

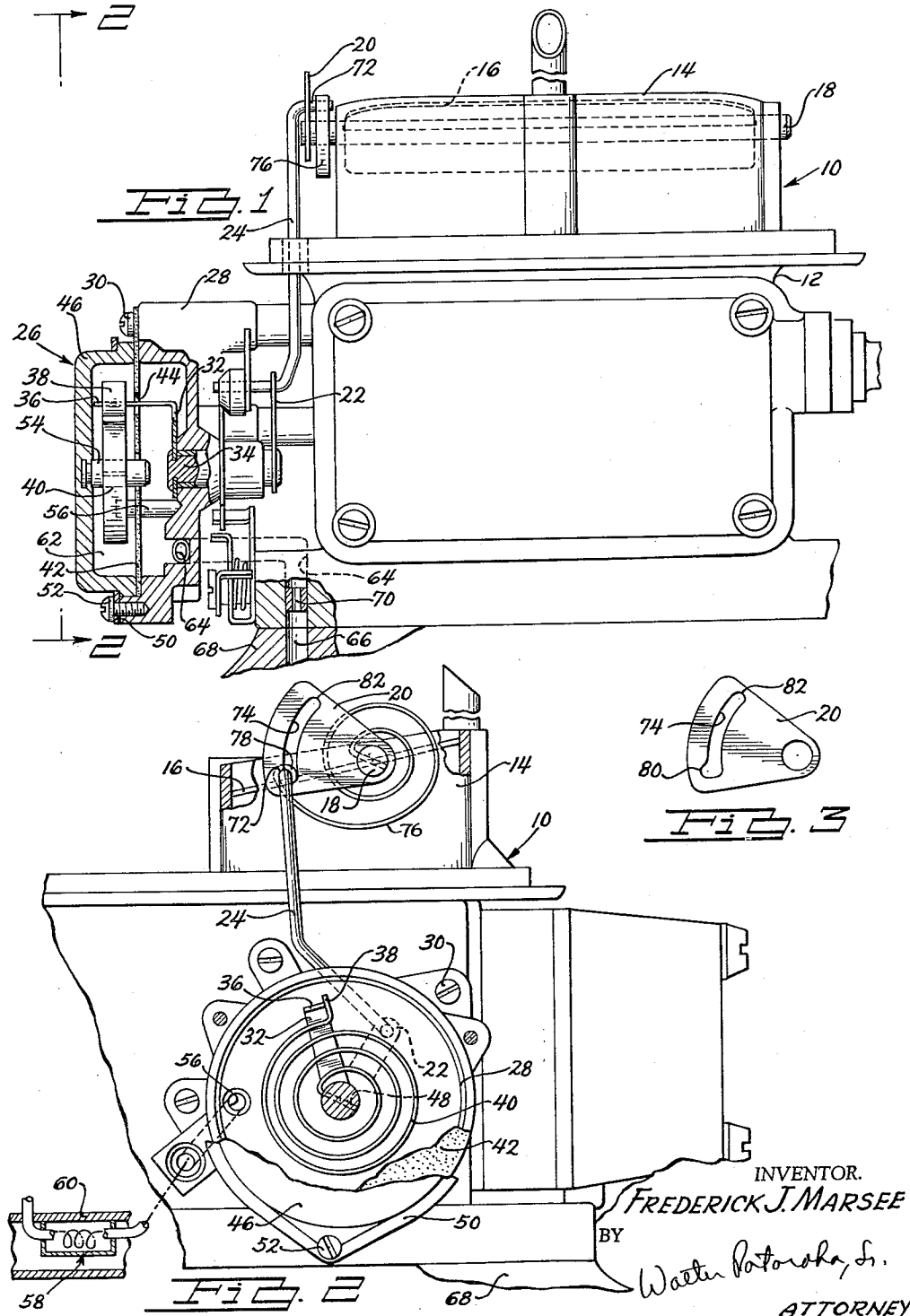
Aug. 29, 1961

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AUTOMATIC CHOKE

2,998,233

Filed Nov. 18, 1959

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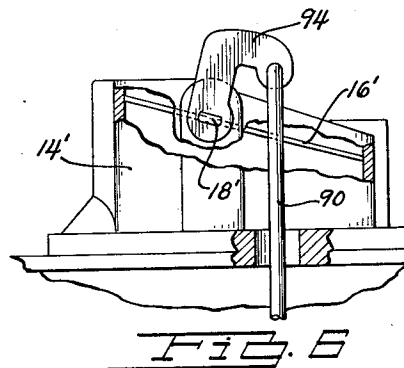
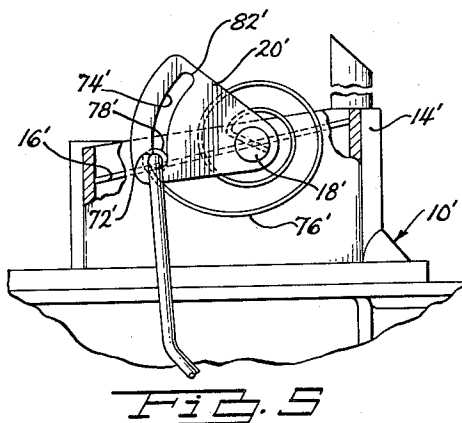
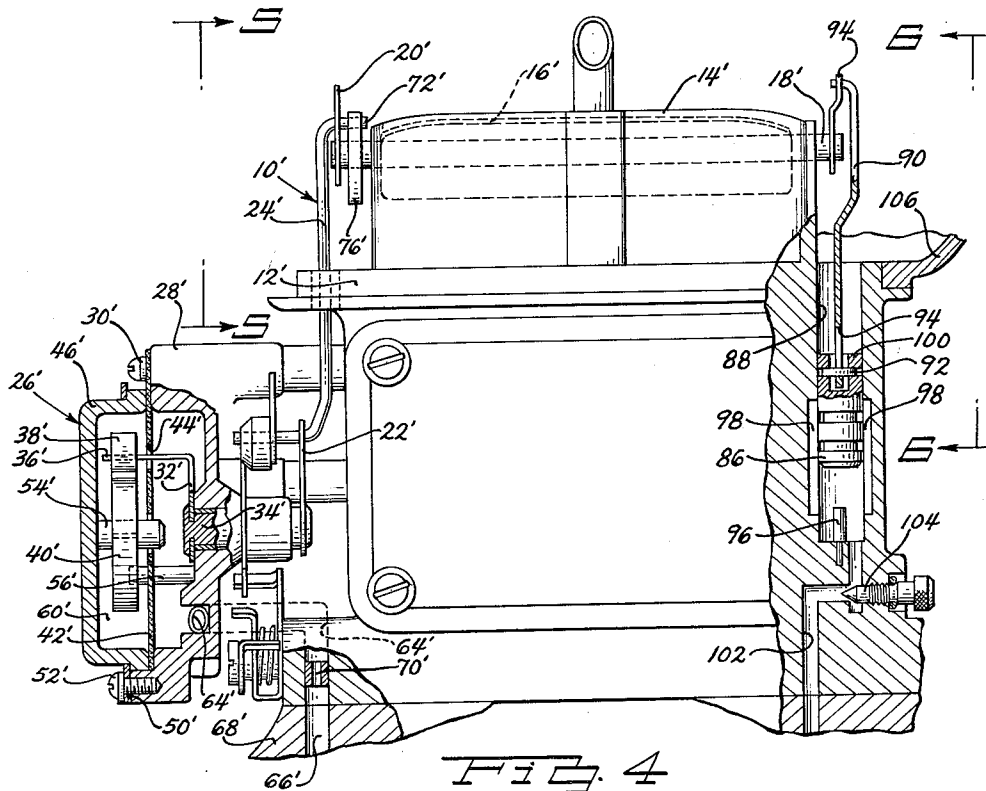
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Filed Nov. 18, 1959

2 Sheets-Sheet 2



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2,998,233

AUTOMATIC CHOKE

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Filed Nov. 18, 1959, Ser. No. 853,771

5 Claims. (Cl. 261—39)

This invention relates generally to internal combustion engines, and more particularly to means for controlling the starting and subsequent warm-up period thereof.

Most internal combustion engines and particularly those employed to drive motor vehicles are now equipped with a so-called automatic choke, the main purpose of which is to provide a relatively rich fuel-air mixture for the engine on cold starting and until the engine has reached normal operating temperature.

In all such automatic chokes, it is conventional practice to provide a thermostatic element connected directly to the choke valve in a manner so as to offer resistance to any choke opening movement in accordance with engine temperature. A problem which arises with this construction is that if the thermostatic element is made sufficiently strong so as to maintain the choke valve fully closed during cold engine cranking then it usually provides too great a force during cold idle conditions, resulting in an overly rich fuel-air mixture.

