No. 881,927. PATENTED MAR. 17, 1908.

J. ILLINGWORTH.

INGOT COMPRESSING APPARATUS.

APPLICATION FILED JUNE 28, 1906.

3 SHEETS—SHEET 1.

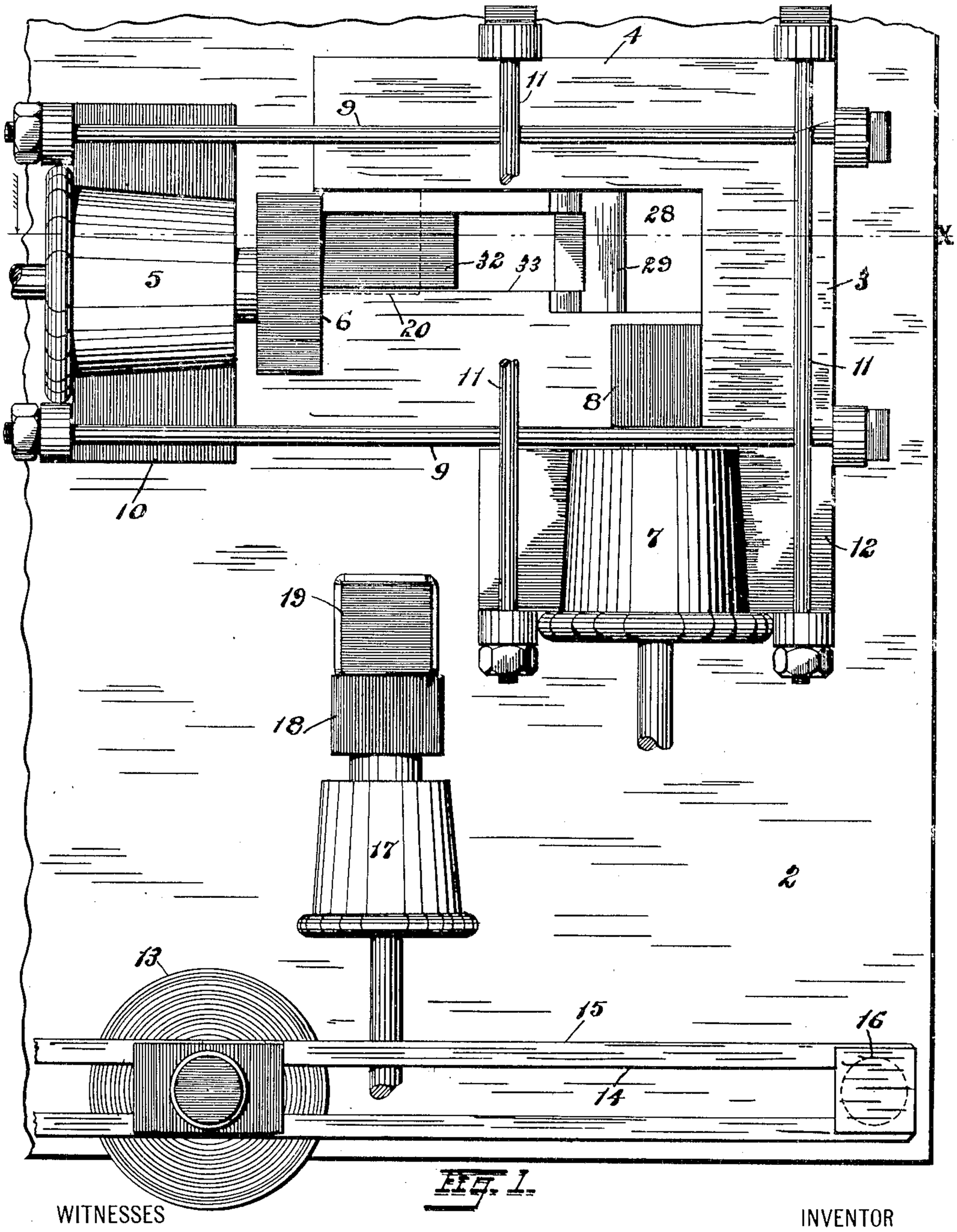

FIG. 1.

