

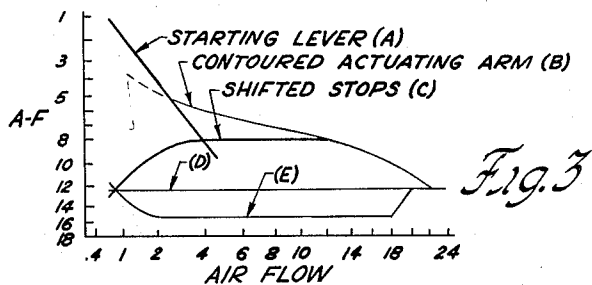
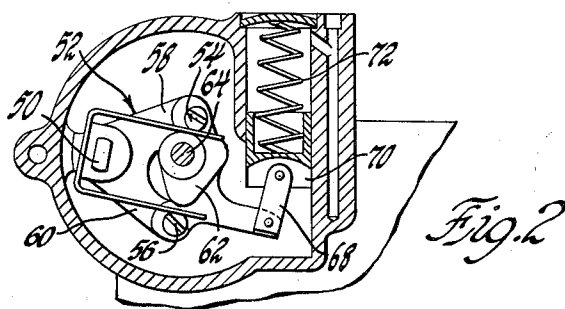
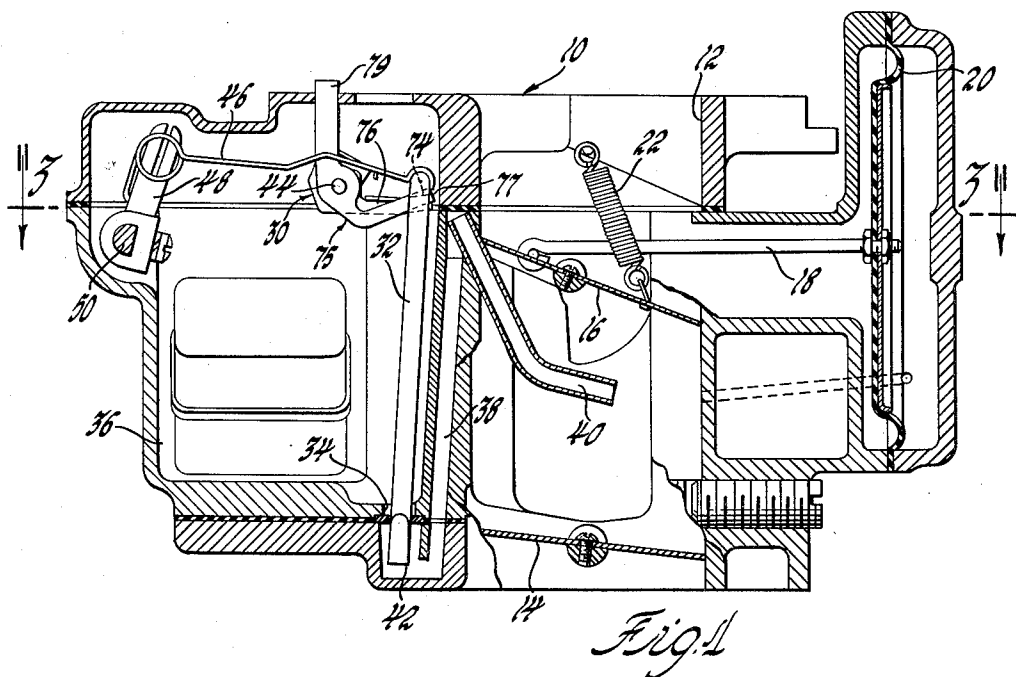
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S. H. MICK
CARBURETOR

