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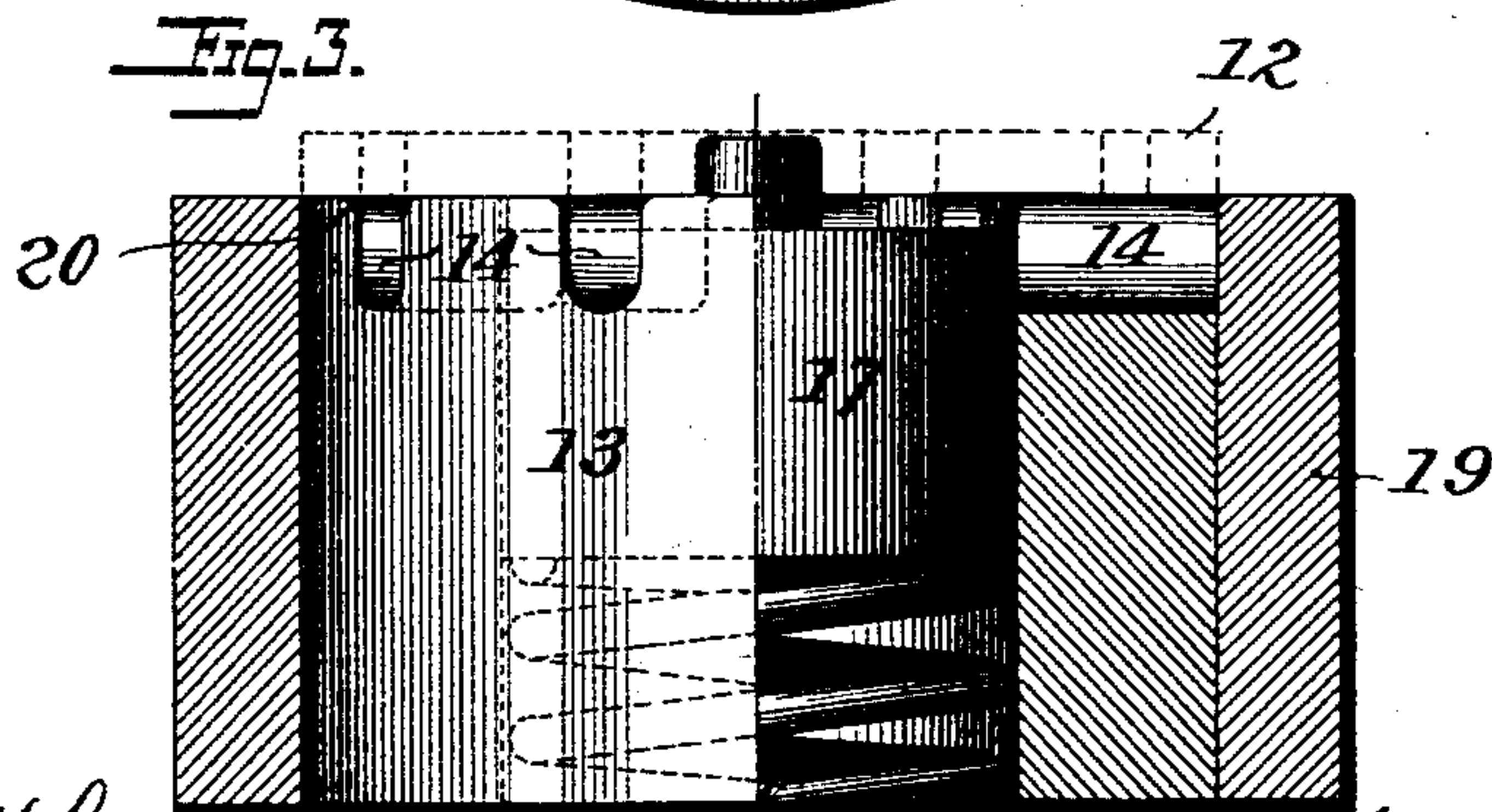
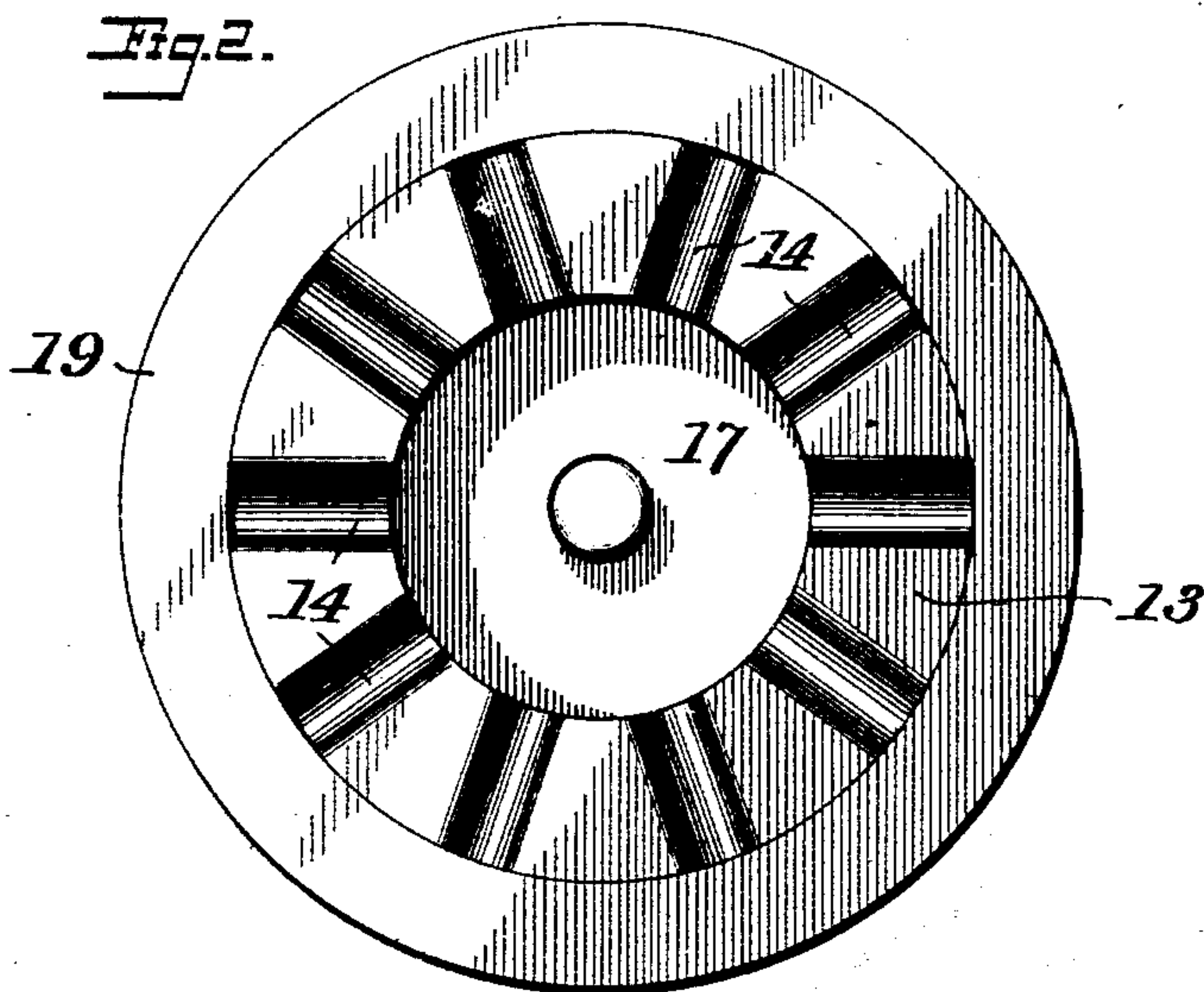