WITNESSES

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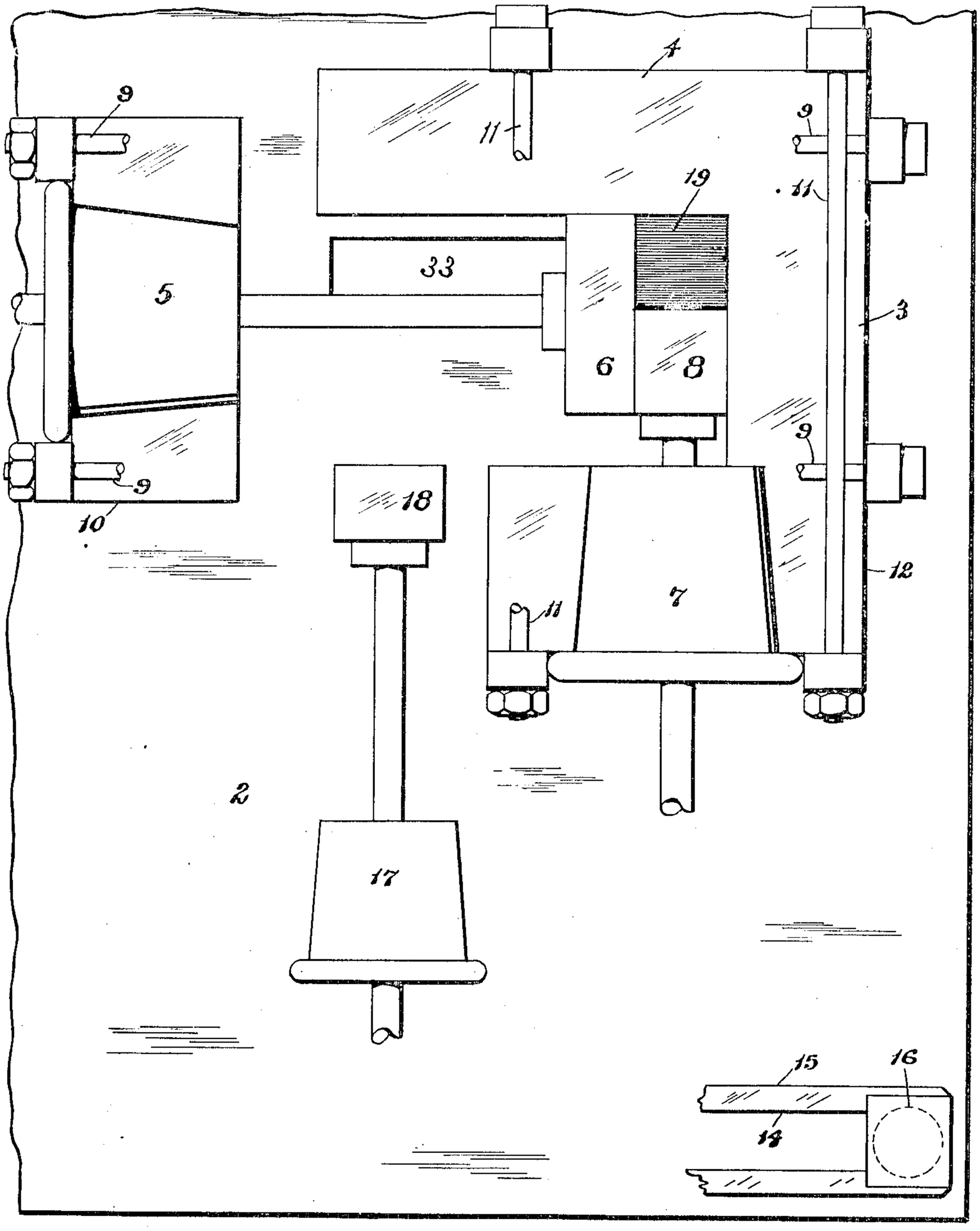

Fig. 2.

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3 SHEETS—SHEET 3.

