

N. A. CHRISTENSEN.
METHOD OF FORMING HERRING BONE GEARS.
APPLICATION FILED JUNE 20, 1904.

914,700.

Patented Mar. 9, 1909.
2 SHEETS—SHEET 1.

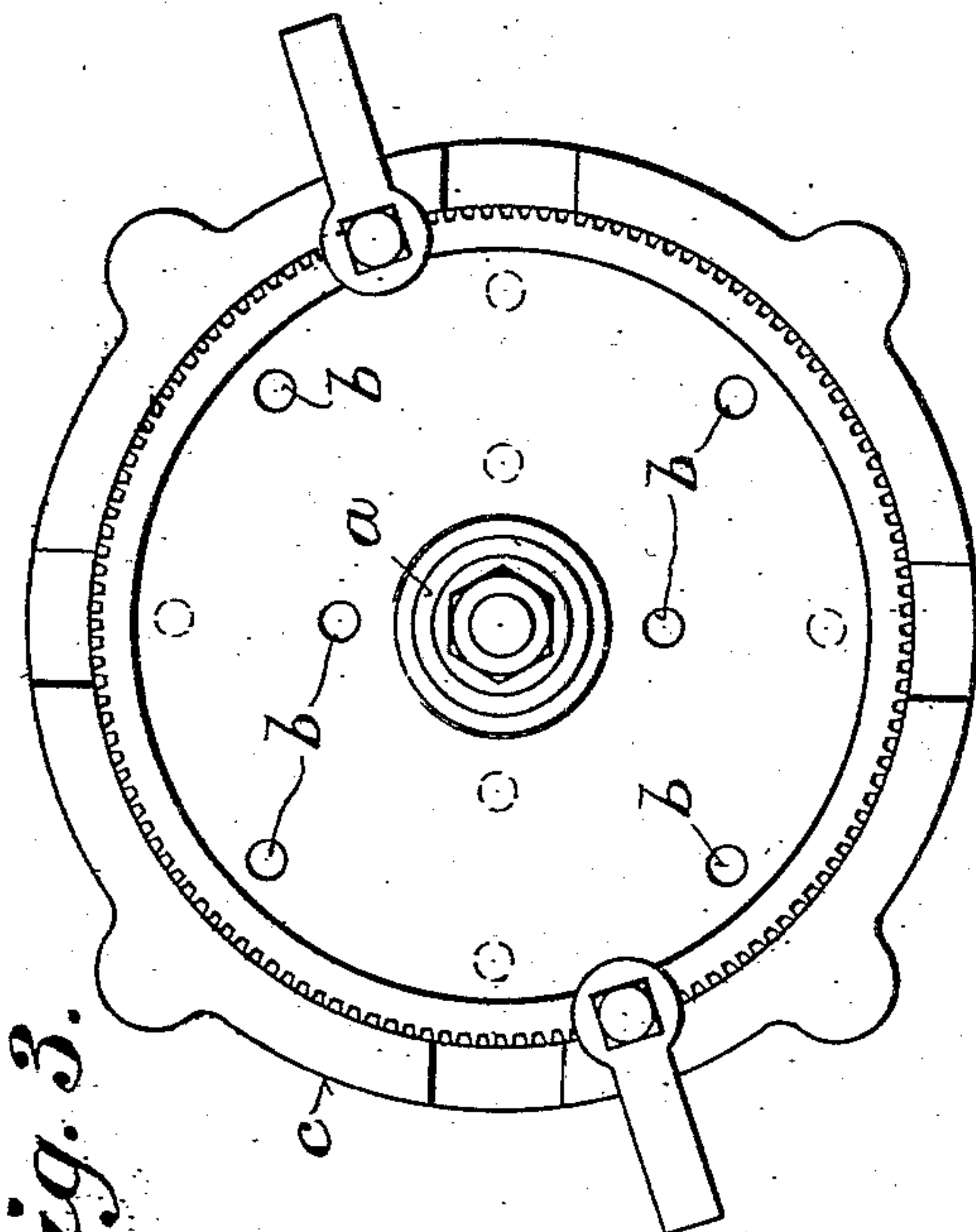


Fig. 3.

