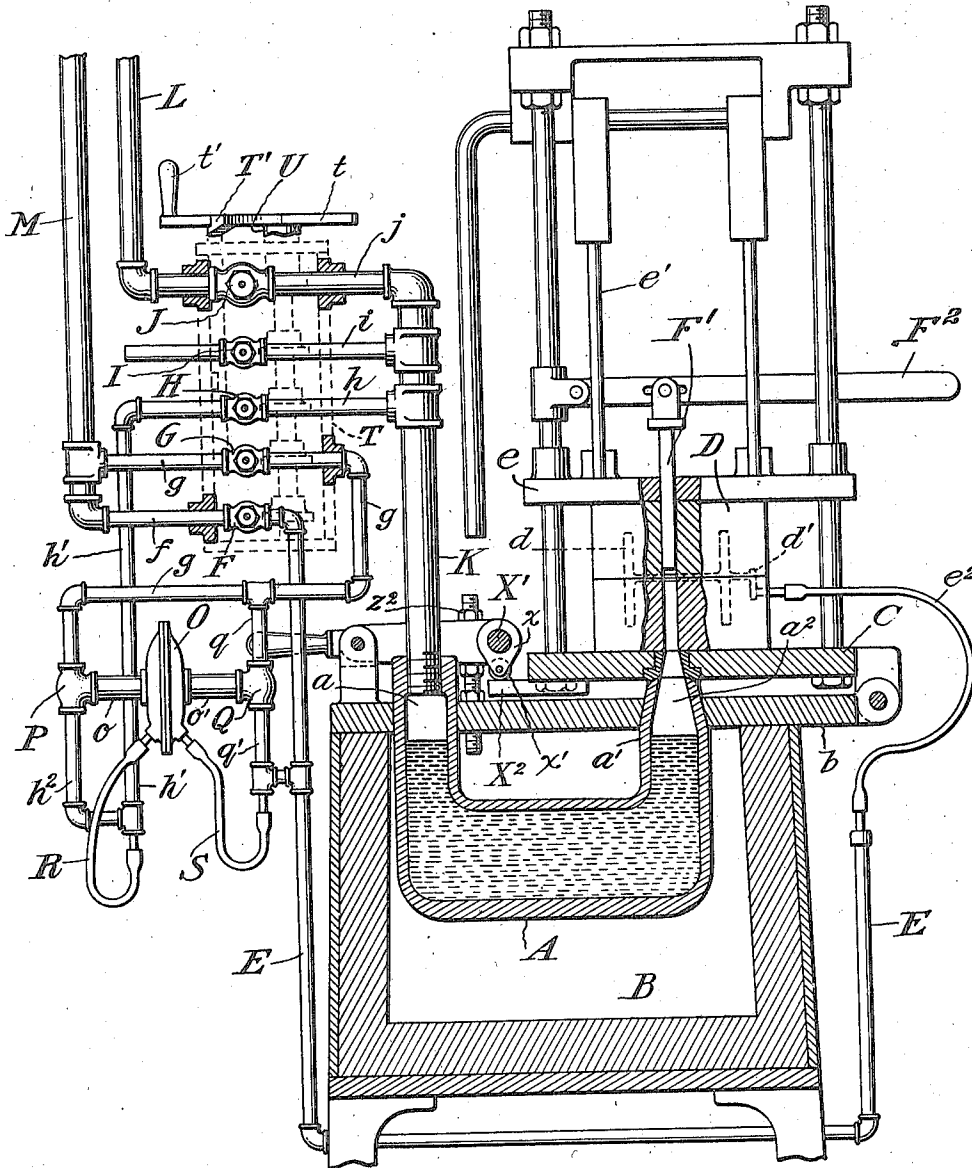


1,153,220.

Fig. 1.



Witnesses
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1,153,220.

2 SHEETS—SHEET 2.

Fig. 3.

