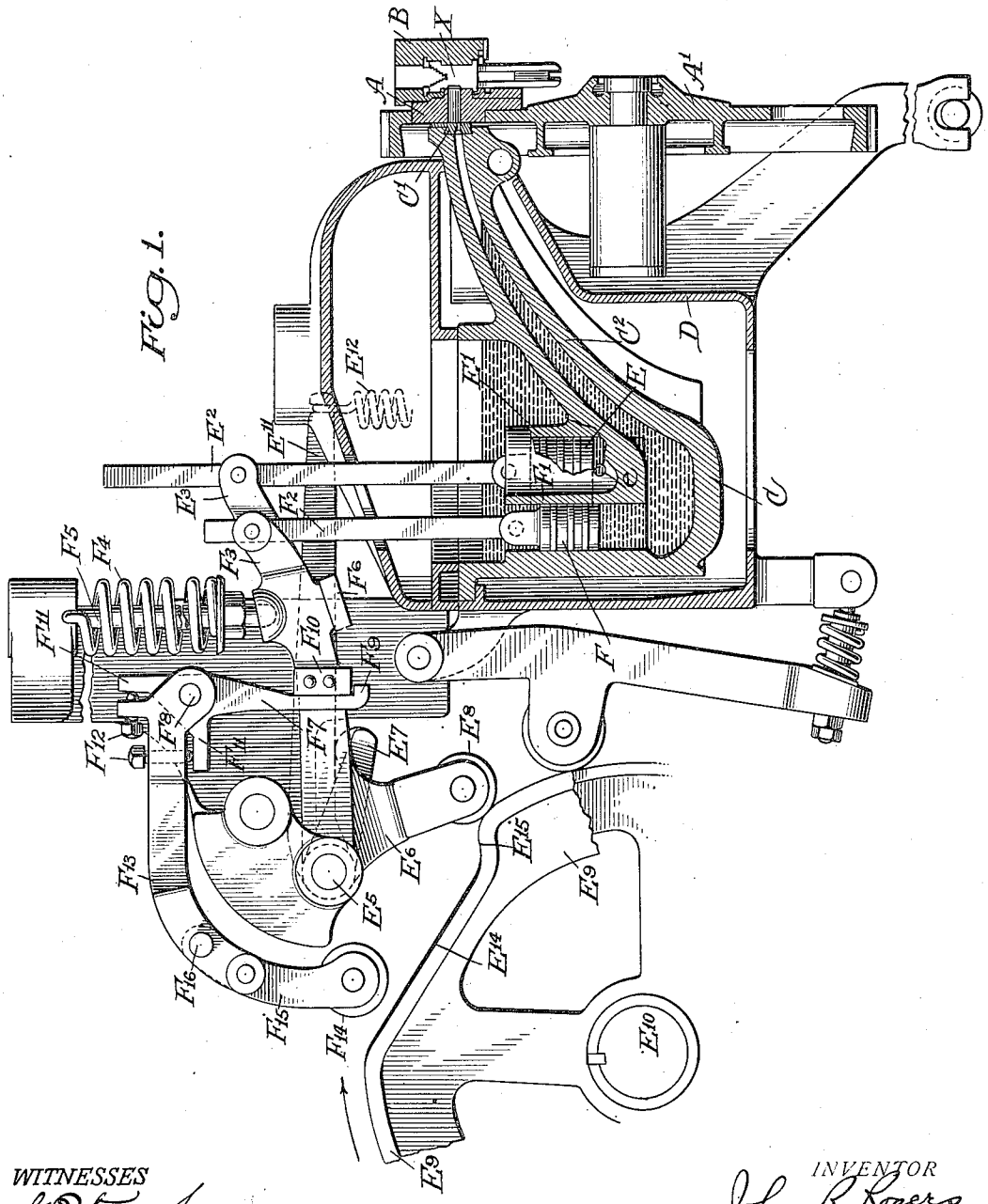
Nov. 4, 1924. 1,514,103

J. R. ROGERS

TYPOGRAPHICAL CASTING METHOD AND APPARATUS

Filed Sept. 24, 1920 3 Sheets-Sheet 1

Fig. 1.



WITNESSES

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Nov. 4, 1924. 1,514,103

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TYPOGRAPHICAL CASTING METHOD AND APPARATUS

Filed Sept. 24, 1920 3 Sheets-Sheet 2

Fig. 2.

