

No. 641,502.

Patented Jan. 16, 1900.

J. EVANS.

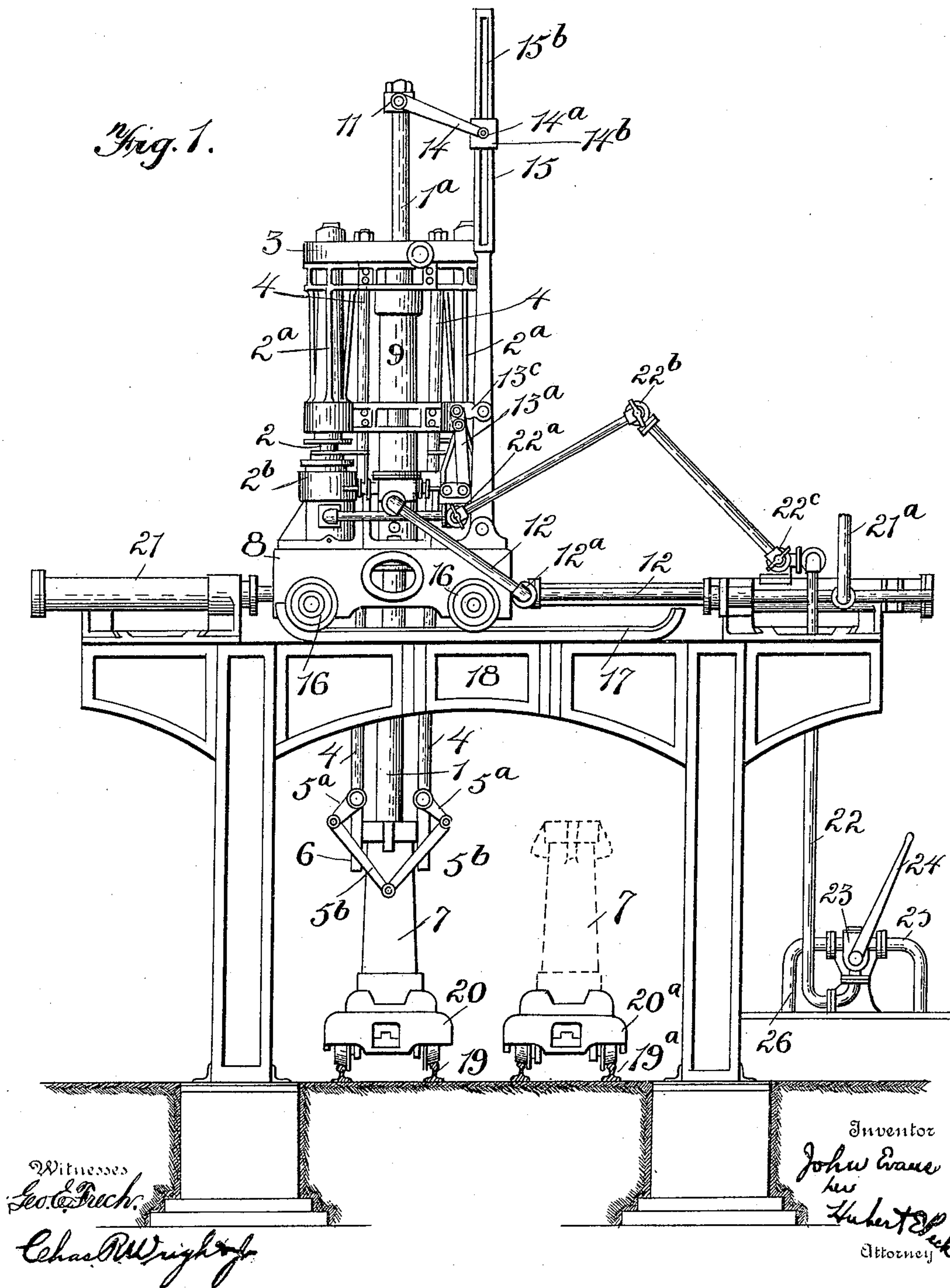
APPARATUS FOR REMOVING MOLDS FROM INGOTS.

(Application filed Sept. 6, 1898.)

(No Model.)

5 Sheets—Sheet 1.

Fig. 1.



