N° 8633 A.D. 1899

Date of Application, 25th April, 1899
Complete Specification Left, 24th Jan., 1900—Accepted, 31st Mar., 1900

PROVISIONAL SPECIFICATION.

Improvements in Machines for Casting and Setting Type.

A communication from the LANSTON MONOTYPE MACHINE COMPANY, a Corporation created, and existing under the Laws of the State of Virginia, and having its principal place of business at Washington, District of Columbia, United States of America.

I, ALFRED JULIUS BOULT, of 111, Hatton Garden, in the County of London, Chartered Patent Agent, do hereby declare the nature of this invention to be as follows :—

The present invention relates to and constitutes an improvement upon the type making and composing mechanism forming part of what is known as the Lanston monotype system, wherein a previously prepared record strip is employed to control and govern the operations of an automatic type casting machine in the production of justified lines of type, and the assembling of such justified lines of type in column form ready for use.

In view of the somewhat complex character of the apparatus, embodying these improvements, and as an aid in understanding the description of the several mechanisms and their relations one to another and to the machine as a whole, it is desirable that the general mode of operation of the Lanston monotype system should be understood, to which end a brief description of its salient features, as embodied in the most highly developed form in which it has been introduced to the public prior to the present invention, will be attempted.

The Lanston system makes use of a record strip prepared by punching, at regular intervals, holes representing each character and space entering into the composition of the matter to be set up. At the end of each series of perforations, representing a complete line, there is formed one or more perforations representing the amount to be added to each space type of normal width, in order to cause the series of character type and spaces to justify, or just fill the line. These perforations occurring at the end of the line are known as the justification perforations. Another perforation succeeds the justification perforation and is known as the galley perforation. The next line in the composition is set up in the same manner, that is to say, characters and spaces, in the order in which they occur, are registered by perforations, the amount of justification, *i.e.*, the increase in the width of the normal space types, is then registered, after which the galley perforation is made, and so on to any extent.

The perforated record-strip thus made is delivered to the type-making and composing mechanism in the reverse order of composition so that, in the procession of events, the justification adjustments for the first line produced in the machine will first be effected, then the characters and spaces in inverse order of composition will be successively formed, and, after the last character for the line is completed, the justification devices will be returned to zero and the galley mechanism brought into action to transfer the completed line to the galley, after which the justification for the next line and the formation of the characters for said line will proceed as before.

The principal elements of the type-making and composing machine are the die-case, and its centering and clamping mechanisms; the mold, with its adjustable mold-blade for varying the size of the mold-cavity, to produce type-bodies of different widths; the normal adjusting mechanism for the mold-blade, for determining its position to correspond with the normal widths of the several characters represented by the matrices; the abnormal or justifying mechanism for varying the position of the mold-blade, as effected by the normal adjusting devices, so as to increase the dimensions of the mold as to width when certain selected type, such as the space type, are to be produced; the metal-injecting mechanism; the galley mechanism, the latter containing devices for assembling the completed type into a line, carrying said line into position to be transferred to the galley and transferring the line into the galley; and a pneumatic system through which the perforated record-strip exercises control over the several devices or mechanisms enumerated.

According to the plan or system upon which said machine is constructed a complete rotation of the driving shaft is required for the making of a single type. The die-case in which the series of matrices representing the characters are assembled is given a compound motion in two directions, for centering or bringing any selected matrix into position above the mold, said motions being performed with reference to a common starting point or zero position, hence a complete reciprocation of the die-case in two directions is required each time a type is produced, the selection of the character being determined by the degree of motion given the die-case measured from the common zero or starting position to which latter the die-case is returned after the formation of each type. This involved a considerable travel of the die-case, even when a limited number of matrices was employed, and when it was sought to materially increase the number of matrices in the die-case, the increased weight and range of motion, incident thereto, seriously affected the speed of the machine.

Time was also lost in setting the justification devices and in starting the galley mechanism. For the former there was a starting or zero position to which the justification devices had to be returned at the completion of a line, and with reference to which the adjustment was performed for the next succeeding line. Moreover, the setting of the justifying devices absorbed several otherwise useless rotations of the driving shaft, and the starting of the galley mechanism also required a blank or unproductive rotation of said shaft.

It will readily be perceived that the foregoing, among other minor features not here enumerated, constitute distinct limitations upon the speed capacity of the machine, considered as a whole, and it is one of the special and important objects of the present invention to overcome or at least materially modify these restrictions, and to not alone improve the mechanisms whereby the several operations are performed, but to materially increase the capacity of the machine, both as to number of available characters and speed of production.

With this end in view a new die-centering system has been contrived, whereby the zero or starting point for the die-case has been eliminated and the motions reduced to a minimum, by causing it to move directly from one point of adjustment to the next without first returning to a common starting point. By this means the range of motion and consequent number of characters may be increased without correspondingly increasing the speed of motion of the die-case, and the shock of arrest incident to increased weight of the die-case is avoided.

A new system for effecting both the normal and the abnormal or justifying adjustments of the mold-blade has also been devised, in which the zero position is likewise eliminated, the mechanism simplified, and the adjustment effected almost instantaneously, the maximum degree being produced by but two revolutions of the driving shaft; whereas in the Lanston machine several revolutions were consumed for this purpose.

Instead of employing a separate perforation in the record-strip, and consuming one complete revolution of the driving shaft for setting the galley mechanism into action, the galley perforation is dispensed with and the justification perforation utilized for the purpose.

The foregoing are some of the principal fundamental improvements embodied in the present machine, and, in addition thereto, there are numerous subordinate features pertaining to the construction, arrangement and combinations of the several mechanisms, all as will hereinafter more fully appear.

In the accompanying drawings representing the preferred, but not the only, embodiment of all the several improvements in an organized machine,—

Figure 1 is a perspective view looking toward the front left-hand corner of the machine.

Figure 2 is a top elevation or plan view.

Figure 3 is a front elevation.

Figure 4 is a side elevation (looking towards right-hand side of the machine).

Figure 5 is a rear elevation.

Figure 6 is a side elevation (looking towards left-hand side of machine).

Figure 7 is a vertical transverse section on the line A—A, Figure 2.

Figure 8 is a vertical longitudinal section on the line B—B, Figure 2.

Figure 9 is a vertical section through a portion of the matrix or die-carrier, its supports and the centering plunger.

Figure 10 is a horizontal section on the line C—C, Figure 9.

Figure 11 is a vertical section on line D—D, Figure 13, showing a portion of the machine, including the guide for the centering plunger the die-case supporting frame and the arrangement of the friction clamps or brakes for the die-case carrier.

Figure 12 is a detached view of one of the friction blocks for die-case carrier.

Figure 13 is a bottom view of the die-case supporting frame and centering plunger.

Figure 14 is a detail view illustrating one of the levers for the friction blocks, Figure 12.

Figure 15 is a perspective view of the die-case carrier, inverted.

Figure 16 is a perspective view of a portion of the underside of the die-case supporting frame on which the die-case carrier, Figure 15, is mounted and reciprocates.

Figure 17 is a perspective view showing a portion of the die or matrix case.

Figure 18 is a sectional view of a portion of the die or matrix case.

Figure 19 is a perspective view of the mold, detached.

Figure 20 is a sectional view of the mold on line E—E, Figure 21.

Figure 21 is a horizontal section through the mold on the line F—F, Figure 20.

Figure 22 is a top plan view on an enlarged scale of that portion of the machine containing the matrix or die-centering mechanism, the normal adjusting devices for the mold-blade, and the abnormal or justifying devices.

Figure 23 is a perspective view showing a portion of the mechanism for controlling the position of the die-case, in its carrier, including the primary controller, the jaws of the primary positioning mechanism, the secondary controller and the jaws of the secondary positioning mechanism, the levers being broken away.

Figure 24 is a detail view showing one jaw or member of the secondary positioning or gauging mechanism.

Figure 25 is a plan view of the lever system for actuating the jaws of the primary and secondary controlling or positioning mechanisms showing them in two positions of adjustment.

Figure 26 is a detailed view showing the connection between the levers of one primary positioning mechanism and its spring.

Figures 27, 28, 29 and 30 are diagramatic views showing one set of centering and positioning levers for controlling the position of the die-case in one direction, and representing different positions of adjustment.

Figure 31 is a perspective view of a portion of the translating device through which motion is communicated to the die-case for centering the matrices.

Figure 32 is a side elevation of the set of cams for controlling the mold-blade actuating lever.

Figure 33 is a detail view illustrating the connection between the two locking devices for the secondary controllers.

Figure 34 is a perspective view of the devices for shifting the justifying wedges into and out of operative position and for operating the lock of the transfer wedge.

Figure 35 is a perspective view showing the locking mechanism for the transfer blocks or wedges.

Figure 36 is a vertical sectional view through the locking rod for the transfer blocks.

Figure 37 is a side elevation, partly in section, showing the justifying-wedge actuating devices detached, and one of the trip-lever pistons.

Figure 38 is a vertical section on line G—G, Figure 44, showing the normal wedge and its locking bolt.

Figure 39 is a vertical section on line H—H, Figure 44, showing the transfer-blocks and limiting abutment therefor.

Figure 40 is a similar section on line Z—Z, Figure 44, showing the justifying wedges with their actuating devices.

Figure 41 is a perspective view of the two justifying wedge-shifting levers detached.

Figure 42 is a vertical sectional view on line J—J, Figure 44, showing one of the locking bars for secondary controller.

Figure 43 is a detail perspective view of one of the secondary gauges or controllers.

Figure 44 is a longitudinal vertical section through the mold-blade shifting and adjusting devices taken on the line K—K, Figure 22.

Figure 45 is a perspective view of the upper transfer wedge.

Figure 46 is a similar view of the lower transfer wedge.

Figure 47 is a perspective view of the abutment slide for controlling the position of the mold-blade.

Figure 48 is a bottom view of said abutment slide.

Figure 49 is a detail in perspective of the self-adjusting bearing.

Figure 50 is a perspective view of the normal-wedge.

Figures 51 and 52 are similar views of the justifying wedges.

Figure 53 is a detail showing the locking bolt for the transfer wedges or blocks.

Figure 54 is a detail of the adjustable abutment for the transfer blocks or wedges.

Figure 55 is a diagramatic view illustrating the operations of the normal wedge and lower transfer block.

Figure 56 is a top plan view, on an enlarged scale, of a portion of the machine in the immediate vicinity of the mold, and including a portion of the adjusting and justifying devices for the mold-blade, the type carrier, and the line-channel and line-carrier of the galley mechanism.

Figure 57 is a horizontal sectional view on the line L—L, Figure 63, showing the type-carrier and ejector and the relative arrangement of the normal and justifying wedges and the transfer blocks.

Figures 58 and 59 are diagramatic views illustrating the action of the justifying wedges and the upper transfer wedge or block.

Figure 60 shows a slight modification in the form of the normal-wedge and abutment slide to adapt the machine for use in making type wherein the body sizes do not vary in uniform degrees throughout the font.

Figure 60[a] is a sectional view of the bearing for the modified normal-wedge.

Figure 61 is a diagramatic view illustrating the application of the modified form of normal wedge shown in Figure 60.

Figure 61[a] is a longitudinal section through the abutment slide as modified.

Figure 62 is a section on the line M—M, Figure 57.

Figure 63 is a section on the line N—N, Figure 57.

Figure 64 is a detail view, partly in section, showing the type ejector for the type-carrier.

Figure 65 is a detail view showing said type ejector detached.

Figure 66 is a perspective view of the type-carrier.
Figure 66ª is a section of the type-carrier.
Figure 67 is a rear elevation of the type-carrier.
Figure 68 is a transverse vertical section of the type-carrier on line O—O, Figure 67.
Figure 69 is a perspective view of the movable jaw of the type-carrier.
Figure 70 is a detail of the pressure plate for the ejector-blade.
Figure 71 is a perspective view of a portion of the frame in which the type-carrier and ejector reciprocate.
Figure 72 is a top plan view of the galley mechanism detached.
Figure 73 is a front elevation of the galley mechanism.
Figure 74 is a detail view of the line-transferer.
Figure 75 is a detail showing in perspective the type sustaining springs at one side of the entrance to the line-channel.
Figures 76 and 77 are horizontal sectional views through a portion of the galley mechanism on the line P—P, Figure 86, showing the line-carrier in different positions.
Figure 78 is a vertical section through a portion of the galley, on line Q—Q, Figure 77, showing the line-transferer in the act of forcing the line of type from the line-channel into the galley.
Figure 79 is a detail showing one of the jaws of the primary positioning mechanism with shock arrester applied thereto.
Figure 80 is a detail view illustrating the adjustable connection between the type-carrier and its actuating lever.
Figure 81 is a detail view showing the line-carrier in perspective.
Figure 82 is a detail showing the type sustaining spring at one side of the entrance to the line-channel.
Figure 83 is an end view of the entrance to the line-channel, showing the type sustaining springs.
Figure 84 is a detail view in perspective of the reciprocating support for the line-carrier.
Figure 85 is a horizontal section of a portion of the galley mechanism on the line R—R, Figure 89.
Figure 85ª is a section of the compression link.
Figure 86 is a central vertical section of the galley mechanism on the line S—S, Figure 72.
Figure 87 is a detail of the slide for returning the type-support in the line-channel.
Figure 88 is a detail in perspective of the line-support in the line-channel.
Figure 89 is a vertical section on the line T—T, Figure 86.
Figure 90 is a vertical section on the line U—U, Figure 86.
Figure 91 is a vertical section on the line V—V, Figure 86.
Figure 92 is a rear elevation of the pump and melting pot.
Figure 92ª is a detail of the pump actuating mechanism.
Figure 93 is a top plan view of the supporting frame for the melting pot.
Figure 94 is a top plan view of the melting pot and pump mechanism.
Figure 95 is a side elevation, partly in section, showing the pump actuating and melting pot elevating devices.
Figure 96 is a vertical section through the pump on the line W—W, Figure 94.
Figure 97 is a horizontal section of the pump and melting pot with their connections on the line X—X, Figure 99.
Figure 98 is a perspective showing the pump actuating levers.
Figure 99 is a vertical section through pump and nozzle on the line Y—Y, Figure 97.
Figure 100 is a vertical section on the line Z—Z, Figure 94.
Figure 101 is a detail view illustrating in side elevation the driving connections for the pump, including means for throwing the pump into and out of action automatically.

Figure 102 is a detail of the reciprocating member for disconnecting the pump from its driving mechanism.

Figure 103 is a view in perspective of the driving and driven members of the pump-actuating devices and the detachable connecting link or latch.

Figure 104 is an end view of the pump-driving mechanism shown in Figure 101.

Figure 105 is an end elevation of the paper feed mechanism.

Figure 106 is a detail showing the trip-block for connecting and disconnecting the paper feed driving mechanism.

Figure 107 is a vertical transverse section through the paper feed mechanism and air bar.

Figure 108 is a detail showing the air bar in longitudinal section.

Figure 109 is a longitudinal vertical section through the paper feed mechanism.

Figure 110 is a detail view showing one of the spool-supports in section.

Figure 111 is a diagramatic view showing a section of the perforated record-strip.

Figure 112 is a diagramatic view showing the air passages or connections of the pneumatic system.

Figure 113 is a detail showing the arrangement of the driving cams.

Figure 114 is a perspective view of the link motion for operating the transfer blocks or wedges.

Figure 115 is a transverse section through the driving shafts, showing the arrangement of the lever, the cams illustrated in this figure being those for the type-ejector.

Figure 116 is a detail view showing the manner of adjusting the bevel gear on its driving shaft.

Figures 117 to 122 inclusive illustrate, approximately, the outlines of the various sets of cams for actuating the devices.

Corresponding parts in the several figures bear the same numerals.

For convenience of description the various mechanisms which together constitute the organized machine represented in the drawings may be considered in groups or divisions, according to their special functions, as follows: The mold; the die or matrix-case; the die-centering mechanism; the normal mold-adjusting mechanism; the abnormal adjusting or justifying mechanism; the metal injecting mechanism; the galley mechanism, including the type-carrier, line-carrier and line-transferer; the paper feed; and the pneumatic system.

Generically considered similar elemental features are to be found in the prior Lanston machine upon which this is an improvement, but from which it differs in many respects, more especially in the construction, arrangement and mode of operation of the actuating mechanisms.

The general arrangement of the principal elements is best seen in Figures 1 to 8 inclusive.

The mold occupies a fixed position nearly central of the machine, and above it is arranged the die-case, which latter is mounted to reciprocate horizontally in two directions so as to bring any one of its dies or matrices centrally above the mold. Above the die-case, and in line with the mold, is the centering and pressing plunger by means of which the selected matrix is accurately centered and held tightly upon the upper end of the mold. The metal injecting devices are located to the left of the mold, the nozzle being carried beneath the top plate of the frame in line with the mold. The paper feed is arranged above the left-hand rear corner of the machine.

The die-centering and the normal adjusting and justifying mechanisms occupy positions in rear and to the left of the mold. The main driving shaft is mounted upon the left side of the frame, and in this connection it may be stated that the frame, which may be of any desired or approved form, has, in the present instance, been especially contrived to receive and accommodate the various mechanisms constituting the organized machine, but inasmuch as its form is not essential it will hereinafter be

referred to merely as the main frame, whether considered as an integral structure or as comprised of separable elements.

With this preliminary outline of the relative arrangement and location of the principal elements of the machine, the detail description may be proceeded with.

The Mold.

The mold may be regarded as the center of the entire system of type-forming devices, occupying as it does, a fixed position, about and with reference to which the other mechanisms are grouped and adjusted for co-operative action. Acting in conjunction with a separable matrix or die-block and a metal-injecting apparatus, the mold gives shape and dimension to the bodies of all the type, character as well as space, to which end it is furnished with a movable member or wall capable of adjustment so as to vary the size of the mold-cavity and thus produce type-bodies of different widths, set-wise.

The construction and arrangement of this part of the apparatus will be best understood by reference to Figures 7, 19, 20 and 21 and 56.

Although fixedly secured in position on the top plate of the frame and made up of several distinct parts, the mold, as a whole, constitutes a complete structure which can readily be attached and detached, not only from the main frame, but also from the actuating devices controlling its movable elements. It is composed of two stationary members or blocks 1, 2, forming the opposite side walls of the mold-cavity, and a cross-blade 3, movable across the ends of said blocks 1 and 2 and forming a removable front wall to the mold-cavity. The rear wall of said cavity is formed by the mold-blade 4, guided by and having movement between the proximate faces of the blocks 1 and 2 and constituting the adjustable wall of the mold, as well as the ejector for discharging the type therefrom and delivering them into the type-carrier. These parts are mounted and supported in a frame 5, comprising front and rear vertical walls, a vertical wall extending partly across one end and a bottom plate or support. Although this frame 5 might be formed in one piece, for convenience of manufacture it is composed of several parts firmly united, as clearly indicated in Figures 19, 20 and 21. One special reason for this sectional construction is the desirability of employing hardened and true surfaces for preserving the parts in proper relative position, more especially those parts which furnish the walls of the mold-cavity, hence the blocks 1 and 2, instead of extending down to the bottom plate of the frame, as they well might, are each mounted upon a filling piece, which latter is somewhat narrower than the blocks, as seen in Figure 20. The block 1 is fixed in position, and the opposite block 2 may, in like manner, be fixed; but it is preferred to permit slight lateral play to block 2 so that it may accommodate itself to variations in the temperature not only of the parts themselves, but also of the mold-blade, which latter is movably sustained between the two blocks. A tight joint should at all times be maintained between the mold-blade and the faces of blocks 1 and 2, and unless adequate provision is made to accommodate expansion and contraction due to variations in temperature, there will be danger of binding and serious interference with the movements of the mold-blade. To provide against this the movable or adjustable block 2 is held in contact with the mold-blade by a spring 6 (Figure 21), interposed between said block and the end wall of the frame. A set screw at one end and a clamping screw at the side serve to properly locate block 2, while a plate or keeper 7, fitting accurately in cross-grooves in the upper face of both blocks 1 and 2 and secured to the former and to the frame, insure the alignment and parallelism of the two blocks and furnishes the top guide for the mold-blade. These blocks 1 and 2 are each provided with independent passages in close proximity to the mold-blade for the circulation of water or other cooling agents.

The adjusting means for limiting the forward motion of the mold-blade operate directly upon the latter, instead of upon its actuating devices, thus eliminating irregularities in position incident to lost motion and expansion. Said adjusting means are mounted upon the mold frame and comprise the adjustable wedge 8 with

set screw 9, the former passing through an opening in the mold-blade and taking its bearing on frame 5.

It will readily be understood that in the production of articles such as type whose variations in size are measured by the 1,000 and 10,000 of an inch, and whose bodies must be rectangular, clean and free from fins, the matter of temperature and its incidents, expansion and contraction, is a very material factor, and it is to counteract or neutralize this disturbing element that the mold-blade, as well as its adjusting devices, are mounted directly upon the mold, and provision made for supplying a circulation of liquid in the side blocks 1 and 2 where it will contribute its beneficial action to the mold-blade.

The front block or cross-blade 3 is also preferably made separate from its base 10, to which it is rigidly attached by screws, some of the latter passing through a vertical plate 11 applied to the outer face of the cross-blade 3 and its base 10. Between the side vertical wall of the base and the cross-blade 3 is arranged an adjustable wear-plate 12, which is sustained in position by adjusting screws in the frame, as seen in Figures 20 and 21.

The base 10 of the cross-blade is formed in two sections slightly wider than the cross-blade itself and projecting beneath the blocks 1 and 2, Figure 20, and said sections of the base are separated by an interval forming a transverse groove 13 in which fits and reciprocates the ejector 14, the latter straddling a cam track 15 fixed to the base of the mold. The end of groove 13, when in vertical alignment with the space between blocks 1 and 2, forms the passage through which molten metal is injected into the mold-cavity, and the button or jet formed in this passage is discharged therefrom by the ejector 14 when the cross-blade is moved to uncover the front of the mold-cavity.

Directly beneath and in line with the mold-cavity the bottom plate of the mold frame is cut away for the reception of the nozzle plate 16. As is usual this plate is furnished on its under side with a conical seat for the reception of the nozzle, together with a jet opening or orifice; but it differs from others in having this seat formed with thin bell shape walls 17, and in having the supporting plate slightly concaved on the under side. Two objects are accomplished by this arrangement, in the first place, the chilling of the metal in the nozzle is avoided by diminishing the mass of the metal with which it is brought into close contact when the cast is made, and, in the second place, the warping and splitting of the nozzle plate resulting from the contact with the hot nozzle is prevented.

The rear portion of the mold-blade is perforated or slotted for connection with its adjusting connection, while the cross-blade is furnished with a hook, formed by an inserted block, for detachably connecting it to its actuating devices, all as will hereafter be explained.

It will be observed that the mold is a complete structure which can be readily removed for inspection, repair or substitution, and, further, that the mold-blade is supported and guided wholly by the members of the mold, so that all parts are subjected equally to variations in temperature, and the "hanging up" or "sticking" of the mold-blade, incident to the use of separate and more remote guides, is thereby prevented.

The Die-Case.

Strictly speaking, the die-case includes only the series of dies or matrices and the frame in which they are immediately supported; but, for convenience, the supports and guides in which it travels horizontally, for adjustment, and vertically, for engagement with the mold, will be described under this title.

The general arrangement will best be understood by reference to Figures 1 to 8, inclusive, and Figure 22, the details being found in Figures 9 to 18, inclusive.

The die-case 20, is not substantially different from that heretofore employed, except as to its attachment to the actuating mechanism. It is composed of an open rectangular frame 21, adapted to receive the die or matrix blocks 22, and furnished with parallel guides 23, on opposite edges. An arm 24, projecting from one end of

the frame and furnished with an open traverse groove or socket serves for connection with the die-centering mechanism.

The die or matrix-blocks 22, are rectangular in cross-section, of uniform dimensions, and provided at one end with a die cavity, and at the opposite or upper end with a conical seat 25, for the reception of the centering plunger. They are mounted on rods 26, in parallel series or columns extending longitudinally of frame 21 said rods passing through transverse perforations in the matrix blocks and seated, at opposite ends, in the cross-bars of the frame. The seats for rods 25, extend but part way through the cross-bar at one end of the frame 21, and entirely through the opposite cross-bar, the rods being retained in position by a detachable cap-piece 27, secured to the frame. As will be seen in Figure 18, the holes in the matrix blocks for the reception of rods 26, are of slightly greater diameter than the rods, and said matrix-blocks are not fitted tightly within the frame 21, but are permitted a very slight motion therein, which, together with the loose fitting upon the rods 26 permits any or all of the matrices to have limited vertical and horizontal play within the frame. The purpose of this movement will later appear.

Frame 21 is supported, through its edge-guides 23, in ways 28, formed in opposite lower edges of the die-case carrier 29, (Figure 15). To insure accuracy of movement of the die-case in its carrier, the former is provided with ribs 30, parallel with the edge-guides 23, and fitted to a central guiding way 31, on the die-case carrier. Provision is thus made for the accurate movement of the die-case in its carrier in one direction, and to permit of a similar movement of the die-case carrier 29, upon its supporting frame 32, but in a plane at right angles to the motion of the die-case, said carrier is furnished, on its upper side, with ways 33, and a central way 34, which are received upon parallel side guides 35, and center guide 36, on the lower face of supporting frame 32, (Figures 10, 11 and 13).

The centering of any matrix above the mold is effected by a movement of the die-case in its carrier, in one direction, and of the carrier on its supporting frame, in the other direction, these motions being produced and controlled by the die-centering mechanism.

Provision is made for a vertical motion of the die-case, to seat the selected matrix upon the top of the mold, to which end the supporting frame 32, is attached to the lower ends of two vertical guide-rods 37, passing through the overhanging horizontal portion or bridge forming part of the frame, (Figure 9), said rods being connected together at their upper ends by a cross-bar 38. The guides 39, for rods 37, are preferably in the form of sleeves passing through openings in the frame and adjustably secured thereto by nuts and shoulders, as illustrated in Figure 9, the said frame 32, is normally upheld against the lower ends of guides 39, by springs 40, each surrounding one of the guides 39, and bearing against a cap 41, adjustably attached to its guide rod 37, said cap 41, engaging the upper ends of the guides 39, and forming limiting stops for arresting the downward motion of the supporting frame 32, when the lower faces of the matrices, are brought to the level of the upper surface of the mold, and engage the latter, but without pressure thereon. Between the lower ends of the guides 39, and the supporting frame 32, may be interposed buffer plates to arrest shock and prevent noise. A stud or pin 42, on cross-bar 38, passes through a lever 43, pivoted at one end in a vertically adjustable support or rod 44, and a spring 45, is interposed between said lever 43, and the cross-bar 38, while a nut or head on the stud 42, prevents the escape of lever 43. This lever 43, constitutes the medium through which vertical motion is transmitted to the supporting frame 32, through spring 45, and against the upholding action of springs 40, in lowering the idle die-case, so as to bring the matrix just into contact with the lower face of the mold, the upper ends of the guides 39, forming seats for limiting the downward motion of said frame.

The die-case carrier 29, and its supporting frame 32, are formed with open centers for the passage of the centering plunger 46. This centering plunger is formed with a conical or tapered extremity 47, adapted to enter the conical seat 25, formed in the upper end of each matrix-block 22, for the purpose of accurately centering and firmly

holding the selected matrix in contact with the upper face of the mold, hence it is necessary that said centering-plunger should be accurately adjusted and guided. The means adopted for this purpose are best seen in Figures 9, 10 and 11. Within an opening in the bridge of the frame is located a flanged hub or sleeve 48, against which bear four adjusting screws 49, for centering said hub, the latter being secured in adjusted position by vertical bolts or screws passing through its flange into the frame. The opposite ends of this hub 48, are furnished with conical seats or bearings, the one to receive the conical head of the guiding sleeve 50, and the other to receive the conical split sleeve and nut 51, on the opposite end of said sleeve 50, the latter being split longitudinally (see Fig. 10), so that by means of nut and sleeve 51, it can be caused to contract, and thereby take up lost motion incident to the wear of the interior surface of said sleeve or the exterior surface of the centering-plunger 46, working therein. Vertical motion is transmitted to the centering-plunger through a head 52, and spring 53, the latter interposed between a shoulder on the plunger and the under side of head 52, while the opposite side of said head contacts with an adjustable nut on the plunger, so that the elevation of the plunger will be effected through positive connections and its depression, when centering and seating the matrix, through yielding connections.

When a comparatively heavy die-case and supporting frame are employed in conjunction with rapidly operating actuating devices, it becomes desirable to provide means for temporarily retarding the motions of the die-case while passing from one position of adjustment to another, leaving the parts free, however, when the final centering of the selected matrix is being performed by the centering plunger. In the present instance this is accomplished by two frictional braking devices, one of which is applied in connection with the actuating devices operating directly upon the die-case, while the other is applied to the die-case carrier, and is operated or thrown out of action by the vertical motion of the die-case, hence may properly be referred to in this connection.

On supporting-frame 32, and in line with each guide 35, is mounted a friction block or movable section 54, (Fig. 12). These blocks are preferably located opposite the centering plunger (Figs. 11 and 13), and have their inner edges pivotally attached to one of a pair of curved levers 55, (Fig. 14). Each of said levers 55, is pivoted to the supporting frame 32, above the point of attachment to its friction block 54, and has its free end extended beneath a pin 56, passing through the bridge of the frame. A spring 57, interposed between a shoulder on pin 56, and the stationary frame, operates to hold said pin towards the lower extreme of its vertical movement, which latter is determined by an adjusting nut on the upper end of the pin. When the supporting-frame 32, is elevated to the position it occupies during the adjustment of the die-case, levers 55, engaging pins 56, elevate the latter against the pressure of the springs 57, and said springs, bearing upon the free ends of the levers, press the latter downward and friction-blocks 54, outward, thereby increasing the frictional resistance to the movement of the die-case carrier upon its supporting-frame 32. When the supporting-frame 32, is depressed, to bring the centered matrix down onto the mold, and before the centering-plunger has entered and been seated within the rear end of the selected matrix, pins 56, will be arrested, thereby relieving levers 55 from the pressure of springs 57, thus withdrawing the additional frictional resistance due to the pressure of blocks 54, so that the die-case carrier will be free to move laterally under the influence of the centering-plunger.

The vertical motions communicated to the supportiag frame 32, through its lever 43, and to the centering-plunger 46, through its head 52, are derived from a single actuating lever 58, whose furcated end embraces head 52 between upper and lower shoulders thereon, while the free end of lever 43 is connected to said lever 48 by a link 59 at a point intermediate the head 52 and the fulcrum of said lever, (Figs. 3, 5 and 7).

By means of these connections the vertical motions communicated to the die-case and centering-plunger, although derived from the same prime mover, *i.e.*, lever 58, and coinciding both as to time and direction, differ as to extent of travel, that is to say,

the centering-plunger travels in the same direction, but at a greater speed, than the die-case. This permits the centering plunger to be entirely withdrawn from the matrix when in elevated position, and to overtake and enter the matrix during the downward motion of the die-case.

The horizontal adjustments of the die-case are performed while it is held in elevated position, as indicated in Figs. 7 and 9, with the centering-plunger entirely clear of the matrices. As soon as this preliminary centering of the matrix has been completed, the load arm of lever 48 is advanced towards the mold, thereby lowering the die-case until the latter is arrested by its limiting stops, which occurs when the matrix-block just makes contact with the mold, but without pressure. In the meantime, the centering-plunger will have overtaken the die-case and entered the centering cavity in the preliminary centered matrix, giving the latter its final adjustment, and the plunger continuing to advance after the die-case has been arrested, presses and holds the centred matrix firmly in position on top of the mold. During this final centering of the matrix the retarding frictional devices operating upon the dye-case and its carrier, have been relaxed or withdrawn, leaving the die-case free to respond to the centering action of the plunger, which action may only affect the selected matrix, or may extend to the die-case and its carrier, according to the degree of accuracy with which the die-case centering mechanism operates in effecting the preliminary centering.

Die or Matrix-Centering Mechanism.

As before explained, the centering of the matrices is effected by movements of the die-case in a horizontal plane, on lines intersecting at right angles, the motions in one direction being communicated directly to the die-case through arm 24, and those in the other direction, to the die-case carrier 29. It is obvious that these motions may be effected either separately or simultaneously, or that either may be employed singly, according to the location of the die-case at the time when the adjustment is to be made. Thus, in the example illustrated in the drawings, the types are graded, as to width, into fifteen sizes, whose increments are uniform throughout the series, and the matrices are arranged in fifteen parallel lines, extending transversely of the die-case, each line being composed of a complete series of fifteen matrices representing characters increasing progressively in width from one end of the line to the other. This brings all the matrices representing type of the same body width into alignment longitudinally of the die-case, there being as many columns of matrices as there are sizes of types, the column containing the widest type being located at one extreme of the series of transverse lines, and those of the smallest at the opposite extreme. If, for example, the right hand column is assigned to the type of maximum width, the next succeeding column to the left will contain characters of the next smaller dimensions, and so on throughout the series.

It will be seen, therefore, that the motions of the die-case in one direction will correspond to a change in position from one column to another, which is the same as the change from one size to another, while the movements of the die-case in the other direction, from line to line, will be equivalent to the selection of a particular letter in the column.

To effect and control these motions of the die-case, according to an organized system, is the purpose of the die-centering mechanism.

Although connected for conjoint action, there are, in effect, two controlling mechanisms, the one operating upon the die-case directly, and the other upon the die-case carrier, but, inasmuch as these two mechanisms are in the main duplicates, a description of one will serve in a measure for both.

As organized in the present machine, each of these mechanisms is made up of five elements or groups, to wit: (1) a primary controller or fixed gage; (2) a primary positioning or gaging mechanism; (3) a secondary controller or shiftable gage; (4) a secondary positioning or gaging mechanism, and (5) translating devices.

The primary controller or fixed gage.—This consists of a series of pins or stops, 65 arranged in fixed relation to each other, at distances apart equal and corresponding

of actuating mechanism will be found illustrated in Figure 114. The rear end of actuating rod 151 is pivotally attached to one end of the actuating lever 165 whose opposite end is pivotally connected to the frame, through a compression link 179 (Figure 7). The rear end of actuating rod 150 is in like manner connected to one end of a lever 166, whose opposite end is connected by a link 167 to lever 165 at a point intermediate its ends. The main driver or actuating lever 168 is in like manner connected by a link or pitman 169 to lever 166 intermediate its ends. With this arrangement of levers, when power is transmitted to lever 166 either end of the latter may become the fulcrum. Its actuating rod 150 is locked, the end of lever 166 connected to said rod becomes the pivot end, and motion will be transmitted from the opposite end of said lever to lever 165 and from the latter to actuating bar 151. If, on the other hand, actuating rod 151 is locked, the lower end of lever 166 becomes the pivot, and motion will be transmitted from the upper end of said lever to actuating rod 150. Thus, without changing the connections, the motions of the main driving lever 168 may be utilized for effecting the reciprocation of either transfer-block by the simple expedient of locking one of the two transfer-blocks against longitudinal motion; while, by means of the tripping devices, it can readily be determined which of the two transfer-blocks shall be locked and which brought into action. Compression link 179 is operative at all times during the advancing movements of the transfer-blocks and affords a yielding connection when the transfer-block is seated against its limiting stop or abutment.

Turning now to the means for effecting the adjustments of the justifying-wedges 141 and 142. These, it will be remembered, operate in conjunction with normal-wedge 132 and transfer-block 143. As will be seen by reference to Figures 44, 51 and 52, the vertical dimensions of these wedges is but about half that of the normal-wedge and each is furnished on its underside with a series of centering and holding notches or transverse grooves, corresponding in number to the columns of matrices in the die-case and to the primary controllers or pins 65 for gaging the movements of the die-case carrier. Each wedge is also provided with a head or projection 137 similar to that on the normal-wedge 132. As in the case of the normal wedge the jaws 94, 95, of the secondary positioning or controlling mechanism are utilized for effecting the movements of the justifying-wedges, but inasmuch as it is only required to adjust the justifying-wedges once for each line, whereas the normal-wedge is brought into action for the formation of each type, the justifying-wedges are maintained normally out of connection with the secondary positioning or gaging mechanism, and are connected therewith or thrown into action only when their adjustment is desired, for which purpose controllable actuating devices are employed. The two justifying-wedges 141, 142, at least those portions to which the projections 137 are applied, lie normally in a plane below wings 136, hence entirely beyond the control of the latter; and in order to bring them within the influence of said wings it is only necessary to elevate them or either of them, so that their projecting portions 137 shall stand between and within the range of motion of the two wings or jaws 136, it being understood, of course, that such elevation is to take place while the two wings or jaws are separated or opened to their fullest extent, as indicated by full lines in Figure 58. To provide for thus connecting and disconnecting the two justifying-wedges and their adjusting devices, and for accurately centering and locating them in adjusted position, the following arrangement has been devised and adopted:

Pivoted on frame 146 are two levers 170 and 171 (Figures 40, 41) each provided with two jaws 172 between which one of the justifying-wedges rests. The jaws of lever 170 are shorter than those of 171 and lie in the plane of justifying-wedge 141, while the longer jaws of lever 171 lie in the plane of justifying-wedge 142, as clearly appears in Figures 58 and 59. The justifying wedges ride between the jaws of their respective levers and are elevated and depressed thereby so as to bring their heads 137 into or out of the path of wings 136. Between levers 170 and 171, and mounted in fixed position upon frame 146 is a centering bar 173 with which the centering notches on the undersides of the two justifying-wedges co-operate, when said

to the distance between the center of one line or row of matrices and the center of the next adjacent line or row. Referring, for example, to the mechanism immediately controlling the die-case (Figs. 27 to 30, inclusive), whose movements correspond to a shifting from one line of matrices to another, each of the pins or stops 65, corresponds in relative position and arrangement to one line of characters in the die-case; while the stops or pins of the other series (Figs. 55 to 59), that belonging to the die-case carrier 29, correspond in position and arrangement to the several columns of matrices.

In the example illustrated provision is made for dealing with a die-case containing 225 matrices or a square containing 15 lines of 15 characters each, hence there are 15 stops or pins in each series.

The terminal pin or stop marked 65* is fixed, while all of the others in the series are movable or so arranged that any one may be brought into position for engagement by the co-operating portion or portions of the primary positioning mechanism. In the preferred form of embodiment, the movable pins 65, of each series are pneumatically controlled, as hereinafter explained, to which end each pin is provided with a piston head 66, and retracting spring 67, (Figs. 42 and 63), arranged in a cylinder formed in a supporting plate 68. For convenience of construction this supporting plate 68, is detachably secured to the top plate of the frame, and is formed with the series of cylindrical perforations, constituting the cylinders, the lower end of each cylinder registering with a supply pipe passing through the bed-plate. Inasmuch as it is very desirable that the pins should be accurately located, their upper ends are passed through and guided by a plate 69, overlying the cylinder plate 68.

The primary function of the series of pins 65, is to furnish a controllable gauge for designating and locating the position of each line of matrices contained in the die-case.

The primary positioning or gaging mechanism.—The principal function of this mechanism is to adjust the position of the secondary controller or shiftable gage, to correspond with a designated pin or stop 65, of the primary controller or fixed gage, and the preferred means for accomplishing this will next be described.

Supported to reciprocate upon a fixed guide or bar 70, above and parallel to plate 69, are arranged a pair of jaws or clamping members 71, 71*. One of these jaws 71 is provided with a plate or flange 72, lying in the paths of the several pins 65, when elevated or projected into operating position, while the underside of the opposing jaw (71*) lies in a plane above the extremities of the pins. If, now, any one of the series of pins 65, is elevated, or if the movable pins remain down, and the fixed pin alone stands in the path of jaw 71, and said jaw is moved until its plate 72, contacts with the elevated pin, it is obvious that the position at which said jaw is arrested will coincide with that of the pin against which it bears, and if the opposite jaw 71*, is brought up into contact with the first named jaw, the line of division between the two jaws will coincide as to position to that of the selected pin.

A novel system of actuating devices has been devised for giving motion to these two jaws, whereby, during each revolution of the driving shaft, the two jaws shall separate or assume positions at opposite extremes of their movements, and, in closing or moving toward each other from these extreme positions, that one of the jaws which is to contact with the primary controller or fixed gage, shall be first advanced and its motion continued until arrested by the designated stop, whereupon the other or opposite jaw will be set in motion and caused to advance until it contacts with the previously arrested jaw. The mechanism for effecting these movements comprises two levers 73 and 74, connected together at their inner ends by an adjustable link 75, and each having its outer end pivoted to one of the jaws 71, 71*. Lever 73 is pivotally attached to a link 76, whose opposite end is pivotally supported upon a post secured to the main frame; while lever 74 is similarly connected, by a link 77, to a post or pin carried by a horizontal bell crank lever 78. It will be observed that this system of levers is furnished with but one fixed point of support or center of motion, to wit, the post to which link 76 is connected; that motion is transmitted from the

prime-mover, or driver, (bell-crank 78), through its connection 77, with lever 74, the latter being bodily movable toward and from the fixed pivot of lever 73, by virtue of its connection with the latter; and that both levers 73, 74, are, at the same time, capable of oscillating about the points of attachment to their respective links 76, 77. It results from this arrangement that starting from the position shown in Figure 27, with the jaws open, when the actuating lever 78, is moved to the left, it will operate first to advance the right-hand jaw 71, or that provided with the edging plate 72, until the latter makes contact with and is arrested by one of the elevated pins or stops 65, of the primary controller or fixed gage. During this motion lever 73 remains stationary, the jaw attached thereto remaining against the stop at the outer extreme of its movement, where it is held by a spring 79, connected to lever 73, intermediate link 76 and said jaw, so that the pivot connecting lever 74 to link 75 is for the time being the fulcrum of said lever. As soon, however, as the outer end of lever 74 is arrested by the contact of its jaw with the stop pin, the fulcrum is shifted to the outer end of the said lever and the inner end becomes the power arm, from which motion is transmitted, through connecting link 75, to the inner end of lever 73, thus causing the latter to turn upon the pivots of its link 76, and, overcoming the tension of the spring, moving the opposite jaw 71*, up against the stationary jaw.

As will be seen most clearly in Figures 2, 22 and 25, these lever systems are duplicated for effecting the two motions of the die-case, each system being connected to one arm of the bell crank lever 78; and, in order to equalize the spring action on the corresponding levers 73, for retracting said levers and opening the jaws upon the reverse movement of the bell crank, spring 79 is attached to one end of a lever 80, pivoted upon a fixed support on the frame, while the opposite end of said lever is attached to another spring 81, the latter being in turn connected (through a bell-crank lever 82 carried by bell crank 78, and link 83) to lever 73, at a point intermediate its link 77, and the connecting link 75. Springs 79 and 81 are under initial tension, and they are connected through lever 80 for the purpose of equalizing their action upon the two systems.

Although the two systems of levers above referred to are practically the same, there is a slight difference in the arrangement of the connections, and that is, lever 74, which is connected to the jaw 71 is pivotally connected to the post on the frame, instead of to bell-crank 78, while lever 73 is pivotally connected to bell crank 78, and the spring retractor is attached to the inner arm of lever 73, from which it results that the movement of lever 78 in a direction to close the jaws, causes the inner end of lever 73 of the die-case carrier system to advance, and, acting upon the inner end of lever 74, swings the latter and carries its jaw 71, forward until it encounters the stop-pin, after which the inner end of lever 73 becomes the fulcrum point about which its movements take place in advancing the opposite jaw 71*.

Both sets of jaws 71, 71*, open simultaneously, preliminary to the setting of their primary controllers, but each operates independently with respect to the latter; that is to say, the point at which one set of jaws is arrested does not in any degree affect the position or movement of the other set of jaws.

The secondary controller or shiftable gage.—Having explained how the primary positioning or gaging mechanism is operated and governed by the primary controller, the next in order is the secondary controller or shiftable gage, whose function it is to control the position of the secondary positioning or gaging mechanism. It consists of a movable block or abutment 84, (Fig. 43), located between jaws 71, 71*, and mounted to reciprocate parallel therewith, with a locking device for effecting final adjustment, and holding it in position. To this end the block 84, is supported upon a slide 85, the latter mounted to reciprocate in guides parallel with the movements of jaws 71, 71* and furnished with a regular series of centering and holding detents, composed, in the present instance, of a series of racklike teeth 86. One or both of the jaws 71, 71*, of each set is cut away or recessed to form a seat for the reception of this secondary controller or shiftable gage 84, said seat being of such dimensions that when the jaws are closed the said shiftable gage will be held therein after being

brought to position by the movement of either one of the jaws constituting a set. Preferably but one jaw 71*, of each set is recessed, the face of the opposite jaw 71, forming one wall of the recess, and, if desired, the sliding jaw 71 may be provided with a pivoted and spring retracted engaging lever 91, (Figs. 22 and 79), whose free end stands in line with the secondary controller 84, thus forming a yielding contact for engaging and locating said controller.

The shiftable secondary controller or gage occupies at all times a position intermediate the jaws 71, 71*, and no matter where located at the time the jaws are separated, it will, by the closing of the jaws, be brought to a position corresponding with that of the primary controller or fixed gage.

To ensure a very accurate adjustment of the secondary controller after it has been brought to position, and to lock it against movement while the primary controlling mechanism is being reset or opened preliminary to the next adjustment, a locking bolt 87, adapted to enter between the converging walls formed by rack teeth 86, is employed for each of the secondary controllers. Both locking bolts 87 are operated simultaneously, to center and hold or release the secondary controllers, through the agency of a bell-crank lever 88 (Fig. 33), to which end each locking bolt is furnished with a longitudinally adjustable stem 89, carrying a spring and sliding head 90, between limiting stops. An arm of lever 88 engaging said sliding head 90 acts through its compression spring to advance the locking bolt and hold it in engagement with the notches in the secondary controller, while the retracting movement is positively effected by engagement with the shoulder on stem 89.

The secondary positioning or gaging mechanism.—This acts directly in connection with the secondary controller or gage 84, after the latter has been set or adjusted. Although the two mechanisms are substantially the same in construction and operation, it will be more convenient to consider them separately, in order to distinguish between them in other connections.

Each comprises two jaws or oppositely reciprocating blocks adjacent to the jaws 71, 71*, of the primary positioning or gaging mechanisms, those pertaining to the mechanism acting directly upon the die-case being numbered 92 and 93, (Figs. 23, 24, 27 to 30, inclusive, and 42), and those pertaining to the die-case carrier operating mechanism being numbered 94 and 95, (Figs. 57, 62, 63). Each set of jaws 92, 93 and 94, 95, has one of the secondary controllers, 84, located between its members in position to be engaged thereby, the said jaws being supported in guides directly above the slide or support 85 carrying the movable block or abutment constituting said secondary controller 84.

Each pair of jaws 92, 93 and 94, 95, is controlled and actuated, to open or move away from, and to close or engage upon its controller 84 by a system of levers corresponding, generally, with those which actuate the jaws 71, 71*, of the primary positioning or gaging mechanism. Thus jaw 92 is privotally attached to the outer end of a lever 96, the latter connected at a point intermediate its ends by a link 97 to a pivot on bell crank 78; jaw 93 is pivotally attached to the outer end of lever 98, which latter is connected at a point intermediate its ends, by a link 99, to a fixed pivot on the frame; and the two levers 96 and 98 are connected at their inner ends by an adjustable link 100. In like manner the levers pertaining to jaws 94, 95, are connected to the opposite arm of bell-crank lever 78, that is to say, lever 101 is connected at its outer end to jaw 94, and by a link 102, to a fixed pivot on the frame, while its inner end is connected by an adjustable link 103 to the corresponding end of lever 104, carrying opposite jaw 95, said lever 104 being, in turn, connected by a link 105 to the bell-crank lever 78.

By reference to Figures 22 and 25 it will be seen that the levers of the secondary positioning or gaging mechanisms are connected up oppositely to the levers of the primary positioning or gaging mechanism with which they are associated; that is to say, (referring, for example, to the devices pertaining directly to the die-case movement), while the outer lever 73, or that most remote from the mold, is connected to the pivot on the frame, the corresponding lever 96 of the secondary positioning jaws is connected to the bell-crank lever 78, the opposite levers of the two pairs

being connected respectively to bell-crank lever 78, and to the fixed pivot on the frame.

This reversed order of connection is adopted in order that the two sets of jaws may be moved simultaneously in opposite directions, so that while one set of jaws is closing upon its stop or controller, the other set will open in order that its stop or controller may be set, and *vice versa*.

The secondary controller 84 having been set in position by and during the approach of jaws 71, 71*, and jaws 92, 93 and 94, 95, of the secondary controlling mechanism, having been opened or separated, when the motion of the driving lever 78 is reversed to open jaws 71, 71*, it will bring the jaws of the secondary controlling mechanism together upon opposite sides of the secondary controller 84, the latter serving to determine the point within its range of adjustment at which the jaws of the secondary controlling mechanism shall be brought together.

The translating devices.—The next and last element in this series includes the translating devices, or those through which the adjustments thus effected are made operative upon the die-case and the die-case carrier.

It will be remembered that in addition to the movement from line to line, or in a direction longitudinally of the die-case, the latter is susceptible of a transverse motion communicated through its carrier 29, hence provision must be made in the die-case shifting mechanism to accommodate these lateral motions. First, as to the longitudinal movements of the die-case. In the supporting plate 68, and parallel with the pins in which jaws 92, 93, of the secondary controlling mechanism is formed, a guide or way for the reception of a slide 106 (Figs. 31, 42 and 44) provided with a cross-head 107. This cross-head rides upon ways 108 (Figs. 23, 38, 39, 56), and is furnished with an upwardly projecting rib 109, and two forwardly projecting arms or seats 110. A yoke-plate 111, having a slot, or opening, wider than rib 109, fits over the latter and rests upon arms 110, said yoke being firmly secured in position by screws. The purpose of this construction is to furnish a cross-bar or seat, at right angles to slide 106, adapted to receive and fit between the shoulders or engaging walls of the slot formed in arm 24 of the die-case frame 21, so that the latter will be free to move across the path of slide 106, but will follow accurately the longitudinal motions of said slide; at the same time the construction is one which permits the ready application and removal of the die-case. It is obvious that the yoke-plate 111 and slide 106 might be formed integral, but inasmuch as the greatest amount of wear occurs upon the yoke, and it is desirable that it should be made with true surfaces, it is preferably formed separate from its supporting slide and attached thereto in the manner explained in order to secure fixety of adjustment.

A headed rod 112, is adjustably secured to cross-head 107, as by means of a split socket and pinching screw, said rod extending parallel with slide 106 and through an opening in jaw 93 of the secondary positioning mechanism, thus bringing its head intermediate jaws 92, 93, and in position to be engaged by the latter.

Inasmuch as the die-case carrier is given a lateral motion, its horizontal movements being all in one direction, the translating devices are connected directly to said carrier (Fig. 15), hence a headed rod 113, is adjustably attached to a split socket on the die-case carrier 29. As the point of attachment of the rod 113 to the die-case carrier is slightly to one side of jaws 94, 95, though parallel therewith, its headed end is received between the proximate faces of a lateral projection 114 on jaw 94 (Fig. 63), and a wing or projection 115 on jaw 95 (Fig. 62). This arrangement is not substantially different from that of the translating devices for the die-case, and is only made to accommodate the parts to slight changes in position due to the presence of other elements in the machine.

It may here be remarked that slide 106 furnishes a convenient point of application for the friction device, hereinbefore mentioned as the complement of friction blocks 54 operating upon the die-case carrier. To this end a friction plunger or block 116 (Figs. 22, 23,) is arranged to bear upon the upper surface of slide 106, and is operated upon by lever 117, to whose outer end is connected a link 118, (Fig. 40,) passing upward through a lug on actuating lever 58, said lug engaging a shoulder

being connected respectively to bell-crank lever 78, and to the fixed pivot on the frame.

This reversed order of connection is adopted in order that the two sets of jaws may be moved simultaneously in opposite directions, so that while one set of jaws is closing upon its stop or controller, the other set will open in order that its stop or controller may be set, and *vice versa*.

The secondary controller 84 having been set in position by and during the approach of jaws 71, 71*, and jaws 92, 93 and 94, 95, of the secondary controlling mechanism, having been opened or separated, when the motion of the driving lever 78 is reversed to open jaws 71, 71*, it will bring the jaws of the secondary controlling mechanism together upon opposite sides of the secondary controller 84, the latter serving to determine the point within its range of adjustment at which the jaws of the secondary controlling mechanism shall be brought together.

The translating devices.—The next and last element in this series includes the translating devices, or those through which the adjustments thus effected are made operative upon the die-case and the die-case carrier.

It will be remembered that in addition to the movement from line to line, or in a direction longitudinally of the die-case, the latter is susceptible of a transverse motion communicated through its carrier 29, hence provision must be made in the die-case shifting mechanism to accommodate these lateral motions. First, as to the longitudinal movements of the die-case. In the supporting plate 68, and parallel with the pins in which jaws 92, 93, of the secondary controlling mechanism is formed, a guide or way for the reception of a slide 106 (Figs. 31, 42 and 44) provided with a cross-head 107. This cross-head rides upon ways 108 (Figs. 23, 38, 39, 56), and is furnished with an upwardly projecting rib 109, and two forwardly projecting arms or seats 110. A yoke-plate 111, having a slot, or opening, wider than rib 109, fits over the latter and rests upon arms 110, said yoke being firmly secured in position by screws. The purpose of this construction is to furnish a cross-bar or seat, at right angles to slide 106, adapted to receive and fit between the shoulders or engaging walls of the slot formed in arm 24 of the die-case frame 21, so that the latter will be free to move across the path of slide 106, but will follow accurately the longitudinal motions of said slide; at the same time the construction is one which permits the ready application and removal of the die-case. It is obvious that the yoke-plate 111 and slide 106 might be formed integral, but inasmuch as the greatest amount of wear occurs upon the yoke, and it is desirable that it should be made with true surfaces, it is preferably formed separate from its supporting slide and attached thereto in the manner explained in order to secure fixety of adjustment.

A headed rod 112, is adjustably secured to cross-head 107, as by means of a split socket and pinching screw, said rod extending parallel with slide 106 and through an opening in jaw 93 of the secondary positioning mechanism, thus bringing its head intermediate jaws 92, 93, and in position to be engaged by the latter.

Inasmuch as the die-case carrier is given a lateral motion, its horizontal movements being all in one direction, the translating devices are connected directly to said carrier (Fig. 15), hence a headed rod 113, is adjustably attached to a split socket on the die-case carrier 29. As the point of attachment of the rod 113 to the die-case carrier is slightly to one side of jaws 94, 95, though parallel therewith, its headed end is received between the proximate faces of a lateral projection 114 on jaw 94 (Fig. 63), and a wing or projection 115 on jaw 95 (Fig. 62). This arrangement is not substantially different from that of the translating devices for the die-case, and is only made to accommodate the parts to slight changes in position due to the presence of other elements in the machine.

It may here be remarked that slide 106 furnishes a convenient point of application for the friction device, hereinbefore mentioned as the complement of friction blocks 54 operating upon the die-case carrier. To this end a friction plunger or block 116 (Figs. 22, 23,) is arranged to bear upon the upper surface of slide 106, and is operated upon by lever 117, to whose outer end is connected a link 118, (Fig. 40,) passing upward through a lug on actuating lever 58, said lug engaging a shoulder

beneath it on the rod, and a spring above it, so that during the downward motion of the actuating lever, to depress and center the matrix, the pressure of friction block 116 will be released, and when said actuating lever is elevated, while the adjustment of the matrix is being effected, the friction block will be held, under the elastic pressure of its spring, in contact with slide 106, thereby exerting a limited degree of resistance to motion.

The operations of the die-case centering mechanism are illustrated in the diagramatic views, Figs. 27 to 30, inclusive. Fig. 27 represents the die-case actuating devices immediately after a cast has been made. The secondary controller 84 has been located, and jaws 92, 93, of the secondary positioning or gaging mechanism have been closed upon it, and, in so doing, have, by engagement with the head of rod 112, brought the die-case to position. Locking bolt 87 has been withdrawn, and the parts are in position for the next succeeding adjustment. Jaws 71, 71*, of the primary positioning mechanism being open, that is, separated, the primary controller or pin 65 representing the position in the line of the next character to be formed is projected into the path of jaw. Assume, for example, that the next character or matrix is the first in the line, or that represented by the first of the series of pins 65. Said pin is projected into the path of jaw 71, the bell-crank lever 78 is operated to close the jaws, and at the same time open or separate the jaws of the secondary controlling mechanism. The result is as indicated in Figure 28, the translating device is released and the secondary controller 84 brought to its new position and locked. A reversal of the motion of lever 78 separates jaws 71, 71*, of the primary positioning mechanism and closes jaws 92, 93, of the secondary positioning mechanism upon the secondary controller 84, at the same time shifting the translating devices from the former position, indicated in Figure 27, to the new position of the secondary controller, as indicated in Figure 29. In like manner the adjustment is made for each position, and is determined by the primary controllers. In Figure 30 the shifting of the secondary controller to a position corresponding with the 8th pin is represented.

Corresponding movements of adjustment are performed with respect to the centering mechanisms operating upon the die-case carrier, and it will be apparent that by the conjoint action of both mechanisms, any matrix in the series may be brought into position above the mold, by merely selecting one pin corresponding to the line and another corresponding to the column.