3,053,240

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

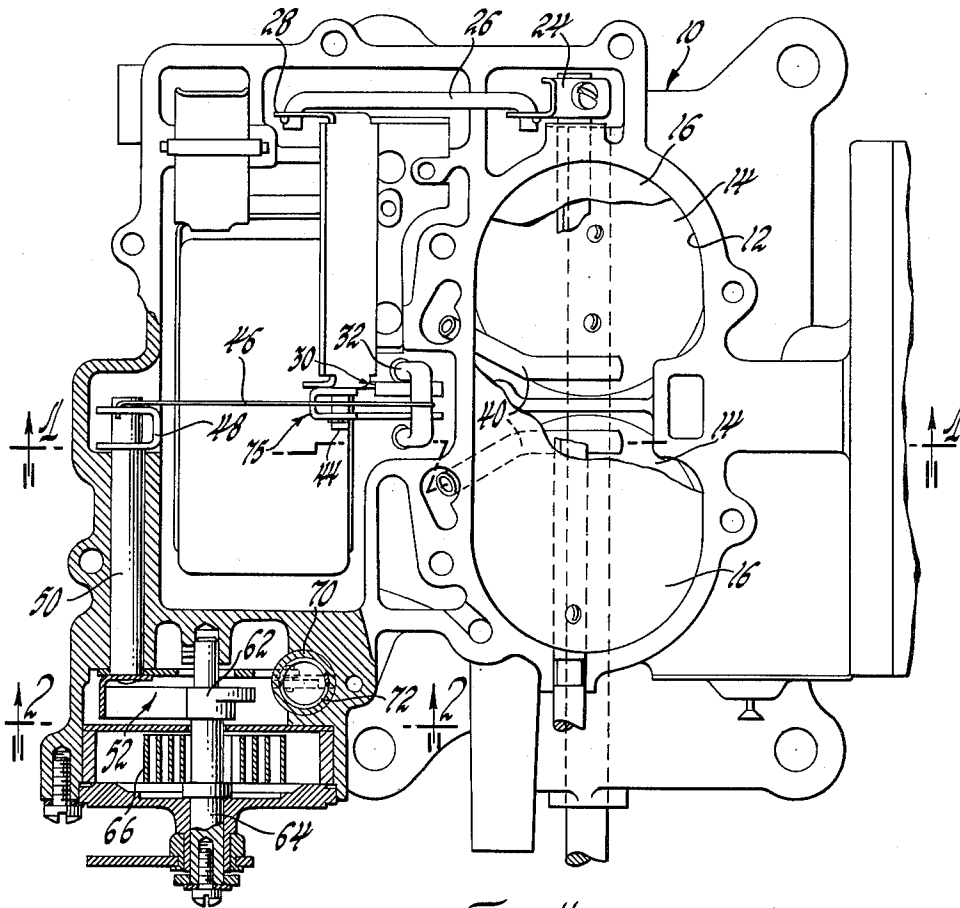


Fig. 4

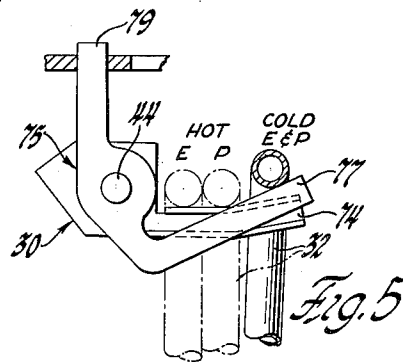


Fig. 5

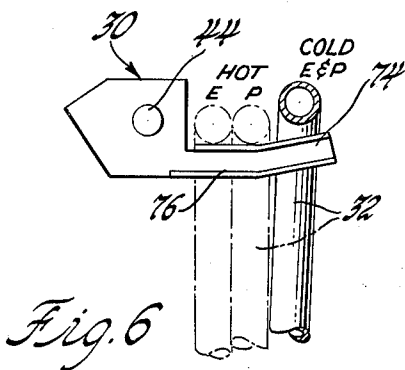


Fig. 6

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1

3,053,240

CARBURETOR

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3 Claims. (Cl. 123-119)

The present invention relates to a diaphragm operated carburetor of the type shown in copending application Serial No. 2,189 Mick now U.S. Patent 2,996,051. More specifically, the present invention is an improvement in the aforementioned Mick application in the provision of an improved and simplified cold starting mechanism.

In the copending application, a cold enrichment device is provided which, in conjunction with the accelerator pump, permits engine cranking vacuum to pull additional fuel into the induction passage during cranking operation. Upon the engine being started, the earlier type enrichment device is rendered inoperative and thus the fuel-air ratio is too lean to sustain smooth engine operation.

