No. 820,944. PATENTED MAY 15, 1906.

J. L. ADAMS, Jr.

COMPOUND SPRING.

APPLICATION FILED JUNE 15, 1905.

Fig. 1.

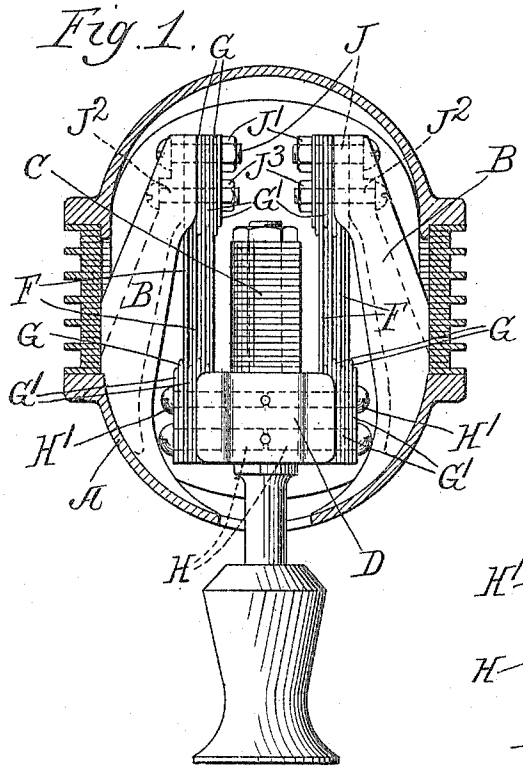


Fig. 2.

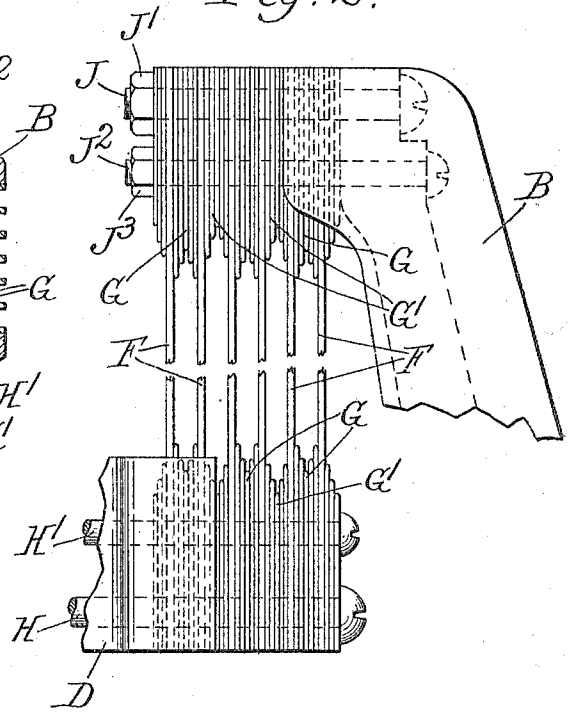


Fig. 5.

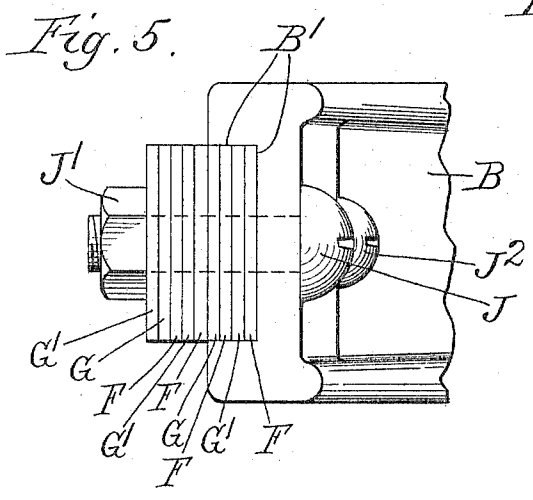


Fig. 4.

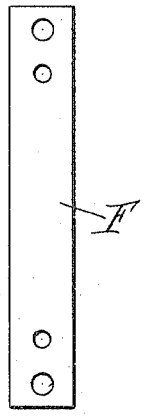
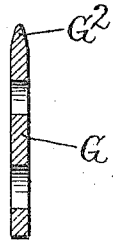


Fig. 3.



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UNITED STATES PATENT OFFICE.

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COMPOUND SPRING.

No. 820,944. Specification of Letters Patent. Patented May 15, 1906.

Original application filed March 24, 1905, Serial No. 251,726. Divided and this application filed June 15, 1905. Serial No. 265,443.

To all whom it may concern:

Be it known that I, JAMES L. ADAMS, Jr., a citizen of the United States, residing at Springfield, in the county of Sangamon and State of Illinois, have invented a certain new and useful Improvement in Compound Springs, of which the following is a specification.

My invention relates to compound springs, and has for its object to provide new and improved constructions for devices of that class.

The invention is illustrated as used in a vibratory motor for the support of the armature; but it will of course be obvious that it is capable of application to other uses.

The invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a section through a vibratory motor, showing the springs in elevation; Fig. 2, a detail elevation of a modified form of spring; Fig. 3, a longitudinal section through one of the spacers; Fig. 4, a detail of one of the leaves, and Fig. 5 a plan view of one of the upper fastenings.

