

Aug. 6, 1929.

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1,723,936

AUTOMATIC CHOKE ACTUATOR

Filed Feb. 13, 1928

2 Sheets-Sheet 1

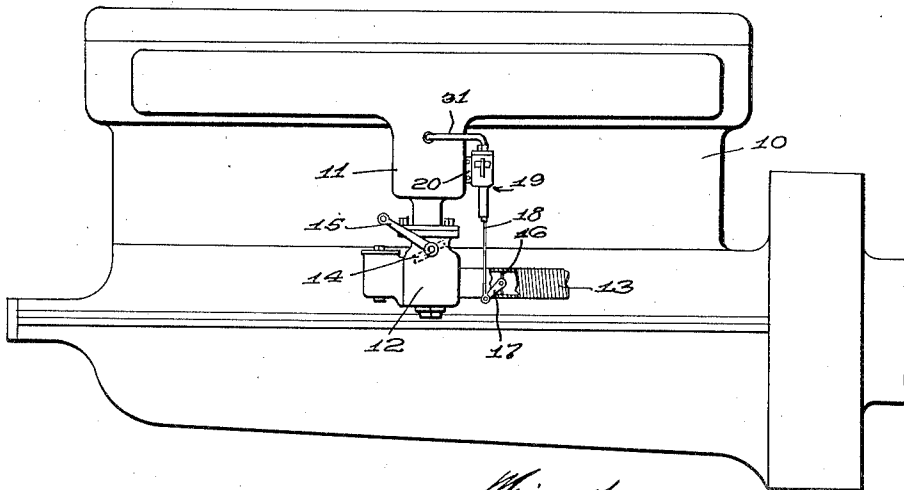
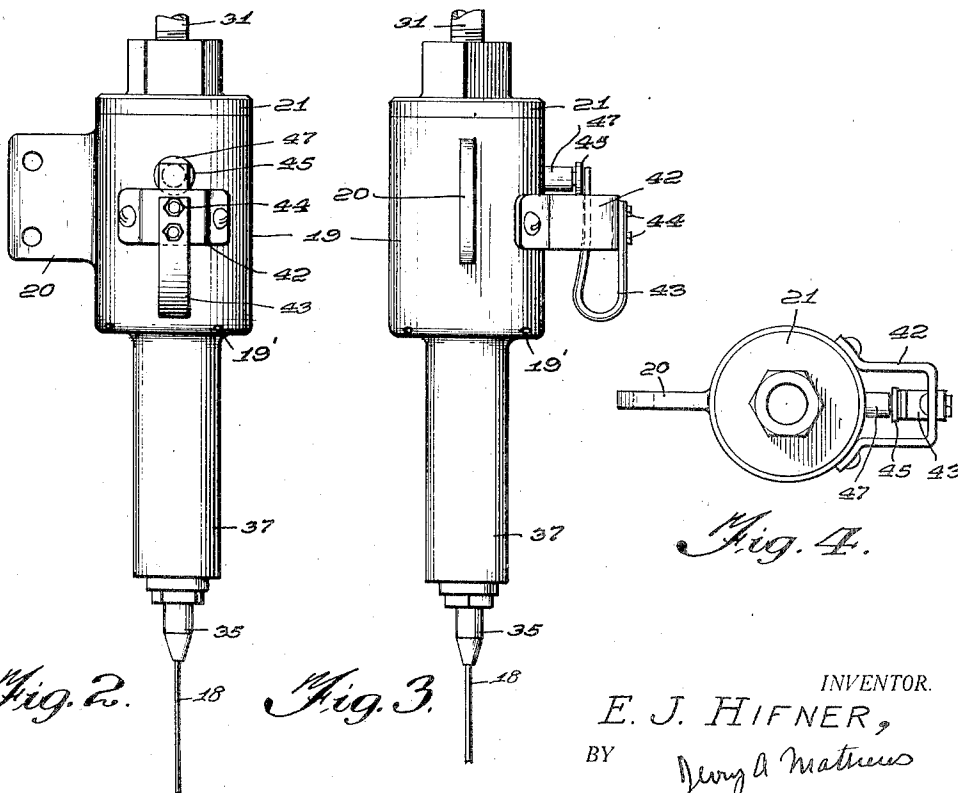


Fig. 1.



