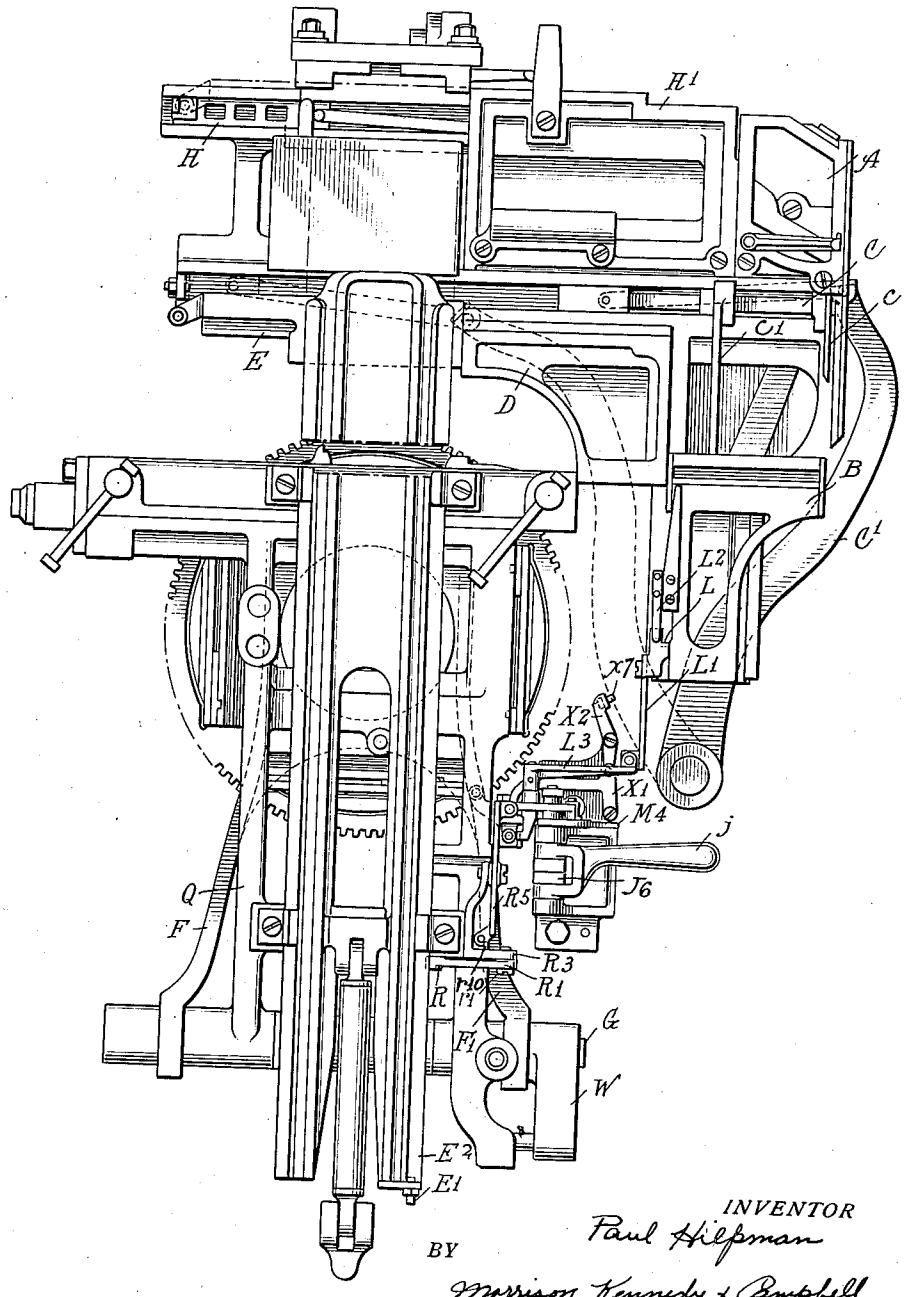
March 18, 1941. P. HILPMAN 2,235,482

SLUG CASTING MACHINE

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Fig. 1.



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Fig. 2.

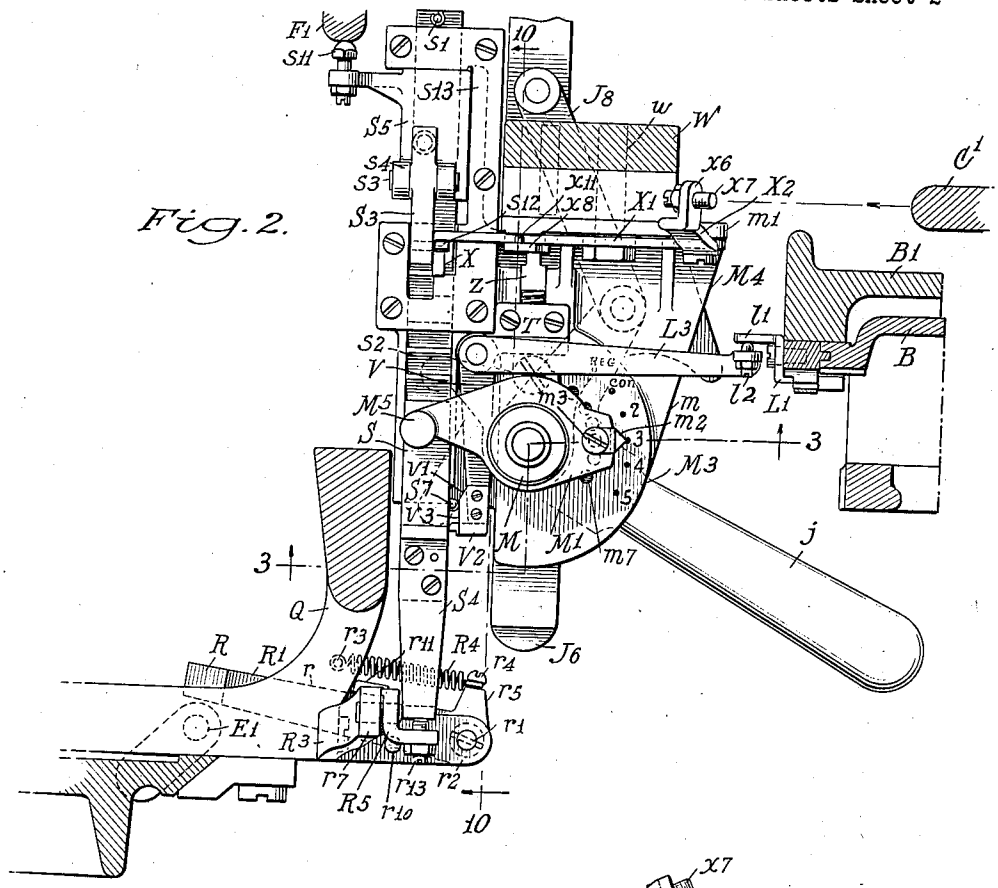
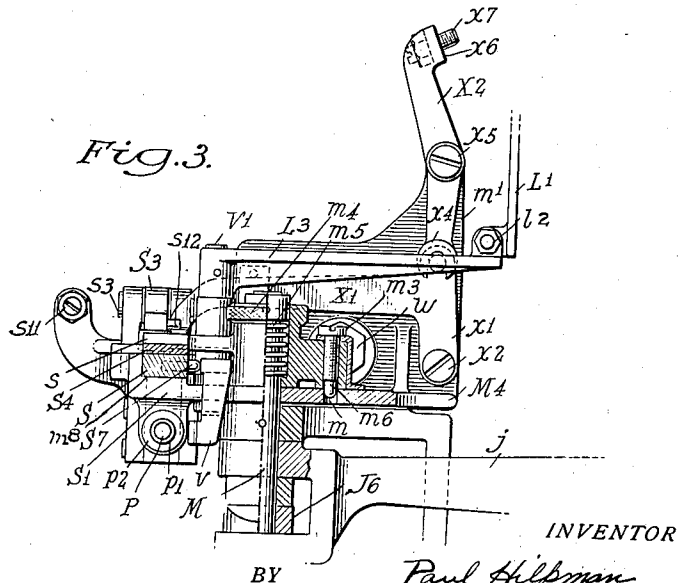


Fig. 3.



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Fig. 4a.