It will be noted that the adjustments of the die-case and of its carrier from one position to another are performed directly, without necessity of returning either the die-case or its carrier to a zero position, whereby excessive motion is avoided and the traverse of the die-case is reduced to the minimum; and where the same letter is repeated no lateral motion of the die-case in either direction is required, it remaining in one position, although its actuating devices operate as before, but without moving the die-case.

So far as the mere operation of moving the die-case to correspond with the various positions indicated by the primary controller or gage is concerned, the translating devices might be connected to one of the jaws of the primary controlling mechanism or to the secondary controller 14, provided both jaws 71, 71* were adapted to contact with the primary controller lying between them, as is done in the case of the jaws of the secondary controlling machinism, where no spring is required. But such an arrangement would be inadequate to deal with a defective record-strip, such as would cause the simultaneous elevation of two or more pins 65 between the jaws, and owing to the necessarily rapid motions of the jaws, the shocks and strains upon the primary controller incident to inertia would tend to disturb the delicate adjustments requisite for the proper centering of the matrices. It is with a view to effecting an improvement in these features that one jaw only of the primary controlling mechanism is arranged to engage the primary controller or gage and the spring applied so that in the event two or more stop-pins 65 are projected into the path of the jaw, the latter will engage the first one, the opposite jaw moving over the pins and contacting with the arrested jaw.

Moreover, by employing the two controlling mechanisms more time is allowed for effecting the necessary movements of the die-case, and the shocks incident to the arrest of the die-case are borne by the secondary instead of by the primary gage.

Normal Mold Adjusting Mechanism.

Accurately speaking, this mechanism might be said to include only those devices which operate to determine the position of the mold-blade when in casting position, but inasmuch as they are directly associated with the mechanism to which the mold-blade is connected and by which it is moved, both for ejecting the type from the mold and for returning it to casting position, it has been thought proper to describe the connections for moving the mold-blade under this head.

Referring particularly to Figures 23, 38, 39, 40, 44, and 56, it will be seen that the mold-blade 4 is attached to the front end of a slide 120 by a detachable cross-pin 121, passing through arms of the slide and the perforation in the rear of the mold-blade. This slide 120 has a vertical opening in rear of the point of attachment of the mold-blade for the accommodation of a stop or abutment for limiting the rearward movement of the said mold-blade, and the rear end of said slide is connected to a rod 122 (Figure 44) passing through the frame below slide 106. This rod 122 carries two springs 123 and 124, the former engaging a shoulder on the rod, and the latter, a nut or collar on the outer or free end of the rod.

The interval between spring 123 and the shoulder on the outer end of the rod is occupied by three sleeves, to wit, a headed or flanged sleeve 126 next spring 123, a sleeve 125 on the outer end of the rod, and a wider sleeve 125* intermediate sleeves 125 and 126.

Spring 124 surrounding sleeve 125 engages a collar 127 riding loosely on said sleeve, to hold it against the end of sleeve 125*.

Embracing sleeve 125*, which latter is flattened on opposite faces (Figure 23), is the furcated end of a lever 128, the latter being somewhat narrower than the interval between collars 127 and the flanged head of sleeve 126, and said lever is connected by a link to its actuating lever 178 (Figure 2).

The operations of these parts will be explained in connection with the normal mold-blade adjusting mechanism. It is sufficient, for present purposes, to state that they constitute the means for communicating reciprocating movements to the mold-blade.

Beneath slide 120, and guided to reciprocate in ways parallel therewith, is another slide 129 (Figures 44, 47 and 48), which is furnished with a stop or abutment 130 standing vertically in the opening in slide 120 and occupying a position immediately in rear of the mold-blade 4. For convenience of adjustment the engaging face of this stop or abutment is rendered adjustable, as by the application of a set screw 131 at this point, one end of the latter standing in line with the rear end of the mold-blade, as seen in Figure 44. It is by the setting or adjusting of this stop or abutment 130 during the forward or ejecting movement of the mold-blade, that the width of the mold is determined for the next type, said stop operating to intercept the rearward motion of the mold-blade at the proper point, and these operations are performed through the medium of what is herein termed the normal-wedge 132 (Figure 50) and the lower transfer block 133 (Figure 46) as will presently appear.

Slide 129 is furnished on the under side with a shoulder or abutment between which and a fixed surface on the frame are arranged the normal-wedge 132 and its transfer-block 130, the two latter extending in a plane substantially at right angles to the direction of motion of said slide (see Figure 44).

The normal-wedge 132 and its transfer-block 133 together constitute a pair of reversed wedges, either or both of which may be varied, as to its angular dimensions, in fixing the size of and the ratio of variation between the types of the particular series being made.

In order, however, to minimize the number of parts or elements to be changed in order to adapt the machine to different kinds or systems, as in changing from brevier to pica or from the American to the English system, the transfer-block is constituted the constant and the normal-wedge the variable factor.

The longitudinal reciprocations of the transfer-block are uniform in extent, and its principal function is to set the abutment slide 129 after the normal-wedge has been adjusted, hence its angle is or may be constant for all kinds of type; and in order that its action may be uniformly and properly gaged, the fixed abutment (preferably formed by a detachable plate 134) has its face inclined to correspond with the engaging face of the transfer-block, while the proximate faces of the normal-wedge and the transfer-block are also given the same angle of inclination.

If the machine is constructed to deal with but one kind of type, the angle of the normal-wedge will be calculated so that each of its fifteen degrees of motion will produce a one-unit variation in the position of the abutment-slide, and in such case either or both faces of the wedge might be inclined to the direction of its motion; but when, as in the example illustrated, the machine is adapted to form different kinds of type, the face of the normal-wedge next the abutment-slide 129 is tapered, in order that any one of a series of normal-wedges with different degrees of taper suited to the different kinds of type, may be inserted between the abutment-slide and the transfer-block, and be made to work in harmony with the latter by reason of the uniform angle of the surface contacting with said transfer-block.

The face of the normal-wedge next the abutment slide thus becomes the variable element, and by increasing or diminishing its angle the ratio of variation between different sized type of the same series can readily be calculated and provided for.

To accommodate normal-wedges of various angles and dimensions, the abutment-slide 129 carries a self-adjusting contact in the form of a block 135 (Figure 49), whose rear surface is curved to fit within a seat in slide 129, and it is held from displacement by a pin on said slide riding in a groove in one end of the block.

It will readily be seen that by changing the position of either the normal-wedge or its transfer-block, the slide 129 carrying abutment 130 can be adjusted or set so as to intercept the mold-blade at any desired point in the line of its backward travel.

Both means of adjustment are utilized in the present machine, the one manual and the other automatic.

The manual adjustment is applied to the transfer-block, and includes the devices for regulating the position of the transfer-block when at one extreme of its movement, its operating position.

The automatic adjustments are effected through the normal wedge alone, the transfer-block being utilized for the purpose of moving the abutment to position after the normal-wedge has been set, and to shift the action of the normal-wedge into connection with the abnormal or justifying mechanism, as will presently appear.

To accomplish this, it is required that the transfer-block 133 should when retracted or inactive occupy the position indicated by dotted lines in Figure 55, thus leaving the normal-wedge free for adjustment, so that after the latter operation has been performed, the transfer-block may be drawn to the position indicated by full lines in Figure 55, thereby effecting the proper adjustment of the abutment-slide. The mechanism for bringing the transfer-block into action at the proper times will be explained in connection with the justifying mechanism. At present the description will be directed to the means for adjusting or setting the normal-wedge.

The angle of the normal-wedge is adjusted to the particular system adopted. Thus if the type bodies are arranged in 15 groups or divisions, with a uniform rate of increase, the taper should be such that 15 equal degrees of movement will cover the entire range of variation in body-width, from the widest to the narrowest. Such being the case, it is only necessary, in order to effect an adjustment of the mold corresponding to the width of type represented by the several columns of matrices in the die-case, to shift the normal-wedge so that its position shall coincide with that

of the column in which the selected character to be formed is found. To effect this adjustment rapidly, accurately and in harmony with the motions of the other mechanisms, the jaws 94, 95, of the secondary positioning or gaging mechanism acting upon the die-case carrier are utilized, to which end each of said jaws is provided with a horizontal extension or wing 136 and the normal-wedge 132 is furnished with a pin or projection 137 fitting the interval between said wings when jaws 94, 95 are in closed position.

It will be borne in mind that these jaws 94, 95 are brought together upon the secondary controller 84 in locating any column of matrices over the mold, and that the column is determined by the selected primary controller 65, hence the same devices which operate to position the die-case carrier are utilized to effect a corresponding movement or adjustment of the normal-wedge, thereby adjusting the width of mold cavity to the selected column of matrices.

Inasmuch as accuracy of adjustment is necessary, the normal-wedge is further provided with a series of equally spaced and accurately located transverse grooves 138 for the reception of a locking and centering pin 139 (Figure 38), the latter passing through a split adjusting sleeve 140 and being connected at its upper end to the lever 58 by which the die-case is depressed into contact with the mold. Lever 58 acts positively against a shoulder on the upper end of the locking-pin, to raise the latter out of engagement with the normal-wedge, and it operates yieldingly, through a spring, to depress and hold said pin in engagement with the normal-wedge after the latter has been adjusted and while a cast is being made. While the normal-wedge is being thus held, the setting devices or wings 136 open or separate preparatory to the next succeeding adjustment, which latter is effected by simply moving the wedge from the last previous point of adjustment to the next, instead of carrying it back to zero between succeeding adjustments.

We have thus far considered those adjustments of the mold-blade which correspond to the normal variations in the body widths of the type and to the 15 columns represented by matrices in the die-case, and the same is true as to such space-type as correspond to any of the 15 dimensions mentioned, it being of course understood that for space types the matrix-block is not provided with a die-cavity. But the more important, or at least equally important, element in the machine is the provision for abnormal adjustments, whereby justified lines of type are produced.

The Justifying Mechanism.

This embraces, in addition to the normal-wedge 132, the two justifying-wedges 141 and 142 (Figures 51 and 52) and a transfer-block or wedge 143 operating in conjunction with the slide carrying the mold-blade stop or abutment 130. Although a single justifying-wedge might under certain conditions be employed, two are preferred as affording a greater range and finer adjustment. The range of motion of the two justifying-wedges 141 and 142 is the same as that of the normal-wedge, and, like the latter, is divided into 15 equal periods or degrees. In the example given, one wedge 141 has a taper giving an adjustment equal to ·0005 of an inch for each degree of longitudinal motion, while the other wedge 142 has a taper giving an adjustment of ·0075 of an inch for each degree of motion.

The transfer-block 143 is located directly above transfer-block 133, and occupies a position between the justifying-wedges and the normal-wedge.

To effect justification it is required that the transfer-block or wedge 133 should be held out of action, the transfer-block or wedge 143 be brought into action, and either one or both justifying-wedge 141, 142, be adjusted to position in order that the variation in the position of the mold-blade abutment, due to the action of the justifying-wedges, may be superadded to the adjustment effected by the normal-wedge when a space type is to be produced.

First as to the means for determining which set of adjusting devices shall be operatively connected with abutment-slide 129, the normal-wedge alone, or the normal and justifying-wedges. The selection is made through the medium of

transfer-blocks 133 and 143, the former serving to connect the normal-wedge alone, and the latter the normal and justifying-wedges. The actuating mechanism for these parts is such that one or the other, but not both, of the transfer-blocks shall be operative during each revolution of the driving shaft, thus rendering active the system of adjusting devices to which it pertains by interposing the wider portion of the transfer-block between the controlling adjusting element or elements and the movable mold-blade abutment.

What may be regarded as the starting positions of the two transfer-blocks are those which they assume after the cast has been made and preliminary to the next adjustment, at which time both transfer-blocks have their wider portions projected beyond or to one side of slide 129, their smaller or narrower portions lying beneath said slide, thereby relieving the latter from the pressure of the wedges and permitting it to be retracted by a spring 144 (Figure 23), as indicated in Figure 57. It is while this condition exists that the adjusting wedges are set, in the event a change of adjustment is to be made, but if not, they retain their positions, although for the time rendered inactive.

The withdrawal of the transfer-blocks from operating position is accompanied by a movement of abutment slide 129 under the influence of spring 144, thus maintaining contact between the sliding surfaces, and preventing the admission of dirt or the formation of a film of oil which might interfere with the accurate adjustment of the mold-blade.

It is important that the two transfer-blocks, 133 and 144, should be susceptible of accurate adjustment, more especially in their forward or active positions, and that they should be loosely or flexibly connected to their actuating devices, both to enable ready removal and replacement, and to render their action as independent as possible of that of their connected actuacting devices.

First as to adjustment. When in operating position transfer-blocks 133 and 143 are brought into engagement with a fixed abutment or limiting gage for accurately determining their position relative to abutment-slide 129 and the adjusting wedges. Such a limiting abutment, with capacity for accurate adjustment, is present in wedge 145 (Figures 38 and 54) whose vertical face stands at right angles to and across the line of movement of the inner ends of the two transfer-blocks. This wedge is mounted in a detachable frame 146, and is adjustable vertically by means of rod 147 and nuts 148. To provide independent adjustment for the two transfer-blocks, one of them, in the present instance the upper one 143, is furnished with an adjusting member, such as screw 149, for contacting with wedge 145. Thus slight variations in the positions of the two transfer-blocks with relation to the fixed limiting stop or abutment can be effected.

The transfer-blocks are reciprocated horizontally through the medium of two rods 150, 151, lying one above the other and each provided with a hooked extremity for engagement with a corresponding hook on the inner end of its transfer-block. The connection is one adapted to permit a limited degree of lateral motion of the transfer-block with relation to its connected actuating bar, such as is occasioned by the adjustment of the normal and justifying wedges. The two rods 150, 151, pass through an opening formed in the lower end of a transverse or vertical locking-rod 152 (Figures 35, 36 and 39) and each of said first named rods is furnished with a notch 153 so related to the movements of the transfer-blocks that when at the extreme of their outward movements, that is, with their wider ends most remote from the abutment 145, the notches 153 will stand in line with locking-rod 152, in position to be entered and held by the latter. Actuating rod 150 carrying transfer-block 133 has its notch 153 in its lower face, while the corresponding notch in the actuating rod 151 of transfer-block 143 is in the upper face thereof, so that when locking-rod 152 is depressed it will enter the notch in actuating rod 151, thus holding the latter and its transfer-wedge 143 against longitudinal motion, while permitting the lower actuating rod 151 and its transfer-block to move freely through the opening in locking-rod 152; but when said rod 152 is elevated the conditions will be reversed, actuating rod 150 being held, and 151 permitted to reciprocate,

The interval between the two locking shoulders of rod 182 is slightly less than the aggregate thickness of rods 150, 151, so that the release of one rod will not take place until after the other has been engaged. The movements of locking-rod 152, whereby one or the other of the two actuating rods 150, 151, is locked in position, take place when the transfer-blocks are both at the outer extremes of their movements and both notches 153 are in line with locking-rod 152, and the motions of the latter are derived from lever 58 through a controllable system of actuating mechanism which will next be described.

The prime factors of this mechanism are a main driver or reciprocating member, such as the lever 58, and controllable connections intermediate said main driver and the locking devices or rod 152, whereby the latter can, at proper intervals, be thrown into engagement with either of the rods 150, 151, thereby arresting either transfer-block 133, 143, so as to hold it out of action, leaving the other free to act. A competent mechanism for this purpose is illustrated in Figures 34 to 37, 39 and 40. The locking-rod 152, guided and supported in frame 146, has its upper end attached to a block or cross-head 154, the latter riding vertically upon a guide pin secured to the frame. This cross-head 154 extends laterally over a lever 155, also pivoted to the frame 146, the said lever and cross-head being united by a yielding connection competent to hold the locking-rod at either extreme of its movement under elastic pressure. Such a connection is formed by guide rod 157 passing loosely through cross-head 154, and having its lower headed end seated in lever 155. Rod 157 is provided immediately above its head with a loose washer 158 engaging lever 155, and between said washer and a loose sleeve is interposed spring 156 through which the vertical motion of lever 155 is transmitted to the locking rod. Between a fixed portion of frame 146 and washer 158 is interposed another spring 159, which operates to depress guide rod 157 and lever 155, and thus hold the locking-rod 152 toward the lower position or in engagement with the actuating rod 151 of the justifying transfer-block 143, which is its usual or normal position, as when character types and normal spaces are being produced. The outer or free end of lever 155 carries a pivoted trip 160 (Figure 34) whose upper end passes through one of a series of slots 161 formed in a lateral horizontal arm or projection of lever 58 (Figures 22 and 40). The upper surface of this arm or projection is stepped (see Figure 40), and the upper end of the pivoted trip 160 is furnished with an adjustable collar or nut, which latter, when moved to a position above the higher step or section of lever 58, will be engaged by the latter as it rises, thereby elevating lever 155 and raising the locking-rod 152 into engagement with the actuating rod 150, and out of engagement with actuating rod 151. This action takes place only when the pivoted trip is moved so as to bring its shoulder above the higher portion of lever 58, and until such motion takes place, and as long as the pivoted trip remains above the lower step or at the opposite end of the slot, no motion will be communicated to locking-rod 152 by the elevation of lever 58, which action, it will be remembered, takes place after the cast has been made and preliminary to the readjustment of the die-case for centering the next succeeding matrix. A spring 162 operates to hold the pivoted trip 160 normally retracted or out of engagement with the elevating portion of lever 58. Immediately in rear of pivoted trip 160 is mounted a trip-lever 163, one arm of which bears against the pivoted trip 160, while the other arm engages a plunger 164 working in a cylinder formed in frame 146. When this plunger is elevated it operates through trip-lever 163, to tilt the pivoted trip 160 and throw its upper end into engagement with the elevating portion of lever 58, hence said plunger serves as a controllable means for effecting the transfer of the locking-rod 152 from one actuating rod 150, 151 to the other. The descent of lever 58 restores the parts to normal position with locking-rod 152 in engagement with actuating rod 143.

Assuming the normal-wedge alone, or the normal-wedge and justifying-wedges together, have been properly adjusted, it is obvious that by thus locking out one of the transfer-blocks and releasing the other, the one so released can, by appropriate actuating mechanism, be advanced and thus caused to set the stop or abutment for the mold-blade in adjusting the dimensions of the mold. A simple and efficient form

of actuating mechanism will be found illustrated in Figure 114. The rear end of actuating rod 151 is pivotally attached to one end of the actuating lever 165 whose opposite end is pivotally connected to the frame, through a compression link 179 (Figure 7). The rear end of actuating rod 150 is in like manner connected to one end of a lever 166, whose opposite end is connected by a link 167 to lever 165 at a point intermediate its ends. The main driver or actuating lever 168 is in like manner connected by a link or pitman 169 to lever 166 intermediate its ends. With this arrangement of levers, when power is transmitted to lever 166 either end of the latter may become the fulcrum. Its actuating rod 150 is locked, the end of lever 166 connected to said rod becomes the pivot end, and motion will be transmitted from the opposite end of said lever to lever 165 and from the latter to actuating bar 151. If, on the other hand, actuating rod 151 is locked, the lower end of lever 166 becomes the pivot, and motion will be transmitted from the upper end of said lever to actuating rod 150. Thus, without changing the connections, the motions of the main driving lever 168 may be utilized for effecting the reciprocation of either transfer-block by the simple expedient of locking one of the two transfer-blocks against longitudinal motion; while, by means of the tripping devices, it can readily be determined which of the two transfer-blocks shall be locked and which brought into action. Compression link 179 is operative at all times during the advancing movements of the transfer-blocks and affords a yielding connection when the transfer-block is seated against its limiting stop or abutment.

Turning now to the means for effecting the adjustments of the justifying-wedges 141 and 142. These, it will be remembered, operate in conjunction with normal-wedge 132 and transfer-block 143. As will be seen by reference to Figures 44, 51 and 52, the vertical dimensions of these wedges is but about half that of the normal-wedge and each is furnished on its underside with a series of centering and holding notches or transverse grooves, corresponding in number to the columns of matrices in the die-case and to the primary controllers or pins 65 for gaging the movements of the die-case carrier. Each wedge is also provided with a head or projection 137 similar to that on the normal-wedge 132. As in the case of the normal wedge the jaws 94, 95, of the secondary positioning or controlling mechanism are utilized for effecting the movements of the justifying-wedges, but inasmuch as it is only required to adjust the justifying-wedges once for each line, whereas the normal-wedge is brought into action for the formation of each type, the justifying-wedges are maintained normally out of connection with the secondary positioning or gaging mechanism, and are connected therewith or thrown into action only when their adjustment is desired, for which purpose controllable actuating devices are employed. The two justifying-wedges 141, 142, at least those portions to which the projections 137 are applied, lie normally in a plane below wings 136, hence entirely beyond the control of the latter; and in order to bring them within the influence of said wings it is only necessary to elevate them or either of them, so that their projecting portions 137 shall stand between and within the range of motion of the two wings or jaws 136, it being understood, of course, that such elevation is to take place while the two wings or jaws are separated or opened to their fullest extent, as indicated by full lines in Figure 58. To provide for thus connecting and disconnecting the two justifying-wedges and their adjusting devices, and for accurately centering and locating them in adjusted position, the following arrangement has been devised and adopted:

Pivoted on frame 146 are two levers 170 and 171 (Figures 40, 41) each provided with two jaws 172 between which one of the justifying-wedges rests. The jaws of lever 170 are shorter than those of 171 and lie in the plane of justifying-wedge 141, while the longer jaws of lever 171 lie in the plane of justifying-wedge 142, as clearly appears in Figures 58 and 59. The justifying wedges ride between the jaws of their respective levers and are elevated and depressed thereby so as to bring their heads 137 into or out of the path of wings 136. Between levers 170 and 171, and mounted in fixed position upon frame 146 is a centering bar 173 with which the centering notches on the undersides of the two justifying-wedges co-operate, when said

wedges are moved to adjusted position, for accurately centering and holding said wedges. The lower jaws 172 of levers 170, 171, are widened or extended somewhat in the direction of the length of their respective wedges in order to furnish bearing surfaces over which the wedges may travel during adjustment, and the upper jaws project towards each other so as to stand above centering bar 173, whereby the proper centering and locking of the justifying-wedges, after preliminary adjustment, is insured.

The controllable mechanism for effecting the adjustment of the justifying-wedges is similar to that employed for operating the pivoted-trip 160. Each lever 170, 171, is provided with a retracting spring 174 which operates to hold the lever in such position that the jaws will depress and hold its justifying-wedge down out of the path of its adjusting devices, and each lever is also provided with a pivoted trip 175, whose upper end is shouldered or provided with an adjusting nut and projects through a slot in lever 58 in position to be engaged by the higher stepped surface, when in one position of adjustment or at one end of the slot, and to be unaffected by said lever 58 when at the other end of the slot. A spring 176 connected to the pivoted trip 175 serves to hold the latter at one extremity of the slot in lever 58, that is away from the higher stepped surface. A trip lever 163 and plunger 164 similar to those employed for actuating the trip of the locking-pin 152 is connected to each pivoted trip 175 to throw the latter into engagement with the elevating portion of lever 58. When it is desired to bring either of the justifying-wedges 141, 142, within the influence of wings 136, it is only necessary to actuate the plunger 164 controlling the trip belonging to that one of the levers 170, 171, which carries the selected justifying-wedge, whereupon the pivoted trip 175 will be thrown into operative engagement with lever 58 so that, as the latter rises, it will tilt lever 170 or 171, and the justifying-wedge lying between the jaws of the lever so tilted will be raised out of engagement with centering bar 173, and its head or lug 137 be brought into position between wings 136, and, as the latter are brought together upon the secondary controller, the justifying wedge will be shifted to the desired extent; after which, and as lever 58 descends, the pivoted trip 175 will be disengaged from said lever and the readjusted justifying-wedge again deposited and held upon the centering bar 173.

The trip-levers controlling the actuating devices for the two justifying-wedges are each provided with a wing or projection 177 (Figures 22 and 56) in rear of and overlapping a portion of the trip-lever for locking-rod 152, so that whenever one of the justifying-wedge trip-levers is operated, to throw its pivoted trip into engagement with lifting lever 58, it will also carry the pivoted trip 160 of locking-rod 152 into engagement with said lever 58, and thus cause said locking-rod to be elevated into engagement with the actuating rod of the lower transfer-block 133. The purpose of this arrangement is to hold the justifying wedges together in close contact while being set to position, so that no opportunity will be afforded for a film or layer of oil to form on their engaging surfaces, as would be the case if they were separated. By causing transfer-block 143 to be brought into action when the justifying wedges are being adjusted, the latter are set against the pressure of spring 144 and are brought accurately to position where they remain during the formation of the line, being brought into action only when a space type is to be made, involving the use of the transfer-block 143.

From the foregoing detailed descriptions of the normal mold adjusting and justifying mechanisms it will be apparent how the mold-blade may be set or adjusted to produce any desired width of type body within the range of the normal and justifying devices. The character types and normal spaces being separated into 15 groups or series having a uniform ratio of increase, and each group or series of the same width being represented by one position of adjustment of the normal-wedge, it is only necessary that the latter should be set to that one of its 15 positions of adjustment which corresponds with the selected group or series, in order to form a mold-cavity of the proper dimensions. The same is true of the justifying-wedges, with the exception that each of said wedges represents a different ratio of increase, justifying-wedge 141 producing a ratio of increase for each of its 15 positions of adjustment,

equal to ·0005 of an inch, while justifying-wedge 142 effects a ratio of increase, for each position of adjustment, equal to ·0075 of an inch.

The American sytem employs fifteen body sizes with a uniform increase of one unit, but the English system has but thirteen body sizes, twelve of which represent uniform increments of one unit each, while the thirteenth represents a two unit increase.

To adapt the present machine to the English or analogous systems presenting other than regular variations in body-sizes, it is only necessary to slightly modify the form of the normal-wedge to correspond with the particular system.

Such a modification is illustrated in Figures 60, 60ª, 61, 61ª.

Here instead of a uniform taper the normal wedge 132* is stepped to represent the thirteen different sizes of type matrices arranged in the fifteen columns of the die-case. Although the ratio of increase is one unit for the first thirteen sizes, beginning with the smallest, the number of different type belonging to each series, that is, type of the same width, is not uniform, there being a larger proportion in in one series than in any of the others. In the example illustrated the size of the type in units is marked upon the normal-wedge at each of its 15 positions of adjustment, the size being expressed in units. The smallest type of this series, corresponding to the first column in the die-case, is 5 units in width, the next 6 units and so on up to the sixth column. As there happen to be more than fifteen type in this division, three columns, the sixth, seventh and eighth are assigned to the 10 unit type. The ninth column contains the 11 unit type, and so on up to the fourteenth column, containing 16 unit type, the sizes increasing regularly by one unit. At this point a two unit increase takes place, from 16 to 18 units, and the latter represented by the last column in the die-case. The figures here given are by way of illustration only, as different fonts and faces require different normal-wedges; and the same is true as applied to the American system.

To accommodate the larger group of 10 unit type and distribute them between the sixth, seventh and eighth columns, the face of the wedge is stepped at the corresponding positions of adjustment, so that at each of said positions its action upon the mold-blade will be the same, or equal to ten units. It is also stepped at the last or fifteenth position, to effect an 18 unit adjustment, or two units in excess of the next adjacent position. Thus the normal-wedge, instead of having a regular taper, whereby its uniform movements from one position of adjustment to another will represent uniform increments in body-sizes throughout the entire series of 15 adjustments, is interrupted or broken up into several series, each representing either the same or uniformly varying, or differently varying adjustments, as circumstances shall require.

The stepped normal-wedge, like the uniformly tapered wedge, occupies a position intermediate the transfer-blocks and abutment-slide 129, with its stepped face next the latter, and to facilitate its adjustment and prevent the shoulders at the ends of the steps or sections from catching upon the bearing face of the abutment-slide the following arrangement has been devised and adopted.

To the shoulder on the underside of abutment-slide 129 is fitted a plate or block 400 whose outer face or that next the stepped surface of the normal-wedge is furnished with a transverse rib or bearing 401 for engagement with said normal-wedge.

Supported within a slot in this block 400 is a flanged plate 402, the flanged edge resting in a groove formed in the abutment-slide and engaged by springs which operate to hold said plate 402 and block 400 outward or off its seat. The outer edge or end of this plate 402 projects beyond the face of rib 401 and into a longitudinal groove or way 403 in the face of the normal-wedge.

During the operation of adjusting the normal-wedge the latter is held away from and out of engagement with the bearing block 400 by the action of the springs on the rear side of plate 402, said wedge riding upon the outer edge of the plate and being held thereby from contact with rib 401.

The longitudinal adjustment having thus been effected and the normal-wedge brought to the desired position, when the transfer-block is advanced or brought into action it will compress the springs and force plate 402 back until the surface of the

wedge becomes seated against the rib 401, and through the latter operates the abutment-slide to fix the position of the mold-blade.

Upon the withdrawal of the transfer-block the springs will again project plate 402 and remove the normal-wedge from rib or bearing 401 so that it can again be adjusted longitudinally without interference.

This modification is well adapted for use in connection with the American system by merely substituting the uniformly tapered wedge for the stepped or variable wedge.

It may be well, at this point, to remark that when setting the justifying-wedges for the line, through the medium of the primary controllers or pins 65, no casts are made, the metal injecting mechanism being thrown out of action. This is effected through the medium of pivoted trips 175, as will be explained in connection with the metal injecting mechanism. Moreover, to produce the finer adjustments of the mold-blade by means of the two justifying-wedges, two complete rotations of the main driving shaft are usually required, one for setting each justifying-wedge, but if the positions of adjustment of the two wedges coincide both may be set at the same time during a single rotation of the driving shaft.

Having explained how the mold-blade positioning stop or abutment 130 is set for each type body, it only remains to be seen how the mold-blade actuating devices are operated to discharge the type and readjust the mold for the next succeeding cast. Let it be assumed that when the parts are as represented in Figure 44, the mold-blade lever 128 is moving outward or in a direction to cause the approach of the mold-blade towards its adjusting abutment. In doing this it acts through spring 124, the latter yielding after the mold-blade takes bearing against its abutment, thus holding the mold-blade firmly in adjusted position. The next movement of the lever is toward the mold-blade sufficiently to take pressure off spring 124, but without making contact with the head of sleeve 126. This leaves the mold-blade abutment free for readjustment, and affords opportunity for the withdrawal of the transfer-block and the shifting of the normal-wedge. After a brief dwell, the lever is advanced again, and, operating through sleeve 126 and spring 123, drives the mold-blade forward, to eject the type from the mold. The movement of the lever is now reversed and it retracts until contact is made with collar 127, thereby withdrawing mold-blade until its outer face is slightly within the mold-cavity, so as to remove it from the track of the cross-blade. The lever again advances slightly to free the mold-blade and permit the transfer block to be brought forward into operating position, after which, by a continued rearward movement, the mold-blade is again drawn firmly in contact with the readjusted abutment and the mold is in condition for the formation of the next succeeding type.

The Metal Injecting Mechanism.

Under this title is included not only the melting pot, the pump for forcing the metal from the metal pot, and the nozzle through which the molten metal is injected into the mold, but also the mechanisms operating to seat the nozzle or bring it in proper communication with the nozzle-plate of the mold, to operate the pump plunger, to throw the pump plunger into and out of action, and to permit the removal of the metal injecting mechanism from operating position into one where its parts can be more readily approached for inspection, adjustment and repair.

This part of the machine will best be understood by reference to Figures 2 to 5 inclusive, 7, 8 and 92 to 104 inclusive.

The melting pot and its connections are all mounted upon an independent frame 180 which is pivotally supported at one side upon a vertical threaded shaft 181 mounted in bearings in the main frame. Shaft 181 forms a pivotal support for frame 180 about which the latter can be swung horizontally, but as such movement would be interferred with if the melting pot and its attachments remained in the positions they occupy in operation, the said pivotal shaft is threaded into frame 180 and provided with a handle whereby it can be rotated to elevate or depress the frame. A lock is provided for holding the frame in working position, such, for example, as

that formed by an angular tongue or projection 182 (Figure 97) located on the main frame, in position to enter and engage a corresponding seat 183 on frame 180, when in elevated or working position. The lowering of frame 180 by means of screw 181 withdraws the seat from locking tongue 182 and permits the frame to be swung horizontally.

The melting pot 184 instead of being mounted directly upon frame 180 is pivotally attached to a series of arms 185 forming part of a set of parallel motion links. These arms are secured to parallel shafts 186 mounted in bearings on frame 180 and connected by a link 187, so that both shafts 186 and arms 185 will move in unison and thus preserve the horizontal plane of the melting pot during its vertical motions toward and from the mold. The object of this is not alone to properly seat the nozzle but also to prevent tilting the melting pot, thus avoiding agitation or flowage of the fluid metal, more particularly in the passage leading to the nozzle.

The melting pot is formed or provided with a passage or conduit 188 leading to the nozzle 189, the whole enclosed within a casing 190 between which and the melting pot is a chamber for the reception of a non-conducting material such as asbestos. It is desirable that the mold and connected parts should be protected from the influence of the heat generated in maintaining the type metal in molten condition, hence, aside from the question of economy of fuel, it is important to so arrange the heating apparatus that it will maintain the type metal in molten condition, both in the pot and in the passage leading to the nozzle, by a minimum expenditure of energy in the form of heat. To this end a combustion chamber 192 (Figures 96, 99) is formed under the bottom of the metal containing chamber 193, beneath which is arranged the burner 194, preferably of the bunson type.

The products of combustion are conducted from the combustion chamber horizontally beneath the supply passage 188 and vertically to a point near the nozzle, thence over a vertical deflecting plate through a chamber above supply passage 188 and out through a side passage into the escape pipe, a jet-pipe 196 located in said escape-pipe facilitating the withdrawal of the products of combustion.

The cover of the melting pot is formed in sections, and the space above the melting pot is in open communication with a pipe surrounding escape-pipe 191, through which the fumes arising from the molten metal escape.

The metal chamber 193 is provided with a seat for the attachment of the pump cylinder 198, the latter communicating directly with an opening formed in the seat at the end of the passage 188 through which the metal is forced into the nozzle. A solid piston 199 is arranged in cylinder 198, and an induction port, formed in the body of the cylinder but to one side of the piston and controlled by an inwardly opening valve 200, admits the molten metal into the cylinder below the piston.

When in working position the melting pot is so arranged that its nozzle 189 will stand directly beneath and substantially in line with the bell mouth 17 of nozzle-plate 16, as represented in Figure 7. When the mold has been adjusted and the matrix seated preparatory to making a cast, the nozzle must be elevated into close and accurate contact with the nozzle-plate. This movement is effected through the agency of an arm 201, secured to a rock shaft 202, and bearing a roller 203 in contact with the melting pot immediately in line with, but below, the nozzle (Figure 99). This rock shaft 202 is supported in bearings on frame 180 and is furnished with an arm 204 whose outer or free end is attached to a vertical rod 205 (Figure 95) the upper end of the latter passing through a bearing on frame 180 and engaging one end of a lever 206. A spring 207, interposed between frame 180 and an adjustable collar on rod 205, operates, normally, to turn rock shaft 202 in a direction to cause the elevation and seating of the nozzle; but, except when a cast is to be made, the spring is not permitted to elevate the nozzle, but is held in restraint and under compression by a bar 208 acting on lever 206. This bar 208 forms a part of the pump actuating mechanism about to be described.

The upper end of pump cylinder 198 is furnished with seats for the reception of the bifurcated end of lever 209 (Figure 98) whose opposite end stands in line with the axis of threaded shaft 181 and is pivotally attached to a swivel 210 carried by a

bracket on sleeve 211. The piston 199 is connected by a link 214 to the outer end of lever 215 extending substantially parallel with lever 209 and attached to the latter at or about the middle of its length, by a link 216. The inner or power end of lever 215 is attached to a swivel 217 carried by cross-head 208 in line with shaft 181. The object in thus bringing the supports for the inner ends of levers 209 and 215 in axial alignment with shaft 181 is to accommodate the actuating devices to the swinging motion of the melting pot about said shaft.

Sleeve 211 to which lever 209 is connected extends vertically through bearings in the frame, and the bar or cross-head 208 to which lever 215 is connected is secured to the upper end of a shaft 212 passing longitudinally through sleeve 211. A shouldered pin 213 secured to the frame and extending vertically through brackets on sleeve 211 and cross-head 208, serves to limit the vertical movement of sleeve 211 and to prevent rotation of cross-head 208, while a spring 218 surrounding the lower portion of sleeve 211 and interposed between a shoulder thereon and the frame, operates in a direction to elevate said sleeve. The lower end of shaft 212 is engaged by one arm of a bell-crank lever 219 whose other arm is connected through a compression link or elastic connection 220 with controllable actuating devices governing the operation of the pump and the elevation of the nozzle.

Bearing in mind that the elevation of the melting pot and the seating of the nozzle is effected by the action of spring 207, and that the latter is held in check or under restraint by cross-head 208, the object in connecting the pump actuating devices to the cylinder as well as the piston will be understood.

The throw of the piston, when operated to drive the metal into the mold, is in a direction opposite to that of the spring holding the nozzle in contact with the nozzle-plate, hence would tend to unseat the nozzle. This is avoided by attaching one of the pair of levers 209, 215, to the cylinder and the other to the piston, and connecting the levers together as by link 216, in such manner that the pressure exerted in effecting the stroke of the pump will be distributed equally between the piston and cylinder and be exerted in opposite directions; that is to say, the power exerted at the load end of lever 215, to drive the piston down, will be opposed by an equal force exerted by the load end of lever 209 tending to raise the cylinder. By this means the pump action is neutralized insofar as it might otherwise tend to disturb the position of the melting pot or withdraw the nozzle from its seat, and it can be rendered both quick and powerful, desirable conditions in machines for casting type.

To accommodate the pump operating devices to the different positions occupied by the melting pot as the nozzle is alternately elevated to casting position and withdrawn therefrom, the power ends of the levers 209 and 215 are moved vertically in unison with the melting pot, and are separated only when the nozzle has been seated in the nozzle-plate and is held thereto by the full power of its elevating spring.

This is accomplished by attaching the inner or power end of lever 215 to the cross-head 208 which controls the movements of the nozzle, and the inner or power end of lever 209 to sleeve 211. Motion is communicated to cross-head 208 through shaft 212, and inasmuch as sleeve 211 is held by its spring 218 in contact with said cross-head, it follows that the elevation of cross-head 208 and lever 215 will be accompanied by a corresponding movement of sleeve 211 and lever 209, thereby maintaining the parallelism of said levers 215 and 209.

This relation is preserved until the nozzle is seated and cross-head 208 rises above lever 206, at which time sleeve 211 contacts with pin 213 and is arrested, while cross-head 208 continuing to rise effects the stroke of the piston.

The controllable actuating devices for the pump serve as a means for connecting and disconnecting the metal injecting mechanism with the driving shaft, and they or an equivalent thereof, are required in order that the action of the injecting mechanism may be suspended, at intervals, as, for example, while setting the justifying-wedges, or when, for any purpose, it becomes necessary or desirable to operate the machine without making casts.

In the present form of embodiment the pump actuating lever 221, which derives

formed in the front vertical wall of the recess in the frame for the reception of said carrier, as indicated in Figure 3.

In the end of the type-carrier nearest the cross-blade is located the type-holder, which latter includes the slotted head 250, provided with a type opening or channel extending transversely through the end of said carrier, and a clamping member 251 (Figure 69) movable across the channel in head 250 and co-operating with one wall thereof in receiving and clamping the type as it is ejected from the mold. The clamping member 251 is supported in guides within the type-carrier, and is held normally forward or toward the opposing clamping surface by a spring 252. A lug or projection 253 on the clamping member 251 rides in an inclined groove 254 in the frame, the angle of inclination corresponding with that of rib 249 on the type-carrier. Said groove 254 terminates at such point in the movement of the type-carrier towards the mold that it will, by its engagement with lug 253 arrest the movement of clamping member 254 just before the channel in head 250 is brought opposite the mold-cavity, thereby opening the passage for the admission of the type.

Upon the return motion of the type-carrier, after the type has been inserted between the clamping member 251 and the opposite face of the opening or channel in the carrier, the clamp 251 will remain stationary until engaged by the type, when it too will be moved, thereby clamping and holding the type securely in position while being transported from the mold to the type-channel.

As this action would leave the type unsupported at the time of its delivery by the mold-blade, the carrier is furnished with a type support 255. This consists of a spring tongue whose outer or free end rests and is guided in the clamping number 251, while the opposite or rear end is secured to a slide 251* supported in ways and movable longitudinally of the carrier. Slide 251* is furnished with two shoulders between which is received a block 256 carrying a headed pin, the latter extending through the shoulder on slide 251* and provided with a spring 257 interposed between the head of the pin and the slide. This spring tends at all times to hold block 256 against the shoulder on slide 251* through which the pin passes. A lever 258 (Figures 57 and 67) mounted on the type-carrier and provided with a roller on its outer end, has its inner end in engagement with block 256.

The outer end of lever 258 extends between two fixed abutments on the frame (Figure 56) so located and arranged that as the type-carrier approaches the mold the lever will engage one of said abutments and be turned in a direction to advance the type support 255 so that its end will be projected across the channel in the type-carrier. While it occupies this position the type is delivered to the type-carrier, the mold-blade forcing the flexible type-supporting blade 255 back until the type is fully entered between the clamping surfaces.

While the type is thus held between support 255 and the mold-blade, the type carrier is retracted or moved towards the line-channel, and as the type passes beyond the mold-blade it is firmly grasped and held by clamping member 251, the movement of the type-carrier withdrawing the lug 253 from its engagement with the end wall of the slot and permitting spring 252 to advance clamping member 251 towards the opposite clamping surface and thus grip the type lying between. As the type-carrier nears the end of its movements towards the line-channel, lever 258 contacts with the opposite abutment and is turned in a direction to withdraw the type-support 255 out of the way so that the type may be pushed out of the type-carrier into the line-channel.

The line assembling mechanism.—This includes the devices for removing the type from the type-carrier and holding them in position until all the types which are to compose a line have been assembled.

When at the outer extreme of its movement, that farthest from the mold, the type-carrier stands with its slot or channel opposite the entrance to the line-channel and in line with the ejector blade 259 (shown detached in Figure 65), which latter reciprocates through the type-carrier and delivers the type held therein to the line-channel. The rear end of this blade is attached to one arm of a

bell-crank lever 331 (Figure 22) the other arm being connected through a compression link 332 with the actuating lever 333.

Bevel shoulders on ejector engage bevels on type-carrier to insure entrance without requiring exact register to meet line channel.

The present machine being designed to deal with different sizes of type, the delivery of the type from the type-carrier to the line-channel by means of an ejector-blade working through the type-carrier is a matter of some difficulty, owing to the fact that provision must be made for supporting the type at all times, and for dealing with small as well as large type bodies.

The support for the type is furnished by the spring actuated clamp of the type-carrier, which is competent to deal with all sizes of type. But the ejector-blade 259 whose end is required to pass between the clamping surfaces must be as narrow as the narrowest kind of type with which it has to deal, hence it becomes necessary to make special provision for ensuring its proper entrance between the clamping surfaces, and this, too, without requiring exact register between the channel in the type-carrier and the line-channel. To this end a spring pressed guide 260 (Figs. 57 and 70) is arranged to press and hold the ejector-blade in contact with the face of its guiding way nearest the mold, so that it will always enter on the side of the type-channel formed by the movable clamping jaw or member 251.

The ejector-blade is flanged along its upper and lower edges, said flanged portions riding in grooves formed in opposite walls of the type-channel, extending beyond the engaging face or end of the blade, where they are notched to admit the type and are beveled on their outer surfaces so that by their engagement with bevels on the type-carrier they will act as guides for directing the ejector-blade into the type channel formed between the clamping surfaces. In the event no type is contained in the type-carrier, these bevels will serve to open the type channel by forcing back the movable clamping surface 251, so that the blade can pass it.

What is herein designated as the line-channel comprises a horizontal table or supporting plate 261, and two vertical sustaining walls such as are formed in part by blocks 262 and 263. The block 262 (Fig. 82) forming part of the wall nearest the mold is preferably though not necessarily provided with a spring 264 extending longitudinally of said block and having its outer end curved backwardly and overlapping the beveled end of said block (see Figs. 76, 77, 82 and 83). The opposite wall or block 263 (Figs. 75 and 83) is provided with two yielding surfaces, the one formed by a spring 265 sustained in position by a plate 266, and having its outer or free end bent around said plate and terminating within the line-channel, while the other one 267, is bifurcated at one end and extends on opposite sides of spring 265 lengthwise of the line-channel, the inner end being guided by a pin 268 playing in a slot formed in the tail of spring 265, as clearly seen in Figures 75, 76 and 77. Upon reference to Figure 66 it will be seen that the walls of the slot or passage in the type-carrier are cut away horizontally and that the face or engaging end of the clamping member 251 is likewise slotted. This is done to permit the outer ends or faces of springs 264, 265, to enter within the type passage in the type-carrier, as the latter is retracted to deliver the type therein. Springs 264 and 265 at the entrance to the line channel constitute flexible jaws between which the type are delivered, said jaws opening or yielding readily to the entrance of the type between them, but offering resistance to their withdrawal, thereby insuring the retention of the type when advanced by the ejector blade 259.

As type accumulate in the line-channel they are forced back and sustained by the pressure of spring 267, the forward end of the latter overlapping spring 265 so that the type are at all times retained in proper position, for as the line is pushed towards and beyond the rear end of spring 267 it is engaged by the line supporting-blade 269 (Fig. 88) which latter, as it forms a connecting link between the line-assembling and line-carrying devices, will be explained in connection with the latter.

Immediately in rear of the block 262 is arranged the galley 270, the entrance to which is closed by a vertically movable blade 271, whose outer surface is in line with and forms a continuation of that wall of the line-channel of which block 262 forms a

portion. Pivoted in bearings on the frame (it may here be remarked that the galley mechanism is mounted upon a frame detachably secured to the main frame), beneath and parallel with blade 271, is a lever 272 (Fig. 74) the upper portion of which is provided with a grooved bar 273 lying opposite and parallel with blade 271. When in normal position the face of this bar 273 is in line with the inner ends of spring 267, so that it may be said that bar 273, and blade 271 constitute, in effect, parts of the line-channel, the bottom of which is formed by a plate 261 extending horizontally beneath both of these members, as indicated in Figure 86. The line-supporting blade 269 is guided to reciprocate upon the face of bar 273, to which end it is provided with a dovetail fitting the groove in said bar, and is furnished with one or more springs 274, bearing against the wall of the groove and serving to create frictional resistance to the movement of the blade. The end of the line-supporting blade 269 nearest the type is notched, as shown, for a purpose to be explained. It will suffice, for the present, to state that the line-supporting blade is engaged by the type as they emerge from between spring 267 and the opposite wall, and is pushed back as type accumulate and by the action of the line-carrier in shifting the line to a position in front of the galley, which is the operation performed after all the type composing a line have been delivered into the line-channel.

The line carrier.—This includes, in addition to the line-channel and the line-supporting blade, a pair of arms 275, (Fig. 81) provided at their outer ends with type engaging shoulders or hooks, which latter are advanced beyond the last type of the completed line, then drawn outward to bring the completed line opposite the entrance to the galley, and, after the line has been transferred to the galley, the arms of the line carrier are withdrawn from the line-channel in which the next line is being set up, and carried to a position beyond that to which the type is advanced by the ejector blade 259, preparatory to engaging the next line when completed.

The means for effecting these movements of the line-carrier or arms 275, and for returning the line-supporting blade 269, after the transfer of the line to the galley, will now be described.

In the frame of the galley mechanism, beneath and parallel with bar 273, of lever 272, are formed two parallel guides or ways 276 and 277 (Figs. 89, 90). In the lower of these two guides is mounted a slide 278 (Fig. 84) provided with a vertical socket or bearing 279 into which is fastened the axis or fulcrum-pin 280 of head 281 carrying the line-carrier blades 275. This head is also provided with a lateral projection or arm 282 extending between shoulders 285 and having its end resting in a seat formed in a slide 283, the latter riding in the upper guide 277. A friction spring 284 (shown in dotted lines Fig. 85) operates to retard the movements of slide 278, so that when slide 283 is moved in either direction, it will first act on arm 282 and move the latter into engagement with one of the shoulders 285, thus oscillating head 281 to bring arms 275 of the line-carrier into or out of the plane of the line-channel, and then, by the continuation of the movement of said slide 283, motion will be communicated to slide 278, the arms of the line-carrier remaining in the position to which they were brought by the initial movement of arm 282. Thus, during the outward stroke of slide 283, the hooked ends of arms 275 will be advanced across the line-channel so as to engage the last type of the completed line, and the line will be drawn forward to a position in front of the galley, when, by a reversal of the direction of its movement, slide 283 will cause the withdrawal of arms 275, and the return of said arms, together with their supporting-slide 278, to first position, ready to engage the next succeeding line when completed. These motions of slide 283 are transmitted from the actuating lever 286 (Figs. 72 and 73) through a slide 287 riding in guides or ways 276 and provided with a pin 288, the latter working in a slot in slide 283 (Figs. 85, 89 and 90) so as to alternately engage opposite ends thereof, when at the extremes of the movements of slide 287. A screw 289 or equivalent adjustable device operates to engage slide 283, at the limit of its outward movement, and thus ensure the arrest of the line-carrier with the inner faces of its hooks in line with the wall of the galley, in order that the end of the line shall be accurately adjusted to position. Slide 287 is connected to its actuating

lever 286 through a double acting compression link 290, the latter including, in the present instance, a rod 291 pivotally attached to the outer end of the lever and extending through a sleeve 292 pivotally attached to slide 287.

Rod 291 is shouldered and between said shoulder and a sleeve on the end of the rod are arranged two loose collars with an interposed spring 293. The collars engage opposite ends of the sleeve 292 so that the spring is rendered active when the rod is reciprocated in either direction.

The outward and inward motions of lever 286 are slightly in excess of the permissible movement of slide 283, so that the latter will be held firmly in position against a fixed abutment at each extreme of its movement. This slide 287 is also furnished with a post or vertical projection 294 (Fig. 91) carrying a pivoted latch 295, whose inner or free end, held down by the spring 296, rests between shoulders on a slide 297 (Figs. 87 and 89) the latter riding in the groove or way formed in the face of bar 273 in line with line-supporting blade 269. Slide 297 engaging line supporting blade 269, as the line-carrier moves inward, serves to retract said line-supporting blade after the completed line has been delivered to the galley.

The line transferring devices.—The column forming mechanism includes the devices by which successive lines of type brought forward by the line-carrier are transferred or delivered from the line-channel into the galley.

As hereinbefore explained the entrance to the galley is closed by blade 271. This blade, which forms a portion of the right or front wall of the line-channel, fits loosely the shouldered upper end of a rod 298 passing vertically through a bearing in the galley frame and supported upon its actuating lever 299. The blade is held from horizontal movement by a steady pin 300, and is elevated, to admit the line of type to the galley, after which it descends behind the line and sustains the latter until the next succeeding line is brought forward.

The completed line is pushed or advanced into the galley by the movement of the transfer bar 237. It will be remembered that this bar is carried by a lever 272 and forms a portion of the left-hand or outer wall of the line-channel. Said lever is held normally retracted by a spring 301 (Fig. 86) and is advanced toward the galley by pressure transmitted from its actuating lever 302 through a compression link 303. Lever 302 engages an adjustable abutment 304 for positioning bar 273, and the spring in compression link 303 is brought into action during the forward movement of lever 302, said spring yielding in the event the forward motion of lever 272, when operated to deliver the line to the galley, is arrested.

The trip mechanism.—The last of the elemental parts of the galley mechanism is the tripping device. Its primary function is that of stopping the machine in the event an unjustified line is presented to the galley.

Mounted in guides on the galley frame is an adjustable block 305 carrying an arm 306 overlying plate 261, and forming the front wall of the galley entrance. The adjustment referred to is one by which the width of the galley entrance is varied to correspond with the length of the lines cast, whatever this may be. Arm 306 is provided with guides for the reception of a tripping block 307, the latter having its surface flush with the wall of the galley entrance, and its end nearest the line-channel projecting beyond arm 306 and of proper shape and dimensions to fit within the notch formed in the end of line-supporting blade 269. If the line delivered by the line-carrier and advanced by the line-transferrer, is of standard length, it will just pass between tripping-block 307 and the opposite wall of the galley entrance; but if the line is either too long or too short, tripping-block 307 will be engaged, either by the type, if the line is too long, or by the line-supporting blade 269, if the line is too short, and will be forced back by the bar 273 when the latter is advanced to push the line into the galley.

A lever 308, pivoted upon block 305, is connected at one end to this tripping-block 307 and its opposite end rests in contact with a wide vertical lever 309, mounted in bearings on the frame, and provided with a retracting spring 310 (see Fig. 73). The other arm of lever 309 co-operates with the shouldered arm 312

of the belt-shifting lever 313 (Fig. 85) and operates, when in engagement with said shoulder, to hold the belt-shifting lever in operating position, that is with the belt on the fast pulley. When, however, tripping block 307 is forced back it will operate through lever 308 to disengage lever 309 from the shoulder on arm 312, thus permitting the belt shifting lever to be thrown so as to shift the belt onto the loose pulley and stop the machine.

The connections between the belt-shifting lever 313 and the belt shifter 314, can best be seen in Figures 2, 6, 72 and 73. One arm of said lever engages a rod whose opposite end is in contact with an arm on rod 315 extending from front to rear of the machine, said rod 315 being provided with a spring 316, the latter operating in a direction to throw the belt from the fast to the loose pulley except when restrained by the engagement of lever 309 with the belt-shifting lever 312.

Galley driving mechanism.—The motions of the galley mechanism, although derived primarily from the main driving shaft, are communicated through a supplemental shaft 317 mounted in bearings on the galley frame and rotated through the medium of a worm wheel 318. This shaft carries a cam wheel 319 provided with three operating surfaces or cams, one, a peripheral cam 320, for engaging actuating lever 302 of the line transferrer or pusher; a second, face cam 321, engaging actuating lever 299 for blade 271; and a third, a grooved or face cam 322, engaging actuating lever 286 of the line-carrier. The cam wheel 319 is loose on its shaft and is connected therewith, for operation, by means of a ratchet wheel 323 keyed to the shaft, and a spring actuated pawl 324, carried by cam wheel 319, thus forming a clutch or detachable connection between the shaft and cam wheel.

The pawl 324 is provided with an angular shoulder or arm 325 and a beveled pin 326, and is held, normally, from engagement with ratchet wheel 323 by an intercepting and arresting lever 327, the latter pivotally supported on a vertical post on the galley frame and having its opposite end standing in line with shaft 232 of the pump actuating mechanism, so that when said shaft 232 is moved longitudinally by shifting levers 170, 171, to throw the pump out of action, the same movement will throw lever 327 out of engagement with pawl 324 and thus start the galley mechanism in motion. The angular shoulder 325 of pawl 324 is received and held between a fixed shoulder 328 on lever 327 and a vertical movable shoulder formed by a latch 329 pivotally connected to said lever 327. The instant pawl 324 is released, by the withdrawal of lever 327, it flies into engagement with its ratchet wheel and, in so doing, its angular shoulder 325 passes beyond the engaging face of fixed shoulder 328 on lever 329, so that it cannot be re-engaged thereby should lever 327 be released before the pawl is carried beyond its path. The withdrawal of lever 327 is followed by its return to normal position, under the action of spring 330, which position is one lying in the path of movement of the angular shoulder 325, so that when the cam 319 carrying said pawl shall have made a complete revolution, the pawl will be engaged by the fixed shoulder 328 on lever 327, thereby withdrawing the pawl from its ratchet wheel and arresting the motion of cam wheel 319. In doing this the bevelled pin 326 on pawl 324 by its engagement with latch 329 will lift the latter and pass beyond it, whereupon said latch will resume its position behind shoulder 325 and retain the latter in position.

It may here be mentioned that the galley-actuating devices are protected by a detachable cover plate 311 seen only in Fig. 1, it being omitted in the other views in order to disclose the mechanism beneath.

From the foregoing description it will appear that the controllable members of the galley mechanism, or those through which its movements are inaugurated, are actuated, to set the mechanism in motion, by the same devices that are employed for setting the justifying mechanism for the next succeeding line, thus dispensing with one useless rotation of the driving shaft, and obviating the necessity for a separate galley perforation in the record strip.

The Paper Feed.

The office of the paper feeding mechanism is to advance the record strip, inter-

mittingly, at regular intervals, so as to bring the perforations opposite the air ports of the pneumatic system for controlling the various operations of the machine. In its general features it resembles that heretofore employed for the same purpose and differs therefrom mainly with respect to the actuating devices. The details of this mechanism are best seen in Figures 105 to 110 inclusive.

The devices comprising this part of the machine are mounted upon a frame, separable from, but secured to, the main frame, and include supports for the winding and supply spools 335, 336; a rounded or semi-cylindrical cross-bar 337; pin wheels 338, one at each end of the cross-bar; a shaft 339 carrying said pin-wheels; a pulley 340 on shaft 339; a pulley on the winding spool; and an elastic belt 341 through which motion is transmitted from pulley 340 to the winding spool.

