(No Model.)

4 Sheets—Sheet 1.

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APPARATUS FOR TREATING HEATED METALS UNDER PRESSURE.

No. 571,265. Patented Nov. 10, 1896.

Fig:1.

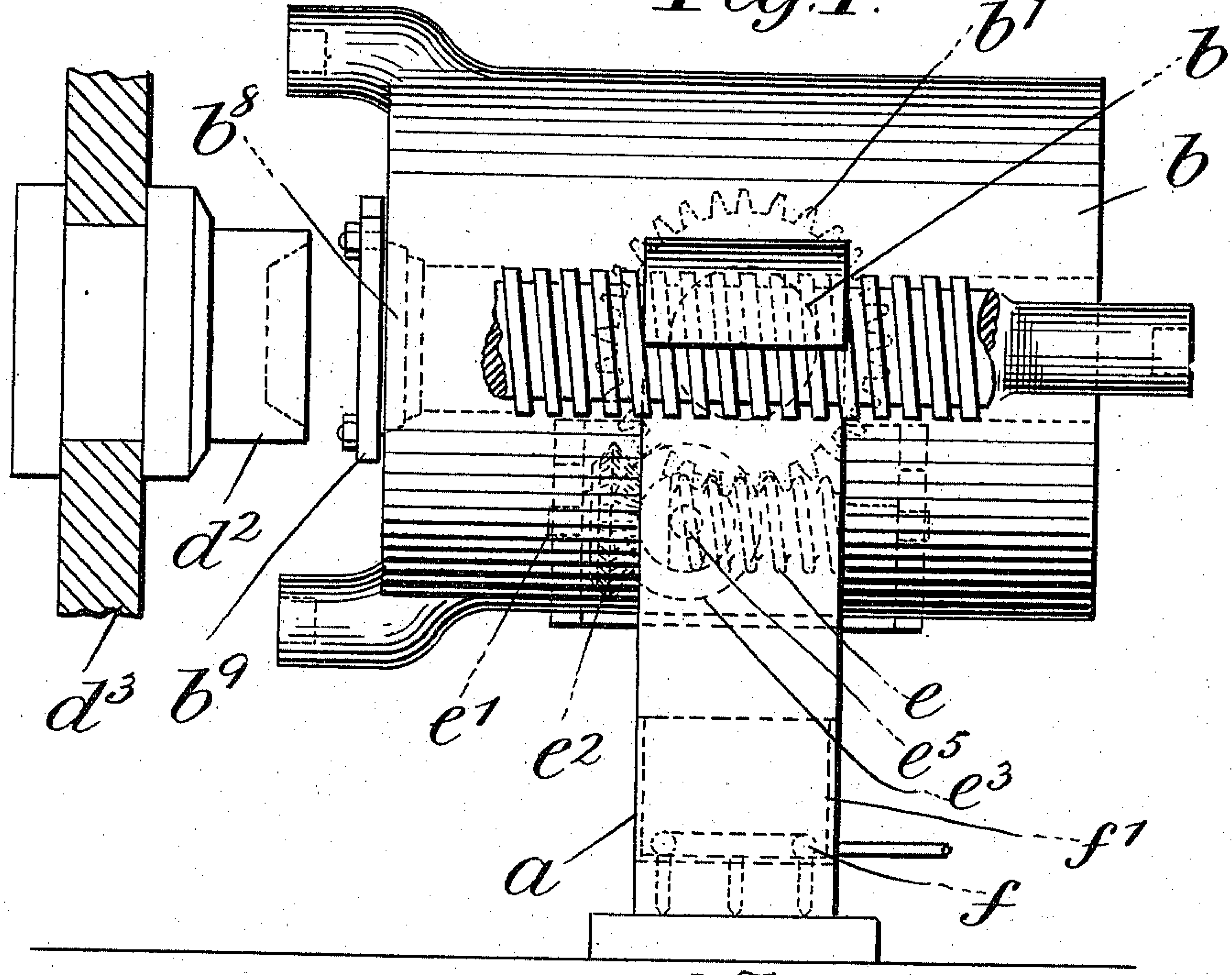
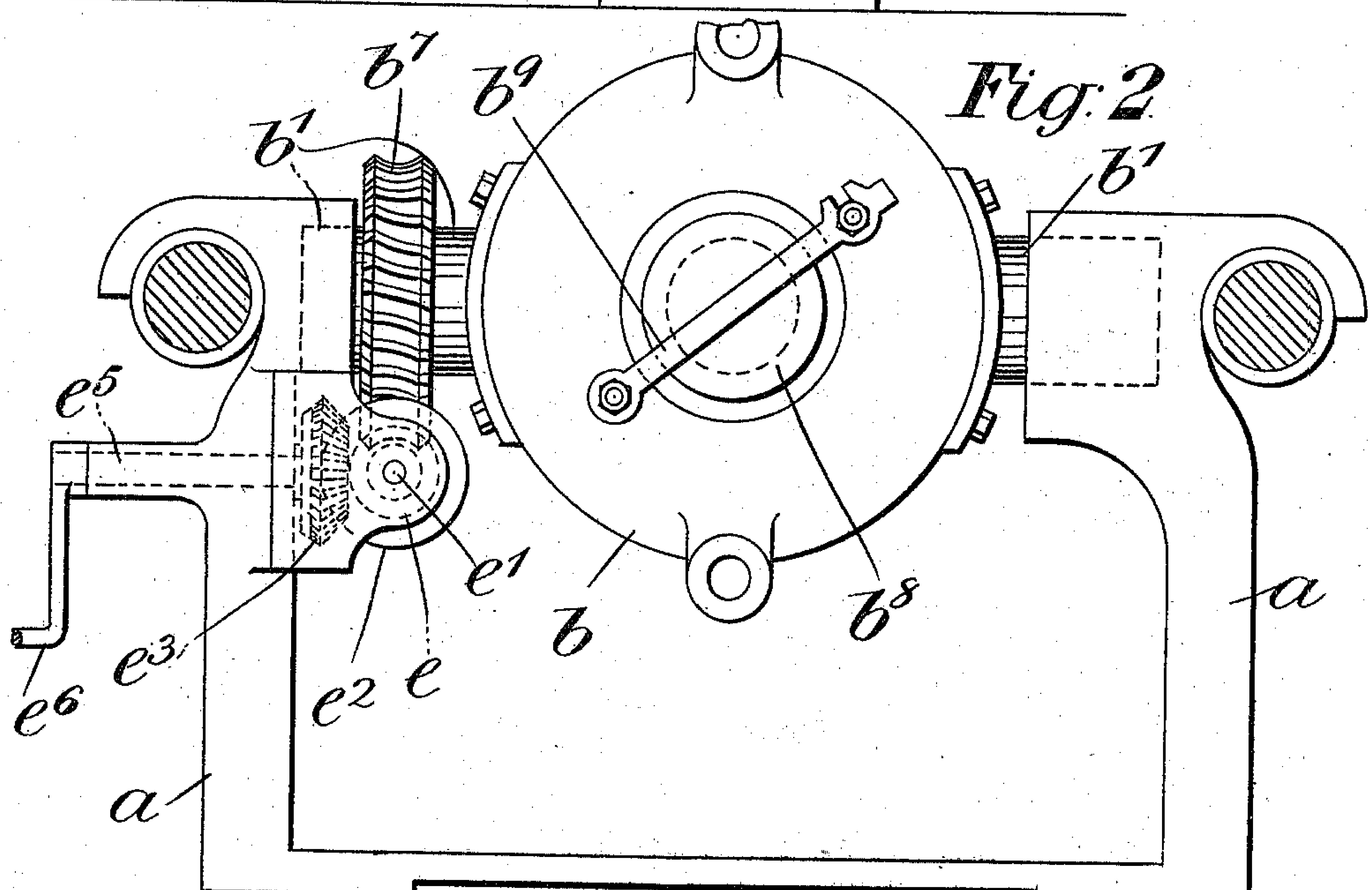


Fig:2.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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Fig: 3.

