Oct. 5, 1965 P. R. HUNT ETAL 3,210,004

THERMOSTATIC CHOKE VALVE

Filed Dec. 26, 1962

FIG. 1.

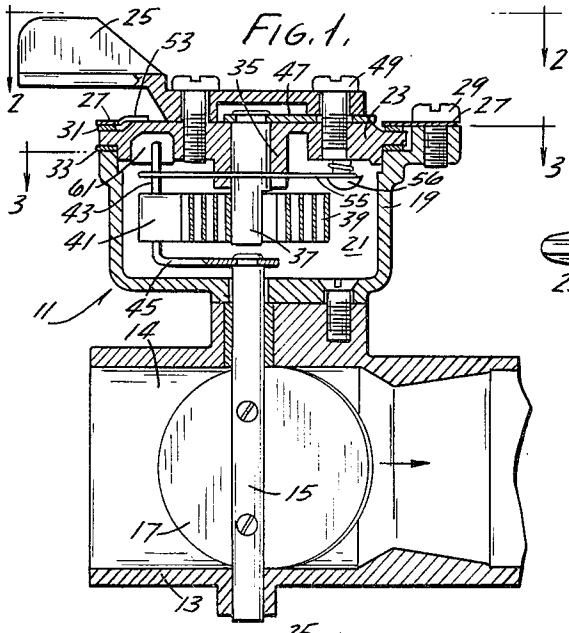


FIG. 2.

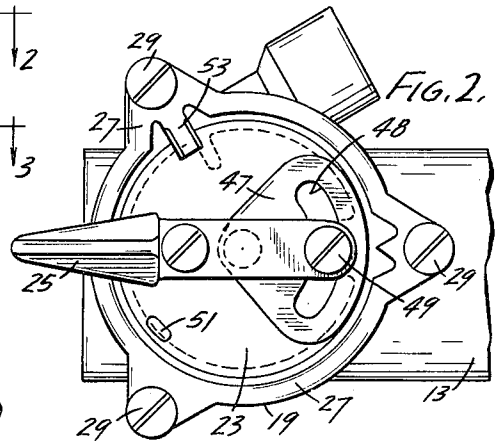


FIG. 3.

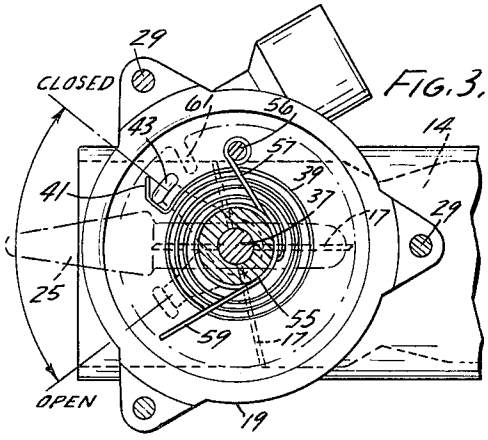


FIG. 4.

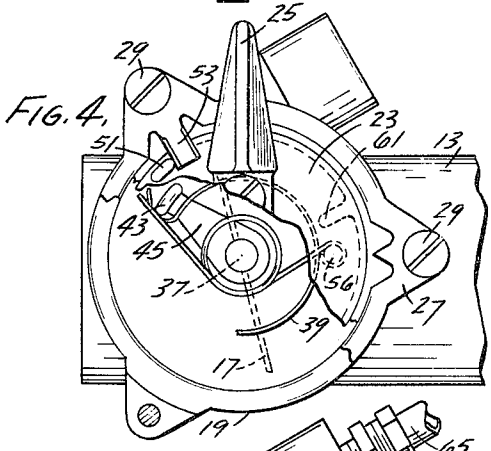


FIG. 5.

