

(No Model.)

2 Sheets—Sheet 1.

G. F. SIMONDS, Dec'd.

M. D. A., F. M. & W. A. SIMONDS, Executors.

METHOD OF AND APPARATUS FOR HARDENING STEEL RINGS.

No. 539,089.

Patented May 14, 1895.

Fig. 1.

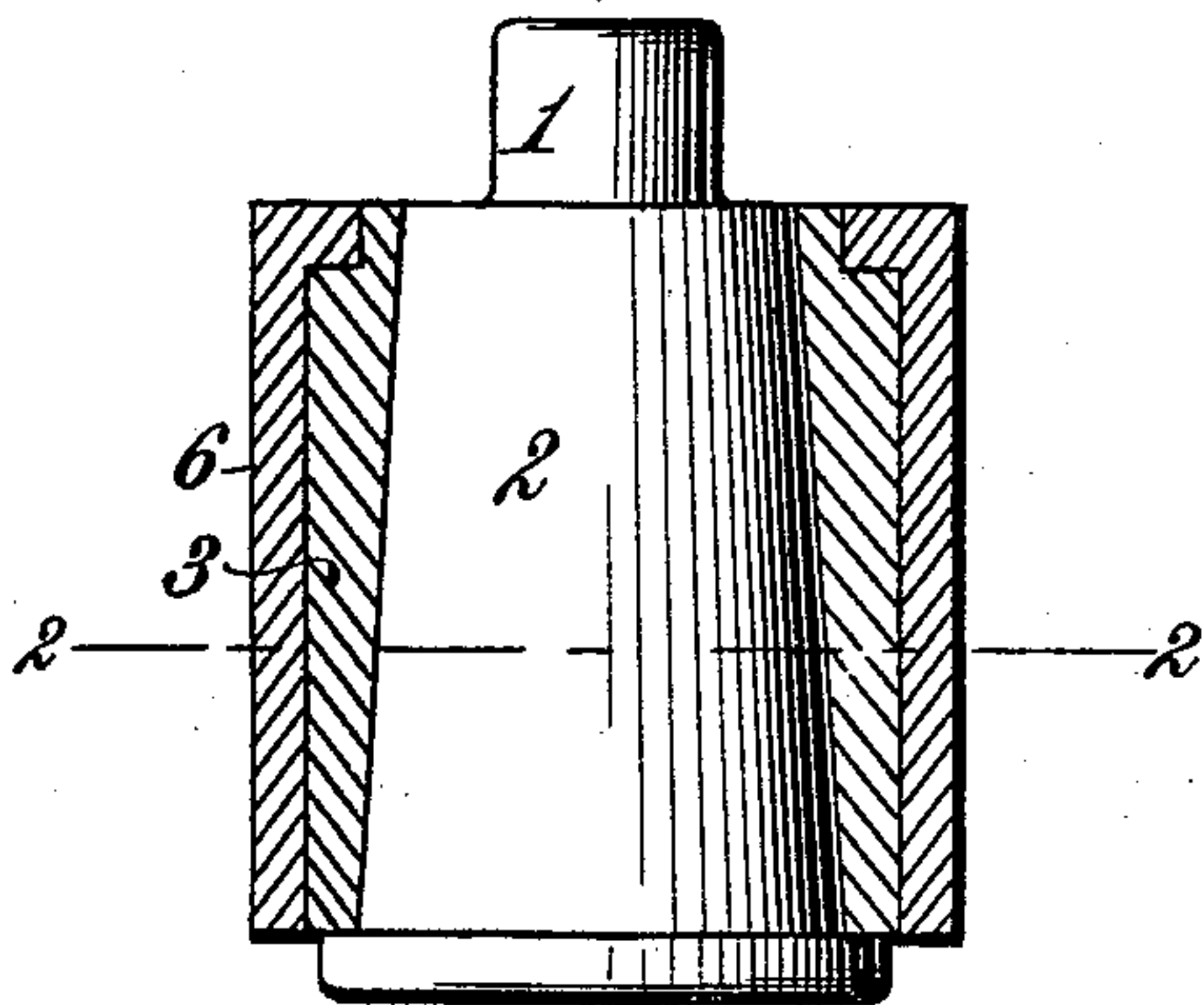


Fig. 2.

