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F. T. IRGENS

2,148,071

CHARGE FORMING DEVICE

Filed Feb. 1, 1936

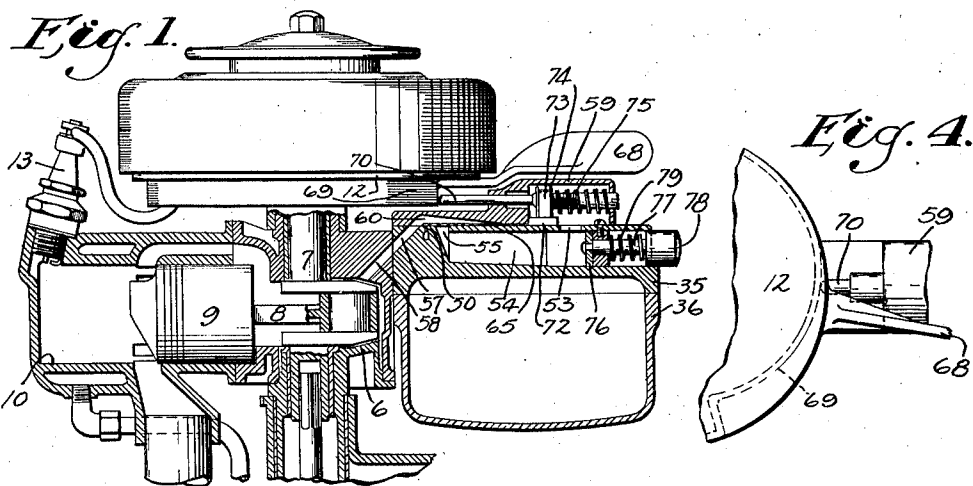


Fig. 5.

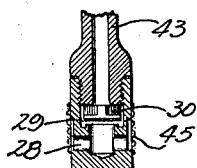


Fig. 3.

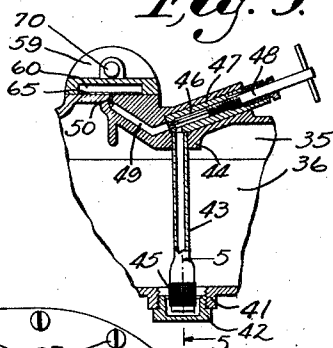


Fig. 2.

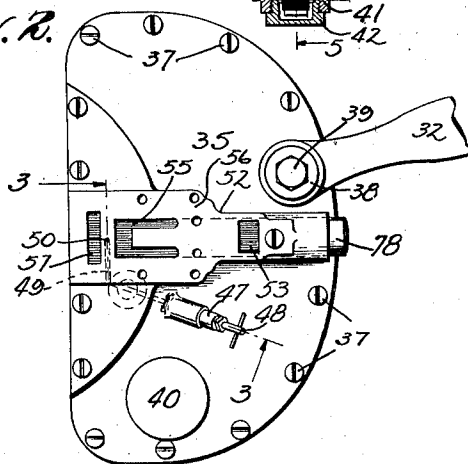


Fig. 6.

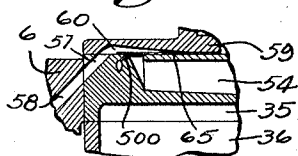
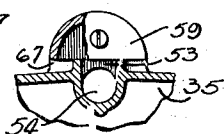


Fig. 7.



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CHARGE FORMING DEVICE

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mesne assignments, to Outboard, Marine &
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Application February 1, 1936, Serial No. 61,917

10 Claims. (Cl. 123—73)

This invention relates to improvements in charge forming devices. The present application is a continuation in part containing subject matter divisional with respect to my Patent 2,069,315, for improvements in Internal combustion engines, granted February 2, 1937.

It is the primary object of the invention to provide novel and improved charge forming means incorporated directly into the top or cover of a fuel reservoir, thus eliminating a float chamber and providing simplified mechanism for mixing a hydrocarbon fuel with air and for controlling the formation and delivery of the mixture.

More specifically, it is one of the principal purposes of the invention to provide a novel and improved type of mixing valve employing a resiliently yieldable flat spring which is biased normally to close both the air and fuel passages and which is opened to a greater or less degree by the differential pressures existing across the plate to admit fuel in proportion to the air admitted.

It is a further object of the invention to provide a novel and improved form of choke for use in a device of the character described and also to provide a novel and improved throttle valve arranged to be automatically controlled in accordance with timer settings.

