No. 844,169. PATENTED FEB. 12, 1907.

W. A. McADAMS.

CASTING MACHINE.

APPLICATION FILED JUNE 21, 1902.

5 SHEETS—SHEET 1.

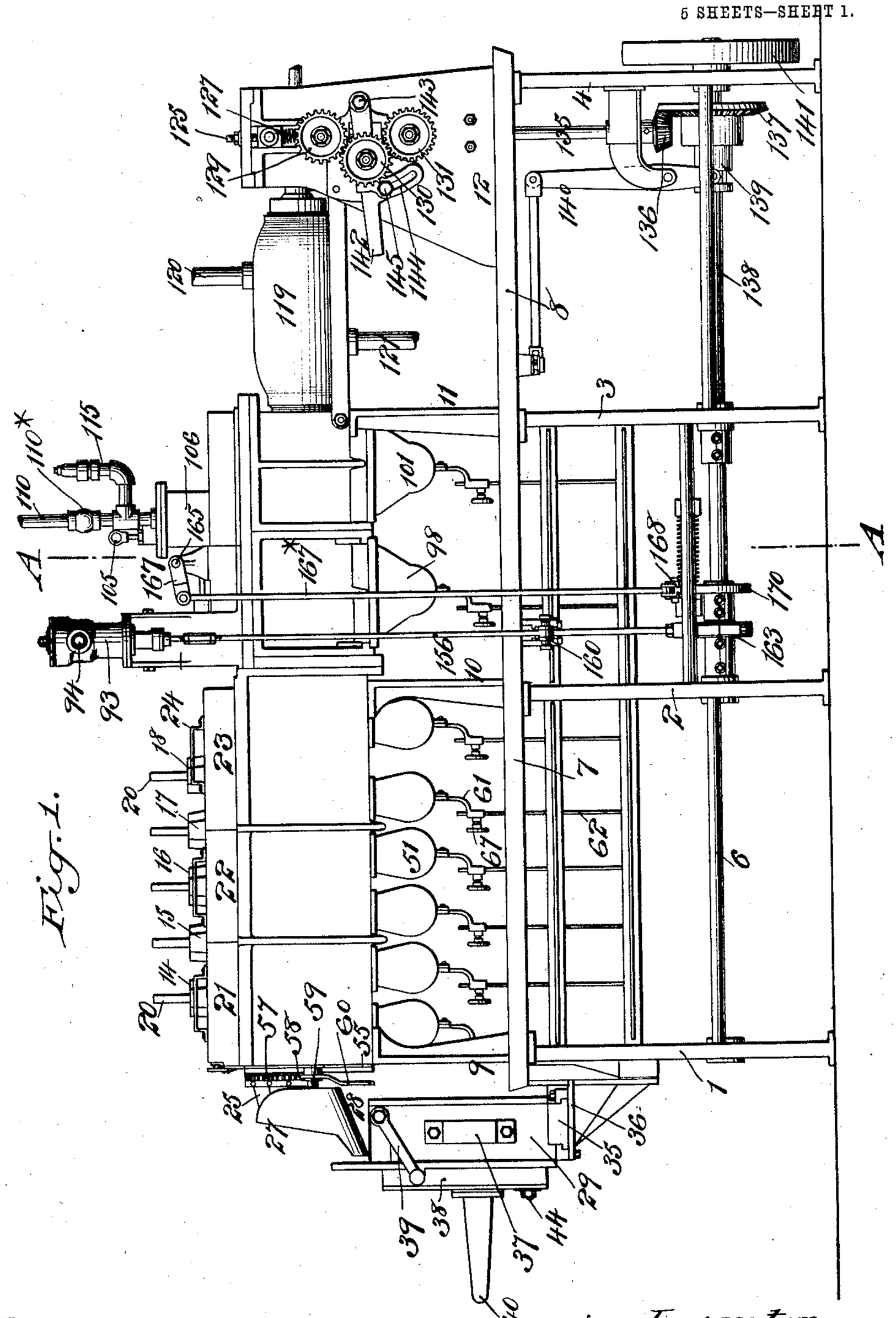

Fig. 1.

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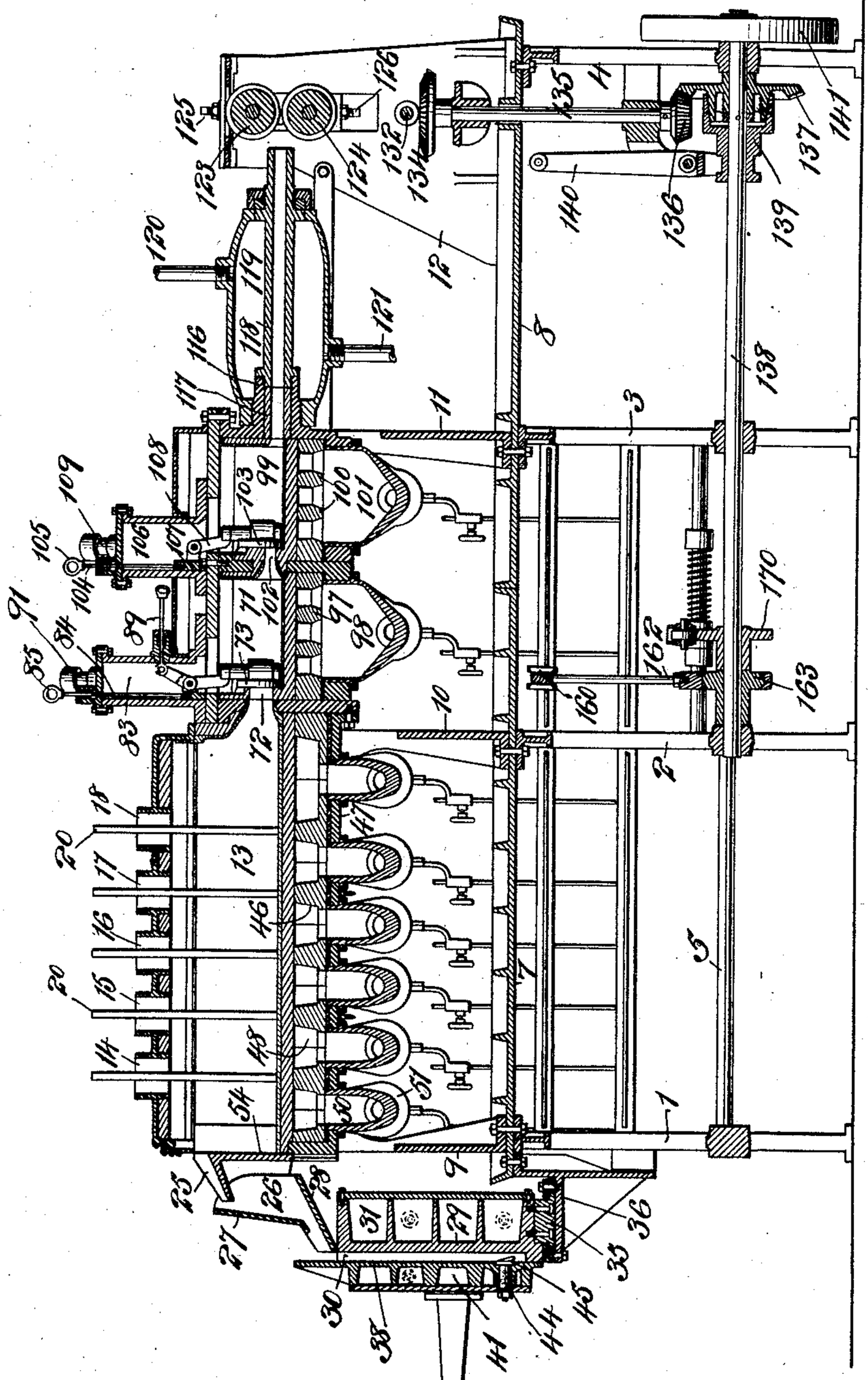
5 SHEETS—SHEET 2.