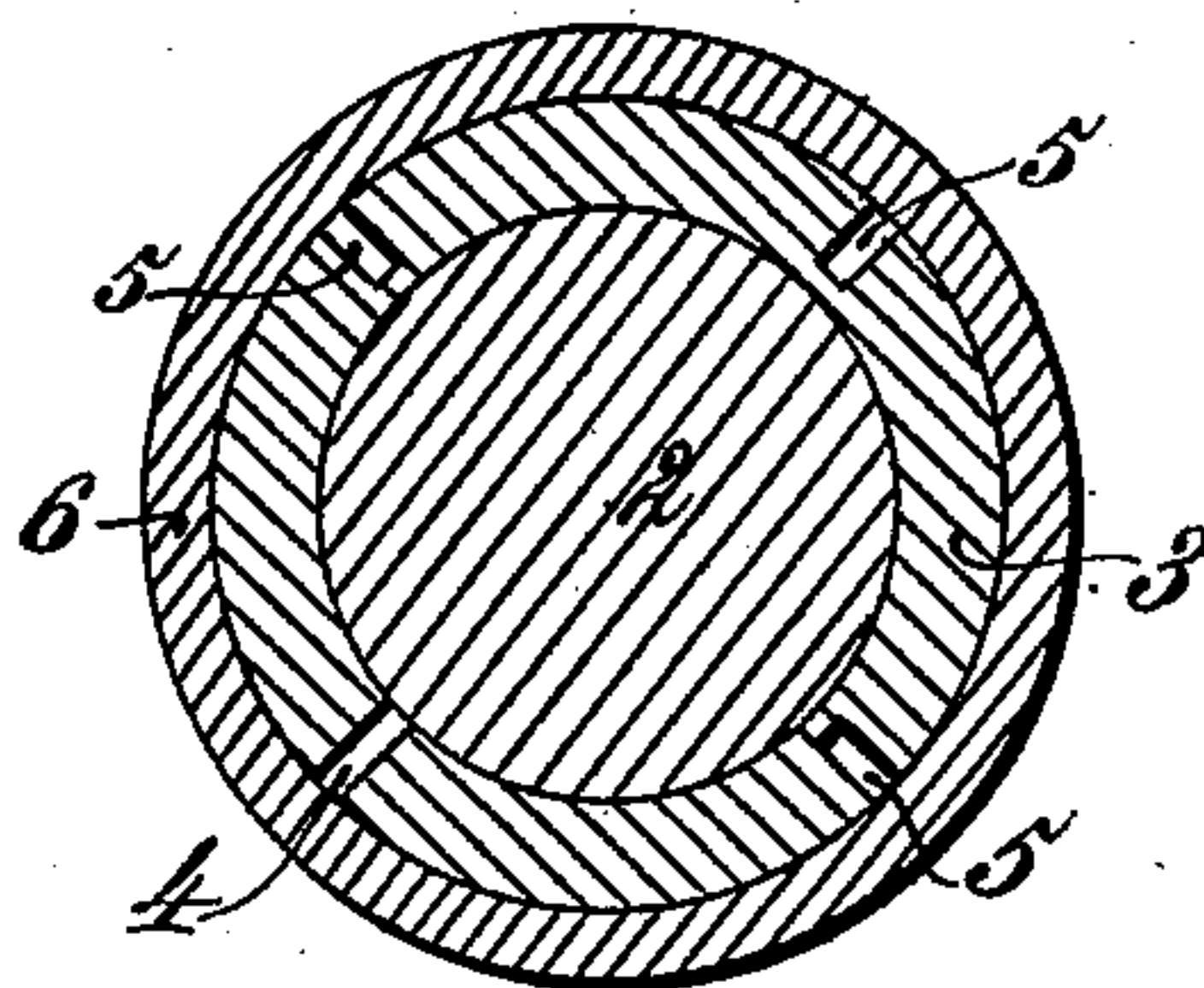


Fig. 3.

