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W. H. SHAW

1,972,908

THERMOSTATIC CONTROL

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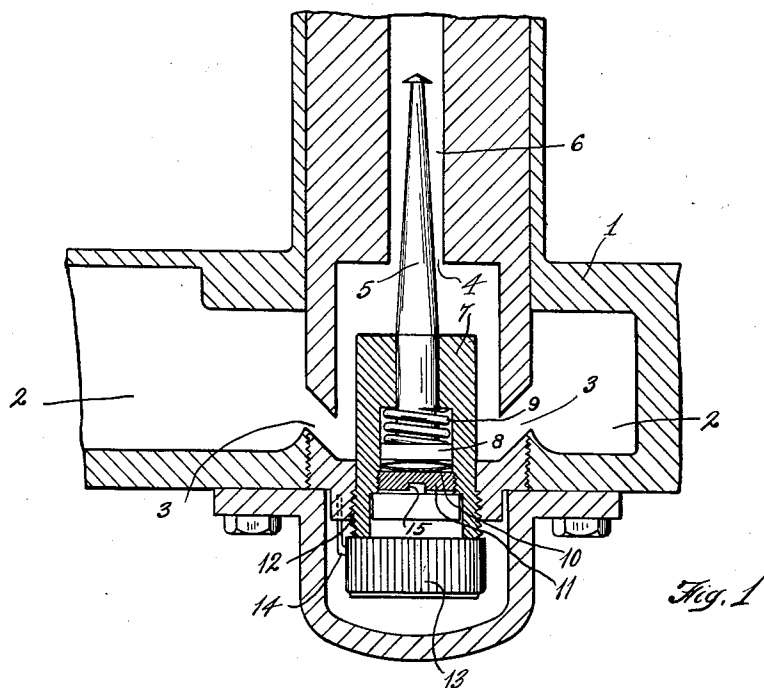


Fig. 1

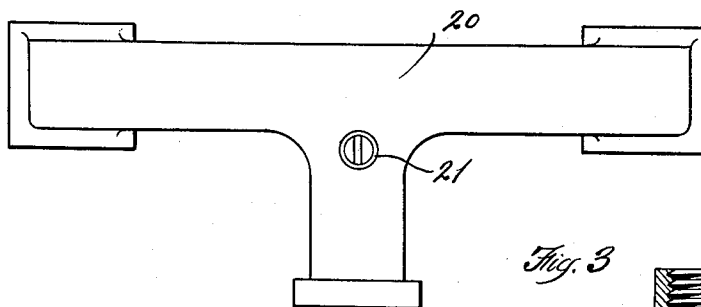


Fig. 3

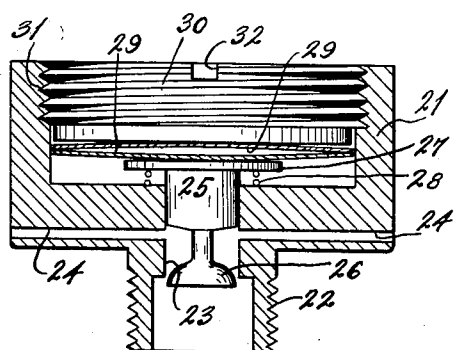


Fig. 2

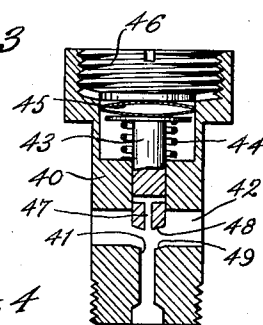


Fig. 4

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## UNITED STATES PATENT OFFICE

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## THERMOSTATIC CONTROL

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4 Claims. (Cl. 236—93)

The present invention relates to a thermostatic means for automatically controlling the fuel feed to an internal combustion engine. More particularly, the invention contemplates the provision of an orifice adjustable in size whereby the ratio of vaporized fuel to the air intake will be decreased in direct proportion to the temperature of operation of the internal combustion engine.

The ratio of fuel to air in such an engine is commonly referred to as the "mixture". It is well known that a rich mixture is required for an internal combustion engine operating under relatively low temperature conditions; and correspondingly, that a lean mixture will suffice for higher temperature conditions. Accordingly, it is a general object and nature of my invention to provide a temperature responsive means which will so vary either the amount of vaporized fuel or the amount of air which is induced in an engine, in a manner directly dependent upon temperature conditions. The advantage of such a thermostatic control should be apparent, in that the internal combustion engine is permitted to operate at a higher efficiency, and excess vaporized fuel which is induced into the engine at higher temperature conditions is not wasted due to incomplete combustion.

Another object of the invention is to provide "snap-action" thermostatic control. In this modified form of the invention, the change in the size of the orifice is made abruptly and suddenly, as distinguished from a gradual variation in the effective orifice area. In other words, the change in orifice size in this last-mentioned form of construction will occur entirely at a single predetermined temperature rather than throughout a temperature range.