Fig. 2.



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5 SHEETS—SHEET 3.

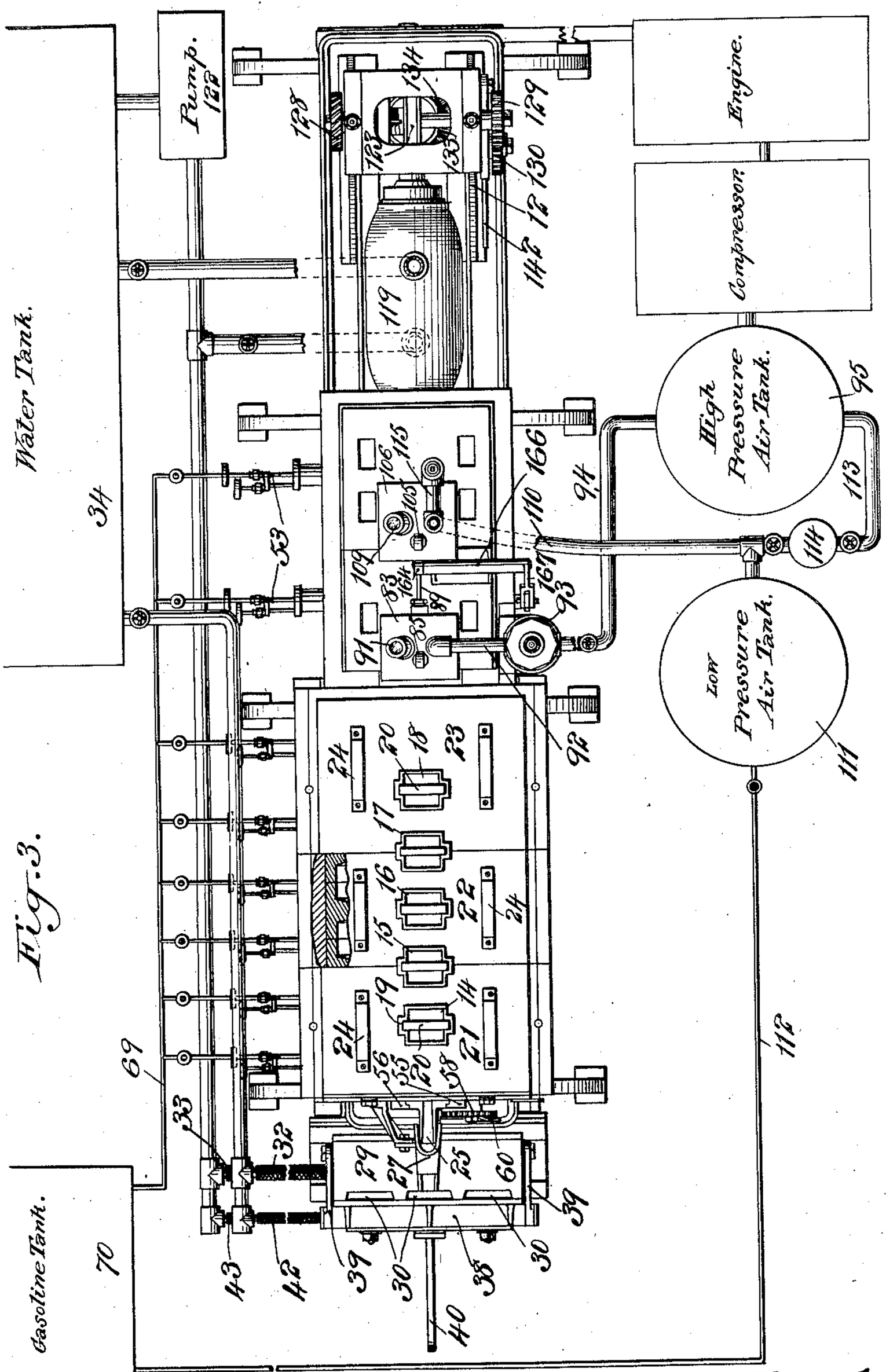

Fig. 3.

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5 SHEETS—SHEET 4.

Fig. 5.

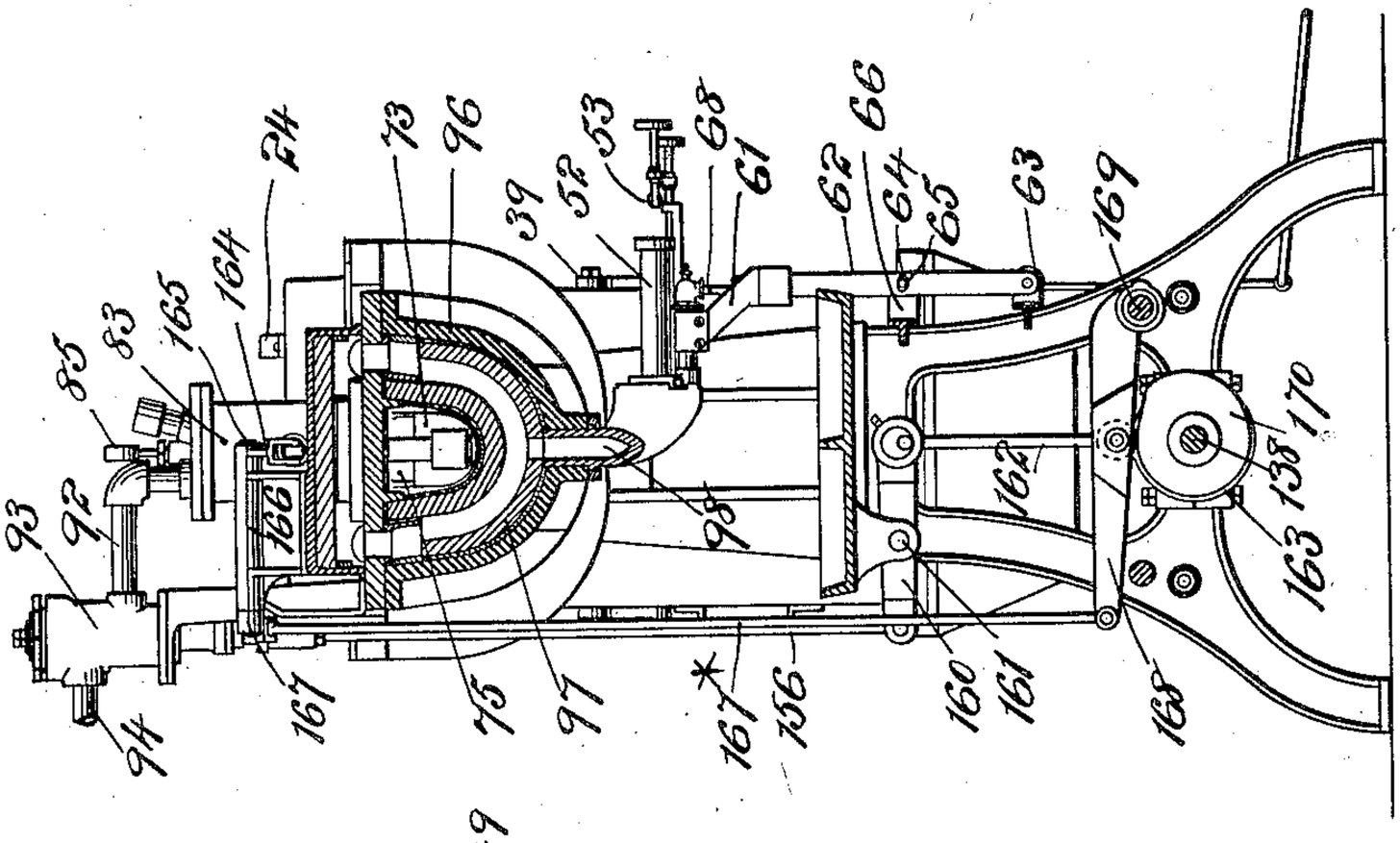


Fig. 12.