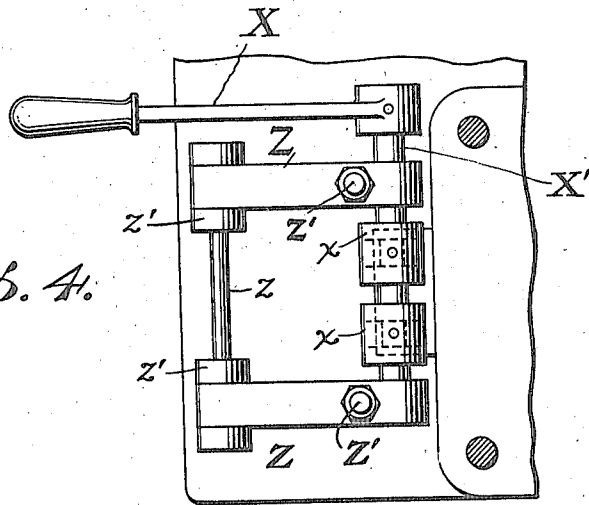


Fig. 4.

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UNITED STATES PATENT OFFICE.

CHARLES M. GREY, OF EAST ORANGE, NEW JERSEY.

CASTING-MACHINE.

1,153,220.

Specification of Letters Patent.

Patented Sept. 14, 1915.

Application filed January 4, 1912. Serial No. 669,350.

To all whom it may concern:

Be it known that I, CHARLES M. GREY, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented a certain new and useful Casting-Machine, of which the following is a specification.

This invention is a casting machine particularly adapted for carrying out the process described and claimed in my Patent No. 1,013,548 of January 2, 1912.

The object of the invention is to produce uniform, solid castings, *i. e.*, castings substantially free from entrained air or gases, and, with this object in view, the invention, in one of its broadest aspects, embodies a die casting apparatus which permits of more readily securing than has heretofore been possible, such an effective vacuum in the die as to produce the results specified.

In a more specific aspect, the apparatus embodies two chambers or compartments for containing the molten material or metal, said chambers having communication only beneath the surface of the metal, one of said chambers having free communication with the die or mold space, and means for simultaneously producing a partial vacuum in the two chambers and the die, whereby the metal at this stage is restrained from entering the die, notwithstanding the free communication of the chamber therewith, in combination with means for subsequently forcing the metal into the die. It will be observed that I dispense with the employment of a valve intermediate the metal chamber and the mold, and with all its inherent disadvantages, such as freezing, etc.

Other features of the invention, as well as the functions and advantages thereof, will appear from the hereinafter detailed description.

In the accompanying drawings, I have illustrated one practical embodiment of the invention; but the construction shown therein is to be understood as illustrative, only, and not as defining the limits of the invention.

Figure 1 is a vertical section, partly in elevation, illustrating an apparatus embodying this invention. Fig. 2 is a detail view illustrating means for operating a series of valves in a certain predetermined order. Fig. 3 is a cross section on the line 3—3 of

Fig. 2 looking in the direction of the arrow. 55
Fig. 4 is a detail view of a cover-locking lever and parts associated therewith.

A designates a reservoir for containing molten metal. As shown, this reservoir is substantially U-shaped, one of the legs of which provides a chamber *a*, and the other leg communicates with a nozzle *a'* having a chamber *a''*. The reservoir is positioned within a furnace chamber B, as is usual in the art, said chamber being covered by a top *b* through which extends the nozzle *a'* and that leg of the reservoir having chamber *a*. Above the top *b* is a plate or bed C, upon which rests a mold or die D, said mold being shown as having a casting chamber *d* of any suitable form, with which casting chamber communicates a metal inlet passage and a second chamber *d'*, the latter being positioned in the die exteriorly to the casting or die chamber *d*. The die is shown as consisting of separable parts adapted to be held or clamped together by any means known to the art, such as by a clamping plate *e* and suitable pressure mechanism *e'*, but as this clamping mechanism does not constitute any part of the present invention, it has not been considered necessary to describe or illustrate the same.

A salient feature of this invention consists in the provision of means for exhausting air from the chambers *a*, *a''* of the reservoir in order to produce a partial vacuum in said reservoir above the mass of molten metal contained therein, whereby the molten metal is restrained from flowing toward the die by the presence of an equal vacuum in chambers *a*, *a''*, thus enabling me to dispense with a valve usually employed for shutting off the flow of metal from the reservoir to the mold or die. An exhaust pipe E is connected in a suitable way, as by a flexible hose *e''*, with chamber *d'* of the die, and this exhaust pipe is connected by means hereinafter described with a suitable exhauster, for the purpose of exhausting air from the pipe itself, the die cavity and chamber *a''* of the reservoir. Pipe E is provided with a branch pipe *f* which contains a valve F, said valve constituting one of a series of valves, F, G, H, I, J, which valves severally operate to control the exhausting of air from both compartments of reservoir A, the venting of said reservoir, and the flow of air or gas under

pressure to chamber *a* of the reservoir for the purpose of imparting to the molten metal a quick movement toward the die.

