Mar. 27, 1923. 1,449,664.

M. FRIZ.

MULTIPLE JET CARBURETOR.

FILED SEPT. 3, 1920.

Fig. 2.

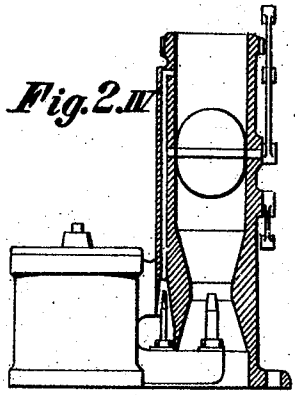


Fig. 1.

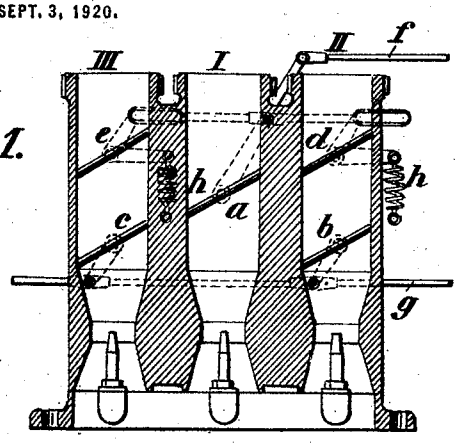
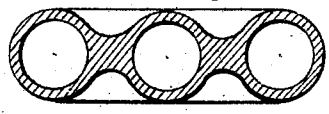


Fig. 3.



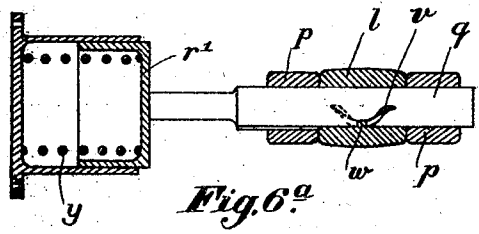


Fig. 6a.

Fig. 4.

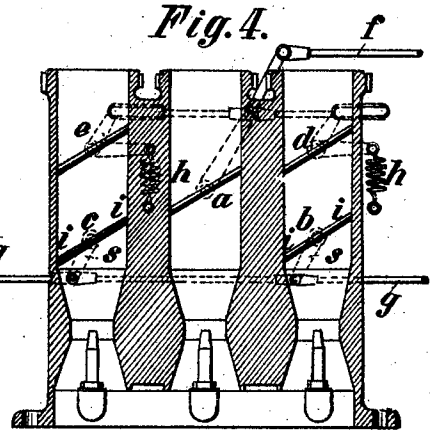


Fig. 6.

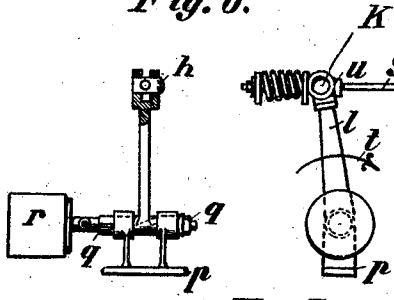


Fig. 7.

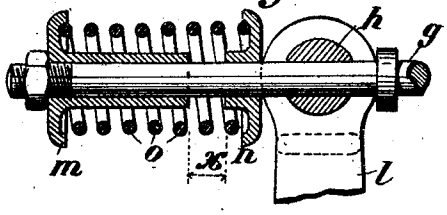
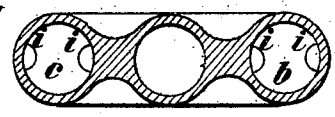


Fig. 5.



Inventor:
Max Friz,
By B. Singer,
Atty.

Patented Mar. 27, 1923. 1,449,664

UNITED STATES PATENT OFFICE.

MAX FRIZ, OF MILBERTSHOFEN, NEAR MUNICH, GERMANY, ASSIGNOR TO BAYERISCHE MOTOREN WERKE AKTIENGESELLSCHAFT, OF MUNICH, GERMANY.

MULTIPLE-JET CARBURETOR.

Application filed September 3, 1920. Serial No. 408,067.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, MAX FRIZ, a citizen of the German Republic, and a resident of Milbertshofen, near Munich, Bavaria, Germany, have invented a new and useful Multiple-Jet Carburetor, for which I have filed application for patent in Germany June 9, 1917, and of which the following is a specification.