The cross-bar 337 is provided with a longitudinal series of ports, and above the latter operates the air-bar 342 containing an air-chamber, said air-bar being supported upon arms 343 pivoted loosely on shaft 344. This shaft is furnished with two arms 346, each of which is connected to one end of the air-bar by a rod 350, pivoted upon the air-bar and passing through a lug on arm 346. A nut or shoulder on the rod above the lug forms a positive connection for raising the air-bar, while a spring 351 interposed between said lug and the air-bar furnishes a yielding connection for depressing and seating the latter. The air-bar is normally upheld or elevated by a spring 345 engaging one of the arms 346, while the other arm carries an adjustable contact for engaging the inlet valve 347, to open the latter when the air-bar is depressed and seated upon the record-strip.

The operation of these parts, briefly stated, is as follows: The air bar being elevated and inlet valve closed, shaft 339 is turned sufficiently to advance the record strip from one line of perforations to the next, in doing which the pin wheels engage perforations in opposite edges of the record strip, and, at the same time, turns the winding spool by means of the belt and pulleys, thus drawing the record strip from the supply spool and winding it up on the winding spool. When a feed motion has been thus produced the air-bar is brought down into close contact with the surface of the record strip, and at the same time, or immediately thereafter, the inlet valve is opened and air, under pressure, admitted within the air-bar, from whence it escapes through such of the ports in the cross-bar as are uncovered by perforations in the record strip, and passes to the various actuating or controllable members of the machine.

The movements of the paper-feed and air-bar, are derived from the main actuating lever 349, and are transmitted through connecting rod 352 to lever 353 pivoted on the side of the paper feed frame and provided with two connections, the one extending to the air-bar actuating devices and the other to the paper-feed actuating devices. The connection between lever 353 and the air-bar actuating devices is through a link 354 provided with a slotted head open on one side, for the entrance and engagement of pin 348 on arm 346, a spring 355 serving to hold the link in engaging position, at the same time permitting it to be withdrawn when desired.

Upon one end of shaft 339 is secured a ratchet wheel 356, and surrounding the latter and concentric therewith is an annulus 357 provided with a lug 358 located between adjustable limiting stops 359. This annulus is permitted a limited movement around the ratchet wheel 356 (the extent of such movement being governed by the position of the stops 359) and upon it is pivoted a three-armed pawl 360, one branch being furnished with an angular engaging portion adapted to enter between the teeth of the ratchet wheel, the second branch, on the opposite side of the pivot, riding in a curved recess or slot in the outer end of a locking pawl 361, the latter pivotally supported on the frame, while the third or intermediate branch is connected to lever 353 through a compression link 362, the latter yielding on the downward stroke of lever 353. When the load end of lever 353 is elevated it will operate first upon pawl 360, tilting the latter in a direction to withdraw its engaging point from the ratchet wheel, at the same time throwing the locking pawl 361 into engagement therewith through the medium of the arm riding in the slot in said locking-pawl, thus locking shaft 339 against rotation, after which the motion is transmitted to the

annulus or support 357, and the pawl is retracted until arrested by the engagement of lug 358 with stop 359. Upon the reversal of the movement of lever 353 locking pawl 361 will be withdrawn from the ratchet wheel, and simultaneously therewith the engaging end of pawl 360, will be brought into engagement with said wheel 356, after which the motion will be communicated to the supporting annulus, and shaft 339 will be turned until the movement is arrested by the contact of lug 358 with the opposite stop 359. A reversal of the movements will cause the re-engagement of locking pawl 361 and the disengagement of pawl 360, as before explained.

A cam lever 363 pivoted upon the frame above locking pawl 361, in position to engage the latter, may, when desired, be employed to hold the locking pawl in engagement with the ratchet wheel 356 and thus prevent the movement of the pin wheel shaft 339, connection 362 yielding in such case during the throw of lever 353.

As it is sometimes desirable to start up the machine with the paper-feed mechanism inactive, or to arrest the action of the latter while the machine is in motion, an uncoupling device has been interposed between actuating-lever 349 and lever 353, as indicated in Figure 106. The lower end of connecting rod 352 is provided with a bifurcated head 364, the arms of which are slotted for the reception of pin 365 carried by actuating lever 349. Pivoted upon this pin 365, between the arms of head 364, is a block 366 adapted, when swung into position, to occupy the space between pin 365 and head 364, so that said head and its connecting rod will move in unison with actuating lever 349. A spring actuated latch 367 serves to hold block 366 in position. To disengage actuating lever 349 from connecting rod 352 it is only necessary to press block 366 down or swing it out from between the arms of head 364, as indicated by dotted lines in Fig. 106, thus permitting pin 365 to ride freely in the slots formed in the arms of head 364.

Each spool is mounted upon a removable pin supported in bearings in the frame, so that it can be withdrawn for the removal and insertion of the spools, the pin for the winding spool passing through the pulley and carrying a feather or equivalent device for locking the pulley and spool so that they will be rotated together.

The supply spool is usually furnished with permanent flanges or heads, but the winding spool is provided with one head only (in order that the strip, after use, may be readily slipped off without unwinding it), the other head being mounted in bearings in the frame as shown in Fig. 110.

The Driving Mechanism.

Thus far in describing the various mechanisms the several movable parts have been, in most instances, traced back only to their actuating levers, it being presumed that suitable and properly timed and connected driving mechanism for giving to the several actuating levers their proper motions, was supplied. The special and preferred arrangement, and the approximate forms of the cams are illustrated in Figures 32, and 113 to 122 inclusive.

Although grooved or other known forms of cams might be employed for giving motion to the several actuating levers the preferred arrangement is one in which a pair of cams acting in opposition are employed for each actuating lever, one of said cams effecting the motions in one direction, and the other in the opposite direction, and both acting upon a roller carried by the lever between the opposing surfaces of the cams. By this means the wearing surfaces are preserved, as the motion of the roller, instead of being alternately in opposite directions, is continuously in the same direction, although varying in speed. The two sets of cams are mounted upon parallel shafts 370, 371, supported in bearings on the side of the main frame and connected through a train of gears 372, to operate in the same direction and at the same rate of speed (Figs. 1 to 6 inclusive). The fast and loose pulleys 373 are mounted upon one of these shafts 370 and the intermediate gear in the train of gears 372 carries a worm 374 (Fig. 6) in engagement with worm wheel 318 of the galley driving mechanism. As matter of convenience and adaptation the several actuating levers are arranged in two series each provided with its own shaft

or fulcrum (Fig. 6). By reference to Figures 1 and 113 it will be seen that the lower or power ends of the actuating levers extend down between driving shafts 370, 371, in line with their respective pairs of cams, and beginning at the left, these are the pair of cams 377 (Fig. 115) operating upon the actuating lever 333 for ejector blade 259; cams 378 (Fig. 32) and actuating lever 178 for advancing and retracting the mold-blade 4; cams 379 (Fig. 122) and actuating lever 349 of the paper feed; cams 380 (Fig. 121) for actuating lever 78 of die-centering mechanism, connected through main actuating lever 390 and compression link 391 (Figs. 2, 6 and 22); cams 381 (Fig. 120) and actuating lever 58 for die-centering plunger; cams 382 (Fig. 119) and actuating lever 168 for transfer wedges; cams 383 (Fig. 118) and actuating lever 221 for pump mechanism; and cams 384 (Fig. 117) and actuating lever 246 for type carrier. The relative positions of adjustment of these several cams upon the two driving shafts are indicated by the grooves for receiving the keys.

The bell-crank 88 (Fig. 33) operating the locking bolts 86 of the secondary controller for the die-case centering mechanism, is caused to operate in unison with the actuating lever 58 of the centering plunger, to unlock said controllers as the centering plunger enters its seat in the matrix block, by having the power arm of its actuating lever 392 connected to the power arm of lever 58, the load end of said lever being connected to bell-crank 88 through rod 393.

The Pneumatic System.

From the foregoing description of the several mechanisms, separately considered, it must be plain that all that is required to complete the machine and render its several parts co-operative and responsive to the will of the operative who prepares the record strip, is a competent system of communication between the perforated record-strip and the several controllable members of the die-case centering mechanism, the justifying-wedges and the transfer-blocks.

This function is performed by what is herein termed the pneumatic system or series of air-tubes or passages 385 through which communication is established between the parts in the cross-bar and the pistons 66 of the primary controllers 65 and those of plungers 164 operating upon the trip levers of the justifying-wedges and the locking rod for the transfer-blocks.

By reference to the diagram (Fig. 112) it will be seen that each port in the cross-bar 337 is in open communication with one of the several cylinders referred to, so that any one or more of the pistons can be operated by forming a perforation in the record-strip in line with the desired pin or plunger. There being but 14 movable stop pins in each series of primary controllers the omission of a perforation in the record-strip corresponding to one of them effects the interposition of the fifteenth stop or fixed pin 65*, which is the equivalent of a movable pin directly controlled by a perforation in the record-strip, so that it may rightly be said that the record-strip directly controls the die-case centering mechanism as to each of its series of adjustments in transverse planes—lines and columns—through the pneumatic system.

Summary of Operation.

Having described in detail the several constituent elements of the organized machine, a brief summary of its operation will suffice.

At the commencement of each line the justifying-wedges are to be set to produce space type that will justify or fill out the line, assuming the character type are of normal dimensions according to the particular system of measurement adopted. It is the office of the operative who prepares the record-strip to determine not only what characters and spaces shall be produced and their order, but also to ascertain and impress the ratio of increase to be given each normal space type, in the performance of which he is aided by a special machine, adapted to form the required type-perforations in the record strip and indicate the justification ratio for the spaces.

Each justifying-wedge represents fifteen degrees of adjustment on a regular scale whose increments are uniform and proportional to the taper of the wedge, hence to produce a mold-cavity of the desired width for the space type, it is only necessary that the justifying-wedge should be set at that one of its positions of adjustment whose value, *plus* that of the normal wedge, represents the required position of the mold-blade.

The setting of each justifying-wedge involves two operations, first, for position, and, second, for connection with the positioning mechanism. Position is determined through the medium of the primary controllers or stop-pins 65 of the die-case carrier system, consequently a perforation is made in the record-strip to designate which of the fourteen positions of adjustment represented by the movable stop-pins 65, the wedge is to occupy; or the perforation for position is omitted, in which case the maximum adjustment, produced by fixed stop-pin 65* will be attained.

Another perforation is required to designate the particular wedge and to place it in connection with the actuating devices for adjustment, and this done by forming a perforation in line with the port leading to one or the other of the pistons controlling the justifying-wedge trip-lever. Thus either or both justifying-wedges are set to position and locked, and, incidentally, the galley mechanism is started in action to take care of the preceding line.

But, although adjusted for the line, the justifying wedges are inoperative to affect the position of the mold-blade and the size of the type, until through the action of the transfer-blocks, the control of the mold-blade is shifted from the normal-wedge alone, to the normal *plus* the justifying wedges.

To effect this two things are required, first, that the normal-wedge should be properly adjusted to harmonize with the justifying-wedge or wedges in determining the position of adjustment of the mold-blade; and, second, that the normal-wedge transfer-block should be thrown out of action and the justifying-wedge transfer-block thrown into action.

Two or at the most three perforations in the record-strip are sufficient to accomplish these results. If, as is preferred, the space matrix-blocks, are located in the last line in the die-case, the adjustment of the normal-wedge will be produced by a perforation communicating with the port leading to the primary controller or stop-pin representing the column whose width-value corresponds with the desired position of adjustment of the normal-wedge. Should the space matrix blocks be located in any other than the last line, another perforation corresponding to line adjustment would be required.

Having thus provided for setting the normal-wedge, another perforation serves to bring the justifying-wedges into action, and that is one opposite the port leading to the trip-lever which controls the locking-bolt of the transfer-blocks, whereby the normal-wedge transfer-block is locked out of action, and the justifying-wedge transfer-block brought into operation so as to act in conjunction with the normal and justifying-wedges in setting the mold-blade for a space type.

One or two perforations, according to the position of the matrix in the die-case, suffice for locating each character-matrix, and adjusting the normal-wedge to correspond therewith, through the medium of the two series of primary controllers pertaining to the line and column movements of the die-case.

The readjustment of the die-case, the normal and justifying wedges and the mold-blade are each affected by a movement direct from the position of prior adjustment to the position of next subsequent adjustment, thus the normal or zero position is eliminated and the motions incident to the return to a zero point before advancing to the next succeeding position are entirely avoided.

The adjustments effected by the normal and justifying wedges while accurate, delicate and positive, are not dependent upon rigid or inflexible connections, the wedges, themselves being loosely and flexibly connected to their positioning devices so as to avoid binding and distortion, and the interference due to variations in temperature.

So, too, the connection between the mold-blade and its actuating and adjusting devices, is of a character well adapted to prevent interference by variations in temperature

The setting of the justifying-wedges for the line taking place as it does after one line is completed, and before another is begun, affords an opportunity for the starting of the galley mechanism to take care of the completed line, and by utilizing the devices which bring the justifying-wedges into position for readjustment, to automatically start the galley mechanism, not only is there a saving of time effected, but the necessity of a special galley perforation is avoided.

Dated this 25th day of April 1899.

BOULT & WADE,
Agents for the Applicant.

COMPLETE SPECIFICATION.

Improvements in Machines for Casting and Setting Type.

A communication from the LANSTON MONOTYPE MACHINE COMPANY, a Corporation created, and existing under the Laws of the State of Virginia, and having its principal place of business at Washington, District of Columbia, United States of America.

I, ALFRED JULIUS BOULT, of 111, Hatton Garden, in the County of London, Chartered Patent Agent, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

The present invention relates to and constitutes an improvement upon the type making and composing mechanism forming part of what is known as the Lanston monotype system, wherein a previously prepared record strip is employed to control and govern the operations of an automatic type casting machine in the production of justified lines of type, and the assembling of such justified lines of type in column form ready for use.

In view of the somewhat complex character of the apparatus, embodying these improvements, and as an aid in understanding the description of the several mechanisms and their relations one to another and to the machine as a whole, it is desirable that the general mode of operation of the Lanston monotype system should be understood, to which end a brief description of its salient features, as embodied in the most highly developed form in which it has been introduced to the public prior to the present invention, will be attempted.

The Lanston system makes use of a record strip prepared by punching, at regular intervals, holes representing each character and space entering into the composition of the matter to be set up. At the end of each series of perforations, representing a complete line, there is formed one or more perforations representing the amount to be added to each space type of normal width, in order to cause the series of character type and spaces to justify, or just fill the line. These perforations occurring at the end of the line are known as the justification perforations. Another perforation succeeds the justification perforation and is known as the galley perforation. The next line in the composition is set up in the same manner, that is to say, characters and spaces, in the order in which they occur, are registered by perforations, the amount of justification, *i.e.*, the increase in the width of the normal space types, is then registered, after which the galley perforation is made, and so on to any extent.

The perforated record-strip thus made is delivered to the type-making and composing mechanism in the reverse order of composition so that, in the procession of events, the justification adjustments for the first line produced in the machine will first be effected, then the characters and spaces in inverse order of composition will be successively formed, and, after the last character for the line is completed, the justification devices will be returned to zero and the galley mechanism brought into action to transfer the completed line to the galley, after which the justification for the next line and the formation of the characters for said line will proceed as before.

The principal elements of the type-making and composing machine are the die-case, and its centering and clamping mechanisms; the mold, with its adjustable mold-blade for varying the size of the mold-cavity, to produce type-bodies of different widths; the normal adjusting mechanism for the mold-blade, for determining its position to correspond with the normal widths of the several characters represented by the matrices; the abnormal or justifying mechanism for varying the position of the mold-blade, as effected by the normal adjusting devices, so as to increase the dimensions of the mold as to width when certain selected type, such as the space type, are to be produced; the metal-injecting mechanism; the galley mechanism, the latter containing devices for assembling the completed type into a line, carrying said line into position to be transferred to the galley and transferring the line into the galley; and a pneumatic system through which the perforated record-strip exercises control over the several devices or mechanisms enumerated.

According to the plan or system upon which said machine is constructed a complete rotation of the driving shaft is required for the making of a single type. The die-case in which the series of matrices representing the characters are assembled is given a compound motion in two directions, for centering or bringing any selected matrix into position above the mold, said motions being performed with reference to a common starting point or zero position, hence a complete reciprocation of the die-case in two directions is required each time a type is produced, the selection of the character being determined by the degree of motion given the die-case measured from the common zero or starting position to which latter the die-case is returned after the formation of each type. This involved a considerable travel of the die-case, even when a limited number of matrices was employed, and when it was sought to materially increase the number of matrices in the die-case, the increased weight and range of motion, incident thereto, seriously affected the speed of the machine.

Time was also lost in setting the justification devices and in starting the galley mechanism. For the former there was a starting or zero position to which the justification devices had to be returned at the completion of a line, and with reference to which the adjustment was performed for the next succeeding line. Moreover, the setting of the justifying devices absorbed several otherwise useless rotations of the driving shaft, and the starting of the galley mechanism also required a blank or unproductive rotation of said shaft.

It will readily be perceived that the foregoing, among other minor features not here enumerated, constitute distinct limitations upon the speed capacity of the machine, considered as a whole, and it is one of the special and important objects of the present invention to overcome or at least materially modify these restrictions, and to not alone improve the mechanisms whereby the several operations are performed, but to materially increase the capacity of the machine, both as to number of available characters and speed of production.

With this end in view a new die-centering system has been contrived, whereby the zero or starting point for the die-case has been eliminated and the motions reduced to a minimum, by causing it to move directly from one point of adjustment to the next without first returning to a common starting point. By this means the range of motion and consequent number of characters may be increased without correspondingly increasing the speed of motion of the die-case, and the shock of arrest incident to increased weight of the die-case is avoided.

A new system for effecting both the normal and the abnormal or justifying adjustments of the mold-blade has also been devised, in which the zero position is likewise eliminated, the mechanism simplified, and the adjustment effected almost instantaneously, the maximum degree being produced by but two revolutions of the driving shaft; whereas in the Lanston machine several revolutions were consumed for this purpose.

Instead of employing a separate perforation in the record-strip, and consuming one complete revolution of the driving shaft for setting the galley mechanism into action, the galley perforation is dispensed with and the justification perforation utilized for the purpose.

The foregoing are some of the principal fundamental improvements embodied in the present machine, and, in addition thereto, there are numerous subordinate features pertaining to the construction, arrangement and combinations of the several mechanisms, all as will hereinafter more fully appear.

In the following description reference is made to the following drawings (representing the preferred, but not the only, embodiment of all the several improvements in an organized machine,) filed with the Provisional Specification,—

Figure 1 is a perspective view looking toward the front left-hand corner of the machine.

Figure 2 is a top elevation or plan view.

Figure 3 is a front elevation.

Figure 4 is a side elevation (looking towards right-hand side of the machine).

Figure 5 is a rear elevation.

Figure 6 is a side elevation (looking towards left-hand side of machine).

Figure 7 is a vertical transverse section on the line A—A, Figure 2.

Figure 8 is a vertical longitudinal section on the line B—B, Figure 2.

Figure 9 is a vertical section through a portion of the matrix or die-carrier, its supports and the centering plunger.

Figure 10 is a horizontal section on the line C—C, Figure 9.

Figure 11 is a vertical section on line D—D, Figure 13, showing a portion of the machine, including the guide for the centering plunger the die-case supporting frame and the arrangement of the friction clamps or brakes for the die-case carrier.

Figure 12 is a detached view of one of the friction blocks for die-case carrier.

Figure 13 is a bottom view of the die-case supporting frame and centering plunger.

Figure 14 is a detail view illustrating one of the levers for the friction blocks, Figure 12.

Figure 15 is a perspective view of the die-case carrier, inverted.

Figure 16 is a perspective view of a portion of the underside of the die-case supporting frame on which the die-case carrier, Figure 15, is mounted and reciprocates.

Figure 17 is a perspective view showing a portion of the die or matrix case.

Figure 18 is a sectional view of a portion of the die or matrix case.

Figure 19 is a perspective view of the mold, detached.

Figure 20 is a sectional view of the mold on line E—E, Figure 21.

Figure 21 is a horizontal section through the mold on the line F—F, Figure 20.

Figure 22 is a top plan view on an enlarged scale of that portion of the machine containing the matrix or die-centering mechanism, the normal adjusting devices for the mold-blade, and the abnormal or justifying devices.

Figure 23 is a perspective view showing a portion of the mechanism for controlling the position of the die-case, in its carrier, including the primary controller, the jaws of the primary positioning mechanism, the secondary controller and the jaws of the secondary positioning mechanism, the levers being broken away.

Figure 24 is a detail view showing one jaw or member of the secondary positioning or gauging mechanism.

Figure 25 is a plan view of the lever system for actuating the jaws of the primary and secondary controlling or positioning mechanisms showing them in two positions of adjustment.

Figure 26 is a detailed view showing the connection between the levers of one primary positioning mechanism and its spring.

Figures 27, 28, 29 and 30 are diagramatic views showing one set of centering and positioning levers for controlling the position of the die-case in one direction, and representing different positions of adjustment.

Figure 31 is a perspective view of a portion of the translating device through which motion is communicated to the die-case for centering the matrices.

Figure 32 is a side elevation of the set of cams for controlling the mold-blade actuating lever.

Figure 33 is a detail view illustrating the connection between the two locking devices for the secondary controllers.

Figure 34 is a perspective view of the devices for shifting the justifying wedges into and out of operative position and for operating the lock of the transfer wedge.

Figure 35 is a perspective view showing the locking mechanism for the transfer blocks or wedges.

Figure 36 is a vertical sectional view through the locking rod for the transfer blocks.

Figure 37 is a side elevation, partly in section, showing the justifying-wedge actuating devices detached, and one of the trip-lever pistons.

Figure 38 is a vertical section on line G—G, Figure 44, showing the normal wedge and its locking bolt.

Figure 39 is a vertical section on line H—H, Figure 44, showing the transfer-blocks and limiting abutment therefor.

Figure 40 is a similar section on line Z—Z, Figure 44, showing the justifying wedges with their actuating devices.

Figure 41 is a perspective view of the two justifying wedge-shifting levers detached.

Figure 42 is a vertical sectional view on line J—J, Figure 44, showing one of the locking bars for secondary controller.

Figure 43 is a detail perspective view of one of the secondary gauges or controllers.

Figure 44 is a longitudinal vertical section through the mold-blade shifting and adjusting devices taken on the line K—K, Figure 22.

Figure 45 is a perspective view of the upper transfer wedge.

Figure 46 is a similar view of the lower transfer wedge.

Figure 47 is a perspective view of the abutment slide for controlling the position of the mold-blade.

Figure 48 is a bottom view of said abutment slide.

Figure 49 is a detail in perspective of the self-adjusting bearing.

Figure 50 is a perspective view of the normal-wedge.

Figures 51 and 52 are similar views of the justifying wedges.

Figure 53 is a detail showing the locking bolt for the transfer wedges or blocks.

Figure 54 is a detail of the adjustable abutment for the transfer blocks or wedges.

Figure 55 is a diagramatic view illustrating the operations of the normal wedge and lower transfer block.

Figure 56 is a top plan view, on an enlarged scale, of a portion of the machine in the immediate vicinity of the mold, and including a portion of the adjusting and justifying devices for the mold-blade, the type carrier, and the line-channel and line-carrier of the galley mechanism.

Figure 57 is a horizontal sectional view on the line L—L, Figure 63, showing the type-carrier and ejector and the relative arrangement of the normal and justifying wedges and the transfer blocks.

Figures 58 and 59 are diagramatic views illustrating the action of the justifying wedges and the upper transfer wedge or block.

Figure 60 shows a slight modification in the form of the normal-wedge and abutment slide to adapt the machine for use in making type wherein the body sizes do not vary in uniform degrees throughout the font.

Figure 60ª is a sectional view of the bearing for the modified normal-wedge.

Figure 61 is a diagramatic view illustrating the application of the modified form of normal wedge shown in Figure 60.

Figure 61ª is a longitudinal section through the abutment slide as modified.

Figure 62 is a section on the line M—M, Figure 57.

Figure 63 is a section on the line N—N, Figure 57.

Figure 64 is a detail view, partly in section, showing the type ejector for the type-carrier.

Figure 65 is a detail view showing said type ejector detached.

Figure 66 is a perspective view of the type-carrier.
Figure 66[a] is a section of the type-carrier.
Figure 67 is a rear elevation of the type-carrier.
Figure 68 is a transverse vertical section of the type-carrier on line O—O, Figure 67.
Figure 69 is a perspective view of the movable jaw of the type-carrier.
Figure 70 is a detail of the pressure plate for the ejector-blade.
Figure 71 is a perspective view of a portion of the frame in which the type-carrier and ejector reciprocate.
Figure 72 is a top plan view of the galley mechanism detached.
Figure 73 is a front elevation of the galley mechanism.
Figure 74 is a detail view of the line-transferer.
Figure 75 is a detail showing in perspective the type sustaining springs at one side of the entrance to the line-channel.
Figures 76 and 77 are horizontal sectional views through a portion of the galley mechanism on the line P—P, Figure 86, showing the line-carrier in different positions.
Figure 78 is a vertical section through a portion of the galley, on line Q—Q, Figure 77, showing the line-transferer in the act of forcing the line of type from the line-channel into the galley.
Figure 79 is a detail showing one of the jaws of the primary positioning mechanism with shock arrester applied thereto.
Figure 80 is a detail view illustrating the adjustable connection between the type-carrier and its actuating lever.
Figure 81 is a detail view showing the line-carrier in perspective.
Figure 82 is a detail showing the type sustaining spring at one side of the entrance to the line-channel.
Figure 83 is an end view of the entrance to the line-channel, showing the type sustaining springs.
Figure 84 is a detail view in perspective of the reciprocating support for the line-carrier.
Figure 85 is a horizontal section of a portion of the galley mechanism on the line R—R, Figure 89.
Figure 85[a] is a section of the compression link.
Figure 86 is a central vertical section of the galley mechanism on the line S—S, Figure 72.
Figure 87 is a detail of the slide for returning the type-support in the line-channel.
Figure 88 is a detail in perspective of the line-support in the line-channel.
Figure 89 is a vertical section on the line T—T, Figure 86.
Figure 90 is a vertical section on the line U—U, Figure 86.
Figure 91 is a vertical section on the line V—V, Figure 86.
Figure 92 is a rear elevation of the pump and melting pot.
Figure 92[a] is a detail of the pump actuating mechanism.
Figure 93 is a top plan view of the supporting frame for the melting pot.
Figure 94 is a top plan view of the melting pot and pump mechanism.
Figure 95 is a side elevation, partly in section, showing the pump actuating and melting pot elevating devices.
Figure 96 is a vertical section through the pump on the line W—W, Figure 94.
Figure 97 is a horizontal section of the pump and melting pot with their connections on the line X—X, Figure 99.
Figure 98 is a perspective showing the pump actuating levers.
Figure 99 is a vertical section through pump and nozzle on the line Y—Y, Figure 97.
Figure 100 is a vertical section on the line Z—Z, Figure 94.
Figure 101 is a detail view illustrating in side elevation the driving connections for the pump, including means for throwing the pump into and out of action automatically.

Figure 102 is a detail of the reciprocating member for disconnecting the pump from its driving mechanism.

Figure 103 is a view in perspective of the driving and driven members of the pump-actuating devices and the detachable connecting link or latch.

Figure 104 is an end view of the pump-driving mechanism shown in Figure 101.

Figure 105 is an end elevation of the paper feed mechanism.

Figure 106 is a detail showing the trip-block for connecting and disconnecting the paper feed driving mechanism.

Figure 107 is a vertical transverse section through the paper feed mechanism and air bar.

Figure 108 is a detail showing the air bar in longitudinal section.

Figure 109 is a longitudinal vertical section through the paper feed mechanism.

Figure 110 is a detail view showing one of the spool-supports in section.

Figure 111 is a diagramatic view showing a section of the perforated record-strip.

Figure 112 is a diagramatic view showing the air passages or connections of the pneumatic system.

Figure 113 is a detail showing the arrangement of the driving cams.

Figure 114 is a perspective view of the link motion for operating the transfer blocks or wedges.

Figure 115 is a transverse section through the driving shafts, showing the arrangement of the lever, the cams illustrated in this figure being those for the type-ejector.

Figure 116 is a detail view showing the manner of adjusting the bevel gear on its driving shaft.

Figures 117 to 122 inclusive illustrate, approximately, the outlines of the various sets of cams for actuating the devices.

Corresponding parts in the several figures bear the same numerals.

For convenience of description the various mechanisms which together constitute the organized machine represented in the drawings may be considered in groups or divisions, according to their special functions, as follows: The mold; the die or matrix-case; the die-centering mechanism; the normal mold-adjusting mechanism; the abnormal adjusting or justifying mechanism; the metal-injecting mechanism; the galley mechanism, including the type-carrier, line-carrier and line-transferer; the paper feed; and the pneumatic system.

Generically considered similar elemental features are to be found in the prior Lanston machine upon which this is an improvement, but from which it differs in many respects, more especially in the construction, arrangement and mode of operation of the actuating mechanisms.

The general arrangement of the principal elements is best seen in Figures 1 to 8 inclusive.

The mold occupies a fixed position nearly central of the machine, and above it is arranged the die-case, which latter is mounted to reciprocate horizontally in two directions so as to bring any one of its dies or matrices centrally above the mold. Above the die-case, and in line with the mold, is the centering and pressing plunger by means of which the selected matrix is accurately centered and held tightly upon the upper end of the mold. The metal injecting devices are located to the left of the mold, the nozzle being carried beneath the top plate of the frame in line with the mold. The paper feed is arranged above the left-hand rear corner of the machine.

The die-centering and the normal adjusting and justifying mechanisms occupy positions in rear and to the left of the mold. The main driving shaft is mounted upon the left side of the frame, and in this connection it may be stated that the frame, which may be of any desired or approved form, has, in the present instance, been especially contrived to receive and accommodate the various mechanisms constituting the organized machine, but inasmuch as its form is not essential it will hereinafter be

referred to merely as the main frame, whether considered as an integral structure or as comprised of separable elements.

With this preliminary outline of the relative arrangement and location of the principal elements of the machine, the detail description may be proceeded with.

The Mold.

The mold may be regarded as the center of the entire system of type-forming devices, occupying as it does, a fixed position, about and with reference to which the other mechanisms are grouped and adjusted for co-operative action. Acting in conjunction with a separable matrix or die-block and a metal-injecting apparatus, the mold gives shape and dimension to the bodies of all the type, character as well as space, to which end it is furnished with a movable member or wall capable of adjustment so as to vary the size of the mold-cavity and thus produce type-bodies of different widths, set-wise.

The construction and arrangement of this part of the apparatus will be best understood by reference to Figures 7, 19, 20 and 21 and 56.

Although fixedly secured in position on the top plate of the frame and made up of several distinct parts, the mold, as a whole, constitutes a complete structure which can readily be attached and detached, not only from the main frame, but also from the actuating devices controlling its movable elements. It is composed of two stationary members or blocks 1, 2, forming the opposite side walls of the mold-cavity, and a cross-blade 3, movable across the ends of said blocks 1 and 2 and forming a removable front wall to the mold-cavity. The rear wall of said cavity is formed by the mold-blade 4, guided by and having movement between the proximate faces of the blocks 1 and 2 and constituting the adjustable wall of the mold, as well as the ejector for discharging the type therefrom and delivering them into the type-carrier. These parts are mounted and supported in a frame 5, comprising front and rear vertical walls, a vertical wall extending partly across one end and a bottom plate or support. Although this frame 5 might be formed in one piece, for convenience of manufacture it is composed of several parts firmly united, as clearly indicated in Figures 19, 20 and 21. One special reason for this sectional construction is the desirability of employing hardened and true surfaces for preserving the parts in proper relative position, more especially those parts which furnish the walls of the mold-cavity, hence the blocks 1 and 2, instead of extending down to the bottom plate of the frame, as they well might, are each mounted upon a filling piece, which latter is somewhat narrower than the blocks, as seen in Figure 20. The block 1 is fixed in position, and the opposite block 2 may, in like manner, be fixed; but it is preferred to permit slight lateral play to block 2 so that it may accommodate itself to variations in the temperature not only of the parts themselves, but also of the mold-blade, which latter is movably sustained between the two blocks. A tight joint should at all times be maintained between the mold-blade and the faces of blocks 1 and 2, and unless adequate provision is made to accommodate expansion and contraction due to variations in temperature, there will be danger of binding and serious interference with the movements of the mold-blade. To provide against this the movable or adjustable block 2 is held in contact with the mold-blade by a spring 6 (Figure 21), interposed between said block and the end wall of the frame. A set screw at one end and a clamping screw at the side serve to properly locate block 2, while a plate or keeper 7, fitting accurately in cross-grooves in the upper face of both blocks 1 and 2 and secured to the former and to the frame, insures the alignment and parallelism of the two blocks and furnishes the top guide for the mold-blade. These blocks 1 and 2 are each provided with independent passages in close proximity to the mold-blade for the circulation of water or other cooling agents.

The adjusting means for limiting the forward motion of the mold-blade operate directly upon the latter, instead of upon its actuating devices, thus eliminating irregularities in position incident to lost motion and expansion. Said adjusting means are mounted upon the mold frame and comprise the adjustable wedge 8 with

set screw 9, the former passing through an opening in the mold-blade and taking its bearing on frame 5.

It will readily be understood that in the production of articles such as type whose variations in size are measured by the 1,000th and 10,000th of an inch, and whose bodies must be rectangular, clean and free from fins, the matter of temperature and its incidents, expansion and contraction, is a very material factor, and it is to counteract or neutralize this disturbing element that the mold-blade, as well as its adjusting devices, are mounted directly upon the mold, and provision made for supplying a circulation of liquid in the side blocks 1 and 2 where it will contribute its beneficial action to the mold-blade.

The front block or cross-blade 3 is also preferably made separate from its base 10, to which it is rigidly attached by screws, some of the latter passing through a vertical plate 11 applied to the outer face of the cross-blade 3 and its base 10. Between the side vertical wall of the base and the cross-blade 3 is arranged an adjustable wear-plate 12, which is sustained in position by adjusting screws in the frame, as seen in Figures 20 and 21.

The base 10 of the cross-blade is formed in two sections slightly wider than the cross-blade itself and projecting beneath the blocks 1 and 2, Figure 20, and said sections of the base are separated by an interval forming a transverse groove 13 in which fits and reciprocates the ejector 14, the latter straddling a cam track 15 fixed to the base of the mold. The end of groove 13, when in vertical alignment with the space between blocks 1 and 2, forms the passage through which molten metal is injected into the mold-cavity, and the button or jet formed in this passage is discharged therefrom by the ejector 14 when the cross-blade is moved to uncover the front of the mold-cavity.

Directly beneath and in line with the mold-cavity the bottom plate of the mold frame is cut away for the reception of the nozzle plate 16. As is usual this plate is furnished on its under side with a conical seat for the reception of the nozzle, together with a jet opening or orifice; but it differs from others in having this seat formed with thin bell shape walls 17, and in having the supporting plate slightly concaved on the under side. Two objects are accomplished by this arrangement, in the first place, the chilling of the metal in the nozzle is avoided by diminishing the mass of the metal with which it is brought into close contact when the cast is made, and, in the second place, the warping and splitting of the nozzle plate resulting from the contact with the hot nozzle is prevented.

The rear portion of the mold-blade is perforated or slotted for connection with its adjusting connection, while the cross-blade is furnished with a hook, formed by an inserted block, for detachably connecting it to its actuating devices, all as will hereafter be explained.

It will be observed that the mold is a complete structure which can be readily removed for inspection, repair or substitution, and, further, that the mold-blade is supported and guided wholly by the members of the mold, so that all parts are subjected equally to variations in temperature, and the "hanging up" or "sticking" of the mold-blade, incident to the use of separate and more remote guides, is thereby prevented.

The Die-case.

Strictly speaking, the die-case includes only the series of dies or matrices and the frame in which they are immediately supported; but, for convenience, the supports and guides in which it travels horizontally, for adjustment, and vertically, for engagement with the mold, will be described under this title.

The general arrangement will best be understood by reference to Figures 1 to 8, inclusive, and Figure 22, the details being found in Figures 9 to 18, inclusive.

The die-case 20, is not substantially different from that heretofore employed, except as to its attachment to the actuating mechanism. It is composed of an open rectangular frame 21, adapted to receive the die or matrix blocks 22, and furnished with parallel guides 23, on opposite edges. An arm 24, projecting from one end of

the frame and furnished with an open traverse groove or socket serves for connection with the die-centering mechanism.

The die or matrix-blocks 22, are rectangular in cross-section, of uniform dimensions, and provided at one end with a die cavity, and at the opposite or upper end with a conical seat 25, for the reception of the centering plunger. They are mounted on rods 26, in parallel series or columns extending longitudinally of frame 21 said rods passing through transverse perforations in the matrix blocks and seated, at opposite ends, in the cross-bars of the frame. The seats for rods 25, extend but part way through the cross-bar at one end of the frame 21, and entirely through the opposite cross-bar, the rods being retained in position by a detachable cap-piece 27, secured to the frame. As will be seen in Figure 18, the holes in the matrix blocks for the reception of rods 26, are of slightly greater diameter than the rods, and said matrix-blocks are not fitted tightly within the frame 21, but are permitted a very slight motion therein, which, together with the loose fitting upon the rods 26 permits any or all of the matrices to have limited vertical and horizontal play within the frame. The purpose of this movement will later appear.

Frame 21 is supported, through its edge-guides 23, in ways 28, formed in opposite lower edges of the die-case carrier 29, (Figure 15). To insure accuracy of movement of the die-case in its carrier, the former is provided with ribs 30, parallel with the edge-guides 23, and fitted to a central guiding way 31, on the die-case carrier. Provision is thus made for the accurate movement of the die-case in its carrier in one direction, and to permit of a similar movement of the die-case carrier 29, upon its supporting frame 32, but in a plane at right angles to the motion of the die-case, said carrier is furnished, on its upper side, with ways 33, and a central way 34, which are received upon parallel side guides 35, and center guide 36, on the lower face of supporting frame 32, (Figures 10, 11 and 13).

The centering of any matrix above the mold is effected by a movement of the die-case in its carrier, in one direction, and of the carrier on its supporting frame, in the other direction, these motions being produced and controlled by the die-centering mechanism.

Provision is made for a vertical motion of the die-case, to seat the selected matrix upon the top of the mold, to which end the supporting frame 32, is attached to the lower ends of two vertical guide-rods 37, passing through the overhanging horizontal portion or bridge forming part of the frame, (Figure 9), said rods being connected together at their upper ends by a cross-bar 38. The guides 39, for rods 37, are preferably in the form of sleeves passing through openings in the frame and adjustably secured thereto by nuts and shoulders, as illustrated in Figure 9, the said frame 32, is normally upheld against the lower ends of guides 39, by springs 40, each surrounding one of the guides 39, and bearing against a cap 41, adjustably attached to its guide rod 37, said cap 41, engaging the upper ends of the guides 39, and forming limiting stops for arresting the downward motion of the supporting frame 32, when the lower faces of the matrices, are brought to the level of the upper surface of the mold, and engage the latter, but without pressure thereon. Between the lower ends of the guides 39, and the supporting frame 32, may be interposed buffer plates to arrest shock and prevent noise. A stud or pin 42, on cross-bar 38, passes through a lever 43, pivoted at one end in a vertically adjustable support or rod 44, and a spring 45, is interposed between said lever 43, and the cross-bar 38, while a nut or head on the stud 42, prevents the escape of lever 43. This lever 43, constitutes the medium through which vertical motion is transmitted to the supporting frame 32, through spring 45, and against the upholding action of springs 40, in lowering the idle die-case, so as to bring the matrix just into contact with the lower face of the mold, the upper ends of the guides 39, forming seats for limiting the downward motion of said frame.

The die-case carrier 29, and its supporting frame 32, are formed with open centers for the passage of the centering plunger 46. This centering plunger is formed with a conical or tapered extremity 47, adapted to enter the conical seat 25, formed in the upper end of each matrix-block 22, for the purpose of accurately centering and firmly

holding the selected matrix in contact with the upper face of the mold, hence it is necessary that said centering-plunger should be accurately adjusted and guided. The means adopted for this purpose are best seen in Figures 9, 10 and 11. Within an opening in the bridge of the frame is located a flanged hub or sleeve 48, against which bear four adjusting screws 49, for centering said hub, the latter being secured in adjusted position by vertical bolts or screws passing through its flange into the frame. The opposite ends of this hub 48, are furnished with conical seats or bearings, the one to receive the conical head of the guiding sleeve 50, and the other to receive the conical split sleeve and nut 51, on the opposite end of said sleeve 50, the latter being split longitudinally (see Fig. 10), so that by means of nut and sleeve 51, it can be caused to contract, and thereby take up lost motion incident to the wear of the interior surface of said sleeve or the exterior surface of the centering-plunger 46, working therein. Vertical motion is transmitted to the centering-plunger through a head 52, and spring 53, the latter interposed between a shoulder on the plunger and the under side of head 52, while the opposite side of said head contacts with an adjustable nut on the plunger, so that the elevation of the plunger will be effected through positive connections and its depression, when centering and seating the matrix, through yielding connections.

When a comparatively heavy die-case and supporting frame are employed in conjunction with rapidly operating actuating devices, it becomes desirable to provide means for temporarily retarding the motions of the die-case while passing from one position of adjustment to another, leaving the parts free, however, when the final centering of the selected matrix is being performed by the centering plunger. In the present instance this is accomplished by two frictional braking devices, one of which is applied in connection with the actuating devices operating directly upon the die-case, while the other is applied to the die-case carrier, and is operated or thrown out of action by the vertical motion of the die-case, hence may properly be referred to in this connection.

On supporting-frame 32, and in line with each guide 35, is mounted a friction block or movable section 54, (Fig. 12). These blocks are preferably located opposite the centering plunger (Figs. 11 and 13), and have their inner edges pivotally attached to one of a pair of curved levers 55, (Fig. 14). Each of said levers 55, is pivoted to the supporting frame 32, above the point of attachment to its friction block 54, and has its free end extended beneath a pin 56, passing through the bridge of the frame. A spring 57, interposed between a shoulder on pin 56, and the stationary frame, operates to hold said pin towards the lower extreme of its vertical movement, which latter is determined by an adjusting nut on the upper end of the pin. When the supporting-frame 32, is elevated to the position it occupies during the adjustment of the die-case, levers 55, engaging pins 56, elevate the latter against the pressure of the springs 57, and said springs, bearing upon the free ends of the levers, press the latter downward and friction-blocks 54, outward, thereby increasing the frictional resistance to the movement of the die-case carrier upon its supporting-frame 32. When the supporting-frame 32, is depressed, to bring the centered matrix down onto the mold, and before the centering-plunger has entered and been seated within the rear end of the selected matrix, pins 56, will be arrested, thereby relieving levers 55 from the pressure of springs 57, thus withdrawing the additional frictional resistance due to the pressure of blocks 54, so that the die-case carrier will be free to move laterally under the influence of the centering-plunger.

The vertical motions communicated to the supporting frame 32, through its lever 43, and to the centering-plunger 46, through its head 52, are derived from a single actuating lever 58, whose furcated end embraces head 52 between upper and lower shoulders thereon, while the free end of lever 43 is connected to said lever 58 by a link 59 at a point between the head 52 and the fulcrum of said lever, (Figs. 3, 5 and 7).

By means of these connections the vertical motions communicated to the die-case and centering-plunger, although derived from the same prime mover, *i.e.*, lever 58, and coinciding both as to time and direction, differ as to extent of travel, that is to say,

the centering-plunger travels in the same direction, but at a greater speed, than the die-case. This permits the centering plunger to be entirely withdrawn from the matrix when in elevated position, and to overtake and enter the matrix during the downward motion of the die-case.

The horizontal adjustments of the die-case are performed while it is held in elevated position, as indicated in Figs. 7 and 9, with the centering-plunger entirely clear of the matrices. As soon as this preliminary centering of the matrix has been completed, the load arm of lever 58 is advanced towards the mold, thereby lowering the die-case until the latter is arrested by its limiting stops, which occurs when the matrix-block just makes contact with the mold, but without pressure. In the meantime, the centering-plunger will have overtaken the die-case and entered the centering cavity in the preliminary centered matrix, giving the latter its final adjustment, and the plunger continuing to advance after the die-case has been arrested, presses and holds the centred matrix firmly in position on top of the mold. During this final centering of the matrix the retarding frictional devices operating upon the dye-case and its carrier, have been relaxed or withdrawn, leaving the die-case free to respond to the centering action of the plunger, which action may only affect the selected matrix, or may extend to the die-case and its carrier, according to the degree of accuracy with which the die-case centering mechanism operates in effecting the preliminary centering.

Die or Matrix-centering Mechanism.

As before explained, the centering of the matrices is effected by movements of the die-case in a horizontal plane, on lines intersecting at right angles, the motions in one direction being communicated directly to the die-case through arm 24, and those in the other direction, to the die-case carrier 29. It is obvious that these motions may be effected either separately or simultaneously, or that either may be employed singly, according to the location of the die-case at the time when the adjustment is to be made. Thus, in the example illustrated in the drawings, the types are graded, as to width, into fifteen sizes, whose increments are uniform throughout the series, and the matrices are arranged in fifteen parallel lines, extending transversely of the die-case, each line being composed of a complete series of fifteen matrices representing characters increasing progressively in width from one end of the line to the other. This brings all the matrices representing type of the same body width into alignment longitudinally of the die-case, there being as many columns of matrices as there are sizes of types, the column containing the widest type being located at one extreme of the series of traverse lines, and those of the smallest at the opposite extreme. If, for example, the right hand column is assigned to the type of maximum width, the next succeeding column to the left will contain characters of the next smaller dimensions, and so on throughout the series.

It will be seen, therefore, that the motions of the die-case in one direction will correspond to a change in position from one column to another, which is the same as the change from one size to another, while the movements of the die-case in the other direction, from line to line, will be equivalent to the selection of a particular letter in the column.

To effect and control these motions of the die-case, according to an organized system, is the purpose of the die-centering mechanism.

Although connected for conjoint action, there are, in effect, two controlling mechanisms, the one operating upon the die-case directly, and the other upon the die-case carrier, but, inasmuch as these two mechanisms are in the main duplicates, a description of one will serve in a measure for both.

As organized in the present machine, each of these mechanisms is made up of five elements or groups, to wit: (1) a primary controller or fixed gage; (2) a primary positioning or gaging mechanism; (3) a secondary controller or shiftable gage, (4) a secondary positioning or gaging mechanism, and (5) translating devices.

The primary controller or fixed gage.—This consists of a series of pins or stops, 65 arranged in fixed relation to each other, at distances apart equal and corresponding

to the distance between the center of one line or row of matrices and the center of the next adjacent line or row. Referring, for example, to the mechanism immediately controlling the die-case (Figs. 27 to 30, inclusive), whose movements correspond to a shifting from one line of matrices to another, each of the pins or stops 65, corresponds in relative position and arrangement to one line of characters in the die-case; while the stops or pins of the other series (Figs. 55 to 59), that belonging to the die-case carrier 29, correspond in position and arrangement to the several columns of matrices.

In the example illustrated provision is made for dealing with a die-case containing 225 matrices or a square containing 15 lines of 15 characters each, hence there are 15 stops or pins in each series.

The terminal pin or stop marked 65* is fixed, while all of the others in the series are movable or so arranged that any one may be brought into position for engagement by the co-operating portion or portions of the primary positioning mechanism. In the preferred form of embodiment, the movable pins 65, of each series are pneumatically controlled, as hereinafter explained, to which end each pin is provided with a piston head 66, and retracting spring 67, (Figs. 42 and 63), arranged in a cylinder formed in a supporting plate 68. For convenience of construction this supporting plate 68, is detachably secured to the top plate of the frame, and is formed with the series of cylindrical perforations, constituting the cylinders, the lower end of each cylinder registering with a supply pipe passing through the bed-plate. Inasmuch as it is very desirable that the pins should be accurately located, their upper ends are passed through and guided by a plate 69, overlying the cylinder plate 68.

The primary function of the series of pins 65, is to furnish a controllable gange for designating and locating the position of each line of matrices contained in the die-case.

The primary positioning or gaging mechanism.—The principal function of this mechanism is to adjust the position of the secondary controller or shiftable gage, to correspond with a designated pin or stop 65, of the primary controller or fixed gage, and the preferred means for accomplishing this will next be described.

Supported to reciprocate upon a fixed guide or bar 70, above and parallel to plate 69, are arranged a pair of jaws or clamping members 71, 71*. One of these jaws 71 is provided with a plate or flange 72, lying in the paths of the several pins 65, when elevated or projected into operating position, while the underside of the opposing jaw (71*) lies in a plane above the extremities of the pins. If, now, any one of the series of pins 65, is elevated, or if the movable pins remain down, and the fixed pin alone stands in the path of jaw 71, and said jaw is moved until its plate 72, contacts with the elevated pin, it is obvious that the position at which said jaw is arrested will coincide with that of the pin against which it bears, and if the opposite jaw 71*, is brought up into contact with the first named jaw, the line of division between the two jaws will coincide as to position to that of the selected pin.

A novel system of actuating devices has been devised for giving motion to these two jaws, whereby, during each revolution of the driving shaft, the two jaws shall separate or assume positions at opposite extremes of their movements, and, in closing or moving toward each other from these extreme positions, that one of the jaws which is to contact with the primary controller or fixed gage, shall be first advanced and its motion continued until arrested by the designated stop, whereupon the other or opposite jaw will be set in motion and caused to advance until it contacts with the previously arrested jaw. The mechanism for effecting these movements comprises two levers 73 and 74, connected together at their inner ends by an adjustable link 75, and each having its outer end pivoted to one of the jaws 71, 71*. Lever 73 is pivotally attached to a link 76, whose opposite end is pivotally supported upon a post secured to the main frame; while lever 74 is similarly connected, by a link 77, to a post or pin carried by a horizontal bell crank lever 78. It will be observed that this system of levers is furnished with but one fixed point of support or center of motion, to wit, the post to which link 76 is connected; that motion is transmitted from the

prime-mover, or driver, (bell-crank 78), through its connection 77, with lever 74, the latter being bodily movable toward and from the fixed pivot of lever 73, by virtue of its connection with the latter; and that both levers 73, 74, are, at the same time, capable of oscillating about the points of attachment to their respective links 76, 77. It results from this arrangement that starting from the position shown in Figure 27, with the jaws open, when the actuating lever 78, is moved to the left, it will operate first to advance the right-hand jaw 71, or that provided with the edging plate 72, until the latter makes contact with and is arrested by one of the elevated pins or stops 65, of the primary controller or fixed gage. During this motion lever 73 remains stationary, the jaw attached thereto remaining against the stop at the outer extreme of its movement, where it is held by a spring 79, connected to lever 73, intermediate link 76 and said jaw, so that the pivot connecting lever 74 to link 75 is for the time being the fulcrum of said lever. As soon, however, as the outer end of lever 74 is arrested by the contact of its jaw with the stop pin, the fulcrum is shifted to the outer end of the said lever and the inner end becomes the power arm, from which motion is transmitted, through connecting link 75, to the inner end of lever 73, thus causing the latter to turn upon the pivots of its link 76, and, overcoming the tension of the spring, moving the opposite jaw 71*, up against the stationary jaw.

As will be seen most clearly in Figures 2, 22 and 25, these lever systems are duplicated for effecting the two motions of the die-case, each system being connected to one arm of the bell crank lever 78; and, in order to equalize the spring action on the corresponding levers 73, for retracting said levers and opening the jaws upon the reverse movement of the bell crank, spring 79 is attached to one end of a lever 80, pivoted upon a fixed support on the frame, while the opposite end of said lever is attached to another spring 81, the latter being in turn connected (through a bell-crank lever 82 carried by bell crank 78, and link 83) to lever 73, at a point between its link 77, and the connecting link 75. Springs 79 and 81 are under initial tension, and they are connected through lever 80 for the purpose of equalizing their action upon the two systems.

Although the two systems of levers above referred to are practically the same, there is a slight difference in the arrangement of the connections, and that is, lever 74, which is connected to the jaw 71 is pivotally connected to the post on the frame, instead of to bell-crank 78, while lever 72 is pivotally connected to bell crank 78, and the spring retractor is attached to the inner arm of lever 73, from which it results that the movement of lever 78 in a direction to close the jaws, causes the inner end of lever 73 of the die-case carrier system to advance, and, acting upon the inner end of lever 74, swings the latter and carries its jaw 71, forward until it encounters the stop-pin, after which the inner end of lever 73 becomes the fulcrum point about which its movements take place in advancing the opposite jaw 71*.

Both sets of jaws 71, 71*, open simultaneously, preliminary to the setting of their primary controllers, but each operates independently with respect to the latter; that is to say, the point at which one set of jaws is arrested does not in any degree affect the position or movement of the other set of jaws.

The secondary controller or shiftable gage.—Having explained how the primary positioning or gaging mechanism is operated and governed by the primary controller, the next in order is the secondary controller or shiftable gage, whose function it is to control the position of the secondary positioning or gaging mechanism. It consists of a movable block or abutment 84, (Fig. 43), located between jaws 71, 71*, and mounted to reciprocate parallel therewith, with a locking device for effecting final adjustment, and holding it in position. To this end the block 84, is supported upon a slide 85, the latter mounted to reciprocate in guides parallel with the movements of jaws 71, 71* and furnished with a regular series of centering and holding detents, composed, in the present instance, of a series of racklike teeth 86. One or both of the jaws 71, 71*, of each set is cut away or recessed to form a seat for the reception of this secondary controller or shiftable gage 84, said seat being of such dimensions that when the jaws are closed the said shiftable gage will be held therein after being

brought to position by the movement of either one of the jaws constituting a set. Preferably but one jaw 71*, of each set is recessed, the face of the opposite jaw 71, forming one wall of the recess, and, if desired, the sliding jaw 71 may be provided with a pivoted and spring retracted engaging lever 91, (Figs. 22 and 79), whose free end stands in line with the secondary controller 84, thus forming a yielding contact for engaging and locating said controller.

The shiftable secondary controller or gage occupies at all times a position between the jaws 71, 71*, and no matter where located at the time the jaws are separated, it will, by the closing of the jaws, be brought to a position corresponding with that of the primary controller or fixed gage.

To ensure a very accurate adjustment of the secondary controller after it has been brought to position, and to lock it against movement while the primary controlling mechanism is being reset or opened preliminary to the next adjustment, a locking bolt 87, adapted to enter between the converging walls formed by rack teeth 86, is employed for each of the secondary controllers. Both locking bolts 87 are operated simultaneously, to center and hold or release the secondary controllers, through the agency of a bell-crank lever 88 (Fig. 33), to which end each locking bolt is furnished with a longitudinally adjustable stem 89, carrying a spring and sliding head 90, between limiting stops. An arm of lever 88 engaging said sliding head 90 acts through its compression spring to advance the locking bolt and hold it in engagement with the notches in the secondary controller, while the retracting movement is positively effected by engagement with the shoulder on stem 89.

The secondary positioning or gaging mechanism.—This acts directly in connection with the secondary controller or gage 84, after the latter has been set or adjusted. Although the two mechanisms are substantially the same in construction and operation, it will be more convenient to consider them separately, in order to distinguish between them in other connections.

Each comprises two jaws or oppositely reciprocating blocks adjacent to the jaws 71, 71*, of the primary positioning or gaging mechanisms, those pertaining to the mechanism acting directly upon the die-case being numbered 92 and 93, (Figs. 23, 24, 27 to 30, inclusive, and 42), and those pertaining to the die-case carrier operating mechanism being numbered 94 and 95, (Figs. 57, 62, 63). Each set of jaws 92, 93 and 94, 95, has one of the secondary controllers, 84, located between its members in position to be engaged thereby, the said jaws being supported in guides directly above the slide or support 85 carrying the movable block or abutment constituting said secondary controller 84.

Each pair of jaws 92, 93 and 94, 95, is controlled and actuated, to open or move away from, and to close or engage upon its controller 84 by a system of levers corresponding, generally, with those which actuate the jaws 71, 71*, of the primary positioning or gaging mechanism. Thus jaw 92 is pivotally attached to the outer end of a lever 96, the latter connected at a point between its ends by a link 97 to a pivot on bell crank 78; jaw 93 is pivotally attached to the outer end of lever 98, which latter is connected at a point between its ends, by a link 99, to a fixed pivot on the frame; and the two levers 96 and 98 are connected at their inner ends by an adjustable link 100. In like manner the levers pertaining to jaws 94, 95, are connected to the opposite arm of bell-crank lever 78, that is to say, lever 101 is connected at its outer end to jaw 94, and by a link 102, to a fixed pivot on the frame, while its inner end is connected by an adjustable link 103 to the corresponding end of lever 104, carrying opposite jaw 95, said lever 104 being, in turn, connected by a link 105 to the bell-crank lever 78.

By reference to Figures 22 and 25 it will be seen that the levers of the secondary positioning or gaging mechanisms are connected up oppositely to the levers of the primary positioning or gaging mechanism with which they are associated; that is to say, (referring, for example, to the devices pertaining directly to the die-case movement), while the outer lever 73, or that most remote from the mold, is connected to the pivot on the frame, the corresponding lever 96 of the secondary positioning jaws is connected to the bell-crank lever 78, the opposite levers of the two pairs

being connected respectively to bell-crank lever 78, and to the fixed pivot on the frame.

This reversed order of connection is adopted in order that the two sets of jaws may be moved simultaneously in opposite directions, so that while one set of jaws is closing upon its stop or controller, the other set will open in order that its stop or controller may be set, and *vice versa*.