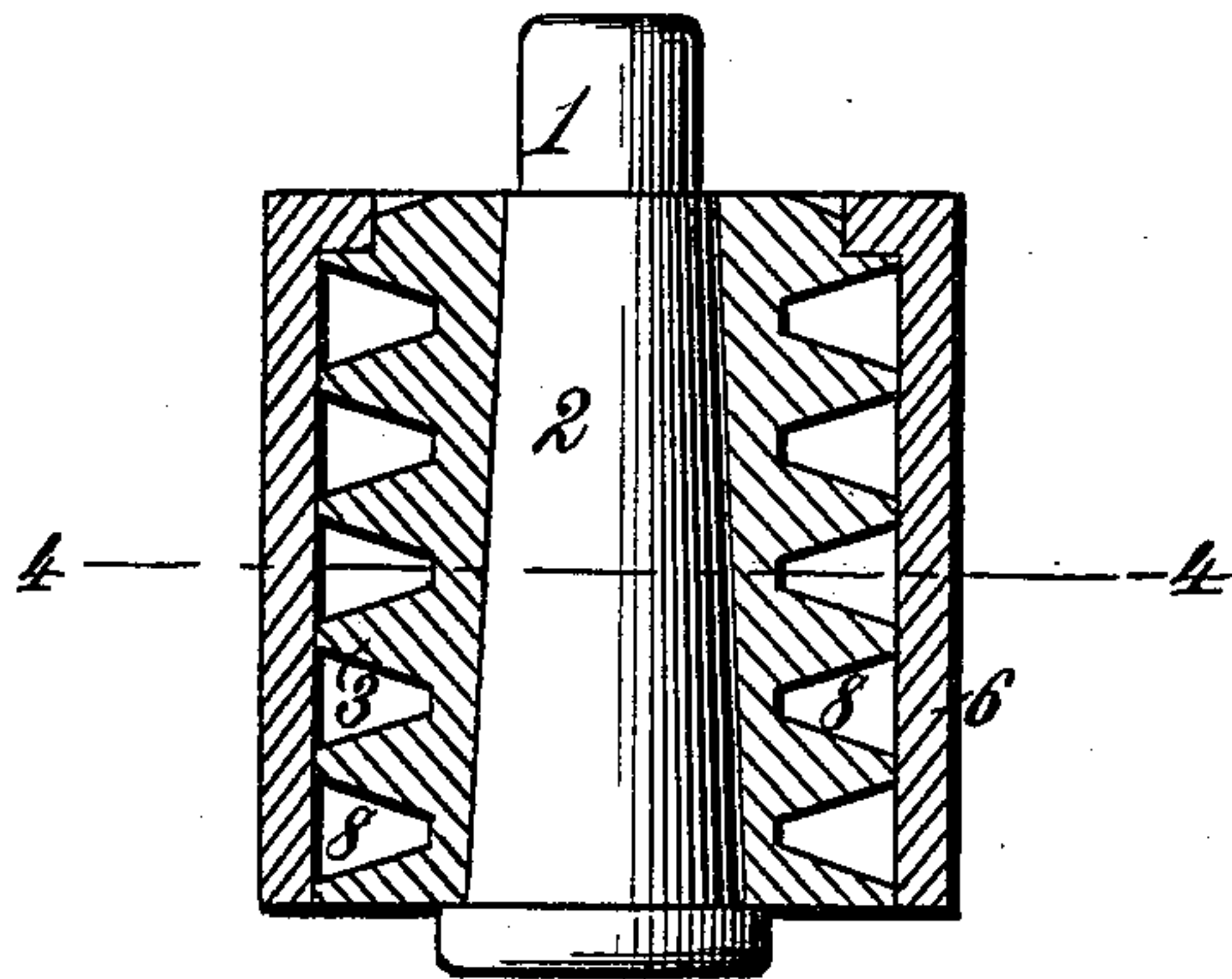
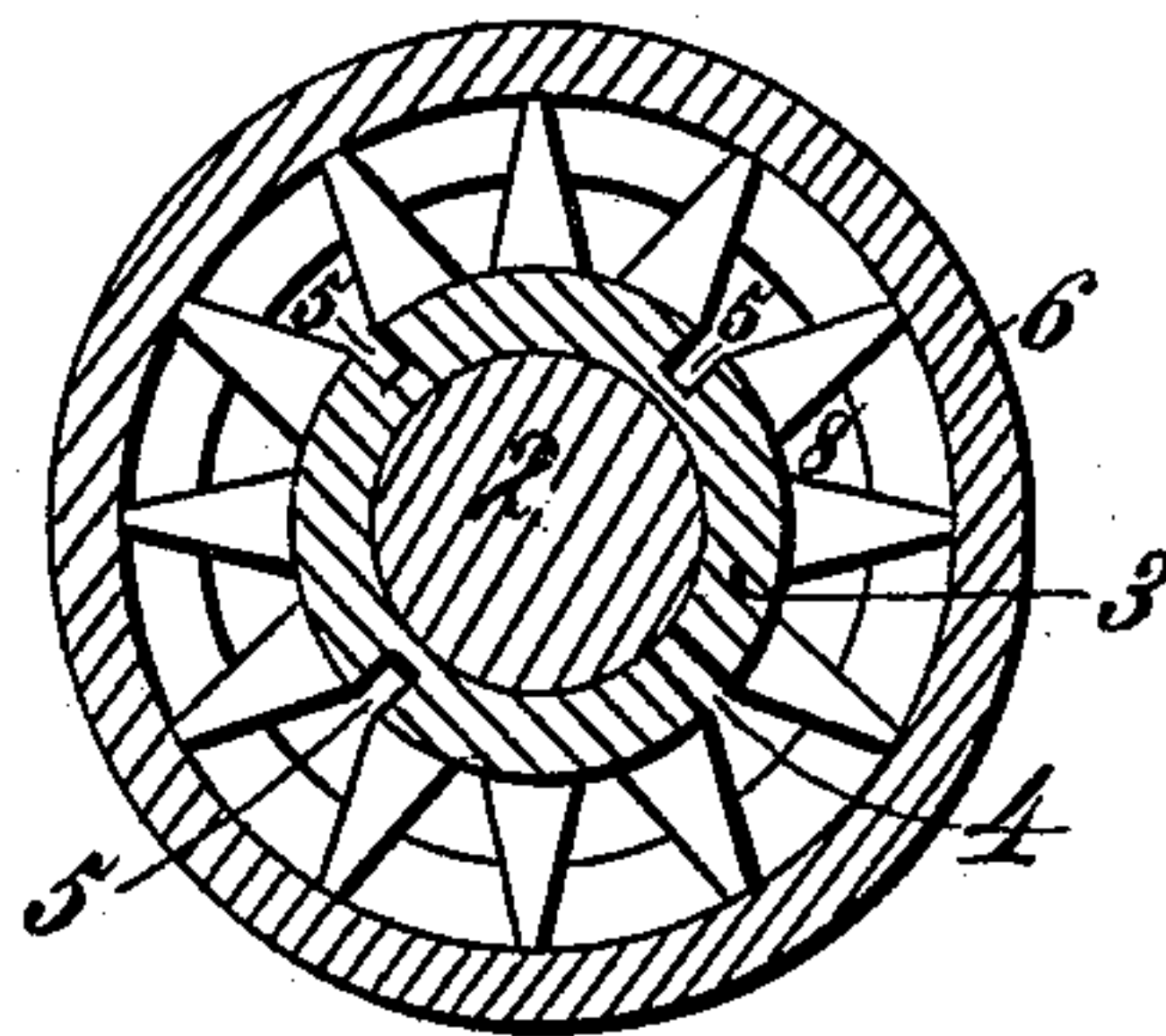