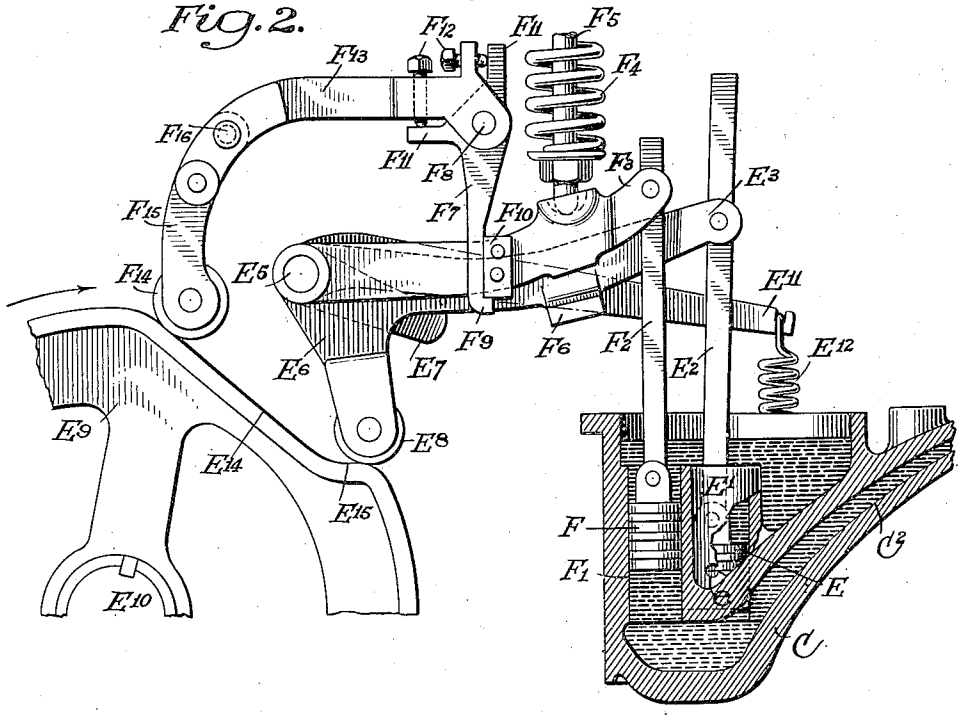


Fig. 3.

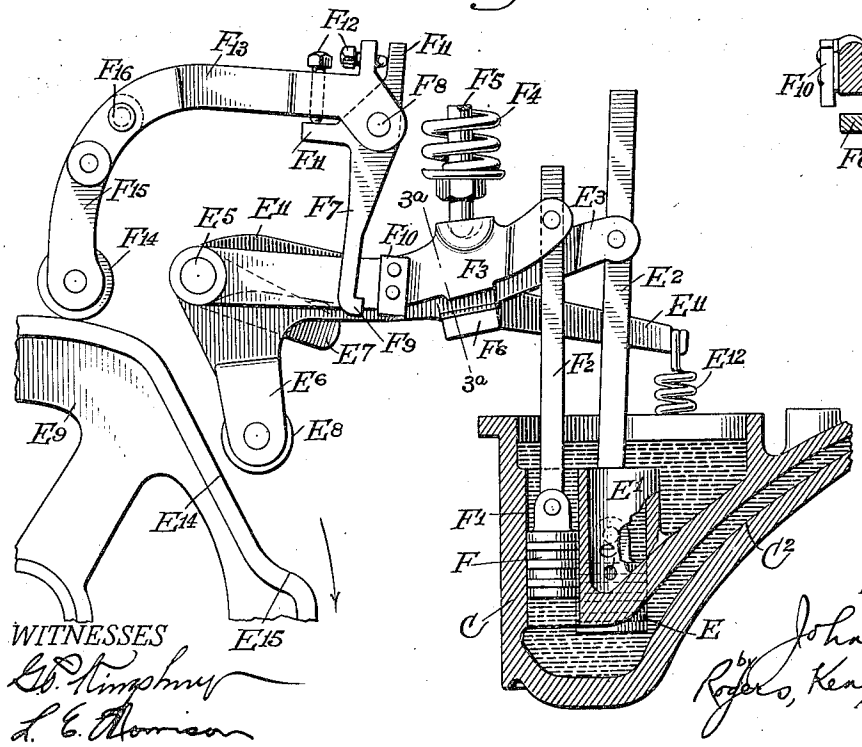
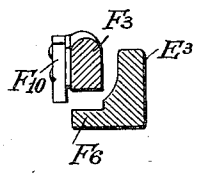


Fig. 3a.



