Dec. 15, 1959 G. M. HOLLEY, JR 2,917,294

AUTOMATIC CHOKE DEVICE

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FIG.1.

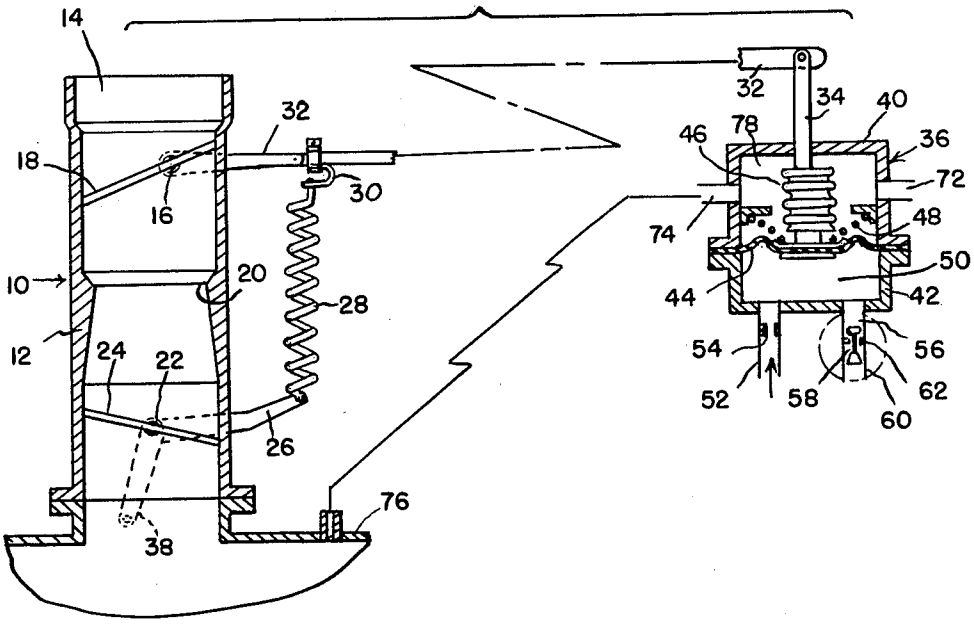


FIG.2.

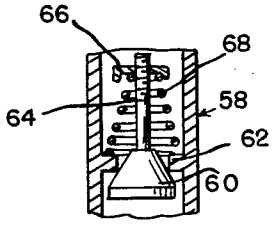
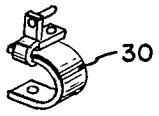


FIG.3.



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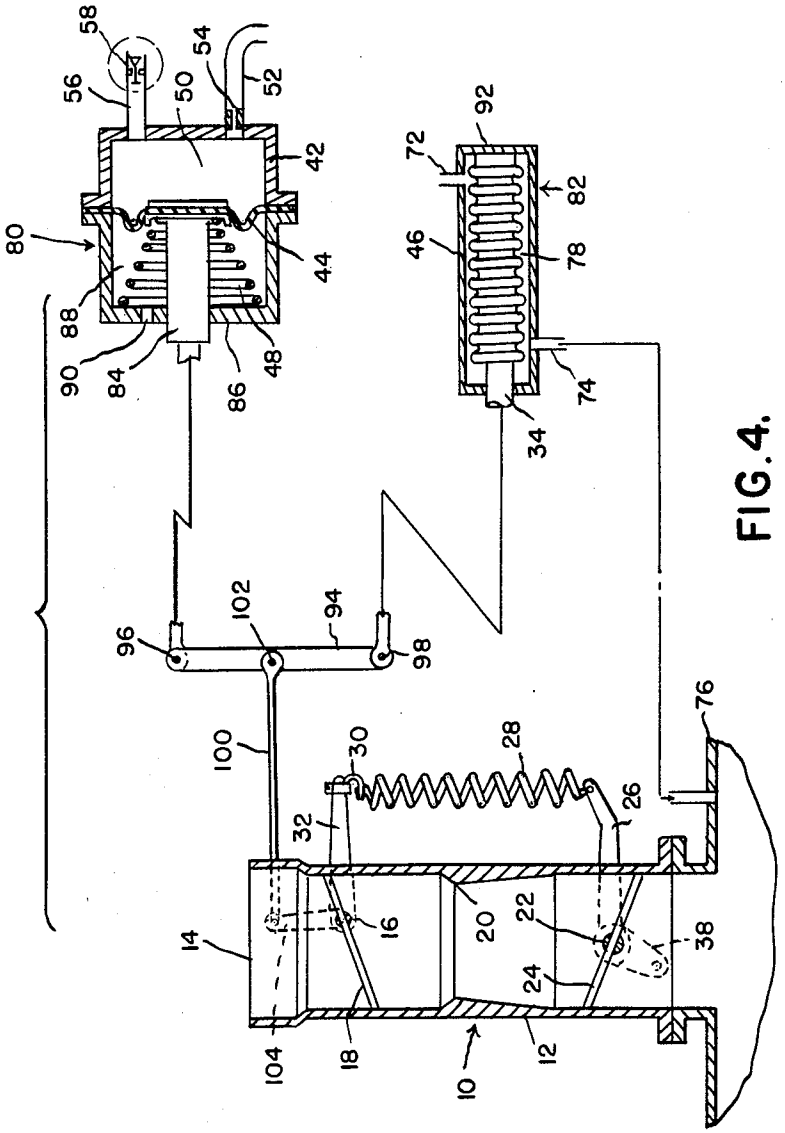


