E. B. VAN WAGNER.

CASTING APPARATUS.

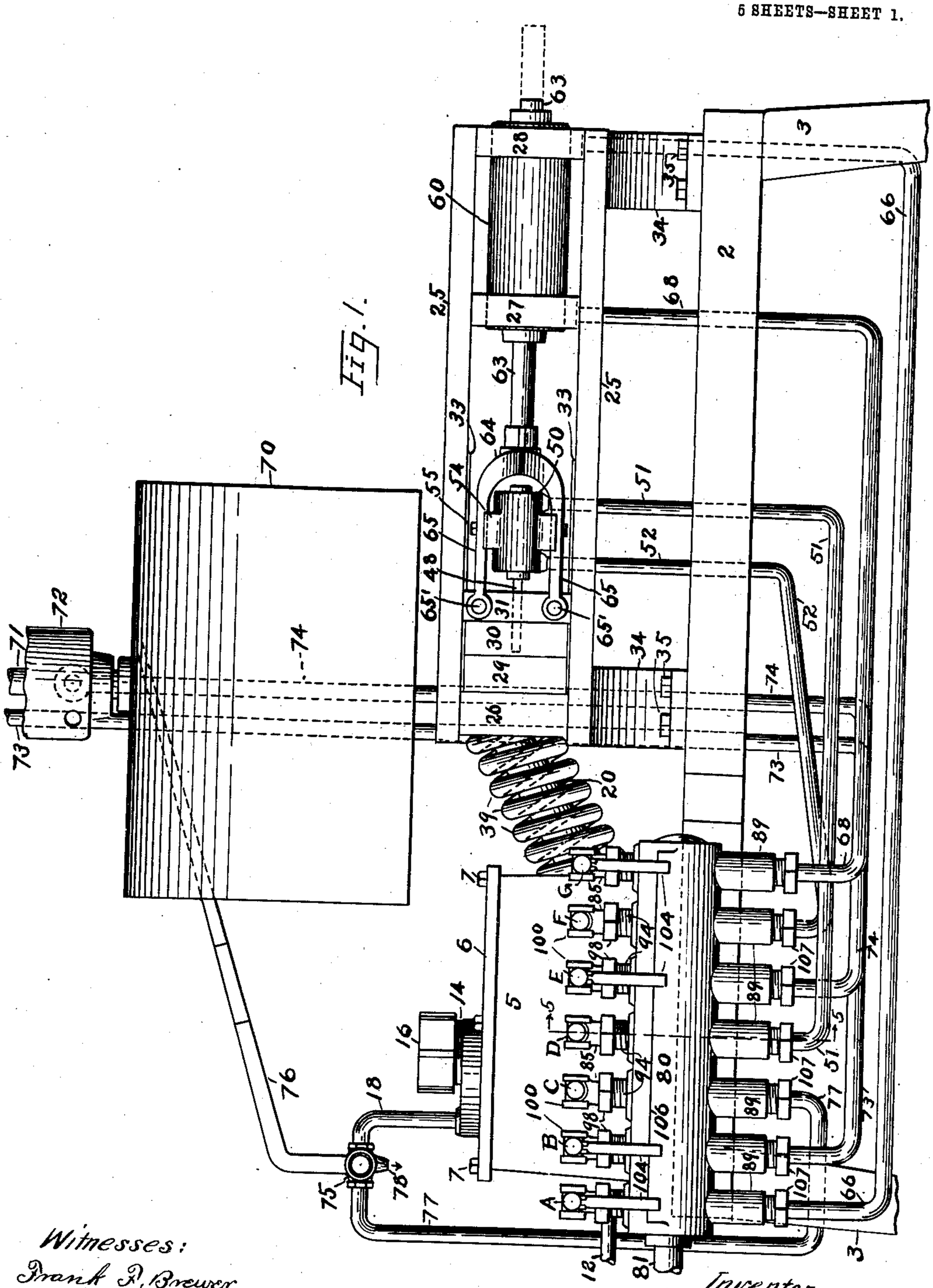
APPLICATION FILED DEC. 26, 1908.

924,858.

Patented June 15, 1909.

5 SHEETS—SHEET 1.

Fig. 1.



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5 SHEETS—SHEET 2.

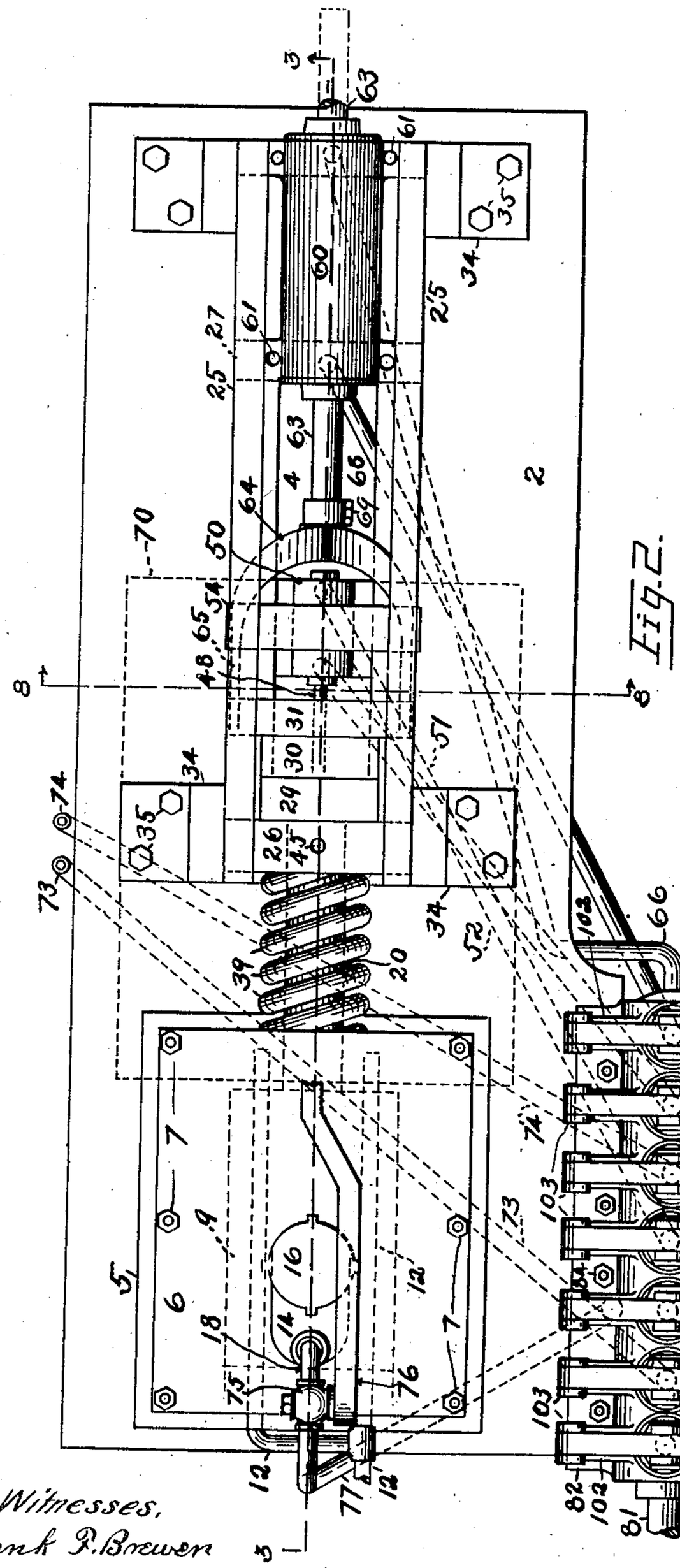

Fig. 2.

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5 SHEETS—SHEET 3.