The secondary controller 84 having been set in position by and during the approach of jaws 71, 71*, and jaws 92, 93 and 94, 95, of the secondary controlling mechanism, having been opened or separated, when the motion of the driving lever 78 is reversed to open jaws 71, 71*, it will bring the jaws of the secondary controlling mechanism together upon opposite sides of the secondary controller 84, the latter serving to determine the point within its range of adjustment at which the jaws of the secondary controlling mechanism shall be brought together.

The translating devices.—The next and last element in this series includes the translating devices, or those through which the adjustments thus effected are made operative upon the die-case and the die-case carrier.

It will be remembered that in addition to the movement from line to line, or in a direction longitudinally of the die-case, the latter is susceptible of a transverse motion communicated through its carrier 29, hence provision must be made in the die-case shifting mechanism to accommodate these lateral motions. First, as to the longitudinal movements of the die-case. In the supporting plate 68, and parallel with the pins therein and with jaws 92, 93, of the secondary controlling mechanism, is formed, a guide or way for the reception of a slide 106 (Figs. 31, 42 and 44) said slide being provided with a cross-head 107. This cross-head rides upon ways 108 (Figs. 23, 38, 39, 56), and is furnished with an upwardly projecting rib 109, and two forwardly projecting arms or seats 110. A yoke-plate 111, having a slot, or opening, wider than rib 109, fits over the latter and rests upon arms 110, said yoke being firmly secured in position by screws. The purpose of this construction is to furnish a cross-bar or seat, at right angles to slide 106, adapted to receive and fit between the shoulders or engaging walls of the slot formed in arm 24 of the die-case frame 21, so that the latter will be free to move across the path of slide 106, but will follow accurately the longitudinal motions of said slide; at the same time the construction is one which permits the ready application and removal of the die-case. It is obvious that the yoke-plate 111 and slide 106 might be formed integral, but inasmuch as the greatest amount of wear occurs upon the yoke, and it is desirable that it should be made with true surfaces, it is preferably formed separate from its supporting slide and attached thereto in the manner explained in order to secure fixity of adjustment.

A headed rod 112, is adjustably secured to cross-head 107, as by means of a split socket and pinching screw, said rod extending parallel with slide 106 and through an opening in jaw 93 of the secondary positioning mechanism, thus bringing its head between the jaws 92, 93, and in position to be engaged by the latter.

Inasmuch as the die-case carrier is given a lateral motion, its horizontal movements being all in one direction, the translating devices are connected directly to said carrier (Fig. 15), hence a headed rod 113, is adjustably attached to a split socket on the die-case carrier 29. As the point of attachment of the rod 113 to the die-case carrier is slightly to one side of jaws 94, 95, though parallel therewith, its headed end is received between the proximate faces of a lateral projection 114 on jaw 94 (Fig. 63), and a wing or projection 115 on jaw 95 (Fig. 62). This arrangement is not substantially different from that of the translating devices for the die-case, and is only made to accommodate the parts to slight changes in position due to the presence of other elements in the machine.

It may here be remarked that slide 106 furnishes a convenient point of application for the friction device, hereinbefore mentioned as the complement of friction blocks 54 operating upon the die-case carrier. To this end a friction plunger or block 116 (Figs. 22, 23,) is arranged to bear upon the upper surface of slide 106, and is operated upon by lever 117, to whose outer end is connected a link 118, (Fig. 40,) passing upward through a lug on actuating lever 58, said lug engaging a shoulder

beneath it on the rod, and a spring above it, so that during the downward motion of the actuating lever, to depress and center the matrix, the pressure of friction block 116 will be released, and when said actuating lever is elevated, while the adjustment of the matrix is being effected, the friction block will be held, under the elastic pressure of its spring, in contact with slide 106, thereby exerting a limited degree of resistance to motion.

The operations of the die-case centering mechanism are illustrated in the diagramatic views, Figs. 27 to 30, inclusive. Fig. 27 represents the die-case actuating devices immediately after a cast has been made. The secondary controller 84 has been located, and jaws 92, 93, of the secondary positioning or gaging mechanism have been closed upon it, and, in so doing, have, by engagement with the head of rod 112, brought the die-case to position. Locking bolt 87 has been withdrawn, and the parts are in position for the next succeeding adjustment. Jaws 71, 71*, of the primary positioning mechanism being open, that is, separated, the primary controller or pin 65 representing the position in the line of the next character to be formed is projected into the path of jaw. Assume, for example, that the next character or matrix is the first in the line, or that represented by the first of the series of pins 65. Said pin is projected into the path of jaw 71, the bell-crank lever 78 is operated to close the jaws, and at the same time open or separate the jaws of the secondary controlling mechanism. The result is as indicated in Figure 28, the translating device is released and the secondary controller 84 brought to its new position and locked. A reversal of the motion of lever 78 separates jaws 71, 71*, of the primary positioning mechanism and closes jaws 92, 93, of the secondary positioning mechanism upon the secondary controller 84, at the same time shifting the translating devices from the former position, indicated in Figure 27, to the new position of the secondary controller, as indicated in Figure 29. In like manner the adjustment is made for each position, and is determined by the primary controllers. In Figure 30 the shifting of the secondary controller to a position corresponding with the 8th pin is represented.

Corresponding movements of adjustment are performed with respect to the centering mechanisms operating upon the die-case carrier, and it will be apparent that by the conjoint action of both mechanisms, any matrix in the series may be brought into position above the mold, by merely selecting one pin corresponding to the line and another corresponding to the column.

It will be noted that the adjustments of the die-case and of its carrier from one position to another are performed directly, without necessity of returning either the die-case or its carrier to a zero position, whereby excessive motion is avoided and the traverse of the die-case is reduced to the minimum; and where the same letter is repeated no lateral motion of the die-case in either direction is required, it remaining in one position, although its actuating devices operate as before, but without moving the die-case.

So far as the mere operation of moving the die-case to correspond with the various positions indicated by the primary controller or gage is concerned, the translating devices might be connected to one of the jaws of the primary controlling mechanism or to the secondary controller 14, provided both jaws 71, 71* were adapted to contact with the primary controller lying between them, as is done in the case of the jaws of the secondary controlling mechanism, where no spring is required. But such an arrangement would be inadequate to deal with a defective record-strip, such as would cause the simultaneous elevation of two or more pins 65 between the jaws, and owing to the necessarily rapid motions of the jaws, the shocks and strains upon the primary controller incident to inertia would tend to disturb the delicate adjustments requisite for the proper centering of the matrices. It is with a view to effecting an improvement in these features that one jaw only of the primary controlling mechanism is arranged to engage the primary controller or gage and the spring applied so that in the event two or more stop-pins 65 are projected into the path of the jaw, the latter will engage the first one, the opposite jaw moving over the pins and contacting with the arrested jaw.

Moreover, by employing the two controlling mechanisms more time is allowed for effecting the necessary movements of the die-case, and the shocks incident to the arrest of the die-case are borne by the secondary instead of by the primary gage.

Normal Mold Adjusting Mechanism.

Accurately speaking, this mechanism might be said to include only those devices which operate to determine the position of the mold-blade when in casting position, but inasmuch as they are directly associated with the mechanism to which the mold-blade is connected and by which it is moved, both for ejecting the type from the mold and for returning it to casting position, it has been thought proper to describe the connections for moving the mold-blade under this head.

Referring particularly to Figures 23, 38, 39, 40, 44, and 56, it will be seen that the mold-blade 4 is attached to the front end of a slide 120 by a detachable cross-pin 121, passing through arms of the slide and the perforation in the rear of the mold-blade. This slide 120 has a vertical opening in rear of the point of attachment of the mold-blade for the accommodation of a stop or abutment for limiting the rearward movement of the said mold-blade, and the rear end of said slide is connected to a rod 122 (Figure 44) passing through the frame below slide 106. This rod 122 carries two springs 123 and 124, the former engaging a shoulder on the rod, and the latter, a nut or collar on the outer or free end of the rod.

The interval between spring 123 and the shoulder on the outer end of the rod is occupied by three sleeves, to wit, a headed or flanged sleeve 126 next spring 123, a sleeve 125 on the outer end of the rod, and a wider sleeve 125* between sleeves 125 and 126.

Spring 124 surrounding sleeve 125 engages a collar 127 riding loosely on said sleeve, to hold it against the end of sleeve 125*.

Embracing sleeve 125*, which latter is flattened on opposite faces (Figure 23), is the furcated end of a lever 128, the latter being somewhat narrower than the interval between collar 127 and the flanged head of sleeve 126, and said lever is connected by a link to its actuating lever 178 (Figure 2).

The operations of these parts will be explained in connection with the normal mold-blade adjusting mechanism. It is sufficient, for present purposes, to state that they constitute the means for communicating reciprocating movements to the mold-blade.

Beneath slide 120, and guided to reciprocate in ways parallel therewith, is another slide 129 (Figures 44, 47 and 48), which is furnished with a stop or abutment 130 standing vertically in the opening in slide 120 and occupying a position immediately in rear of the mold-blade 4. For convenience of adjustment the engaging face of this stop or abutment is rendered adjustable, as by the application of a set screw 131 at this point, one end of the latter standing in line with the rear end of the mold-blade, as seen in Figure 44. It is by the setting or adjusting of this stop or abutment 130 during the forward or ejecting movement of the mold-blade, that the width of the mold is determined for the next type, said stop operating to intercept the rearward motion of the mold-blade at the proper point, and these operations are performed through the medium of what is herein termed the normal-wedge 132 (Figure 50) and the lower transfer block 133 (Figure 46) as will presently appear.

Slide 129 is furnished on the under side with a shoulder or abutment between which and a fixed surface on the frame are arranged the normal-wedge 132 and its transfer-block 130, the two latter extending in a plane substantially at right angles to the direction of motion of said slide (see Figure 44).

The normal-wedge 132 and its transfer-block 133 together constitute a pair of reversed wedges, either or both of which may be varied, as to its angular dimensions, in fixing the size of and the ratio of variation between the types of the particular series being made.

In order, however, to minimize the number of parts or elements to be changed in order to adapt the machine to different kinds or systems, as in changing from brevier to pica or from the American to the English system, the transfer-block is constituted the constant and the normal-wedge the variable factor.

The longitudinal reciprocations of the transfer-block are uniform in extent, and its principal function is to set the abutment slide 129 after the normal-wedge has been adjusted, hence its angle is or may be constant for all kinds of type; and in order that its action may be uniformly and properly gaged, the fixed abutment (preferably formed by a detachable plate 134) has its face inclined to correspond with the engaging face of the transfer-block, while the proximate faces of the normal-wedge and the transfer-block are also given the same angle of inclination.

If the machine is constructed to deal with but one kind of type, the angle of the normal-wedge will be calculated so that each of its fifteen degrees of motion will produce a one-unit variation in the position of the abutment-slide, and in such case either or both faces of the wedge might be inclined to the direction of its motion; but when, as in the example illustrated, the machine is adapted to form different kinds of type, the face of the normal-wedge next the abutment-slide 129 is tapered, in order that any one of a series of normal-wedges with different degrees of taper suited to the different kinds of type, may be inserted between the abutment-slide and the transfer-block, and be made to work in harmony with the latter by reason of the uniform angle of the surface contacting with said transfer-block.

The face of the normal-wedge next the abutment slide thus becomes the variable element, and by increasing or diminishing its angle the ratio of variation between different sized type of the same series can readily be calculated and provided for.

To accommodate normal-wedges of various angles and dimensions, the abutment-slide 129 carries a self-adjusting contact in the form of a block 135 (Figure 49), whose rear surface is curved to fit within a seat in slide 129, and it is held from displacement by a pin on said slide riding in a groove in one end of the block.

It will readily be seen that by changing the position of either the normal-wedge or its transfer-block, the slide 129 carrying abutment 130 can be adjusted or set so as to intercept the mold-blade at any desired point in the line of its backward travel.

Both means of adjustment are utilized in the present machine, the one manual and the other automatic.

The manual adjustment is applied to the transfer-block, and includes the devices for regulating the position of the transfer-block when at one extreme of its movement, its operating position.

The automatic adjustments are effected through the normal wedge alone, the transfer-block being utilized for the purpose of moving the abutment to position after the normal-wedge has been set, and to shift the action of the normal-wedge into connection with the abnormal or justifying mechanism, as will presently appear.

To accomplish this, it is required that the transfer-block 133 should when retracted or inactive occupy the position indicated by dotted lines in Figure 55, thus leaving the normal-wedge free for adjustment, so that after the latter operation has been performed, the transfer-block may be drawn to the position indicated by full lines in Figure 55, thereby effecting the proper adjustment of the abutment-slide. The mechanism for bringing the transfer-block 133 into action at the proper times will be explained in connection with the justifying mechanism. At present the description will be directed to the means for adjusting or setting the normal-wedge.

The angle of the normal-wedge is adjusted to the particular system adopted. Thus if the type bodies are arranged in 15 groups or divisions, with a uniform rate of increase, the taper should be such that 15 equal degrees of movement will cover the entire range of variation in body-width, from the widest to the narrowest. Such being the case, it is only necessary, in order to effect an adjustment of the mold corresponding to the width of type represented by the several columns of matrices in the die-case, to shift the normal-wedge so that its position shall coincide with that

of the column in which the selected character to be formed is found. To effect this adjustment rapidly, accurately and in harmony with the motions of the other mechanisms, the jaws 94, 95, of the secondary positioning or gaging mechanism acting upon the die-case carrier are utilized, to which end each of said jaws is provided with a horizontal extension or wing 136 and the normal-wedge 132 is furnished with a pin or projection 137 fitting the interval between said wings when jaws 94, 95 are in closed position.

It will be borne in mind that these jaws 94, 95 are brought together upon the secondary controller 84 in locating any column of matrices over the mold, and that the column is determined by the selected primary controller 65, hence the same devices which operate to position the die-case carrier are utilized to effect a corresponding movement or adjustment of the normal-wedge, thereby adjusting the width of mold cavity to the selected column of matrices.

Inasmuch as accuracy of adjustment is necessary, the normal-wedge is further provided with a series of equally spaced and accurately located transverse grooves 138 for the reception of a locking and centering pin 139 (Figure 38), the latter passing through a split adjusting sleeve 140 and being connected at its upper end to the lever 58 by which the die-case is depressed into contact with the mold. Lever 58 acts positively against a shoulder on the upper end of the locking-pin, to raise the latter out of engagement with the normal-wedge, and it operates yieldingly, through a spring, to depress and hold said pin in engagement with the normal-wedge after the latter has been adjusted and while a cast is being made. While the normal-wedge is being thus held, the setting devices or wings 136 open or separate preparatory to the next succeeding adjustment, which latter is effected by simply moving the wedge from the last previous point of adjustment to the next, instead of carrying it back to zero between succeeding adjustments.

We have thus far considered those adjustments of the mold-blade which correspond to the normal variations in the body widths of the type and to the 15 columns represented by matrices in the die-case, and the same is true as to such space-type as correspond to any of the 15 dimensions mentioned, it being of course understood that for space types the matrix-block is not provided with a die-cavity. But the more important, or at least equally important, element in the machine is the provision for abnormal adjustments, whereby justified lines of type are produced.

The Justifying Mechanism.

This embraces, in addition to the normal-wedge 132, the two justifying-wedges 141 and 142 (Figures 51 and 52) and a transfer-block or wedge 143 operating in conjunction with the slide carrying the mold-blade stop or abutment 130. Although a single justifying-wedge might under certain conditions be employed, two are preferred as affording a greater range and finer adjustment. The range of motion of the two justifying-wedges 141 and 142 is the same as that of the normal-wedge, and, like the latter, is divided into 15 equal periods or degrees. In the example given, one wedge 141 has a taper giving an adjustment equal to ·0005 of an inch for each degree of longitudinal motion, while the other wedge 142 has a taper giving an adjustment of ·0075 of an inch for each degree of motion.

The transfer-block 143 is located directly above transfer-block 133, and occupies a position between the justifying-wedges and the normal-wedge.

To effect justification it is required that the transfer-block or wedge 133 should be held out of action, the transfer-block or wedge 143 be brought into action, and either one or both justifying-wedge 141, 142, be adjusted to position in order that the variation in the position of the mold-blade abutment, due to the action of the justifying-wedges, may be superadded to the adjustment effected by the normal-wedge when a space type is to be produced.

First as to the means for determining which set of adjusting devices shall be operatively connected with abutment-slide 129, the normal-wedge alone, or the normal and justifying-wedges. The selection is made through the medium of

transfer-blocks 133 and 143, the former serving to connect the normal-wedge alone, and the latter the normal and justifying-wedges. The actuating mechanism for these parts is such that one or the other, but not both, of the transfer-blocks shall be operative during each revolution of the driving shaft, thus rendering active the system of adjusting devices to which it pertains by interposing the wider portion of the transfer-block between the controlling adjusting element or elements and the movable mold-blade abutment.

What may be regarded as the starting positions of the two transfer-blocks are those which they assume after the cast has been made and preliminary to the next adjustment, at which time both transfer-blocks have their wider portions projected beyond or to one side of slide 129, their smaller or narrower portions lying beneath said slide, thereby relieving the latter from the pressure of the wedges and permitting it to be retracted by a spring 144 (Figure 23), as indicated in Figure 57. It is while this condition exists that the adjusting wedges are set, in the event a change of adjustment is to be made, but if not, they retain their positions, although for the time rendered inactive.

The withdrawal of the transfer-blocks from operating position is accompanied by a movement of abutment slide 129 under the influence of spring 144, thus maintaining contact between the sliding surfaces, and preventing the admission of dirt or the formation of a film of oil which might interfere with the accurate adjustment of the mold-blade.

It is important that the two transfer-blocks, 133 and 143, should be susceptible of accurate adjustment, more especially in their forward or active positions, and that they should be loosely or flexibly connected to their actuating devices, both to enable ready removal and replacement, and to render their action as independent as possible of that of their connected actuating devices.

First as to adjustment. When in operating position transfer-blocks 133 and 143 are brought into engagement with a fixed abutment or limiting gage for accurately determining their position relative to abutment-slide 129 and the adjusting wedges. Such a limiting abutment, with capacity for accurate adjustment, is present in wedge 145 (Figures 39 and 54) whose vertical face stands at right angles to and across the line of movement of the inner ends of the two transfer-blocks. This wedge is mounted in a detachable frame 146, and is adjustable vertically by means of rod 147 and nuts 148. To provide independent adjustment for the two transfer-blocks, one of them, in the present instance the upper one 143, is furnished with an adjusting member, such as screw 149, for contacting with wedge 145. Thus slight variations in the positions of the two transfer-blocks with relation to the fixed limiting stop or abutment can be effected.

The transfer-blocks are reciprocated horizontally through the medium of two rods 150, 151, lying one above the other and each provided with a hooked extremity for engagement with a corresponding hook on the inner end of its transfer-block. The connection is one adapted to permit a limited degree of lateral motion of the transfer-block with relation to its connected actuating bar, such as is occasioned by the adjustment of the normal and justifying wedges. The two rods 150, 151, pass through an opening formed in the lower end of a transverse or vertical locking-rod 152 (Figures 35, 36 and 39) and each of said first named rods is furnished with a notch 153 so related to the movements of the transfer-blocks that when at the extreme of their outward movements, that is, with their wider ends most remote from the abutment 145, the notches 153 will stand in line with locking-rod 152, in position to be entered and held by the latter. Actuating rod 151 carrying transfer-block 133 has its notch 153 in its lower face, while the corresponding notch in the actuating rod 150 of transfer-block 143 is in the upper face thereof, so that when locking-rod 152 is depressed it will enter the notch in actuating rod 150, thus holding the latter and its transfer-wedge 143 against longitudinal motion, while permitting the lower actuating rod 151 and its transfer-block to move freely through the opening in locking-rod 152; but when said rod 152 is elevated the conditions will be reversed, actuating rod 151 being held, and 150 permitted to reciprocate.

The interval between the two locking shoulders of rod 152 is slightly less than the aggregate thickness of rods 150, 151, so that the release of one rod will not take place until after the other has been engaged. The movements of locking-rod 152, whereby one or the other of the two actuating rods 150, 151, is locked in position, take place when the transfer-blocks are both at the outer extremes of their movements and both notches 153 are in line with locking-rod 152, and the motions of the latter are derived from lever 58 through a controllable system of actuating mechanism which will next be described.

The prime factors of this mechanism are a main driver or reciprocating member, such as the lever 58, and controllable connections between said main driver and the locking devices or rod 152, whereby the latter can, at proper intervals, be thrown into engagement with either of the rods 150, 151, thereby arresting either transfer-block 133, 143, so as to hold it out of action, leaving the other free to act. A competent mechanism for this purpose is illustrated in Figures 34 to 37, 39 and 40. The locking-rod 152, guided and supported in frame 146, has its upper end attached to a block or cross-head 154, the latter riding vertically upon a guide pin secured to the frame. This cross-head 154 extends laterally over a lever 155, also pivoted to the frame 146, the said lever and cross-head being united by a yielding connection competent to hold the locking-rod at either extreme of its movement under elastic pressure. Such a connection is formed by guide rod 157 passing loosely through cross-head 154, and having its lower headed end seated in lever 155. Rod 157 is provided immediately above its head with a loose washer 158 engaging lever 155, and between said washer and a loose sleeve is interposed spring 156 through which the vertical motion of lever 155 is transmitted to the locking rod. Between a fixed portion of frame 146 and washer 158 is interposed another spring 159, which operates to depress guide rod 157 and lever 155, and thus hold the locking-rod 152 toward the lower position or in engagement with the actuating rod 150 of the justifying transfer-block 143, which is its usual or normal position, as when character types and normal spaces are being produced. The outer or free end of lever 155 carries a pivoted trip 160 (Figure 34) whose upper end passes through one of a series of slots 161 formed in a lateral horizontal arm or projection of lever 58 (Figures 22 and 40). The upper surface of this arm or projection is stepped (see Figure 40), and the upper end of the pivoted trip 160 is furnished with an adjustable collar or nut, which latter, when moved to a position above the higher step or section of lever 58, will be engaged by the latter as it rises, thereby elevating lever 155 and raising the locking-rod 152 into engagement with the actuating rod 151, and out of engagement with actuating rod 150. This action takes place only when the pivoted trip is moved so as to bring its shoulder above the higher portion of lever 58, and until such motion takes place, and as long as the pivoted trip remains above the lower step or at the opposite end of the slot, no motion will be communicated to locking-rod 152 by the elevation of lever 58, which action, it will be remembered, takes place after the cast has been made and preliminary to the readjustment of the die-case for centering the next succeeding matrix. A spring 162 operates to hold the pivoted trip 160 normally retracted or out of engagement with the elevating portion of lever 58. Immediately in rear of pivoted trip 160 is mounted a trip-lever 163, one arm of which bears against the pivoted trip 160, while the other arm engages a plunger 164 working in a cylinder formed in frame 146. When this plunger is elevated it operates through trip-lever 163, to tilt the pivoted trip 160 and throw its upper end into engagement with the elevating portion of lever 58, hence said plunger serves as a controllable means for effecting the transfer of the locking-rod 152 from one actuating rod 150, 151 to the other. The descent of lever 58 restores the parts to normal position with locking-rod 152 in engagement with actuating rod 143.

Assuming the normal-wedge alone, or the normal-wedge and justifying-wedges together, have been properly adjusted, it is obvious that by thus locking out one of the transfer-blocks and releasing the other, the one so released can, by appropriate actuating mechanism, be advanced and thus caused to set the stop or abutment for the mold-blade in adjusting the dimensions of the mold. A simple and efficient form

of actuating mechanism will be found illustrated in Figure 114. The rear end of actuating rod 151 is pivotally attached to one end of the actuating lever 165 whose opposite end is pivotally connected to the frame, through a compression link 179 (Figure 7). The rear end of actuating rod 150 is in like manner connected to one end of a lever 166, whose opposite end is connected by a link 167 to lever 165 at a point between its ends. The main driver or actuating lever 168 is in like manner connected by a link or pitman 169 to lever 166 between its ends. With this arrangement of levers, when power is transmitted to lever 166 either end of the latter may become the fulcrum. If actuating rod 150 is locked, the end of lever 166 connected to said rod becomes the pivot end, and motion will be transmitted from the opposite end of said lever to lever 165 and from the latter to actuating bar 151. If, on the other hand, actuating rod 151 is locked, the lower end of lever 166 becomes the pivot, and motion will be transmitted from the upper end of said lever to actuating rod 150. Thus, without changing the connections, the motions of the main driving lever 168 may be utilized for effecting the reciprocation of either transfer-block by the simple expedient of locking one of the two transfer-blocks against longitudinal motion; while, by means of the tripping devices, it can readily be determined which of the two transfer-blocks shall be locked and which brought into action. Compression link 179 is operative at all times during the advancing movements of the transfer-blocks and affords a yielding connection when the transfer-block is seated against its limiting stop or abutment.

Turning now to the means for effecting the adjustments of the justifying-wedges 141 and 142. These, it will be remembered, operate in conjunction with normal-wedge 132 and transfer-block 143. As will be seen by reference to Figures 44, 51 and 52, the vertical dimensions of these wedges is but about half that of the normal-wedge and each is furnished on its underside with a series of centering and holding notches or transverse grooves, corresponding in number to the columns of matrices in the die-case and to the primary controllers or pins 65 for gaging the movements of the die-case carrier. Each wedge is also provided with a head or projection 137 similar to that on the normal-wedge 132. As in the case of the normal wedge the jaws 94, 95, of the secondary positioning or controlling mechanism are utilized for effecting the movements of the justifying-wedges, but inasmuch as it is only required to adjust the justifying-wedges once for each line, whereas the normal-wedge is brought into action for the formation of each type, the justifying-wedges are maintained normally out of connection with the secondary positioning or gaging mechanism, and are connected therewith or thrown into action only when their adjustment is desired, for which purpose controllable actuating devices are employed. The two justifying-wedges 141, 142, at least those portions to which the projections 137 are applied, lie normally in a plane below wings 136, hence entirely beyond the control of the latter; and in order to bring them within the influence of said wings it is only necessary to elevate them or either of them, so that their projecting portions 137 shall stand between and within the range of motion of the two wings or jaws 136, it being understood, of course, that such elevation is to take place while the two wings or jaws are separated or opened to their fullest extent, as indicated by full lines in Figure 58. To provide for thus connecting and disconnecting the two justifying-wedges and their adjusting devices, and for accurately centering and locating them in adjusted position, the following arrangement has been devised and adopted:

Pivoted on frame 146 are two levers 170 and 171 (Figures 40, 41) each provided with two jaws 172 between which one of the justifying-wedges rests. The jaws of lever 170 are shorter than those of 171 and lie in the plane of justifying-wedge 141, while the longer jaws of lever 171 lie in the plane of justifying-wedge 142, as clearly appears in Figures 58 and 59. The justifying wedges ride between the jaws of their respective levers and are elevated and depressed thereby so as to bring their heads 137 into or out of the path of wings 136. Between levers 170 and 171, and mounted in fixed position upon frame 146 is a centering bar 173 with which the centering notches on the undersides of the two justifying-wedges co-operate, when said

wedges are moved to adjusted position, for accurately centering and holding said wedges. The lower jaws 172 of levers 170, 171, are widened or extended somewhat in the direction of the length of their respective wedges in order to furnish bearing surfaces over which the wedges may travel during adjustment, and the upper jaws project towards each other so as to stand above centering bar 173, whereby the proper centering and locking of the justifying-wedges, after preliminary adjustment, is insured.

The controllable mechanism for effecting the adjustment of the justifying-wedges is similar to that employed for operating the pivoted-trip 160. Each lever 170, 171, is provided with a retracting spring 174 which operates to hold the lever in such position that the jaws will depress and hold its justifying-wedge down out of the path of its adjusting devices, and each lever is also provided with a pivoted trip 175, whose upper end is shouldered or provided with an adjusting nut and projects through a slot in lever 58 in position to be engaged by the higher stepped surface, when in one position of adjustment or at one end of the slot, and to be unaffected by said lever 58 when at the other end of the slot. A spring 176 connected to the pivoted trip 175 serves to hold the latter at one extremity of the slot in lever 58, that is away from the higher stepped surface. A trip lever 163 and plunger 164 similar to those employed for actuating the trip of the locking-pin 152 is connected to each pivoted trip 175 to throw the latter into engagement with the elevating portion of lever 58. When it is desired to bring either of the justifying-wedges 141, 142, within the influence of wings 136, it is only necessary to actuate the plunger 164 controlling the trip belonging to that one of the levers 170, 171, which carries the selected justifying-wedge, whereupon the pivoted trip 175 will be thrown into operative engagement with lever 58 so that, as the latter rises, it will tilt lever 170 or 171, and the justifying-wedge lying between the jaws of the lever so tilted will be raised out of engagement with centering bar 173, and its head or lug 137 be brought into position between wings 136, and, as the latter are brought together upon the secondary controller, the justifying wedge will be shifted to the desired extent; after which, and as lever 58 descends, the pivoted trip 175 will be disengaged from said lever and the readjusted justifying-wedge again deposited and held upon the centering bar 173.

The trip-levers controlling the actuating devices for the two justifying-wedges are each provided with a wing or projection 177 (Figures 22 and 56) in rear of and overlapping a portion of the trip-lever for locking-rod 152, so that whenever one of the justifying-wedge trip-levers is operated, to throw its pivoted trip into engagement with lifting lever 58, it will also carry the pivoted trip 160 of locking-rod 152 into engagement with said lever 58, and thus cause said locking-rod to be elevated into engagement with the actuating rod of the lower transfer-block 133. The purpose of this arrangement is to hold the justifying wedges together in close contact while being set to position, so that no opportunity will be afforded for a film or layer of oil to form on their engaging surfaces, as would be the case if they were separated. By causing transfer-block 143 to be brought into action when the justifying wedges are being adjusted, the latter are set against the pressure of spring 144 and are brought accurately to position where they remain during the formation of the line, being brought into action only when a space type is to be made, involving the use of the transfer-block 143.

From the foregoing detailed descriptions of the normal mold adjusting and justifying mechanisms it will be apparent how the mold-blade may be set or adjusted to produce any desired width of type body within the range of the normal and justifying devices. The character types and normal spaces being separated into 15 groups or series having a uniform ratio of increase, and each group or series of the same width being represented by one position of adjustment of the normal-wedge, it is only necessary that the latter should be set to that one of its 15 positions of adjustment which corresponds with the selected group or series, in order to form a mold-cavity of the proper dimensions. The same is true of the justifying-wedges, with the exception that each of said wedges represents a different ratio of increase, justifying-wedge 141 producing a ratio of increase for each of its 15 positions of adjustment,

equal to ·0005 of an inch, while justifying-wedge 142 effects a ratio of increase, for each position of adjustment, equal to ·0075 of an inch.

The American system employs fifteen body sizes with a uniform increase of one unit, but the English system has but thirteen body sizes, twelve of which represent uniform increments of one unit each, while the thirteenth represents a two unit increase.

To adapt the present machine to the English or analogous systems presenting other than regular variations in body-sizes, it is only necessary to slightly modify the form of the normal-wedge to correspond with the particular system.

Such a modification is illustrated in Figures 60, 60ª, 61, 61ª.

Here instead of a uniform taper the normal wedge 132* is stepped to represent the thirteen different sizes of type matrices arranged in the fifteen columns of the die-case. Although the ratio of increase is one unit for the first thirteen sizes, beginning with the smallest, the number of different type belonging to each series, that is, type of the same width, is not uniform, there being a larger proportion in in one series than in any of the others. In the example illustrated the size of the type in units is marked upon the normal-wedge at each of its 15 positions of adjustment, the size being expressed in units. The smallest type of this series, corresponding to the first column in the die-case, is 5 units in width, the next 6 units and so on up to the sixth column. As there happen to be more than fifteen type in this division, three columns, the sixth, seventh and eighth are assigned to the 10 unit type. The ninth column contains the 11 unit type, and so on up to the fourteenth column, containing 16 unit type, the sizes increasing regularly by one unit. At this point a two unit increase takes place, from 16 to 18 units, and the latter represented by the last column in the die-case. The figures here given are by way of illustration only, as different fonts and faces require different normal-wedges; and the same is true as applied to the American system.

To accommodate the larger group of 10 unit type and distribute them between the sixth, seventh and eighth columns, the face of the wedge is stepped at the corresponding positions of adjustment, so that at each of said positions its action upon the mold-blade will be the same, or equal to ten units. It is also stepped at the last or fifteenth position, to effect an 18 unit adjustment, or two units in excess of the next adjacent position. Thus the normal-wedge, instead of having a regular taper, whereby its uniform movements from one position of adjustment to another will represent uniform increments in body-sizes throughout the entire series of 15 adjustments, is interrupted or broken up into several series, each representing either the same or uniformly varying, or differently varying adjustments, as circumstances shall require.

The stepped normal-wedge, like the uniformly tapered wedge, occupies a position between the transfer-blocks and abutment-slide 129, with its stepped face next the latter, and to facilitate its adjustment and prevent the shoulders at the ends of the steps or sections from catching upon the bearing face of the abutment-slide the following arrangement has been devised and adopted.

To the shoulder on the underside of abutment-slide 129 is fitted a plate or block 400 whose outer face or that next the stepped surface of the normal-wedge is furnished with a transverse rib or bearing 401 for engagement with said normal-wedge.

Supported within a slot in this block 400 is a flanged plate 402, the flanged edge resting in a groove formed in the abutment-slide and engaged by springs which operate to hold said plate 402 and block 400 outward or off its seat. The outer edge or end of this plate 402 projects beyond the face of rib 401 and into a longitudinal groove or way 403 in the face of the normal-wedge.

During the operation of adjusting the normal-wedge the latter is held away from and out of engagement with the bearing block 400 by the action of the springs on the rear side of plate 402, said wedge riding upon the outer edge of the plate and being held thereby from contact with rib 401.

The longitudinal adjustment having thus been effected and the normal-wedge brought to the desired position, when the transfer-block is advanced or brought into action it will compress the springs and force plate 402 back until the surface of the

wedge becomes seated against the rib 401, and through the latter operates the abutment-slide to fix the position of the mold-blade.

Upon the withdrawal of the transfer-block the springs will again project plate 402 and remove the normal-wedge from rib or bearing 401 so that it can again be adjusted longitudinally without interference.

This modification is well adapted for use in connection with the American system by merely substituting the uniformly tapered wedge for the stepped or variable wedge.

It may be well, at this point, to remark that when setting the justifying-wedges for the line, through the medium of the primary controllers or pins 65, no casts are made, the metal injecting mechanism being thrown out of action. This is effected through the medium of pivoted trips 175, as will be explained in connection with the metal injecting mechanism. Moreover, to produce the finer adjustments of the mold-blade by means of the two justifying-wedges, two complete rotations of the main driving shaft are usually required, one for setting each justifying-wedge, but if the positions of adjustment of the two wedges coincide both may be set at the same time during a single rotation of the driving shaft.

Having explained how the mold-blade positioning stop or abutment 130 is set for each type body, it only remains to be seen how the mold-blade actuating devices are operated to discharge the type and readjust the mold for the next succeeding cast. Let it be assumed that when the parts are as represented in Figure 44, the mold-blade lever 128 is moving outward or in a direction to cause the approach of the mold-blade towards its adjusting abutment. In doing this it acts through spring 124, the latter yielding after the mold-blade takes bearing against its abutment, thus holding the mold-blade firmly in adjusted position. The next movement of the lever is toward the mold-blade sufficiently to take pressure off spring 124, but without making contact with the head of sleeve 126. This leaves the mold-blade abutment free for readjustment, and affords opportunity for the withdrawal of the transfer-block and the shifting of the normal-wedge. After a brief dwell, the lever is advanced again, and, operating through sleeve 126 and spring 123, drives the mold-blade forward, to eject the type from the mold. The movement of the lever is now reversed and it retracts until contact is made with collar 127, thereby withdrawing mold-blade until its outer face is slightly within the mold-cavity, so as to remove it from the track of the cross-blade. The lever again advances slightly to free the mold-blade and permit the transfer block to be brought forward into operating position, after which, by a continued rearward movement, the mold-blade is again drawn firmly in contact with the readjusted abutment and the mold is in condition for the formation of the next succeeding type.

The Metal Injecting Mechanism.

Under this title is included not only the melting pot, the pump for forcing the metal from the melting pot, and the nozzle through which the molten metal is injected into the mold, but also the mechanisms operating to seat the nozzle or bring it in proper communication with the nozzle-plate of the mold, to operate the pump plunger, to throw the pump plunger into and out of action, and to permit the removal of the metal injecting mechanism from operating position into one where its parts can be more readily approached for inspection, adjustment and repair.

This part of the machine will best be understood by reference to Figures 2 to 5 inclusive, 7, 8 and 92 to 104 inclusive.

The melting pot and its connections are all mounted upon an independent frame 180 which is pivotally supported at one side upon a vertical threaded shaft 181 mounted in bearings in the main frame. Shaft 181 forms a pivotal support for frame 180 about which the latter can be swung horizontally, but as such movement would be interferred with if the melting pot and its attachments remained in the positions they occupy in operation, the said pivotal shaft is threaded into frame 180 and provided with a handle whereby it can be rotated to elevate or depress the frame. A lock is provided for holding the frame in working position, such, for example, as

that formed by an angular tongue or projection 182 (Figure 97) located on the main frame, in position to enter and engage a corresponding seat 183 on frame 180, when in elevated or working position. The lowering of frame 180 by means of screw 181 withdraws the seat from locking tongue 182 and permits the frame to be swung horizontally.

The melting pot 184 instead of being mounted directly upon frame 180 is pivotally attached to a series of arms 185 forming part of a set of parallel motion links. These arms are secured to parallel shafts 186 mounted in bearings on frame 180 and connected by a link 187, so that both shafts 186 and arms 185 will move in unison and thus preserve the horizontal plane of the melting pot during its vertical motions toward and from the mold. The object of this is not alone to properly seat the nozzle but also to prevent tilting the melting pot, thus avoiding agitation or flowage of the fluid metal, more particularly in the passage leading to the nozzle.

The melting pot is formed or provided with a passage or conduit 188 leading to the nozzle 189, the whole enclosed within a casing 190 between which and the melting pot is a chamber for the reception of a non-conducting material such as asbestos. It is desirable that the mold and connected parts should be protected from the influence of the heat generated in maintaining the type metal in molten condition, hence, aside from the question of economy of fuel, it is important to so arrange the heating apparatus that it will maintain the type metal in molten condition, both in the pot and in the passage leading to the nozzle, by a minimum expenditure of energy in the form of heat. To this end a combustion chamber 192 (Figures 96, 99) is formed under the bottom of the metal containing chamber 193, beneath which is arranged the burner 194, preferably of the Bunson type.

The products of combustion are conducted from the combustion chamber horizontally beneath the supply passage 188 and vertically to a point near the nozzle, thence over a vertical deflecting plate through a chamber above supply passage 188 and out through a side passage into the escape pipe, a jet-pipe 196 located in said escape-pipe facilitating the withdrawal of the products of combustion.

The cover of the melting pot is formed in sections, and the space above the melting pot is in open communication with a pipe surrounding escape-pipe 191, through which the fumes arising from the molten metal escape.

The metal chamber 193 is provided with a seat for the attachment of the pump cylinder 198, the latter communicating directly with an opening formed in the seat at the end of the passage 188 through which the metal is forced into the nozzle. A solid piston 199 is arranged in cylinder 198, and an induction port, formed in the body of the cylinder but to one side of the piston and controlled by an inwardly opening valve 200, admits the molten metal into the cylinder below the piston.

When in working position the melting pot is so arranged that its nozzle 189 will stand directly beneath and substantially in line with the bell mouth of nozzle-plate 16, as represented in Figure 7. When the mold has been adjusted and the matrix seated preparatory to making a cast, the nozzle must be elevated into close and accurate contact with the nozzle-plate. This movement is effected through the agency of an arm 201, secured to a rock shaft 202, and bearing a roller 203 in contact with the melting pot immediately in line with, but below, the nozzle (Figure 99). This rock shaft 202 is supported in bearings on frame 180 and is furnished with an arm 204 whose outer or free end is attached to a vertical rod 205 (Figure 95) the upper end of the latter passing through a bearing on frame 180 and engaging one end of a lever 206. A spring 207, interposed between frame 180 and an adjustable collar on rod 205, operates, normally, to turn rock shaft 202 in a direction to cause the elevation and seating of the nozzle; but, except when a cast is to be made, the spring is not permitted to elevate the nozzle, but is held in restraint and under compression by a bar 208 acting on lever 206. This bar 208 forms a part of the pump actuating mechanism about to be described.

The upper end of pump cylinder 198 is furnished with seats for the reception of the bifurcated end of lever 209 (Figure 98) whose opposite end stands in line with the axis of threaded shaft 181 and is pivotally attached to a swivel 210 carried by a

bracket on sleeve 211. The piston 199 is connected by a link 214 to the outer end of lever 215 extending substantially parallel with lever 209 and attached to the latter at or about the middle of its length, by a link 216. The inner or power end of lever 215 is attached to a swivel 217 carried by cross-head 208 in line with shaft 181. The object in thus bringing the supports for the inner ends of levers 209 and 215 in axial alignment with shaft 181 is to accommodate the actuating devices to the swinging motion of the melting pot about said shaft.

Sleeve 211 to which lever 209 is connected extends vertically through bearings in the frame, and the bar or cross-head 208 to which lever 215 is connected is secured to the upper end of a shaft 212 passing longitudinally through sleeve 211. A shouldered pin 213 secured to the frame and extending vertically through brackets on sleeve 211 and cross-head 208, serves to limit the vertical movement of sleeve 211 and to prevent rotation of cross-head 208, while a spring 218 surrounding the lower portion of sleeve 211 and interposed between a shoulder thereon and the frame, operates in a direction to elevate said sleeve. The lower end of shaft 212 is engaged by one arm of a bell-crank lever 219 whose other arm is connected through a compression link or elastic connection 220 with controllable actuating devices governing the operation of the pump and the elevation of the nozzle.

Bearing in mind that the elevation of the melting pot and the seating of the nozzle is effected by the action of spring 207, and that the latter is held in check or under restraint by cross-head 208, the object in connecting the pump actuating devices to the cylinder as well as the piston will be understood.

The throw of the piston, when operated to drive the metal into the mold, is in a direction opposite to that of the spring holding the nozzle in contact with the nozzle-plate, hence would tend to unseat the nozzle. This is avoided by attaching one of the pair of levers 209, 215, to the cylinder and the other to the piston, and connecting the levers together as by link 216, in such manner that the pressure exerted in effecting the stroke of the pump will be distributed equally between the piston and cylinder and be exerted in opposite directions; that is to say, the power exerted at the load end of lever 215, to drive the piston down, will be opposed by an equal force exerted by the load end of lever 209 tending to raise the cylinder. By this means the pump action is neutralized insofar as it might otherwise tend to disturb the position of the melting pot or withdraw the nozzle from its seat, and it can be rendered both quick and powerful, desirable conditions in machines for casting type.

To accommodate the pump operating devices to the different positions occupied by the melting pot as the nozzle is alternately elevated to casting position and withdrawn therefrom, the power ends of the levers 209 and 215 are moved vertically in unison with the melting pot, and are separated only when the nozzle has been seated in the nozzle-plate and is held thereto by the full power of its elevating spring.

This is accomplished by attaching the inner or power end of lever 215 to the cross-head 208 which controls the movements of the nozzle, and the inner or power end of lever 209 to sleeve 211. Motion is communicated to cross-head 208 through shaft 212, and inasmuch as sleeve 211 is held by its spring 218 in contact with said cross-head, it follows that the elevation of cross-head 208 and lever 215 will be accompanied by a corresponding movement of sleeve 211 and lever 209, thereby maintaining the parallelism of said levers 215 and 209.

This relation is preserved until the nozzle is seated and cross-head 208 rises above lever 206, at which time sleeve 211 contacts with pin 213 and is arrested, while cross-head 208 continuing to rise effects the stroke of the piston.

The controllable actuating devices for the pump serve as a means for connecting and disconnecting the metal injecting mechanism with the driving shaft, and they or an equivalent thereof, are required in order that the action of the injecting mechanism may be suspended, at intervals, as, for example, while setting the justifying-wedges, or when, for any purpose, it becomes necessary or desirable to operate the machine without making casts.

In the present form of embodiment the pump actuating lever 221, which derives

its motions directly from the driving cams, is connected by a link 222 (Figures 7, 101 and 104) to an arm 223 carried by rock shaft 224, the latter supported in bearings on the main frame. Arm 223 reciprocates in unison with lever 221, and it is provided with an angular head or shoulder 225 for engagement with a latch 226, the latter pivoted in the outer end of an arm 227. This arm is carried by a sleeve 228, surrounding rock shaft 224, and is provided with another arm 229, to which compression link 220 is connected. When latch 226 is in engagement with the angular head 225 of arm 223, as represented in Figure 104, said head 225 will be so held between the latch and the end of arm 227 that the movements derived from driving lever 221 will be communicated through arm 227, sleeve 228, arm 229 and link 220, to the metal injecting mechanism; or, in other words, the pump actuating mechanism will be connected up for operation. To disconnect the actuating devices, and thus throw the pump out of action, it is only necessary to raise latch 226, and to effect this automatically the following arrangement has been adopted. Extending in a plane parallel with latch 226 is a tripping arm 230 whose sleeve 231 is loosely supported upon a shaft 232, the latter being supported in bearings upon the frame so as to permit longitudinal motion therein.

Sleeve 231 is furnished with a second arm 233 carrying a spring operated plunger 234 in position to engage a lug on the frame, said lug containing a recess for the reception of the end of the plunger when the sleeve is moved longitudinally of its axis into operative position.

Arm 233 is also provided with a pin 235 for receiving the hooked end of a rod or link 236 whose opposite end is attached to the main driver or actuating lever 168 of the transfer-blocks. During each rotation of the driving shaft tripping arm 230 will thus be given a complete reciprocation, its periods of rest and movement coinciding with those of the transfer-blocks. On the side of latch 226, facing the tripping arm 230, is arranged a spring projected pin 237, and the upper surface of tripping arm 230 is slightly curved or so disposed relative to the latch that when the former is in its lower position it will stand below the plane of pin 237. When in normal position, tripping arm 230 stands just beyond the plane of motion of pin 237 (Figure 101), hence does not contact with the latter, but if said tripping arm is shifted into the plane of the pin and is then elevated, it will, by engagement with said pin 237, raise the latch 226 out of engagement with arm 223 (as indicated by dotted lines in Figure 104) thereby disconnecting said arm from the pump-actuating devices, and holding the latter out of action while the movements of arm 223 are completed. Upon the withdrawal of the tripping arm the connection will be re-established.

To effect the disengagement and re-engagement of the pump-actuating devices by a longitudinal movement of shaft 232, the latter is furnished with a shoulder on one side of sleeve 231 and a spring 238, on the other, said spring operating to hold the sleeve over against the shoulder, the latter, in the present instance, being formed by reducing the diameter of that portion of the shaft on which the sleeve is mounted. Interposed between a head on the end of shaft 232 and the frame is another spring 239, the latter surrounding the larger diameter of shaft 232 and operating to move said shaft longitudinally in a direction to carry tripping arm 230 away from the latch, and to hold it in contact with the lower ends of levers 170 and 171, which operate upon the justifying devices to bring them into operative connection with their adjusting mechanism.

From this arrangement it will be seen that when either of the levers 170, 171, is operated, to adjust its justifying-wedge, shaft 232 will be moved longitudinally in a direction to bring tripping arm 230 beneath and in the path of pin 237 on latch 226, thereby arresting the pump by disconnecting its actuating devices.

In the present machine the timing of the mechanisms is such that levers 170, 171 retract before the tripping arm 230 completes its movement, hence means for locking said arm against lateral displacement while in engagement with the latch are provided. This function is performed by plunger 234 carried by arm 233 which, as the sleeve is rotated to lift latch 226, is brought into engagement with the seat in its lug on the frame, thereby holding the sleeve against longitudinal motion after lever 170, 171

have retracted and until said plunger is withdrawn during the reverse motion of the sleeve, when spring 239 restores the sleeve to normal position with its lifting arm removed from the latch.

As it is sometimes necessary or desirable to disconnect the pump, independently of the levers 170, 171, the tripping arm, instead of being secured to shaft 232, as it might otherwise be, is permitted longitudinal movement thereon against the tension of spring 238, and a rod 240, extending through to the front of the machine and provided with a head or lateral extension 241 in rear of a wing or shoulder 242 on sleeve 231, furnishes a medium whereby said sleeve 231 can be moved, against the tension of spring 238, to bring its tripping arm 230 in position to engage latch 226.

To avoid accidents and permit rod 240 to be pulled out at any time, the lifting pin 237 instead of being rigid with latch 226 is movable longitudinally and held projected by a spring, so that if sleeve 231 is drawn out when its tripping arm is in line with the pin, the latter will be retracted until the tripping arm is carried below it, when it will again be projected above the tripping arm in position to be elevated by the latter.

It is, of course, understood that the pump operating devices are brought into action to project a stream of molten metal into the mold only after the latter has been completed by the adjustment of the mold-blade and the seating of a selected matrix, and, further, that the action is a very rapid and powerful one, in order to fill the mold and produce good type, both as to bodies and heads or faces, hence the necessity for throwing the pump out of action when no casts are to be made, as when setting the justifying-wedges. This suspension of the pump action is insured by placing the actuating devices under the direct control of the mechanism through whose movements the adjustment of the justifying devices are effected.

The Galley Mechanism.

The office of this mechanism is to take the individual type, as they are delivered complete from the mold, assemble them in line, in the order of production, and transfer the justified lines of type to the galley.

The mechanism for effecting these operations (best seen in Figures 56, 57 and 66 to 91 inclusive) may, for convenience of description, be divided, according to the order in which they operate upon the type, into five groups as follows: The type-carrier; the line assembling devices; the line carrying devices; the line transferring devices; and the trip mechanism for stopping the machine in the event an unjustified line should be presented to the galley.

The type carrier. It will be remembered that after the cast is made cross-blade 3 is moved to uncover the side of the mold and cut off the jet, after which the mold-blade 4 is advanced slightly to drive the type out of the mold. The type so ejected is delivered to the type-carrier 245 and by it transferred into position to enter the line-channel.

This type-carrier (shown detached in Figures 66 and 67) is arranged in the line of communication between the cross-blade and its actuating lever 246, the latter being connected through link 247 to one end of type-carrier. The opposite end of the type-carrier is provided with a vertical hooked portion 248, engaging a corresponding but reversed hook on the cross-blade (see Figures 21, 56 and 57), a form of connection which permits the ready removal of the cross-blade, and, at the same time, insures the desired correspondence in movement between the cross-blade and type-carrier.

It is desirable, in order to shorten the strike of the type-carrier and prevent interference between it and the die-case centering mechanism that the type-carrier should be given a limited degree of vertical motion, so that its type-receiving and holding devices may be brought up opposite the mold, and, after receiving the type, be carried downwards again out of the way of the die-centering mechanism and into the plane of the type-channel. To effect this the type-carrier is provided with a diagonal rib or projection 249 (Fig. 66) which rides in an inclined groove or way

formed in the front vertical wall of the recess in the frame for the reception of said carrier, as indicated in Figure 3.

In the end of the type-carrier nearest the cross-blade is located the type-holder, which latter includes the slotted head 250, provided with a type opening or channel extending transversely through the end of said carrier, and a clamping member 251 (Figure 69) movable across the channel in head 250 and co-operating with one wall thereof in receiving and clamping the type as it is ejected from the mold. The clamping member 251 is supported in guides within the type-carrier, and is held normally forward or toward the opposing clamping surface by a spring 252. A lug or projection 253 on the clamping member 251 rides in an inclined groove 254 in the frame, the angle of inclination corresponding with that of rib 249 on the type-carrier. Said groove 254 terminates at such point in the movement of the type-carrier towards the mold that it will, by its engagement with lug 253 arrest the movement of clamping member 254 just before the channel in head 250 is brought opposite the mold-cavity, thereby opening the passage for the admission of the type.

Upon the return motion of the type-carrier, after the type has been inserted between the clamping member 251 and the opposite face of the opening or channel in the carrier, the clamp 251 will remain stationary until engaged by the type, when it too will be moved, thereby clamping and holding the type securely in position while being transported from the mold to the type-channel.

As this action would leave the type unsupported at the time of its delivery by the mold-blade, the carrier is furnished with a type support 255. This consists of a spring tongue whose outer or free end rests and is guided in the clamping member 251, while the opposite or rear end is secured to a slide 251* supported in ways and movable longitudinally of the carrier. Slide 251* is furnished with two shoulders between which is received a block 256 carrying a headed pin, the latter extending through the shoulder on slide 251* and provided with a spring 257 interposed between the head of the pin and the slide. This spring tends at all times to hold block 256 against the shoulder on slide 251* through which the pin passes. A lever 258 (Figures 57 and 67) mounted on the type-carrier and provided with a roller on its outer end, has its inner end in engagement with block 256.

The outer end of lever 258 extends between two fixed abutments on the frame (Figure 56) so located and arranged that as the type-carrier approaches the mold the lever will engage one of said abutments and be turned in a direction to advance the type support 255 so that its end will be projected across the channel in the type-carrier. While it occupies this position the type is delivered to the type-carrier, the mold-blade forcing the flexible type-supporting blade 255 back until the type is fully entered between the clamping surfaces.

While the type is thus held between support 255 and the mold-blade, the type carrier is retracted or moved towards the line-channel, and as the type passes beyond the mold-blade it is firmly grasped and held by clamping member 251, the movement of the type-carrier withdrawing the lug 253 from its engagement with the end wall of the slot and permitting spring 252 to advance clamping member 251 towards the opposite clamping surface and thus grip the type lying between. As the type-carrier nears the end of its movements towards the line-channel, lever 258 contacts with the opposite abutment and is turned in a direction to withdraw the type-support 255 out of the way so that the type may be pushed out of the type-carrier into the line-channel.

The line assembling mechanism. This includes the devices for removing the type from the type-carrier and holding them in position until all the types which are to compose a line have been assembled.

When at the outer extreme of its movement, that farthest from the mold, the type-carrier stands with its slot or channel opposite the entrance to the line-channel and in line with the ejector blade 259 (shown detached in Figure 65), which latter reciprocates through the type-carrier and delivers the type held therein to the line-channel. The rear end of this blade is attached to one arm of a

bell-crank lever 331 (Figure 22) the other arm being connected through a compression link 332 with the actuating lever 333.

Bevel shoulders on ejector engage bevels on type-carrier to insure entrance without requiring exact register to meet line channel.

The present machine being designed to deal with different sizes of type, the delivery of the type from the type-carrier to the line-channel by means of an ejector-blade working through the type-carrier is a matter of some difficulty, owing to the fact that provision must be made for supporting the type at all times, and for dealing with small as well as large type bodies.

The support for the type is furnished by the spring actuated clamp of the type-carrier, which is competent to deal with all sizes of type. But the ejector-blade 259 whose end is required to pass between the clamping surfaces must be as narrow as the narrowest kind of type with which it has to deal, hence it becomes necessary to make special provision for ensuring its proper entrance between the clamping surfaces, and this, too, without requiring exact register between the channel in the type-carrier and the line-channel. To this end a spring pressed guide 260 (Figs. 57 and 70) is arranged to press and hold the ejector-blade in contact with the face of its guiding way nearest the mold, so that it will always enter on the side of the type-channel formed by the movable clamping jaw or member 251.

The ejector-blade is flanged along its upper and lower edges, said flanged portions riding in grooves formed in opposite walls of the type-channel, extending beyond the engaging face or end of the blade, where they are notched to admit the type and are beveled on their outer surfaces so that by their engagement with bevels on the type-carrier they will act as guides for directing the ejector-blade into the type channel formed between the clamping surfaces. If no type is contained in the type-carrier, these bevels will serve to open the type channel by forcing back the movable clamping surface 251, so that the blade can pass it.

What is herein designated as the line-channel comprises a horizontal table or supporting plate 261, and two vertical sustaining walls such as are formed in part by blocks 262 and 263. The block 262 (Fig. 82) forming part of the wall nearest the mold is preferably though not necessarily provided with a spring 264 extending longitudinally of said block and having its outer end curved backwardly and overlapping the beveled end of said block (see Figs. 76, 77, 82 and 83). The opposite wall or block 263 (Figs. 75 and 83) is provided with two yielding surfaces, the one formed by a spring 265 sustained in position by a plate 266, and having its outer or free end bent around said plate and terminating within the line-channel, while the other one 267, is bifurcated at one end and extends on opposite sides of spring 265 lengthwise of the line-channel, the inner end being guided by a pin 268 playing in a slot formed in the tail of spring 265, as clearly seen in Figures 75, 76 and 77. Upon reference to Figure 66 it will be seen that the walls of the slot or passage in the type-carrier are cut away horizontally and that the face or engaging end of the clamping member 251 is likewise slotted. This is done to permit the outer ends or faces of springs 264, 265, to enter within the type passage in the type-carrier, as the latter is retracted to deliver the type therein. Springs 264 and 265 at the entrance to the line channel constitute flexible jaws between which the type are delivered, said jaws opening or yielding readily to the entrance of the type between them, but offering resistance to their withdrawal, thereby insuring the retention of the type when advanced by the ejector blade 259.