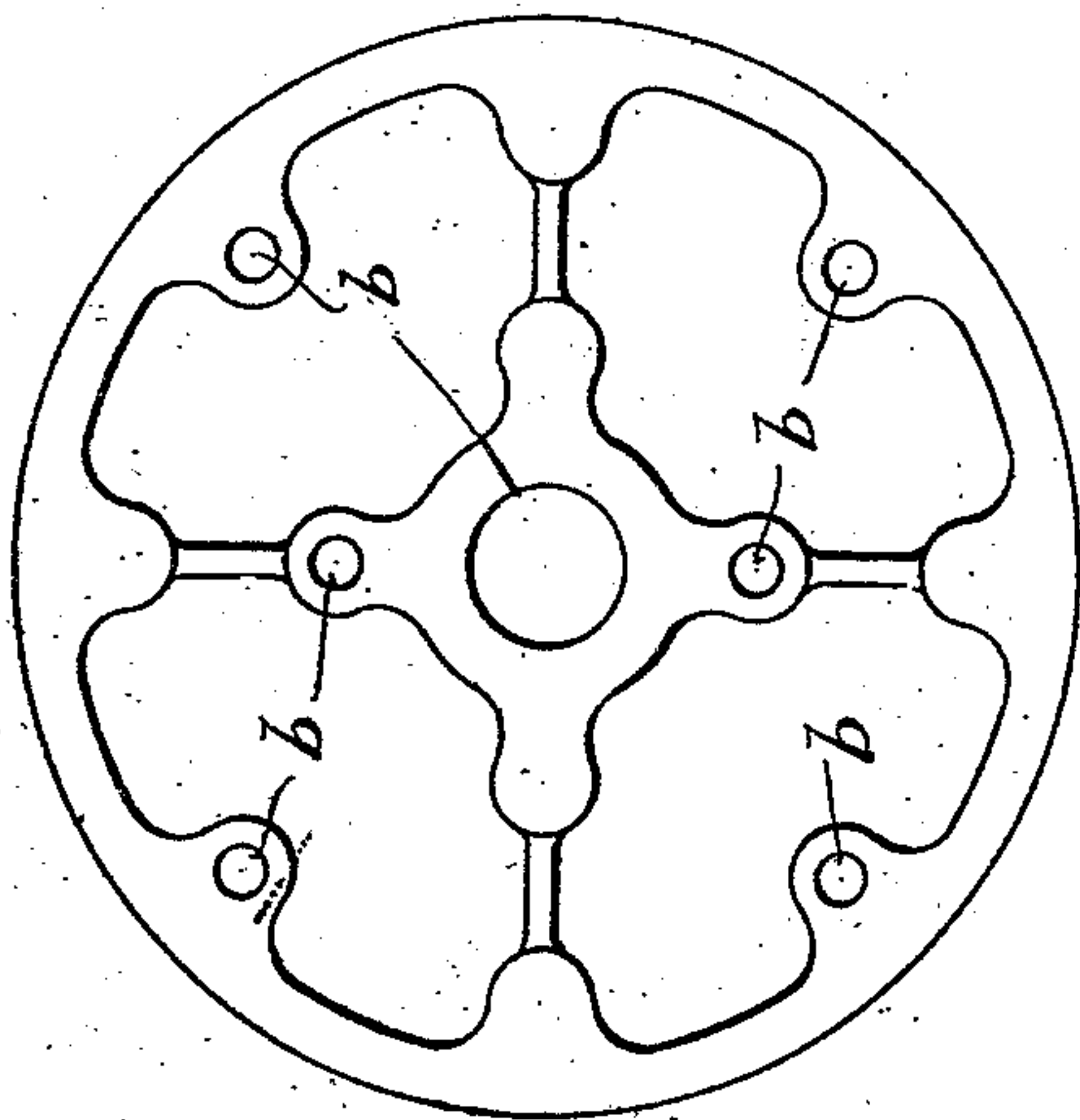
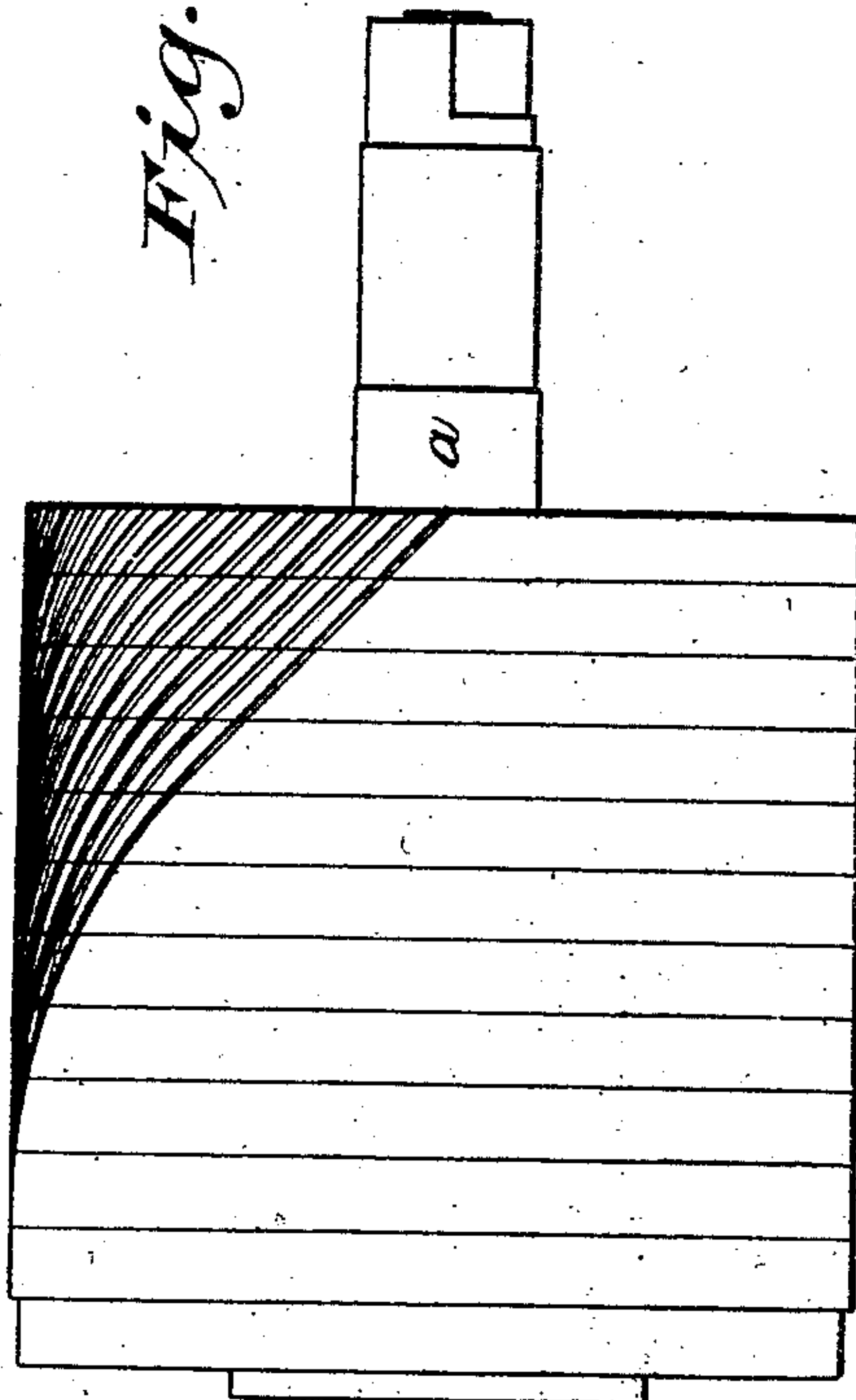


