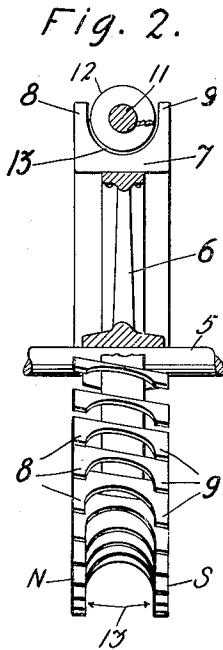
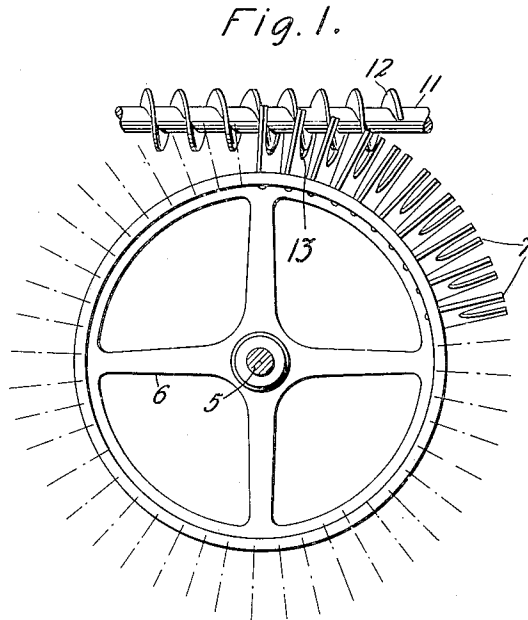
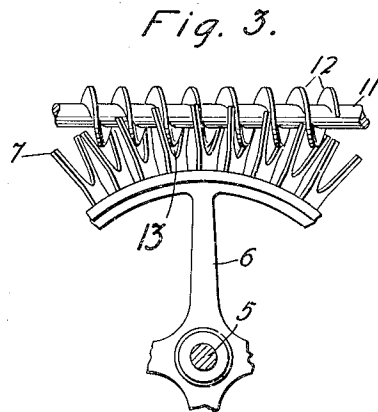


1,337,732.

Patented Apr. 20, 1920.
3 SHEETS—SHEET 1.



H. M. STOLLER.
MAGNETIC GEARING.
APPLICATION FILED NOV. 7, 1916.

1,337,732.

Patented Apr. 20, 1920.
3 SHEETS—SHEET 2.

Fig. 5.

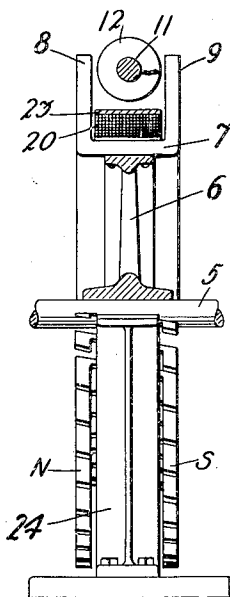
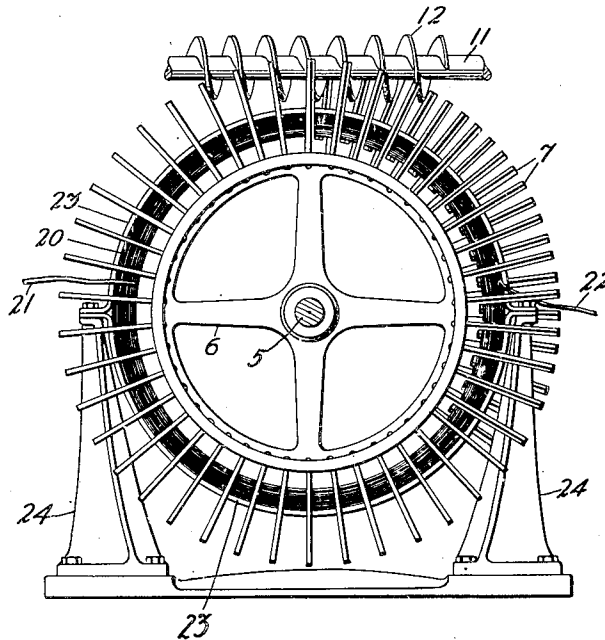


Fig. 4.



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1,337,732.

Patented Apr. 20, 1920.
3 SHEETS—SHEET 3.

Fig. 7.

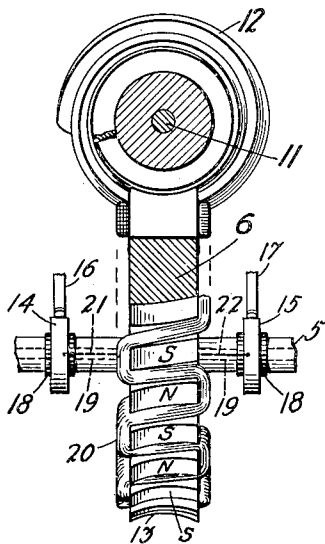


Fig. 6.