As type accumulate in the line-channel they are forced back and sustained by the pressure of spring 267, the forward end of the latter overlapping spring 265 so that the type are at all times retained in proper position, for as the line is pushed towards and beyond the rear end of spring 267 it is engaged by the line supporting-blade 269 (Fig. 88) which latter, as it forms a connecting link between the line-assembling and line-carrying devices, will be explained in connection with the latter.

Immediately in rear of the block 262 is arranged the galley 270, the entrance to which is closed by a vertically movable blade 271, whose outer surface is in line with and forms a continuation of that wall of the line-channel of which block 262 forms a

portion. Pivoted in bearings on the frame (it may here be remarked that the galley mechanism is mounted upon a frame detachably secured to the main frame), beneath and parallel with blade 271, is a lever 272 (Fig. 74) the upper portion of which is provided with a grooved bar 273 lying opposite and parallel with blade 271. When in normal position the face of this bar 273 is in line with the inner ends of spring 267, so that it may be said that bar 273, and blade 271 constitute, in effect, parts of the line-channel, the bottom of which is formed by a plate 261 extending horizontally beneath both of these members, as indicated in Figure 86. The line-supporting blade 269 is guided to reciprocate upon the face of bar 273, to which end it is provided with a dovetail fitting the groove in said bar, and is furnished with one or more springs 274, bearing against the wall of the groove and serving to create frictional resistance to the movement of the blade. The end of the line-supporting blade 269 nearest the type is notched, as shown, for a purpose to be explained. It will suffice, for the present, to state that the line-supporting blade is engaged by the type as they emerge from between spring 267 and the opposite wall, and is pushed back as type accumulate and by the action of the line-carrier in shifting the line to a position in front of the galley, which is the operation performed after all the type composing a line have been delivered into the line-channel.

The line carrier. This includes, in addition to the line-channel and the line-supporting blade, a pair of arms 275, (Fig. 81) provided at their outer ends with type engaging shoulders or hooks, which latter are advanced beyond the last type of the completed line, then drawn outward to bring the completed line opposite the entrance to the galley, and, after the line has been transferred to the galley, the arms of the line carrier are withdrawn from the line-channel in which the next line is being set up, and carried to a position beyond that to which the type is advanced by the ejector blade 259, preparatory to engaging the next line when completed.

The means for effecting these movements of the line-carrier or arms 275, and for returning the line-supporting blade 269, after the transfer of the line to the galley, will now be described.

In the frame of the galley mechanism, beneath and parallel with bar 273, of lever 272, are formed two parallel guides or ways 276 and 277 (Figs. 89, 90). In the lower of these two guides is mounted a slide 278 (Fig. 84) provided with a vertical socket or bearing 279 into which is fastened the axis or fulcrum-pin 280 of head 281 carrying the line-carrier blades 275. This head is also provided with a lateral projection or arm 282 extending between shoulders 285 and having its end resting in a seat formed in a slide 283, the latter riding in the upper guide 277. A friction spring 284 (shown in dotted lines Fig. 85) operates to retard the movements of slide 278, so that when slide 283 is moved in either direction, it will first act on arm 282 and move the latter into engagement with one of the shoulders 285, thus oscillating head 281 to bring arms 275 of the line-carrier into or out of the plane of the line-channel, and then, by the continuation of the movement of said slide 283, motion will be communicated to slide 278, the arms of the line-carrier remaining in the position to which they were brought by the initial movement of arm 282. Thus, during the outward stroke of slide 283, the hooked ends of arms 275 will be advanced across the line-channel so as to engage the last type of the completed line, and the line will be drawn forward to a position in front of the galley, when, by a reversal of the direction of its movement, slide 283 will cause the withdrawal of arms 275, and the return of said arms, together with their supporting-slide 278, to first position, ready to engage the next succeeding line when completed. These motions of slide 283 are transmitted from the actuating lever 286 (Figs. 72 and 73) through a slide 287 riding in guides or ways 276 and provided with a pin 288, the latter working in a slot in slide 283 (Figs. 85, 89 and 90) so as to alternately engage opposite ends thereof, when at the extremes of the movements of slide 287. A screw 289 or equivalent adjustable device operates to engage slide 283, at the limit of its outward movement, and thus ensure the arrest of the line-carrier with the inner faces of its hooks in line with the wall of the galley, in order that the end of the line shall be accurately adjusted to position. Slide 287 is connected to its actuating

lever 286 through a double acting compression link 290, the latter including, in the present instance, a rod 291 pivotally attached to the outer end of the lever and extending through a sleeve 292 pivotally attached to slide 287.

Rod 291 is shouldered and between said shoulder and a sleeve on the end of the rod are arranged two loose collars with an interposed spring 293. The collars engage opposite ends of the sleeve 292 so that the spring is rendered active when the rod is reciprocated in either direction.

The outward and inward motions of lever 286 are slightly in excess of the permissible movement of slide 283, so that the latter will be held firmly in position against a fixed abutment at each extreme of its movement. This slide 287 is also furnished with a post or vertical projection 294 (Fig. 91) carrying a pivoted latch 295, whose inner or free end, held down by the spring 296, rests between shoulders on a slide 297 (Figs. 87 and 89) the latter riding in the groove or way formed in the face of bar 273 in line with line-supporting blade 269. Slide 297 engaging line supporting blade 269, as the line-carrier moves inward, serves to retract said line-supporting blade after the completed line has been delivered to the galley.

The line transferring devices.—The column forming mechanism includes the devices by which successive lines of type brought forward by the line-carrier are transferred or delivered from the line-channel into the galley.

As hereinbefore explained the entrance to the galley is closed by blade 271. This blade, which forms a portion of the right or front wall of the line-channel, fits loosely the shouldered upper end of a rod 298 passing vertically through a bearing in the galley frame and supported upon its actuating lever 299. The blade is held from horizontal movement by a steady pin 300, and is elevated, to admit the line of type to the galley, after which it descends behind the line and sustains the latter until the next succeeding line is brought forward.

The completed line is pushed or advanced into the galley by the movement of the transfer bar 237. It will be remembered that this bar is carried by a lever 272 and forms a portion of the left-hand or outer wall of the line-channel. Said lever is held normally retracted by a spring 301 (Fig. 86) and is advanced toward the galley by pressure transmitted from its actuating lever 302 through a compression link 303. Lever 302 engages an adjustable abutment 304 for positioning bar 273, and the spring in compression link 303 is brought into action during the forward movement of lever 302, said spring yielding if the forward motion of lever 272, when operated to deliver the line to the galley, is arrested.

The trip mechanism.—The last of the elemental parts of the galley mechanism is the tripping device. Its primary function is that of stopping the machine should an unjustified line be presented to the galley.

Mounted in guides on the galley frame is an adjustable block 305 carrying an arm 306 overlying plate 261, and forming the front wall of the galley entrance. The adjustment referred to is one by which the width of the galley entrance is varied to correspond with the length of the lines cast, whatever this may be. Arm 306 is provided with guides for the reception of a tripping block 307, the latter having its surface flush with the wall of the galley entrance, and its end nearest the line-channel projecting beyond arm 306 and of proper shape and dimensions to fit within the notch formed in the end of line-supporting blade 269. If the line delivered by the line-carrier and advanced by the line-transferrer, is of standard length, it will just pass between tripping-block 307 and the opposite wall of the galley entrance; but if the line is either too long or too short, tripping-block 307 will be engaged, either by the type, if the line is too long, or by the line-supporting blade 209, if the line is too short, and will be forced back by the bar 273 when the latter is advanced to push the line into the galley.

A lever 308, pivoted upon block 305, is connected at one end to this tripping-block 307 and its opposite end rests in contact with a wide vertical lever 309, mounted in bearings on the frame, and provided with a retracting spring 310 (see Fig. 73). The other arm of lever 309 co-operates with the shouldered arm 312

of the belt-shifting lever 313 (Fig. 85) and operates, when in engagement with said shoulder, to hold the belt-shifting lever in operating position, that is with the belt on the fast pulley. When, however, tripping block 307 is forced back it will operate through lever 308 to disengage lever 309 from the shoulder on arm 312, thus permitting the belt shifting lever to be thrown so as to shift the belt onto the loose pulley and stop the machine.

The connections between the belt-shifting lever 313 and the belt shifter 314, can best be seen in Figures 2, 6, 72 and 73. One arm of said lever engages a rod whose opposite end is in contact with an arm on rod 315 extending from front to rear of the machine, said rod 315 being provided with a spring 316, the latter operating in a direction to throw the belt from the fast to the loose pulley except when restrained by the engagement of lever 309 with the belt-shifting lever 312.

Galley driving mechanism.—The motions of the galley mechanism, although derived primarily from the main driving shaft, are communicated through a supplemental shaft 317 mounted in bearings on the galley frame and rotated through the medium of a worm wheel 318. This shaft carries a cam wheel 319 provided with three operating surfaces or cams, one, a peripheral cam 320, for engaging actuating lever 302 of the line transferrer or pusher; a second, face cam 321, engaging actuating lever 299 for blade 271; and a third, a grooved or face cam 322, engaging actuating lever 286 of the line-carrier. The cam wheel 319 is loose on its shaft and is connected therewith, for operation, by means of a ratchet wheel 323 keyed to the shaft, and a spring actuated pawl 324, carried by cam wheel 319, thus forming a clutch or detachable connection between the shaft and cam wheel.

The pawl 324 is provided with an angular shoulder or arm 325 and a beveled pin 326, and is held, normally, from engagement with ratchet wheel 323 by an intercepting and arresting lever 327, the latter pivotally supported on a vertical post on the galley frame and having its opposite end standing in line with shaft 232 of the pump actuating mechanism, so that when said shaft 232 is moved longitudinally by shifting levers 170, 171, to throw the pump out of action, the same movement will throw lever 327 out of engagement with pawl 324 and thus start the galley mechanism in motion. The angular shoulder 325 of pawl 324 is received and held between a fixed shoulder 328 on lever 327 and a vertically movable shoulder formed by a latch 329 pivotally connected to said lever 327. The instant pawl 324 is released, by the withdrawal of lever 327, it flies into engagement with its ratchet wheel and, in so doing, its angular shoulder 325 passes beyond the engaging face of fixed shoulder 328 on lever 329, so that it cannot be re-engaged thereby should lever 327 be released before the pawl is carried beyond its path. The withdrawal of lever 327 is followed by its return to normal position, under the action of spring 330, which position is one lying in the path of movement of the angular shoulder 325, so that when the cam 319 carrying said pawl shall have made a complete revolution, the pawl will be engaged by the fixed shoulder 328 on lever 327, thereby withdrawing the pawl from its ratchet wheel and arresting the motion of cam wheel 319. In doing this the beveled pin 326 on pawl 324 by its engagement with latch 329 will lift the latter and pass beyond it, whereupon said latch will resume its position behind shoulder 325 and retain the latter in position.

It may here be mentioned that the galley-actuating devices are protected by a detachable cover plate 311 seen only in Fig. 1, it being omitted in the other views in order to disclose the mechanism beneath.

From the foregoing description it will appear that the controllable members of the galley mechanism, or those through which its movements are inaugurated, are actuated, to set the mechanism in motion, by the same devices that are employed for setting the justifying mechanism for the next succeeding line, thus dispensing with one useless rotation of the driving shaft, and obviating the necessity for a separate galley perforation in the record strip.

The Paper Feed.

The office of the paper feeding mechanism is to advance the record strip, inter-

mittingly, at regular intervals, so as to bring the perforations opposite the air ports of the pneumatic system for controlling the various operations of the machine. In its general features it resembles that heretofore employed for the same purpose and differs therefrom mainly with respect to the actuating devices. The details of this mechanism are best seen in Figures 105 to 110 inclusive.

The devices comprising this part of the machine are mounted upon a frame, separable from, but secured to, the main frame, and include supports for the winding and supply spools 335, 336; a rounded or semi-cylindrical cross-bar 337; pin wheels 338, one at each end of the cross-bar; a shaft 339 carrying said pin-wheels; a pulley 340 on shaft 339; a pulley on the winding spool; and an elastic belt 341 through which motion is transmitted from pulley 340 to the winding spool.

The cross-bar 337 is provided with a longitudinal series of ports, and above the latter operates the air-bar 342 containing an air-chamber, said air-bar being supported upon arms 343 pivoted loosely on shaft 344. This shaft is furnished with two arms 346, each of which is connected to one end of the air-bar by a rod 350, pivoted upon the air-bar and passing through a lug on arm 346. A nut or shoulder on the rod above the lug forms a positive connection for raising the air-bar, while a spring 351 interposed between said lug and the air-bar furnishes a yielding connection for depressing and seating the latter. The air-bar is normally upheld or elevated by a spring 345 engaging one of the arms 346, while the other arm carries an adjustable contact for engaging the inlet valve 347, to open the latter when the air-bar is depressed and seated upon the record-strip.

The operation of these parts, briefly stated, is as follows: The air bar being elevated and inlet valve closed, shaft 339 is turned sufficiently to advance the record strip from one line of perforations to the next, in doing which the pin wheels engage perforations in opposite edges of the record strip, and, at the same time, turn the winding spool by means of the belt and pulleys, thus drawing the record strip from the supply spool and winding it up on the winding spool. When a feed motion has been thus produced the air-bar is brought down into close contact with the surface of the record strip, and at the same time, or immediately thereafter, the inlet valve is opened and air, under pressure, admitted within the air-bar, from whence it escapes through such of the ports in the cross-bar as are uncovered by perforations in the record strip, and passes to the various actuating or controllable members of the machine.

The movements of the paper-feed and air-bar, are derived from the main actuating lever 349, and are transmitted through connecting rod 352 to lever 353 pivoted on the side of the paper feed frame and provided with two connections, the one extending to the air-bar actuating devices and the other to the paper-feed actuating devices. The connection between lever 353 and the air-bar actuating devices is through a link 354 provided with a slotted head open on one side, for the entrance and engagement of pin 348 on arm 346, a spring 355 serving to hold the link in engaging position, at the same time permitting it to be withdrawn when desired.

Upon one end of shaft 339 is secured a ratchet wheel 356, and surrounding the latter and concentric therewith is an annulus 357 provided with a lug 358 located between adjustable limiting stops 359. This annulus is permitted a limited movement around the ratchet wheel 356 (the extent of such movement being governed by the position of the stops 359) and upon it is pivoted a three-armed pawl 360, one branch being furnished with an angular engaging portion adapted to enter between the teeth of the ratchet wheel, the second branch, on the opposite side of the pivot, riding in a curved recess or slot in the outer end of a locking pawl 361, the latter pivotally supported on the frame, while the third or intermediate branch is connected to lever 353 through a compression link 362, the latter yielding on the downward stroke of lever 353. When the load end of lever 353 is elevated it will operate first upon pawl 360, tilting the latter in a direction to withdraw its engaging point from the ratchet wheel, at the same time throwing the locking pawl 361 into engagement therewith through the medium of the arm riding in the slot in said locking-pawl, thus locking shaft 339 against rotation, after which the motion is transmitted to the

annulus or support 357, and the pawl is retracted until arrested by the engagement of lug 358 with stop 359. Upon the reversal of the movement of lever 353 locking pawl 361 will be withdrawn from the ratchet wheel, and simultaneously therewith the engaging end of pawl 360, will be brought into engagement with said wheel 356, after which the motion will be communicated to the supporting annulus, and shaft 339 will be turned until the movement is arrested by the contact of lug 358 with the opposite stop 359. A reversal of the movements will cause the re-engagement of locking pawl 361 and the disengagement of pawl 360, as before explained.

A cam lever 363 pivoted upon the frame above locking pawl 361, in position to engage the latter, may, when desired, be employed to hold the locking pawl in engagement with the ratchet wheel 356 and thus prevent the movement of the pin wheel shaft 339, connection 362 yielding in such case during the throw of lever 353.

As it is sometimes desirable to start up the machine with the paper-feed mechanism inactive, or to arrest the action of the latter while the machine is in motion, an uncoupling device has been interposed between actuating-lever 349 and lever 353, as indicated in Figure 106. The lower end of connecting rod 352 is provided with a bifurcated head 364, the arms of which are slotted for the reception of pin 365 carried by actuating lever 349. Pivoted upon this pin 365, between the arms of head 364, is a block 366 adapted, when swung into position, to occupy the space between pin 365 and head 364, so that said head and its connecting rod will move in unison with actuating lever 349. A spring actuated latch 367 serves to hold block 366 in position. To disengage actuating lever 349 from connecting rod 352 it is only necessary to press block 366 down or swing it out from between the arms of head 364, as indicated by dotted lines in Fig. 106, thus permitting pin 365 to ride freely in the slots formed in the arms of head 364.

Each spool is mounted upon a removable pin supported in bearings in the frame, so that it can be withdrawn for the removal and insertion of the spools, the pin for the winding spool passing through the pulley and carrying a feather or equivalent device for locking the pulley and spool so that they will be rotated together.

The supply spool is usually furnished with permanent flanges or heads, but the winding spool is provided with one head only (in order that the strip, after use, may be readily slipped off without unwinding it), the other head being mounted in bearings in the frame as shown in Fig. 110.

The Driving Mechanism.

Thus far in describing the various mechanisms the several movable parts have been, in most instances, traced back only to their actuating levers, it being presumed that suitable and properly timed and connected driving mechanism for giving to the several actuating levers their proper motions, was supplied. The special and preferred arrangement, and the approximate forms of the cams are illustrated in Figures 32, and 113 to 122 inclusive.

Although grooved or other known forms of cams might be employed for giving motion to the several actuating levers the preferred arrangement is one in which a pair of cams acting in opposition are employed for each actuating lever, one of said cams effecting the motions in one direction, and the other in the opposite direction, and both acting upon a roller carried by the lever between the opposing surfaces of the cams. By this means the wearing surfaces are preserved, as the motion of the roller, instead of being alternately in opposite directions, is continuously in the same direction, although varying in speed. The two sets of cams are mounted upon parallel shafts 370, 371, supported in bearings on the side of the main frame and connected through a train of gears 372, to operate in the same direction and at the same rate of speed (Figs. 1 to 6 inclusive). The fast and loose pulleys 373 are mounted upon one of these shafts 370 and the intermediate gear in the train of gears 372 carries a worm 374 (Fig. 6) in engagement with worm wheel 318 of the galley driving mechanism. As matter of convenience and adaptation the several actuating levers are arranged in two series each provided with its own shaft

or fulcrum (Fig. 6). By reference to Figures 1 and 113 it will be seen that the lower or power ends of the actuating levers extend down between driving shafts 370, 371, in line with their respective pairs of cams, and beginning at the left, these are the pair of cams 377 (Fig. 115) operating upon the actuating lever 333 for ejector blade 259; cams 378 (Fig. 32) and actuating lever 178 for advancing and retracting the mold-blade 4; cams 379 (Fig. 122) and actuating lever 349 of the paper feed; cams 380 (Fig. 121) for actuating lever 78 of die-centering mechanism, connected through main actuating lever 390 and compression link 391 (Figs. 2, 6 and 22); cams 381 (Fig. 120) and actuating lever 58 for die-centering plunger; cams 382 (Fig. 119) and actuating lever 168 for transfer wedges; cams 383 (Fig. 118) and actuating lever 221 for pump mechanism; and cams 384 (Fig. 117) and actuating lever 246 for type carrier. The relative positions of adjustment of these several cams upon the two driving shafts are indicated by the grooves for receiving the keys.

The bell-crank 88 (Fig. 33) operating the locking bolts 86 of the secondary controller for the die-case centering mechanism, is caused to operate in unison with the actuating lever 58 of the centering plunger, to unlock said controllers as the centering plunger enters its seat in the matrix block, by having the power arm of its actuating lever 392 connected to the power arm of lever 58, the load end of said lever being connected to bell-crank 88 through rod 393.

The Pneumatic System.

From the foregoing description of the several mechanisms, separately considered, it must be plain that all that is required to complete the machine and render its several parts co-operative and responsive to the will of the operative who prepares the record strip, is a competent system of communication between the perforated record-strip and the several controllable members of the die-case centering mechanism, the justifying-wedges and the transfer-blocks.

This function is performed by what is herein termed the pneumatic system or series of air-tubes or passages 385 through which communication is established between the parts in the cross-bar and the pistons 66 of the primary controllers 65 and those of plungers 164 operating upon the trip levers of the justifying-wedges and the locking rod for the transfer-blocks.

By reference to the diagram (Fig. 112) it will be seen that each port in the cross-bar 337 is in open communication with one of the several cylinders referred to, so that any one or more of the pistons can be operated by forming a perforation in the record-strip in line with the desired pin or plunger. There being but 14 movable stop pins in each series of primary controllers the omission of a perforation in the record-strip corresponding to one of them effects the interposition of the fifteenth stop or fixed pin 65*, which is the equivalent of a movable pin directly controlled by a perforation in the record-strip, so that it may rightly be said that the record-strip directly controls the die-case centering mechanism as to each of its series of adjustments in transverse planes—lines and columns—through the pneumatic system.

Summary of Operation.

Having described in detail the several constituent elements of the organized machine, a brief summary of its operation will suffice.

At the commencement of each line the justifying-wedges are to be set to produce space type that will justify or fill out the line, assuming the character type are of normal dimensions according to the particular system of measurement adopted. It is the office of the operative who prepares the record-strip to determine not only what characters and spaces shall be produced and their order, but also to ascertain and impress the ratio of increase to be given each normal space type, in the performance of which he is aided by a special machine, adapted to form the required type-perforations in the record strip and indicate the justification ratio for the spaces.

Each justifying-wedge represents fifteen degrees of adjustment on a regular scale whose increments are uniform and proportional to the taper of the wedge, hence to produce a mold-cavity of the desired width for the space type, it is only necessary that the justifying-wedge should be set at that one of its positions of adjustment whose value, plus that of the normal wedge, represents the required position of the mold-blade.

The setting of each justifying-wedge involves two operations, first, for position, and, second, for connection with the positioning mechanism. Position is determined through the medium of the primary controllers or stop-pins 65 of the die-case carrier system, consequently a perforation is made in the record-strip to designate which of the fourteen positions of adjustment represented by the movable stop-pins 65, the wedge is to occupy; or the perforation for position is omitted, in which case the maximum adjustment, produced by fixed stop-pin 65* will be attained.

Another perforation is required to designate the particular wedge and to place it in connection with the actuating devices for adjustment, and this is done by forming a perforation in line with the port leading to one or the other of the pistons controlling the justifying-wedge trip-lever. Thus either or both justifying-wedges are set to position and locked, and, incidentally, the galley mechanism is started in action to take care of the preceding line.

But, although adjusted for the line, the justifying wedges are inoperative to affect the position of the mold-blade and the size of the type, until through the action of the transfer-blocks, the control of the mold-blade is shifted from the normal-wedge alone, to the normal plus the justifying wedges.

To effect this two things are required, first, that the normal-wedge should be properly adjusted to harmonize with the justifying-wedge or wedges in determining the position of adjustment of the mold-blade; and, second, that the normal-wedge transfer-block should be thrown out of action and the justifying-wedge transfer-block thrown into action.

Two or at the most three perforations in the record-strip are sufficient to accomplish these results. If, as is preferred, the space matrix-blocks, are located in the last line in the die-case, the adjustment of the normal-wedge will be produced by a perforation communicating with the port leading to the primary controller or stop-pin representing the column whose width-value corresponds with the desired position of adjustment of the normal-wedge. Should the space matrix blocks be located in any other than the last line, another perforation corresponding to line adjustment would be required.

Having thus provided for setting the normal-wedge, another perforation serves to bring the justifying-wedges into action, and that is one opposite the port leading to the trip-lever which controls the locking-bolt of the transfer-blocks, whereby the normal-wedge transfer-block is locked out of action, and the justifying-wedge transfer-block brought into operation so as to act in conjunction with the normal and justifying-wedges in setting the mold-blade for a space type.

One or two perforations, according to the position of the matrix in the die-case, suffice for locating each character-matrix, and adjusting the normal-wedge to correspond therewith, through the medium of the two series of primary controllers pertaining to the line and column movements of the die-case.

The readjustment of the die-case, the normal and justifying wedges and the mold-blade are each affected by a movement direct from the position of prior adjustment to the position of next subsequent adjustment, thus the normal or zero position is eliminated and the motions incident to the return to a zero point before advancing to the next succeeding position are entirely avoided.

The adjustments effected by the normal and justifying wedges while accurate, delicate and positive, are not dependent upon rigid or inflexible connections, the wedges, themselves being loosely and flexibly connected to their positioning devices so as to avoid binding and distortion, and the interference due to variations in temperature.

So, too, the connection between the mold-blade and its actuating and adjusting devices, is of a character well adapted to prevent interference by variations in temperature.

The setting of the justifying-wedges for the line taking place as it does after one line is completed, and before another is begun, affords an opportunity for the starting of the galley mechanism to take care of the completed line, and by utilizing the devices which bring the justifying-wedges into position for readjustment, to automatically start the galley mechanism, not only is there a saving of time effected, but the necessity of a special galley perforation is avoided.

Having now particularly described and ascertained the nature of my said invention, as communicated to me by my foreign correspondents, and in what manner the same is to be performed, I declare that what I claim is:—

1. In an organized type-casting machine such as described, the combination with an adjustable mold, and a movable series of dies or matrices, of a controllable centering mechanism operating upon the dies or matrices to carry them directly from one position of adjustment to another without returning to a zero or normal point of departure; substantially as described.

2. In an organized type-casting machine such as described, the combination with an adjustable mold, a movable series of dies or matrices, and mold-adjusting devices, of a controllable centering mechanism engaging the series of dies or matrices and the mold-adjusting devices to transport them from one position of adjustment to another directly without returning to a normal or zero point of departure; substantially as described.

3. In a die or matrix centering mechanism the combination with a movable series of dies or matrices, of a positioning or adjusting mechanism for shifting the series of dies or matrices from any one position of adjustment to another directly without returning to a normal or initial point of departure; substantially as described.

4. In a type-casting machine such as described employing an adjustable mold and a series of dies or matrices adjustable with respect thereto to form different type, the combination with the mold-blade of an adjusting mechanism containing a variable factor, such as the normal-wedge, automatically shifted from one position of adjustment to any other without returning to a normal or zero position; substantially as described.

5. In a type-casting machine such as described, the combination of the following elements, to wit; a die or matrix case; a mold provided with a movable mold-blade; a normal-wedge for positioning the mold-blade; and an adjusting or centering mechanism for shifting the die-case and the normal-wedge directly from one position of adjustment to another without first returning to a zero or normal starting point; substantially as described.

6. In a type-casting machine provided with an automatically adjustable mold the combination with the adjustable member or mold-blade, of abnormal adjusting devices containing a variable factor—such as the justifying-wedge—and controllable adjusting devices shifting said variable factor directly from one position of adjustment to another without returning to a normal or zero position; substantially as described.

7. In a type-casting machine the combination with the mold-blade through which the size of the mold-cavity is varied, of a normal and an abnormal adjusting mechanism, operating separately or together, and each containing a variable factor, with controlling or adjusting devices for moving said variable factors directly from one position of adjustment to another without returning to a normal or zero position; substantially as described.

8. In a type-casting machine provided with an automatically adjustable mold, the combination with the adjustable member—such as the mold-blade—of an abnormal adjusting or justifying mechanism containing a plurality of variable factors—such as the justifying-wedges—and controllable adjusting devices for shifting or adjusting each of said variable factors; substantially as described.

9. In a type-casting machine such as described, the combination with the movable die-case, the mould provided with an adjustable section or mold-blade, the normal-

wedge for determining by its position of adjustment the size of the mold-cavity, and the centering plunger, of the following elements, to wit; an adjusting or centering mechanism connected with the die-case to move the latter directly from one position of adjustment to another, said mechanism also operating upon the normal-wedge to shift it directly from one position of adjustment to another, and a lock for the normal-wedge operated by the actuating lever for the centering plunger; substantially as described.

10. In a type-casting machine the combination of the following elements, to wit; a movable die-case; a mold provided with an adjustable mold-blade; a normal-wedge for adjusting the position of the mold-blade; and a die-case centering or adjusting mechanism including a pair of oppositely movable jaws with intercepting devices for arresting them in closed position at any point within the limits of their motion towards each other, said jaws engaging both the normal-wedge and translating devices connected to the die-case; substantially as described.

11. In a type-casting machine provided with a movable die-case, a centering plunger and an adjustable mold, the combination therewith of the following elements, to wit; a die-case centering mechanism whose positioning devices are a pair of oppositely movable jaws with a controllable gage determining the closed position of said jaws; a normal-wedge normally controlled as to position by said jaws; a lock for said normal-wedge; a justifying-wedge normally disconnected from said jaws; a lock or detent for holding the justifying wedge in adjusted position; controllable shifting devices for temporarily connecting the justifying-wedge with the jaws of the positioning mechanism; and a mold-blade abutment controlled, as to position, by the normal and justifying-wedges; substantially as described.

12. In a type-casting machine provided with a movable die-case, a centering plunger and an adjustable mold; the combination therewith of the following elements, to wit; a die-case centering mechanism whose positioning devices are a pair of oppositely movable jaws with a controllable gage determining the closed position of said jaws; a normal-wedge controlled as to position by said jaws; a lock for said normal-wedge; a justifying-wedge normally disconnected from said jaws; a lock or detent for holding the justifying-wedge in adjusted position; controllable shifting devices for temporarily connecting the justifying-wedge with the jaws of the positioning mechanism; transfer-blocks; actuating devices for said transfer blocks; controllable locking mechanism for suspending the action of either transfer block, thereby selecting either the normal-wedge or the normal and justifying-wedges for determining the size of the mold cavity; and a mold-blade abutment controlled, as to position, by the normal and justifying wedges; substantially as described.

13. In a type-casting machine provided with a movable die-case, a centering plunger, and an adjustable mold, the combination therewith of the following elements, to wit; a die-case centering mechanism provided with a positioning mechanism containing oppositely movable jaws and a controllable gage for determining the closed position of said jaws; a normal-wedge provided with a shoulder extending between and in the path of movement of said jaws; a justifying-wedge normally disconnected from the jaws of the positioning mechanism; controllable devices, such as a shifting lever, trip, trip-lever and actuating lever, for connecting and disconnecting the justifying-wedge and the positioning mechanism; transfer-blocks; controllable mechanism for locking either transfer-block out of action; and a mold-blade abutment whose position is determined by the normal or normal and justifying-wedges and a transfer-block; substantially as described.

14. In a type-casting machine such as described the combination with the abutment slide for the mold-blade, of the following elements, to wit; a positioning mechanism provided with oppositely movable jaws and a controllable gage for determining their closed position at different points in the line of their motion when approaching; a normal-wedge extending parallel with the direction of motion of said jaws and provided with a shoulder projecting between and in the path of the two jaws, a plurality of dissimilarly tapered justifying-wedges extending parallel with the normal-wedge, each provided with a projection or shoulder adapted to be engaged by

the positioning jaws but held normally outside of the paths of said jaws; controllable devices for bringing the justifying-wedges successively and temporarily into the path of the jaws and between the latter, to adjust said wedges longitudinally to any of the series of positions indicated by the controllable gage; a pair of transfer-blocks or wedges, extending longitudinally of the normal-wedge, the one lying between the normal-wedge and a fixed abutment, and the other between the normal and justifying-wedges; actuating devices for reciprocating the transfer-blocks; and controllable locking devices for arresting either transfer-block in inoperative position while the other is moved to operative position; substantially as described.

15. In a type-casting machine such as described the combination with the mold and the series of movable matrices or dies, of a mold adjusting mechanism including a stepped or irregular wedge with controllable mechanism for adjusting or positioning said wedge; substantially as described.

16. In a type-casting machine the combination of the following elements, to wit: a movable die-case; a mold provided with a movable wall or mold-blade; a die-case centering mechanism provided with a controllable positioning mechanism; a stepped or irregular normal-wedge connected to said positioning mechanism for adjustment through uniformly spaced intervals; and an abutment slide through which the normal-wedge is caused to act upon the mold-blade in positioning the latter; substantially as described.

17. The combination in a type-casting machine such as described of the following elements, to wit: a fixed mold provided with mold-blade and cross-blade; a die-case movable horizontally for bringing different matrices or dies in alignment with the mold, and vertically, to seat the centered matrix on the mold; and a type-carrier guided to rise and fall in an oblique direction, to receive the type from the mold and carry it laterally and downwardly out of the path of the die-case; substantially as described.

18. The combination in a type-casting machine such as described of the following elements, to wit; a fixed mold provided with a type ejecting mold-blade and a movable front wall or cross-blade; a die-case movable in a plane transverse to the axis of the mold, for centering the matrices or dies, and parallel with the axis of the mold, to seat the centered die or matrix on the mold; and a type-carrier reciprocating in a plane inclined to the axis of the mold, whereby as it recedes from the latter it will be carried downward or away from the path of the die-case; substantially as described.

19. In a type-casting machine the combination of the following elements, to wit; a fixed mold with horizontally reciprocating cross blade and mold-blade ejector; a horizontally and vertically movable die-case; and a type-carrier connected to the cross-blade, but guided to reciprocate in a path inclined to that of the cross-blade, whereby the type-carrier is alternately elevated and depressed as it travels towards and from the mold; substantially as described.

20. In a type-casting machine the combination of the following elements, to wit; a fixed mold with cross-blade and ejecting mold-blade; a horizontally and vertically movable die-case; and a type-carrier mounted to reciprocate in a plane inclined to the horizon, said type-carrier being furnished with a clamping member and a yielding gate or type supporting blade, substantially as described.

21. In an organized type-casting and composing machine such as described the combination of the following elements, to wit; a mold with movable mold-blade; a die-case with controllable centering mechanism therefore; a controllable normal adjusting mechanism for the mold-blade; a plurality of abnormal or justification adjusting devices for the mold-blade, with controllable mechanism for adjusting each of said devices; a galley mechanism provided with a controllable starting mechanism connected with the controllable abnormal or justification adjusting mechanism; a controlling strip; and a transmitting system governed by the controlling strip and operating upon the controllable members of the die-case centering mechanism, the normal mold adjusting mechanism, and each of the abnormal mold-blade adjusting devices; whereby the abnormal adjusting devices may be independently adjusted

predetermined positions, and the adjustment of either will operate to start the galley mechanism; substantially as described.

22. In an organized type-casting and composing machine such as described, the combination of the following elements, to wit; a mold with movable mold-blade; a die-case with controllable centering mechanism; a controllable normal adjusting mechanism for the mold-blade; a controllable abnormal or justification adjusting mechanism for the mold-blade; a galley mechanism provided with a controllable starting and stopping mechanism connected with a controllable abnormal or justification mechanism; and a controlling system governed by a controller or record strip and operating upon the controllable members of the die-case centering mechanism and the normal and abnormal mold-blade adjusting mechanisms, to center the dies or matrices and adjust the mold to correspond therewith, and to set the abnormal adjusting mechanism and start the galley mechanism; substantially as described.

23. The combination in a type-casting machine such as described, of the following elements, to wit; a mold provided with an adjustable mold-blade; a movable die-case; a controllable centering mechanism for the die-case; a controllable normal adjusting mechanism for the mold-blade; a controllable abnormal mold-blade adjusting mechanism comprising a plurality of independent adjustable elements, such as justifying-wedges; a controlling member, such as a perforated strip; and a controlling system, such as a pneumatic system, between said controlling member and the controllable mechanisms mentioned, for governing the centering of the die-case, the position of the normal adjusting mechanism, and the positions of each abnormal adjusting mechanism; substantially as described.

24. In a type-casting and composing machine such as described the combination with the abnormal or justifying mechanism for the mold, and the controllable devices for setting or adjusting said mechanism, of a galley mechanism provided with a controllable driving mechanism, and connections between the abnormal or justifying mechanism and the controllable member of the galley driving mechanism for starting the latter when the abnormal or justifying mechanism is set or adjusted, substantially as described.

25. In a type-casting machine such as described provided with a movable die-case containing a plurality of dies or matrices; a fixed mold with an adjustable member, such as a mold-blade, for varying the dimensions of the mold-cavity; normal and abnormal or justifying mold-adjusting mechanisms; and a galley mechanism provided with a controllable driving mechanism; the combination with the controllable mechanism for setting the abnormal or justifying mold-adjusting members and the controllable member of the galley driving mechanism, of connecting mechanism for actuating the controllable member of the galley driving mechanism to set the latter in motion when the adjustment of the abnormal or justifying mechanism is effected; whereby the setting of the justifying mechanism for a line starts the galley mechanism in action, to dispose of the previously completed line; substantially as described.

26. In a type-casting and composing machine such as described the combination with the controllable member of the galley driving mechanism, of actuating devices engaging said controllable member connected with and operated by the controllable adjusting mechanism of the mold-justifying devices, substantially as described, whereby the setting of the justifying mechanism connects the galley mechanism with its driving mechanism.

27. In a type-casting and composing machine such as described, the combination with the adjusting or setting mechanism of the abnormal or justifying devices, a controllable pump actuating mechanism, and a controllable galley actuating mechanism, of actuating devices controlled by the setting mechanism of the justifying devices and engaging the controllable members of the pump and galley actuating mechanisms, whereby the setting of the justifying mechanism will effect a suspension of the pump action and start the galley mechanism; substantially as described.

28. In a type-casting and composing machine the combination with the starting

lever of the galley mechanism and the shifting lever of the justifying-wedge, of a shaft interposed between said shifting lever and starting lever for transmitting motion from the former to the latter; substantially as described.

29. In a type-casting machine the combination with the mold, of a vertically reciprocating injecting mechanism including melting-pot, pump and nozzle, and a supporting frame pivotally attached to the main frame on a vertical axis; substantially as described.

30. In a type-casting machine such as described and in combination with the vertically movable injecting devices, including melting-pot, pump and nozzle, of a vertically adjustable and laterally movable supporting frame therefor, and a lock for holding said frame from lateral motion when in elevated position, whereby the injecting mechanism can be lowered and swung from beneath the mold; substantially as described.

31. In a type-casting machine the combination with the pump and the actuating mechanism therefor, of a controllable disengaging or arresting device including a reciprocating driving member, a driven member carrying a latch for engagement with the driving member, and reciprocating member, moving in a direction to release the latch from engagement with the driving member and shiftable into and out of the path of said latch; substantially as described.

32. In an adjusting or centering mechanism for shifting a member from one to another of a series of indicated positions the combination of the following elements, to wit; a positioning or gaging mechanism provided with oppositely movable jaws; a fixed gage composed of a plurality of stops or pins serially arranged and each adapted to be projected into the path of one of said jaws to arrest the latter as it approaches the opposite jaw; a shiftable member or gage located between the two jaws in position to be engaged by the latter as they approach; and actuating devices engaging and connecting the two jaws, to cause them to advance successively in closing upon the shiftable member, said devices including a pair of levers, the one pivotally connected to the frame and the other to the actuating lever at points between their ends respectively, each of said levers being pivotally connected at one end to one of the jaws while their opposite ends are connected together, and a spring operating through the connected levers to hold one jaw against a stop at the outer extreme of its motion while the opposite jaw is advancing and until it contacts with its stop, when, by the continued motion of the actuating lever, the second jaw will be advanced thus positioning the shiftable member projecting between the jaws; substantially as described.

33. In a type-casting machine the combination with the adjustable mold-blade for varying the size of the mold-cavity, its actuating devices and limiting abutment, of a normal-wedge, a justifying-wedge and a reciprocating transfer-block, substantially as described.

34. In a type-casting machine, as a means for effecting the adjustments of the mold for both normal and justifying type, the combination with the adjustable member or mold-blade, of a normal adjusting device, an abnormal adjusting device, and two interponents or transfer-blocks operating alternatively, the one to throw the normal adjusting devices into operative relation with the mold-blade and the other to throw both the abnormal and normal adjusting devices into operative relation with the mold-blade; substantially as described.

35. In a type-casting machine the combination with a stationary mold and a movable metal injecting mechanism including a pump and nozzle, of two opposing connected levers, one connected to the cylinder and the other to the piston of the pump, an actuating device for each lever, and mechanism operating upon said actuating devices to move them in unison with the injecting mechanism as the latter advances towards and recedes from the mold, and to separate them and thus project the metal into the mold after the nozzle has been seated; substantially as described.

36. In a die or matrix adjusting mechanism the combination with the movable die or matrix case, and a gage or controller presenting a graduated series of stops or

contacts corresponding to the various positions of adjustment of the die-case, of actuating and controlling mechanism between the die-case and gage and controlled, as to position, by the latter, said actuating and controlling mechanism being moved alternately into and out of engagement with the die-case, so that in moving or setting the latter it will be carried directly from one position of adjustment to another; substantially as described.

37. In a type-casting machine the combination, to form an adjusting mechanism for a shiftable member, such as a die-case, of the following elements, to wit; a primary controller or fixed gage comprising a plurality of controllable contacts or stops serially arranged and constituting an index for the various positions of adjustment; a primary positioning mechanism controlled as to position by the primary gage; a secondary or shiftable gage controlled, as to position, by the primary positioning mechanism; a secondary positioning mechanism, controlled, as to position, by the shiftable gage; a shiftable member such as a die-case; and translating devices between the secondary positioning mechanism and the shiftable member for moving the latter from one position of adjustment directly to another position of adjustment; substantially as described.

38. In a die or matrix adjusting or centering mechanism, the combination with the die-case and the controlling gage by which the position of the die-case is determined, of a centering or adjusting mechanism independent of the die-case, and co-operating alternately with the controlling gage and the die-case, to first set or determine the adjusting motion and then transmit or communicate the adjusting motion to the die-case, substantially as described.

39. In an adjusting mechanism for a shiftable member, such as the secondary gage of the die-case centering mechanism, the combination of the following elements, to wit; a fixed gage comprising a series of controllable stops or contacts indicating relative positions of adjustment; a positioning mechanism including a pair of oppositely movable jaws, one of which is adapted to engage and be arrested by the fixed gage and form a stop or abutment for limiting the movement of the opposite jaw; and a shiftable member occupying a position between the jaws of the positioning mechanism; whereby the position of said shiftable member is varied to accord with that one of the stops or contacts of the fixed gage at the time operating upon the positioning mechanism; substantially as described.

40. In a die-case centering mechanism the combination of the following elements, to wit; a shiftable gage; a positioning mechanism provided with oppositely moving jaws adapted to close upon the shiftable gage in any position of adjustment; a shiftable die-case; and translating devices connected to the die-case and projecting between the jaws of the positioning mechanism so that in closing upon the gage the jaws will bring the die-case into a position corresponding with that of the gage; substantially as described.

41. In an adjusting or centering mechanism the combination of the following elements, to wit; a shiftable gage with means for locking it in adjusted position; a primary positioning mechanism provided with oppositely moving jaws between which the shiftable gage is located and by which the latter is carried to position; a secondary positioning mechanism provided with oppositely movable jaws for engagement with the shiftable gage; a translating device located between the jaws of the secondary positioning mechanism; and a primary gage acting upon the primary positioning mechanism to determine the position of its jaws when closed; substantially as described.

42. The combination in a die or matrix centering or adjusting mechanism of the following elements, to wit; a die-case movable in guides to bring successive sections in line with a fixed point or center; a translating device connected to said die-case; a positioning mechanism comprising oppositely movable jaws between which said translating device extends and by which the die-case is carried in either direction to adjusted position; and a shiftable gage interposed between and movable in the plane of motion of the said jaws, to determine by its position the point at which the two jaws shall be brought together; whereby, during the separation of the two jaws,

preliminary to the resetting of the gage, the die-case is released from its actuating devices, and as the jaws are again brought together to the position indicated by the gage the die-case will be shifted; substantially as described.

43. In a matrix centering mechanism the combination with a mold, a die-case, actuating devices for the die-case and a centering plunger of a friction device or brake for alternately retarding and releasing the die-case, substantially as described.

44. In a matrix centering mechanism the combination with a die-case, its carrier and the mold, of centering devices for the die-case and its carrier operating on intersecting lines, to center individual dies or matrices above the mold; a centering plunger; and brakes or friction devices for the die-case and its carrier, engaging the latter during their motions of translation and being withdrawn or relieved during the action of the centering plunger; substantially as described.

45. In a die-case centering mechanism, the combination of the following elements, to wit: a die-case; a die-case carrier; a die-case centering or shifting mechanism; a die-case carrier centering or shifting mechanism; a mold; a centering plunger in line with the mold; a brake or friction device for the die-case applied to the connection between the die-case and its centering mechanism; and a brake or friction device applied to the die-case carrier; said brake or friction devices operating during the motions of translation of the die-case and its carrier, and being suspended during the action of the centering plunger; substantially as described.

46. In a die or matrix centering mechanism the combination of the following elements, to wit; a die-case; a die-case carrier; a supporting frame for the die-case and its carrier; independent actuating devices for the die-case and for its carrier; a centering plunger; frictional braking devices between the die-case and its carrier; and actuating devices for reciprocating the centering plunger and simultaneously therewith withdrawing the braking devices, substantially as described.

47. In a die or matrix centering mechanism the combination with the vertically movable supporting frame, the die-case carrier, the die-case and the centering plunger, of the following elements, to wit; a friction block mounted upon the supporting frame in position to engage the die-case carrier; an actuating device, such as a lever, for operating the friction block; and a spring with limiting stops interposed between the frame and the friction-block actuating device; whereby, as the die-case supporting frame is lowered, after the preliminary centering of the die-case, the friction-block actuating device will be withdrawn from its actuating spring, leaving the die-case free to respond to the action of the centering plunger, substantially as described.

48. In a die or matrix centering mechanism, the combination with the horizontally reciprocating die-case carrier and its vertically movable supporting frame, of the centering-plunger; the friction blocks mounted upon the supporting frame in line with the guides for the carrier and engaging the latter; the curved levers pivoted in the supporting frame engaging the friction-blocks and partially encircling the centering plunger; and the vertically movable pins each contacting with one of the levers and provided with an actuating spring and a limiting stop or gage; substantially as described.

49. In a die or matrix centering mechanism, the combination with the supporting frame for the die-case and its carrier, and the centering-plunger, of the actuating lever engaging the centering plunger, and the link and lever for transmitting motion from the actuating lever to the supporting frame, substantially as and for the purpose set forth.

50. In a die or matrix centering mechanism the combination with the centering-plunger and the spring sustained supporting frame upon which the die-case is adjusted to bring any matrix block into alignment with the centering-plunger, of the actuating lever engaging the centering-plunger, the lever connected to the supporting frame, and a connection between said last named lever and the actuating lever, whereby motion in the same direction but at relatively different speeds

will be communicated to the centering-plunger and supporting-frame; substantially as described.

51. In an adjusting or centering mechanism such as described containing a primary controller or fixed gage, a primary positioning or gaging mechanism provided with oppositely movable jaws, and a secondary controller or shiftable gage, the combination, to form an actuating mechanism for the jaws of the said positioning or gaging mechanism, of the following elements, to wit; a lever mounted on a fixed fulcrum and having one end attached to one of the jaws; a second lever having one end attached to the other jaw and its opposite end connected through a link to the first named lever; a spring operating to hold one of said levers retracted; and an actuating lever connected to said second lever between its ends; whereby, as the actuating lever is moved in one direction, it and the spring will separate the jaws, and when moved in the opposite direction, will advance one jaw until arrested by a stop pin of the fixed gage and then advance the opposite jaw against the resistance of the spring, thus carrying the shiftable member to a position of adjustment corresponding with the position in the series of the stop pin in engagement with the first arrested jaw, substantially as described.

52. The combination with the two pairs of connected levers 73, 74, one lever of each pair being attached to a fixed pivot and the other to a reciprocating actuating device, of a spring retractor connected to one lever of each pair, whereby the corresponding levers of each pair are advanced and continued in motion until arrested before the opposite levers are affected by the actuating device; substantially as described.

53. The combination with two positioning mechanisms each provided with a pair of oppositely movable jaws and a fixed gage for determining the closing position of each pair of jaws, of the two sets of connected levers pivotally attached to the jaws, one lever of each set attached to a fixed pivot and the other to a reciprocating driver, and a spring retractor engaging one lever of each set or pair, so that in the act of closing the jaws of each positioning mechanism, the jaw which is to come in contact with the fixed gage will be first advanced and when arrested motion will be communicated to the upper jaw; substantially as described.

54. In a centering or adjusting mechanism and as a means for operating the pairs of oppositely movable jaws of the positioning or gaging mechanisms, the combination with said jaws of a lever system for each pair of jaws comprising two levers or members pivotally connected together at one end and each attached to one of the jaws, a fixed bearing or pivot to which one of said levers or members is connected by a link attached at a point between its points of attachment to the jaw and the opposite lever or member, and an actuating device or mechanism connected to the other lever or member at a point between its points of attachment to the jaw and first named lever or member; substantially as described.

55. In a centering or positioning mechanism, as a means for actuating the jaws of the primary and secondary positioning or gaging mechanisms, the combination of the following elements, to wit; a pair of levers pivotally connected together at one end and having their opposite ends connected respectively to the opposing jaws, one of said levers being furnished with a fixed fulcrum and the other connected at a point between its ends to the actuating lever; and a second pair of connected levers engaging the other pair of jaws, the fixed fulcrum and the connection with the actuating lever of this second pair being reversed in position as compared with those of the first named pair; whereby the two pairs of jaws will be caused to move in relatively opposite directions, one pair closing as the other separates or opens; substantially as described.

56. In a centering or adjusting mechanism such as described for locating the position of a movable member, such as a die-case, at any of a series of indicated positions by a two-way movement on intersecting lines, the combination with such movable member or die-case of the following elements, to wit; two fixed gages or controllers; two positioning mechanisms each provided with oppositely movable jaws whose closed position is determined by a member of the fixed gage; a secondary or shiftable gage

between the jaws of each positioning mechanism; two secondary positioning mechanisms each provided with oppositely movable jaws whose closed position is determined by the shiftable gage; and translating devices between the jaws of one secondary positioning mechanism and the movable member or die-case, and between the jaws of the other secondary positioning mechanism and the carrier or support for said movable member or die-case; substantially as described.

57. In a centering or adjusting mechanism such as described, for locating the position of a movable member, such as a die-case, by movements in transverse lines, the combination of the following elements, to wit; two primary controllers or fixed gages; a primary positioning mechanism with oppositely movable jaws co-acting with each primary controller, the latter determining the closed position of said jaws; a secondary controller or shiftable gage between the jaws of each primary positioning mechanism and set thereby; a lock for each secondary controller; a secondary positioning mechanism for each secondary controller provided with oppositely movable jaws whose closed position is determined by the secondary controller; translating devices between the secondary positioning mechanisms and the movable member or die-case; and actuating devices operating upon the jaws of the primary and secondary positioning mechanisms to open one set of jaws while closing the other set; substantially as described.

58. In a centering or adjusting mechanism, such as described, for locating the position of a two-way movable member, such as a die-case, the combination of the following elements, to wit; two primary controllers or fixed gages; two primary positioning or gaging mechanisms each provided with oppositely movable jaws, whose closed positions are determined by the members of the fixed gages; a secondary controller or shiftable gage interposed between and located by the jaws of each primary positioning mechanism; a secondary positioning or gaging mechanism with oppositely movable jaws for each secondary controller, the latter determining the closed position of said jaws; translating devices between the jaws of the two secondary positioning mechanisms and the movable member or die-case; and a single actuating lever mediately connected to the jaws of the primary and secondary positioning mechanism for opening and closing them in alternation; substantially as described.

59. The combination with a fixed controller or gage and a positioning mechanism containing two oppositely movable members or jaws whose closed position is determined by engagement with the fixed controller, of a shiftable member lying between and in the path traversed by said jaws when approaching or closing, and a centering and locking device engaging said shiftable member when brought to position by the jaws, for effecting final adjustment and locking the shiftable member while the jaws are receding therefrom, substantially as described.

60. A type mold for use in a casting machine comprising side blocks; a movable cross-blade; an adjustable mold-blade, the latter serving as an ejector; and an adjustable limiting stop for the mold-blade, the whole mounted upon a detachable mold-frame.

61. In a type-casting mold for use in connection with a reciprocating nozzle, the combination therewith of a nozzle-plate provided with a thin walled and bell-shaped seat for the nozzle, to prevent chilling the metal in the nozzle when the latter is seated in position to inject the molten metal into the mold; substantially as described.

62. In combination with the mold and nozzle, the nozzle-plate mounted upon the mold and provided with concave face and projecting bell nozzle-seat; substantially as described.

63. In a type-casting machine the combination with the detachable mold and its movable mold-blade for varying the dimensions of the mold-cavity and ejecting the type therefrom of the adjustable limiting stop carried by the mold-frame and engaging the mold-blade; substantially as described.

64. In a mold adjusting mechanism such as described, the combination with the mold-blade, its abutment slide, the normal-wedge and the justifying-wedge, of

oppositely reciprocating jaws engaging said wedges to set or adjust the latter; substantially as described.

65. The combination with the mold-blade abutment and an adjustable normal-wedge for positioning the former, of a movable transfer-block interposed in the line of connection between the fixed bearing or abutment and the movable mold-blade abutment; substantially as described.

66. In a mold adjusting mechanism the combination with the mold-blade abutment slide, a main adjusting element, such as the normal-wedge an adjustment setting member, such as a transfer-block, and a plurality of supplemental adjusting elements, such as justifying-wedges, of controllable positioning mechanism for separately positioning each supplemental adjusting element and the main adjusting element; substantially as described.

67. The combination with a movable abutment-slide furnished with an adjustable contact for engagement with the mold-blade, of a normal-wedge for determining the position of adjustment of the mold-blade, and a reciprocating wedge-shaped transfer-block co-operating with the normal-wedge in setting the abutment-slide to the position indicated by the normal-wedge; substantially as described.

68. In a mold adjusting mechanism for type-casting machines, the combination with the mold-blade, actuating devices therefor and an adjustable intercepting abutment, of a transfer-block, a normal-wedge, and actuating devices for reciprocating the transfer block and adjusting the normal-wedge; substantially as described.

69. In a mold adjusting mechanism for type machines, the combination with adjusting devices operating upon the mold-blade to determine its position in the mold when a cast is to be made, of a setting or adjusting mechanism including a transfer-block having a uniform range of motion, and a normal-wedge having a variable motion of adjustment; substantially as described.

70. In a mold-blade adjusting mechanism the combination with devices directly controlling the position of the mold-blade, such as an abutment slide, of an adjusting or normal-wedge, variable adjusting devices for moving said wedge to different positions of adjustment, a second-wedge or transfer-block, and actuating devices for communicating uniform reciprocating movements to said second wedge; substantially as described.

71. In a mold-blade adjusting mechanism the combination with the mold-blade abutment and the variably adjustable normal-wedge, of the transfer-block having a uniform reciprocating movement, and an adjustable abutment fixed to the frame for defining one extreme of said reciprocating movement; substantially as described.

72. The combination with the abutment slide for the mold-blade, a variably adjustable normal-wedge and a reciprocating transfer-block having a uniform degree of motion, of actuating devices for said transfer-block including yielding or elastic connections, and an adjusting wedge against which the transfer-block contacts at the limit of its operative stroke in setting the abutment slide to the position of adjustment determined by the normal-wedge; substantially as described.

73. In a type-casting machine the combination with the movable mold-blade and its adjustable stop or abutment, of mold-blade actuating mechanism, substantially as described, the latter comprising the head or slide carrying a cross-pin for engagement with the mold-blade, a rod connected to said head and provided with two springs, a headed sleeve engaging one of said springs and a loose collar the other, a sleeve interposed between the said loose collar and the headed sleeve, and an actuating lever narrower than the interval between said collar and sleeve; substantially as described.

74. The combination with the transfer-blocks and a lock for holding either of the said blocks at one extreme of its motion, or in inoperative position, of an actuating lever and intermediate connections for transmitting the motion of said lever to either block; substantially as described.

75. The combination with the reciprocatory transfer-blocks of the actuating rods,

the locking rod and the yielding actuating devices between said actuating rods and the actuating lever; substantially as described.

76. In combination with the transfer-blocks, their limiting abutment and a lock for holding either block out of action, of an actuating mechanism comprising a spring-seated lever connected to one transfer-block, a second lever pivoted upon the first-named lever and connected to the other transfer-block and the driving mechanism or main actuating lever connected to said second lever; substantially as described.

77. In a type casting machine such as described, the combination with the mold and its movable mold-blade, of the abutment slide located immediately in rear of the mold-blade, and the normal and justifying wedges located directly beneath said abutment slide; substantially as described.

78. In a mold adjusting mechanism such as described the combination with the normal and justifying wedges of the transfer-blocks loosely connected to their actuating rods, to permit lateral displacement; substantially as described.

79. In a type-casting machine the combination with the mold, the horizontally and vertically movable die-case, and the actuating lever controlling the vertical movements of the die-case, of the mold-blade adjusting devices including the adjustable normal-wedge, the reciprocatory transfer-block and the locking bolt for said transfer-block connected to the die-case-actuating lever; substantially as described.

80. In a mold adjusting mechanism the combination with the mold-blade, its abutment and actuating devices therefor, and the normal-wedge, of the normal-wedge setting or adjusting mechanism including a primary controller or fixed gage; a primary positioning mechanism; a secondary controller or shiftable gage; and a secondary positioning mechanism, the latter operating upon the normal-wedge to shift it to the position indicated by the primary controller; substantially as described.

81. In a mold adjusting mechanism the combination with the mold-blade abutment and its movable support, of a longitudinally adjustable normal-wedge resting loosely in the interval between the mold-blade abutment support and a fixed abutment or bearing, a reciprocating transfer-block between said normal-wedge and the fixed bearing, and actuating devices for retracting the transfer-block, during the adjustment of the normal-wedge and bringing it into operating position after the normal-wedge is adjusted, to set or position the mold-blade abutment; substantially as described.

