Feb. 14, 1967 C. C. HEBERT 3,304,067

ENGINE CHARGE FORMING DEVICE HAVING A THERMOSTATICALLY CONTROLLED ACCELERATING PUMP

Filed Feb. 28, 1966 4 Sheets-Sheet 1

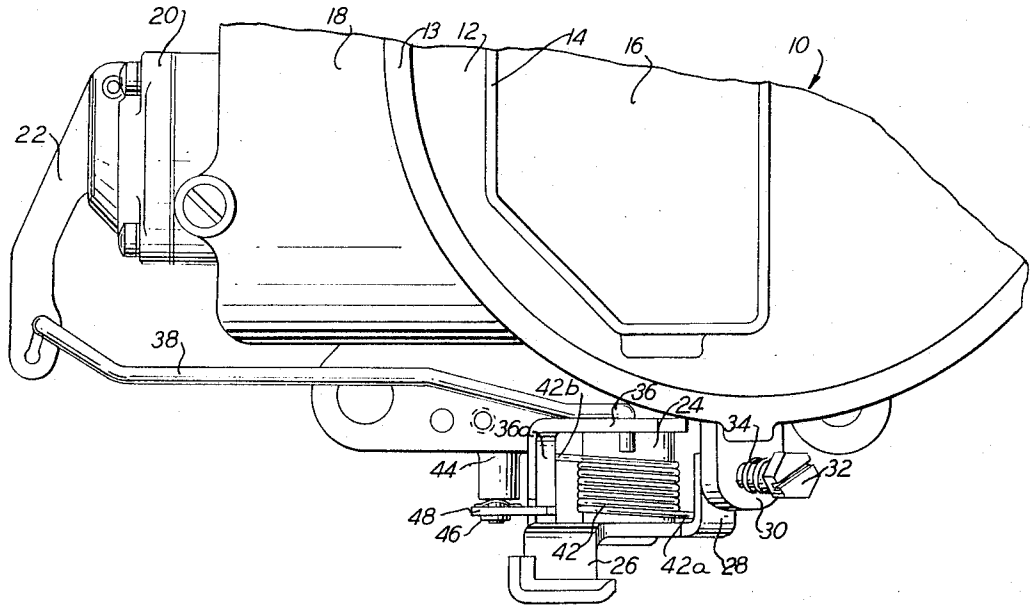


FIG. 1

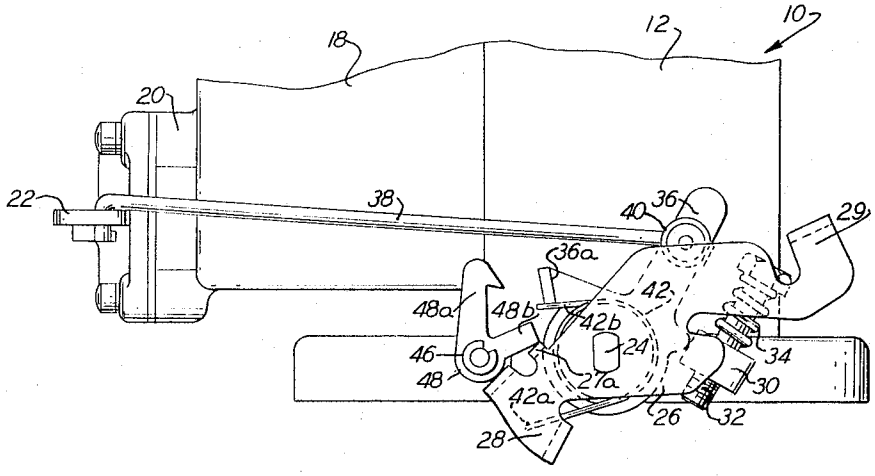