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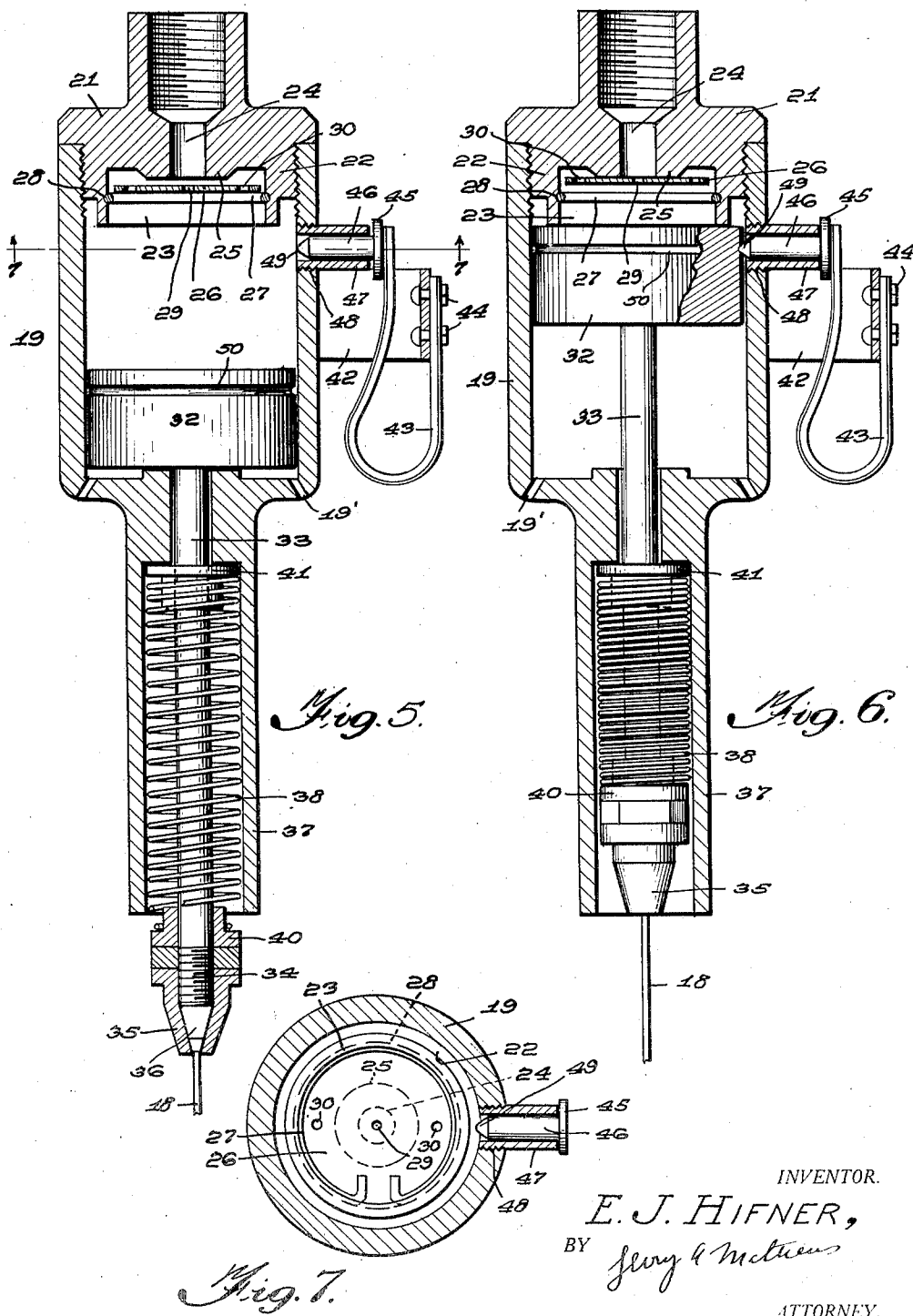
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

ERNEST J. HIFNER, OF LEXINGTON, KENTUCKY.

