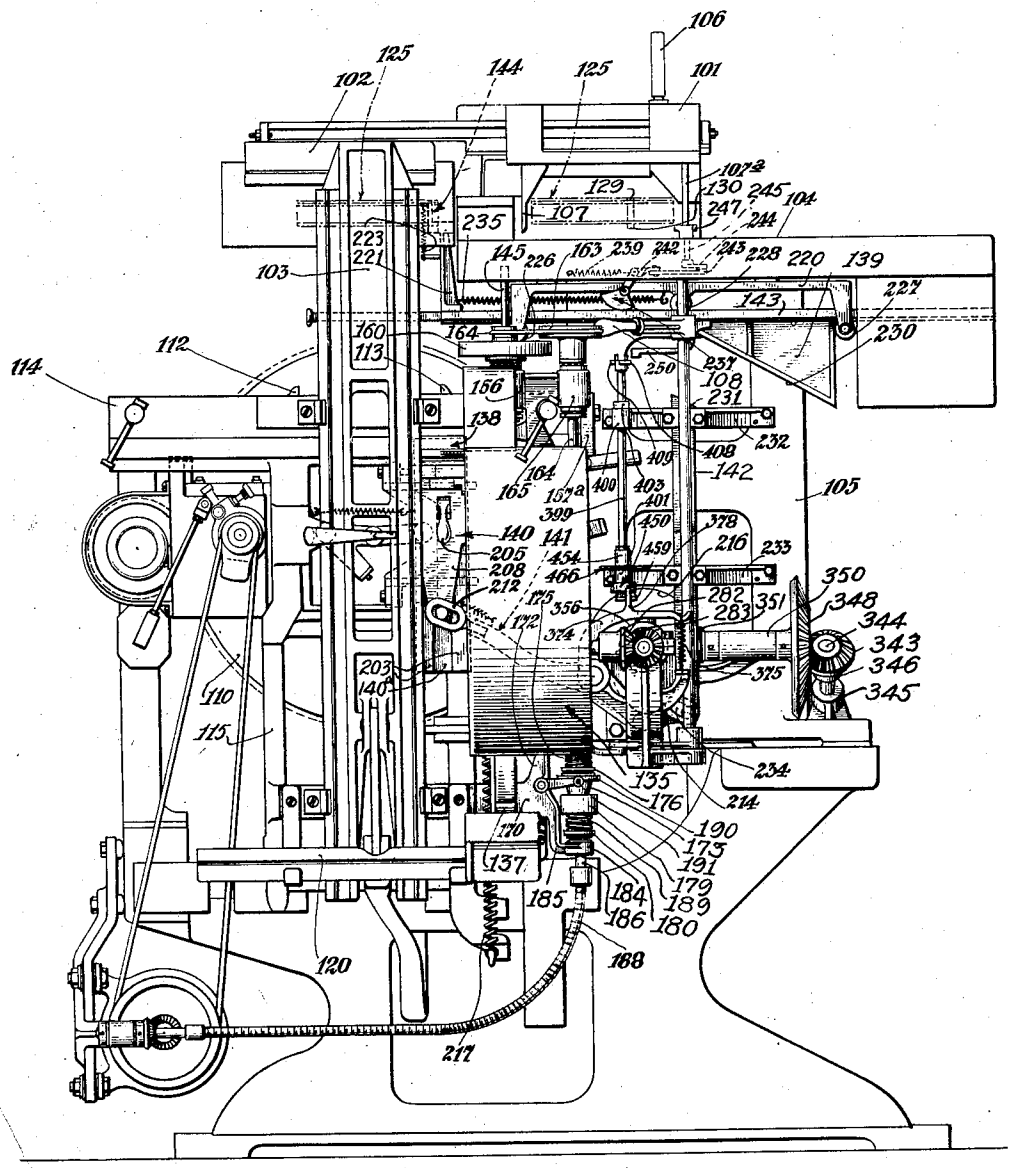
Oct. 5, 1937. L. E. MORRISON ET AL 2,095,004

SLUG CASTING MACHINE

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Fig. 1



INVENTORS
L. E. Morrison
F. C. Meucke

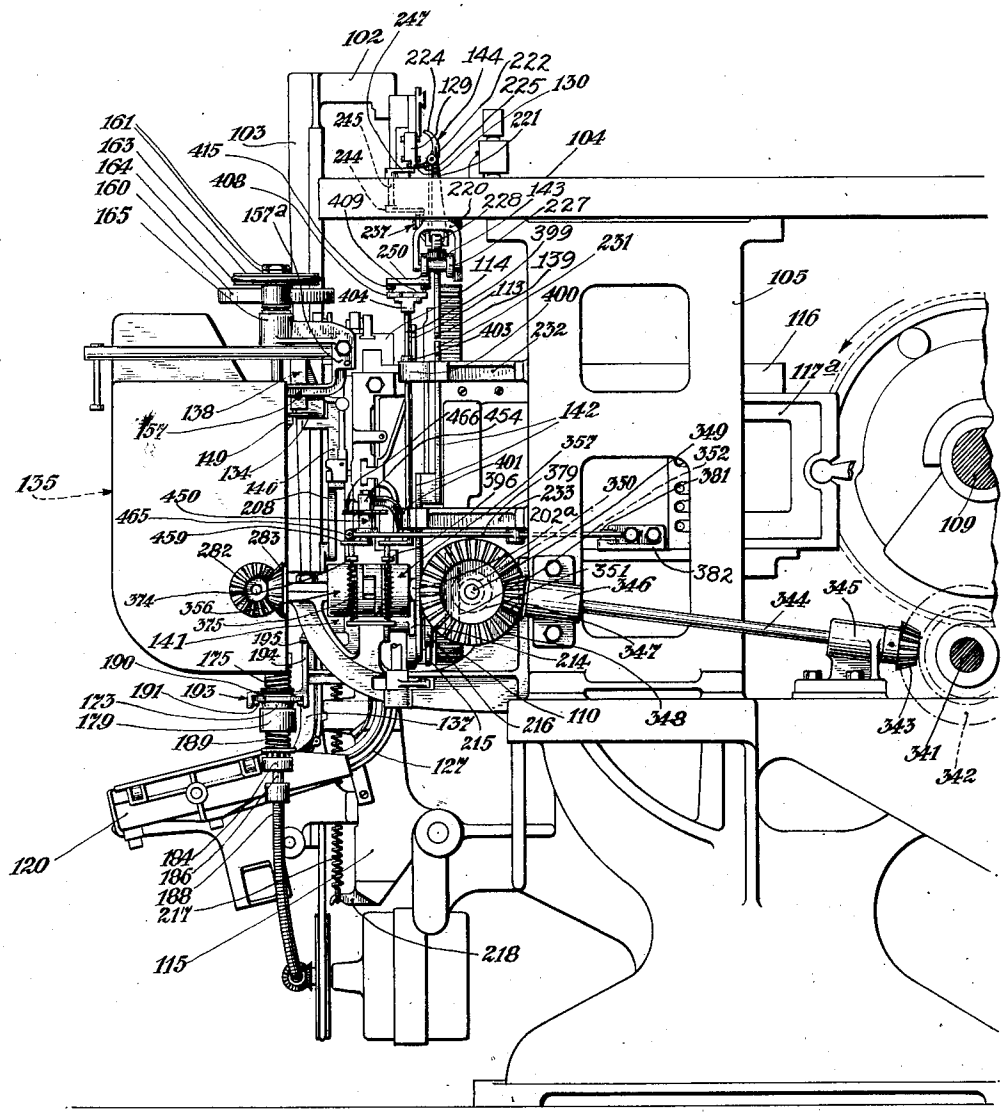
BY
Morrison, Kennedy & Campbell
ATTORNEYS.

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SLUG CASTING MACHINE

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Fig. 2



INVENTORS

L. E. Morrison

F. C. Meuche

BY

Morrison, Kennedy & Campbell

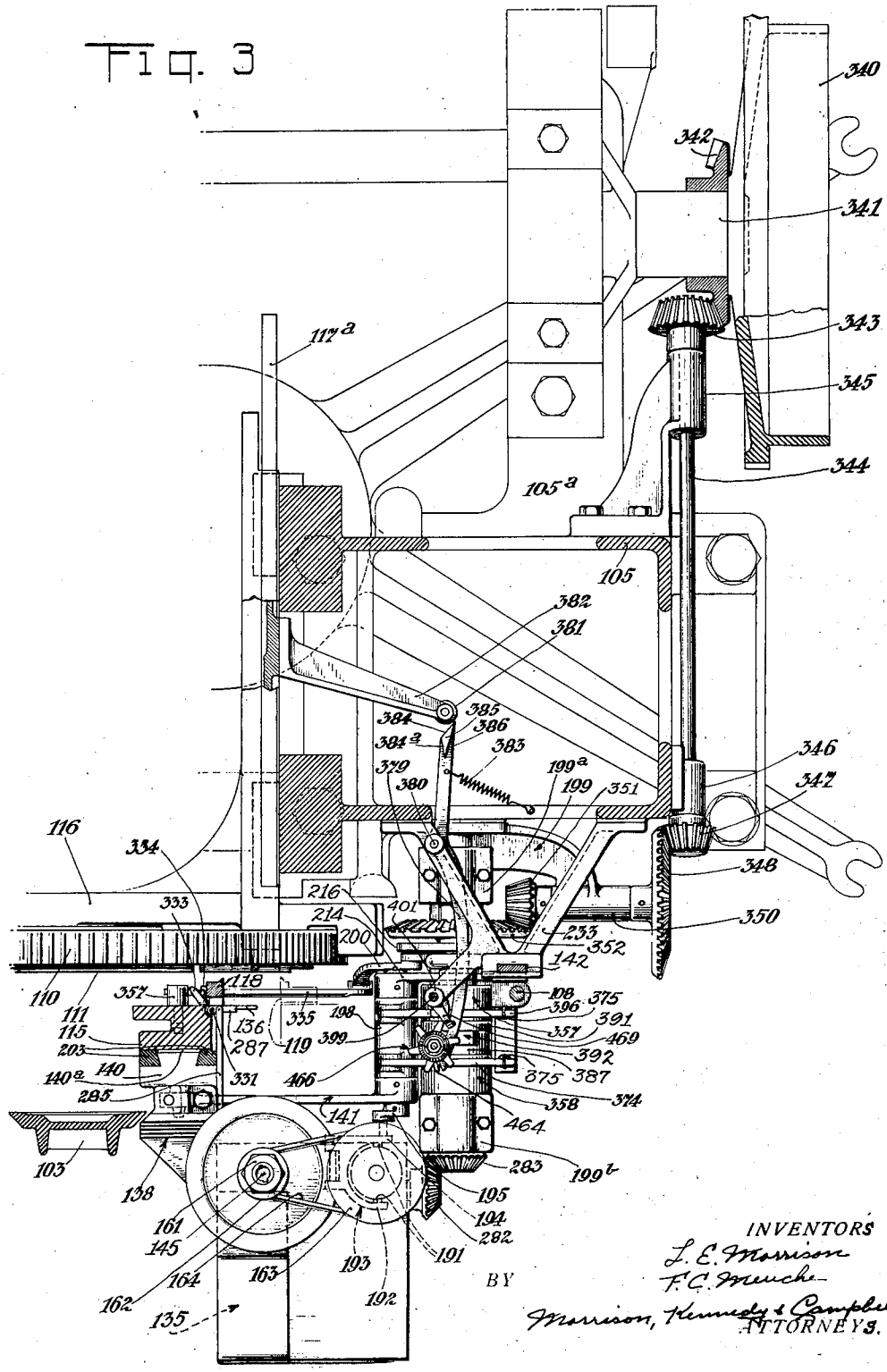
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Fig. 3



INVENTORS
L. E. Morrison
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Fig. 5

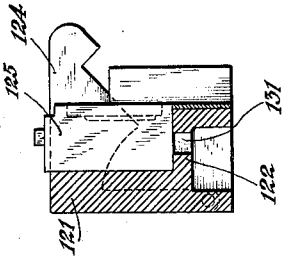


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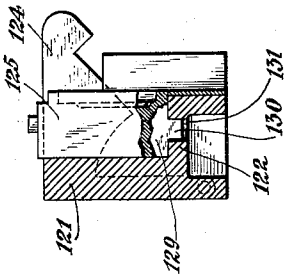


Fig. 4

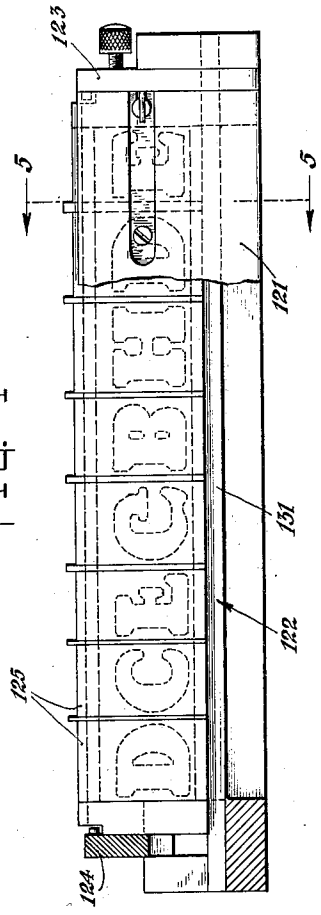
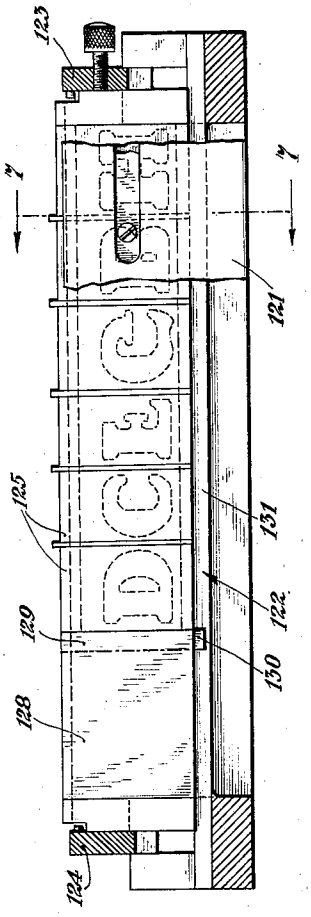


Fig. 6



INVENTORS
L. E. Morrison
F. C. Meuche

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SLUG CASTING MACHINE

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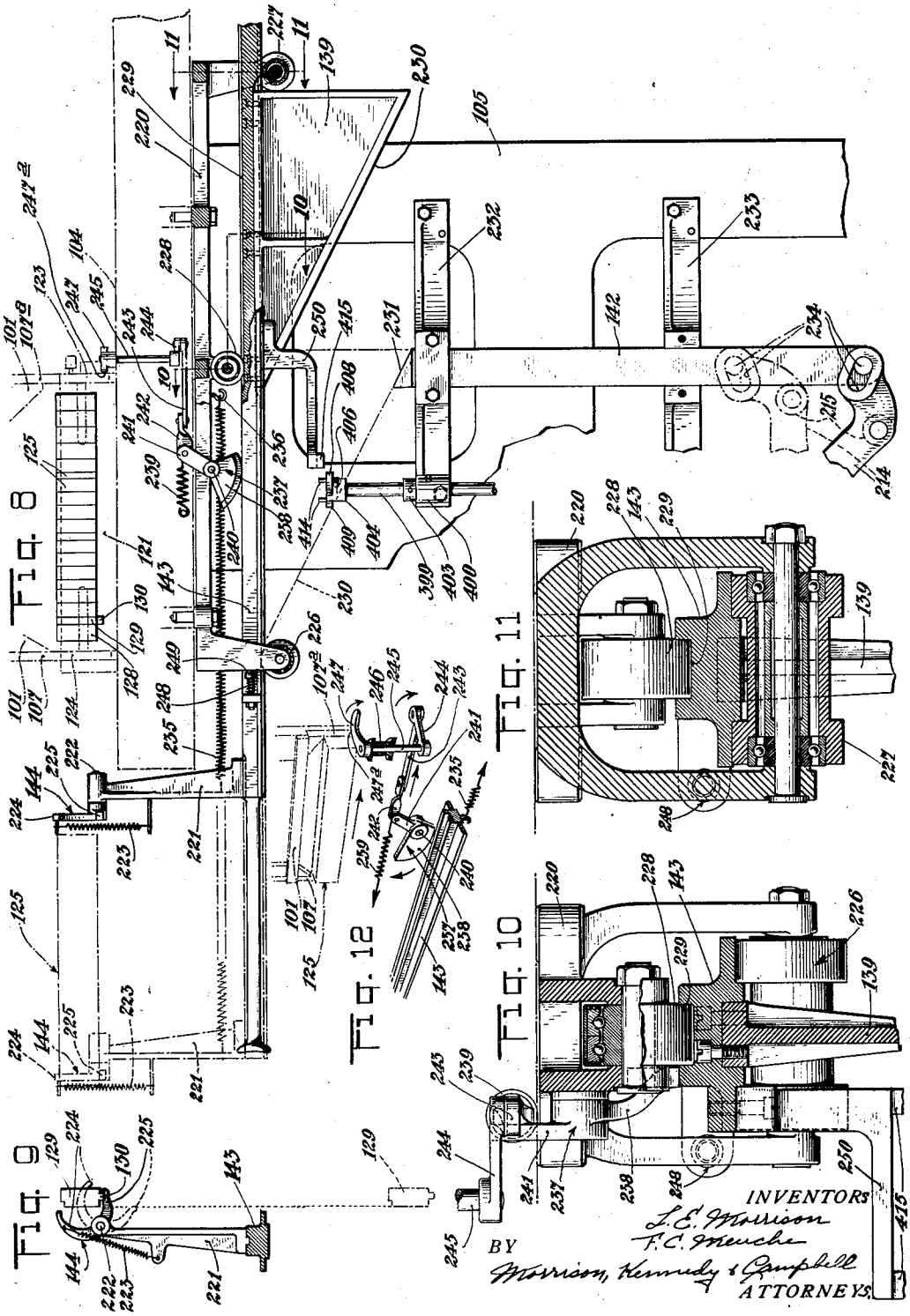