Fig. 1.

Fig. 2.



Witnesses
Geo. W. Young
Chas. L. Love

Inventor:
Niels A. Christensen

By Wm. H. Linder with Arthur W.
O'Connor

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Fig. 6.

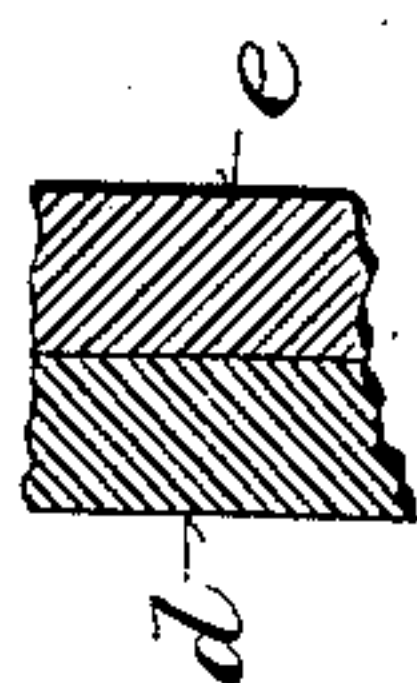


Fig. 5.

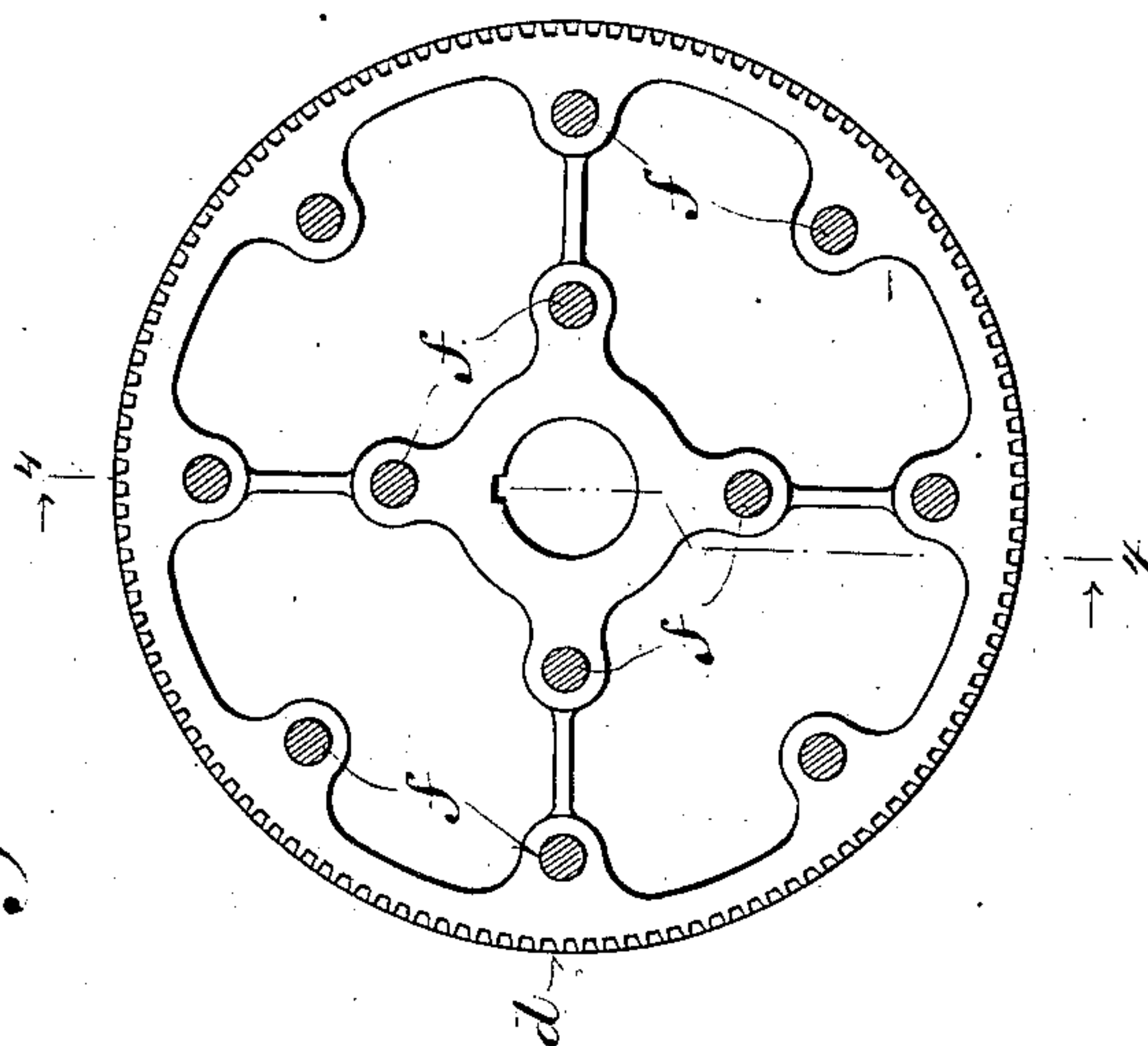
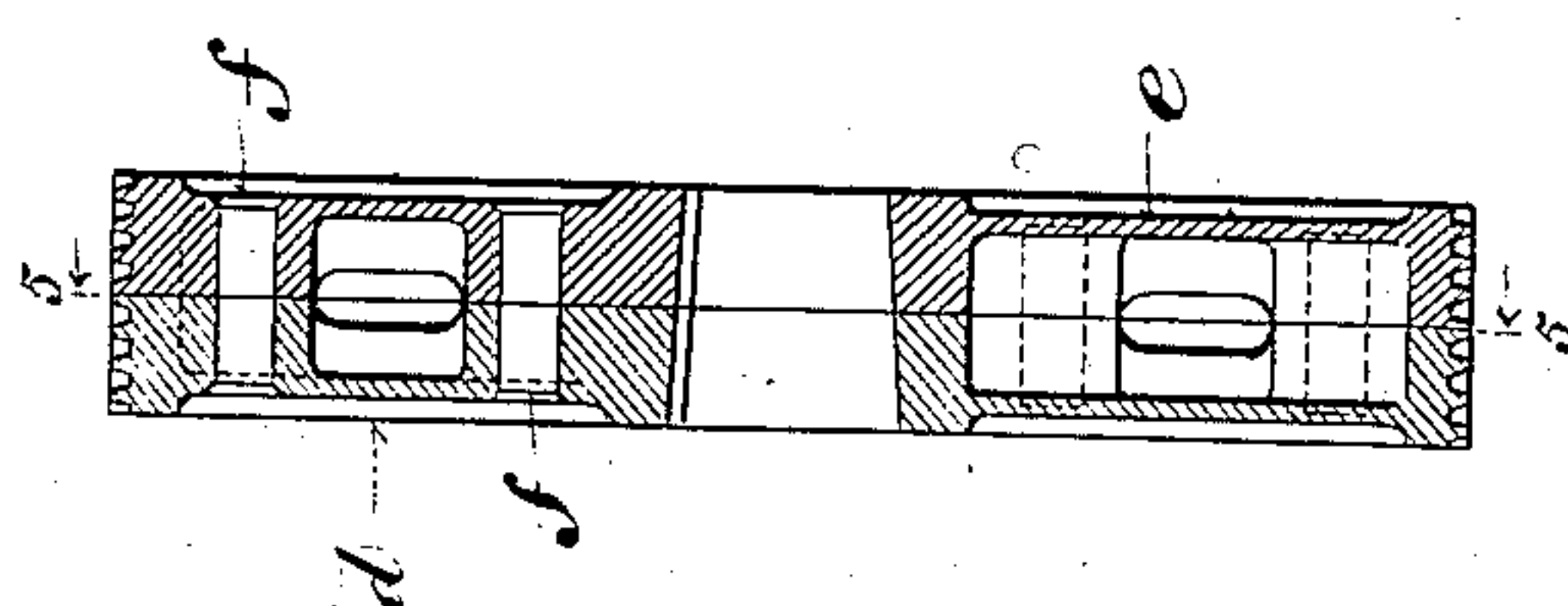