This problem has been alleviated to some extent by the addition of a vacuum responsive piston which tends to open the choke valve to some predetermined degree immediately after the engine is cranked and becomes self-sustaining. However, as a practical matter the vacuum piston has not overcome the basic difficulty since in many cases the piston is unable to adequately overcome the force of the thermostatic element, especially when the ambient temperatures vary so as to increase the closing force of the thermostatic element far beyond that for which the piston was designed.

Accordingly, it is a general object of this invention to provide means whereby the choke valve can be adequately closed by the thermostatic element during cranking and yet open a predetermined amount as soon as the engine fires without having to work against the full force of the thermostatic element.

It is a further object of this invention to provide such means which is capable of achieving the above general objective either in an automatic choke having only a thermostatic element therein or an automatic choke having both a thermostatic element and a cooperating pressure responsive device, such as the conventional vacuum piston.

Other objects and advantages will become apparent when reference is made to the following detailed description and the accompanying drawings wherein:

FIGURE 1 is a front elevational view, with portions thereof cut away and in cross-section, illustrating a carburetor having an automatic choke embodying the invention.

FIGURE 2 is a fragmentary side elevational view, with portions thereof cut away and in cross-section, taken on the plane of line 2—2 of FIGURE 1 and looking in the direction of the arrows.

FIGURE 3 is a view illustrating in greater detail, an element of the invention.

FIGURE 4 is a front elevational view, with portions thereof cut away and in cross-section, illustrating a carburetor having an automatic choke embodying a modification of the invention.

FIGURE 5 is a fragmentary side elevational view, with portions thereof broken away and in cross-section, taken on the plane of line 5—5 of FIGURE 4 and looking in the direction of the arrows.

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FIGURE 6 is a fragmentary side elevational view, with portions thereof broken away and in cross-section, taken on the plane of line 6—6 of FIGURE 4 and looking in the direction of the arrows.

Referring to the drawings in greater detail, FIGURE 1 illustrates a carburetor 10 having a throttle body 12 and an air intake 14 with induction passages therethrough adapted to be controlled by a choke valve 16 pivotally mounted on shaft 18. The choke valve 16 is operatively connected to the automatic choke control 26 by means of levers 20 and 22 and link 24.

A housing 28, suitably secured to the carburetor 10 by any suitable means such as screws 30, contains a choke lever 32. A shaft 34, extending through and rotatable in one wall of the housing 28, has secured to it at one end thereof the choke lever 32, and at the other end thereof a lever 22. The choke lever 32 has an outwardly extending projection 36 which is adapted to coact with the free outer end 38 of thermostatic element 40 through an arcuate opening 44 in the housing cover plate 42.

The thermostatic housing 46 has a centrally located shaft 54 rigidly secured therein to which the inner end of the thermostatic element is secured, as by means of a slotted portion 48. Any suitable means such as a clamping ring 50 may be employed to hold the cover plate 42 and housing 46 in alignment with and against the housing 28. Screws 52 may of course be provided for such purpose.

A conduit 56 communicating with a source of heated atmospheric air, as by the provision of a stove 58 included within the engine exhaust manifold 60, directs heated air to chamber 62 formed by cover housing 46 and cover plate 42. A second conduit 64, communicating with a source of engine vacuum by means of a conduit 66 formed within the engine intake manifold 68, serves to draw the heated air from chamber 62, through the arcuate slot 44 and into the engine induction system. A restriction 70 may be included within conduit 64 in order to regulate the flow rate of the heated air through the choke control mechanism 26.

FIGURE 3 illustrates in detail the lever 20 which is adapted to be rigidly secured to the choke shaft 18, in any suitable manner, and to rotate therewith. A slot 74 of generally arcuate shape is formed within the lever 20 and is adapted to slideably receive the transversely projecting end portion 72 of linkage 24. Suitable means such as a conventional clip (not shown) may of course be provided in cooperation with portion 72 to prevent the accidental disengagement of the portion 72 with slot 74 of lever 20. A torsion spring 76 wound about and secured at one end to the choke shaft 18 has its other end 78 formed so as to be in continual engagement with the end portion 72 of linkage 24.

The normal force of the spring 76 tends to hold end portion 72 at one end of and against the outer surface of the slot 74. Accordingly, a detent like cam portion 80, formed at this same end of the slot 74 receives the end portion 72 and thereby increases the force necessary to create relative motion between lever 20 and portion 72 over the nominal force of spring 76.

