Dec. 25, 1928. 1,696,361

F. REICH

COMPENSATING MEANS FOR VALVE OPERATING CONNECTIONS

Filed April 2, 1926 2 Sheets-Sheet 1

Fig. 1.

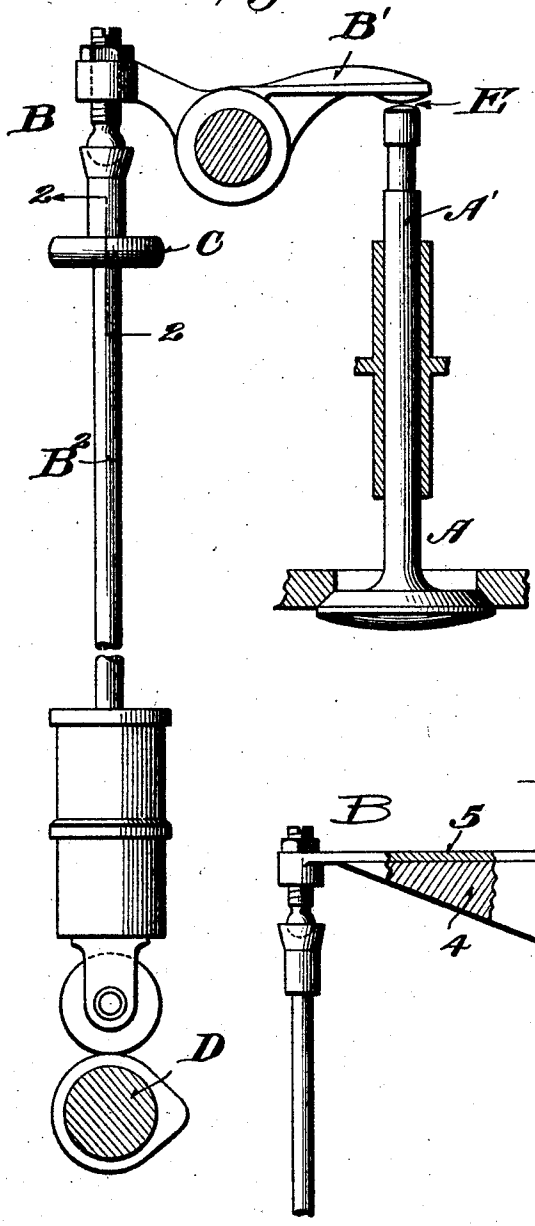


Fig. 2.

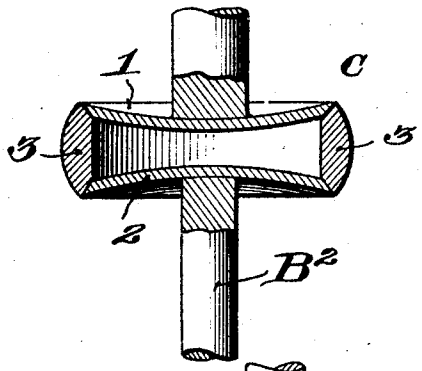


Fig. 7.

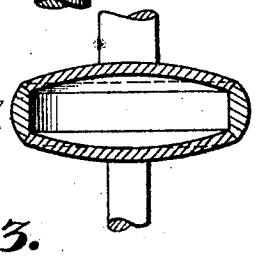
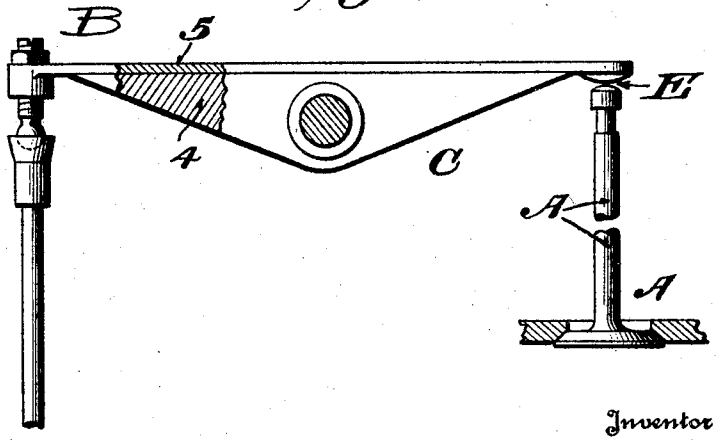


Fig. 3.



Witnesses:-

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Filed April 2, 1926 2 Sheets-Sheet 2

Fig. 4.