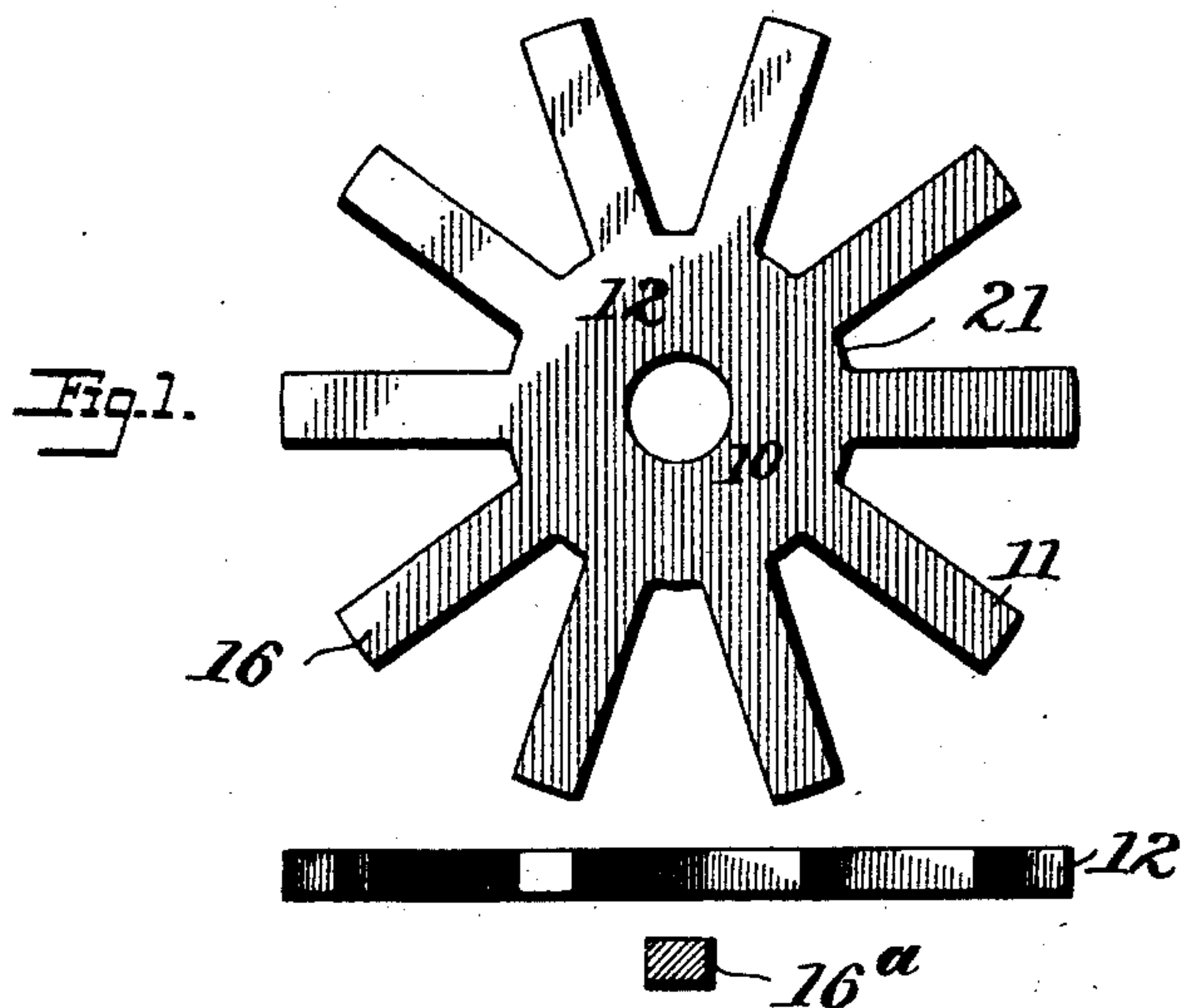
2 Sheets—Sheet 1.

