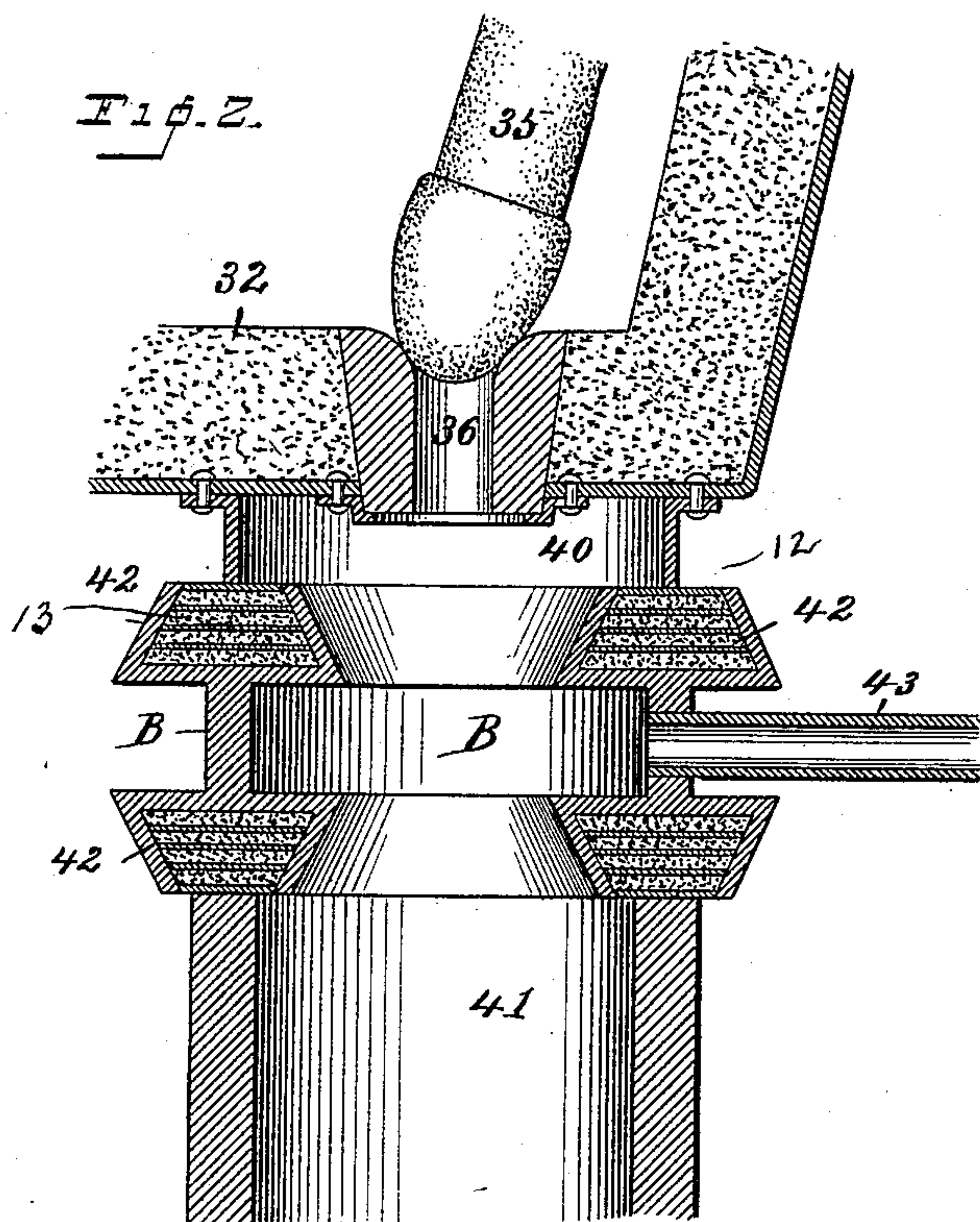
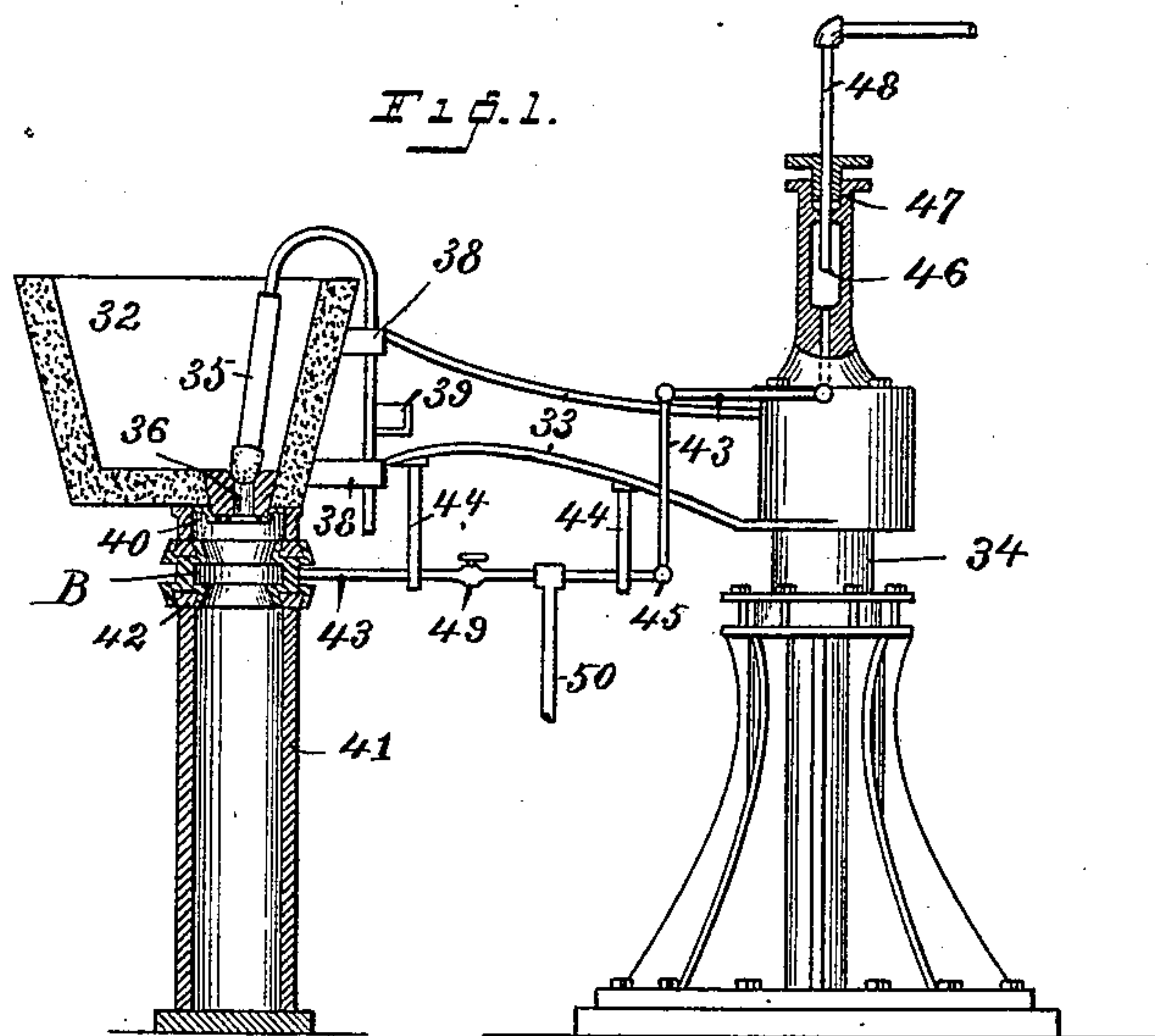


