

(No Model.)

W. F. DURFEE & N. B. WITTMAN.

APPARATUS FOR REMOVING GASES FROM MOLTEN METAL.

No. 448,944.

Patented Mar. 24, 1891.

Fig. 1.

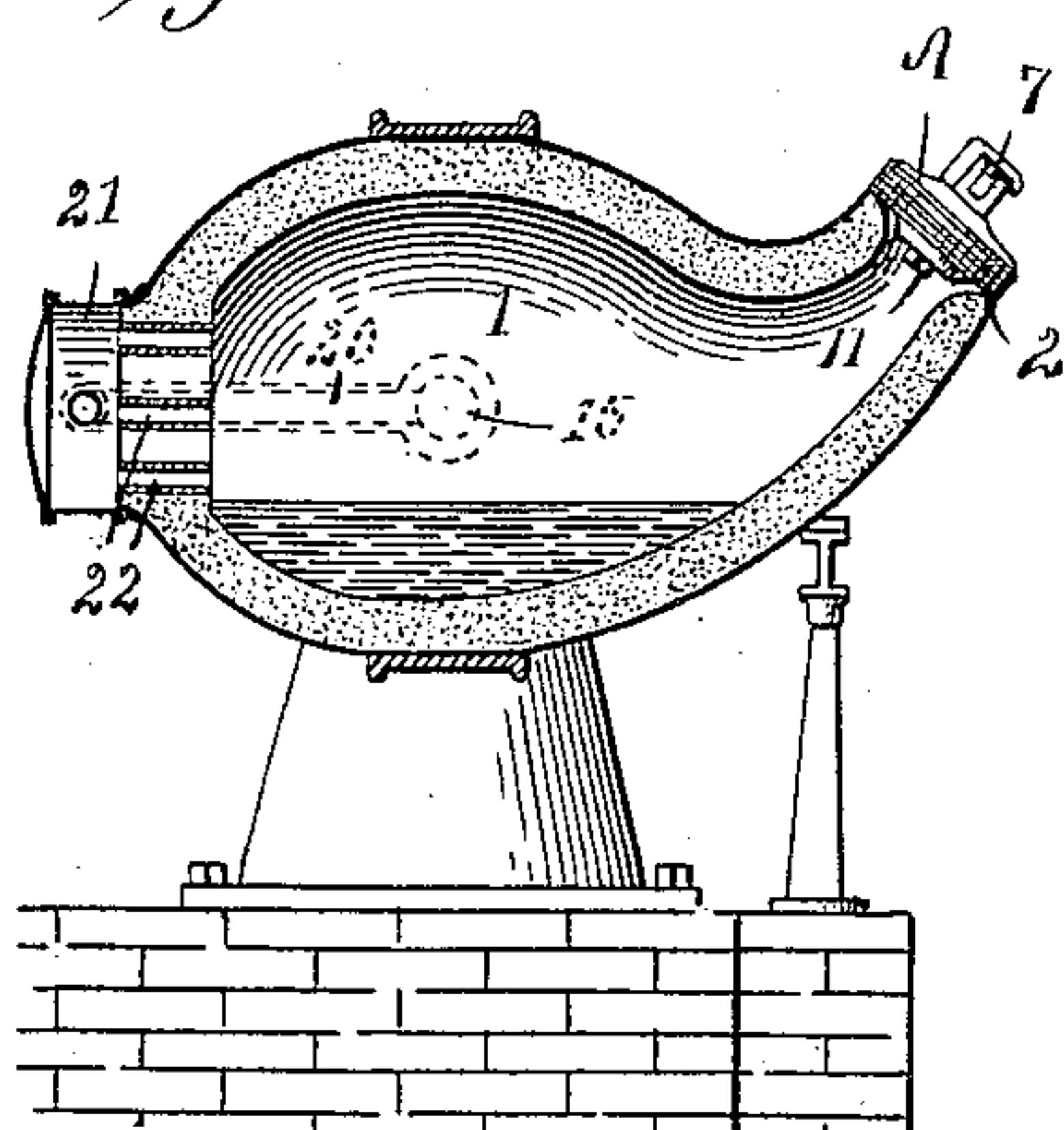


Fig. 2.

