

H. J. SCHMICK.
GEARING.
APPLICATION FILED APR. 16, 1920.

1,384,541.

Patented July 12, 1921.

Fig. 1.

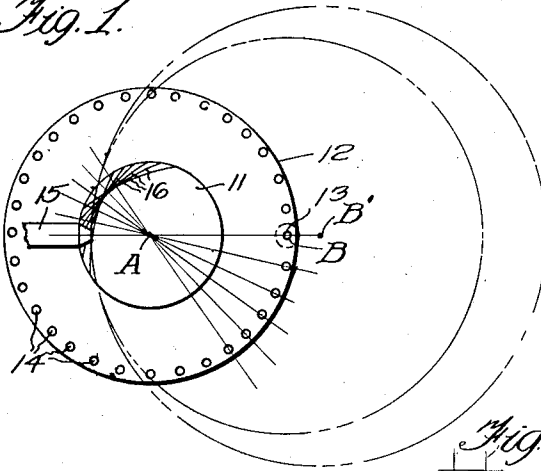


Fig. 2.

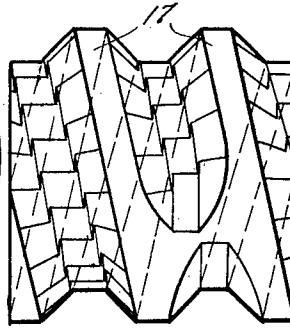


Fig. 3.

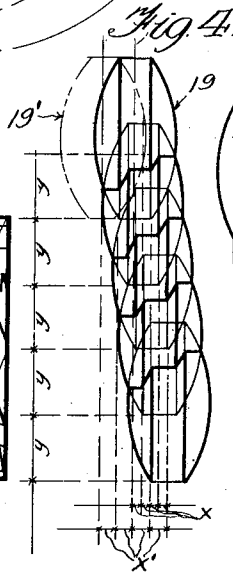
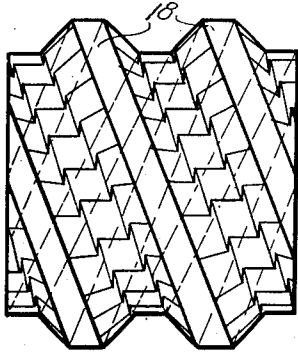


Fig. 5.

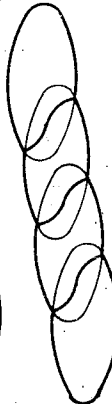


Fig. 7.



Fig. 6.



Fig. 8.

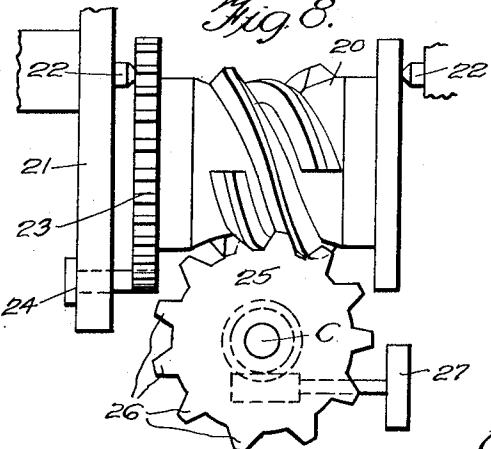
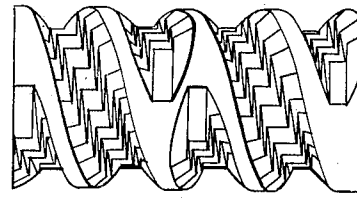


Fig. 9.



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GEARING.

1,384,541.

Specification of Letters Patent. Patented July 12, 1921.

Application filed April 16, 1920. Serial No. 374,468.

To all whom it may concern:

Be it known that I, HENRY J. SCHMICK, a citizen of the United States, and a resident of Williamsport, in the county of Lycoming and State of Pennsylvania, have invented an Improvement in Gearing, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to gearing of the type which is commonly termed screw or worm gearing, and consists in a new form of tooth, particularly the working faces of the tooth, whereby certain advantages are secured as compared with screw and worm gearing of usual form.

The objects and advantages of the invention may be understood from the following description of the nature of the invention and the principles upon which it operates, and what is claimed as the invention is set forth in the appended claims, reference being made to the accompanying drawings by way of illustration of a preferred form of the invention.

In the drawings, Figure 1 is a diagram showing a preferred method of generating one form of tooth comprised in the invention;

Fig. 2 is a side view of a partly finished gear or worm embodying the invention, the light lines indicating (much exaggerated) the shape and nature of the working faces of the teeth;

Fig. 3 is a similar view of a modified form of gear having two threads;

Fig. 4 is a diagrammatic view representing a development of a portion of the surface of a gear which has been lined off to indicate the relative peripheral and axial displacement of successive cuts of the generating tool whereby different pitches may be formed;

Figs. 5, 6 and 7 are diagrams illustrating the overlapping of the successive cuts made in generating a gear by a square end cutting tool, a round point cutting tool, and a sharp pointed or V-thread cutting tool, respectively, the portion of the cut which remains in the finished gear being shown in heavy

lines and the portions which are cut away by preceding or succeeding cuts being shown in light lines;

Fig. 8 is a side elevation of a device for generating a Hindley type worm according to the invention; and

Fig. 9 is a side view of a partly finished gear showing the character of the surface formed according to one mode of carrying out the invention.