AUTOMATIC CHOKE ACTUATOR.

Application filed February 13, 1928. Serial No. 254,031.

My invention relates to improvements in the choke valve actuator shown and described in Letters Patent No. 1,630,614, issued to me under date of May 31, 1927.

5 The choke valve actuator shown in my Patent No. 1,630,614 includes in its preferred embodiment, a cylinder in communication with the intake manifold of the carburetor, above the throttle valve. A
10 plunger reciprocates within the cylinder and is mechanically connected with the choke valve. A light spring serves to return the plunger to the lower or normal position, whereby the choke valve is held
15 closed when the engine is stationary and cold. This slight spring opposes the upward movement of the plunger, and operates in conjunction with a pressure actuated disc valve having contracted openings or
20 ports. The disc valve, when seated, affords a restricted communication between the cylinder and the intake manifold, but when unseated, this restricted communication is dispensed with.

25 The improvement embodied in the present invention resides particularly in the provision of thermostatic means for holding or assisting in holding the plunger in the raised position, when the engine is operating while heated, under a light vacuum in
30 the intake manifold. The thermostatic means, in its preferred embodiment, includes a brake element, arranged to contact with the plunger, when it is shifted to the uppermost position, and will hold or aid in
35 holding the plunger elevated if the engine is heated at a sufficiently high temperature to cause the thermostatic element to properly hold the brake element in engagement
40 with the plunger. When the engine cools off, the brake element releases the plunger and the device will operate just as if the thermostatic device were not present.

45 In the accompanying drawings, forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

50 Figure 1 is a side elevation of a device embodying my invention, showing the same applied to a carburetor,

Figure 2 is an enlarged side elevation of the device removed,

Figure 3 is a similar view taken at a right angle to Figure 2,

55 Figure 4 is a plan view of the device,

Figure 5 is a central vertical longitudinal

section through the device, parts in elevation, and the piston in the lower position, and the thermostatic device inactive,

60 Figure 6 is a similar view, showing the plunger elevated, and the thermostatic device active, for assisting in holding the same elevated, and,

Figure 7 is a horizontal section taken on line 7-7 of Figure 5.

65 In the drawings, wherein for the purpose of illustration, is shown a preferred embodiment of my invention, the numeral 10 designates the cylinders of an internal combustion engine, and 11 the intake manifold. This intake manifold is preferably double-walled so that it is heated by gases from the exhaust, from the engine, as is customary upon many automobile engines. The manifold 11 is connected with the outlet end of
70 a carburetor 12, having an air intake 13. The carburetor is equipped with the usual throttle valve 14, actuated by a lever 15, which is operated by the gas lever on the steering wheel, as is well known. The air
75 intake pipe 13, may lead to an air heating jacket or the like, surrounding the exhaust manifold, and is equipped with a pivoted choke valve 16, swung by a lever 17, connected therewith. This lever has connection
80 with a sufficiently rigid rod or wire 18, to move it in opposite directions, for opening and closing the choke valve 16.

85 The control device embodies a cylinder 19, preferably vertically arranged, and rigidly attached to the intake manifold 11 by means of a bracket 20 or the like. This cylinder has breathing ports 19'. The cylinder is arranged close to the manifold, such as about three-eighths of an inch, and hence
90 the thermostatic device, to be described, carried by the cylinder, is properly heated from the heated manifold 11. The upper end of the cylinder 19 is preferably internally screw-threaded for receiving an externally
95 screw-threaded head 21, provided at its lower end with a depending annular flange 22, provided with a depending annular plunger seat 23. The head 21 is provided centrally thereof with an opening or bore 24, and a
100 depending annular valve seat 25, preferably surrounds this bore or opening. The numeral 26 designates a valve disc, which is slidably mounted within the annular flange 22, and its downward movement is limited by a
105 stop ring 27, removably mounted within an annular groove 28, as shown. The disc