Fig. 8

Fig. 11

Fig. 12

Fig. 10

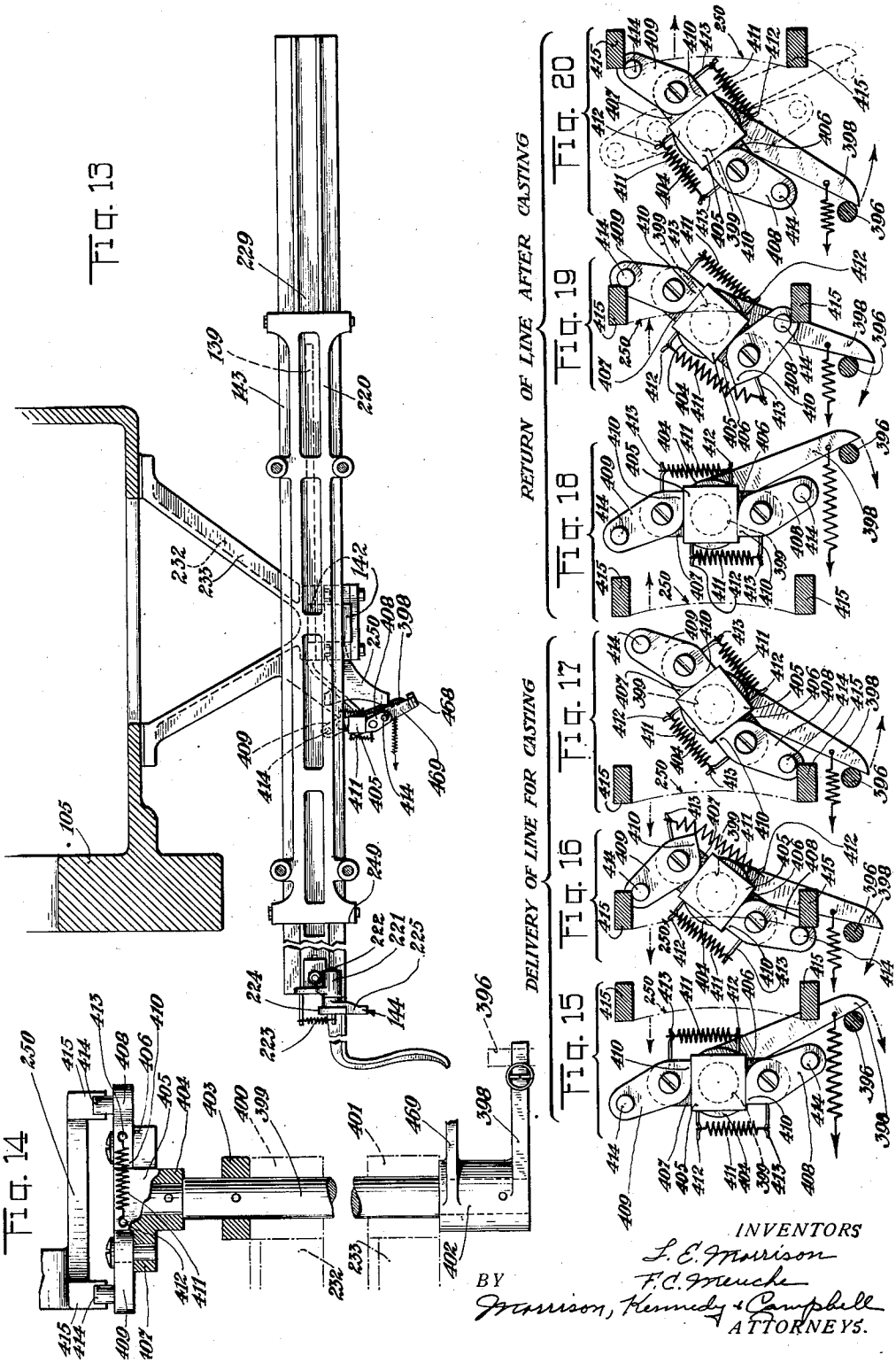
Fig. 9

INVENTORS
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F. C. Meuche
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Morrison, Kennedy & Campbell
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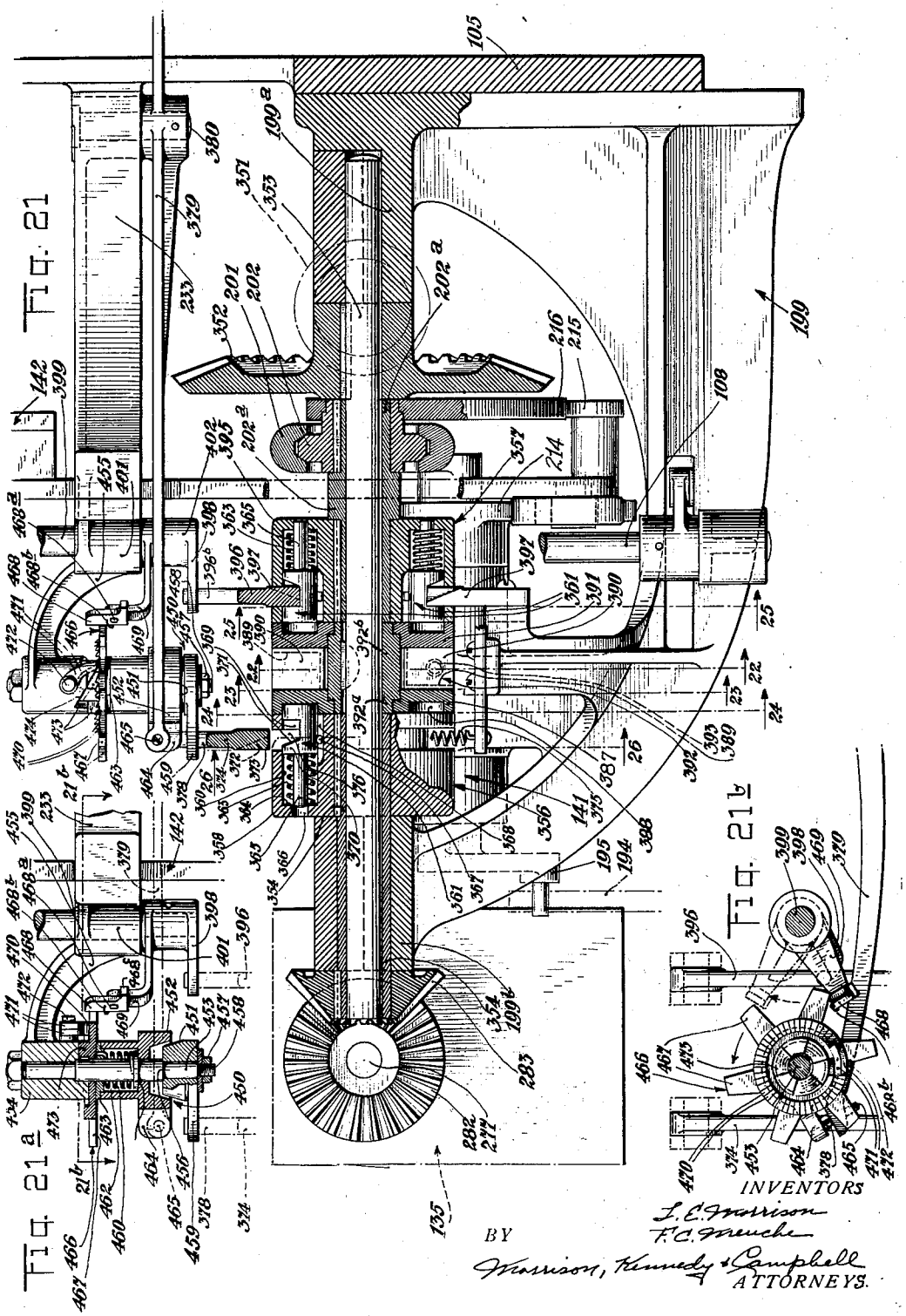


Fig. 21

Fig. 21a

Fig. 21b

INVENTORS
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Fig. 22

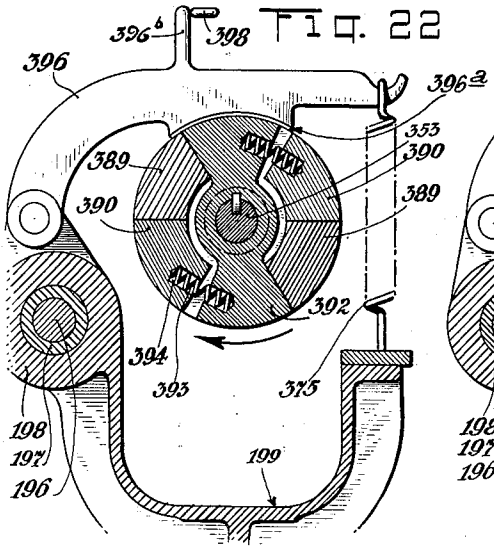


Fig. 23

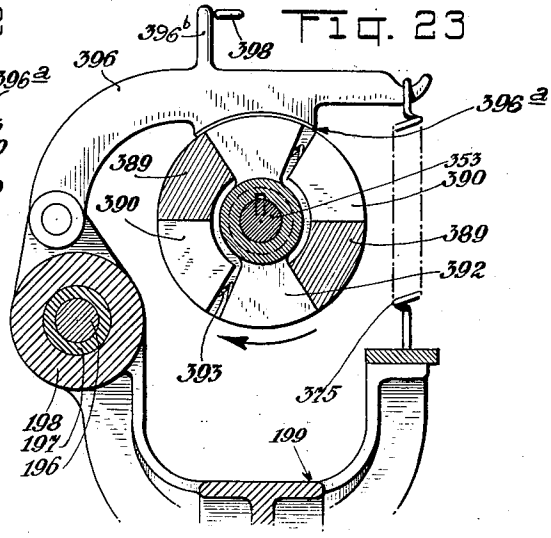


Fig. 24

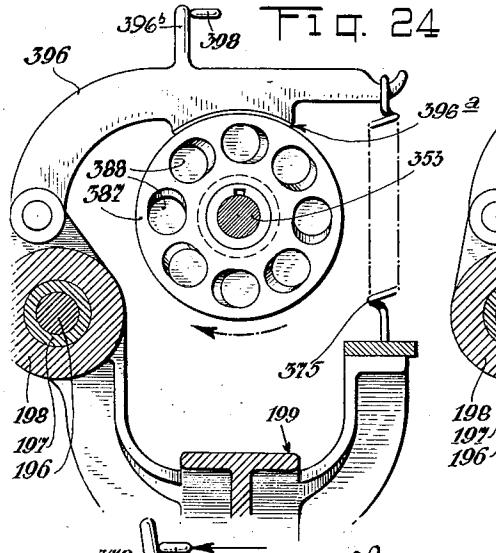


Fig. 25

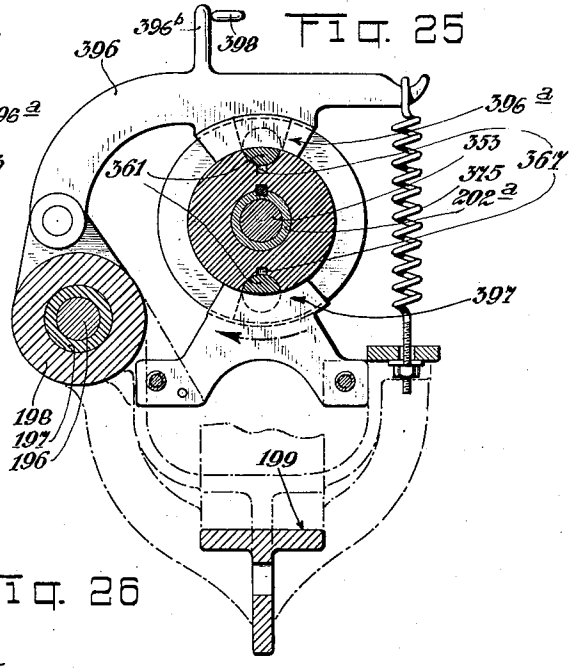
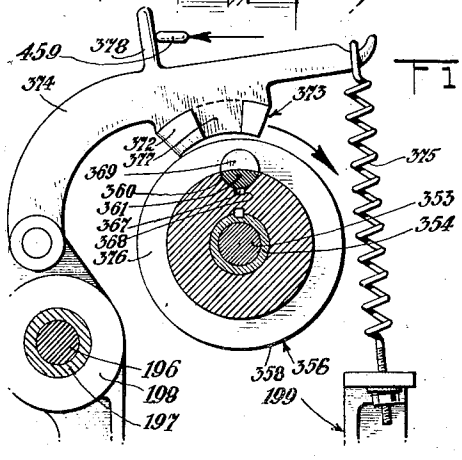


Fig. 26



INVENTORS
L. E. Morrison
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Morrison, Kennedy & Campbell
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SLUG CASTING MACHINE

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Fig. 27

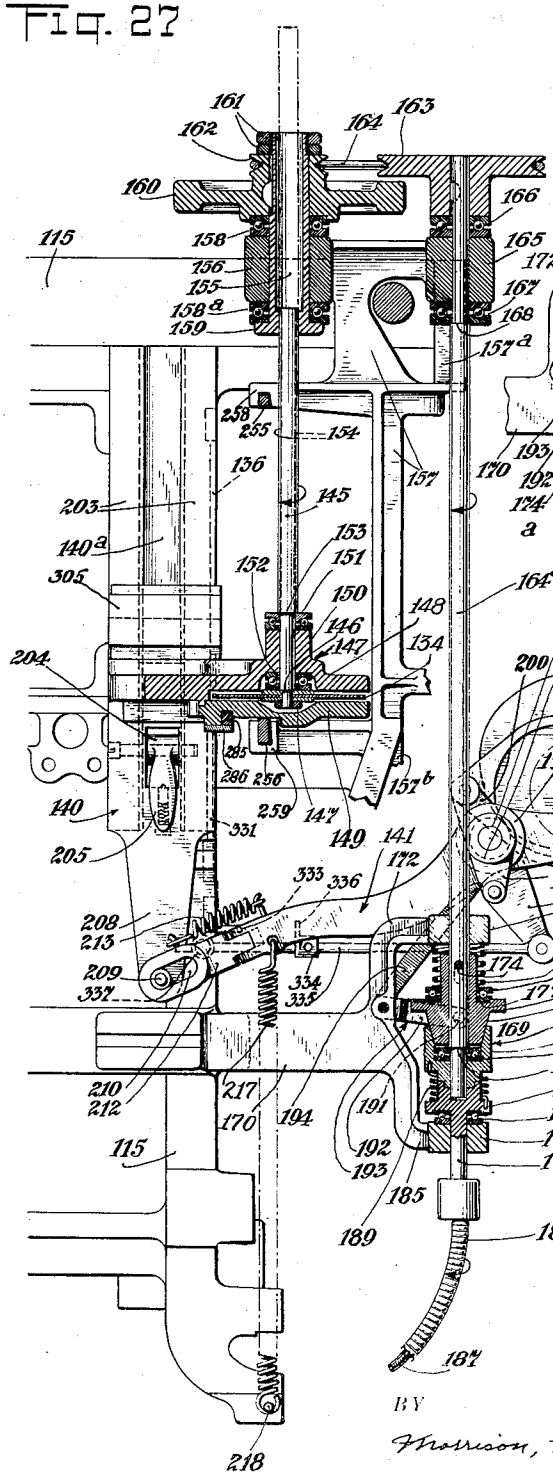
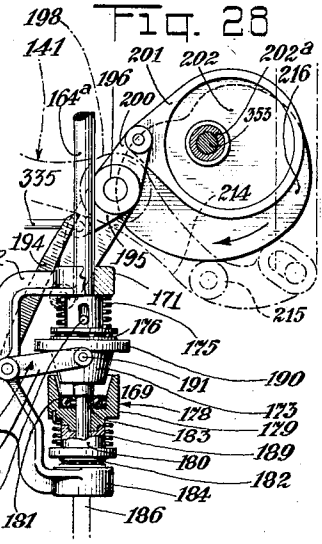
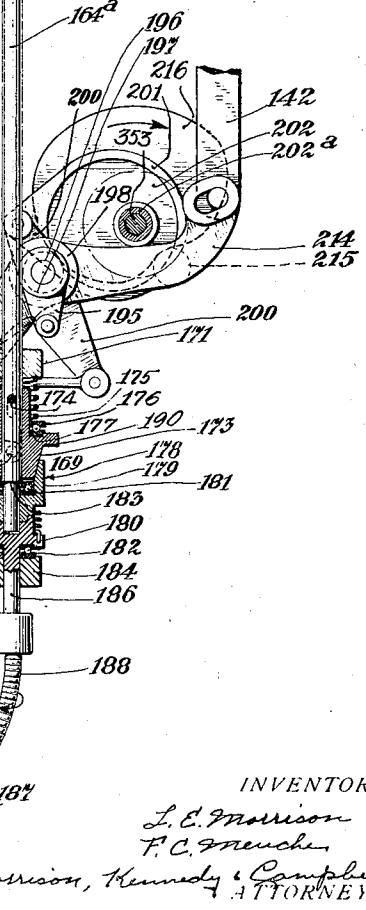


