June 22, 1965 W. O. MANNING, JR., ETAL 3,190,274

CHOKE STOVE HEAT REGULATOR VALVE

Filed March 21, 1962 2 Sheets-Sheet 1

FIG. 1

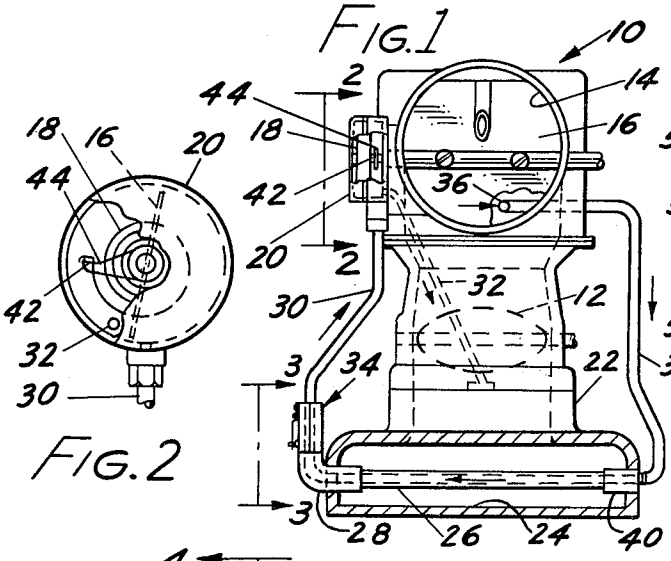


FIG. 2

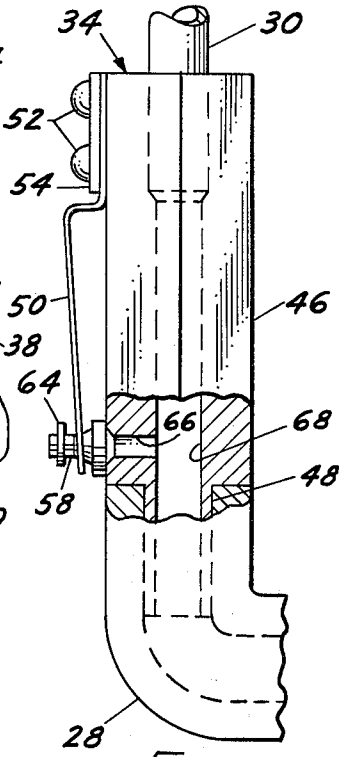


FIG. 5

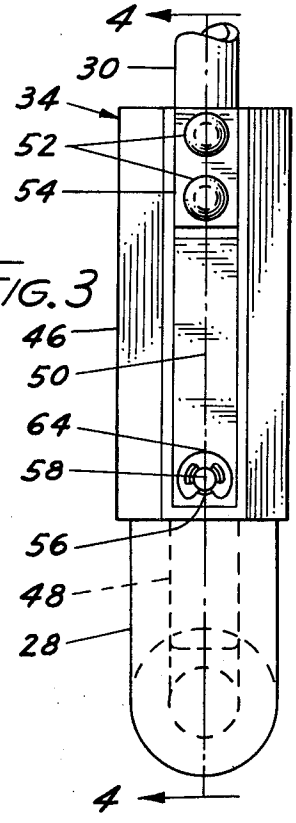


FIG. 3

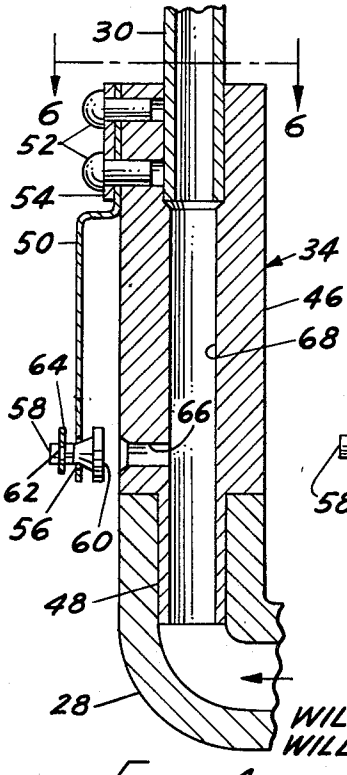


FIG. 4

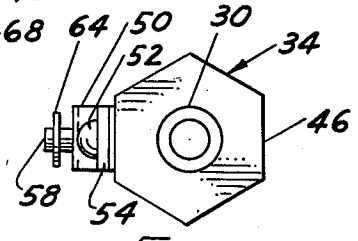


FIG. 6

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CHOKE STOVE HEAT REGULATOR VALVE