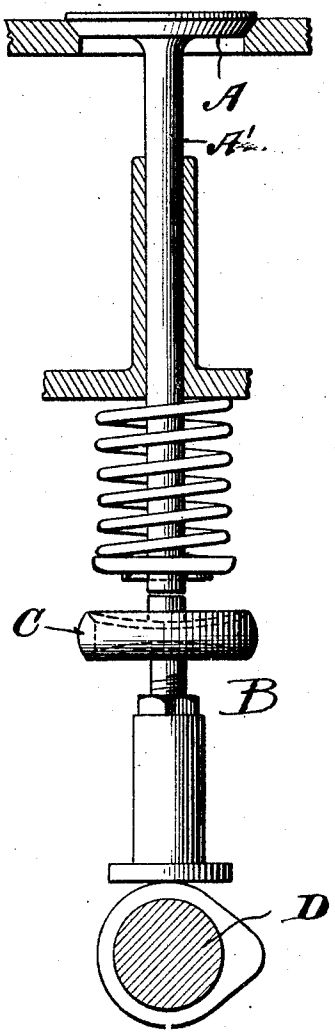


Fig. 5.

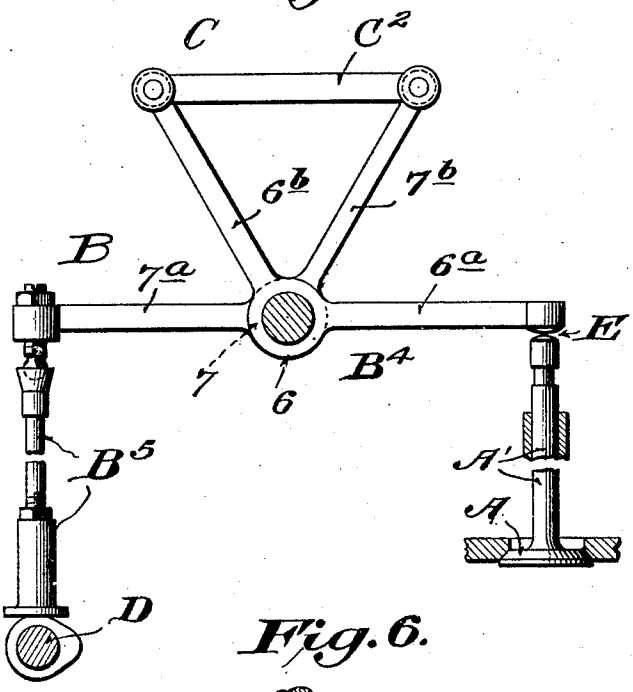
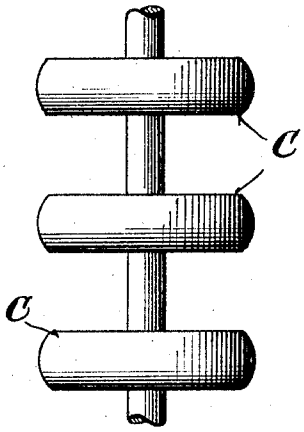


Fig. 6.



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UNITED STATES PATENT OFFICE.

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COMPENSATING MEANS FOR VALVE-OPERATING CONNECTIONS.

Application filed April 2, 1926. Serial No. 99,302.

This invention relates to an improvement in internal combustion engines, and more particularly to means for maintaining the proper relation between the valve and the means for operating the same under varying motor temperatures.

In all internal combustion engine construction enough space or clearance must be provided between the end of the valve stem and the valve tappets to provide proper valve operation under all conditions of motor temperature. The usual clearance should be about one thousandth of an inch; just enough to permit oil to get in between the rocker arm or tappet and the valve stem. In event that the space between the end of the valve stem and the rocker arm or tappet is diminished before the maximum motor temperature is reached, the valve is likely to be held open, thereby subjecting it to damage by warping and burning, and also resulting in a considerable loss of power. Or, if the space increases the valves are noisy and are not properly timed.

In some motors the specified clearance between the valves and the operating means is from six to eight thousandths of an inch, the adjustment being made when the motor is cold, and this clearance is supposed to provide for the maximum expansion of the valve and its operating connections at maximum motor temperature. However, this adjustment does not provide for intermediate temperatures and obviously owing to varying climatic conditions under which the motor is operated the predetermined maximum temperature may also vary. Therefore, it is difficult, if not impossible to provide a predetermined clearance adequately to meet all conditions of use when the valves are adjusted on a cold motor. For instance if clearance is allowed initially to give proper operation at maximum motor temperature, there will be more clearance between the valve and its tappet than is required at any temperature below maximum, thereby making the valves noisy from that cause.