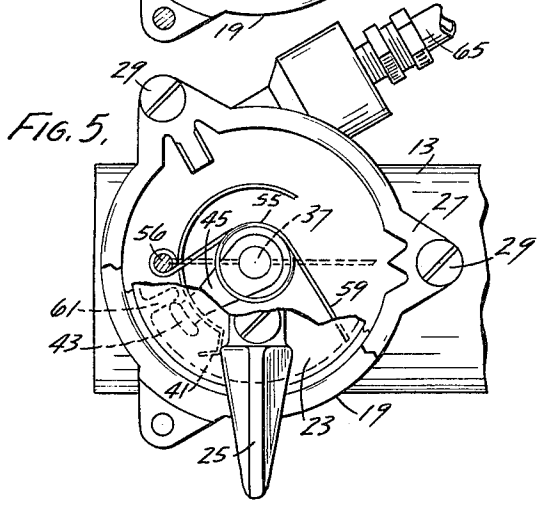
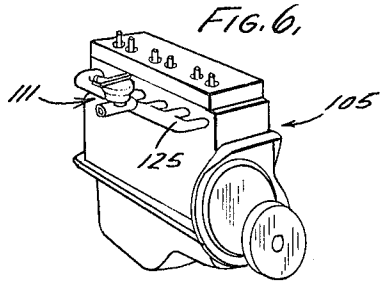


FIG. 6.



INVENTORS.
PAUL R. HUNT
CHESTER DU BOIS
BY
Wheeler, Wheeler & Wheeler
ATTORNEYS.

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THERMOSTATIC CHOKE VALVE

Paul R. Hunt, Lindenhurst, and Chester Du Bois, Zion, Ill., assignors to Outboard Marine Corporation, Waukegan, Ill., a corporation of Delaware

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The invention relates generally to chokes such as are associated with carburetors or other combustion air-intake arrangements for internal combustion engines. More specifically, the invention relates to automatic chokes including temperature responsive means for providing a variably controlled air flow so as to obtain a variably enriched fuel-air mixture for engine starting and operating.

For various reasons including, for instance, a sticky choke shaft, damage to the temperature responsive automatic operating means, or faulty delivery of heat to the temperature responsive means, the operation of an automatic choke may become either partially or wholly unreliable or ineffective.

The invention provides means for manually overriding the automatic operation of the choke, preferably by means for impositively or resiliently closing the choke and for positively opening the choke. More particularly, in one embodiment of the invention, the overriding positive and impositive means are both mounted on a single member which is shiftable from an "automatic" setting to a first or "closed" position removed from said "automatic" setting and to a second or "open" position remote from the "automatic" setting. In said one embodiment, the automatic temperature responsive means also is mounted on the shiftable member.

Other objects and advantages of the invention will become known by reference to the following description and the accompanying drawings of one embodiment of the invention.

In the drawings:

FIGURE 1 is an elevational view partially in section of a choke **11** in accordance with the invention;

FIGURE 2 is a plan view taken generally along line 2—2 of FIGURE 1;

FIGURE 3 is a view taken generally along line 3—3 of FIGURE 1, showing the choke in its "automatic" control setting and with the choke valve member closed;

FIGURE 4 is a view similar to FIGURES 2 and 3, showing the choke in its "manually closed" settitng;

FIGURE 5 is a view similar to FIGURES 2, 3, and 4, showing the choke in its "manually open" setting; and

FIGURE 6 is a perspective view showing the mounting of an automatic choke, such as disclosed herein, on an internal combustion engine.

As shown in the drawings, the choke **11** comprises, in part, a frame or element **13** including an air or gas passage **14**, and a shaft **15** extending across the passage **14** and carrying a valve member or plate **17**. The shaft **15** is rotatably journaled by the frame **13** for variably locating the valve member **17** between a substantially open position, shown in outline in FIGURE 5, wherein the valve member **17** lies substantially in a plane extending axially of the air passage **14** and a closed position, shown in outline in FIGURE 4, wherein the valve member **17** extends across the air passage **14** in generally blocking relation thereto at an angle of about 75 degrees relative to its open position.

The frame **13** also includes or has mounted thereon a housing or chamber **19** which contains an operating mechanism **21** connected to the shaft **15**. Although various configurations can be employed, the housing **19** is generally cup shaped and is closed by a cap or cover **23** which is angularly shiftable around the mouth of the

housing **19** and is connected to a handle **25** to facilitate such angular shifting.