FIG. 2

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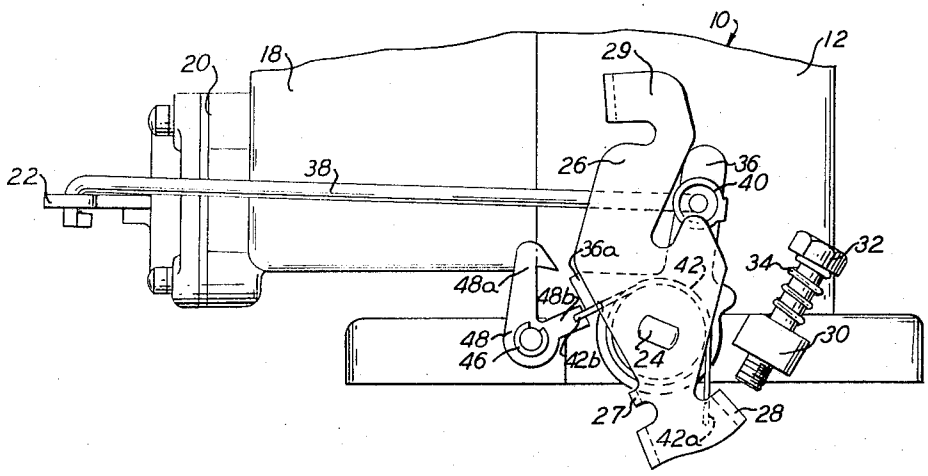


FIG. 3

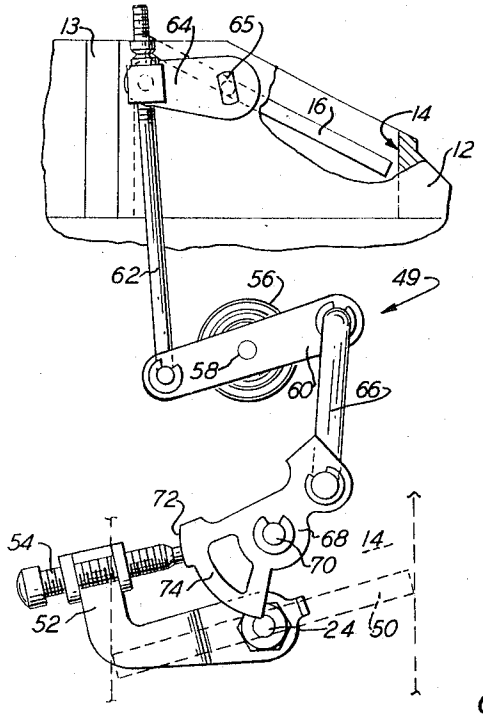


FIG. 4

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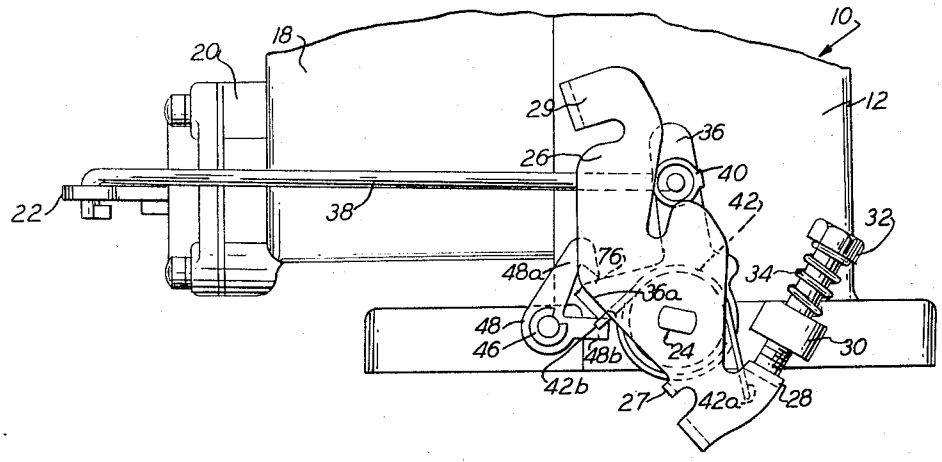