Filed March 21, 1962 2 Sheets-Sheet 2

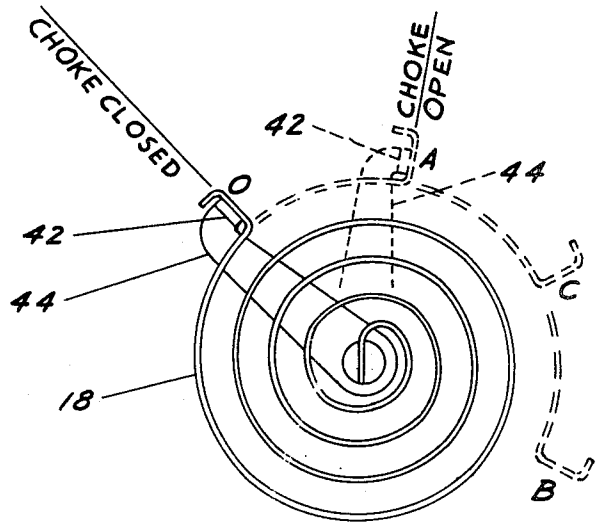


FIG. 7

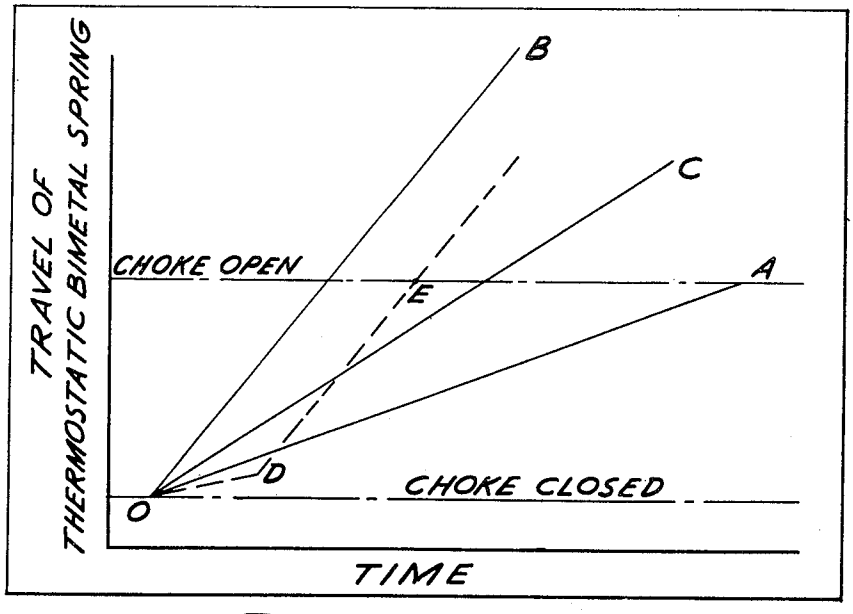


FIG. 8

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CHOKE STOVE HEAT REGULATOR VALVE

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7 Claims. (Cl. 123—119)

This invention relates generally to internal combustion engine carburetors having thermostatically controlled automatic choke systems, and more particularly to novel means for reducing the temperature of the heated air used to warm the thermostatic element prior to its entry into the choke housing.

Most carburetors currently include a bimetallic thermosatt spring for controlling the amount of choke opening according to temperature. In other words, when the engine is cold the bimetallic spring, through appropriate linkage, closes the choke plate for the starting operation. As the engine warms up, hot air is circulated through the choke housing to warm the bimetallic spring. As the bimetallic spring becomes warm, it releases its tension on the choke shaft and allows the choke plate to be gradually opened.

Although this general arrangement has been accepted commercially, certain inherent characteristics thereof have been found to cause undesirable results. Some of these results are improper choke "come-off and "come-on" times. By "come-off" time is meant the time required to fully open the choke after the cold engine is started. By "come-on" time is meant that time required to close the choke after a substantially warmed engine is shut down. When the latter time is too short, there is a resultant difficulty in starting an engine after it has been shut down for a short time interval.

Since perfect coordination between "come-off" and "come-on" times is difficult to achieve, quite often a low temperature rate bimetallic spring is used, with the intent to produce the best "come-off" time available, regardless of the corresponding "come-on" time. However, when the spring used has a low enough temperature rate for proper choke operation in the earlier stages, the choke is apt to not "come-off" properly in the latter stages.