WITNESSES

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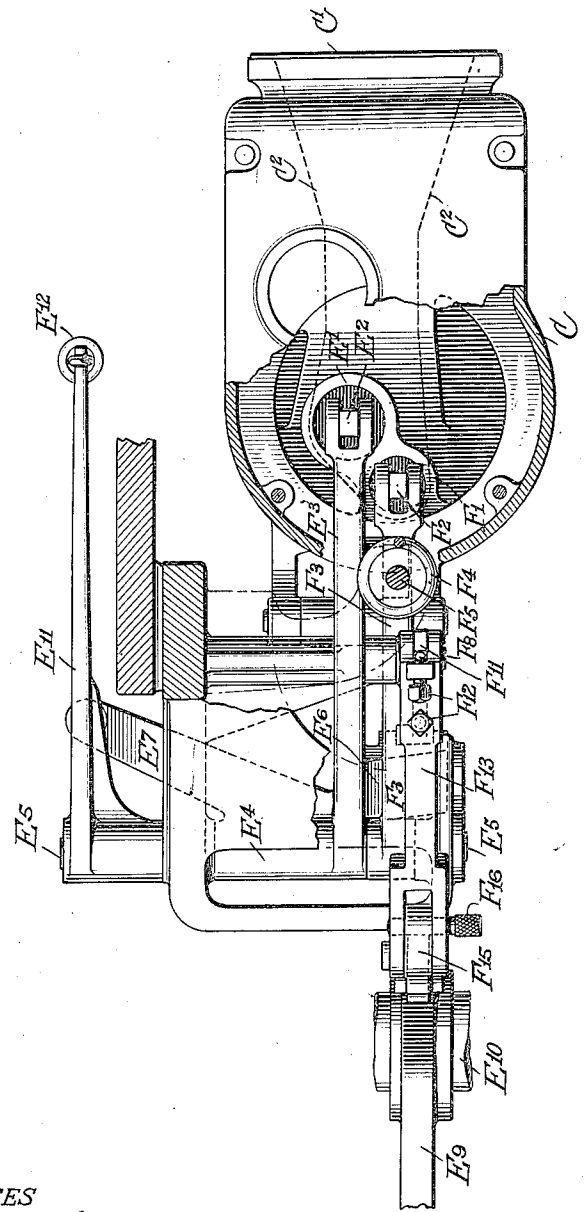
Nov. 4, 1924. 1,514,103

J. R. ROGERS

TYPOGRAPHICAL CASTING METHOD AND APPARATUS

Filed Sept. 24, 1920 3 Sheets-Sheet 3

Fig. 4.



WITNESSES

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Patented Nov. 4, 1924. 1,514,103

UNITED STATES PATENT OFFICE.

JOHN R. ROGERS, OF BROOKLYN, NEW YORK, ASSIGNOR TO MERGENTHALER LINOTYPE COMPANY, A CORPORATION OF NEW YORK.

TYPOGRAPHICAL CASTING METHOD AND APPARATUS.

Application filed September 24, 1920. Serial No. 412,548.

To all whom it may concern:

Be it known that I, JOHN R. ROGERS, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Typographical Casting Methods and Apparatus, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to typographical casting machines, such as linotype machines of the general organization represented in U. S. Letters-Patent to O. Mergenthaler, No. 436,532, wherein a melting pot is arranged to deliver molten metal into a slotted mold and up against a composed line of matrices to produce a type bar or slug bearing on its edge type characters corresponding to the intaglio characters of the matrices. In these machines, the molten metal is introduced into the mold by means of a spring-actuated pump piston or plunger arranged within the pot and controlled in its action by a rotary cam which, as well known, makes one complete rotation for each cycle of operation of the machine. The cam is so shaped as normally to maintain the pump plunger in a raised position out of action, but at one point in its circumference, it is formed with a depression which, at the proper time, permits the plunger to descend more or less gradually and uniformly under the influence of its actuating spring to fill the mold with molten metal for the casting operation. This old arrangement is entirely satisfactory and efficient for the production of slugs of ordinary sizes, say up to 18 pt. or thereabouts, but it has not been found to be so satisfactory or efficient in machines of more recent development, which provide for the production of slugs of much larger sizes, extending up to 36 pt. and above. For instance, in casting slugs of these larger sizes, it frequently happens that because of imperfections many of the slugs must be recast one or more times before they are at all suitable for use; in fact, it is seldom attempted to make use of such slugs for high-grade work. The more serious imperfections are present in the type characters, which often appear in ragged or porous condition, due to the incomplete filling of the matrix cavities and the formation of air pockets, etc. These and other objections may be explained partly by the fact that the pump plunger fails to exert sufficient pressure upon the molten metal to drive it with the requisite force into the matrix cavities or to expel the air completely from the mold. Indeed, near the completion of the casting operation, the load applied to the plunger (which should be at its maximum) is actually at its minimum, due to the lost tension or relaxation of the actuating spring at that time. There are many other difficulties that might be mentioned, but it would serve no useful purpose to discuss the matter further.

My invention is intended to overcome the foregoing objections and aims to produce slugs of all sizes in practically perfect condition. To this end, specifically, I propose to cast the larger sized slugs by filling the mold with molten metal under the action of two distinct impelling forces of different relative intensities and applied respectively at different periods in the casting operation. The first force (of lesser intensity), which is applied more or less slowly and gradually, acts to introduce the molten metal into the mold at a corresponding rate of flow, while the second force (of greater intensity), which is applied more quickly and abruptly than the first, acts to accelerate the flow of metal and to subject the metal to a sudden, heavy pressure near the completion of the casting operation. Actual practice has shown that a slug produced in this way is practically perfect and particularly as regards its type characters, which are sharply and clearly defined and conform in the minutest detail to the configuration of the matrix cavities and whose printing faces are entirely free from pores or other imperfections.

