May 31, 1927. 1,630,614

E. J. HIFNER

AUTOMATIC CHOKE ACTUATOR

Filed May 13, 1926

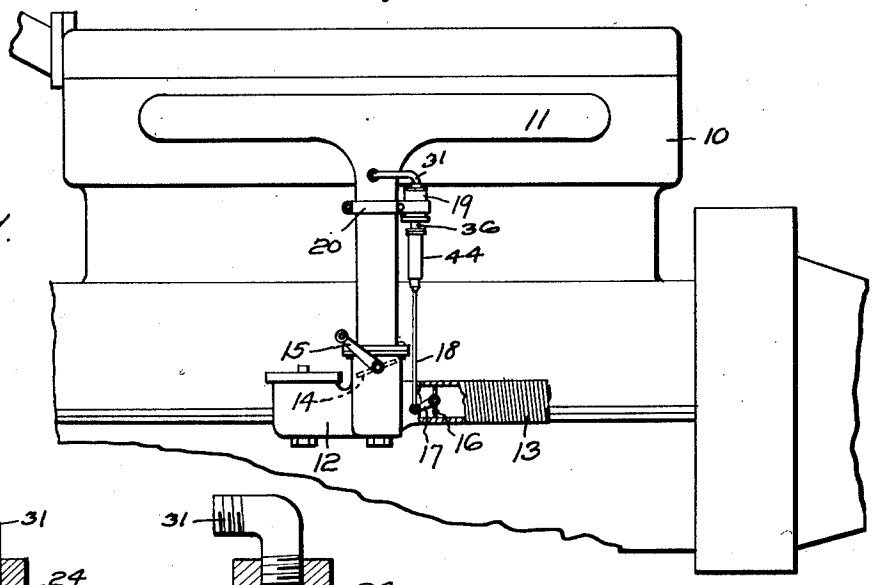


Fig. 1.

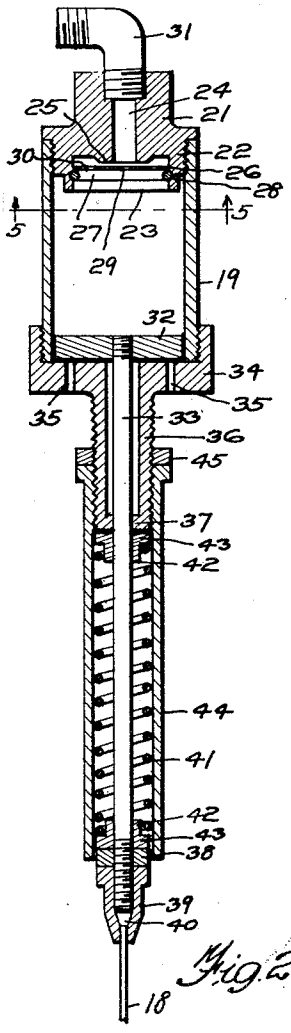


Fig. 2.

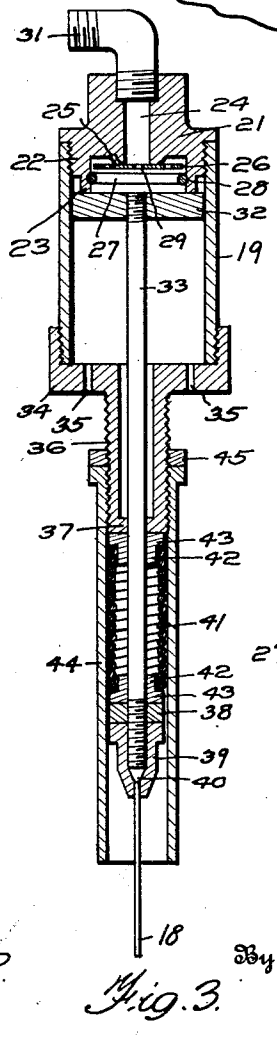


Fig. 3.

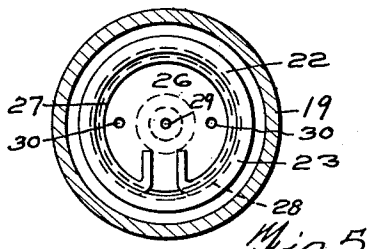


Fig. 5.

