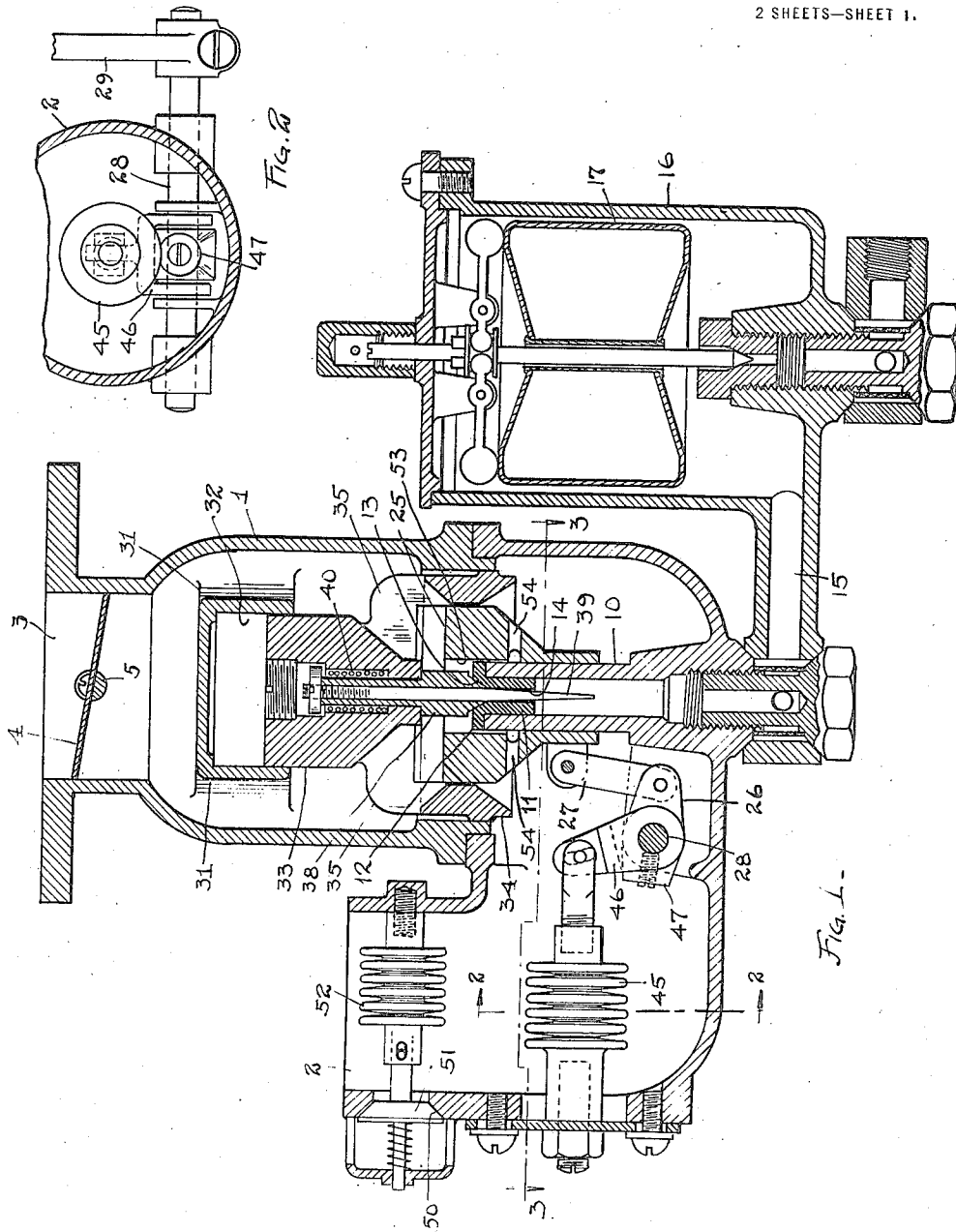


J. J. TRACY AND L. H. MORSE.
CARBURETOR.
APPLICATION FILED MAR. 8, 1918.

1,433,689.