Fig. 4.



Witnesses.

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Fig. 5.

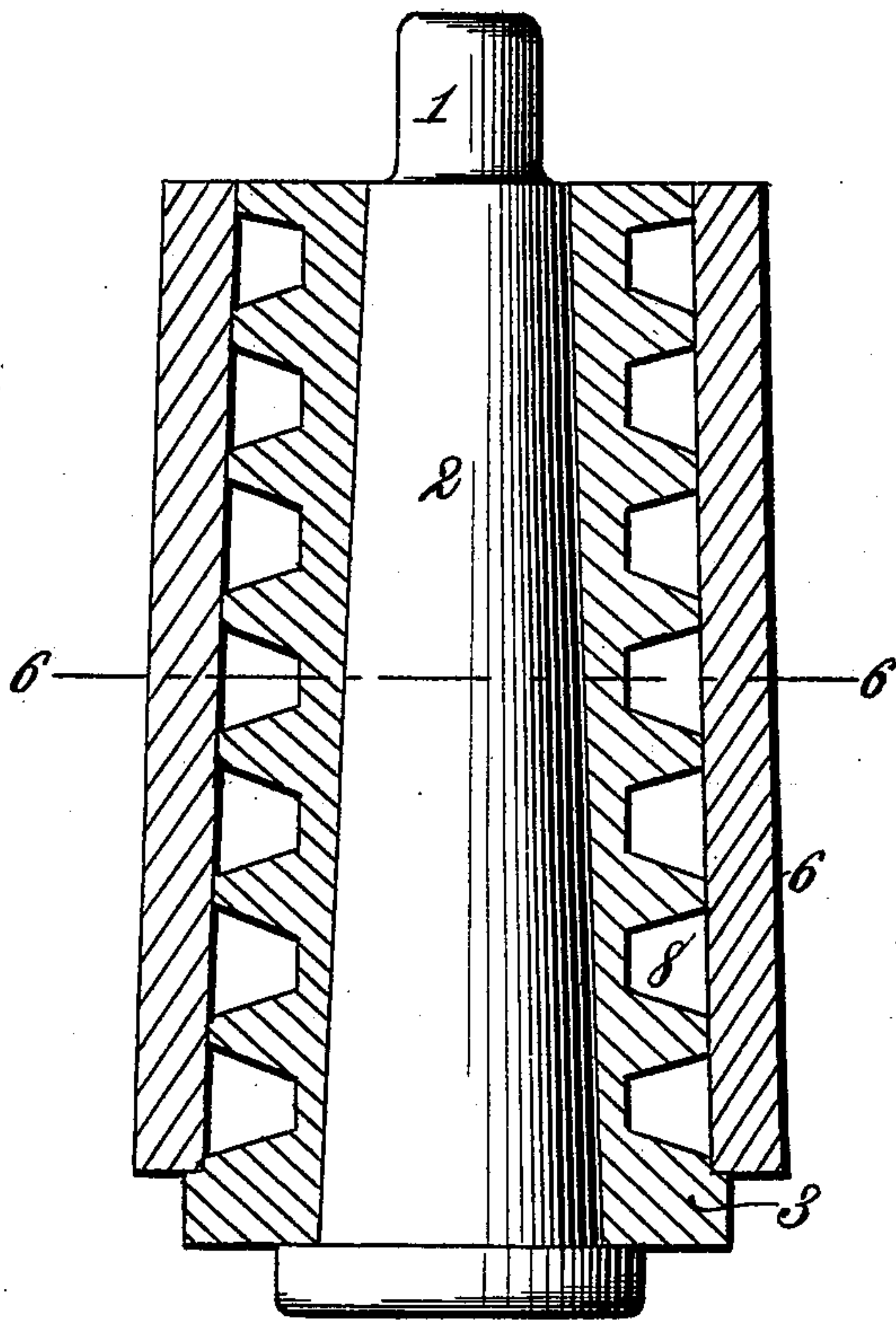


Fig. 7.

