

[54] **DEVICE FOR FEEDING THE AIR-FUEL MIXTURE TO AN INTERNAL COMBUSTION ENGINE DURING IDLING**

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[51] **Int. Cl.**..... **F02m 3/08**

[58] **Field of Search**..... 261/41 D

[56] **References Cited**

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[57]

ABSTRACT

A device for feeding an internal combustion engine with a fuel and air mixture during idle running, the device being characterized by an extremely easy adjustment. The device is constituted by a chamber communicating with the atmosphere, the float chamber of the carburettor and the engine intake duct downstream of the throttle, and it comprises an additional chamber which communicates with the atmosphere and with the intake duct of the engine, downstream of the throttle, the communication with the intake duct being manually adjustable; the additional chamber, in addition, communicates with the first named chamber through a calibrated hole.

2 Claims, 2 Drawing Figures

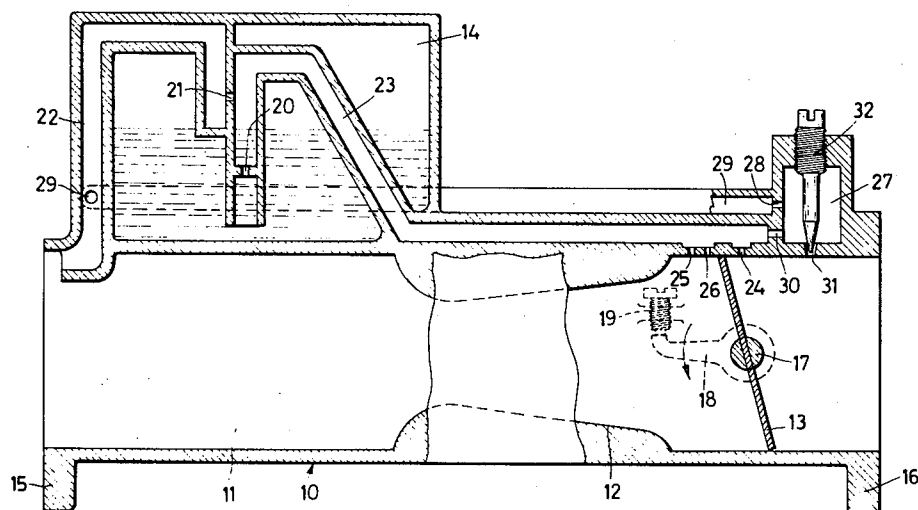


Fig. 1

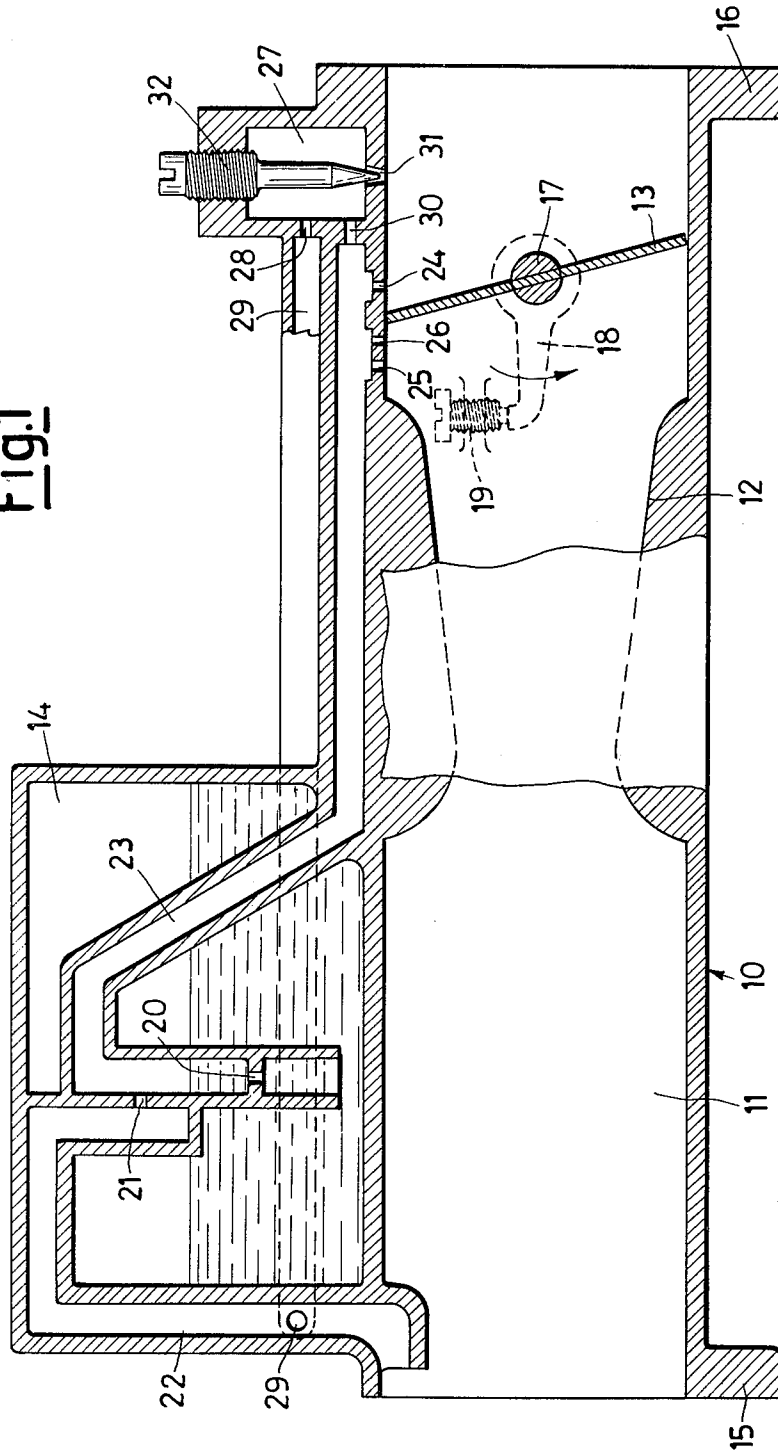
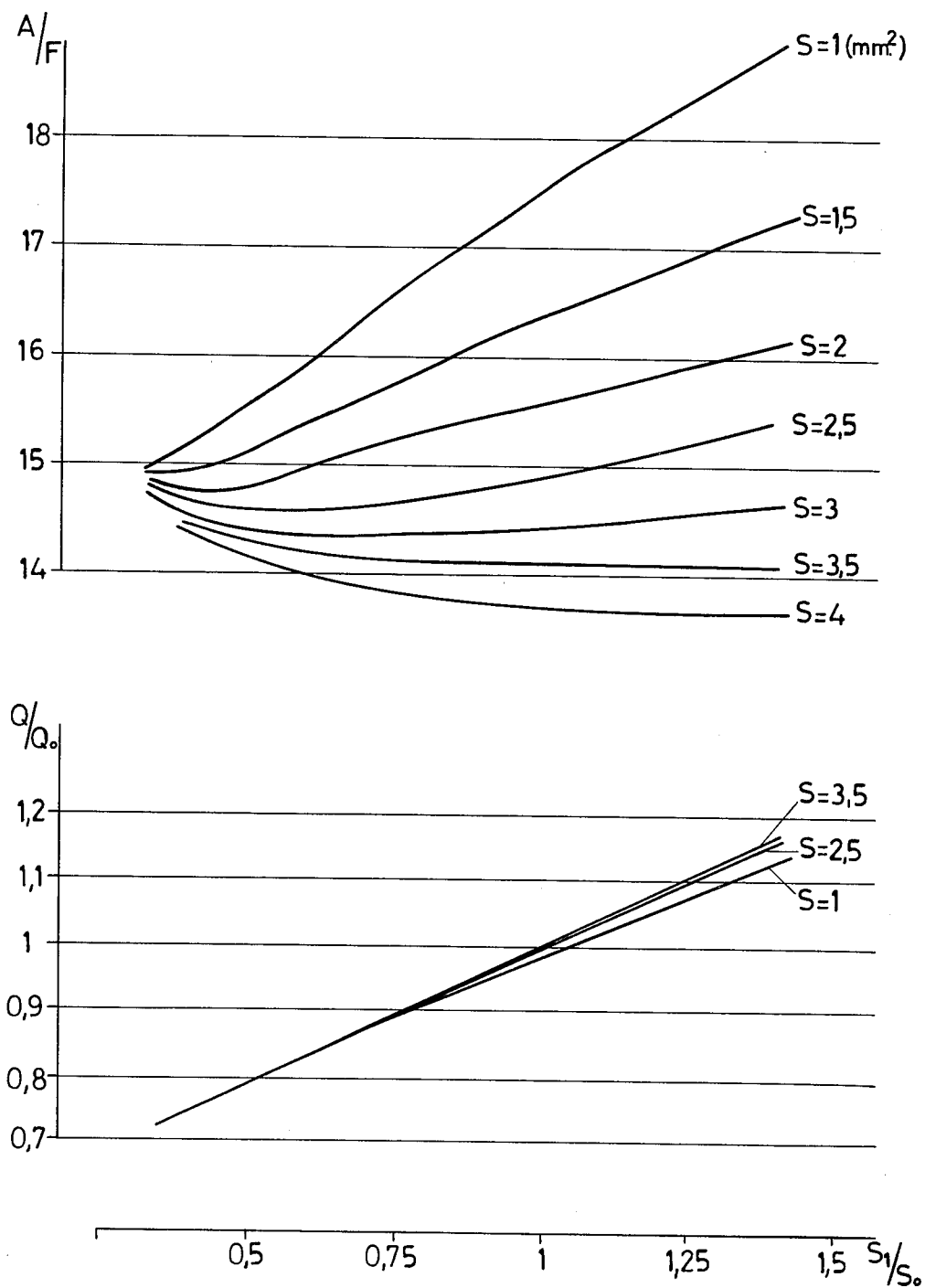