Patented Oct. 31, 1922.
2 SHEETS—SHEET 1.



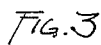
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FIG. 4 is a cross-sectional view of a mechanical assembly. It shows a central vertical shaft (11) passing through a housing (1). The shaft has a threaded section (13) and a flange (14). A piston (10) is located at the bottom of the shaft. A lever (60) is pivoted to the side of the shaft. A spring (56) is shown at the bottom of the shaft. A nut (55) is at the very bottom. Various other parts are labeled with numbers: 3, 4, 5, 31, 32, 33, 35, 38, 39, 40, 53, 54, 57, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72.

FIG. 5 is a cross-sectional view of a mechanical assembly, similar to FIG. 4. It shows a central vertical shaft (11) passing through a housing (1). The shaft has a threaded section (13) and a flange (14). A piston (10) is located at the bottom of the shaft. A lever (60) is pivoted to the side of the shaft. A spring (56) is shown at the bottom of the shaft. A nut (55) is at the very bottom. Various other parts are labeled with numbers: 3, 4, 5, 31, 32, 33, 35, 38, 39, 40, 53, 54, 57, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72.



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CARBURETOR.

Application filed March 8, 1918. Serial No. 221,108.

To all whom it may concern:

Be it known that we, JAMES J. TRACY and LAWRENCE H. MORSE, citizens of the United States, and residents of Cleveland, county of Cuyahoga, State of Ohio, have jointly invented a new and useful Improvement in Carburetors, of which the following is a specification, the principle of the invention being herein explained and the best mode in which we have contemplated applying that principle, so as to distinguish it from other inventions.

The present invention has as its object the provision of a carburetor, in which the character of the charge, or mixture, is properly controlled to meet variations in the temperature of the air as it is drawn into the carburetor. A further object is to provide for the maintenance of a uniform temperature in such air under normal operating conditions. In other words, the first feature of control functions during the starting stage when only relatively cold air is available, but under normal operating conditions, it is contemplated that pre-heated air will be available and that by controlling the temperature of such air, the setting of the carburetor parts for varying the mixture will remain practically constant.

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 drawings and the following description setting forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but several of the various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a vertical sectional central view of one form of the carburetor embodying our present improvements; Fig. 2 is a vertical section of a portion of said carburetor taken at right angles to the plane of Fig. 1 as indicated by the line 2—2 thereon; Fig. 3 is a horizontal sectional view of the same device with the plane of the section being indicated by the line 3—3, Fig. 1; Fig. 4 is a vertical sectional central view similar to that of Fig. 1, but illustrating a modified form of construction; and Fig. 5 is a sec-

tional view of a detail of the latter showing parts in different operative positions. 55

The carburetor, in connection with which our present improvements are shown in the aforesaid drawings, belongs to that type wherein the air friction, or flow of air drawn through the device by the suction of the engine, is relied upon to open and regulate not only such flow of air, but also the flow of the hydrocarbon fuel which is mixed therewith to form the charge proper. More specifically still, the construction of the carburetor, proper, in both the modified forms of the present invention is substantially the same as that described and claimed in our co-pending application, filed June 30, 1916, Serial No. 106,777, re-filed April 8, 1918, Serial No. 227,400. Accordingly, so far as similar parts occur in Figs. 1 and 4, such parts will be designated by like numerals.