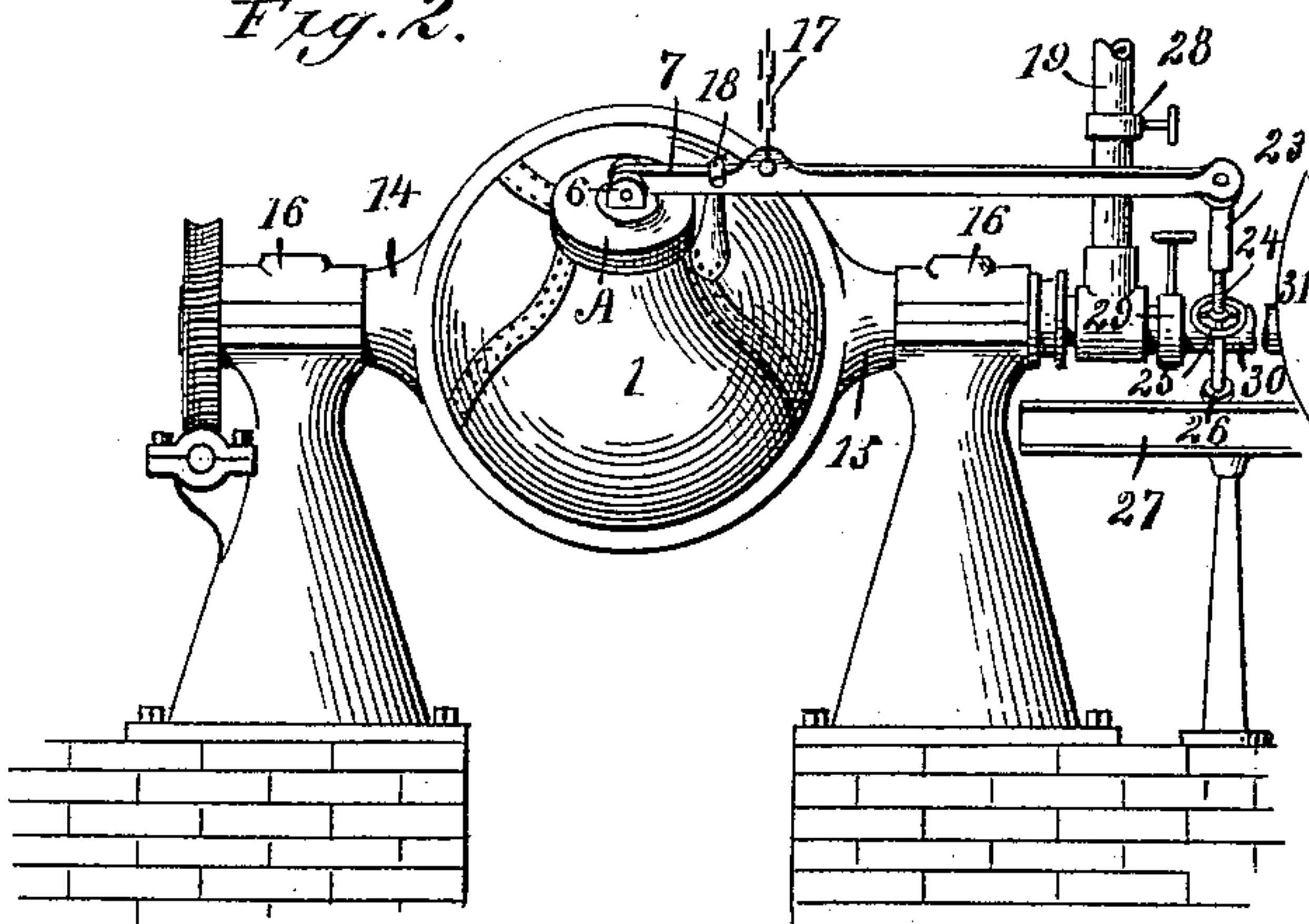


Fig. 3.