82. In a type-casting machine the combination with oppositely movable jaws for positioning the die-case by engagement with translating devices connected therewith, of the normal-wedge controlling the position of the mold-blade in the mold, said normal-wedge or a part connected thereto projecting between said jaws, so that the position of adjustment of the normal-wedge will correspond with that of the die-case; substantially as described.

83. In a mold adjusting mechanism the combination with the mold-blade and its abutment slide, of a longitudinally adjustable normal-wedge, an abutment and a device engaging the normal-wedge to withdraw it from the abutment during the adjustment of said wedge; substantially as described.

84. In a mold adjusting mechanism such as described, the combination with the mold-blade and its positioning mechanism, of a stepped or irregular normal-wedge; an abutment against which said wedge acts, a spring seated holding plate, for disengaging the wedge and holding it separated from its abutment during adjustment, and a reciprocating transfer-block or wedge; substantially as described.

85. The combination to form a mold-blade adjusting mechanism, of a normal-wedge, a justifying-wedge and two transfer-blocks, one acting in conjunction with the normal-wedge and the other with both the normal and justifying wedges; substantially as described.

86. The combination with a normal-wedge movable to vary the position of the mold-blade in the mold, and a justifying-wedge whose adjustments, added to those of the normal-wedge, determine the position of the mold-blade when type of abnormal

width are to be produced, of two transfer-blocks, one for the normal-wedge alone, and the other for the normal and justifying wedges together, actuating mechanism for reciprocating both transfer-blocks, and locking devices for locking or throwing out of action either of the transfer-blocks; substantially as described.

87. In a mold-blade and adjusting mechanism for varying the size of the mold cavity, the combination of the following elements, to wit; a normal-wedge for effecting normal adjustments of the mold-blade; a justifying-wedge for effecting abnormal adjustments of the mold-blade; a transfer-block or wedge co-operating with the normal wedge; a second transfer-block or wedge co-operating with the normal and justifying wedges; actuating devices connected to both transfer-blocks; and a lock adapted to arrest one or the other of the transfer-blocks in retracted position leaving the other free to advance to operative position; substantially as described.

88. The combination with a laterally and longitudinally movable wedge, such as the justifying-wedge, of a positioning mechanism for effecting the longitudinal adjustments of the wedge, a lever or support engaging the wedge to shift it laterally into and out of engagement with the positioning mechanism, and controllable actuating devices for said shifting lever or support, substantially as described.

89. In a wedge adjusting mechanism such as described, the combination with a wedge supported to move laterally as well as longitudinally, and a positioning mechanism for engaging and setting the wedge longitudinally, of shifting devices to move the wedge laterally into and out of engagement with the positioning mechanism; substantially as described.

90. In a mold adjusting mechanism the combination with a controllable positioning mechanism provided with oppositely movable jaws, of an adjusting device or mechanism comprising a wedge movable longitudinally for adjustment and laterally for engagement with the jaws of the positioning mechanism; substantially as described.

91. The combination with the oppositely movable jaws of a controllable positioning mechanism, of an adjusting member, such as a justifying-wedge, normally disconnected from the positioning mechanism and provided with means for temporarily placing it under the control of the jaws of said positioning mechanism; substantially as described.

92. In an adjusting mechanism such as described the combination with a controllable positioning mechanism provided with oppositely movable jaws, of a justifying-wedge lying normally to one side of the plane of motion of said jaws but capable of being brought into engagement therewith, a shifting lever engaging the wedge to carry it laterally into or out of the path of the jaws, a trip pivoted upon the shifting lever, and a stepped actuating lever adapted to engage said trip to shift the wedge; substantially as described.

93. In an adjusting mechanism the combination with a controllable positioning mechanism provided with oppositely movable jaws, of an adjusting member, such as the justifying-wedge, controllable mechanism for temporarily establishing an operative relation between said adjusting member and the jaws of the positioning mechanism, and a lock for holding said adjusting member in position when disengaged from its positioning mechanism; substantially as described.

94. In a mold adjusting mechanism, the combination with the oppositely movable jaws of the positioning mechanism, of a justifying-wedge, a locking bar engaging detents on said wedge, a shiftable support or lever engaging the wedge, to temporarily disengage it from the locking bar and carry it into the path of the positioning mechanism for effecting adjustment; substantially as described.

95. The combination to form a wedge setting or adjusting mechanism of the following elements, to wit; a reciprocating positioning mechanism provided with oppositely movable jaws; a laterally and longitudinally movable wedge provided with a shoulder adapted to enter between and be engaged by the jaws of the positioning mechanism; a locking projection or bar engaging detents on the wedge when the latter is withdrawn from between the jaws; and a controllable mechanism

for shifting the wedge laterally from the plane of the locking bar into that of the jaws and *vice versa*; substantially as described.

96. The combination with a laterally and longitudinally movable adjusting wedge, such as the justifying-wedge, and a controllable positioning mechanism for determining the position of adjustment of the wedge, of a detent engaging the wedge to hold it in adjusted position, a lever provided with jaws embracing the wedge and adapted to shift the latter from the detent into engagement with the positioning mechanism, an actuating lever, and a trip intermediate said actuating lever and shifting lever; substantially as described.

97. The combination with a laterally and longitudinally movable wedge, such as the justifying-wedge, and a controllable positioning mechanism for effecting the longitudinal adjustments of the same, of a shifting lever movable laterally of the wedge and engaging the latter to carry it into or out of connection with the positioning mechanism, an actuating lever, a trip between said actuating lever and the shifting lever, and a controllable trip-lever engaging the trip; substantially as described.

98. In a mold adjusting mechanism such as described, the combination with the justifying-wedge and the positioning mechanism therefor, of the wedge shifting lever provided with jaws between which said wedge is received and guided, a trip pivoted to said shifting lever, a reciprocating actuating lever for engaging the trip, a trip-lever operating upon said trip to shift it into engagement with the actuating lever at predetermined intervals, and a piston operating said trip-lever; substantially as described.

99. The combination with oppositely movable jaws and a gage or stop for determining their closed position, of a normal-wedge provided with an engaging portion lying between and in the plane of movement of said jaws, a justifying-wedge provided with an engaging portion normally to one side of the plane of movement of the jaws but capable of being brought into said plane between the jaws, and two transfer-blocks brought into action dissimultaneously for rendering the adjustments of the normal-wedge or of the normal and justifying wedges operative to affect the position of the mold-blade; substantially as described.

100. In a machine for automatically effecting the adjustments of a mold, to produce normal and justifying type, the combination of the following elements, to wit; a normal-wedge and transfer-block for effecting normal adjustments or those corresponding with different widths of normal type; a justifying-wedge and transfer-block for effecting, in conjunction with the normal-wedge, abnormal adjustments such as are required for justification; adjusting mechanism intermittingly engaging the wedges to set and then release them; controllable devices for bringing the justifying-wedge temporarily under the influence of its adjusting mechanism; actuating devices for the transfer-blocks; and a lock for suspending the action of one or the other transfer-block; substantially as described.

101. In a mold adjusting mechanism the combination with the mold and its mold-blade, and a movable abutment controlling the mold-blade when in casting position, of a wedge for adjusting the position of the mold-blade abutment, adjusting mechanism intermittingly engaging said wedge to carry it to any position of adjustment and there leave it, a lock for holding the wedge in adjusted position, and a second wedge or transfer-block operating in conjunction with the first named wedge to set the mold-blade abutment; substantially as described.

102. In a mold adjusting mechanism, the combination with the mold and its mold-blade, of a normal-wedge, a justifying-wedge, an adjusting mechanism normally in operative relation with the normal-wedge and in inoperative relation with the justifying-wedge, controllable devices for placing the justifying-wedge temporarily within the control of said adjusting mechanism, and transfer-blocks for determining which of the adjusting factors—normal-wedge alone or normal and justifying-wedges together—shall operate upon the mold-blade; substantially as described.

103. In a mold adjusting mechanism for type-casting machines the combination of the following elements, to wit; a main adjusting element, such as the normal-wedge; a supplemental adjusting element, such as a justification-wedge;

controllable positioning mechanism for the main and supplemental adjusting elements; independent controllable devices for connecting the supplemental adjusting element with the controllable positioning mechanism; and two setting devices, such as the transfer-blocks, with controllable devices for bringing them alternately into action, to cause either the main or the main and supplemental adjusting elements to operate in conjunction with the movable member of the mold in fixing the width of the mold cavity; substantially as described.

104. In a mold adjusting mechanism for type casting machines the combination with the normal-wedge and the controllable positioning mechanism therefor, of a plurality of differently tapered justifying wedges, and controllable mechanism governing the connections between said positioning mechanism and the justifying-wedges to set the latter, whereby the adjustment effected is compounded of the separate adjustments of the several wedges as determined by their relative positions and tapers; substantially as described.

105. In a mold adjusting mechanism for type casting machines the combination with the normal and justifying-wedges, the transfer-blocks, the mold-blade abutment slide, and the controllable positioning mechanism with its oppositely movable jaws for setting the wedges, of the locking bolt for the normal-wedge, the detent for the justifying-wedge, the shifting lever for the justifying-wedge provided with a trip, and the actuating lever operating both the normal-wedge lock and the shifting-lever for the justifying-wedge; substantially as described.

106. In a mold adjusting mechanism such as described, the combination with a slide or movable member connected to the mold-blade, to determine the position of the latter in the mold, of the following elements, to wit; a bearing or shoulder upon said slide or movable member; two fixed abutments; a longitudinally adjustable normal-wedge engaging the bearing on the slide; an adjustable member, such as a justifying-wedge engaging one of the fixed abutments; two reciprocatory transfer-blocks or setting wedges, the one interposed between the normal-wedge and a fixed abutment, and the other between the normal-wedge and the adjustable member or justifying-wedge; and controllable mechanisms for setting the normal and justifying wedges and reciprocating the transfer-blocks; substantially as described.

107. In a type-casting and composing machine the combination of the following elements, to wit; a fixed mold; a horizontally and vertically movable die-case; a line channel located to one side of and below the level of the mold; an ejector opposite the line-channel; and an angularly reciprocating type-carrier provided with a type receiving channel, a clamping member, and a type sustaining gate or blade; whereby the type received from the mold are transported opposite the line-channel in position to be entered therein by the ejector; substantially as described.

108. In a type casting machine the combination with the mold and its cross-blade, the latter guided to reciprocate in a plane, of a type-carrier guided to reciprocate in a plane inclined to that of the cross-blade, and connected to the latter by a joint or coupling adapted to permit of a sliding action between the two in a vertical direction, substantially as described.

109. The combination to form a type-carrier adapted to transport and deliver individual type, of a slide provided with a type-channel or passage, a clamping jaw movable transversely of said channel or passage, and a reciprocating and laterally yielding type sustaining blade projecting into said channel, substantially as described.

110. In a type-carrier such as described, the combination with the reciprocating slide provided with a transverse type passage or channel, of a spring actuated clamping jaw movable across said channel, a stop engaging said jaw to restrain the latter as the slide approaches the receiving station, a laterally yielding type supporting blade movable across the type-channel, and a lever mounted upon the slide and contacting with fixed abutments near opposite ends of its path to alternately project said type-supporting blade across the type-channel and withdraw it therefrom; substantially as described.

111. In a type casting machine the combination with the mold, its movable wall

or cross-blade and the ejector or mold-blade, of a type-carrier provided with a type receiving channel or passage, a clamping jaw movable transversely of said passage, a flexible type-sustaining blade extending across said passage, and actuating devices for retracting the clamping jaw and advancing the type sustaining blade as the carrier approaches the mold, for advancing the clamping jaw to grasp the type as the carrier is retracted, and for retracting the type sustaining blade as the carrier arrives in front of the ejector; substantially as described.

112. In a type-casting machine the combination with the mold, its cross-blade and mold-blade, the latter serving as an ejector, of the type-carrier, the latter comprising a reciprocating slide with transverse type channel; a spring actuated clamping dog with limiting stop; a flexible type sustaining blade extending through the clamping dog and attached to a slide and a lever mounted upon the carrier-slide in position to engage fixed abutments and acting through a block and spring to advance and retract the type supporting blade; substantially as described.

113. The combination with the type-carrier provided with a movable clamping jaw, of an ejector flanged along its upper and lower edges and provided with bevelled shoulders in advance of its type engaging face, to insure the passage of the latter between the clamping walls or members; substantially as described.

114. In a type-carrier for casting machines the combination with the slide provided with a transverse type channel and a spring actuated clamping member, of a type sustaining blade or gate, including a spring blade 255 guided at its front or operating portion in the clamping member and carried by a slide 251*, the latter operated through block 256, lever 258 and spring 257 to alternately advance said blade or gate into the type channel and to withdraw it therefrom as the type-carrier slide is reciprocated between the receiving and delivering stations; substantially as described.

115. The combination to form a type-carrier such as described, of the following elements, to wit; a slide provided with a transverse type channel; a clamping member or type holder 251 guided to reciprocate laterally of the type channel and projected therein by a spring; a gate or type support 255 mounted upon a supporting slide 251*, the latter furnished with shoulders or stops between which is received a block 256; and a lever 258 mounted upon the type-carrier in position to engage fixed stops on the frame, said lever operating through elastic connections to reciprocate the type supporting gate; substantially as described.

116. The combination with the reciprocating type-carrier provided with clamping jaw and a reciprocating and laterally yielding type sustaining blade, of the ejector for discharging the type from the carrier, said ejector being held under spring tension against one of its guiding surfaces and provided with inclines at its entering end engaging the carrier to facilitate the entrance of the ejector; substantially as described.

117. In a galley mechanism such as described the combination of the following elements, to wit; an oscillatory reciprocating line-carrier pivotally attached to a reciprocating slide and provided with an arm movable between stops or shoulders on said slide, a slide mounted in ways parallel with the first named slide and engaging the arm of the line-carrier, and a reciprocating driving member movable between stops or bearings on said second slide and engaging the latter; substantially as described.

118. In a galley mechanism such as described, and as a means for actuating the line-carrier, the combination with the latter, of a slide or support mounted to reciprocate parallel with the line-channel, a line carrier pivotally attached to said slide and provided with a laterally projecting arm extending between limiting stops on the slide, a second slide, such as 283, engaging the arm on the line-carrier, a third slide, such as 287, provided with a pin riding in a longitudinal slot or opening in slide 283, and actuating devices including a double compression link or connection for reciprocating slide 287; substantially as described.

119. In a galley mechanism such as described the combination of the following elements, to wit; a line-carrier pivotally supported on a slide and provided with an

arm extending between limiting stops on said slide; a reciprocating slide, such as 283, engaging the line-carrier arm to oscillate the line-carrier and reciprocate it and its supporting slide; a third slide or reciprocating member, such as 287, engaging slide 283; a laterally movable bar; or line-transferrer; a line supporting blade and resetting slide carried by said movable bar; and a latch carried by slide 287 for engagement with the resetting slide of the line supporting blade; substantially as described.

120. In a galley mechanism such as described and as a means for reciprocating the line-transferrer, the combination with the latter and its pivoted support or lever, of the cam, the actuating lever and the compression link between said actuating lever and the line-transferrer; substantially as described.

121. In a galley mechanism such as described, the combination with the driving shaft, of a controllable connection between said shaft and the actuating devices of the galley mechanism, the same including a ratchet wheel, a spring actuated pawl provided with an engaging shoulder and a pin, and an arresting and releasing lever provided with a shoulder extending normally in the path of the pawl and engaging the latter to withdraw it from the ratchet wheel and arrest the motion of the actuating devices, and a latch carried by said lever and engaging the pawl in rear of the fixed shoulder on the lever, said latch being elevated by the pin to permit the passage of the pawl; substantially as described.

122. In a galley mechanism such as described and in combination with the actuating mechanisms for the line-carrier, the line-transferrer and the vertically movable blade, of the vertical driving shaft, the cam loosely mounted thereon, the ratchet wheel fast on the shaft, the pawl pivoted upon the cam, and the locking and releasing lever provided with a fixed and a movable jaw or abutment, said lever operating both as a starting and stopping device; substantially as described.

123. In a type composing mechanism such as described, the combination with a reciprocating type-carrier provided with a transverse type receiving channel having fixed and movable clamping walls or members recessed or slotted horizontally at the delivery end in the plane of motion of said type-carrier, of a line-channel provided at its entering end with type-sustaining devices, such as springs, the latter projecting partially within the line of motion of the type-carrier and entering the recessed or slotted portions of the clamping members, and an ejector reciprocating through the type-carrier to force the type held between the clamping members thereof into the line channel; substantially as described.

124. In combination with the reciprocating type-carrier and the ejector blade, the line channel furnished at its entering end with the type holding and sustaining springs 265 and 267; substantially as described.

125. In a controllable pump actuating mechanism for type casting machines such as described, the combination with the reciprocating driving member, the driven member and the interposed latch or detachable connection, of a power actuated arm for operating said latch or detachable connection, a longitudinally movable shaft upon which said arm is supported and moved into or out of engagement with the latch or detachable connection, said shaft being interposed between the controllable mechanism for setting the justifying devices and the controllable starting devices of the galley mechanism and actuated by the former to suspend the pump action and start the galley mechanism when the justifying adjustments are effected; substantially as described.

126. In a type casting machine the combination to form a controllable pump actuating mechanism, of a reciprocating driving member, such as arm 223; a driven member, such as arm 227, connected to the pump actuating devices and provided with a latch, such as 226, for engagement with the driving member; a member, such as tripping arm 230, reciprocating in a plane parallel with the latch; and actuating devices for shifting said last named member into and out of the path of the latch or a part connected therewith; substantially as described.

127. In a controllable pump actuating mechanism for type casting machines such as described, the combination with the driving and driven members and interposed

connecting and disconnecting device, of a power driven reciprocating disconnecting member, such as arm 230, a longitudinally movable shaft to which said arm is connected, a connection with the justifying adjusting mechanism for shifting said shaft, and a detent, such as the spring actuated plunger, connected to and moving in unison with the arm and engaging a seat on the frame, for maintaining the arm in adjusted position; substantially as described.

128. In a pump controlling mechanism such as described the combination with a driving member or arm 223 connected to the pump actuating lever or prime mover and provided with an angular head, of a driven member or arm 227 connected to the pump actuating devices; a latch carried by said driven member in position to engage the angular head of the driving member; a reciprocating member, such as tripping arm 230, movable longitudinally of its pivot to carry it into or out of the path of the latch; and a spring-seated pin or shoulder on the latch with which said tripping arm engages when moved laterally; substantially as described.

129. In a controllable pump actuating mechanism for a type-casting machine such as described, the combination with driving arm 223, driven arm 227 with its latch 226 and tripping arm 230, of the shifting lever for the justifying-wedge operating to shift the tripping arm into engagement with the latch, and a detent for holding said tripping arm in engagement with the latch after the withdrawal of the justifying-wedge shifting lever; substantially as described.

130. In a controllable actuating mechanism such as described, the combination with a driving member, a driven member, and a latch or interlocking member, of a reciprocating arm 230, movable into and out of connection with said latch or interlocking member, a longitudinally movable shaft upon which said arm is pivoted, and actuating devices for reciprocating the shaft to carry the latch engaging arm into and out of operative connection with said latch; substantially as described.

131. In a pump actuating mechanism such as described the combination of the following elements, to wit; a pivotally supported power actuated driving arm 223; a driven arm 227 sleeved upon the pivot of arm 223 and provided with an arm connected to the pump operating devices; a latch 226 pivoted to one of said arms and detachably engaging the other arm; a shaft parallel with the axis of the driving and driven arms; a latch operating arm 230 attached to a sleeve turning loosely upon said shaft and held in position thereon between a shoulder and spring, so that the sleeve can be moved longitudinally of the shaft together with or independently of the latter, to bring its arm into the path of the latch; and controllable devices for moving either the shaft and sleeve or the sleeve alone longitudinally of the shaft for causing the vibrating arm to engage the latch and thereby arrest the pump action; substantially as described.

132. In a pump actuating mechanism such as described, as a means for transmitting motion from the actuating lever to the connected piston and cylinder levers, the combination of sleeve 211 and its spring, shaft 212 passing through said sleeve and connected to the actuating lever through a compression link and controllable power transmitting devices, a cross-bar 208 secured to said shaft, and a pin passing through said cross-bar and a projection on sleeve 211 and provided with a stop or shoulder engaging said sleeve to limit its movement; substantially as described.

133. In a type-casting machine such as described, the combination with the metal injecting devices and the mechanism controlling their motions towards and from the mold, of a vertical threaded shaft mounted in bearings on the main-frame, and a supporting frame or base for the injecting devices pivoted upon said shaft and movable both longitudinally and laterally thereon; substantially as described.

134. In a metal injecting apparatus such as described, the combination of the following elements, to wit; a supporting base or frame attached to the main frame by a vertical pivot about which it can swing horizontally; the melting pot, pump, nozzle and their elevating devices mounted upon said pivoted base or frame; and a pump lever pivotally connected to the actuating devices in line with the axis of the supporting frame; substantially as described.

135. The combination with a reciprocating pump and nozzle, the spring actuated

mechanism for advancing and seating the nozzle and the connected opposing pump actuating levers, of a reciprocating power-driven shaft carrying a bar or cross-head engaging both the piston lever and the spring actuated mechanism, a sleeve surrounding the shaft and connected to the cylinder lever, a spring for advancing said sleeve, and a stop for arresting the sleeve; substantially as described.

136. In a type casting machine the combination with the mold, of a metal injecting mechanism movable towards and from the mold and including a melting-pot, nozzle and pump, a parallel link support or guide therefor, and actuating devices for elevating and depressing the connected receptacle, nozzle and pump, whereby regurgitation of the molten metal is prevented; substantially as described.

137. In a type casting machine the combination with the mold and its nozzle plate, of the nozzle, pump and melting-pot connected to move in unison, a parallel link support or guide, and a lifting lever applied in line with the nozzle for elevating the metal injecting devices and seating the nozzle thereof; substantially as described.

138. In a metal ejecting apparatus for type casting machines the combination with the melting pot, pump and nozzle, connected together and movable towards and from the mold, of a spring actuated elevating and seating mechanism, and a pump operating mechanism engaging the said elevating mechanism to limit and control the action of its spring; substantially as described.

139. In a metal ejecting apparatus for type casting machines the combination with the pump, melting-pot and nozzle connected to move in unison and provided with a parallel link guiding mechanism, of spring actuated elevating devices and pump actuating devices engaging said elevating devices to control the action of the spring in seating the nozzle; substantially as described.

140. In a pump operating mechanism such as described, and in combination with the cylinder and piston thereof, two opposing levers connected together and to the piston and cylinder respectively, and actuating devices engaging said levers to move them in relatively opposite directions, whereby the power for actuating the pump will operate equally upon the cylinder and piston but in opposite directions; substantially as described.

141. In a type casting machine the combination with the vertically reciprocating injecting devices mounted upon a vertically and horizontally movable support or frame, of the pump actuating levers connected together and to the piston and cylinder respectively, and vertically reciprocating actuating devices attached to the pump actuating levers by swivel connections in alignment with the axis of the pivot by which the support of the injecting devices is attached to the main frame; substantially as described.

142. The combination with a reciprocating pump and its connected actuating levers, the one operating upon the piston and the other upon the cylinder, of an actuating mechanism comprising a bar or cross-head 208, secured to a longitudinally reciprocating power shaft and connected to the piston lever, sleeve 211 surrounding said shaft and connected to the cylinder lever, a spring engaging the sleeve and a stop for limiting the movement of the sleeve, substantially as described.

143. The combination with the movable melting-pot, nozzle and pump and the lever for actuating the same, of the spring actuated rod engaging said lever, a lever 206 operating upon the rod in opposition to the spring, and the reciprocating shaft provided with a pump actuating bar or cross-head, the latter engaging lever 206, substantially as described.

144. The combination with the injecting devices, including melting-pot, pump and nozzle, and the support therefor, of the two parallel shafts mounted upon the support and provided with arms to which the injecting devices are pivoted, connections between said shafts to cause them to turn in unison, and a lifting lever engaging the injecting devices, to reciprocate the latter; substantially as described.

145. In a paper feeding mechanism the combination with the ratchet wheel, of a

locking pawl guided to move radially of the ratchet wheel and provided with a slot or recess substantially concentric with said wheel, and a feeding pawl mounted upon a support movable concentrically with the wheel and provided with two operating arms extending on opposite sides of its pivotal connection with its support, one of said arms engaging the ratchet wheel and the other riding in the slot or recess of the locking pawl; substantially as described.

146. In a paper feeding mechanism the combination with the ratchet wheel, of the slotted locking pawl, a pivoted actuating pawl extending on opposite sides of its pivot for engagement with the ratchet wheel and the locking pawl respectively, a movable support for said actuating pawl provided with limiting stops, and driving mechanism connected to the actuating pawl to oscillate and reciprocate the latter; substantially as described.

147. In a paper feeding mechanism the combination of the ratchet wheel, pivoted locking pawl, annular supporting plate, and a feeding pawl pivoted upon the supporting plate and provided with three arms one engaging the ratchet wheel, another the locking pawl and the third the actuating devices, the said actuating devices including a compression link or equivalent yielding connection; substantially as described.

148. In a paper feeding mechanism the combination with the ratchet wheel, and locking pawl, of an oscillatory reciprocating actuating pawl engaging the locking pawl and the ratchet wheel, actuating mechanism engaging the actuating pawl and including a compression link, and a controllable stop or lever for holding the locking pawl in fixed relation to the ratchet wheel, thereby suspending the feed motion; substantially as described.

149. In a paper feeding mechanism such as described the combination with mechanism for intermittingly advancing the strip, of a stationary cross-bar containing air ports, an air-bar supported upon pivoted arms, a lever connected to the driving mechanism, a rod connected to the air-bar and passing through the lever and a spring interposed between said air-bar and lever; substantially as described.

150. The combination in a paper feed operating mechanism and with the actuating lever thereof, of the link provided with a slotted head engaging a pin on the actuating lever, and a swinging block interposed between said pin and slotted head and provided with a detent; substantially as described.

Dated this 24th day of January 1900.

BOULT, WADE & KILBURN,
Agents for the Applicant.

Redhill: Printed for Her Majesty's Stationery Office, by Malcomson & Co., Ltd.

SHEET 1.

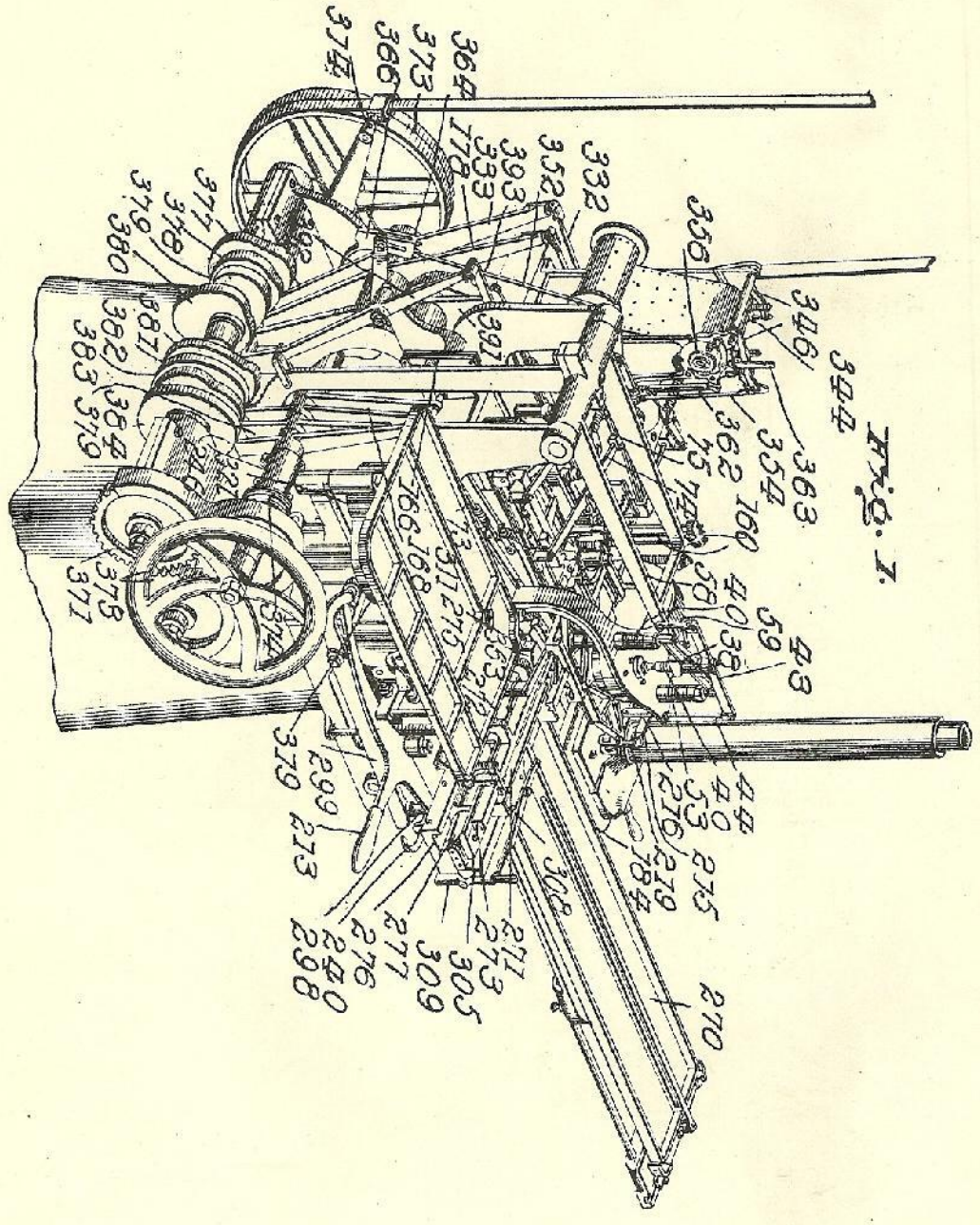
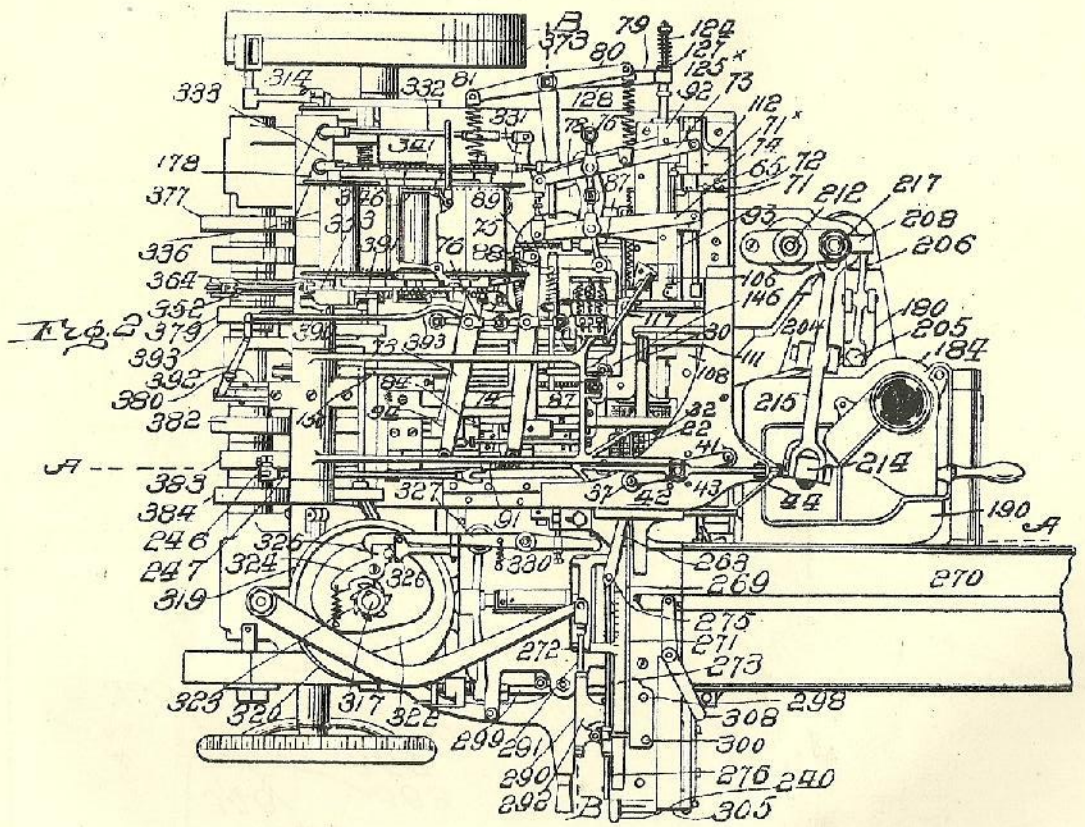
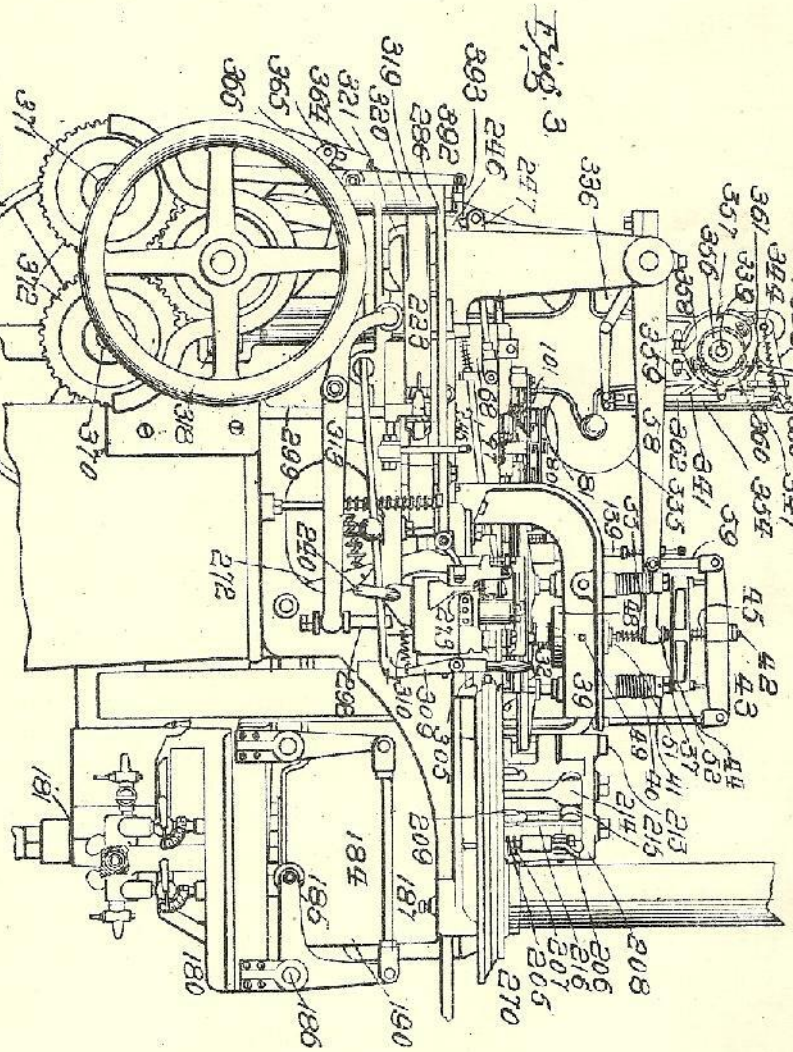

364
373
366
372
370
380
377
378
381
362
383
354
379
377
378
332
352
393
333
397
350
346
344
363
354
362
45
160
168
169
43
59
40
39
44
53
276
279
275
270
308
299
273
279
277
280
298
211
213
305
309

Fig. 1.



SHEET 2.

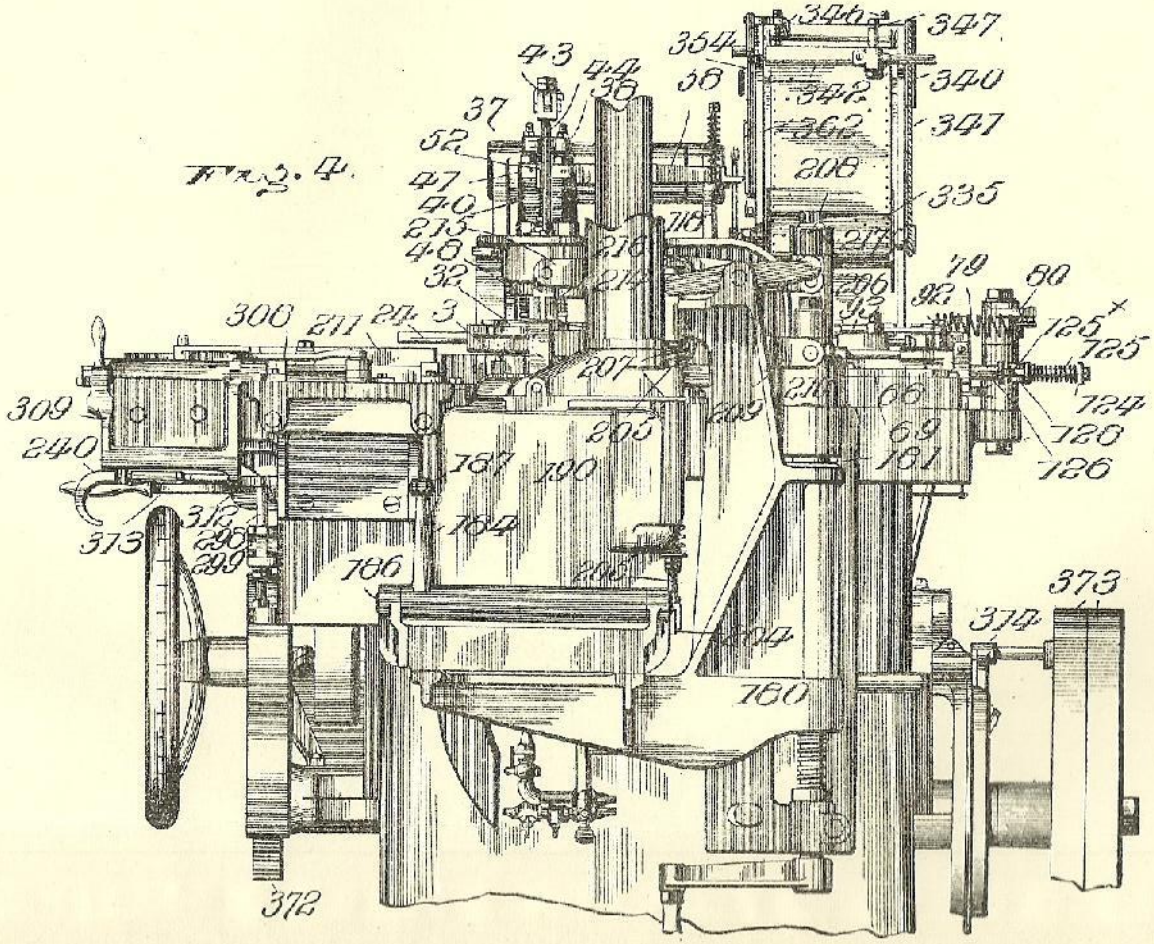
Fig. 3.


180
181
184
185
186
190
205
206
207
208
209
210
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000

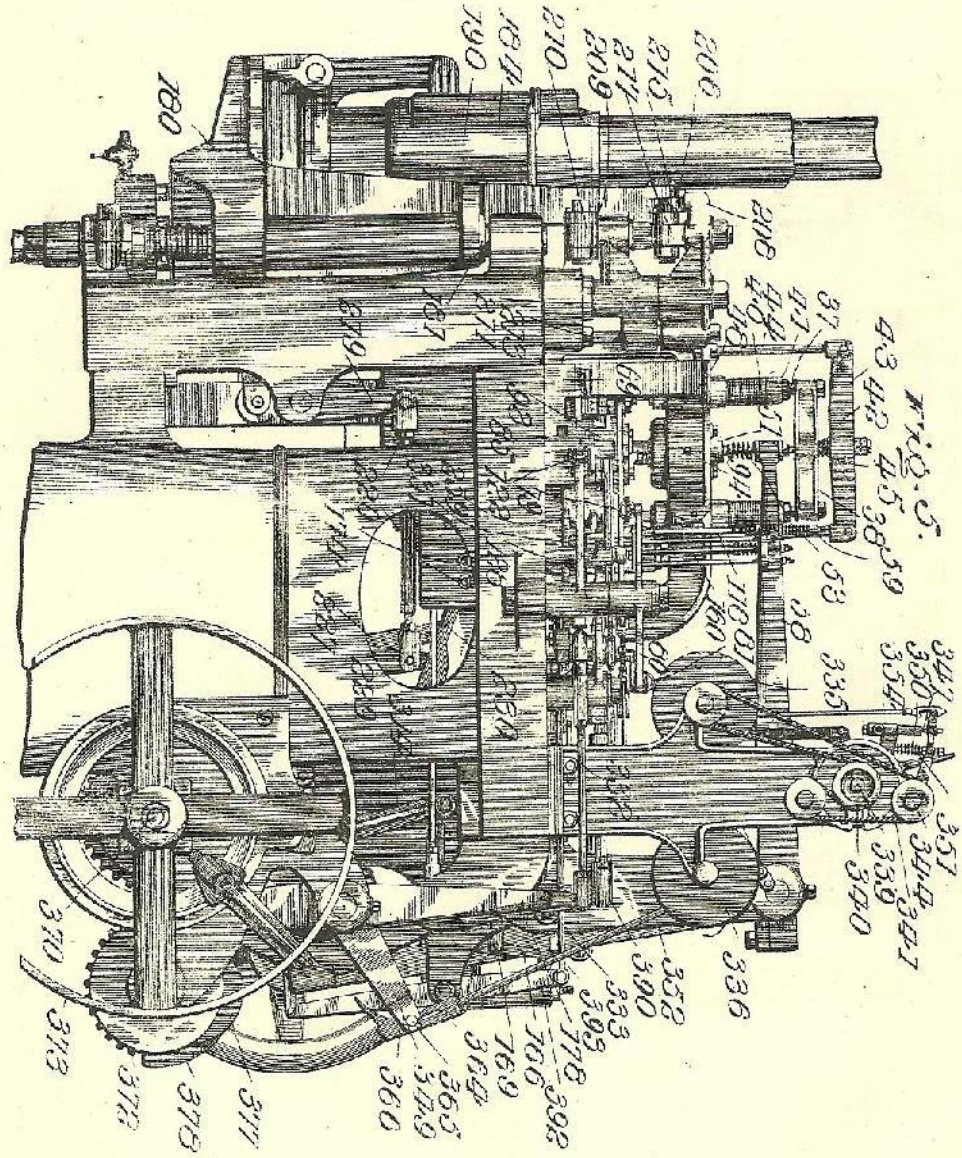
[This Drawing is a reproduction of the Original on a reduced scale.]

56 SHEETS.
SHEET 4.

Fig. 2.



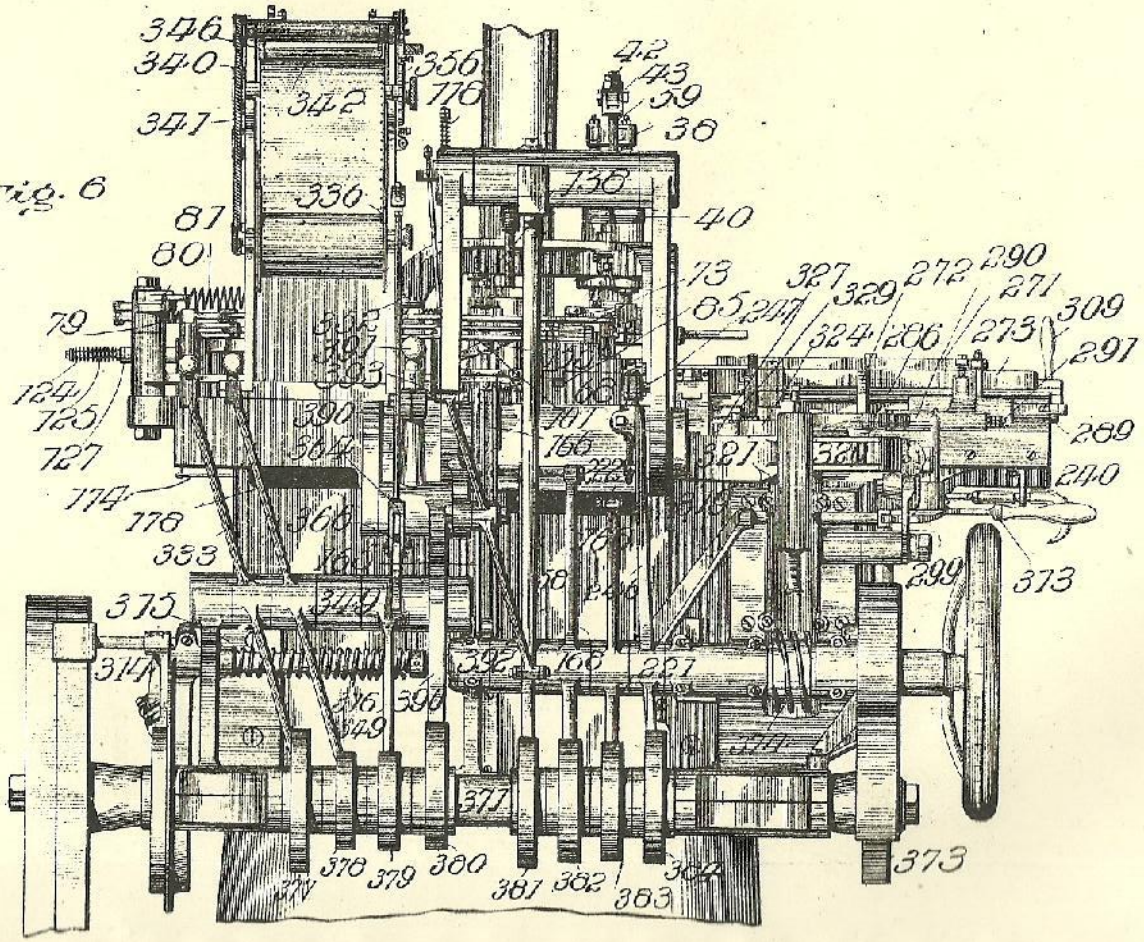
SHEET 5.


180
190
210
270
274
206
200
FIG. 5.
336
350
390
333
769
366
360
370
313
373
377
317

[This Drawing is a reproduction of the Original on a reduced scale.]

56 SHEETS
SHEET 6.

Fig. 6



SHEET 7.

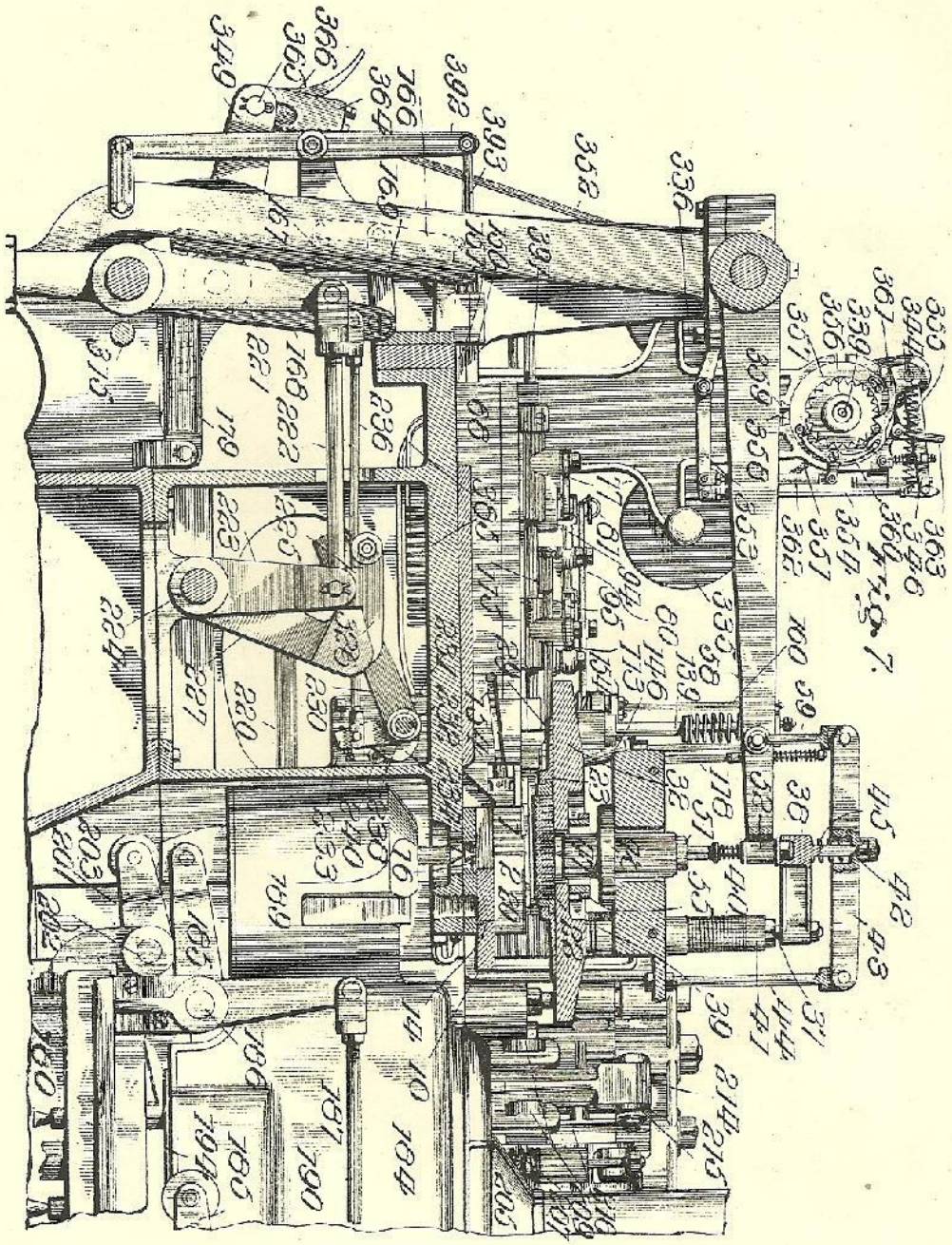
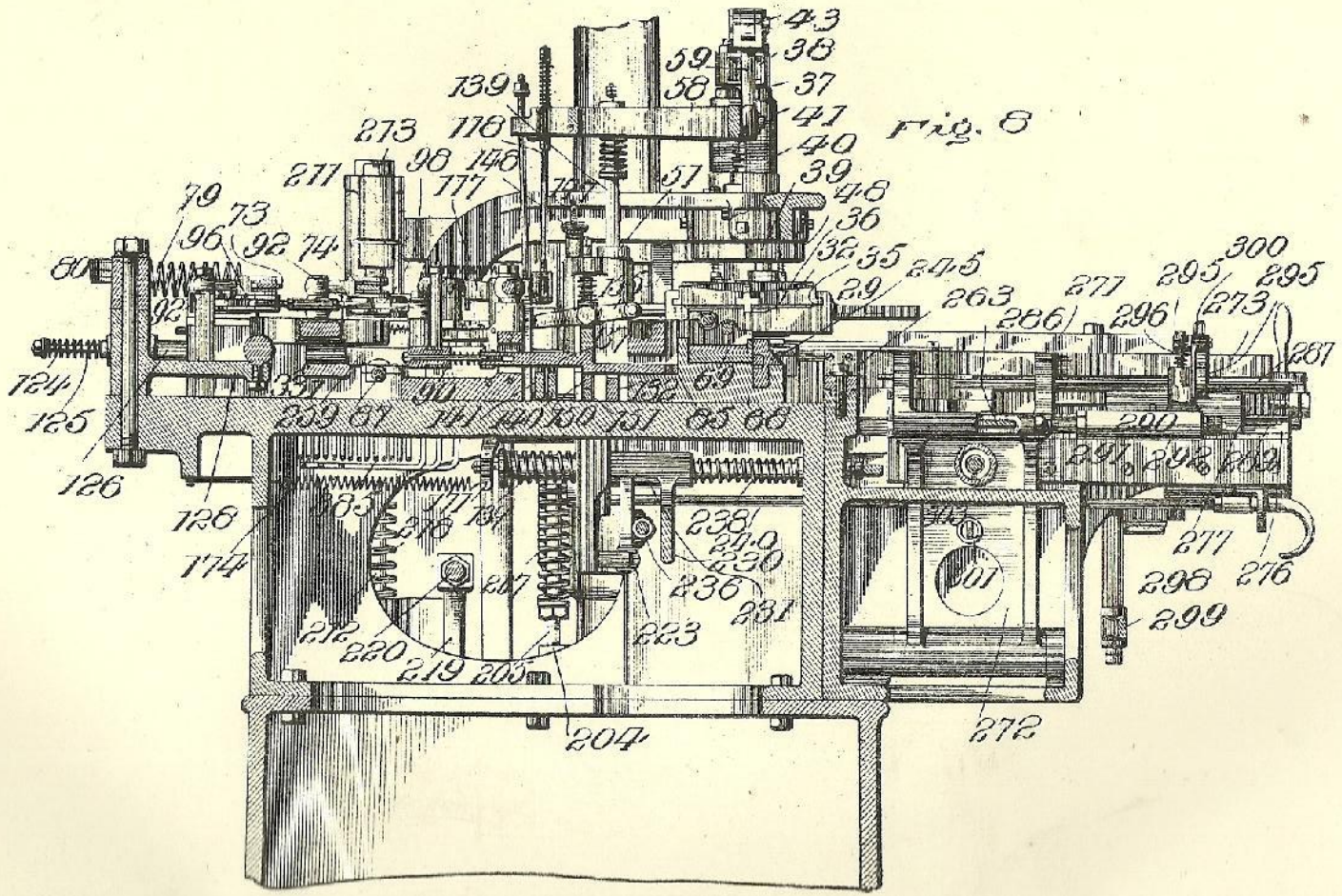


Fig. 7.

[This Drawing is a reproduction of the Original on a reduced scale.]

(45 SHEETS)
SHEET 8.



Maltby & Sons, Photo-Litho.

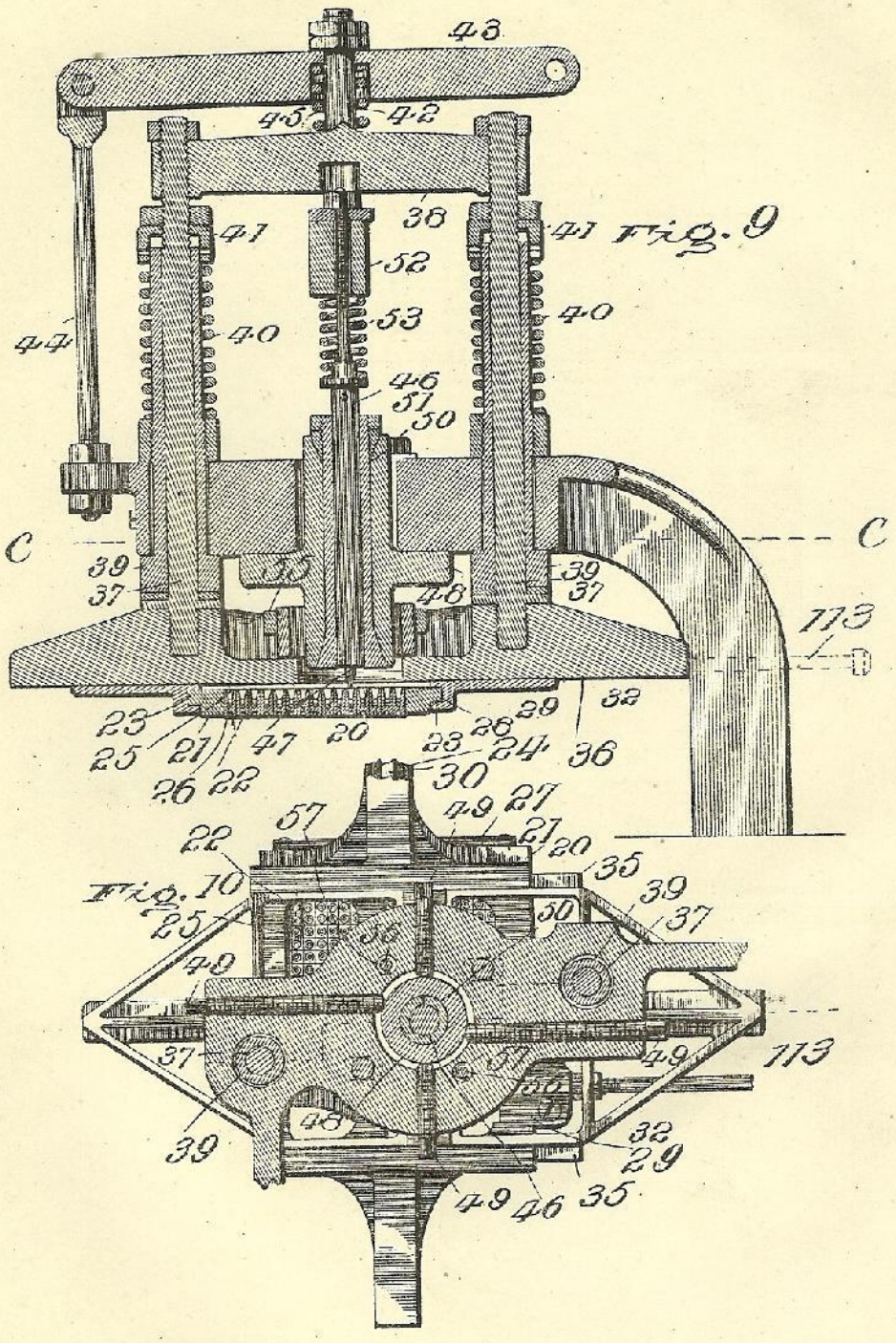

43
45
42
41
38
41
52
53
40
40
44
46
51
50
C
C
39
37
35
48
39
37
113
23
25
27
47
20
28
26
29
24
32
36
26
22
30
57
49
27
22
21
20
35
39
37
25
50
56
40
37
49
113
48
39
32
29
49
46
35

Fig. 9

Fig. 10

Fig. 11.