FIG.6

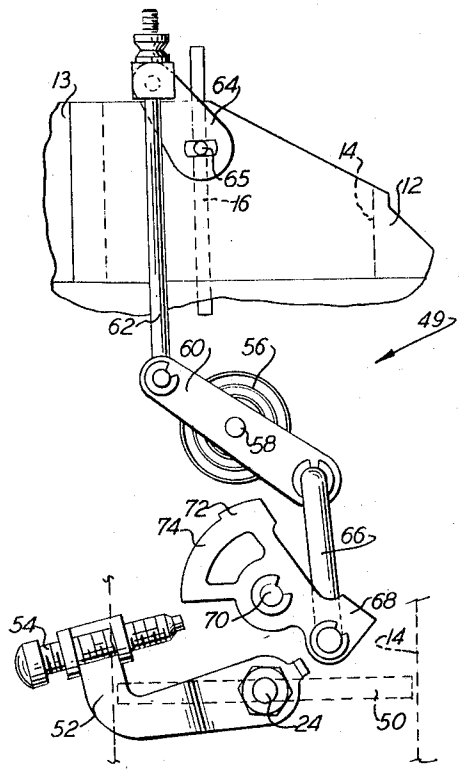


FIG.7

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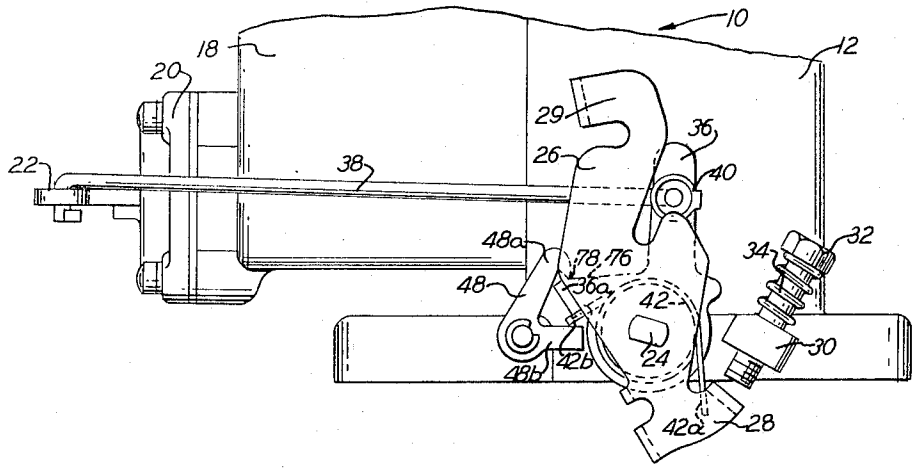


FIG.8

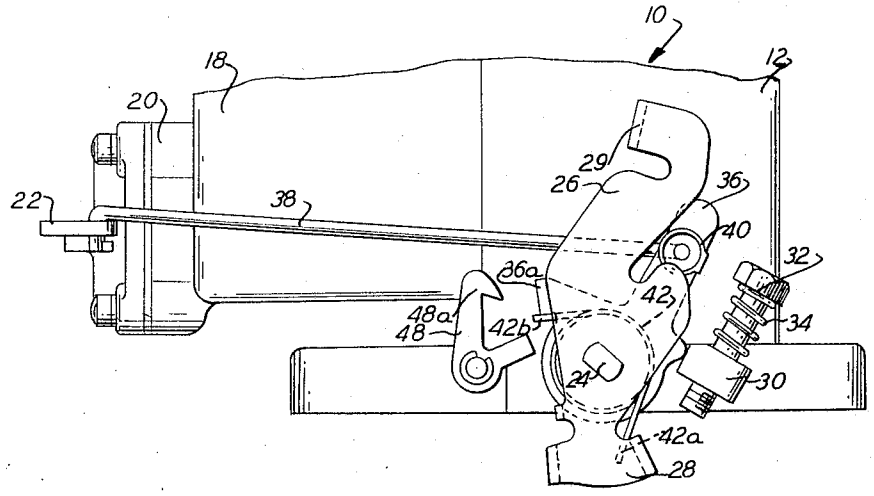


FIG.5

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ENGINE CHARGE FORMING DEVICE HAVING A THERMOSTATICALLY CONTROLLED ACCELERATING PUMP

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Filed Feb. 28, 1966, Ser. No. 530,288
9 Claims. (Cl. 261—34)

This invention relates to a charge forming device for an internal combustion engine including a temperature compensated accelerating pump.

