

G. J. SPOHRER.
AEROPLANE ENGINE CARBURATION.
APPLICATION FILED OCT. 16, 1918.

1,360,041.

Patented Nov. 23, 1920.

Fig. 1.

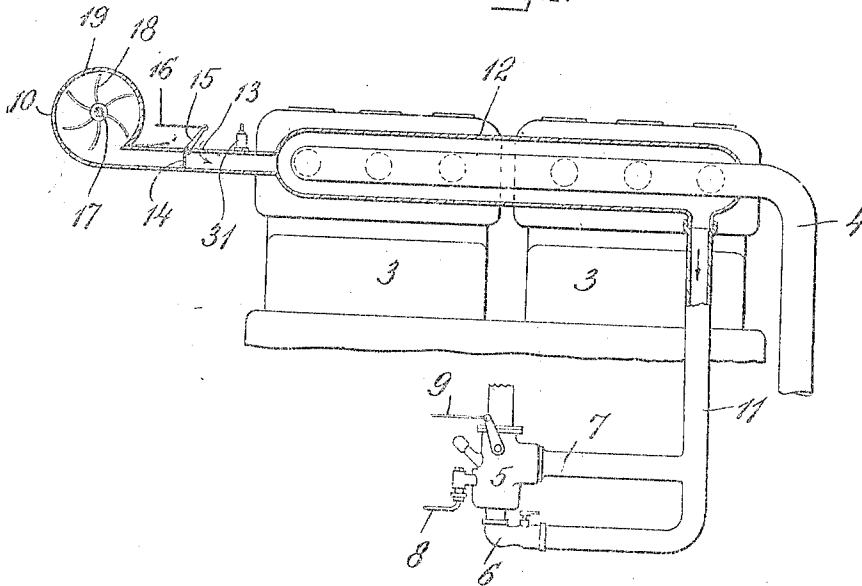
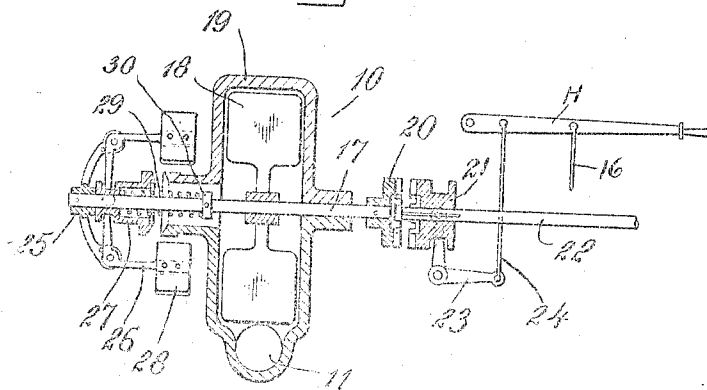


Fig. 2.



Inventor
G. J. Spohrer.
By *Charles H. Spohrer*
Attorney

UNITED STATES PATENT OFFICE.

GREGORY J. SPOHRER, OF EAST ORANGE, NEW JERSEY, ASSIGNOR OF ONE-HALF TO
CHARLES E. VAN VLECK, OF MONTCLAIR, NEW JERSEY.

AEROPLANE-ENGINE CARBURATION.

1,360,041.

Specification of Letters Patent. Patented Nov. 23, 1920.

Application filed October 16, 1918. Serial No. 258,401.

To all whom it may concern:

Be it known that I, GREGORY J. SPOHRER, a citizen of the United States, residing at East Orange, in the county of Essex, State of New Jersey, have invented certain new and useful Improvements in Aeroplane-Engine Carburation; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to internal combustion engines adapted for the propulsion of aeroplanes. When an aeroplane propelled by an internal combustion engine ascends to a considerable elevation above the earth, difficulty is experienced in operating the engine by reason of the rarefied condition of the atmosphere in which the machine is operated. Various expedients have been resorted to for reducing these difficulties, as for instance by constructing the engine on the theory that the normal conditions of its operation will be the conditions prevailing at a definite altitude, but all such expedients have succeeded to but a limited extent.