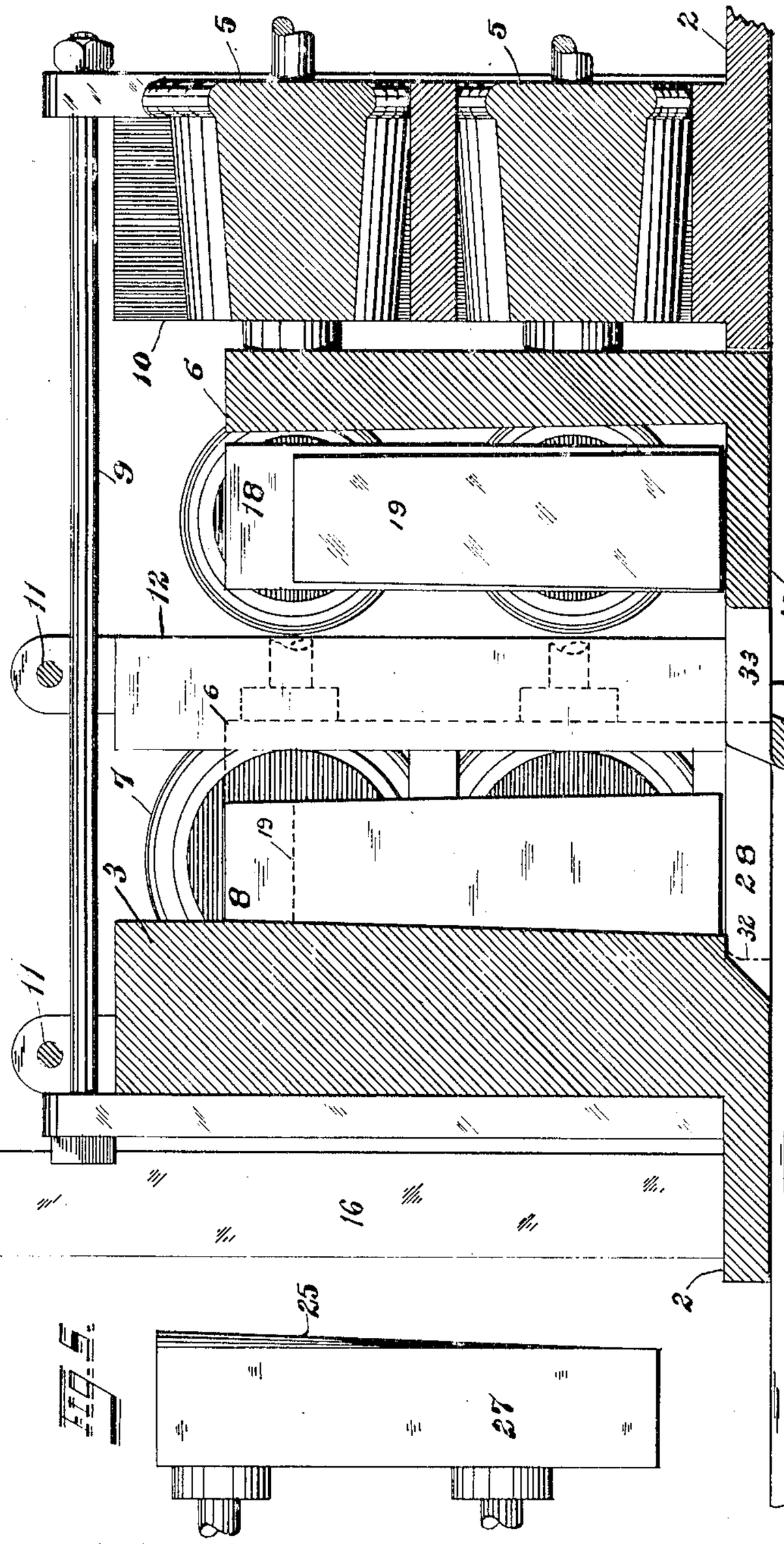

FIG. 5.

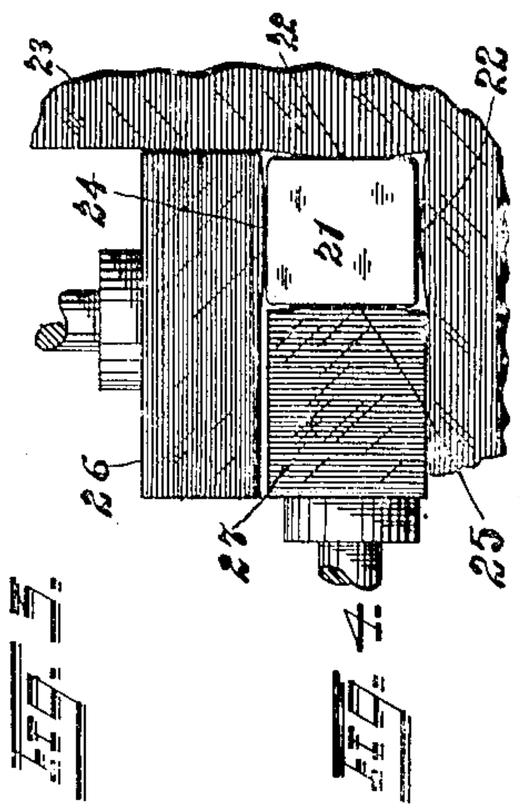

FIG. 4.