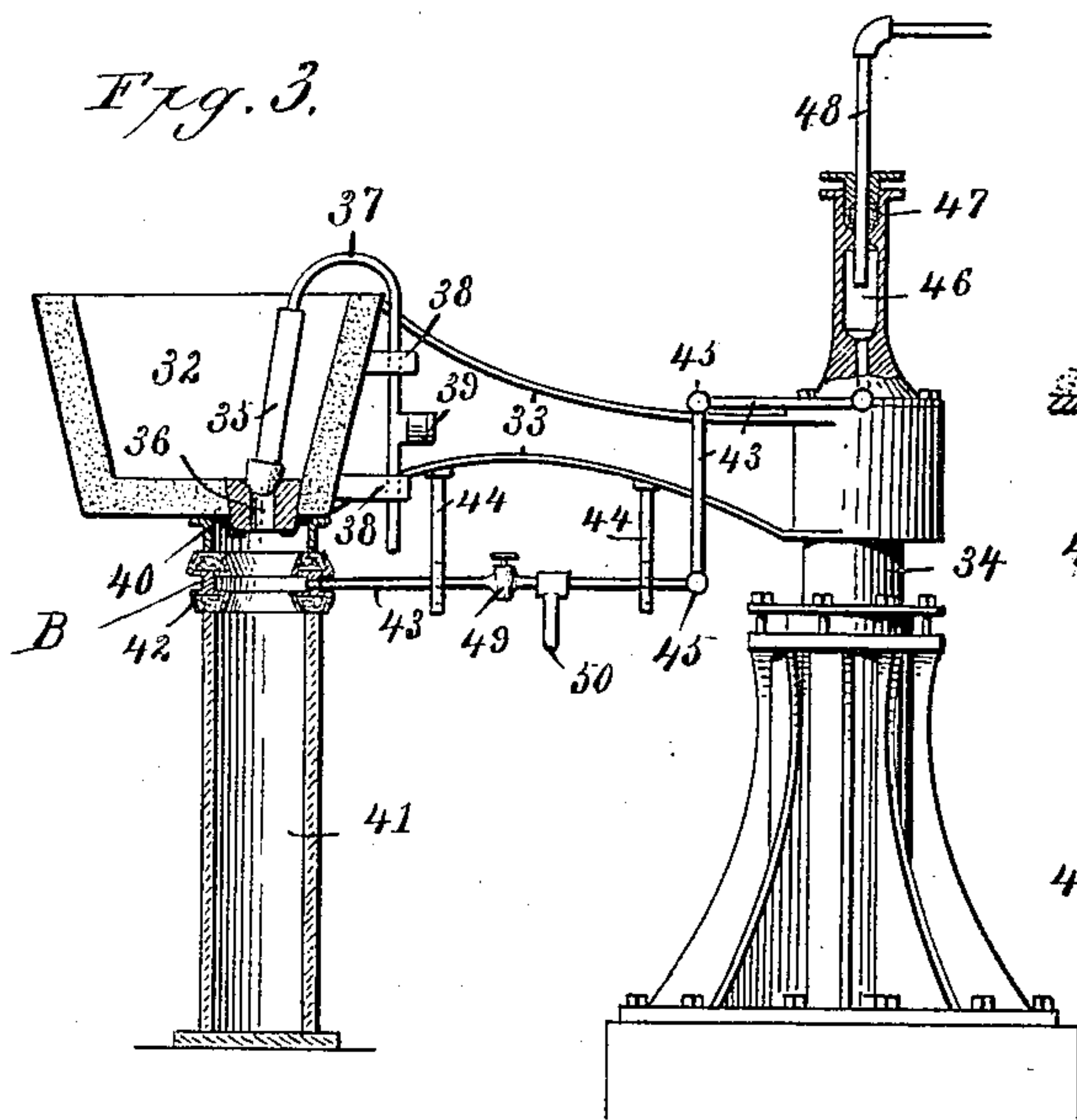


Fig. 5.