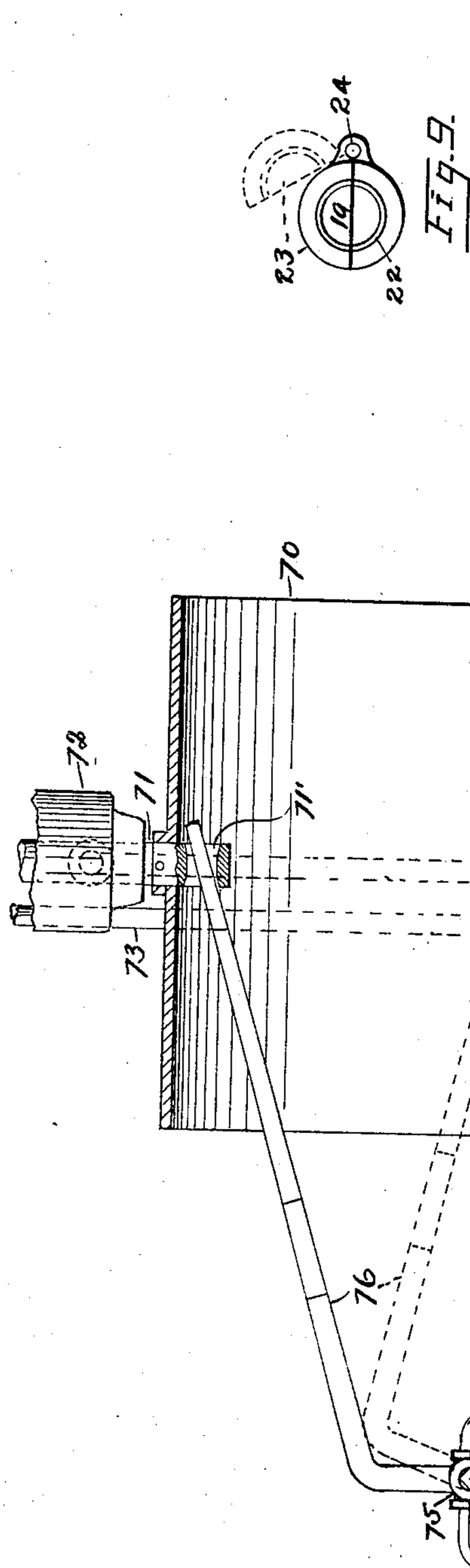

Fig. 3.

Fig. 4.

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6 SHEETS—SHEET 4.

Fig. 6.

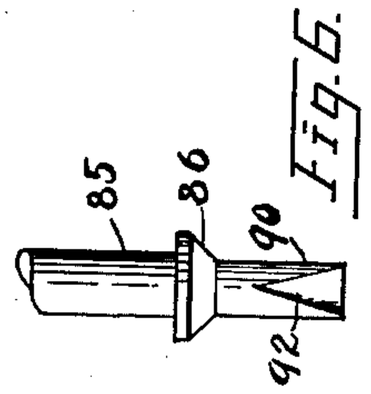


Fig. 5.

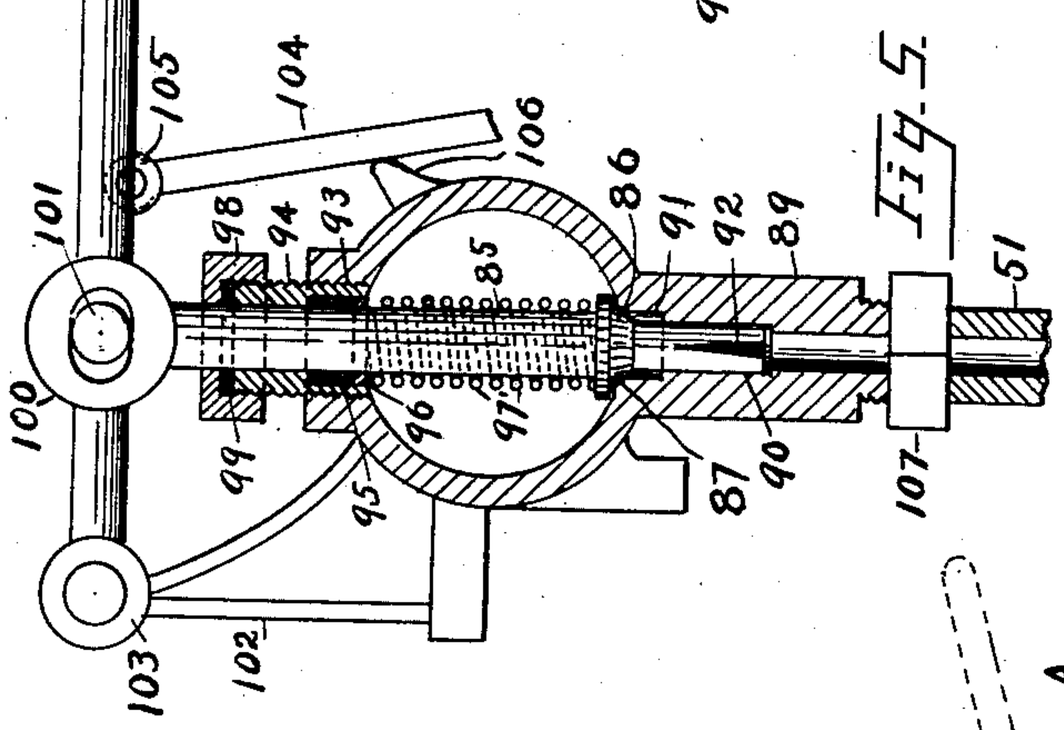
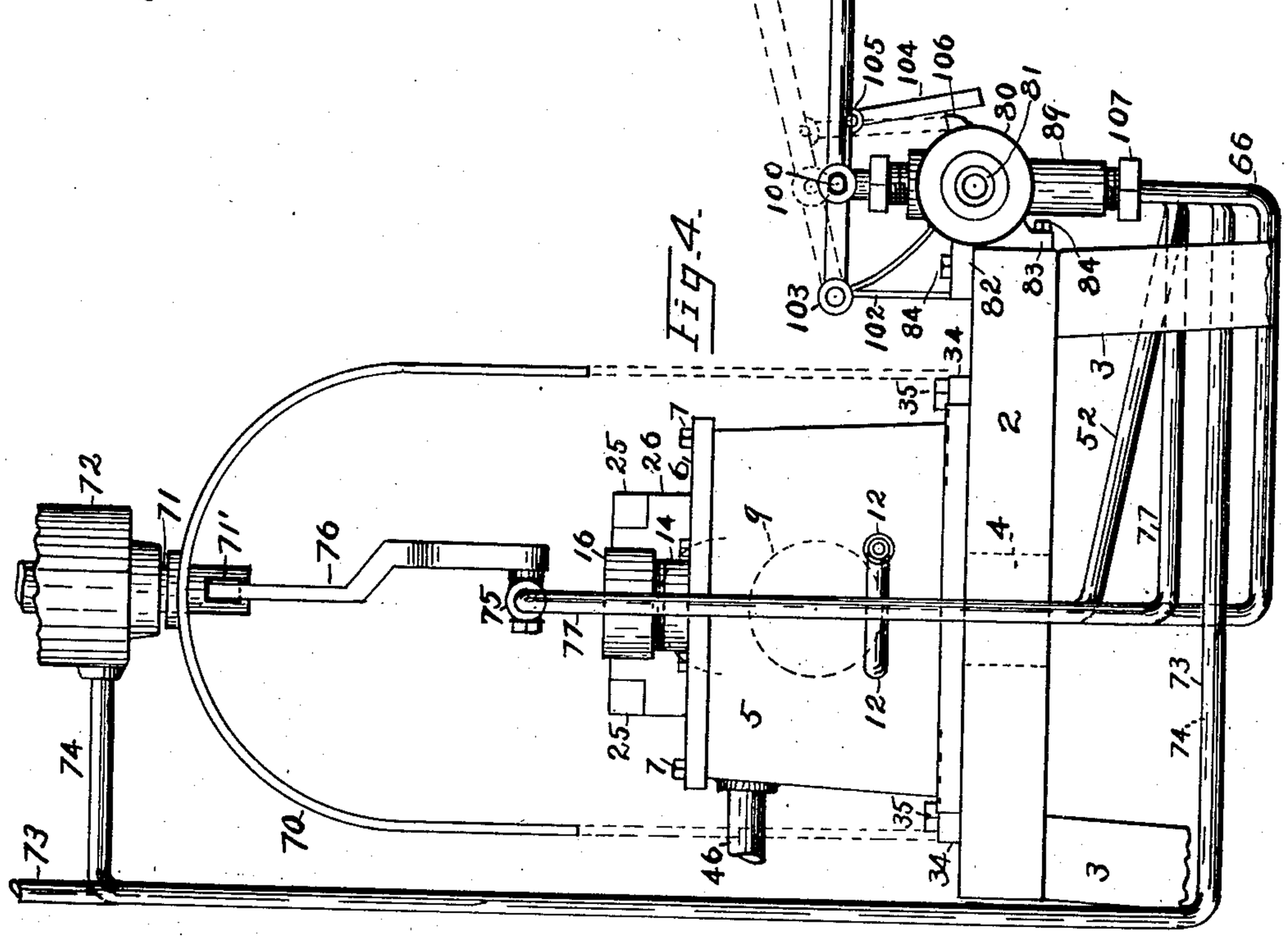