valve is provided at its center with an opening 29 and is also provided with preferably diametrically arranged auxiliary openings 30. The openings 29 and 30 are preferably of the same diameter and the combined cross sectional area of the openings 29 and 30 is preferably equal to the cross sectional area of the bore 24. The valve disc 26 is slidably mounted within the flange 22. When the valve disc 26 is moved upwardly, due to the action of suction above the same, the intermediate portion of this valve disc engages the valve seat 25, and hence the outer openings 30 are cut out of communication with the opening or bore 24. When the valve disc 26 drops to the lower position, resting upon the stop ring 28, the three openings 29 and 30 are in communication with the opening or bore 24, and since the combined cross sectional area, of these openings 29 and 30, is equal to the cross sectional area of the openings 24, the suction within the opening or bore 24 will be transmitted freely to the cylinder 19, and beneath the valve disc. The provision of this valve disc with the central opening and the outer opening or openings, is a very important feature of the invention, and the function of the same will be explained more fully later.

The head 21 has connection with a pipe 31, which leads into the upper portion of the intake manifold 11, above the throttle valve 14, as shown.

Mounted to reciprocate within the cylinder 19 is a plunger 32, having a sliding fit therein, and this plunger is connected with a plunger rod 33. This plunger rod has its lower end screw-threaded, as shown at 34, for engagement with a coupling cap 35, receiving an enlarged head 36, formed upon the rod or wire 18 and connects rod 18 with the plunger rod 33. Preferably formed integral with the lower end of the plunger 19 is a tubular neck 37, surrounding the plunger rod 33 and enclosing a relatively slight compressible coil spring 38, surrounding the plunger rod, and engaging tubular keepers 40 and 41.

The function of the slight spring 38 is important. The choke valve 16 may be swung in either direction, by a slight pressure, such as, a half ounce pressure. The weight of the plunger 32 and associated elements, is sufficient, when the plunger is released, to return the choke valve to the closed position. The spring 38 is slight, and does aid in returning the choke valve to the closed position, although the device could operate for this purpose, without the spring. The principal purpose of this spring is not to return the choke valve to the closed position, but to provide a yielding cushion for the action of the plunger 32 when it is drawn upwardly, due to the suction. When the plunger is drawn upwardly rapidly, its

upper face impinges against the lower face of the annular seat 23, and this plunger is held firmly on this seat, as long as the engine is operating, due to the combustion of its fuel. The plunger is not intended to move up and down during the running of the engine. The annular seat 23 is provided, to prevent the possibility of any air leaking about the periphery of the plunger and hence getting into the intake manifold 11 about the throttle valve. It is preferred that some means be provided to positively prevent air passing the plunger 32 and entering the intake manifold. I have found that this can be effectively accomplished by providing the annular seat 23. The coil spring serves to yieldingly oppose the upward movement of the plunger 32, thus preventing undue hammering of the plunger against the plunger seat 23.

A thermostatic device is provided for co-action with the plunger 32, to hold or assist in holding the same elevated, when the engine is heated, and operating with a low vacuum in the intake manifold. This thermostatic device embodies a U-shaped bracket 42, rigidly mounted upon the side of the cylinder 19. This U-shaped bracket carries a generally U-shaped thermostatic element 43, rigidly attached thereto by bolts 44 or the like. The free end of the thermostatic element 43 is arranged to engage the head 45 of a brake element or plunger 46. This brake element or plunger has a sliding gas-tight fit within a guide sleeve 47, mounted within an opening 48, formed in the side of the cylinder 19, and forming a gas-tight joint with the cylinder. The inner end of the brake element or plunger 46 is conical and tapers forwardly, as shown at 49. The guide sleeve 47 serves to limit the inward movement of the brake element 16 whereby the conical or tapered end 49 projects into the cylinder 19, for only a slight distance. The plunger 32 is provided upon its periphery with an annular groove 50, which is generally V-shaped in cross section, and when the plunger 32 is in the uppermost position in contact with the plunger seat 23, the tapered end 49 may enter the groove 50, if the brake element is forced inwardly by the opening or expansion of the thermostatic element 43.

