

J. N. HEALD.

PROCESS AND APPARATUS FOR GRINDING THE CENTER OPENING OF GEAR WHEELS.

APPLICATION FILED APR. 4, 1911.

1,058,237.

Patented Apr. 8, 1913.

2 SHEETS—SHEET 1.

Fig. 1.

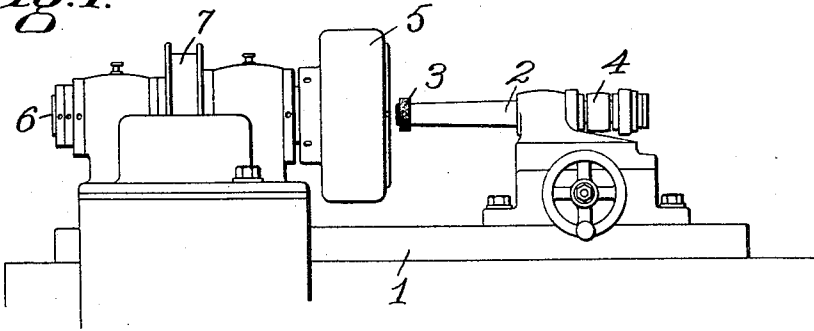
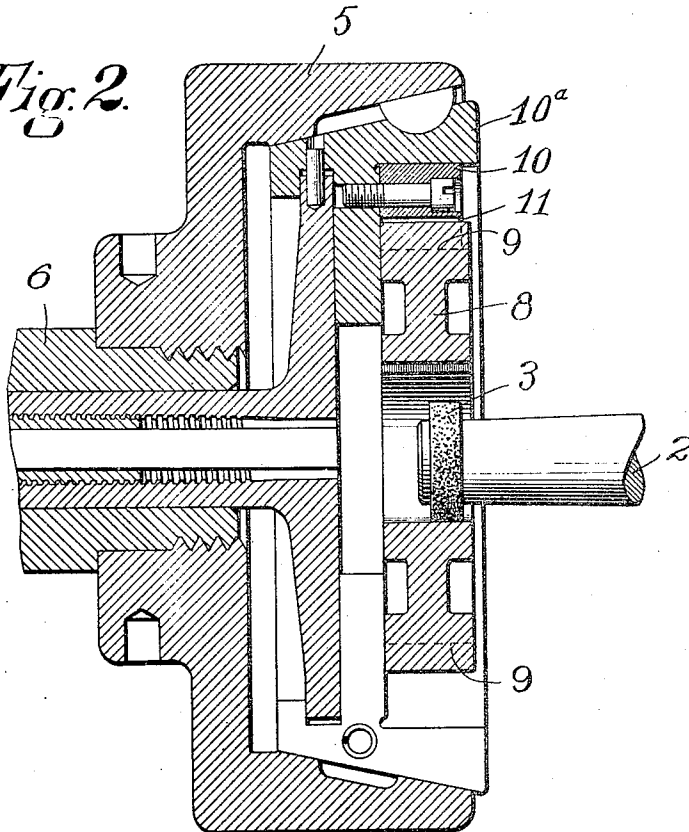


Fig. 2.



Witnesses

R. D. Tolman.
Paulus Comberbach

Inventor
James N. Heald.
By Rufus B. Fowler
Attorney

J. N. HEALD.

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Fig. 3.

