Jan. 23, 1934. O. C. BERRY 1,944,397

CARBURETOR

Filed Jan. 27, 1932 2 Sheets-Sheet 1

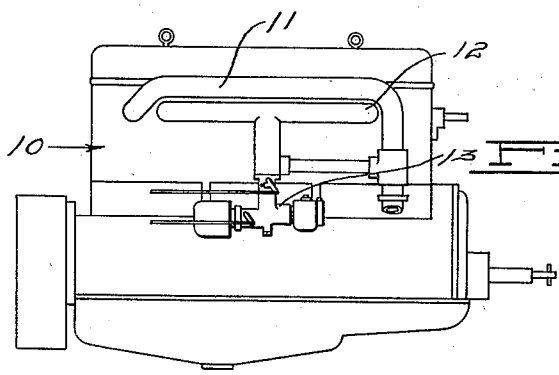


Fig. 1.

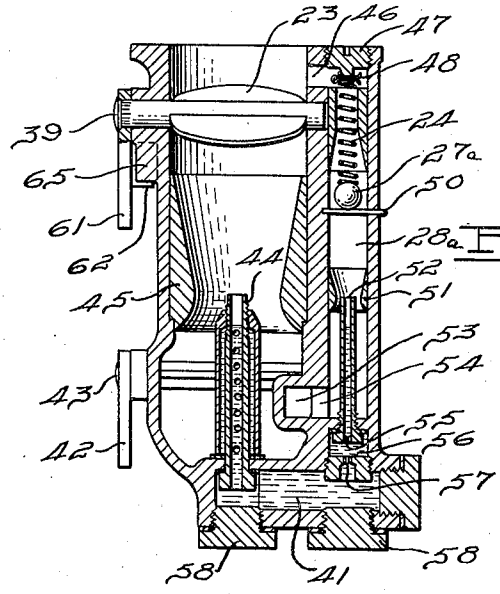


Fig. 5.

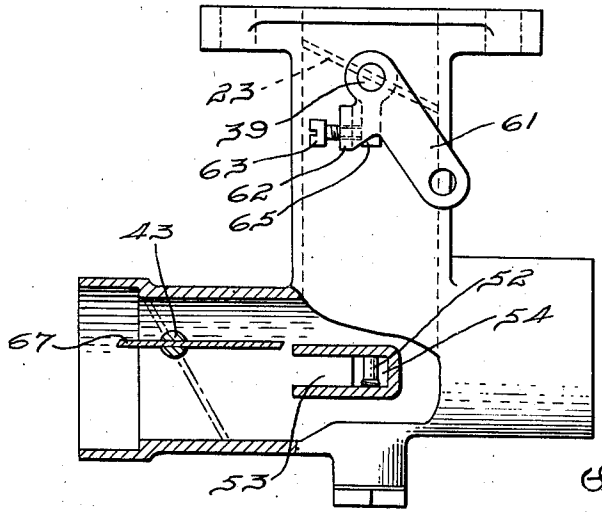


Fig. 6.

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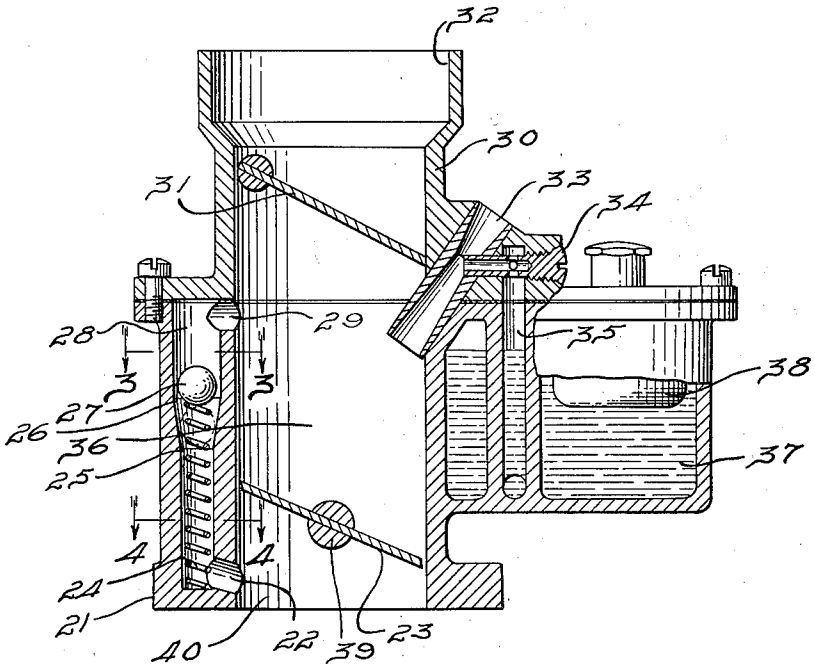


Fig. 2.