J. THOMSON.

DIE FOR THE MANUFACTURE OF CROWN GEAR WHEELS.

No. 520,194.

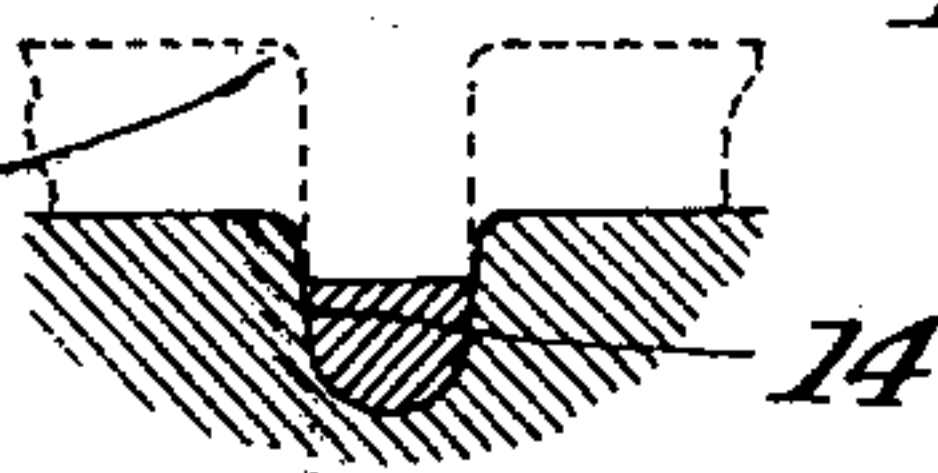
Patented May 22, 1894.



Witnesses  
*Geo. G. Hinkel*

*A. H. Dobson*

Fig. 4.



Inventor

*John Thomson*  
*James Freeman*  
Attorneys

(No Model.)

2 Sheets—Sheet 2.

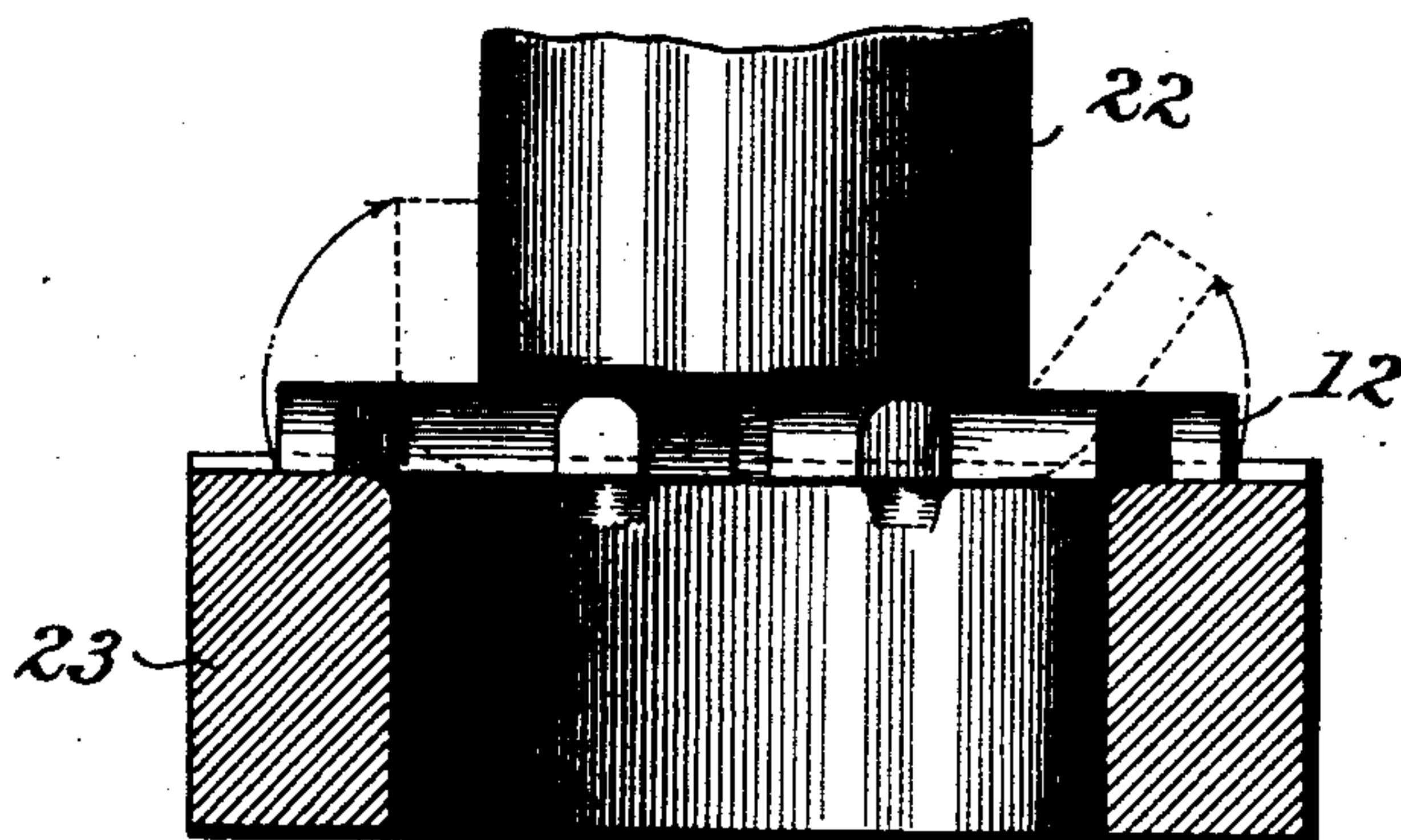
J. THOMSON.