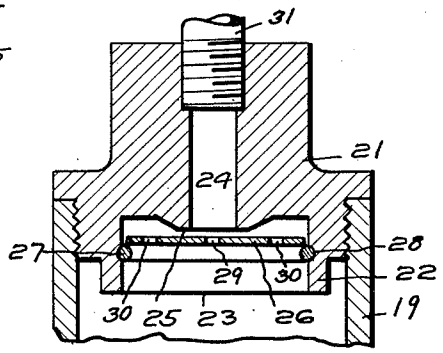


Fig. 4.

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Patented May 31, 1927. 1,630,614

UNITED STATES PATENT OFFICE.

ERNEST J. HIFNER, OF LEXINGTON, KENTUCKY.

AUTOMATIC CHOKE ACTUATOR.

Application filed May 13, 1926. Serial No. 108,875.

My invention relates to choke valve actuators.

The invention embodies a device for automatically opening and closing the choke valve of the carburetor in accordance with the requirements of the motor. In the ordinary automobile engine, the choke valve of the carburetor is normally open so that air may freely enter the carburetor and intake manifold. The choke valve is connected to a device, on the instrument board of the automobile, by the manipulation of which the choke valve may be closed, or opened, at will, by the driver. The difficulty encountered in connection with this arrangement is that the operation of the choke valve requires separate attention, while the vehicle is being driven, and further, it is practically impossible to adjust the choke valve manually, to meet the requirements of the motor, in operation.

In the operation of the ordinary internal combustion engine, of an automobile, upon starting the engine, particularly when it is cold, the choke valve is manually actuated so that it is closed. When the engine starts, the choke valve must be released, or the engine will choke. The operation is manual and in no sense automatic.

By the use of my invention, the objectionable features encountered in connection with the manually operated choke valve are overcome, and the choke valve is closed when the engine is not running, and will accordingly properly function to supply a rich mixture to the cylinders, upon starting, and the choke valve will be automatically opened as soon as the engine begins its running operation, and will be held permanently opened during the entire running operation of the engine.

The invention further provides a device which is in the nature of an attachment, and which may be placed upon the ordinary carburetor, without alteration thereof.

The invention further provides means whereby air leakage into the manifold, above the carburetor throttle valve, is prevented.

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

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

Figure 2 is a central vertical longitudinal section through the device, parts in elevation, and the piston in the lower position,

Figure 3 is a similar view, with the piston raised,

Figure 4 is an enlarged fragmentary central vertical section, similar to Figure 2, and,

Figure 5 is a transverse section taken on line 5—5 of Figure 2.

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, connected with the outlet end of 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 intake pipe 13, which may lead to an air heating jacket or the like, surrounding the exhaust manifold, is equipped with a pivoted choke valve 16, swung by a lever 17, connected therewith. This lever has connection with a sufficiently rigid rod or wire 18, to move it in opposite directions, for opening and closing the choke valve 16.

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. The upper end of the cylinder 19 is preferably internally screw-threaded, for receiving an externally screw-threaded end of a 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 depending annular valve seat 25 preferably surrounds this opening or bore. The numeral 26 designates a valve disc which is slidably mounted within the annular flange 22, and its downward movement is limited by a stop ring 27, removably mounted within an annular groove 28, as shown. This disc valve is provided at its center with an opening 29, and it is also provided with preferably diametrically oppositely arranged auxiliary openings 30. These 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 opening or 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 opening 24, the suction within the opening or bore 24 will be transmitted freely to the cylinder 19, beneath this 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. The lower end of the cylinder 19 is preferably externally screw-threaded for engagement with a cap 34, having breathing ports 35, whereby the plunger 32 may move freely. Preferably formed integral with the cap 34 and depending therefrom is a tubular neck 36, and the plunger rod 33 passes centrally through this neck in spaced relation thereto. At its lower end the neck 36 is provided with an inwardly projecting flange 37, slidably receiving the plunger rod 33 and constituting a guide for the same. It is thus seen that the flange 37 will produce the minimum friction with the plunger rod.

The lower end of the plunger rod 33 is screw-threaded, for receiving a cylindrical lock nut 38, and a cap nut 39 is also screw-threaded upon this lower end, and is engaged by the lock nut. The cap nut receives the upper end of the rod or wire 18 and this upper end is provided with an enlargement 40, thereby attaching the rod or wire to the cap nut.