A further object of the invention is to provide such a thermostatic control means which readily lends itself to an economy of manufacture. Another object is to provide a valve together with a plurality of bi-metallic thermally responsive discs which may be easily, cheaply and operatively assembled as a complete unit. Still another object is to so design such a completely assembled unit whereby the moving parts such as the bi-metallic discs and the valve stem are protected from the interference and injurious effect caused by the ingress of dirt and foreign particles. Additional objects and advantages shall become apparent as the following description proceeds.

To the accomplishment of the foregoing and

related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawing and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawing:

Fig. 1 is a section view showing the thermostatic control means constructed according to the principle of my invention as applied to the fuel feed orifice of the carburetor of an internal combustion engine; Fig. 2 is a sectional view of an alternative form of construction in which the principle of my invention is incorporated in an air bleeder for the intake manifold of an internal combustion engine; Fig. 3 is an elevational view showing the automatic bleeder of Fig. 2 in position on the intake manifold; Fig. 4 is a sectional view of another modified form of construction which may be substituted for the form shown in Fig. 1 and which is intended to possess the above-mentioned "snap-action" mode of operation.

Now referring more particularly to the drawing, in Fig. 1 there is shown a portion of a carburetor housing or casing indicated generally by the numeral 1. A liquid fuel conduit 2 is connected by means of the openings 3 to the orifice 4. A tapered or cone-shaped needle valve 5 extends through the orifice 4 and for a short distance up into the intake passage 6.

Longitudinal movement of the needle valve 5 with respect to the orifice 4 will, of course, result in a variation of the effective size of such orifice. The lower end of the needle valve 5 is movably supported in a housing member 7. Between the enlarged lower end 8 of the needle valve 5 and the inner wall of the housing 7 there is positioned the coiled spring 9. A plurality of bi-metallic discs 10 are located in contact with the end of the enlarged portion 8 and are held in position by means of the cap 11 which threadably engages with the inner wall of the housing 7.

The exterior of the housing 7 is threadably engaged as at 12 to the carburetor housing 1. An annular milled cap 13 is provided on the lower end of the housing 7. A small resilient finger 14 is adapted to engage in the grooves in the milled cap 13. It will thus be seen that the cap 13 may be manipulated to vary the vertical position of the housing 7 with respect to the carburetor casing 1, and incidentally to regulate a po-

sition of the needle valve 5 with respect to the orifice 4. The resilient finger 14 functions as a detent for holding the cap 13 and housing 7 against rotation. A rectangular slot 15 is provided in the outer side of the cap 11 for the insertion of a manipulating tool such as a screw driver.

The operation of the above described device is as follows:

- 10 Under relatively low temperature conditions, the bi-metallic discs 10 will assume a flattened condition. The action of the compression spring 9 will tend to force the valve stem 5 downwardly with respect to the orifice 4, thereby enlarging the effective size of the latter. Upon an increase in temperature, the bi-metallic discs 10 will commence to bend or assume a "dished" conformation somewhat as shown in Fig. 1. Such deflection of the bi-metallic discs 10 will then overcome the force of the spring 9 and thereby urge the needle valve 5 in an upward direction with the result that the effective size of the orifice 4 will be decreased. Thus the amount of fuel which is drawn in through the intake passage 6 is gradually decreased in direct proportion to temperature increases, and a fuel mixture varying from rich to lean is correspondingly supplied to the engine as the temperature of operation rises.
- 30 As shown in Figs. 2 and 3, the principle of my invention may also be utilized and incorporated in a slightly modified form of design for the purpose of varying the amount of air which is induced into the engine. In this instance, a thermostatic control means takes the form of a bleeder attached to the intake manifold 20. The bleeder consists of a housing member 21 which is attached by means of the threaded portion 22 to the wall of the manifold 20. An orifice 23 is placed in communication with the atmosphere by means of the passages 24 in the housing 21. A valve 25 is movably mounted and supported in the housing 21. The lower end of the valve is enlarged as at 26 for the purpose of closing the orifice 23. The upper end of the valve 25 is laterally flanged as at 27 and a spring 28 is positioned between the flange 27 and the inner wall of the housing 21. A plurality of bi-metallic discs 29 contact the upper surface of the flange 27 and are also in contact with and held in position by means of the threaded cap member 30. The cap 30 engages with the inner walls of the housing 21 by means of the threads 31. A rectangular slot 32 is provided in the outer surface of the cap 30 for the reception of a manipulating tool such as a screw driver. The operation of the last described form of construction is substantially analogous to that set forth in connection with the structure shown in Fig. 1.
- 60 The force of the spring 28 is made greater than the effective force of the maximum vacuum pressure which is exerted on the surface of the valve head 26. In this manner, variations in vacuum pressure will affect the operation of the air bleeder. It should also be noted that the conformation of the valve head 26 proceeds rather abruptly from a maximum to a minimum cross section. The purpose of this latter construction is to permit the extremely rapid increase of the effective size of the orifice 23 upon a slight movement of the valve stem 25.