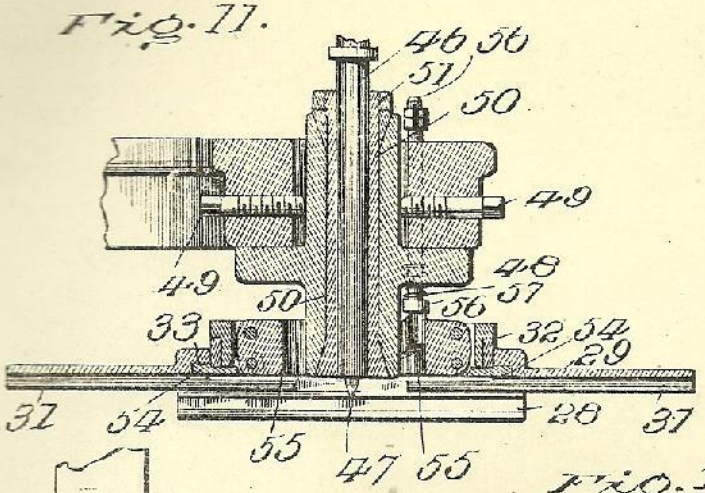


Fig. 12.

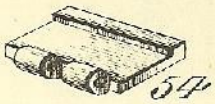
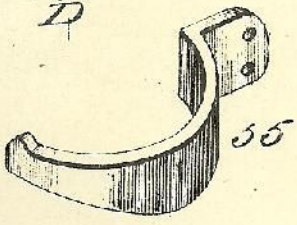


Fig. 13

Fig. 14.

D



[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 15.

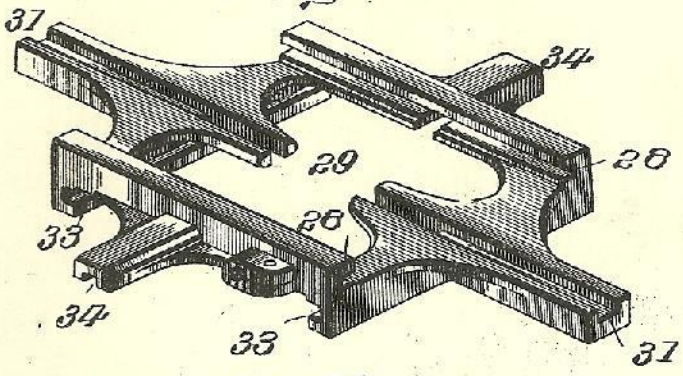


Fig. 16.

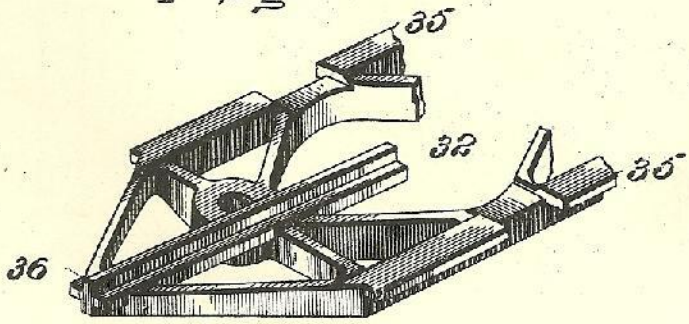


Fig. 17.

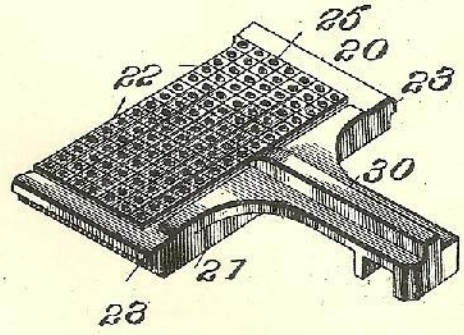


Fig. 18.

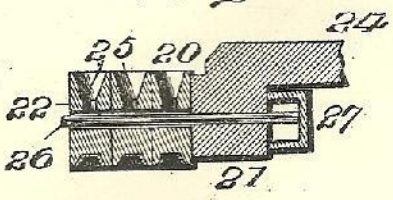


Fig. 19.

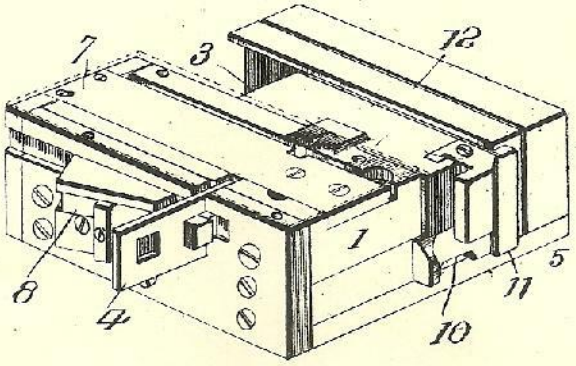


Fig. 20.

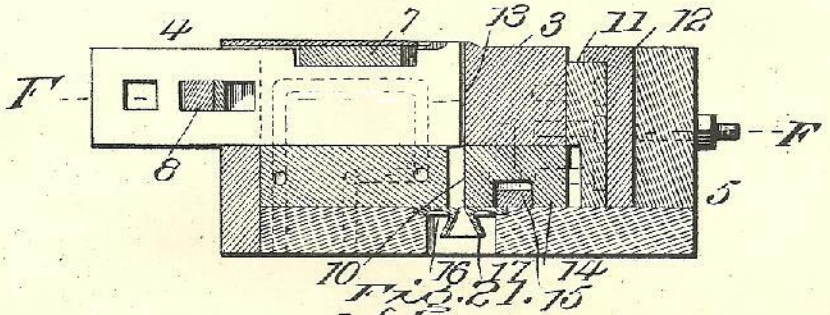
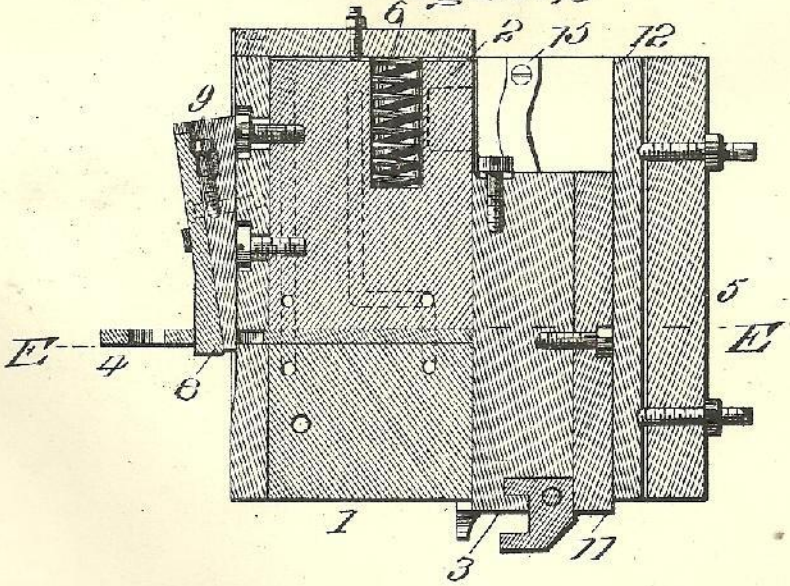


Fig. 21.



[This Drawing is a reproduction of the Original on a reduced scale.]

Malby & Sons, Photo-Litho.

SHEET 13.

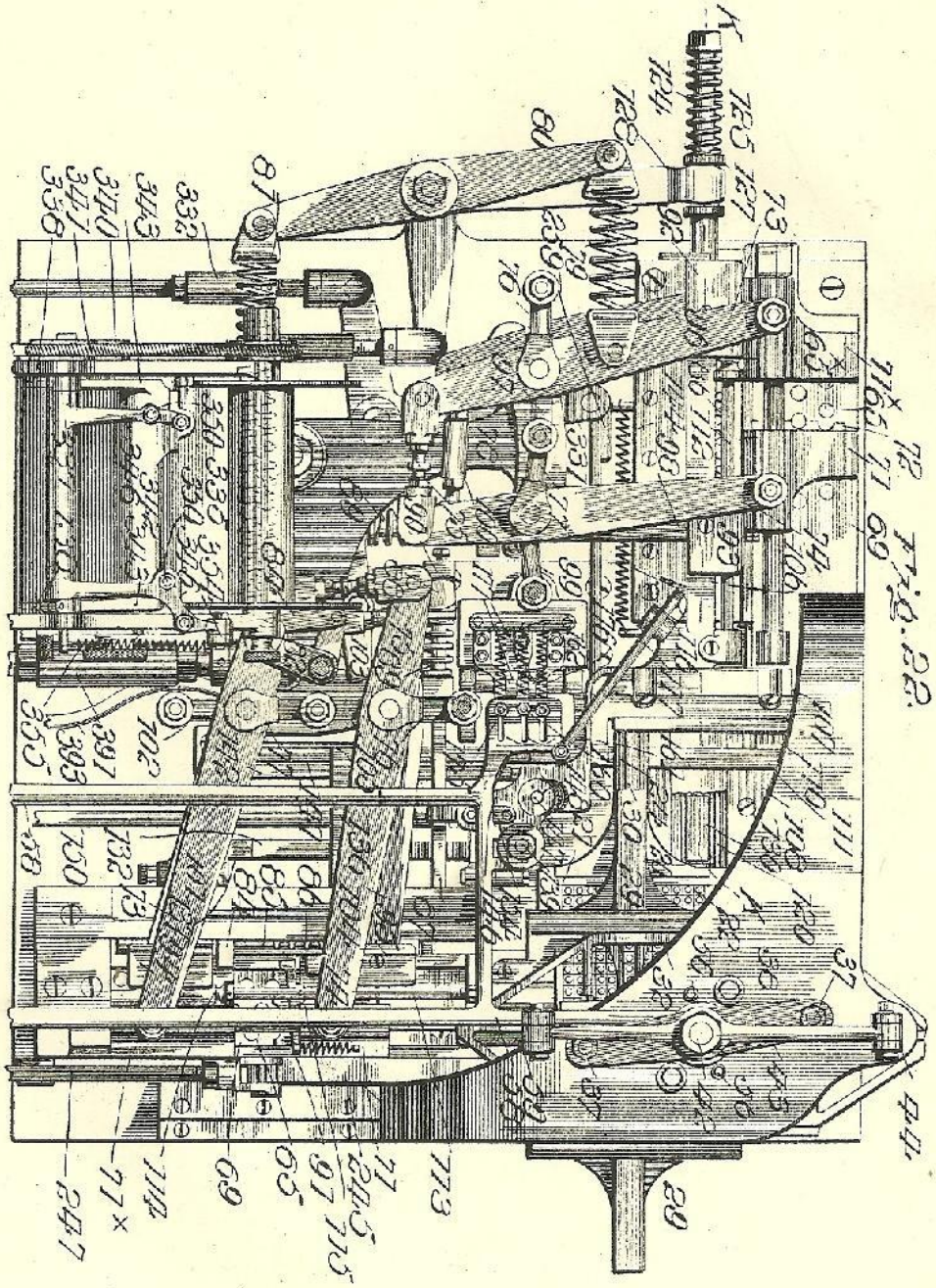


Fig. 22.

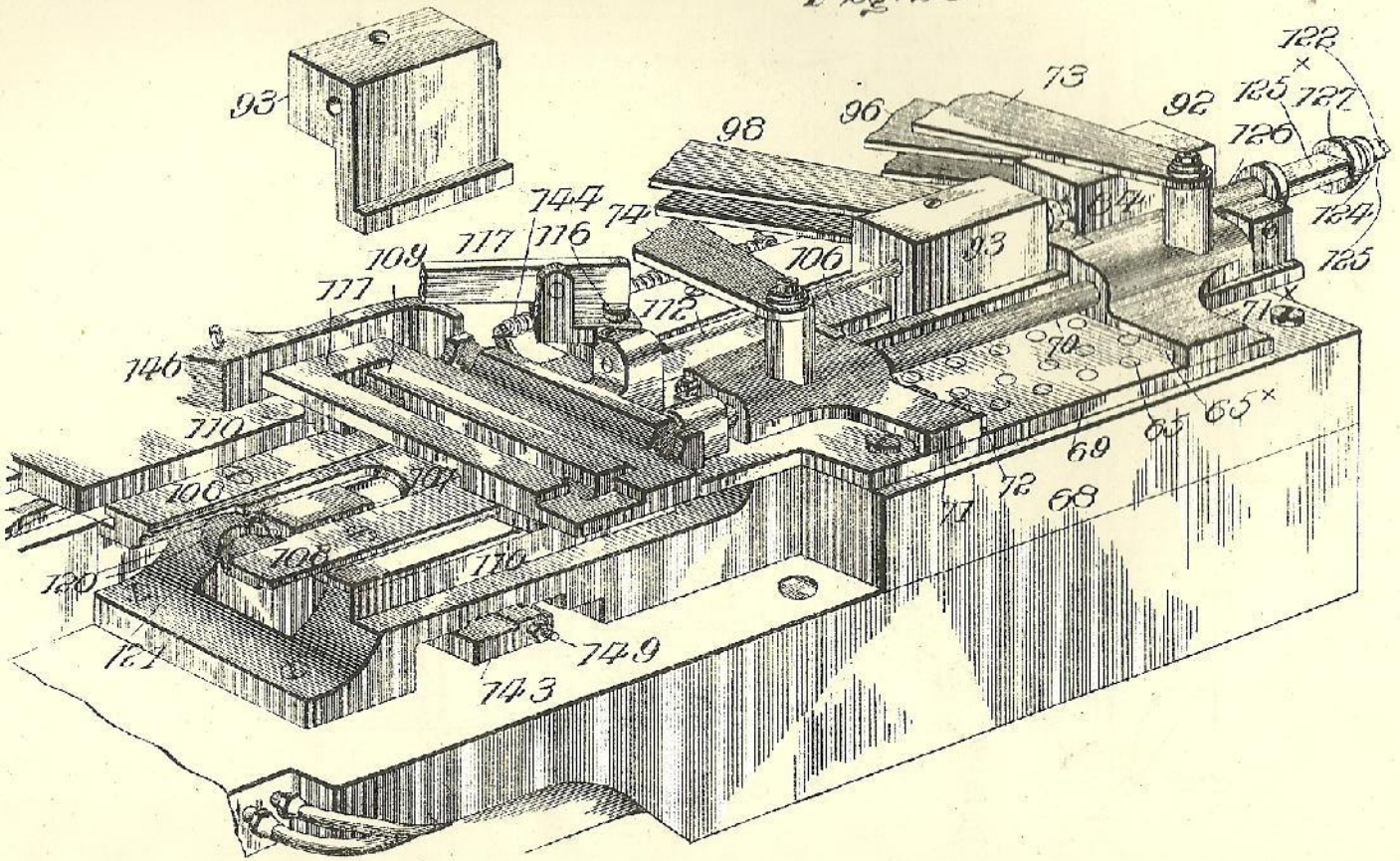
[This Drawing is a reproduction of the Original on a reduced scale.]

(35 SHEETS)

SHEET 14.

Fig. 24.

Fig. 23.



(35 SHEETS)

SHEET 13.

Vaulby & Sons, Photo Litho.

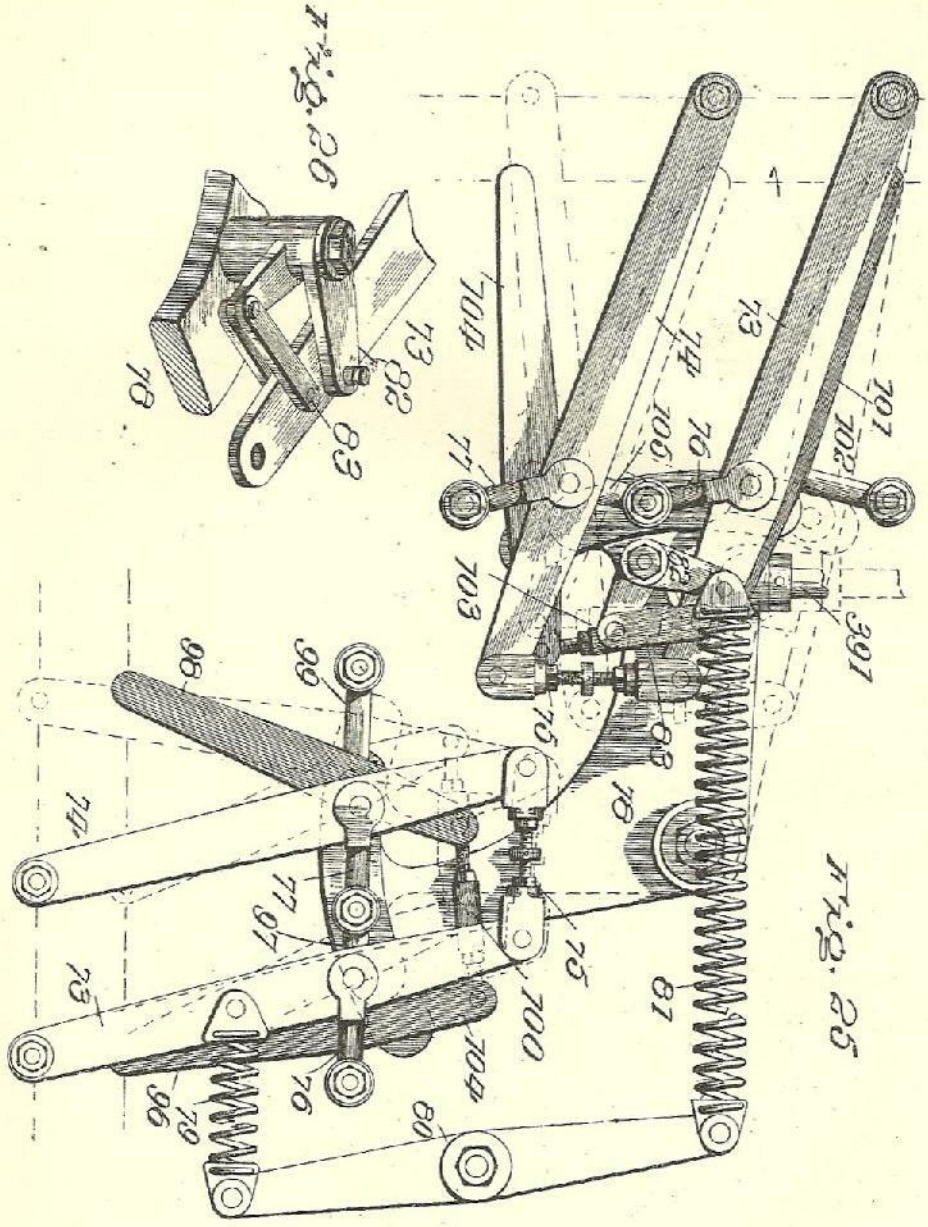

78
73
82
83
70B
77
106
74
76
73
70
70A
70C
70D
70E
96
99
76
98
78
77
97
73
70
70C
76
96
79
80
81
75
70E
70D
70C
70A
70
73
74
106
76
77
70B
70A
70
70C
70D
70E
96
99
76
98
78
77
97
73
70
70C
76
96
79
80
81
75
70E
70D
70C
70A
70

Fig. 26.

Fig. 25.

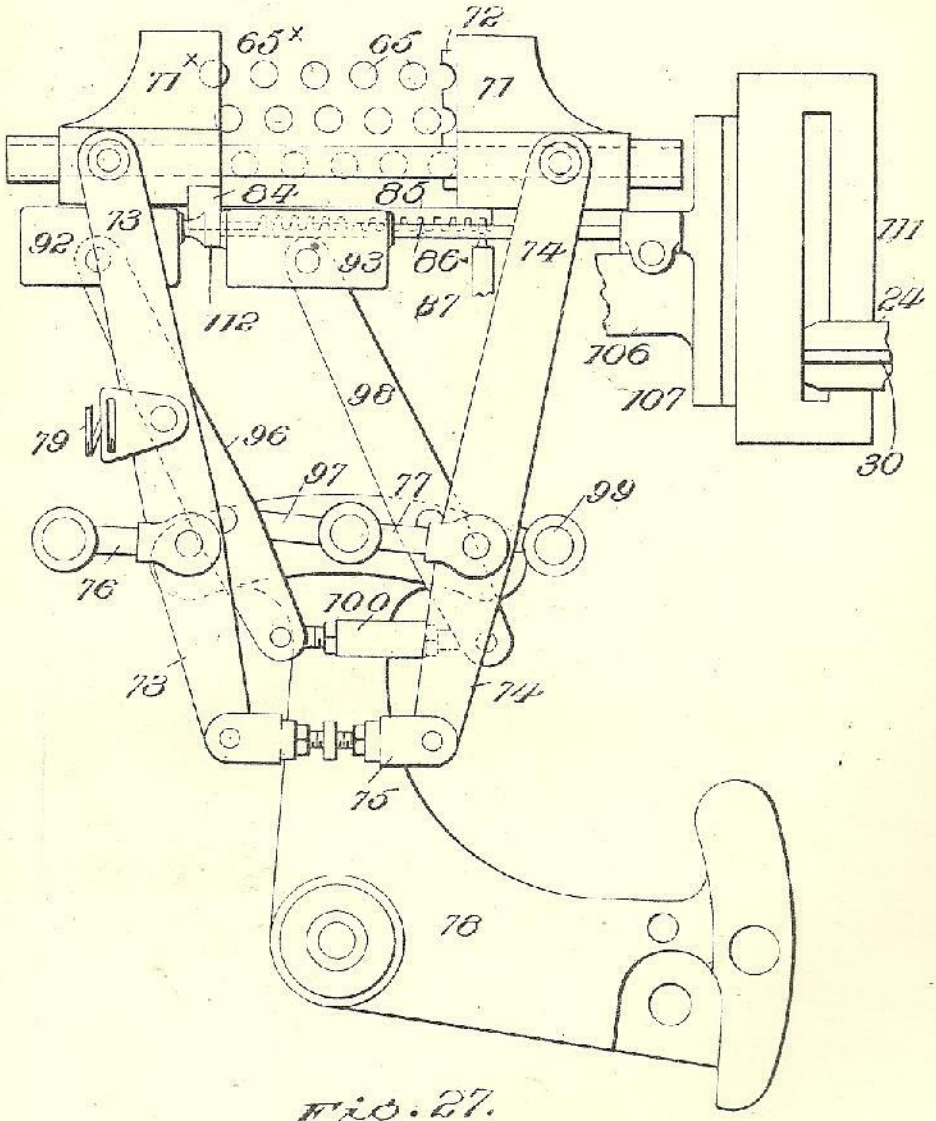


Fig. 27.

[This Drawing is a reproduction of the Original on a reduced scale.]

Malby & Sons, Photo-Litho

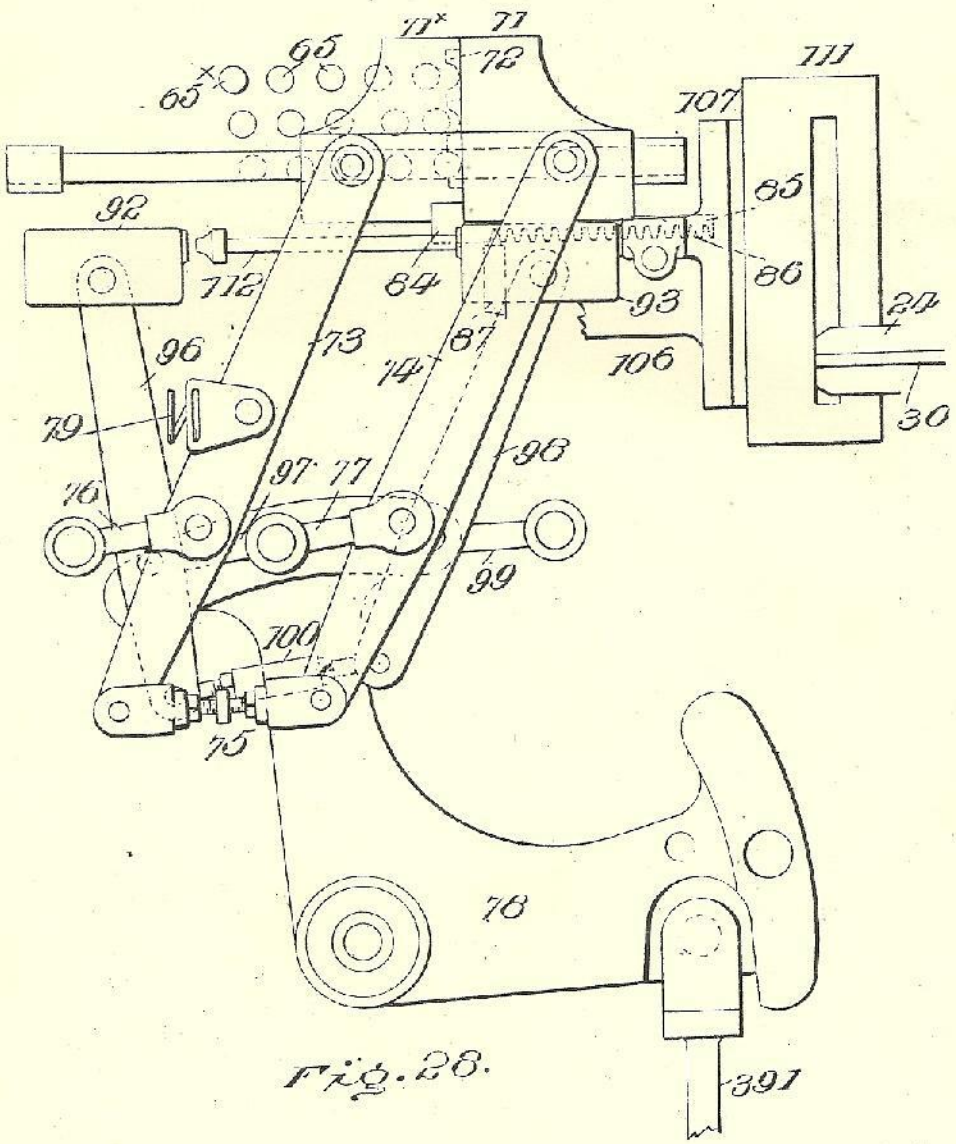

71x
71
65x
65
72
111
707
92
85
712
84
86
93
24
96
73
87
74
706
79
30
97
77
98
76
99
100
75
78
391

Fig. 28.

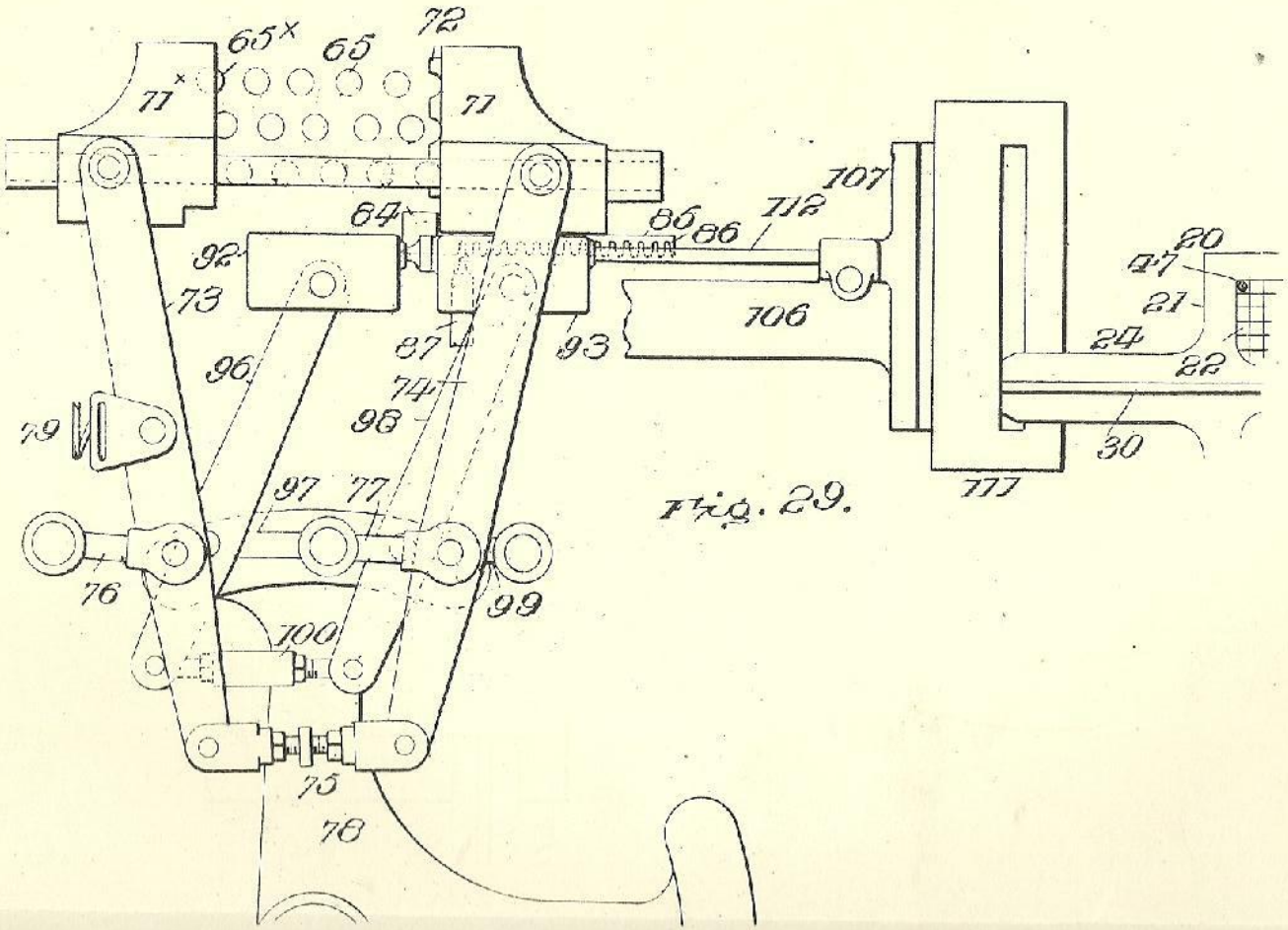


Fig. 29.

Malby & Sons, Photo-Lith.

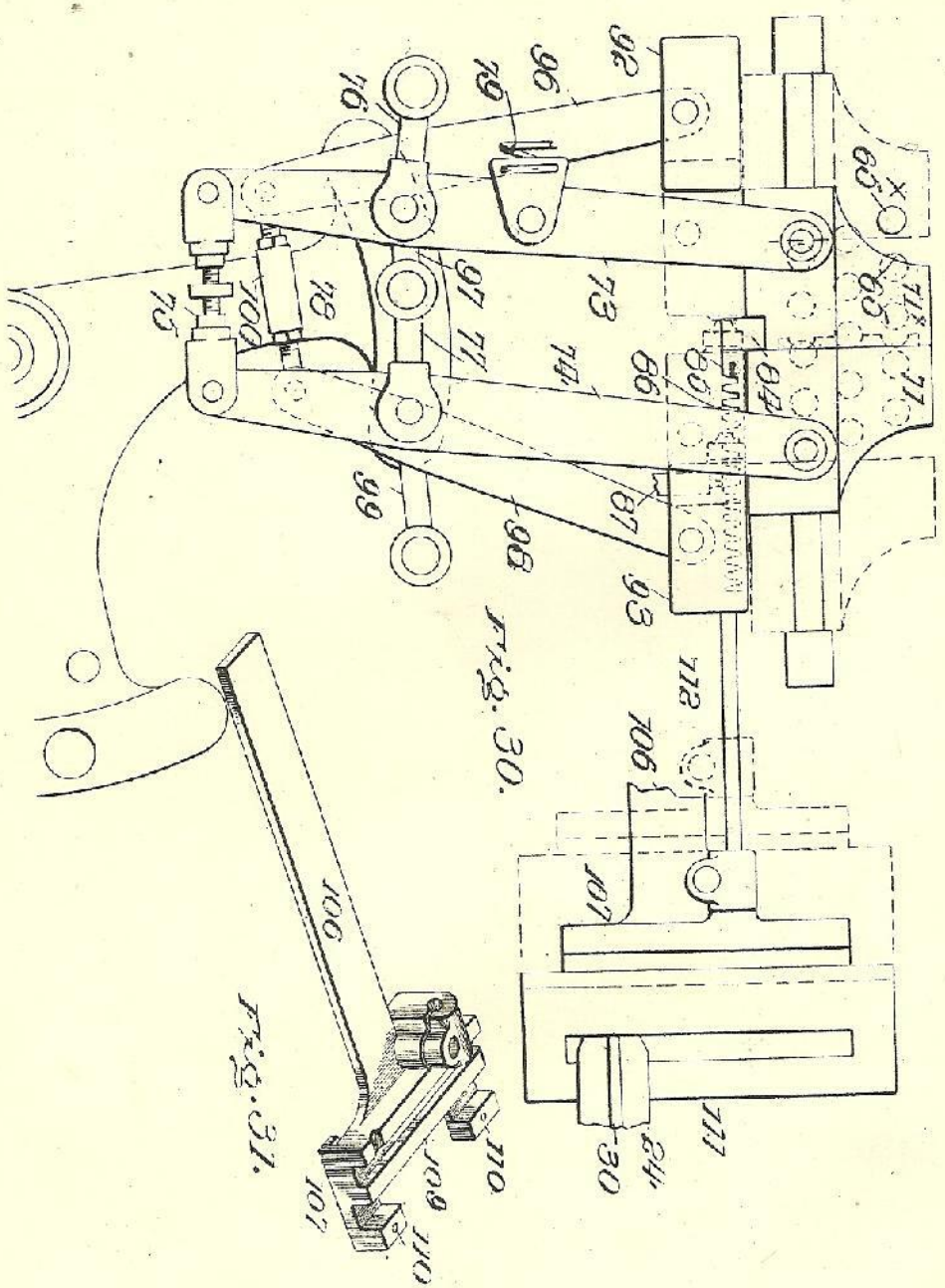

92
96
76
74
100
98
97
77
73
72
71
71a
66
68
67
99
93
112
106
101
111
30
24
110
109
107

Fig. 30.

Fig. 31.

Fig. 32.

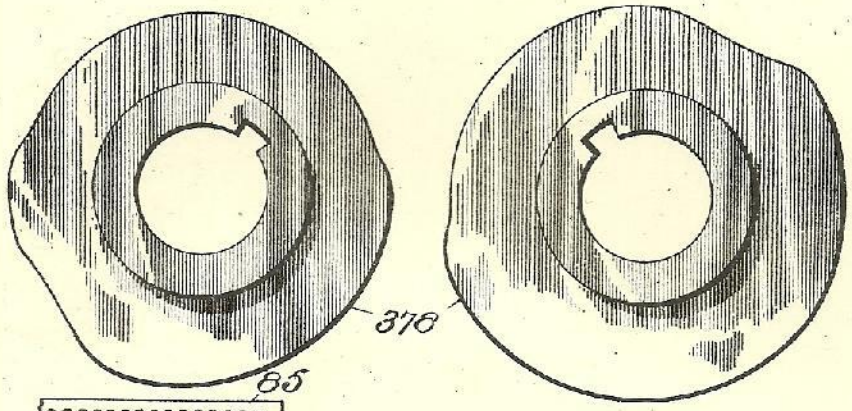
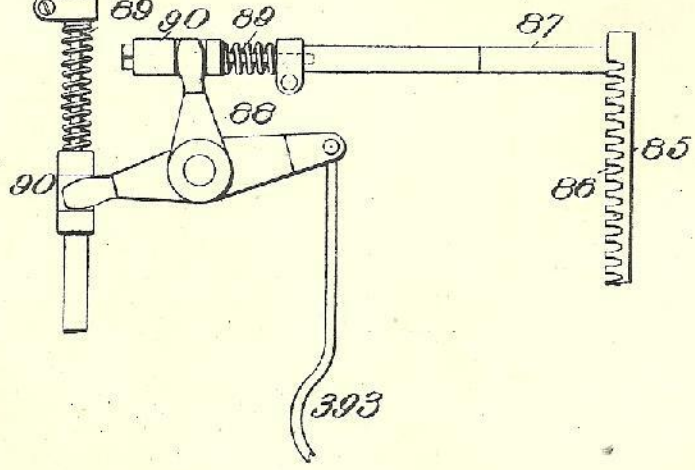


Fig. 33



[This Drawing is a reproduction of the Original on a reduced scale.]

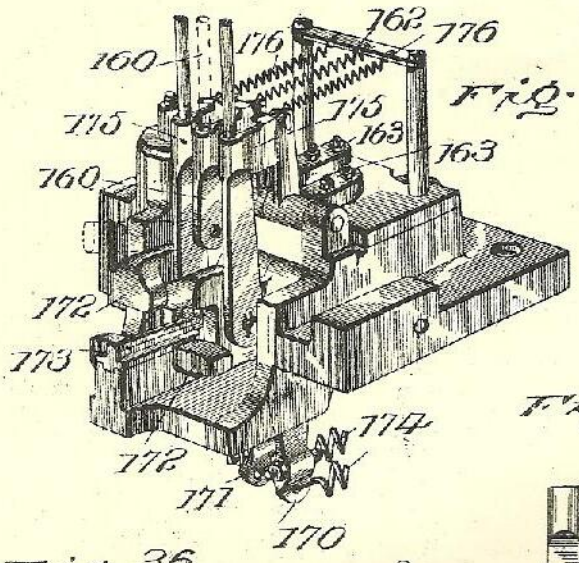


Fig. 34.

Fig. 37.

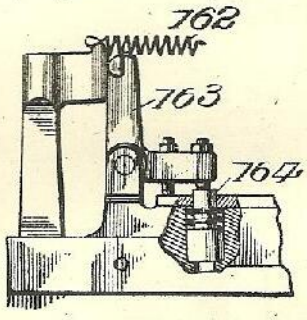


Fig. 36.

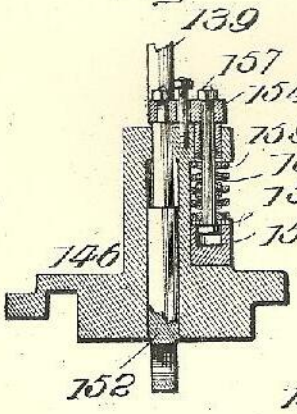
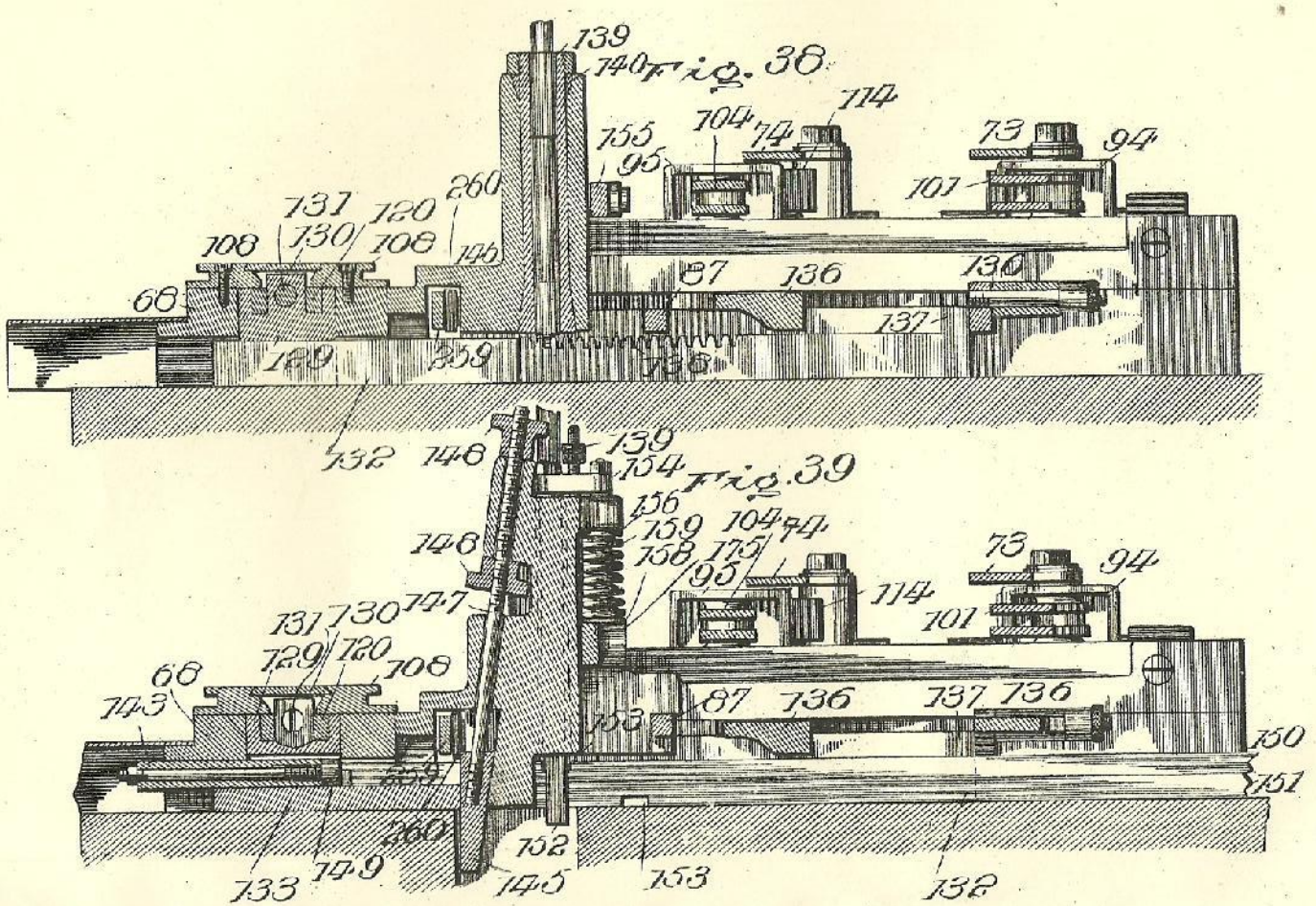


Fig. 35.



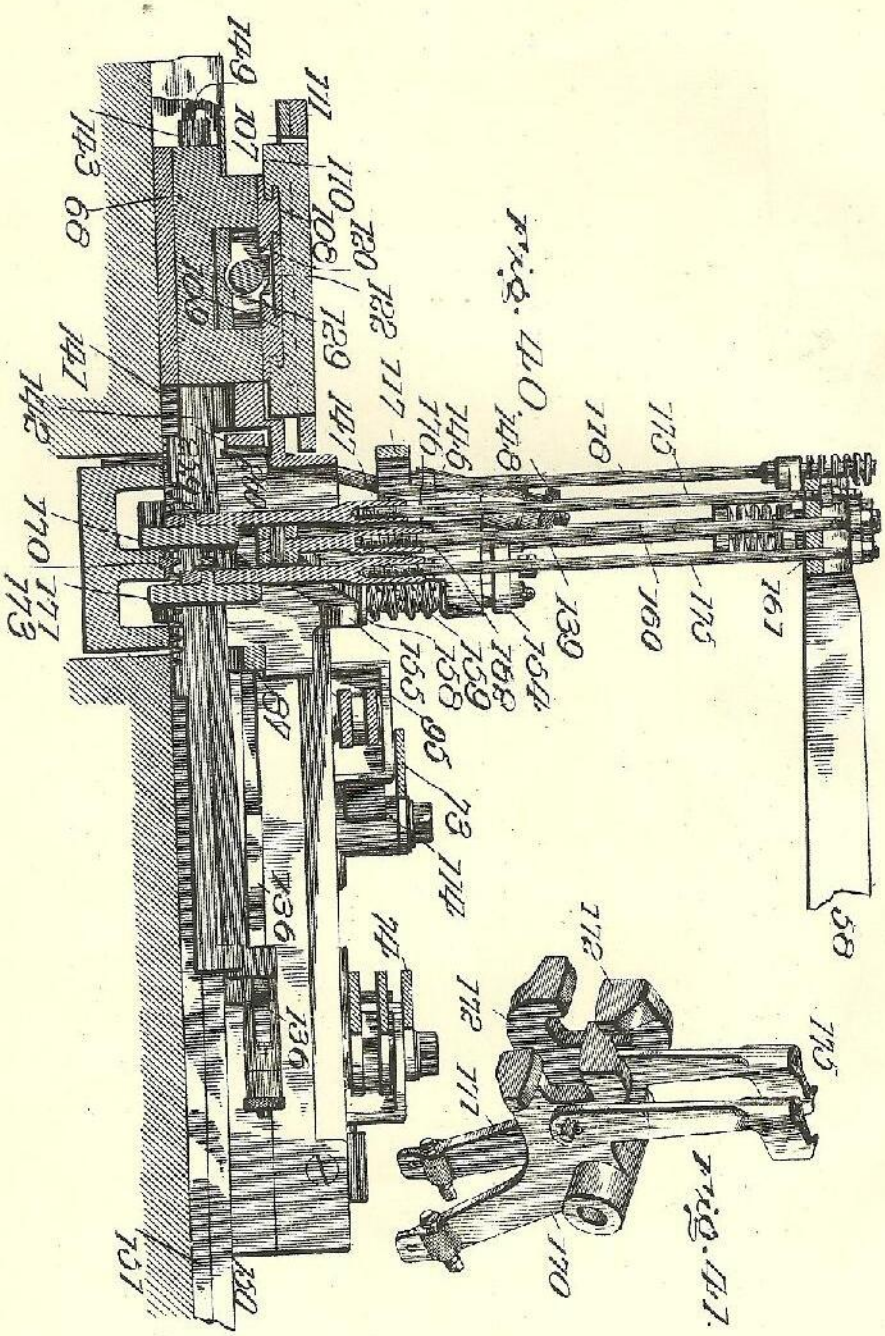


Fig. 10.
Fig. 11.

[This Drawing is a reproduction of the Original on a reduced scale.]

(56 SHEETS)

SHEET 24.

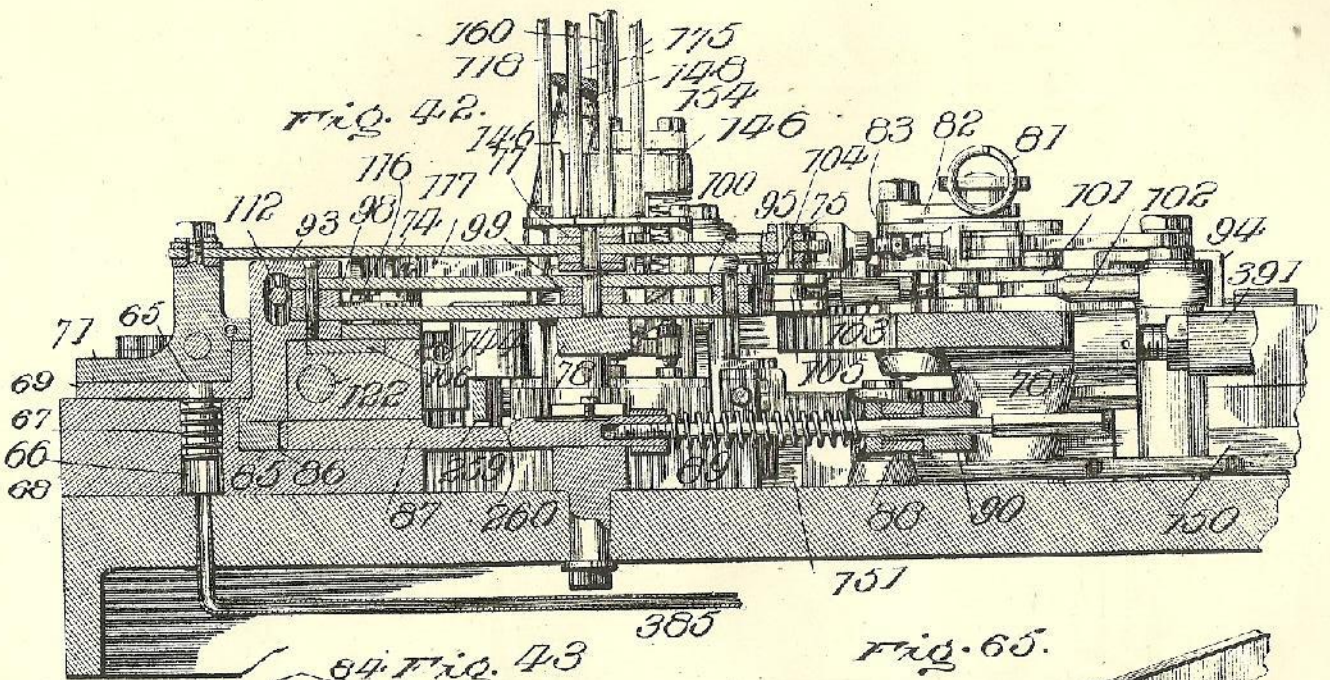


Fig. 42.

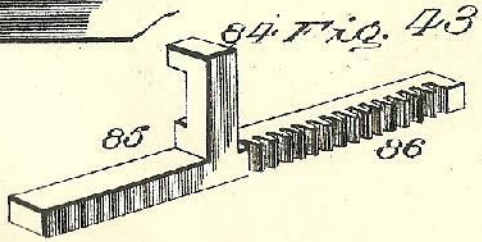


Fig. 43

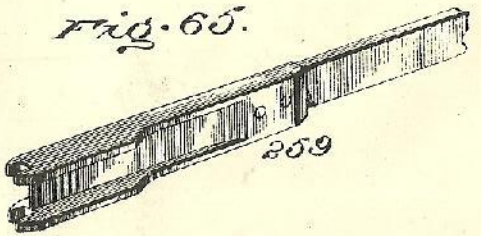


Fig. 65.

SHEET 23.

Malby & Sons, Photo-Litho

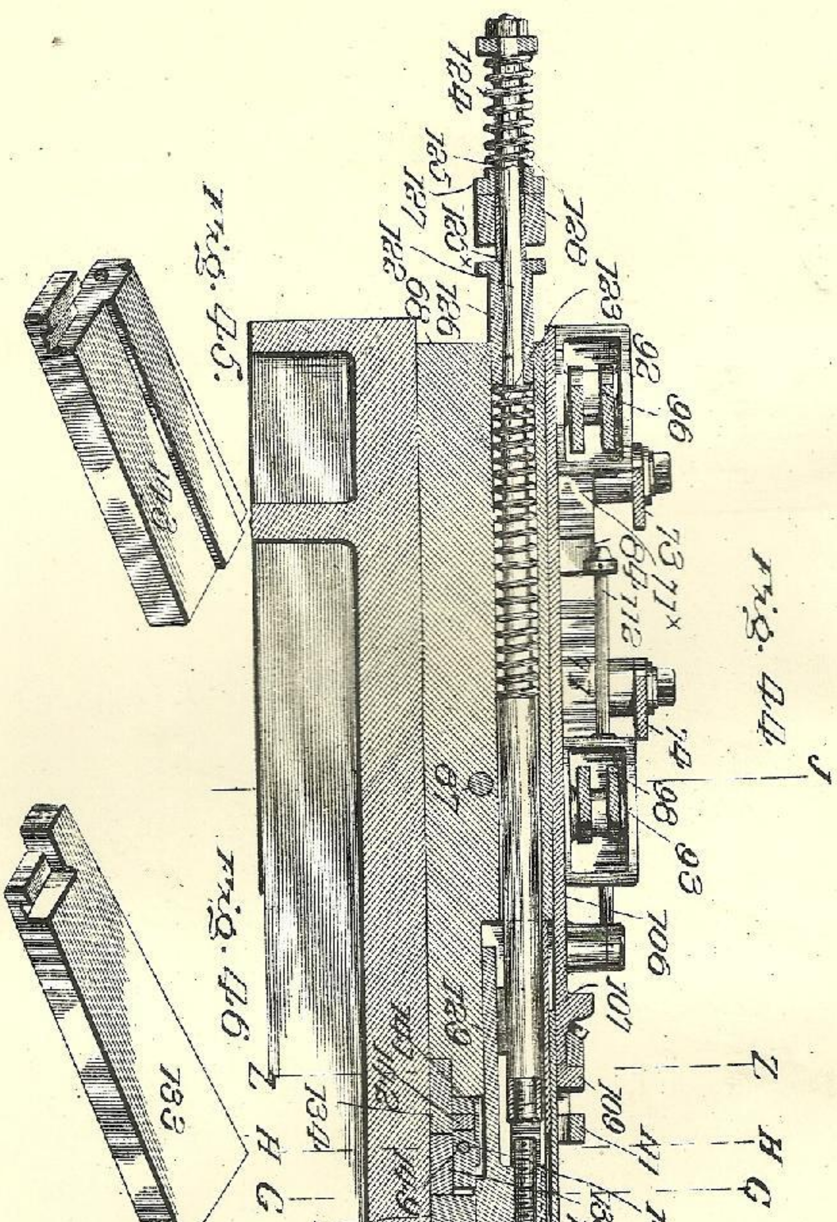


Fig. 44
Fig. 45
Fig. 46

Fig. 47.

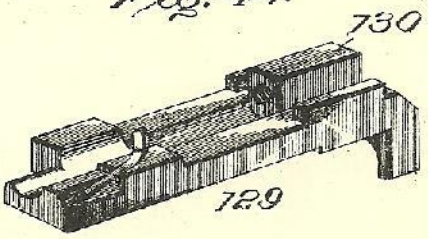


Fig. 48.

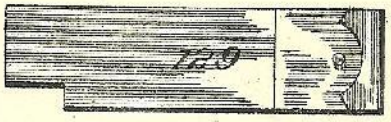


Fig. 49.

Fig. 50.

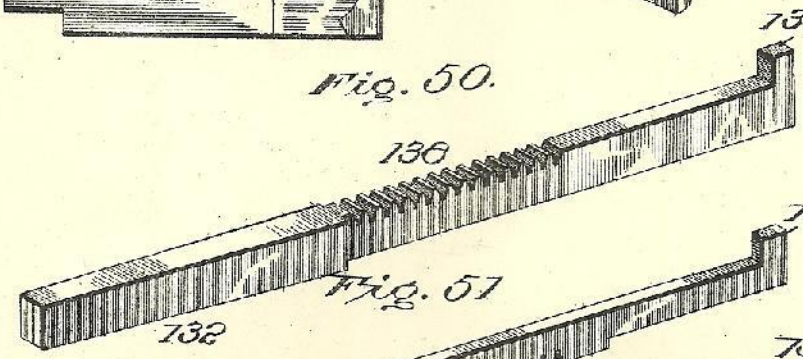


Fig. 51.

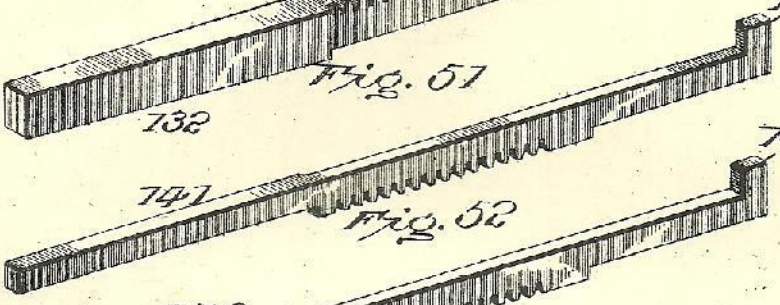


Fig. 52.

Fig. 53.

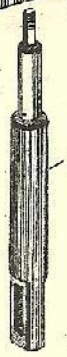


Fig. 54.

[This Drawing is a reproduction of the Original on a reduced scale.]

SHEET 27.

Fig. 55.