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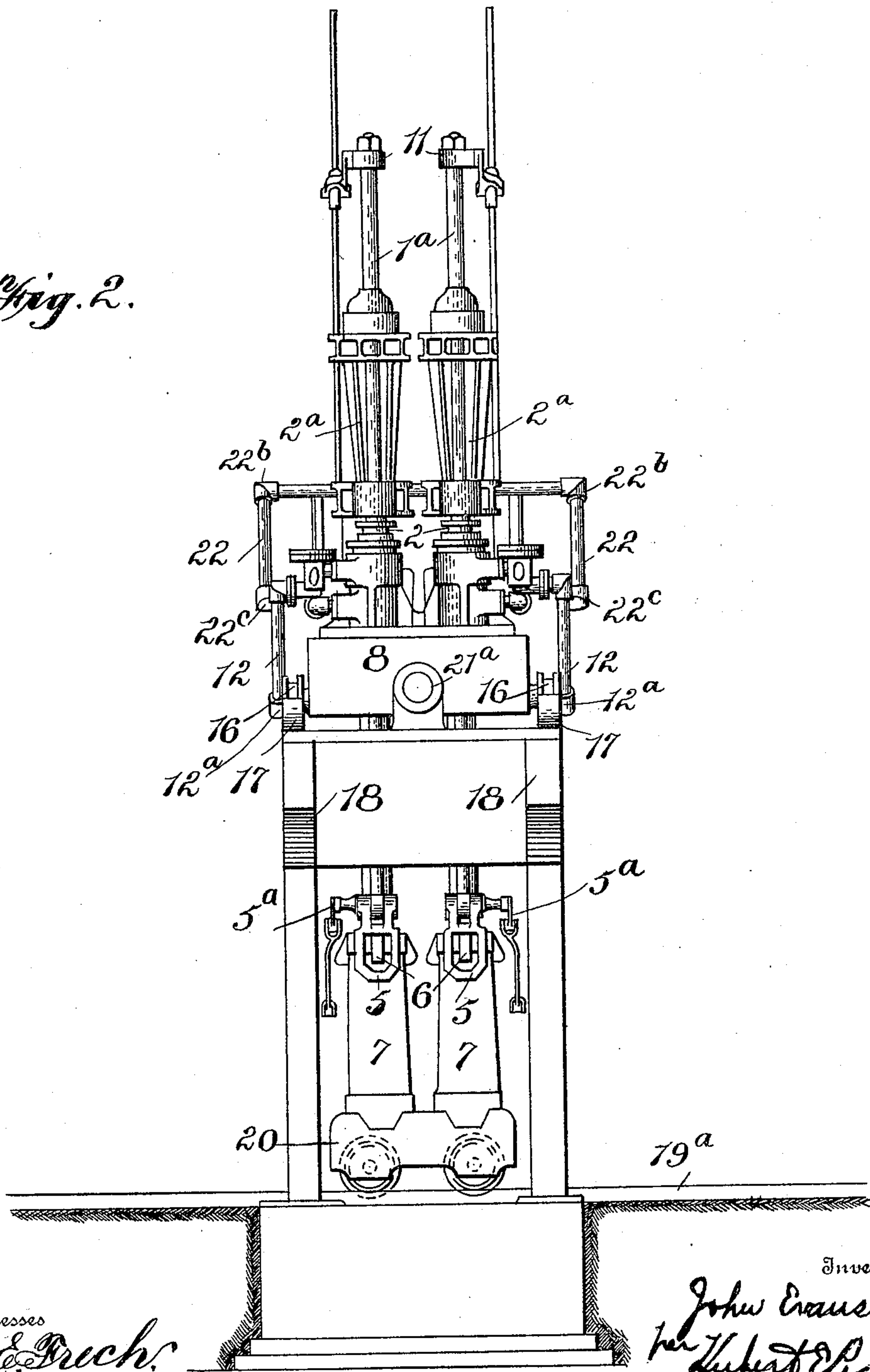
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5 Sheets—Sheet 2.

Fig. 2.