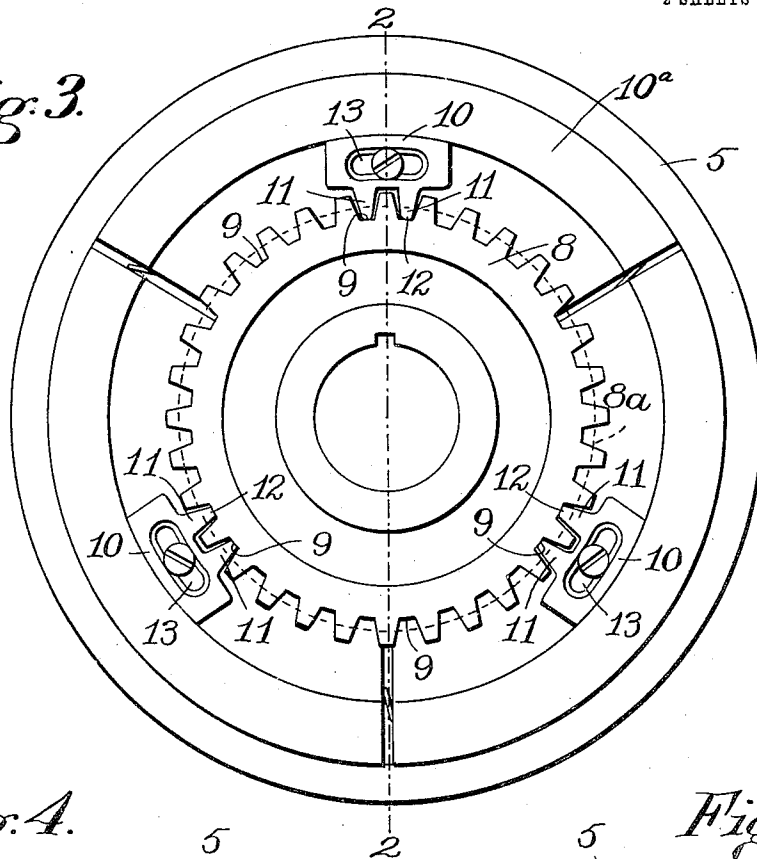


Fig. 4.

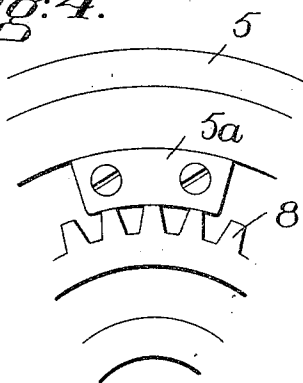
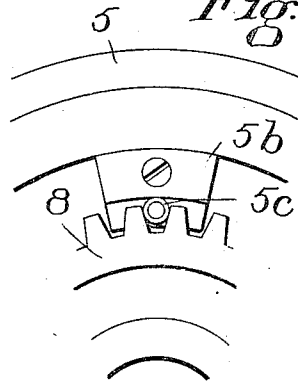


Fig. 5.



Witnesses

R. D. Tolman.

Develops/Comberback.

Inventor

James N. Heald.

By Rufus B. Fowler

Attorney

UNITED STATES PATENT OFFICE.

JAMES N. HEALD, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO THE HEALD MACHINE COMPANY, OF WORCESTER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

PROCESS AND APPARATUS FOR GRINDING THE CENTER OPENING OF GEAR-WHEELS.

1,058,237.

Specification of Letters Patent.

Patented Apr. 8, 1913.

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To all whom it may concern:

Be it known that I, JAMES N. HEALD, a citizen of the United States, residing at Worcester, in the county of Worcester and Commonwealth of Massachusetts, have invented a new and useful Improvement in Processes and Apparatus for Grinding the Center Openings of Gear-Wheels, of which the following is a specification.

My invention relates to an improvement in the process of finishing the center opening of gear wheels, by which the necessary grinding for said finishing is accomplished with greater accuracy with relation to the pitch line of the gear.

The object of my invention is to provide an apparatus for holding the gear during the grinding process more nearly related to said pitch line, so as to render the finished opening in the center of the gear more nearly concentric with the pitch line of the gear than is possible with the methods and apparatus employed at present for holding the gear during said grinding process. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of an apparatus for grinding the center opening of a gear and embodying my invention. Fig. 2 is a central sectional view of the holding chuck, shown on the plane of the broken line 2—2, Fig. 3. Fig. 3 is an end view of the chuck, and Figs. 4 and 5 are diagrammatic views illustrating the methods employed at present for supporting a gear during the grinding process, Fig. 4 showing the gear held by the ends of its teeth, and Fig. 5 showing the gear held by the insertion of rolls or balls in the spaces between the teeth and having their centers presumably coincident with the pitch line of the gear.

Similar reference characters refer to similar parts in the different figures.

1 is the framework of a grinding machine in which is supported a shaft 2 of a grinding wheel 3 driven by a driving wheel 4. Opposite to the grinding wheel 3, a chuck 5 is supported upon a shaft 6 which is driven by a driving wheel 7. It is customary by a present method of finishing the center opening of gear wheels to hold the gear wheel 8 to be finished by jaws 5^a engaging its periphery or outer ends of the teeth, and the grinding wheel 3 is arranged to enter the center