Fig. 4.



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5 SHEETS—SHEET 5.

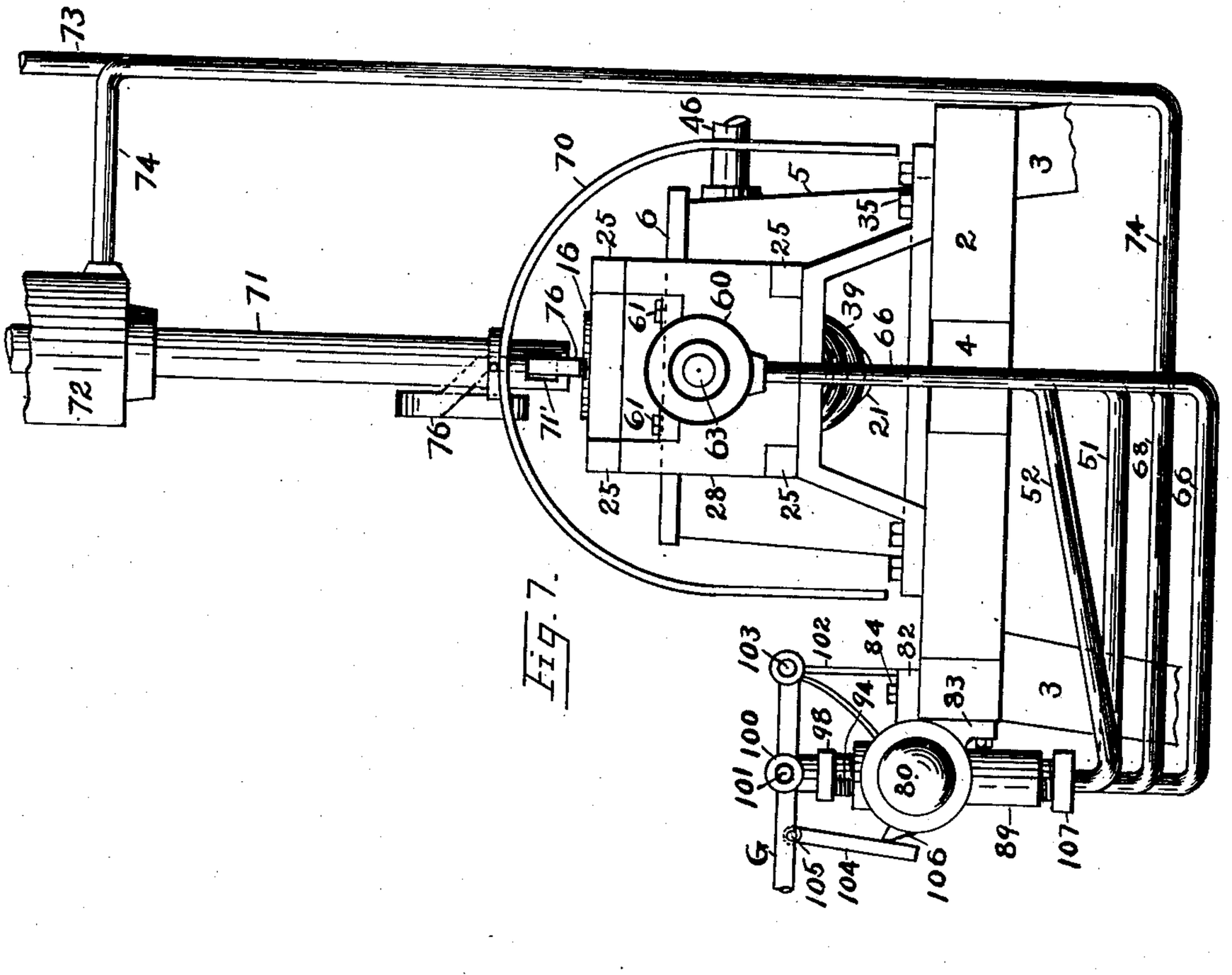

Fig. 7.

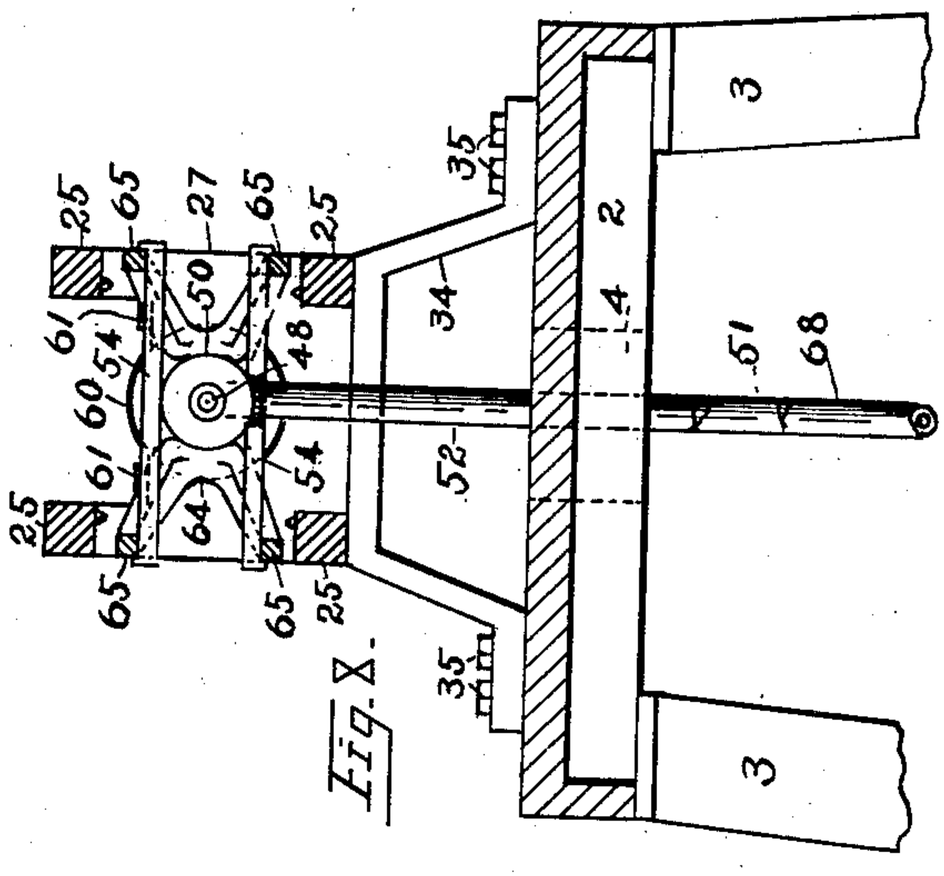

Fig. 8.