FIG. 4.

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AUTOMATIC CHOKE DEVICE

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9 Claims. (Cl. 261—39)

The present invention relates to improvements in automatic chokes for carburetors for internal combustion engines.

It is an object of the invention to provide an automatic choke device which provides a rich fuel mixture for the engine intake manifold during initial engine cranking, a less rich fuel-air ratio as the engine becomes self sustaining and runs in a comparatively cold condition, with a progressive opening of the choke as the temperature increases, and a fully open positioning of the choke when normal operating temperature is reached.

More specifically, it is an object to provide a choke device in which these progressive adjustments are accomplished by a mechanical biasing of the choke to a firmly closed position during cranking, by a partial opening of the choke, in response to a pressure change which is a function of engine speed or load, at the commencement of self-sustaining engine operation, and by a final adjustment of the choke to open position under the control of a thermostatic element responsive to engine temperature rise. This thermal adjustment may be coupled with the pressure responsive action in effect during initial engine operation.

In one embodiment of the invention, the control functions referred to are accomplished by a combined, dual acting temperature and pressure responsive control device or unit which has provision for the accurate adjustment of its control pressure; while in another embodiment the functions are performed by independent devices, one pressure sensitive and the other thermally sensitive, with an appropriate linkage coupling the same operatively with the carburetor choke.

In both of the adaptations, the control operations may be further assisted by the use of a thermally responsive bimetallic element whose function, once the engine operation is self sustaining, is to proportionately offset the tendency of the choke to close, under spring force applied thereto, a tendency which would, unless compensated for, undesirably enrich the fuel-air ratio as the throttle is opened.

The foregoing as well as other objects will become more apparent as this description proceeds, especially when considered in connection with the accompanying drawings illustrating preferred embodiments of the invention, wherein:

Fig. 1 is a fragmentary schematic view in vertical section through a carburetor and carburetor control structure in accordance with one embodiment of the invention;

Fig. 2 is a fragmentary view in enlarged vertical section through a pressure control valve associated with the combined, dual acting control device of this form of the invention;

Fig. 3 is a perspective view of a bimetallic element which may be associated with the control; and

Fig. 4 is a schematic view illustrating the application of the principle of the invention in another embodiment.

Referring to Figs. 1–3, a carburetor is schematically illustrated at 10, being comprised of a body 12 providing an air passage 14 in which a choke shaft 16 mounts a choke valve 18 above a venturi 20. A throttle shaft 22 has a throttle valve 24 secured thereon posterior to the venturi and choke valve. A lever 38 is rigidly connected to the throttle shaft and is part of a standard throttle control linkage.