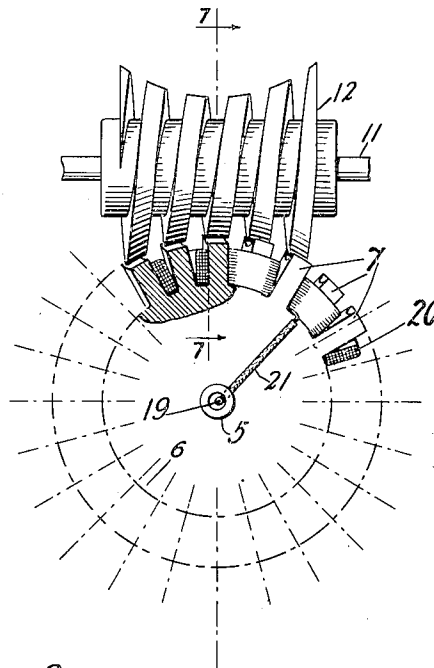
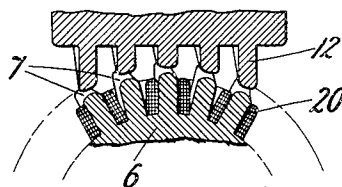


Fig. 8.



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UNITED STATES PATENT OFFICE.

HUGH M. STOLLER, OF NEW YORK, N. Y., ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

MAGNETIC GEARING.

1,337,732.

Specification of Letters Patent.

Patented Apr. 20, 1920.

Application filed November 7, 1916. Serial No. 129,985.

To all whom it may concern:

Be it known that I, HUGH M. STOLLER, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Magnetic Gearing, of which the following is a full, clear, concise, and exact description.

This invention relates to gearing and more particularly to gearing wherein magnetic force is substituted for the usual mechanical engagement between the parts.

The principal object of this invention is to eliminate mechanical contact and friction between transmission members and to produce a gearing which is more noiseless, efficient and durable than the types at present in use.

This invention therefore provides a gear wheel having radial extensions in the form of electromagnetic poles, and a controlling armature in the form of a worm gear, whose magnetic thread, passing between or close to the magnetic poles on the gear wheel, drives or is driven by the gear wheel through the agency of the magnetic poles.

This invention is illustrated in the accompanying drawings in which Figure 1 is a side view of a worm gear coöperating with a gear wheel, whose teeth are formed of permanent magnets. Fig. 2 is an end elevation of the assembly illustrated in Fig. 1 with portions thereof shown in perspective and other portions in section. Fig. 3 is a side view illustrating the pitch or permanent twist given to the magnetic teeth in order that they may conform to the pitch of the spiral worm. Figs. 4 and 5, respectively, are the same as Figs. 1 and 2 except that an alternative arrangement of the electromagnetic teeth is substituted for the permanently magnetized teeth of the gear wheel. Figs. 6 and 7 are, respectively, side and end views of an alternative arrangement comprising a worm gear curved to conform to the contour of the gear wheel. In these figures some portions are shown in perspective, while other portions are shown in section. Fig. 8 is a cross section illustrating an alternative arrangement of facing the thread of a worm gear, and the teeth of a gear wheel.

Referring to Figs. 1, 2 and 3 of the drawing, a shaft 5, provided with suitable bearings (not shown) permitting rotatable

movement thereof, carries a gear wheel 6, the teeth 7 of which are formed of U-shaped permanent magnets. Each of the teeth 7 has a north pole 8 and a south pole 9. A worm gear of magnetic material and comprising a shaft 11 and a spiral worm 12 is mounted to rotate between the poles 8 and 9, and serves to complete the magnetic path between them, being separated therefrom, however, by an air gap 13 so that no mechanical contact takes place.

In describing the operation of this magnetic gear, let it be assumed that the shaft 11 is being rotated in a clockwise direction by any suitable means. Accordingly, the spiral worm 12 is revolved to set up a so-called endless screw action, and through the agency of the magnetic flux between the poles 8 and 9 of the teeth 7, this spiral operates as a tractor in carrying successively approaching teeth 7 through the zone of its travel, thereby imparting a clockwise rotating movement to the gear wheel 6.

In the arrangement shown in Figs. 4 and 5 the poles 8 and 9 are given the required polarity by means of the magnetizing coil 20, common to all the teeth 7. The coil 20 does not rotate with the gear wheel 10, but is held in a fixed position by means of clamping bands 23, which, in turn, are mounted on supporting columns 24. The operation of this arrangement is identical to that described in connection with the form shown in Figs. 1, 2 and 3.

