

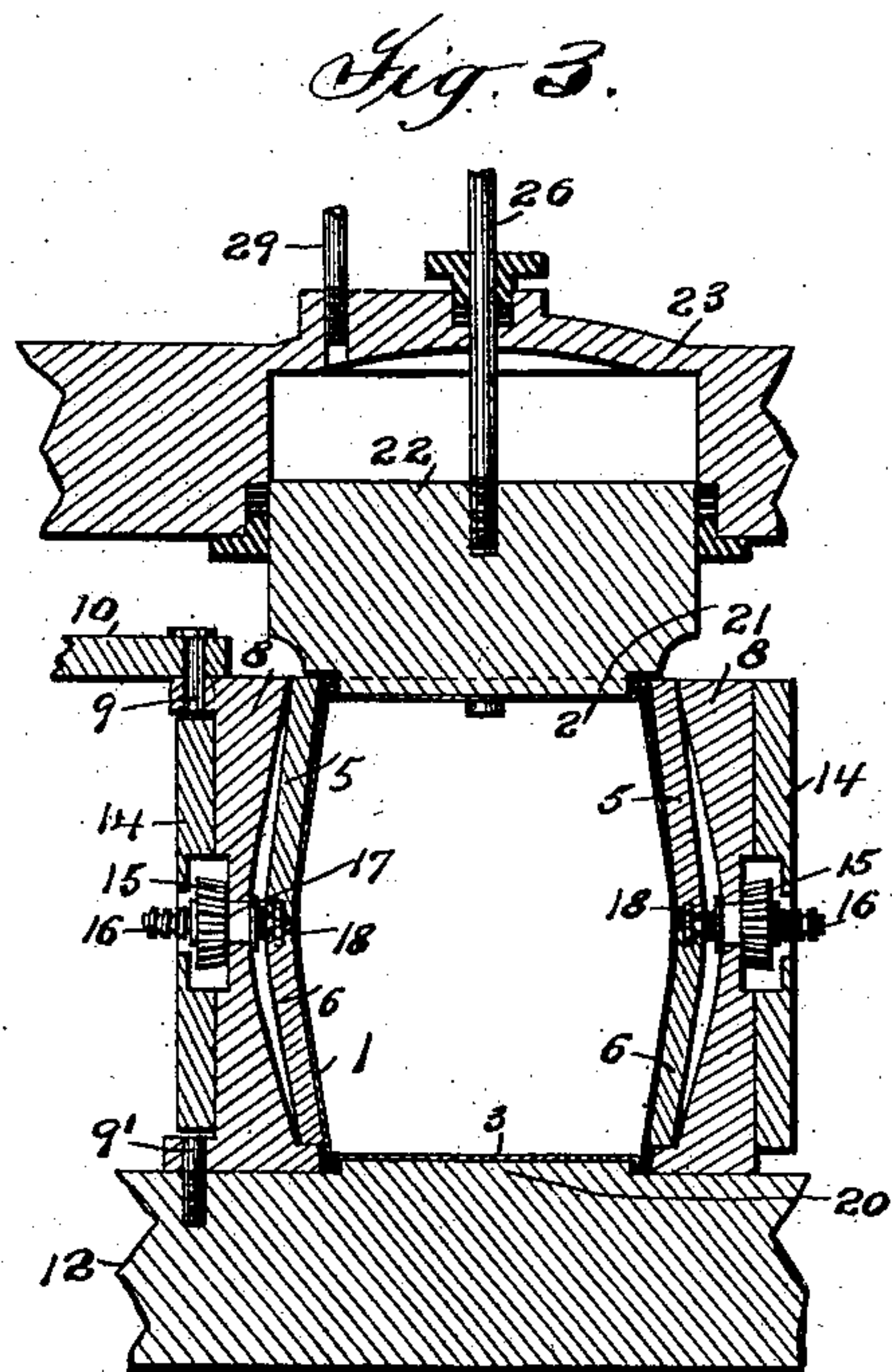