This invention relates to a carburetor for use in such high altitude motors as have, in comparison with their normally designed under-structures an excessively large cylinder volume swept by the piston and excessively small compression spaces, or one of these features, and in which it is of great importance that they receive at every moment exactly that mixture (weight of charge) which they require in view of the density of the air at each particular altitude.

The invention, therefore, has for its main object a carburetor, by means of which the correct mixture can be admitted to the aforesaid type of motor at every flying elevation up to that particular altitude for which the motor has been constructed.

Another object consists in the provision of means affording a power reserve which the pilot may use in order to overcome greater resistances, at low altitudes, for example when starting, by temporarily increasing the weight of charge admitted to the cylinders and thereby augmenting the output of the engine.

A further object of the invention is to provide a carburetor which shall be reliable in its action and very economical in the consumption of fuel by always giving the most favorable opening at every particular flying elevation.

In carrying out the invention a multi-chamber carburetor is used, in which, according to the invention, two sets of throttle valves are provided, of which one is intended to be actuated at the lower elevations and the other according to altitude, the arrangement being such, that one of the carburetor chambers is only intended for use at low elevations and is just sufficiently large to supply the correct mixture at these elevations. The other chambers have throttle valves which are operated together with that of the first-named chamber, and additional throttle valves which are actuated according to altitude, automatically or by hand, and they are only opened after such height has been reached in which the pressure of the atmosphere has already considerably diminished.

The invention will best be understood by reference to the accompanying drawings which illustrate by way of example one form of carburetor with three distinct carburetor chambers, each having its own fuel and air nozzles and its own throttle valve or valves respectively.

Fig. 1 is a longitudinal section through the carburetor.

Fig. 2 a vertical cross section through the central chamber, and

Fig. 3 a horizontal cross section through Fig. 1

Fig. 4 is a sectional view similar to Fig. 1, illustrating the application of the augmenting device of the carburetor.

Fig. 5 is a horizontal cross section through the carburetor shown in Fig. 4.

Fig. 6 is a largely diagrammatic view, partly in section, of the automatic altitude control.

Fig. 6[a] is a detail sectional view of the same.

Fig. 7 illustrates the augmenting device and is a longitudinal section through same.

As will be seen from these figures the carburetor is subdivided into three chambers, the central chamber being denoted by I and the two side chambers by II and III respectively. Chamber I is that section of the carburetor which is not influenced by the varying atmospheric pressure as it is only provided with a manually controlled throttle valve *a*. Chambers II and III represent those sections in which the throttle valves *b* and *c* are controlled according to the varying air pressure. Said control is preferably carried out automatically by some barometric device, but it may be effected by hand, means being provided, independently to adjust the throttles by hand a small amount in excess of the position inparted to them by the said barometric device. The chambers II and III are further provided with throttle valves *e*, *d* capable of being operated by hand together with the valve *a* in chamber I by means of the control rod *f*. On the latter being shifted to the left, the throttle valve *a* will open first until it is about half

open, during which time the slotted link in connection with the valves ineffectively passes, owing to the slots, the throttle levers of the valves *e* and *d*. These throttle levers eventually come into contact with the respective end of the slots and the valves *e* and *d* begin to open. Since the lever of throttle valve *a* has double the length of the throttle levers for the valves *e* and *d*, the latter will open twice as quickly and be fully open when the throttle valve *a* has passed through the second half of its movement. The throttles *a*, *e* and *d* therefore will be fully open all at the same time. When closing the valves, the same proceedings take place in the reversed way; all three throttle valves starting to move simultaneously and the valves *e* and *b* being already closed by the action of their springs *h*, when the valve *h* is still half open. In this position of the carburetor the chamber I is the only one to supply mixture until fully closed.

The throttle valves *b* and *c* only begin to open after an altitude has been attained, in which the atmospheric pressure has already considerably diminished. They are entirely closed at ground level and in order to maintain, as far as possible, the mean pressure of the engine constant during the ascent and according to the respective flying altitude, they are gradually opened by displacement of the rod *g* towards the right until, at the ultimate flying altitude, for which the motor has been constructed, they are fully open. The operation of these throttle valves *b* and *c* will be the same whether they are controlled automatically by the barometric device or by hand, as even in the latter case the pilot must not begin to actuate these throttles before he has attained an altitude of considerably low atmospheric pressure.