Referring now to Figs. 6 and 7, the alternative structure therein shown is of such form that a relatively large area of the spiral worms is under the magnetic influence of a corresponding area of the gear wheel, thereby securing more steady operation and also permitting the efficient transmission of greater power. This arrangement has the further advantage of compactness. In this case each tooth 7 forms a single magnetic pole, the winding 20 being applied in such a way as to give adjacent teeth 7 opposite polarities. For the sake of clearness, the winding 20 is shown in the drawing as being looped back and forth around the teeth 7. It is, however, to be understood that any of the winding arrangements commonly used in the construction of dynamo-electric machinery to produce adjacent pole pieces of opposite polarities may be employed. Inasmuch as the

winding 20 is here carried by the gear wheel, it, of course, follows that some arrangement, such as brushes 16 and 17 and slip rings 14 and 15, will be required to lead the energizing current to and from the winding 20. It will be noted that the teeth 7 are formed with a spiral pitch which corresponds to the spiral pitch of the thread of the spiral worm 12, thereby increasing the effective cross-section of the magnetic path, decreasing its reluctance and effectively increasing the tractor action. While the teeth 7 have a uniform circumferential pitch, the thread of the spiral worm 12 is preferably designed to accurately register with the teeth 7. In this case the threads of the worm 12 have a non-uniform pitch which at any point is equal to the projection of the circumferential pitch of the teeth 7 on the axial line of the shaft 11. The operation of this embodiment of the invention will be apparent from the description previously given.

It may in some cases be desirable to round off the pole faces of the teeth 7 and the thread 12, as shown in Fig. 8, in order to resist more effectively the magnetic shearing stress between the worm and the gear wheel, thereby securing more steady and efficient operation of the gearing.

It will be understood that the rule as to the velocity ratio between a spiral worm and a gear wheel operated thereby will be the same in the present invention as the existing rules for velocity ratio covering the usual meshed or mechanically engaging gearings.

In view of the fact that no physical contact is present between the moving members of this magnetic speed reducing gear, it will be obvious that relatively high speeds may be employed with the driving spiral 12 without entailing the mechanical wear or friction between this member and its associated gear wheel. Although the direction of the transmitted motion has for convenience been considered as from the spiral worm 12 to the gear wheel 6, it will be understood that motion may also be transmitted in the opposite direction; that is, from the gear wheel 6 to the worm gear or screw 12.

What is claimed is:

1. A gearing mechanism comprising a rotatable gear having a plurality of radial magnetic extensions, adjacent extensions being of unlike magnetic polarity, and a spiral armature out of mechanical engagement with said gear at all times mounted to rotate adjacent to some of said magnetic extensions.

2. A gearing mechanism comprising a rotatable gear having a plurality of radial magnetic extensions, means for magnetizing

said extensions whereby adjacent extensions are given opposite magnetic polarities, and a spiral armature out of mechanical engagement with said gear at all times rotatable adjacent said extensions for completing the magnetic circuit between adjacent extensions.

3. A gearing mechanism comprising a movable magnetizable threaded worm, and a rotatable gear wheel out of mechanical engagement with said worm at all times having a plurality of magnetic teeth arranged to provide a series of sets of adjacent poles of unlike magnetic polarity; the thread of said worm being mounted adjacent to said teeth and serving to bridge the gap between poles of unlike polarity to transmit motion between said worm and wheel upon relative movement therebetween.

4. A gearing mechanism comprising a movable magnetizable threaded worm, and a rotatable gear wheel out of mechanical engagement with said worm at all times and having a plurality of magnetic teeth, adjacent teeth being of unlike magnetic polarity; the thread of said worm being mounted adjacent to said teeth to bridge the gap between adjacent teeth and said teeth serving to attract said worm to transmit motion between said worm and wheel upon relative movement therebetween.

5. A magnetic gear mechanism comprising a rotatable shaft, a magnetizable spiral worm thread carried thereby, a rotatable gear wheel mounted on an axis substantially at right angles to said shaft, and a plurality of magnetic extensions carried by said wheel spaced to correspond to the pitch of the worm thread and partially inclosing but out of contact with said thread at all times; said thread serving to bridge the gap between adjacent extensions to transmit motion between said shaft and wheel upon relative rotation therebetween.

6. A magnetic gear mechanism comprising a rotatable shaft, a magnetizable spiral worm thread carried thereby, a rotatable gear wheel mounted on an axis substantially at right angles to said shaft, and a plurality of substantially U-shaped magnetic teeth carried by said wheel spaced to correspond to the pitch of said worm thread and partially inclosing but out of contact with said thread at all times; opposite legs of each of the U-shaped teeth being of unlike magnetic polarity and said thread serving to bridge the gap between the opposite legs of the respective teeth to transmit motion between said shaft and wheel upon relative rotation therebetween.

In witness whereof, I hereunto subscribe my name this 6th day of November, A. D. 1916.

HUGH M. STOLLER.