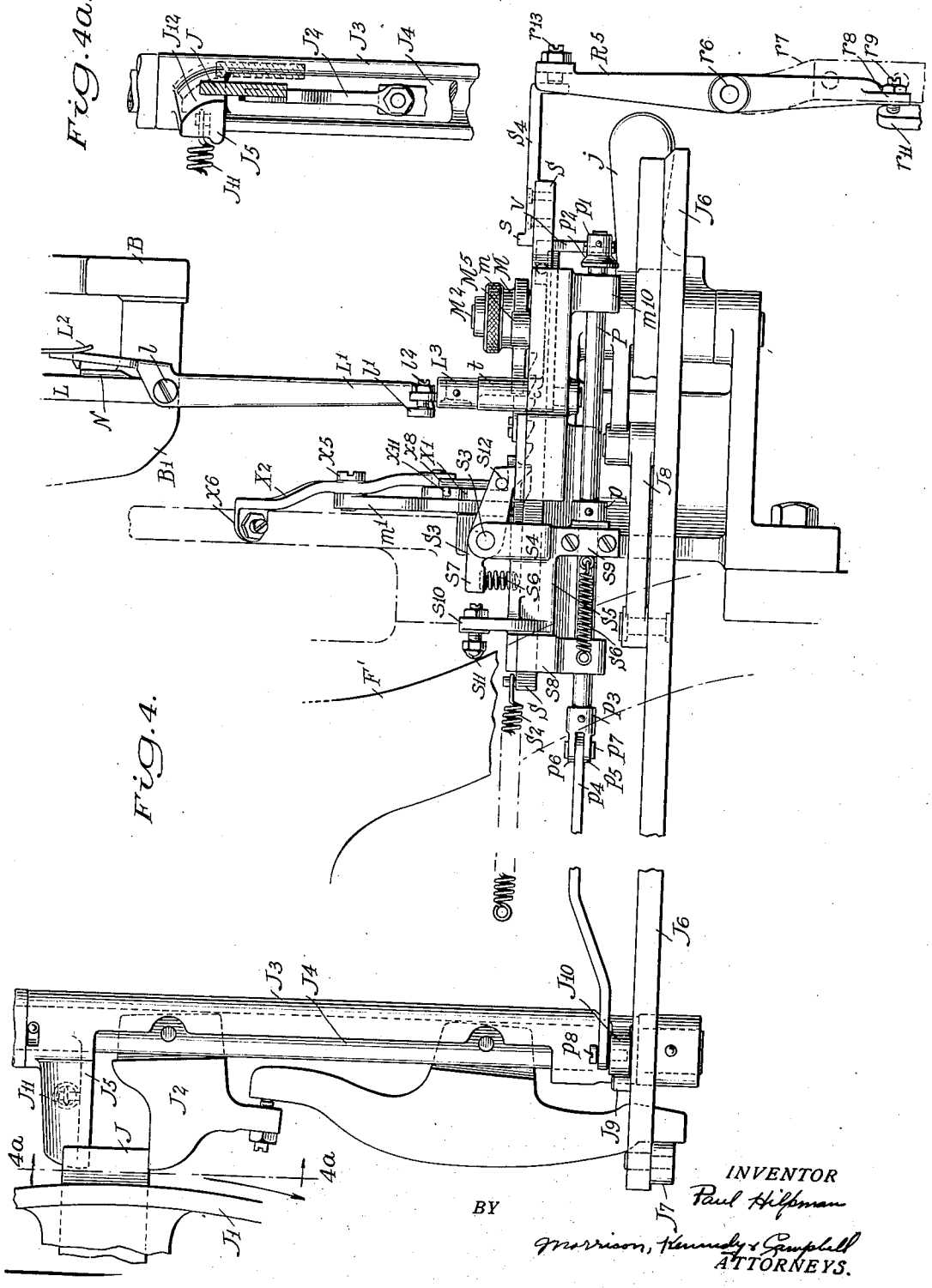


Fig. 4.

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SLUG CASTING MACHINE

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Fig. 5.

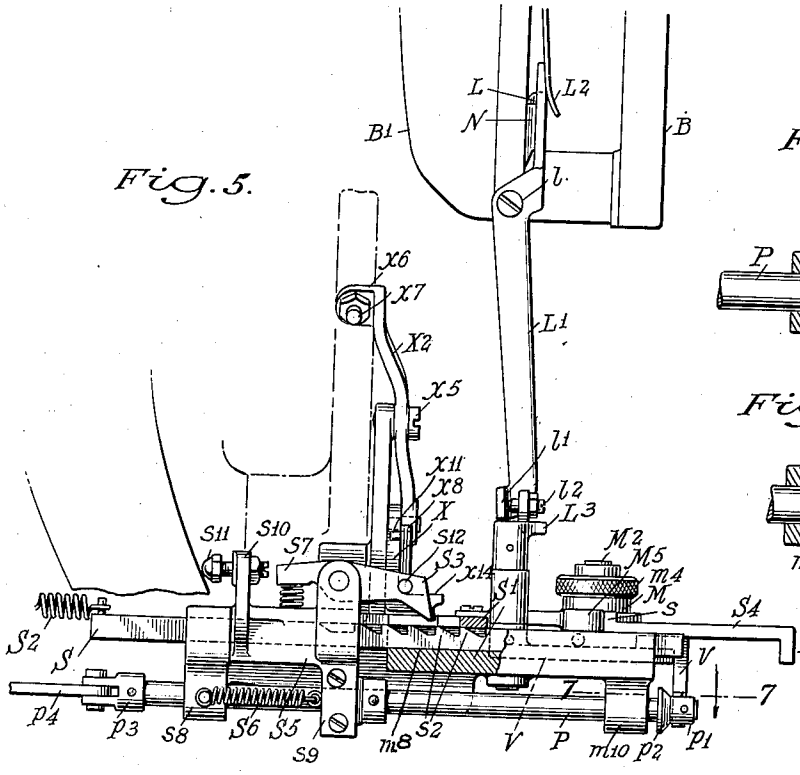


Fig. 7.

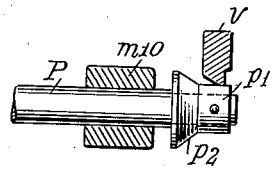


Fig. 8.

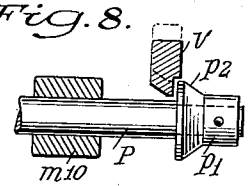
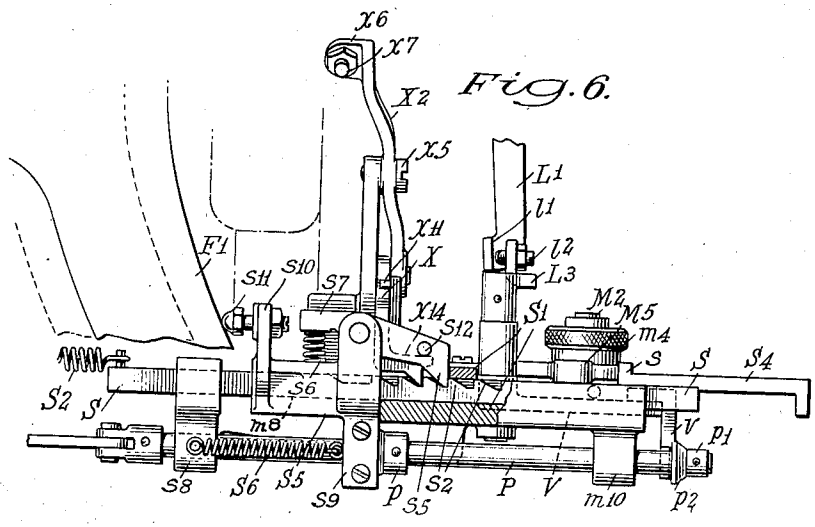


Fig. 6.



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Fig. 9.