opening of the gear wheel, which is ground concentric with its axis of rotation. The grinding wheel 3 receives a rapid rotation during the grinding process and the chuck 5 is also slowly rotated, turning the gear wheel during the grinding of the center opening. When thus held the accuracy of the finish of the center opening of the gear wheel relatively to the pitch line of the gear, indicated by the broken line 8^a, is dependent upon the accuracy of the periphery of the gear engaged by the holding chuck relatively to the pitch line of the gear. The holding surface of the jaws 5^a, Fig. 4, is concentric with its axis of rotation, but this axis may not be concentric with the pitch line of the gear 8. If, however, the method of contact between the gear and the holding surface is such that the surfaces in contact are concentric to the pitch line of the gear, then the finished surface of the central opening will also be concentric with the pitch line of the gear. By another method, sometimes employed, the jaws 5^b are arranged to contact with small rolls 5^c inserted between the teeth and intended to be held in contact with the spaces of the teeth, with the centers of the rolls coinciding with the pitch line 8^a of the gear 8, as shown in Fig. 5. The desired accuracy, however, cannot be secured by this method of holding the gear, for the reason that a slight difference in the distances between the teeth on the pitch line may vary considerably the radial position of the rolls. The pitch line, however, in the finished gear should be concentric with its axis of rotation, and I secure this result by my present invention.

In cutting the teeth of a gear the pitch line is concentric with the bottoms of the spaces between the gear teeth, that is, the bottoms of the spaces 9 between the gear teeth bear in every case an exact relation to the pitch line and are arranged upon a circle concentric with the pitch line of the gear. The circle, corresponding to the outer ends of the gear teeth, may be slightly eccentric to the pitch line, in which case the length of the teeth will be varied to bring the bottoms of the spaces between the teeth in exact relation to and concentric with the pitch line. I, therefore, contact the holding surface of the jaws 10 with the bottoms of the spaces 9 between the gear teeth, by which method I am enabled to hold the gear

teeth exactly concentric with the pitch line during the grinding process and finish the central opening in the gear, thereby causing the opening, when finished, to be exactly concentric with the pitch line. To carry out this method, I extend projections 11 upon the inner sides of the jaws 10 capable of contacting with the bottoms of the spaces 9 between the teeth, with the ends 12 of all these projections 11 at equal radial distances from the axis of rotation of the chuck, as shown in Figs. 2 and 3. The ends 12 of the projections 11 form the holding surfaces of the chuck and contact with the bottoms of the spaces 9 and, as these are concentric with the pitch line, I am enabled by this method of holding the gear during the grinding process to secure absolute concentricity of the pitch line with the axis of rotation of the gear. Adjustment of each jaw in a line concentric with the pitch line is provided by the slots 13 in the jaws 10, shown in Fig. 3. The motion of each jaw during adjustment is further determined along the said concentric line by a supporting flange 10^a on the chuck, the flange back of each jaw also being suitably curved for this purpose.

The method of holding the gear by the outside diameter depends upon the accuracy of the outside of the blank, which is very often not truly concentric with the pitch line. In the method of pitch line control, shown in Fig. 5, a slight variation in the distances between the teeth makes many times that difference in the radial location of the rolls as related to the pitch line. In my invention the gear is held by the solid metal at the bottom of the tooth space, which is always concentric with the pitch line, being produced by the cutting of the teeth without reference to any other operation upon the gear.

I claim,

1. The apparatus for holding a gear wheel during the process of finishing the central opening of said gear wheel, compris-

ing a rotating chuck having concentric holding surfaces shaped to contact with the bottoms of the spaces between the gear teeth. 50

2. The apparatus for holding a gear wheel during the process of finishing the central opening of said gear wheel, comprising a rotating chuck having holding jaws, projections on said jaws extending radially inward, with the ends of said projections shaped to contact with the bottoms of the spaces between said gear teeth. 55

3. The apparatus for holding a gear wheel during the process of finishing its central opening, comprising a rotating chuck having an adjustable holding jaw and means to limit the adjusting movement of said jaw to a path concentric with the axis of rotation of the chuck. 60

4. The apparatus for holding a gear wheel during the process of finishing its central opening, comprising a rotating chuck having an adjustable holding jaw provided with holding surfaces shaped to contact with the bottoms of spaces between teeth of the gear, said chuck also having means to limit the adjusting movement of said jaw to a path concentric with the axis of rotation of the chuck. 65

5. A method of finishing the central opening of a gear, comprising the centering of the gear in a chuck by means acting on the bottoms of spaces between teeth of the gear. 70

6. The method of operating upon the central opening of a gear, which consists in centering the gear in a chuck by means acting on the bottoms of spaces between teeth of the gear, whereby the bottoms of said spaces are brought concentric with the axis of rotation of the gear, rotating the gear, and shaping the central opening of the gear concentrically with its axis of rotation. 75

Dated this thirty-first day of March 1911.

JAMES N. HEALD.

Witnesses:

PENELOPE COMBERBACH,
NELLIE, WHALEN.