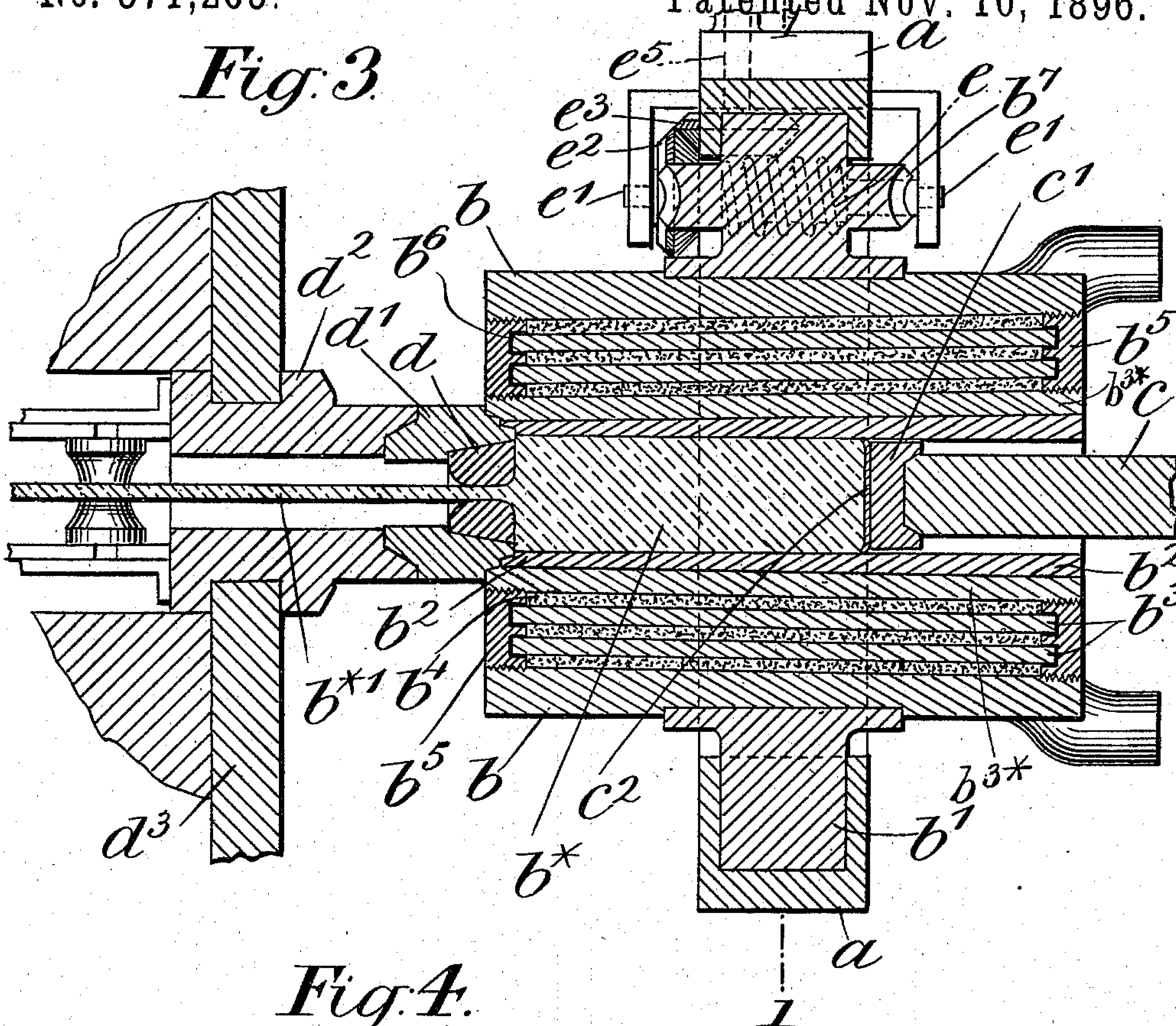

Fig: 4.