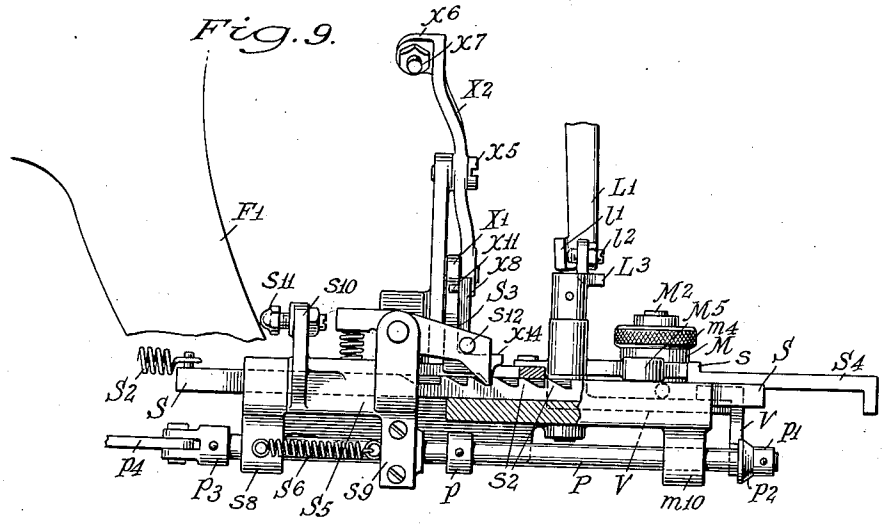
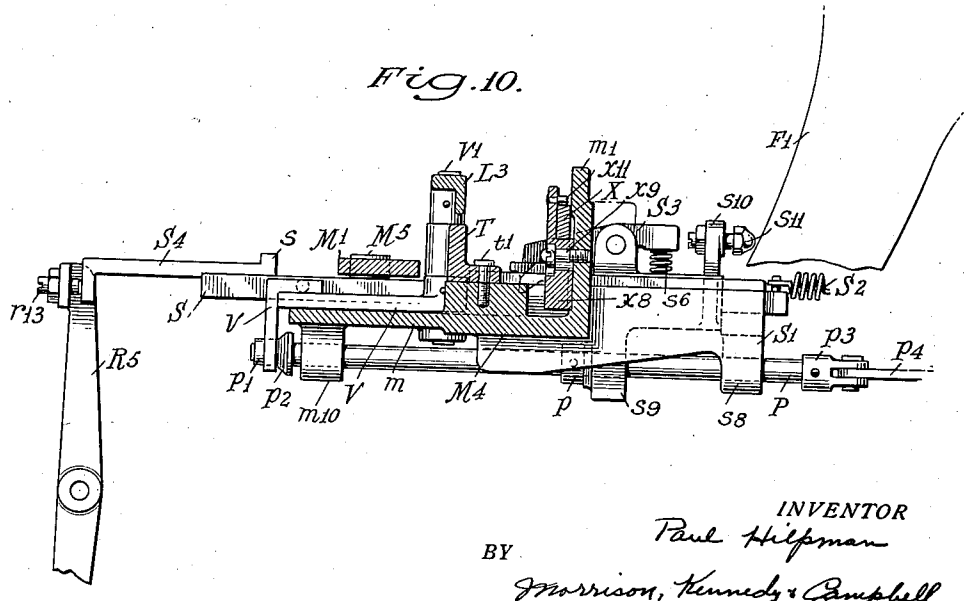


Fig. 10.



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Fig. 11.

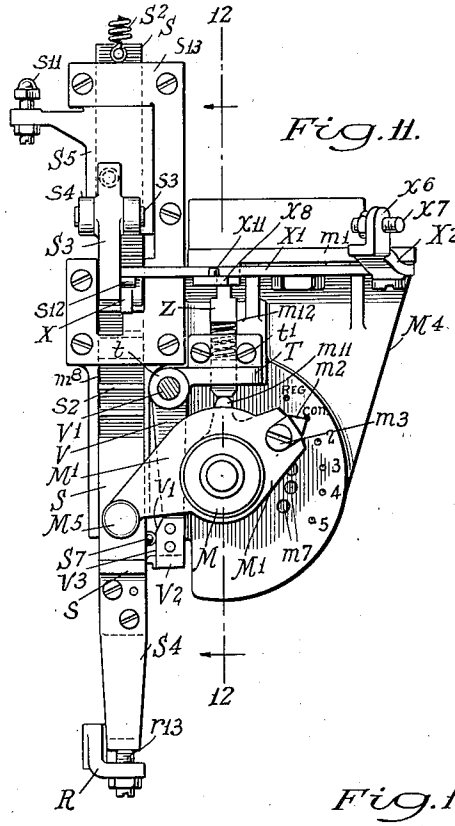


Fig. 14.

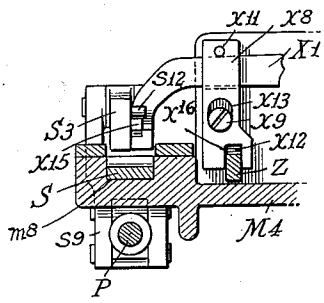


Fig. 12.

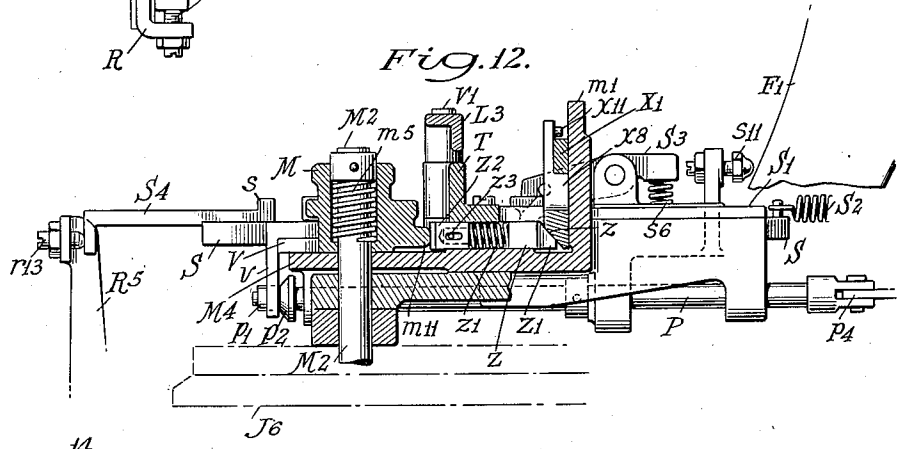
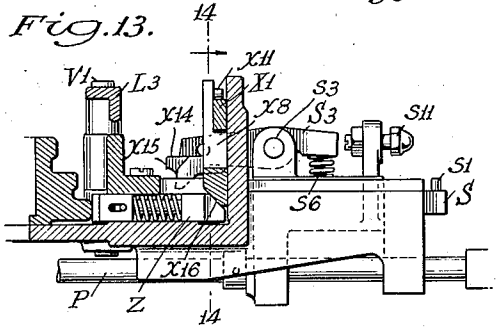


Fig. 13.



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Patented Mar. 18, 1941

2,235,482

UNITED STATES PATENT OFFICE

2,235,482

SLUG CASTING MACHINE

Paul Hilpman, Garden City, N. Y., assignor to Mergenthaler Linotype Company, a corporation of New York

Application January 31, 1940, Serial No. 316,505

32 Claims. (Cl. 199—47)

This invention relates to slug casting machines, such as "Linotype" machines of the general organization represented in U. S. Letters Patent No. 436,532 to O. Mergenthaler, wherein circulating matrices are released from a magazine in the order in which their characters are to appear in print, and then composed in line together with spacers, the composed line transferred to the face of a slotted mold, the mold filled with molten metal to form a slug or type-bar against the matrices which produce the type characters thereon, and the matrices and spacers thereafter returned through distributing mechanism to the magazines from which they started. More particularly, it relates to certain improvements which adapt these machines, when so desired, to cast successively and automatically a plurality of duplicate slugs from each composed line.

In the preferred embodiment illustrated (although it is not essential), the improvements have been worked out in the nature of an attachment, which can be applied to almost any of the commercial machines with little or no alteration. The equipment consists of mechanism arranged at the front of the machine and adapted to be adjusted to cause the machine to operate continuously for a plurality of cycles to cast an infinite number of duplicate slugs or a selected number of duplicate slugs. When set to cast one or more duplicate slugs, the mechanism functions at the beginning of the first machine cycle: first, to render inactive the means for automatically stopping the machine at the end of the cycle; second, to render active a stop which limits the upward movement of the first elevator or line transporter to prevent the removal of the composed line therefrom until the last duplicate slug has been cast from the line; and third, to lock the assembler or assembling elevator to prevent its upward movement for the delivery of another composed line to the first elevator prior to the casting of the last duplicate slug.

Specifically, a single control element is provided which can be set manually to perform the dual function of conditioning the machine to cast a selected number of duplicate slugs or, alternatively, to condition it to cast an infinite number of duplicate slugs. When the control has been set, the movement of the line delivery slide lever in transferring a line from the assembler to the first elevator releases a feed device in the form of a ratchet bar, which is retracted by a spring for a given distance according to the setting of the control. The retraction of the ratchet bar automatically effects the actuation of a series of levers to engage a latch under spring pressure with a lug on the assembler to lock the latter in its lower assembling position. At the same time, the retraction of the ratchet bar effects the location of a stop in the path of a lug on the first elevator to arrest the elevator short of line transfer position and thus prevent removal of the composed line therefrom for distribution, so that the same line will be presented to the mold for casting successive slugs. A sliding pawl is mounted to reciprocate relatively to the ratchet bar and is moved in one direction by the forward movement of the metal pot (prior to casting) and in the opposite direction by the pull of a tension spring which exercises itself as the metal pot is moved back (after casting) to its original position.