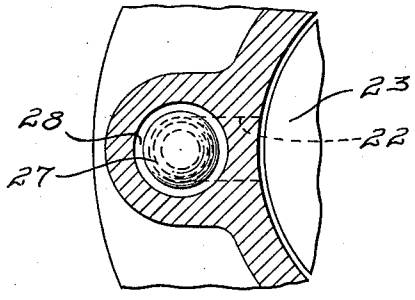


Fig. 3.

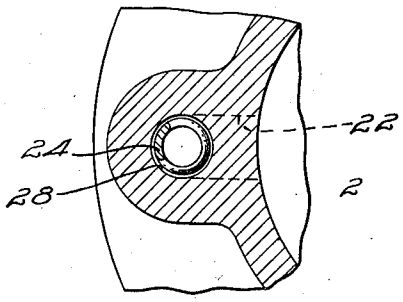


Fig. 4.

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CARBURETOR

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11 Claims. (Cl. 261—56)

This invention relates to carburetors for internal combustion engines and has for its object an improved organization of parts whereby the tendency of the engine to stall when idling is counteracted and whereby its starting either when cold or relatively hot is facilitated. My improved construction also automatically effects such by-passing around the carburetor throttle that the effective area for the passage of the mixture will increase gradually from practically nothing at normal idle suction to the full and proper amount at a chosen lower suction.

When the engine is thoroughly warmed up, it is possible to idle a motor vehicle down to a four or five mile per hour speed, but if even a slight variance from such ideal operating conditions takes place, such as either too thin an explosive mixture or an excessive richness thereof, the engine is apt to stall. This is also likely to occur if some one of the now numerous "free wheeling" appurtenances is made use of. If the engine does tend to stall, the vacuum generated in the intake manifold drops very rapidly. By the use of my improved mechanism, however, an additional supply of explosive mixture is by-passed from the carburetor into the intake manifold of the engine the instant the intake vacuum falls below a predetermined point, without affecting the metering of the carburetor, and with the same result as though the throttle had been opened to the requisite degree, and stalling of the engine is thus prevented.

It requires a great deal more power to start an engine when cold, and when the lubricating oil is relatively stiff, than is required to continue the idling of an already warmed-up engine. Consequently when the throttle stop is adjusted for a slow idling on a warm engine, the engine can not develop power enough to keep running when it is cold unless the throttle is open more than for the idling phase. Many drivers are not familiar with this fact, and persist in trying to start a cold engine with the throttle in idling position, which causes trouble and dissatisfaction. My invention automatically provides the required extra air supply necessary for the starting of a cold engine, while allowing it to return to the normal amount required for idling after the engine has been adequately warmed up.

The prevalent practice of applying exhaust heat to the intake manifolds is often attended with objectionable results, such as unduly high heating when the cars are driven at high speeds, and difficulty in starting the engine with the throttle closed against the idle stop. Opening of the throttle will help this latter condition and make the hot starting easier, and my invention is designed to automatically accomplish this without the necessity of throttle adjustment.

The driver of a car would not want his engine to speed up vigorously after the car was supposed to be running slowly and steadily. This is guarded against in the case of my invention by providing the relatively slow and gradual opening up of the auxiliary air supply.

In the drawings:

Figure 1 is a more or less conventional elevational showing of an internal combustion engine block with my improved apparatus positioned in operative relation thereon.

Figure 2 is a large scale sectional elevation of a down-draft carburetor equipped with one of my improved appurtenances.

Figure 3 is a horizontal section on an even larger scale through the line 3—3 of Figure 2 and looking in the direction of the arrows there shown.

Figure 4 is a horizontal section on the same proportional scale as Figure 3, taken on the line 4—4 of Figure 2, and looking in the direction of the arrows there shown.

Figure 5 is a vertical section through a more or less conventional up-draft plain tube carburetor, which is equipped with a slight modification of my improved construction from that shown in Figure 2.

Figure 6 is a partly sectional and partly elevational view of the carburetor shown in Figure 5, though taken from a direction at right angles to the plane thereof.

In Figure 1, 10 is an engine of conventional design having an exhaust manifold 11 and an intake manifold 12. The up-draft carburetor 13 is attached to the intake manifold 12 in the usual way. In Figure 2, 21 is the lower casting in which is located the throttle-valve 23 on the shaft 39 and the constant level fuel chamber 37. The upper casting 30 is bolted to the lower casting 21, and contains the air-valve 31, the main air inlet 32, the venturi 33 and the fuel nozzle 34. The fuel passes up through the passageway 35, fuel nozzle 34 and venturi 33 and into the mixing chamber 36. 38 is the ordinary float for regulating the level of the fuel. The method of metering the fuel may vary with the design of the carburetor and is not shown as it is not a part of this invention.