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UNITED STATES PATENT OFFICE.

ELBERT B. VAN WAGNER, OF SYRACUSE, NEW YORK.

CASTING APPARATUS.

No. 924,858. Specification of Letters Patent. Patented June 15, 1909.

Application filed December 26, 1908. Serial No. 469,236.

To all whom it may concern:

Be it known that I, ELBERT B. VAN WAGNER, citizen of the United States, residing at Syracuse, in the county of Onondaga and State of New York, have invented certain new and useful Improvements in Casting Apparatus, of which the following is a specification.

This invention relates to improvements in casting apparatus, and has for its object the providing of a device for making what is commonly known as "finished" castings, wherein the molten metal is forced into the molds or dies by fluid pressure, and wherein all of the working parts of the machine are also operated by fluid pressure, instead of by hand or other means.

This invention relates particularly to improvements in the casting apparatus shown and described in my United States Patents numbered 900,802 and 900,803, dated October 13, 1908.

The invention consists principally of a fire-box mounted on a table or stand, in which is suspended a melting-pot or cylinder, the latter heated by means of gas burners in the ordinary manner, the melting-pot having a filling neck, a pressure inlet, and a discharge spout for delivering the molten metal to a mold formed in a die, or in a pair of dies.

The invention further consists of a die frame, disposed horizontally and mounted on the table at an elevation slightly above the fire-box and melting chamber. The said frame arranged to operatively support the die-sections and other working parts of the device. The invention further consists of a fluid pressure cylinder supported by the frame, and employed for opening and closing the dies, as well as for holding the sections of the dies together during the casting.

The invention further consists of a fluid pressure cylinder supported by the piston-rod of the die-operating cylinder, which is employed for operating the gate plunger.

The invention further consists of a shield for inclosing the dies and other parts of the device, to prevent injury to the operator by the escape of molten metal during the casting periods, and of a fluid pressure cylinder for raising and lowering the shield.

The invention further consists of means operable in connection with the shield, for permitting or preventing the discharge of molten metal from the melting-pot.

The invention further consists of means for admitting fluid pressure to the melting-pot for forcing the molten metal into the mold to make the casting. And the invention further consists of a common air or other pressure retainer, mounted on the table, the said retainer being fitted with a series of valves and each valve provided with a handle or lever capable of being operated independently and sequentially, for supplying pressure to the several cylinders and also to the melting-pot, in the order in which the casting operations are to be carried out.

Other features and parts of the invention will be understood from the detail description which follows, and by reference to the accompanying drawings which form a part of this specification, and in which—

Figure 1 is a side elevation of the complete machine. Fig. 2 is a plan view of the same. Fig. 3 is a central longitudinal section substantially on the line 3—3 of Fig. 2. Fig. 4 is a front end elevation of the complete machine, showing the shield lifted to permit access to the die. Fig. 5 is an enlarged detail sectional view on the line 5—5 of Fig. 1, showing the construction and arrangement of one of the fluid pressure valves. Fig. 6 is an enlarged detail view of a part of the casting valve. Fig. 7 is a rear end elevation of the machine, showing the shield in its lower position, as when the machine is ready for casting. Fig. 8 is a cross-section substantially on the line 8—8 of Fig. 2, showing the gating cylinder and the manner of supporting it in working position. Fig. 9 is an enlarged detail view of the nozzle showing the provision for opening and cleaning the same.

Similar characters of reference are assigned to corresponding parts throughout the several views.

In the drawings, 2 represents a table or stand supported by legs 3, and having a large slotted opening 4 extending centrally from the middle to near the rear end.

5 represents a fire-box, which is mounted near the front end of the table, to which it may be secured in any suitable manner. The fire-box has an open top, which is closed by a removable cover 6, which is preferably applied so as to make a tight closure of the upper side of the box. The cover 6 is secured in place by a series of bolts 7. The fire-box is preferably lined with asbestos or some suitable refractory substance 5′.

9 represents a casting-cylinder or melting-pot, in which the metal is prepared for cast-

ing. The melting-pot is preferably cylindrical in form, except its upper side which is made flat for convenience in attaching the pot to the cover 6, by which it is suspended in the fire-box. The melting-cylinder is secured to the cover by bolts 10. The metal is placed in the large cylindrical interior 11, and is melted by means of gas flames, the gas being supplied by a pair of pipes 12, 12, which enter the fire-box through suitable openings, and extend, one on each side, the full length of the melting-cylinder. These gas pipes are perforated (not shown) at close intervals for the purpose of providing a number of gas jets, by which the flames are directed against the under side of the melting-pot. The interior of the melting-chamber is preferably lined with some suitable refractory material, as 11′, to prevent the molten metal from coming in contact with the walls of the pot and injuring the same. The gas, as a rule, is supplied to the melting-pot under considerable pressure, in order to produce the required heat.

13 represents a filling passage formed in an upwardly projecting neck or portion 14, preferably formed integrally with the melting-pot, as best seen in Fig. 3. This passage is closed by means of a screw cap 16 which, in order to make a tight closure of the filling opening is screwed down upon a packing 15, which preferably consists of asbestos or other heat resisting material.

17 represents a fluid pressure duct or passage formed in the raised portion adjacent the filling neck, into which is inserted a pipe 18, through which air or other fluid pressure may be admitted to force the molten metal from melting-chamber 11 into the molds.

19 represents a molten metal discharge passage formed in an integral neck or spout 20, cast on the rear end of the pot, which passes out through an opening 21 in the fire-box, and inclines upwardly and rearwardly to a height slightly above the top of the cavity of the pot 9. The spout 20 terminates in a horizontal nozzle 22 which is split, and the upper loose section 23 is connected to the stationary part by means of a hinge 24 (see Fig. 9). This construction is provided for permitting the nozzle to be opened and cleaned, in case the metal becomes cold and clogs up passage 19.

The die supporting frame consists of four like metallic bars or rods 25, preferably made of steel or iron, and these rods, for convenience and economy in constructing and applying them, are preferably made square in cross-section. The guide-rods 25 are preferably disposed in a manner to form a hollow square extending horizontally from near the middle of the table to the rear end thereof, and these rods are held in such position by means of a heavy metallic head piece 26, and two spaced tail pieces 27 and 28, the rods being secured to the head and tail parts in suitable manner, to make the frame rigid and strong.

29 and 30 represent respectively the stationary and the movable die sections, which may be inter-locked by means of dowel-pins 30′, such as commonly employed for the purpose. Die section 29 is intended to be rigidly mounted on the rear side of head piece 26, and is preferably held immovable during all the casting operations. Die section 30 is intended to be rigidly secured to the front face of a movable plate or block 31 by bolts or pins 32, and the die plate is slidable within the frame, by means of a series of guides 33, which are formed near the inner corners of the rods 25. The guides 33 are employed for the purpose of permitting plate 31 and die section 30 to be operated reciprocally in the frame in a truly horizontal manner. The frame thus described, is supported in its elevated position some distance above the top of the table and concentric to the nozzle 22, by means of a pair of angular brackets 34, which are secured to the table by bolts 35. The die frame is disposed upon the table directly above the slotted opening 4.