My invention also contemplates an improved form of apparatus for carrying out the foregoing casting method in the regular linotype machine, and this incidentally by making as little change as possible in the existing parts of such machine. In the preferred embodiment herein illustrated, such apparatus comprises two distinct pump pistons or plungers arranged within the melting pot and operated one after the other in the casting operation to force the molten metal into the mold in the required manner.

The exact construction and operation of parts will best be understood from the detailed description to follow.

Referring to the drawings:

Fig. 1 is a vertical section taken through the casting mechanism of a linotype machine having my invention embodied therein;

Figs. 2 and 3 are similar views, showing the parts in different relative positions;

Fig. 3ª is a section taken on the line 3ª, 3ª of Fig. 3; and

Fig. 4 is a plan view of the devices shown in Fig. 1.

In Fig. 1, the parts are shown in the relative positions they occupy just prior to the commencement of the casting operation. In this condition of the parts, the slotted mold A, carried by the rotary disk A^1, is closed at the front by the composed line of matrices X presented momentarily thereto by the vertically movable first elevator B, and it is closed at the rear by the mouthpiece C^1 of the melting pot C sustained within the rocking frame or jacket D. The pot C, which contains a supply of type metal maintained in a molten condition by means of a suitable burner (not shown) is formed with a throat or passage C^2 through which the molten metal is forced into the mold during the casting operation. The foregoing parts are of ordinary construction and operate in the well known manner.

While my new method of casting might be carried out by various means, I have herein provided an improved form of pumping apparatus specially adapted for that purpose, which apparatus in the preferred embodiment illustrated comprises two distinct pistons or plungers E and F arranged to reciprocate within separate wells or cylinders E^1 and F^1, both communicating with the discharge throat or passage C^2 and the former having a port opening *e* for the admission of molten metal thereto.

The plunger E is substantially of the same dimensions as heretofore and is connected by means of a rod or link E^2 to the free end of a vertically movable lever E^3, which latter is formed at its opposite end with a bearing sleeve E^4 mounted loosely on a fixed transverse rod E^5 of the machine frame. The sleeve E^4 is provided with two arms E^6 and E^7, the former carrying a roller E^8 which is arranged to track upon the periphery of the usual rotary cam E^9 fast to the main shaft E^{10} of the machine, and the latter being extended laterally beneath a further lever E^{11} which is also mounted loosely on the fixed rod E^5 and has its free end connected to a tension spring E^{12} pulling downwardly thereon from a fixed part of the machine. As well understood, the peripheral face of the cam E^9 is concentric throughout except at one portion of its circumference, where it is cut away or formed with a depression to provide the customary sloping surfaces E^{14} and E^{15}. When the machine is at rest, the roller E^8 is in contact with the concentric portion of the cam E^9, so that the plunger E is maintained in its raised or inoperative position, as indicated in Fig. 1. This condition obtains until the casting period arrives, when the cam (rotating in the direction of the arrow) brings its sloping surface E^{15} into engagement with the roller E^8, which then descends along such surface to the bottom of the depression, thus permitting the spring E^{12}, through the connections described, to depress the plunger E and force a charge of molten metal into the mold. As the cam continues to rotate, the roller E^8 is engaged sooner or later by the sloping surface E^{14} and the parts thereby restored to and maintained in their original condition to await the next casting operation.

Referring now to the second plunger F, it is connected by means of a rod or link F^2 to a vertically movable lever F^3 pivotally mounted on the fixed rod E^5 alongside of the lever E^3 and constantly urged downward by a compression spring F^4 of substantially the same strength as the spring E^{12} and which acts on the lever F^3 through the sliding rod F^5. This lever F^3 normally rests upon a supporting piece F^6 projecting laterally from the lever E^3 and is thereby maintained in its raised or inoperative position indirectly by the cam E^9. It is apparent, therefore, that in the absence of some means to prevent it, the plunger F would be raised and lowered simultaneously with the plunger E under the influence of the cam E^9. However, and as before intimated, I propose to actuate the two plungers at different periods in the casting operation, and means are therefore provided to delay the operation of the plunger F until the plunger E nears the end of its full pumping stroke. In the present instance, such means comprise a locking pawl or detent F^7 loosely suspended from a fixed rod F^8 and formed with a lip or projection F^9 arranged to engage beneath a lug F^{10} on the side of the lever F^3. Adjacent its pivotal point, the pawl F^7 is formed with right-angularly disposed arms F^{11}, against which bear a pair of set screws F^{12} carried by an operating lever F^{13} also loosely mounted on the fixed rod F^8. At its rear end, the lever F^{13} is provided with a roller F^{14} adapted to be engaged by the rotary cam E^9 at the proper time to trip the pawl F^7. If desired, the pawl F^7 and its operating lever F^{13} may be made integral, but it is preferred to make them relatively adjustable by some such means as described, so that the tripping of the locking pawl by the rotary cam may be varied or controlled as desired.