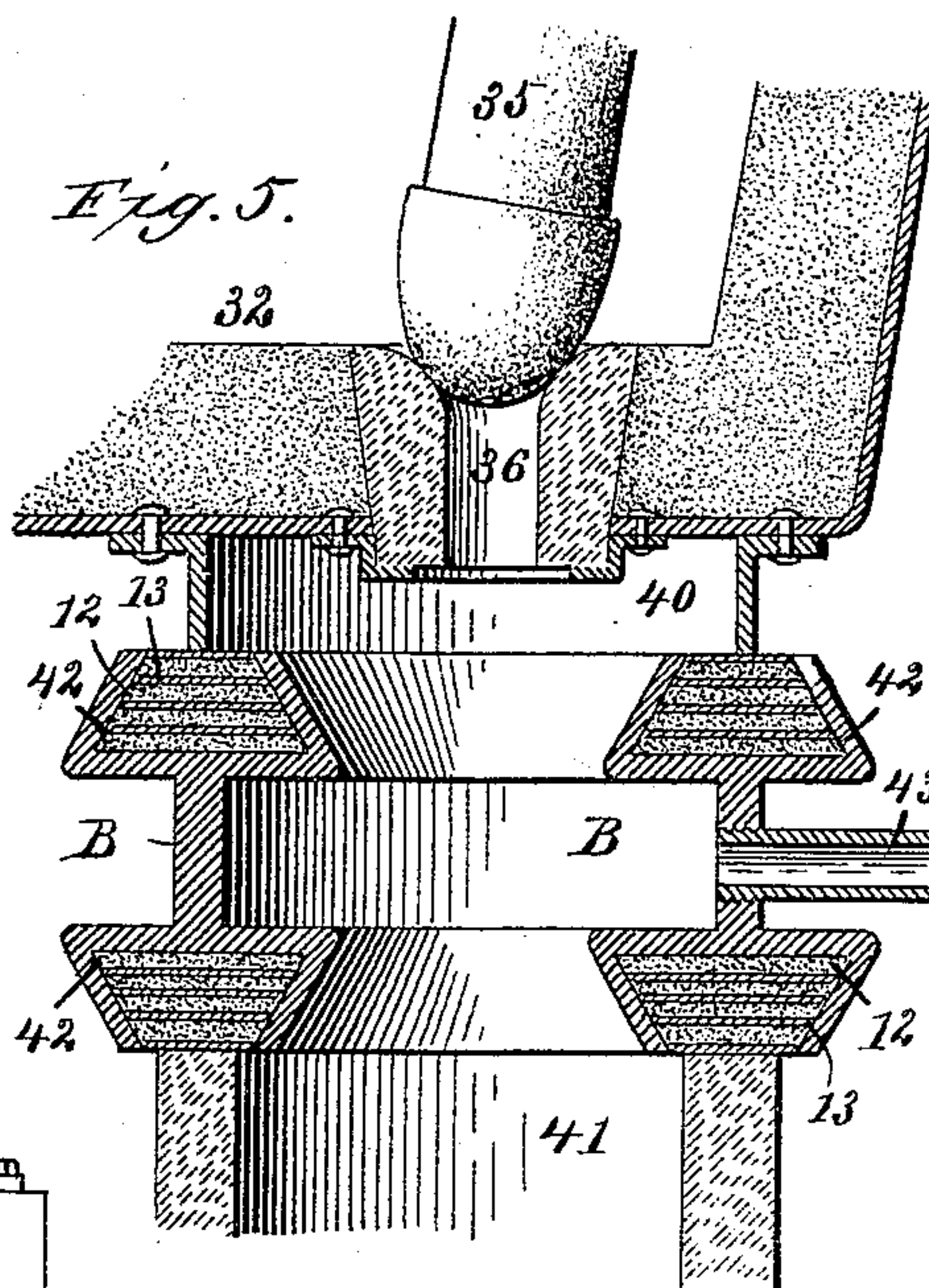