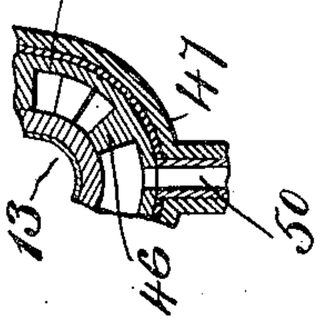
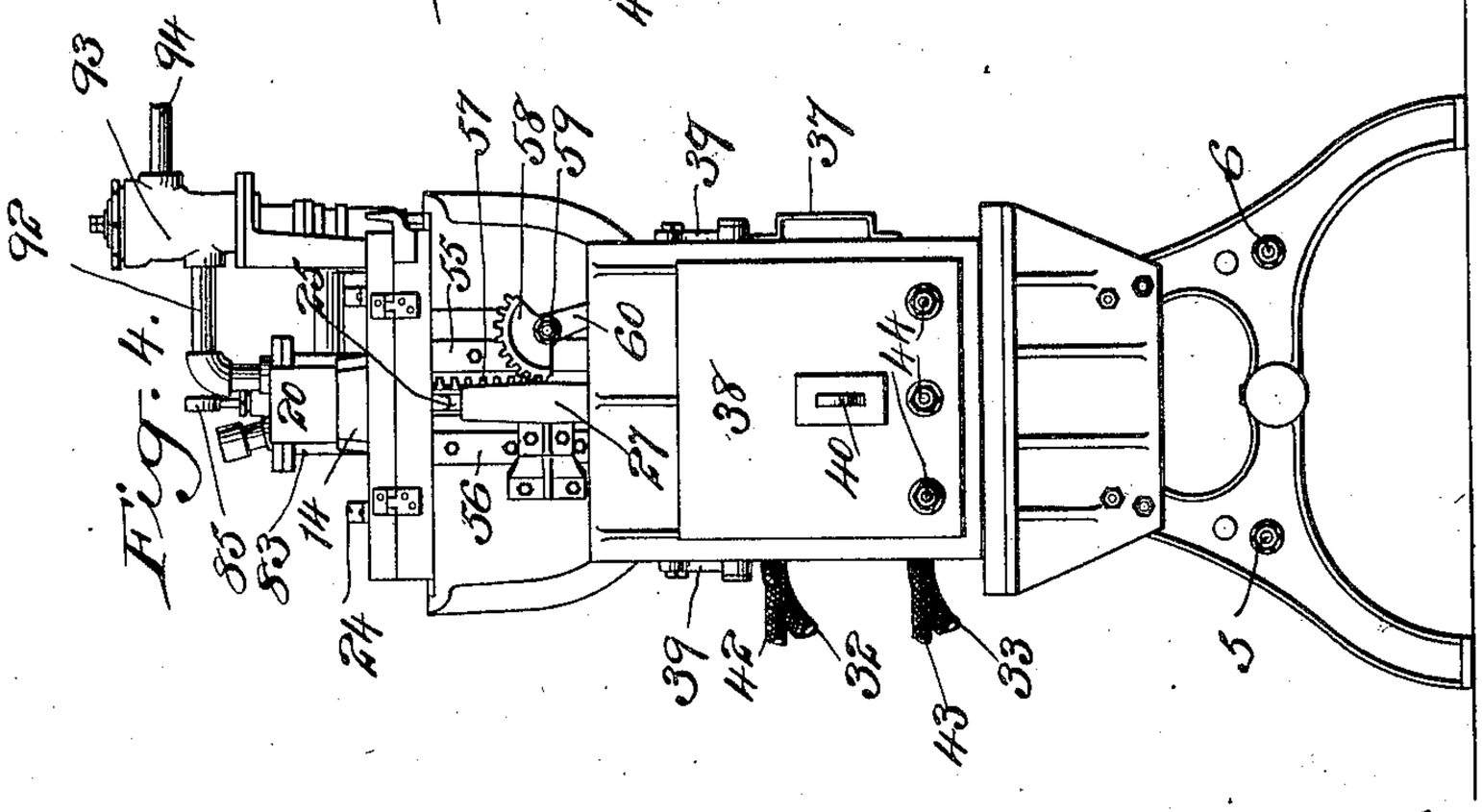


Fig. 4.



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No. 844,169. PATENTED FEB. 12, 1907.

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CASTING MACHINE.

APPLICATION FILED JUNE 21, 1902.

5 SHEETS—SHEET 5.

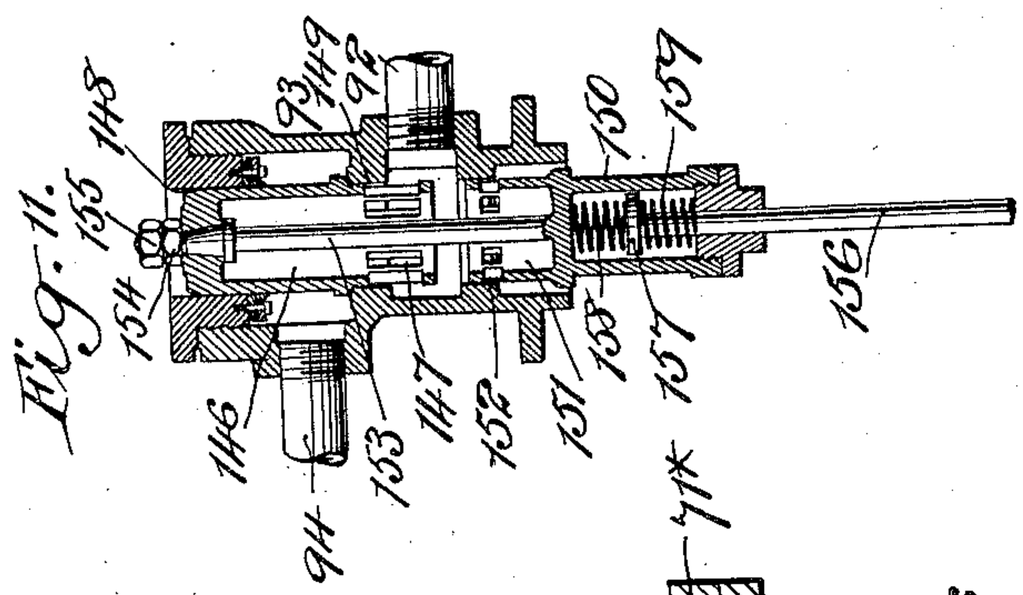

Fig. 11.

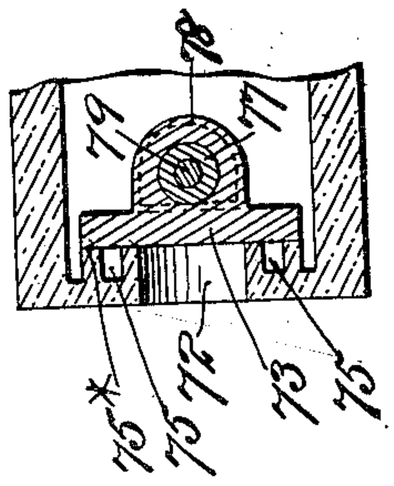

Fig. 10.