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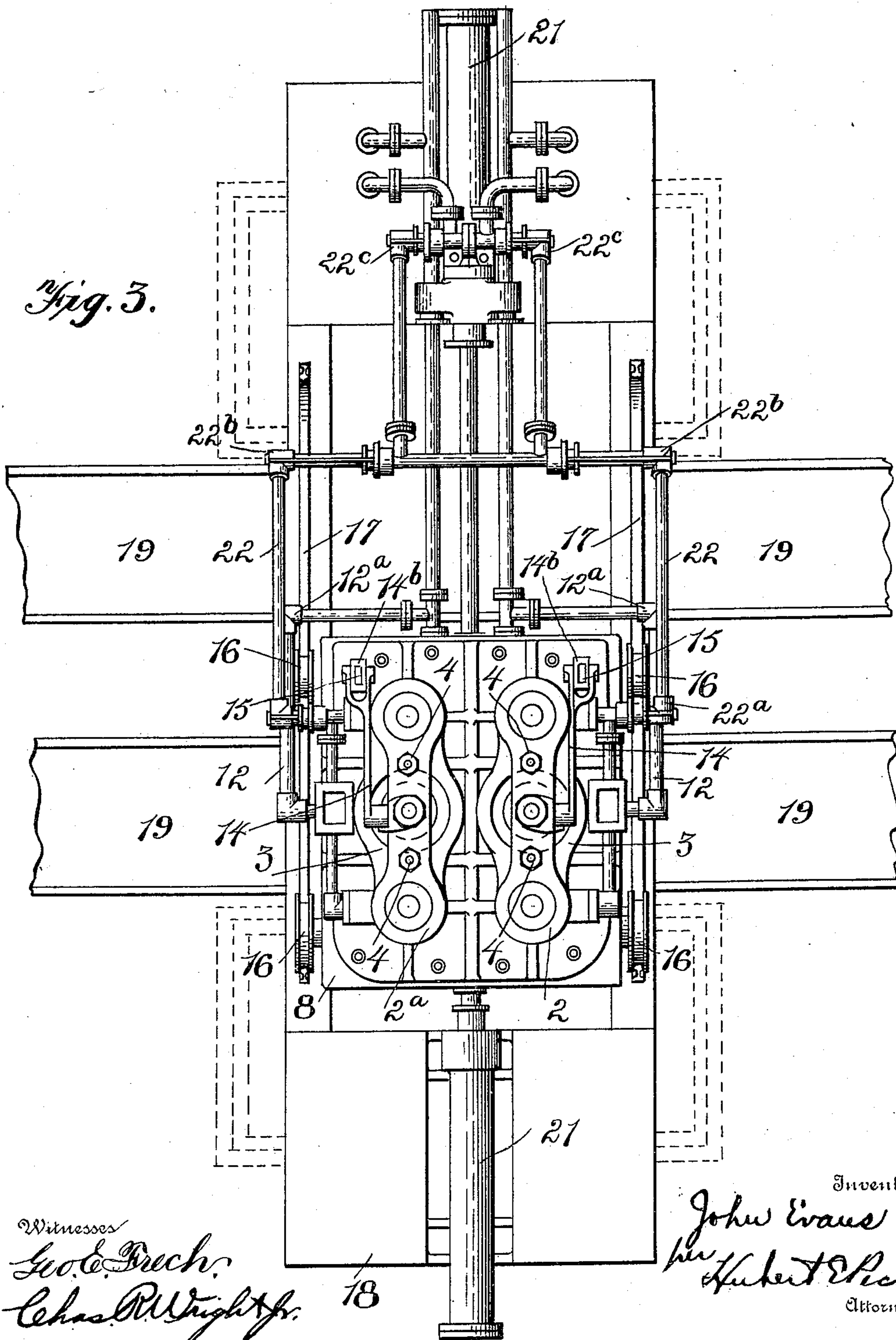
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Fig. 3.



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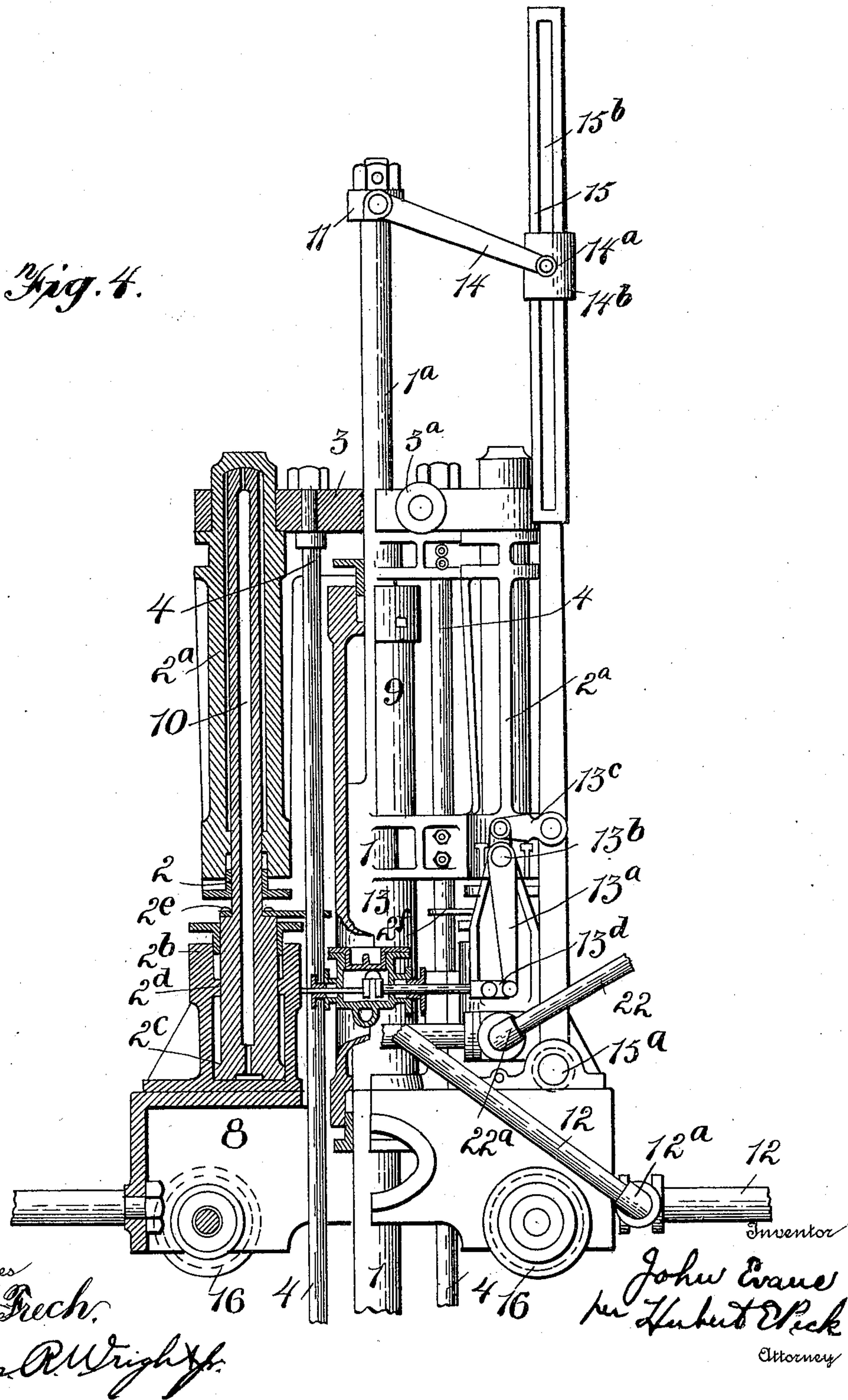
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5 Sheets—Sheet 4