Like letters of reference indicate like parts in all the drawings.

A indicates the casing of the motor, which may be of any preferred form.

B B are brackets extending from either side of the case A.

C is the armature of the motor, supported on the block D and adapted to vibrate between the brackets B B by any desired disposition of field-magnets.

The block D is supported on the brackets by two compound springs, which form the subject of this application. These springs consist of a plurality of leaves F F, separated by spacers, the arrangement being mechanically the same on each side of the device. Referring particularly to Fig. 1, the spacers between the leaves are of two lengths (indicated by the letters G G′) and are arranged staggered. The spacers are preferably rounded at the end on a curve approximately parabolic, as shown at G^2, Fig. 3. The springs and spacers are secured to the block D by means of the screws H H′ of different diameters, the inner screw H′ being preferably the smaller. The spacers and springs are of course apertured correspondingly. The arrangement is similar at the upper end of the spring. The bracket B is channeled, as shown at B′ in the detail view of Fig. 5, and the springs and spacers are secured thereto by means of the large bolt J at the outer end with its corresponding nut J′ and the smaller bolt J^2 and its nut J^3. The spacers at this end of the spring are also of two different lengths and disposed in a staggered arrangement corresponding to that at the other end of the spring. This staggering is preferably so carried out at the two ends of each compound spring that in a given space between leaves of such spring if a long spacer is used at one end a corresponding long spacer is used at the opposite end, the short spacers being similarly disposed.

A modified arrangement with laminated spacers is shown in Fig. 2. Between each leaf and the next is interposed a set of spacers similar to that shown in Fig. 3, but of different lengths and stepped with the shortest in the middle. Preferably the lengths of the spacers of alternate sets are different, so that the springs are flexed at different points at alternate oscillations. It will of course be understood that this arrangement may be carried out at each end of each of the springs.

I have illustrated and described certain forms of my spring as used on a vibratory motor; but it will be understood that the device is capable of very different applications and that considerable change might be made in the form and arrangement of the parts without departing from the spirit of my invention. Therefore I do not wish to limit myself to the particular devices and constructions herein shown.

The use and operation of my device are as follows: The spring is particularly adapted to support a part which is to be oscillated at high speed and where it is desirable that the displacement should be on a line substantially perpendicular to the axis of the vibrating element. These are the conditions met with in the case of a high-speed vibratory motor. The construction and arrangement here shown permits of this transverse displacement of the block D and its armature C, so that the latter instead of swinging as an ordinary pendulum moves in such manner that the major axis of the moving element remains at every instant approximately parallel to the position it assumes when at rest. It is to be noted that the apparatus dispenses entirely with shafts and the like requiring lubrication. The leaves of the springs are separated one from another either by simple or by laminated compound spacers of two different lengths, the inner ends of all the spacers usually being rounded off, so as to

form a convex gradually-curved seat or bearing for the springs. The springs are not therefore flexed immediately adjacent to the bolt-holes, but at some distance therefrom and very gradually. This construction serves the additional purpose of eliminating all rubbing friction between the leaves of the spring, thereby adding very materially to both the freedom of motion and the amplitude of vibration of the moving element. The staggered arrangement of the spacers also adds materially to the life of the springs by shifting the location of the strain centers under flexure during alternate half-periods of oscillation of the moving element. This is particularly desirable in high-speed machines, where the elastic limit of the springs is often very closely and repeatedly approached many times per second while the motor is in actual use.

I claim—

1. A compound spring comprising a plurality of leaves which are separated one from another by spacers said leaves secured together so as to be flexible between the spacers.

2. A compound spring comprising a plurality of leaves which are separated one from another by spacers having curved inner ends.

3. A compound spring comprising a plurality of leaves which are fastened together and separated one from another at each end by a plurality of separate short spacers extending a short distance between the several leaves.

4. A compound spring comprising a plurality of leaves which are separated one from another at each end by a plurality of short spacers having curved inner ends.

5. A compound spring comprising a plurality of leaves, in combination with a plurality of separators of different lengths separating the ends of said leaves.

6. A compound spring comprising a plurality of leaves separated one from another by spacers of different lengths, the different lengths alternating.

7. A compound spring comprising a plurality of leaves separated one from another by compound leaf-spacers.

8. A compound spring comprising a plurality of leaves separated one from another by short compound leaf-spacers, the individual leaves of which are of different lengths.

9. A compound spring comprising a plurality of leaves separated one from another by short compound leaf-spacers, the individual leaves of which are of different lengths, the said compound spacers being in their entirety of different lengths, the different lengths alternating between leaves of the spring.

10. A compound spring comprising a plurality of leaves which are separated one from another by short compound leaf-spacers, the individual leaves of such spacers being of different lengths and stepped with the shortest in the middle.

11. In a vibratory device, a straight-leaf spring having a plurality of mounting holes at each end of the leaf and arranged longitudinally thereof.

12. In a vibratory device, a leaf-spring having a plurality of mounting holes at each end of such spring, such holes having different diameters, those of the smaller diameter being nearer the center of such spring.

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