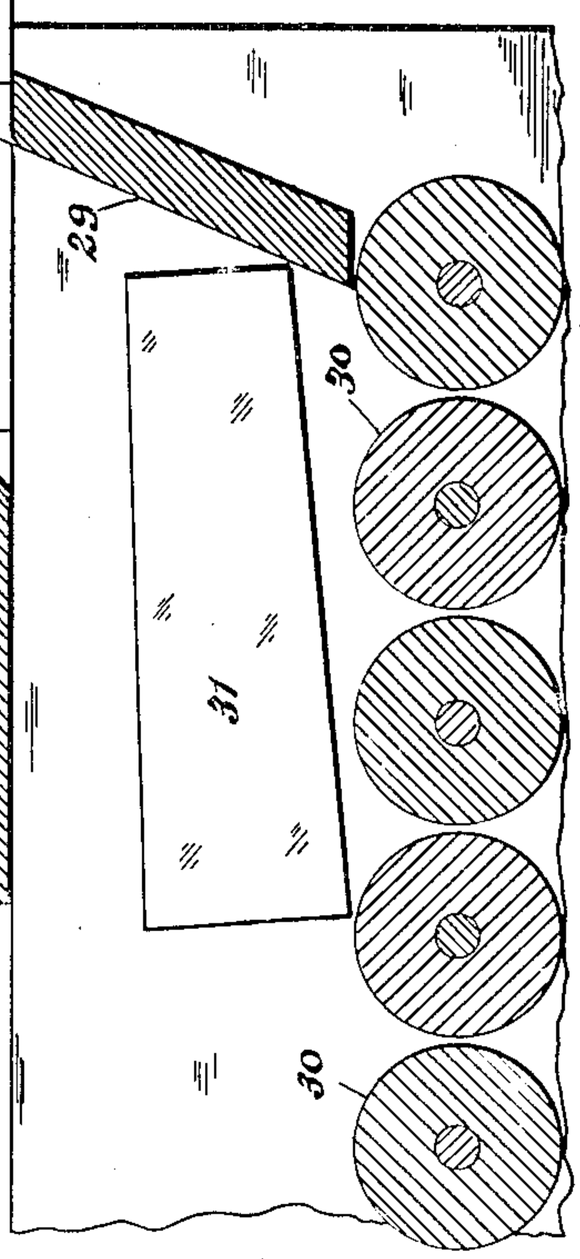

FIG. 3.

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INGOT-COMPRESSING APPARATUS.

No. 881,927. Specification of Letters Patent. Patented March 17, 1908.

Application filed June 28, 1906. Serial No. 323,822.

To all whom it may concern:

Be it known that I, JOHN ILLINGWORTH, a citizen of the United States, residing at Newark, county of Essex, and State of New Jersey, have invented new and useful Improvements in Ingot-Compressing Apparatus, of which the following is a specification.

This invention relates to the art of casting ingots as illustrated by my prior patents No. 594,157 of November 23, 1897, No. 644,918 of March 6, 1900, and No. 810,654 of January 23, 1906, and the objects of the present improvements are to enable the ingot to be compressed directly, or without the intervention of the mold, for the removal or prevention of piping; to thus eliminate the strain and wear upon the molds, as well as their liability to breakage under the severe pressure; to thus reduce expense; to enable either a sectional or solid mold to be employed in connection with compression of the ingots; to locate the pressure where it will be most effective upon the sides of the ingot and thus economize force or power; to secure more effective pressure of the ingot and thus a better product; to obtain a quick release of the ingot after it has been compressed, and to secure other advantages and results which may be brought out in the following description.

Referring to the accompanying drawings, in which like numerals of reference indicate corresponding parts in each of the several figures, Figure 1 is a plan of a machine of my improved construction showing an ingot just entering the same; Fig. 2 is another plan similar to Fig. 1 except that it shows the ingot just about to be released from compression; Fig. 3 is a vertical section on line *x*, Fig. 1, and showing a compressed ingot just discharged; Fig. 4 is a detail plan of an ingot being compressed by rams with rounded faces, and Fig. 5 is a side elevation of one of such rams.