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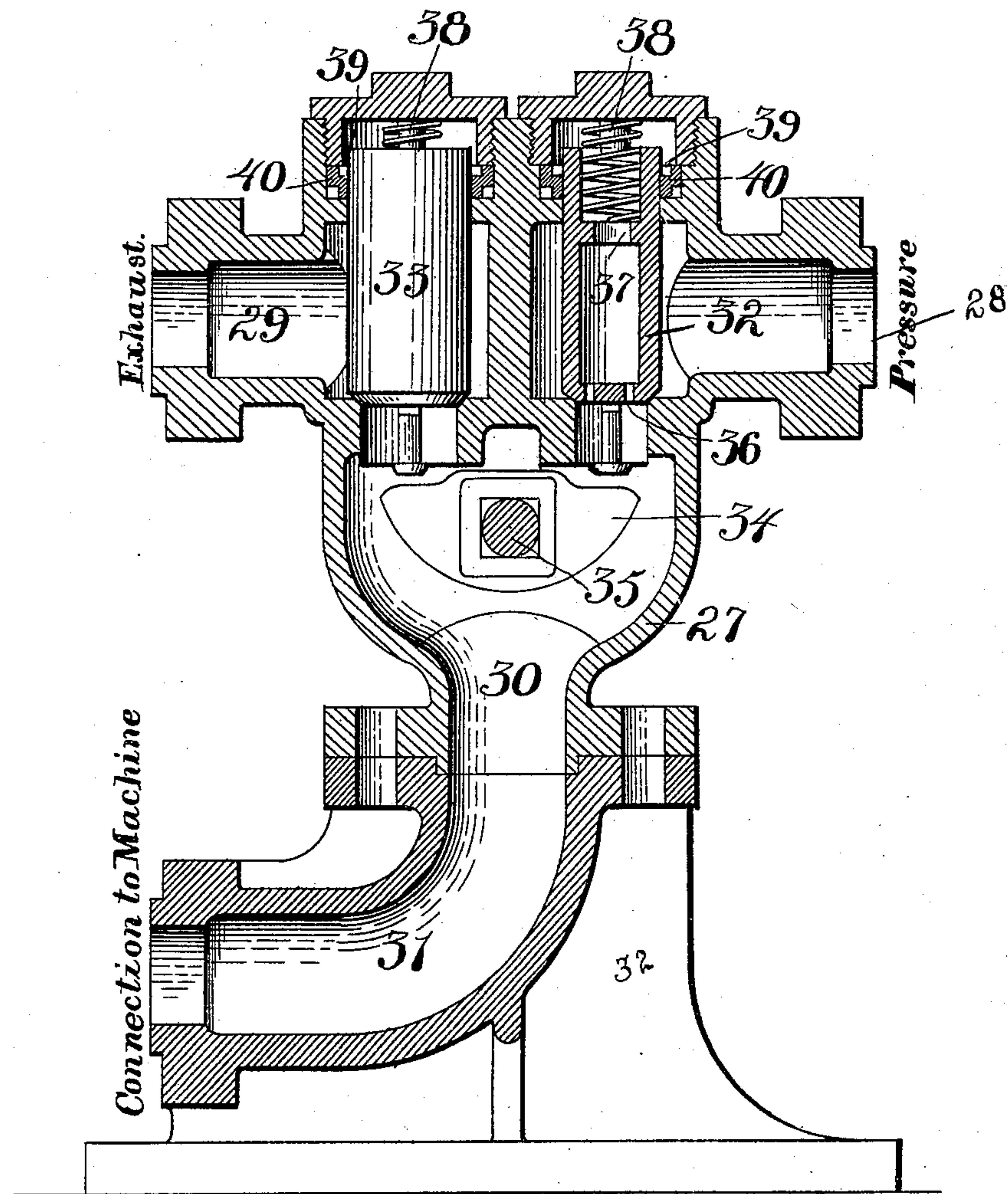
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5 Sheets—Sheet 5.