K designates a pipe one end of which is connected with a leg of reservoir A so as to communicate directly with chamber *a*. This pipe is provided with a branch *i* containing valve I, the branch pipe *i* and valve I constituting a vent for the escape of air from the reservoir after the casting operation. To pipe K is connected a branch pipe *j* which contains valve J, and communicating with this branch pipe *j* is a pressure pipe L, the latter being in communication with any suitable source or air or gas pressure for the purpose of supplying pressure to chamber *a* of the reservoir at a predetermined time, whereby the molten metal within said reservoir is caused to flow toward the die. It will be understood that valve J is normally closed in order to preclude the flow of air or gas under pressure from pipe L through branch *j* and pipe K to reservoir chamber *a*, but at the proper time said valve J is opened by the operation of one form of valve operating means, said valve operating means controlling the opening and closing of the series of valves F, G, H, I, J, in a predetermined order.

M is a vacuum pipe connected with an exhaustor or any other form of apparatus adapted to produce a partial vacuum through the pipe and within the die and the respective chambers of the reservoir. Pipe E is provided with branch *f* which communicates directly with vacuum pipe M, and in this branch *f* between the pipes E, M is positioned the valve F.

O designates a regulator operatively connected with chambers *a*, *a*² of the reservoir and with the vacuum pipe M in such a manner as to automatically and simultaneously establish an equal degree of vacuum in the respective chambers of the reservoir. This regulator is of the form disclosed in my Patent, No. 1,013,548 of January 2, 1912, for an invention appertaining to "art of making castings". Said regulator embodies a diaphragm casing within which is positioned a flexible diaphragm which divides said chamber into two compartments, and to the respective sides of this diaphragm are attached valve rods leading to valves P, Q. Said valve rods extend through suitable tubes *o*, *o'*, attached to the shells of valves P, Q, whereby the valves are controlled by the movement of the diaphragm within the regulator chamber. The valves are so positioned that both of them are open when the diaphragm of regulator O is in a central position between the compartments of the regulator chamber. With valve P communicates a pipe *g* containing valve G, one end portion of said pipe *g* being attached directly to vacuum pipe M, and the other end

portion of the pipe being directly connected with the shell of valve P.

Valve H is positioned within a pipe *h*, one end of which is directly connected with pipe K having communication with chamber *a* of the reservoir. Said pipe *h* extends downwardly in the form of a branch *h'* having at its lower end another branch *h*² which is connected to valve P at the opposite end from the attachment of pipe *g* to said valve P. It will thus be seen that valve P is connected at one side by pipe *g* with vacuum pipe M when valve G is opened, and said valve P is connected at its other side by pipes *h*², *h'*, *h* with pipe K leading to reservoir chamber *a*. The line of pipe between valve P and chamber *a* has a by-pass connection with one chamber of regulator O by a flexible tube R, one end of said tube being connected with branch pipe *h'* and the other end of said tube being attached to the casing of the regulator at one side of the diaphragm so as to communicate with one compartment of the diaphragm chamber. Valve Q at the opposite side of the diaphragm from valve P is connected at one end by a pipe *g* with the pipe *g* having valve G and leading to vacuum pipe M. The other side of this valve Q is connected by a pipe *q'* directly with the pipe E, the latter having communication at one end with the die and reservoir chamber *a*², whereas the other end of said pipe E has connection by branch pipe *f* with vacuum pipe M. The pipe E is connected through a by-pass S with the other compartment of the diaphragm chamber, said by-pass being in the form of a flexible hose similar to the hose R, one end of said hose S being attached directly to the diaphragm casing, and the other end of said hose being connected with exhaust pipe E by branch pipe *q'*.