More specifically, the cap **23** is retained on the housing **19** by a retainer ring **27** which can be secured to the housing **19** by suitable means, as for example, a plurality of screws **29**. Notwithstanding the angular shiftability of the cap **23** to the housing **19**, the cap **23** is sealed to the housing **19** and friction is reduced by means of a pair of gaskets **31** and **33** respectively interposed between the retaining ring **27** and the cap **23** and between the cap **23** and the housing **19**. The cap **23** and its attached handle **25** are shiftable relative to, and between, "manually closed" and "manually open" positions located approximately 180 degrees apart and shown respectively in FIGURES 4 and 5, and relative to an intermediate "automatic" position located midway between the open and closed positions, as shown in FIGURES 2 and 3.

Passing through the cap **23** and through a hub **35** projecting from the undersurface of the cap **23** is a stud **37** which is angularly shiftable about its own axis relative to the cap **23** and which extends into the housing **19** in generally axial alignment with the shaft **15**. Carried by the stud **37** is a temperature sensitive or responsive means in the form of a bimetallic element or coil **39** having an outer free end which is indicated at **41** and which is reversely curved or hooked. The outer hooked end **41** of the bimetallic coil **39** is located for engagement with an arm **43** which extends in parallel relation to the axes of the stud **37** and shaft **15** and which constitutes one part of a right angle leg or bracket **45** fixed to the end of the shaft **15** extending in the housing **19**.

In order to adjust the choke, means are provided for varying the relation of the bimetallic coil **39** to the cap **23**. In the specifically disclosed construction, such means take the form of an arrangement including a plate **47** which is fixed to the outer end of the stud **37** and which is angularly positionable on the top surface of the cap **23**. The plate **47** can be fixed in any desired position of angular relation to the cap **23** by means including an arcuate cut out **48** in the plate **47** and a screw **49** which connects the handle **25** to the cap **23** and which passes through the cut out **48**. By loosening the screw **49**, the plate **47** and the connected stud **37**, together with the bimetallic coil **39**, can be angularly shifted relative to the cap **23**. When a desired adjustment is obtained, the screw **49** is then tightened to prevent further relative angular movement between the plate **47** and the cap **23**.

When the bimetallic coil **39** is cold, and when the cap **23** is in "automatic" position, as shown in FIGURES 2 and 3, the hooked outer end **41** of the bimetallic coil **39** is positioned to engage the arm **43** to locate the valve member **17** in its closed position. Heating of the bimetallic coil **39** causes its hooked outer end **41** to rotate in a counterclockwise direction, as shown in FIGURE 3, permitting the arm **43** to move, under the influence of gas flow within the air passage **13** from the closed position, shown in full lines in FIGURE 3, to the open position shown in dotted outline in FIGURE 3. Should the bimetallic coil **39** again cool, the hooked end **41** will rotate in a clockwise direction toward the closed, full line position shown in FIGURE 3, thereby proportionately restricting the amount of gas flow permitted by the valve member **17** as the hooked end of the bimetallic coil travels from its open position to its closed position.

The air passageway **14** can be manually closed, when the bimetallic coil is heated, by rotating the cap **23** in a clockwise direction as seen in FIGURES 2 through 5, through an angle of about 90 degrees from the "automatic" setting to the position shown in FIGURE 4. Counter-clockwise movement of the cap **23** can be limited to about 90 degrees by suitable means, such as by en-

gagement of a stop 51 on the top surface of the cap 23 with a radially inwardly extending detent or lug 53 projecting from the retainer ring 27.

Such movement of the cap to its manually closed position rotates the stud 37 and the connected bimetallic coil 39 through a corresponding angle. In the event the bimetallic coil 39 is cooled with its hooked end located as shown in full lines in FIGURE 3, such movement will effect resilient displacement of the bimetallic coil 39 from its normal relation to the stud 37. In the event the bimetallic coil 39 is heated and the valve member 17 is at least partially open, the hooked end 41 will be rotated so as to engage and at least partially advance the arm 43 toward its closed position.