It will be understood that heretofore in the art, as shown by my prior patents, the ingot has been compressed while still in its mold, and to this end the mold has been made sectional with filler pieces to be removed, or wedges to be inserted in a solid mold, and so both mold and ingot have received the pressure together. As a result the molds have been liable to be broken or damaged, and inasmuch as the construction of said molds involves much labor and expense, their breakage is a considerable item. By my present improved method herein set forth, the ingot is removed from its mold while yet partially soft and subjected to pressure directly and alone, without the mold.

In carrying out this method, after the molten metal has been poured in any ordinary and well-known manner, the ingot is allowed to cool slightly so as to solidify at its outer portions next the mold and is then removed from said mold either by its natural shrinkage or by the use of a stripper or in any other suitable manner. After this removal, and while the central portion of the ingot is still soft, it is subjected to compression by any suitable means such as one of those which will be hereinafter described. Preferably this pressure is applied to the lateral sides of the ingot and initially at a point directly opposite the point of greatest piping or shrinkage.

Coming now to a description of the apparatus employed in carrying out my invention, Figs. 1 to 5 inclusive show a construction which is preferred for large ingots, or such as weigh several tons. In these drawings, 2 indicates a suitable base or bed-plate for the machine and upon which its various parts are arranged. Extending upward from this bed-plate 2 are walls or plates 3, 4, preferably at right angles to each other and it is in the corner between the bed-plate 2 and upright plates 3, 4, that the ingot is compressed. To effect such pressure a pair of vertically arranged hydraulic cylinders 5 are arranged opposite the upright plate 3, their pistons carrying at the end next said plate 3, a vertically disposed ram 6; this ram by the operation of the hydraulic cylinders moves toward the compression plate 3 along a line parallel to the face of the compression plate 4 and adjacent thereto. Similarly hydraulic cylinders 7 are arranged opposite the compression plate 4 and carry a ram 8 which moves parallel to the compression plate 3 to press against the compression plate 4. Tie rods 9, 9, bind the frame 10 of the cylinders 5 to the compression plate 3 and other rods 11, 11, serve in a similar capacity with reference to the frame 12 of the cylinder 7 and the compression plate 4, so that great rigidity is attained.

The ingot is brought to the compression machine by means of a stripper 13, adjustably mounted in the slide-way 14, of a crane-arm 15, adapted to swing upon a vertical

pivot 16, so that the ingot can be deposited wherever desired. This stripper is of any ordinary construction common in the art, and is adapted to bring the ingot in its mold and force the same out of said mold in delivering it. Preferably an auxiliary hydraulic cylinder 17 and ram 18 are employed upon the bed-plate 2 to push the ingot 19 from where it is delivered by the stripper, into position in front of the ram 6, as shown in dotted lines at 20 in Fig. 1. The ram 6 is then moved forward to bring the ingot against the compression plate 3, and then the ram 8 advanced so that the parts of the machine appear in the positions shown in Fig. 2. Compression of the ingot then occurs, and obviously the walls of the rams and compressing plates may be inclined or otherwise shaped to correspond to the ingot. Furthermore, since the piping of an ingot occurs increasingly toward its top, the faces of both the rams and compression plates are wedge-like from the top downward, and also rounded transversely, all as shown in Figs. 4 and 5, because the piping is only at the center of the ingot. In said Figs. 4 and 5, 21 indicates an ingot being compressed between such rounded faces 22 of compression plates 23, and 24, 25 of rams 26, 27. After compression, the ingot should be released as quickly as possible in order to pass onward to the furnace and allow another one to take its place, without loss of time and heat, and for this purpose I have provided in the bed-plate 2 an opening 28 through which the ingot may fall as soon as the rams are slackened, and be directed by a guide 29 onto conveyer rollers 30 adapted to transport it wherever desired, the reference numeral 31 in Fig. 3, indicating an ingot being thus discharged from the machine. To support the ingot while being compressed, the ram 6, has a foot or ledge 32 adapted to slide in the opening 28, and an extension 33 thereof, flush with the bed-plate 2, to carry the ingot, as shown in Fig. 3 more particularly.

Obviously neither the stripper nor a solid mold is essential to my invention, but a sectional or divided mold could be employed, the only new feature being to remove the ingot from the mold and thus secure a more effective pressure.