The series of valves F, G, H, I, J, are positioned in any suitable order, but preferably in the same plane as shown in Figs. 1 and 2, in order that a frame T may be brought into coöperative relation to all the valves, whereby a valve-operating mechanism is adapted to be supported by said frame T so as to coöperate with the series of valves. The frame T is provided with suitable bearings for an operating shaft U, one end portion of said shaft being provided with a lever arm *t* having a crank handle *t'*, whereby the shaft may be turned in its bearings. The shaft is provided with a series of cams *u*, *u'*, *u*², *u*³, *u*⁴, and these cams control levers *v*, the series of levers being operatively connected with the series of valves F to J, both inclusive. Any suitable form of cam and lever mechanism may be employed for operating each valve upon the rotation of shaft U, but the cams *u* to *u*⁴, both inclusive, are so arranged that the

valves will be operated in a certain order. In Fig. 3 there is shown one form of the cam and lever mechanism. Each cam is provided with a groove in which operates a pin or roller on a yoke-shaped member U' , one end of said member being connected by a pin v' to lever v . The member is positioned across the valve operating shaft U , preferably below it, one end of said lever being fulcrumed as at v^2 on frame T . The other end of lever v is connected to the rod or stem w of the valve. When the cam is turned to a certain position, the yoke member U' is lifted for the purpose of raising lever v and valve stem w , thus opening the particular valve, but the valve may be held in a closed position by any suitable means, as for example, by arranging the groove in the cam to seat the valve at the proper time. Associated with the lever arm t of valve operating shaft U is a locking mechanism for restraining the shaft from movement when all the valves except valve I are closed. This locking mechanism is embodied in a locking bar W slidably supported in frame T . The locking bar is impelled in one direction by suitable means, such as spring w' , and this locking bar is adapted to engage with a notch provided in a segment T' , the latter being attached to or made integral with lever arm t or shaft U . The locking bar may be operated by suitable means, such as lever T^2 pivoted on the frame, and engaging with a notch in the locking bar as shown in Fig. 2, so that the movement in one direction will compress the spring w' and withdraw the end portion of the locking bar from engagement with the notch in the segment T' , whereby shaft U is released in order that it may be turned by operating lever arm t .

From the foregoing it will be noted that with valves I , J and F closed, valves G , H open, and both regulator valves P , Q , in their normal open positions, the vacuum pipe M and regulator O are in communication with chambers a , a^2 of the reservoir and with the die, so that the operation of exhausting air will be carried on simultaneously in the two reservoir chambers a , a^2 , and in the die, whereby the same, or substantially the same, degree of vacuum will be obtained in the two reservoir chambers, the result of which is to restrain the flow of metal toward the die without the employment of a valve to cut off the flow of metal from the reservoir to said die, the use of such a valve being objectionable for the reason that the metal tends to solidify around the valve or "freeze" it. The two reservoir chambers a , a^2 and the die communicate with the vacuum pipe and the regulator, under the conditions just named, as follows:—

Air is drawn from chamber a through a

part of pipe K , pipe branches h , h' , h^2 past valve H , through hose R , valve P , pipe g , and through valve G . From chamber a^2 and the die air flows through pipe E , branch pipes q , q' , through valve Q , hose S and pipe g through valve G , thereby exhausting air equally from the two reservoir chambers a , a^2 and from the two compartments of the regulator O . In practice, there is a slight variation in the degree of vacuum within the two reservoir chambers and in the pipe lines, as a result of which a pulsating movement is given to the diaphragm of the regulator owing to the difference in the degree of vacuum in the compartments of the regulator chamber, but the operation of exhausting air, as a whole, is carried on simultaneously in the two reservoir chambers and the die, so as to produce a relatively high degree of vacuum in said two reservoir chambers and the die, whereby the molten metal is caused to remain quiescent in the reservoir during the said exhausting operations.

For impelling the molten metal with a quick movement toward the die, suitable means are provided for exerting pressure upon the metal. As shown, the pressure is applied by air or gas admitted to reservoir chamber a by pipes L , j , K upon opening valve J ; but prior to this operation, valves G , H have been previously closed, and valve F opened.

The valve F operates to open communication between chamber a^2 and the vacuum pipe M through the pipes E and f , and is so actuated as to be opened immediately after valves G and H are closed, to continue the exhaustion of air from the die. Thus, when the valve J is opened, to admit pressure to chamber a , the exhaustion of air from the die and chamber a^2 continues, whereby residual air and gases are exhausted from the die during the passage of metal thereto. Thus, residual air and gases are exhausted from the mold during the passage of metal thereto.