Referring first of all to the construction illustrated in Figs. 1 to 3, inclusive, the body of the device will be seen to consist of a tubular casing 1 provided with an air inlet opening 2 and an outlet opening 3. Such outlet opening is, of course, connected to the engine manifold, as need not be further explained, and is controlled by a throttle in the form of a butterfly valve 4 of usual construction, carried by an oscillatory shaft 5 transversely mounted in such outlet opening and provided with suitable operating means (not shown). The inlet opening 2 is designed to be connected with a suitable heating arrangement (not shown) wherein the exhaust gases from the engine or other heat source are utilized as the heating agent, as need not be explained in detail. 80 85 90

Rising centrally from the bottom of the casing 1 is a fuel-supply duct or nozzle 10, in the upper part of which is fitted a nozzle proper 11, that has enlarged head 12 of a diameter substantially equal to the external diameter of said duct. The upper portion 13 of the discharge opening through such nozzle is of conical shape, communicating with a cylindrical portion 14, which in turn is in free communication with the interior of duct 10. Suitably connected with the lower end of said duct 10 is a fuel supply line 15, shown in the particular instance 105 110

in hand as leading from a float-chamber 16, wherein the height of the liquid fuel is controlled by means of a float 17, as will be readily understood.

5 Surrounding the duct 10 and the upper end of the nozzle 11, so as to be freely slidable thereon, is an annular valve 25 that serves to partially fill the annular space between the duct and the surrounding casing wall. This valve is adapted to be raised 10 from its normal position (somewhat lower than illustrated in Fig. 1) to the position thus illustrated, or to a higher position, by means of a rocker 26 mounted in the lower 15 portion of the casing and to one side of said nozzle 10, said rocker being connected to said valve by a link 27. This rocker is carried by a transverse shaft 28, one end of which projects without the casing, and 20 is provided with a lever 29 and link 30 for the purpose of manually controlling the setting of said valve 25, in a fashion that will be hereinafter fully described.

Centrally disposed in the upper portion 25 of the casing 1, being held there by means of radial arms 31, is a cylindrical chamber 32 that serves as a dash-pot to receive the upper piston-like projection 33 of a second annular valve 34, which, in the normal position of 30 the valve illustrated in Fig. 1, surrounds the first-named annular valve 25, and substantially shuts off communication between the upper and lower portions of the casing. A predetermined vertical movement of this 35 valve 34, however, will leave an annular opening, as will be obvious, the size of such opening increasing as the valve continues its upward movement, while the point at which the opening first occurs, depends upon the 40 setting of the annular valve 25. The piston-like portion 33 is spaced from the valve proper, and at the same time attached thereto, by means of radial arms 35, between 45 which the air is free to pass when the valve is raised, as just described.

Centrally mounted in the piston portion 33 of the annular air valve 34 is yet another valve 38, which controls the opening in the fuel-supply nozzle 11. The body of this 50 valve 38 is coned on its under side to fit the beveled discharge orifice 13 in nozzle 12, and is further provided with a relatively adjustable spindle or needle-valve extension 39 threaded in said body and adapted to project 55 within the bore 14 of the nozzle, such extension being tapered, as shown in Fig. 1. This fuel valve is not rigidly mounted in the piston portion of valve 34, but is vertically reciprocable relatively thereto, a spring 60 40 serving to maintain it in normal position, but allowing it to have a certain amount of play, in order to insure that it will properly center itself in the nozzle.

In addition to the means, including the 65 lever 29 and link 30 connected with the rock-

shaft 28 for manually positioning or setting the inner annular valve 25 that surrounds the nozzle, we provide a thermostatic device that is adapted to modify such setting as the temperature of the air drawn into the casing 70 1 varies.

In the form illustrated in Figs. 1 to 3, this device consists of a short corrugated tube 45 filled with a suitable fluid, so as to elongate axially as the temperature rises 75 and shorten as the temperature falls. One end of this element is fixedly attached to the side wall of the casing 1, while the other end is connected to a second rocker 46 loosely mounted on the shaft. This rocker 46 is in 80 the form of a yoke that is adapted to engage with an extension 47 of the rocker 26. Normally the weight of the valve 25 which may be supplemented by a suitable spring if desired will be sufficient to maintain said 85 rocker 26 thus in engagement with said yoke, the result being that, as the thermostatic element expands, the yoke turns toward the right, as shown in Fig. 1, and the valve 25 will gradually drop, or assume a lower and 90 lower position, with respect to the supply-fuel nozzle.