Fig. 28





INVENTORS

L. E. Morrison

F. C. Meuche

BY

Morrison, Kennedy & Campbell

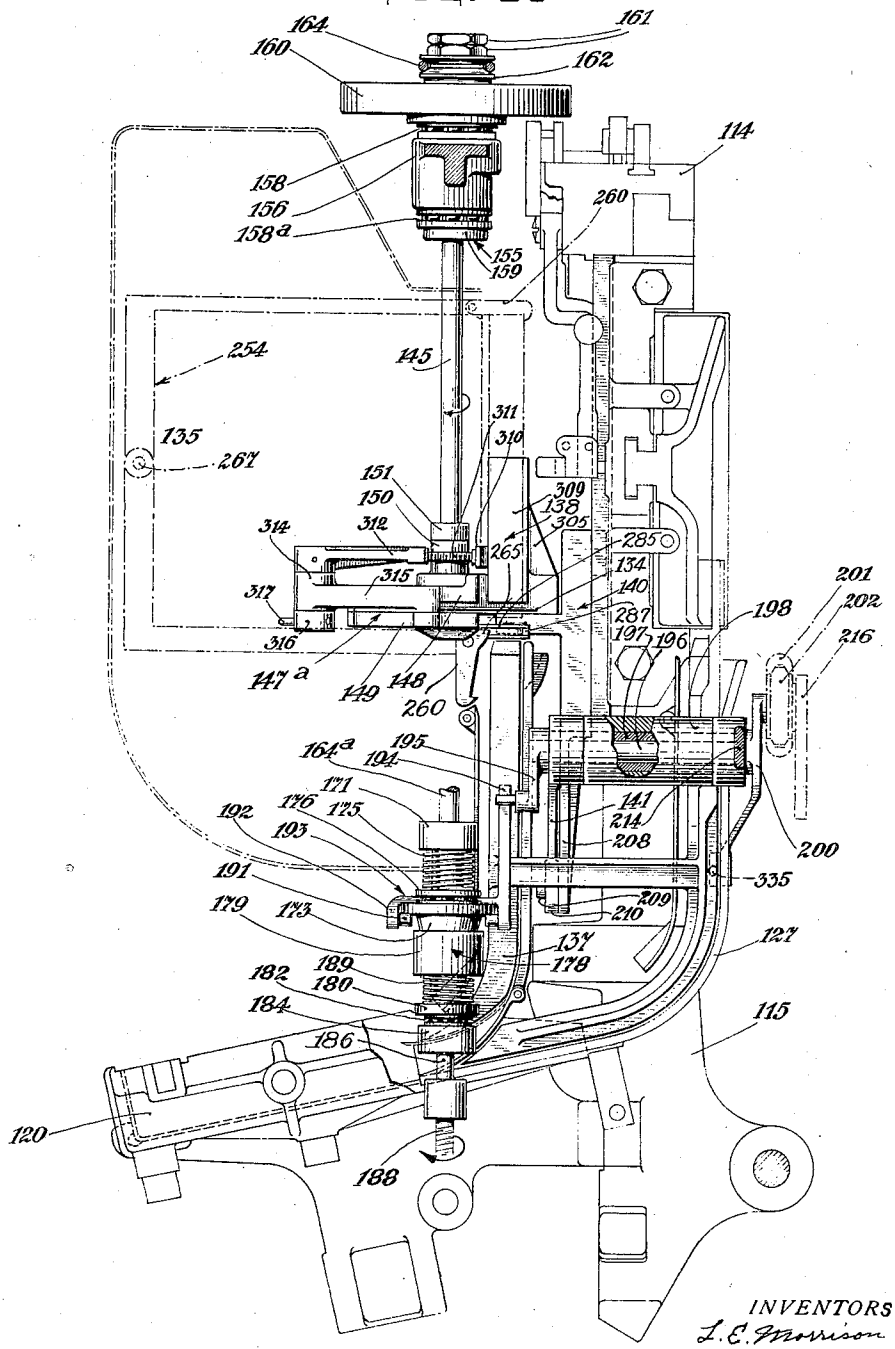
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Fig. 29



INVENTORS
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H. C. Meuche

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SLUG CASTING MACHINE

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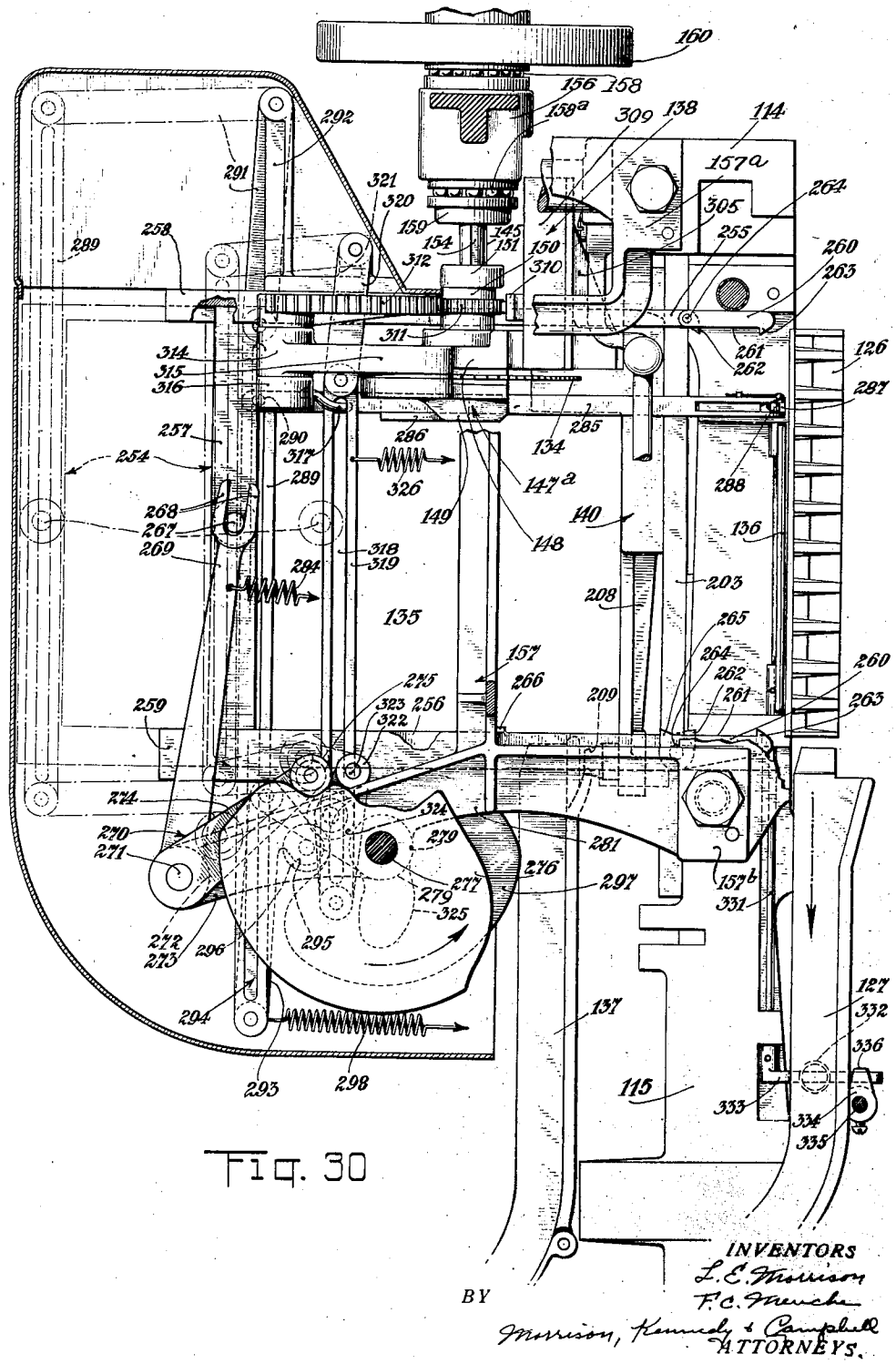


Fig. 30

INVENTORS
L. E. Morrison
F. C. Mercha

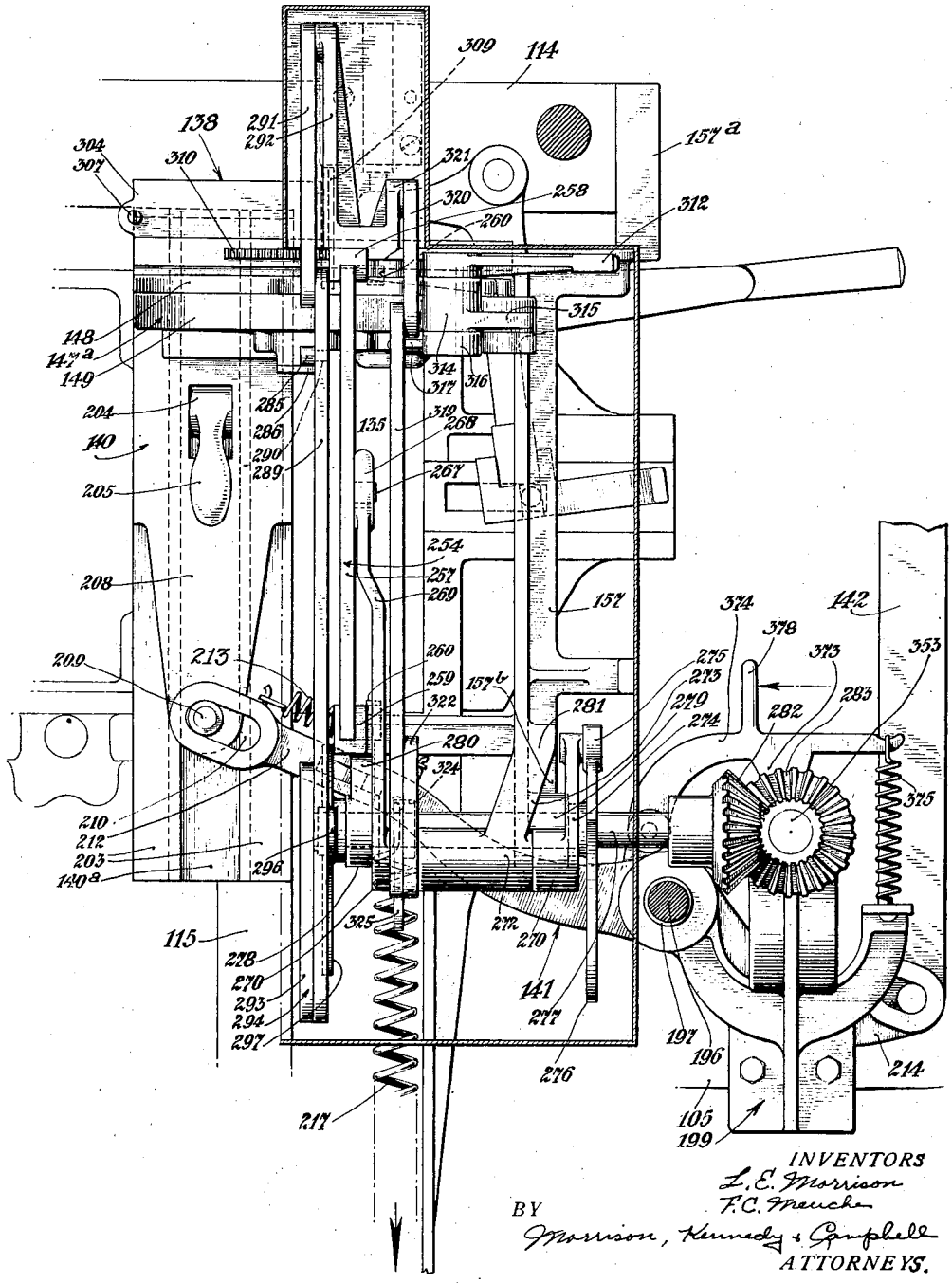
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SLUG CASTING MACHINE

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Fig. 31



INVENTORS
L. E. Morrison
F. C. Meuche

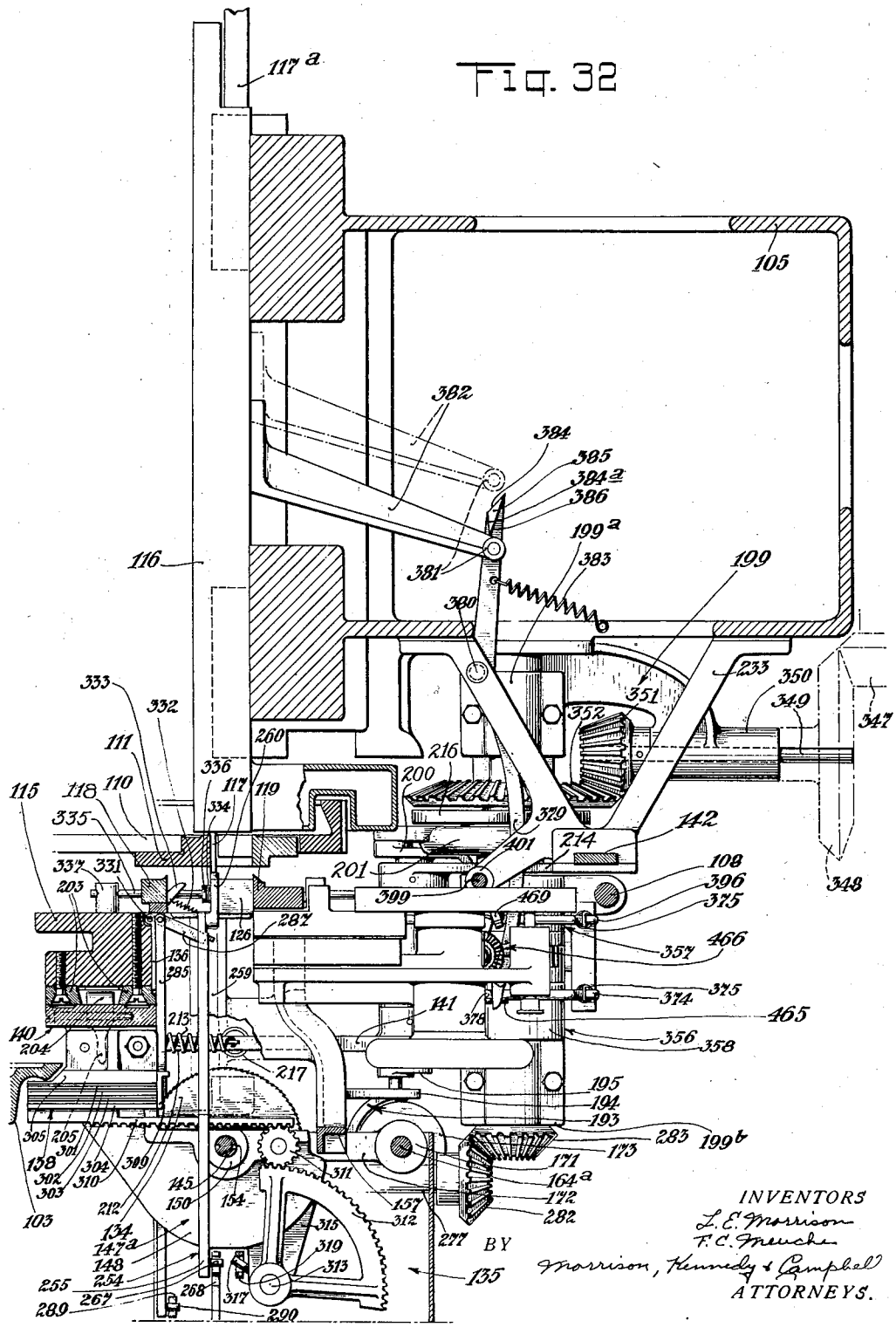
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Fig. 32



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SLUG CASTING MACHINE

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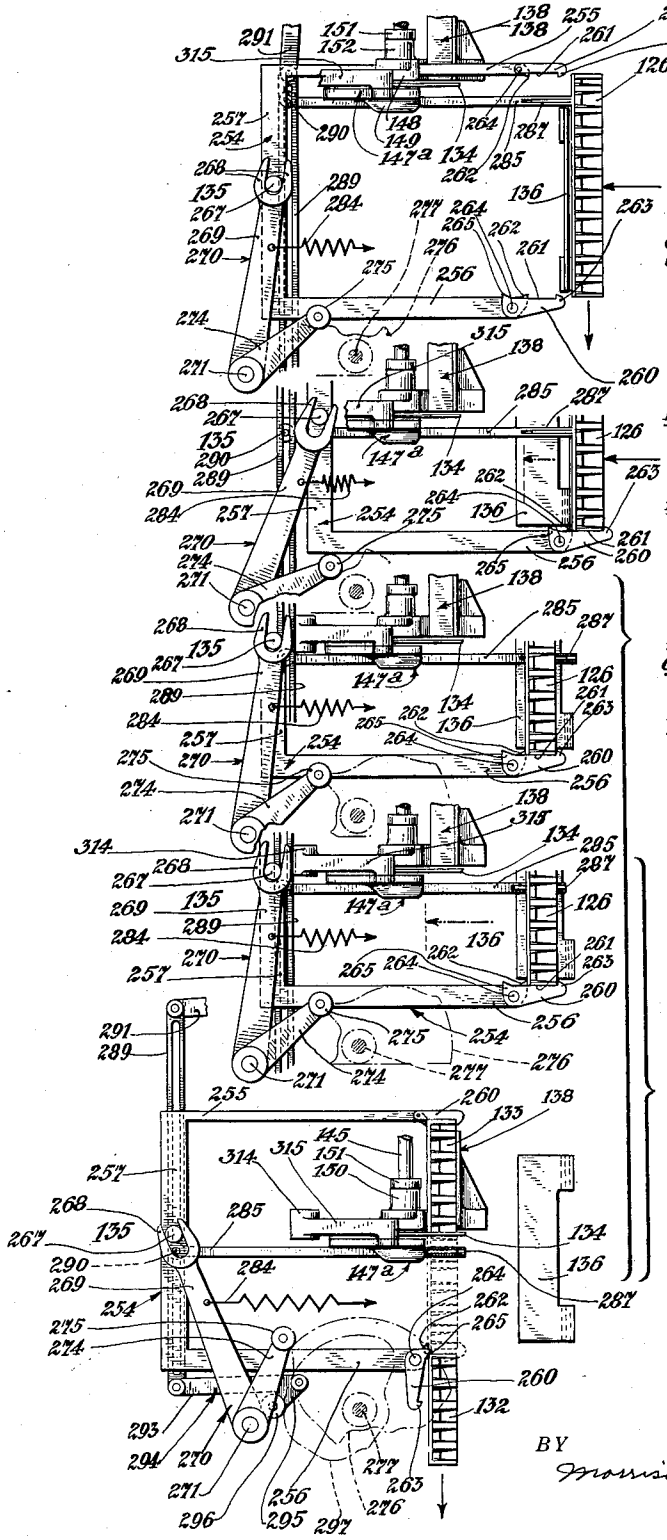


Fig. 33

NORMAL POSITION

GATE CLOSED FOR DELIVERY OF UNSHORTENED SLUGS.

