T. S. KEMBLE.

EXHAUST VALVE SPRING.

APPLICATION FILED OCT. 4, 1917.

1,368,439. Patented Feb. 15, 1921.

FIG. 1.

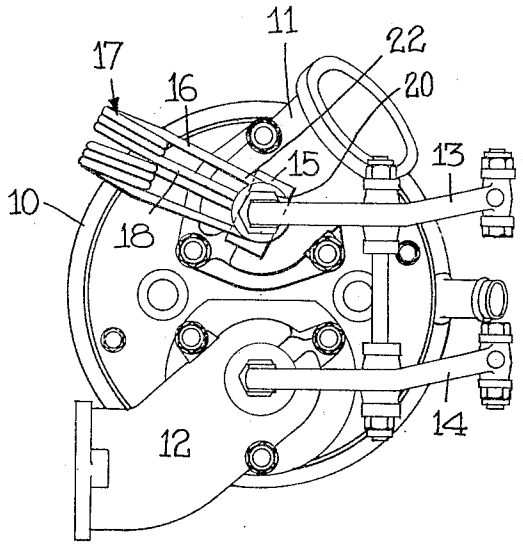


FIG. 6.

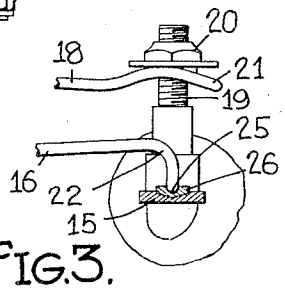


FIG. 2.

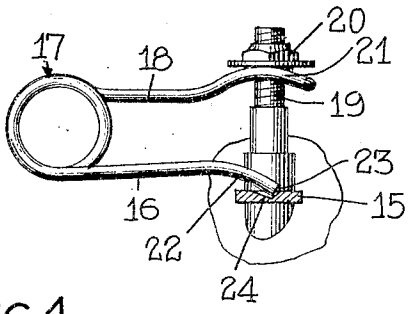


FIG. 3.

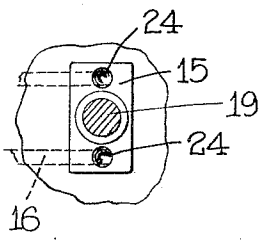


FIG. 4.

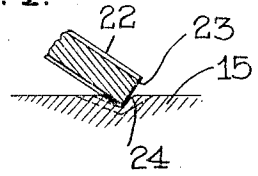
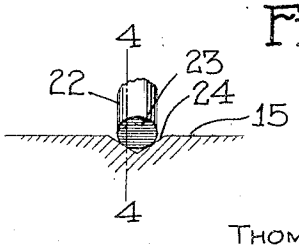


FIG. 5.



Inventor
THOMAS S. KEMBLE

By

Attorney

UNITED STATES PATENT OFFICE.

THOMAS SETH KEMBLE, OF BUFFALO, NEW YORK, ASSIGNOR TO CURTISS AEROPLANE AND MOTOR CORPORATION, A CORPORATION OF NEW YORK.

EXHAUST-VALVE SPRING.

1,368,439. Specification of Letters Patent. Patented Feb. 15, 1921.

Application filed October 4, 1917. Serial No. 194,795.

To all whom it may concern:

Be it known that I, THOMAS S. KEMBLE, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Exhaust-Valve Springs, of which the following is a specification.

My invention relates to valve operating mechanism for internal combustion engines and more particularly to the closing springs for the valves thereof. In the construction and operation of internal combustion engines, particularly of that type designed for aeronautical purposes wherein excessively high operating speeds are necessary, the problem of maintaining the valve operating springs at a sufficiently low temperature to insure them against deterioration has made it necessary to develop a bow spring wherein the coil portion is located remote from the point of application of the spring. This type of spring I am aware has been in use among motor manufacturers for some time and it is not the construction of the spring *per se* which I desire to claim as my invention.

The particular objection to using a spring of the above mentioned type, however, has been due to the fact that some difficulty has always been experienced in properly correlating the spring to the valve stem and the cylinder or valve cage between which it operates. The usual method has heretofore been to provide the upper pair of arms which extend inwardly from the coil with a substantially rounded bearing portion adapted to engage with a cap carried by the valve stem. The lower pair of arms, however, simply extended straight in and were seated upon a flat bearing provided on the valve cage. It is very apparent that this arrangement is objectionable by reason of the fact that the lower arms of the spring, as the valve operates, are subjected to variable angularity thus causing the fulcrum to be a variable point. This not only resulted in excessive wear upon the spring and the portion of the valve cage upon which it bears but also exerted quite a material tendency to throw the valve stem out of alinement.

It is the object of this invention to provide a means whereby the above mentioned type of spring may be used without the disadvantages attending its usual mode of attachment. In other words, the arrangement of the spring relative to the valve stem and the valve cage is such that the full value of thrust exerted by the spring is at all times in true axial alinement with the valve stem and valve.