Accordingly, a general object of the invention is to provide means forming a part of the heat passage extending from the so-called "stove" in the exhaust manifold to the choke housing for controlling the choke "come-off" and "come-on" times.

Another more specific object of this invention is to provide such a means which includes automatic control of the opening and closing of an ambient air bleed in response to heat transmitted by conduction and convection from the exhaust manifold.

Other more specific objects and advantages of the invention will become apparent when reference is made to the following description and accompanying illustrations wherein:

FIGURE 1 is a side elevational view, with portions thereof cut away, illustrating generally a carburetor embodying the invention, the carburetor being mounted on the intake manifold of an engine;

FIGURE 2 is an enlarged fragmentary view of the automatic choke housing taken on the plane of line 2—2 of FIGURE 1 and looking in the direction of the arrows;

FIGURE 3 is an enlarged, fragmentary side elevational view of the invention taken on the plane of line 3—3 of FIGURE 1 and looking in the direction of the arrows;

FIGURE 4 is a cross-sectional view taken on the plane of line 4—4 of FIGURE 3 and looking in the direction of the arrows;

FIGURE 5 is similar to FIGURE 4, except that it is

an elevational view, with a portion thereof broken away, to illustrate the invention under different operational conditions;

FIGURE 6 is an end view taken on the plane of line 6—6 of FIGURE 4 and looking in the direction of the arrows;

FIGURE 7 is a diagram illustrating the various bimetallic thermostat spring positions relative to the temperature rate of the spring;

FIGURE 8 is a graph comparing the operation of a choke mechanism embodying the invention with that of presently used choke mechanisms embodying various temperature rate bimetallic thermostat springs.

Referring to the drawings in greater detail, FIGURE 1 illustrates generally a carburetor **10** having a throttle valve **12** and an air intake **14** with induction passages therethrough and adapted to be controlled by a choke valve **16**. The choke valve **16** is operatively connected to a bimetallic thermostat spring **18** (FIGURE 2) positioned in the automatic choke housing **20** by any conventional means, such as that shown in Patent No. 2,998,233 to Frederick J. Marsee. The carburetor is shown mounted on the intake manifold **22** near the usual exhaust crossover passageway **24**.

An Inconel or other suitable heat tube **26** (usually referred to as the "stove") leads through the exhaust crossover passageway **24** located within the intake manifold **22** and connects at the outlet **28** with a hot air tube **30** leading to the choke housing **20** and thence back again to the intake manifold **22** via the return line **32**. The choke stove heat regulator valve **34** contemplated by the invention is incorporated in the heat tube line **30** in the proximity of the exhaust passageway outlet **28**. Clean air enters the system through the cold air intake **36** of the cold air tube **38**, usually located in the air intake **14** of the carburetor **10**, and leads to the inlet **40** at the intake manifold **22**.

FIGURE 2 illustrates the bimetallic thermostat spring **18** in contact with the projection **42** of the choke lever **44**.

FIGURES 3 and 4 illustrate the choke stove heat regulator valve **34** as comprising a main body **46** suitably secured to the outlet **28**, preferably by being slip fitted into outlet **28** by means of an extended small diameter end **48**. The downstream end of the valve body **46** may be counterbored to a suitable depth so as to receive the heat tube **30**. A formed bimetallic strip **50** is attached to a side of the valve body **46** by any suitable means such as rivets **52** and a hold-down plate **54**. Located through a hole **56** at the free end of the bimetallic strip **50** is a loosely fitting closure element **58** having an enlarged flat end **60** facing the valve body **46** and an annular groove **62** near the small end on the opposite side of the bimetallic strip **50**. The element **58** is held in place by a retaining ring **64** fastened around the annular groove **62**.

FIGURE 4 further illustrates the fresh air bleed **66** connecting the axial passageway **68** with the outside wall of the valve body **46**. The bimetallic strip **50** and element **58** are designed such that the larger flat face **60** of the element **58** is positioned away from the air bleed **66** so long as the bimetallic strip **50** is at its normal cold start condition.

FIGURE 5 shows the closure element **58** in a closed position, as would be the case when the bimetallic strip **50** has been heated by conduction through the valve body **46**. The fit of the element **58** in the bimetallic strip **50** can be seen to be such as to permit radial and axial movement so that proper closing off of the air bleed **66** is accomplished.

FIGURE 6 is illustrative of a suitable and economical hexagonal shape for the valve body **46**. It can be readily seen that any external shape would be generally suitable, so long as there is a flat surface on the body **46** at

the outlet end of the air bleed **66** and so long as the material and mass of the body **46** is selected for proper conductive characteristics.