Fig. 5.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR REMOVING MOLDS FROM INGOTS.

SPECIFICATION forming part of Letters Patent No. 641,502, dated January 16, 1900.

Application filed September 6, 1898. Serial No. 690,323. (No model.)

To all whom it may concern:

Be it known that I, JOHN EVANS, a subject of the Queen of Great Britain and Ireland, residing at Merthyr Tydvil, in the county of Glamorgan, England, have invented Improvements in Apparatus for Removing Molds from Ingots, of which the following is a specification.

This invention relates to apparatus for removing molds from the ingots that have been cast therein, and has for its object the construction of apparatus that shall be stable, shall be less in height than those heretofore usually employed, capable of automatic adaptation to suit either long or short ingots, and economical of pressure fluid and speedy and yet very powerful at the initial part of the movement, so as to overcome the great resistance occasionally offered by the adhesion of the molds to the ingots. With these objects according to this invention apparatus is constructed and arranged as hereinafter fully described, with reference to the accompanying drawings, in which—

Figures 1, 2, and 3 are respectively a side elevation, end elevation, and plan of an example of such apparatus. Fig. 4 is a vertical sectional side elevation, drawn to a larger scale, of the upper portion thereof; and Fig. 5 is a vertical section, drawn to a larger scale than Fig. 4, of a three-way-valve apparatus.

For removing a mold from its ingot there are provided three hydraulic or other fluid-pressure rams arranged, preferably, as shown, side by side and with their axes in a single vertical plane, the central ram 1 being for holding down the ingot and the two side rams 2 2 for raising the mold. The two side rams are each made with two portions of different cross-sectional areas and each is provided with two barrels—viz., in example shown an upper free barrel 2^a, containing the part of smaller cross-section and connected to a strong cross-head 3 common to both upper barrels and provided with pendent rods 4, carrying at their lower ends slings or links 5, adapted to engage automatically with lugs 6 on the mold 7, and a lower barrel 2^b, containing the portion of larger cross-section and fixed to a base-frame 8, to which is also fixed the barrel 9 of the central ram, the interiors of the two barrels

2^a and 2^b of each side ram being connected together by a passage 10 in the ram.

The lower end of each side ram is provided with suitable ribs or projections by means of which it rests on the bottom of its barrel 2^b, so that the pressure fluid can act upon almost the whole of its surface even when the ram is in its lowest position. In order to limit the upward movement of each side ram, there are provided at its lower end a number of radial projections 2^c, with spaces between them, and on its barrel there are provided corresponding radial projections 2^d, the spaces between which enable the ram to be inserted, and for the purpose of keeping the projections 2^c under or in line with the projections 2^d there is secured to the shoulder 2^e a ring 2^f, that engages loosely with the adjacent pendent rod 4 for the purpose of preventing the ram 2 from turning in its barrel.

The arrangement is such that a larger cross-section of each side ram (in the example shown the effective cross-section of the lower portion) will be used for the initial movement of the mold upon the ingot, and the action will therefore be powerful, whereas the mold will after the stoppage of the side rams be lifted clear of the ingot by the action of the pressure fluid upon a part of each ram of effectively smaller cross-section—in the example shown by its action between the upper ends of the rams and the upper ends of the upper barrels 2^a. It will be obvious that instead of having a lower portion of larger cross-section and an upper portion of smaller cross-section contained in fixed and free barrels, respectively, as shown, each side ram might have a lower portion in a fixed barrel, but of smaller cross-section, and an upper portion in a free barrel, but of larger cross-section; but as this would entail the placing of the heavier portion at the top the arrangement shown is preferred.

The central ram has an upward extension 1^a, carrying a boss 11, which may be adjustable thereon, and the barrel of the central ram is connected by pipes 12 to a tank or other reservoir of water (hereinafter, for distinction, called "non-pressure" water) at a suitable elevation above it. The slings or links 5 may be connected together by lever-arms 5^a

and links 5^b to facilitate their working by hand.

