

June 19, 1923.

1,459,409

H. W. McQUAID

PROCESS OF CARBURIZING HOLLOW ARTICLES

Filed Jan. 9, 1922

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Fig. 3.

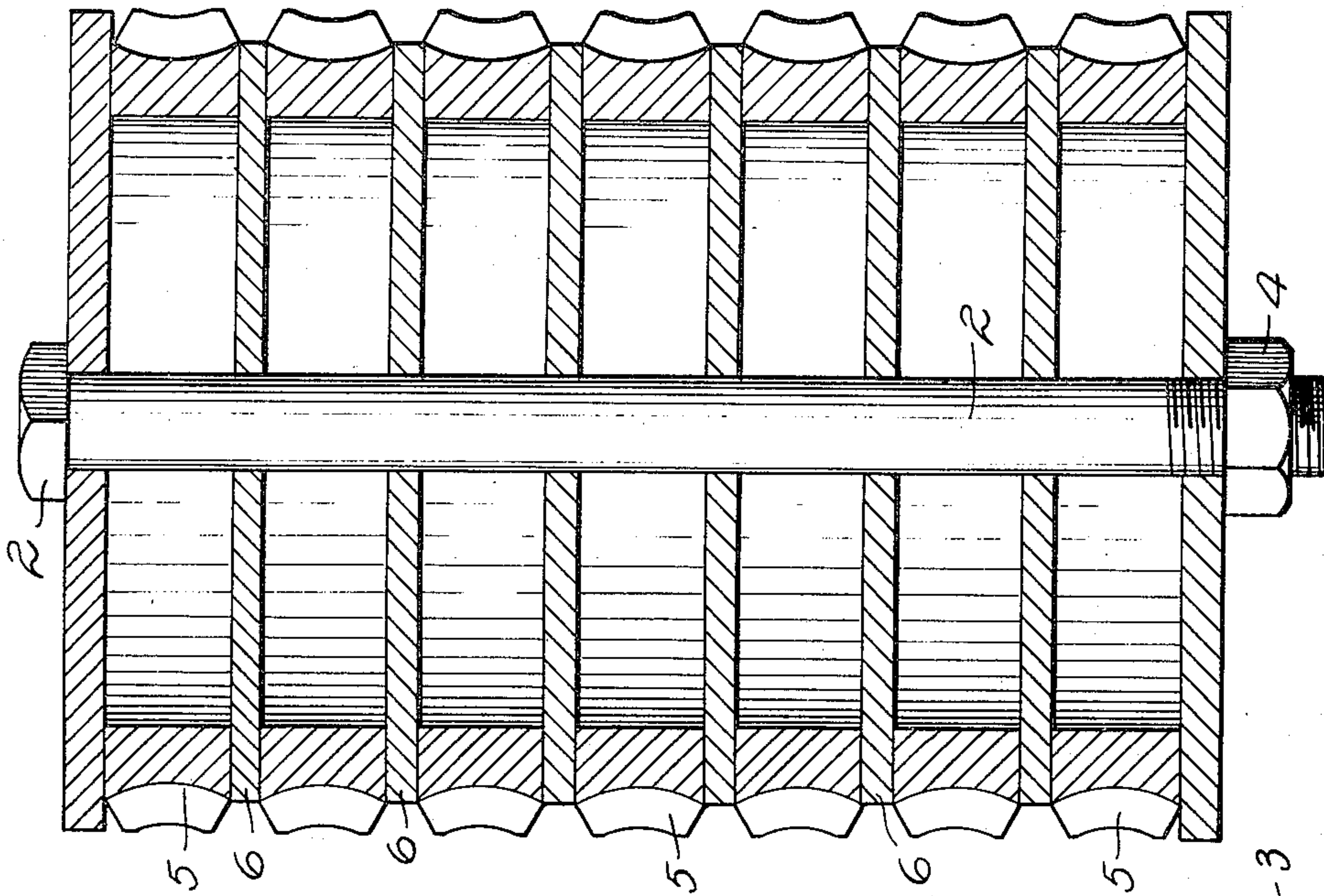


Fig. 2.