Operation

The purpose and operation of the stove 58, and conduits 56, 64 and 66 are well known in the art and a detailed discussion beyond that already supplied is not deemed necessary.

For purposes of discussion, let it be assumed that the engine is cold and is being cranked. At this time, all of the elements as illustrated in FIGURES 1 and 2 will assume the respective positions illustrated. The force of spring 76 now tends to keep portion 72 at the bottom of slot 74 and to the left against the cam portion 80.

Since linkage 24 cannot move downwardly because of the restraining effect of thermostatic element 40, the end result is that the choke valve 16 is moved upwardly to closed position.

As the engine is cranked, a pressure is created, due to engine cranking vacuum, on the choke valve 16 tending to rotate it counterclockwise along with its pivotal support, shaft 18. However, because of the fact that spring 76 is urging portion 72 against cam 80, the closing force on the choke valve is sufficient to overcome the engine cranking vacuum tending to open the choke valve.

As soon as the engine fires and becomes self-sustaining, the pressure drop across the choke valve is increased because of the substantial increase in engine vacuum. This increase in choke opening force then becomes sufficient to dislodge portion 72 out of cam 80 and force it against the biasing force of spring 76 into the uniform portion of arcuate slot 74.

Additionally, the spring 76 is designed so as to be unable to keep portion 72 from coming into contact with end 82 of slot 74 whenever the portion 72 is forced out of cam 80 and the engine is running. As a result of this, once the engine is started, portion 72 will slide along slot 74 until the end 82 abuts against the portion 72. From this, it is apparent that as soon as the engine is started, the choke valve 16 will be moved a predetermined degree towards open position.

Once this is accomplished, the thermostat 40 continues to control the subsequent positions of the choke valve 16 in accordance with engine temperature by the flow of heated air through the conduits 56 and 64 and chamber 62. As the temperature of element 40 increases, end 38 will move clockwise allowing lever 32 to follow it thereby further opening the choke valve 16.

It should be mentioned that if for any reason the engine should be stopped, the spring 76 does have sufficient force to move the choke plate in the choke closing direction until portion 72 once more engages cam portion 80.

FIGURE 4 illustrates another embodiment of the invention wherein the choke valve is initially controlled conjunctively by a vacuum responsive piston and a thermostatic element. In referring to FIGURE 4 in greater detail, all elements which are alike or similar to those of FIGURES 1, 2 and 3 are identified with corresponding primed reference numerals and as such will not be discussed in any detail.

The embodiment of FIGURE 4 has, in addition to lever 20' connected to one end of its choke shaft 18', a second lever 84 rigidly secured to the other end of the choke shaft. The lever 84 is in turn operatively connected to a vacuum responsive piston 86, located in cylinder 88, as by means of a linkage 90. The linkage 90 may be secured to the vacuum piston 86 by any suitable means such as a pin 92; additionally a slotted portion 94 may be provided within the linkage 90 so as to permit continued movement of the choke valve 16' after the movement of the vacuum piston 86 has been arrested, if such be the case, by a stop member 96.

Slots 98 may be formed in the walls of cylinder 88 so as to effectively diminish the force of the vacuum on the piston 86 after the end 100 is drawn down past the edge of the slots. This, in effect, establishes the degree of initial choke opening due to engine vacuum. The slots are not absolutely necessary and are illustrated only as one possible construction of the vacuum piston assembly. Various combinations are possible; that is, one construction could be completely devoid of slots, another could have no slots but provide a positive stop such as illustrated at 96, while a third could use both the slots and a positive stop member. The precise construction in any event would be based on the particular characteristics of both the carburetor and the engine on which it is to be used.

Conduit 102, having a restriction 104 therein, com-

municates between a source of engine vacuum and the lower end of the cylinder 88. The restriction 104, although illustrated as being an adjustable one, may alternatively be a fixed one inserted into the conduit 102.

It should also be noted that it is not necessary to vent the other end of cylinder 88 to the inside of the air cleaner 106; it may instead be vented, if desired, to the atmosphere. This consideration again becomes a matter of design.