For admitting non-pressure water to the barrel of the central ram there is employed 5 a slide-valve 13, which may be operated by hand or by any suitable means, electrical or other. In the example shown means are provided for automatically opening and closing this valve, these means comprising a link 14, 10 connected to the boss 11 on the extension 1^a of the ram 1, and a slotted lever 15, which has its fulcrum at 15^a and is operated by means of the link 14, being connected thereto by a pin 14^a, passing through a slide-block 14^b, 15 that embraces the said lever and engages in its slot 15^b. The weight of the slide-block 14^b is such as normally to keep the lever 15 in the vertical position, and consequently the valve 13 closed, as shown in Fig. 4. The 20 cross-head 3 carries on a suitable stud an antifriction-roller 3^a, adapted to come against the link 14. The slide-valve 13 is connected with and worked by the lever 15 by means of a lever 13^a, pivoted at 13^b on a bracket fixed 25 to one of the barrels 2^b, and two links 13^c and 13^d.

When it is desired to use the apparatus, pressure is put under the side rams 2, and their upper barrels 2^a ascend together, carrying 30 with them ultimately the central ram 1 by means of the boss 11, against which the cross-head 3 comes to bear. The roller 3^a also comes into contact with and raises the link 14, and thereby moves the long lever 15 outward and opens the valve 13. When the central 35 ram 1 has been sufficiently raised, the ingot-mold 7 is brought into position, whereupon the pressure is reduced below the side rams 2, whose barrels then, along with the 40 central ram 1, descend until the latter rests upon the ingot, the barrel of the central ram being meanwhile filled above the ram 1 and around its extension 1^a with non-pressure water gravitating from the reservoir above 45 mentioned. The side barrels 2^a continue to descend until the slings 5 automatically engage with and under the lugs 6 of the mold 7. The roller 3^a simultaneously descending allows the link 14 to return the lever 15 to 50 its upright position, and thus to close the valve 13, which then imprisons in the barrel 9 of the central ram the non-pressure water contained therein. Such imprisonment may take place at any time between the central rams 55 coming into contact with the ingot and the lifting of the mold. Pressure is now again put under the side rams and the mold is lifted, while the ingot is kept down by the central ram, which is held rigid and immovable by 60 the imprisoned water, which is released when the boss 11 is reached by the cross-head, the roller 3^a then raising the link 14, and thereby opening the valve 13. The central ram and the side barrels then rise together, and the 65 non-pressure water is forced back into the reservoir for use over again.

The apparatus shown can be used for ingots

varying from one foot six inches to six feet long, and in the figures the boss 11 is shown as adjusted to suit all ingots between those 70 two lengths; but, for example, should it be desired to use the apparatus only for ingots of a certain length—say from five feet to six feet—then the boss 11 can be lowered on the extension a suitable distance, whereby the 75 central ram will be prevented from passing, during the raising of the mold, so far into the latter before being raised by the cross-head, and the time and energy spent in lifting the central ram will consequently be reduced. 80

The base-frame 8, which may carry any convenient number of sets of rams such as described, (herein illustrated with two sets,) is preferably mounted on wheels or slides 16, 85 arranged to run on a track 17, carried by a suitable framework 18, transversely over two tracks 19 19^a, one, 19, for carriages 20, bringing the full molds, and the other, 19^a, for carriages 20^a to receive the molds removed from 90 the ingots, and hydraulic or other fluid-pressure rams 21 21^a may advantageously be provided for transferring the vertical rams from over one track, 19, to over the other, 19^a, and vice versa. To allow for this movement of 95 the apparatus, the pipes 12, leading to the central barrel 9, are provided with telescopic joints 12^a, and the pipes 22, for supplying fluid under pressure to the side rams, are provided with swivel connections at 22^a, 22^b, and 22^c. 100 The supply and escape of pressure fluid to and from the side-ram barrels 2^b is controlled by a suitable three-way-valve apparatus 23, provided with a hand-lever 24, the pressure 105 fluid being supplied to the valve by a pipe 25 and escaping fluid passing away by a pipe 26. The three-way-valve apparatus preferably employed is represented in vertical section in Fig. 5. It comprises a casing 27, provided 110 with a pressure-fluid inlet 28, an exhaust-outlet 29, and an orifice 30, which communicates with the pipes 22 through a passage 31 in a stool 32, which supports the casing 27. The communications between the orifice 30 and the inlet 28 and the outlet 29 are respectively 115 controlled by two hollow cylindrical valves 32 and 33, which are similar to each other, except that the exhaust-valve 33 is made the larger, in order to facilitate the escape of the fluid. The valves are operated as required 120 by means of a cam 34, secured on the shaft 35 of the hand-lever 24. Each valve has holes 36 and 37 in its transverse walls to allow the pressure fluid to get behind the valves and so keep them in equilibrium when open and 125 insure their being shut tight when closed. 38 are springs for overcoming the sticking of the leathers 39, and 40 are brass glands surrounding the valves.