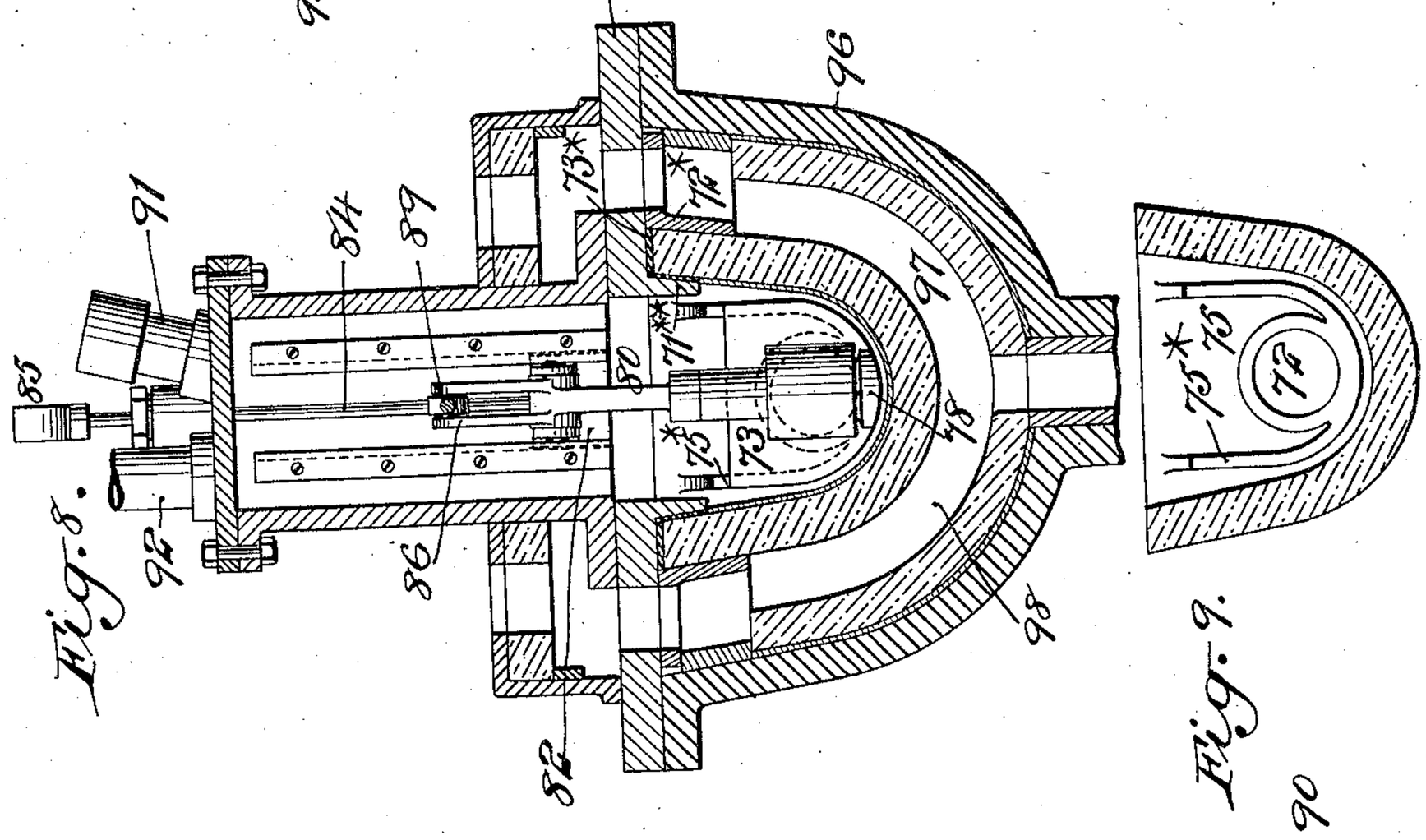

Fig. 8.

Fig. 9.

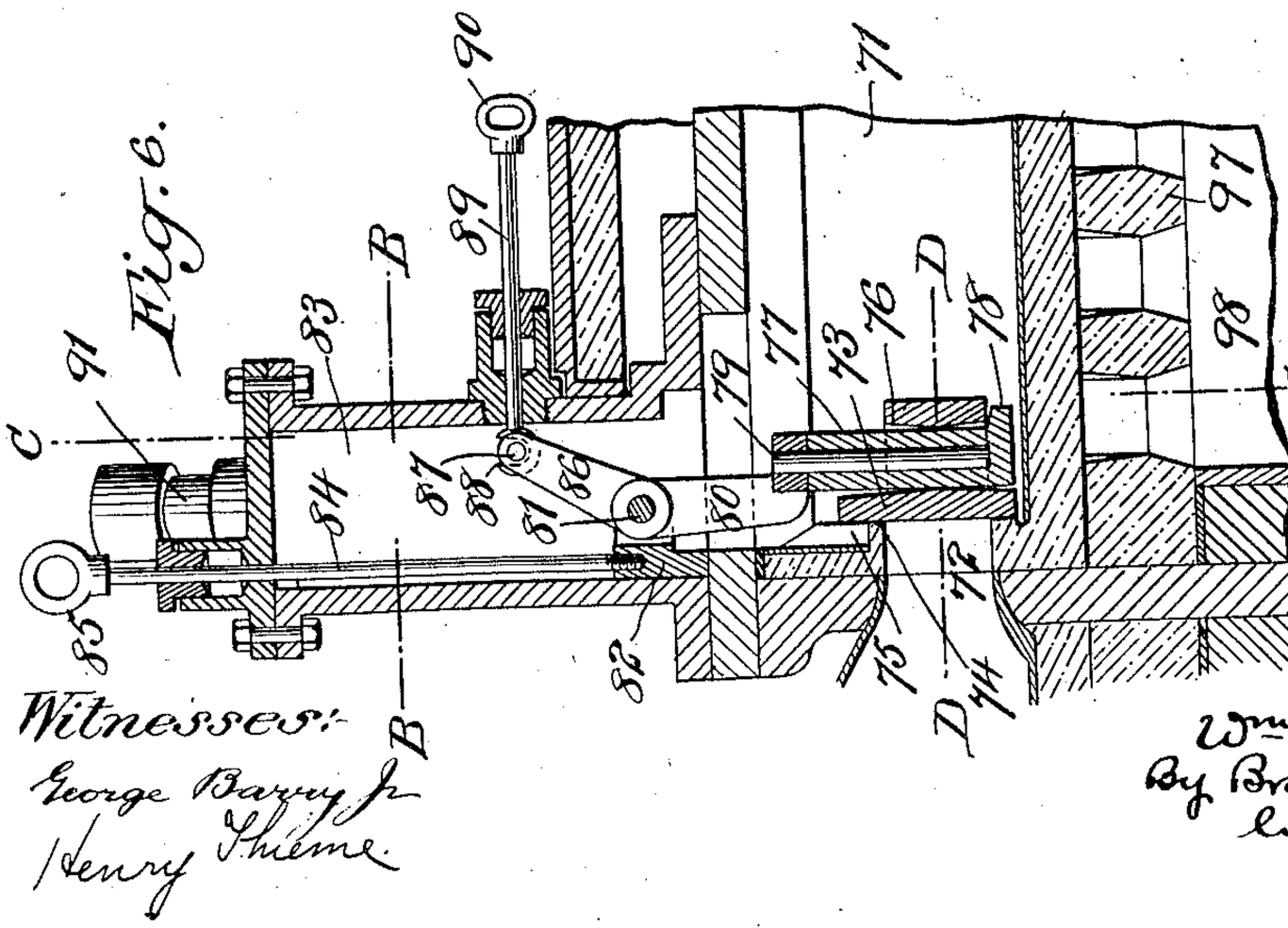

Fig. 6.