In the present device the cold starting mechanism is temperature responsive during the entire engine warm-up period. In the present instance the fuel metering rods are operated, as before, through a diaphragm operated lever which lifts the metering rods out of metering orifices to increase fuel flow as air flow increases through the induction passage. As before, the upper ends of the metering rods are adapted to be moved radially inwardly and outwardly along the metering rod controlling lever in accordance with engine temperature in order to vary the fuel-air ratio.

The present invention, however, includes an inclined starting lever in combination with a metering rod actuating lever having a contoured portion to insure the metering rods are lifted out of their metering orifices to a considerably greater extent when the engine is cold to thereby insure an adequately enriched fuel air ratio under cold starting and operating conditions. In the present device, when the engine has fully warmed the metering rod is moved off both the inclined starting lever and the contoured portion of the metering rod controlling lever and the control of the metering rods is as with the previously noted device.

The details as well as other objects and advantages of the present invention will be apparent from a perusal of the detailed description which follows.

In the drawings:

FIGURE 1 is an elevational view of a carburetor embodying the subject invention;

FIGURE 2 is a fragmentary elevational view of the thermostatic control mechanism;

FIGURE 3 graphically depicts the fuel-air ratio effect of the subject invention;

FIGURE 4 is a plan view of FIGURE 1;

FIGURE 5 is an enlarged view of the starting lever and actuating arm; and

FIGURE 6 shows the metering rod controlling lever with the metering rods represented in different operating conditions.

Except as specifically hereinafter distinguished, the basic carburetor construction and operation is the same as in the aforementioned copending application of Mick. The carburetor is indicated generally at 10 and includes an induction passage 12 in which a throttle valve 14 is rotatably disposed. An air valve 16 is also rotatably disposed in induction passage 12 anteriorly of throttle 14 and is articulated through a rod 18 to a diaphragm 20. A light spring 22 urges air valve 16 in a closed direction. Basic to all air valve type carburetors, the angular position of air valve 16 is varied to maintain a constant pressure drop

2

thereacross under all air flow conditions. The control of the angular position of the air valve is determined by diaphragm 20 the left side of which communicates with the induction passage anteriorly of the air valve and the right side of which communicates with the induction passage immediately posterior of the air valve. Thus an air flow increases through the induction passage, in accordance with engine demand, the pressure drop across the air valve would also tend to increase. This increased pressure differential is translated into a rightward movement of diaphragm 20 occasioning a further opening of air valve 16 until the pressure drop thereacross was once again stabilized.

With the increased air flow through induction passage 12, it is necessary to increase the quantity of fuel flow in order to maintain a substantially constant fuel-air ratio. Accordingly, air valve 16 includes a lever 24 fixed thereto which connects through a link 26 with a pivotally mounted lever 28. Lever 28 in turn is fixed to an actuating arm indicated generally at 30 which is adapted to coast with U-shaped metering rods 32. Metering rods 32 are adapted to be lifted out of fuel metering orifices 34 progressively with increased opening movement of air valve 16. Metering orifices 34, in turn, communicate fuel reservoir 36 with a passage 38 in the upper end of which a fuel discharge tube 40 is disposed. As air flow increases past the tube 40, fuel will be induced to flow through orifices 34 in a quantity determined by the position of the tapered ends 42 therewithin.

As thus far described, it is apparent that as air flow increases through induction passage 12, air valve 16 will be increasingly opened by diaphragm 20 causing metering rods 32 to increase fuel flow.

Arm 30 rotates about a shaft 44 in accordance with air valve actuation as already described. As the point of radial contact of metering rods with arm 30 is varied, so will the movement of the tapered ends 42 of the metering rod relative to metering orifices 34 be varied. This radial movement is utilized to provide variations in the fuel-air ratio to meet certain operating requirements of the engine. The means whereby the fuel-air ratio is thus varied will now be considered in greater detail.