It is a further purpose of the invention to provide conveniently controlled means for regulating the flow of fuel to the mixing nozzle and for otherwise facilitating the incorporation of a charge forming device directly in the top or cover of a fuel reservoir.

In the drawing:

Figure 1 is a view partially in section and partially in side elevation showing the power head of an outboard motor equipped with a charge forming device embodying the present invention.

Figure 2 is a plan view of the fuel reservoir as it appears with the cover of the charge forming device removed.

Figure 3 is a detail view taken in section on the line 3—3 of Figure 2.

Figure 4 is a fragmentary plan view of a portion of the timer and a portion of the throttle valve of the charge forming device.

Figure 5 is a detail view on an enlarged scale taken in section on the line 5—5 of Figure 3.

Figure 6 is a fragmentary detail view of the mixing valve arrangement slightly modified from the structure shown in Figure 1.

Figure 7 is a fragmentary detail view partially

in front elevation and partially in transverse section through a portion of the fuel reservoir and the cover applied thereto.

Like parts are designated by the same reference characters throughout the several views.

The power head as herein disclosed comprises an engine having a crank case 6, crank shaft 7, connecting rod 8, piston 9, cylinder 10, flywheel magneto, timer plate 12, and spark plug 13, all of which may be of conventional design except as hereinafter specified.

The front side of the crank case 6 is formed to provide a seat to which the top section 35 of the fuel reservoir 36 is secured. The screws 37 shown in Fig. 2, support the lower section of the fuel reservoir from the upper section thereof.

The tiller by which the entire outboard motor is dirigibly controlled is mounted directly on the top member 35 of the fuel tank reservoir, thus further economizing in weight by eliminating a special tiller arm. In practice this tiller preferably comprises a handle 32 made of elastically yieldable rubber or the like, the rear end of which is engaged under compression by a washer 38 retained by the head 39 of a cap screw in threaded engagement with the fuel tank cover 35. By loosening the cap screw 39, the tiller handle may be adjusted to any convenient angle, and when the cap screw is tightened down the adjustment is made permanent. The flexibility of the handle grip 32 per se takes up all torque vibration. The upper and lower sections of the fuel reservoir are preferably both made of die castings and consequently are comparatively rigid. Also, by reason of this fact, they may readily be varied in thickness as required to provide the various ducts and passages hereinafter to be described. A removable closure is provided at 40 for the introduction of the liquid fuel.

In the lower unit of the fuel reservoir there is an annular flange 41 (see Fig. 3) threaded to receive a clean-out plug 42. Through the opening thus provided, a fuel supply pipe 43 may be introduced for connection with a boss 44 formed on the underside of the top section of the reservoir. The inlet at the lower end of pipe 43 is preferably covered by a screen 45. Within the screen 45 is a passage 28 leading to a chamber 29 within which I preferably provide a check valve 30 (Fig. 5), although such a check valve is unnecessary because of the function of the spring valve hereinafter to be described.

At its upper end the fuel pipe 43 communicates with a duct 46 in the interior of a plug 47 with which a needle valve 48 is in screw threaded

connection. The plug 47 provides a suitable seat for the needle valve and also carries conventional packing for the stem thereof.

Beyond the needle valve the duct 46 has an upward extension 49 (Figs. 2 and 3) terminating in a jet opening 50 at the upper face of the top section 35 of the fuel reservoir.

The longitudinally extending boss 52 in the top section 35 of the fuel reservoir through which duct extension 49 leads to jet opening 50, has an air admission port 53 leading to an interior air passage 54 opening adjacent the jet 50 through a U-shaped port 55 in the substantially planiform upper surface 56 of the section 35 of the reservoir. Beyond this point there is another duct 57 leading downwardly and communicating with a duct 58 which carries the mixture to the interior of the crank case.

Applied to the flat surface 56 of the top member 35 of the fuel reservoir is a cap 59 channeled at 60 to provide a passage communicating with passages 57 and 58 which lead to the crank case, and also potentially communicating with the jet port 50 and the passage 54 through which the fuel and air are respectively supplied. It is in the passage 60 that carburetion actually occurs.