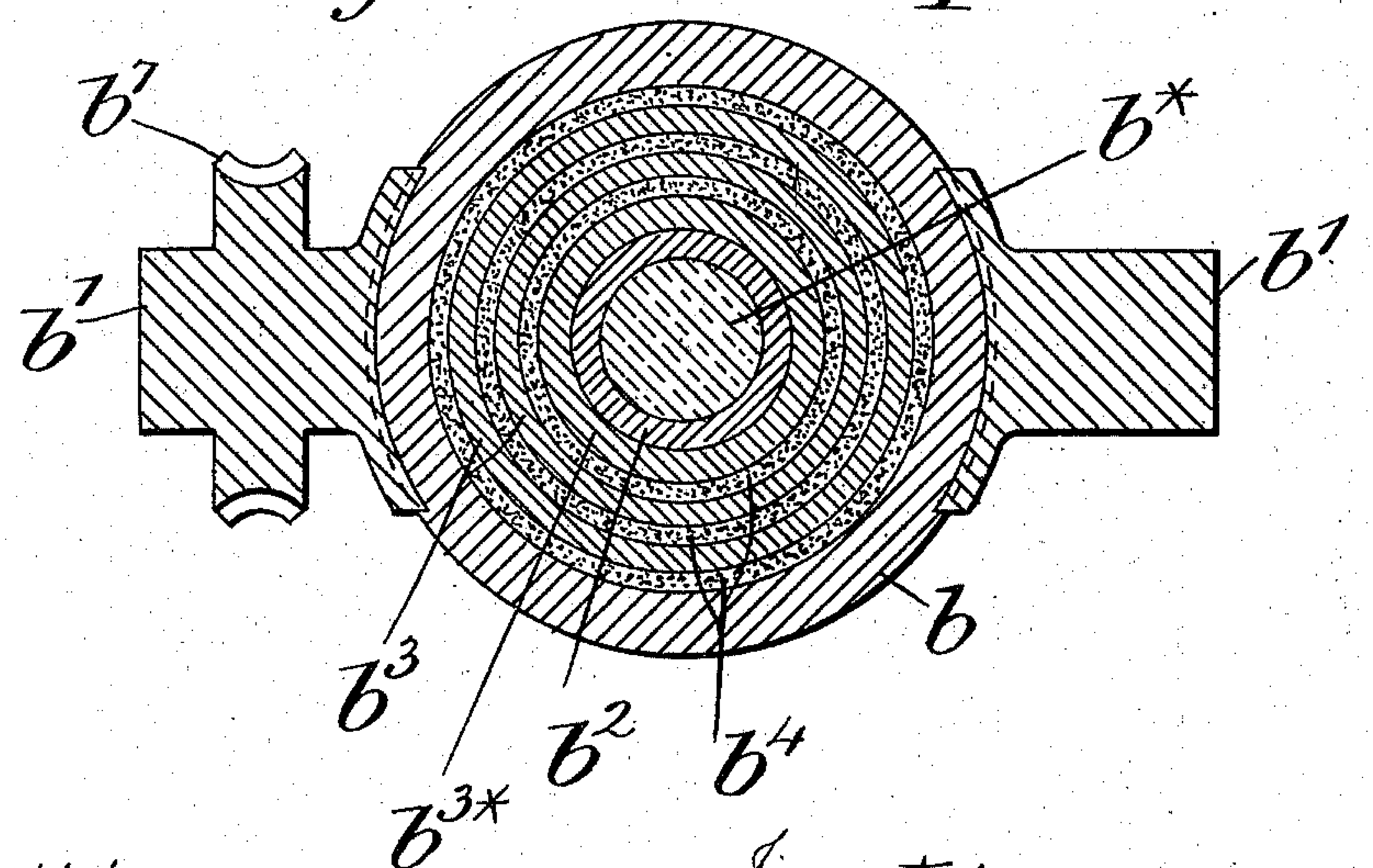

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Fig: 5.

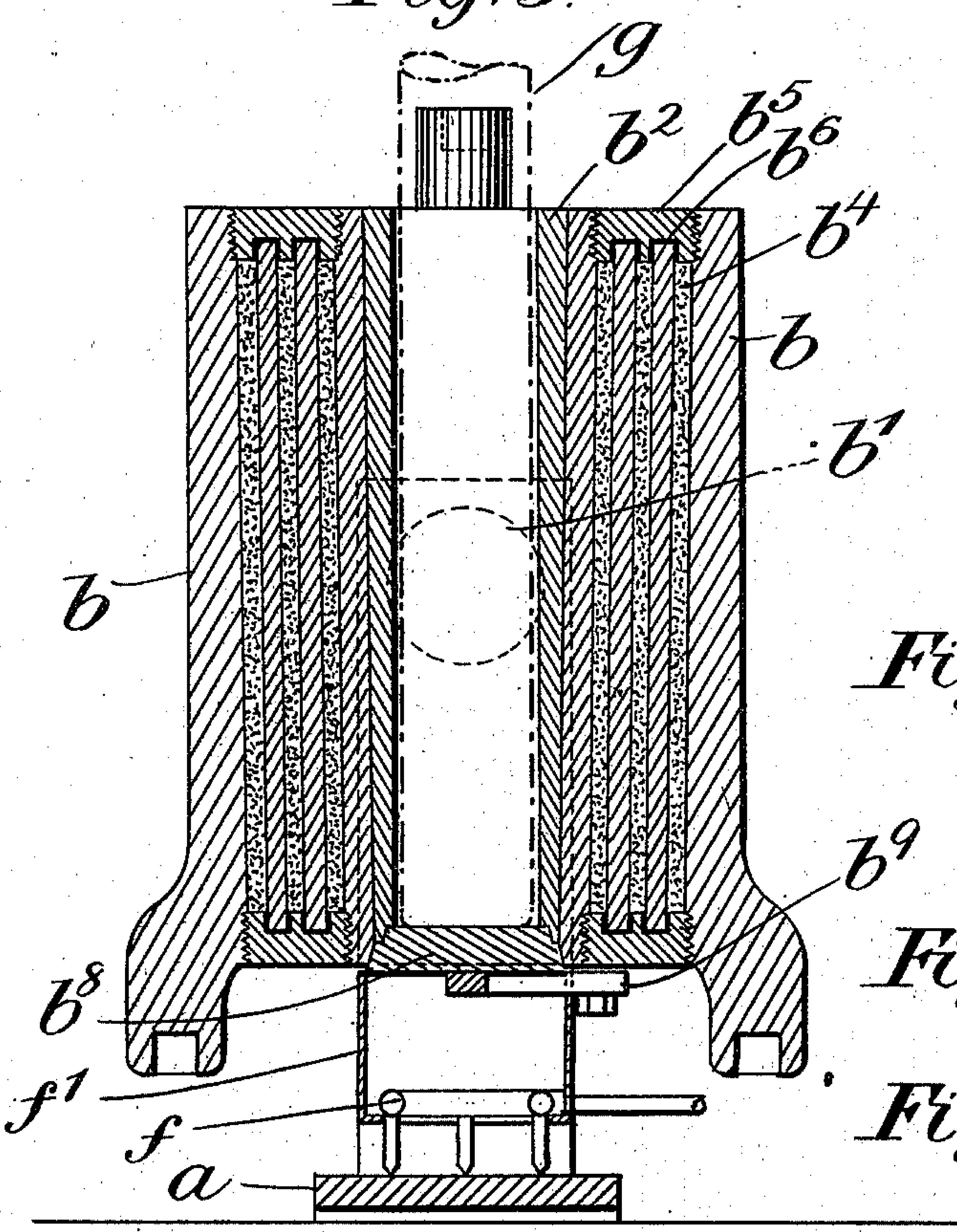

Fig: 11.

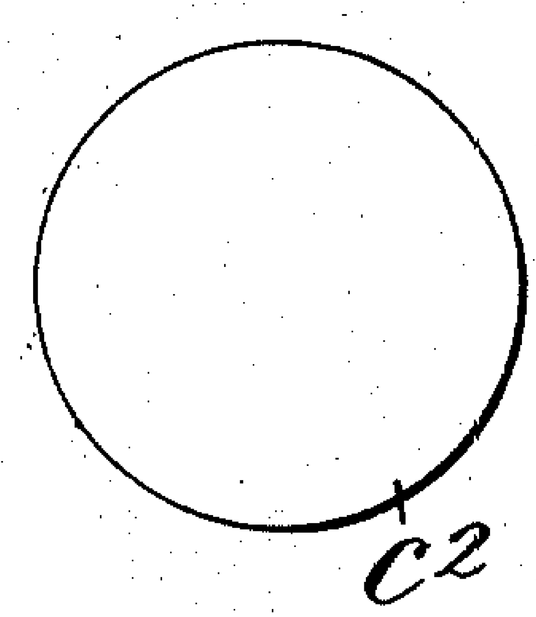

Fig: 12.

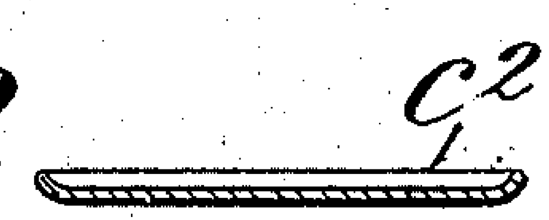

Fig: 13.