The passageway 28 is in the lower casting 21, and is a by-pass around the throttle 23. It communicates with the mixing chamber 36 through

the passageway 29 and with the mixture passageway 40 below the throttle, through the opening 22. In the passageway 28 there is a tapered section extending from 26 to 25. The spring 24 lies inside the lower end of the passageway 28. On the top of this spring rests the ball 27, said ball 27 being larger than the small end of the tapered section 26—25. The spring 24 is so calibrated that the ball 27 will be seated at the lower end of the tapered section 26—25 when the suction in the intake manifold of the engine is just below that at which the engine normally idles. The sizes of all of these various passageways forming the by-pass are so proportioned that the extra air passing through them will enable the engine to get a good start in the coldest weather. These sizes will therefore vary somewhat with different engines.

It is sometimes desirable to avoid cutting down the size of the by-pass until considerable suction has been developed in the intake manifold. The suction at which this area begins to be cut down can be varied by changing the length of the spring 24. This will vary the amount which the ball 27 must compress the spring 24 before said ball enters the tapered section 26—25.

When the engine is at rest, the spring 24 is loaded only by the almost negligible weight of the ball 27. Any suction in the passageway 40 below the throttle 23 will pull down on the ball 27 and compress the spring 24. The greater the suction in the passageway 40, the lower the ball 27 will go. After the center of the ball 27 passes the top 26 of the tapered section, any increase in suction in the passageway 40 will decrease the area through the by-pass, until at some suction approaching that at which the engine normally idles, the ball 27 will become firmly seated and the by-pass will be closed. There is a considerable range of suctions corresponding to the period during which the ball 27 lies in the tapered section 26—25. This means that the by-pass opens and closes gradually, and will therefore not cause violent racing of the engine.

The by-pass 28 communicates with the main air passageway of the carburetor below the air valve. Fuel is therefore metered into the mixture to correspond to the air passing through the by-pass, just the same as it is for air passing the throttle of the carburetor. Opening and closing the by-pass at a constant air-flow through the carburetor will therefore not effect the richness of the mixture ratio at all.

When starting a cold engine this by-pass will be wide open, and the engine will be able to develop enough speed and power to keep running. Since the oil will be stiff and a considerable torque will be required to keep going, no high intake suction can be developed and the by-pass will remain open. As the oil warms up and the intake suction increases the ball 27 will be pulled lower and lower in the tapered section and the effective area of the by-pass will be cut down until finally when the engine is warmed up, the ball 27 will be seated, the by-pass will be closed and the engine will be in a position to idle normally, just as though the by-pass did not exist.

Since the by-pass is entirely closed when the engine is idling normally, the idle speed is adjusted in the regular way. This may be illustrated by referring to Figure 6. Here the throttle 23 is shown in dashed lines. The throttle shaft 39 has the throttle lever 61 riveted to one end. The lever 61 has a flange 62, which is drilled and tapped for a screw 63. There is a lug 65 cast on the carburetor body in such a way that when the throttle is closed, the end of the screw 63 rests against the face of said lug. It is customary to have some kind of a spring means to normally hold the screw 63 against the lug 65, so that any speed above idle must be obtained by opening the throttle against this spring. By turning the screw 63 in the flange 62 the throttle opening at idle can be varied and the idle speed thus adjusted. Thus my invention makes it possible to adjust an engine to a slow idle speed when hot, and still get a positive start when cold without the operator having to open the throttle.

As has previously been mentioned, when an engine has been stopped while the manifolds are very hot, it is often hard to start it with the throttle set in the idle position. This is due to a loaded condition, or too much fuel in the mixture. The best remedy is to open the throttle considerably. My invention accomplishes this automatically. The starting motor can not turn the engine over fast enough to create sufficient intake suction to close the bypass. This bypass will therefore remain open until the engine has started and is running normally. Thus my device helps in starting a hot engine.

When an engine is running at a moderately high speed, many things may be wrong without causing it to stall. The carburetor may be out of adjustment, the plugs bad, the valves leaking or the engine improperly timed, and it may still keep going. When the idle speed is slow, the reverse is the case. The least thing going wrong will cause a stall, unless the throttle is opened at the first indication of an irregularity. The least irregularity in operation will cause a decided and immediate drop in the intake suction. In my device this will cause the ball 27 to rise from its seat and serve the same purpose as opening the throttle. If the trouble persists, said ball 27 will remain off of its seat and the engine speed will be held above normal. If at any time the trouble is corrected and the idle suction returns to normal, the ball 27 will return to its seat and the idle speed will return to normal. Thus my invention is a very positive anti-stalling device.