Fig. 4.



Witnesses:
Geo. W. Young,
Chas. L. Hoar

Inventor:
Nils A. Christensen,
By Wm. H. Anderson, Atty. in Law,
C. H. Ormery.

UNITED STATES PATENT OFFICE.

NIELS A. CHRISTENSEN, OF MILWAUKEE, WISCONSIN.

METHOD OF FORMING HERRING-BONE GEARS.

No. 914,700.

Specification of Letters Patent.

Patented March 9, 1909.

Original application filed October 19, 1899, Serial No. 734,091. Divided and this application filed June 20, 1904. Serial No. 213,337.

To all whom it may concern:

Be it known that I, NIELS A. CHRISTENSEN, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Methods of Forming Herring-Bone Gears, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

This invention relates to spiral gearing of the class shown and described in my application Serial No. 734,091, filed October 19, 1899, of which my present application is a division.

The main object of the invention is to simplify and improve the construction and operation of this class of gearing, and to facilitate and cheapen the manufacture thereof.

It consists in the method or process hereinafter particularly described, of constructing herringbone gears of sections having reversely arranged spiral teeth and secured together side by side.

In the accompanying drawing like letters designate the same parts in the several figures.

Figure 1 is an inner side view of one of the component sections of a gear made in accordance with my invention; Fig. 2 is a face view of a number of such sections secured together side by side on a mandrel for turning their peripheral faces and cutting teeth therein; Fig. 3 is a view illustrating the manner of clamping two gear sections together in a centering ring or holder for completing the holes partially formed in the sections for bolting or riveting them together; Fig. 4 is a section indicated by the line 4 4, Fig. 5, in a plane parallel with the axis of the gear, and Fig. 5 is a section indicated by the line 5 5, Fig. 4, in a plane at right angles to the axis of the gear, showing a finished gear constructed in accordance with my improved process and illustrating the manner and means of assembling and securing together the component sections of the gear; and Fig. 6 is a view of a portion of the face of a finished gear showing the arrangement and herringbone form of its teeth.