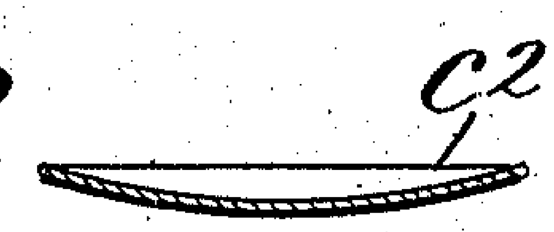

Fig: 14.

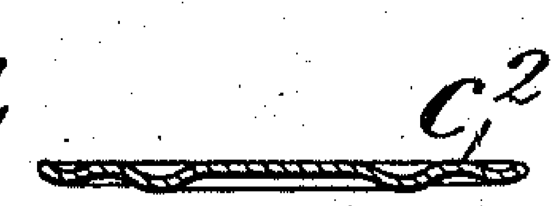

Fig: 15.

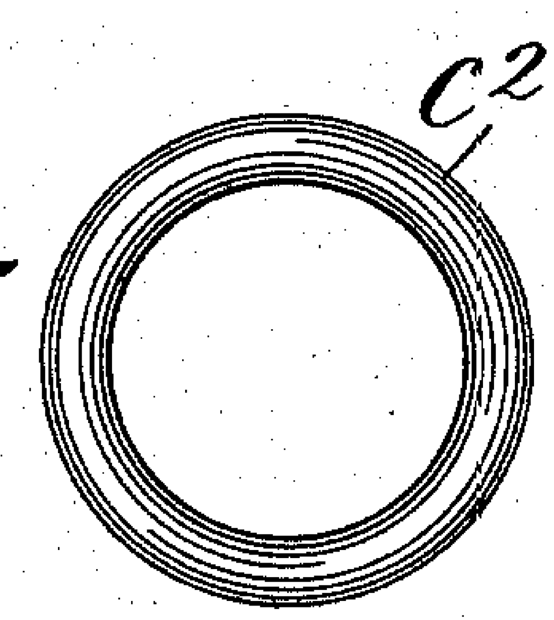

Fig: 16.

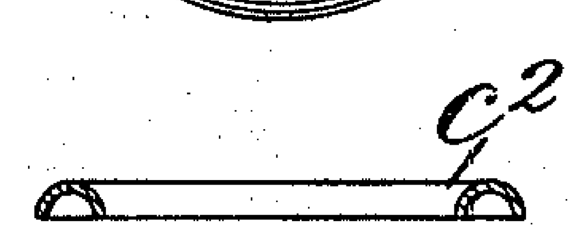

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Fig. 8.

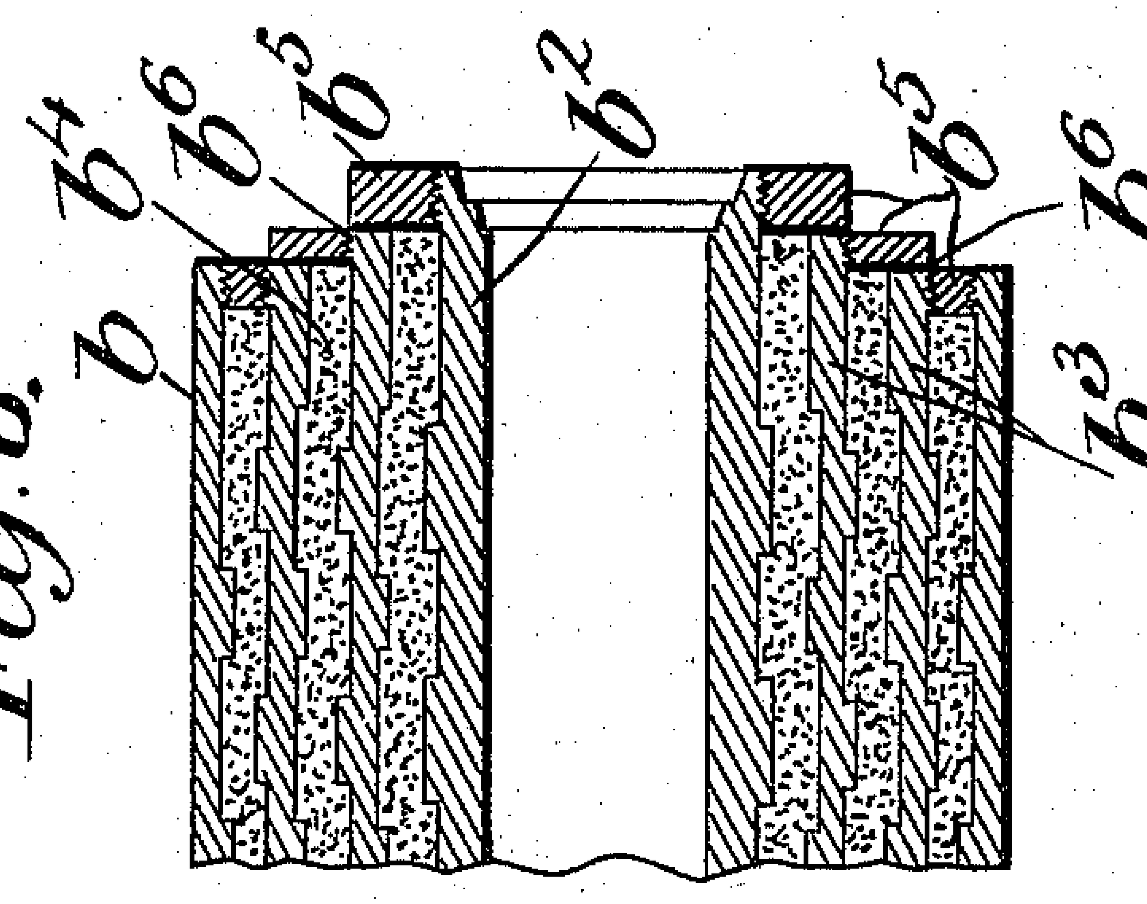


Fig. 10.