The pawl performs two functions: First, when moved forward during the first machine cycle, it carries with it a sliding rod which becomes engaged with a locking finger to prevent retrograde movement of the rod. This slide rod is connected to the mechanism for tripping the stop dog, as in starting the operation of the machine by the customary manual control; and when the rod is held in its forward position, as stated, the tripping mechanism is set to prevent the machine from being stopped automatically. Secondly, each time the pawl is actuated by the forward movement of the metal pot, it engages one of a series of teeth on the ratchet bar and moves the latter forwardly against the pull of its retracting spring an extent equal to the distance between two of the teeth on the ratchet bar, a detent being provided to hold the ratchet bar in the position to which it has been moved so that, as the metal pot recedes, the pawl is free to be retracted for engagement with the next tooth on the ratchet bar. During the casting of the last of the selected number of duplicate slugs, the pawl imparts the final movement to the ratchet bar and returns it to its original position, whereupon it effects the operation of associated parts of the mechanism to unlock the assembler, remove the stop from the path of the lug on the first elevator, and release the slide rod to allow the stop dog to bring the machine to rest at the end of the cycle. If the same number of duplicate slugs is to be cast from the composed line next to be delivered to the first elevator, of course, it is only necessary to raise the assembler in the customary manner to present the line to the delivery slide. On the other hand, if no duplicate slugs are to be cast from the next composed line, or if a different number of duplicate slugs is to

be cast from that line, the control element must be adjusted to the proper setting.

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

In the accompanying drawings, the invention has been shown merely by way of example and in preferred form, and obviously many variations and modifications may be made therein which will still be comprised within its spirit. It is to be understood, therefore, that the invention is not limited to any specific form or embodiment, except insofar as such limitations are specified in the appended claims.

Referring to the drawings:

Fig. 1 is a front elevation of a portion of a slug casting machine equipped with the present improvements;

Fig. 2 is a top plan view of the control element and associated mechanism, some of the machine parts being shown in section;

Fig. 3 is a vertical section taken substantially on the line 3—3 of Fig. 2, looking in the direction of the arrows;

Fig. 4 is a side elevation of the improved mechanism, partly broken away, looking from the left-hand side of the machine as shown in Fig. 1;

Fig. 4*a* is a fragmentary vertical section taken on the line 4*a*—4*a* of Fig. 4, looking in the direction of the arrows;

Figs. 5 and 6 are comparative side elevations, partly broken away, of a part of the structure shown in Fig. 4;

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 5, looking in the direction of the arrow;

Fig. 8 is a view similar to Fig. 7, showing the parts in a different position;

Fig. 9 is a view similar to Fig. 6, but showing the parts at a later stage in their operation;

Fig. 10 is a vertical section, taken substantially on the line 10—10 of Fig. 2, looking in the direction of the arrows;

Fig. 11 is a top plan view similar to Fig. 2, some of the parts shown in Fig. 2 being omitted;

Fig. 12 is a vertical section taken on the line 12—12 of Fig. 11, looking in the direction of the arrows;

Fig. 13 is a vertical section similar to Fig. 12, showing the parts in a different position, and some of the parts shown in Fig. 12 being omitted; and

Fig. 14 is a sectional view taken on the line 14—14 of Fig. 13, looking in the direction of the arrows.

Referring to Fig. 1, when the machine is employed in the customary manner, that is to say, to produce a single slug from each composed line, the matrices are released from their storage magazine (not shown) and the spacers from their magazine A by the usual keyboard and are delivered to and composed in line in the assembler B. The assembler B is then manually elevated to present the composed line between the fingers *c* and c^1 of the line delivery slide C, which thereupon is released to transfer the line from the assembler through the intermediate channel D to the first elevator E, at which time the power operation of the machine is inaugurated automatically. The first elevator E then descends to present the line to the mold into which molten metal is injected from the metal pot to cast a slug against the then justified line, after which the slug is ejected from the mold, trimmed, and delivered to a galley at the front of the machine.

The metal pot is provided with depending legs F and F^1 pivotally mounted on a supporting rod G in the machine frame W and is movable forwardly into casting relation with the mold and back to its position of rest once during each casting cycle of the machine. After the slug is cast, the first elevator E ascends to its uppermost position and the line is shifted therefrom by the slide H into the upper transfer channel H^1, from which the spacers are returned to their magazine A and the matrices raised by the second elevator (not shown) and delivered to the distributing mechanism whereby they are restored to their proper channels in the magazine from which they started.

As is well understood in the art, the parts referred to, with the exception of the assembler B which is under manual control, are operated from the main drive shaft (not shown) of the machine which is caused to make one complete rotation for each cycle of operation. The main shaft is power driven and clutch controlled in its operation, the clutch being thrown into action by a trip dog J carried by a cam J^1 which is fastened to the main shaft (see Figs. 4 and 4*a*). When the parts are at rest, the dog J engages and depresses a stop lever J^2 which, when depressed, acts through the usual connections to disengage the clutch. When, however, the dog J is moved laterally, as indicated by the dotted lines in Fig. 4*a*, to clear the stop lever J^2, as is done automatically when the line is delivered to the first elevator, the clutch is engaged and thus starts the operation of the machine.

The trip dog J is also under manual control, there being employed for this purpose a train of connections leading to a control lever *j* at the front of the machine and which comprises, in part, a vertical sleeve J^3 mounted to turn upon a fixed rod J^4 and which is provided near its upper end with a radially extending arm J^5 arranged in position to engage the side face of the trip dog. This train of connections also includes the bar J^6 which connects the clutch actuating lever J^7 and the control lever *j*, the bar J^6 and control lever *j* in turn being connected by a form of toggle joint J^8. By this arrangement, when the control lever *j* is swung forwardly, the pin J^9 rising from the upper edge of the bar J^6 engages the radially extending arm J^{10} at the lower end of the sleeve J^3 and thereby rotates the sleeve against the pull of a spring J^{11}, connected to the upper arm J^5, to swing the arm counterclockwise, in Figs. 4 and 4*a*, and move the trip dog J clear of the stop lever J^2 so that the clutch may be engaged. The surface J^{12} of the arm J^5 is cam shaped, so that when the arm remains in its tripping position in the path of the trip dog J, the latter will be cammed sidewise at each revolution of the cam J^1 and will not engage the stop lever J^2, whereby the clutch will remain engaged and the machine operation will continue without interruption. The details of the clutch control mechanism are fully shown and described in the Rogers Patent No. 661,386, and, being so well known, they do not require any further description here.

The parts so far described and their normal mode of operation in casting single slugs, in themselves, constitute no part of the present invention and are or may be of any suitable construction such, for instance, as disclosed in the previously mentioned Letters Patent No. 436,532, or as presented in the commercial slug casting machine.

As already stated, the improved equipment is

intended to adapt the machine automatically to cast duplicate slugs from each of the composed lines as desired. To this end, there are employed means which may be called into action, when desired, for actuation by a moving element of the machine, such as the metal pot which has been selected in the present instance, and it may be adjusted so that the first elevator E is prevented from ascending to its uppermost position, thereby preventing the transfer of the composed line therefrom, the assembler B locked in its normal position to prevent the delivery of a new line to the first elevator, and the clutch control dog rendered inoperative so as to prevent the machine from stopping at the end of a completed casting cycle. The adjustment is selective so that the functions enumerated are carried out for either a selected or an infinite number of machine cycles, thereby permitting a composed line to be returned to the casting mechanism a plurality of times as determined by the adjustment of the mechanism.

The machine is conditioned for casting duplicate slugs by the adjustment of a single control element M (Figs. 2, 3, 4, 5, 6, 9, 11, 12 and 13), which comprises a rotatable two-armed member M^1 adapted to be set in any one of several different positions according to the number of duplicate slugs to be cast. The member M^1 is mounted on a vertically disposed shaft M^2 so as to overlie a plate M^3 formed on a horizontal portion m of a bracket M^4, which also has a vertical portion m^1 and is secured to the machine frame W by bolts w and w^1 (Fig. 1). The plate M^3 bears the markings "Reg, Con, 2, 3, 4, 5," meaning, respectively, regular machine operation, continuous casting of an infinite number of duplicate slugs, and selective casting of 2, 3, 4 or 5 duplicate slugs. One arm of the member M^1 has a pointer m^2 fixed to its free end by a screw m^3, the pointer being adapted to register with one of the markings on the plate M^3 when the member M^1 is set in the selected position. A knurled knob m^4 is formed on the member M^1 and the latter is adjusted to different positions by grasping the knob m^4 and lifting the member M^1 vertically against the tension of a spring m^3 (see Fig. 12). This disengages the plain or unthreaded end m^6 of the screw m^3 (Fig. 3) from whichever recess m^7 in the plate M^3 it may be seated in at the time to free the member M^1, which is then rotated to the desired position, released, and retracted by the spring m^5 to engage the plain end m^6 of the screw m^3 in a new recess m^7 with which it then registers and so lock the member M^1 in its adjusted position. The setting of the member M^1, so that the pointer m^2 registers with the selected marking on the plate M^3, locates a stop M^5 in a definite casting control position according to the selected setting, compare Figs. 2 and 11, said stop being carried by an arm of the member M^1 extending in a direction substantially opposite to the arm which carries the pointer m^2. It may be pointed out at this time that, while the mechanism is shown as adapted for conditioning the machine for casting up to a maximum of five duplicate slugs, it can, of course, be adapted for a different range of selectivity.