A compressible coil spring 41 surrounds the outer end of the plunger rod 33 and receives in its opposite ends the reduced extensions 42 of keepers 43, which are slidably mounted upon the rod 33 and within a protecting tube or sleeve 44. The sleeve 44 is longitudinally adjustably mounted upon the neck 36, and has screw-threaded engagement therewith, for this purpose, and may be locked in adjustment, upon this neck, by means of a lock nut 45, as shown. The function of the spring 41 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 41 is a slight spring, and does aid in returning the choke valve to the closed position, although the device could operate for this purpose, without this spring. The primary 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 rapidly, due to the suction. When this plunger 32 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 does not 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 above the throttle valve. It is a recognized fact that if a minute amount of air is allowed to enter the intake manifold above the throttle valve, such as, the amount of air which could pass through an opening as small as the point of a pin, that the adjustment of the carburetor would be impaired and the engine would not operate properly, particularly, when running idle. It is, therefore, essential 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 suction acting upon the plunger 32 serves to throw it upwardly, and the plunger will impinge on the seat 23 and the even contact faces of these parts would be readily injured or destroyed. To prevent the hammering action between these parts, I have provided shock absorbing means, including the coil spring 41. This coil spring is preferably of such a construction that it has the same strength, when almost completely compressed, as when only slightly compressed. This coil spring is of such a length that it becomes completely compressed, so that its turns completely close or contact, at about the same time that the plunger 32 contacts with the seat 23. The contact is made between the plunger and its seat a little in advance of the complete closing of the spring 41, so that a perfect seating of these parts is assured, but at about the instant of contact, the turns of the coil spring 41 become completely closed. At about the time the coil spring is being completely closed, it offers substantial resistance to the movement of the plunger, and, therefore, will absorb the shocks which prevent undue hammering. Further, if there is any tendency for the

contacting parts of the plunger and seat 23 to wear away, it is obvious that the spring will be closed, at the instant of contact, and hence the hammering action is relieved. In other words, the parts are so adjusted that the spring is completely closed at about the same time that the plunger contacts with its seat, but an instant after this contact whereby a perfect seating of the plunger is assured, and hammering eliminated.

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 which is transmitted to the intake manifold 11 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 opening 24, and hence the movement of the plunger 32 upwardly is retarded. 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 of the 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 41, satisfactory results could not 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 my 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 its fuel, regardless of the variance in the load on 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 has started, the engine will operate upon such fuel, and the valve disc 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 back fire, 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 instantly are 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 increase of pressure permits the plunger to quickly return to its lowermost position and close the choke valve. This also 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 32 and retain the same open.

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. The combination with the intake manifold of an internal combustion engine and carburetor connected therewith, said carburetor having a choke valve and throttle valve, of a cylinder associated with the intake manifold, a head for the cylinder having an inner bore in communication with the interior of the intake manifold above the throttle valve, a suction operated valve disc mounted within the cylinder beneath the head and adapted to be seated upwardly against the head, said valve disc having an inner opening in permanent communication with the inner bore and outer opening or openings in communication with said bore when the valve disc is unseated and out of communication with said bore when the valve disc is seated, a plunger operating within the cylinder beneath the valve disc, and connecting means between the plunger and choke valve.

2. The combination with the intake mani-

fold of an internal combustion engine and carburetor connected therewith, said carburetor having a choke valve and throttle valve, a cylinder associated with the intake manifold, a conduit leading into the intake manifold and into the cylinder, an automatic suction operated device to control the communication of said conduit and the interior of said cylinder, said device when shifted in one direction reducing such communication and when shifted in an opposite direction increasing such communication, a plunger operating within the cylinder, and connecting means between the plunger and the choke valve.

3. The combination with the intake manifold of an internal combustion engine and carburetor connected therewith, said carburetor having a choke valve, a cylinder associated with the intake manifold, a conduit leading into the intake manifold and into the cylinder, an automatic suction valve shifted to its seat by suction within the conduit, said valve being so constructed that it affords a reduced communication between the conduit and interior of the cylinder when it is seated and increases this communication when it is unseated, a plunger within the cylinder beneath the valve, and a connection between the plunger and choke valve.

4. The combination with the intake manifold of an internal combustion engine and carburetor connected therewith, said carburetor having a choke valve, a cylinder associated with the intake manifold, a conduit leading into the intake manifold and into the cylinder, an automatic valve shifted to its seat by suction within the conduit, said valve being so constructed that it affords a reduced communication between the conduit and interior of the cylinder when it is seated and increases this communication when it is unseated, and suction operated means actuated by the suction in the cylinder and connected with the choke valve.