The manual raising of the valve 25, in order to provide the necessary rich mixture on starting up the engine, is, of course, in no 95 wise interfered with by the presence of this thermostatic controlling element and the operation just described, but as soon as the rock-shaft 28 is left free, the position of the valve 25 is determined by such thermostatic 100 device.

As has been previously explained, when a temperature is reached where complete vaporization of the liquid fuel results, it is desirable to maintain the temperature of the 105 air supplied to the carburetor at a constant point. We accordingly provide a supplemental air inlet opening 50 in the casing 1 such opening communicating directly with the atmosphere, or, in other words, having 110 no connection with any heating apparatus as has the main inlet opening 2. This supplemental air inlet opening is normally closed by a suitable valve 51, but is adapted to be 115 opened, when the temperature of the air drawn into the casing reaches a predetermined point, by means of a second thermostatic element 52 similar to the one just described, such element having a lost motion connection with the valve, so as to lift it 120 from its seat only after it has expanded a certain amount.

The general operation of the device as now described in full should be readily understood. Normally, the outer annular air- 125 valve 34 will be in the position shown in Fig. 1. In order to start, the inner valve 25 will be manually raised to a point somewhat higher than indicated in said figure, the effect of cranking the engine being to raise 130

the outer valve by the suction induced until it clears the inner valve. The fuel supply valve 38 will be raised correspondingly high and thus provide a rich mixture, as is desirable in starting. As soon, however, as the engine is started and the manual control released, the inner valve 25 drops until the extension 47 on the rocker 26 engages with the thermostatically controlled yoke 46. The outer valve 34, together with the fuel valve, will drop a corresponding amount, and as the air drawn into the inlet opening 2 becomes heated, the thermostatic element 45 will allow the valves in question to drop still lower, correspondingly reducing the proportion of fuel to the volume of air being drawn in. When the temperature of such air reaches the desired point, its further rise will be checked by the action of the second thermostatic element 52 in raising the valve 51 from its seat, so as to open the supplemental air inlet opening 50. Upon this device becoming thus operative, there will, under normal conditions, be no further action on the part of the first thermostatic device; the setting of the inner annular valve, in other words, remains fixed under such condition.

It will be noted that, as shown in Figs. 1 and 4, only a slight space is left between the two annular valves to provide an easy working fit; also that the upper portion of the bore of the inner annular valve is enlarged so as to leave an annular space 53 between the same and the fuel-supply duct and nozzle, this space 53 being connected by means of a series of apertures 54 with the lower portion of the casing.

In the modified construction illustrated in Fig. 4, the construction and operation of the carburetor proper is substantially identical with that just described, except that instead of utilizing a float chamber to maintain the fuel at a predetermined level in the nozzle, we here illustrate the use of a direct connection 55 with the source of fuel supply, the admission of the fuel into the nozzle being controlled by a weighted valve in the form of a plunger 56, that has its lower end coned to conform with an upwardly facing seat 57 in the lower end of the nozzle.

The connections, however, between the manually operable rock-shaft 28 and the inner annular valve 25 are of different construction from that previously described, in order to utilize a thermostatic element of a different form, viz, a strip of so-called "thermostatic metal" instead of a hollow corrugated tube. As known in the art, such thermostatic metal is a composite bi-metallic article made up of two metals of relatively different co-efficients of expansion, these being securely united to form mechanically a metallic strip or bar. Assuming that such a bar is approximately straight at a

normal temperature, a rise in temperature will cause the same to bend in a predetermined direction, the amount of the bending being proportionate to the change in temperature.