DIE FOR THE MANUFACTURE OF CROWN GEAR WHEELS.

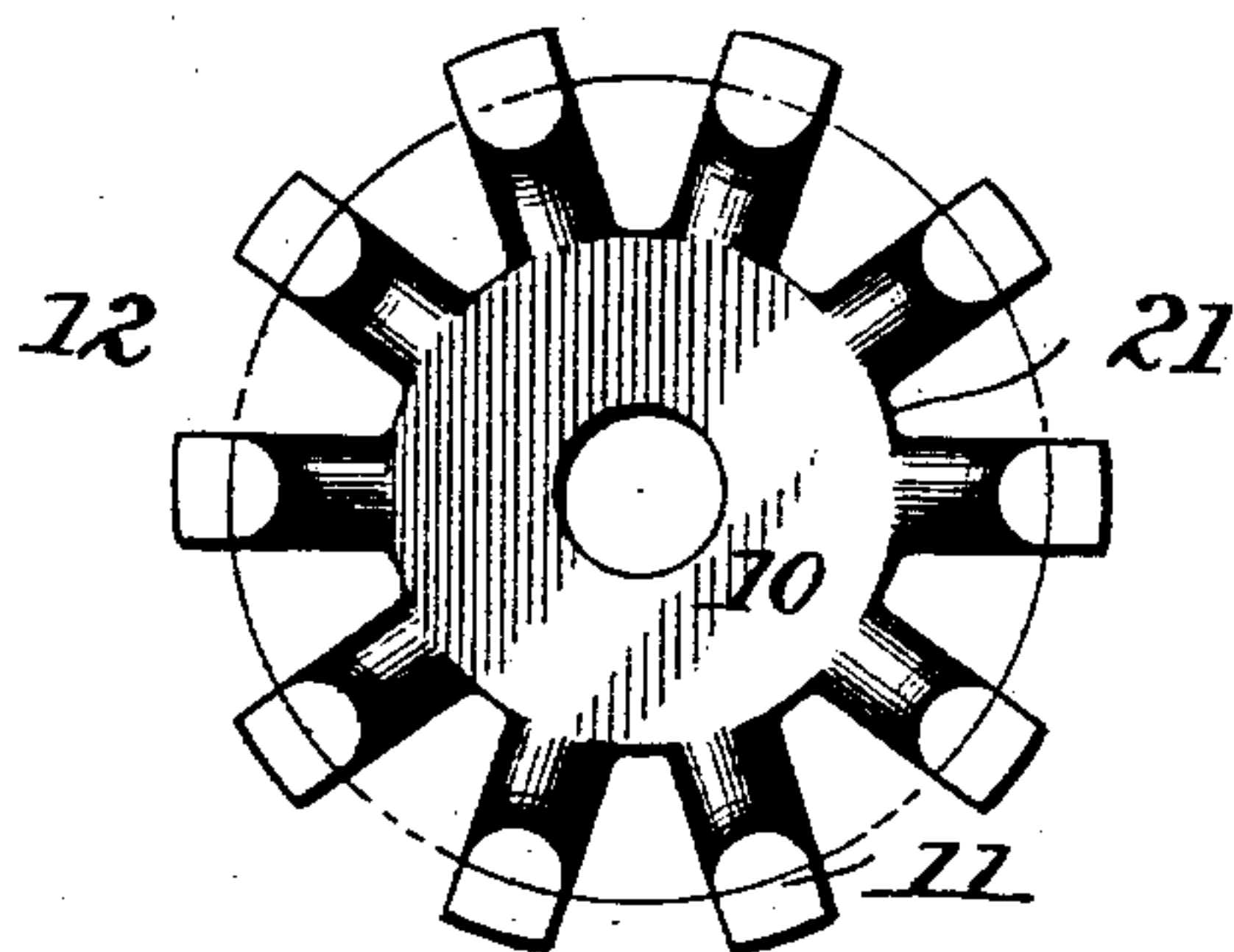
No. 520,194.

