No. 781,600. PATENTED JAN. 31, 1905.

F. HAMACHEK.

WORM GEARING.

APPLICATION FILED DEC. 5, 1903.

Fig. 1.

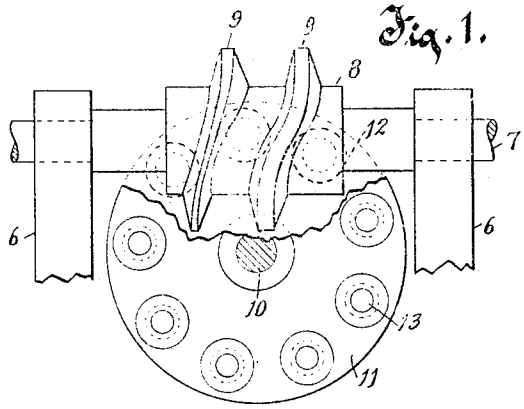


Fig. 2.

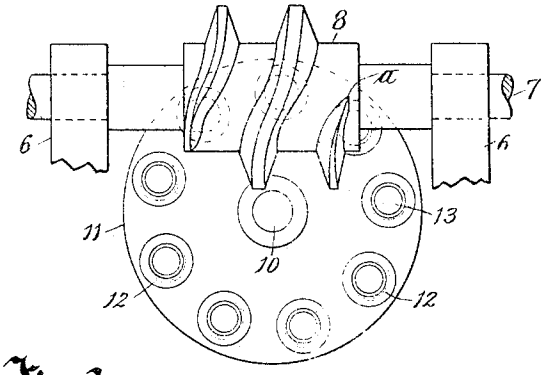


Fig. 5.

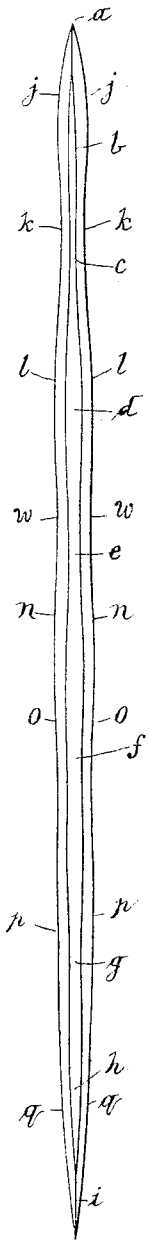


Fig. 3.

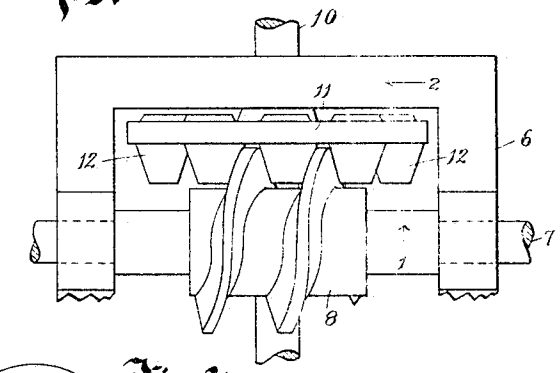
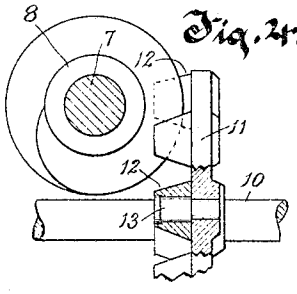


Fig. 4.



Witnesses.

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No. 781,600. Patented January 31, 1905

UNITED STATES PATENT OFFICE.

FRANK HAMACHEK, OF KEWAUNEE, WISCONSIN.

WORM-GEARING.

SPECIFICATION forming part of Letters Patent No. 781,600, dated January 31, 1905.

Original application filed September 5, 1899, Serial No. 729,410. Divided and this application filed December 5, 1903. Serial No. 183,917.

To all whom it may concern:

Be it known that I, FRANK HAMACHEK, residing at Kewaunee, in the county of Kewaunee and State of Wisconsin, have invented a new and useful Improvement in Worm-Gearing, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

My invention relates to certain new and useful improvements in worm-gearing, and has for its object to produce a worm-gearing of the crown-wheel type with which there will be practically no backlash or lost motion and which preferably is adapted to transform a high-speed constant rotation of the worm to a lower-speed intermittent rotation of the crown-wheel.

This invention is adapted for many purposes, one of which is shown and described in my copending application for feed-cutters, Serial No. 729,410, filed September 5, 1899, of which this is a division.

With the above objects in view the invention consists of the devices and parts or their equivalents, as hereinafter set forth.

