

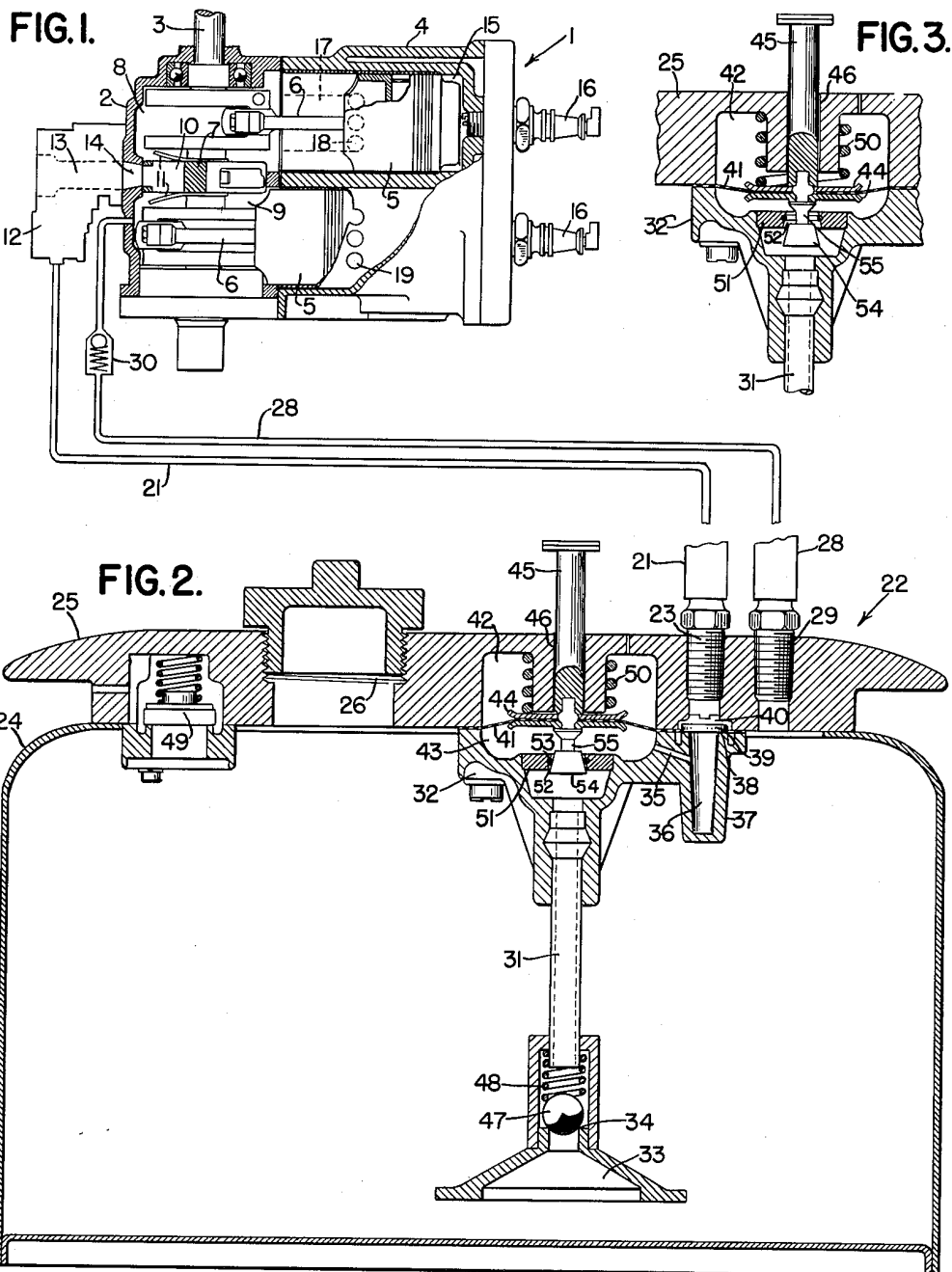
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COMBINED PRIMING PUMP AND PRESSURE REGULATOR

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COMBINED PRIMING PUMP AND PRESSURE
REGULATOR

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This invention relates to a combined priming pump
and pressure regulator for pressurized engine fuel sup-
ply systems.