What I claim is—

1. Apparatus for removing molds from ingots, comprising a vertical hydraulic ram adapted to act as an abutment against one end of an ingot, mechanism for lifting the

mold off the ingot when the latter is so held, and means for automatically connecting said mechanism to said ram so as to raise the same after the mold has been partially raised.

5 2. Apparatus for removing molds from ingots, comprising a vertical hydraulic ram adapted to act as an abutment against one end of an ingot, mechanism for lifting the mold off the ingot when the latter is so held, 10 means for automatically effecting connection between said mechanism and said ram so that said ram will be thereby raised after the mold has been partially raised, and means for varying the movement of said mechanism 15 required to effect said connection.

3. Apparatus for removing molds from ingots, comprising a ram adapted to hold an ingot, a barrel in which said ram is located, a passage adapted to supply liquid to the space 20 between the end of the ram remote from the ingot and the corresponding end of the barrel, a valve for controlling said passage, two rams arranged one on each side of aforesaid ram, barrels in which the last-mentioned two 25 rams are located, means for supplying pressure fluid to the last-mentioned barrels and discharging it therefrom, means for connecting and disconnecting the last-mentioned rams with and from the ingot-mold, and means 30 for connecting the last-mentioned rams with the first-mentioned ram after a movement of the former dependent on the length of the ingot, substantially as hereinbefore described.

4. Apparatus for removing molds from ingots, comprising a vertical hydraulic ram adapted to act as an abutment against one end of an ingot, a barrel in which said ram is located, a passage adapted to supply liquid to the space between the end of the ram remote 40 from the ingot and the corresponding end of said barrel, a valve for controlling said passage, mechanism for lifting the mold off the ingot when the latter is held by the said ram as aforesaid, means for automatically effecting 45 connection between said mechanism and said ram so that said ram will be thereby raised after the mold has been partially raised, and means adapted to open said valve automatically after a movement of said mechanism of an extent dependent on the length of the ingot. 50

5. Apparatus for removing molds from ingots, comprising a vertical hydraulic ram adapted to act as an abutment against one end 55 of an ingot, a barrel in which said ram is located, a passage adapted to supply liquid to the space between the end of the ram remote from the ingot and the corresponding end of said barrel, a valve for controlling said passage, mechanism for lifting the mold off the ingot when the latter is held by said ram as 60 aforesaid, means for automatically effecting connection between said mechanism and said ram so that said ram will be thereby raised 65 after the mold has been partially raised, means adapted to open said valve automatically after a movement of said mechanism

of an extent dependent on the length of the ingot, and means for varying the necessary extent of said movement. 70

6. Apparatus for removing molds from ingots, comprising means for holding an ingot, two rams arranged on opposite sides of said means and each having a portion of larger cross-sectional area and a portion of smaller 75 cross-sectional area, a relatively-fixed barrel and a relatively-movable barrel for each ram, one barrel receiving the portion of larger cross-sectional area and the other barrel the portion of smaller cross-sectional area, means 80 for supplying pressure fluid to, and discharging it from, said barrels, a fluid-passage connecting the interiors of said barrels, means for arresting the movement of the portions of larger cross-sectional area within their respective 85 barrels after a short initial movement of the respective rams, and means for connecting and disconnecting with and from the ingot-mold those barrels of the said rams that are the more remote from the said mold substantially as described. 90

7. Apparatus for removing molds from ingots, comprising a ram adapted to hold an ingot, a barrel in which said ram is located, a passage adapted to supply liquid to the 95 space between the end of the ram remote from the ingot and the corresponding end of the barrel, a valve for controlling said passage, two rams arranged on opposite sides of aforesaid ram and each having a portion of 100 larger cross-sectional area and a portion of smaller cross-sectional area, a relatively-fixed barrel and a relatively-movable barrel for each of said two rams, one barrel receiving the portion of larger cross-sectional area and 105 the other barrel the portion of smaller cross-sectional area, means for supplying pressure fluid to, and discharging it from, the last-mentioned two barrels, a fluid-passage connecting the interiors of the last-mentioned 110 two barrels, means for arresting the movement of the portions of larger cross-sectional area within their respective barrels after a short initial movement of the respective rams, means for connecting and disconnecting 115 with and from the ingot-mold those barrels of the last-mentioned two rams that are the more remote from said mold, and means for connecting the last-mentioned rams with the first-mentioned ram after a movement of 120 the former dependent on the length of the ingot, substantially as hereinbefore described.