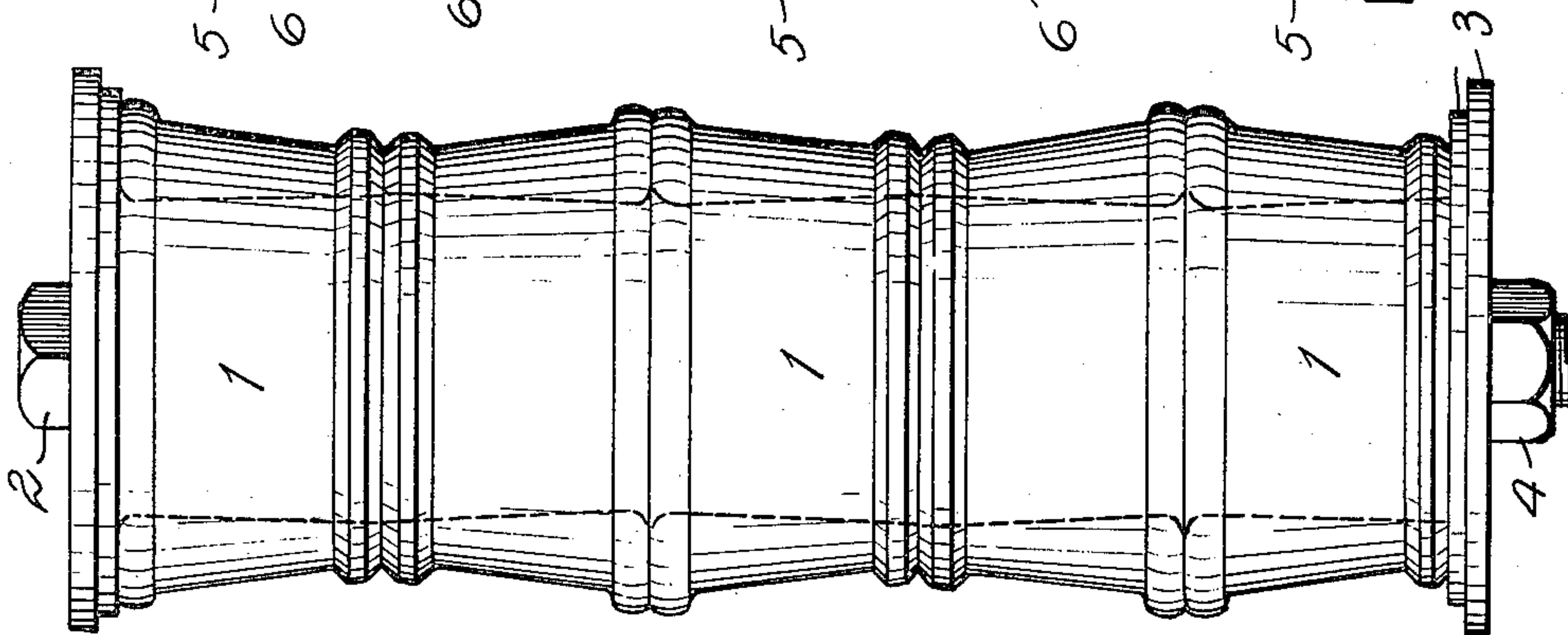
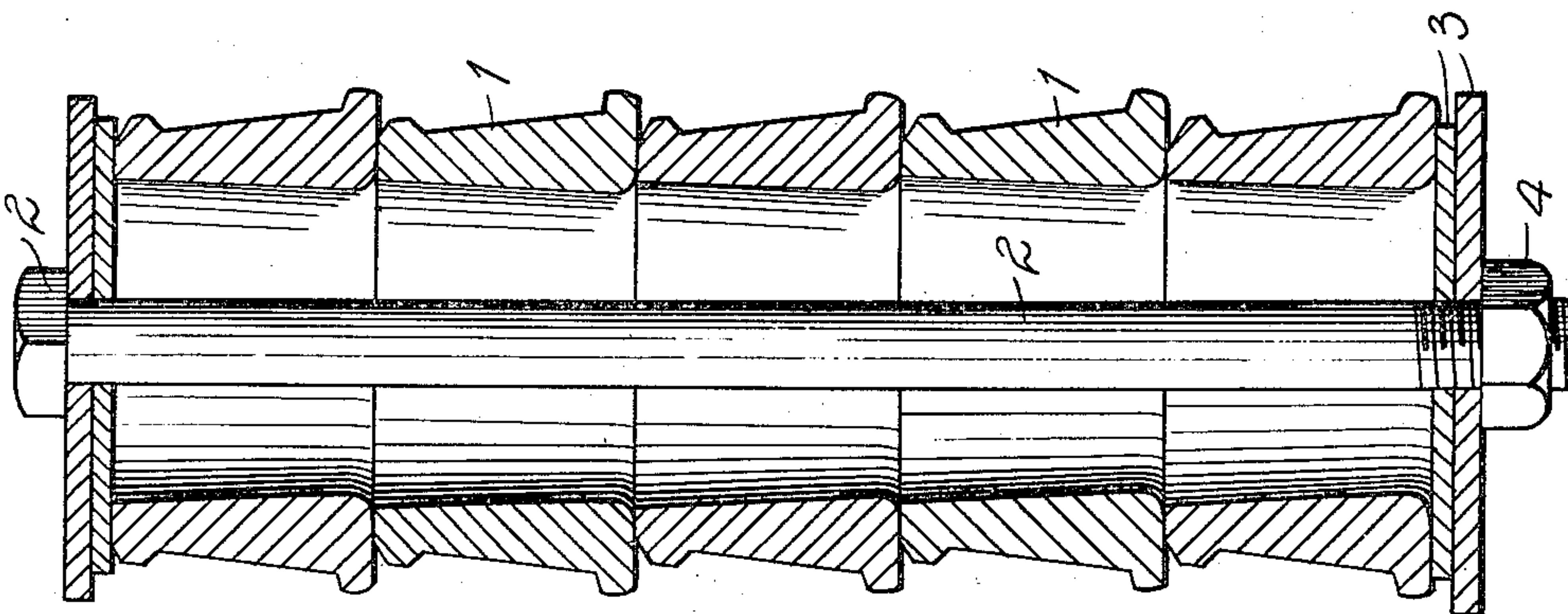