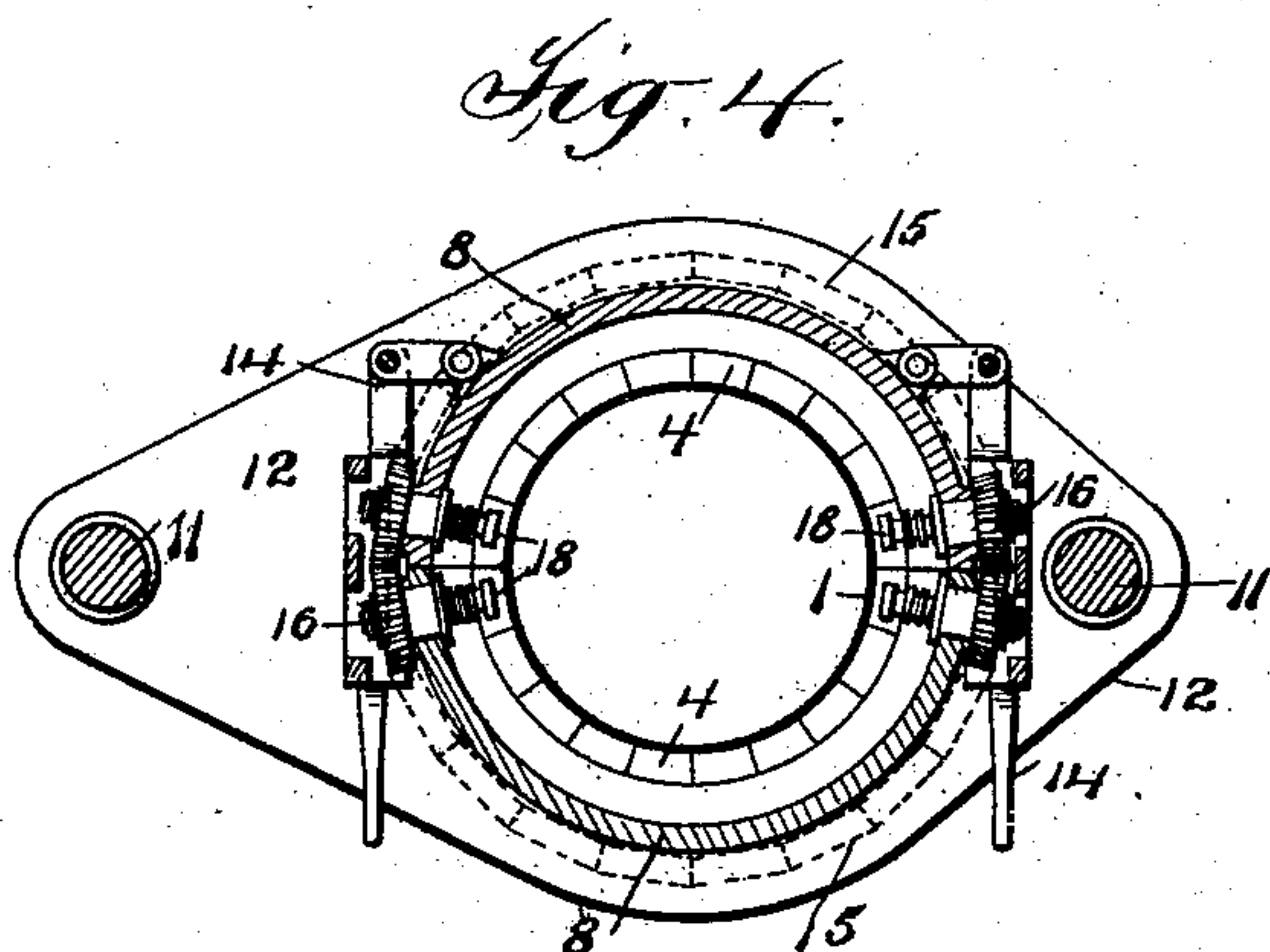