The operation of the pump plunger F is as follows: When the machine is at rest or

during the rotation of the cam E^9 preceding the casting operation, the roller F^{14} tracks upon the concentric portion of the cam, which therefore maintains the locking detent F^7 disengaged from the operating lever F^3, leaving the latter to be supported by the operating lever E^3 in the manner before described. However, immediately preceding the casting operation, the roller F^{14} becomes momentarily disengaged from the cam E^9, due to the presence of the depression therein, and hence allows the operating lever F^{13} to fall by gravity and rock the detent F^7 to locking position (Fig. 1). Consequently, when the lever E^3 is subsequently rocked downwardly by its actuating spring E^{12} to operate the pump plunger E as before described, the detent F^7 serves to support the lever F^3 and the attached plunger F in their raised condition (Fig. 2). But the support thus furnished by the detent F^7 is only momentary, as almost immediately the roller F^{14} again passes onto the concentric and highest portion of the rotary cam E^9, which then lifts the operating arm F^{13} and withdraws the detent F^7 from engagement with the operating lever F^3 (Fig. 3). This withdrawal of the detent F^7 instantly releases the actuating spring F^4, whose full load is immediately applied to the plunger F to complete the casting operation. As before noted, the tripping of the pawl F^7 to release the spring F^4 is timed to take place just before the plunger E completes its full downward stroke, see Fig. 2. The parts are finally restored to their original condition by the continued rotation of the cam F^9, which acts indirectly through the lever E^3 and its projecting piece F^6 to return the lever F^3 and the attached plunger F to their raised position, when the machine completes its cycle of operation and again comes to rest.

It will be noted that the action of the plunger E takes place more or less slowly and gradually, due to the engagement of the roller E^8 with the sloping cam surface E^{15}; whereas, the action of the plunger F is more rapid and abrupt, due to the absence of any such restraining influence. This arrangement has been devised not only to provide for the later operation of the plunger F, but also to enable it to exert a sudden hammer-blow effect upon the molten metal at or near the completion of the casting operation. While such a difference in operation of the two plungers might be sufficient under certain conditions to accomplish the desired results, the parts are otherwise constructed and arranged so that the difference in force of the respective plungers in acting upon the metal will be more pronounced and effective. Thus, as shown, the diameter of the plunger F or its well F^1 is considerably less than that of the plunger E or its well E^1. As a result, and since the two actuating springs F^4 and E^{12} are of substantially the same strength, it necessarily follows that the smaller plunger F is capable of exerting a pressure greatly in excess of that in the case of the plunger E, due of course to their different effective areas which vary accordingly to the square of the diameter. As a matter of fact however, the difference in pressure is even greater because of the more rapid and abrupt action of the smaller plunger. It may be remarked in passing that the inertia of the plunger E is quite sufficient to enable it to withstand the high pressure developed by the plunger F for the brief period during which such pressure is maintained.

It will now be clear that, in the operation of my improved apparatus, the two pump plungers act upon the molten metal with different relative intensities, the plunger E in its earlier operation serving to introduce molten metal into the mold at a given rate of flow, and the plunger F in its later operation serving to accelerate said flow of metal near the completion of the casting operation as well as to subject the flowing metal to a suddenly applied pressure at that time. Or stated differently, the plunger E acts first to introduce a charge of molten metal into the mold which is substantially filled thereby, while the plunger F acts subsequently to subject said charge before it hardens or solidifies to the required pressure, which as above noted is much greater than that capable of being exerted by the plunger E acting alone. In a sense, therefore, the plunger E is a charging-medium, and the plunger F a pressure-medium, although the latter will, if need be, assist in introducing any further metal necessary to fill the mold completely. Thus, as indicated in Fig. 3, the extent of descent of the plunger F is very slight as compared with that of the plunger E, and hence, considering the small area of the operative face of the plunger F, the volume of metal displaced by it is comparatively small. Of course, if desired, the plunger F could be made to displace a greater quantity of metal, but it is preferred to employ it essentially as a pressure medium as herein, so that as much pressure as possible may be exerted upon the molten metal near the completion of the casting operation.

By casting the slugs in the foregoing manner, not only is the complete filling of the mold and the expulsion of all air therefrom positively insured, but, in addition, the molten metal while still in a fluid state, or before it has had a chance to cool or harden, is driven forcibly and certainly into every portion of the matrix cavities and then held there under intense pressure, although only for a moment, until solidification takes place. It

has been found that slugs as thus produced are satisfactory in every respect and entirely free from the many imperfections so common in the past. The type characters, in particular, are complete, clear and well defined, and present a hard, even, solid printing face suitable for the highest grade of work. Indeed, for all practical purposes, the slugs may be said to be perfect, or as nearly so as it is practicable to make them by casting.