The stop M^5 overlies a ratchet bar S and is adapted to be engaged by an upstanding lug s on the top edge of a forward extension S^4 fixed to the ratchet bar S. This ratchet bar S is mounted in a guideway m^8 formed in the bracket M^4, being slidably held therein by a gib s^{13}. The ratchet bar S normally tends to move rearwardly under the influence of a spring S^2 (Fig. 4) having one end fixed to a pin s^1 at the rear end thereof and its opposite end attached to the fixed part of the machine. A series of five teeth s^2 are formed in the upper surface of the ratchet bar S and are adapted to be engaged by a spring-pressed pawl S^3 and by a holding detent X. The pawl S^3 is pivoted, as at s^3, between upstanding lugs s^4 on a carrier S^5 which is mounted on the ratchet bar S to move relatively thereto, the nose s^5 of the pawl being held down in engagement with one of the teeth s^2 by a spring s^6 arranged between the opposite end s^7 of the pawl and the top edge of the carrier S^5. The carrier S^5 is normally held back against a depending leg s^8 of the bracket S^1 by a tension spring S^6, which has one end anchored to the leg s^8 and the opposite end connected to a depending leg s^9 at the forward end of the carrier S^5. An arm s^{10} extends upwardly from the carrier S^5 in laterally offset relation thereto, and at its upper end is equipped with an adjustable bumper S^{11} which is screwed into a threaded opening in the arm. The bumper s^{11} is thus located in front of and in the path of movement of the leg F^1 of the metal pot, so that, when the leg F^1 moves forward, it strikes the bumper s^{11} and urges the carrier S^5 forwardly against the pull of the spring S^6. As the leg F^1 of the metal pot rocks back to its normal position, the spring S^6 exercises itself to return the carrier S^5 to its rearward position.

A rod P (Fig. 4) is slidably mounted at its forward end in a bearing formed in a depending portion m^{10} of the bracket M^4 and at its rear end in a bearing formed in the depending leg s^8 of the bracket S^1 A collar p is fixed to the rod P in advance of the leading edge of the leg s^9 on the carrier S^5, whereby the rod P is moved forward when the carrier is advanced by the movement of the metal pot. The rod P is equipped at its forward end with a collar p^1, which is formed with a front cam face p^2. In the forward movement of the rod P, the collar p^1 moves past a locking finger v formed by the depending end of an arm V (Figs. 2 and 11) fixed to a vertically disposed rock shaft V^1 mounted in a bearing t formed in a bracket T, the cam face p^2 urging the finger v to one side out of the path of the collar p^1 to allow the latter to pass. Thereafter, the finger v swings back to its original position and lies behind the collar p^1 to prevent a return movement of the rod P. A yoke p^3 is pinned to the rear end of the rod P and one end of a link p^4 is secured between the yoke arms p^5 and p^6 by a pin p^7, the link extending rearwardly to the arm J^{10} of the clutch control sleeve J^3 and being connected to the arm by a screw p^8.

The arm V is equipped at its forward end with a cam plate V^2 (Figs. 2 and 11) having a surface v^1 adapted to be engaged by a projection S^7 on the slide bar S when the latter moves into its forward position during the casting of the last duplicate slug. Such engagement of the projection S^7 with the cam face v^1 swings the arm V to the position shown in Fig. 2, thus withdrawing the depending finger v from in back of the collar p^1 on the slide rod P and releasing the rod for retraction by the spring J^{11} (Fig. 4a) to return the arm J^5 to inoperative position, so that, as the machine cycle is completed, the stop J will strike the lever J^2 and bring the machine to rest.

A latch L (Figs. 2 and 4) for locking the assembler B against upward movement is carried

by a vertically disposed lever L^1, pivoted as at l to the assembler slide frame B^1. The latch L is normally held out of engagement with a lug N on the assembler against the action of a leaf spring L^2 fixed to the frame B^1 and bearing against the upper end of the lever L^1. The end of the lever L^1 below the pivot l is offset, as at l^1, and engages freely with the end of an adjusting screw l^2 carried in an upstanding free end of an arm L^3 whose opposite end is fixed to the upper end of the rock shaft V^1 before referred to.

The swinging of the arm V to the position shown in Fig. 2 rotates the rock shaft V^1 to which it is secured, the rock shaft in turn swinging the arm L^3 counterclockwise (Fig. 2) so that the adjusting screw l^2 strikes the lower end l^1 of the lever L^1 and rocks the lever against the action of the spring L^2 to disengage the latch L from the lug N on the assembler B, releasing the assembler for the delivery of another line to the first elevator.

A stop R for arresting the first elevator E in its upward movement (see Figs. 1, 2, 4, 5 and 10) is carried at the end of a long arm r of a bell crank lever R^1, and is adapted to be swung forwardly into the path of a lug E^1 fixed to the lower end of the first elevator slide E^2 and projecting rearwardly therefrom, so that when the elevator rises to a given height short of its line transfer position, the lug E^1 will strike the under surface of the stop R and the elevator will be arrested. The bell crank lever R^1 has pivoted on a screw stud r^1 (Fig. 1) anchored in a horizontal arm r^2 of a bracket R^3 fixed to the vise frame Q, and is adapted to swing the stop R into active position by the pull of a spring R^4 having one end anchored as at r^3 to the vise frame Q and its opposite end secured to a screw r^4 in the end of a short arm r^5 of the lever R^1. The bell crank lever R^1 is actuated by a vertically disposed lever R^5 to return the stop R to inactive position against the pull of the spring R^4, the lever R^5 being pivoted as at r^6 to a vertical arm r^7 of the bracket R^3 and at its lower end being offset, as at r^8, and equipped with an adjusting screw r^9 (Figs. 4 and 5) which engages an upstanding lug r^{11} formed on the arm r of the bell crank lever R^1. The upper end of the lever R^5 is offset as at r^{12} and equipped with an adjusting screw r^{13} located in the path of the forward end of the extension S^4 of the ratchet bar S.

With this arrangement, the stop R is normally held in its inactive position, as shown in Fig. 2. When the machine is conditioned for casting duplicate slugs and the ratchet bar S is retracted during the first cycle of operation of the machine, the end of the extension S^4 of the ratchet bar S moves away from the adjusting screw r^{13}, allowing the spring R^4 to swing the bell crank lever R^1 counterclockwise in Fig. 2 to locate the stop R in the path of the lug E^1, the location of the stop R being determined by the banking of the lower end of the vertical lever R^5 against an upstanding pin r^{10} on the bracket R^3. During the cycle of machine operation for casting the last duplicate slug, as the ratchet bar S is returned to its original forward position, the end of the extension S^4 thereof engages and rocks the vertical lever R^5 clockwise, swinging the bell crank lever R^1 to the position shown in Fig. 2 against the pull of the spring R^4 and thus removing the stop R from the path of the lug E^1 on the first elevator E and allowing the latter to partake of its full ascent to upper line transfer position.

When the machine is conditioned by adjustment of the member M to cast duplicate slugs, the ratchet bar S is adapted to be released at the start of the first machine cycle for retraction by the spring S^2. The release of the ratchet bar S is effected by the final movement of the line delivery slide lever C^1 in transferring the line from the assembler B to the first elevator E (see dotted lines in Fig. 1), the lever C^1 actuating a series of levers which lift the pawl S^3 and the holding detent X out of engagement with the teeth s^2 on the upper surface of the ratchet bar. For this purpose, the holding detent X is formed at the end of a long arm x of a bent lever X^1 (Figs. 2 and 3), and is arranged to underlie a pin s^{12} projecting laterally from the side of the pawl S^3. The lever X^1 has a short arm x^1 pivoted by a screw stud x^2 to the upstanding portion m^1 of the bracket M^4. At its bend, the lever X^1 is provided with a pin x^3 adapted to be straddled by the lower forked end x^4 of a lever X^2 which is pivoted by means of a screw stud x^5 to the portion m^1 of the bracket M^4. The upper end of the lever X^2 is formed with an offset portion x^6 which is equipped with an adjustable screw x^7 located in the path of movement of the aforementioned line delivery slide lever C^1. When engaged by the edge of the line delivery slide lever C^1, the lever X^2 is rocked in a counterclockwise direction in Fig. 3, acting in turn to rock the lever X^1 in a clockwise direction about its pivot x^2 and thus raise the holding detent X, which by striking the pin s^{12} lifts the pawl S^3 along with it out of engagement with the teeth s^2 on the ratchet bar S. The arm x of the lever X^1 is held against lateral displacement and is limited in its upward movement by a small plate x^8 (Figs. 10 and 14) fastened to the vertical portion m^1 of the bracket M^4 by a screw x^9 and having an upper portion (Fig. 12) cut away to provide a space between its inner face and the bracket M through which the lever X^1 passes, a pin x^{11} being provided to overlie the top edge of the lever. An elongated slot x^{13} in the plate x^8, through which the screw x^9 extends, allows the plate to rise and fall with the lever X^1 within the limits of the ends of the slot x^{13} and yet acts to guide the lever X^1 so that it will always drop into engagement with the proper tooth s^2 on the ratchet bar S. As soon as the line has been delivered to the first elevator E, the line delivery slide lever C^1 returns to its original position and, as it moves out of engagement with the screw x^7 carried by the lever X^2, the spring s^6 on the pawl S^3 returns the parts to their original positions with both the pawl S^3 and the holding detent X in engagement with one or another of the teeth s^2 on the ratchet bar S according to the retracted position of said bar as determined by the location of the control stop M^5.