As in the aforementioned copending application, temperature and manifold vacuum responsive means are provided for moving metering rods 32 radially relative to pivot axis 44 of arm 30. This radial movement of metering rods 32 is achieved by securing one end of a relatively stiff wire member 46 to the closed upper end of metering rods 32 with the other end of wire 46 being secured to a lever 48 fixed to shaft 50. The other end of shaft 50 has a bifurcated lever 52 secured thereto. Bifurcated lever 52 includes power and economy stops 54 and 56 respectively mounted on arms 58 and 60 thereof. A warm-up cam member 62 is disposed between arms 58 and 60 and is fixed to a shaft 64 which is adapted to be rotated by a coiled bimetal member 66. Thus with the engine cold, the cam is in the position shown in FIGURE 2 which causes lever 52, shaft 50, lever 48 and wire 46 to move the upper end of metering rods 32 radially away from pivot axis 44 of arm 30 whereby any rotation of the latter lever will occasion maximum fuel flow through metering orifices 34 for any particular position of air valve 16. As engine temperature warms, cam 62 is rotated in a counterclockwise direction which also imparts a similar rotation to lever 52 which in turn occasions a movement of the upper end of metering rods 32 toward pivot axis 44 of arm 30 to thereby decrease or lean out the fuel-air ratio.

Bifurcated lever 52 is also articulated through a link 68 to a vacuum piston 70 which is suitably connected with a source of manifold vacuum which tends to urge the lever in a counterclockwise direction against the force of a

spring 72. Thus, under normal operating conditions, manifold vacuum will rotate bifurcated lever 52 until the economy stop 56 is brought into engagement with cam 62. Under these conditions, maximum fuel economy is realized. On the other hand, under conditions of high power demand, the manifold vacuum acting on vacuum piston 70 will decrease sufficiently to permit spring 72 to move bifurcated lever 52 in a clockwise direction to bring power stop 54 into engagement with cam 62 which in turn increases the fuel-air ratio until the power demand is met.

The metering rod control arm of the aforementioned depending application was basically straight or flat and temperature controlled variations in the fuel flow between metering rods 32 and metering orifices 34 were determined solely by changes in the radial distance between the pivot point of the lever and the metering rod. This type of operation is, however, inadequate for cold starting and enrichment purposes, as seen by referring to curve (C) of FIGURE 3. Curve (C) indicates the extremely lean fuel-air ratios under low air flow conditions with the previous flat or straight metering control lever. This is to be compared with the rich fuel-air ratios during cold start and running represented by curves (A) and (B), infra.

Accordingly, the metering rod control lever 30 has been modified to provide a contoured or inclined end portion 74 and inclined starting lever 75 also added. Lever 75 and inclined portion 74 are operative solely under cold starting and warm-up conditions to increase fuel flow through the extended retraction of the tapered ends 42 of metering rods 32 from metering orifices 34.

Starting lever 75 is supported upon shaft 44 and retained against movement by an arm 79 projecting upwardly from the lever through an opening in the carburetor cover casing.

Referring to FIGURE 5, metering rods 32 are shown in various operative positions. In this representation, numerals "E" and "P" refer to the "economy" or "power" positions of bifurcated lever 52. When the engine is cold, bimetal 66 will have moved the metering rods to the "cold" position, FIGURE 5, in which the rods will have been moved up inclined portion 77 of starting lever 75 to retract tapered ends 42 from metering orifices 34 to maximize fuel flow for any particular angular position of air valve 16. Thereafter as the engine warms, rods 32 will progressively move down inclined arm portion 77 following fuel-air ratio curve (A) of FIGURE 3.

While starting lever 75 considerably improves cold starting and running operation, the fuel-air ratio proves to be slightly lean as the engine continues to warm up. To cover this period of operation, indicated between approximately 2 and 14 lb./min., inclined portion 74 of lever 30 is provided and duly picks up metering rods 32 whereby the fuel-air ratio now follows curve (B).

As the engine becomes fully warmed, metering rods 32 are moved to the flat portion 76 of lever 30 and the fuel-air ratio follows either power or economy curves (D) or (E).

Thus with the engine cold and the metering rods on inclined arm portion 74, any radial movement of the rods under the influence of bimetal 66 will also be accompanied by limited circumferential movement. On the other hand, after bimetal 66 has moved the metering rods to the flat portion 76 of arm 30, indicative of a warm engine, only radial movement of the rods between the "E" and "P" positions will occur and this solely under the influence of vacuum piston 70 to provide economy or power fuel flow.