However, in the event that the linkage between the cap 23 and the shaft 15 is interrupted, as by breaking of the bimetallic coil 39 or by loosening of the screw 49, thereby permitting shifting of the plate 47 relative to the cap 23, movement of the arm 43 to its valve member closing position is assured by biasing means which, in the specifically disclosed construction, takes the form of a spring 55 carried by the cap 23.

More specifically, the spring 55 is formed with at least one coil encircling the hub 35 and is fixedly connected, by suitable means indicated at 56 in FIGURE 3, at the end of one leg 57 to the cap 23. The other leg 59 projects into a position for engagement with the arm 43 to displace the arm to its valve member closing position in response to rotation of the cap 23 to its manually closed position. As the full range of movement of the arm 43 between its open and its closed positions is through an arc of about 75 degrees, movement of the spring 55 through an angle of 90 degrees, by reason of like angular shifting of the cap 23 to its "manually closed" position, serves both to engage the arm 43 by the spring in response to initial shifting of the cap 23 and to locate the end or leg 59 of the spring 55 in a tensioned condition after displacement of the arm 43 to its valve member closing position. Consequently, maintenance of the valve member 17 in closing relation to the air passage 14 is assured when the cap 23 is in its manually closed position.

Notwithstanding the above, when the cap 23 is in its manually closed position with the valve member 17 retained in closing relation to the air passage 14 by the spring 55 and by the bimetallic coil 39, the arrangement permits "breathing" through the air passage 14 by reason of valve member action against the torque loading of the bimetallic coil 39 and spring 55 in response to a sufficient draft or vacuum in the air passage 14. Such "breathing" provides the operator with time to reset the cap to its "automatic" position before the engine dies because of an excessively rich mixture.

When a lean mixture is required for starting, the cap 23 can be rotated to the manually open position shown in FIGURE 5. Such action can occur when the bimetallic coil 39 is cold and in the position shown in FIGURE 3. Because of the absence of fixed engagement between the bimetallic coil 39 and the arm 43, mere rotation of the bimetallic coil 39 in a counterclockwise direction as seen in FIGURE 5, accompanying like rotative movement of the cap 23, will not effect positive movement of the valve member 17 from its closed position in the absence of a sufficient pressure differential or draft across the opposite faces of the valve member. Accordingly, means in the form of a lug 61 is provided on the undersurface of the cap 23, which lug projects for engagement with the arm 43 in response to movement of the cap through an arc of about 90 degrees from the "automatic" position. As only about 75 degrees of rotation is required to displace the arm 43 from its valve member closing position to its valve member opening position, the initial 15 degrees of movement of the cap 23 permits disengagement of the hooked end 41 of the bimetallic coil 39 from the arm 43 prior to engagement of the lug 61 with the arm. Thus, movement of the arm 43 from its valve member closing position to its valve member opening position occurs entirely without any load on the bimetallic element.

Upon return of the cap 23 to its automatic position, the hooked end 41 of the bimetallic coil 39 will engage the arm 43 for movement of the arm between its valve member opening position and its valve member closing position in accordance with the extent to which the bimetallic coil 39 is heated. Movement of the cap 23 through the automatic position to the manually closed position will effect displacement of the arm 43 to its valve member closing position, notwithstanding any heated condition of the bimetallic coil 39 by action of the spring 55.

Various arrangements can be used to effect heating of the bimetallic coil 39 in response to heating of the engine. For instance, the housing 19 could be arranged so that it is mounted on an engine block or otherwise conveniently located so as to be heated by conduction. In FIGURE 6, a choke 111 embodying various of the features of the invention is shown mounted on the exhaust manifold 125 of an engine 105 so as to receive heat from the engine 105 incident to operation thereof. In addition, or alternatively, the heat source for the bimetallic coil 39 can take the form of an air flow which has been previously heated by the exhaust of the engine and which is drawn into the housing by intake manifold vacuum pressure, as for instance, through a conduit 65 such as shown in FIGURE 5.