It will be noted that pipes h , h' , h^2 with valve H , and pipe g with valve G , operate, mainly, to introduce the regulator in the exhausting connections between the vacuum pipe M and the chamber a of the reservoir, but prior to admitting pressure to the reservoir through pipes L , j , K , valves G , H are closed, thereby cutting off the communication between the regulator and the vacuum pipe and pipe K so that the air or gas supplied to said reservoir cannot flow past said valve H and into the regulator, thus precluding injury thereto.

As shown in Fig. 1, a gate F' is adapted to operate across the passage through which the molten metal flows from the reservoir into the die. This gate is shown in the form of a piston, the upper part of which is con-

5 nected to a lever F^2 adapted to be operated by hand, whereby the gate may be depressed across the inlet to the die for the purpose of forcing the metal in the passage way back into the reservoir.

The operation may be described as follows:—Assuming that mold D is properly prepared for casting and that the reservoir A contains molten metal, the exhausting apparatus is put into operation so as to exhaust air through vacuum pipe M. At this time no communication between the vacuum pipe M or the pressure pipe L with the mold or die and the reservoir takes place, for the reason that valves F, G, H and J are closed, but as valve I is open, the chamber a of the reservoir is vented. In carrying out the operation, the workman manipulates lever T^2 so as to withdraw the locking bar W from the segment of lever arm t , and thereafter the lever arm is operated so as to turn shaft U. As this shaft begins to turn, one of the lever and cam devices operates so as to first close valve I, all the valves being thus closed at this time, but as the shaft continues to turn, two of the valve operating devices are so actuated as to simultaneously open the two valves G, H. The effect of this is to establish communication from vacuum pipe M with chambers a , a^2 of the reservoir and with the die. The opening of valve H allows air to pass from reservoir chamber a through a part of pipe K, branch pipes h , h' , h^2 , valve P, pipe g , valve G and thence to the vacuum pipe, thus exhausting air from chamber a of the reservoir, and at the same time air is drawn from reservoir chamber a^2 , the die, pipe E, pipes g , g' , valve Q, pipe g , valve G, and thence into the vacuum pipe. The opening of the valves H, G thus places vacuum pipe M in communication with both reservoir chambers a , a^2 , and with the die so as to exhaust the air therefrom, but any difference in the pressure in the chambers a , a^2 of the reservoir brings into operation the regulator O so as to establish a substantially uniform degree of vacuum in said chambers a , a^2 of the reservoir and in the die. When the degree of partial vacuum desired has been secured in the die and in the two chambers of the reservoir, the operator moves lever arm t in order to impart further movement to the shaft U, the effect of which is to close valves G, H, and to open valve F, thus placing the die through pipes E, g in direct communication with vacuum pipe M, for the purpose of exhausting air from the die during the flowing of the metal into said die. Thereafter, the continued turning of shaft U opens valve J, whereupon the pressure of air or gas is supplied to chamber a through pipe K, branch pipe j and pipe L, the valves G, H and I being closed and the valve F remaining open. The admission of pressure to chamber a imparts move-

ment to the molten metal so as to impel the metal from the reservoir A and nozzle a' into the molding space of die D, and thereafter the operator turns shaft U so as to close valves J and F for cutting off the pressure to reservoir chamber a , and the suction in pipe E. The casting operation being concluded, valve I is then opened for the purpose of venting reservoir chamber a when the molten metal flows back into the reservoir, at which time the notch in segment T' is opposite to the locking bar W, the spring of which impels said locking bar into engagement with the segment so as to lock the shaft in a fixed position after which it shall have completed the cycle of operations for opening and closing the series of valves.

In Figs. 1 and 4 of the drawings there is shown one embodiment of means for locking member C in a fixed position. As there shown, lever arm X is fixed upon one end of a rock shaft X' , said rock shaft having cams x provided with rollers x' adapted to apply force to lugs X^2 provided at the free edge of said member C. The rock shaft X' is supported in arms Z having loose connections with a rod z supported in lugs z' of furnace B, and through these arms Z pass threaded stems Z' . The stems are attached to cover plate b , and their upper ends pass loosely through openings provided in arms Z, suitable nuts z^2 being provided on the stems for holding the arms Z in fixed positions. By turning shaft X' , the cams and rollers apply pressure to lugs X^2 and the member C, but to release the member the shaft is turned in a direction to remove the rollers from the lugs, after which the upper nuts may be unscrewed from the stems so that the arms Z and the cam shaft may be swung upwardly and out of the way.