The mold by which a casting is made is sometimes formed in one, but as a general rule, the mold cavity is partly formed in each, of the die sections, as indicated by the numeral 36 (see Fig. 3). The molten metal reaches the mold by means of a small port 37 formed in the die section 29, and which is disposed concentric to the nozzle 22.

In order to carry out the workings of the present machine, the spout 20 is necessarily a foot or more in length, and in order to reach the die sections, the spout extends for some distance beyond the fire-box. Under this arrangement it is difficult to maintain the required temperature in the discharge passage 19, so as to prevent the metal from becoming chilled before it enters the mold, unless some independent heating means is provided for this part.

39 represents a coiled gas pipe, which surrounds the discharge throat 20. Each coil of pipe 39 having a number of perforations 40 formed on its inner circumference, through which gas is discharged, and then burned, the flames from the jets being directed against the spout 20, for the purpose of heating the same. By the use of the coil 39, the discharge passage 19 may be heated to substantially the same temperature as the melting-pot within the fire-box. A pipe 41 supplies gas to the coil 39. The head piece 26 of the frame is provided with a cavity 42 formed concentric to the nozzle 22, and within this cavity is placed a coil of gas pipe 43, which surrounds the nozzle and is perforated the same as the coils 39, and forms a gas burner for heating the nozzle, to prevent the cooling of the metal during the casting period. The nozzle heater 43 receives its sup-

ply of gas from the coil 39 through a small pipe 44. A vent 45 is formed in the head piece 26 for supplying draft for the burner 43, and also allows the burned gas to escape from the cavity 42.

46 represents a discharge pipe for carrying off the burned gas, as well as providing draft for the fire-box.

The working parts of my improved casting machine are all operated and controlled automatically by pressure, which in the present device consists of compressed air, although any other fluid pressure may be employed for operating all of the movable parts with the same results.

As heretofore explained the casting is done by means of air pressure, which enters the melting-chamber through the duct or passage 17, and forces the molten metal out through the throat 19 and nozzle 22, through the port 37 into the mold 36. As soon as the metal enters and fills the mold, the next operation is the "gating" of the casting. This is done by a reciprocating plunger 48, which passes through hole 49 formed in die section 30, and is preferably disposed concentric to the port 37. The gate 48 also passes through a hole in the die plate 31 (see Fig. 3).

To properly gate a casting after the mold is filled with molten metal, the plunger 48, is driven inwardly until it enters and closes the port 37, which effects the confining of the molten metal in the mold. The gate is then left in the last position until the metal hardens and the casting is completed.

To operate the gate 48, I provide a small cylinder 50, having a piston (not shown) common to cylinders of the class, to which the gate 48 is connected and also serves as the piston-rod. Air pressure is supplied to cylinder 50 for gating the casting through a pipe 51, and the pressure to release or withdraw gate 48, is supplied through a pipe 52. Die section 30 and its supporting plate 31 are operated reciprocally in the frame, to open and close the mold, by means of a large cylinder 60, which is mounted upon the tail pieces 27 and 28, and is held in place by bolts 61. Cylinder 60 is disposed concentric to the frame and mold the same as gate 48. Cylinder 60 is provided with a piston 62, mounted on a piston-rod 63 which extends through the cylinder, in order to assist in guiding and holding the rod truly concentric to the other parts. One end of piston rod 63 is fitted with a fork 64, having four prongs or arms 65, the extremities of the arms being secured to the vertical edges of the guide block 31, and by means of which the block and die section 30 are operated to open and close the mold. The "gating" cylinder 50 is mounted between, and carried backward and forward at each opening and closing of the mold by the fork 64. Cylinder 50 is connected to the arms of the fork by means of a pair of cross bars or lugs 54, which are secured to the arms by bolts 55. The pressure for closing the dies is supplied to cylinder 60 by a pipe 66, the pressure entering the rear end of said cylinder through a port 67. The pressure for reversing the piston and withdrawing die section 30, to open the mold for the removing of a casting, is supplied through a pipe 68, and enters the cylinder through a port 68′ (see Fig. 3).

69 represents a split ring or collar, hinged at one side and clamped on piston rod 63 for shortening the backward stroke of the piston and die section 30 during the casting period.

After the die sections have been closed up by the operation of cylinder 60, and before any molten metal can be forced into the mold, a shield 70, preferably made of heavy sheet metal in the form shown in the drawings, and which is disposed directly above the die sections, must first be lowered from its upper position shown in Figs. 1, 3 and 4, to its lower position shown in Fig. 7. This shield is provided to prevent injury to the workmen which might result from the escape of molten metal from between the die sections, or by the bursting of the discharge spout 20, while the heavy pressure for casting is being applied. The shield 70 is suspended by means of a piston rod 71, which is operated by a piston (not shown) in a cylinder 72, which may be supported from the ceiling of the shop or by any other suitable means. The piston rod 71 is operated downwardly by pressure supplied to cylinder 72 through a pipe 73, and it is operated for raising the shield by pressure received through a pipe 74.

In order to render the machine safe, and to prevent accidental application of the pressure to the melting-pot and the forcing of the metal into the mold when the die sections are open, I provide a valve 75, preferably a three-port valve, which is disposed in the pipe 18 above the melting-pot. This valve is operated by a lever 76 which extends upwardly underneath the shield 70, and its free end passes loosely through a slot 71′, formed in the lower end of piston rod 71. The arrangement of lever 76 is such, that when the shield is raised to its highest position, it closes valve 75 and prevents the pressure from flowing from a supply pipe 77 into the pipe 18, and at the same time opens a port 78 at the under side of the valve 75, for exhausting the air from the melting-pot, and this last provision is made to permit the unused metal remaining in spout 20 after the mold is filled, to gravitate back into chamber 11 following each casting operation. The full and dotted lines in Fig. 3 illustrate the disposition and operation of the lever 76.

To accomplish the automatic operation of the several parts of the apparatus by the employment of air or other pressure, I provide a common pressure retainer 80, which consists

of a one-part cylindrical casting, closed at one end, the opposite end being fitted with a pressure supply pipe 81, which may be connected with an air pump or other source of pressure. The retainer 80 is mounted on the table 2 by means of flanges 82 and 83 and held in place by bolts 84. To effect the operation of the several cylinders and direct the pressure to the melting-pot for forcing the molten metal into the mold, I employ seven separate, but like valves, each valve consisting of a plunger 85, which is disposed vertically in, and passes through the retainer 80. Near the lower end of the plunger 85 is formed a cone valve 86, which fits in a corresponding seat 87 formed in the bottom of the retainer.

89 represents a series of depending tubular extensions or valve casings formed integrally on the underside of the retainer, one for each of the valves, and which are bored out to receive the lower ends 90 of the plungers or valve stems 85. Immediately below the valve seat 87, the casings 89 are counter-bored, as at 91, to allow the free passage of the pressure from the retainer into the passage occupied by the stem 90. Below this counter-bored portion, the stem 90 is intended to fit the bore closely so as to prevent leakage of the air past the stem, until the latter is raised upwardly far enough to bring the upper end of a groove or recess 92 formed in the side of the stem opposite the cavity 91. The groove 92 is made V-shaped as shown in Fig. 5, with the narrow point disposed so that when the valve is first lifted the feed of the pressure through the valve will be slight, and then as the raising of the valve is continued, the flow of air will increase accordingly as the groove becomes wider. This provision is made to afford a gradual rather than a sudden charging of the several cylinders, as 50, 60 and 72.