In the construction of gearing in accordance with my process, a number of sections cast like or similar to that shown in Fig. 1, are accurately turned true or faced on the sides perpendicular or at right angles to their axes and their hubs are bored. They are then secured together side by side upon a

mandrel *a*, as shown in Fig. 2, and their peripheral faces are turned in a lathe. The sections having been turned true, are placed with the same mandrel in a milling or gear cutting machine and spiral teeth are simultaneously cut therein, the teeth all running one way, either right or left, as shown in Fig. 2. In other sections, secured together and turned true on a mandrel as above explained, spiral teeth running in the opposite direction are cut in like manner.

Holes *b*, are drilled for bolting or riveting the component sections of each gear together. In order to form these holes so that they will exactly register with each other in the component sections of a gear and such sections when bolted or riveted together will be exactly concentric and their teeth will have an exact predetermined relation to each other, only a part of the holes, for example alternate holes, are primarily drilled in each section, as shown in Figs. 1 and 3. Two sections, one from each group or series, having teeth running in opposite directions and arranged with the holes *b* of one section out of register with, preferably midway between, the holes in the other section, and the teeth of each section in the exact desired relation to the teeth of the other section, are clamped together in a centering ring or holder *c*, as shown in Fig. 3. The bolt or rivet holes are then completed, the drill being guided by the holes previously formed in each section in drilling the additional holes in the other section. Each section thus serves as a jig for exactly locating and drilling the registering holes in the other section. In this way the additional holes in each section are formed exactly in line with the holes primarily formed in the other section, so that when the two sections are bolted or riveted together they will be exactly concentric and the teeth of each will be in the exact desired relation to the teeth of the other. The two sections *d* and *e* thus prepared and drilled, are then secured together side by side, by bolts or rivets *f*, as shown in Figs. 4 and 5, and form in effect an integral herringbone gear, the teeth of whose component sections may be arranged to exactly meet each other at their inner ends, as shown in Fig. 6, or may be offset or staggered if desired. After the sections are thus assembled and secured together, the gear may be centered by its periphery in a lathe and the bore of its hub finished concentrically with its

periphery, and if desired, one or more key seats may be cut therein.

5 In the construction of gears of the larger sizes, the sides of the sections are preferably recessed, as shown in Figs. 1 and 5, to reduce their weight, save material and economize in the time and labor required to face them. The outer ends of the holes through which the rivets pass are preferably countersunk,
10 as shown in Fig. 4, so that when the rivets are upset therein, their ends will be substantially flush with the webs or side faces of the gear.

Herringbone gears constructed in accordance with my invention as hereinbefore explained, can be made more rapidly and economically and their teeth can be more accurately cut, than when they are made according to the usual practice, in a single
20 piece. By my method of construction the angles produced by the meeting teeth of adjoining sections are sharp and perfectly formed, a result that cannot be obtained by cutting angular teeth on a gear made in one
25 piece or having an integrally formed rim. It is obvious also, that by cutting the teeth simultaneously in a number of assembled sections, in the manner hereinbefore explained, a great saving of time, labor and
30 expense is effected.

Various changes in the minor details of construction of the gear and in the order and manner of performing the several operations hereinbefore described, may be made without departing from the principle and intended scope of the invention.

I claim:

1. The method of forming herringbone gears, consisting in cutting spiral or oblique teeth running in opposite directions in separate sections, primarily forming transverse holes in each section, temporarily securing said sections together in the exact relation they are to have in the finished gear, with the holes in one section out of register with the holes in the other, exactly locating and forming additional holes in each section by the holes primarily formed in the other section, while the two sections are temporarily held together in the exact desired relation to each other, and securing the sections together by means passing through the holes thus formed, substantially as described.

2. The method of forming herringbone gears, in sections, consisting in cutting spiral or oblique teeth running in opposite directions in the separate sections, primarily forming transverse holes in one section of each gear, temporarily securing the sections together in the exact relation they are to have in the finished gear, exactly locating and forming holes in the other section by the holes primarily formed in the first section while the two sections are temporarily held together in the exact desired relation to each other, and finally securing the sections together by means passing through the holes thus formed, substantially as described.

In witness whereof, I hereto affix my signature in presence of two witnesses.

NIELS A. CHRISTENSEN.

Witnesses:

JNO. DADMUN,
CHAS. L. GOSS.

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