In the foregoing description, I have set forth one mode of operation of my invention wherein the valve arrangement is such that the suction mechanism operates to exhaust residual air or gas from the mold during the passage of molten metal thereinto, in accordance with the process described and claimed in my Patent #1,013,548, hereinbefore referred to. Manifestly, however, the valves may be so operated that the suction mechanism is precluded from operating on the mold during the passage of molten metal thereinto. This may be accomplished by simply adjusting the valve F so that said valve will be closed just prior to the opening of valve J. Thus, either method of casting may be carried out by the apparatus of the present invention.

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

1. In a casting machine, the combination of two chambers having communication be-

beneath the surface of molten metal adapted to be contained therein, a die, means for simultaneously producing a partial vacuum in the two chambers and the die, and means
5 for automatically controlling the vacuum producing means whereby a substantially uniform vacuum is produced in the two chambers and the die.

13. In a casting machine, the combination
10 of a substantially U-shaped receptacle for containing metal, a die, an unobstructed passage connecting the top of one leg of said receptacle with the die, means for exhausting air from both legs of said receptacle and
15 the die, and means for applying gaseous pressure to the metal in that leg of the receptacle not connected with the die for forcing metal into the die.

14. In a casting machine, the combination
20 of a reservoir for containing molten metal, said reservoir having two chambers above the level of the metal, a die having unobstructed communication with one of said chambers, means for producing a partial
25 vacuum in both chambers of the reservoir and in said die, and regulating means operable upon a difference in the vacuum between said two chambers for securing a substantially equal degree of vacuum in both
30 chambers of said reservoir.

15. In a casting machine, the combination
of a reservoir for containing molten metal, said reservoir having two chambers above the level of the metal, a die having unob-
35 structed communication with one of said chambers, means for producing a partial vacuum in both chambers of the reservoir and in said die, and a diaphragm regulator operatively connected with said reservoir
40 and the vacuum-producing means for securing a substantially equal degree of vacuum in both chambers of said reservoir.

16. In a casting machine, the combination
of a reservoir for containing molten metal,
45 said reservoir having two chambers above the level of the metal, a die having unobstructed communication with one of said chambers, a vacuum pipe having branches in communication with both chambers of
60 said reservoir, valves in said branch pipes, a pressure pipe connected with one of said chambers, a valve in said pressure pipe, and means for operating said valves in a predetermined order.

55 17. In a casting machine, the combination of a reservoir for containing molten metal, said reservoir having two chambers above the level of the metal, a die having unobstructed communication with one of said
60 chambers, a vacuum pipe having branches in communication with both chambers of said reservoir, valves in said branch pipes, a pressure pipe connected with one of said chambers, a valve in said pressure pipe,

means for venting the reservoir, and means
65 for operating said valves in a predetermined order.

18. In a casting machine, the combination of a reservoir for containing molten metal, said reservoir having two chambers above
70 the level of the metal, a die having unobstructed communication with one of said chambers, a vacuum pipe having branches in communication with both chambers of said reservoir, valves in said branch pipes,
75 a pressure pipe connected with one of said chambers, a valve in said pressure pipe, a vent pipe connected with one chamber of the reservoir, a valve in the vent pipe, and means for operating said valves in a prede-
80 termined order.

19. In a casting machine, the combination of a reservoir for containing molten metal, said reservoir having two chambers above the level of the metal, a die having unob-
85 structed communication with one of said chambers, a vacuum pipe, means whereby said vacuum pipe is connected to said reservoir for communication with both chambers thereof and with the die, valves in said con-
90 necting means, a pressure pipe adapted for communication with that chamber of the reservoir which is not connected with the die, a valve in said pressure pipe, a vent pipe, a valve in said vent pipe, regulating
95 means connected for communication with the vacuum pipe and with the chambers of the reservoir, and a single operating means for opening the valves in a predetermined
1 order.