A second lever 26 is rigidly connected to throttle shaft 22 and has the other end connected by a coiled tension spring 28 with a thermostatic bimetallic element 30, which in turn is secured to an intermediate point on an arm or lever 32 secured at one end to the choke shaft 16. Bimetallic element 30 is thermally sensitive to ambient temperature changes adjacent the engine to exert increased closing force on choke 18 at temperatures beneath a predetermined minimum. Lever 32 is an elongated one and its other end is connected to a vertically movable rod or stem 34 of a dual acting choke control device, generally designated 36.

The choke control 36 comprises a pair of cup shaped housings 40 and 42 between which a diaphragm 44 is rigidly clamped, and a temperature responsive bellows element 46 of known type is secured centrally to the diaphragm 44, being free to move with it. A conical compression spring 48 is placed about the bellows 46 and acts between the housing 40 and diaphragm 44 to bias the latter downward. Rod 34 is secured at its lower end to the temperature responsive bellows element 46 and at its upper end to carburetor arm or lever 32.

Lower housing part 42 and diaphragm 44 define a cavity 50 which is subjected to fluid pressure in an inlet conduit 52, which has a restriction 54 anterior to the cavity 50. Liquid pressure thus imposed on diaphragm 44, as from an engine driven pump handling a pressure liquid such as engine lubricating oil, a fuel pump, or the like, is a function of engine speed. An exit or return line 56 from cavity 50 has a pressure responsive flow valve 58 therein, comprised of a conical valve portion 60 which acts against a circular metering shoulder or seat 62 in the line 56. Valve 60 has a stem 64 provided with a spring retaining head 66, and a spring 68 acts between the shoulder 62 and head 66, causing the valve 60 to be biased upwards.

The upper housing part 40 has a warm air inlet 72 from a suitable heater device and an outlet 74, which communicates with the intake manifold 76 of the engine. Thus a chamber or cavity 78 above the diaphragm 44 is placed in the path of circulation of warm air induced by manifold vacuum. Such vacuum, being a function of engine load, may be employed in substitution for or in supplementation of the action of positive pressure in lower housing cavity 50.

In operation, as the engine is being cranked the throttle valve 24 is turned clockwise, causing the arm 26 to place the spring 28 and thermostatic element 30 in tension. This in turn causes the lever 32 to be biased clockwise, thereby keeping the choke valve 18 shut tightly against the interior wall of air passage 14 in this initial stage. Bimetallic element 30 determines the degree of force thus exerted on choke 18, and determines a proper fuel-air ratio as the engine warms up, as will be explained.

As the engine becomes self sustaining, engine oil is directed through conduit 52 to the cavity 50 of control 36; and the increase in oil pressure occasioned as the engine becomes self sustaining causes the diaphragm 44 to move upwards against the force of spring 48, thereby lifting the temperature responsive element 46 and rod 34. This in turn works against spring 28 and causes the choke valve 18 to rotate a certain degree in the counter-clockwise direction, thereby admitting more air and reducing the richness of the fuel-air ratio.

As the engine continues to run, the warm air obtained

from a typical heated part or stove is drawn into and through chamber 78 of control 36, thereby warming the temperature responsive element 46. As this element 46 becomes warmer, it causes the lever 32 to move a greater degree counter-clockwise. This in turn causes the choke valve 18 to open to a greater degree.

When the engine has reached its normal operating temperature, the diaphragm 44 will be in its furthermost upward position and the thermostatic bellows element 46 will also have reached one of its extreme expanded positions.

It should be noted that the control or relief valve 58 is used primarily to maintain the pressure in the chamber 59 at a desired value, and is therefore provided with means to adjust its spring compression.

Fig. 4 depicts a modification of the invention, in which elements corresponding to those in Fig. 1 are identified by like numerals. Instead of using a combined, dual acting control as that of Fig. 1, the embodiment of Fig. 4 has a separate pressure responsive device 80 and separate temperature responsive device 82.