The term "ram" is used herein to designate any suitable pressure exerting means, whether operated by hydraulic cylinders or otherwise.

Having thus described the invention, what I claim is:—

1. Ingot-compressing apparatus comprising in combination ingot supporting and holding means forming a backing for one end and certain of the sides of an ingot, and pressure-exerting means adapted to act on the remaining side portions of an ingot so held.

2. Ingot-compressing apparatus comprising in combination ingot supporting and holding means forming a backing for certain of the sides of an ingot, and pressure-exerting means adapted to act on the remaining side portions of an ingot so held and comprising a seat on which an ingot held between said backing and pressure-exerting means will rest.

3. In an ingot compressing apparatus, the combination of fixed plates adapted to engage a portion of the sides of an ingot, a ram adapted to engage another portion of the sides of the ingot, and having a seat for the bottom end of the ingot, and a second ram adapted to engage the remaining portion of the sides of the ingot.

4. In an ingot compressing apparatus, the combination of means forming a backing for certain of the sides of an ingot, pressure exerting means adapted to act on the remaining side portions of the ingot, and a movable support for one end of the ingot adapted to be operated by said pressure exerting means.

5. In an ingot compressing apparatus, the combination of compression plates forming a backing for certain of the sides of an ingot, and two independently operated pressure exerting means, one of them having a seat for the end of the ingot.

6. In an ingot-compressing machine, the combination of compression plates forming between themselves an angle providing a seat for an ingot, a plurality of rams adapted to engage said ingot from different directions and compress it against the said plates, and means for operating said rams.

7. In an ingot-compressing machine, the combination of a seat for one end of the ingot, supporting means forming a backing for certain of the sides of the ingot on said seat, and movable compressing means adapted to engage the remaining side portions of the ingot on said seat and coöperate with said seat and backing in inclosing and pressing the ingot.

8. The combination with the bed-plate, of upright compression plates arranged at substantially right angles to each other, and rams moving one parallel to each of the said compression plates, adjacent thereto, and means for operating said rams.

9. The combination with the bed-plate, and upright compression plates arranged thereon at an angle to each other, of rams moving one parallel to each of the faces of said compression plates, cylinders and pistons for operating said rams and tie rods connecting each compression plate to the cylinder opposite it.

10. In an ingot compressing apparatus, the combination of compression plates forming a backing for certain of the sides of an ingot, a plurality of independent pressure exerting means adapted to engage said ingot

from different directions and compress it against said plates, and means for passing an ingot through the apparatus.

11. In an ingot-compressing machine, the combination of the bed-plate having an aperture therein, compression plates on two sides of said aperture extending upward from the bed-plate, rams on the other two sides of the aperture, each adapted to be moved towards and away from its opposite compression plate; and trap means for holding the ingot in place while being pressed and adapted to allow it to drop through said opening when released.

12. The combination with the bed-plate having an opening therein, of compression plates arranged on two sides of said opening, rams on the other two sides of said opening adapted each to move toward and away from its opposite compression plate, trap means adapted to support the ingot while being compressed and allow it to drop downward when the rams are withdrawn, and conveying means beneath said bed-plate to receive the ingot.

13. The combination of a bed-plate having an opening therein and a slot extending from one side, compression plates partly surrounding said opening, a ram adapted to coöperate with said plates in compressing an ingot, means for operating said ram, a foot on said ram normally lying in said slot and adapted to project into the opening to support the ingot while being compressed.

14. The combination of a bed-plate having an opening therein with a slot extending from one side, compression plates extending upward from said bed-plate at two adjacent sides of its opening, rams working one parallel to the face of each of said compression plates against the face of the other, and a foot on one of said rams normally lying in the slot of the bed-plate flush therewith and adapted to project into the said opening.

15. The combination with two compression plates arranged at substantially right angles to each other and adapted to receive an ingot in said angle, of rams one working parallel to the face of each compression plate against the other, one of said rams being of greater width than the ingot and adapted to overlap the same, and the other ram being of substantially the width of the ingot and adapted to enter inside the first ram, and means for operating said rams.

16. In an ingot compressing apparatus, the combination with supporting means forming a backing for certain of the sides of an ingot, and other supporting means forming a seat for one end of said ingot, said two supporting means being one movable with respect to the other, of pressure exerting means adapted to act on the remaining side portion of the ingot.

JOHN ILLINGWORTH.

Witnesses:

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ETHEL B. REED.