Fig.2



DEVICE FOR FEEDING THE AIR-FUEL MIXTURE TO AN INTERNAL COMBUSTION ENGINE DURING IDLING

It is known that in the majority of motor vehicles having an internal combustion engine fitted with a carburettor, when the engine is idling, that is when the clutch is shifted and the accelerator pedal is released, then with the throttle in its minimum opening position, the feed of the mixture to the air-fuel cylinders takes place in that, through the minimum opening of the throttle a certain volume of air is drawn and, in parallel with this volume of air also a certain volume of "premixture" is drawn, that is, of very rich mixture; the volume of air drawn in is thus dependent upon said volumes, on the other hand the strength of the mixture drawn by the cylinders is dependent upon the values of said volumes and the strength of the premixture. It is recalled that, in fact, in the conventional carburettors when idling, there is no dispensing of fuel in corresponding with the "main system" as formed by the choke and the relative calibrated holes for delivering fuel and air.

Said premixture rate of flow for idling is drawn through a port whose opening is adjusted by an idling system comprising an emulsion chamber fed through a calibrated hole for fuel and through a calibrated hole for air; the strength of the premixture is dependent upon the sizes of these calibrated holes, and the strength remains constant as the rate of flow of the premixture is varied, both as a result of the variation of the negative pressure prevailing in the intake duct and of a variation of the cross-sectional area of the above mentioned adjustable port.

With carburettor arrangements of this kind, which are now in general use, it is extremely difficult to adjust the rotation rate to the value which has been preselected as the optimum one for engine idling; with such an adjustment, in fact, the rate of flow of the mixture drawn in by the cylinders should be correlated to the requirements of the particular engine concerned, these requirements being variable as a function of the internal friction, the general conditions of the engine as a result of a more or less prolonged use thereof, etc.: but the adjustment operation, for example in the sense of increasing the rate of flow of the mixture, cannot be performed by only increasing (by means of the specially provided screw) the above cited adjustable port surface since, concurrently, the strength of the total mixture is varied in the sense of "strengthening" it; likewise, it is not possible to act only upon the degree of minimum opening of the throttle (in the sense of increasing said opening) since, at the same time, the strength of the final mixture is varied in the sense of "weakening" the mixture. The operator thus should simultaneously act upon the adjustment screw and the throttle in order to obtain the required RPM without modifying the strength of the mixture. A considerable skill is required so that the operation is successful without requiring too long a time.

The device according to the present invention seeks to remove the intricacy and difficulties of such an operation, so that the operator is required to act on a single adjustment member only (for example an adjustable screw) in order to obtain the desired rate of rotation whereas the mixture strength is in no way altered by the manipulation thereof.

The device comprises a first cavity equipped with at least a calibrated hole which establishes communication between the cavity and the atmosphere, with a calibrated hole which establishes a communication between the cavity and the usual carburettor float chamber and with a calibrated hole which establishes a communication between the cavity and the intake duct of the engine downstream of said throttle, and it also comprises a second cavity equipped with a calibrated hole which establishes a communication between the second cavity and the atmosphere and with a manually adjustable port which establishes a communication between the second aforesaid cavity and the intake duct of the engine downstream of said throttle, the first and the second cavity being also mutually in communication through a further calibrated hole.

