No. 676,324. Patented June 11, 1901.

H. B. KEIPER.

MECHANICAL MOVEMENT.

(Application filed Oct. 10, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

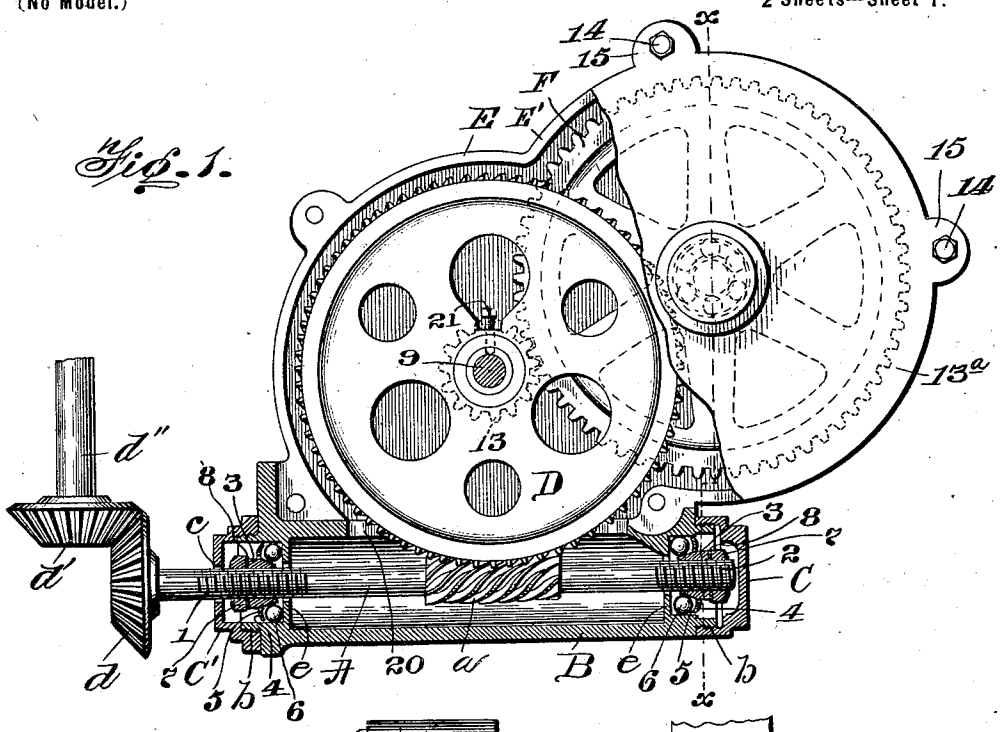


Fig. 2.

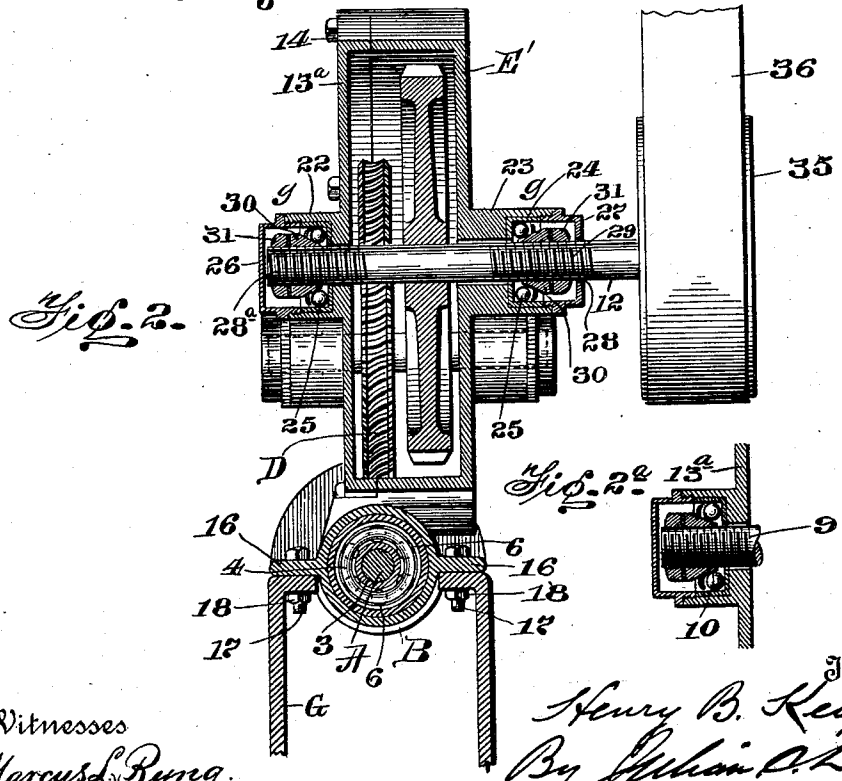


Fig. 2a.