The upper ends of the seven valve plungers project some distance above the top side of the retainer, and to facilitate the constructing and assembling of the valves, a large circular threaded opening 93 is formed in the top wall of the retainer concentric to the valve seat 87. This opening is fitted with a threaded bushing 94 through which the plunger 85 passes, and the bushing is counter-bored at its lower end to receive a packing 95, provided to prevent escape of the pressure around the plunger. The packing 95 is held in place by a ring 96 which fits in the counter-bore of the bushing, and the ring is held in place and the packing compressed, by a spring 97, which surrounds the valve rod 85 and rests upon the cone valve 86. The spring is also employed to assist the valve in closing and remaining seated, during the intervals in which no pressure is required for operating the working parts of the machine. The upper end of the bushing 94 is fitted with a gland-nut 98 which is screwed down on a packing 99. Each of the seven valves is provided with a hand-lever for use in operating the valves independently. For convenience in identifying and also describing the operations of the valves and their relation to the several working parts of the machine, the valves and valve handles are designated by letters, as A, B, C, D, E, F and G, and these letters are assigned in the order in which the several valves are to be operated during each complete cycle of casting operation. Figs. 1 and 2 show the arrangement of the valves and their operating handles and Fig. 5 shows the construction of the valves. The upper ends of the valve plungers 85 are slotted, at 100 to receive the handle bars, which are secured in place by pins 101. The inner end of each handle is pivotally connected by a pin 103 to a bracket 102, the latter preferably cast with the retainer 80. The seven valves and their fittings including the operating levers are preferably constructed and arranged exactly alike, except the casting-valve controlled by lever C, the stem of which is provided with a large groove 92, so as to permit a heavy charge of the pressure to pass to the melting-pot at the initial movement of the valve.

The molten metal being heavy, and it being necessary to fill the mold quickly as possible, to prevent the chilling of the metal before the mold is completely filled, it is important that the pressure for casting be applied strongly and rather suddenly. Fig. 6 shows the size of the groove 92 for the casting valve C, as compared with the like part provided for the other valves, as shown in Fig. 5.

In the operation of the present machine, it is essential that certain of the parts after being operated automatically by the pressure, be held for a time in the position to which they were set or forced by the application of the air. For this purpose certain of the operating-levers as A, B, E and G are provided with stop levers 104, which are pivoted at their upper ends to the said levers, as at 105, the lower ends of the stops disposed so that when the levers are raised to the position shown by dotted lines in Fig. 4, to open the valves, the lower ends of the stops swing inwardly and catch upon a ledge or shelf 106 and thus prevent the closing of the valves, and the shutting off of the pressure, in case the operator lets go the handles ahead of time. When it is time to shut off the pressure, the operator may disengage the stops 104, and allow the handles and valves to gravitate to closed position, as shown by the full lines in Figs. 1, 4 and 5. The several pipes employed for conducting the pressure from the retainer to the cylinders and melting-pot are connected to their respective valves by means of gland-nuts 107. The pipes 51 and 52 which supply

pressure for the gating cylinder 50, should preferably be flexible, as rubber hose (not shown), so as to allow said cylinder to move reciprocally with the piston rod of cylinder 60, which controls the die 30. It is understood that suitable means may be employed for exhausting the pressure from the several cylinders, after each charging, though none such are shown herein.

The operation of my casting apparatus is as follows: Assuming that die section 29 has been mounted in place upon head piece 26, and die section 30 has been mounted upon the guide block 31, the operator will first raise the valve lever A to the position shown by dotted lines, Fig. 4, until the stop 104 catches upon the ledge 106. The lifting of lever A opens the corresponding valve and admits the pressure to pipe 66, which conducts the air to the rear end of cylinder 60, and drives piston 62 in the direction to close up the die sections 29 and 30 ready for casting, and stop 104 serves to hold the pressure in said cylinder to prevent the separation of the die sections when the metal is forced into the mold. For the second step in the operation, the operator will lift the handle B, and send the pressure through pipe 73 into cylinder 72, for the lowering of the canopy or shield 70 from its upper position shown in Figs. 1, 3 and 4, to its lower position shown in Fig. 7. The lowering of the shield, carries with it the lever 76, which opens valve 75, to permit the passage of the pressure from pipe 77 into pipe 18, thence into the melting-pot 9. The valve lever B being provided with a stop 104, the latter will hold the valve B open, and prevent the accidental lifting of the shield. The operator will next raise lever C, to open the valve which supplies the pressure to the melting-pot, for forcing the molten metal from the pot through discharge passage 19 into the mold 36. It is intended that a high pressure be employed for operating the present machine, and that the mold should fill instantly the valve C is opened. The operator will then close valve C, thus confining the pressure in the melting-pot, which will hold the metal from gravitating away from the mold. The operator should then quickly raise the lever D and send the pressure into the rear end of cylinder 50, and drive the gate 48 inwardly through die sections 29 and 30, and also mold cavity 36, until it reaches and closes port 37, which extends between the nozzle 22 and the mold. Valve D may then be allowed to close. For the next step the operator will lift lever E, to send the pressure through pipe 74 into cylinder 72, for lifting the shield to its upper position, and at the same time operating valve 75, to close the same against the flow of pressure from the retainer. The last operation of valve 75 opens port 78 in said valve, to exhaust the pressure confined in the melting-pot, so as to allow the molten metal which had been held in the discharge passage 19, to gravitate back into the melting-pot. The valve lever E by means of its stop 104, will be held in the open position, to prevent the lowering of the shield until the machine is made ready for a subsequent casting. The sixth step consists of raising lever F, for supplying pressure through pipe 52, to the forward end of cylinder 50 for withdrawing the gate 48. The final step in the cycle of operations consists of releasing the stop of lever A and then raising the lever G, for supplying pressure to the forward end of cylinder 60, to reverse the piston 62, for opening or spreading die sections 29 and 30. By this last operation the arms 65 of fork 64 move the die plate 31, and with it the die section 30, to the right, away from section 29, a sufficient distance to permit the removal of the casting from the mold. Valve G will then be held in open position by its stop 104 for the purpose of preventing the accidental closing up of the die sections while the casting is being removed. Any of the well known ejecting means may be employed for releasing the casting. After the casting has been removed and the mold cavity cleaned out, the machine is ready for the next cycle of operations, the initial step of which consists of releasing the stop of valve G and closing the same, and then opening valve A, to again close up the die sections, after which the other steps or operations already described may be repeated in regular order for each casting.

It is obvious that many other forms and arrangements of valves may be employed for directing the pressure to the several parts of the machine and produce the same results, the essential and important features of the device consisting of the use of a fluid pressure for filling the molds, and for operating the dies, the gate and the shield.

Under the construction, arrangement and operation of my improved casting apparatus, as herein shown and described, it is possible to make perfect "finished" castings more rapidly and with less labor and expense, than by the use of any of the casting devices heretofore devised and employed.

Having thus described my invention what I claim as new and desire to secure by Letters Patent, is—

1. The combination of a melting-pot and a sectional mold, the said melting-pot having a fluid pressure inlet, and a molten metal outlet, terminating in a split nozzle, the said inlet connecting with a pressure pipe, the said pressure pipe having an automatic valve for controlling the flow of pressure to and from said melting-pot, the said pressure pipe connecting with a retainer by means of a hand controlled valve, the said mold sections opened and closed by a double headed fluid

pressure cylinder, the said cylinder receiving pressure for operating its piston reciprocally through a pair of independent pipes connected by means of independent hand-controlled valves with said retainer, one of said mold sections carrying a gate-plunger, and the piston-rod of said cylinder carrying a fluid pressure cylinder for operating said gate-plunger, the last named cylinder connecting with said retainer by means of a pair of pipes and a pair of independent valves.