For the purpose of automatic control the rod *g* is extended and passes loosely through a hole drilled in a bolt *k* which is swiveled in the free end of the barometer controlled lever *l*. At its extreme end said rod *g* carries a fixed spring plate *m*, whilst a second spring plate *n* is slidable between the head of lever *l* and the said spring plate *m* and is pressed against the lever by means of a compression spring *o* arranged between the two spring plates. The amount which the spring plates may approach each other is limited by the distance marked *x* in Fig. 7. The purpose of this arrangement will be described at a later stage. Lever *l* is supported with its lower end on a shaft *q* which is adapted to slide, but not to rotate, in a bracket *p* and is in connection with an aneroid barometer or the like *r*, by the aspirations of which it is moved to and fro within the said bracket. The said aneroid barometer forms no part of the invention and is therefore shown only diagrammatic in Figs. 4 and 6 of the drawings. That portion of the shaft *q* upon which the lever *l* is mounted is provided with a spiral groove into which the boss of the lever fits with a key. It will be seen, thus, that any displacement of the shaft *q* by the barometer will cause the lever to divert towards or away from the carburetor. When the lever *l* turns in the direction of the arrow *t* in Fig. 4 it presses against a collar *u* upon the rod *g* causing same to move to the right and to open the throttles *b* and *c*, whereas movement of the lever *l* in the reverse direction will cause the said throttles to be closed.

The various controlling operations are effected in the following manner: When the aeroplane starts to ascend the pilot opens the throttle *a* by means of the rod *f*. After this throttle *a* has opened half its amount, the throttles *e* and *d* begin to open and they are fully open the moment the throttle *a* reaches its full open position. This, however brings only the carburetor chamber I into operation, since the chambers II and III are still closed by the throttle valves *b* and *c*. With this carburetor opening the motor will give its normal output at ground level. When the aeroplane now continues to ascend, this output would decrease with the diminishing pressure of the atmosphere and to avoid this, the throttle valves *b* and *c* are now opened automatically by the air pressure, or by hand as said before, by a corresponding movement of rod *g*. The passages given free by these throttles *b* and *c* are at every flying elevation of the aeroplane such, that the motor would always maintain its normal performance up to that height for which it has been constructed and in which altitude the throttles *b* and *c* would be fully open and would remain so as long as the aeroplane would be flying at that or a higher elevation. If now the engine is to be throttled or stopped, the throttles *b* and *c* would remain open, whereas the throttles *a*, *d* and *e* would be closed by hand by shifting the rod *f* towards the right. The throttles *d* and *e* will be closed already after the rod *f* has moved through half its distance and the carburetor chamber I will be the only one to continue in operation until, at last, the throttle valve *a* has been closed. To again increase the engine performance the throttle *a* only is at first opened and after it has moved through half its amount, the throttles *e* and *d* are likewise caused to open in the manner already described.

On the aeroplane descending into lower elevations the throttles *b* and *c* are closed according to the altitudes passed without any regard to the position of the throttles *a*, *d* and *e* until, at ground level, both throttles *b* and *c* are again fully closed. The no load or idling arrangement which is usual in connection with most carburetors may be used in the ordinary way. It is shown in Fig 2

in which it is referred to as carburetor chamber IV.

In order to permit the chambers II and III to commence work already at ground level, small slits *i* may be made in the throttles *b* and *c* through which, with the throttles *d* and *e* partly or fully open but the throttles *b* and *c* still closed, a small amount of mixture would be admitted, sufficient just to ensure of the jets in the chambers II and III working properly when the corresponding throttles *d*, *e* begin to open.

To increase for a short time, as for example when starting, the output of the engine and to cause the same to deliver all that power which it is in position to deliver in view of its large cylinders, the spring plate *m* which is fixed at the extreme end of rod *g* may be depressed by hand against the resistance of the barometric device through the distance marked *x* in Fig. 7. Hereby the throttle valves *b* and *c* are opened a certain amount beyond the position imparted to them by the said barometric device and temporarily to admit an increased weight of charge into the cylinders.

What I claim is:—

1. A multiple jet carburetor for use in high altitude motors having excessively large cylinders and excessively small compression spaces in comparison with the under-structure of the motor, said carburetor being subdivided into two groups of self-contained curburetor chambers, one group having a single set of throttles and the other group having a duplicate set of throttles, each set being independent of the other.