The pressure device 80 is constructed like the control 36 of Fig. 1; however, the diaphragm 44 has a rod 84 connected directly to it instead of through an intermediate temperature responsive element. A spring 48 is placed about rod 84, acting between the housing part 86 and diaphragm 44 in such a manner as to bias the diaphragm to the right. The chamber 88 formed by diaphragm 44 and the housing part 86 is vented to atmosphere by means of port 90.

The temperature responsive device 82 comprises a housing 92 having a warm air inlet 72 and an outlet 74, and a temperature responsive bellows element 46 is fastened securely at one end to said housing. The other end of element 46 has a rod 34 secured to it. Rods 34 and 84 are connected to opposite ends of a yoke bar 94 at pivot points 96 and 98, and bar 94 is pivotally connected to a rod 100 at a point 102 between the two ends. Rod 100 is pivoted to an arm 104 secured on choke valve shaft 16.

The operation of this modification is similar to that of Fig. 1, and it should be noted that the spring 28 and bimetallic element 30 of Fig. 1, along with associated linkages, may also be used in the modification of Fig. 4.

An important function of the device is that of increasing the fuel-air ratio by means of lever 26, spring 28 and thermostatic element 30 as shown in Fig. 1. It will be seen that once the engine is self sustaining, and the throttle valve 24 is opened to some degree, the choke will tend to close because of the tension applied to spring 28 and bimetallic element 30. As the bimetallic element 30 becomes warm, this tendency to enrich the fuel-air ratio as the throttle is opened is proportionately decreased because of the expansion of the bimetal.

It should also be noted that the invention is not limited to the use of a hydraulic pressure fluid, such as oil, as a source of pressure for diaphragm 44. Any fluid, such as the fuel itself, may be used to deliver the required actuating force to the control diaphragm. If fuel is used, as from the conventional fuel pump system, it is then not necessary to use valve 58, because of the lower pressures in such system.

It should be further noted that the invention is not limited to the use of air as the medium for warming the thermostatic element 46. Any medium which is indicative of engine temperatures can be used, such as water from the cooling system. Moreover, as indicated above, in the event warm air is employed, the engine vacuum inducing its flow may be employed, as an agency responsive to engine operation, in effecting that part of the control operation involving the bodily shift of bellows element 46.

The drawing and the foregoing specification constitute a description of the improved automatic choke device in such full, clear, concise and exact terms as to

enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. An automatic choke device for an engine carburetor having choke and throttle valves controlling a fuel-air flow passage, comprising means connecting said valves to one another and acting to bias the former toward closing position, and a control structure operatively connected to said choke valve and acting to increasingly open the same as engine operation continues and engine temperature increases, comprising a pressure-responsive member subject to pressure change which is a function of engine operation and bodily movable in response to such change, a thermally responsive member individually movable in response to change in engine temperature, and means operatively connecting said thermally and pressure responsive members to said choke valve to open the same progressively in response to movements of said members as the operation of the engine progresses.

2. An automatic choke device for an engine carburetor having choke and throttle valves controlling a fuel-air flow passage, comprising means including a thermally responsive element responsive to engine ambient temperature connecting said valves to one another and acting to bias the former toward closing position when the latter is opened upon starting of the engine, and a control structure operatively connected to said choke valve and acting to increasingly open the same as engine operation continues and engine temperature increases, comprising a pressure-responsive member subject to pressure change which is a function of engine operation and bodily movable in response to such change, a thermally responsive member individually movable in response to change in engine temperature, and means operatively connecting said thermally and pressure responsive members to said choke valve to open the same progressively in response to movements of said members as the operation of the engine progresses following starting.

3. An automatic choke device for an engine carburetor having choke and throttle valves controlling a fuel-air flow passage, comprising means connecting said valves to one another and acting to bias the former toward closing position when the latter is opened upon starting of the engine, and a control structure operatively connected to said choke valve and acting to increasingly open the same as engine operation continues and engine temperature increases, comprising a pressure-responsive member subject to positive pressure change which is a function of engine operation and bodily movable in response to such change, a thermally responsive member individually movable in response to change in engine temperature, and means operatively connecting said thermally and pressure responsive members to said choke valve to open the same progressively in response to movements of said members as the operation of the engine progresses following starting.