In view of the discussion as presented with regard to FIGURES 1, 2 and 3, the operation of the embodiment as disclosed in FIGURES 4, 5 and 6 becomes apparent. That is, as soon as the engine fires and becomes self-sustaining, manifold vacuum is communicated to the bottom of piston 86 by means of conduit 102 causing the piston 86 to move downwardly and thereby rotate lever 94 and choke valve 16' in the opening direction by means of choke shaft 18'. Because of the provision of spring 76' and lever 20', it is now possible to open the choke valve 16' its desired predetermined amount, regardless of the opposing force of the thermostatic element 40', even under conditions of severely cold ambient temperatures. It is of course apparent that with an embodiment such as that disclosed in FIGURES 4-6, it is not necessary that an unbalanced choke valve be employed, since the vacuum piston 86 is capable of providing the necessary choke opening force independently.

Although but two embodiments of the invention have been disclosed and described, it is evident that other modifications are possible within the scope of the appended claims.

What I claim as my invention is:

1. In a carburetor for an internal combustion engine, a choke valve, thermostatic means responsive to an indicium of engine temperature for controlling the position of said choke valve, linkage means operatively connected at its opposite ends to said thermostatic means and said choke valve, and spring biased lost motion connecting means interposed between one end of said linkage means and said choke valve for allowing a predetermined maximum choke opening movement as soon as the engine is started, regardless of the magnitude of the choke closing force exerted by said thermostatic means.

2. In a carburetor for an internal combustion engine, a choke valve, a choke shaft secured to and rotatable with said choke valve, thermostatic means responsive to an indicium of engine temperature for controlling the position of said choke valve, linkage means operatively connected at its opposite ends to said thermostatic means and said choke shaft, and spring biased lost motion connecting means interposed between one end of said linkage means and said choke shaft for allowing a predetermined maximum choke movement as soon as the engine is started, regardless of the magnitude of the choke closing force exerted by said thermostatic means.

3. In a carburetor for an internal combustion engine, a choke valve, thermostatic means adapted to urge said choke valve in the closing direction when cold, a source of manifold suction, pressure responsive means communicating with said source of suction operatively connected to said choke valve so as to urge said choke valve in a direction opposite to that of said thermostatic means upon engine starting, and lost motion connecting means interposed between said thermostatic means and said choke valve so as to enable said pressure responsive means to move said choke valve in the opening direction without having to work against the full choke closing force of said thermostatic means.

4. In a carburetor for an internal combustion engine having a choke valve therein, an automatic choke control device comprising, a choke shaft secured to said valve, a first member having a slot formed therein secured to said shaft and adapted to be rotated therewith, a second member secured to said shaft and adapted to be rotated therewith, pressure responsive means, a source of vacuum, con-

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duit means communicating between said pressure responsive means and said source of vacuum, linkage means connecting said second member and said pressure responsive means, a housing, a second shaft mounted through one side of said housing and adapted to be rotated therein, an arm secured to one end of said second shaft externally of said housing so as to be rotatable therewith, second linkage means connecting said first member with said arm, said second linkage means being so formed so as to be slidably received within said slot formed within said first member, a second arm having a projection thereon secured to the other end of said second shaft within said housing and being adapted to rotate said second shaft, thermostatic means within said housing adapted to bias said projection in a direction so as to close said choke valve, means for directing a flow of engine heated air at substantially atmospheric pressure through said housing so as to cause said thermostatic means to react to changes in engine temperature, a cam portion formed within said slot, and resilient means operatively connected to said second linkage means so as to urge said second linkage means into engagement with said cam portion during periods of choke valve closure.

5. In a carburetor for an internal combustion engine having a choke valve therein, an automatic choke control device comprising, a choke shaft secured to said valve, a first member having a slot formed therein secured to said shaft and adapted to be rotated therewith, a second member secured to said shaft and adapted to be rotated therewith, a cylinder, a piston received within said cylinder,

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a source of vacuum, conduit means communicating between said cylinder and said source of vacuum, linkage means connecting said second member and said piston, a housing, a second shaft mounted through one side of said housing and adapted to be rotated therein, an arm secured to one end of said second shaft externally of said housing so as to be rotatable therewith, second linkage means connecting said first member with said arm, said second linkage means being so formed so as to be slidably received within said slot formed within said first member, a second arm having a projection thereon secured to the other end of said second shaft within said housing and being adapted to rotate said second shaft, thermostatic means within said housing adapted to bias said projection in a direction so as to close said choke valve, means for directing a flow of engine heated air at substantially atmospheric pressure through said housing so as to cause said thermostatic means to react to changes in engine temperature, a cam portion formed within said slot, and spring means mounted on and rotatable with said choke shaft operatively connected to said second linkage means so as to urge said second linkage means into engagement with said cam portion during periods of choke valve closure.

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