20. In a casting machine, the combination of a reservoir for containing molten metal, said reservoir having two chambers above the level of the metal, a die having unob-
1 structured communication with one of said chambers, a vacuum pipe, means whereby said vacuum pipe is connected to said reservoir for communication with both chambers thereof and with the die, valves in said con-
1 connecting means, a pressure pipe adapted for communication with that chamber of the reservoir which is not connected with the die, a valve in said pressure pipe, a vent pipe, a valve in said vent pipe, regulating
1 means connected for communication with the vacuum pipe and with the chambers of the reservoir, a single operating means for opening the valves in a predetermined order, and means for locking the valve operating means.

21. In a casting machine, a reservoir for containing molten metal, said reservoir having a plurality of chambers above the metal level, a die having unobstructed communication with one of said reservoir chambers, means for admitting air or gas under pressure to the other of said reservoir chambers, means for exhausting air from both reser-

low the surface of material adapted to be contained therein, means for exhausting air from both of said chambers; whereby a partial vacuum is produced above the material therein and the metal freed from entrained gases, and means whereby one of said chambers may be exhausted independently of the other.

2. In a casting machine, the combination of two chambers having communication below the surface of material adapted to be contained therein, a mold having unobstructed communication with one of said chambers, and a vacuum conduit having a branch thereof connected with one of said chambers and another branch thereof connected to the mold for simultaneously producing a partial vacuum in the two chambers and the mold while restraining the material from flowing toward the mold.

3. In a casting machine, the combination of two chambers spaced apart but having communication below the surface of material adapted to be contained therein, a mold having unobstructed communication with one of said chambers, and means for simultaneously exhausting air from the two chambers and directly from the mold while restraining the flow of material into the mold.

4. In a casting machine, the combination of two chambers having communication only below the surface of material adapted to be contained therein, a mold having unobstructed communication with one of said chambers, means connected with one of said chambers and directly to the mold, whereby the air may be simultaneously exhausted from both chambers and from the mold while restraining the material from flowing toward the mold, and means for subsequently forcing the material into the mold.

5. In a casting machine, the combination of two chambers spaced apart and having communication only below the surface of material adapted to be contained therein, a mold having unobstructed communication with one of said chambers, means connected with one of said chambers and directly to the mold whereby a partial vacuum is produced in both chambers and in the mold while restraining the flow of material into the mold, and means for subsequently forcing the material into the mold.

6. In a casting machine, the combination of two chambers of substantially the same volume and having communication below the surface of material adapted to be contained therein, a mold positioned above said chambers and having unobstructed communication with one of said chambers, means connected with the other of said chambers and directly to the mold whereby the air may be simultaneously exhausted from both chambers and from the mold

while restraining the material from flowing toward the mold, and means for subsequently applying pressure interiorly of one of said chambers whereby the material is forced into the mold.

7. In a casting machine, the combination of two chambers having communication below the surface of material adapted to be contained therein, a mold having unobstructed communication with one of said chambers, an air exhaust conduit leading from one of said chambers and the mold, and a common exhaust and pressure conduit communicating with the other chamber.

8. In a casting machine, the combination of two chambers having communication below the surface of material adapted to be contained therein, a mold having unobstructed communication with one of said chambers, an air exhaust pipe leading from one of said chambers and the mold, an exhaust pipe leading from the other of said chambers, air exhausting means connected with said exhaust pipes, and means for applying pressure to one of said chambers through its air exhaust pipe.

9. In a casting machine, the combination of two chambers having free communication beneath the surface of molten metal adapted to be contained therein, a die, a passage connecting one of said chambers with the die and providing unobstructed communication between said chamber and the die, means for exhausting both of said chambers and the die, and means for applying pressure to one of said chambers while continuing the exhaustion of air from the other chamber and the die.

10. In a casting machine, the combination of two chambers having communication below the surface of the material adapted to be contained therein, a mold in communication with one of said chambers, means for exhausting air from one of said chambers and simultaneously from the other chamber and the mold associated therewith, and means for introducing pressure into the first mentioned chamber for the purpose of forcing the material into the mold while a partial vacuum is simultaneously produced in the mold and the last mentioned chamber whereby residual air and gases may be abstracted from the mold during the passage of material thereinto.