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Fig. 3.

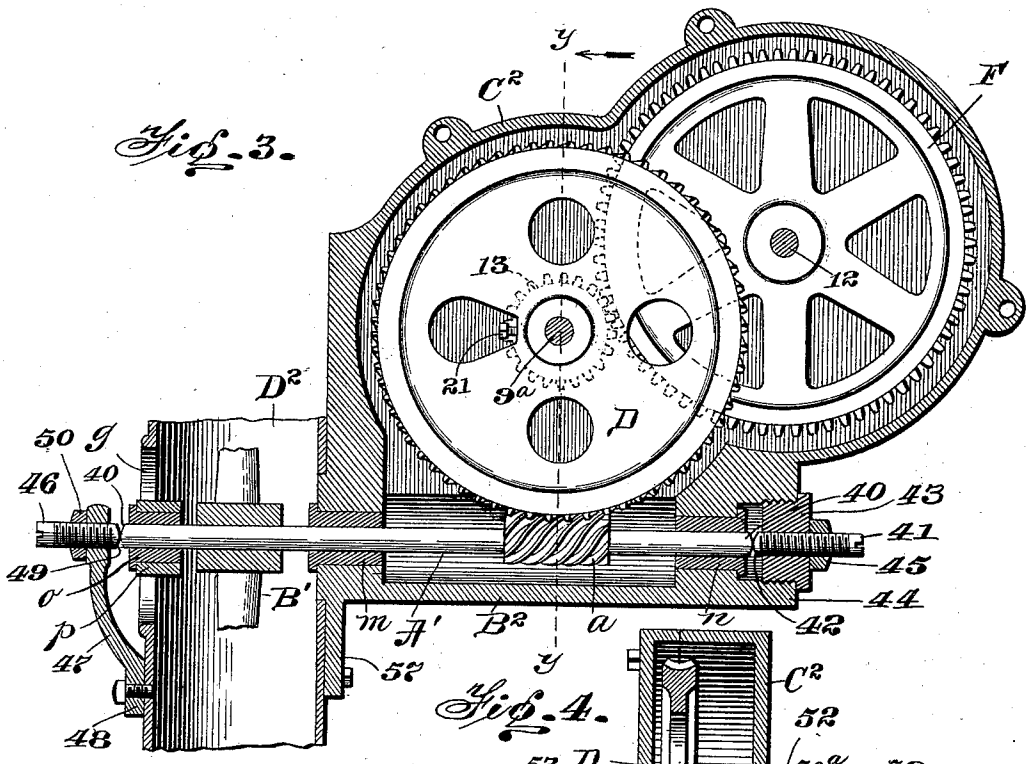


Fig. 4.

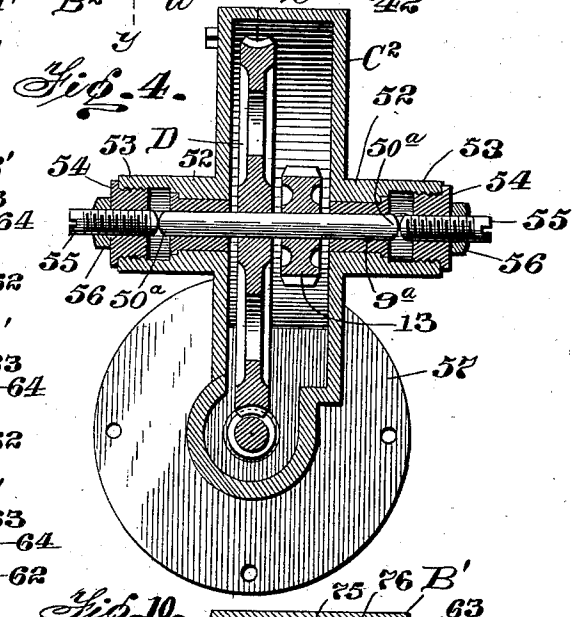


Fig. 5.