(No Model.)

W. F. DURFEE & N. B. WITTMAN.
VACUUM CASTING APPARATUS.

No. 448,945.

Patented Mar. 24, 1891.



WITNESSES

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UNITED STATES PATENT OFFICE.

WILLIAM F. DURFEE AND NOEL B. WITTMAN, OF BIRDSBOROUGH, PENN-
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VACUUM CASTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 448,945, dated March 24, 1891.

Application filed July 9, 1890. Serial No. 358,126. (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 Process of 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 means for removing air and other occluded gases from molten metal, and also special mechanism, operating in connection with a tilting converter, for carrying our invention into effect, which we will now describe, referring by numbers to the accompanying drawings, forming part of this specification, in which—

Figure 1 is 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. 2 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.

32 denotes a casting-ladle, and 34 a crane-post having an arm 33.

The molten metal having been prepared or treated in any usual or preferred manner, is poured into the 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 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 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 when it is desired to raise the stopper. Said bar may be an ordinary crow-bar or iron rod unconnected with the crane, and we have therefore not deemed it necessary to show the same on the drawings. 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. 2:) 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 the 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. 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. 2, 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 Fig. 2.

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 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 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 of molten metal into a mold from which the air has been exhausted that 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 into the vacuum-chamber.

It is not necessary for the carrying out of our novel 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.

Having thus described our invention, we claim—

1. An exhausting-ring for use in casting ingots, having dovetail grooves in its upper and lower faces, and lying in said grooves a yielding refractory material comprising alternate layers of clay and asbestos cloth, said ring having a pipe leading from one side thereof, as and for the purpose set forth.

2. The combination, with a casting-ladle having a tap-hole and a stopper and an ingot-mold, of an exhausting-ring interposed between said casting-ladle and mold and having yielding fillings in its upper and lower sides, a vacuum-chamber, and a pipe leading from said exhausting-ring to the vacuum-chamber and provided with a suitable valve, whereby when said valve is opened air and gases contained in the mold will pass therefrom into the vacuum-chamber, and also air and gases contained in molten metal, while being poured into the mold.

3. The combination, with the casting-ladle, the crane-arm, the ingot-mold, and the exhausting-ring, of a vacuum-chamber, intermediate stuffing-box concentric with the axis of the crane-arm, and pipes leading from the exhausting-ring through the stuffing-box to the vacuum-chamber, and a valve in one of said pipes, substantially as described.

4. An exhausting-ring for use in casting ingots, having dovetail grooves in its upper and lower faces and lying in said grooves layers of compressible material, said ring having a pipe leading from one side thereof, as and for the purpose set forth.

5. An exhausting-ring for use in casting ingots, having dovetail grooves in its upper and lower faces and lying in said grooves a yielding refractory material, said ring having a pipe leading from one side thereof, substantially as set forth.

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

WILLIAM F. DURFEE.
NOEL B. WITTMAN.

Witnesses:

LESLIE GRISCOM,
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