2. The combination of a melting-pot having a fluid-pressure inlet and a molten metal discharge throat terminating in a split nozzle, and a sectional mold connecting with said throat, the said inlet connecting with a pressure pipe, the said pipe carrying a three-way valve adapted to control the flow of pressure to and from said melting-pot, the said pipe connecting with a fluid pressure retainer by means of a valve arranged for graduating the feed of pressure from the retainer into said pipe, one of said mold sections movable toward and from the other section by the piston-rod of a fluid pressure cylinder, the piston-rod of said cylinder supporting a second cylinder adapted to operate a gate-plunger carried by said movable mold section, each of said cylinders connected with said retainer by means of a pair of independent supply pipes and a pair of independent valves, and a fluid pressure operated shield adapted to conceal the mold sections during the casting period and also to control the operation of said three-way valve.

3. The combination with a fire-box and a melting-pot, the said pot having a fluid pressure inlet passage and a molten metal discharge passage, of a sectional mold connecting with said discharge passage, a horizontal frame to support said mold, fluid pressure actuated means for opening and closing the mold sections, a fluid pressure actuated plunger to gate a casting formed in said mold, a fluid pressure actuated shield adapted when set in one position to inclose the mold sections and permit the forming of a casting, and when shifted from said position to permit the removal of the casting and at the same time prevent the discharge of molten metal from said melting-pot, a fluid pressure retainer, a pair of valves in said retainer adapted to control the flow of pressure from said retainer to said mold operating means, a pair of valves in said retainer adapted to control the flow of pressure from said retainer for reciprocally operating said plunger, a pair of valves in said retainer adapted to control the flow of pressure for raising and lowering said shield, a single valve in said retainer to control the flow of pressure from the retainer to said melting-pot, a hand-lever for operating each of said valves, and means for gradually increasing the flow of pressure through each of said valves during the opening movement thereof.

4. The combination with a fire-box and a melting-pot, the said pot having a fluid-pressure inlet passage and a molten metal discharge passage, of a sectional mold connecting with said discharge passage, a horizontal frame to support said mold, fluid-pressure actuated means for opening and closing the mold sections, a fluid-pressure actuated plunger to gate a casting formed in said mold, a fluid-pressure actuated shield adapted when set in one position to inclose the mold sections and permit the forming of a casting, and when shifted from said position to permit the removal of the casting and at the same time prevent the discharge of molten metal from said melting-pot through the discharge passage, a common fluid-pressure retainer, for supplying pressure to operate the mold sections, the gate plunger, the shield, and also to force the molten metal into the mold, a series of independent valves to control the flow of pressure from said retainer to all of said parts, and a hand-lever for operating each of said valves.

5. The combination with a fire-box and a melting-pot, the said pot having a fluid-pressure inlet passage and a molten metal discharge passage, of a sectional mold connecting with said discharge passage, a horizontal frame to support said mold, fluid-pressure actuated means for opening and closing the mold sections, a fluid-pressure actuated plunger to gate a casting formed in said mold, a fluid-pressure actuated shield adapted when set in one position to inclose the mold sections and permit the forming of a casting, and when shifted from said position to permit the removal of the casting and at the same time prevent the discharge of molten metal through the discharge passage, a common fluid-pressure retainer, for supplying pressure to operate the mold sections, the gate plunger, the shield, and also to force the molten metal into the mold, a series of independent valves to control the flow of pressure from said retainer to all of said parts, a hand-lever for operating each of said valves, and a series of stops for holding certain of said valves in open position, to prevent the accidental shifting of the parts controlled by said valves.

6. An automatic casting apparatus, comprising a fire-box, a melting-pot in said fire-box having a pressure inlet port, means for heating said melting-pot, a molten metal discharge spout for said melting-pot, a nozzle formed on one end of said spout, means for heating said discharge spout and said nozzle, a two-part mold connecting with said nozzle, a horizontal frame to support said mold, fluid pressure actuated means for opening and closing the mold parts, a fluid pressure

actuated plunger to gate a casting formed in said mold, a fluid pressure actuated shield adapted when set in one position to inclose the mold sections and permit the forming of a casting, and when shifted from said position to permit the removal of the casting, and at the same time prevent the discharge of molten metal from said melting-pot, a common fluid pressure retainer, for supplying pressure to operate the mold sections, the gate plunger, the shield, and also to force the molten metal into the mold, and a series of independent valves to control the flow of pressure from said retainer to all of said parts.

7. A casting machine comprising a fire-box, a melting-pot in said fire-box, having a pressure inlet and a molten metal discharge spout terminating in a nozzle, means for heating said melting-pot, means for heating the discharge spout and nozzle, a retainer for fluid pressure, a plurality of independent pressure-control-valves connected to said retainer, a pipe to conduct pressure from the retainer to the melting-pot through one of said valves, a valve in said pipe capable of being operated independent of said first valve, adapted to permit or prevent the passage of pressure from said pipe to the melting-pot, a lever for operating said second valve, a die frame, a pair of dies supported by said frame, a mold cavity in said dies connecting with the nozzle of said discharge spout, a shield to conceal said dies and said discharge spout while the mold is being filled with molten metal, means for connecting the lever of said second valve with said shield, whereby said valve may be opened and closed by the lowering and raising of said shield, a fluid pressure cylinder for raising and lowering said shield, and a pair of pipes for conducting pressure from said retainer to said cylinder, each of said pipes connecting with one of said control valves.

8. A casting machine, comprising a fire-box, a melting-pot in said fire-box, having a pressure inlet and a molten metal discharge spout terminating in a nozzle, means for heating said melting-pot, means for heating the discharge spout and nozzle, a retainer for fluid pressure, a plurality of pressure-control-valves connected to said retainer, each valve having a hand-lever, a pipe to conduct pressure from the retainer to the melting-pot through one of said valves, a valve in said pipe adapted to be operated independent of said first valve, adapted to permit or prevent the passage of pressure from said pipe to the melting-pot, a lever for operating said second valve, a die frame, a pair of dies supported by said frame, a mold cavity in said dies connecting with the nozzle of said discharge spout, a shield to conceal said dies and said discharge spout while the mold is being filled with molten metal, means for connecting the lever of said second valve with said shield, whereby said valve may be opened and closed by the lowering and raising of said shield, a fluid pressure cylinder for raising and lowering said shield, a pair of pipes for conducting pressure from the retainer to said cylinder, each of said pipes connecting with one of said control valves, and a stop-lever for maintaining the pressure in said pipes and said cylinder.

9. A casting apparatus, comprising a melting-pot having a discharge spout and a pressure inlet, a pressure retainer, a pipe connecting said retainer with the melting-pot, a valve interposed between said pipe and the retainer, a hand-lever to operate said valve, a three-way valve disposed in said pipe adapted to permit or prevent the flow of pressure from the retainer to the melting-pot when said first valve is open, and for exhausting the pressure from said pot, a lever to operate said three-way valve, a vertically movable shield to temporarily cover the casting machine, the said shield connected to and capable of operating the lever of said three-way valve, a pressure actuated cylinder to raise and lower said shield, pipes to carry pressure from said retainer to said cylinder for reciprocally operating said shield, a valve interposed between each of said pipes and said retainer, hand-levers for operating said valves, a die connecting with the discharge spout of said melting-pot, a frame to supply said die, a mold formed in said die adapted to be filled with molten metal when the pressure is applied to said melting-pot, a fluid pressure actuated plunger carried by said die adapted for "gating" a casting after the mold is filled, pipes to supply pressure for operating said plunger, and a valve for controlling the flow of pressure from said retainer to each of said pipes.