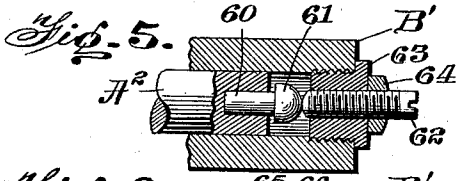


Fig. 6.

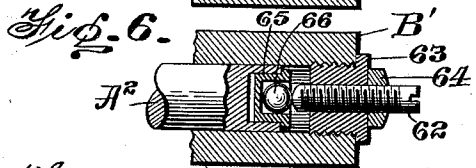


Fig. 7.

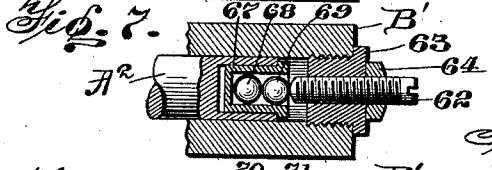


Fig. 8.

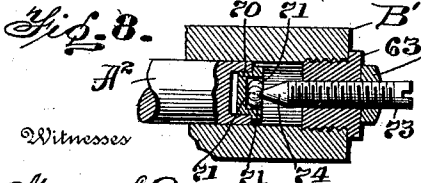


Fig. 9.

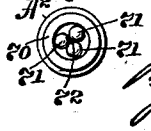
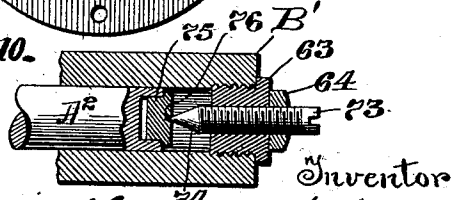


Fig. 10.



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UNITED STATES PATENT OFFICE.

HENRY B. KEIPER, OF LANCASTER, PENNSYLVANIA.

MECHANICAL MOVEMENT.

SPECIFICATION forming part of Letters Patent No. 676,324, dated June 11, 1901.

Application filed October 10, 1900. Serial No. 32,634. (No model.)

To all whom it may concern:

Be it known that I, HENRY B. KEIPER, a citizen of the United States, residing at Lancaster, in the county of Lancaster and State of Pennsylvania, have invented certain new and useful Improvements in Mechanical Movements; 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 mechanical movements; and it consists, substantially, in such improvements therein as will hereinafter be more particularly described, and definitely pointed out in the claims.

The primary object of the invention is to provide an exceedingly-light-running mechanical movement for operating various kinds of machinery at a uniform high rate of speed with the least expenditure of power and also to provide such a device in which the several elements are compactly arranged or assembled, so as to occupy but small space in use and be of ready access and capable of easy adjustment, regulation, and repair.

The above and additional objects I attain by the means substantially as illustrated in the accompanying drawings, wherein—

Figure 1 is a side elevation in part section representing one form or embodiment of my invention; and Fig. 2 is a vertical sectional view thereof on the line x x, the drive-shaft being in elevation. Fig. 2^a is a separate detail view. Fig. 3 is a similar view to Fig. 1, representing another form or embodiment of my invention; and Fig. 4 is a vertical sectional view thereof on the line y y. Figs. 5 to 10, inclusive, are enlarged views in detail and principally in section representing different forms or modifications in the construction of antifriction devices employed for the different bearings.

Preliminarily to a more detailed description it may be stated that my invention is capable of various different embodiments, several of which are herein shown, and to which specific reference will hereinafter be made. In practice the several operative devices or elements are arranged in parallelism and as nearly as possible in the same plane, so as to occupy but small space in use as well as in transportation. I employ a worm-shaft to be geared to the device or object to be driven, and which worm-shaft is operated or rotated by means of a worm-wheel that is driven by suitable gearing from a main driving-shaft. The worm-shaft and worm-wheel are in substantially the same plane, the threads on the one and the teeth on the other being given the requisite inclination and pitch to effect a positive rotation of said worm-shaft in a direction substantially at right angles to the direction of rotation of both the said worm-wheel and its driving-gear. The device can be driven either electrically, mechanically, or by hand, according to the particular work to which it is applied, and, preferably, I provide an inclosing case therefor to protect the parts or elements thereof from dirt and moisture, as well as to furnish convenient supports for the several bearings for the worm-shaft, the worm-gear, and other parts.