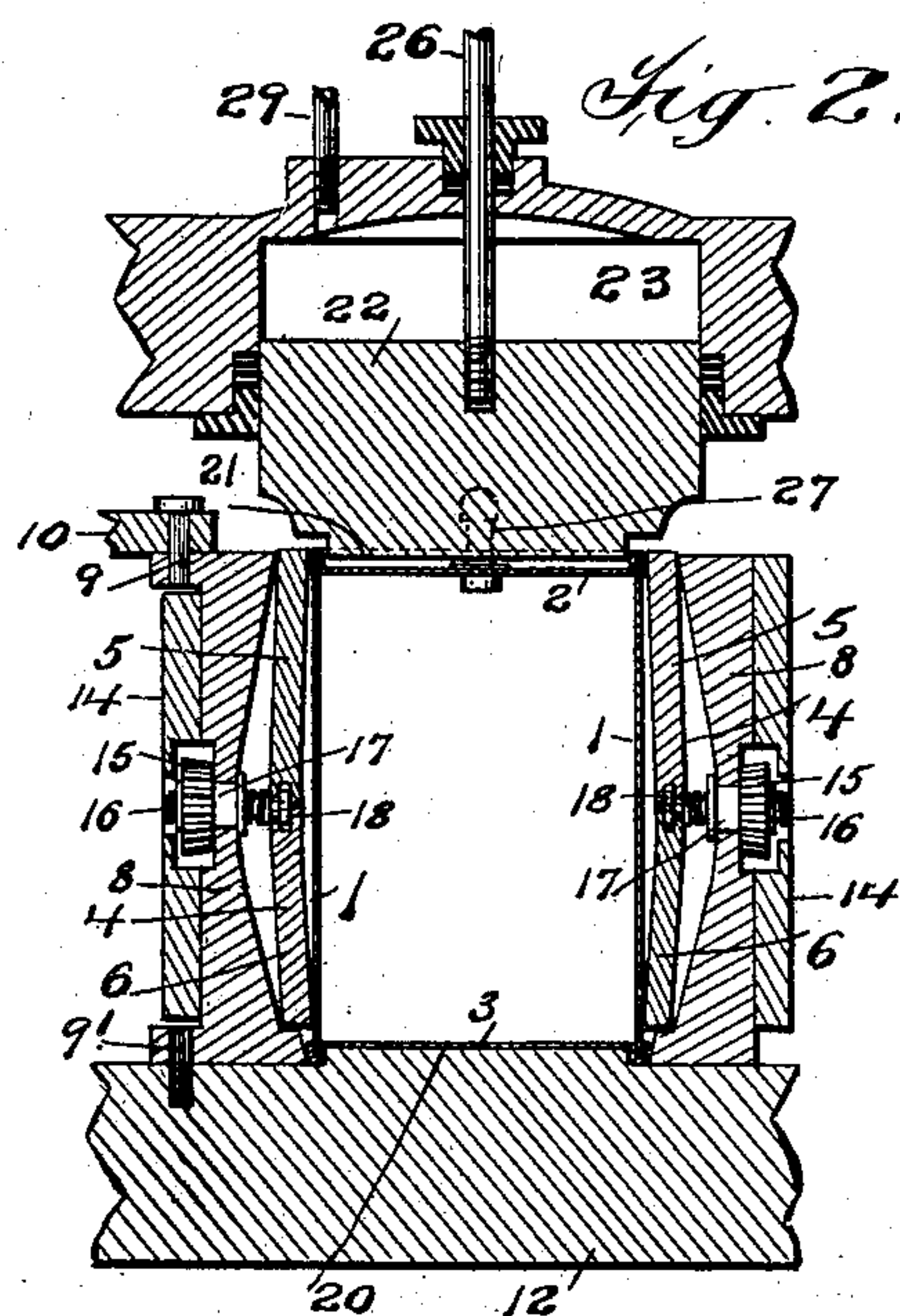