Thus, in the preferred embodiment of the invention, the fuel-air ratio "curve" is tailored to engine needs by providing inclined starting lever 75 and contoured or inclined portion 74 of lever 30. It is to be understood, however, that other variations of the basic "inclining-lever" concept are possible. For instance, it would be possible to incline starting lever 75 in such a way as

to approximate the desired fuel-air ratio represented by curves (A) and (B). In this event, it would be unnecessary to incline metering arm 30.

I claim:

1. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve rotatably mounted in said induction passage, an air valve rotatably mounted in said induction passage anteriorly of said throttle valve, a pressure responsive device operatively connected to and adapted to control the position of said air valve in accordance with the pressure drop across the air valve, a source of fuel, conduit means communicating said fuel source with said induction passage intermediate said air and throttle valves, a metering orifice in said conduit means, a metering rod adapted to coact with said metering orifice to control the quantity of fuel flow therethrough, said metering rod being adjustably connected to said pressure responsive device whereby fuel flow through the metering orifice is proportional to the degree of opening of said air valve, means for varying the adjustable connection between the metering rod and said pressure responsive device to vary the fuel flow rate through said metering orifice in accordance with certain engine operating conditions, said varying means including an arm non-rotatably fixed upon a support axis and adapted to support said metering rod, said arm including a first portion extending radially from said axis and a second portion upwardly inclined from said first portion and engageable by the metering rods, and an arm rotatably mounted on said axis and operatively connected to said air valve, said rotatable arm being adapted to engage the metering rod to vary fuel flow through the metering orifice.

2. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve rotatably mounted in said induction passage, an air valve rotatably mounted in said induction passage anteriorly of said throttle valve, a pressure responsive device operatively connected to and adapted to control the position of said air valve in accordance with the pressure drop across the air valve, a source of fuel, conduit means communicating said fuel source with said induction passage intermediate said air and throttle valves, a metering orifice in said conduit means, a metering rod adapted to coact with said metering orifice to control the quantity of fuel flow therethrough, said metering rod being adjustably connected to said pressure responsive device whereby fuel flow through the metering orifice is proportional to the degree of opening of said air valve, means for varying the adjustable connection between the metering rod and said pressure responsive device to vary the fuel flow rate through said metering orifice in accordance with certain engine operating conditions, said varying means including an arm pivotal about an axis and adapted to support said metering rod, said arm including a first portion proximate said axis and supporting the metering rod in radial alignment with said axis, and a second portion upwardly inclined and extending from said first portion, and a second arm fixed relative to said axis, said second arm including a portion inclined to a greater extent than the inclined portion of the pivotal arm whereby the greater inclined portion will be engaged first by the metering rod when the engine is cold.

3. A charge forming device for an internal combustion engine comprising an induction passage, a throttle valve rotatably mounted in said induction passage, an air valve rotatably mounted in said induction passage anteriorly of said throttle valve, a pressure responsive device operatively connected to and adapted to control the position of said air valve in accordance with the pressure drop across the air valve, a source of fuel, conduit means communicating said fuel source with said induction passage intermediate said air and throttle valves, a metering orifice in said conduit means, a metering rod adapted to coact with said metering orifice to control the quantity of fuel flow

5

therethrough, said metering rod being adjustably connected to said pressure responsive device whereby fuel flow through the metering orifice is proportional to the degree of opening of said air valve, means for varying the adjustable connection between the metering rod and said pressure responsive device to vary the fuel flow rate through said metering orifice in accordance with certain engine operating conditions, said varying means including an arm pivotal about an axis and adapted to support said metering rod, said arm including a first portion supporting the metering rod in radial alignment with said axis, a second portion upwardly inclined from said first portion, and engine temperature responsive means for moving said

5

10

6

metering rod from said first to said second arm portion as engine temperature decreases, and a second arm fixed relative to said axis, said second arm including a portion inclined to a greater extent than the inclined portion of the pivotal arm whereby the greater inclined portion will be engaged first by the metering rod when the engine is cold.

References Cited in the file of this patent

UNITED STATES PATENTS

2,540,607	Boyce	Feb. 6, 1951
2,710,604	Snyder	June 14, 1955
2,715,522	Carlson et al.	Aug. 16, 1955
2,942,596	Carlson	June 28, 1960