Operation

Assuming, for purposes of illustration, that the engine is cold and is being cranked, the bimetallic thermostat spring **18** of the mechanism shown would be in its unwound condition. As such, its outer free end would have rotated the choke lever **44** and associated linkage (not shown), closing the choke valve **16** in a manner well known in the art. As mentioned above, the associated linkage could be of the type disclosed by Marsee 2,998,233. All of the elements will maintain their respective positions while the engine is being cranked.

Once the engine fires and becomes self-sustaining, air warmed in the exhaust passageway **24** of the intake manifold **22** will be drawn in the well known manner through the outlet **28** and thence through the heat regulator valve **34** and hot air tube **30** into the choke housing **20**. This air, of course, warms the bimetallic thermostat spring **18**, causing it to wind up about its center and allowing the choke valve **16** to progress toward a fully open position.

As was mentioned earlier, the "come-off" time, which is that time required to fully open the choke after the cold engine is started, cannot always be properly coordinated. Where a high temperature rate bimetallic spring **18** has been selected as most suitable in view of all the circumstances, the early rise in temperature of the bimetallic spring **18** is sometimes too great, and "come-off" time is arrived at much too soon. Likewise, where a low temperature rate spring **18** has been selected, the early movement of the spring may be ideal, but the "come-off" time is very apt to be much too late. It is deficiencies such as these which are readily corrected by the invention. Instead of the air passing through the heat tube **30** to the choke housing **20** in a normally heated condition during the first stages of engine operation, lower temperature ambient air is caused to enter through the air bleed **66** to mix with the heated air passing through the axial passageway **68** of heat regulator valve **34**. This, of course, cools the air entering the choke housing **20**, thereby influencing the bimetallic thermostat spring **18** to a lesser degree than would normally be the case. As the engine heats up and the exhaust passageway **24** through the intake manifold **22** becomes progressively hotter, the heat therefrom is transmitted to the body **46** of the regulator valve **34**. As the mass of the valve body **46** increases in temperature, the bimetallic strip **50** which is fastened thereto is also caused to heat up. As this bimetallic strip **50** increases in temperature, it bends toward the fresh air bleed **66** in the valve body **46**. This causes the closure element **58** to be pressed against the flat surface surrounding the fresh air bleed **66**, thereby closing off the bleed. Thereafter, the air from the manifold passageway **24** enters the choke housing **20** in its regularly heated condition, causing the bimetallic thermostat spring **18** to complete its winding process, thereby permitting full opening of the choke valve **16**.

The valve body **46** is heated to some extent by radiation and convection. However, in the range of engine operation during which the regulator **34** must operate, heating by conduction from the exhaust manifold is an important additional source of heat.

Consideration of the diagram of FIGURE 7 and the curves of FIGURE 8 will illustrate specific advantages of a choke system embodying the invention. For example, a typical low temperature rate spring **18**, represented by A in the figures, would wind about its center to a position approximately as shown in FIGURE 7, at which point the choke valve **16** would be fully opened. However, as can be seen in FIGURE 8, the time that would be required to reach this position would be relatively long.

A typical high temperature rate spring **18**, illustrated by B in the figures would be such that the choke valve **16** again would open as spring B passed the point A location, and then continue travelling to a location as shown. FIGURE 8 indicates that the "choke open" location would have been reached relatively quickly. Incidentally, the choke valve **16**, being fully open, would prevent the associated choke lever **44** and the projection **42** from passing beyond the point A; however, the free outer end of spring **18** could continue to wind up to point B.

If some intermediate temperature rate spring **18** were selected, there would result a curve as illustrated by C in FIGURE 8.

It is apparent in each instance that a linear relationship exists between the time involved and the travel of the bimetallic thermostat spring **18**. The effect of this relationship, when the invention is included in a system, is as illustrated by the broken line curve. It can readily be seen that the initial winding of the thermostatic spring **18** can be retarded in any desired manner, as along O–D, after which the choke valve **16**, can be quickly moved to a fully open position as represented by D–E. This incorporates the best characteristics of both the low temperature rate and the high temperature rate springs, in addition to permitting as slow a "come-off" time as desired without affecting the "come-on" time. In other words, the "come-on" time would remain the same as if the invention were not being used, and it would depend upon the normal rate of the spring selected. For instance, spring B of FIGURE 7 would still have to unwind from B to O during the cooling off period of the engine before the choke plate would close.

