be expelled from the cylinder and stored in the container to maintain pressure therein and upon beginning of the compression stroke fluid will be forced through said conduit leading from the container to feed a charge of motive fluid into the cylinder.

2. A motor comprising a cylinder, a piston therein, a container for fluid under pressure, a conduit leading from the cylinder to the container, a mixing chamber, fuel feeding means adapted to discharge into said chamber, an intake pipe leading from the mixing chamber into the cylinder, valves controlling said conduit pipe, respectively, means for igniting a charge in the cylinder, a conduit leading from the container to the mixing chamber, means for controlling the valves whereby, upon firing of the charge in the cylinder, upon power stroke, a portion of the pressure fluid will be expelled from the cylinder and stored in the container to maintain pressure therein and upon the beginning of the compression stroke fluid will be forced through said conduit from the container to feed a charge of motive fluid into the cylinder, an air pipe leading into the outer end of the cylinder, an exhaust pipe leading out from the outer end of the cylinder and valves controlling said air pipe and exhaust pipe.

3. In an internal combustion motor a cylinder having a head, a piston therein, a container for fluid under pressure, a conduit leading from the cylinder to the container, a mixing chamber, fuel feeding means adapted to discharge into said mixing chamber, an intake pipe leading from the mixing chamber into the cylinder, valves controlling said conduit and pipe, respectively, means for igniting a charge in the cylinder, a conduit leading from the container to the mixing chamber, means for controlling the valves whereby upon firing of the charge in the cylinder a portion of the pressure fluid will be expelled, upon power stroke, from the cylinder and stored in the container to maintain pressure therein and upon the beginning of compression stroke fluid will be forced through said conduit leading from the container to feed a charge of motive fluid into the cylinder, and valve controlled means for creating a scavenging current through the head end of the cylinder.

4. In an internal combustion motor a cylinder having a head, a piston therein, a container for fluid under pressure, a conduit leading from the cylinder to the container, a mixing chamber, fuel

feeding means adapted to discharge into the mixing chamber, an intake pipe leading from the mixing chamber into the cylinder, valves controlling said conduit and pipe, respectively, means for igniting a charge in the cylinder, a conduit leading from the container to the mixing chamber, means for controlling the valves whereby upon firing of the charge in the cylinder a portion of the pressure fluid will be expelled, upon power stroke, from the cylinder and stored in the container to maintain pressure therein and upon the beginning of compression stroke fluid will be forced through said conduit leading from the container to feed a charge of motive fluid into the cylinder, an air pipe leading into the head end of the cylinder, and an exhaust pipe leading out therefrom, valves controlling said air pipe and exhaust pipe and means for opening said last mentioned valves upon exhaust stroke of the piston.

5. In an internal combustion motor a cylinder having a head, a piston therein, a container for fluid under pressure, a conduit leading from the cylinder to the container, a mixing chamber, a fuel feeding means adapted to discharge into the mixing chamber, an intake pipe leading from the mixing chamber into the cylinder, valves controlling said conduit and pipe, respectively, means for igniting a charge in the cylinder, a conduit leading from the container to the mixing chamber, means for controlling the valves whereby upon firing of the charge in the cylinder a portion of the pressure fluid will be expelled, upon power stroke, from the cylinder and stored in the container to maintain pressure therein and upon the beginning of compression stroke fluid will be forced through said conduit leading from the container to feed a charge of motive fluid into the cylinder, an air pipe leading into the head end of the cylinder, and an exhaust pipe leading out therefrom, valves controlling said air pipe and exhaust pipe, means for opening said last mentioned valves upon exhaust stroke of the piston and means for forcing air under pressure through said air pipe into the outer end of the cylinder.

6. A motor comprising a cylinder, a piston therein, a pressure container, a conduit leading from the cylinder to the container, a mixing chamber, fuel feeding means adapted to discharge into the mixing chamber, an intake conduit leading from the mixing chamber into the cylinder, valves controlling the respective conduits, a conduit leading from the container to the mixing chamber, means for controlling the valves whereby, upon firing of the charge in the cylinder, upon power stroke, a portion of the pressure fluid will be expelled from the cylinder and stored in the container to maintain pressure therein and upon beginning of the compression stroke, fluid will be forced through said conduit leading from a container to feed a charge of motive fluid into the cylinder, and means for controlling the conduit which leads from the container to the mixing chamber.

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