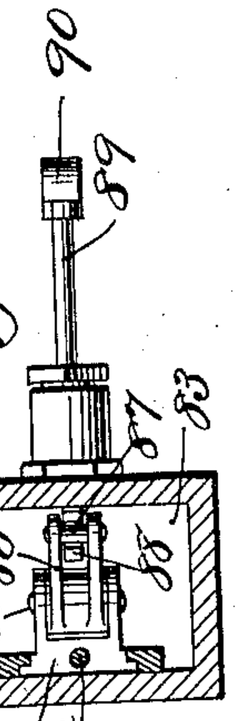

Fig. 7.

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UNITED STATES PATENT OFFICE.

WILLIAM A. McADAMS, OF NEW YORK, N. Y.

CASTING-MACHINE.

No. 844,169. Specification of Letters Patent. Patented Feb. 12, 1907.

Application filed June 21, 1902. Serial No. 112,646.

To all whom it may concern:

Be it known that I, WILLIAM A. McADAMS, a citizen of the United States, and resident of the borough of Brooklyn, in the city and State of New York, have invented a new and useful Casting-Machine, of which the following is a specification.

My invention relates to a casting-machine, and more particularly to a machine for casting aluminium alloys in the form of a continuous bar or rod, although the main body of the machine may be utilized to advantage in connection with other forms and arrangements of molds than that or those for forming the metal in a continuous bar or rod and for casting other metals than aluminium alloys.

My invention contemplates a furnace in which the metal to be cast may be introduced while the melting is going on, so as to keep a constant supply of molten metal, and means for automatically discharging the molten metal and forcing it into the die or mold by fluid-pressure in such a manner as to maintain a continuous outgoing stream of the molten metal to be cooled and carried on in the form of a bar or rod without interruption other than the intentional interruption produced by the stopping of the machine.

My invention further contemplates means for converting the overflow from the furnace, in the event the molten metal accumulates therein above a predetermined level, into ingots of such size and shape that they may be again introduced into the furnace to keep up the supply of molten metal.

A practical embodiment of my invention is represented in the accompanying drawings, in which—

Figure 1 is a view of the machine in side elevation. Fig. 2 is a longitudinal vertical section of the same. Fig. 3 is a top plan view showing the top of the furnace partially broken away. Fig. 4 is a view in end elevation. Fig. 5 is an end section in the plane of the line A A of Fig. 1 looking toward the end represented in Fig. 4. Fig. 6 is an enlarged partial longitudinal section showing the parts in the vicinity of the point where the crucible discharges into the pressure-chamber. Fig. 7 is a horizontal section in the plane of the line B B of Fig. 6. Fig. 8 is a transverse vertical section in the plane of the line C C of Fig. 6. Fig. 9 is a partial transverse section on the same plane in which Fig. 8 is taken, showing the seat of the valve which closes the passage-way between the crucible and the pressure-chamber, the valve being removed. Fig. 10 is a horizontal section in the plane of the line D D of Fig. 6. Fig. 11 is an enlarged vertical section through the valve-chamber and valves for regulating the discharge of the pressure fluid into the pressure-chamber; and Fig. 12 is a partial transverse section through the crucible, showing one of its supporting-ribs perforated to permit the free distribution of heat among the fire-chambers located at the bottom of the crucible.

The casting-machine, including the crucible and furnace or heating-chambers, is conveniently supported by a series of two-legged pedestals, in the present instance four, (denoted by 1, 2, 3, and 4.) These are connected by suitable tie-rods, two of them being denoted by 5 and 6, respectively, and capped by shallow pans 7 and 8, to which superposed standards 9, 10, 11, and 12 are bolted, the bolts extending, preferably, through the standards 9 10 11 12 and through the bottoms of the shallow pans 7 and 8 and through flanges at the tops of the pedestals 1 2 3 4.

The superposed standards 9 10 are so shaped at their upper ends as to form suitable supports for the fire-chambers and crucible, the latter being preferably U-shaped in cross-section and the fire-chambers arranged to follow the curve of the exterior of the crucible from beneath the bottom of the crucible to the top, so as to completely enwrap the crucible in flames save only at the points where the crucible is supported.

The crucible is denoted as a whole by 13. It is formed of some suitable refractory material, the particular material which I find it advantageous to use being what is known in the art as "Dinas brick." It is suitably lined and is provided through its top or cover with a series of openings, in the present instance five, (denoted by 14, 15, 16, 17, and 18,) in communication with the fire-chambers beneath the crucible and through which the bars of metal—in the present instance aluminium alloy—are fed into the crucible to be melted.

The openings 14 to 18, inclusive, (see Fig. 3,) are provided with recesses 19 at their opposite ends fitted to receive with an easy sliding fit the opposite edges of the bars 20 of metal to be melted, leaving spaces between the opposite walls of the openings and the opposite sides of the bars, through which the hot flame or gases from the fire-chambers es-

cape, and in so doing heat the metal of the bars 20 before they enter the hottest part of the crucible.

The cover of the crucible is preferably made in sections, in the present instance three sections, (denoted by 21 22 23,) these sections being provided with handles 24 for convenience in removing them to gain free access to the interior of the crucible. The cover-sections are free to lift under abnormal pressures which may occur from the explosion of accumulated gas or vapor in the fire-chamber or from any other cause, thus providing against injury to the body of the crucible and walls of the fire-chamber.

The crucible is provided at its front end with an overflow-spout 25 for directing the overflow of molten metal, whether it takes place intentionally or from supplying the metal bars or ingots to the crucible faster than the molten metal is discharged into the die or mold at its rear end, into a hopper-like guide 26. The latter has a wall 27, against which the stream of molten metal impinges on leaving the spout 25, and an inclined bottom 28, on which the metal falls from the wall 27 and which serves to direct the molten metal under a comparatively slow speed into the mold for casting it again into ingots suitable for insertion into the crucible.

The mold for receiving the overflow metal consists of a body 29, having vertical channels 30 formed in its face—in the present instance, three channels—said channels having a cross-section and a length corresponding to the cross-section and length of the ingot 20. This body portion of the mold is provided with a series of chambers 31 at its back, through which water or other cooling medium is circulated by means of pipes 32 33, (see Fig. 4,) leading to a supply 34. (Indicated in Fig. 3.) The said body portion of the mold is supported on a slide 35, (see Fig. 2,) mounted on a suitable way 36 on a bracket at the front of the machine, so that it may be slid transversely to bring one or another of the mold-openings 30 into position to receive its charge.

A handle 37 is applied to the side of the body 29 for convenience in sliding it. The mold is completed by a cover 38, hung on the body 29 by means of a pair of links 39, so that when dropped the cover will be held by its own gravity and the restraining influence of the links snugly against the front of the body 29, closing the mold openings or cavities, save only at the top, and when the said cover is lifted by the handle 40 the links 39 will force the cover away from the front of the body 29, leaving the ingots free to drop out.

The cover 38 is, like the body 29, provided with chambers 41 for the circulation of a cooling medium—water, for example—supplied from the tank 34 through pipes 42 43. (See Fig. 4.)

The cover 38 projects upwardly in front of the discharge end of the hopper-like guide 26 to help direct the molten metal into the molds and carries ingot-extractors 44, one for each mold-cavity, the nose 45 of which projects into the mold-cavity a short distance in a downwardly and inwardly slanting direction.

In operation the extractor when the cover is swung away on its links first draws the lower end of the ingot out of the mold-cavity and then permits the ingot to drop under the influence of gravity free from the nose 45 of the extractor, thus removing the ingot from the mold-cavity simultaneously with the opening of the cover.