The operation of the parts thus far described is as follows:

When it is desired to cast a single slug from a composed line, the control member M^1 is set so that the pointer m^2 registers with the marking "Reg" on the plate M^3. This locates the stop M^5 in the forward dotted line position shown in Fig. 2, where the stop will engage the lug s on the ratchet bar S so as to hold the latter in its normal forward position. Thus, even though the pawl S^3 and holding detent X are raised out of engagement with the teeth s^2 on the ratchet bar S when the line is delivered to the first elevator E, the ratchet bar will not be retracted by the spring S^2, but will be held in its forward position

by the stop M^5 and, hence, the assembler lock L will be maintained in its inactive position as shown in Fig. 4, the first elevator stop R will likewise be maintained in its inactive position as shown in Fig. 2, and the clutch control sleeve J^3 will remain in its inactive position as shown in Figs. 4 and 4*a* to permit the automatic stopping of the machine at the end of the cycle. As shown in Fig. 4, in this condition of the parts, the pawl S^3 and holding detent X engage the last tooth s^2 on the ratchet bar S when the carriage S^5 is in its rearmost position and, consequently, provision is made for the ratchet bar S to partake of lost motion when the metal pot moves up for casting and forces the carriage S^5 to its forward position (see Fig. 6 for comparison). Thus, when the movement of the pawl S^3 carries the ratchet bar S beyond its normal forward position, the spring R^4 permits the lever R^5 to yield and the stop R is moved idly in a clockwise direction in Fig. 2. At the same time, the projection S^7 (Figs. 2 and 11) rides along a straight surface v^3 on the cam plate V^2 so that the arm V, and likewise the arm L^3, remain in the positions shown, unaffected by the movement of the ratchet bar S. As the metal pot recedes, the carriage S^5, ratchet bar S and stop R are returned to their original positions, having merely partaken of a lost motion to permit movement of the metal pot for casting single slugs.

On the other hand, when the control member M^1 is set for casting duplicate slugs, for example in the position shown by the full lines in Fig. 2 with the pointer m^2 registering with the numeral 3 (which means that three slugs in all will be cast), the stop M^5 is located so that it is spaced from the lug *s* on the ratchet bar S. As the lever C^1 completes its stroke in delivering the composed line to the first elevator E (see the dotted lines in Fig. 1), its leading edge will strike the end of the screw x^7 and rock the lever X^2 in a counterclockwise direction, the movement of the lever X^2 in turn rocking the lever X^1 in a clockwise direction to lift the holding detent X and the pawl S^3 out of engagement with the teeth s^2 on the ratchet bar S and release the ratchet bar for retraction by the spring S^2 until it is stopped by the engagement of the lug *s* with the control stop M^5. The retraction of the ratchet bar S carries the end of the extension S^4 out of engagement with the screw r^{13}, allowing the spring R^4 to rock the bell crank lever R^1 in a counterclockwise direction (Fig. 2) to locate the stop R above the lug E^1 on the first elevator E. At the same time, the retraction of the ratchet bar S carries the projecting S^7 out of engagement with the cam plate V^2 on the arm V, and the rock shaft V^1 is turned in a clockwise direction (Fig. 2) by the action of the leaf spring L^2 on the end of the lever L^1 in engaging the latch L with the lug N on the assembler B to lock the latter in its lower assembling position (see Fig. 5). The rocking of the shaft V^1 swings the arm V so as to locate the depending locking finger *v* in the path of the collar p^1 on the forward end of the slide rod P.

Now, as soon as the line is delivered to the first elevator E, the stop J is automatically moved sidewise (see dotted lines in Fig. 4*a*) out of engagement with the lever J^2 by the usual automatic means (not shown) to engage the main clutch and start the cycle of operation of the machine, whereupon the lever C^1 is immediately returned to and locked in its original position. The return of the lever C^1 moves it out of engagement with the screw x^7 and the force of the spring s^6 acting on the pawl S^3 engages the pawl and the holding detent X with one of the teeth s^2 on the ratchet bar S. Thereafter, as the metal pot moves into casting relation to the mold, the leg F^1 of the metal pot strikes the bumper s^{11} and moves the carriage S^5 forwardly, the movement of the carriage simultaneously advancing the ratchet bar S and the slide rod P so that the holding finger *v* is cammed to one side and then swings in back of the collar p^1 to hold the rod P in its forward position (see Figs. 6 and 8) and the holding detent X engages with the following tooth s^2 on the ratchet bar S to hold the latter in the forward position to which it has been moved (see again Fig. 6). As explained previously, the holding of the rod P in its forward position maintains the sleeve J^3 (Figs. 4 and 4*a*) in a position where the arm J^5 is located in the path of the trip dog J to cam the latter sidewise at each revolution of the cam wheel J^1 and prevent the dog from striking the stop lever J^2 and thus prevent the stoppage of the machine at the end of the cycle. When the metal pot returns to its normal position after the slug is cast, the return movement of the metal pot leg F^1 allows the spring S^6 to retract the carriage S^5 and pawl S^3 for the engagement of the pawl with the next following tooth s^2 of the ratchet bar S, the spring s^6 yielding to allow the pawl to ride over the tooth and then expanding to force the nose of the pawl down in back of the tooth. Subsequent movements of the metal pot actuate the carriage S^5 and pawl S^3 merely to advance the ratchet bar S an extent equal to the distance between successive teeth s^2, until finally the last step through which the ratchet bar S is advanced carries its forward end into engagement with the screw r^{13} at the upper end of the lever R^5 and the projection S^7 into engagement with the cam surface v^1 of the cam plate V^2. This final movement of the ratchet bar S restores it to its original or normal position and thus incapacitates the first elevator stop R and assembler lock L in the manner previously described. A new line can then be delivered by the assembler B to the delivery slide C, even though the cycle of the machine operation has not been completed, since the cam on the main shaft for returning the delivery slide lever C^1 will hold the latter in the so-called "waiting position" and prevent the delivery of the line to the first elevator E until the machine cycle is completed. At the completion of the machine cycle, the arm J^5, having been moved to the full line position shown in Fig. 4*a* by the action of the spring J^{11}, due to the release of the slide rod P by the locking finger *v* when the ratchet bar S was returned to its original position, will be out of the path of the trip dog J so that the latter will strike the stop lever J^2 and throw out the main clutch to stop the operation of the machine.

By way of comparison, if five duplicate slugs were to be cast, the member M^1 would be adjusted so that the pointer m^2 would register with the numeral 5 thus locating the stop M^5 in the rearward dotted line position in Fig. 2. Hence, the ratchet bar S, when released by the delivery of a composed line to the first elevator E, would be retracted a greater distance than when the pointer registered with the numeral 3 in the example previously given, and five casting movements of the metal pot instead of three would be required to return the ratchet bar S to its original forward position.

It is pointed out also, that the graduations on

the plate M^3 are not uniformly spaced apart. For example, the spaces between "Con" and "2", and "4" and "5" are greater than those between "2" and "3", and "3" and "4". This is so, because the rotation of the member M^1 moves the stop M^5 in an arcuate path; whereas the path of movement of the ratchet bar S is rectilinear.

In order to condition the machine to cast an infinite number of duplicate slugs, the member M is set with the pointer m^2 registering with the marking "Con" on the plate M^3. Under this setting, when the composed line is delivered to the first elevator, the pawl S^3 and the holding detent X are lifted out of engagement with the teeth s^2 on the ratchet bar S in the manner already stated, thus allowing the ratchet bar to be retracted a distance of one tooth or sufficiently to render active the first elevator stop R as well as the assembler lock L and also to allow the stop finger v to move into position to engage behind the collar p^1 and hold the clutch control sleeve J^3 in dog tripping position for continuous machine operation. In this instance, however, the pawl S^3 and holding detent X are held in their raised position and prevented from reengaging the teeth s^2 on the ratchet bar S so that, although the carrier S^5 on which the pawl S^3 is mounted will be reciprocated with each casting movement of the metal pot, the ratchet bar S will not be moved at all and will remain in its retracted position. The first forward movement of the carrier S^5, however, will carry the slide rod P forwardly so that the finger v will engage behind the collar p^1 and retain the rod P in its forward position and cause the machine to operate continuously. Subsequent casting movements of the metal pot will merely effect an idle reciprocation of the carrier S^5, the pawl S^3 remaining in its raised position with the pin s^{12} riding back and forth on the top surface x^{14} (Fig. 13) of the holding detent X which is extended forwardly as at x^{15}.