REARWARD TRAVEL of SLUG GRIPPER

Fig. 34

1st STAGE RECEIVING POSITION GATE OPEN, SAW-UNIT LOCATED.

FORWARD TRAVEL of SLUG GRIPPER

Fig. 35

2nd STAGE STRADDLING OF SUPPORT FINGER TO REAR OF SLUG.

Fig. 36

3rd STAGE LINING UP SLUG GRIPPER AND SUPPORT FINGER IN POSITIVE RELATION.

SYNCHRONIZED FORWARD TRAVEL OF SLUG GRIPPER AND SUPPORT FINGER.

Fig. 37

4th STAGE SAWING, DELIVERY OF SHORTENED SLUG, DISPOSAL OF WASTE.

RETURN to NORMAL POSITION

INVENTORS
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SLUG CASTING MACHINE

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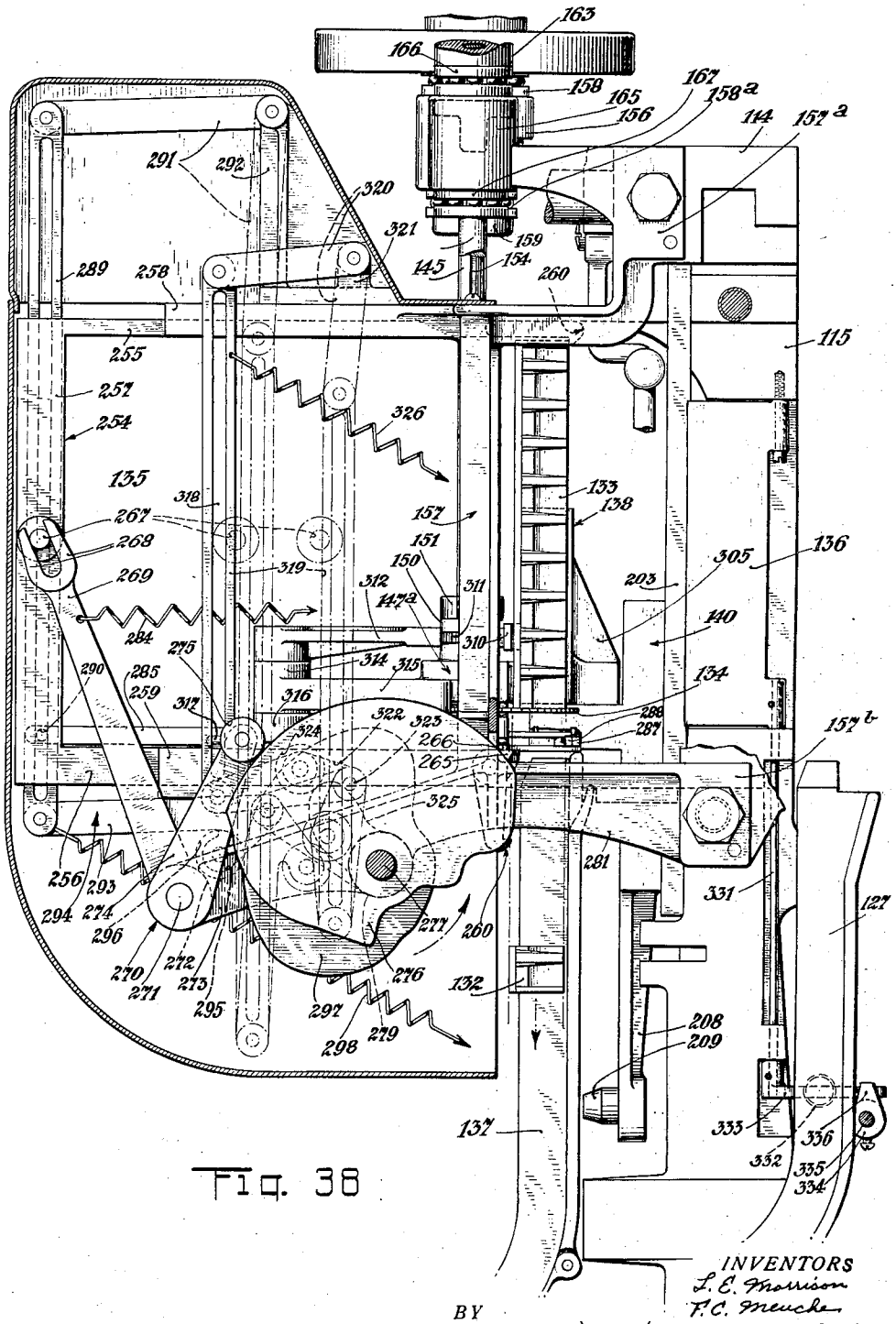


Fig. 38

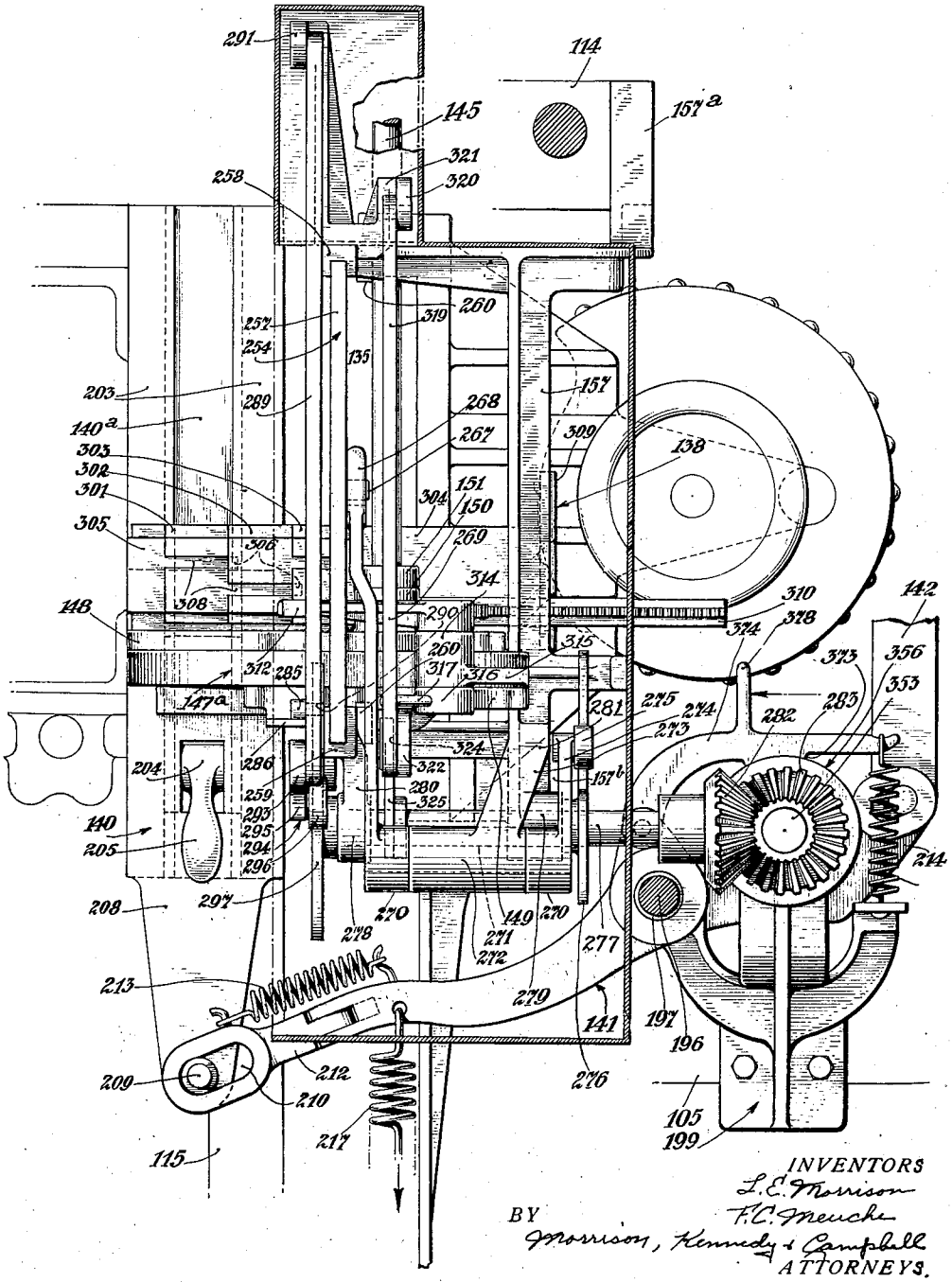
INVENTORS
L. E. Morrison
F. C. Meucke
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ATTORNEYS.

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SLUG CASTING MACHINE

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Fig. 39



INVENTORS
L. E. Morrison
F. C. Meuche

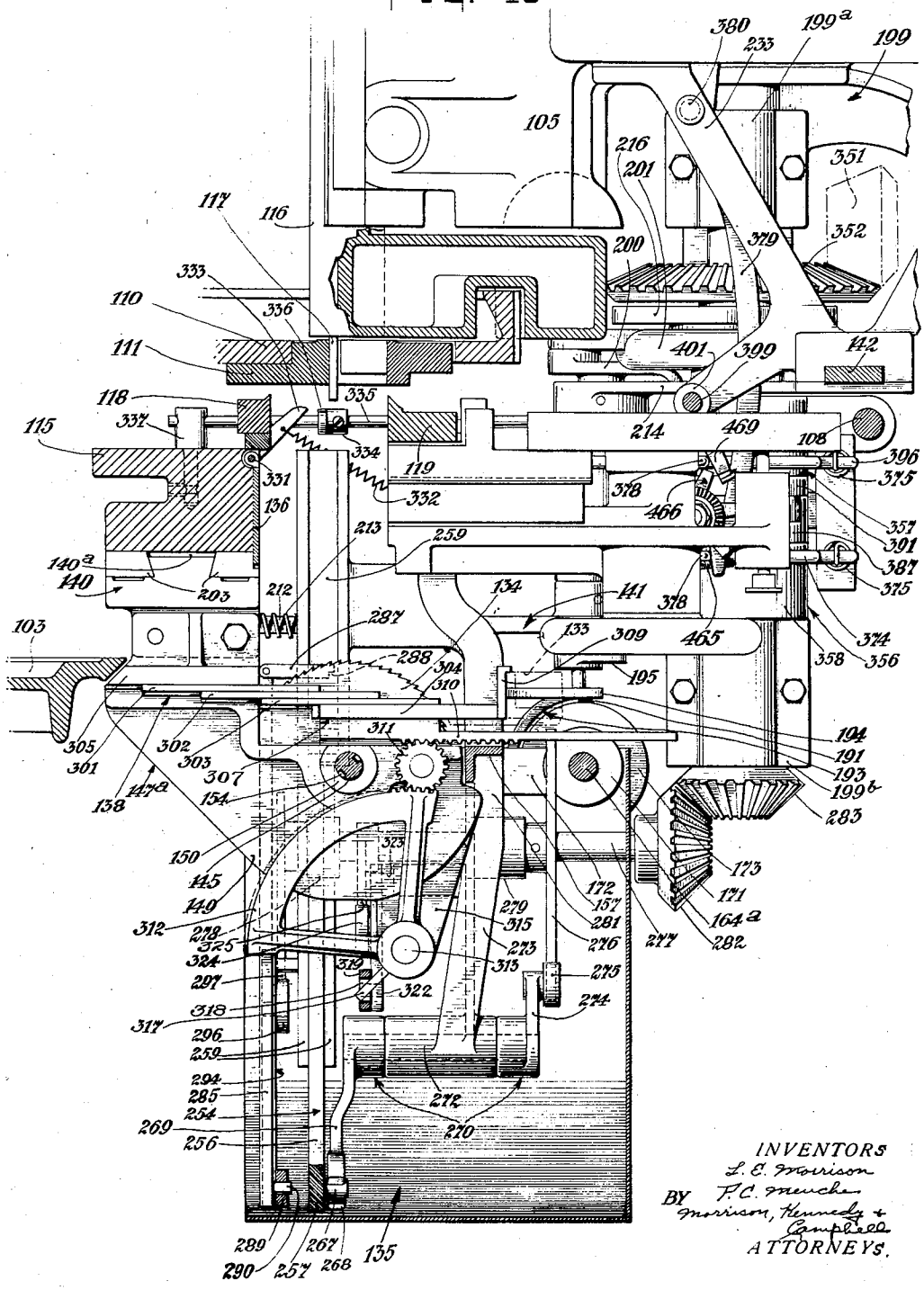
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SLUG CASTING MACHINE

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Fig. 40



INVENTORS
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ATTORNEYS.

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SLUG CASTING MACHINE

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Fig. 41

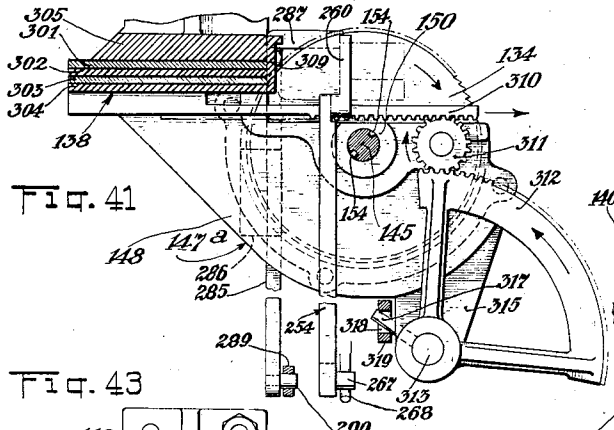


Fig. 42

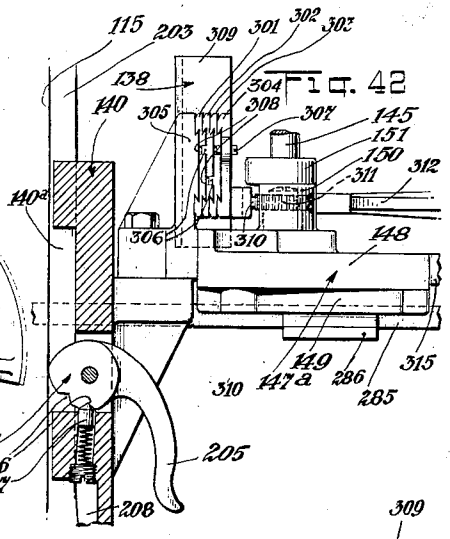


Fig. 43

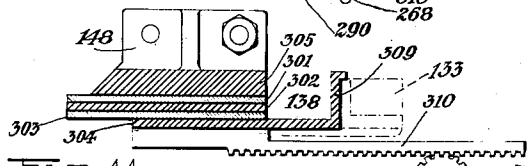


Fig. 44

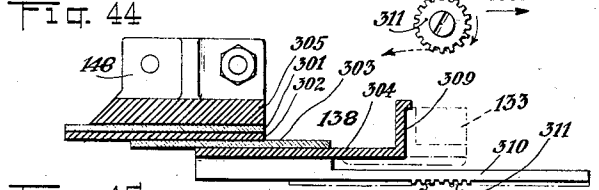


Fig. 45

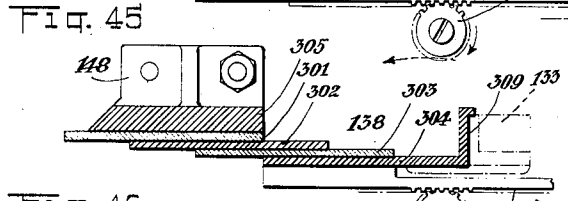


Fig. 46

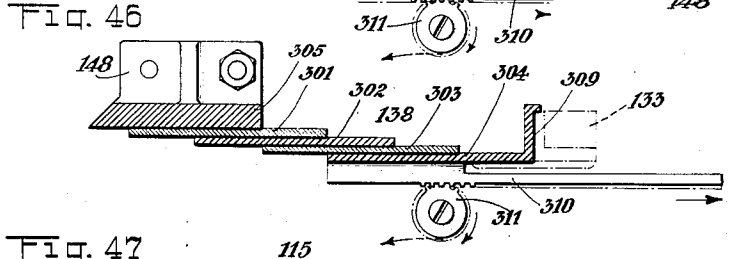


Fig. 47

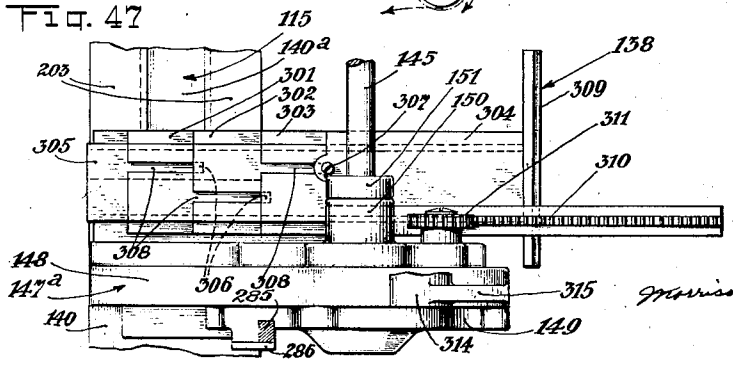
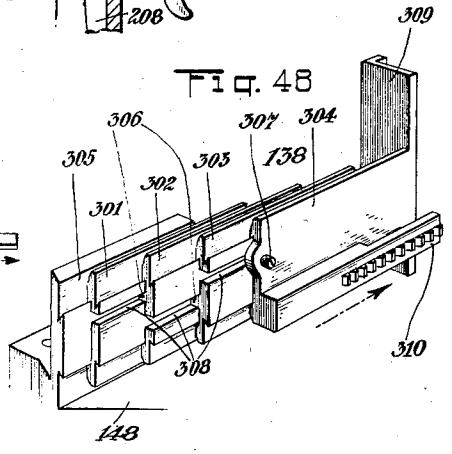