The function of an accelerating pump, to inject a small amount of liquid fuel into the induction passage of a charge forming device during rapid opening of its throttle valve, is well known. It is equally well known that the required amount of fuel discharge of an accelerating pump is considerably less at high engine temperatures than at low engine temperatures. For example, a common requirement for accelerating pump operation is that two and one-half cubic centimeters of fuel be discharged during rapid opening of the throttle valve when the engine is cold, and that one cubic centimeter of fuel be discharged upon rapid opening of the throttle valve when the engine has reached its normal operating temperature. For this reason, it has been proposed to vary the output of an accelerating pump either seasonally through a mechanical adjustment or automatically in response to temperature variations.

The automatic mechanisms heretofore provided have required some form of temperature responsive element for their operation. It has been common practice to provide a separate temperature responsive element that acts only on the accelerating pump in conjunction with some form of control link shortening device. Although such accelerating pump control systems presently function in a satisfactory manner, their use gives rise to increased costs and attendant maintenance requirements.

It is, therefore an object of this invention to provide a temperature compensated accelerating pump that does not necessitate the provision of a separate, thermally responsive element and/or link shortening arrangement.

A further object of this invention is to provide a temperature compensated accelerating pump utilizing the thermally responsive element of the choke mechanism to achieve proper temperature compensation.

A charge forming device incorporating this invention includes a main body having a longitudinal passage extending therethrough and a throttle valve plate and choke valve plate positioned in said passage for controlling the flow of fuel mixture and the flow of air respectively. Accelerating pump means having a pump member operatively connected to the throttle valve delivers a metered charge of fuel to the induction passage upon a predetermined degree of opening of the throttle valve. This connection is accomplished by lever means mounted on the throttle valve shaft and rotatable relative thereto. Resilient means operatively connects said lever means and the throttle lever. Positive latch means, responsive to throttle movement, positively engage and partially impede movement of the lever means when the engine has reached normal operating temperature except when a full throttle condition occurs.

Further objects and advantages of this invention will become more apparent as this description proceeds, particularly when considered in conjunction with the accompanying drawings wherein:

FIGURE 1 is a top view of a portion of a charge forming device constructed in accordance with this invention;

FIGURE 2 is a side elevation view of the charge forming device of FIGURE 1 showing part orientation when the vehicle engine is cold and the throttle pedal is fully depressed;

FIGURE 3 is a view similar to FIGURE 2 showing part orientation when the engine temperature is cold and the charge forming device is at full choke and fast idle;

FIGURE 4 is a schematic illustration of the choke mechanism of the charge forming device of FIGURE 1 with the charge forming device operating conditions corresponding to those shown in FIGURE 3;

FIGURE 5 is a view similar to FIGURE 2 showing part orientation when the engine temperature is cold and the charge forming device is at partial throttle;

FIGURE 6 is a view similar to that of FIGURE 2 showing part orientation when the engine is in a fully warmed condition and the charge forming device is at idle;

FIGURE 7 is a view similar to FIGURE 4 but with engine and charge forming device operating conditions corresponding to those shown in FIGURE 6;

FIGURE 8 is a view similar to FIGURE 2 showing part orientation when the engine temperature corresponds to that illustrated in FIGURE 5 but with the charge forming device at partial throttle.

Referring now in detail to the drawings and in particular to FIGURES 1, 2, 3, 5, 6 and 8, the numeral **10** designates generally a charge forming device constructed in accordance with this invention. A main body **12** has formed therein a longitudinal induction passage **14**, the upper most portion of which is surrounded by air horn **13**. A choke valve plate **16** is positioned for partial rotation in induction passage **14**.