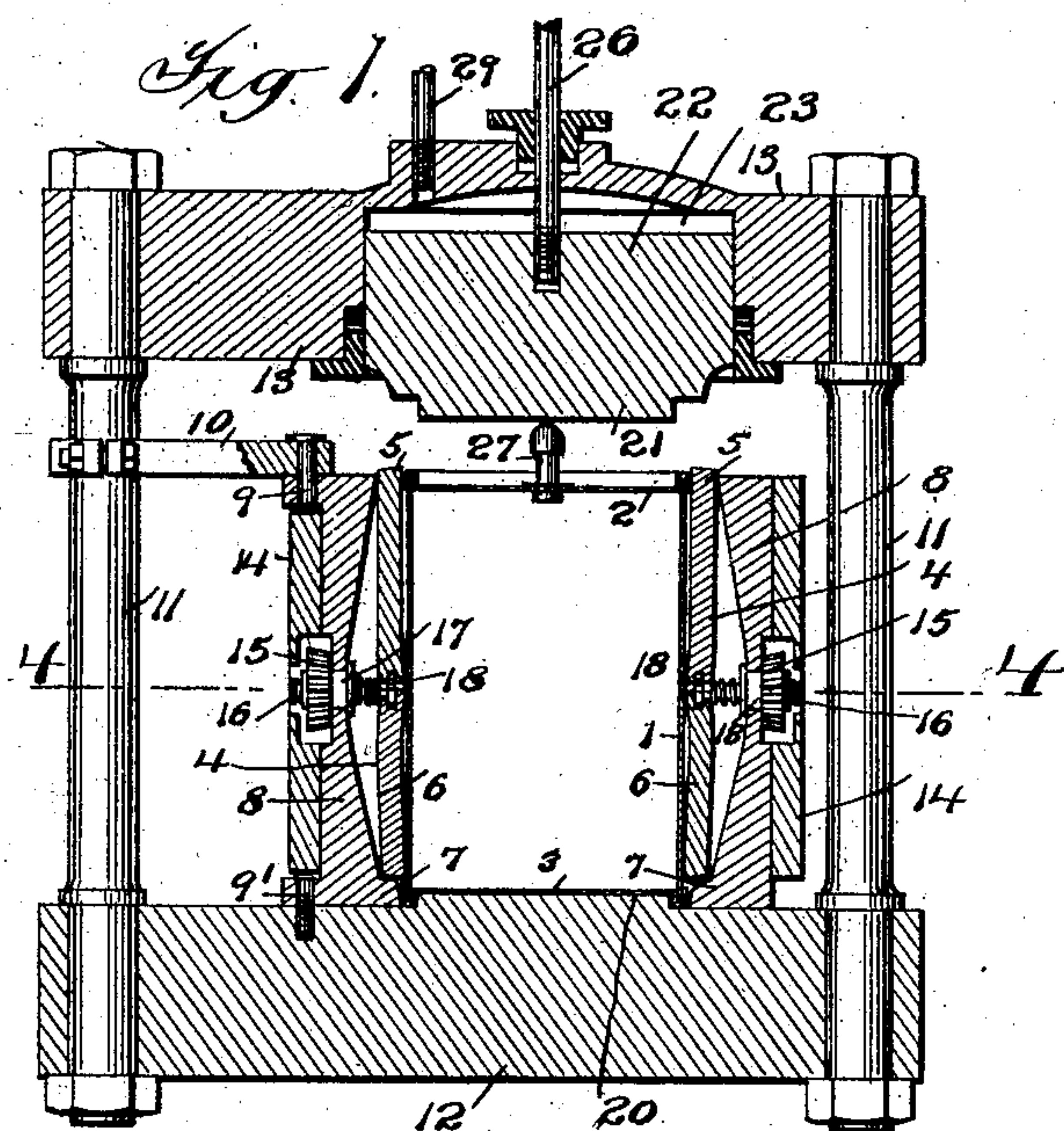
No. 701,550.