While the discussed arrangement has included a handle 25 attached to the cap 23 for angularly shifting the cap, various arrangements such as cable or other means can be employed for angularly shifting the cap from a remote point.

Various of the features of the invention are set forth in the following claims.

What is claimed is:

1. A choke for controlling gas flow comprising means defining a gas passage, a valve member, means mounting said valve member in said gas passage for rotative movement about an axis transverse to said gas passage between a first position closing said passage and a second position permitting relatively free flow through said passage, temperature responsive means free of fixed connection with said valve member and operative to connect with said valve member for controlling the movement of said valve member between said first position and said second position, and manually operative means for locating said valve member relative to said first and second positions notwithstanding the action of said temperature responsive means.

2. A choke for controlling gas flow comprising means defining a gas passage, a valve member, means mounting said valve member in said gas passage for rotative movement abount an axis transverse to said gas passage between a first position closing said passage and a second position permitting relatively unobstructed flow through said passage, temperature responsive means free of fixed connection with said valve member and operative to connect with said valve member for displacing said valve member from said second position to said first position in response to a change in one direction of the temperature of said temperature responsive means and for permitting movement of said valve member from said second position to said first position in response to a change in the other direction of the temperature of said temperature responsive means, and manually operative means for locating said valve member relative to said first and second positions notwithstanding the action of said temperature responsive means.

3. A choke for controlling gas flow comprising means defining a gas passage, a valve member, means mounting said valve member in said gas passage for displacement between a first position closing said passage and

a second position permitting relatively unobstructed flow through said passage, means connected to said valve member for displacing said valve member between said first and second positions, temperature responsive means having a portion disposed for engagement with said valve member displacing means to displace said valve member to its first position in response to cooling of said temperature responsive means from a relatively heated condition and for permitting movement of said valve member from its first position toward its second position in response to heating of said temperature responsive means from a relatively cool condition, manually shiftable resilient means connected to said gas passage defining means for engaging said valve member displacing means to locate said valve member in said first position notwithstanding the action of said temperature responsive means, and manually shiftable rigid means connected to said gas passage defining means for engagement with said valve member displacing means to locate said valve member in its second position notwithstanding the action of said temperature responsive means.

4. A choke for controlling gas flow comprising means defining a gas passage, a valve member, means mounting said valve member in said gas passage for displacement between a first position closing said passage and a second position permitting relatively unobstructed flow through said passage, means for displacing said valve member between said first and second positions including a crank arm connected to said valve member and movable between a first position locating said valve member in its first position and a second position locating said valve member in its second position, means manually shiftable for movement in opposite directions from a predetermined position, resilient means carried by said shiftable means for engaging said crank arm to locate said crank arm in its first position in response to movement of said shiftable means in one direction from said predetermined position, fixed means on said shiftable means in position for engagement with said crank arm to locate said crank arm in its second position in response to movement of said shiftable means from said predetermined position in a direction opposite from said one direction, and temperature responsive means carried by said shiftable means and having a portion disposed, when said shiftable means is in said predetermined position, for movement in the path of movement of said crank arm for engagement with said crank arm to displace said crank arm to its first position in response to cooling of said temperature responsive means from a relatively heated condition and for permitting movement of said crank arm from its first position toward its second position in response to heating of said temperature responsive means from a relatively cool condition.

5. A choke in accordance with claim 4 including means for limiting movement of said manually shiftable means in said one direction to control the stress in said resilient means.

6. A choke in accordance with claim 4 wherein said temperature responsive means is carried on said manually shiftable means by means for selectively shifting the disposition of said temperature responsive means relative to said manually shiftable means.