According to the invention, a priming pump is modi-
fied to operate also as a pressure regulator and is ad-
vantageously located remote from the engine and not
subject to the vibration of the engine.

The invention is particularly intended for outboard
motors of the type including a crankcase-induction, two-
cycle internal-combustion engine supplied with fuel from
a tank remote from the engine. During operation of
the engine the intermittent pressure developed in the
crankcase is utilized to pressurize the fuel tank.

The priming pump, as customarily provided, and car-
ried by the tank, when in operation as a pressure reg-
ulator, limits the pressure of the fuel supplied to the
engine carburetor to within the safe pressure limit of
the carburetor.

The pressure developed in the tank by crankcase com-
pression is not uniform and the regulation of the pres-
sure at a constant value assures more consistent engine
performance. Furthermore, the regulating valve of any
carburetor is adapted to handle the fuel only within a
limited pressure range. The pressure regulator main-
tains the fuel pressure within the range to prevent flood-
ing of the engine.

The drawings furnished herewith illustrate the best
mode of carrying out the invention as presently con-
templated and set forth hereinafter.

In the drawings:

Figure 1 is a side elevation of a two cylinder, two-
cycle engine with parts broken away and sectioned and
showing a fuel line connected to the carburetor and a
pressure line to one crank chamber;

Fig. 2 is an enlarged section of a fuel tank with a
priming pump incorporating the invention and with the
remote ends of the fuel supply and pressure lines shown
in Figure 1 connected to the tank; and

Fig. 3 is a sectional view of the priming pump shown
in Fig. 2 and in open position.

The engine 1 shown in the drawings includes the
crankcase 2 carrying the vertical crankshaft 3. The
cylinder block 4 joined to crankcase 2 carries the pistons
5 connected by the rods 6 to the corresponding crank
throws of crankshaft 3. The bearing member 7 inter-
mediate the crank throws of crankshaft 3 divides crank-
case 2 into the upper and lower crank chambers 8 and
9, respectively, and is provided with the induction pas-
sage 10 opening into chambers 8 and 9 as by the reeds
11. The carburetor 12 shown diagrammatically is se-
cured to crankcase 2 and includes a mixing passage 13
which communicates through the opening 14 in crank-
case 2 with passage 10 for the delivery of air and car-
bureted fuel to chambers 8 and 9 in the operation of
the engine.

The upward stroke of each piston 5 compresses the
fuel charge in the respective combustion chamber 15
above the piston for ignition by the corresponding spark

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plug 16, and at the same time effects the induction of
air from carburetor passage 13 into the crank chamber
below the piston. With the downward stroke of each
piston 5 as effected by the burning of the fuel charge
in the combustion chamber, the fuel and air mixture
in the crank chamber below the piston is compressed
for transfer through the communicating passage 17
shown in dotted lines and the ports 18 formed in the
cylinder wall on one side of the piston. Ports 18 and
the opposite exhaust ports 19 in each cylinder are con-
trolled by the corresponding piston and opened substan-
tially simultaneously for the discharge of the exhaust
gases through the ports 19 and the recharging of the
cylinder.

The liquid fuel is supplied to carburetor 12 by the
supply line 21 connected to the carburetor at one end
and to the tank 22 provided with the fitting 23 to re-
ceive the line 21. The tank 22, shown in Fig. 2, in-
cludes the stamped shell 24 and the top member 25 pro-
vided with the threaded opening 26 for filling the tank.

The line 28 from chamber 9 of the engine case 2 is
connected to the fitting 29 of member 25 to communi-
cate with tank 22 provided with the check valve 30
which allows air and carbureted fuel to pass from crank-
case 9 to the tank and maintains in the tank the maxi-
mum pressure attained in the crankcase.