Patented June 3, 1902.

M. L. DEERING.
METHOD OF SHAPING METAL RECEPTACLES.

(Application filed Jan. 11, 1902.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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METHOD OF SHAPING METAL RECEPTACLES.

SPECIFICATION forming part of Letters Patent No. 701,550, dated June 3, 1902.

Application filed January 11, 1902. Serial No. 89,315. (No model.)

To all whom it may concern:

Be it known that I, MARK L. DEERING, a citizen of the United States, residing at New York, county of Kings, and State of New York, have
5 invented certain new and useful Improvements in Methods of Shaping Metal Receptacles, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

10 This invention relates to a method of shaping hollow metal articles by fluid-pressure.

It has been customary to shape hollow metal articles by inclosing them in a mold of the shape which it was desired that the articles assume and then causing them to assume that
15 shape by subjecting the articles to an interior expanding force—that is to say, by fluid-pressure applied to the interior of the articles. While this method can be successfully practiced with articles which are formed of soft
20 metal—such, for instance, as lead or the composition known as “Britannia metal”—it cannot be practiced in the shaping of hard-metal articles—that is to say, articles made of iron
25 or steel—when it is desired to give the article any considerable degree of expansion, for the reason that the iron or steel is of unequal tensile strength. When, therefore, such an article is subjected to great interior pressure,
30 some parts will expand in advance of others, and if these parts have any considerable distance to travel before reaching the walls of the mold by which the article is to be shaped the metal will break. Furthermore, in shaping
35 metal articles by the method hereinbefore referred to it has been customary, as before stated, to place the article in the mold and subject it to pressure, which forces the article to assume the shape of the mold this expansion of the article of course thinning the
40 metal of which it is composed. In some cases, however, this thinning of the wall of the article during the process of expanding is undesirable, particularly, for instance, in the
45 case of metal barrels in which it is desired that the side walls shall be exceedingly strong and rigid.

The present invention has for one of its objects to shape hollow metal articles by interior

fluid expanding pressure and to do this in 50 such a way as to avoid the danger of rupturing or breaking the article.

A further object of the invention is to shape metal articles by means of fluid expanding pressure and to do this in such a way as to 55 avoid the necessity of unduly thinning the expanded parts of the receptacle.

With these and other objects in view the invention consists in certain operations which will be hereinafter fully described and then 60 specifically set forth in the claims hereunto appended.

As the method or series of operations which constitute the invention may best be understood by reference to an apparatus by which 65 they can be carried out, such an apparatus is shown in the drawings which form a part of this specification, it being understood, however, that the method is in no way dependent upon the particular apparatus illustrated. 70

Referring to said drawings, in which like characters of reference indicate the same parts, Figure 1 is a sectional view of an apparatus by which the invention may be carried out. Fig. 2 is a sectional view similar to 75 Fig. 1, certain parts of the apparatus shown in Fig. 1 being omitted and certain other parts, being shown in a different position. Fig. 3 illustrates still a different position of the parts of the apparatus. Fig. 4 is a sectional plan view on the line 4 4 of Fig. 1. 80

According to the preferred manner of carrying out the present invention the article to be shaped is subjected to an interior expanding fluid-pressure, and the exterior walls of 85 the article are supported during the expanding operation. This may best be effected by inclosing the article in a mold and causing the walls of the mold to retreat as the shaping operation proceeds. The walls of the 90 mold may be caused to remain constantly in contact with the outer wall or walls of the article or they may be retreated from time to time during the expanding operation, so as to support the article at successive periods 95 during said operation. The construction which has been selected to illustrate the carrying out of the invention is arranged to sup-

port the walls of the article to be expanded at successive periods during the shaping operation.