The operation of the device is as follows:

It may be assumed that the engine is at rest and cold, and that it is desired to start the same. The operator adjusts the gas lever on the steering wheel to the starting position. He then steps upon the starter. The starter turns the crank shaft and reciprocates the pistons. When this occurs, in the beginning, the choke valve 16 is closed, and hence a rich mixture is drawn into the cylinders. When the engine is thus being cranked, suction is created in the cylinders, 130

which is transmitted to the intake manifold, and hence to the opening or bore 24. This suction immediately acts upon the disc valve 26, shifting it upwardly and holding it upon the upper seat 25, thereby cutting openings 30 out of communication with the opening or bore 24. Hence the suction must be transmitted entirely through the single opening 29 in entering the top of the cylinder 19, for acting upon the plunger 32. The opening 30 is considerably reduced with respect to the diameter of the bore 24, and hence the movement of the plunger 32 upwardly is retarded, by virtue of this reduced opening 30. This is important, as it permits the choke valve 16 to remain wholly or partly closed for a sufficient length of time, when cranking the engine, prior to the combustion of the fuel. Now if the retarding movement of the plunger 32 upwardly were attempted to be effected by means of a heavy coil spring, a spring considerably heavier than the spring 38, satisfactory results could be obtained. A heavy spring could retard the movement of the plunger sufficiently, but when the suction was slightly lowered in the intake manifold, as when the engine becomes more or less overloaded, this heavy coil spring would return the choke valve 16 to the closed position, and hence choke the engine. This is obviously eliminated by the arrangement, for the disc valve 26 is seated upwardly instantly upon a slight suction in the intake manifold, as by cranking the engine, and remains permanently seated upwardly during the entire operation of the engine under the combustion of the fuel, regardless of the variance in the load of the engine. When the plunger 32 reaches its uppermost position, it engages the seat 23 and forms therewith an air-tight joint. By this time, the choke valve has been completely opened. Assuming that the ignition of the fuel is started, the engine will operate upon such fuel, and the disc valve 26 and plunger 32 will remain in the uppermost position, during this entire operation of the engine. Particular attention is called to the fact that the plunger 32 does not fluctuate up and down, during the operation of the engine upon its fuel. Now should the engine backfire, the pressure in the intake manifold is at once increased to or above atmospheric pressure, and it is desired that the choke valve close immediately. When this occurs, the valve disc 26 drops upon the stop ring 28, and all of the openings 29 and 30 are instantly placed in communication with the opening or bore 24, and opening 24 thereby placed in communication with the cylinder 19, above the plunger 32, and this increase of pressure permits the plunger to quickly return to its lowermost position and close the choke valve. This occurs when the operation of the engine upon its power

is stopped. Should the carburetor flood, the engine may be cranked with the choke valve open. This is accomplished by adjusting the gas lever on the steering wheel a little below the normal starting position. This will more or less close the throttle valve 14, whereby the major portion of the suction will be deflected into the cylinder 19. Hence, as soon as the engine is turned over by the starter, the increased suction will immediately raise the plunger and retain the same open.