The means provided for holding the pawl S^3 and holding detent X disengaged from the teeth s^2 on the ratchet bar S comprises a spring detent Z (Figs. 11, 12 and 13) actuated by a cam m^{11} formed integrally with the adjustable control member M^1. The detent Z is arranged to move in a guideway m^{12} formed in the bracket M^4 and enclosed in part by the bracket T which supports the rock shaft V^1, the bracket T being detachably secured over the guideway m^{12} by means of screws t^1. The detent Z is formed with a nose portion Z^1 having an inclined cam surface z adapted to engage with a correspondingly inclined surface x^{16} formed on the wall of a recess x^{12} in the lower edge of the plate x^8. The nose portion Z is formed on a rod z^1 which passes through a coiled spring z^2 and is slidably secured to a tail piece Z^2 by a pin and slot connection z^3. When the member M^1 is set to engage the cam m^{11} with the tail piece Z^2 of the detent Z, the tail piece is moved toward the nose portion Z^1 of the detent and compresses the spring z^2, the relative movement of the parts being permitted by the pin and slot connection z^3. Thereafter, when the holding detent X is raised to disengage it and the pawl S^3 from the teeth s^2 on the slide bar S, the spring z^2 projects the nose portion Z^1 beneath the plate x^8 (compare Figs. 12 and 13), whereby the detent Z maintains the holding detent X and the pawl S^3 in their raised position after the line has been delivered to the first elevator and the line delivery lever C^1 returns to its original position.

When it is desired to stop the machine, this can be accomplished by setting the member M^1 in the position marked "Reg," which will remove the cam m^{11} from engagement with the tail piece Z^2 of the detent Z and allow the latter to be moved back to its inactive position by the action by the spring s^6 in effecting a reengagement of the pawl S^3 and holding detent X with the teeth s^2 on the ratchet bar S, and which will also move the stop M^5 to carry the slide bar S to its forward position, releasing the assembler B, allowing the first elevator E to partake of a full ascent, and causing the machine to stop automatically at the end of the cycle of operation then taking place. Of course, the machine could be stopped by adjusting the control member M^1 to have the pointer m^3 register with one of the numerical markings on the plate M^3, in which case the machine would automatically come to rest at the end of one or more cycles in the usual manner as when casting a selected number of duplicate slugs.

It will be clear now, that by adjusting the single control member M^1, not only is the machine conditioned for casting duplicate slugs, but it is also conditioned for casting a selected number of duplicate slugs, the determination of the number of duplicate slugs to be cast being in accordance with the extent to which the ratchet bar S is retracted and, hence, the number of steps through which it is progressively advanced before being returned to its original forward position. Moreover, as last described, the machine may be conditioned to operate continuously to cast an infinite number of duplicate slugs, merely by adjusting the same control member M^1 to register the pointer m^2 with the marking "Con" on the plate M^3.

As already stated, a preferred embodiment of the invention has been shown and described and, as shown, is adapted for casting an infinite number of duplicate slugs or a maximum of five duplicate slugs. Obviously, the device can be modified to change the range of selectivity, and other variations and modifications may occur to those skilled in the art which will still be comprised within the scope of the invention. It is to be understood, therefore, that the invention is not limited to any specific form or embodiment, except insofar as such limitations are specified in the appended claims.

Having thus described my invention, what I claim is:

1. In a slug casting machine, the combination of means for casting a slug during each cycle of machine operation, means for inaugurating the operation of the machine, and common means for conditioning the machine to operate continuously or for a definite selected number of cycles, as required.

2. In a slug casting machine, the combination of means for casting a slug during each cycle of machine operation, means for inaugurating the operation of the machine, means operative automatically for stopping the machine at the end of one cycle of operation, means for rendering said stopping means inoperative so as to cause the machine to operate continuously, means for rendering said stopping means inoperative for a definite selected number of cycles, and common control means for the last two mentioned means.

3. In a slug casting machine, the combination of means for casting a slug during each cycle of machine operation, means for inaugurating the operation of the machine, and a single control

element for conditioning the machine to operate continuously or for a definite selected number of cycles, as required.

4. In a slug casting machine, the combination of means for casting a slug during each cycle of machine operation, means for inaugurating the operation of the machine, means operative automatically for stopping the machine at the end of one cycle of operation, means for rendering said stopping means inoperative so as to cause the machine to operate continuously, means for rendering said stopping means inoperative for a definite selected number of cycles, and a single control element common to the last two mentioned means.

5. In a slug casting machine, the combination of a metal pot movable to and from casting position, means for inaugurating the operation of the machine, means operative automatically to stop the machine at the end of one cycle, and means actuated by the movement of the metal pot to render the stopping means momentarily inoperative.

6. In a slug casting machine, the combination of a metal pot movable to and from casting position, means for inaugurating the operation of the machine, means operative automatically to stop the machine at the end of one cycle, and means actuated by the movement of the metal pot to render the stopping means inoperative for a definite selected number of cycles.

7. In a slug casting machine, the combination of a metal pot movable to and from casting position, means for inaugurating the operation of the machine, means operative automatically to stop the machine at the end of one cycle, means actuated by the movement of the metal pot to render the stopping means inoperative for a definite selected number of cycles, and means actuated by the metal pot to render the stopping means operative again to stop the machine at the end of the last of the selected cycles.

8. In a slug casting machine, the combination of a reciprocable feed device adapted to be actuated by a periodically movable part of the machine once during each machine cycle of operation, a ratchet bar adapted to cause the machine to operate for a plurality of cycles, the feed device and ratchet bar being arranged to move relatively to one another, and the ratchet bar being adapted to be moved progressively by scuccessive actuations of the feed device, and means for adjusting the ratchet bar to different positions relatively to the feed device to vary the number of cycles through which the machine will operate continuously.

9. A combination according to claim 8, wherein the ratchet bar normally occupies a forward position and is adapted to be retracted different distances according to the number of cycles of machine operation desired.

10. A combination according to claim 8, wherein the ratchet bar normally occupies a forward position and is adapted to be retracted different distances according to the number of cycles of machine operation desired, and including a movable assembler and means controlled by the ratchet bar and operative when the ratchet bar is retracted to lock the assembler against movement.

11. A combination according to claim 8, wherein the ratchet bar normally occupies a forward position and is adapted to be retracted different distances according to the number of cycles of machine operation desired, and including a vertically movable line transporter, and means controlled by the ratchet bar and operative when the ratchet bar is retracted to limit the upward movement of the transporter.

12. A combination according to claim 8, wherein the ratchet bar normally occupies a forward position and is adapted to be retracted different distances according to the number of cycles of machine operation desired, and including a vertically movable line transporter, an assembler movable to deliver a line to the transporter, and means controlled by the ratchet bar and operative when the ratchet bar is retracted to limit the upward movement of the transporter and to lock the assembler against movement.

13. A combination according to claim 8, wherein the ratchet bar normally occupies a forward position and is adapted to be retracted different distances according to the number of cycles of machine operation desired, and including a trip dog for automatically stopping the machine at the end of a cycle, means for tripping said dog, and means controlled by the ratchet bar and operative when the ratchet bar is retracted for locking said tripping means in active position to cause the machine to operate for the requisite number of cycles.

14. A combination according to claim 8, wherein the ratchet bar normally occupies a forward position and is adapted to be retracted different distances according to the number of cycles of machine operation desired, and including a trip dog for automatically stopping the machine at the end of a cycle, means for tripping the dog, a vertically movable line transporter, and means controlled by the ratchet bar and operative when the ratchet bar is retracted to lock said tripping means in active position to cause the machine to operate for the requisite number of cycles and to limit the upward movement of the transporter.

15. A combination according to claim 8, wherein the ratchet bar normally occupies a forward position and is adapted to be retracted different distances according to the number of cycles of machine operation desired, and including a trip dog for automatically stopping the machine at the end of a cycle, means for tripping the dog, a vertically movable line transporter, a movable assembler for delivering a composed line to the transporter, and means controlled by the ratchet bar and operative when the ratchet bar is retracted to lock said tripping means in active position to cause the machine to operate for the requisite number of cycles, to limit the upward movement of the transporter, and to lock the assembler against movement.