It will therefore be apparent that under the present practice, if the valve and its operating means are set when cold to a clearance for maximum motor temperature, the valve will not properly seat at the beginning of the explosion stroke when maximum temperature is reached, thereby materially reducing the power of the motor, whereas on the other hand, if the valve is adjusted when cold to give proper operation at the maximum temperature of the motor, more clearance will be provided than is necessary at temperatures below maximum. Thus, the present practice only permits of the setting of the valves and their connections to provide for extreme or average conditions, neither one permitting full efficiency of the valves.

Accordingly, the present invention has primarily in view means for initially providing and always maintaining a minimum clearance between the valve and its operating member under all conditions of temperature, that is, just enough for the valve to be properly seated at maximum temperature which would probably be less than one thousandth of an inch.

To that end the invention contemplates the provision of compensating means in the line of the valve operating connections or parts to proportionately compensate for the variation of the length of the parts as the motor temperature varies, thereby maintaining the desired clearance between the valve and its tappet or rocker arm under all conditions of use. In that connection the invention contemplates a construction which permits of making the adjustment under favorable conditions when the motor is cold.

A further and more specific object of the invention is to provide means for carrying out the foregoing object which may be readily applied to motors now in use as well as to also provide a construction which may be built in motors at the time of assembly.

With these and other objects in view which will be more readily apparent as the nature of the invention is better understood, the same consists in the novel construction, combination and arrangement of parts as will be hereinafter fully pointed out, illustrated and claimed.

Preferred and practical forms of the invention are shown in the accompanying drawings in which

Fig. 1 is a more or less diagrammatic view illustrating a valve of the overhead type and its train of operating connections having compensating means arranged therein.

Fig. 2 is a detail sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is a detail view of a modified form of the invention, for operating valves of the overhead type.

Fig. 4 is a view illustrating the application of the invention to the operation of a valve of type used in L-head motors.

Fig. 5 is a view illustrating a further modification of the invention for operating valves of the overhead type.

Fig. 6 is a view illustrating the use of compensating units in tandem.

Fig. 7 is a detail sectional view illustrating the range of modification of the invention.

Similar reference characters designate corresponding figures in the drawings.

A distinctive feature of the invention is to provide means anywhere in the train of a motion transfer from the cam to the valve itself to compensate for the variations in the motion transferring parts or valve.

Internal combustion engine motors, while built to a high standard, are probably used under a wider range of temperature conditions, than any other similar engine, and considering the relatively hard usage of a motor of this type, it probably receives less attention than the average unit of machinery. Therefore, it is particularly desirable to provide some means for automatically compensating for the different conditions under which the motor is used, particularly with reference to the expansion of the means for operating the valves.

Referring generally to the accompanying drawings, the valve of an internal combustion engine is designated in the several examples shown as A, and the operating connections therefor are designated in their entirety as B, the same having interposed therein a novel compensating means C, and actuated by cam D. Obviously the said means C may be positioned at different points in the train of operating connections B according to the design and type of motor, the object of the invention being to locate the same at a point where it will be most efficient to maintain at all times a minimum clearance between the end of the valve stem and its tappet.

Fig. 1 of the drawings illustrates the application of the invention to a valve construction of the overhead type wherein the stem A′ of the valve A is engaged by a rocker arm B′ which in turn is operated by a push rod B^2 operated in the usual manner by the cam D. As shown, the compensating unit C is preferably, in this instance, arranged in the push rod B^2, and by reference to Fig. 2 it will be observed that the same may be conveniently inserted between the top of the push rod and the socket or cup at the top of the push rod which receives the rocker arm bearing.

The said unit "C" in the embodiment shown preferably consists of a pair of reversely bowed or concave disks 1 and 2 held together by an outer ring-like band or wall 3. The disks 1 and 2 are preferably made of any suitable material having a different coefficient of expansion from the outer ring or casing 3 to obtain the desired compensating effect.

If the operating connections for the valve have a tendency to expand under variation in motor heat, the spaced concave members 1 and 2 may be made of Monel metal which has a relatively high coefficient of expansion as compared with the surrounding steel ring or casing 3. Or, on the other hand, if it is determined that the connections are such that the space between the end of the connections and the valve stem is increased under the heat of the motor, the disks 1 and 2 may be made of metal having a relatively low coefficient of expansion so as to increase the length of the connections to compensate for varying degrees of motor heat. In the latter case the disks 1 and 2 would also be arranged reversely to the position shown in Fig. 2, that is as shown in Fig. 7 where their concave sides face each other so that the effect of expansion in causing them to push outward against the ring would be to push the crown portions of the disks further apart.