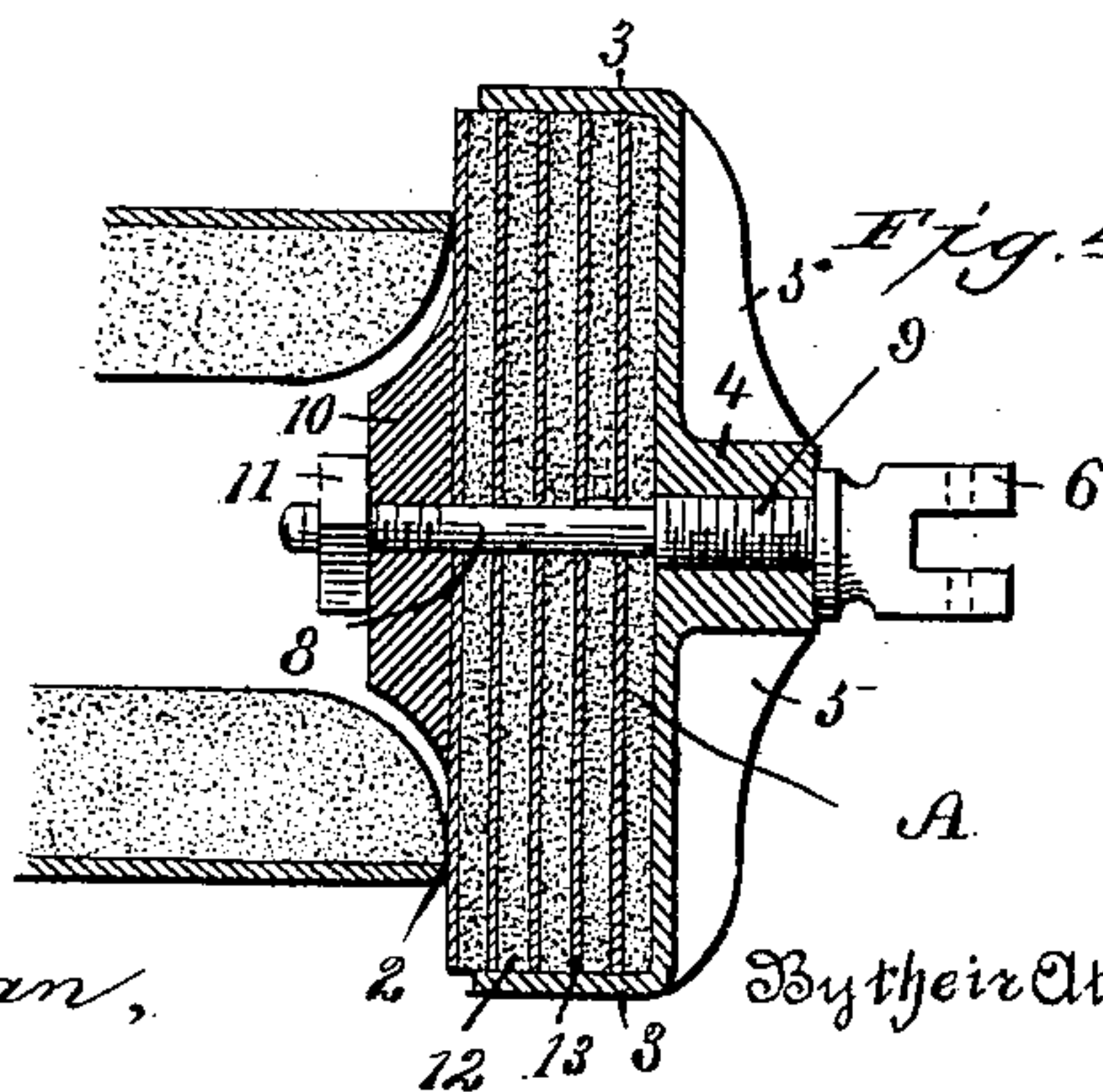