10. A casting apparatus, comprising a fire-box, a melting-pot in said fire-box, having a pressure inlet and a molten metal discharge spout, a pair of die sections, a mold in said die sections communicating with the discharge spout, a frame to support said die sections, a fluid pressure actuated cylinder mounted in said frame, for opening and closing said die sections, pipes to supply pressure to said cylinder to actuate the same, a gate operatively connected to said die sections, a fluid pressure actuated cylinder to operate said gate reciprocally, pipes to supply pressure to said cylinder, a shield disposed above said die sections, a fluid pressure actuated cylinder to raise and lower said shield to expose or conceal said die sections, pipes to supply pressure for actuating said cylinder, a pipe to supply pressure to said melting-pot, a three-way valve in said pipe, said valve adapted to permit or prevent the flow of pressure to said melting-pot and to exhaust the pressure from said pot, a lever to operate said three-way valve, said lever connected

to said shield and capable of being operated by the raising and lowering of said shield to permit or prevent the flow of pressure to said pot, a common fluid pressure retainer, a series of valves disposed in said retainer, one of said valves connecting with each of said supply pipes, the said valves adapted to be operated sequentially to direct the pressure from said retainer to said cylinder and said melting-pot in the order of the casting operations, and a separate lever to open and close each valve.

11. An automatic casting apparatus, comprising a melting-pot having a port to admit pressure to force molten metal from said pot, and having a discharge spout to conduct the metal to a mold, a source of pressure, a retainer for said pressure, a plurality of valves operatively disposed in said retainer, adapted to be operated sequentially in the order of the casting operations, a mold formed in a pair of die sections, a frame to support said sections, a nozzle formed on the outer end of the discharge spout of the melting-pot, adapted for filling the mold with molten metal when the pressure is applied to said melting-pot, a fluid pressure cylinder mounted on said frame adapted to open and close said die sections, a gate operatively disposed in said die sections concentric to the mold and the nozzle, a fluid-pressure cylinder to operate said gate immediately after the mold is filled, the said gate-cylinder supported in operative position by and movable with the piston-rod of said first named cylinder, a shield to inclose the dies during the casting period, a fluid pressure cylinder to operate said shield, a pipe for conducting pressure from said retainer to the melting-pot, a three-port valve disposed in said pipe adapted to admit or prevent the passage of the pressure from the retainer to the melting-pot and also to exhaust the pressure from the said pot, a lever to operate said valve, the said lever connected to and operated by said shield, and a pair of pipes to conduct the pressure from said retainer to each of said cylinders, each of said pipes connected to and controlled by one of said retainer valves.

12. A casting apparatus, comprising a melting-pot inclosed in a fire-box, and having a pressure inlet and a molten metal discharge spout, a nozzle formed on one end of said spout, a pair of die sections, a mold in said die sections communicating with said nozzle by means of a port, a plate to support one of said die sections, a frame to support said die sections and said plate, a series of guides to permit the reciprocal movement of said plate within said frame, a pressure actuated cylinder carried by said frame, a piston and piston-rod for said cylinder, the said piston-rod connected to said plate and adapted to operate the same on said guides for opening and closing said mold, a fluid pressure retainer, a pipe to conduct pressure from said retainer to said melting-pot, a valve interposed between the retainer and said pipe, a lever to operate said valve, a pair of pipes to conduct pressure from said retainer to said cylinder, a valve interposed between each of said pipes and said retainer, a lever for operating each of said last named valves, said levers provided with stops for holding said valves in open position, a shield disposed above said die sections, a pressure actuated cylinder to raise and lower said shield, pipes to carry pressure to said cylinder, a valve interposed between each of said pipes, and said retainer, levers to operate said valves, the said levers provided with stops to hold the valves in open position, a valve disposed in the pipe leading to the melting-pot, and a lever to operate said valve, said lever connected with and operable by the raising and lowering of said shield, for preventing or permitting the flow of pressure into the melting-pot after said first named valve is opened.

13. An automatic casting machine, comprising a fire-box, a table to support said fire-box, a melting-pot in said fire-box, the said pot having a fluid pressure inlet and a molten metal discharge spout, a gas burner to heat said pot, a like burner to heat said spout, a nozzle having a hinged section forming the outer extremity of said spout, a die supporting frame mounted on said table, having a hollow head piece to receive the said nozzle, a heater for said nozzle disposed in said head piece, a pair of die sections, one of said sections secured to said head piece, the other section mounted on a plate slidable in said frame by means of a series of guides, a mold in said die sections, a port to connect said mold with said nozzle, a fluid pressure cylinder mounted in said frame, a piston rod operatively connected to said cylinder and connected to said plate by means of a fork formed on one end thereof, adapted to reciprocally operate said plate and one of said die sections, a fluid pressure cylinder carried by said piston rod, a piston rod for said second cylinder, the said rod projecting from said cylinder and forming a gate-plunger, the free end of said plunger adapted to be driven through said plate and through both of said die sections by the first charging of said cylinder, for the purpose of gating a casting formed in said mold, a pair of pipes to supply pressure for operating both of said piston rods reciprocally, a pipe to supply pressure to the melting-pot to force the molten metal into the mold, a retainer for fluid pressure mounted on said table, a series of valves disposed in said retainer, each valve connecting with one of said supply pipes, and adapted to be operated separately to draw pressure from said retainer and direct the same through said pipes, a

hand-lever for operating each valve, and a stop pivoted to certain of said levers, adapted to hold the corresponding valves in open position during the intervals of making and removing a casting.

14. A casting apparatus, comprising a fire-box mounted upon a table, a melting-pot suspended in the fire-box, the said melting-pot having a fluid pressure inlet and a tubular discharge outlet, the said discharge outlet terminating in a nozzle, a gas pipe for heating said melting-pot, a gas pipe for heating the discharge outlet, a gas pipe for heating the nozzle, a pair of dies having a mold formed partly in each, a frame disposed horizontally mounted on the table to operatively support the said dies, a fluid-pressure cylinder carried by said frame for operating one of said dies toward or away from the other die, a piston-rod for said cylinder, a plunger for "gating" a casting operatively connected to one of the said dies, a fluid-pressure cylinder supported by the said piston-rod for operating the said plunger reciprocally, a shield to inclose the said dies during the casting operations, a fluid pressure cylinder to raise and lower said shield, a valve to admit, or exclude fluid pressure from the melting-pot, a lever to operate said valve, the said lever being operatively connected to said shield, whereby when the shield is raised the said valve is closed against the pressure employed for casting and opened to exhaust the pressure confined in the melting-pot, and when the shield is lowered the said valve is opened to admit the pressure for forcing the molten metal into the mold, a source of fluid pressure, a retainer to receive said pressure, a series of independent valves carried by said retainer adapted to withdraw a portion of the pressure and direct the same to said cylinders and also to said melting-pot, a series of pipes to conduct the pressure from said valves to said cylinders and to the melting-pot, and an operating-lever for each of said valves, the said levers adapted to be operated sequentially in the order of the casting operations.

15. In a casting apparatus, the combination with a table and a fire-box mounted thereon, of a melting-pot disposed in the fire-box, a fluid pressure inlet for admitting pressure to and for exhausting the same from said melting-pot, a molten metal discharge spout formed integrally with said melting-pot and projecting through an opening in the fire-box, a nozzle formed on the outer end of the said spout, a coiled pipe heater for said spout, a coiled pipe heater for said nozzle, a pair of die sections having a mold formed in their abutting sides, a port to connect the mold with said nozzle, a horizontal frame mounted on the table for supporting said die sections, a fluid pressure cylinder carried by said frame, a piston in said cylinder, a piston-rod operated by said piston, the said piston-rod connected by means of a fork to one of said die sections, and capable of moving said die section reciprocally for opening and closing the mold, a retainer mounted on the table adapted to receive pressure from a pump or other source, a series of independent valves carried by said retainer, two of said valves adapted to supply pressure for operating said piston reciprocally, one of said valves adapted to supply pressure to said melting-pot to force the molten metal into the mold, and means operable independent of said last named valve for permitting or preventing the passage of the pressure into said melting-pot.

In testimony whereof I affix my signature in presence of two witnesses.

ELBERT B. VAN WAGNER.

Witnesses:
HARRY DE WALLACE,
ROBERT L. WALLACE.