Main body **12** has an extension **18** upon which is mounted an accelerating pump **20**. Extension **18** has a conventional passage (not shown) communicating between the accelerating pump **20** and the induction passage **14** for the flow of fuel. The degree of movement of a pump actuating arm **22** controls the volume of fuel discharged from accelerating pump **20** to induction passage **14**.

A rotatable throttle shaft **24** extends through main body **12** and induction passage **14** below choke valve plate **16**. Throttle lever **26** is mounted for unitary rotation with throttle shaft **24** and includes a small projection **27** extending from one side thereof, projection **28** extending from the other side thereof and arm **29**. Arm **29** is joined by a suitable conventional linkage (not shown) to the throttle pedal of the motor vehicle.

A centrally drilled and tapped projection **30** extends from main body **12**. Throttle stop screw **32** is threaded through projection **30** and is partially surrounded by compression spring **34**. As is conventional, the throttle pedal linkage of the vehicle is biased so that projection **28** of throttle lever **26** rests against throttle stop screw **32** when the throttle pedal of the vehicle is not positively depressed.

Accelerating pump overtravel lever **36** is mounted for independent rotation on throttle shaft **24** interior of throttle lever **26**. Rod **38** connects overtravel lever **36** to the pump actuating lever **22**. Fastener **40** joins rod **38** to overtravel lever **36**. Spring **42** is mounted on shaft **24** between throttle lever **26** and overtravel lever **36**. End **42*b*** of spring **42** is hooked under projection **36*a*** of overtravel lever **36** and spring end **42*a*** is hooked under projection **28** of throttle lever **26**. Thus, spring **42** resiliently connects throttle lever **26** and overtravel lever **36** for unitary rotation when no impeding force acts to restrict rotation of overtravel lever **36**.

Projection **44** extends from main body **12** and mounts accelerating pump adjustment arm **48** by means of fas-

tener 46. Adjustment arm 48 has latch portion 48*a*, formed in the configuration of a hook, and a projection 48*b*. The orientation of adjustment arm 48 relative to shaft 24 is such that upon clockwise movement of shaft 24, projection 27, formed on throttle lever 26, will abut projection 48*b* of adjustment arm 48 and force adjustment arm 48 in a counterclockwise direction. Upon counterclockwise movement of shaft 24 as seen in FIGURE 3, projection 36*a* of overtravel lever 36 will contact projection 48*b* and force adjusting arm 48 in a clockwise direction. However, such counterclockwise movement of a sufficient magnitude to effect this movement of arm 48 will occur only when normal engine operating temperature has been reached as will be seen from the description of FIGURES 4 and 7 below. The significance of this arrangement as well as the operation of the parts described above will be discussed below.

Referring now in detail to FIGURES 4 and 7 there can be seen a conventional charge forming device choke mechanism 49. A choke mechanism such as this is well known in the art and is located on the opposite side of main body 12 from that shown in FIGURE 1. Throttle plate 50, shown in phantom, can be seen as mounted for rotation with shaft 24 which extends through main body 12 as described above. Also mounted on shaft 24 for unitary rotation therewith is fast idle adjusting lever 52 which carries fast idle stop screw 54.

Thermally responsive bimetallic element 56 is connected by means of shaft 58 to link 60 of the choke mechanism. Link 60 is connected to choke shaft 65 by means of rod 62 and link 64. Choke valve plate 16 rotates in unison with shaft 65 in induction passage 14. Link 60 is also connected by means of shaft 66 with the fast idle cam 68 that is pivotally mounted on shaft 70. Fast idle cam 68 has two cam portions 72 and 74 for a fast idle and an increased idle respectively. This composite linkage and the thermally responsive element 56 cooperate so that shaft 58 and, of course, choke valve plate 16 and fast idle cam 68 rotate clockwise in response to increasing temperatures and counterclockwise in response to decreasing temperatures.