The unit C shown in Fig. 2 provides a rigid compensating unit susceptible, however, of changing under high temperature conditions proportionately to the degree of heat, whereby the expansion or contraction of the steel constituting the train of operating connections for the valve will be compensated for thereby to safeguard the minimum clearance E provided between the end of the valve stem and the rocker arm. By the use of the present invention valves may be adjusted when cold thereby to provide the minimum clearance between the rocker arm and the valve stem, and as the motor heat varies and the expansion and contraction of the operating connections varies, the same will be readily compensated for by the unit C.

Fig. 3 of the invention illustrates a further embodiment of the invention wherein the compensating means C is incorporated as a part of the rocker arm. In this embodiment of the invention the rocker arm B is formed of two different metals having different coefficients of expansion, the arrangement being such that expansion of the rocker arm under varying temperature conditions will cause the ends of the arms to move in such a way as to conserve the minimum space between the valve stem and its operating member. In the example shown the rocker arm may consist of a body 4 of brass and a top member 5 of steel. However, other metals having different coefficients of expansion may be utilized as will be readily apparent.

Fig. 4 of the drawings illustrates the application of the compensating means C to a standard type of valve, the same preferably being embodied in the tappet for the valve,

although it of course may be readily attached to the end of the valve stem if desired. The unit C used in connection with the train of valve operating connections shown in Fig. 4 may be the same as that shown in Fig. 2 and the functions thereof are the same as described in connection with Fig. 1. The object of Fig. 4 is to show the application of the invention to a valve of the type used in L-head motors.

Fig. 5 of the drawings illustrates a still further modified form of construction adapted to valves of the overhead type. In this arrangement the valve A and its stem A′ are operated by a train of connections B actuated by the usual cam D, the said connections including a rocker arm unit B^4 and the push rod assembly B^5. The rocker arm B^4 preferably consists of a pair of concentrically mounted angular arms 6 and 7. These arms 6 and 7 have the horizontal arms 6^a and 7^a respectively and the upstanding arms 6^b and 7^b. The latter arms are connected at their upper ends by a compensating member C^2 having a different coefficient of expansion from the arms whereby the differential size of the parts of the train of operating connections for the valve will result in the control of the ends of the arms 6^a and 7^a similar to that described in connection with Fig. 3 to maintain minimum clearance.

From the foregoing examples of the manner in which the invention may be embodied in a practical structure, it will be apparent that the valve operating connections may be adjusted when the motor is cold so as to provide a minimum clearance at the point E between the end of the valve stem and its rocker arm, tappet, or the like. As temperature conditions vary, the compensating means will automatically take care of the differential expansion and contraction of metal in the valve operating train, thereby to preserve the clearance at E under all conditions of use.

It will therefore be understood that the present invention is directed primarily to compensating means for controlling the proper operation of the valve under varying temperatures and in accordance with different motor designs.

Without further description it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will of course be understood that changes in the form, proportion and minor details of construction may be resorted to, without departing from the spirit of the invention and scope of the appended claims.

I claim:—

1. In an internal combustion engine, the combination with a valve and the operating connections therefor, including a member having a predetermined minimum clearance from the valve, of a unit included in said operating connections and comprising two dished metallic members of different coefficients of expansion to preserve said predetermined minimum clearance under different temperature of the engine.

2. In an internal combustion engine, the combination with a valve and the operating connections therefor, of two dished metallic members included in said operating connections and being of different coefficients of expansion thereby to maintain a predetermined clearance between the valve and its operating connections under different temperatures of the engine.

3. In an internal combustion engine, the combination with a valve, operating means therefor including a rod, a cam for operating the push rod, and a unit associated with the push rod and including spaced members surrounded by a ring of different coefficient expansion from said members thereby to automatically compensate for the expansion and contraction of the metal in the push rod.

4. In an internal combustion engine, the combination with a valve and the operating connections therefor, including a member having a predetermined minimum clearance from the valve, of a unit included in said operating connections and itself including a pair of bowed members, and means for spacing said members, said means and members being of metals of different coefficients of expansion.

5. In an internal combustion engine, the combination with a valve and the operating connections therefor, including a member having a predetermined minimum clearance from the valve, of a unit included in said operating connections and comprising a pair of bowed members and a surrounding ring, said disks and ring being of metals having different coefficients of expansion.

6. In an internal combustion engine, the combination with a valve and the operating connections therefor, including a member having a predetermined minimum clearance from the valve, of a unit included in said operating connections and including a pair of concave disks and a surrounding ring, said disks and ring being of metals having different coefficients of expansion.

In testimony whereof I hereunto affix my signature.

FREDERICK REICH.