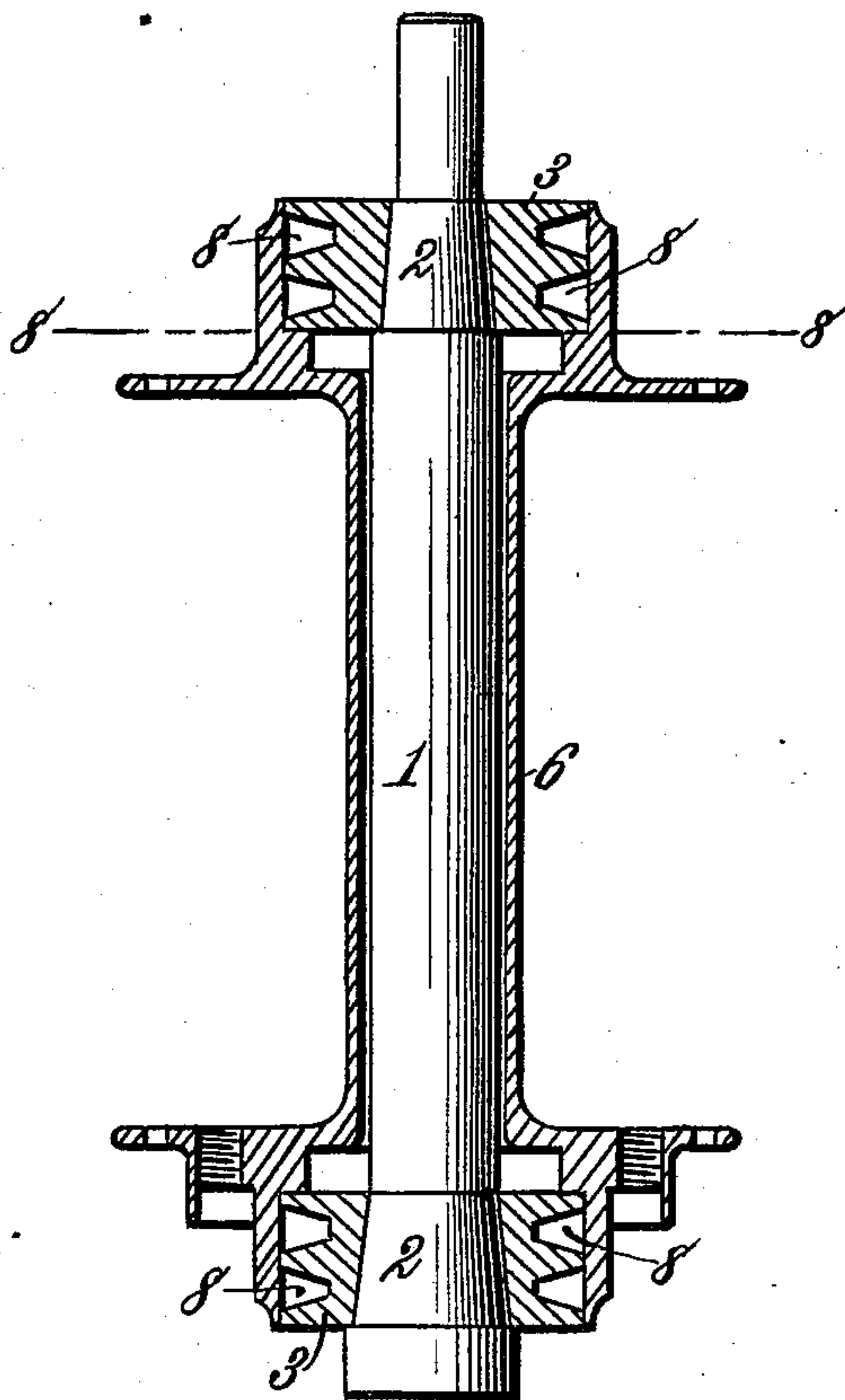


Fig. 6.