As described above, the accelerator pedal of the vehicle is biased so that projection 28 of throttle lever 26 normally abuts throttle stop screw 32. Due to the fact that fast idle adjusting lever 52 and throttle lever 26 rotate in unison with shaft 24, this biasing force urges fast idle adjusting lever 52 in a clockwise direction so that the fast idle stop screw 54 will abut fast idle cam 68 if the latter is positioned in the path of movement of the former as seen in FIGURE 4. Thus, it may be seen that when this condition exists, lever 26 cannot return into abutment with throttle stop bolt 32 and projection 36*a* cannot rotate counterclockwise to a sufficient degree to contact arm 48*b* of adjustment arm 48. This condition is seen in FIGURE 3.

The operation of this device is as follows. Standard instructions to the operator of a vehicle having an internal combustion engine for starting the engine when cold include the provision of fully depressing the throttle pedal before cranking the engine. This full depression of the throttle pedal serves to rotate shaft 24 (clockwise as seen in FIGURE 2 and counterclockwise as seen in FIGURE 4) and fully open throttle valve plate 50. This rotation of shaft 24 causes fast idle adjusting lever 52 to rotate counterclockwise so that fast idle stop screw 54 moves away from fast idle cam 68. Thus unimpeded, fast idle cam 68 is motivated by element 56 so that portion 72 is in the path of motion of screw 54 (FIGURE 4). Also choke valve plate 16 is partially closed.

FIGURE 2 shows the elements of the device when the throttle pedal is fully depressed. Throttle lever 26 has been rotated clockwise to its fullest extent. Whenever such a rotation occurs, projection 27 of lever 26 abuts projection 48*b* of the accelerating pump adjustment arm 48 forcing it to rotate in a counterclockwise direction. Since latch portion 48*a* is thus moved away from overtravel lever 36, the overtravel lever 36 is free to rotate in unison with throttle lever 26 due to the force of spring 42. Connecting arm 28 is pulled by overtravel lever 36 to the right and a full stroke of pump 20 discharges the large required volume of fuel (i.e. 2½ cc.) into induction passage 14.

After the operator releases the accelerator pedal following this full depression (FIGURES 3 and 4), fast idle stop screw 54 abuts portion 72 of fast idle cam 68. Shaft 24 cannot rotate to its original position and throttle lever 26 does not return to abut bolt 32. Projection 36*a* thus does not contact projection 48*b* of adjustment arm 48 and overtravel lever 36 remains unlatched and free to rotate with shaft 24. Therefore, as long as the engine is cold, pump 20 will discharge a volume of fuel that varies with the throttle opening as is required.

However, as the engine reaches its normal fully warmed operating temperature, a condition illustrated in FIGURES 6 and 7, bimetallic element 56 causes fast idle cam 68 to rotate clockwise so that it is not contacted by screw 54. This allows the normal acceleration pedal bias to rotate throttle lever 26 so that projection 28 contacts screw stop 32 when the engine is idling. As throttle lever 26 and the other parts which rotate with shaft 24 return to this position, projection 36*a* of overtravel lever 36 contacts projection 48*b* of adjustment arm 48 and forces the adjustment arm to rotate in a clockwise direction, hooking latch 48*a* over overtravel lever 36.

Therefore, when the accelerator pedal is partially depressed after the engine has reached normal operating temperature, a condition shown in FIGURE 8, throttle lever 26 and shaft 24 will rotate clockwise as usual. However, the impeding force of latch portion 48*a* of adjustment arm 48 is sufficient to overcome strength of spring 42 and thus prevent rotation of overtravel lever 36 but for a small degree of rotation.

This limited movement of overtravel lever 36 even when latched may be seen by comparing FIGURES 6 and 8. In FIGURE 6, the lever 36 is latched and the throttle is at idle. Latch portion 48*a* of adjustment arm 48 contacts lever 36 at point 76. Upon a depression of the accelerator pedal, a condition shown in FIGURE 8, latch portion 48*a* slides along lever 36 to point 78 allowing limited rotation of lever 36 with shaft 24 due to the force of spring 42. This limited rotation of lever 36 allows a small discharge (i.e. 1 cc.) from pump 20, actuated by the correspondingly limited movement of rod 38. When latch portion 48*a* reaches point 78, the configuration of lever 36 is such that a firm latching is achieved and further rotation of lever 36 is precluded.