Fig. 48

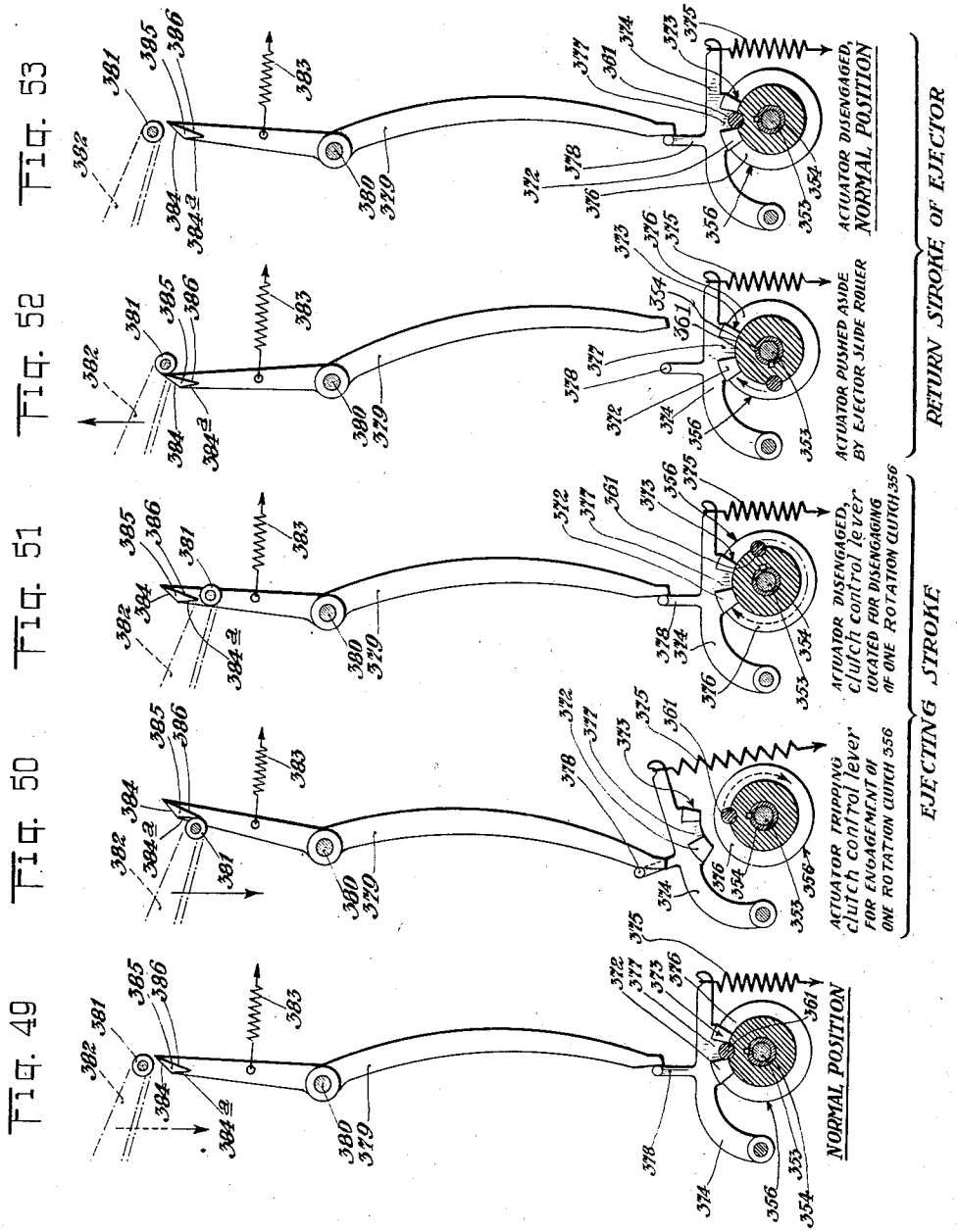


INVENTORS
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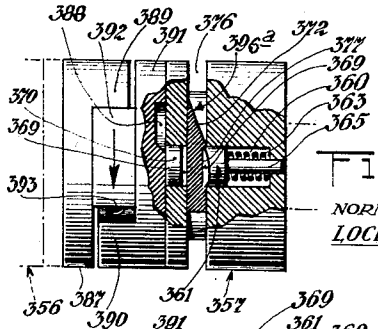


Fig. 54

NORMAL POSITION, LOCKED by CAM

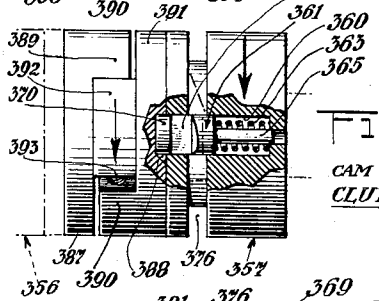


Fig. 55

CAM WITHDRAWN, CLUTCH ENGAGED

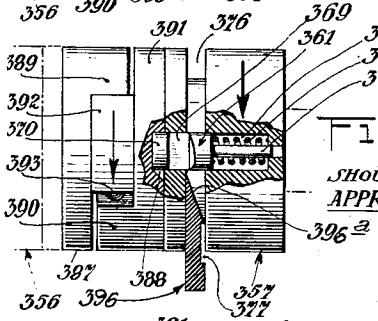


Fig. 56

SHOULDER OF PIN APPROACHES CAM

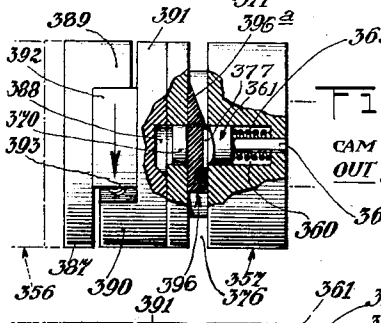


Fig. 57

CAM HAS FORCED PIN OUT of ENGAGEMENT

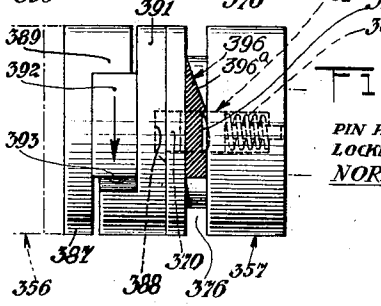


Fig. 58

PIN HAS SETTLED IN LOCKING RECESS OF CAM, NORMAL POSITION

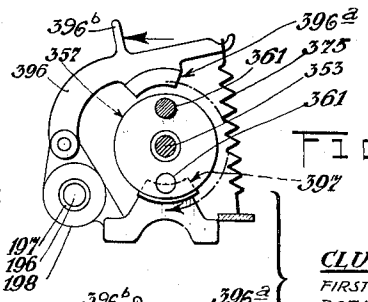


Fig. 59

CLUTCH 357 FIRST HALF OF A ROTATION

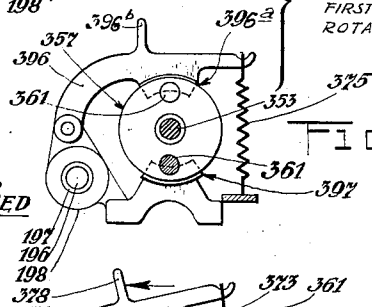


Fig. 60

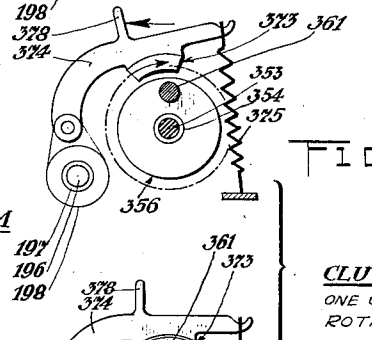


Fig. 61

CLUTCH 356 ONE COMPLETE ROTATION

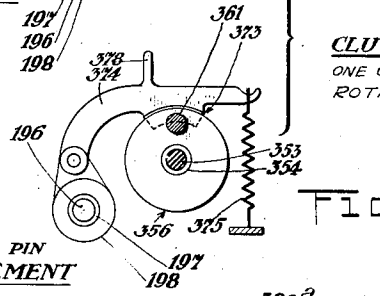


Fig. 62

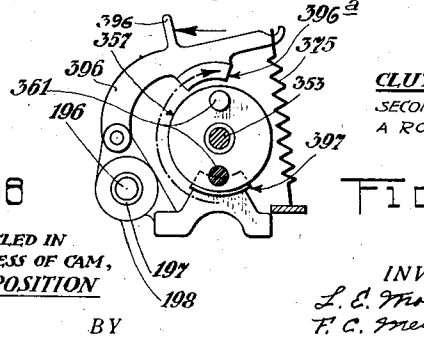


Fig. 63

CLUTCH 357 SECOND HALF OF A ROTATION

INVENTORS
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F. C. Meuche
BY
Morrison, Kennedy & Campbell
ATTORNEYS.

Patented Oct. 5, 1937

2,095,004

UNITED STATES PATENT OFFICE

2,095,004

SLUG CASTING MACHINE

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This invention relates to slug casting machines, such as Linotype machines of the general organization represented in U. S. Letters Patent to O. Mergenthaler, No. 436,532, wherein a composed line of matrices is presented to the face of a mold, the mold filled with molten metal to form a slug or Linotype against the matrices which produce the line of type characters thereon, and the matrices thereafter returned to their place of storage. As the slugs are successively cast, they are ejected from the mold and delivered into a receiving galley at the front of the machine.

It is common practice to equip these machines with a rotary power driven saw which is arranged to sever the blank portions from individual slugs as they are ejected from the mold, and which can be changed in position by hand to produce the final slugs of any length desired. However, such practice not only requires a great deal of care and attention on the part of the operator, but in addition entails a considerable loss of time in the operation of the machine.

The present invention aims to obviate the foregoing and other difficulties and contemplates a rotary power driven saw which is changed in position automatically to accord with the condition of the composed matrix line. More specifically, it is proposed to control the positioning of the saw by means of a specially formed blank matrix contained in the composed line. In the embodiment illustrated, the saw is moved bodily lengthwise of the slug by automatic mechanism controlled by the specially formed matrix. This mechanism includes an adjustable gaging device which determines the extent of movement of the saw and which is equipped with a feeler arranged to be picked up by and carried along with the specially formed matrix as the composed line is transferred into the so-called first elevator or transporter which presents the line to the mold for casting. The whole organization is such that, by locating the specially formed matrix at any selected point in the length of the composed line, it will automatically locate the saw to cut at a corresponding point in the length of the slug. Ordinarily, the special matrix will be placed ahead of the first type producing matrix in the composed line so as to cause the saw to cut through the slug just beyond the line of type characters, but actually the special matrix may be located at any desired point in the length of the composed line to cause the saw to cut through the slug at a corresponding point in the length thereof,—this latter condition making it possible to produce the final slug of any desired length and irrespective of the actual length of the type line.

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

In the accompanying drawings the invention is shown in preferred form and by way of example and as applied to the machine of the class stated, but obviously many changes and variations may be made therein and in its mode of application without departing from the spirit of the invention. It should, therefore, be understood 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 slug casting machine embodying the invention;

Fig. 2 is a side elevation, looking from the right in Fig. 1;

Fig. 3 is a horizontal section illustrating primarily the power transmission, the parts being shown in normal position with the slug gate closed;

Fig. 4 is a front elevation, partly broken away, of a hand stick in which the matrix line is composed, the stick being shown in the position it occupies during the transfer of the line from the stick into the transporter;

Fig. 5 is a vertical section taken on the line 5—5 of Fig. 4;

Fig. 6 is a view similar to Fig. 4, but showing the composed line as containing a specially formed matrix such as is used for locating the saw in a slug severing position;

Fig. 7 is a section taken on the line 7—7 of Fig. 6;

Fig. 8 is a front elevation of the gaging mechanism which cooperates with the composed line as the latter is transferred from the hand stick into the transporter;

Fig. 9 is an end elevation, looking from the left in Fig. 8, of the feeler device associated with the gaging mechanism;

Fig. 10 is a vertical section taken on the line 10—10 of Fig. 8;

Fig. 11 is a vertical section taken on the line 11—11 of Fig. 8;

Fig. 12 is a perspective view of the brake associated with the gaging mechanism;

Fig. 13 is a top plan view of the parts shown in Fig. 8;

Fig. 14 is a side elevation, looking from the

left in Fig. 13, of the clutch actuating shaft and its associated parts;

Figs. 15, 16 and 17 are top plan views, partly diagrammatic, of the clutch actuating shaft, showing three different stages of its operation by the gaging mechanism during the transfer of the composed line into the transporter;

Figs. 18, 19 and 20 are views similar to Figs. 15 to 17, and showing three different stages of operation of the clutch actuating shaft by the gaging mechanism when the composed line is removed from the transporter;

Fig. 21 is a central vertical longitudinal section taken through the cam shaft and its multi-clutch assembly;

Fig. 21[a] is a vertical section taken through the synchronizing mechanism shown in Fig. 21;

Fig. 21[b] is a horizontal section taken on the line **21[b]—21[b]** of Fig. 21[a];

Figs. 22, 23, 24, 25 and 26 are vertical sections taken, respectively, on the lines **22—22**, **23—23**, **24—24**, **25—25** and **26—26** of Fig. 21;

Fig. 27 is a transverse vertical section taken through the power driven saw and its driving and adjusting mechanism;

Fig. 28 is a fragmentary view of the driving clutch of the power driven saw and the clutch actuating mechanism;

Fig. 29 is a side elevation, looking from the right in Fig. 27, of the power driven saw and associated mechanism;

Fig. 30 is a side elevation, looking from the right, of the gripper device (and its operating mechanism) which receives the cast slug after ejection and pulls it forwardly past the power driven saw;

Fig. 31 is a front view of the parts shown in Fig. 30, the cover for the parts being removed;

Fig. 32 is a horizontal section showing the general relation of the parts during the slug ejecting period;

Figs. 33, 34, 35, 36 and 37 are side elevations, looking from the right of the machine, of the slug gripper device, and showing it in its five different stages of operation;

Fig. 38 is a view similar to Fig. 30, but showing the parts in a different position, namely, in the position they occupy after the slug has been severed and the type line section dropped into the second galley chute;

Fig. 39 is a front elevation of the parts shown in Fig. 38, the cover plate being removed;

Fig. 40 is a view similar to Fig. 32, but showing the parts in a different position, namely, in the condition they occupy after the slug has been severed and disposed of;

Fig. 41 is a top plan view of the power driven saw and the pusher which is associated therewith for carrying off the waste or blank end portions of the severed slug;

Fig. 42 is a side elevation of the parts shown in Fig. 41, looking from left to right;

Figs. 43, 44, 45 and 46 are horizontal sections taken through the slug pusher and showing it in four different stages of its operation;

Fig. 47 is a front elevation of the parts shown in Fig. 41, but showing the pusher in its fully extended position;

Fig. 48 is a perspective view of the pusher in its extended condition and showing in detail the telescopic sections of which it is composed;

Figs. 49, 50, 51, 52 and 53 are diagrammatic views illustrating five different stages of operation of the one-rotation clutch which controls the operation of the slug gripper device;

Figs. 54, 55, 56, 57 and 58 are diagrammatic views showing five different stages of operation of the coupling pin associated with the half-rotation clutch;

Figs. 59 and 60 are diagrammatic views illustrating the operation which takes place in the first half-rotation of the half-rotation clutch, which controls the adjustment of the saw and other parts;

Figs. 61 and 62 are diagrammatic views illustrating the operation which takes place during the complete rotation of the one-rotation clutch; and

Fig. 63 is a diagrammatic view illustrating the operation which takes place in the second half-rotation of the half-rotation clutch.

The invention is shown herein as applied to the so-called "All Purpose Linotype", which is the machine shown and described in the Stouges U. S. Letters Patent Nos. 1,899,648, dated February 28, 1933, 1,980,110, 1,980,111 and 1,980,112, all dated November 6, 1934, and 2,023,557 dated December 10, 1935. In this machine, the matrices are composed in a hand stick and the composed line thereafter transferred into a so-called first elevator or transporter which presents the line to the mold for the slug casting operation. In the first four patents referred to, the line is transferred out of the hand stick into the transporter, whereas in the last mentioned patent the whole unit (the hand stick with the composed line) is inserted in the transporter. So far as the present invention is concerned, the composed line may be handled either way. Only such parts of the Stouges machine as are necessary to an understanding of the invention have been shown in the drawings, and for such details of construction as may be lacking, reference may be had to the patents which have been referred to.

Referring first to Fig. 1, the composed matrix lines are delivered by means of the manually operated carriage **101** to the supporting head **102** of the first elevator or transporter **103** from the table **104** mounted on the column **105** and wherewith the transporter is adapted to register when the machine is at rest. The carriage **101** is slidably mounted in fixed horizontal guideways supported on the table **104** and is operated by the handle **106** rising from one end of the carriage. The carriage also includes the pair of depending fingers **107** and **107[a]** between which the composed lines are positioned on the table **104** and whereby each line may be shifted into and out of the transporter as the carriage is reciprocated. In operating the parts, the carriage **101** is moved to the left from the position shown in Fig. 1 to deliver a composed line into the transporter head **102**. The machine is then started manually by the operation of the handle **108**, and after the cycle of operation has been completed, the carriage is returned to its original position to transfer the line from the transporter back onto the table **104**, the line during this cycle of operation being lowered from its position between the fingers **107** and **107[a]** when the transporter descends preparatory to the slug casting operation, and later being re-positioned between the fingers when the transporter rises after the slug casting operation.

As the machine is started by the operation of the handle **108** the main cam shaft **109** (Fig. 2) is rotated slowly, and the mold disc or carrier **110** is given a quarter turn in an anti-clockwise direction (looking from the front of the machine) to

locate the selected mold 111 in the casting position. The elevator or transporter 103 then descends to position the composed line in front of the mold, where the line is justified between the clamping jaws 112 and 113 mounted in the cap portion 114 of the fixed vertically disposed vise frame 115. The mold slide 116 is now moved forward to bring the mold up against the matrix line, which thereby closes the mold slot at the front, and the metal pot (not shown) is likewise advanced from its normal position behind the disc to bring its mouthpiece up against the back of the mold, thereby closing the mold slot at the rear. The descent of the pot plungers immediately follows, and molten metal is ejected from the pot into the mold to produce the cast slug. As the cycle of operation proceeds, the pot plungers are raised, the metal pot and the mold slide are caused to recede, and the disc is given a three-quarter turn in the same direction as before to carry the mold with the contained slug to a vertical position between the ejector blade 117 (Figs. 32 and 40) at the rear and the trimming knives 118 and 119 at the front. The mold slide is next advanced a second time to locate the mold against the vise frame 115 in close relation to the knives 118 and 119, whereupon the ejector blade 117 carried by the slide 117a is thrust forwardly to eject the slug from the mold. By the forward movement of the ejector blade, the slug is forced between the two knives, whose cutting edges trim the side faces of the slug, and the latter is subsequently delivered to and stacked in the galley 120 supported upon the vise frame 115. About this time, and as the casting cycle is completed, the line transporter and the mold disc are restored to their original and normal positions of rest.