It will have been understood that the foregoing description deals only with the production of slugs of the larger sizes. For slugs of the smaller or ordinary sizes, it is not necessary, (in fact, it might be dangerous) to make use of the second pump plunger F in the casting operation. For this reason, I have provided means whereby the plunger F may be rendered inactive when desired. As a simple and convenient way to accomplish such result, the operating lever F^{13} for the locking pawl F^{7} is provided with a pivoted section F^{15} wherein the roller F^{14} is journalled and which is normally held in operative position by a removable pin or stud F^{16}. By removing this pin F^{16}, the pivoted section F^{15} may be swung upwardly to an inoperative position to locate the roller F^{14} out of contacting relation with the rotary cam E^{9}, so as to allow the detent F^{7} to remain in locking position throughout the casting operation and thus to prevent the operation of the plunger F. Under such circumstances, the plunger E acts alone in casting the slugs, functioning in substantially the same way as the single pump plunger heretofore employed. As before stated, this old method of casting is entirely satisfactory and efficient for the production of slugs or ordinary sizes, which do not require the intense pressure so desirable in connection with the larger sized slugs.

I have herein shown my improved apparatus merely in preferred form and by way of example, and obviously many changes and variations may be made therein without departing from the spirit of my invention. For instance, in lieu of their present arrangement, the two pump plungers might be made to force the molten metal into the mold from different melting pots or different compartments of the same pot. Or, instead of arranging the plungers side by side in the pot as herein shown, they might be fitted one within the other, in which case the interior bore of the outer plunger would act as the well or cylinder for the inner plunger. As a matter of fact, in the broader aspects of my invention, the smaller plunger might be dispensed with entirely and some other means employed for treating the molten metal in the manner above described. In short, many modifications and alterations will readily suggest themselves to those skilled in the art without departure from the scope of my invention.

It should also be understood that my improved method of casting slugs may be carried out by means of other apparatus than that herein disclosed, and quite irrespective of whether or not such apparatus is capable of being employed in the regular linotype machine. In fact, my invention in this respect contemplates any form of apparatus capable of carrying out the novel method of casting set forth in the particular claims directed thereto.

Having thus described my invention, its construction and mode of operation, what I claim is as follows:

1. In a typographical casting machine, the combination of a mold, and mechanism for introducing molten metal into the mold at a given rate of flow and for accelerating but maintaining said flow of metal near the completion of the casting operation.

2. In a typographical casting machine, the combination of a mold, and mechanism for introducing molten metal into the mold at a given rate of flow and for applying a sudden pressure to the flowing metal near the completion of the casting operation while maintaining said flow.

3. In a typographical casting machine, the combination of a mold, and mechanism for filling the mold with molten metal, said mechanism including two distinct intermittently actuated impelling means acting respectively upon the molten metal at different periods in the casting operation while maintaining the flow of metal into the mold from the source of supply.

4. In a typographical casting machine, the combination of a mold, and mechanism for filling the mold with molten metal, said mechanism including two distinct impelling means of different relative intensities acting respectively upon the molten metal at different periods in the casting operation while maintaining the flow of metal into the mold from the source of supply.

5. In a typographical casting machine, the combination of a mold, and mechanism for filling the mold with molten metal, said mechanism including two distinct impelling means acting respectively upon the molten metal at different periods in the casting operation, the second more quickly and abruptly than the first while maintaining the flow of metal into the mold from the source of supply.

6. In a typographical casting machine, the combination of a mold, intermittently actuated means for introducing a charge of molten metal into the mold, and separate intermittently actuated means for subjecting said charge to a predetermined pressure

before it is allowed to harden or solidify while maintaining the flow of metal into the mold from the source of supply.

7. In a typographical casting machine, the combination of a mold, means operated at one period in the casting operation to introduce a charge of molten metal into the mold, and separate means operated at a later period in the casting operation to subject said charge to the required pressure before it is allowed to harden or solidify while maintaining the flow of metal into the mold from the source of supply.

8. In a typographical casting machine, the combination of a mold, and a pumping apparatus for filling the mold with molten metal, said apparatus comprising two plungers operated at different periods in the casting operation while maintaining the flow of metal into the mold from the source of supply.

9. In a typographical casting machine, the combination of a mold, and a pumping apparatus for filling the mold with molten metal, said apparatus comprising two plungers operated at different periods in the casting operation and acting upon the molten metal with different relative intensities in the successive periods while maintaining the flow of metal into the mold from the source of supply.