Confined between the cap 59 and the top section 35 of the fuel reservoir is a mixing valve comprising a flat spring plate 65 which covers the U-shaped air port 55 and the fuel jet port 50. The end of the spring valve plate above the fuel port is free and the other end is fixed. Thus the pressure differential between the crank case and the atmosphere during the compression stroke of the piston in its cylinder will cause atmospheric air to pass under the margins 67 of cap 59 and through port 53 and passage 54 to port 55, where the air pressure will cause valve 65 to bow upwardly, thus admitting air to the mixing passage 60 and directing its flow across the jet orifice 50. The greater the pressure differential, the greater will be the upward movement of the spring mixing valve 65 and the greater will be the vacuum on the fuel orifice, thereby producing increased flow of both air and gasoline to supply the increased demand. The mixing valve 65 comprises a fairly light spring plate and serves as a check valve to prevent the escape of mixture when the mixture is compressed in the crank case.

It has been found that the shape of port 55 and passage 57, as clearly shown in Fig. 2, is admirably adapted to ensure a proper proportion of fuel and air subject, of course, to the control of the fuel by means of the needle valve. The exact type of spring must be determined by experiment since the requirements will vary with each installation, but its resilience is not critical and it is only desirable that its range of movement between closed and open positions in passage 60 should approximately correspond to the range of air flow through the passage so that the valve will be fully open in response to maximum air requirements and will be barely open in response to minimum air requirements.

The jet opening 50 need not necessarily open midway between the air port 55 and the mixture port 57, as shown in Figures 1 and 2. I have found it desirable for many purposes to carry the jet opening almost to the margin of port 55, as shown at 50a, in Figure 6 (a modification). Where this is done, the check valve 30 is not at all necessary, since practically no back pressure is ever communicated to the fuel.

The fuel reservoir is so designed as to have a large area in proportion to the amount of depth

of fuel therein. Therefore the head against which the fuel must be drawn to the jet orifice 50 will not vary as greatly as would be the case if a high narrow tank were used. The design is preferably such that at normal operating speeds there will be ample depression at the jet orifice to draw the fuel from the bottom of the tank (at maximum head).

At the same time the depression available for lifting the fuel to the jet should not exceed the actual requirements of the motor, since otherwise the motor will operate at low volumetric efficiency. Accordingly I have provided means by which the volumetric efficiency may be at a maximum during normal operating speeds and means is provided to increase the depression in the mixing passage at low engine speeds sufficiently to compensate for the decrease of vacuum in the crank case at such speeds.

In this, as in many other two cycle engines, 20 speed is controlled by the timer, the plate 12 being mounted for angular adjustment about the axis of the crank shaft under control of the handle 68. Since the position of handle 68 and plate 12 is directly related to engine speeds, I am able to provide on plate 12 a cam at 69 having a surface of the generally helical form shown in Fig. 4. This cam acts upon a cam follower 70 which is in the form of a plunger and is effective to choke the air inlet port 53.

The choke comprises a slide valve 72 removable across the top of port 53 to restrict the opening thereof. A yoke 73 carried by the slide valve engages a spool-shaped nut 74 which is screw threaded to the cam follower plunger 70, the nut 35 being restrained by the yoke from rotation. A compression spring at 75 acts on nut 74 to maintain the slide valve 72 in its normally retracted wide open position and to maintain the cam follower 70 in abutment with the operating surface of cam 69.

As the lever 68 is actuated toward the retarded spark position shown in Fig. 4 it pushes the cam follower rod 70 to the right as viewed in Fig. 1, until the slide valve 72 partially covers the aperture 53. The exact degree of coverage may be controlled and adjusted by the rotation of the cam follower rod 70 in nut 74, and by the end of the rod being exposed and provided with a screw driver slot for this purpose.

At normal operating speeds the parts are as shown in Fig. 1, port 53 being wide open.

It is also desirable to choke the air intake for starting. For this purpose a separate choke may conveniently be provided comprising a piston type slide valve in the bore beneath the inlet port 53 at 76. This choke valve is mounted on a valve stem 77 having an exposed button at 78 normally held in the retracted position by a compression spring at 79. By pressing the button the operator may substantially close off the air below port 53, as will be obvious from inspection of Fig. 1.

I claim:

1. The combination with a fuel reservoir from which carburetion is effected directly without the intermediation of a float valve, of a charge forming device in communication with said reservoir to receive fuel therefrom, and provided with an air inlet, a valve controlling air flow into said device, a mixing valve automatically regulating the mixture of air with fuel from said reservoir and subject to variation in response relative to differential pressures thereacross, engine speed control mechanism upon the adjustment of which such differential pressures are dependent,

and means connected with said mechanism for adjusting said first mentioned valve in a direction adapted for compensation for pressure fluctuations to which said mixing valve is subject.