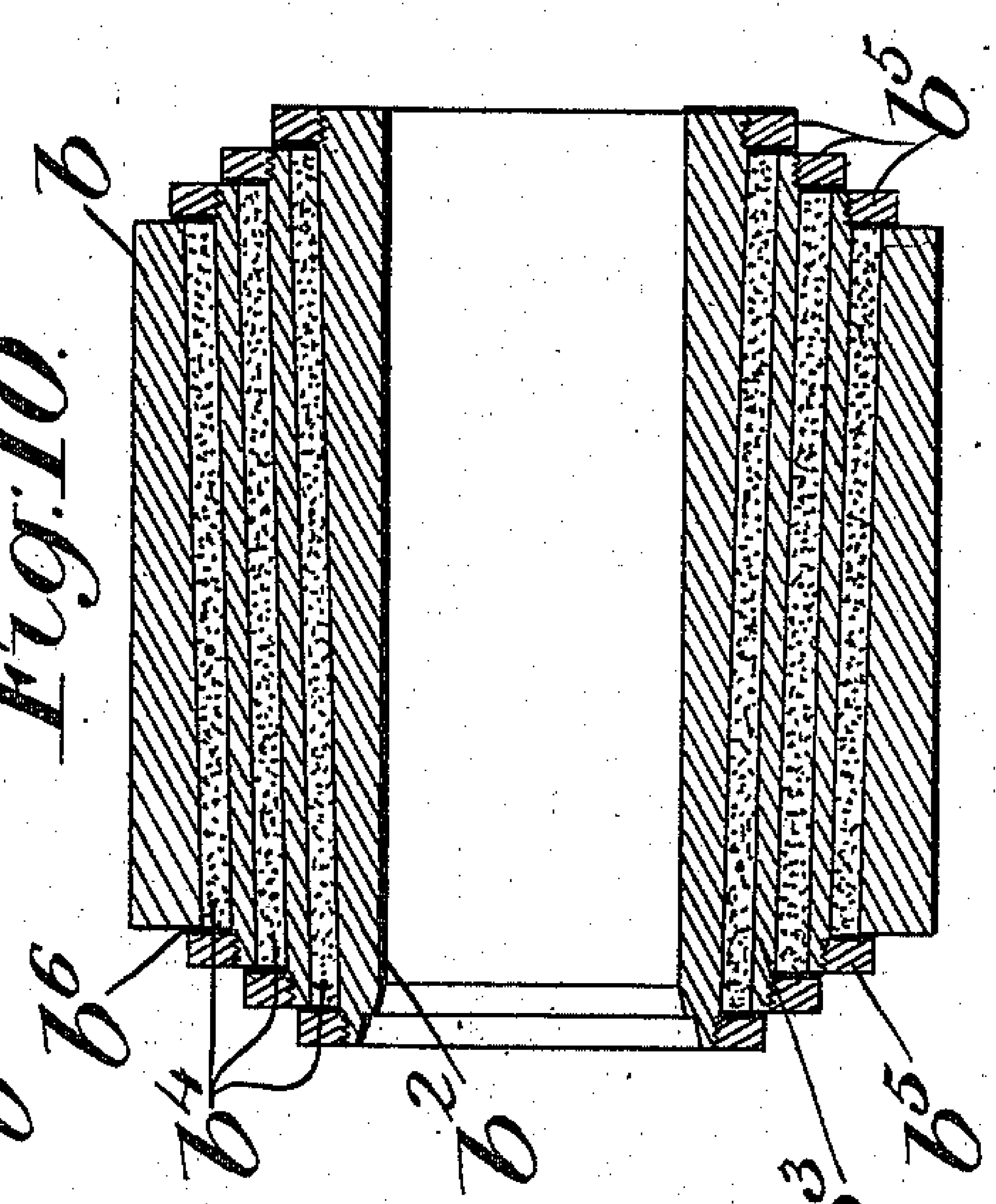


Fig. 9.

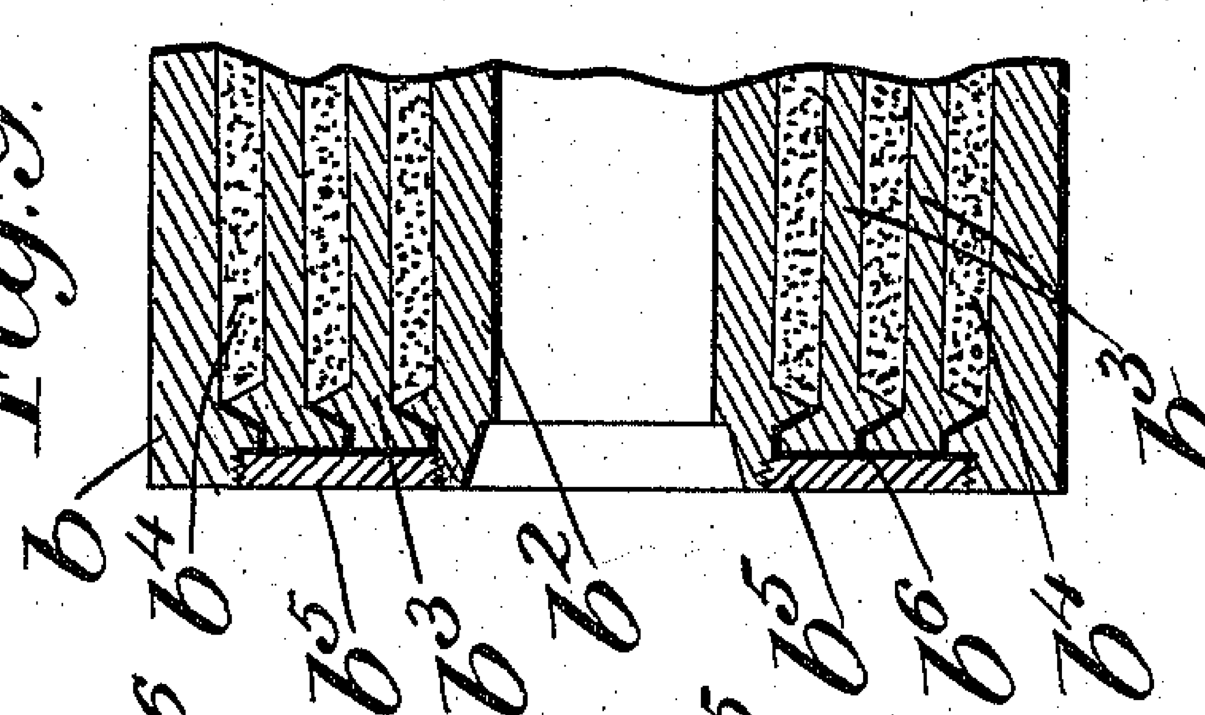


Fig. 6.