My said improved mechanical movement or device is also provided with suitable means for overcoming the friction accompanying the rotary working of both the worm-shaft and worm-gear, and said means are so constructed and arranged as to overcome any undesirable effects produced by endwise thrust of either the said worm-shaft, the shaft of the said worm-gear, or the drive-shaft.

Reference being had to the accompanying drawings, and more especially to Figs. 1 and 2 thereof, A represents a shaft formed at about its central portion with a spiral or worm a and extending lengthwise of an inclosing tubular casing B therefor, each end of which is slightly contracted and exteriorly screw-threaded, as shown at b. Screwing into said screw-threaded ends are the caps C and C′, respectively, the one, C, being entirely closed to exclude dirt and moisture and the other, C′, having a central opening c for the passage of one end of the worm-shaft A, which projects beyond the casing B and is provided with a beveled or other gear-wheel d, engaging a similar gear-wheel d' on the shaft d'' of the device or object to be driven. The said worm-wheel A may be supported in the casing B in different ways; but in the present instance I provide ball-bearings therefor, so as to reduce friction and render the said shaft as light-running as possible. Thus interiorly

of casing B, at near each end thereof, I provide an annular flange *e*, surrounding the shaft, and screwing onto the screw-threaded portions 1 and 2 of said shaft are the adjustable cones 3 3, each having a saucer-like projection 4 coöperating with its adjacent flange *e* in the formation of a raceway 5 for the antifriction-balls 6. The said balls partially bear or rest upon the sides of the said adjustable cones, and it is evident that as any wear occurs through friction between the parts the wear can be readily compensated for or taken up by simply screwing up the said cones. Also screwing onto the screw-threaded portions of the worm-shaft behind or to the rear of each of the said adjustable cones is a lock-nut 7, and preferably located between each cone and its nut is a washer 8, against which the nut bears. On screwing up the cones or either of them and then turning or screwing up said nuts it is evident that the cones will be prevented from turning backward on the worm-shaft, and the bearings will thus be kept in proper working order without any wabbling or undue endwise thrust of said worm-shaft. To gain access to said bearings or cones, it is simply necessary to unscrew the caps C C′ on the ends of casing B, as is evident. The worm *a* of the said worm-shaft A is engaged by a worm-wheel D, the shaft 9 of which is mounted in suitable bearings at the sides of an inclosing casing E, formed with or mounted upon the shaft-casing B, the two said casings being substantially integral. As shown in a separate detail at Fig. 2ª, the said shaft 9 is preferably mounted in adjustable cone and ball-bearings 10 substantially the same as are employed in connection with the worm-shaft A and also substantially the same, as will be presently described, with reference to the bearings *g g* for the drive-shaft 12. Instead, however, the bearings for said shaft 9 may be the same as those hereinafter described with reference to the corresponding shaft shown in Fig. 3. Indeed, it is preferable in some instances that one form of bearings herein shown in the several views be employed for the worm-shaft, another for the shaft of the worm-wheel, while for the drive-shaft the bearings may be such as are employed for either of the worm-wheel shafts shown in Figs. 2ª and 4. Engaging a pinion 13 on the said shaft 9 of the said worm-wheel D is a driving gear-wheel F, which is mounted on the said drive-shaft 12 closely adjacent to the said worm-wheel, as shown, and this drive-gear is also inclosed in an extension E′, so as to be protected from dirt and moisture. It will be understood that the said inclosing casings B, E, and E′, herein separately referred to as such, are practically integral and that access is had to the several parts inclosed thereby on the removal of the cover or side plate 13ª. (Shown in section, Fig. 2, and as partly broken away in Fig. 1.) Said cover or side plate 13ª is secured or held in place by means of screws 14, as shown, which enter suitable openings therefor in corresponding lugs or projections 15, formed with the said casing and cover-plate. As shown in Fig. 2, the part B of the casing is provided at opposite sides with longitudinal flanges or ribs 16, by which the entire device may be mounted or placed in proper position upon a suitable standard or support G and secured thereto by means of bolts 17 and nuts 18. It is evident, however, that other means could be employed for supporting the structure, according to the particular exigencies or requirements of the case. The said part B of the casing is left open at the point 20, so as to partially admit the worm-wheel D for engaging with the worm *a* of the worm-shaft A, and the compactness of the several elements of the device will be at once apparent. The worm-wheel D is secured to its shaft 9 by means of a screw 21, Fig. 1, passing down through the wheel, as shown. The said bearings *g g* for the said drive-shaft 12 are constituted of substantially tubular portions 22 and 23, (see Fig. 2,) each having seated in the outer end thereof a hard-metal seat or race 24 for containing the antifriction-balls 25, and screwing into said tubular portions are the removable covers or caps 26 and 27, respectively, the former being closed and the latter having a central opening 28 for the passage of the outwardly-projecting end of the said drive-shaft. The screw-threaded portions 28ª and 29 of this shaft are, in like manner as the worm-shaft A, provided with adjusting regulating-cones 30, against which the balls 25 partially bear or rest, and screwing up behind the said cones are similar lock-nuts 31 for keeping the same in place. The threads of the worm *a* and the teeth of the worm-wheel D are given such inclination and pitch as will insure the perfect rotation of the shaft A, and it will be seen that the working of the several elements or parts is easy and that a uniform high rate of speed of the said shaft can be maintained at all times. There is no tendency to binding between the worm-shaft and worm-wheel, since, while the rotation of said shaft is accomplished with the least possible friction, the construction and arrangement of the antifriction-bearings therefor is also such as to effectually resist any undue endwise motion or thrust of said worm-shaft exerted by the worm-wheel. The drive-shaft 12 may be driven by hand or from an electrical motor, as desired; but preferably I have shown the same provided at one end with a pulley 35 and belt 36, by which suitable connections may be made with any source of mechanical power.