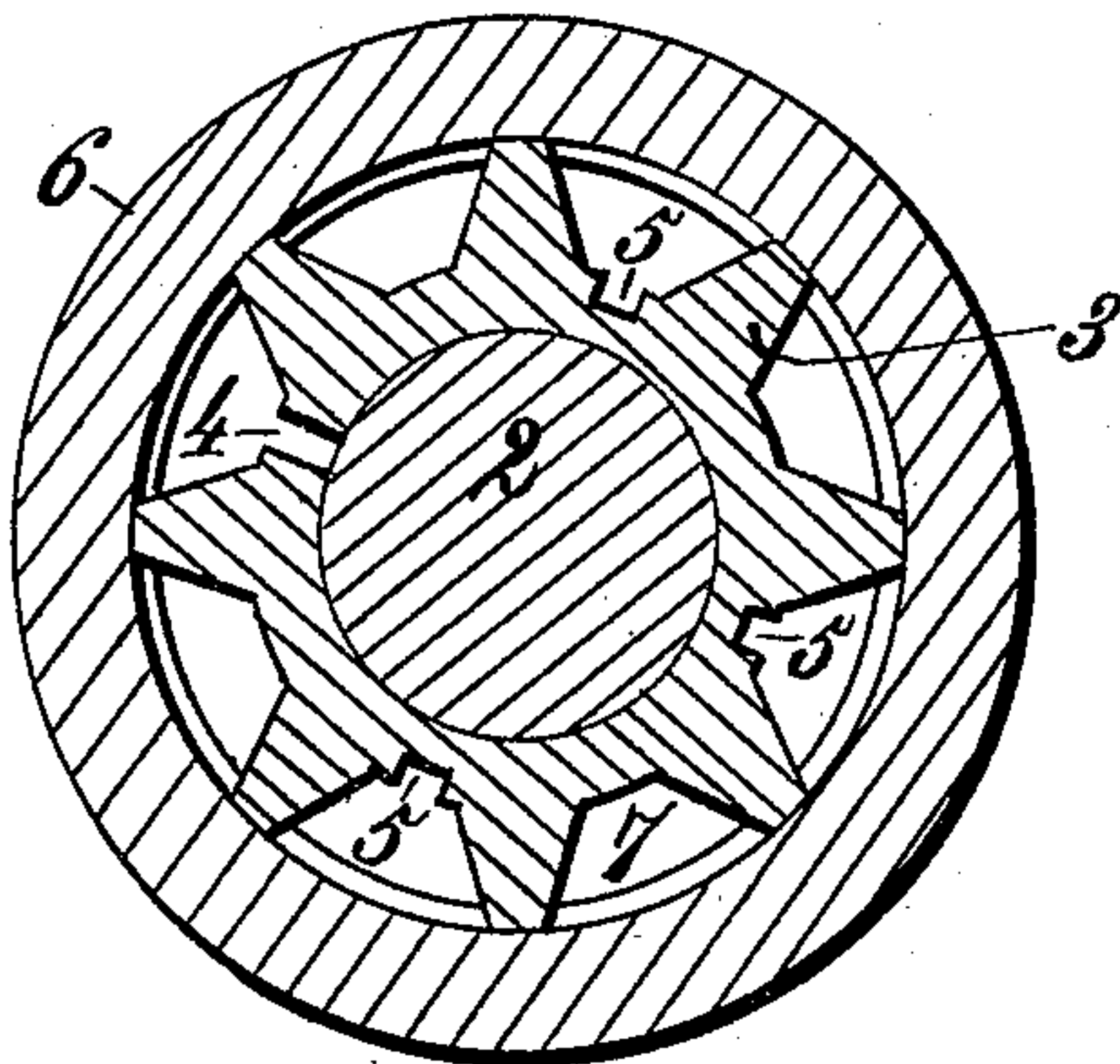
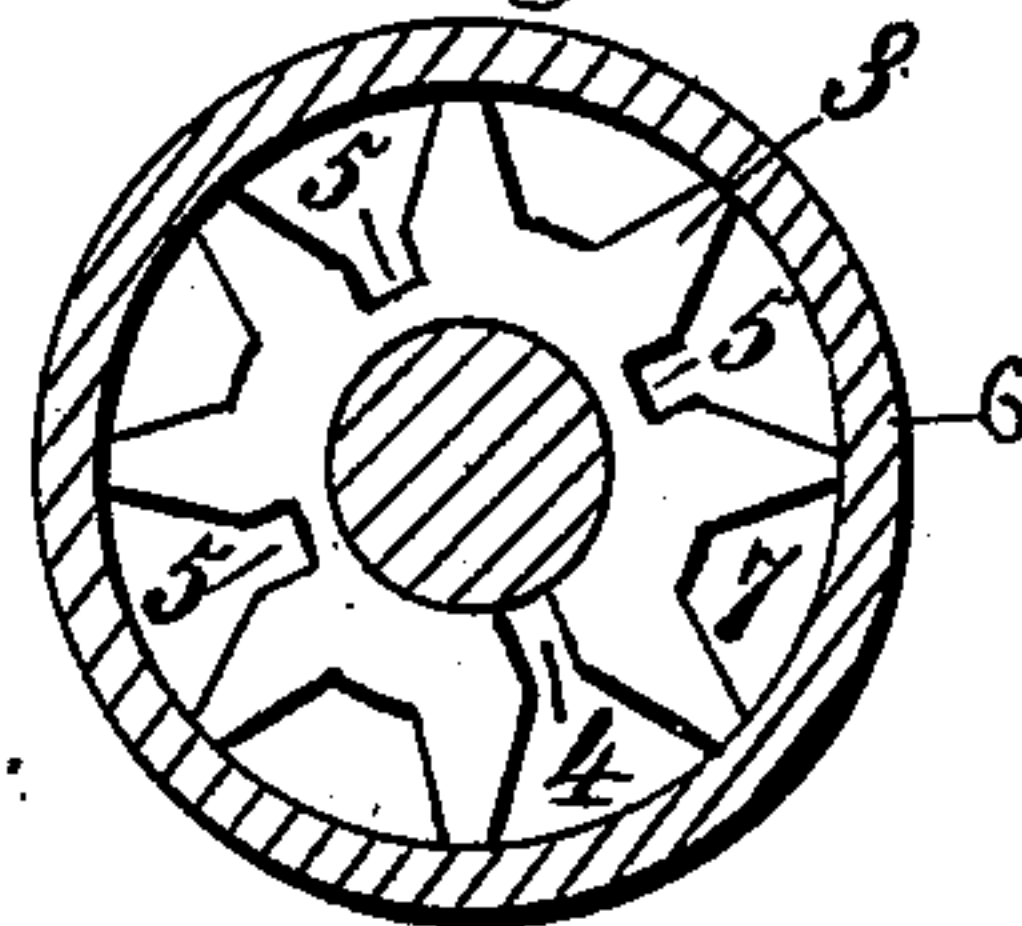