The spout 25 at the front of the crucible is arranged to be raised and lowered to determine the point at which the overflow shall take place by making a narrow opening in the front of the crucible extending from the top of the crucible to its bottom and closing this by means of the vertically-sliding shank 54 of the spout 25, the said shank forming suitable overlapping ways 55 56. (See Fig. 4.) The said shank has at one side a rack 57, which engages a segmental gear 58, pivoted at the end of the crucible-casing, the said gear being provided with a handle 60 for operating the gear, and hence the sliding spout 25, so that the latter may draw the metal from the bottom of the crucible or from any desired level above the bottom of the crucible.

The crucible 13 is supported on a series of ribs or lugs 46, interposed between the bottom and sides of the metallic casing 47 and the outer surface of the body of the crucible, the ribs or lugs 46 forming the walls of fire-chambers 48 along the bottom and sides of the crucible.

The ribs or lugs 46 are formed of suitable refractory material and preferably arranged in staggered order, as shown in Fig. 12, to form intercommunication between the several fire-chambers, so that the heat may equalize itself throughout the length of the crucible. The metallic casing 47 is also preferably lined with refractory material 49, integral with lugs 46.

From the bottoms of the fire-chambers passage-ways 50 lead to hollow subchambers 51, into which the flames are directed through horizontally-arranged cylinders 52, which receive the flames from the nipples 53 of the burners.

The burner-cylinder 52, together with the nipple 53 and the several coacting parts which constitute the burner complete, are mounted upon a bracket 61, which has a vertically-sliding engagement with the standard 62, pivoted to a support 63 on the pedestal and capable of adjustment toward and away from the subchamber 51 by a transversely-elongated socket 64, through which a set-screw 65 passes into a clip 66, also supported by the pedestal. The bracket 61 may be se-

cured in vertical adjustment on the standard 62 by means of a set-screw provided with a hand-wheel 67 for operating it. (See Fig. 1.) By this structure the burner may be swung slightly away from the face of the subchamber 51, then lowered on the standard 62, and the burner started in operation, and when it is burning well it may be raised onto the level of the mouth of the subchamber 51 and moved into close adjustment against said subchamber, when the flame will shoot through the subchamber and up through the U-shaped chambers around the sides of the crucible.

The pipe for conveying gasolene or other suitable hydrocarbon to the burner is denoted by 68 and communicates with a pipe 69, (see Fig. 3,) leading to a gasolene-tank, (indicated at 70.)

I have referred above to the support for one of the burners in connection with one of the subchambers 51, leading to the fire-chamber surrounding the crucible. It is to be understood that these burners are to be located at short intervals along the length of the crucible, one of the burners being preferably provided for each of the U-shaped fire-chambers between the supporting-ribs 46, the gang of burners for the crucible illustrated in the present case being six.

The crucible 13 discharges the molten metal under the influence of gravity into a fluid-pressure chamber 71 through an opening 72, arranged to be closed by a valve 73.

The seat 74, on which the valve 73 rests, projects a short distance into the chamber 71, and the top and sides of the valve project beyond the valve-seat, leaving a space 75 between the valve and the inner end wall of the pressure-chamber 71, within which the molten metal will accumulate when the chamber 71 is charged with metal from the crucible, thereby forming an effective seal against any escape of the fluid past the valve-seat into the crucible. This recess 75 is continued around the opposite sides of the valve-seat to the bottom of the valve by means of a rib 75*, (see Figs. 8 and 9,) so that a small amount of the metal is pocketed between the valve and the outer margin of its seat at each discharge of metal from the chamber 71. I have found this a very effective means of sealing the valve against back fluid-pressure, the seal being renewed at every successive charge and preventing all trouble from that source.

The valve 73 is provided with a socket 76 on its back, the said socket being made slightly flaring from its central portion toward its outer ends, and in this socket there is located a coupling-piece—in the present instance a cylindrical piece 77—having its lower end 78 enlarged to engage the lower end of the socket-wall and having a bore extending downwardly from its upper end for the reception of a coupling-pin 79, which extends through the arm 80 of the valve-operating lever and into the coupling-piece 77 for the purpose of attaching the valve to the arm 80 of the valve-operating lever. The valve-operating lever is pivoted at 81 to a vertically-reciprocating slide 82, mounted in a cylindrical dome 83, uprising from and having its interior in communication with the fluid-pressure chamber 71.

A rod 84 is connected at its lower end with the slide 82 and extends up through the top of the dome 83, where it is provided with a handle 85 for lifting the rod and slide 82, and hence the valve-operating lever and valve, upwardly in a direction parallel with the valve-seat away from in front of the passage-way 72 whenever it is desired to leave free communication between the fluid-pressure chamber 71 and the crucible—as, for example, for the purpose of drawing off the molten metal, cleaning the interior, or to prevent breaking of the valve by the solidifying of the metal, if it be desirable to let the metal solidify—as, for instance, when stopping at night.

The valve-operating lever 80 has also a lever-arm 86 connected therewith, the upper end of which arm is provided with a transverse pin 87, resting in the upwardly-opening socket 88 in the end of a rod 89, extending horizontally through the wall of the dome 83 and provided with a bearing 90 for the purpose of rocking the arm 86, and hence the arm 80, to throw the valve 73 away from and toward its seat when desired.

When the valve is lifted by means of the rod 84, as hereinabove described, the cross-pin 87 on the lever-arm 86 is lifted out of its socket 88, and when the valve is lowered again the pin seats again in its socket and may then be manipulated by the rod 89.

The valve 73 with its socket 76 and coupling-piece 77 are preferably made of some suitable refractory material—such, for example, as the Dinas brick above referred to—and the metallic pin 79 is protected by the coupling-piece from contact with the molten alloy, which in the case of aluminium alloy will attack the iron and not only destroy the iron, but will itself suffer deterioration from the mixture.

The shape of the socket in which the coupling-piece 77 is located and the flat side of the head 78 in proximity to the back of the valve permit the valve to adjust itself to its seat and at the same time prevent it from turning on the coupling-piece to any great extent.

The top of the dome is provided with a short tube 91, through which an opening extends into communication with the interior of the dome, the said tube being provided with a transverse diaphragm of glass or other suitable transparent substance, so that the

eye of the observer may determine the condition of the metal in the fluid-pressure chamber 71.

The top of the dome 83 also has connected therewith the pipe 92, leading to a valve-chamber 93, which valve-chamber is in communication through a pipe 94 with a suitable fluid-pressure supply, indicated at 95. (See Fig. 3.)

The fluid-pressure chamber 71, like the crucible 13, is formed of suitable refractory material, is U-shaped in cross-section, and is spaced from the outer casing 96 (see Fig. 8) by ribs 97, which forms the side walls of fire-chambers communicating with the subchamber 98, into which a burner discharges its flames in the manner hereinbefore set forth in describing the crucible.

A fluid-tight joint is formed between the walls and cover of the fluid-pressure chamber by providing the cover 71* with a depending flange 71**, (see Fig. 8,) which fits the inner face of the upper part of the chamber-wall, and locating an angle-iron 72* with one of its branches against the outer face of the upper portion of the chamber-wall and its other flange against the under side of the cover 71* and bolting the said angle-iron in place, inserting some suitable packing material 73* between the parts.

In proximity to the fluid-pressure chamber 71—in the present instance in alinement therewith—I locate what I am pleased to term the "discharge-chamber" 99. This chamber, like the chamber 71, is U-shaped in cross-section and is formed of suitable refractory material and spaced from the outer casing by means of ribs 100, which form the side walls of U-shaped fire-chambers communicating with a subchamber 101, into which a burner similar to that hereinbefore referred to discharges its flame for the purpose of keeping the material in the discharge-chamber in the fluid state. The cover of the discharge-chamber 99 is made fluid-tight at the joint with the walls of the chamber in a manner quite similar to that hereinabove described, referring to the fluid-pressure chamber.