Referring to the accompanying drawings, in which like characters of reference indicate same parts throughout the several views, Figure 1 is a side elevation of a worm-gearing in accordance with my invention looking upon the side of the crown-wheel opposite to the side from which the conical rollers project and showing the upper portion of the disk broken away, the broken-away portion being carried out in dotted lines. Fig. 2 is a side elevation looking on the face of the disk from which the conical rollers project. Fig. 3 is a plan view of Fig. 2. Fig. 4 is a cross-section through the worm-shaft and looking on the edge of the disk, a portion of said disk being broken away; and Fig. 5 is a detail view showing the ribs or guides removed from the hub of the worm and straightened out so as to clearly illustrate the variations in the thickness of said ribs or guides both at the outer edge and at the base thereof.

My invention may be mounted in any suitable form of framework. In the drawings I show a fragment of a rectangular frame 6, in which is mounted a main shaft 7, which may be driven in any suitable manner. This shaft carries the worm, and the ribs or guides of said worm spirally encircle the shaft, preferably winding spirally around a hub 8, which for convenience in construction is advisably integral with the shaft. The ribs or guides for the major part encircle the hub in lines inclined to the axis or shaft 7; but at certain points there are parallel portions of the ribs or guides (designated by the numerals 9 9 and shown most clearly in Fig. 1) and which describe an arc of a circle of which the shaft 7 is the center or axis. Also journaled in the framework and on a plane across the plane of the shaft 7 is a shaft 10. Upon this shaft 10 is mounted a crown wheel or disk 11. The face of this disk nearest to the worm is provided circularly therearound with a series of conical projections. These conical projections are preferably in the form of conical rollers 12, mounted on pins 13, projecting from the disk. The shape of the rollers is such that if the cones were continued toward the shaft 7 the points thereof would meet the center of said shaft. The angle of each conical roller corresponds with the angle or taper of the guides or ribs of the worm notwithstanding the changing positions which the rollers assume in the rotation of the disk. In order to clearly illustrate this principle of the invention, particular reference is made to Fig. 5 of the drawings, wherein the ribs or guides are removed from the hub and straightened out into a continuous rib. Before attempting to explain specifically the construction of the ribs or guides attention is directed to the fact that the nearer any two of the rollers in the rotation of the disk are brought toward an upper position or toward a horizontal plane the greater will be the space afforded between the rollers for the accommodation of the ribs or guides and as the rollers in the rotation of the disk are carried away from the upper position in which they are in an approximately horizontal plane the less will be the space presented for the accommodation of the ribs or guides. Now if the ribs or guides were of a uniform thickness or of a uniform taper it is apparent that

under the changing positions of the rollers said ribs or guides would either fit too loose or too tight in the spaces between the rollers or possibly might be so wide as to be absolutely prevented from entering between the rollers. The result of such conditions would be either an entirely inoperative device or else a device wherein an uneven rotation would be imparted to the disk and wherein also considerable friction, as well as play or rattle, would be present. To avoid these difficulties, it is necessary not only to construct the ribs or guides beveled in order to correspond to the beveled rollers, but also to construct them of varying thicknesses both at the base and at the outer edge thereof. Referring particularly to Fig. 5 for a clear elucidation of this construction and beginning at the point *a*, and which point is clearly shown in Fig. 2, it will be seen that the rib or guide at *a* is pointed or tapered, and this pointed edge affords opportunity for the rib or guide to initially and freely engage one of the conical rollers, it being understood that the initial engagement occurs when the roller which is engaged is out of the extreme upper position, and consequently there is but a small space for the entrance of the rib. Now, referring particularly to the variations in the thicknesses of the upper edge of the rib, it will be seen that beginning with the point *a* said outer edge gradually widens, as indicated by the letter *b*. This widened portion is followed by a very narrow portion *c*, which merges into a wider portion *d*, which portion *d* is followed by a narrow portion *e*, said narrow portion *e* merging into a wide portion *f*, said wide portion *f* merging into a more narrow portion *g* and said portion *g* followed by a slightly-wider portion *h*, which portion *h* tapers and merges into the tapered and terminal end edge *i*. Referring to the variations in thicknesses at the base of the ribs or projections, said base from the end-tapered edge *a* for a short distance is somewhat wide, as indicated by the letters *j j*. These wide portions merge into narrower base edges *k k*, which in turn merge into wider base edges *l l*, followed by narrower base edges *w w*, which latter merge into slightly-wider edges *n n*, which edges are followed by narrower edges *o o*, and said edges *o o* are followed by still narrower edges *p p*, and finally said edges *p p* merge into slightly-wider base edges *q q*, which edges *q* taper to the tapered edge *i*.