In screw and worm gears of usual form having one or more helical threads, the working faces of the thread are composed of straight line elements which may be extended to intercept the axis of the gear at a constant angle. In gears embodying my invention, the working faces of the thread (whether single or multiple) are composed of narrow strips of surfaces of revolution the centers of curvature of which are eccentrically disposed about the axis of the gear, each center also being laterally displaced in an axial direction with reference to the centers of adjoining strips.

A suitable method and machine for generating a gear embodying the invention is disclosed in application for U. S. patent filed December 11, 1919 (Serial No. 344,265) for improvements in method of and means for generating mechanical elements; but any suitable method or machine may be used.

The particular form of the invention shown in the drawings has a tooth of approximately truncated V-shape, and may be produced as follows:

Referring to Fig. 1, the gear blank 11 is fixed to the face plate 12 and arranged to be turned through successive small angles on its axis by an index device which may be of any suitable kind, such as a pin 13 fitting the series of holes 14. The face plate and index mechanism are rotatable about the center axis B of the machine to present the outer segment of the blank to the action of the cutter 15 at each rotation to cut an arc shaped groove. A series of such grooves 16 are shown in the figure.

Between successive cuts the index mechanism is operated to cause successive segments of the blank to be presented to the tool, and the tool is moved laterally (length-

wise of the main axis of the machine) to cause the successive cuts to be displaced slightly axially of the blank, thereby generating a stepped groove on the blank following the general direction of a helix. If more than one thread is to be cut the axial displacement of the successive cuts must be increased in proportion to the number of threads.

- 10 In cutting a plural number of threads, it is desirable to use as many cutters as threads, mounting them side by side, spaced apart a distance equal to the pitch. A worm 17 provided with a single thread is shown in Fig. 2, and a worm 18 provided with a double thread is shown in Fig. 3. Fig. 4 illustrates the effect of doubling the lateral displacement x to x' with respect to the angular displacement y of the successive cuts 19, as shown by the dotted outline 19'.

The eccentricity of the axis A of the blank with respect to the principal axis B (see Fig. 1) may be varied so as to produce a greater or less degree of curvature of the elements constituting the working surfaces of the tooth as shown at B' for example. Also the point of the cutting tool may be flat, rounded or sharp or square resulting in the formation of threads as shown in Figs. 4, 5, 6 and 7.

30 In Fig. 8, the blank 20 is mounted on a face plate 21 between the centers 22 of the machine. The blank may be indexed around its axis by means of the index plate 23 and pin 24. The cutter 25 has a series of teeth 26 formed on a circular arc having its center C at one side of the axis of the blank, about which the cutter is rotatable by means of the index mechanism 27, to which it is connected by suitable gearing, whereby it may be turned intermittently as the blank is indexed. The worm having been thus generated may be used as a hob to cut a suitable wheel to mesh with it.

45 From the foregoing description it is evident that gears embodying my invention have their working faces composed of a series of adjoining similarly shaped elements of curvilinear form disposed substantially at right angles to the main axis of rotation (see Fig. 9) and with their respective centers of curvature non-concentrically disposed about and along the main axis of rotation. If a straight sided cutter is used in generating the gear these elements will be strips of conical surfaces having their apices arranged in a helix of the same axial pitch as the lead of the gear.

60 It is obvious that considerable latitude in the shape of the cutter is permissible, and that the depth of cut and lateral displacement of the cutter may be adjusted to suit the pitch and lead desired.

The invention is not restricted to the apparatus shown and described, nor to the particular mode of operation thereof, nor to the precise forms of gear shown in the drawing.

I claim the following as my invention:

1. A gear having teeth with their working faces composed of a series of adjoining elementary surfaces of curvilinear form each consisting of coaxial arcs disposed in parallel planes substantially at right angles to the axis of rotation of the gear, respective centers of curvature of said elementary surfaces being non-concentrically disposed about said axis.

2. A gear having teeth with their working faces composed of a series of elementary surfaces of curvilinear form disposed with their axes of curvature parallel to the axis of rotation of said gear and with their respective centers of curvature spirally disposed about said axis, said elementary surfaces conforming to strips of conical surfaces having their apices arranged in a helix of the same axial pitch as the lead of the gear.

3. A gear having teeth extending around the axis of rotation, the working faces of the teeth being composed of successive strips disposed transversely to said axis and of conical shape of greater radius of curvature than the radius of the gear at corresponding points.

4. A gear having teeth extending around the axis of rotation, the working faces of the teeth being composed of successive strips disposed transversely to said axis and of conical shape of greater radius of curvature than the radius of the gear at corresponding points, the bottom portions of said teeth being composed of overlapping similar portions of surfaces of revolution of greater radius than the root diameter of the teeth.

5. A gear provided with a thread the working faces of which are composed of adjoining narrow strips of surfaces of revolution having their respective centers of curvature non-concentrically disposed about the axis of the gear.

6. A rotary member having a peripheral groove the side walls of which comprise a series of adjoining axially spaced elementary surfaces having centers of curvature remote from the axis of said rotary member.

7. A rotary member having a series of overlapping cuts in its perimeter transverse to the axis of said member, said cuts being axially spaced whereby they merge into a groove making an angle to the axis of said member.

8. A rotary member having a series of overlapping cuts in its perimeter transverse to the axis of said member, said cuts having convex side walls of greater radius of curvature than their respective distances from the

axis of said member and being axially spaced whereby they merge into a spiral groove.

9. An article of the character described
5 having a principal axis of rotation and a working face composed of a series of non-radial linear elements converging in groups at eccentric points spaced lengthwise of said

axis and angularly around said axis, the linear elements of each group of said series 10 conforming substantially to the surface of a cone having its axis parallel to the axis of said article.

In testimony whereof I have signed my name to this specification.

HENRY J. SCHMICK.