Patented May 22, 1894.

*Fig. 5.*



*Fig. 6.*



Witnesses  
*John G. Hinkel*  
*Alfred Dobson*

Inventor  
*John Thomson*  
*by Foster Freeman*  
Attorneys



# UNITED STATES PATENT OFFICE.

JOHN THOMSON, OF BROOKLYN, NEW YORK, ASSIGNOR TO THE NEPTUNE  
METER COMPANY, OF NEWARK, NEW JERSEY.

## DIE FOR THE MANUFACTURE OF CROWN GEAR-WHEELS.

SPECIFICATION forming part of Letters Patent No. 520,194, dated May 22, 1894.

Application filed August 4, 1893. Serial No. 482,395. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN THOMSON, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Dies for the Manufacture of Crown Gear Wheels, of which the following is a specification.

My invention relates to the manufacture of crown gear wheels, and it has for its object to improve the means whereby the said wheels may be made, and my invention consists in the various features, substantially as herein-after pointed out.

Referring to the accompanying drawings, wherein I have illustrated my improved article, the means for manufacturing and the method of making the same, Figure 1, is a plan and edge view of a punched metal blank, from which the wheel is made, showing also a cross-section of one of the arms of the blank. Fig. 2, is a top plan; and Fig. 3, is a partial center section and elevation of the swaging die, by means of which the blank is formed into the proper cross-sectional contour to form the teeth. Fig. 4, is a detail sectional view of one of the slots in the face of the die, showing the wheel therein, and the punch in dotted lines. Fig. 5, is an elevation and central section of a punch and die suitable for upsetting the arms of the blank to form the wheel; and Fig. 6, is a face and side view of the finished crown gear wheel the working faces projecting inwardly.

The object of my invention is to provide a crown gear wheel which can be quickly and cheaply made, and when made shall have certain features of construction rendering it well adapted for use, especially in connection with comparatively small wheels.