Fig. 1.



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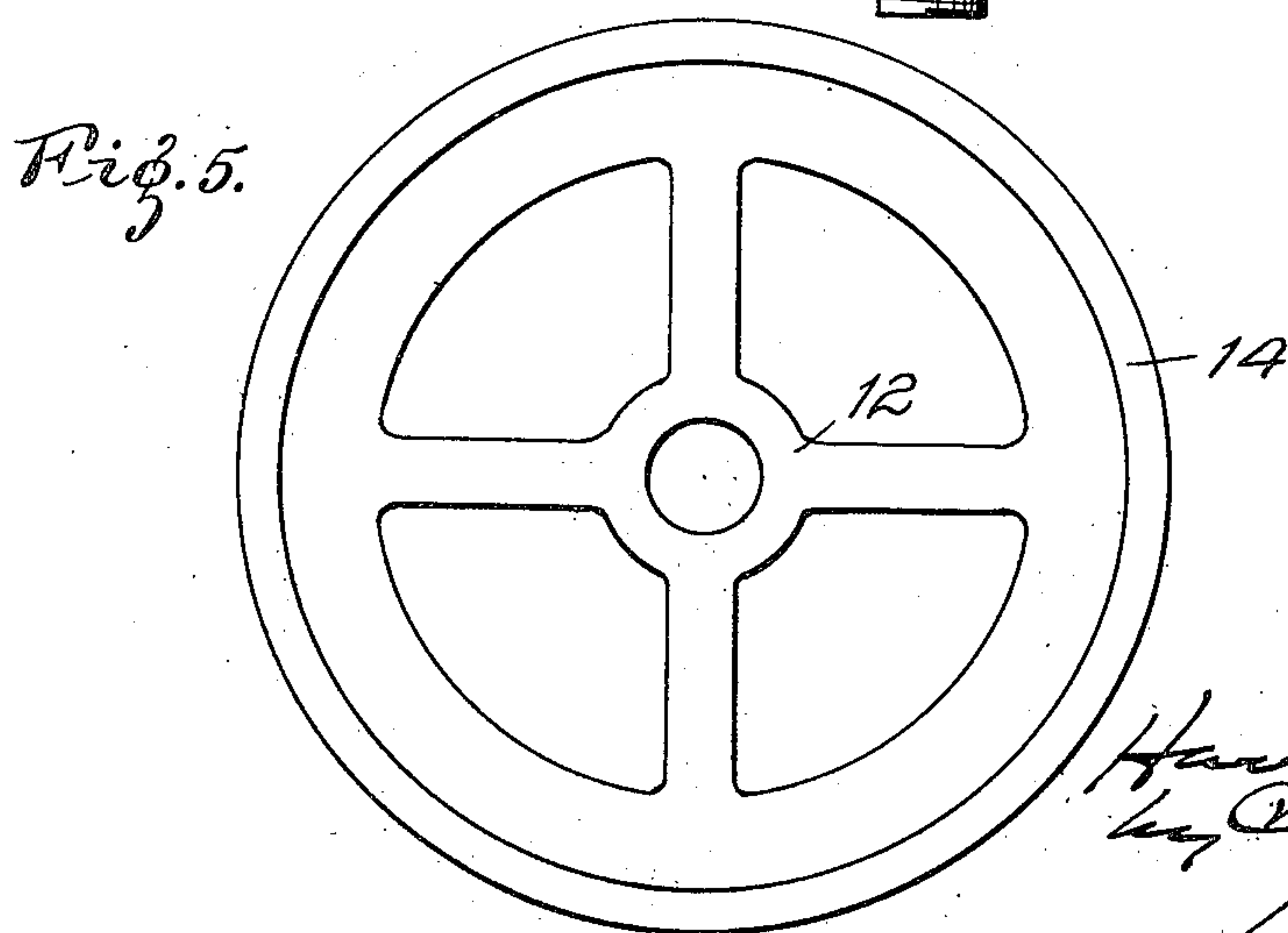
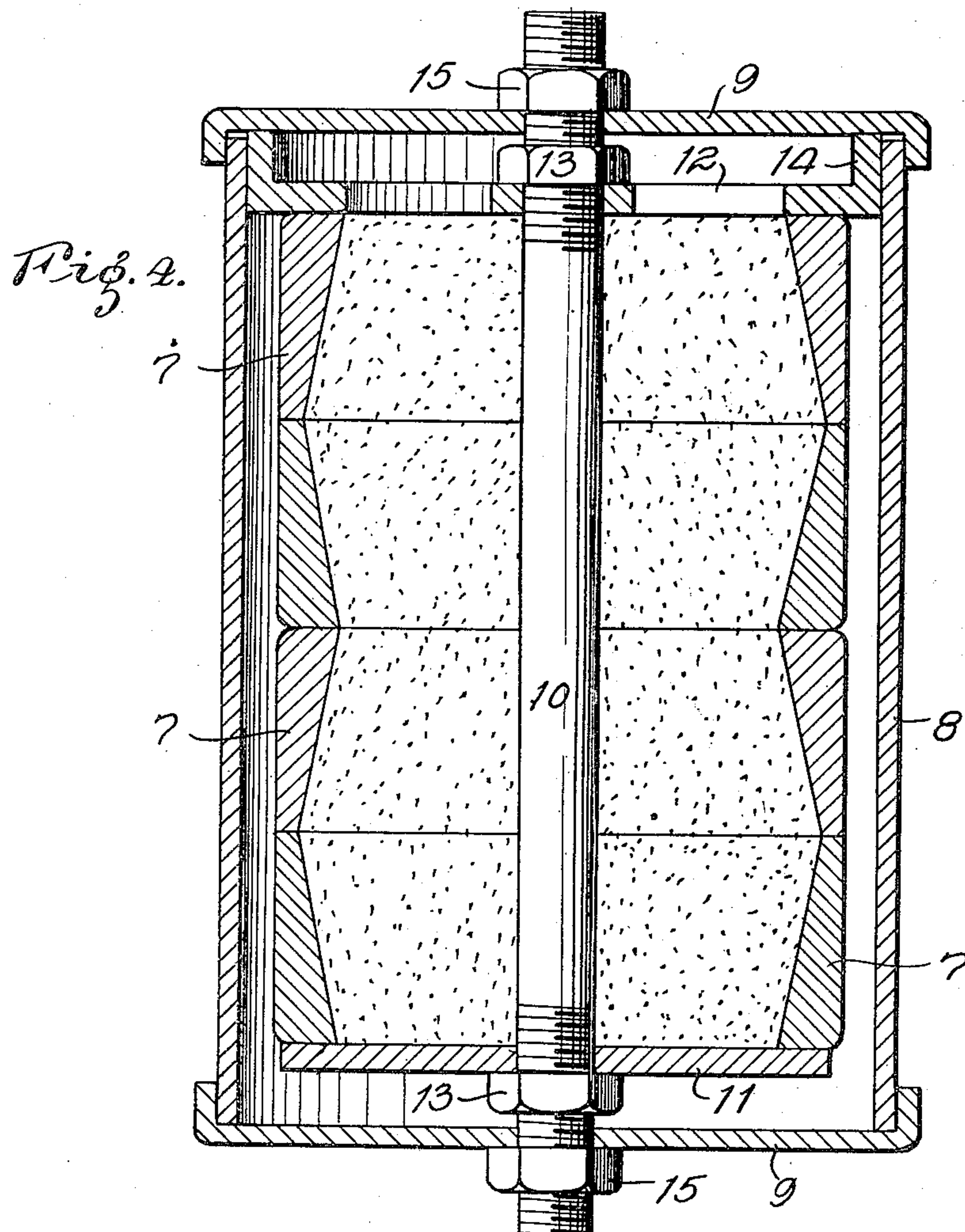
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2 Sheets-Sheet 2



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# UNITED STATES PATENT OFFICE.