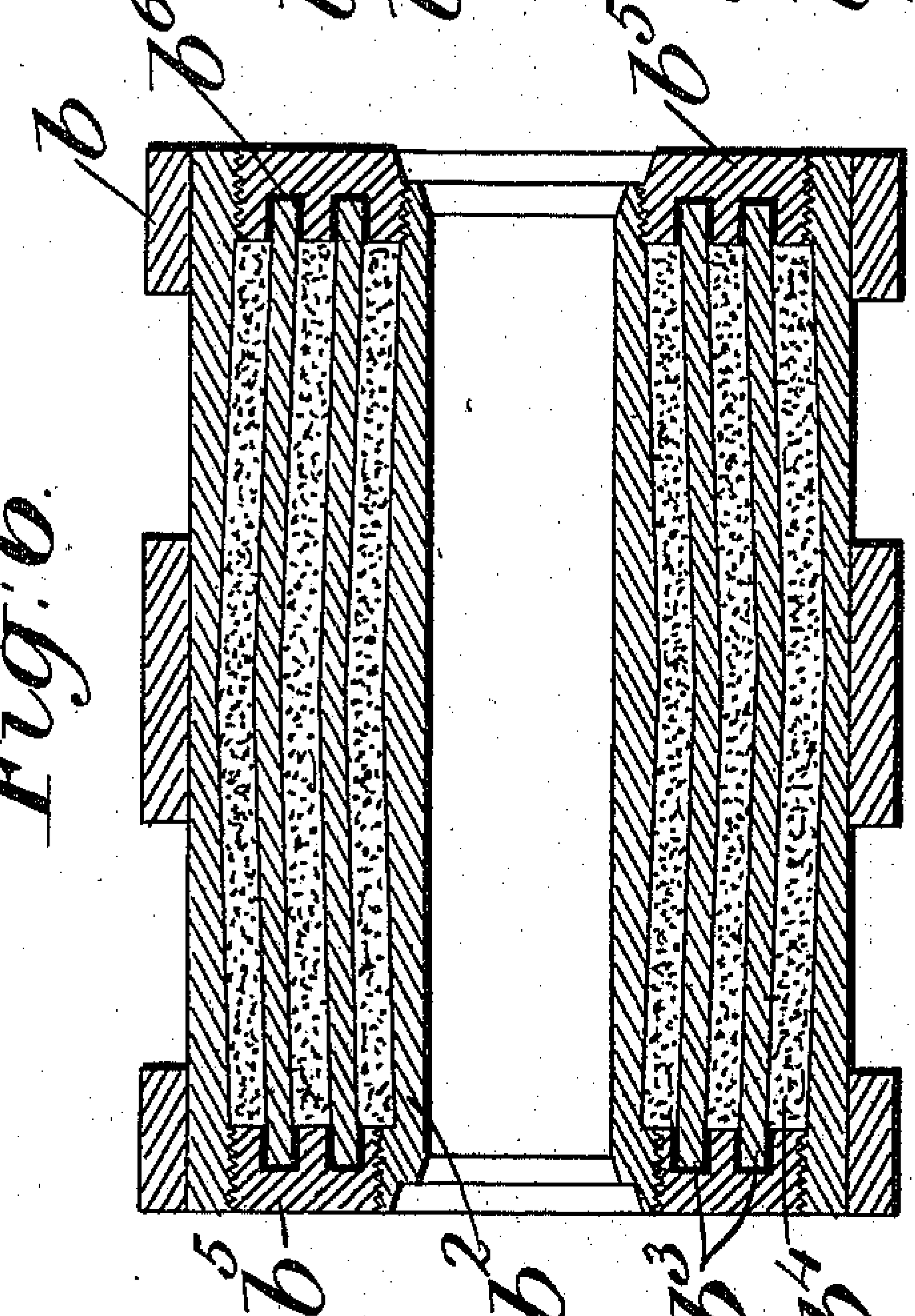
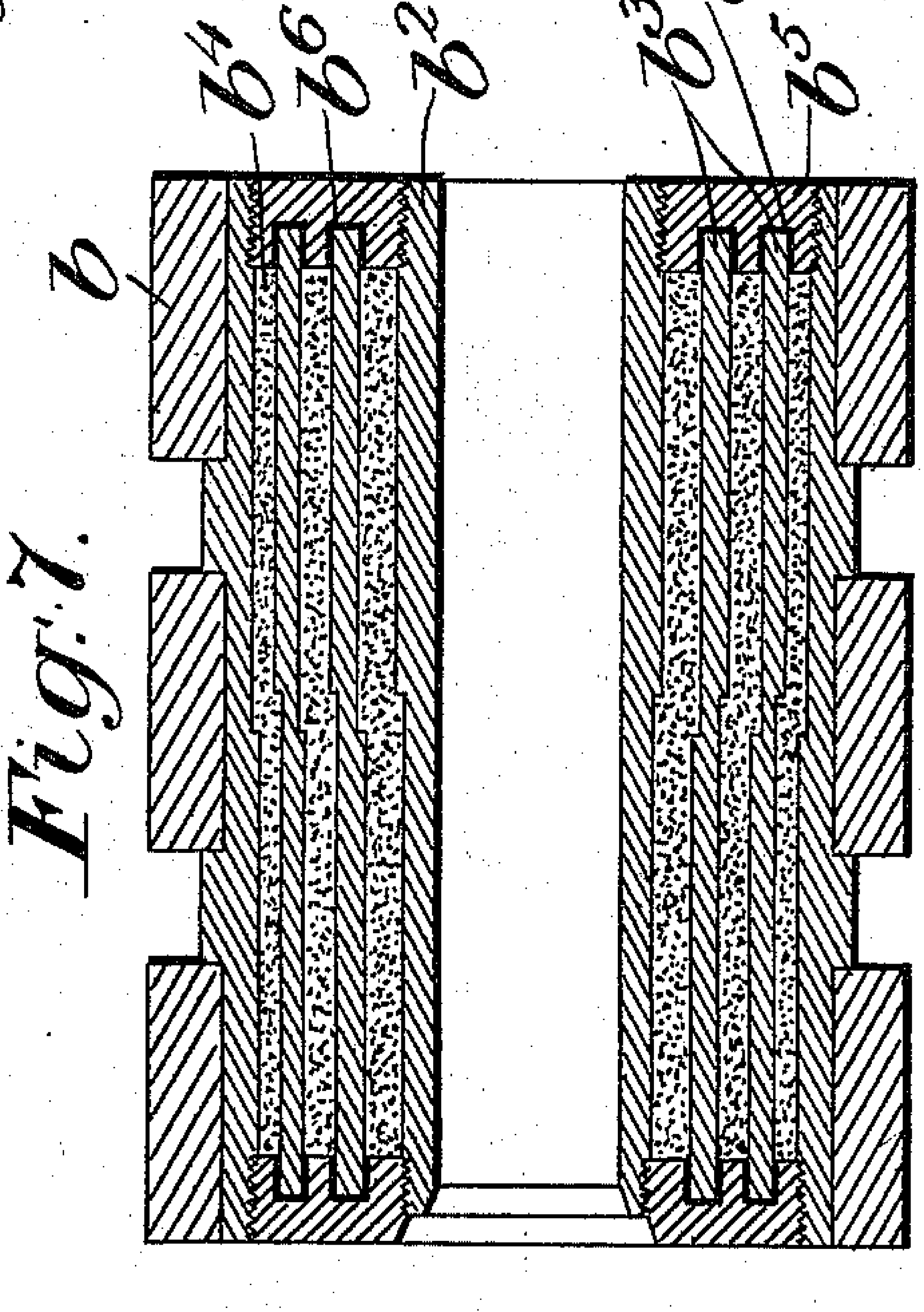


Fig. 7.



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UNITED STATES PATENT OFFICE.

GEORGE ALEXANDER DICK, OF LONDON, ENGLAND.

APPARATUS FOR TREATING HEATED METALS UNDER PRESSURE.

SPECIFICATION forming part of Letters Patent No. 571,265, dated November 10, 1896.

Application filed December 20, 1894. Serial No. 532,486. (No model.)

To all whom it may concern:

Be it known that I, GEORGE ALEXANDER DICK, engineer, a subject of the Queen of Great Britain, residing at No. 110 Cannon Street, in the city of London, England, have invented certain new and useful Improvements in or Connected with Means or Apparatus for Treating Heated Metals Under Pressure, of which the following is a specification.