The stove **26**, the hot air tube **30** and the automatic choke housing **20** are always present in some form or other on automatic choke carburetor installations. It is thus apparent that the control valve **34** can readily be designed and constructed in a manner so that it can be sold as an aftermarket item for quick and easy installation on automatic choke systems not originally provided with the invention, or as a replacement item. The valve body **46** may be constructed so as to have appropriate heat conductivity and mass to provide a good heat reservoir for storing heat transmitted to it from the exhaust passage **24**.

Although but one embodiment of the invention has been shown and described, it is apparent that other modifications may be made without exceeding the scope of the appended claims.

What we claim as our invention is:

1. In an internal combustion engine including an exhaust manifold having a stove therein and a carburetor having an induction passage controlled by a choke valve, automatic means for operating said choke valve, said automatic means including a housing, a thermostatic spring positioned in said housing, a conduit for communicating heated air from said stove to said housing, and thermostatic means in said conduit for reducing the temperature of said heated air prior to its entry into said housing.

2. In an internal combustion engine including an automatic choke type carburetor in which the choke position is controlled at least in part by a thermostatic element, a housing in said carburetor for said thermostatic element, a conduit communicating heated air from said engine to said housing, thermostatic means heated by said engine for reducing the temperature of said heated air during initial stages of engine operation prior to the entry of said air into said housing containing said thermostatic element.

3. In an internal combustion engine including an intake manifold having a stove therein and a carburetor having an induction passage and a choke valve therein, a thermostatic element operatively connected to said choke valve for regulating the opening and closing of said choke valve

in accordance with engine temperature and a conduit for communicating heated air from said stove to said thermostatic element, a heat regulating means comprising:

(a) a body adapted to be inserted in said conduit and having an axial passageway therethrough,

(b) an air bleed leading from said axial passageway to the outside surface of said body, and

(c) a thermostatic means for at times closing off said air bleed at said outside surface of said body.

4. In an internal combustion engine including an intake manifold having a stove therein and a carburetor having an induction passage and a choke valve therein, a thermostatic element operatively connected to said choke valve for regulating the opening and closing of said choke valve in accordance with engine temperature and a conduit for communicating heated air from said stove to said thermostatic element, a heat regulating means comprising:

(a) a body inserted in said conduit in the proximity of said engine for being heated by conduction from said engine,

(b) an axial passageway through said body,

(c) an air bleed leading through the wall of said body from said axial passageway to the outside surface of said body, and

(d) a thermostatic means fastened to said body for closing off said air bleed in response to heat conducted through said body.

5. In an internal combustion engine including an intake manifold having a stove therein and a carburetor having an induction passage and a choke valve therein, a thermostatic element operatively connected to said choke valve for regulating the opening and closing of said choke valve in accordance with engine temperature and a conduit for communicating heated air from said stove to said thermostatic element, a heat regulating means comprising:

(a) a body having an axial passageway therethrough and adapted to be inserted in said conduit,

(b) an air bleed leading from said axial passageway to the outside surface of said body,

(c) a thermostatic element fastened at one end thereof to said body,

(d) a hole through the other end of said thermostatic element,

(e) a valve member having an enlarged flat face facing said air bleed and located in said hole of said other end of said thermostatic element, and

(f) a retaining means for holding said valve member in said hole.

6. In an internal combustion engine including an intake manifold having a stove therein and a carburetor having an induction passage and a choke valve therein, a thermostatic element operatively connected to said choke valve for regulating the opening and closing of said choke valve in accordance with engine temperature and a conduit for communicating heated air from said stove to said thermostatic element, a heat regulating means comprising:

(a) a body adapted to be inserted at the upstream end of said conduit,

(b) an axial passageway through said body,

(c) an air bleed leading from said axial passageway to the outer surface of said body near the upstream end thereof,

(d) a thermostatic element fastened at one end thereof to the downstream end of said body,

(e) a hole through the other end of said thermostatic element,

(f) a valve member having an enlarged flat face facing said air bleed and located in said hole of said other end of said thermostatic element, and

(g) a retaining means for holding said valve member in said hole.

7. A heat regulating device for use in an internal combustion engine including an intake manifold having a stove and a carburetor having an induction passage and a choke valve, a thermostatic element operatively connected to said choke valve for regulating the opening and closing of said choke valve in accordance with engine temperature and a conduit for communicating heated air from said stove to said thermostatic element, said heat regulating device comprising:

(a) a body having a passageway extending therethrough so as to adapt the same to be inserted in said conduit,

(b) an air bleed leading from said passageway to the outside surface of said body, and

(c) thermostatic means for at times closing off said air bleed.

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