4. An automatic choke device for an engine carburetor having choke and throttle valves controlling a fuel-air flow passage, comprising means connecting said valves to one another and acting to bias the former toward closing position when the latter is opened upon starting of the engine, and a control structure operatively connected to said choke valve and acting to increasingly open the same as engine operation continues and engine temperature increases, comprising a pressure-responsive member subject to positive pressure change which is a function of engine operation and bodily movable in response to such change, a thermally responsive member mounted on said pressure-responsive member for bodily movement therewith, said thermally responsive member being individually movable in response to change in engine temperaure, and means operatively connecting said thermally responsive member to said choke valve to open the same progressively in response to compounded move-

ments of said members as the operation of the engine progresses following starting.

5. An automatic choke device for an engine carburetor having choke and throttle valves controlling a fuel-air flow passage, comprising means connecting said valves to one another and acting to bias the former toward closing position when the latter is opened upon starting of the engine, and a control structure operatively connected to said choke valve and acting to increasingly open the same as engine operation continues and engine temperature increases, comprising a pressure-responsive member subject to positive pressure change which is a function of engine operation and bodily movable in response to such change, a separate thermally responsive member individually movable in response to change in engine temperature, and a linkage separately connecting said thermally responsive member and said pressure-responsive member, respectively, to said choke valve to open the same progressively in response to individual movements of said members as the operation of the engine progresses following starting.

6. An automatic choke device for an engine carburetor having choke and throttle valves controlling a fuel-air flow passage, comprising means including a thermally responsive element responsive to engine ambient temperature connecting said valves to one another and acting to bias the former toward closing position, and a control structure operatively connected to said choke valve and acting to increasingly open the same as engine operation continues and engine temperature increases, comprising a pressure-responsive member subject to pressure change which is a function of engine operation and bodily movable in response to such change, a thermally responsive member mounted on said pressure-responsive member for bodily movement therewith, said thermally responsive member being individually movable in response to change in engine temperature, and means operatively connecting said thermally responsive member to said choke valve to open the same progressively in response to compounded movements of said members as the operation of the engine progresses.

7. An automatic choke device for an engine carburetor having choke and throttle valves controlling a fuel-air flow passage, comprising means including a thermally responsive element responsive to engine ambient temperature connecting said valves to one another and acting to bias the former toward closing position, and a control structure operatively connected to said choke valve and acting to increasingly open the same as engine operation continues and engine temperature increases, comprising a pressure-responsive member subject to pressure change which is a function of engine operation and bodily movable in response to such change, a separate thermally responsive member individually movable in response to change in engine temperature, and a linkage separately connecting said thermally responsive member and said pressure-responsive member, respectively, to said choke valve to open the same progressively in response to individual movements of said members as the operation of the engine progresses.

8. An automatic choke device for an engine carburetor having choke and throttle valves controlling a fuel-air flow passage, comprising means connecting said valves to one another and acting to bias the former toward closing position, and a control structure operatively connected to said choke valve and acting to increasingly open the same as engine operation continues and engine temperature increases, comprising a pressure-responsive member subject to pressure change which is a function of engine operation and bodily movable in response to such change, means to control the pressure acting on said member, a thermally responsive member movable in response to change in engine temperature, and means operatively connecting said thermally and pressure responsive members to said choke valve to open the same progressively in response to movements of said members as the operation of the engine progresses.

9. An automatic choke device for an engine carburetor having choke and throttle valves controlling a fuel-air flow passage, comprising means including a thermally responsive element responsive to engine ambient temperature connecting said valves to one another and acting to bias the former toward closing position when the latter is opened upon starting of the engine, and a control structure operatively connected to said choke valve and acting to increasingly open the same as engine operation continues and engine temperature increases, comprising a pressure-responsive member subject to pressure change which is a function of engine operation and bodily movable in response to such change, means to control the pressure acting on said member, a thermally responsive member individually movable in response to change in engine temperature, and means operatively connecting said thermally and pressure responsive members to said choke valve to open the same progressively in response to movements of said members as the operation of the engine progresses following starting.

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