In the accompanying drawing FIG. 1 diagrammatically shows, by way of example, the idling system of a carburettor, according to the invention; and FIG. 2 is a graph which shows its operation.

Numeral 10 generally indicates the carburettor of an internal combustion engine; there can be seen intake duct 11 with its Venturi 12, throttle 13 and constant level float chamber 14; at 15 and 16 are shown the connection flanges for the air filter and the engine head. The drawing does not show conventional details which are of no interest to this invention, such as the main ducts for the mixture which reaches the choke and the relevant air and fuel jets.

The throttle 13 is fastened to the shaft 17 which is supported for rotation in the duct 11 and is mechanically connected to the accelerator pedal (not shown) of the vehicle. The shaft 17 is also integral with lever 18 which, as the accelerator pedal is released, abuts the end of stroke screw 19, which defines the minimum opening position of the throttle 13.

Numeral 20 indicates the idling jet, that is, the calibrated hole through which the fuel emerges during engine running with the throttle in the maximum closure position and 21 indicates the calibrated hole through which the relative emulsifying air comes from duct 22 which is in parallel with respect to duct 11.

The duct 23 which feeds the engine with the air and fuel premixture during idling is in communication with the duct 11 through calibrated hole 24, placed downstream of the throttle 13: in the duct 11, upstream of the throttle, open also the usual progression holes, shown at 25 and 26, with which carburettors are generally equipped.

There is shown at 27 a chamber, fed through calibrated hole 28, by the duct 29 (partially shown) with air drawn from the duct 22.

The chamber 27 is in communication with the duct 23 through calibrated hole 30 and a hole 31 opens into chamber 27 and the duct 11 downstream of the throttle 13. The hole 31 has a variable flow passage area, which is manually adjustable between a maximum and a minimum value by a conical tip screw 32.

To adjust the idle speed of the engine in the usual carburettors, where there is no chamber such as 27 nor an adjustment screw such as 32, there is placed a screw in correspondence with the mixture feeding hole 24, and the simultaneous adjustment of the screw 19 and the screw in hole 24 is required so that, as the rate of flow is varied, the strength of the final mixture remains unaltered.

With the idling system as shown herein, conversely, the screw 19, after as first initial adjustment of the position of minimum opening of the throttle 13, is no longer acted upon. To effect the adjustment of the idling speed of the engine it is sufficient to adjust the screw 32 which permits increase or decrease of the total rate of flow of the mixture drawn by the engine without varying the mixture strength.

As a matter of fact, the ratio of the cross-sectional area of the hole 28 and the cross-sectional area of the hole 31 is chosen to be lower than the ratio of the areas of the air intake holes in the duct 23 and the area of the hole 24 through which the premixture emerges, also when the cross-sectional area of the hole 31 is adjusted to its lowest value (during idle running air enters the duct 23 not only through the calibrated hole 21 but also through the progression holes 25 and 26); inasmuch as the conditions of intake and outlet pressure are the same, the negative pressure which is established within the chamber 27 is lower than that prevailing in the duct 23, so that through the hole 30 there is a fluid flow which depends on the setting of the screw 32.

If, starting from an intermediate condition, that is for an intermediate setting of the screw 32, adjustments should be made so as to increase the idling speed of the engine (to bring it to the desired value), the screw 32 should be loosened somewhat; by increasing the passage area 31 the negative pressure in the chamber 27 will be consequentially increased. The importance of the hole 30 and its size for the operation of the device can be explained at this stage by considering the two hypothetical limiting conditions, that is, the one with the hole 30 having a zero cross-sectional area and that with the hole 30 having a very large cross-section. In the former case the negative pressure in the duct 23 is not varied even though the negative pressure magnitude in the chamber 27 is increased; thus the flow of fuel through the jet 20 does not vary; but the air which is drawn by the engine as a total is increased due to the increase of the flow passage area 31; thus the mixture which is drawn by the engine as a total is leaner. In the latter case, conversely, the negative pressure in the duct 23 is always equal to that of the chamber 27 and is increased concurrently therewith; the ratio of flow of air drawn through the ports (communicating with the atmosphere) 21, 25, 26 and 28 is a function of said negative pressure only. However, the rate of flow of fuel drawn through the port 20 is also a function of said negative pressure only. Consequently the air/fuel ratio of the premixture which flows into the intake duct downstream of the throttle through the two ports 24 and 31 is constant. The rate of flow of this premixture is however increased whereas the rate of flow of the air which enters by seeping at the throttle edges remains constant so that the mixture as drawn in total by the engine is richer.