To use my invention on a plain tube carburetor, some additions must be made. In Figures 5 and 6 I show how it can be applied to an updraft plain tube carburetor. In Figure 5 the throttle disc 23, throttle shaft 39 and throttle lever 61 all appear at the top of the carburetor. The venturi 45 concentrates the suction at the end of the fuel nozzle 44. The shaft of the choker valve 67 is shown at 43 and the choker lever at 42. The bypass 28*a* communicates with the carburetor air inlet passageway through channels 53 and 54 and with the mixture passageway beyond the throttle through the channel 46. The plug 47 closes the upper end of the bypass 28 and also holds the spring 24 in place. The cotter pin 48 passes through a drilled hole in the plug 47 and helps to hold the spring 24. The pin 50 is placed centrally through the bypass 28 and holds the ball 27*a*. The weight of the ball 27*a* is so small that considerable strength is required in the spring 24*a*, even though the suction of the engine is working against the weight of the ball as well as the compressive strength of the spring.

No fuel is delivered out of the main nozzle of a plain tube carburetor when idling. It all comes through the idle device and is controlled

by the position of the throttle disc. The mixture ratio is not changed much by a considerable change in the idle suction, so long as the throttle remains stationary. If air is allowed to enter the intake manifold below the throttle while the engine is running at idle, this extra air must therefore carry its own fuel. To accomplish this I put the venturi 51 in the passageway 28, and a fuel nozzle 52 feeds fuel into the choke of the venturi 51. Fuel nozzles 44 and 51 are at about the same elevation above the fuel level in the float bowl of the carburetor (not shown). The capacity of the venturi 51 is so small that its fuel will be picked up at very low air flows, and no trouble need be experienced by getting below its minimum capacity. The nozzle 52 has a fuel metering orifice 55 at its base. The latter is calibrated so as to make the mixture furnished by the bypass correspond to the full power mixture of the engine, or about eight pounds of fuel to one hundred pounds of air. The pasageway 56 leads directly to the float chamber and delivers the fuel both to the metering orifice 55 for the bypass, and the main metering orifice 57, which controls the fuel supplied to the main nozzle 44. The passageway 41 carries the fuel from the metering orifice 57 to the nozzle 44. The plugs 58 serve to close the ends of the drilled fuel passageways.

In the plain tube carburetor the mixture passing the throttle 23 will not be affected appreciably by the opening and closing of the bypass valve. Since the bypass itself always furnishes a full power mixture, it will not upset the engine when it opens, but merely furnish it with an additional supply of fuel and air, so that it can run faster and develop more power, just as it would if the throttle were opened a little. Thus this modified design accomplishes the same results in the same general way on a plain tube carburetor that the simpler design does on an air valve carburetor.

In Figure 6 I show the air intake passage 53 of the by-pass 28. It extends nearly to the choker valve 67 and faces directly toward the stream of incoming air. This is done to keep the suction on the nozzle 52 from becoming great enough to deliver fuel when the ball 27 is seated and the engine is running at a high speed. It will also be noted that the choker valve is effective in choking the bypass 28 as well as the main carburetor, so that both streams of mixture are made richer by equal amounts when a cold start is being made.

While more than one form the invention has been illustrated and described, it will be clear to those familiar with the art that various modifications may be made without departing from the scope of the appending claims.

What I claim is:

1. In combination with an internal combustion engine and its intake manifold, a carburetor connected with said intake manifold, a throttle control for the main passageway through said carburetor incapable of complete closure against the passage of air therethrough when the engine is in operation, a by-pass structure provided with an opening on the manifold side of said throttle control. a valve seat in said by-pass passageway, a ball valve adapted to cooperate with said seat to prevent any substantial flow through the by-pass passage when said ball valve is in its closed position, and means for yieldingly holding said valve against seating except when the degree of vacuum approaches that at which said engine normally idles.

2. In combination with the charge-forming apparatus of an internal combustion engine, a throttle member having its most nearly closed position normally adjusted to control the idle speed of the engine, a by-pass structure operatively associated therewith with its outlet on the manifold side of said throttle member, a ball valve member adapted to close the by-pass channel when drawn theretoward by the suction due to the idling of the engine, and a spring member adapted to yieldingly displace and hold said ball valve member from its described seated position whenever the suction in the manifold is appreciably less than the normal idling suction of the engine.