8. Apparatus for removing molds from ingots comprising a ram adapted to hold an ingot, a barrel in which said ram is located, a 125 passage adapted to supply liquid to the space between the end of said ram remote from the ingot and the corresponding end of said barrel, a valve for controlling said passage, two rams arranged one on each side of aforesaid 130 ram, barrels in which the last-mentioned two rams are received, a cross-piece connecting the two last-mentioned barrels, means for supplying pressure fluid to the two last-men-

tioned barrels and means for discharging it therefrom, means for connecting and disconnecting the last-mentioned rams with and from the ingot-mold, a lever connected with
 5 said valve, a link connecting said lever, along which it is adapted to slide, to the first-mentioned ram, and an abutment carried by the upper barrels of the last-mentioned rams and adapted to come against and operate said le-
 10 ver and thereby to open said valve automatically after a movement of the two side rams of an extent dependent on the length of the ingot, substantially as hereinbefore described.

9. Apparatus for removing molds from in-
 15 got, comprising a ram adapted to hold an ingot, a barrel in which said ram is located, a passage adapted to supply liquid to the space between the end of said ram remote from the ingot and the corresponding end of
 20 said barrel, a valve for controlling said passage, two rams arranged one on each side of aforesaid ram, barrels in which the last-mentioned two rams are received, a cross-piece connecting the two last-mentioned barrels,
 25 means for supplying pressure fluid to the two last-mentioned barrels and means for discharging it therefrom, means for connecting and disconnecting the last-mentioned rams with and from the ingot-mold, a lever con-
 30 nected with said valve, a link connecting said lever, along which it is adapted to slide, to the first-mentioned ram, an abutment carried by the upper barrels of the last-mentioned rams and adapted to come against and
 35 operate said lever and thereby to open said valve automatically after a movement of the two side rams, and means whereby the connection between said lever and said first-mentioned ram can be adjusted so as to vary
 40 the time of opening of said valve.

10. Apparatus for removing molds from in-
 got, comprising a ram adapted to hold an ingot, a barrel in which said ram is located, a
 45 passage adapted to supply liquid to the space between the end of said ram remote from the ingot and the corresponding end of said barrel, a valve for controlling said passage, two rams arranged one on each side of aforesaid
 50 ram, barrels in which the last-mentioned two rams are located, means for supplying pressure fluid to the two last-mentioned barrels and means for discharging it therefrom, means for connecting and disconnecting the last-mentioned rams with and from the ingot-
 55 mold, means for automatically opening said valve after a movement of the last-mentioned two rams of an extent dependent on the length of the ingot, and means for immediately thereafter automatically connecting the last-men-
 60 tioned two rams with the first-mentioned ram.

11. Apparatus for removing molds from in-
 got, comprising a ram adapted to hold an ingot, a barrel in which said ram is located, a
 65 passage adapted to supply liquid to the space between the end of the ram remote from the

ingot and the corresponding end of the barrel, a slide-valve for controlling the said passage, two rams arranged on opposite sides of afore-
 said ram and each having its lower portion of larger cross-sectional area and its upper por-
 70 tion of smaller cross-sectional area, two fixed barrels in each of which a larger diameter portion of a side ram is located, and two movable barrels in each of which a smaller diameter
 75 portion of a side ram is located, a three-way-valve apparatus for supplying pressure fluid to and discharging it from the two side barrels a fluid-passage extending through each side
 80 ram from end to end, a cross-piece connecting said two movable barrels, pendent rods provided with slings adapted to engage with and disengage from lugs on the mold, an external
 85 projection or external projections on the lower end of each side ram, an internal projection or internal projections on each of said fixed barrels and located on over and adapted to
 90 engage with said internal projection or projections, rings fixed to said side rams and engaging loosely with said pendent rods, a two-armed lever pivoted to a fixed bracket, a sec-
 95 ond lever having a fixed fulcrum, links connecting said two-armed lever with said valve and with said second lever respectively, a link adapted to slide along said second lever and connecting it with an extension of the
 100 first-mentioned ram, and a roller carried by aforesaid cross-piece and adapted to come against the last-mentioned link, substantially as hereinbefore described.

12. Apparatus for removing molds from in-
 100 got, comprising means for holding an ingot, two rams arranged on opposite sides of said means and each having a portion of larger cross-sectional area and a portion of smaller
 105 cross-sectional area, a relatively-fixed barrel and a relatively-movable barrel for each ram, one barrel receiving the portion of larger cross-sectional area and the other barrel the portion of smaller cross-sectional area, means
 110 for supplying pressure fluid to, and discharging it from, said barrels, a fluid-passage connecting the interiors of said barrels, an external projection or external projections on the lower end of each of the said rams, an in-
 115 ternal projection or internal projections on each of said fixed barrels and located over and adapted to engage with said internal projection or projections, means for preventing the said rams from rotating in their barrels,
 120 and means for connecting and disconnecting with and from the ingot-mold those barrels of the said rams that are the more remote from the said mold substantially as described.

Signed at London, England, this 22d day of August, 1898.

JOHN EVANS.

Witnesses:

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