Just in connection with this consideration, on the opposite effects which takes place (as regards the mixture strength) in the two hypotheses aforesaid (hole 30 with a zero crosssection and hole 30 with a very large cross-section) that it has been envisaged to be able to size the hole 30 so as to obtain a certain intermediate condition, that is, one in which the mixture does not become richer or leaner. A mathematical model of the above indicated phenomena has thus been studied and with the aid of an electronic calculator there have thus been calculated the mixture ratios which, as the port 31 is var-

ied, are obtained with different values allotted to the hole 30. FIG. 2 graphically shows the results of this theoretical data processing.

Having reference to a certain size of the idling device, the lower plot of FIG. 2 shows the variations of the rate of flow Q of the mixture as totally drawn by the engine, as a function of the area S_1 of the port 31, for different values (expressed in square mms) of the area S of the calibrated hole 30. The values of the abscissae are referred to the value S_0 of the port 31 which corresponds to the intermediate position of the screw 32 and those shown on the ordinates are referred to the value Q_0 of the rate of flow of the drawn in mixture, still with the screw 32 in the intermediate position.

The upper plot shows curves which show, still as a function of the S_1/S_0 ratio, the variation of the mixture ratio A/F for different values (expressed in sq.mms) of the cross-sectional area S of the hole 30. The plot thus confirms the possibility of obtaining that which is desired. For determined values of the port 30 (more particularly, for example, with $S = 3.5$), in point of fact, the strength of the mixture as totally drawn in by the engine remains virtually constant for variations of the air rate of flow (as great as ± 15 percent) obtained by acting only upon the screw 32 which determines the size of the port 31. Practical tests both on the carburettor test bench and on the engine have then confirmed the validity of the theoretical calculations.

Obviously, that which has been said above for the case of an increase of the rate of rotation of the engine as obtained by increasing the area of the port 31 (i.e. loosening the screw 32), is valid also for the opposite situation, that is, the reduction of the rate of speed as obtained by decreasing the area of the port 31, i.e. by tightening the screw 32: also in this case the strength of the mixture as totally drawn in by the engine does not change.

What has been said above is obviously true also in the case in which there are no holes 25 and 26 and thus there is only a device for the idle operation and there is not provided any device for the operation at small throttle openings (progression).

What is claimed is:

1. A carburettor for an internal combustion engine and of the type essentially comprising at least a main system for feeding and forming a fuel/air mixture aspirated by the engine on operating at medium and high outputs, and at least one additional feeding system for the idling and accelerating operation for feeding and forming a fuel/air mixture aspirated by the engine on operating at zero and low outputs, a throttle for controlling the feeding of the engine, the output delivered by the engine being dependent on the position of said throttle, said idling and accelerating system comprising a first and a second cavity intercommunicating with each other through a calibrated port, the first cavity being in communication through a first calibrated hole with a fuel feeding duct, through at least one second calibrated hole with the ambient atmosphere and through at least one third calibrated hole with the engine inlet duct downstream of the throttle, the second cavity being in communication through at least one fourth calibrated hole with the ambient atmosphere and at least through a manually adjustable port with the engine inlet duct downstream of the throttle, the ratio between the area of said second calibrated hole and the area of said third calibrated hole being correlated with

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the ratio between the area of said fourth calibrated hole and the area of said manually adjustable port such that when the area of said adjustable port assumes intermediate values in the adjustment range of the same area, the first ratio is greater than the second even when said area of the adjustable port is in the vicinity of the lower limit of said range.

2. A carburettor as claimed in claim 1, wherein the size of the communication port between the first and

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the second cavity is such that, during the adjustment of the idling operation of the engine, on varying the section of the adjustable port, while the air passage area left uncovered by the throttle is unchanged, the flow rate of the air mixed with fuel passing from the first to the second cavity varies so that the fuel/air ratio of the total mixture aspirated by the engine remains constant.

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