HARRY W. McQUAID, OF CANTON, OHIO, ASSIGNOR TO THE TIMKEN ROLLER BEARING COMPANY, OF CANTON, OHIO, A CORPORATION OF OHIO.

## PROCESS OF CARBURIZING HOLLOW ARTICLES.

Application filed January 9, 1922. Serial No. 527,971.

*To all whom it may concern:*

Be it known that I, HARRY W. McQUAID, a citizen of the United States, and a resident of Canton, county of Stark, and State of Ohio, have invented a new and useful Improvement in Processes of Carburizing Hollow Articles, of which the following is a specification.

Heretofore, when it has been desired to harden only the inner or the outer surface of a hollow article, it has been common practice to coat one surface with a varnish or other compound that would not interfere with cementation or carburizing, and then dip the article thus coated into a solution of copper for the purpose of coating with copper the unvarnished portion and thereby protecting such copper-coated portion against carburization when the article is packed and heated in the presence of the carburizing material. The principal object of the present process is to wholly dispense with the preliminary operation of varnishing the surface to be hardened and also with the operation of copper-coating or otherwise protecting the other surfaces against carburizing. The invention consists principally in assembling the uncarburized articles axially into the form of tubes with substantially tight joints between successive sections and with means for substantially excluding air and carburizing gases from access to the surface that is to be left unhardened. It also consists in the construction and arrangement hereinafter described and claimed.

In the accompanying drawing, wherein like reference numbers refer to like parts wherever they occur,

Fig. 1 is a vertical section of a number of roller bearing cones assembled conformable to my invention preparatory to the case-hardening thereof on their outer surfaces;

Fig. 2 is a similar view showing alternate cones oppositely disposed, the cones being shown in side elevation.

Fig. 3 is a view similar to Fig. 1 showing a group of worm gears that are spaced apart by copper washers.

Fig. 4 is a longitudinal view of a group of oppositely disposed roller bearing cups assembled in condition for carburization of their inner surfaces, together with the holding tube arranged to exclude air and gases from the exterior surfaces thereof; and

Fig. 5 is a detail view of the spider washer at the upper end of the assembly shown in Fig. 4.

The article illustrated in Fig. 1 is the inner bearing member or cone 1 of a roller bearing. Both ends of this article are accurately finished prior to the heat treatment and it requires to be carburized only on the outer surface. According to my invention, such cones are assembled axially in the form of a sectional tube of convenient length; and are held in assembled relation by means of a bolt 2 which extends axially through them and whose ends are provided with washers 3, of steel, copper or other suitable material, that are large enough to lap the ends of the endmost cones and serve as reaction members for the bolthead and nut. The nut 4 on the threaded end of the bolt is then turned until the assembled cones are held sufficiently tight to prevent being displaced during the heat treatment. When thus assembled, the inner surfaces of the cones are sufficiently protected to escape carburization during the heat treatment; for the hollow interior of the assembled tube is adequately protected from carburizing gases by the washers at the end and by the joints between successive articles being sufficiently tight for the purpose. Accordingly, when such an assembly is packed in the carburizing material and subjected to the usual heat treatment, the cementation or carburization is practically limited to the exterior surfaces of the cones.

In the assembly illustrated in Fig. 1, all of the cones are arranged in the same position, whereby the small end of one cone is in contact with the large end of the next cone. In this arrangement, a portion of the large end of each cone is exposed to carburizing action. In the assembly of Fig. 2, alternate cones are reversed, so that the large end of each cone abuts against the large end of the next cone, while its small end also abuts against the small end of the adjacent cone. In this arrangement, both the large end and the small end are better protected against carburizing than is the case in the assembly of Fig. 1.

The article illustrated in Fig. 3 is a worm gear 5 which requires to be hardened only on its outer surface. The ends or faces of such gear are not usually finished with the same degree of accuracy as the roller bear-



ing cone illustrated in Fig. 1; and therefore, in order to make an adequately tight joint between successive gears, a washer 6 of copper or other suitable soft metal is interposed  
5 between successive gears. Otherwise the assembly illustrated in Fig. 3 is similar to that of Fig. 1. In assembling article with rough ends or faces, as in Fig. 2, the nut 4 should be turned tight enough for the soft  
10 washers 6 to conform to the surfaces of the gears in contact therewith and thereby form a substantially tight joint between successive gears. In this way, carburizing gases will be substantially excluded from the inside or  
15 bore of the gear.