Fig. 4.



Witnesses

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APPARATUS FOR REMOVING GASES FROM MOLTEN METAL.

SPECIFICATION forming part of Letters Patent No. 448,944, dated March 24, 1891.

Application filed March 17, 1890. Serial No. 344,136. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM F. DURFEE and NOEL B. WITTMAN, citizens of the United States, residing at Birdsborough, in the county of Berks and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Removing Air and Gas from Molten Metal; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention has for its object the production of steel ingots which shall be free from what are commonly known as "blow-holes" and similar imperfections caused by air and other gases becoming mechanically mixed with or occluded in the metal. We thereby produce a quality of metal which is especially adapted for the manufacture of heavy shafting, gun-forgings, and other articles in which it is important that the metal should possess the greatest possible soundness and strength.

With these ends in view we have devised the novel apparatus for removing air and other occluded gases from molten metal, and also special mechanism operating in connection with a tilting converter, which we will now describe, referring by letters and numbers to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a longitudinal section of an ordinary Bessemer converter in operative position; Fig. 2, a front elevation thereof; Fig. 3, a longitudinal section of the casting-ladle and the mold, with the exhausting-ring thereon, showing the crane which carries the casting-ladle in elevation; Fig. 4, a sectional view, on an enlarged scale, of the muzzle-stopper for the converter; and Fig. 5 is a sectional view, on an enlarged scale, of the top of the ingot-mold, the exhausting-ring, and the bottom of the casting-ladle.

1 denotes the converter, 2 the muzzle or mouth thereof, and A the stopper, which we preferably construct as follows, (see Fig. 4:)

3 denotes a cylindrical cap, having a hub 4 cast on the center of its top, the cap and hub being braced and strengthened by means of radial ribs 5.

6 denotes a yoke, to which lever 7, by which

the stopper is operated, is pivoted. This yoke is provided with a shank 8, a portion of which is threaded, as at 9, to engage an internal screw-thread in hub 4, the reduced end thereof passing through the filling of the stopper and through a metal washer 10, the parts of said stopper being rigidly clamped together and held in position by means of a key driven through a transverse slot at the end of the shank, or, if preferred, by means of a nut 11, engaging a thread at the end of the shank, as shown in Fig. 4. The filling of the stopper consists, preferably, of alternate layers of clay (denoted by 12) and asbestos cloth, (denoted by 13.) It will of course be understood that any suitable or convenient number of layers of clay and asbestos cloth may be used in the stopper, and that felt or other kinds of cloth may be substituted for asbestos cloth, if preferred, the object being to provide a filling that will be refractory and air-tight and that will yield and cohere while being compressed.

17 denotes the end of a chain by which lever 7 is suspended from the arm of a crane or any other suitable means for supporting and manipulating said lever and its attachments.

18 denotes a hook upon the converter under which lever 7 is swung and which acts as a fulcrum for said lever, as will be more fully explained.

The converter is provided with trunnions 14 and 15, one of which, the latter, as shown in the drawings, is made hollow. These trunnions are adapted to turn in suitable boxes 16 on the tops of the standards. The blast is supplied to the converter by a suitable engine (not shown) through a pipe 19, the hollow trunnion 15, and a pipe 20, leading from said trunnion to the tuyere-box 21, from whence the blast passes into the converter through tuyeres 22. It will of course be understood that during that part of the ordinary process known as "the blow" the muzzle-stopper is removed from the mouth of the converter. At this stage of the process the converter is turned down and the spiegeleisen or other recarburizing material is added to the metal in the converter, or, in case the metal therein is so constituted as to require no such addition, the other steps of the process are

proceeded with. At the other end of lever 7 is pivoted an internally-threaded tube 23, which is engaged by a screw 24, having a hand-wheel 25 for convenience in operation.