It will be seen that whenever any of the parts have become worn or broken they can readily be replaced by other similar parts, and also that the said parts can be easily reached both for the purposes of cleaning and adjustment of the same.

In Figs. 3 and 4 I have shown another form or embodiment of my invention and to which

specific reference will now be made. In said figures the general arrangement of the several parts or elements is substantially the same as in the preceding figures, the differences residing principally in the antifriction devices employed, of which several forms or modifications are shown and which will also be described. In said embodiment of the invention and as indicated at Fig. 3 the projecting end of the worm-shaft A′ is provided with a device or object—such as a fan, propeller, or other similar device B′—to be operated by said shaft, and which device or object is preferably shown as broken off and is also shown as operating within a separate casing D^2, which, for convenience, is likewise broken away both at its upper and lower portions. The purpose of such showing is simply to indicate the application of the particular form or forms of antifriction devices employed in this particular embodiment of the invention. Thus the worm-shaft A′ extends through the lower part B^2 of the inclosing casing C^2, similarly as before, and the said shaft has its bearings in bushings *m n*, removably inserted in the end walls of said part B^2 of the casing, and in the present instance an additional bushing *o* is employed, which is removably inserted in a tubular bearing *p*, supported in any suitable manner centrally of the opening *g′* in the side of the fan or other casing D^2. It will be understood that, if desired, the said several mentioned bushings could be provided with ball-bearings or other devices for reducing the friction caused by the rotation of said shaft; but preferably I resort to the construction shown. Whenever said bushings become worn, they can readily be replaced by others, as is evident. These bushings are of brass or phosphor-bronze, and by their use an easy rotation of the worm-shaft is obtained. As shown in Fig. 3, each end of the worm-shaft A′ is rounded off at 40, and bearing against said shaft at one end is a hardened adjustable antifriction-screw 41, also having its end rounded off at 42. Said screw works in or has its bearing in an exteriorly-screw-threaded bushing 43, which screws into a socket 44 therefor, formed in the end wall of the part B^2 of the inclosing casing, and working on the said screw outside of the said bushing is a jam-nut 45 for locking or holding the screw to its different adjustments. Also bearing in like manner against the opposite rounded end of the worm-shaft is a similar hardened adjustable antifriction-screw 46, working or having its bearing in a bracket 47, secured in place at 48, the end of said screw being similarly rounded off at 49. Fitting upon this screw also is a jam-nut 50 for locking or holding said screw to its adjustments. In addition to said screws 41 and 46 being hardened the ends of the worm-shaft are also preferably hardened, and from the construction and arrangement shown and described it will be seen that a very easy working or running of the said worm-shaft is obtained and that the effects of endwise thrust of this shaft are overcome with equal if not with greater efficiency than with the construction previously described with reference to Figs. 1 and 2. By the employment of either set of said antifriction devices, however, any endwise thrust of the worm-shaft exerted by the worm-wheel is received by said devices, and thus any tendency to binding between the worm-shaft and worm-wheel is practically overcome. In this way the desired engagement between the worm *a* and the worm-wheel is constantly maintained and a continuous uniform motion derived. As shown in Fig. 4, I also employ substantially the same construction and arrangement of antifriction devices for the shaft 9^a of the worm-wheel D, or, as is preferred in some instances, I may employ for this shaft the same form of bearings employed for the shaft corresponding thereto in Fig. 2. In this view, Fig. 4, the ends of said shaft 9^a are similarly rounded off and preferably hardened at 50^a, and the shaft is supported in bushings removably inserted in tubular projections 52, formed or arranged at the sides of the inclosing casing. Screwing into sockets 53 in the ends of said tubular projections are exteriorly-threaded plugs or bushings 54, in which the screws 55 have their adjustable support or bearing, and fitting on said screws are jam-nuts 56 for locking them in position after adjustment. The ends of said screws bear against the ends of said shaft with an effect which is clearly obvious from the preceding description. As shown in said Fig. 4, a plate 57 is attached to one end of the inclosing casing for the several parts, the said plate serving as a means for attachment of the entire device to any suitable support.