The hand stick wherein the matrices are composed in line is illustrated in Figs. 4 to 7 and comprises, as shown, a back wall 121, a bottom wall 122, and two movable end walls 123 and 124. These end walls 123 and 124 are moved out of the way when the hand stick is registered with the transporter head 102 so as to allow the transfer carriage 101 to shift the line from the stick into the transporter and back from the transporter into the stick before and after the casting operation, all as more fully set forth in the Stouges Patent 1,899,648.

The foregoing description will serve to identify those parts of the Stouges machine shown in the drawings and to explain their general mode of operation. If any further explanation is desired, reference may be had to the patents themselves.

Coming now to the present invention, before embarking upon a detailed description of the various parts, it may be helpful to indicate in a general way the principal parts and how they cooperate in producing the desired result. It may first be pointed out that, when casting slugs with full length type lines (in the present instance 42 ems), there will be no occasion to sever the slugs,—on the contrary, they must be left of full length,—and under such conditions the machine will be allowed to operate in the regular way. Thus in Figs. 3, 4 and 5, the hand stick is shown as containing a full line of type producing matrices 125, and, when such line is introduced into the machine, the machine will function in the normal way to cast a full length slug 126 and deliver it into the galley 120. In this connection, it may be noted that the slug, as it is ejected from the mold and after passing between the trimming knives 118 and 119, will be allowed to drop vertically into the chute 127 leading to the galley 120, (see Fig. 30) all in the manner set forth in the Stouges patent. When, however, it is desired to produce a slug of less than 42 em length, the condition of the composed line will be similar to that illustrated in Figs. 6 and 7. Here it will be seen that the hand stick is only partially filled with type producing matrices 125 and the remaining space in the stick is occupied by blank matrices or quads 128 and 129. The blank matrix 129, it will be observed, is formed at its lower end with a downwardly projecting lug 130 which is accommodated by a longitudinal groove 131 cut in the bottom wall of the hand stick. It is this special matrix 129, or one having a lug 130, which is utilized to locate the power driven saw in position to cut through the cast slug at a predetermined point in the length of the slug. In the embodiment illustrated, the special matrix 129 is located just ahead of the first type producing matrix in the stick and, as a consequence, the saw will be caused to cut through the slug just beyond the end of the type line produced on the slug by the matrices 125. In other words, the saw will be caused to cut the slug into two sections (see Figs. 33 to 37), one, the lower section 132 which carries the type line and which becomes the final printing slug, and the other, the upper section 133 which is blank and becomes so much waste. This is the situation which will normally prevail, although there may be times when the special matrix 129 will need to be positioned in spaced relation to the type producing matrices so as to leave a blank portion on the final slug. The exact location of the special matrix 129 may be readily determined by means of a scale with which the hand stick is always provided.

The power driven saw, designated 134, is normally located in an uppermost position, as shown in Fig. 30, and, when the ejected slug is to be severed, the saw is moved downwardly to a predetermined cutting position, as shown, for example, in Fig. 29, it being understood that this cutting position is determined by the location of the special matrix 129 in the composed line. Actually, the power driven saw is located beyond the reach of the slug as the latter is pushed forward from the mold by the ejector blade 117 and hence a gripper device, designated 135, is employed to receive the ejected slug and carry it past the saw after the latter has been set in its proper position, see the diagrams of Figs. 33 to 37. When the slug is not to be sawed, it will be arrested in the position shown in Fig. 33 by a gate 136 and then allowed to drop vertically into the galley chute 127, as indicated in Fig. 30. When, however, the slug is to be sawed, the gate 136 will be opened, as shown in Figs. 34 and 38, and the slug carried forwardly by the gripper device 135 until it has been completely severed, the lower type line section 132 then dropping into a second galley chute 137, as shown in Figs. 37 and 38, and the upper blank section 133 being carried off by the telescopic pusher 138 as shown in Figs. 41 to 46. After the slug severing operation, the saw is restored to its uppermost normal position, the gate 136 is re-closed, and the gripper device 135 is returned to its normal position, all as shown in Fig. 33.

The setting of the saw in its proper cutting position is controlled by a gage plate 139 which is set in different positions by the special matrix 129 (see Fig. 8), and which acts when in its set position to limit the downward movement of the

saw under the influence of its adjusting mechanism. Thus, as shown in Fig. 27, the saw is mounted on a sliding carriage 140 which is raised and lowered by a cam operated lever 141 connected to a stop bar 142 adapted to bank against the gage plate 139. Normally, the gage plate 139 occupies a position to the extreme right, as shown by the full lines in Fig. 8, where it will permit a full upward movement of the stop bar 142 and therefore a full downward movement of the saw. When, however, the plate 139 is moved to the extreme left, as shown by the dotted lines in Fig. 8, it will prevent any upward movement of the stop bar 142 and therefore any downward movement of the saw. In any intermediate position of the gage plate 139, the stop bar 142 is free to move upwardly to the extent permitted by the adjusted position of the plate and thus permit a corresponding downward movement of the saw. The setting of the gage plate 139 in such intermediate positions is effected by the special matrix 129, it being noted that the gage plate 139, or rather its carrying slide 143, is provided at the extreme left with a feeler 144 which is arranged at the entrance to the transporter head 102 in position to be engaged and picked up by the lug 130 of the special matrix 129 as the composed line is transferred from the hand stick into the transporter head. This pick up of the feeler 144 will, of course, take place sooner or later according to the actual location of the special matrix 129 in the composed line, and the parts are so proportioned that whatever movement is actually imparted to the gage plate 139 by the engagement of the special matrix 129 with the feeler 144 will bring about a correspondingly reduced downward movement of the saw 134. To be more exact, the saw 134 will be moved to the same position in the length of the ejected slug as that occupied by the special matrix 129 in the composed line, it being understood that the length of the composed line is the same as the length of the cast slug body, or 42 ems in both cases.

With this brief introduction it is believed that a detailed description of the parts and their mode of operation may now be proceeded with.

The saw and driving connections

The saw 134 is detachably secured to the lower end of a vertically movable shaft 145 (Fig. 27) between a shoulder 146 formed on the shaft and a nut 147 threaded on the extreme end of the shaft, and is encased in a protective housing 147a comprising a main upper section 148 and a lower cover portion 149. The housing 147a is open at the rear (Figs. 40 and 41) so that the saw is exposed sufficiently to cut through the slug body, the saw being of such diameter that at the same time it will sever the widest slug face which may be cast. The shaft 145 passes upwardly through a bearing 150 formed in the upper section 148 of the housing, running in thrust bearings 151 and 152, one arranged inside the section 148 between the bearing 150 and the saw 134, and the other exteriorly of the section 148 between the bearing 150 and a shoulder 153 formed on the shaft.

The shaft 145 is slidably keyed or splined on opposite sides, as at 154, in a vertically disposed bushing 155, which is rotatably arranged in a bearing 156 formed in an arm of a skeleton frame 157 secured to the vise frame 115 as at 157a and 157b (Fig. 30). Above and below the bearing 156 are arranged thrust bearings 158 and 158a, the lower one, 158a, being located between a collar 159 on the bushing 155 and the underside of the bearing 156, while the upper bearing, 158, rests directly on the upper surface of the bearing 156. A horizontally disposed flywheel 160 is keyed to the bushing 155 and clamped by lock nuts 161 in engagement with the upper thrust bearing 158, the flywheel being formed with a pulley 162 in horizontal alinement with a second pulley 163 to which it is connected by a belt 164. With this mounting, the shaft 145 carrying the saw 134 can be moved vertically relatively to the flywheel 160 and the bushing 155 for the adjustment of the saw, without affecting its driving connections.

The pulley 163, in turn, is keyed to the upper end of a vertical shaft 164a mounted in a bearing 165, with thrust bearings 166 and 167 arranged, respectively, between the pulley 163 and the upper surface of the bearing 165 and between the lower surface of said bearing and a shoulder 168 formed on the shaft 164a. The lower end of the shaft 164a is connected with a driving clutch 169 arranged in a bracket 170, the shaft passing through a bearing 171 formed in an upper arm 172 of the bracket and below which it is equipped with a clutch cone 173, slidably splined thereto as at 174, and a compression spring 175 arranged between the under surface of the bearing 171 and a thrust bearing 176 seated in a recess 177 in the upper surface of the cone. Immediately below the cone 173, and loosely mounted on the extreme lower end of the shaft 164a, is a split female clutch member 178, comprising upper and lower sections 179 and 180, respectively, and arranged between thrust bearings 181 and 182, the former seating against a shoulder 183 on the shaft 164a and the latter being located between the lower section 180 of the clutch member 178 and a bearing 184 formed in a lower arm 185 of the bracket 170. The upper section 179 of the clutch member 178 is adapted to be engaged by the cone 173 under pressure of the spring 175, while the lower section 180 is formed with a spindle 186 passing through the bearing 184 and detachably connected to a flexible propeller shaft 187 housed in a cable 188 and leading to an electric motor or suitable driving mechanism. The split clutch member 178 is employed so that its two sections 179 and 180 can be connected by a coil spring 189 to absorb torque, the opposite ends of the spring being securely anchored in the respective clutch sections.

The cone 173 is formed exteriorly with an annular flange 190 adapted to overlie pins 191 projecting inwardly from arms 192 of a forked lever or yoke 193, which is pivotally secured to the bracket 170 and actuated by a lever 194 for raising the cone relatively to the shaft 164a against the pressure of the compression spring 175. The lever 193 engages loosely with a crank arm 195 fixed to one end of a shaft 196 mounted in a hollow sleeve 197, which is arranged in a bearing 198 formed in one arm of a multi-arm bracket 199 fixed to the column 105 of the machine; and the shaft 196 is rocked by a cross arm 200 (see Fig. 29) fixed to the opposite end thereof and to an eccentric strap 201 actuable by an eccentric 202 fixed to a sleeve 202a which operates intermittently through steps of one-half rotation each. By the rocking of the shaft 196 in one direction under the influence of the eccentric 202 in making a half rotation, the yoke 193 allows the cone 173 to be lowered relatively to the shaft 164a under the pressure of the spring 175 to engage with the clutch mem-

ber 178 and effect the drive of the saw, while the return movement of the shaft 196 as the eccentric completes its rotation returns the parts to the positions formerly occupied with the clutch members 173 and 178 disengaged to interrupt the drive of the saw.

Saw adjustment

The carriage 140 (Figs. 31, 32, 39, 40, 41, 42 and 47), which permits adjustment of the saw 134, is connected with the main section 148 of the saw housing 147a in offset relation and is slidably dove-tailed as at 140a with a pair of vertical straps 203 secured to the vise frame 115, whereby the saw is guided in its vertical movement to different operative positions. The carriage 140 is formed to accommodate a pivoted eccentric wedge clamp 204 engageable with the vise frame 115 between the straps 203 and provided with a handle 205 for manual operation, it being notched as at 206 (Fig. 42) to cooperate with a spring detent 207 which holds it in clamped and unclamped condition. The clamp 204 is used, however, only to lock the parts against accidental movement when the vise frame is opened and the sawing mechanism carried therewith, since at other times the carriage must be free to move and is then sustained by the lever 141. The carriage 140 is also formed with a depending tongue 208 provided with a forwardly projecting pin 209 arranged to engage in an elongated slot 210 formed in a pivoted section 212 of the lever 141, which section, upon the opening of the vise frame, moves relatively to the remainder of the lever and breaks the connection with the pin 209 as the vise frame is swung forwardly, a spring 213 retracting the section clear of the tongue 208. When the vise frame is closed again, the section 212 may be returned manually to engage the pin 209. The arrangement could be such, however, that the section 212 would swing against the pull of a spring and thereby be returned automatically upon the closing of the vise frame.

The lever 141 is fixed to one end of the hollow sleeve 197, already referred to, arranged in the bearing 198 (Figs. 27–29). A short arm 214 is fixed to the opposite end of the sleeve 197 and carries a friction roller 215 arranged to track on the periphery of an actuating cam 216, the cam acting positively through the arm 214, sleeve 197 and lever 141 to elevate the saw to its normal uppermost position, while a spring 217, one end of which is fixed to the vise frame 115, as at 218, and the other end to the lever 141, tends to maintain the roller 215 in engagement with the cam 216 and to pull the saw downwardly to cutting position as the roller rides onto the low portion of the cam. It may be noted here that the cam 216 is mounted on the sleeve 202a along with the eccentric 202 and is operated intermittently, first through a one-half rotation to permit the downward movement of the saw to its active sawing position and, subsequently, after the sawing operation, it completes its rotation to return the saw against the pull of the spring 217 to its upper inactive position.

Gaging mechanism

The gage plate 139 carried by the slide 143 is mounted in a bracket 220 secured to the column 105 (Figs. 8–14). At its left end, the slide 143 is provided with an upstanding post 221 which carries the two-armed feeler 144 mounted to have a limited rocking movement in a vertical plane about its pivot 222, a tension spring 223 secured thereto and to the post 221 being adapted to pull and maintain the feeler in position when the latter is moved beyond center in either direction. Normally the feeler 144 occupies a position such that its upper arm 224 is out of the path of the incoming line, while the lower arm 225 is in active position to be engaged by the lug 130 on the special matrix 129 and be carried along by the continued movement of the line during its transfer into the transporter 103, thus moving the slide 143 to the left (dotted lines Fig. 8) to a definite position depending upon the position occupied by the special matrix in the line.

The purpose of the rocking feeler arrangement is to permit the line to be lowered out of engagement with the feeler to casting position by the line transporter (Fig. 9). As the line is lowered, the engagement of the line with the lower arm 225 rocks the feeler 144 downwardly until the spring 223 acts to snap it out of the path of the descending line. This brings the upper arm 224 into position to be engaged upon the return of the transporter after the casting operation and rock the feeler in the opposite direction sufficiently for the spring 223 to snap it back to its former position.

The slide 143 rests upon two rollers 226 and 227 mounted in the bracket 220 and spaced apart lengthwise of the slide, a third roller 228, also mounted in the bracket 220 intermediate the rollers 226 and 227, tracking in a groove or channel 229 formed in the upper surface of the slide. The gage plate 139 has an inclined banking surface 230 against which the correspondingly inclined end 231 of the stop bar 142, slidable vertically in guideways formed in brackets 232 and 233, is adapted to bank (Fig. 8). The lower end of the stop bar 142 is connected by a pin and slot connection 234 with the short arm 214 of the saw adjusting lever assembly, so that as the latter rocks about its pivot when the saw is allowed to be lowered by the cam 216 and spring 217 the stop bar 142 is moved upwardly until its inclined end 231 engages the banking surface 230 of the gage plate 139 and arrests the saw in a definite position. When the saw has been arrested by the gage plate 139, the cam 216 continues idly for the remainder of its half rotation and in no wise functions in the support of the saw in its adjusted position. The two lever arms 141 and 214, the incline of the surfaces 230 and 231 and the length of the stop bar 142 are so proportioned that the saw will be positioned accurately in the particular cutting position determined by the position of the special matrix 129 in the line; and the roller 228 tracking on the upper surface of the slide 143, is arranged directly above the point at which the end 231 of the stop bar 142 banks against the gage plate 139 and serves as a firm abutment to prevent the gaging mechanism from yielding under the pull of the spring 217.

The movement of the slide 143 to the left by the special matrix 129 is effected against the pull of a spring 235 for returning the slide to its normal position, one end of the spring being secured to the post 221 on the end of the slide and the other end anchored to a hook 236 on the fixed bracket 220. Hence, a braking device 237 is provided to resist the spring 235 and maintain the slide in the position to which it is moved when the line is carried away from the feeler 144 by the transporter 103 for the casting operation. The braking device 237 is in the form of a slip brake and comprises a pivoted brake shoe 238 which

allows the slide 143 to move freely to the left (Fig. 8), but which, under the pull of a spring 239, maintains a constant frictional engagement with the upper surface of the slide and any tendency of the latter to move to the right back to normal position effects a wedging of the brake shoe therewith. The brake shoe 238 is pivoted, as at 240, to the bracket 220 and is provided with an arm 241 extending beyond the pivot and which in turn is pivotally connected to a twisted horizontal link 242. The link 242 is connected to a second link 243 pivoted to an arm 244 fixed to the lower end of a vertical rock shaft 245 passing upwardly through a bearing 246 arranged in the table 104 of the machine and which carries at its upper end a horizontally disposed curved arm 247. The arm 247 is fixed to the shaft 245 so that a portion only of its arcuate surface 247a stands in the path of the finger 107a of the carriage 101, and as the line is being transferred to and from the transporter 103 the arm 247 is cammed by the finger 107a in a clockwise direction (Fig. 12) to rock the shaft 245 against the tension of the pull spring 239 and, through the arm 244 and links 243 and 242, swing the brake shoe 238 about its pivot 240 in a clockwise direction and momentarily disengage it from the slide 143. Of course, the slide 143 is always free to be moved to the left since the brake shoe is only effective to prevent its rightward or return movement to normal position and, hence, the release of the brake upon delivery of a line to the transporter is merely incidental. However, upon the removal of the line from the transporter, the momentary disengagement of the brake shoe from the slide 143 allows the latter to be returned to the right by the spring 235 until a spring cushioning device 248 on the slide strikes against an arm 249 depending from the bracket 220 and the slide is thereby resiliently arrested in its normal position.

Fixed to the under side of the slide 143 is a forked bracket 250 for controlling the saw mechanism in a manner which will be set forth in detail hereinafter.