5 The lower end of this screw rests in a step 26, which is secured to a suitable platform 27. As soon as the metal in the converter is ready for the application of the exhausting process the communication with the blast-engine is

10 cut off by closing valve 28 in pipe 19, the stopper is placed over the mouth of the converter, and lever 7 is passed under hook 18. As soon as the stopper is properly adjusted to the mouth and the lever engaged by the

15 hook the lower end of screw 24 is placed in the step 26 and the hand-wheel is rotated to raise the outer end of the lever and force the stopper tightly against the mouth of the converter, thereby effectually closing it. As soon

20 as the mouth of the converter is closed a valve 29 is opened in a pipe 30, which leads directly from the hollow trunnion (see Fig. 2) to a suitable vacuum-chamber or exhausted receiver 31, said chamber being indicated at

25 the right in Fig. 2. As soon as valve 29 is opened the air and heated gases within the converter and the metal contained therein will, by reason of the diminished pressure on the surface of said metal, escape rapidly and

30 completely therefrom and pass through the tuyeres, the tuyere-box, pipe 20, the hollow trunnion, and pipe 30 into the vacuum-chamber, it being understood, of course, that external air and gases are prevented from entering

35 the vacuum-chamber by the closing of the mouth of the converter and the valve in the pipe from the blast-engine. As soon as the air and gases have escaped from the converter and the metal contained therein into

40 the vacuum-chamber, valve 29 in pipe 30 is closed, thus cutting off all communication between the vacuum-chamber and the converter. Hand-wheel 25 is then turned backward, so as to lower the outer end of lever 7 and per-

45 mit said lever to be removed from under the hook, leaving said lever suspended by chain 17. Valve 28 in the blast-pipe is then opened, which admits air to the interior of the converter through pipe 20, the tuyere-box,

50 tuyeres, &c., thus counterbalancing the pressure of the external air on the stopper and permitting it to be swung away from the converter by means of the suspending-chain, after which the converter is turned down in the usual

55 manner and its contents poured through the mouth into a casting-ladle 32, which is attached to the arm 33 of a hydraulic or other crane so constructed that the casting-ladle can be raised or lowered at pleasure, and also made

60 to swing in a complete circle whose center is the post 34 of the crane. The casting-ladle is provided with a plug or stopper 35, which closes a tap-hole 36 in the bottom thereof. This stopper is carried by an arm 37, which

65 curves over the top of the casting-ladle and passes through guides 38 on the outer side thereof. A lug 39 is provided on arm 37,

which is adapted to be engaged by a suitable bar or lever (not shown) when it is desired to raise the stopper. On the under side of the casting-ladle and surrounding the tap-hole is rigidly secured a metallic ring 40.

41 denotes an ingot-mold of any ordinary or preferred construction. Before permitting the metal to pass from the casting-ladle into the ingot-mold we interpose between ring 40 and the ingot-mold an exhausting-ring B, which we preferably construct as follows, (see Fig. 5:) In the upper and lower faces of this ring are dovetail grooves 42, which are filled with alternating layers of clay and asbestos cloth, denoted, respectively, by 12 and 13. The exact number of layers is of course not of the essence of our invention. We use any number that may be found most convenient, the special object being the yielding refractory air-tight coherence of the filling under compression, as will be more fully explained.

43 denotes a pipe leading out from one side of the exhausting-ring. This pipe is made of sufficient strength to support the weight of the ring and is kept at its proper position by arms 44, which extend downward from the arm of the crane. The lower ends of these arms are provided with elongated openings, through which pipe 43 passes, thus permitting said pipe to be moved vertically, longitudinally, and axially, but retaining it in position against lateral movement.