The upper end of tube 31 is secured to the hollow
member 32 bolted to the lower face of member 25 of
tank 22 and extends downwardly within the tank. The
screen 33 across the enlarged lower open end of the
valve 34 fixed to the lower end of tube 31 prevents foreign
particles in the fuel from entering tube 31. The upper
end of tube 31 opens into member 32 and communicates
through the passage 35 with the adjacent well 36 pro-
vided in the trap 37. The annular valve seat 38 defining
the upper open end of well 36 carries the valve disc 39
which is seated by gravity and fits within the lower end
of the passage 40 associated with fitting 23 of member
25. Trap 37 and member 32 are integrally formed and
secured to the lower face of member 25 of tank 22 with
the outer margins of the diaphragm 41 therebetween.
Diaphragm 41 separates the upper annular chamber 42
formed in member 25 and the lower chamber 43 formed
in member 32 and is centrally retained between the discs
44 carried by the stem 45 which is adapted for manual
reciprocation in the bore 46 concentric of chamber 42
whereby the diaphragm operates as a pump. The up-
ward movement of stem 45 enlarges the volume of cham-
ber 43 to draw fuel from the tank past the ball-check 47
of valve 34 while disc 39 remains seated. Upon down-
ward movement of diaphragm 41, the ball-check 47
closes and forces the fuel past disc 39 through passage
40 into fuel line 21 to the carburetor 12. A light spring
48 may be employed, as required to assure closing of
ball-check 47.

The movement of the diaphragm effects the initial
supply of fuel to carburetor 12 as required to start en-
gine 1. Thereafter the pressure developed in crankcase
9 is maintained in tank 22 by check valve 30 in line 28,
provides for the delivery of fuel to carburetor 12 under
the pressure referred to. A spring biased valve assembly
49 in member 25 provides for the relief of excess pres-
sures developed in the tank.

According to the invention, the diaphragm 41 is biased
by the spring 50 in chamber 42 against the pressure of
the fuel in the chamber as supplied to carburetor 12 and
is utilized to prevent the delivery of fuel to the chamber
whenever the pressure therein exceeds a predetermined
maximum.

The plug 51 seated in member 32 closes the entry of
tube 31 into chamber 43 and is provided with a central
opening 52 fitted with an O-ring seal 53. The conical

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valve member 54 is formed at the lower end of the rivet 55 which secures discs 44 to the lower end of the stem 45, and is disposed to seat upwardly against O-ring 53 upon upward movement of diaphragm 41.

The capacity of spring 50 is predetermined by the desired pressure to be maintained in fuel line 21 and the effective area of diaphragm 41 while of a practicable normal size for pump operation is of considerable size respecting its responsiveness to pressure variations. Accordingly, pressure of the fuel in chamber 43 and also line 21 to carburetor 12 raises diaphragm 41 to close valve 52 which prevents the further delivery of fuel by tank pressure through tube 31. As the carburetor receives the fuel from line 21 the pressure drop in the line and chamber 43 allows spring 49 to lower valve member 54 and allows fuel to pass into chamber 43 until the predetermined maximum pressure is again reached. In regular operation, the pressure and valve opening approach an equilibrium to maintain a relatively constant pressure of the fuel supplied to carburetor 12 for consistent engine operation.

The pressure responsive diaphragm 41 located remote from engine 1 is not subject to the vibration of the engine so that the reliable pressure control allows the carburetor to be designed for lower pressures and the larger area of the pump diaphragm provides the desired sensitive operation of the valve.

Various modes of carrying out the invention are contemplated as within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

We claim:

1. In an engine fuel supply system, a pressurized fuel supply tank, a fuel supply line from said tank for connection with the engine and delivery of fuel thereto, a delivery control valve in said fuel supply line, a movable member exposed to the pressure within the tank and connected to said valve to close the valve in response to pressure within the tank, means biasing said movable member in a direction to open said control valve and yieldable to a predetermined minimum pressure within the tank to maintain within a maximum limit the pressure of the fuel supplied to the engine, check valves in said fuel supply line, and means for manually moving said member, said check valves being disposed for operation with said movable member to provide for pumping of the fuel through the supply line to the engine for initial engine operation.