The fluid-chamber 71 communicates with the discharge-chamber 99 through a passage-way 102 near its bottom, which passage-way is closed by a valve 103, constructed and supported in a manner quite similar to the valve 73, hereinbefore described, and, like the valve 73, arranged to be sealed by the molten metal within the discharge-chamber.

The valve 103, like the valve 73, is capable of being positively lifted from its position in front of the passage-way 102 by means of an operating-rod 104, provided with a handle 105 and extending down through the top of a dome 106 into connection with a slide 107, to which the valve-supporting lever 108 is hinged.

The dome 106, like the dome 83, is provided with a peep-hole 109 (see Fig. 3) and also has connected therewith a pipe 110, leading to a low-pressure tank, (indicated by 111,) which tank 111 is also utilized to supply the pressure on the gasolene in the tank 70 by means of a communicating pipe 112.

The low-pressure fluid in the tank 111 is conveniently supplied from the high-pressure tank 95 through a pipe 113, provided with a reducing-pressure valve (indicated at 114) of any well-known or approved form.

The pipe 110, leading to the dome 106, is provided with a check-valve 110* and with a branch 115, in which there is located a safety-valve of any well-known or approved form for maintaining the pressure in the chamber 99 uniform when the metal accumulates in the chamber 99 faster than it is ejected therefrom.

The discharge-chamber 99 is provided with a discharge-nozzle 116, lined with a suitable refractory material 117 and having connected with its outer end the die or mold 118, which determines the size and shape of the cross-section of the continuous rod, plate, or bar to be cast. In the present instance the die or mold is shown removably attached to the nozzle 116 by means of its screw-threaded inlet end, which screws into the end of the nozzle, thus permitting the die to be removed at pleasure for change of size.

The die or mold 118 is surrounded by a cooling-chamber 119, which cooling-chamber extends back around the discharge-nozzle 116, so that the die or mold 118, which is preferably formed of metal, may be kept cool throughout its entire length or for a considerable distance from the point where the molten metal enters it. It is important that the metal be cooled quickly on entering the die or mold, and to this end the cooling liquid is caused to enter the cooling-chamber 119 opposite the inlet end of the die or mold, which, together with the extension of the chamber 119 back toward the chamber 99 beyond the inlet end of the die or mold, serves to keep the inlet end of the die or mold where the hot metal first touches it cool.

The refractory lining 117 receives the molten metal from the discharge-chamber 99 and protects the nozzle 116 until such a point has been reached away from the chamber 99 as to admit of the convenient location of the cooling-chamber 119, at which point the metallic die or mold receives the molten metal and cools it to a rigid condition. The cooling medium enters the chamber 119 through pipe 121 and flows from it through pipe 120, leading to the water-tank, (indicated at 34,) a pump (indicated at 122) being used in connection with the tank to keep the circulation constant.

From the die or mold 118 the bar, plate, or rod of metal, cooled sufficiently to be fairly rigid, is received between rollers 123 124,

which by their frictional grip on the bar and by the rate at which they are made to rotate serve either to accelerate the passage of the metal through the die or mold 118 or to retard it, as may be required, to form the most perfect casting.

The rollers 123 and 124 for determining the speed at which the bar shall be cast are mounted in vertically-adjustable boxes controlled by set-screws 125 126, the boxes being held apart by interposed springs 127. (See Fig. 1.) This provides means for locating the space between the rollers in perfect alinement with the die or mold 118 and also for determining the pressure which the rollers shall exert upon the bar or rod being cast. The rollers 123 124 are geared to rotate together by means of intermeshing gear 128, it being understood that the corresponding gear for the roller 124 is immediately under the gear 128. (Shown in Fig. 3.) The roller 124 is positively driven by means of a spur-gear 129 on the opposite end of its shaft, which intermeshes with an intermediate spur-wheel 130, which in turn is positively driven by a spur-wheel 131 on a transverse shaft 132, (see Fig. 2,) which carries a bevel-faced pinion 133 (see Fig. 3) in gear with a bevel-faced wheel 134, (see Fig. 2,) fixed to rotate with a vertical shaft 135, mounted in suitable bearings in the supporting-frame and provided with a bevel-faced pinion 136 on its lower end in mesh with a bevel-faced gear-wheel 137, loosely mounted on the drive-shaft 138 and arranged to be locked to and released from the shaft 138 by means of a sliding clutch 139 under the control of the clutch-operating lever 140.

The drive-shaft 138 is mounted in the pedestals of the machine and is provided with a band-pulley 141, from which it receives motion from a source of power not shown.

The intermediate gear 130 (see Fig. 1) hereinabove referred to is mounted on a lever 142, fulcrumed at 143 to the standard 12 and provided with an elongated curved slot 144, through which a set-screw 145 extends into the standard 12 for the purpose of locking the lever, and hence the gear-wheel 130, carried thereby, in position to intermesh with the wheels 129 and 131 when for any reason the said wheel 129 has been adjusted to a new position or when it has been interchanged for a wheel of greater or lesser diameter to diminish or increase the rate of movement of the rollers. To this same end the bearing of the gear-wheel 130 on the lever 142 is made to slide longitudinally on the lever and is locked in its adjusted position by any well-known or approved means.

The valve 73 for opening and closing communication between the crucible and pressure-chamber is operated at regular intervals, and the fluid-pressure is admitted to cause the alloy to escape from the chamber 71 at regular intervals corresponding to the closing and opening of the valve 73 by means of controlling-valves in the chamber 93, as follows:

The pipe 94 (see Fig. 11) leads from the high-pressure tank to the interior of the valve-chamber 93, and the pipe 92 leads from the said valve-chamber to the interior of the dome 83. An upper valve consisting of a cylindrical barrel portion 146 and a reticulated head 147 is arranged to slide in a seat 148 at the top of the valve-chamber and in a seat 149, located in the valve-chamber at a point intermediate the points where the pipes 92 and 94 communicate therewith.

A lower valve, consisting of a cylindrical barrel portion 150 and a reticulated upper portion 151, is arranged to slide in a seat 152 in a part of the valve-chamber below the point where the pipe 92 communicates with the interior of the valve-chamber.

The upper and lower valves are connected by a central rod 153 and locked to move together by means of a nut 154 and jam-nut 155.

The valve-operating rod 156 is connected with the barrel portion 150 of the lower valve by means of an enlarged head 157, which is permitted to move within the barrel 150 and is held normally at a position about midway of the barrel by interposed springs 158 and 159. This attachment of the valve-operating rod 156 permits the rod to receive an initial impulse from the drive-shaft, which impulse is received first upon the spring 158 or 159, according to the direction in which the valve is moved, and which in turn is imparted to the valve by the springs in the one or the other of two opposite directions, thereby avoiding undue strain upon the valve-seats as the valve-operating rod is positively reciprocated.

When the parts of the valve are in the position shown in Fig. 11, the pressure of the fluid from the high-pressure reservoir is cut off from the fluid-pressure chamber 71 by the barrel portion 146 of the upper valve, which closes communication from the pipe 94 past the seat 149 to the pipe 92, and the pressure-chamber 71 is open to the atmosphere through the reticulated portion 151 of the lower valve. This is the position which the parts assume while the valve 73, which opens and closes communication between the crucible and fluid-pressure chamber 71, is opened and a charge of the molten metal or alloy allowed to flow under the influence of gravity from the crucible 13 into the fluid-pressure chamber 71. Just as soon as the fluid-pressure chamber 71 has received its charge the valve 73 is closed, and at this moment the valves under the control of the rod 156 are lifted, closing communication past the seat 152 with the atmosphere and opening communication between the pipes 94 and 92 through the reticulated por-

tion 147 of the upper valve, thereby admitting high pressure on the change of molten metal or alloy in the chamber 71 and forcing it past the valve 103 into the discharge-chamber 99 and thence into and through the mold or die 118.