The article illustrated in Fig. 4 is a roller bearing cup 7 that requires to be hardened on its interior surface only. For the purpose of treating such articles, they are assembled axially inside a metal tube or shell  
20 8 whose ends are closed by caps 9. The cups are held in assembled relation by means of a bolt 10 whose ends are provided with washers 11 and 12 that lap the ends of the  
25 endmost cups and serve as reaction members for clamping nuts 13. The lowermost washer 11 closes the lower end of the control bore of the assembled tube; and the uppermost washer 12 is shown in the form of  
30 a spider, whereby the carburizing material may be readily inserted into said control bore through the openings in said spider. The annular space between the upper end of the shell and the ends of the uppermost cup  
35 is closed by means of a flanged imperforate portion 14 of the uppermost washer, which portion engages the interior surface of the casing 8 and the uppermost cap 9, thereby excluding the carburizing gases from the  
40 annular space outside of the cups.

The threaded ends of the tightening bolt 10 extend through the caps 9 and are provided with nuts 15 which engage said caps and hold them in place. The ends of the  
45 cups are usually sufficiently well finished to dispense with the use of copper washers between successive cups; but with articles that are not so well finished, it is preferable to use soft washers to make a sufficiently tight  
50 joint, the inner diameter of such washers being sufficiently large to permit free circulation of the carburizing gases. With this assembly, the carburizing material may be readily inserted into the central bore  
55 through the openings in the spiders; and when the assembly is submitted to the usual heat treatment, the cementation or case-carburizing is limited to the inner surfaces of the roller bearing cups, the outer surfaces  
60 being only slightly affected or not at all.

One of the principal advantages of my present process is that it dispenses wholly with the preliminary steps heretofore commonly practiced; that is, it dispenses with  
65 the copper coating of the portion of the

surfaces that is to be left unhardened and it also dispenses with the varnishing of the surface that is to be hardened: and in dispensing with these two operations it saves the material and labor involved therein. 70 Obviously the process is not limited to the treatment of the articles specified above but is applicable generally to hollow articles that are to be carburized on only the inner or the outer surface, as the case may be. 75 Obviously also the simple mechanical devices herein illustrated admit of considerable variation without departing from my invention.

What I claim is:

1. The improvement in the process of carburizing the inner or outer surface of hollow articles without carburizing the other surface thereof which consists in assembling such articles axially and clamping  
85 ing the same together in assembled relation by means that will exclude carburizing agent from such other surface without inert packing.

2. The improvement in the process of 90 carburizing the outer surfaces of hollow articles without carburizing the inner surface thereof which consists in assembling such articles axially and clamping the same together in assembled relation by means 95 that will exclude carburizing gases from the interior thereof.

3. The improvement in the process of carburizing the inner or outer surface of hollow articles without carburizing the 100 other surface which consists in assembling such articles in the form of a sectional tube, and then drawing the sections together to prevent passage of carburizing gases therebetween. 105

4. The improvement in the process of carburizing the outer surfaces of hollow articles without carburizing the inner surfaces thereof which consists in assembling 110 such articles axially in the form of a sectional tube and closing the ends of said tube by means that will clamp said articles together in assembled relation and thereby exclude carburizing gases from the interior of the assembled articles. 115

5. The improvement in the process of carburizing the outer surface of hollow articles without carburizing the inner surface thereof which consists in assembling such 120 articles axially in the form of a sectional tube and clamping said sections together by means of a bolt which extends axially through said section and is provided at each end with means that closes the ends of the tube and clamps the section together to secure substantially tight joints therebetween 125 thereby excluding carburizing gases from the interior of said assembled articles.

6. The improvement in the process of carburizing the outer surfaces of hollow 130



articles without carburizing the inner surfaces thereof which consists in assembling such articles axially in the form of a sectional tube with washers interposed between successive articles, holding said articles in assembled relation by means of a bolt that extends axially therethrough and whose ends are provided with end washers that lap the ends of the endmost articles, and then tightening said bolt to obtain substantially tight joints between the successive articles and between the endmost articles and the end washers thereby substantially excluding air and carburizing gases from the inner surface of the articles that is to be left unhardened.

Signed at Canton, Ohio, this 4th day of January, 1922.

H. W. McQUAID.