2. In an engine fuel supply system, a pressurized fuel supply tank, a fuel supply line from said tank for connection with the engine, a priming pump in said supply line including a movable member and check valves disposed to provide for the delivery of fuel from the tank to the engine upon manual reciprocation of the movable pump member, a control valve in said fuel supply line including a movable element connected to the movable member of said priming pump, said valve being disposed to close said fuel supply line upon movement of said pump member in a given direction and in response to pressure within the supply tank, and a regulator spring biasing said movable pump member in the opposite direction, said spring being yieldable to the manual reciprocation of the pump member and otherwise to a minimum pressure within the tank to establish a predetermined maximum limit of pressure of the fuel delivered to the engine.

3. In a two-cycle engine employing crankcase induction and precompression and having a carburetor, a fuel supply tank, a pressure line from said crankcase to said fuel supply tank and having non-return valve means disposed whereby the maximum intermittent pressure within the crankcase is maintained within the fuel supply tank, a fuel supply line from said tank to said engine carburetor for delivery of fuel thereto, a delivery control valve in said fuel supply line, a flexible diaphragm responsive to

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the pressure within the tank and connected to said control valve to close the control valve in response to pressure within the tank, biasing means acting on the diaphragm in a direction to open the control valve and determine a maximum pressure of the fuel supplied to the engine less than said maximum intermittent pressure, a check valve provided in the supply line on each side of the control valve, and means for manually operating said diaphragm, said check valves cooperating with the manually operated diaphragm to provide a pump for initially priming the fuel supply system.

4. In an engine fuel supply system, a pressurized fuel supply tank, a fuel supply line interconnecting the tank and engine for delivery of fuel to the engine, a priming pump in said supply line including a flexible diaphragm, means for manually actuating said diaphragm, check valves disposed in the supply line and with respect to the diaphragm to provide for the initial delivery of fuel from the tank to the engine upon manual actuation of the diaphragm, a control valve in said supply line including a movable element connected to the flexible diaphragm of the priming pump and being disposed to close the fuel line upon movement of the diaphragm in response to pressure within the fuel tank, and a regulator spring biasing the diaphragm in the opposite direction to establish a predetermined maximum limit of pressure of the fuel delivered to the engine in operation.

5. In combination with an engine having a crankcase wherein intermittent pressure is developed as an incident to engine operation, a fuel tank remote from the engine, a pressure line interconnecting the crankcase and the tank for communicating crankcase pressure to the tank, a check valve in said pressure line to maintain pressure in the tank substantially uniform and equal to the maximum pressure reached in the crankcase, a fuel supply line interconnecting the tank and the engine for delivery of fuel to the engine by the pressure maintained in the tank, a delivery control valve in said fuel line, a movable member responsive to the pressure within the fuel line and connected to said control valve to close the same in response to tank pressure, biasing means acting on said movable member in a direction to open the control valve and yieldable at a predetermined limit to the pressure of the fuel supplied to the engine, check valves in said fuel supply line, and means for manually operating said movable member, said check valves in the fuel supply line being disposed to cooperate with the movable member and provide for pumping of the fuel through the supply line to the engine for initial engine operation.

6. In combination with a crankcase fuel induction engine, a pressurized fuel supply system including a crankcase wherein intermittent pressure is developed as an incident to engine operation, a fuel tank remote from the crankcase, a pressure line in communicative connection between the fuel tank and the crankcase, non-return valve means in the pressure line to maintain crankcase pressures to a substantially uniform pressure in the tank, a fuel supply line interconnecting the tank and the engine for delivery of fuel to the engine by virtue of the pressure maintained in the tank, a pressure control valve in the supply line, a flexible diaphragm responsive to the tank pressure and connected to the control valve to close the same in response to the tank pressure, a regulator spring acting on the diaphragm in a direction to open the control valve and establish the maximum predetermined pressure of the fuel supplied to the engine, a check valve provided in the supply line on each side of the control valve, and means for manually operating said diaphragm, said check valves in the fuel supply line cooperating with the manually operated diaphragm to provide a pump for initially priming the fuel supply system.

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