3. An auxiliary appurtenance for increasing the range of operative efficiency of an internal combustion engine, comprising, in combination therewith and with an operatively associated charge-forming mechanism, a throttle member adapted to limitedly regulate the passage of air through said carburetor though incapable of effecting the complete cessation thereof, a by-pass structure having its inlet and outlet openings positioned on opposite sides of said throttle member, a selected portion of the by-pass channel being tapered, and a spring-actuated ball valve member adapted to be seated therein against the pressure of the spring by the action of said engine and to be displaced therefrom in response to a diminution in the suction below the normal idling suction of the engine, the amount of the by-pass area resulting from specified intake suctions being determined by the contouring of said tapered section of the by-pass cooperatively with the effected positioning of the ball valve relatively thereto.

4. An auxiliary appurtenance to an operatively connected internal combustion engine and its charge-forming apparatus, comprising, in combination with a throttle member having its minimum opening adjusted to control the idling speed of the engine, a by-pass structure having its inlet and outlet terminals located on opposite sides of said throttle, a ball valve adapted to substantially negative the suction-induced flow of air therethrough under normal idling and a spring adapted to yieldingly oppose such described action of the ball valve and to force said ball valve to open when the intake suction is appreciably below the normal idling suction of the engine.

5. In combination with the air inlet portion of an internal combustion engine unit, a throttle member capable of all but complete closure of said air inlet, a by-pass channel whose terminal connection with said air inlet is located on the manifold side of said throttle member, and a spring-actuated ball valve located within the by-pass channel and adapted for suction-induced closure against the action of said spring under normal idling operation of the engine and adapted to be displaced from such seated position upon a lowering of the vacuum condition in the intake.

6. In combination with an internal combustion engine and its intake manifold and charge-forming means, a throttle valve incapable of complete closure while the engine is in operation, a by-pass around said throttle, a selected portion of the by-pass channel being tapered, a valve adapted to cooperate with said tapered portion to substantially close said by-pass, a spring normally holding said valve open at low intake suctions but allowing it to close as said intake suction approaches the normal idling suction of the engine, the effective cross-sectional size of the tapered by-pass channel resulting from specified intake suctions being determined by the contouring of said tapered section co-

operatively with the positioning of said valve relatively thereto.

7. In combination with a throttle by-pass appurtenance of an internal combustion engine, the channel thereof having a selectively tapered section, a ball valve in said by-pass channel and capable of determining by its position relatively to said tapered section the area available in said by-pass channel for the transmission of a suction flow therethrough, and a spring normally holding said valve from seating at low intake suction though permitting its closure movement as the engine intake suction approaches the normal idling suction of the engine.

8. In combination with an internal combustion engine and its intake manifold and charge-forming structure, a throttle control therefor whose minimum opening is adjusted to the normal idling speed of the engine, a by-pass structure provided with openings on either side of said throttle, certain parts of the by-pass channel being selectively tapered, a valve adapted to cooperate with said tapered section in regulating the possible flow through the by-pass channel, means for yieldingly holding said valve against seating except when the degree of vacuum approaches that at which said engine normally idles, and means for metering fuel into said by-pass channel.

9. The combination, with the air inlet elements of an internal combustion engine and its associated charge-forming mechanism, of a throttle element in said air inlet, a by-pass structure having an outlet to said air inlet element on the manifold side of said throttle element, a ball valve in said by-pass arranged to vary the size of the passageway through said by-pass by changes in its position therein, and a spring yieldingly pushing said ball valve toward its open position and allowing it to come to its most nearly closed position only when the suction in said air inlet element approaches that at which said engine normally idles.

10. Means for effectuating the control of the carburetor feed of an internal combustion engine while the latter is at idling speed, comprising a supplemental by-pass structure adapted for operative connection with the carburetor on the outlet side of its throttle control, comprising in combination with such a by-pass, a ball valve of such size relatively to the throat of the by-pass as to substantially prevent any flow therethrough when the by-pass is under a suction in excess of that prevailing under normal idling condition, and a spring for yieldingly holding such ball valve from such described seating except when the degree of vacuum approaches that prevailing under normal idling condition of the engine.

11. An appurtenance to the charge-forming apparatus of an internal combustion engine, comprising a carburetor throttle by-pass exposed to intake manifold suction above the throttle, and a spring-displaceable ball valve adapted to close the throat of the by-pass when the engine suction thereon equals or exceeds that prevailing during the normal idling action of the engine, said valve being held in ineffective position as regards closure of the by-pass except under suction conditions inferior to those prevailing under normal idling action of the engine.

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