The valve-operating rod 156 is reciprocated by means of a lever 160, fulcrumed at 161 to the pan 7 and operated by a pitman 162, connected with an eccentric 163, fixed to rotate with the drive-shaft 138.

The valve 73 is opened and closed by means of a crank-arm 164 on a rock-shaft 165, journaled in a socket 166, mounted on the top of the casing of the fluid-pressure chamber, a crank-arm 167 on the opposite end of the rock-shaft 165 (see Fig. 1) being connected by a rod 167* with a lever 168, (see Fig. 5,) fulcrumed at 169 on a tie-rod and controlled by a cam 170, carried by the drive-shaft 138.

The structure of the crucible and pressure-chambers is such that the metallic casing, which supplies the strength, is protected from the intense heat and serves to hold the refractory material securely in position.

The operation of the machine may be briefly stated as follows: The bars or ingots 20 having been inserted in the crucible 13 and the fires started, as soon as the crucible is supplied with molten metal or alloy the drive-shaft 138 may be set in motion, and the charges of molten metal will thereupon be received into and forced from the fluid-pressure chamber 71, as hereinbefore described. As soon as the high pressure is removed from the fluid-chamber 71 the valve 103 will promptly seat itself by back pressure and the pressure under which the metal is to be forced into the die will be maintained in the discharge-chamber 99, causing the metal to flow into and through the die or mold 118. As soon as the bar, rod, or plate passes from the end of the die or mold into position to be gripped by the rollers 123 124 the latter may be set in motion by throwing the clutch 139, and the retarding or accelerating effect of these rollers will determine the rate at which the bar, rod, or plate shall be cast. If at any time the molten metal in the crucible 13 reaches a point higher than is required for the best results, the overflow will pass through the spout 25 and be recast, as hereinbefore described. When for any reason it is desired to clear the crucible of molten metal, the spout 25 may be lowered and the metal from the crucible cast into bars or ingots in form and size suitable for being again inserted into the crucible, when the casting process shall be again started.

What I claim is—

1. A casting-machine comprising a crucible, a die or mold through which the molten mass is to be passed, a fluid-pressure chamber intermediate of the crucible and the die or mold, means for admitting fluid under pressure to the said fluid-pressure chamber to force the molten mass through the die or mold and means for controlling the speed of the mass through the die or mold.

2. A casting-machine comprising a crucible, a fluid-pressure chamber for receiving the molten mass from the crucible, a die or mold through which the mass to be cast is caused to pass, means for admitting fluid under pressure to the fluid-pressure chamber to force the mass through the die or mold and means for gripping the cast material as it leaves the die or mold to control the speed of the mass through the die or mold.

3. A casting-machine comprising a crucible, a fluid-pressure chamber for receiving the molten mass from the crucible, a die or mold through which the mass is caused to pass, means for admitting fluid under pressure into the fluid-pressure chamber to force the mass through the die or mold, rollers for receiving the cast material as it leaves the die or mold and means for regulating the speed of the rollers and thereby controlling the rate at which the cast mass shall pass through the die or mold.

4. A casting-machine comprising a die or mold through which the material to be cast is caused to pass, means for forcing the material to be cast through the die or mold, gripping-rollers arranged to engage the cast material as it leaves the die or mold and means for determining the speed at which the gripping-rolls shall rotate and thereby controlling the speed of the mass through the die or mold.

5. A casting-machine comprising a crucible, a fluid-pressure chamber, a discharge-chamber, valves arranged to open and close communication between the crucible and fluid-pressure chamber and between the fluid-pressure chamber and discharge-chamber, a die or mold for receiving the mass from the discharge-chamber, means for admitting the fluid under pressure into the fluid-pressure chamber at intervals and means for maintaining pressure in the discharge-chamber constant.

6. A casting-machine comprising a crucible, a mold arranged to receive the metal overflowing from the crucible, a second mold and means for conducting the metal into the said second mold under pressure.

7. A casting-machine comprising a crucible, openings for admitting bars of metal of a predetermined size and shape into the crucible to be melted, a mold, means for conducting the molten metal from the crucible and discharging it into the mold under pressure and another mold having its cavity corresponding in cross-section to the opening for the admission of bars into the crucible, the last-named mold being arranged to receive the molten mass which may overflow from the crucible.

8. In a casting-machine, the combination with the crucible and a fluid-pressure chamber in communication therewith, of a valve for opening and closing communication between the crucible and fluid-pressure chamber, the said valve being projected beyond its seat to form a recess between it and a part of the wall of the chamber for receiving the molten mass to form a seal between the valve and its seat during the discharge of the metal from the fluid-pressure chamber.

9. The combination with the crucible having a cover provided with openings for the reception of ingots, said openings being shaped to leave open spaces between their walls and the sides of the ingots, of a crucible-support spaced from the crucible to form fire-chambers, the said fire-chambers being in communication with the openings.

10. The combination with the crucible and fluid-pressure chamber, of a valve for opening and closing communication between the crucible and fluid-pressure chamber, means for rocking the valve on its seat and means for lifting the valve bodily in a direction parallel with its seat.

11. The combination with a crucible, of a fluid-pressure chamber, a valve for opening and closing communication between the two, a valve-operating rod and a refractory coupling-piece arranged to connect the valve-lifting rod with the valve and at the same time protect the rod from contact with the molten metal.

12. The combination with the crucible and fluid-pressure chambers and a valve for opening and closing communication between the two, of a valve-operating rod and a piece of suitable refractory material for connecting the valve, the said valve having a limited rocking movement on the piece of refractory material to permit it to adjust itself to its seat.

13. The combination with the crucible, fluid-pressure chamber, die or mold and means for controlling the speed of the casting from the die or mold, of a drive-shaft, means connected with the drive-shaft for controlling the flow of metal into and through the die or mold and mechanism for connecting the said means for controlling the speed of the casting with and disconnecting it from the drive-shaft at pleasure.

14. The combination with the crucible and discharge-chambers and means for transmitting the metal from the crucible to the discharge-chamber, of means for conducting fluid under pressure to the discharge-chamber and an escape-valve in connection with the discharge-chamber for maintaining the fluid-pressure in said chamber constant.

15. The combination with the crucible, the fluid-pressure chamber and the discharge-chamber, of means for admitting fluid at intervals into the fluid-pressure chamber under high pressure and means for admitting fluid to the discharge-chamber constantly under low pressure.

16. The combination with the crucible provided with an overflow lip or conduit, of a mold for receiving the overflow metal, and means for adjusting the overflow lip or conduit vertically with respect to the crucible to cause the metal to overflow at a higher or lower level at pleasure.

17. The combination with the crucible and discharge-chamber and means for transmitting fluid from the crucible to the discharge-chamber, of a die or mold for receiving the metal from the discharge-chamber, the said discharge-chamber being provided with a projection of suitable refractory material for directing the metal to the metallic die or mold and means for maintaining a cooling medium around said projection and metallic die or mold whereby the inlet end of the die or mold is kept cool.

18. The combination with the fluid-pressure chamber provided with a cover having depending flanges in position to engage the inner faces of the walls of the chamber, of angle-iron pieces secured to the cover with one flange engaging the outer face of the walls of the crucible.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 20th day of June, 1902.

WILLIAM A. McADAMS.

Witnesses:

FREDK. HAYNES,

HENRY THIEME.