45 denotes joints in pipe 43 similar to ordinary gas-pipe joints, which permit the pipe to be carried in any direction, in order to connect it with a chamber 46 on the top of crane-post 34. This chamber has at its top a stuffing-box 47, through which passes a pipe 48, the same size as pipe 43, which leads to a vacuum-chamber. This vacuum-chamber may be chamber 31, a portion of which is shown in Fig. 2, and which is described as connected with the converter, or a special vacuum-chamber may be provided, if preferred. Pipe 43 is provided with a valve 49, by which it is opened and closed, and with a handle 50, by which it may be moved longitudinally or vertically or axially, as may be required. When it is desired to tap the metal in the casting-ladle into an ingot-mold placed in proper position to receive it, the exhausting-ring B is placed upon the top of the mold, as clearly shown in Fig. 5, and the casting-ladle is lowered upon it, ring 40 upon the under side thereof coming in contact with the filling in the upper dovetail groove in said ring, and the filling in the lower dovetail groove being forced against the top of the ingot-mold, as clearly shown in Figs. 3 and 5.

In practice the casting-ladle is lowered until both the upper and lower fillings in the exhausting-ring are somewhat compressed by the weight of the ladle and its contents, so as to make practically air-tight joints between ring 40 and the upper filling and between the top of the ingot-mold and the lower filling. As soon as the casting-ladle has been lowered

sufficiently to insure perfectly-tight joints its downward movement is stopped and valve 49 in pipe 43 is opened, which permits the air in the ingot-mold to pass through said pipe 5 into the vacuum-chamber or exhausted receiver with which said pipe is connected. The ladle-stopper 35 is then raised by means of a suitable bar or lever acting on the lug 39, which permits the molten metal in the casting-ladle to pass out at the tap-hole and 10 through the exhausting-ring into the ingot-mold, which has previously been exhausted of air, as described.

We find in practice that by running a stream 15 of molten metal into a mold from which the air has been exhausted all the air and other occluded gases in said molten metal are caused to pass out therefrom while the stream is descending and to pass through pipe 43 20 into the vacuum-chamber. It is not necessary for the carrying out of the exhausting process that the vacuum in the vacuum-chamber or exhausted receiver should be perfect; but we preferably make it as nearly so as is practicable. 25

We wish it distinctly understood that we do not confine our invention to use in connection with the particular metal-holding devices described herein.

30 We have in our application, Serial No. 358,126, filed July 9, 1890, made claim to the closing-ring and apparatus shown in Figs. 3 and 5.

Having thus described our invention, we 35 claim—

1. A muzzle-stopper for converters, consisting of a cylindrical cap having a hub, infusible yielding material—for example, alternate layers of clay and asbestos cloth—within the 40 cap and exposed and adapted to rest directly upon the edge of the mouth of the converter,

a metal washer on the outside of the filling, and a shank passing through said washer, the cap, and the filling, whereby said parts are compressed together, as and for the purpose set forth. 45

2. The combination, with a converter having a hollow trunnion, a suitable stopper, a lever by which said stopper is carried, a chain by which said lever is suspended, and a hook 50 18 to engage said lever, of a threaded sleeve at the other end of said lever, a screw engaging said sleeve and acting to close the stopper against the converter, a fixed stop for said screw, a vacuum-chamber, pipes 19, 20, and 55 30, connecting the converter with an air forcing or blast device and with said vacuum-chamber, and suitable valves in said pipes, substantially as described.

3. A muzzle-stopper for converters, consisting of a cylindrical cap having a hub, layers of compressible material within the cap and exposed and adapted to rest directly upon the edge of the mouth of the converter, a metal washer on the outer side of the filling, and a 65 shank passing through said washer, the cap, and the filling, whereby said parts are compressed together, as and for the purpose set forth.

4. In combination with a vessel for receiving molten metal, a yielding closing device or valve comprising a rigid backing or support and alternate layers of clay and asbestos exposed and adapted to rest on the edge of the mouth of the vessel, substantially as set forth. 75

In testimony whereof we affix our signatures in presence of two witnesses.

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NOEL B. WITTMAN.

Witnesses:

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ALBERT FRITZ.