5. The combination with the intake manifold of an internal combustion engine and carburetor connected therewith, said carburetor having a choke valve, a suction control device connected with the intake manifold and embodying a valve seat and an automatic valve shifted to said seat by suction within the manifold, said valve being so constructed that it affords a reduced communication with the manifold when it is seated and increases such communication when it is unseated, a suction operated device acted upon by the suction within the manifold through the medium of the control device, and means connecting the suction operated device with the choke valve.

6. A suction control device having means for communication with the intake manifold of an internal combustion engine to be acted upon by the varying suction therein produced by the change in load upon the engine, said device embodying a valve seat and automatic suction valve to engage and disengage said valve seat, said valve being so constructed that it affords a permanent reduced communication with the manifold when it is seated and increases this communication when it is unseated, a suction device having communication with the manifold through the medium of the control device, said suction device being adapted for connection with the choke valve of the carburetor.

7. The combination with the intake manifold of an internal combustion engine and carburetor connected therewith, said carburetor having a choke valve and throttle valve, of a cylinder associated with the intake manifold, a conduit leading into the intake manifold and into one end of the cylinder, a plunger seat arranged within the cylinder, a plunger slidable within the cylinder and having its end engaging the seat when it is shifted in one direction to the end of its stroke by the suction within the conduit, a plunger rod connected with the plunger, a compressible coil spring surrounding the plunger rod and compressed thereby when the plunger moves toward its seat, the spring being of such a construction that its turns are completely closed and contact when the plunger engages the seat, and a connection between the plunger rod and choke valve.

8. The combination with the intake manifold of an internal combustion engine and carburetor connected therewith, said carburetor having a choke valve and throttle valve, of a cylinder associated with the intake manifold, a head mounted upon one end of the cylinder and having an inner bore and an annular flange constituting a plunger seat, said head being provided at said bore with a valve seat, a disc valve mounted within the annular flange and adapted to be automatically seated against the valve seat by suction in said bore, said disc valve having an inner reduced opening in permanent communication with said bore and outer openings disposed outwardly of said bore, a conduit connecting said bore with the interior of the manifold, a plunger within the cylinder adapted to move into engagement with the plunger seat, a plunger rod connected with the plunger, a slight compressible coil spring surrounding the plunger rod and compressed thereby when the plunger moves toward its seat, and a connection between the plunger rod and choke valve.

9. The combination with a carburetor having a mixture outlet passage way, of a suction actuated control device having communication with said passage way, said device embodying a seat and valve adapted to engage and disengage the seat, said valve

being so constructed that it affords a permanent reduced communication with the passage way when it is seated and increases such communication when it is unseated, a suction operated device placed in communication with the passage way through the medium of the suction control device, and means for connecting the suction actuated device with the choke valve of the carburetor.

10. In a device of the character described, a suction control device comprising a member having a passage and a valve seat adjacent to the passage, and a suction actuated valve arranged to engage and disengage the valve seat, said valve having an opening which remains permanently uncovered when the valve is seated and unseated, and having additional opening or openings which are in communication with the passage when the valve is unseated and out of communication therewith when the valve is seated.

11. A device of the character described, a member having a passage, a suction operated device connected with the member, and a suction actuated valve to control the communication between the passage and the suction actuated device, said valve being so constructed that it affords a permanent reduced communication between the passage and said suction actuated device when it is seated and increases such permanent communication when it is unseated.

12. A suction actuated device embodying a member having a passage and a valve seat adjacent to the passage, and a suction actuated valve to engage and disengage the valve seat, said valve having an inner opening in permanent communication with the passage when said valve is seated and unseated, and outer opening or openings in communication with the passage when the valve is unseated and out of communication therewith when the valve is seated.

13. A suction actuated device including a member having a passage and a valve seat surrounding the passage, and a suction actuated disc valve to engage and disengage the valve seat, said disc valve having a central opening in permanent communication with the passage when it is seated and unseated and additional outer opening or openings adapted to communicate with the passage when the disc valve is unseated.

14. A suction actuated device including a member having a passage and a valve seat surrounding the passage, and a disc valve to engage and disengage the valve seat, said disc valve having an opening in permanent alinement with said passage and additional opening or openings out of alinement with said passage.

15. A suction actuated device including a cylinder, a member closing one end of the cylinder, said member having a passage and a valve seat surrounding said passage, a plunger seat surrounding the valve seat, a disc valve arranged to engage and disengage said valve seat and having an opening in alinement with said passage and additional opening or openings out of alinement with said passage and a plunger to reciprocate within the cylinder and adapted to engage the plunger seat.

In testimony whereof I affix my signature.

ERNEST J. HIFNER.