Fig. 8.



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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR HARDENING STEEL RINGS.

SPECIFICATION forming part of Letters Patent No. 539,089, dated May 14, 1895.

Application filed August 8, 1892. Serial No. 442,505. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. SIMONDS, a citizen of the United States, residing at Fitchburg, in the county of Worcester and State of Massachusetts, have invented new and useful Improvements in Methods of and Appliances for Retaining the Shape of Steel Rings and Sleeves during the Process of Hardening, of which the following is a specification.

10 This invention relates to an improved method of and appliances for retaining the shape of steel rings and sleeves during a process of hardening the same, in which the ring, sleeve or similar article is so supported that
15 it can be hardened to an exact given form and size and subsequently removed from its support without injury and in readiness for use without any necessity of being subjected to a grinding operation.

20 The object of my invention is to provide for conveniently and economically hardening either the inside or outside, or both surfaces, of a steel ring, sleeve or similar article, either straight or tapering, to an exact form and size
25 without injury to the shape of said article and in such manner that it can be readily removed from a supporting mandrel after the operation of hardening is completed.

30 To this end my invention consists in the method of hardening a steel ring or sleeve, or other tubular steel body and retaining the shape of the same during the hardening operation, which consists in heating the ring, sleeve or like article to a hardening temperature, then placing it upon a collapsible support, the opening in the ring, sleeve or like
35 article before heating being slightly smaller than said support, then cooling the article while held on said support in such a manner as to prevent warping and distortion, and
40 finally removing the collapsible support.

My invention also consists in the peculiar features of construction and novel combinations of parts in a collapsible mandrel or support for use in hardening steel rings, sleeves and similar tubular articles, as hereinafter more particularly described and claimed.

50 In the annexed drawings, illustrating the invention, Figure 1 is a longitudinal section, and Fig. 2 a transverse section, of a mandrel provided with a movable and collapsible collar arranged to support and retain in shape a

straight steel ring or sleeve while its outer side is subjected to a hardening process. Figs. 3 and 4 are similar views of a mandrel provided with a detachable and collapsible collar adapted to support and retain in shape a straight steel sleeve or ring while its inner side (and if desired its outside also) is subjected to a hardening process. Figs. 5 and 6
55 are respectively a longitudinal section and a transverse section of a mandrel provided with a detachable and collapsible collar of such form as to support and retain in shape a tapering steel ring or sleeve during its subject-
60 tion to the hardening process. Fig. 7 shows the manner of supporting and retaining in shape during the hardening process a steel sleeve or tubular body, such as the hub of a bicycle-wheel; and Fig. 8 is a transverse section of the same, showing the form of one of
65 the collapsible collars forming part of the mandrel.

The lines 2, 4, 6 and 8 in Figs. 1, 3, 5 and 7, respectively, indicate the planes in which the
70 transverse sections, Figs. 2, 4, 6 and 8 are taken.

In carrying my invention into practice I provide a mandrel 1, or similar support, with one or more tapering seats 2 adapted to be engaged with a detachable and collapsible collar 3 having a tapered inner face corresponding with the surface of said seat. The collapsible collar 3 is split or provided with a gap 4 extended entirely through its body as shown
80 in Figs. 2, 4, 6 and 8. It may be also provided at suitable intervals in its exterior with recesses 5 that serve to increase its flexibility and enable it to collapse more readily when the mandrel 1 is withdrawn. By reason of
85 the tapered seat 2 and the corresponding construction of the inner face of the collapsible collar 3 the mandrel and collar can be readily engaged and disengaged when required.