In Figs. 5 to 10, inclusive, I have shown a number of different embodiments or modifications of the antifriction devices employed in Figs. 3 and 4, and wherein the worm-shaft A^2 is necessarily enlarged over what is shown in the preceding figures. In each of said Figs. 5 to 10 the end of said worm-shaft A^2 is shown simply as bearing in the end of part B′ (broken off) of the inclosing casing, the removable bushing therefor being omitted for convenience. Thus in Fig. 5 instead of rounding off the end of the worm-shaft I simply insert therein a hardened-steel plug 60, having a rounded head 61, preferably somewhat enlarged. In the use of this plug the end of the worm-shaft may or may not be previously hardened, as desired. In this view, Fig. 5, the same form of adjustable antifriction-screw 62 is used as in Figs. 3 and 4, said screw being also similarly held or supported in a removable screw-threaded plug 63 and having a jam-nut 64. In Fig. 6 the construction and arrangement are the same, with the exception that I insert in the end of the worm-shaft a hardened-metal socket or "race" 65, in which is contained a single metal ball 66, against which the end of the screw 62 is made to bear. In Fig. 7 the construction is the

same, with the exception that the hardened-metal socket or race 67 is made deeper and two hardened-metal balls 68 69 are inserted therein, one upon the other, with the end of the screw 62 bearing against the outermost ball. In Figs. 8 and 9 a practically shallow socket or race 70 is employed in the end of the worm-shaft, the said socket containing three balls 71, all arranged on the bottom or base of the socket, so as to form a central or middle recess 72, (see Fig. 9,) which receives the end of the screw 73, which in this instance is made conical or tapering at 74, so as to enter said recess. It is evident that in this form the friction will be reduced to a minimum on account of the tapered end of the screw having a movable bearing on all sides. In Fig. 10 the construction is the same as in Figs. 8 and 9, except that the hardened-metal socket or race 75 is substantially a solid block having a conical recess 76 therein which receives the end of the conical or tapered portion of the screw 73.

It will of course be understood that accordingly as the driving-gear is operated in a right or left hand direction the tendency to endwise thrust of the worm-shaft will be mainly in one direction or the other, and hence if such driving mechanism is always to be operated in one direction only it will only be necessary to employ the antifriction devices at one end of the worm-shaft, the other end of said shaft being simply a naked straight journal. From this construction the operation will be practically as easy as when such devices are employed at both ends of the shaft.