The article to be shaped which has been selected for illustrative purposes is a cylinder, and by the shaping operation the cylinder is converted into a bilged barrel. In the drawings the cylinder is marked 1 and has heads 2 and 3. The mold is generally cylindrical in form, and its wall consists of independent sections 4, each section being composed of two blocks 5 and 6, which have their adjacent edges abutting and are carried on a ledge 7 on a two-part support 8. One of the parts of the support is hinged by a pin 9 to a bracket 10, extending from one of a series of pillars 11, which connect the base 12 and top piece 13 of the frame in which the apparatus is mounted, and by a pin 9' to the base of the apparatus. The other part of the two-part support is rigidly connected to the frame, the construction being such that the pivoted part can be swung toward and away from the stationary part to open and close the mold and allow the barrel to be inserted and removed. When the parts are closed, they are locked by means of notched locking-levers 14, this construction enabling the supports to withstand great pressure.

Assuming that the mold is in the position shown in Fig. 1 when it is closed, the sections of the mold are retreated slightly, as shown in Fig. 2, this being accomplished by means of a series of intermeshing gears 15, which carry nuts 17, said nuts engaging screws 16, which are in turn connected to the mold-blocks in any desired way—as, for instance, by having their heads 18 engaging recesses in the blocks.

The bottom of the mold is formed by an abutment 20 and the top of the mold by a head 21, which is formed on a press-block 22, contained in a pressure-chamber 23. The press-block is forced downward, so that the head 21 will be in contact with the head of the barrel or other receptacle by means of fluid-pressure created in the chamber 23. The block may be drawn up out of contact with the head of the barrel by any suitable means and a pin 26 which takes through a stuffing-box in the top of the pressure-chamber.

When the article to be shaped, as in the present case, has heads and side walls, the heads will be fixed in position before it is introduced into the mold, the receptacle being thus made fluid-tight. The fluid expanding pressure is then applied to the interior of the barrel through a pipe 27, which passes into an opening in the head of the barrel—as, for instance, the spigot-hole. In the apparatus which is being described the perforation through the block is made large enough to permit a movement of the block with respect to the pipes. The pipe 27 is provided with a suitable valve, and this pipe may be connected with a valved pipe 29, which leads to a

pump or any other suitable source of pressure. The pipe 29 in the apparatus being described is connected to the pressure-chamber 23, which coöperates with the press-block 22.

In case it is desired to simply expand the receptacle without providing against undue thinning of the metal due to the expansion, as might be the case where the walls of the receptacle were not sufficiently thick to stand the expansion, the pressure-block is simply brought down with its head snugly against the end of the receptacle, and when it has reached this position the valve in the pipe 29 is closed. The valve in the pipe 27 is then opened and the receptacle subjected to great pressure. This causes the walls of the receptacle to expand; but since the walls of the mold are comparatively close to the walls of the receptacle they will, should the receptacle expand unevenly, support the parts which reach them first until the remainder of the wall or walls of the receptacle has expanded and the receptacle has assumed the configuration of the mold. When this point has been reached, the pressure in the receptacle is somewhat slacked off and the wall of the mold is retreated slightly. The article is then again subjected to expanding pressure, and these steps are repeated until the article has been caused to assume the configuration it is desired to give it. During the expanding operation the head 21 of the press-block and the abutment 20 support and prevent any outward movement of the heads or ends of the receptacle.

By causing the walls of the mold to support the article during the expanding operation the liability of breaking or rupturing the article is obviated, because no one part of the wall of the receptacle can expand sufficiently far beyond any other part to permit it to break or tear, and this is true whether the walls of the receptacle are continuously supported by a mold whose walls are gradually retreated during the expanding operation or whether the article be supported at successive periods during the expanding operation. In the latter case, however, care must of course be taken not to move the walls of the mold too far from the walls of the receptacle. The distance which it will be safe or desirable to move the walls can be determined by calculating the tensile strength of the material to be operated upon. In expanding an ordinary steel barrel from cylindrical to bilge shape, in which the metal of the barrel is from one-eighth to about three thirty-seconds of an inch thick, the walls of the mold will preferably not be moved more than an average of about a quarter of an inch at a time, more movement of the walls being permissible at the beginning of the operation than after the expansion is nearly completed.