2. A multiple jet carburetor for use in high altitude motors having excessively large cylinders and excessively small compression spaces in comparison with the under-structure of the motor, said carburetor comprising one self-contained carburetor chamber having only one throttling organ, and a number of likewise self-contained chambers having a duplicate set of throttling organs, each set being independent of the other.

3. A multiple jet carburetor for use in high altitude motors having excessively large cylinders and excessively small compression spaces in comparison with the under-structure of the motor, said carburetor comprising two groups of self-contained carburetor chambers, one set of throttling organs common to both groups and actuated in unison at low altitudes and a second set of throttling organs for only one group to be actuated at high altitudes.

4. A multiple jet carburetor for use in high altitude motors having excessively large cylinders and excessively small compression spaces in comparison with the under-structure of the motor, said carburetor comprising two groups of self-contained carburetor chambers, one set of throttling organs common to both groups and actuated in unison at low altitudes, a second set of throttling organs for only one group to be actuated at high altitudes and having small by-pass openings through which to supply a moderate amount of mixture when the said throttles are closed and the first named set opened.

5. A multiple jet carburetor for use in high altitude motors having excessively large cylinders and excessively small compression spaces in comparison with the under-structure of the motor, said carburetor comprising two groups of self-contained carburetor chambers, a hand operated set of throttles common to both groups to be actuated at low altitudes, an additional set of throttles for only one group to be actuated at high altitudes, a barometric device to automatically actuate said additional set of throttles in accordance with the varying pressure of the atmosphere.

6. A multiple jet carburetor for use in high altitude motors having excessively large cylinders and excessively small compression spaces in comparison with the under-structure of the motor, said carburetor comprising one group of carburetor chambers to supply the correct mixture at low altitudes and another group to supply correct mixture at high altitudes, a set of throttling organs common to both groups, an additional set of throttling organs for only one group, hand controlled means to actuate the low altitude throttles so that the throttles in the first named group of carburetor chambers open in advance of the throttles in the second named groups.

7. A multiple jet carburetor for use in high altitude motors having excessively large cylinders and excessively small compression spaces in comparison with the under-structure of the motor, said carburetor comprising a self-contained carburetor chamber to supply the correct mixture at low altitudes, a number of likewise self-contained carburetor chambers to supply correct mixture at high altitudes, a set of throttling organs common to all chambers, an additional set of throttling organs within the high-altitude chambers to be actuated in unison, a hand operated control rod to actuate the low altitude throttling organs, a lever in connection with said control rod to move the throttling organ in the low altitude chamber, a slotted link connecting the low altitude throttles in the high altitude chambers with that in the low altitude chambers, throttle levers in operative connection with said slotted link and of a shorter length than the first named throttle lever and acted upon by springs tending to keep the throttle organs in their closed position.

8. A multiple jet carburetor for use in

high altitude motors having excessively large cylinders and excessively small compression spaces in comparison with the under-structure of the motor, said carburetor comprising two groups of self-contained carburetor chambers, a hand operated set of throttles common to both groups to be actuated at low altitudes, an additional set of throttles for only one group to be actuated at high altitudes, a barometric device to automatically actuate said additional set of throttles in accordance with the varying pressure of the atmosphere, and means temporarily to open the high altitude throttles by hand against the resistance of the barometric device.

9. A multiple jet carburetor for use in high altitude motors having excessively large cylinders and excessively small compression spaces in comparison with the under-structure of the motor, said carburetor comprising two groups of self-contained carburetor chambers, a hand operated set of throttles common to both groups to be actuated at low altitudes, an additional set of throttles for only one group to be actuated at high altitudes, a barometric device to automatically actuate said additional set of throttles in accordance with the varying pressure of the atmosphere, a lever adapted to be oscillated by the aspirations of the barometric device, a control rod to actuate the high altitude throttles and having an extension passing loosely through a hole in the head of said lever, a collar on the control rod serving as a stop for the lever, a fixed spring plate at the extremity of the control rod, a loose spring plate between the said fixed spring plate and the lever head and a compression spring between the two spring plates.

In testimony whereof I affix my signature in presence of two witnesses.

MAX FRIZ.

Witnesses:
BRUNO KATZ,
EMIL FRIZ.