11. In a casting machine, the combination of two chambers having free communication beneath the surface of molten metal adapted to be contained therein, a die, means for exhausting air from both of said chambers and the die, and means for automatically controlling the exhausting means whereby a substantially uniform vacuum is produced in the two chambers and the die.

12. In a casting machine, the combination of two chambers having free communication

voir chambers and from the die, and means operating to continue the exhaustion of air from the die.

22. In a casting machine, a reservoir for
5 containing molten metal, said reservoir hav-
ing a plurality of chambers above the metal
level, a die having unobstructed communica-
tion with one of said reservoir chambers,
means for admitting air or gas under pres-
10 sure to the other of said reservoir chambers,
means for exhausting air from both reservoir
chambers and from the die, and a valved
pipe affording a direct connection from the
die to the exhausting means and operating
15 to continue the exhaustion of air from said
die.

23. In a casting machine, a reservoir for
containing molten metal, said reservoir hav-
ing a plurality of chambers above the metal
20 level, a die having unobstructed communica-
tion with one of said reservoir chambers,
means for admitting air or gas under pres-
sure to the other of said reservoir chambers,
means for exhausting air from both reser-
25 voir chambers and from the die, and a vent
for the reservoir, said vent being opened
subsequent to the flow of metal toward the
die and during the period of the backward
flow of metal into the reservoir.

24. In a casting machine, a reservoir for
30 containing molten metal, said reservoir hav-
ing a plurality of chambers above the metal
level, a die having unobstructed communica-
tion with one of said reservoir chambers,
35 means for admitting air or gas under pres-
sure to the other of said reservoir chambers,
regulating means communicating with said
chambers of the reservoir, exhausting means
in communication with the regulating means
40 and with the reservoir chambers whereby
air is exhausted simultaneously from the
reservoir chambers and a partial vacuum is
established uniformly in said chambers, and
means for cutting off communication be-
45 tween the regulating means and the reservoir
upon the admission of compressed air or gas
thereto.

25. In a casting machine, a reservoir for
containing molten metal, said reservoir hav-
50 ing a plurality of chambers above the metal
level, a die having unobstructed communica-
tion with one of said reservoir chambers, a
valved pipe for supplying compressed air or
gas to that chamber of the reservoir not con-
55 nected to the die, a vacuum pipe, a regula-
tor connected by valved pipes with the vac-

uum pipe, the pressure pipe, and the die and
reservoir, and means for operating the
valves within said pipes in a certain order to
effect the exhaustion of air from the reser- 60
voir and die, to continue exhaustion of air
from the die, and to admit air or gas under
pressure to the reservoir, in successive order.

26. In a casting machine, the combination
of two chambers having communication with 65
one another beneath the surface of the mol-
ten metal adapted to be contained therein, a
die in communication with one of said cham-
bers, means for simultaneously exhausting
air from the two chambers and from the die 70
to produce a partial vacuum therein, and
means for applying pressure to one of said
chambers while continuing the exhaustion of
air from the other chamber and from the die.

27. In a casting machine, the combination 75
of two chambers having communication be-
neath the surface of the molten metal adapt-
ed to be contained therein, suction means
communicating with each of said chambers
for simultaneously exhausting gases or air 80
therefrom, and a regulating device coopera-
ting with the exhausting means and said
chambers whereby substantially the same de-
gree of vacuum is produced in both cham-
85 bers.

28. In a casting machine, a material-heat-
ing reservoir, a supporting member having
the outlet from said reservoir extending
therethrough, a bed plate, to which a die is
adapted to be secured, pivoted to the sup- 90
porting member in such position that the in-
let to the die is in alinement with the outlet
of the reservoir, in combination with a plu-
rality of links pivoted to the supporting
member and over-reaching the free edge of 95
the bed plate, a cam mounted at the free ends
of said links, means for operating said cam
whereby the cam engages with the bed plate
and forces it toward the supporting member
for the purpose of insuring proper commu- 100
nication between the inlet to the die and the
outlet of the reservoir, and means for gov-
erning the pressure exerted by the cam on
the bed plate.

In testimony whereof I have signed my 105
name to this specification in the presence of
two subscribing witnesses.

CHARLES M. GREY.

Witnesses:

J. F. MOTHERSHEAD,
M. E. FREEMAN.