It is desirable first to provide a crown gear wheel in which the teeth are of the proper shape to form good bearing surfaces, and arranged on the inner side of the crown, and the teeth shall be of practically the same dimensions throughout their entire vertical extension, and not be distorted at or near their points of junction with the main body of the gear, and when completed, the gear (as indicated in Fig. 6) will be composed of a central portion 10, of less diameter than that of the

inner faces of the teeth, so that there are openings or recesses 21, between the central portion 10 and the inner vertical faces of the teeth. In producing these gears I provide a suitable blank 12 (Fig. 1), preferably by punching it from a sheet of metal, or otherwise, it being flat and composed of the body portion 10, and the radially extended arms 16, leaving the recesses 21, between the arms. The blank being thus provided, the next step is to form the arms 16 of proper configuration to constitute the teeth, and this is accomplished by pressing or otherwise causing the metal to flow into the proper shape to provide the inner bearing surface of the teeth of the complete gear, and this may be accomplished in various ways, and I will hereinafter describe a preferred means for accomplishing it. The blank then being in the proper shape, with the teeth rounded on one surface, the next step is to bend the teeth vertically or at right angles to the body, to form the gear with the bearing surfaces of the teeth on the inner sides, and this may be variously accomplished, as by means of a die and plunger, or otherwise.

In order to carry out the various steps and to produce the gear, I provide a mold or form, preferably of steel, and I have shown a cylindrical plug 13, provided with a series of grooves 14 on its face, corresponding to the number of arms 16 of the blank 12, and these grooves are of a proper contour or configuration to form the faces or bearing surfaces of the teeth. The blank 12, is placed upon this cylindrical plug or die, as indicated in dotted lines, Fig. 3, each arm lying in or above one of the recesses 14, and a suitable punch, as 15, Fig. 4, is then brought against the blank with sufficient power to cause the metal which is originally of a square or rectangular cross-section, as shown at 16<sup>a</sup>, Fig. 1, to flow and completely fill the spaces or grooves, so that each arm will assume the form or contour of a slot, as indicated in Fig. 4.

The die 13, is preferably provided with a plunger 17, supported by a spring 18, so that it will yield under pressure and act as a discharger, and in order to prevent the metal flowing longitudinally and thereby elongating the arms of the blank, I provide a ring 19,



against which the ends of the arms of the blank will impinge, thereby forcing the metal of the arms to flow only in the direction of the applied pressure.

5 The edges of the die or plug 14, are preferably rounded, as at 20, so as to permit the more ready insertion of the blank, and to guide the arms if they should be in any way distorted. The blank then being removed from  
10 the die, is in the condition substantially indicated in Fig. 5, and it only remains to carry out the next step of the process, to bend the arms at right angles to the body to form the teeth, and this may be conveniently per-  
15 formed by the use of a punch, as 22, which is brought to bear upon the central portion of the plate, while the arms bear upon the upper surface of a suitable die, as 23, and then pressure being applied, the arms will be  
20 bent, as clearly indicated in Fig. 5, so as to form the completed article.

It will be observed that the spaces or notches 21, are formed deep enough and approach nearer to the center of the body than  
25 the inner bearing faces of the teeth, and this is an important feature in the manufacture of the gears, as when the arms are bent upward to form the teeth, they can be bent with comparatively little power, and practically  
30 no distortion at the inner bending point, there being plenty of room for whatever flow of metal there may be caused in the bending process, although this flow in practice is exceedingly small, and does not in any way  
35 weaken the teeth or interfere with their perfect operation.

While I have thus described my improvement as applied more particularly to a crown wheel having internal teeth, it is evident that it is equally applicable to the production of  
40 crown wheels having external spur teeth, it being only necessary to reverse the position of the blank in Fig. 5, to accomplish this end, and it may be used in manufacturing any  
45 gears in which the axes of the driving and driven members are parallel to each other.

While I have thus described my invention in detail, it will be understood that the details of construction, arrangement and operation may be varied in accordance with the  
50 particular features of construction desired, and I do not limit myself to the precise construction and arrangement shown and described.

What I claim is—

1. As a means for forming crown gears, a die comprising a cylindrical plug having radial recesses with curved faces, an external ring surrounding the plug, and a spring-actuated plunger, substantially as described. 55

2. As a means for forming crown gears, a die comprising a cylindrical plug having radial recesses with curved bottoms and rounded edges, an external ring, and a spring-actuated plunger, substantially as described. 60

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN THOMSON.

Witnesses:

ROBERT S. CHAPPELL,  
J. MCKINNON.