When it is desired to provide against undue thinning of the metal, the area of the pressure-chamber 23 is made greater than the area of the head 21 and the valve in the pipe

29 is opened during the expanding operation, so that pressure is exerted both in the receptacle and in the pressure-chamber. Since, however, the area of the press-block exposed to pressure in the pressure-chamber is greater than the area of the head which is in contact with the end of the receptacle, the pressure in the chamber will cause the block and head to move inward, notwithstanding the expanding force which is being exerted in the receptacle. This will shorten the receptacle slightly, and it has been found by experiment that the surplus metal which would otherwise be produced by this shortening operation is taken up in the side wall of the receptacle as the same expands. The press-block is provided with a shoulder, which abuts against the top of the mold-sections 4 in order to limit the inward movement of the press-block and head. The force with which the pressures operate will be so calculated that the shoulder on the press-block will come in contact with the mold-sections at about the time when the expansive force within the receptacle has caused its wall or walls to come in contact with the wall of the mold.

While the invention will usually be practiced by subjecting the article to be shaped to an interior fluid-pressure and supporting its sides during the shaping operation, it is believed to be novel to subject a completed receptacle having ends and side walls to interior expanding pressure after the ends are in place, preventing at the same time any outward movement or bulging of the ends. Such a method, therefore, is within the invention.

The apparatus hereinbefore described forms the subject-matter of a companion application, serially numbered 89,314, filed January 11, 1902, and is not claimed herein.

What is claimed is—

1. The method of shaping hollow metal articles which consists in subjecting the articles to an interior expanding fluid-pressure and supporting the walls or parts to be expanded exteriorly at successive separated positions during the shaping operation, substantially as described.

2. The method of shaping hollow metal articles which consists in subjecting the articles to an interior expanding fluid-pressure and simultaneously shortening the article by an exterior pressure the lines of force of the exterior pressure being at an angle to the movement of the metal produced by the interior expansive force, and supporting the walls of

the articles or the parts thereof to be expanded exteriorly at their several positions during the shaping operation, substantially as described.

3. The method of shaping hard-metal receptacles having heads or ends and side walls which consists in subjecting a receptacle with its heads or ends in position to an interior expanding fluid-pressure, supporting the walls during the expanding operation and simultaneously with the expanding operation preventing an outward movement of the heads or ends, substantially as described.

4. The method of shaping hard-metal receptacles having heads or ends and side walls which consists in subjecting a receptacle with its heads or ends in position to an interior expanding fluid-pressure, supporting said walls at successive separated positions during the expanding operation and simultaneously therewith preventing an outward movement of the heads or ends, substantially as described.

5. The method of shaping hard-metal receptacles having heads or ends and side walls which consists in subjecting a receptacle with its heads or ends in position to an interior expanding fluid-pressure, supporting said walls during the expanding operation and simultaneously with the expanding operation subjecting the heads or ends to an exterior pressure which is greater than the interior pressure whereby the receptacle is shortened in a line which is at an angle to the direction of the expanding force, substantially as described.

6. The method of shaping hard-metal receptacles having heads or ends and side walls which consists in subjecting a receptacle with its heads or ends in position to an interior expanding fluid-pressure, supporting said walls at successive separated positions during the expanding operation and simultaneously with the expanding operation subjecting the heads or ends to an exterior pressure which is greater than the interior pressure whereby the receptacle is shortened in a line which is at an angle to the direction of the expanding force, substantially as described.

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

MARK L. DEERING.

Witnesses:

T. F. KEHOE,
C. J. SAWYER.