16. In a slug casting machine, the combination of a reciprocable pawl adapted to be actuated by a periodically movable part of the machine once during each cycle of machine operation, a ratchet bar normally occupying a forward position when the machine is conditioned for casting single slugs, the pawl and ratchet bar being arranged for relative movement, means for conditioning the machine for casting duplicate slugs adapted to permit retraction of the ratchet bar from its forward position, means for disengaging the pawl from the teeth on the ratchet bar to permit its retraction, and means to hold the pawl disengaged from the teeth on the ratchet bar to prevent the return of the ratchet bar to its forward position, whereby the machine will operate continuously for an infinite number of cycles.

17. A combination according to claim 16, including a holding detent arranged at the side of the pawl to engage the teeth in the ratchet bar and underlying a pin projecting from the side of the pawl, and means for elevating the detent and the pawl to disengage them from the teeth on the ratchet bar, and wherein the means to hold the pawl disengaged comprises a locking detent cooperable with said elevating means.

18. A combination according to claim 16, including a holding detent arranged at the side of the pawl to engage the teeth in the ratchet bar and underlying a pin projecting from the side of the pawl, and means for elevating the detent and the pawl to disengage them from the teeth on the ratchet bar, and wherein the means to hold the pawl disengaged comprises a locking detent cooperable with said elevating means according to the setting of the means for conditioning the machine for casting duplicate slugs.

19. A recasting control device for slug casting machines, comprising a clutch control element, a reciprocable rod to maintain the clutch engaged, said rod being actuated by a periodically operated part of the machine during each cycle of operation, a detent to hold said rod temporarily in its actuated position, a ratchet bar to disengage said detent at the end of a given cycle of operation, a pawl for actuating the ratchet bar step by step and in turn actuated by a periodically operated part of the machine during each cycle of operation, and means for adjusting the ratchet bar with reference to its actuating pawl to vary the stepwise movement of the ratchet bar by the pawl, whereby to vary the number of casting cycles of the machine.

20. A recasting control device for slug casting machines, comprising a clutch control element, a reciprocable rod to maintain the clutch engaged, said rod being actuated by a periodically operated part of the machine during each cycle of operation, a detent to hold said rod temporarily in its actuated position, a ratchet bar to disengage said detent at the end of a given cycle of operation, a pawl for actuating the ratchet bar step by step and in turn actuated by a periodically operated part of the machine during each cycle of operation, means for moving the ratchet bar with reference to its actuating pawl, and a stop for limiting such movement of the ratchet bar to locate it in a given position relatively to the pawl for stepwise actuation thereby.

21. A recasting control device for slug casting machines, comprising a clutch control element, a reciprocable rod to maintain the clutch engaged, said rod being actuated by a periodically operated part of the machine during each cycle of operation, a detent to hold said rod temporarily in its actuated position, a ratchet bar to disengage said detent at the end of a given cycle of operation, a pawl for actuating the ratchet bar step by step and in turn actuated by a periodically operated part of the machine during each cycle of operation, means for moving the ratchet bar with reference to its actuating pawl, a stop for limiting such movement of the ratchet bar to locate it in a given position relatively to the pawl for stepwise actuation thereby, and means for adjusting the stop to different positions to vary the location of the ratchet bar relatively to the pawl, whereby to vary the stepwise movement of the ratchet bar by the pawl and thereby to vary the number of casting cycles of the machine.

22. A recasting control device for slug casting machines, comprising a clutch control element, a reciprocable rod to maintain the clutch engaged, said rod being actuated by a periodically operated part of the machine during each cycle of operation, a detent to hold said rod temporarily in its actuated position, a ratchet bar to disengage said detent at the end of a given cycle of operation, a pawl for actuating the ratchet bar step by step and in turn actuated by a periodically operated part of the machine during each cycle of operation, means for moving the ratchet bar with reference to its actuating pawl, a stop for limiting such movement of the ratchet bar to locate it in a given position relatively to the pawl for stepwise actuation thereby, means for adjusting the stop to different positions to vary the location of the ratchet bar relatively to the pawl, whereby to vary the stepwise movement of the ratchet bar by the pawl and thereby to vary the number of casting cycles of the machine, and a detent to hold the ratchet bar in its advanced position after each stepwise actuation thereof by the pawl.

23. A recasting control device for slug casting machines, comprising a clutch control element, a reciprocable rod to maintain the clutch engaged, said rod being actuated by a periodically operated part of the machine during each cycle of operation, a detent to hold said rod temporarily in its actuated position, a ratchet bar to disengage said detent at the end of a given cycle of operation, a pawl for actuating the ratchet bar step by step and in turn actuated by a periodically operated part of the machine during each cycle of operation, means for moving the ratchet bar with reference to its actuating pawl, a stop for limiting such movement of the ratchet bar to locate it in a given position relatively to the pawl for stepwise actuation thereby, a detent to hold the ratchet bar in its advanced position after each stepwise actuation thereof by the pawl, and means for releasing the pawl and holding detent to permit the locating movement of the ratchet bar.

24. A recasting control device for slug casting machines, comprising a clutch control element, a reciprocable rod to maintain the clutch engaged, said rod being actuated by a periodically operated part of the machine during each cycle of operation, a detent to hold said rod temporarily in its actuated position, a ratchet bar to disengage said detent at the end of a given cycle of operation, a pawl for actuating the ratchet bar step by step and in turn actuated by a periodically operated part of the machine during each cycle of operation, means for moving the ratchet bar with reference to its actuating pawl, a stop for limiting such movement of the ratchet bar to locate it in a given position relatively to the pawl for stepwise actuation thereby, a detent to hold the ratchet bar in its advanced position after each stepwise actuation thereof by the pawl, means for releasing the pawl and holding detent to permit the locating movement of the ratchet bar, and means to hold the pawl and detent released to prevent actuation of the ratchet bar by the pawl and cause the machine to operate continuously for an infinite number of cycles.

25. A recasting control device for slug casting machines, comprising a clutch control element, a reciprocable rod to maintain the clutch engaged, said rod being actuated by a periodically operated part of the machine during each cycle of operation, a detent to hold said rod temporarily in its actuated position, a ratchet bar to disengage said detent at the end of a given cycle of oper-

ation, a constantly operated pawl for actuating the ratchet bar step by step and in turn actuated by a periodically operated part of the machine during each cycle of operation, and means for adjusting the ratchet bar with reference to its actuating pawl to vary the stepwise movement of the ratchet bar by the pawl, whereby to vary the number of casting cycles of the machine.

26. A recasting control device for slug casting machines, comprising a clutch control element, a reciprocable rod to maintain the clutch engaged, said rod being actuated by a periodically operated part of the machine during each cycle of operation, a detent to hold said rod temporarily in its actuated position, a ratchet bar to disengage said detent at the end of a given cycle of operation, a constantly operated pawl for actuating the ratchet bar step by step and in turn actuated by a periodically operated part of the machine during each cycle of operation, and means for rendering said pawl inoperative to actuate the ratchet bar, whereby to cause the machine to operate continuously for an infinite number of cycles.

27. A recasting control according to claim 19, including a movable assembler wherein a line of matrices is composed, and a latch controlled by the ratchet bar for momentarily locking the assembler to prevent the delivery of a new line for casting prior to the commencement of the last casting cycle.

28. A recasting control according to claim 19, including a vertically movable line transporter, and a stop controlled by the ratchet bar for limiting the upward movement of the line transporter to prevent the removal of the line therefrom prior to the last casting cycle.

29. A recasting control according to claim 19, including a movable assembler wherein a line of matrices is composed, a latch for momentarily locking the assembler to prevent the delivery of a new line for casting prior to the commencement of the last casting cycle, a vertically movable line transporter, a stop for limiting the upward movement of the line transporter to prevent the removal of the line therefrom prior to the last casting cycle, and two series of levers, one leading to the assembler latch and the other to the line transporter stop, actuated by the ratchet bar to render said latch and stop active and inactive.

30. A recasting control according to claim 19, wherein the pawl for actuating the ratchet bar is constantly actuated, and wherein the ratchet bar is adapted to partake of a lost motion during the casting of single slugs.

31. A recasting control according to claim 23, wherein the pawl and holding detent are arranged side by side and a pin projecting from one side of the pawl overlies the holding detent, and including a series of levers connected to the holding detent and actuated by the delivery of a line for casting to release the holding detent and the pawl by moving them momentarily out of engagement with the ratchet bar.

32. A recasting control according to claim 23, wherein the pawl and holding detent are arranged side by side and a pin projecting from one side of the pawl overlies the holding detent, and including a series of levers connected to the holding detent and actuated by the delivery of a line for casting to release the holding detent and the pawl by moving them momentarily out of engagement with the ratchet bar, a spring detent cooperable with said series of levers to hold them in their actuated positions to maintain the pawl and holding detent released, and a cam control for rendering said spring detent active, as desired.

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