The present invention is directed to the provision of certain improvements in the construction of an internal combustion engine for use in propelling an aeroplane whereby far superior results may be attained at high altitudes.

In accordance with the invention, power driven devices are provided in connection with the engine for compressing air and supplying the air so compressed through a conduit leading to the intake of the carbureter, this conduit preferably inclosing the exhaust outlet of the cylinders so that the compressed air passing therethrough will be heated prior to its admission to the carbureter. The compressor for compressing the air so supplied to the carbureter may be actuated by the engine itself or by an independent motor and if desired it may be arranged for continuous operation whenever the engine of the aeroplane is in operation. I prefer, however, to provide for bringing the compressor into operation under the manual control of the operator as by the provision of a manually operated clutch for connecting the compressor to its driving mechanism. Ordinarily little or no difficulty is experienced in the operation of an internal combustion engine for the propul-

sion of an aeroplane, until a considerable altitude is reached, as for instance, an altitude of 15,000 feet above the earth's surface. Therefore, the compressor may remain idle until this altitude or an even higher altitude is reached, air being drawn into the carbureter at the lower altitudes in the usual manner by the suction of the engine cylinders. When a high altitude is reached at which faulty operation of the engine might be expected, the operator would manipulate the mechanism for connecting the compressor to its driving devices and at the same time close the opening through which air is drawn into the carbureter by the suction of the cylinders. Thereafter air would be supplied to the carbureter by the compressor through a closed conduit system connecting the compressor to the intake of the carbureter. This air would be under pressure with respect to the atmosphere in which the machine is being operated, suitable means being preferably employed for guarding against an excess of pressure in the air conduit.

In combination with the mechanism above outlined, an automatic regulating device is employed for controlling the compression of the air supplied to the carbureter with reference to the density of the atmosphere in which the machine is being operated. Thus, the inlet opening of the compressor may be regulated as to size by a valve or throttle whose position is determined by the density of the surrounding air. One way by which this may be accomplished is to provide swinging fan blades connected to the valve or throttle member and rotated in the atmosphere surrounding the aeroplane so that they will move to positions dependent upon the density of the atmosphere. In this way the freedom of flow of air through the compressor is increased or diminished in accordance with changes in the density of the surrounding atmosphere and a corresponding regulation is effected in the degree to which the air is compressed by the compressor, the degree of compression becoming greater as the density of the surrounding air becomes less, so as to maintain a more or less constant pressure of the air which is supplied by the compressor to the intake of the carbureter notwithstanding variations in the density of the atmosphere in which the aeroplane is operated.

The principles of my invention will be

better understood by reference to the following description in connection with the accompanying drawings which illustrate diagrammatically an internal combustion engine embodying the invention. It should be understood that the construction illustrated in the drawing is selected merely for the purpose of disclosing the principles of the invention and that the invention is in no way limited with respect to the construction of the parts employed in practicing it.

In the drawings, Figure 1 is a diagrammatic view of one side of an internal combustion engine broken away in part and Fig. 2 is a sectional detail view through the axis of the air compressor.

Referring to these drawings, the cylinders of the engine are indicated at 3 and the exhaust outlet valves of the cylinders communicate with an exhaust conduit 4 which extends along one side of the engine. The carbureter is shown at 5 having a main air intake at 6, an auxiliary air intake at 7, a fuel inlet at 8, and an operating mechanism for the throttle valve at 9.

In accordance with this invention, a closed conduit is provided extending from an air compressor 10 to the air inlets 6 and 7 of the carbureter. Preferably this closed conduit 11 surrounds a portion of the exhaust pipe 4 as is shown at 12 so that air passing through the conduit 11 will be heated by the exhaust gases. At any suitable point in the conduit 11, an opening 13 is provided through which the air of the surrounding atmosphere may be drawn into the conduit 11 and supplied therethrough to the carbureter at a pressure depending upon the density of the surrounding air. A valve 14 is provided whereby this opening 13 may be completely closed when desired. This valve 14 is shown as pivotally mounted and provided with a crank 15 to which an operating rod 16 is pivotally connected so that the valve 14 may be swung to the position in which it is shown in Fig. 1 for closing the connection from the compressor 10 to the conduit 11 and opening the passage 13 for atmospheric air to the interior of conduit 11 or to a position for closing the passage 13 so that atmospheric air may not enter the conduit 11 when air is supplied to the carbureter by the compressor 10.