Slug gripper

The slug gripper 135, with its actuating devices (Figs. 30 to 40), is mounted in the skeleton frame 157 and comprises two main elements, namely; mechanism for gripping and conveying the slug from the mold to the saw and mechanism for bracing or backing up the type line section 132 of the slug just below the saw cut. The gripper per se is in the form of a yoke 254 comprising upper and lower arms 255 and 256, respectively, connected by a cross bar 257, and is mounted in channeled guideways 258 and 259 disposed in vertical alinement with the channels facing one another. The arms 255 and 256 are equipped at their free ends each with a claw 260 for gripping the slug upon its ejection from the mold and each claw forms a seat 261 defined by its tooth 263 and a lug 262 on the respective arm, the seat being just long enough to accommodate the slug body. Each claw 260 is spring hinged as at 264 to its respective yoke arm, whereby it can rock to receive the slug and then snap back into gripping engagement therewith when the slug is sufficiently ejected from the mold to fit into the seats 261. The claw on the lower yoke arm 256 is provided with a second lug 265 which, just before the sawing operation is completed, engages a fixed abutment 266 on the frame 157 (Fig. 30) and rocks the claw out of engagement with the type line section 132 of the slug to allow it to drop freely into the second delivery chute 137 leading to the galley. The cross bar 257 of the yoke 254 is provided with a pin or lug 267 engaged by the bifurcated end 268 of one arm 269 of a bell-crank 270, which is pivotally mounted on a shaft 271 journalled in a bearing 272 formed in an arm 273 of the skeleton frame 157. A short arm 274 of the bell-crank 270 is equipped with a roller 275 arranged to track on the periphery of a cam 276, which is fixed to a shaft 277 journalled in bearings 278 and 279 formed in arms 280 and 281, respectively, of the frame 157 (Fig. 31), the shaft 277 being equipped at one end with a bevel gear 282 meshing with a second bevel gear 283 driven through clutching mechanism later to be described.

The normal position of the gripper is that shown in Fig. 33, and the various stages in its operation are illustrated in Figs. 34 to 37. Upon the ejection of the slug from the mold, a spring 284, fixed to the arm 269 and to the frame 157, exercises itself to draw the yoke 254 toward the mold at a rate of speed permitted by the roller 275 on the bell-crank 270 tracking on the rotating cam 276. As the slug is ejected it forcefully enters between the claws 260, the lower claw being located at the mouth of the regular galley chute 127 and preventing the slug from dropping into the chute. Continued rotation of the cam 276 rocks the bell-crank 270 against the pull of the spring 284 to carry the yoke forwardly and thereby deliver the slug to the saw which has previously been adjusted to cutting position, the movement of the yoke being continued sufficiently so that the slug will be severed and the lower claw 260 rocked about its pivot by the engagement of the lug 265 with the abutment 266 to allow the type line section 132 of the slug to drop into the delivery chute 137 (Figs. 37 and 38).

A rod 285, slidably mounted in a guideway 286 formed in the cover portion 149 of the saw housing (Figs. 27 and 47) and equipped at its rear end with a spring pivoted finger 287 (Figs. 32 to 38), occupies a normal rearward position such that as the slug is being conveyed from the mold to the saw by the gripper 135 it engages and rocks the finger 287 about its pivot in passing. After the slug has passed the end of the finger 287, the latter snaps back into position behind the slug. Immediately thereafter the gripper 135 pauses to allow the rod 285 to be moved forwardly until the finger 287 engages the base or back edge of the slug body, the latter seating against a shoulder 288 (Fig. 40) formed at the end of the finger. When the slug has been engaged by the finger 287, the rod 285 and gripper 135 move in unison thereafter to carry the slug past the saw, and the finger prevents the type line section 132 of the slug (which, near the end of the sawing operation is unsupported by the lower claw 260) from twisting or swinging during the final stage of the sawing operation.

The movement of the rod 285 carrying the finger 287 is effected by means of a slotted link 289 (Figs. 30 and 38) mounted for parallel motion and connected to a pin 290 provided in the forward end of the rod. The link 289 is pivoted at its upper end to a shorter link 291, which in turn is pivoted to an upstanding post 292 formed on or fastened to the frame 157; while the lower end of the link 289 is pivoted to one arm 293 (the arm being of the same length as the link 291) of a bell-crank 294 mounted on the shaft 271. The other or short arm 295 of the bell-crank 294 car-

ries a roller 296 which tracks on the periphery of a cam 297 fixed to the shaft 277. As in the case of the yoke 254, the active movement of the rod 285 and finger 287 in backing up the slug is effected by the cam 297, while its idle forward movement to normal position is effected by a spring 298 allowed to exercise itself as the roller 296 rides onto a low portion of the cam 297.

It is pointed out that the link 289 is slotted throughout its entire length, and this for two purposes. In the first place and as already stated, the rod 285 is slidably mounted in a guideway 286 of the cover portion 149 of the saw housing and, hence, partakes of vertical movement to the same extent as the saw when the latter is adjusted. Since the saw is adjustable through a distance of substantially 42 ems (about 7 inches) the slot must be, for this purpose alone, at least 7 inches long. In addition, the link 289 itself moves relatively to the rod 285 during its parallel actuating motion to reciprocate the rod and the slot must also be sufficiently long to allow for this relative movement in any vertical operative position of the saw.

Blank slug ejector

The blank or waste section 133 of the slug is disposed of after the sawing operation by a sectional telescopic pusher 138 (Figs. 39 to 48) mounted on the upper section 148 of the saw housing 147a. The pusher 138 comprises four sections 301, 302, 303 and 304 which are slidably dove-tailed to one another, the section 301 being dove-tailed to a rib 305 formed on the upper section 148 of the housing 147a. The dove-tailing of the sections permits a relative horizontal movement thereof, which is effected successively by lugs 306 provided on the sections 302 and 303 and by a screw 307 in the leading section 304, the screw being removable to permit the sections to be assembled and disassembled. The lugs 306 and the screw 307 ride in slots 308 of definite length extending inwardly from the left end of sections 301, 302 and 303 and formed in staggered relation to one another, limiting the extent of relative movement of contiguous sections to the length of the slot in which the respective lug rides. Section 304 carries a pusher head 309, which is L-shaped to engage one side and the bottom edge of the slug body to prevent the slug from tilting when being pushed off the saw. The section 304 is also equipped with an operating rack 310 adapted to be engaged by a pinion 311 mounted on the upper section 148 of the saw housing and which is rotated by a gear segment 312 fixed to a vertically disposed shaft 313 journalled in a bearing 314 formed in a forward extension 315 of the housing section 148. The opposite end of the shaft 313 has a collar 316 fixed to it which is equipped with a pin 317 engaging in a slot 318 of a parallel motion link 319 by which the gear segment 312 is actuated. The link 319, like the gripper actuating link 289 already described, is slotted throughout its entire length, since the gear segment 312, pinion 311 and pusher 138 are mounted on and movable with the saw housing 147a and carriage 140. The link 319 is pivotally connected at its upper end to one end of a short link 320, the opposite end of which is in turn pivoted to an upstanding post 321 fixed or secured to the frame 157; while the lower end of the link is pivoted to the end of a second short link 322 of the same length as the link 320 and which has its opposite end pivoted on a rod 323 (Fig. 39) mounted in the frame 157. The short link 322 carries a roller 324 about midway of its length adapted to be engaged by a cam or trip dog 325 fixed to the cam shaft 277.

After the slug has been severed and the type bearing portion allowed to descend into the galley, the cam 325 engages the roller 324 on the link 322 and quickly moves the link 319 to the full line position shown in Fig. 38, the movement of the link rocking the gear segment 312 counterclockwise to rotate the pinion 311 which, through the rack 310, moves the pusher head 309 into engagement with the blank slug section 133 to carry it off the saw into a waste receptacle. Immediately thereafter, the cam 325 allows the parts to be returned by a spring 326 connected to the link 319 and to the frame 157.

The gate

The ordinary front guide suspended from a pivot and against which the slug strikes upon ejection and is directed thereby into the galley chute is replaced in the present instance by a gate 136 (Figs. 27, 30, 32–40), fixed at one side to a vertical rock shaft 331 mounted on the vise frame 115 and which adapts the gate to be swung sidewise out of the path of the slug when the latter is to be conveyed to the saw. A spring 332, connected at one end to an arm 333 fixed to the lower end of the shaft 331 and at the other end to a fixed part of the machine, tends constantly to maintain the gate 136 in its open condition out of the path of the slug. The gate is closed against the pull of the spring 332 by a collar 334 adjustably fixed to a horizontally disposed reciprocable shaft 335 and formed with an upstanding lug 336 which engages the arm 333. The free end of the shaft 335 is slidably mounted in a rotatable bearing 337 journaled in the vise frame 115 (Fig. 40) and is pivoted at its opposite end to the lower end of the cross arm 200 (Fig. 27) fixed to the shaft 196 previously described in connection with the saw driving mechanism. It will be recalled that the opposite end of the arm 200 is pivoted to the eccentric strap 201 surrounding the eccentric 202, and, hence, when the arm 200 occupies the position shown in Fig. 28, its normal position, the gate 136 is held closed by the collar 334 acting against the tension of the spring 332, as shown in Fig. 3, so that a slug ejected with the gate in this position will be directed by the gate into the regular delivery chute 127. On the other hand, when a slug is to be sawed and the arm 200 is rocked to the position shown in Fig. 27, the shaft 335 is pulled to the right, carrying the lug 336 on the collar 334 out of engagement with the crank arm 333 and allowing the spring 332 to rock the vertical shaft 331 and swing the gate to its open position as shown in Figs. 30 and 40.

Driving mechanism

Except for the driving of the saw, the parts already described are all driven or actuated by the main driving pulley 340 (Fig. 3) of the machine. The pulley shaft 341 is equipped with a bevel gear 342 meshing with a pinion 343 fixed to one end of a shaft 344, which is mounted in bearings 345 and 346 fixed to the machine frame 105a and the column 105, respectively. A second pinion 347 is fixed to the opposite end of the shaft 344 and meshes with a bevel gear 348 fixed to one end of a shaft 349, the latter being arranged at right angles to the shaft 344 and mounted in a bearing 350 formed in the multi-

arm bracket 199. At its opposite end, the shaft 349 carries a pinion 351 in mesh with a bevel gear 352 fixed to a shaft 353 (Fig. 21) which is disposed at right angles to the shaft 349 and journalled at one end in a bearng 199a of the bracket 199, the shaft 353 passing through the sleeve 202a and a second sleeve 354 rotatably mounted in a bearing 199b of the bracket 199 and carrying the bevel gear 283 for rotating the cam shaft 277. It is from this shaft 353 that the several parts of the sawing mechanism are actuated and their movements synchronized by the operation of two clutches 356 and 357.

The clutches

The clutches 356 and 357 (Figs. 21–26 and 49–63) are identical except for the means which controls their rotation, the clutch 356 being adapted to make one complete uninterrupted rotation during each sawing operation and the clutch 357 two half rotations, one before and one after the operation of the clutch 356. Hence, the following description of the one rotation clutch 356 will apply equally well to the half rotation clutch 357 and like reference numerals will refer to identical parts of the clutches except where it is deemed advisable to employ a distinguishing reference character to avoid confusion. The clutch 356 comprises a body 358 (Figs. 21–24 and 26) fixed to the sleeve 354 loosely mounted on the shaft 353. The clutch body 358 is formed off center with a cylindrical recess 360 extending axially thereof and adapted to accommodate a plunger 361 and a compression spring 363 arranged between the bottom wall 364 of the recess and the plunger, the spring 363 tending to project the plunger from the recess at all times. The plunger 361 is formed with a guide shaft 365 which passes through the compression spring 363 and is slidable in an opening 366 formed in the bottom wall 364 of the recess to prevent the plunger from canting during its reciprocation. A lug 367 formed on the side wall of the plunger 361 is arranged to ride in a groove 368 formed in the side wall of the recess 360, allowing the plunger to reciprocate but preventing it from rotating. The side wall of the plunger opposite the lug 367 is formed with a slot 369 extending substantially halfway through the plunger, and what may be termed the inner wall 370 of the slot 369 is bevelled as at 371 to form a camming surface cooperative with a cam 372 for moving the plunger 361 against the action of the compression spring 363. The cam 372 is formed on a segment 373 carried by a control lever 374 pivotally mounted on the bearing 198 so as to overlie the clutch 356 and is normally held with the cam in active position in an annular groove 376 formed in the clutch body 358 by a tension spring 375 fixed to the free end thereof and to an arm of the bracket 199. The segment 373 is formed from left to right, Fig. 26, which is the direction of rotation of the clutch, with the cam 372 and a shallow recess 377 into which the plunger 361 is projected after it rides past the cam 372. The seating of the plunger 361 in the recess 377 prevents rotation of the clutch body 358 in either direction and obviates accidental displacement of the parts under the control of the clutch 356 which would disrupt their synchronization. The lever 374 is formed on the edge opposite the segment 373 with a lug 378 engageable to rock it, its rocking being controlled by a synchronizing mechanism to be described later. The clutch 356 is operated through the synchronizing mechanism, however, by the movement of the ejector slide 117a as it advances during the ejection of a slug from the mold, its movement actuating a lever 379 fixed to a shaft 380 journalled in the bracket 233 and which extends rearwardly to a position whereby it may be engaged by a roller 381 carried at the end of an arm 382 fixed to the ejector slide 117a. The lever 379 is mounted to rock in a horizontal plane and is held in its normal position by a spring 383 (Fig. 3) fixed thereto and to the column 105. As the ejector slide advances during the ejecting stroke, the roller 381, in passing, engages a cam surface 384 on an upstanding lug 385 at the free end of the lever 379 and forces the latter to the right (Figs. 3, 49 and 50). This effects the active stroke of the opposite end of the lever 379 which moves to the left and through the synchronizing mechanism causes the control lever 374 to be rocked upwardly against the pull of the tension spring 375 to withdraw the segment 373 from engagement with the plunger 361 and allow the latter to be projected from the recess by the compression spring 363 to engage the clutch 356. Continued movement of the ejector slide 117a carries the roller 381 off the cam surface 384 onto a surface 384a and allows the latter to swing back gradually to its former position under the influence of the tension spring 375 in returning the control lever 374 to active position. Upon the return stroke of the ejector slide 117a, the roller 381 rides onto the surface 386 on the opposite side of the lug 385 (Figs. 51–53), idly rocking the free end of the lever 374 slightly to the left in passing.

The clutch body 358 is rotated by a constantly rotating disc 387 formed with a plurality of cylindrical recesses 388, with any one of which the plunger 361 may engage when it is freed and projected by the compression spring 363. The disc 387 is loosely mounted on a shouldered extension 392a of a hub 392b of a driving member 392 and is formed on the side opposite the recesses 388 with a pair of diametrically opposed lugs 389 fitting between the wings of the driving member 392 keyed to the shaft 353 and a similar pair of lugs 390 on a second disc 391 located on the opposite side of the driving member. The two pairs of lugs 389 and 390 and the driving member 392 are loosely interfitted and a pair of compression springs 393, seated in recesses 394 formed in the driving member and in the lugs 390, keep the parts in contacting relation and absorb torque when either of the clutches become engaged.

Briefly the half rotation clutch 357 differs from the clutch 356 in that its clutch body 395 is keyed to the sleeve 202a (Fig. 21) rotatable relatively to the shaft 353 and on which the eccentric 202 and cam 216 are mounted, it being driven by the recessed disc 391 already referred to which carries the lugs 390. However, since its rotation is interrupted, the clutch body 395 is equipped with two plungers 361 located diametrically opposite one another, and at a point opposite a control lever 396, identical with the lever 374 and similarly mounted on the bearing 198, a smooth surfaced cam segment 397 is fixed to the bracket 199 (Fig. 25). Hence, when one of the plungers is retracted by the control lever 396, the other plunger is also retracted by the cam segment 397, and at each half rotation of the clutch body 395 one or the other of the plungers is brought under the control of the lever 396, the segment 396a of which is recessed the same as

the segment 373 on the lever 374 and in like manner holds the clutch body 395 against rotation.

The operation of the half rotation clutch 357 is controlled by the special matrix 129 through a series of connections leading to the control lever 396, (Figs. 1, 2, 8, 13–21b). The control lever is engaged by a crank arm 398 fixed to the lower end of a vertical shaft 399 passing through bearings 400 and 401 arranged in the ends of the brackets 232 and 233, respectively, the shaft 399 being sustained in position by a collar 402 on which the crank arm is formed and which bears against the underside of the bearing 401 and a collar 403 fixed to the shaft immediately above the bearing 400. The upper end of the shaft 399 is equipped with a collar 404 fixed thereto and which is formed with a square block 405 and a pair of arms 406 and 407 carrying, respectively, pivotally mounted fingers 408 and 409. The fingers 408 and 409 are formed each with a flat surface 410 rounded off at one end and adapted for engagement with one side of the block 405, being maintained in engagement therewith by a tension spring 411 fixed to a pin 412 projecting from the collar 404 and a pin 413 on the respective finger. Each of the fingers 408 and 409 carries an upstanding pin 414 arranged in the path of a depending lug 415 formed on each arm of the forked bracket 250 previously referred to and which is carried by the slide 143 (Fig. 8). When the slide 143 is moved to the left by the special matrix 129 as the line is being delivered to the transporter, each lug 415 on the bracket 250 engages its respective pin 414 on the fingers. As shown in Figs. 15, 16 and 17, the bracket 250, in passing rocks the finger 409 idly about its pivot in a counterclockwise direction due to the fact that the surface 410 of the finger is rounded at its left-hand end, while the finger 408, rounded at the right-hand end, cannot be rocked idly in a clockwise direction and causes the block 405 to rotate and thereby rock the shaft 399. As the shaft 399 is rocked, the crank arm 398 lifts the control lever 396 through the medium of a lug 396b thereon to withdraw the segment 396a from engagement with the plunger and release the clutch 357 for the first half of its rotation. Continued movement of the bracket 250 carries the lugs 415 beyond the pins 414 on the fingers 408 and 409 and the finger 409 snaps back to normal position under the influence of its spring 411, the shaft 399, the parts carried by the shaft and the finger 408 being brought back to their former positions by the return of the clutch control lever 396 to active position as the tension spring 375 rocks the lever 396 back into position to disengage the clutch 357 at the completion of its first half rotation. Upon the return of the carriage 143 when the line is removed from the transporter, the lugs 415 on the arms of the bracket 250 again engage the pins 414 on the fingers 408 and 409. This time, however the finger 408 is rocked idly in a counterclockwise direction and the finger 409, which cannot be rocked idly in a clockwise direction, acts upon the block 405 to rock the shaft 399 a second time in the same direction to actuate the control lever 396 and allow the clutch 357 to complete the second half of its rotation. The continued return movement of the bracket 250 carries the lugs 415 out of engagement with the pins 414, the fingers and the shaft 399 and its associated parts being returned to normal position as before.