5 2. In a device of the character described, a charge forming device having a fuel nozzle and an air inlet, valve controlling said inlet for varying the suction at the nozzle, a spring urging said valve toward its open position, and a cam provided with a follower connected with said valve for movement thereof in opposition to said spring toward its closed position and a speed control member provided with a connection to the cam for the operation of said valve in a valve closing direction as said speed control member is moved in a speed retarding direction, whereby to compensate for pressure differential changes at the nozzle which would otherwise be effected by change of speed.

20 3. In a device of the character described, the combination with a fuel reservoir and a cover therefor provided with communicating air and fuel passages, of means providing a valve seat about the point of communication of said passages, and a spring plate having one end anchored to said seat and the other end free for resilient movement from said seat for the simultaneous opening of said passages.

30 4. A charge forming device comprising the combination with means providing a mixing chamber having a surface constituting a valve seat, and ducts for air and fuel leading through said surface to said chamber, of a spring plate having one end anchored and a resiliently yieldable end biased toward a position of engagement with said seat to close concurrently the communication of both ducts with said chamber, said free end being yieldable in response to differential pressures to open said ducts.

40 5. In a device of the character described, the combination with a fuel reservoir having a cover provided with a valve seat on its upper face, a discharge duct leading from said seat, and fuel and air admission ducts leading through said seat in proximity to each other, of a cap member extending over said seat and providing a mixing chamber within which said seat is disposed and from which said discharge duct leads, and a mixing valve comprising a spring plate having a yieldable end portion biased toward engagement with said seat to close said fuel and air admission ducts and resiliently yieldable from said seat for the simultaneous opening of said ducts.

55 6. In a device of the character described, the combination with a fuel reservoir having a cover provided with a valve seat on its upper face, a discharge duct leading from said seat, and fuel and air admission ducts leading through said seat in proximity to each other, of a cap member extending over said seat and providing a mixing chamber within which said seat is disposed and from which said discharge duct leads, and a mixing valve comprising a spring plate having a yieldable end portion biased toward engagement with said seat to close said fuel and air admission ducts and resiliently yieldable from said seat for the simultaneous opening of said ducts, said cover being apertured to afford communication between the external atmosphere and the

air admission duct, together with valve means for the restriction of said aperture to regulate air admission toward said seat.

7. In a device of the character described, the combination with a fuel receptacle having a cover provided with a boss, the boss being surfaced to provide a valve seat, of a fuel duct provided with needle valve control and opening from said receptacle through said seat, an air duct in communication with the atmosphere and extending through said boss and opening through said seat, means coacting with said seat to provide a mixing chamber within which said seat is disposed, and a spring plate secured to said seat beyond said air duct from said fuel duct and having its free end portion over said fuel duct and its intermediate portion over said air duct, said plate being yieldable in response to pressure differentials to open said fuel and air ducts and to direct over said fuel duct a flow of air generally proportioned to such pressure differential.

8. The combination with a charge forming device provided with an air passage and a fuel duct communicating therewith and a valve seat across said passage adjacent said duct, of a check valve biased for movement toward said seat and yieldable therefrom responsive to the flow of different volumes of air through said passage, a choke valve spaced from said seat in the path of air moving through said passage toward said duct, and means for moving said choke valve progressively in a direction to close said passage in accordance with a decrease of flow of air therein, whereby the respective openings of said choke valve and said first mentioned valve are concurrently reduced.

9. In a device of the character described, the combination with a charge forming device provided with an air passage having a seat and a duct opening into said passage adjacent said seat, of a fuel reservoir with which said duct communicates for the carburetion of air traversing said passage, a valve biased for movement toward said seat and yieldable therefrom in accordance with the flow of air traversing said passage, means for varying the flow of air through said passage independently of the movement of said valve, said valve being automatic in its operation, and a second valve comprising means for progressively choking said passage in the path of air traversing said passage toward said seat and duct, and means for actuating said second valve in a direction to reduce the capacity of said passage in accordance with a reduction of air flow therethrough as occasioned by said first means.

10. In a device of the character described, the combination with a fluid receptacle and a supporting bracket comprising a cover therefor provided with an air passage having a seat and a duct opening into said passage from said receptacle adjacent said seat, of a check valve comprising a spring reed having a natural bias toward said seat and yieldable therefrom in accordance with air flow through said passage and over said duct, and a second valve adjustable across said passage in the path of air traversing said passage toward said duct and seat, and means for actuating said valve.

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