Accordingly, instead of directly connecting the valve 25 by means of links to a rocker on the shaft 28, in the construction in hand we extend such rocker 60 in the opposite direction, and rigidly attach to the outer end of the same one end of a bar 61 of such thermostatic metal, the layer having the higher co-efficient of expansion being disposed upwardly. The upper end of this bar is then connected by short links 62 with the valve in question. It being understood that the bar is sufficiently rigid, so as not to flex appreciably other than under the influence of a change in temperature, it will follow that manual setting of the valve may be had just as in the other construction. However, upon releasing the manual control and the rock-shaft coming to a position of rest against a stop 63 (for example) any change in the temperature of the incoming air will cause the thermostatic bar to bend or bow in the fashion indicated in Fig. 5, so as to cause its inner end to occupy a relatively lower position and thereby correspondingly to lower the inner annular valve. Should the air, on the contrary, grow colder, the bar will bend in the opposite direction so as to raise the annular valve.

This same type of thermostatic element may be utilized to admit a supplemental supply of cold air, in order to prevent the temperature of the air as mixed with the fuel from rising too high. As illustrated in Fig. 4, a pair of oppositely disposed supplemental air inlet openings 65 are formed in the casing adjacent the main air inlet opening 2, through which pre-heated air is designed to be drawn, and a pair of correspondingly facing valves 66, mounted on a common stem 67, are provided to close these openings. A balanced effect is obviously secured, the stem 67 being guided in a suitable bearing 68 formed in a bar extending transversely of the casing. Rigidly attached at one end to the side wall of the casing is a thermostatic bar 69 of the same sort as the one previously described, the other end of such bar being provided with a fork 70, or otherwise formed to engage a pin 71 in the stem of the valve, and thereby raise the latter whenever the air reaches a predetermined temperature. In this way, a certain amount of colder air is admitted and the mixture maintained approximately at a uniform temperature during the further operation of the engine.

As previously indicated, the temperature which it is desirable thus to maintain constant is that at which complete vaporization of the fuel occurs, there being a loss in

volumetric efficiency owing to the excess expansion of the air, and thus of the charge, if heated beyond this point. However, if the temperature of the air is allowed to go beyond the point just indicated, it should be remarked that the amount of fuel and air going to make up the mixture should be differently proportioned, that is, the setting of the valve 25 under the action of the thermostat must now be different from that previously required. We have found, in other words, that the action of the thermostatic element 61 must be checked, once such a temperature is reached. More specifically, if the mixture is not to be rarified to too great an extent, the action of such thermostat must be reduced approximately one-half. This result is very simply secured in the construction under consideration by providing a projection midway between the ends of the rocker 60 wherewith the thermostatic element 61 contacts, when it is bent or bowed a predetermined amount, corresponding with the critical temperature. This projection conveniently takes the form of a set screw 72, so that adjustment may be had in this particular.

Otherwise than as just indicated, the general mode of operation of this modified form is the same as the one first described above.

Other modes of applying the principle of our invention may be employed instead of the ones 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.

We therefore particularly point out and distinctly claim as our invention:—

1. In a charge-forming device, the combination of a suitable casing having an outlet for the charge and an air-inlet; a fuel nozzle discharging within said casing; two valves co-operating to substantially close the passage through said casing, one of said valves being adapted to be moved by the suction of the engine; a thermostat mounted in the air inlet portion of said casing and arranged to be affected by the temperature of the air admitted to said casing and adapted to operate the other of said valves; and a third valve, operated by said suction-actuated valve, for controlling the supply of fuel to said nozzle.

2. In a charge-forming device, the combination of a suitable casing having an outlet for the charge and an air-inlet; a fuel nozzle discharging within said casing; two valves co-operating to substantially close the passage through said casing, one of said valves being adapted to be moved by the suction of the engine; a thermostat mounted in the air inlet portion of said casing and arranged to be affected by the temperature of the air admitted to said casing and adapted to operate the other of said valves; external means for operating said other valve independently of said thermostat; and a third valve, operated by said suction-actuated valve, for controlling the supply of fuel to said nozzle.

Signed by us, this 6th day of March, 1918.

JAMES J. TRACY.
LAWRENCE H. MORSE.