7. A choke for controlling gas flow comprising means defining a gas passage, a valve member, means mounting said valve member in said gas passage for angular displacement between a first position closing said passage and a second position permitting relatively unobstructed flow through said passage, means for displacing said valve member between said first and second positions including a crank arm connected to said valve member and movable between a first position locating said valve member in its first position and a second position locating said valve member in its second position, means manually shiftable for movement through a first angular distance greater than the angular distance between said first and second positions of said valve member between a first "closed" position and a second "automatic" position and for movement through a second angular distance greater than the angular distance between said first and second positions of said valve member between said "automatic" position and a third "open" position, resilient means carried by said shiftable means for engaging said crank arm to locate said crank arm in its first position in response to movement of said shiftable means from its "automatic" position to its "closed" position only after an initial range of movement from said "automatic" position less than the difference between the range of angular movement of said valve member and the range of angular movement of said shiftable means between its "automatic" and its "closed" positions, fixed means on said shiftable means in position for engagement with said cank arm to locate said crank arm in its second position in response to movement of said shiftable means from its "automatic" position to its "open" position only after an initial range of limited movement from said "automatic" position, temperature responsive means carried by said shiftable means and having a portion disposed, when said shiftable member is in its "automatic" position, for movement in the path of movement of said crank arm for engagement with said crank arm to displace said crank arm to its first position in response to cooling of said temperature responsive means from a relatively heated condition and so as to permit movement of said crank arm from its first position toward its second position in response to heating of said temperature responsive means from a relatively cool condition.

8. A choke for controlling gas flow comprising a frame including means defining a gas passage, a cup-shaped housing on said frame, a shaft extending across said gas passage and into said housing, a valve member on said shaft in said gas passage, means mounting said shaft for angular displacement of said valve member between a first position closing said passage and a second position permitting relatively free flow through said passage, a crank arm in said housing connected to said shaft and movable between a first position locating said valve member in its first position and a second position locating said valve member in its second position, a cover, means mounting said cover on said housing for manual angular shifting relative to said housing in opposite directions from a predetermined position, a spring carried by said cover in said housing and including an end displaceable in the path of movement of said crank arm for engaging said crank arm to locate said crank arm in its first position in response to movement of said cover in one direction from said predetermined position, a lug on said cover within said housing in position for engagement with said crank arm to locate said crank arm in its second position in response to movement of said cover from said predetermined position in a direction opposite from said one direction, and a bimetallic coil carried by said cover within said housing and having a hooked end portion disposed, when said cover is in said predetermined position, for movement in the path of movement of said crank arm so as to engage said crank arm to displace said crank arm to its first position in response to cooling of said temperature responsive means from a relatively heated condition and so as to permit movement of said crank arm from its first position toward its second position in response to heating of said temperature responsive means from a relatively cool condition.

9. A choke in accordance with claim 8 wherein said cover is angularly shiftable about an axis in alignment with the rotational axis of said shaft.

10. A choke in accordance with claim 8 including means for limiting movement of said cover in said one direction to control the stress in said spring.

11. A choke in accordance with claim 8 wherein said bimetallic coil is carried on said cover by means for selectively shifting the disposition of said bimetallic coil relative to said cover.

12. A choke in accordance with claim 8 in combination with an internal combustion engine and means mounting said choke on said engine in position for heating said housing in response to operation of said engine.

13. A choke for controlling gas flow comprising means defining a gas passage, a valve member, means mounting said valve member in said gas passage for rotative movement about an axis transverse to said passage between a first position closing said passage and a second position permitting relatively free flow through said passage, temperature responsive means for controlling the movement of said valve member between said first position and said second position, and manually operative means free of fixed connection with said valve member and operative to connect with said valve member for locating said valve member relative to said first and second positions notwithstanding the action of said temperature responsive means.

14. A choke for controlling gas flow comprising means defining a gas passage, a valve member, means mounting said valve member in said gas passage for rotative movement about an axis transverse to said passage between a first position closing said passage and a second position permitting relatively unobstructed flow through said passage, temperature responsive means engageable with said valve member for displacing said valve member from

said second position to said first position in response to a change in one direction of the temperature of said temperature responsive means and for permitting movement of said valve member from said second position to said first position in response to a change in the other direction of the temperature of said temperature responsive means, and manually operative means free of fixed connection with said valve member and operative to connect with said valve member for locating said valve member relative to said first and second positions notwithstanding the action of said temperature responsive means.

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EDWARD J. MICHAEL, *Primary Examiner.*

ALDEN D. STEWART, *Examiner.*