The sequence of operations may now be briefly summarized. The driving mechanism for the sawing device is constantly driven from the main pulley shaft 341 of the machine and continually rotates the shaft 353 to which the driving member 392 for the clutches 356 and 357 is keyed. When the line of matrices is transferred into the first elevator, the lug 130 on the special matrix 129 picks up the feeler 144 to move the slide 143 to the left to a definite position determined by the location of the special matrix in the line. This movement of the slide effects two results: It locates the gage plate 139 to determine the cutting position of the saw and, at the same time, through the forked bracket 250, rocks the shaft 399 to actuate the clutch control lever 396 and allow the clutch 357 to engage and partake of a one-half rotation. The half rotation of the clutch 357, by means of the eccentric 202 and cam 216, simultaneously effects three different functions, namely; the opening of the gate 136, the engagement of the saw driving clutch 169, and the adjustment of the saw 134. These operations all result from the mere delivery of the line of matrices to the transporter before the machine is started for the casting operation.

After the machine has been started and the slug cast, it is delivered by the mold disc 110 to ejecting position. When the ejector 117 advances to force the slug out of the mold, the roller 381 carried by the ejector slide 117a engages the cam surface 384 at the end of the lever 379 and in passing rocks the lever to actuate the clutch control lever 374, which permits the clutch 356 to be engaged and partake of one continuous rotation. The rotation of the clutch body 358, which is fixed to the sleeve 354 carrying the bevel gear 283, drives the cam shaft 277 to effect the operation of the slug gripper 135, the slug bracing finger 237 and the waste slug pusher 138.

Subsequently, when the line of matrices is removed from the transporter the finger 107a of the carriage 101 rocks the arm 247 to release the wedge brake shoe 238 from its engagement with the slide 143, whereupon the slide is returned to its normal position by the spring 235. During the return movement of the slide 143, the forked bracket 250 again rocks the shaft 399 to release the clutch control lever 396 and allow the clutch 357 to partake of its second half rotation. This completes the rotation of the eccentric 202 and the cam 216, bringing them back to normal position and effecting the closing of the gate 136, the disengagement of the saw driving clutch 169 to stop the rotation of the saw, and the return of the saw 134 to its upper inactive position.

Synchronizing mechanism

As stated previously, when a full length slug is to be cast the machine operates as usual and the saw remains inactive, the slug being ejected from the mold and allowed to drop down the first or regular delivery chute 127 to the galley, and since a special matrix is not included in the composed line, the gage plate will not be moved nor the half rotation clutch engaged to open the gate and adjust and start the saw rotating. However, with only the mechanism thus far described in detail, upon the ejection of the slug the one rotation clutch would be engaged to activate the gripper mechanism for delivering the slug to the saw. For this reason, the synchronizing mechanism referred to is provided to prevent the engagement of the one rotation clutch in the

absence of a special matrix in the composed line, or in other words, to allow the one rotation clutch to be engaged only in the event that the half rotation clutch has operated to open the gate and prepare the saw for cutting a slug.

Referring to Figs. 21, 21ª and 21ᵇ, the synchronizing mechanism comprises a friction clutch **450** interposed between the actuating lever **379** and the control lever **374** for the one rotation clutch **356**, and its male and female members **451** and **452**, respectively, are mounted on a vertically disposed shaft **453** removably secured in a bearing **454** of an extension **455** of the bracket **233**. The clutch member **451** is loosely mounted between a shoulder **456** on the shaft **453** and a retaining nut **457** on the lower threaded end **458** of the shaft and formed with an arm **459** for engaging the lug **378** on the one rotation clutch control lever **374**; while the clutch member **452** is loosely mounted higher up on the shaft **453** and normally held by a coil spring **460** against a flange **461** on the shaft. A housing **462** formed on the top side of the clutch member **452** encloses the spring **460** and the latter has its upper end anchored in a cap **463**, fitted tightly in the open top of the housing **462**, and its lower end anchored to the flange **461** on the shaft **453**.

The spring **460** is arranged in the housing **461** under slight compression so that it exercises itself to keep the clutch member **452** up against the flange **461** and out of engagement with the clutch member **451**. Projecting laterally from the clutch member **452** is a lug **464** provided for engagement with an adjustable screw **465** threaded in the end of the actuating lever **379**, whereby movement of the lever **379** during each slug ejecting operation gives the clutch member **452** a partial rotation against the torsion of the spring **460**, which subsequently returns it to its original position.

A star wheel **466**, having six radiants **467**, is arranged immediately above the housing **462** for intermittent rotation about the shaft **453**, being actuated step by step by an upstanding finger **468** pivoted on a pin **468ª** to an arm **469** formed on the collar **402** fixed to the half rotation clutch control shaft **399**. The finger **468** is provided with an offset lug **468ᶜ** which engages the arm **469** to limit the rocking movement of the finger in one direction and support it for rotating the star wheel **466** during its active stroke, but during its return stroke the finger is free to rock in the opposite direction against the pull of a torsion spring **468ᵇ** surrounding the pivot pin **468ª** and having one free end bearing against the finger **468** and its other free end bearing against the arm **469**, in order to pass the radiant **467** which has been brought into active position by the previous rotation of the star wheel.

A series of teeth **470** are formed on the upper surface of the star wheel **466** adjacent its periphery from which the radiants **467** project and a pair of pawls **471** of slightly different lengths are mounted on a common pivot **472** arranged in the side of the bearing **454** and adapted to engage the teeth **470** to prevent reverse rotation of the star wheel during the inactive stroke of the finger **468**. Nearer the center of the star wheel **466**, on its upper surface, three cam surfaces **473** are formed for engagement with three complementary surfaces **474** formed on the lower end of the fixed bearing **454** and function to engage and disengage the clutch **450** as the star wheel is rotated.

In operation, the delivery to the line transporter of a composed line of matrices including a special matrix **130** advances the slide **143** and rocks the shaft **399** to engage the half rotation clutch **357** in the manner already set forth. In rocking, the shaft **399** rotates the arm **469** carrying the finger **468** and, through the engagement of the finger **468** with the radiant **467** then in active position, imparts a one-sixth rotation to the star wheel **466**, at least one of the pawls **471** being in position to engage one of the teeth **470** on the star wheel to hold it substantially in its rotated position. This rotation of the star wheel **466** moves the cam surfaces **473** thereon relatively to the complementary surfaces **474** on the bearing **454** and forces the clutch member **452** downwardly into engagement with the clutch member **451** (compare Figs. 21ª and 21). The return of the half rotation clutch control lever **396** to disengage the clutch **357** at the completion of its first half rotation returns the shaft **399** and arm **469** to their original positions and during this inactive stroke of the arm **469**, the finger **468** rocks about its pivot against the pull of the spring **468ᵇ** to pass beneath the radiant **467** which has been brought into active position by the previous rotation of the star wheel **466**. When the finger **468** has cleared the radiant **467** it snaps back into upright position ready to engage the radiant during its next active stroke.

While the clutch members **451** and **452** are thus engaged, the movement of the ejector slide **117ª** in ejecting the slug from the mold rocks the actuating lever **379** which, through the screw **465** in engagement with the lug **464** on the clutch member **452**, effects a partial rotation of the clutch **450**. The engagement of the arm **459** on the clutch member **451** with the lug **378** on the one rotation clutch control lever **374**, rocks the latter to effect the engagement of the one rotation clutch **356**.

When the line of matrices is removed from the transporter, the return of the slide **143** again rocks the shaft **399** to inaugurate the second half rotation of the clutch **357** and, hence, a one-sixth rotation is imparted to the star wheel **466** as before. The second one-sixth rotation of the star wheel **466** carries the cam surfaces **473** beyond the high points of the complementary surfaces **474**, whereupon the spring **460** exercises itself to raise the clutch member **452** to break its engagement with the clutch member **451** and return the parts to the condition shown in Fig. 21ª, the arm **469** and finger **468** being returned as before to their initial positions.

It will be apparent now that when a line of matrices which does not contain a special matrix **130** is delivered to the line transporter, the slide **143** will not be advanced and the shaft **399** will not be actuated to engage the half rotation clutch **357**. Hence, the star wheel **466** will not be rotated and the clutch members **451** and **452** will not be engaged, so that when the slug is ejected from the mold, the actuating lever **379** will be rocked as usual but will effect only an idle rocking of the disengaged clutch member **452** and the one rotation clutch **356** will not be activated.

Having thus described our invention, what we claim is:

1. In a slug casting machine, the combination of a mold for casting a slug against a composed line of matrices, means for ejecting the cast slug from the mold, a power driven saw for severing the ejected slug, and means controlled from the composed line for determining the relative positioning of the saw and slug.

2. In a slug casting machine, the combination of a mold for casting a slug of a given length against a composed line of matrices of the same length, means for ejecting the cast slug from the mold, a power driven saw for severing the ejected slug, and means controlled by an element located at a selected point in the length of the composed line for causing the saw to cut through the slug at a corresponding point.

3. In a slug casting machine, the combination of a mold for casting a slug against a composed line of matrices, means for ejecting the cast slug from the mold, a power driven saw for severing the ejected slug, and means controlled by a specially formed matrix contained in the composed line for determining the relative positioning of the saw and slug.

4. In a slug casting machine, the combination of a mold for casting a slug against a composed line of matrices, means for ejecting the cast slug from the mold, an adjustable power driven saw for severing the ejected slug, and means controlled by a specially formed matrix contained in the line for locating the saw in a predetermined position lengthwise of the slug.

5. The combination with a power driven saw for severing a cast slug, means for varying the cutting position of the saw in relation to the slug, and a composed matrix line from which the slug is cast, said line containing a special saw locating element to control the action of said means.

6. In a slug casting machine, the combination of a mold for casting a slug against a composed line of matrices, means for ejecting the cast slug from the mold, a power driven saw for severing the ejected slug, an adjustable gaging device for locating the saw in a predetermined position lengthwise of the slug, and a feeler to cooperate with the composed line and govern the adjustment of the gaging device.

7. In a slug casting machine, the combination of a mold for casting a slug against a composed line of matrices, means for ejecting the cast slug from the mold, a power driven saw for severing the ejected slug, automatic means for moving the saw bodily lengthwise of the slug to locate it in a predetermined cutting position, and an adjustable gaging device controlling the action of said means.

8. In a slug casting machine, the combination of a mold for casting a slug against a composed line of matrices, means for ejecting the cast slug from the mold, a power driven saw for severing the ejected slug, automatic means for moving the saw bodily lengthwise of the slug to locate it in a predetermined cutting position, an adjustable gaging device controlling the action of said means, and a feeler to cooperate with the composed line and govern the adjustment of the gaging device.

9. A combination according to claim 7, including automatic means for restoring the parts to their original condition after the slug severing operation.

10. In a slug casting machine, the combination of a mold, a transporter adapted to receive a composed line of matrices and present the line to the mold, means for ejecting the cast slug from the mold, a power driven saw for severing the ejected slug, and means to cooperate with the composed line while in the transporter for determining the relative positioning of the saw and slug.

11. In a slug casting machine, the combination of a mold, a transporter adapted to receive a composed line of matrices and present the line to the mold, means for ejecting the cast slug from the mold, a power driven saw for severing the ejected slug, and means actuated by a specially formed matrix contained in the composed line as the latter enters the transporter for determining the relative positioning of the saw and slug.

12. In a slug casting machine, the combination of a mold, a transporter adapted to receive a composed line of matrices and present the line to the mold, means for ejecting the cast slug from the mold, a power driven saw for severing the ejected slug, an adjustable gaging device for locating the saw in a predetermined position lengthwise of the slug, and a movable feeler connected to the gaging device for effecting the required adjustment thereof, said feeler being arranged to be picked up by and carried along with a specially formed matrix element contained in the composed line as the latter enters the transporter.

13. In a slug casting machine, the combination of a mold, a transporter adapted to receive a composed line of matrices and present the line to the mold, means for ejecting the cast slug from the mold, a power driven saw for severing the ejected slug, an adjustable gaging device for locating the saw in a predetermined position lengthwise of the slug, a movable feeler connected to the gaging device for effecting the required adjustment thereof, said feeler being arranged to be picked up by and carried along with a specially formed matrix element contained in the composed line as the latter enters the transporter, and means actuated by the composed line as it is removed from the transporter for restoring the gaging device and feeler to their original positions.

14. In a slug casting machine, the combination of a mold for casting a slug against a composed line of matrices, a power driven saw for severing the ejected slug, means for locating the saw in a predetermined cutting position, and automatic means for moving the saw from a normal position to said predetermined cutting position.

15. In a slug casting machine, the combination of a mold for casting a slug against a composed line of matrices, a power driven saw for severing the ejected slug, means for locating the saw in in a predetermined cutting position, and automatic means for moving the saw from a normal position to said predetermined cutting position and then back to its normal position before and after the slug severing operation, respectively.

16. In a slug casting machine, the combination of a mold, means for ejecting the cast slug from the mold, a power driven saw for severing the ejected slug, driving means for the saw including a clutch, and automatic means for engaging and disengaging said clutch before and after the slug severing operation, respectively.

17. In a slug casting machine, the combination of a mold for casting a slug against a composed line of matrices, means for ejecting the cast slug from the mold, a power driven saw for severing the ejected slug, said saw being located beyond the reach of the ejected slug and maintained in a stationary position at the time of ejection of the slug, and means for carrying the cast slug after ejection to the stationarily positioned saw for the severing operation.

18. In a slug casting machine, the combination of a mold for casting a slug against a composed

line of matrices, means for ejecting the cast slug from the mold, a power driven saw for severing the ejected slug, said saw being located beyond the reach of the ejected slug, and a gripper device arranged to seize the ejected slug at its opposite ends and carry it past the saw for the severing operation.

19. In a slug casting machine, the combination of a mold for casting a slug against a composed line of matrices, means for ejecting the cast slug from the mold, a power driven saw for severing the ejected slug, said saw being located beyond the reach of the ejected slug, a gripper device arranged to seize the ejected slug at its opposite ends and carry it past the saw for the severing operation, and a thrust member engageable behind the slug in the vicinity of the saw and movable with the gripper device.

20. A combination according to claim 19, wherein the saw is adjustable to different cutting positions, and wherein the thrust member is adjustable with the saw to maintain their relationship.

21. A combination according to claim 17, wherein the slug carrying means is normally inactive and is rendered active automatically when required.

22. In a slug casting machine, the combination of a mold for casting a slug against a composed line of matrices, means for ejecting the cast slug from the mold, a gate located in the path of the ejected slug, means for opening and closing the gate, a galley chute arranged to receive the ejected slug when arrested by the gate, a second galley chute located beyond the gate in the direction of movement of the slug, a power driven saw disposed between the two galley chutes, and a gripper device arranged to receive the ejected slug when the gate is open and carry it over the first galley chute, past the saw, and drop it into the second galley chute.

23. A combination according to claim 22, wherein the gate is normally closed and is opened automatically when required, and wherein the slug gripper device is normally inactive and is rendered active automatically when required.

24. In a slug casting machine, the combination of a mold for casting a slug against a composed line of matrices, means for ejecting the cast slug from the mold, a power driven saw for severing an end portion of the ejected slug, a pusher for carrying off the severed end portion of the slug, a galley into which the slug is stacked, and means for delivering the slug to the galley.

25. In a slug casting machine, the combination of a mold for casting a slug against a composed line of matrices, means for ejecting the cast slug from the mold, a power driven saw for severing an end portion of the ejected slug, and a pusher for carrying off the severed end portion of the slug, said pusher comprising a plurality of telescopic sections arranged in closely nested relation when the pusher is at rest.

26. In a slug casting machine, the combination of a mold for casting a slug against a composed line of matrices, means for ejecting the cast slug from the mold, a gate located in the path of the ejected slug, means for opening and closing the gate, a galley chute arranged to receive the ejected slug when arrested by the gate, a second galley chute located beyond the gate in the direction of movement of the slug, a power driven saw disposed between the two galley chutes, means controlled by a specially formed matrix contained in the composed line for locating the saw in a predetermined position lengthwise of the slug, and a gripper device arranged to receive the ejected slug and carry it over the first galley chute, past the saw, and drop it into the second galley chute.

27. In a slug casting machine, the combination of a mold for casting a slug against a composed line of matrices, means for ejecting the cast slug from the mold, a gate located in the path of the ejected slug, means for opening and closing the gate, a galley chute arranged to receive the ejected slug when arrested by the gate, a second galley chute located beyond the gate in the direction of movement of the slug, a power driven saw disposed between the two galley chutes, a gripper device arranged to receive the ejected slug when the gate is open and carry it over the first galley chute, past the saw, and drop it into the second galley chute, automatic means for moving the saw bodily lengthwise of the slug to locate it in a predetermined cutting position, an adjustable gaging device, and a feeler to cooperate with the composed line and control the adjustment of the gaging device.

28. A combination according to claim 27, wherein the setting of the gaging device by the composed line effects the opening of the gate, the movement of the saw to its predetermined cutting position, and the operation of the gripper device, all in timed relation to the ejection of the cast slug.

29. A combination according to claim 27, wherein the setting of the gaging device by the composed line effects the opening of the gate, the movement of the saw to its predetermined cutting position, and the operation of the gripper device, all in timed relation to the ejection of the cast slug, and wherein the composed line when removed from the machine restores the feeler and gaging device to their original positions, re-closes the gate, restores the saw to its original position, and restores the gripper device to its original position.

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