However, if the vehicle operator desires the rapid acceleration achieved by a full depression of the accelerator pedal, the full rotation of throttle lever 24 will unlatch overtravel lever 36 as described above, allowing a full stroke pump discharge to aid acceleration. But when the operator releases the accelerator pedal and allows the engine to idle, overtravel lever 36 will immediately become re-latched since the engine is warm and shaft 24 is not prevented by choke mechanism 49 from returning to the position where projection 28 of throttle lever 26 abuts bolt 32. This latched condition will remain until the cycle is begun anew by the operator by fully depressing the accelerator pedal.

It is to be understood that this invention is not limited to the exact construction shown and described, but that various changes and modifications may be made without departing from the spirit and scope of the invention as defined by the appended claims.

1. A charge forming device for an internal combustion engine including a main body having a longitudinal passage extending therethrough, a rotatable shaft mounting a throttle valve plate in said passage, and a variable stroke pump for forcing fuel into said passage, the improvement comprising a throttle lever mounted on said shaft for unitary rotation therewith between a closed and a fully

opened position, said throttle lever being resiliently biased towards the closed position, lever means mounted on said shaft and rotatable relative thereto, said lever means operatively connected to said pump to contral the stroke of said pump, resilient means yieldably connecting said throttle lever for rotation with said lever means, latch means movable for engagement and disengagement with said lever means, latching means forcing said latch means into engagement with said lever means when said throttle lever approaches the closed position, unlatching means forcing said latch means out of engagement with said lever means when said throttle lever approaches the fully opened position, and choke means preventing said throttle lever from approaching the closed position when the engine is cold.

2. The device according to claim 1, wherein said latch means includes a projection located in the path of movement of said unlatching means when said latch means is in engagement with said lever means and in the path of said latching means when said latch means is out of engagement with said lever means.

3. The device according to claim 2, wherein said unlatching means comprises a projection on said throttle lever.

4. The device according to claim 2, wherein said choke means includes a fast idle cam, a stop screw mounted for unitary rotation with said shaft, and temperature sensitive means forcing said fast idle cam into the path of movement of said stop screw when the engine is cold.

5. The device according to claim 2, wherein said latching means comprises a projection on said lever means.

6. The device according to claim 5, wherein said unlatching means comprises a projection on said throttle lever.

7. The device according to claim 6, wherein said choke means includes a fast idle cam, a stop screw mounted for unitary rotation with said shaft, and temperature sensitive means forcing said fast idle cam into the path of movement of said stop screw when the engine is cold.

8. A charge forming device for an internal combustion

engine including a main body having a longitudinal pasage extending therethrough; a rotatable shaft mounting a throttle valve plate in said passage; a variable stroke pump for forcing fuel into said passage; a throttle lever mounted on said shaft for unitary rotation therewith between a closed and a fully opened position, said throttle lever resiliently biased towards the closed position; a pump overtravel lever rotatably mounted on said shaft and joined for rotation with said throttle lever by a yieldable connection; said overtravel lever operatively connected to said pump and actuating said pump upon rotation of said overtravel lever with said throttle lever; a rotatable latch mounted on said main body and movable into engagement with said overtravel lever to substantially impede the rotation thereof; a projection on said throttle lever positioned to contact and force said latch out of engagement with said overtravel lever when said throttle lever approaches the fully opened position; and a projection formed on said overtravel lever and positioned to contact and force said latch into engagement with said overtravel lever when said throttle lever approaches the closed position.

9. The device of claim 8, further including a stop screw mounted on said shaft and rotatable therewith; a cam rotatable into and out of the path of movement of said stop screw; and a thermally responsive element operatively connected to said cam to rotate said cam into the path of movement of said stop screw when the engine is cold, thereby preventing said throttle lever from approaching the closed position.

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