The above operation of the device would occur without the presence of the thermostatic brake device, and it has been found that in a large number of cases, the device without the thermostatic brake device would operate entirely satisfactorily. However, after installing a large number of choke devices upon different engines and upon a number of the same type of engines, it was found that there is a considerable variance of suction or vacuum in the intake manifold, occurring principally when the engine is running at a relatively high speed and heated accordingly. This temperature is ordinarily from about 165° F. to 170° F. As before stated, when the engine warms up to the normal working temperature, of from 165° F. to 170° F., it has been found that the suction in the manifold may vary considerably, and as a result of this, where the suction does vary considerably, each choke device had to be separately adjusted or regulated to meet the demands of the particular engine, upon which it was applied. The adjustment might be made by regulating the weight of the disc valve or the weight of the plunger. To overcome the necessity of this individual regulation or adjustment, and to enable the device to be made to standard specifications, and to be applied to different engines, the thermostatic brake device has been provided. When the plunger 32 rises to the uppermost position, during the operation of the engine, as above explained, and when the engine warms up to about 165° F. or 170° F., the thermostatic element 43 will expand and the brake element 46 will be shifted inwardly so that its tapered end 49 enters the groove 50. This thermostatic element now assists the suction or vacuum to retain the plunger 32 elevated, and should there be a wide variance in the suction, such as a substantial lowering of the same, which may occur, with the engine operating at a temperature of 165° F. to 170° F., the brake element, with or without the aid of the light suction will retain the plunger 32 in the elevated seated position, whereby the choke valve remains open. When the engine is stopped, the brake element may retain the plunger 32 elevated until the engine and thermostatic elements cool off sufficiently at which time, the plunger will be released and

will be returned to the lowermost position, again closing the choke valve. If the engine is stopped while warm and the plunger is held in the elevated position, it may be manually returned to the lowermost position. Should the engine be again started, while hot and while the thermostatic element is expanded, the plunger 32 can again return to the uppermost position as the projected brake element will not prevent the upward movement of the plunger, as the plunger would force it outwardly due to its tapered or conical end 49. When this tapered end again enters the groove in the plunger 32, the brake element would again hold the plunger raised.

While it is preferred to use the thermostatic brake device with the plunger, co-acting with the disc valve, yet the invention is not restricted to this precise combination, as it may be used in connection with the plunger, with or without the disc valve.

It is to be understood that the form of my invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of my invention, or the scope of the subjoined claims.

Having thus described my invention, I claim:—

1. A suction actuated device including a cylinder having a port and a valve seat surrounding said port, a disc valve arranged to engage and disengage said valve seat and having an opening in substantial alinement with said port and additional opening or openings out of such alinement, a plunger to reciprocate within the cylinder, and a thermostatic device embodying a movable part to engage with the plunger when it is shifted toward the valve seat.

2. A suction actuated device including a cylinder having a port and a valve seat surrounding said port, a disc valve arranged to engage and disengage the valve seat and

having a port in substantial alinement with the first named port and another port or ports out of such alinement, a plunger to reciprocate within the cylinder, a movable element adapted to engage the plunger when it is shifted to a selected position, a thermostatic device to actuate said element, and means connecting the plunger with the choke valve of a carburetor.

3. A suction actuated device including a cylinder, a plunger movable within the cylinder, and a thermostatic device including a movable part to engage the plunger when such plunger is shifted to a selected position.

4. A suction actuated device including a cylinder, a plunger to operate within the cylinder and provided upon its periphery with a groove, a movable brake element having a tapered end to project into the cylinder and enter the groove when the plunger is shifted to a selected position, and a thermostatic device adapted to shift the brake element inwardly.

5. The combination with a carburetor having an intake manifold and a choke valve, of a suction operated device embodying a cylinder arranged near the intake manifold to be heated thereby, means of communication between the cylinder and intake manifold, a plunger mounted to reciprocate within the cylinder and connected with the choke valve, a brake element arranged to engage with the plunger when it is shifted to a selected position, and a thermostatic element carried by the cylinder and arranged near the intake manifold and adapted to actuate the brake element.

6. A suction actuated device comprising a cylinder provided in its side with an opening, a plunger to slide in the cylinder, a brake pin slidable within said opening to engage with the plunger when it is shifted to a selected position, and a thermostatic element adapted to move the brake pin inwardly.

In testimony whereof I affix my signature.
ERNEST J. HIFNER.