This invention relates to improvements in or connected with means or apparatus for treating heated metals under pressure, and is more especially applicable to apparatus employed in the manufacture of wire, rods, or bars (hollow or solid) from various copper alloys by squeezing or pressing them through a die or dies.

In operations such as that lastly hereinbefore referred to a pressure-chamber or container for the metal has been employed, such chamber being open at one or both ends. This pressure-chamber or container is generally formed of steel or other metal suitable for the high temperature of the molten or heated metal or alloy when poured or placed therein, and the metal of which the pressure-chamber or container is composed when heated is intended to resist the pressure exercised by the hydraulic ram which is employed in the squeezing or pressing operation.

When steel and other metals are heated to a high temperature, their power to resist pressure is considerably diminished, and the walls of the pressure-chamber or container have necessarily been constructed of a considerable thickness in order to withstand the pressure exerted by the hydraulic ram, and in chambers so constructed in consequence of the slow penetration of the heat through the walls there is an unequal expansion and contraction of the metal of which the container is formed and it frequently cracks or fractures from that cause, thus destroying the device for practical purposes and rendering it useless.

Now the chief object of the present invention is to so construct the pressure-chamber or container that when in use it will better resist the heat and pressure than heretofore.

The present invention is based upon the principle that while, as hereinbefore explained, steel or the like when heated to a high temperature loses its integral strength, yet at lower temperatures, say, for example, about 400° Fahrenheit, it will retain its full power to resist pressure, so that a vessel formed of comparatively thin walls and protected from the extreme heat will be better able to resist pressure than a vessel having walls of greater substance heated to a higher temperature, while a vessel formed with comparatively thin walls and heated to a comparatively high temperature is not so injuriously affected by changes of temperature as a similar vessel having walls of greater substance, and in order that the said invention may be more clearly understood and readily carried into effect I will proceed, aided by the accompanying drawings, more fully to describe the same.

In the drawings, Figure 1 is a side elevation representing an apparatus constructed according to the present invention, but showing the die removed and the stopper or cover in position. Fig. 2 is an end elevation thereof. Fig. 3 is a horizontal section thereof, but showing the stopper or cover removed and the die in position. Fig. 4 is a transverse section of part thereof, taken on the line 1 1 of Fig. 3; and Fig. 5 is a similar view to Fig. 3, but showing the die removed, the cap replaced, and the pressure-chamber or container turned into its vertical position in readiness to receive a charge. Figs. 6 to 10 represent modified forms of the pressure-chamber or container. Fig. 11 is a plan of the disk shown in use at Fig. 3. Fig. 12 is a transverse section thereof. Fig. 13 is a transverse section of a disk having a dished form given thereto. Fig. 14 is a similar view of a disk having a corrugated form given thereto. Fig. 15 is a plan of an annular dished ring answering the same purpose, and Fig. 16 is a transverse section thereof.

In the several figures like parts are indicated by similar letters of reference.

Referring to Figs. 1 to 5, *a* represents the frame of the apparatus, and *b* represents the pressure-chamber or container, which is provided with trunnions *b'*, by means of which it is mounted in the frame *a*, as hereinafter more fully described.

c represents the ram or plunger.

b^+ represents the molten metal within the pressure-chamber or container b. d represents the die through which the same is expressed by the ram or plunger c, and $b^{+\prime}$ represents the rod or bar of metal issuing from the die d.

The pressure-chamber or container b is formed with an interior lining b^2 of comparatively slight substance and having cylindrical or at any rate parallel interior walls and which is open at both ends, while the external face or wall of the lining b^2 is tapered or coned, and around the same is fitted a tubular casing b^{3+}, the internal face or wall of which is correspondingly tapered, while around the latter are arranged several, or there might be only one, tubular and comparatively thin casings b^3, formed of wrought-iron or steel, a space being left around each casing b^3, the whole being contained within a strong outer casing or belt b of wrought-iron or steel and forming in its entirety what I have termed the "concentric tube construction." Into each of the said spaces is interposed in any desired manner the non-conducting material b^4—such as granite—in small pieces, (by preference together with a small quantity of borax,) or any other suitable heat-non-conducting material might be employed in lieu thereof; but it must be a material of such a nature that it will not injuriously affect the lining or casing b^2 of the container or pressure-chamber b nor melt nor become decomposed at the high temperature of the metal b^+, contained within the lining of the pressure-chamber. The spaces filled with (heat) non-conducting material b^4 are inclosed at both ends by means of rings b^5 of iron or steel in order to afford an abutment for and to inclose and prevent the escape of the non-conducting material b^4. These rings are not in metallic contact with the casings b^3, but are separated therefrom by asbestos or other suitable non-conducting material b^6.

The ram or plunger c of the press, which is provided with an extension-block c', adapted to be removed and heated, as hereinafter described, is introduced into the lining b^2 of the pressure-chamber b at the broad end of the conical or tapered exterior thereof, by which means the pressure exerted by the ram c will tend to tighten the lining b^2 in its conical casings b^{3+} b^3, thus preventing any possibility of the lining b^2 being forced therethrough.

The outer belt or casing b of the pressure-chamber is mounted upon trunnions b', as hereinbefore described, and one of these trunnions has fixed therewith a worm-wheel b^7, which engages a worm e, formed upon a shaft e', mounted with capability of revolution in bearings in an offset or bracket from the frame a, and the shaft e' has fixed thereon a beveled-toothed wheel e^2, which engages a corresponding wheel e^3, fixed upon one end of a shaft or spindle e^5, the other end of which is furnished with a crank-handle e^6, by the aid of which the pressure-chamber or container b may be turned upon its axes b' at the times desired into the position represented at Fig. 5 in order to facilitate the filling of the casing b^2 with heated or molten metal, and at this time the lower end of the lining b^2 is temporarily closed by a suitable cap or stopper b^8, held in position by a strap b^9, as will be seen more clearly upon reference to Figs. 1, 2, and 5, and which is removed when the die d is being placed in position.

No exterior heat is generally employed, but the molten metal is introduced directly into the lining b^2 of the chamber or container b, and in cooling down to a plastic condition, which is the desirable condition in which to work it efficiently, heats the comparatively thin lining b^2 of the pressure-chamber or container to the required high temperature evenly throughout its substance, while the heat is to a great extent retained by the jacket or jackets of non-conducting material b^4, and the casings b^3 are thereby protected from the extreme heat, and consequently retain their full strength.

The ram c acts upon the heated metal b^+ through the intervention of the loose block or cylinder of metal c', as will be seen upon reference to Fig. 3, which enters the lining b^2 and bears upon the heated metal b^+, and this loose block c' is made separate from the ram c in order that it may be heated previous to being brought into action and the cooling thereby of the heated metal b^+ thus avoided, while it is formed of such diameter that when expanded by heat it will slide freely within the lining b^2.

That part of the ram or plunger c which enters the lining b^2 of the pressure-chamber or container b is formed of smaller diameter than the bore of the lining b^2, so that it will not come into contact therewith; otherwise it would, in following up the heated loose block c', tend to cool the lining b^2.