The compressor 10 may be of any suitable construction. It is shown as consisting of a shaft 17 on which blades or vanes 18 are mounted radially to rotate within a casing 19 corresponding in shape and size to the blades 18. The casing 19 is provided with an outlet to which the end of the conduit 11 is connected. The shaft 17 is preferably connected to a driving member by means of a manually operated clutch consisting of a clutch member 20 secured on shaft 17 and

a cooperating clutch member 21 which is splined on a driving shaft 22. The member 21 is moved axially on shaft 22 in any suitable manner as by a bell crank lever 23 and operating rod 24. The shaft 22 may be connected by suitable gearing to the shaft of the internal combustion engine or it may be driven by a small independent motor.

The casing 19 of the compressor 10 is provided with an intake opening which is preferably disposed axially in the manner indicated in Fig. 2 and this opening is provided with a regulating device for closing it more or less under automatic control to increase or diminish the freedom of flow of atmospheric air into the compressor casing for compression and supply to the carbureter. In the present instance, the shaft 17 is shown as having a sleeve 25 fixed thereto and provided with radially projecting arms on which bell crank levers 26 are pivotally mounted. The inner ends of these arms extend into a circumferential groove on a valve member 27 in the form of a sleeve which is adapted to slide on the shaft 17. The outer ends of the bell crank levers 26 carry blades 28 of small size and light weight disposed at an incline to the circumference of a circle whose center is in the axis of shaft 17. The valve member 27 is pressed outwardly by a spring 29 coiled on shaft 17 and bearing at one end against a collar 30 on shaft 17 and at the other end against the valve member 27. The coating surfaces of the valve member 27 and its seat on the wall about the inlet opening of the compressor are correspondingly fashioned as by making them of conical formation.

The conduit 11 leading from the compressor to the carbureter is preferably provided with a valve for guarding against the development of excessive pressure conditions within the conduit. In no event would it be desirable to have the pressure within the conduit raised to a point in excess of atmospheric pressure at the earth's surface. The ideal form of relief valve would be one which would allow of the escape of air from the conduit whenever the pressure therein exceeded atmospheric pressure at the earth's surface, irrespective of the density of the air in which the apparatus is being operated. In practice, however, it would suffice to use a simple form of pressure relief valve of a common type except for the fact that instead of being set for a back pressure equal to the atmospheric pressure existing at the earth's surface, it would be set for a less amount of back pressure corresponding to that existing at the approximate elevation at which the machine would be normally operated or a back pressure equal to that existing at the maximum elevation at which the machine would be operated. Such a relief valve is indicated at 31.

The theoretically perfect mechanism for practising the present invention would involve the use of an air compressor and a controlling mechanism therefor such that the compressing action would vary directly at all times with changes in the elevation of the aeroplanes above the earth's surface, the compressing action being zero at the earth's surface and rising steadily with the elevation so that within the conduit from the compressor to the carbureter an air pressure equal to the atmospheric pressure at the earth's surface would be maintained at all elevations. Such a mechanism would seem to involve undue complexity and it is, therefore, considered preferable to use a simple mechanism which approximates the desired end. Practice in the past has shown that aeroplanes driven by internal combustion engines can mount to heights of say 15,000 feet without experiencing difficulty in the operation of the engine due to rarefaction of the air. Therefore, it is not necessary that the air supply to the carbureter be compressed at elevations up to that named. Accordingly, the clutch consisting of the members 20 and 21 is provided permitting the compressor to remain at rest until the operator starts to ascend at a high elevation at which time he would move the lever controlling the movable clutch member 21 to couple the compressor to its driving shaft. With the construction illustrated, the carbureter would be supplied at the lower levels with air drawn into the conduit 11 through the passage 13 leading to the atmosphere. When the compressor is coupled to its driving shaft, by manipulation of the clutch member 21, the opening 13 for the entrance of atmospheric air to the conduit 11 must be closed. The valve 14 for closing this opening may be so arranged that it will be closed by the current of air passing from the compressor 10 through the conduit 11. Or, this valve 14 may be closed by hand through the lever system indicated at 15 and 16. Preferably, the lever 16 is connected to the control lever H for operating the movable clutch member 21 so that the single movement of a control lever by the operator serves to couple the compressor to its driving shaft and at the same time close the atmospheric opening 13 in the conduit 11 by means of the valve 14.