It will be understood that the outer edge of the ribs or guides must be of the varying thicknesses described in order to adapt them to engage the spaces between the conical rollers under all conditions and to bear evenly and truly against the face of the roller against which it is acting. This is most clearly shown in Fig. 1, wherein one portion of the rib or guide is between two of the rollers in which parallel vertical lines drawn through their axes are close together, and consequently thin portions of the ribs or guides are required to enable said ribs or guides to fit the space, and wherein another portion of the ribs or guides is between two rollers in which parallel vertical lines through their axes are farther apart, and consequently said space will accommodate a thicker portion of the ribs or guides. It will also be evident that as the rollers are beveled there must be variations in the thicknesses of the base of the ribs or guides, as hereinbefore described, so that said rollers may bear evenly against the entire side of the rib or guide during the entire time the roller is in bearing contact or engagement, even when said roller travels from the upper position down.

From the construction of the worm-gearing above described it will be seen that I present a device wherein there are two rollers always in bearing contact with the ribs and that the shape of the ribs is such that a full and complete bearing or contact of the roller with the rib is maintained during the entire period of engagement, and hence excessive friction is prevented and even rotation is imparted to the disk carrying the conical rollers and all play and backlash thereby prevented.

My device is designed to impart an intermittent rotation to the disk, and this is accomplished by the provision of the portions 9 9 of the ribs which encircle the hub in an arc of a circle on which the shaft is the center or axis. When the shaft 7 is rotated in the direction of the arrow 1, Fig. 3, the disk of course will be rotated in the direction of the arrow 2.

While it is preferred that my improved worm-gearing be in the form of an intermittent gearing by reason of the provision of the portions 9 9 of the ribs or guides, yet I do not wish to be understood as limiting myself thereto, inasmuch as the invention may be present in a worm-gearing adapted for imparting a continuous rotation to the part to be driven and which may be accomplished merely by having the ribs or guides disposed on inclined planes with reference to their axis throughout their length.

What I claim as my invention is—

1. In an intermittent gearing, the combination of a shaft to be driven, said shaft having a disk or member mounted thereon, which disk or member is provided on one face with conical projections arranged circularly thereabout, a main shaft in a plane intersecting the plane of the driven shaft, a worm on the main shaft, said worm provided with outstanding beveled ribs or guides, parallel portions of said ribs or guides describing an arc of a circle of which the shaft is the center or axis, and other parallel portions of said ribs or guides continuing at oblique angles to the first-referred-to ribs or guides, and said ribs or guides being of such varying thicknesses both

at their base and outer edge as to permit them to conform to the varying spaces between the conical projections due to the circular arc described by the conical projections in their rotation, and as determined by parallel vertical lines drawn through the axes of the conical projections.

2. In an intermittent gearing, the combination of a shaft to be driven, said shaft having a disk or member mounted thereon, which disk or member is provided on one face with conical projections arranged circularly therearound, said conical projections consisting of conical rollers rotatably mounted on pins extending from the face of the disk or member, a main shaft in a plane intersecting the plane of the driven shaft, a worm on the main shaft, said worm provided with outstanding beveled ribs or guides, parallel portions of said ribs or guides describing an arc of a circle of which the shaft is the center or axis, and other parallel portions of said ribs or guides continuing at oblique angles to the first-referred-to ribs or guides, and said ribs or guides being of such varying thicknesses both at their base and outer edge as to permit them to conform to the varying spaces between the conical projections due to the circular arc described by the conical projections in their rotation, and as determined by parallel vertical lines drawn through the axes of the conical projections.

3. In a worm-gearing, the combination of a shaft to be driven, said shaft having the disk or member mounted thereon, which disk or member is provided on one face with conical projections arranged circularly therearound, a main shaft in a plane intersecting the plane of the driven shaft, a worm mounted on the main shaft, said worm provided with outstanding beveled ribs or guides, parallel portions thereof arranged spirally around the shaft, and said ribs or guides being of such varying thicknesses both at their base and outer edge as to permit them to conform to the varying spaces between the conical projections due to the circular arc described by the conical projections in their rotation, and as determined by parallel vertical lines drawn through the axes of the conical projections.

4. In a worm-gearing, the combination of a shaft to be driven, said shaft having a disk or member mounted thereon, projections on the face of the disk arranged circularly therearound, a driving-shaft in a plane intersecting the plane of the driven shaft, and a worm mounted on the driving-shaft, said worm being provided with outstanding ribs varying in thickness to permit them to conform to the varying spaces between the projections on the disk or member due to the circular motion of said projections.

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

FRANK HAMACHEK.

Witnesses:
JOHN WATTAWA,
FRANCES STEINBRECHER.