10. In a typographical casting machine, the combination of a mold, and intermittently actuated pumping apparatus for filling the mold with molten metal, said apparatus comprising two plungers, one acting to introduce a charge of molten metal into the mold, and the other to subject said charge to a predetermined pressure before it is allowed to harden or solidify while maintaining the flow of metal into the mold from the source of supply.

11. In a typographical casting machine, the combination of a mold, and a pumping apparatus for filling the mold with molten metal, said apparatus comprising two plungers, one operated more quickly and abruptly than the other and both acting upon the molten metal while the mold is in communication with the source of supply.

12. In a typographical casting machine, the combination of a mold, and a pumping apparatus for filling the mold with molten metal, said apparatus comprising two plungers having operative faces of different areas, and both acting upon the molten metal while the mold is in communication with the source of supply.

13. In a typographical casting machine, the combination of a mold, and a pumping apparatus for filling the mold with molten metal, said apparatus comprising two plungers having operative faces of different areas and operated at different periods in the casting operation, both of said plungers acting upon the molten metal while the mold is in communication with the source of supply.

14. In a typographical casting machine, the combination of a mold, a pumping apparatus for filling the mold with molten metal and comprising two plungers operated at different periods in the casting operation, and means for rendering one of said plungers inactive when desired.

15. In a typographical casting machine, the combination of a mold, a pumping apparatus for filling the mold with molten metal and comprising two plungers having operative faces of different areas, and means for rendering the smaller plunger inactive when desired.

16. In a typographical casting machine, the combination of a mold, a pumping apparatus for filling the mold with molten metal and comprising two plungers, one operated more quickly and abruptly than the other, and means for rendering the more quickly operated plunger inactive when desired.

17. In a typographical casting machine, the combination of a mold, a pumping apparatus for filling the mold with molten metal and comprising two plungers operated at different periods in the casting operation, and adjusting means for varying the interval between the operation of the two plungers as desired.

18. In a typographical casting machine, the combination of a melting pot formed with a discharge throat and with two pump wells each directly communicating with said throat, a pump plunger arranged within each of said wells, and intermittently actuated means for operating both of said plungers in the casting operation.

19. In a typographical casting machine, the combination of a melting pot formed with a discharge throat and with two pump wells communicating with said throat, a pump plunger arranged within each of said wells, and intermittently actuated means for operating said plungers one after the other in the casting operation.

20. In a typographical casting machine, the combination of a melting pot formed with a discharge throat and with two pump wells of different cross sectional areas each directly communicating with said throat, a pump plunger fitted in each of said wells, and means for operating both of said plungers in the casting operation.

21. In a typographical casting machine, the combination of a melting pot formed with a discharge throat and with two pump wells of different cross sectional areas communicating with said throat, a pump plunger fitted in each of said wells, and means

for operating said plungers one after the other in the casting operation.

22. In a typographical casting machine, the combination of a melting pot formed with a discharge throat and with two pump wells each communicating with said throat, a pump plunger arranged within each of said wells, means for operating both of said plungers in the casting operation, and means for rendering one of said plungers inactive when desired.

23. In a typographical casting machine, the combination of a melting pot formed with a discharge throat and with two pump wells communicating with said throat, a pump plunger arranged within each of said wells, means for operating said plungers one after the other in the casting operation, and means for rendering one of said plungers inactive when desired.

24. In a typographical casting machine, the combination of a melting pot formed with a discharge throat and with two pump wells of different cross sectional areas communicating with said throat, a pump plunger fitted in each of said wells, means for operating both of said plungers in the casting operation, and means for rendering the smaller plunger inactive when desired.

25. In a typographical casting machine, the combination of a melting pot formed with a discharge throat and with two pump wells communicating with said throat, a pump plunger arranged within each of said wells, and means for operating both of said plungers in the casting operation but one more quickly and abruptly than the other.

26. In a typographical casting machine, the combination of a melting pot formed with a discharge throat and with two pump wells communicating with said throat, a pump plunger arranged within each of said wells, means for operating both of said plungers in the casting operation but one more quickly and abruptly than the other, and means for rendering the more quickly operated pump inactive when desired.

27. In a typographical casting machine, the combination of a melting pot formed with a discharge throat and with two pump wells communicating with said throat, a pump plunger arranged within each of said wells, means for operating said plungers one after the other in the casting operation, and adjusting devices to vary the interval between the operation of the two plungers as desired.

28. In a typographical casting machine, the combination of two pump plungers, and means for operating said plungers one after the other in the casting operation, said means including two spring-actuated levers connected to the respective plungers, a rotary cam which directly controls the operation of one of said levers, and intermediate devices through which said cam indirectly controls the operation of the other of said levers.

29. In a typographical casting machine, the combination of two pump plungers, and means for operating said plungers one after the other in the casting operation, said means including two spring-actuated levers connected to the respective plungers, a rotary cam co-operating with one of said levers and controlling the operation thereof, and an automatic detent cooperating with the other of said levers to delay its operation momentarily.