The modified form of construction shown in Fig. 4, which may be substituted for that shown in Fig. 1, contemplates a "snap-action" mode of operation. This form of construction consists

of a housing member 40 in which there is the large or low temperature orifice 41. A passage 42 places the orifice 41 in communication with the exterior of the housing. A valve member 43 is adapted to move longitudinally in the housing, and similarly to the above described forms of construction, a compression spring 44 is mounted against the movement of the valve 43. Bi-metallic discs 45 are loosely mounted in the housing 40 against the end of the valve 43. The discs 45, however, possess an original inherent deformation so that the thermostatic deformation action or movement must necessarily overcome such inherent stress before the bi-metallic disc itself will assume a different conformation. The construction of such a bi-metallic disc which is adapted to have a so-called "snap-action" is thoroughly described in a prior Patent No. 1,639,708 issued August 23, 1927 to John A. Spencer.

A threaded retaining cap 46 is provided in the upper end of the housing 40, similar to the previously described threaded cap 30. A T-shaped passage 47, of smaller cross-sectional area than that of the orifice 41 is provided in the lower end of the valve 43. The extreme lower end of the valve 43 is of a conical or convex shape as indicated at 48 and adapted to seat on the concave face 49 of the orifice 41. In operation, an increase in temperature will not affect the movement of any of the above described parts, until a certain predetermined temperature has been attained. When such predetermined temperature is reached, the bi-metallic discs 45 will then become deformed with a "snap-action", at which time the lower end of the valve 43 will seat upon the orifice face 49. In this manner, it will be seen that a second and smaller passage or orifice 47 has been suddenly substituted for the original and larger orifice 41. A decrease in temperature below the predetermined value will produce an opposite movement of the parts.

It should also be noted that the bi-metallic discs 10, 29 and 45 in all forms of construction are loosely mounted within the housing and are not permanently attached thereto, whereby they will at all times permit a maximum freedom of movement. Furthermore the entire thermostatic control unit may be cheaply and quickly assembled merely by inserting the valve stem, the spring and the discs and then screwing the retaining cap 11 or 30, as the case may be, into position in the housing. In connection with the constructions shown in Figs. 2 and 4, the relative position of the retaining caps 30 and 46 with respect to their respective housings 21 and 40 will also serve as a means for regulating the initial position of the valve stem 25 and for adjustably determining the temperature at which the orifice 23 will be opened.

The fabrication of the bi-metallic elements in the form of discs further insures the positive operation of the device in that the variation in the co-efficient of expansion between the two metals will be concentrated at one point, viz., the center of the disc. The utilization of bi-metallic discs is particularly desirable in the forms of construction of the thermostatic control unit hereinbefore described, inasmuch as there is a certain necessary limitation placed upon the space available for the location of the bi-metallic elements.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the

mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:

1. A device of the character described, comprising a housing member having an exterior screw threaded portion and an interior screw threaded portion, valve means movably mounted in said housing, a screw threaded adjustable member received in said interior screw threaded portion, and thermostatic means comprising a plurality of plates loosely and separately mounted between said valve means and said adjustable member.

2. A device of the character described, comprising a housing member having an exterior screw threaded portion and an interior screw threaded portion, valve means movably mounted in said housing, a screw threaded adjustable member received in said interior screw threaded portion, and thermostatic means comprising a plurality of plates loosely and separately mounted between said valve means and said adjustable member and spring means forcing said valve means against said thermostatic means.

3. A device of the character described, comprising a housing member having an exterior

screw threaded portion and an interior screw threaded portion, passages leading through said housing member, valve means movably mounted in said housing, a valve orifice disposed in said passage and in cooperative relationship to said valve means, a screw threaded adjustable member received in said interior screw threaded portion, and thermostatic means comprising a plurality of plates loosely and separably mounted between said valve means and said adjustable member.

4. A device for metering a fluid intake orifice of an internal combustion engine comprising the combination of a housing member having an interior screw threaded portion, an adjustable cap member mounted therein, passages leading through said housing member, a movable valve stem mounted in said housing member, a valve orifice disposed in said passage and in cooperating relationship to said valve stem, a second orifice of relatively smaller area than that of said first-named orifice positioned in said valve stem, another passage communicating from said first orifice to said second orifice, and a plurality of thermostatic elements loosely and separably mounted between said valve stem and said adjustable cap adapted to actuate the valve stem.

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