The compressing action of the compressor 10 is automatically controlled by regulating the freedom with which air enters the casing 19. When the rotor 18 of the compressor is rotated, the vanes or blades 28 are rotated with it and these blades assume an angular position dependent upon the density of the air in which they are rotated and they control by their angular position the location of the movable valve member 27 with reference to its seat. When the compressor is

first brought into action by manipulating the clutch, the mechanism is in air of the greatest density in which it is supposed to be used. Therefore, the resistance to the angularly disposed vanes or blades 28 as those blades rotate is greatest and the blades move out away from the axis of rotation, thus turning the levers 26 on their pivots and moving the valve member 27 close to its seat. The freedom of entrance of air into the compressor casing 19 is, therefore, restricted and the compressing action of the compressor is reduced to a low point. As the aeroplane ascends into air of less density, the resistance offered by the air to the blades 28 is decreased and these blades move toward each other to a corresponding extent. As they turn thus about their pivots they move the valve member 27 outwardly away from its seat and thus increase the freedom of flow of air into the compressor. The compressing action of the compressor, therefore, becomes greater as the density of the air diminishes. Thus, a pressure of air is maintained within the conduit 11 in excess of the pressure of the air in which the aeroplane is being operated and by reason of the automatic control of the action of the compressor, the pressure of this air within the conduit 11 approximates a constant amount. By reason of this increased pressure of the air supplied to the carbureter at high altitudes over the pressure of the surrounding air and by reason of the approximately constant pressure of the air notwithstanding variations in the density of the surrounding air incident to changes of elevation, far better results in the operation of the engine may be obtained.

I claim:

1. An internal combustion engine comprising the combination of cylinders, pistons therein, a carbureter for supplying a gaseous mixture to the cylinders, an air compressor, a conduit for carrying air under pressure from the compressor to the air intake of the carbureter, and an automatic controlling mechanism comprising continuously rotating vanes for regulating the compressing action of the air compressor.

2. An internal combustion engine having a carbureter for supplying a gaseous mixture to the cylinders of the engine and means for supplying air under pressure to the air intake of the carbureter, comprising the combination of a compressor, a conduit connecting the compressor to the air intake of the carbureter, a valve controlling the admission of atmospheric air to the compressor, and a pair of vanes mounted on the shaft of the compressor and controlling the position of the valve.

3. An internal combustion engine comprising the combination of cylinders, pistons therein, a carbureter for supplying a

- gaseous mixture to the cylinders, an air compressor, a conduit connecting the air compressor to the air intake of the carbureter, a valve controlling an opening in the conduit for admitting atmospheric air thereto, means for connecting the rotary member of the compressor to a power driven member, a port in the casing of the compressor for admitting atmospheric air to the casing to be compressed therein, a valve controlling said port and a pair of vanes pivotally mounted on the rotary member of the compressor so as to be free to assume positions determined by the density of the surrounding atmosphere and connected to said last named valve for positioning the same.
4. In an internal combustion engine, the combination of cylinders, a carbureter, an air compressor, a conduit to lead compressed air from the compressor to the carbureter, 20 valve means associated with said conduit to control the delivery of air from the compressor to the carbureter, and clutch means to control the operation of the air compressor which is interconnected with said 25 valve means, whereby the clutch means and valve means are simultaneously operated.
5. The combination as claimed in claim 4 said conduit being provided with an inlet for atmospheric air, said valve means further functioning to control said inlet. 30
- In testimony whereof I affix my signature.

GREGORY J. SPOHRER.