From the foregoing description, taken in connection with the accompanying illustrations, it is thought the effectiveness of the several parts of my invention will be fully understood, and

Without limiting myself to the precise details of construction and arrangement shown and described, I claim—

1. In a mechanical movement, the combination of a worm-shaft the ends of which are rounded, a worm-gear engaging therewith, means for operating said worm-gear, an inclosing casing for the several mentioned elements, and adjustable screws also having rounded ends and bearing against the ends of said worm-shaft, substantially as described.

2. In a mechanical movement, the combination of a worm-shaft the ends of which are rounded, a worm-wheel engaging therewith, antifriction devices for the shaft of said worm-wheel, means for operating the worm-wheel, an inclosing casing for the several mentioned elements, and adjustable devices also having rounded ends and bearing against the ends of said worm-shaft, substantially as described.

3. In a mechanical movement, the combination of a worm-shaft, a worm-wheel engaging therewith, the ends of the shaft of which are rounded, means for operating said worm-wheel, an inclosing casing for the several mentioned elements, and adjustable devices bearing against the ends of the said worm-wheel shaft, substantially as described.

4. In a mechanical movement, the combination of a worm-shaft, antifriction devices therefor, and a worm-wheel engaging therewith the ends of the shaft of which are rounded, means for operating said worm-wheel, an inclosing casing for the several mentioned elements, and adjustable devices also having rounded ends and bearing against the ends of said worm-wheel shaft, substantially as described.

5. In a mechanical movement, the combination of a worm-shaft, the ends of which are rounded, a worm-wheel engaging therewith in the vertical plane of the axis thereof, means for operating said worm-wheel, an inclosing casing for the several mentioned elements, and adjustable devices also having rounded ends and bearing against the ends of said worm-shaft, substantially as described.

6. In a mechanical movement, the combination of a worm-shaft, the ends of which are rounded, a worm-wheel engaging therewith, means for operating said worm-wheel, an inclosing casing for the several mentioned elements, said casing having tubular bearings for the worm-shaft, and similar side bearings for the worm-wheel shaft, and adjustable devices also having rounded ends and bearing against the ends of said worm-shaft, substantially as described.

7. In a mechanical movement, the combination of a worm-shaft, the ends of which are rounded, a worm-wheel engaging therewith the ends of the shaft of which are also rounded, means for operating said worm-wheel, an inclosing casing for the several mentioned elements, said casing having tubular bearings for the worm-shaft, and similar side bearings for the worm-wheel shaft, and adjustable devices also having rounded ends and bearing against the ends of each of said shafts, substantially as described.

8. In a mechanical movement, the combination of a worm-shaft the ends of which are rounded, a worm-wheel engaging therewith, a pinion on the shaft of said worm-wheel, a drive-wheel engaging the pinion, an inclosing casing for the several mentioned elements, and adjustable screws also having rounded ends and bearing against the ends of said worm-shaft, substantially as described.

9. In a mechanical movement, the combination of a worm-shaft the ends of which are rounded, a worm-wheel engaging therewith the ends of the shaft of which are also rounded, a pinion on the worm-wheel shaft, a drive-wheel engaging the pinion, an inclosing casing for the several mentioned elements, and adjustable devices also having rounded ends and bearing against the ends of each of said shafts, substantially as described.

10. In a mechanical movement, the combination of a worm-shaft, the ends of which are

rounded, a worm-wheel engaging therewith the ends of the shaft of which are also rounded, a pinion on the worm-wheel shaft, a drive-wheel engaging the pinion, and antifriction devices for the shaft of said drive-wheel, an inclosing casing for the several mentioned elements, and adjustable devices also having rounded ends and bearing against the ends of said worm-shaft and worm-wheel shaft, substantially as described.

11. In a mechanical movement, the combination of a worm-shaft the ends of which are rounded, a worm-wheel engaging therewith the ends of the shaft of which are also rounded, a pinion on the worm-wheel shaft, a drive-wheel engaging the pinion, antifriction devices for the shaft of said drive-wheel, an inclosing casing for the several mentioned elements, said casing having tubular bearings for the worm-shaft, and similar side bearings for the shafts of the worm and drive wheels, and adjustable screws bearing against the ends of said worm-shaft and worm-wheel shaft, substantially as described.

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

HENRY B. KEIPER.

Witnesses:
CHAS. E. LONG,
M. G. SWAN.