As shown in Figs. 1 and 2 the exterior of
90 the collapsible collar 3 may be made with a practically unbroken surface, either tapering or cylindrical, to closely fit throughout the interior of a tapering or straight steel ring or sleeve 6 when only the outside of said steel
95 ring or sleeve is to be hardened.

If it is desired to subject to a hardening process the interior of a straight steel ring or sleeve 6, Figs. 3 and 4, there will be placed

on the mandrel seat 2 a collapsible collar 3 having longitudinal corrugations 7 and annular corrugations 8 intersecting each other in the generally cylindrical outer face of said collar. When it is desired to harden the inner face of a tapered steel ring or sleeve, Figs. 5 and 6, the outer face of the collapsible collar 3 will be formed with a corresponding taper and provided with similar intersecting corrugations 7 and 8. These intersecting longitudinal corrugations 7 and annular corrugations 8 serve as passages for the circulation of a cooling fluid such as water, brine, oil or other fluid, in contact with said inner face of the article to complete the hardening process.

When a sleeve having enlarged chambered ends, such for instance as in an axle boxing or the hub of a bicycle wheel, is to have its interior subjected to a hardening process it may be supported and retained in shape during the process by means of two collapsible collars, as shown in Fig. 7, one of said collars being arranged within each enlarged end of the said sleeve. By means of the intersecting corrugations 7 and 8 in the exterior of these collars a free passage is afforded for the circulation of a cooling fluid, in contact with the entire interior of the sleeve and at the same time the ends of the sleeve which are the most apt to become warped and distorted during the operation of cooling are effectively supported and retained in shape.

In the ordinary operations of hardening steel rings, sleeves or similar articles large losses are frequently experienced from the warping and distortion incident to unequal contraction of the article if it is cooled without internal support. If a heated tubular article is allowed to completely cool on an ordinary mandrel of sufficient diameter to furnish an adequate support it will be impossible to remove the article without great injury. These difficulties and objections are wholly obviated by my invention.

According to my method of preserving the proper shape of a tubular steel article during the process of hardening, the article after having been heated to a hardening temperature is placed in its heated and expanded condition upon a collapsible collar 3, of the character hereinbefore described. The said collar, being detachably seated upon a central mandrel 1, will afford such support to the steel ring, sleeve or other tubular article as will effectually prevent warping and distortion of the article while it is being cooled. In practice I prefer to first place the collapsible ring 3 upon the tapered seat 2 of the mandrel. The heated tubular article in its expanded condition is then readily slipped onto the supporting collar. While thus supported the heated article is next subjected to the action of a cooling medium, such as water, brine, oil or other fluid, applied either to the interior or the exterior or to both surfaces of said article. Under this treatment the steel ring, sleeve or like article will contract with great

uniformity, without warping, distortion, or other injury. The channels or passages 7 and 8 formed by the corrugated exterior of the collapsible collar 3 will afford access for the cooling medium to the interior of the steel ring or sleeve, if desired, or if preferred the cooling medium may be applied only to the outside of the article by employing for the support of said article a collapsible collar having a plain or uncorrugated outer surface closely fitting the interior of the ring or sleeve. The collapsible collar 3 should be of the diameter to which it is desired to harden and contract the steel ring, sleeve or other tubular body the opening in which, when cold, is slightly smaller than the exterior of said collar or support. After the steel ring, sleeve or other article has been sufficiently cooled the mandrel 1 will be driven out from its engagement with the collars 3 by suitable force applied to one of the mandrel ends. It will be seen that by providing the mandrel with tapering seats 2 for the collapsible collars the said parts can be readily disengaged by a few blows on the small end of the mandrel. When the collapsible collars 3 are thus relieved from the internal pressure of the mandrel body they can be readily drawn or forced out from the steel ring or sleeve without subjecting the parts to any injurious strain.

What I claim as my invention is—

1. The herein described method of hardening a steel ring, sleeve or other tubular steel body and retaining its proper shape during the cooling operation, which consists in heating the ring, sleeve or other tubular article to a hardening temperature, then placing it while hot upon a collapsible support, then exposing the article to the action of a cooling medium while held on said support whereby warping and distortion are prevented, the opening in the ring, sleeve or like article before heating being slightly smaller than said support, and finally removing the collapsible support after the hardened article is cooled, substantially as described.

2. The combination with a mandrel of a detachable and collapsible collar having an externally corrugated surface, substantially as described.

3. The combination with a mandrel having a tapered seat, of a collapsible and detachable collar having a correspondingly tapered inner face and provided with a corrugated external face, substantially as described.

4. The combination with a mandrel, of a detachable and collapsible collar having its exterior provided with longitudinal and annular corrugations, substantially as described.

In testimony whereof I have hereunto set my hand and affixed my seal in presence of two subscribing witnesses.

GEORGE F. SIMONDS. [L. S.]

Witnesses:

HOWARD M. NORRIS,
J. A. RUTHERFORD.