When charging the lining b^2 with heated metal, a space must be left for the introduction of the loose heated block c', and in order to prevent the plastic metal b^+ in advance of the loose block c' being forced between the same and the walls of the lining b^2 a dished or beveled metal plate or check-disk c^2, which may also have been previously heated, is placed between the heated metal b^+ and the loose block c' of the ram c. This dished or beveled plate or disk c^2 is formed of a metal or alloy that is less plastic and more rigid than the heated metal b^+ at the working temperature, and under the pressure of the loose block c' the disk or plate c^2 spreads and closely fits the lining b^2 and constitutes an efficient check against the passage of the metal b^+ under pressure past the loose block c'.

The end of the ram c and the corresponding end of the loose block c' are formed the one with a conical hemispherical or other suitable projection and the other with a corresponding recess, as shown at Fig. 3, so that the block c' may be centralized with relation to the ram c, and the latter supported and guided by the block c' during the advance of the ram or plunger c.

By constructing a compound pressure-chamber or container b in the manner hereinbefore described the lining b^2, which is exposed to the extreme heat of the metal b^+ under treatment, may be made with comparatively thin walls, and thus will not be liable to fracture caused by unequal heating and cooling, while it is reinforced so as to render it capable of withstanding the necessary pressure by means of the casings b^3 and the outer casing or belt b, which are insulated by the packing of non-conducting material b^4, and are therefore kept at a comparatively low temperature and in a condition to offer the greatest resistance, while should the lining b^2 become injured it can easily be removed and replaced.

When first commencing work, the non-conducting material b^4 is sometimes not as tightly packed as is desirable, and consequently the highly-heated lining b^2 then slightly bulges under the pressure of the ram or plunger c; but when this occurs it is easily corrected by reboring the interior of the lining b^2 and thus truing it to its desired form.

The heated metal b^+ may be introduced into the lining b^2 of the pressure-chamber or container b in a plastic state, and in this case and as represented at Fig. 5 the lining b^2 is previously heated by means of a gas-jet f, contained within a cylinder f', which registers with the bore of the casing b^2 when the latter is turned into the position indicated in Fig. 5; or a heated metal block or billet g might be employed in lieu thereof and removed after the lining is brought to the required heat.

It is desirable that the die d through which the metal b^+ is squeezed and the die-holder d' should be heated previous to each operation, and to enable this conveniently to be done the die d is made to fit into a shouldered recess in the die-holder d', and the die-holder d' is beveled or coned to removably seat into a hollow metal block d^2, which is formed with an annular groove to receive the gripping-jaws d^3 of the holding device, which may be actuated by any suitable power, but preferably by hydraulic power.

In the example hereinbefore given the lining is upon its exterior slightly tapered, and is by a casing b^{3+}, which is upon its interior, correspondingly tapered to closely fit the lining b^2 without the intervention of a wall of packing or non-conducting material, while the outer casings b^3 are protected by walls of packing or non-conducting material b^4, as hereinbefore described. By this arrangement of parts the lining b^2 may be removed and replaced without disturbing the packing or non-conducting material b^4. It will, however, be understood that, if desired, and as represented at Figs. 6, 7, 8, and 10, a wall b^4 of non-conducting material may separate all the casings b^3.

In the example given at Fig. 6 a modification of the device hereinbefore described is shown in which the pressure-chamber b is constructed in such manner that the ram may be inserted from either end of the casing b^2, and for this purpose the exterior walls of the lining b^2 take the form of a double cone, and the casings b^3 are correspondingly shaped, the non-conducting material b^4 being filled in between them, as hereinbefore described, while the spaces at each end of the device containing the non-conducting material b^4 are closed by means of rings b^5 for the purpose hereinbefore described with respect to the previous arrangement. In this case the casing b^{3+} immediately surrounding the lining b^2 is dispensed with.

In the example given at Fig. 7 the outer wall of the lining b^2 and the casings b^3, instead of being formed conical, as hereinbefore described, are formed stepped, so that the pressure will not separate or telescope them.

In the example given at Fig. 8 the outer wall of the lining b^2 and the walls of the casings b^3 are formed with projections and recesses therein for the purpose hereinbefore expressed, while in this example the end of each space filled with granite b^4 is closed by means of a separate ring b^5, and instead of the outer belt or casing b being formed of considerable thickness it is formed of about the same substance as the other casings b^3.

In the example given at Fig. 9 the lining b^2, the outer casing b, and the several casings b^3 are at one end formed with interlocking projections inclosed by a ring b^5, while at the other end the casings would be formed plain and inclosed by a ring or rings b^5.

In the example given at Fig. 10 the device is constructed in substantially the same manner as that represented with reference to Figs. 1 to 5, except that in this case, and as previously explained, the casing b^{3+}, closely fitting the lining b^2, is dispensed with, while the spaces filled with granite b^4 are closed by separate rings b^5.

In the examples given at Figs. 11 to 16 various forms of disks or rings c^2 are represented, the form of which will be readily understood by the aid of the description of these figures and the drawings and the use of which is similar to that described with respect to the disk c^2. (Shown in action at Fig. 3.)

By the means hereinbefore described the apparatus at a small additional cost is rendered much more efficient than heretofore inasmuch as it is comparatively unaffected by the pressure and variations of temperature.

What I claim is—

1. In apparatus for treating heated metals under pressure, the combination of a pressure-chamber or container consisting of a tube or lining of suitable metal open at both ends and surrounded by a series of concen-

tric spaced tubes open at both ends and having interposed between them heat-insulating or non-conducting material, means for preventing the escape of such material, a die and a ram or plunger for pressing the heated metal through the die, substantially as herein shown and described and for the purpose stated.

2. In apparatus for treating heated metals under pressure, a pressure-chamber or container consisting of a tube or lining of suitable metal open at both ends and surrounded by a series of concentric spaced tubes open at both ends and having interposed between them, heat-insulating or non-conducting material and provided with stop-rings at each end for preventing the escape of such material, substantially as herein shown and described, and for the purpose stated.

3. In apparatus for treating metals under pressure a pressure-chamber or container consisting of a tube or lining of suitable metal open at both ends and surrounded by a series of concentric spaced tubes open at both ends and having interposed between them, heat-insulating or non-conducting material, suitable means at each end for preventing the escape of such material, the said lining and tubes being of taper form so that they will not become separated by the pressure exercised upon the heated metal within the lining, substantially as herein shown and described and for the purpose stated.

4. In apparatus for treating heated metals under pressure, a pressure-chamber or container consisting of an exteriorly-tapered tube or lining of suitable metal open at both ends and closely embraced by a correspondingly interiorly-tapered casing open at both ends, the lining and the tapered casing being surrounded by a series of concentric spaced tubes with heat-insulating or non-conducting material interposed between them, the parts being formed to interlock in one direction so that by reversing the direction of the pressure, the lining may be forced out of the tapered casing without disturbing the heat-insulating or non-conducting material, substantially as herein shown and described.

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