Of the drawings:

Figure 1 is a plan view of a cylinder and valve mechanism in connection with which my invention is used;

Fig. 2 is a partial sectional view showing the arrangement of the valve spring and its correlated parts;

Fig. 3 is a partial plan view of the retaining and alining means carried upon the valve cage;

Fig. 4 is a sectional view along the line 4—4 of Fig. 5;

Fig. 5 is a partial sectional view showing the seating of the spring extremities upon the valve cage, and

Fig. 6 is a side view with certain parts illustrated in section illustrating another modification.

In Fig. 1 the internal combustion engine in connection with which the invention is used, comprises a cylinder 10, exhaust valve cage 11, intake valve cage 12 and rocker arms 13 and 14 for operating the exhaust and intake valves respectively. Integrally formed upon the exhaust valve cage 11 is a seat 15 upon which the lower pair of arms 16 of the valve operating spring, wholly designated as 17, are adapted to bear. The upper pair of arms 18 of the spring 17 are upwardly convex in side elevation as shown in Fig. 2. The valve stem 19 is threaded at its upper extremity as shown and is provided with the valve spring retaining cap 20. The upwardly convexed portion 21 of the valve spring is adapted to bear upon the underneath portion of the retaining cap 20 as will be apparent by an inspection of Fig. 2 whereby the varying angularity of the arms 18 due to the opening and closing of the valve will cause the convex portion 21 to have rolling contact with the underneath portion of the cap 20, thus maintaining its fulcrum at a single point only in all positions. Referring again to Fig. 2 it may be seen that the lower arms 16 of the spring are bent downwardly as at 22 in such a manner that their extremities 23 will provide a substantially knife edged ful-

crum when viewed in lateral section as in Fig. 4. The extremities 23, it will be noticed, bear directly within depressions 24 formed within the bearing or seat 15 as in Fig. 3. As herein shown, the depressions 24 are simply drilled in, or countersunk as desired, although a laterally extending slot or nitch would answer the same purpose.

Another embodiment of my invention is shown in Fig. 6 in which the extremity of the spring arm 16 is bent downwardly at substantially a right angle so that it may bear on its hemispherical end 25 within a steel button or bearing 26 which is carried in the valve cage casting 15. The depression formed in the button complements the contour of the extremity 25 in order that the varying position of the spring arm under flexure may be taken care of.

From the above description it is apparent that the full value of the thrust of the spring 17 will be at all times exerted in true axial alinement with the valve stem 19 by reason of the fact that the depressions which serve as a fulcrum and retaining means for the lower arms 16 of the spring are formed in true alinement with the stem 19.

Although I have utilized more or less detailed forms in describing my invention, it is to be understood that interpretation thereof is to be made only in view of its generic spirit and that of the subjoined claims.

What is claimed is:

1. In an internal combustion engine, a valve cage, a valve, an operating bow spring therefor having pairs of upper and lower arms extending from the coil of said spring, one of said pairs of arms being provided with a downwardly extending fulcrum end to engage in a seat formed in said valve cage.

2. In an internal combustion engine, in combination, a valve cage, a puppet valve and operating stem, said stem having a collar on its upper end and said cage having a retaining seat disposed alongside of said stem, and a valve operating spring having a coil remote from said stem and a pair of arms extending inwardly toward said stem, one of said arms engaging said collar and the other arm engaging said seat and anchored therein.

3. In an internal combustion engine, in combination, a valve cage, a puppet valve and operating stem, said stem having a collar on its upper end and said cage having a retaining seat or depression disposed alongside of said stem, and a valve operating spring having a coil remote from said stem and a pair of operating arms extending inwardly toward said stem, one of said arms engaging said collar and the other of said arms having its end bent away from said first named arm and engaging endwise into said seat.

4. In an internal combustion engine, in combination, a valve cage, a puppet valve and operating stem, a valve operating spring having a coil remote from said stem, said stem having spring engaging means on its exposed end and said cage having spring engaging and anchoring means disposed adjacent the stem, and said spring having a pair of operating arms extending inwardly from said coil to said stem, one of said arms engaging the exposed end of said stem and the other arm engaging the anchoring means on said valve cage, whereby the spring is maintained in its assembled position and is caused to deliver its thrust axially of the stem.

5. In an internal combustion engine, in combination, a valve cage, a puppet valve and operating stem, said stem having an engaging member on its upper end and said cage having a retaining means disposed alongside of said stem, and a valve operating spring having a coil remote from said stem and a pair of arms extending inwardly toward said stem, one of said arms having a convexed portion engaging said member and the other arm engaging said retaining means and anchored therein.

In testimony whereof I hereunto affix my signature.

THOMAS SETH KEMBLE.