30. In a typographical casting machine, the combination of two pump plungers, and means for operating said plungers one after the other in the casting operation, said means including two spring-actuated levers connected to the respective plungers and one arranged to give support to the other when the two occupy their inoperative positions, a rotary cam cooperating with one of said levers and formed with a depression to permit the operation thereof at the proper time, and a locking detent acting under the control of the cam to hold the other of said levers momentarily in its inoperative position after the first mentioned lever has begun its operation.

31. In a typographical casting machine, the combination of two pump plungers, and means for operating said plungers one after the other in the casting operation, said means including two spring actuated levers connected to the respective plungers, a rotary cam controlling the operation of one of said levers, a locking detent serving normally to hold the other of said levers out of action, and an operating lever acting under the control of the rotary cam to disengage the locking detent at a predetermined period.

32. In a typographical casting machine, the combination of two pump plungers, and means for operating said plungers one after the other in the casting operation, said means including two spring actuated levers connected to the respective plungers, a rotary cam controlling the operation of one of said levers, a locking detent serving normally to hold the other of said levers out of action, an operating lever acting under the control of the rotary cam to disengage the locking detent at a predetermined period, and adjustable connections between the locking detent and its operating lever for varying the period of disengagement of the former by the latter.

33. In a typographical casting machine, the combination of two pump plungers, and means for operating said plungers one after the other in the casting operation, said means including two spring actuated levers connected to the respective plungers, a rotary cam controlling the operation of one of

said levers, a locking detent serving normally to hold the other of said levers out of action, and an operating lever acting under the control of the rotary cam to disengage the locking detent at a predetermined period, said operating lever being provided with a pivoted section arranged to be moved beyond the control of the rotary cam to allow the locking detent to remain active throughout the casting operation.

34. In a typographical casting machine, the combination of a mold, a melting pot formed with a single discharge throat, two pump plungers arranged with said pot and acting to force the molten metal through the single discharge throat into the mold, and intermittently actuated means for operating both of said plungers in the casting operation.

35. An improvement in the art of type casting, which consists in introducing molten metal into the mold at a given rate of flow, and accelerating but maintaining said flow of metal near the completion of the casting operation.

36. An improvement in the art of type casting, which consists in introducing molten metal into the mold at a given rate of flow, and subjecting the flowing metal to a suddenly applied pressure near the completion of the casting operation while maintaining said flow.

37. An improvement in the art of type casting, which consists in filling the mold with molten metal under the action of two distinct impelling forces applied respectively at different periods in the casting operation while maintaining the flow of metal into the mold from the source of supply.

38. An improvement in the art of type casting, which consists in filling the mold with molten metal under the action of two distinct impelling forces of different relative intensities applied respectively at different periods in the casting operation while maintaining the flow of metal into the mold from the source of supply.

39. An improvement in the art of type casting, which consists in filling the mold with molten metal under the action of two distinct impelling forces applied respectively at different periods in the casting operation, the second force being applied more quickly and abruptly than the first while maintaining the flow of metal into the mold from the source of supply.

40. In a typographical machine, a metal pot having a plurality of pumps and constructed for the delivery of molten metal therefrom to the type casting molds, and means for cutting off the delivery of metal from one of said pumps at the will of the operator.

41. In a typographical machine, a metal pot constructed for the delivery of molten metal to the type casting mold and having a plurality of metal injecting plungers, and means under the control of the operator whereby one of said pumps may operate independently or a plurality of them may operate concurrently, as desired.

42. In a typographical machine, a metal pot constructed for the delivery of molten metal to the type casting mold and having a pair of metal injecting plungers, actuating means common to both plungers, means operative with one of said plungers to cause concurrent operation with the other plunger, and means for restraining the first mentioned plunger from operation during the operation of the latter mentioned plunger.

43. In a typographical machine, a metal pot constructed for the delivery of molten metal to the type casting mold and having a pair of metal injecting plungers, actuating means common to both plungers, and means for preventing the operation of one of said plungers or permitting the concurrent operation of both, as desired.

44. In a typographical machine, a metal pot constructed for the delivery of molten metal to the type casting mold and having a pair of metal injecting plungers, a corresponding pair of spring actuated levers connected to the respective plungers, and a rotary cam cooperating directly with one of said levers and through it with the other of said levers to control the operation of the metal injecting plungers.

45. In a typographical machine, a metal pot constructed for the delivery of molten metal to the type casting mold and having a pair of metal injecting plungers, a corresponding pair of spring actuated levers connected to the respective plungers, a rotary cam cooperating directly with one of said levers and through it with the other of said levers to control the operation of the metal injecting plungers, and means for locking the second mentioned lever against operation, when desired, to permit the independent operation of the first mentioned lever.

In testimony whereof, I have affixed my signature hereto.

JOHN R. ROGERS.