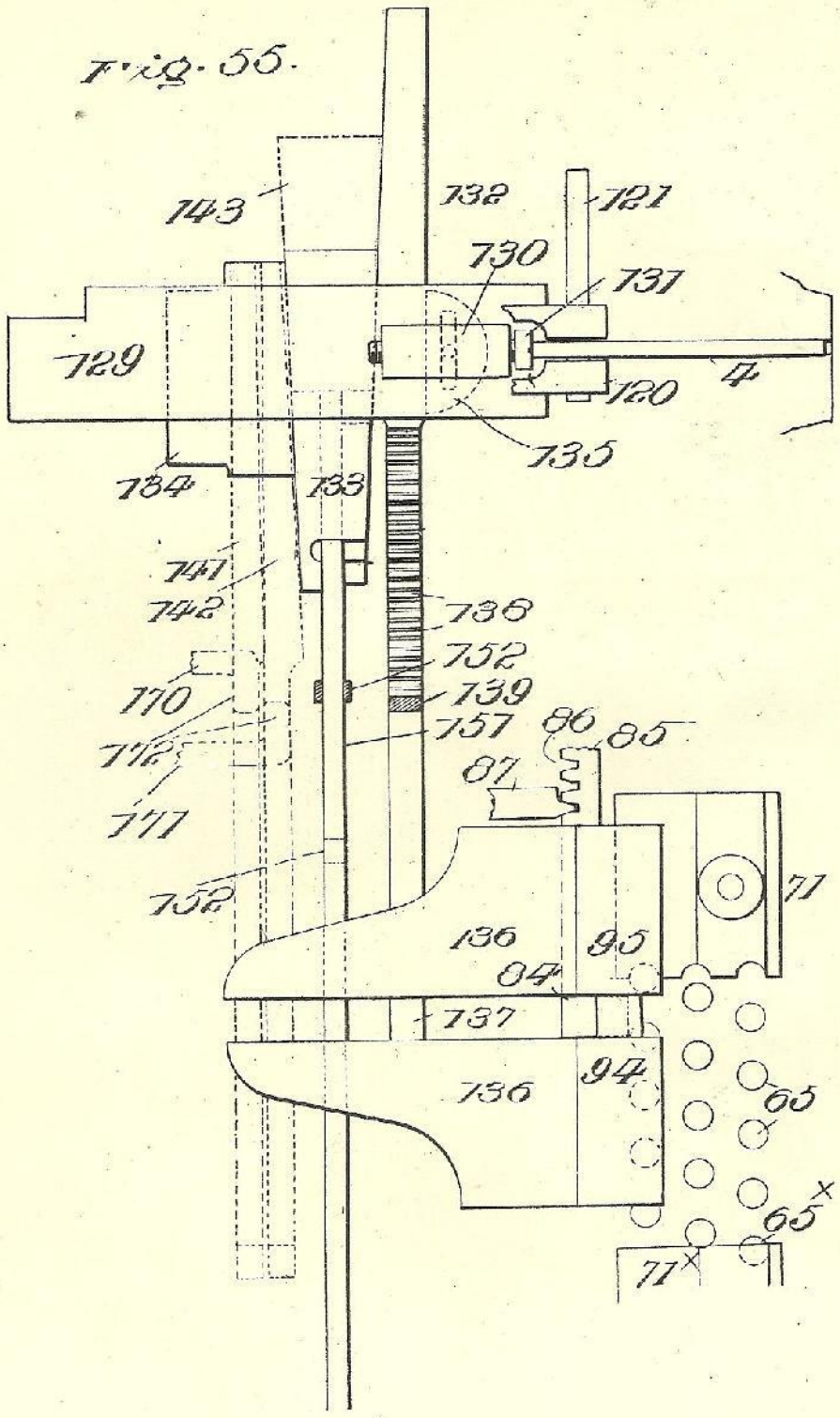
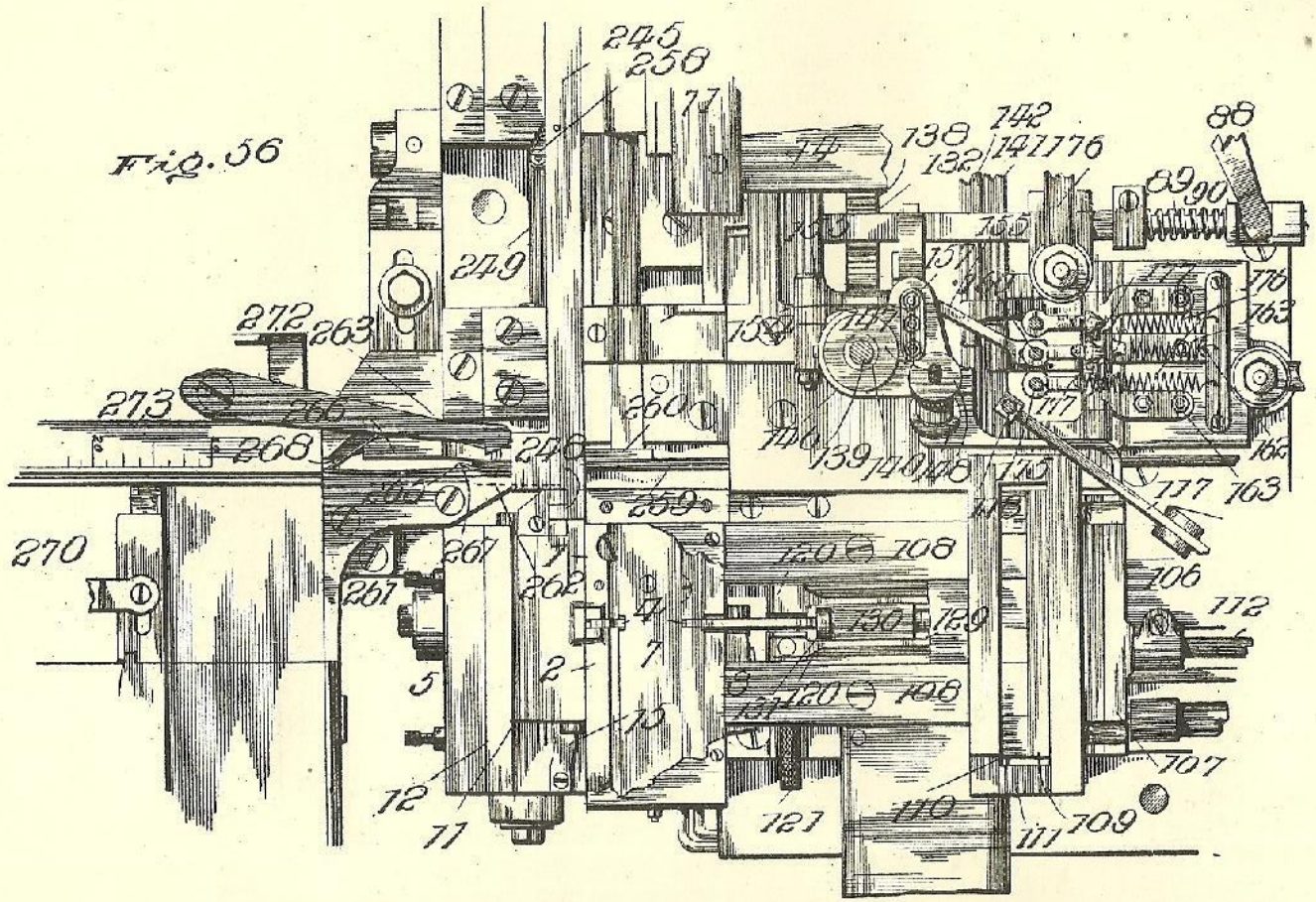


Fig. 56.



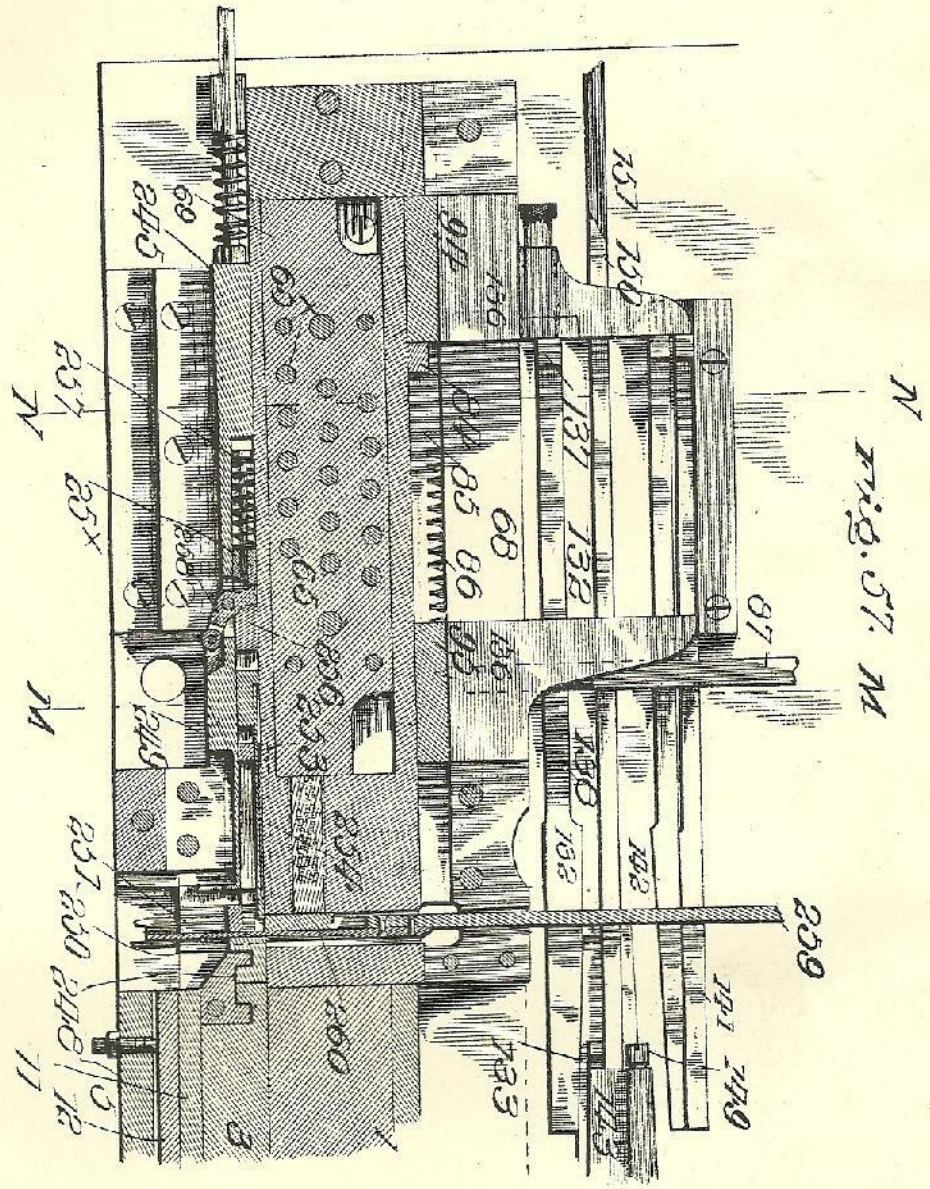
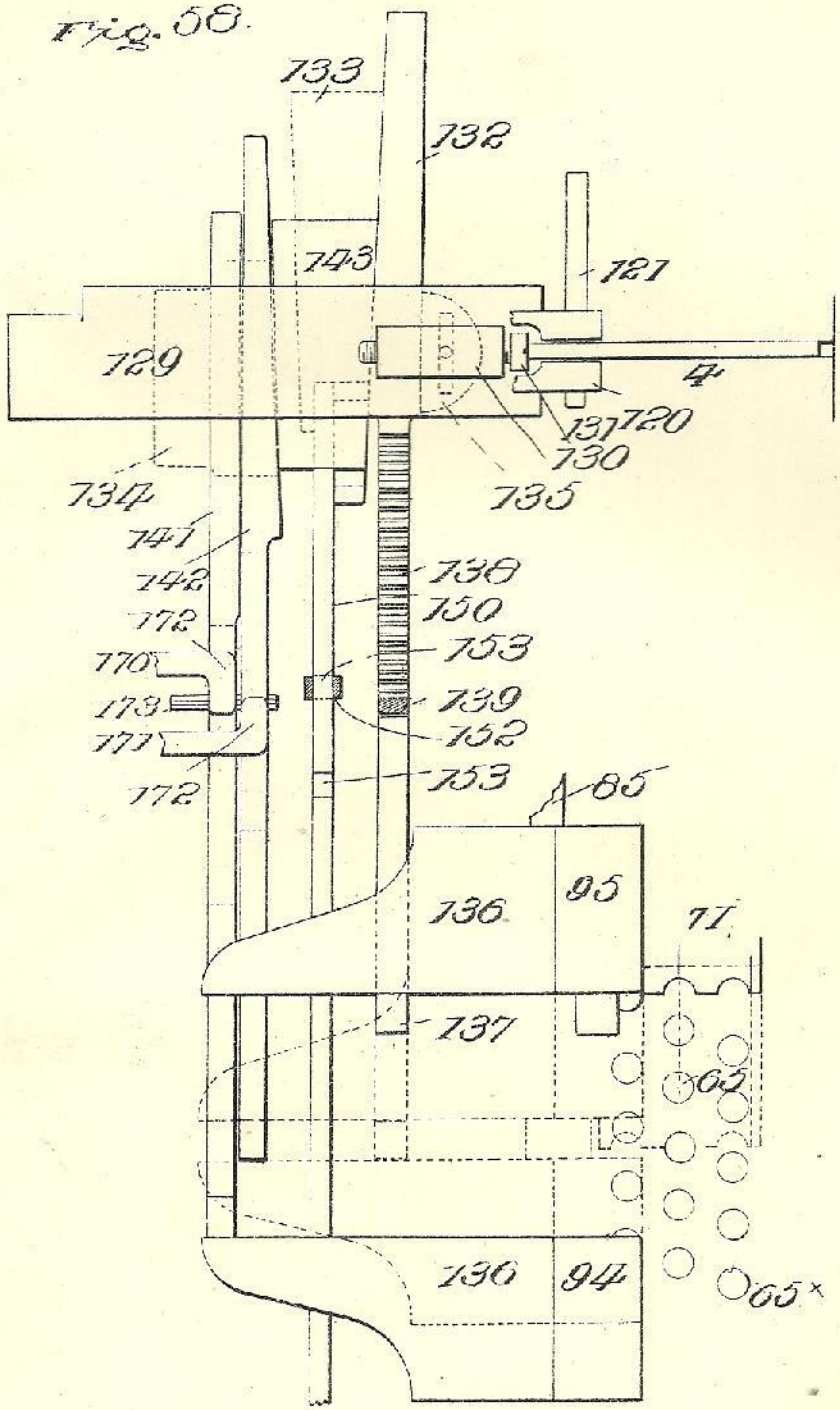


Fig. 57.
M
N
259
M
N
X
Y
3
11
12
68
85
86
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000

Fig. 58.



[This Drawing is a reproduction of the Original on a reduced scale.]

Malby & Sons, Photo-Litho.

SHEET 31.

Fig. 59.

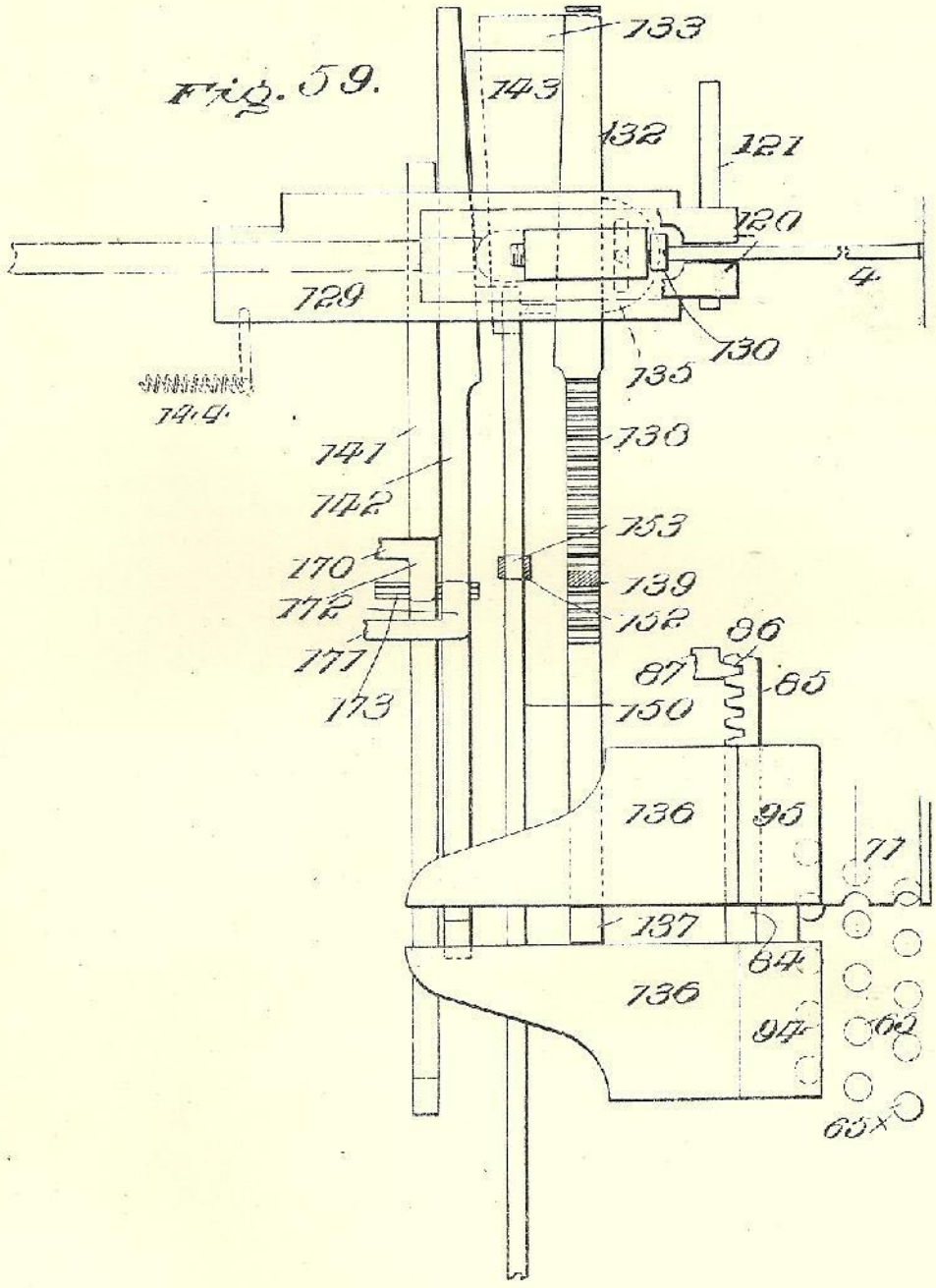
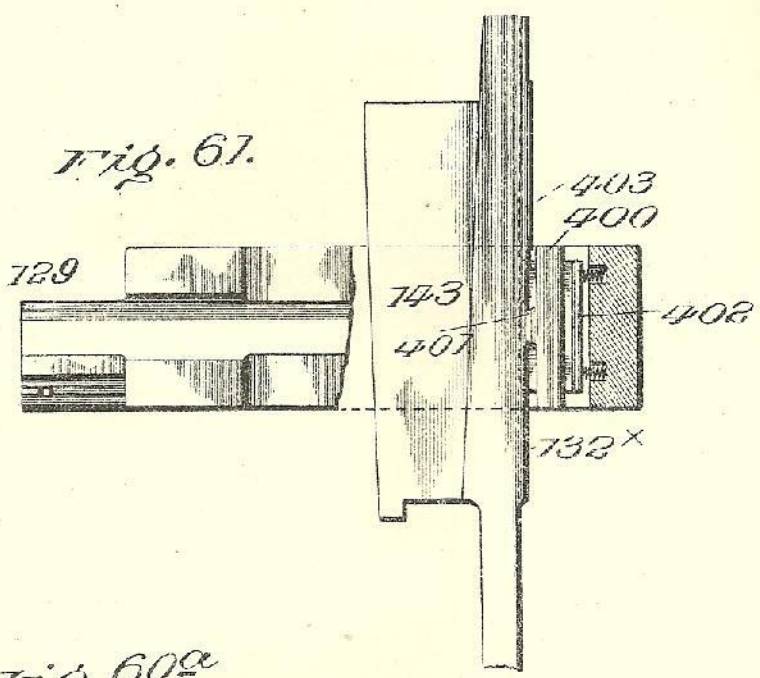


Fig. 61.



732× Fig. 60a

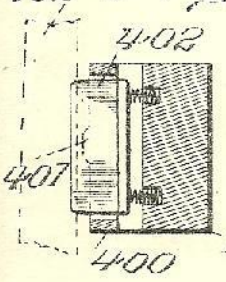


Fig. 61a

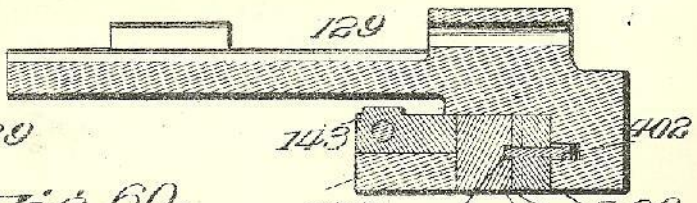
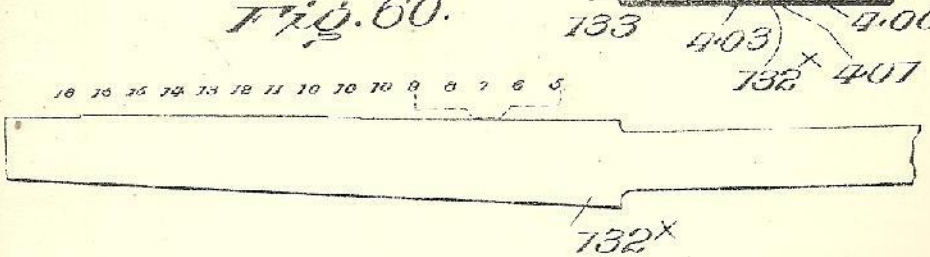


Fig. 60.



[This Drawing is a reproduction of the Original on a reduced scale.]

Malby & Sons, Photo Litho.

Fig. 64.

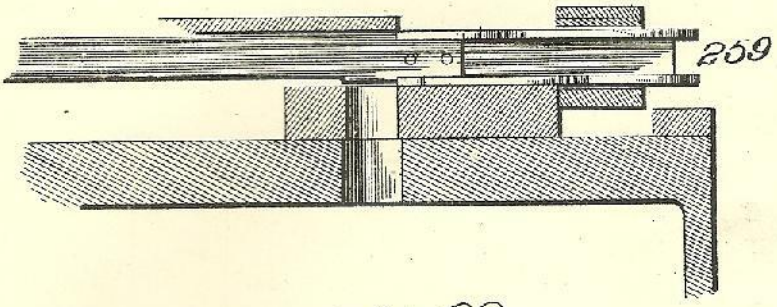


Fig. 62.

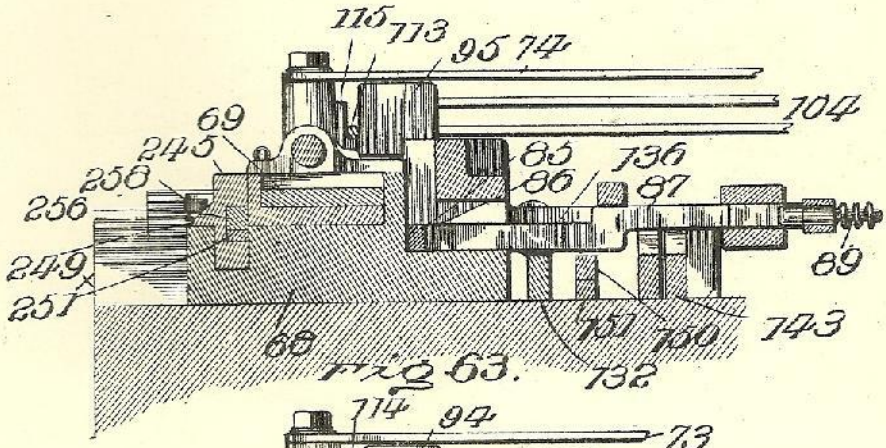


Fig. 63.

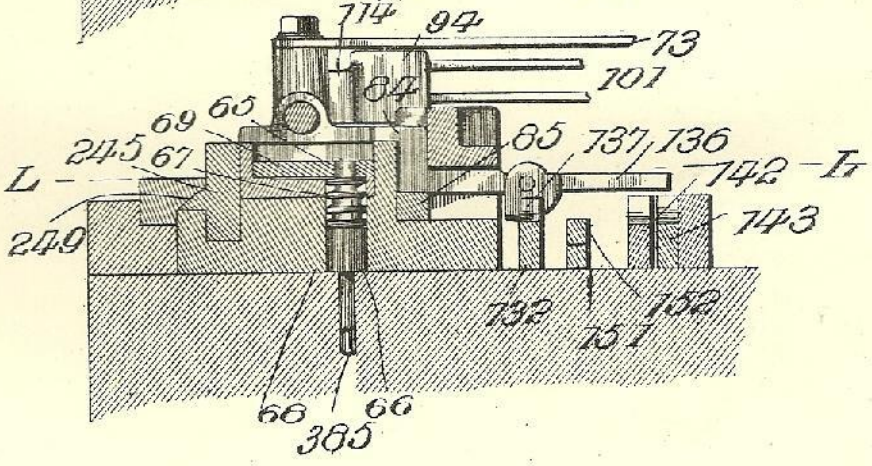


Fig. 66.

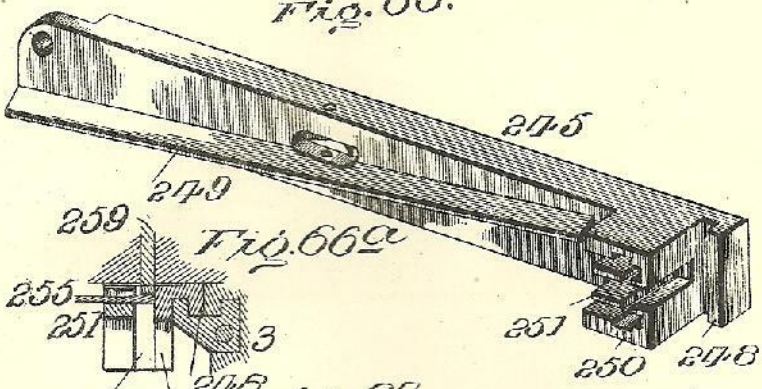


Fig. 66a

Fig. 67.

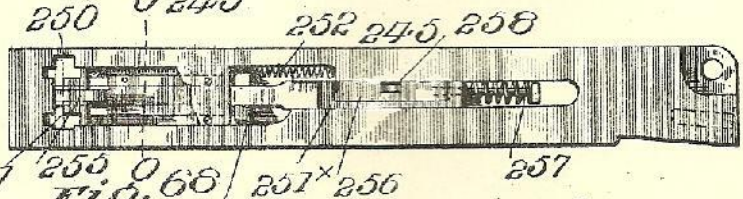


Fig. 68

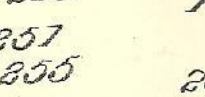
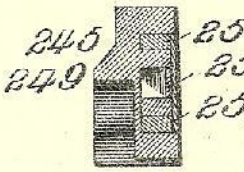


Fig. 69.



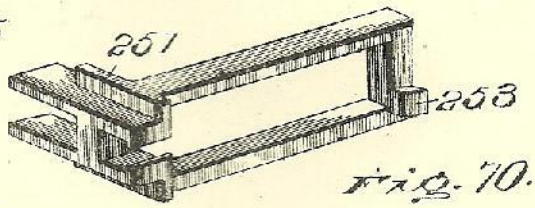


Fig. 70.

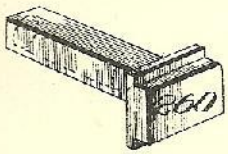
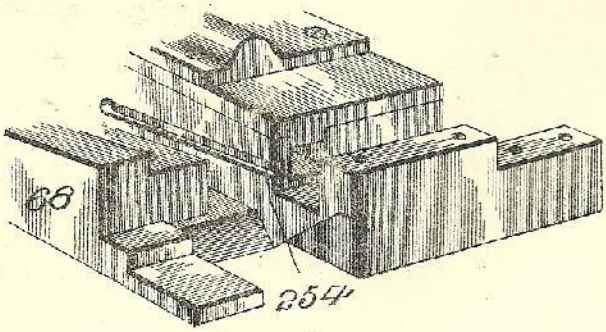


Fig. 71.



[This Drawing is a reproduction of the Original on a reduced scale.]

SHEET 35.

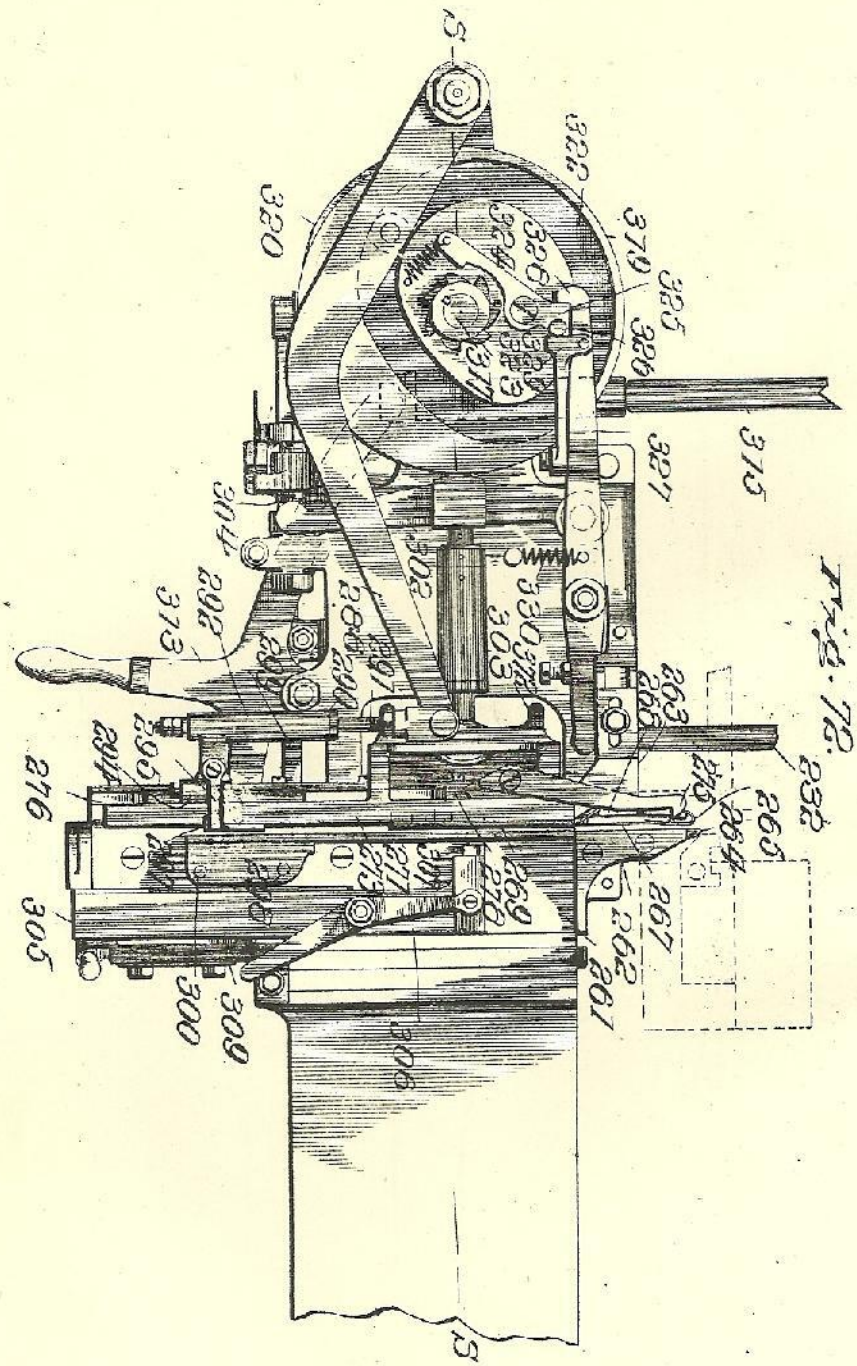
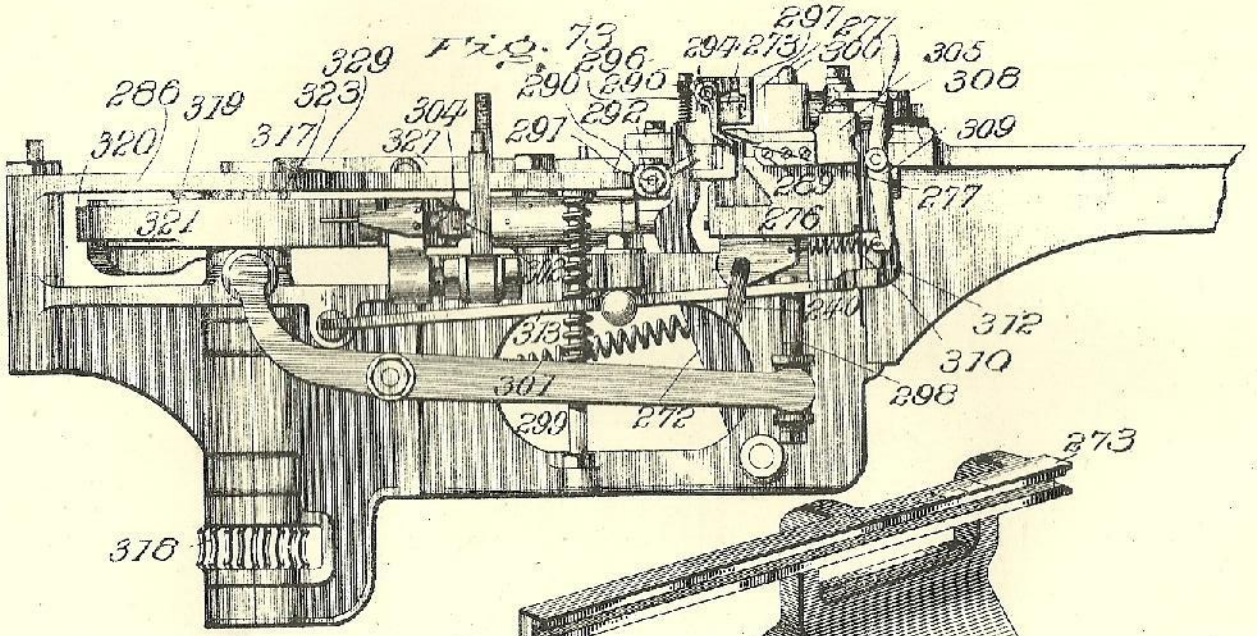


Fig. 12.



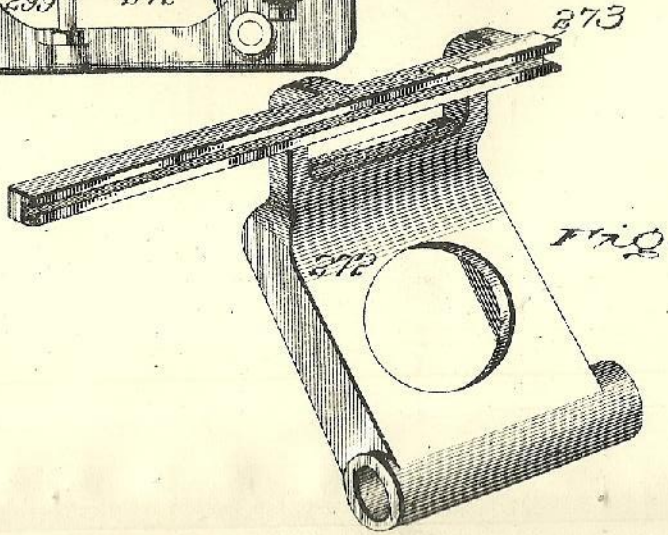


Fig. 74.

Fig. 75

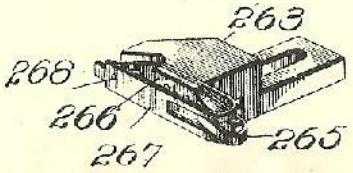


Fig. 76.

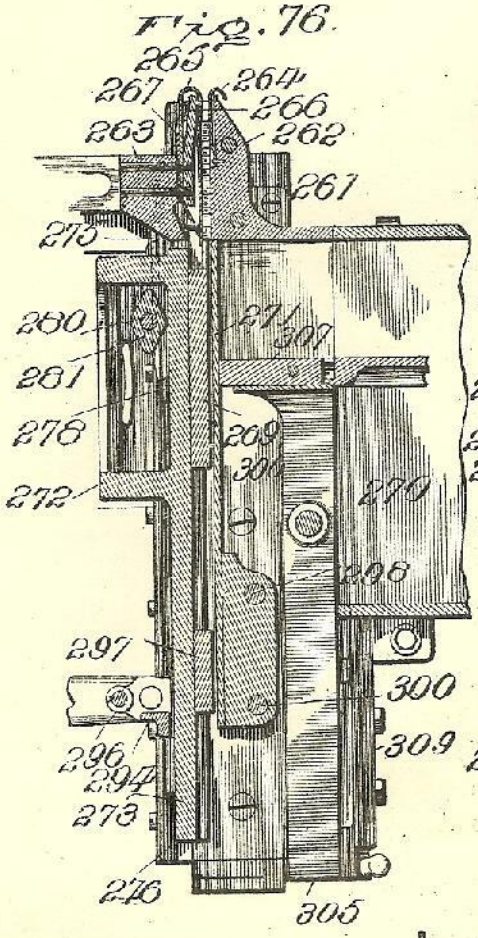


Fig. 77.

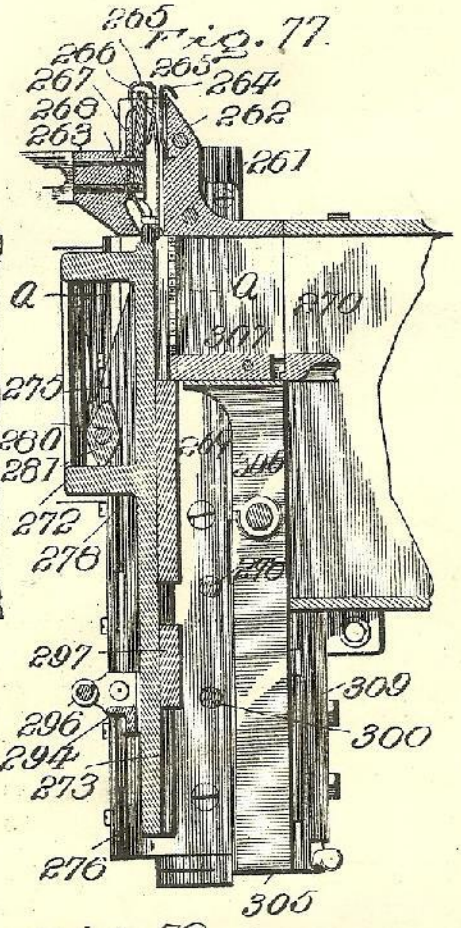


Fig. 78

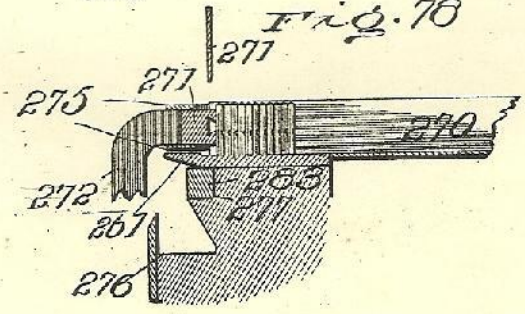


Fig. 79.

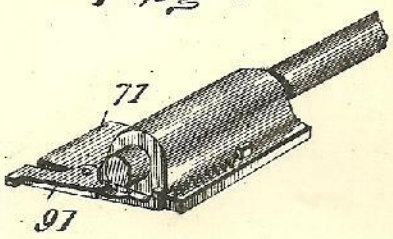


Fig. 80.

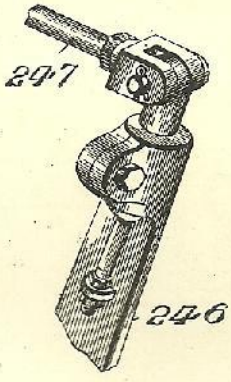


Fig. 81.

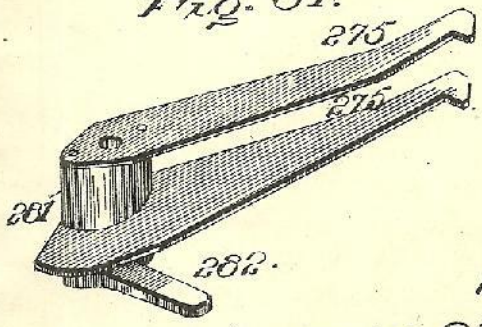


Fig. 82.

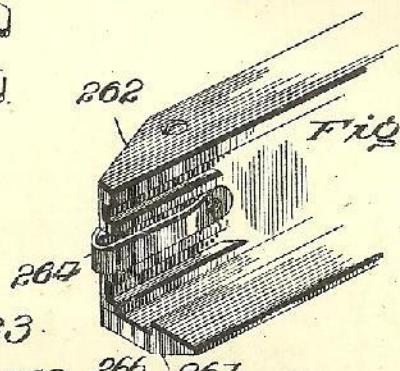


Fig. 83.

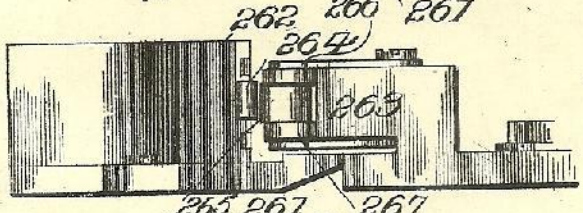
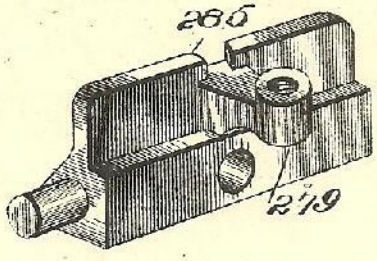


Fig. 84.



[This Drawing is a reproduction of the Original on a reduced scale.]

Malby & Sons, Photo-Litho.

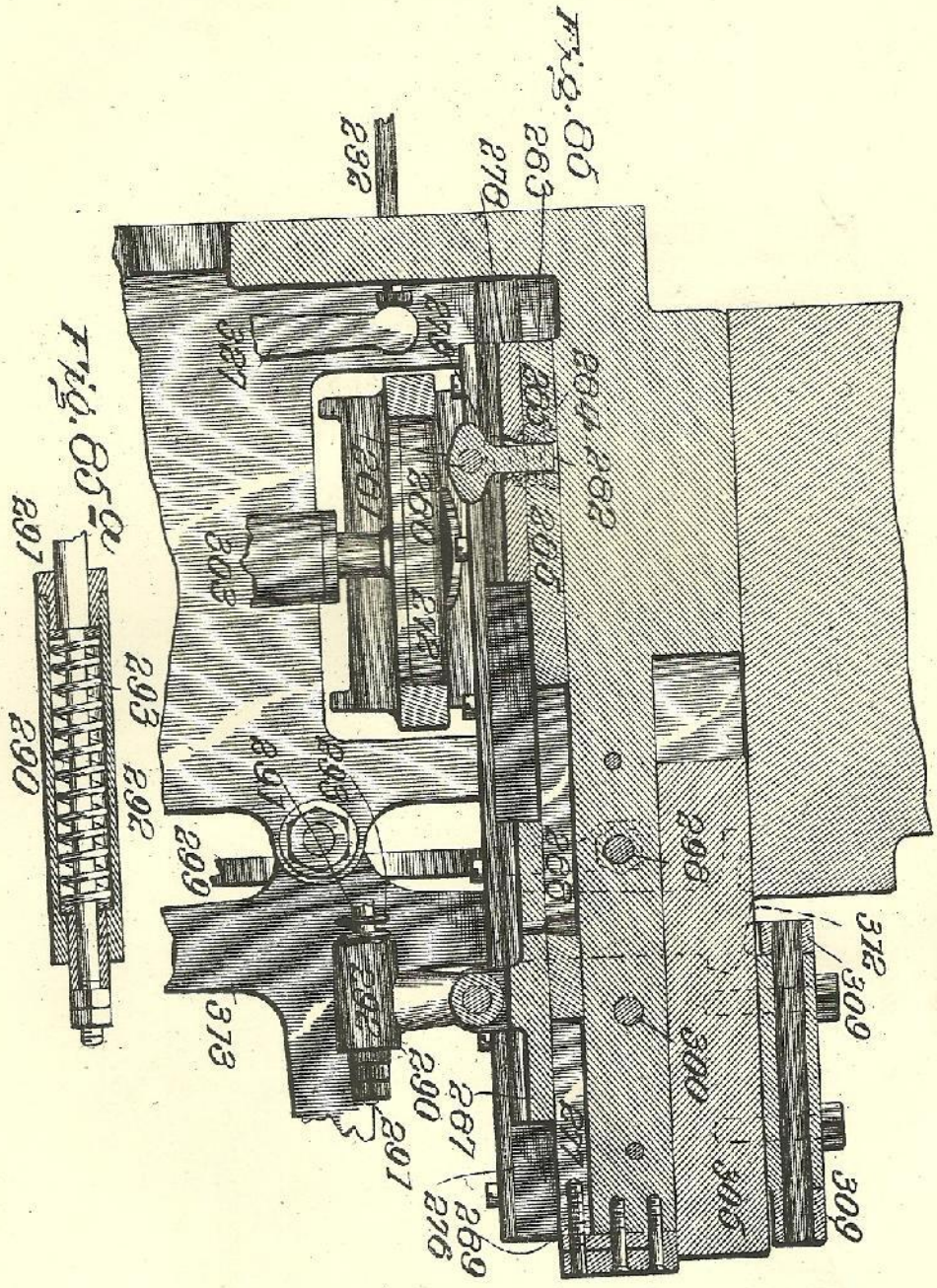


Fig. 85.
Fig. 85a.
292
278
263
264
262
297
291
295
296
290
293
292
313
290
297
291
276
269
306
309
312

Fig. 86.

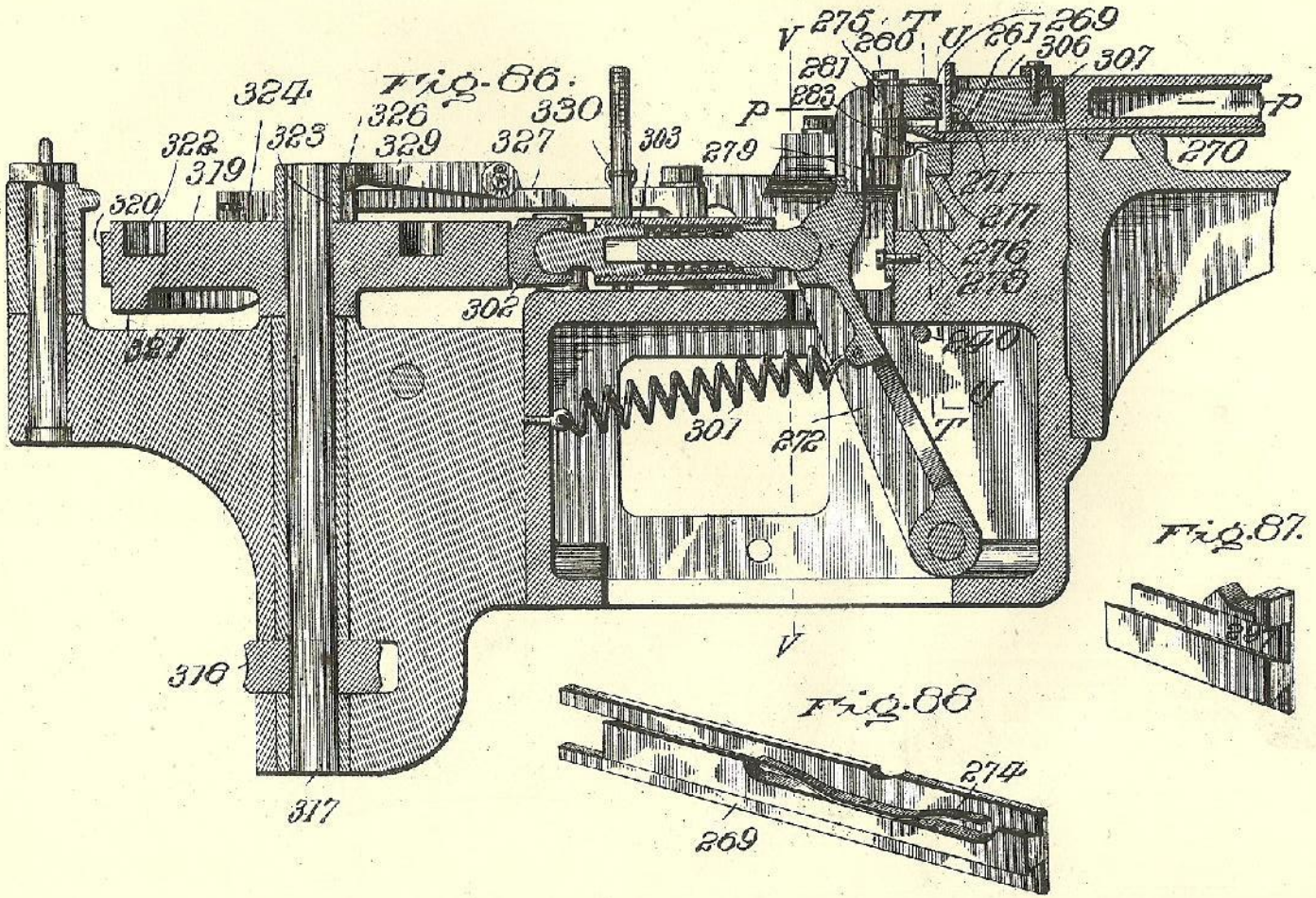


Fig. 87.

Fig. 88

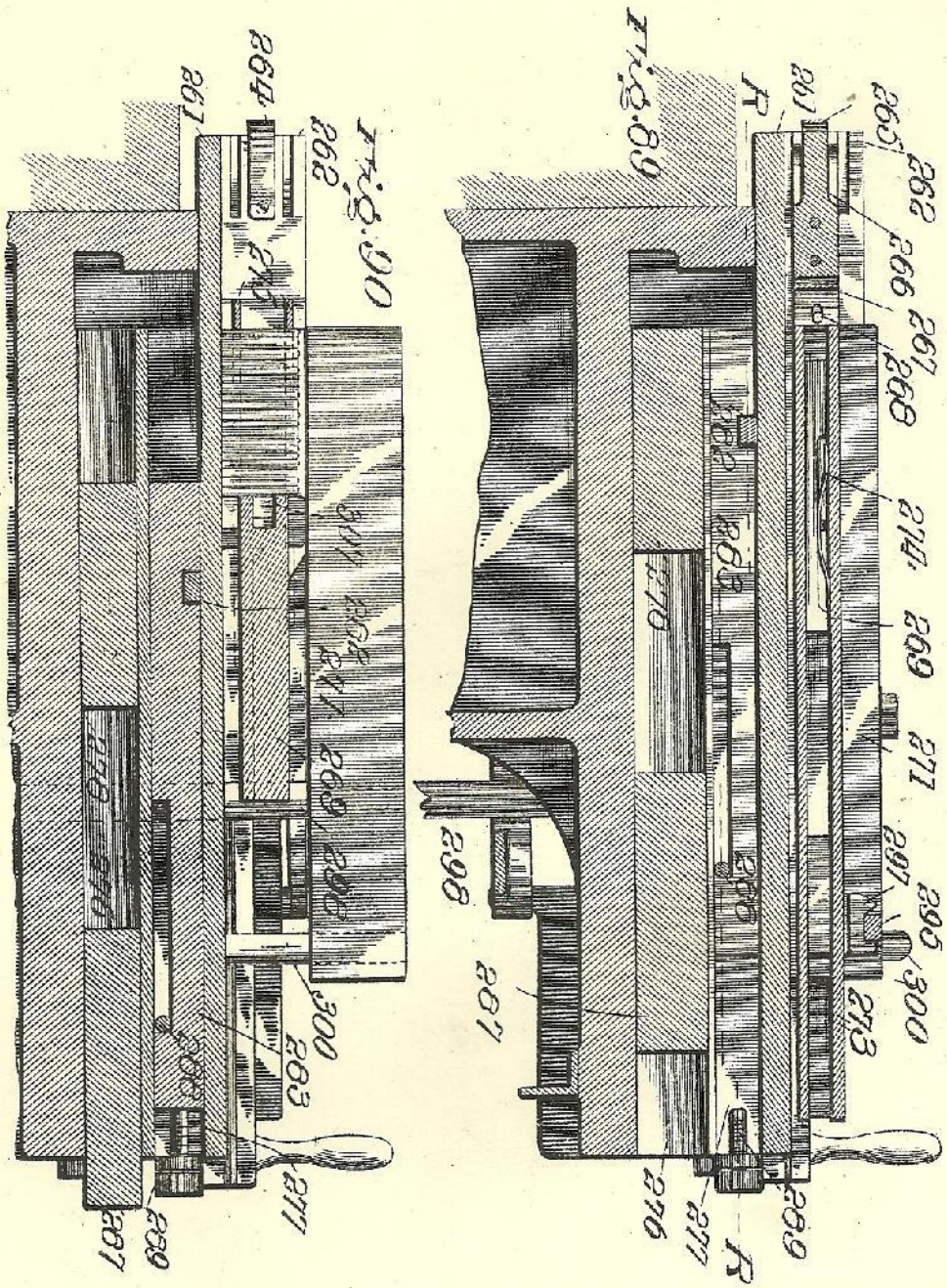


FIG. 89.
FIG. 90.

[This Drawing is a reproduction of the Original on a reduced scale.]

(36 SHEETS)
SHEET 42.

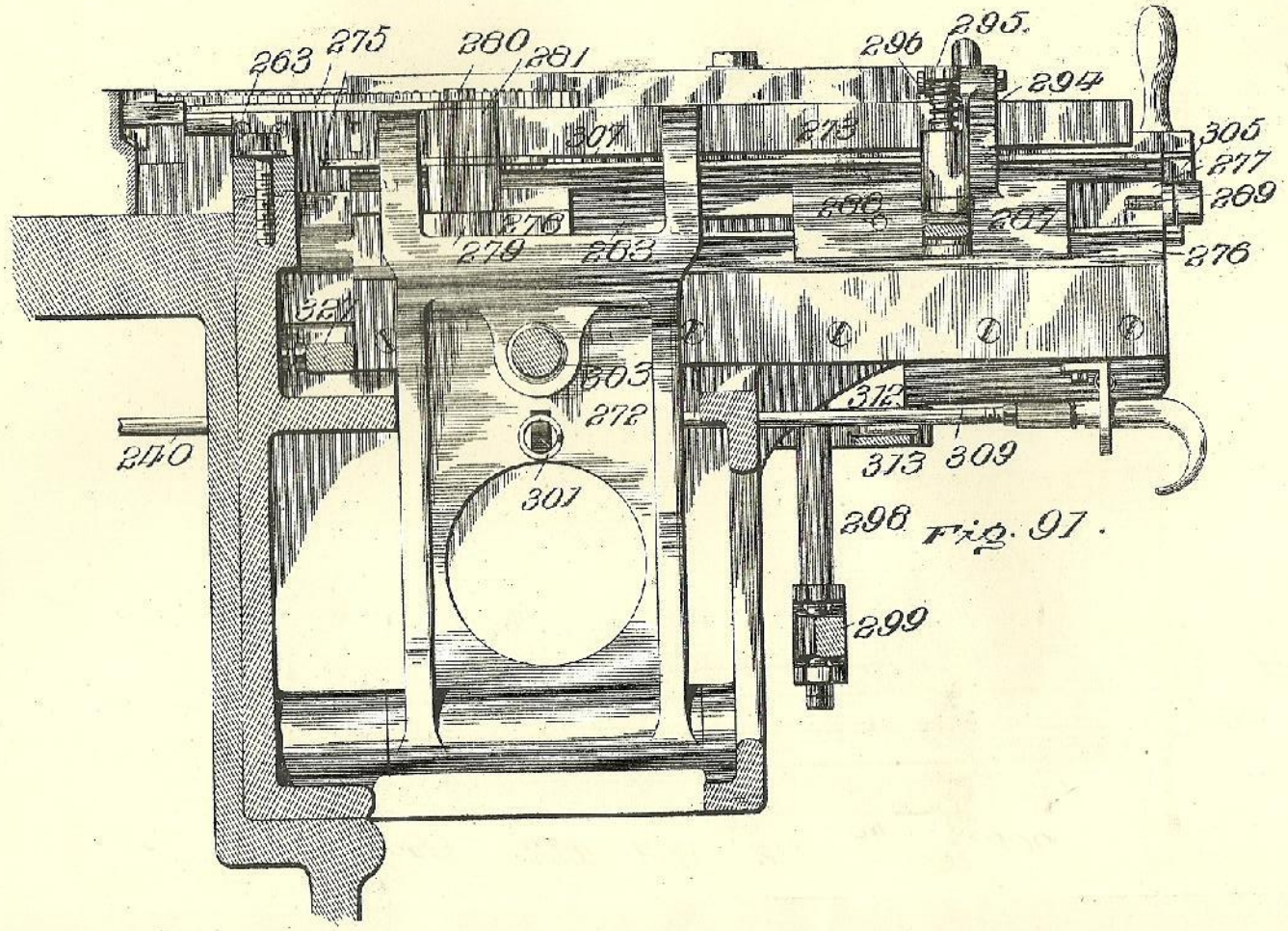


Fig. 97.

Malby & Sons, Photo-Litho.

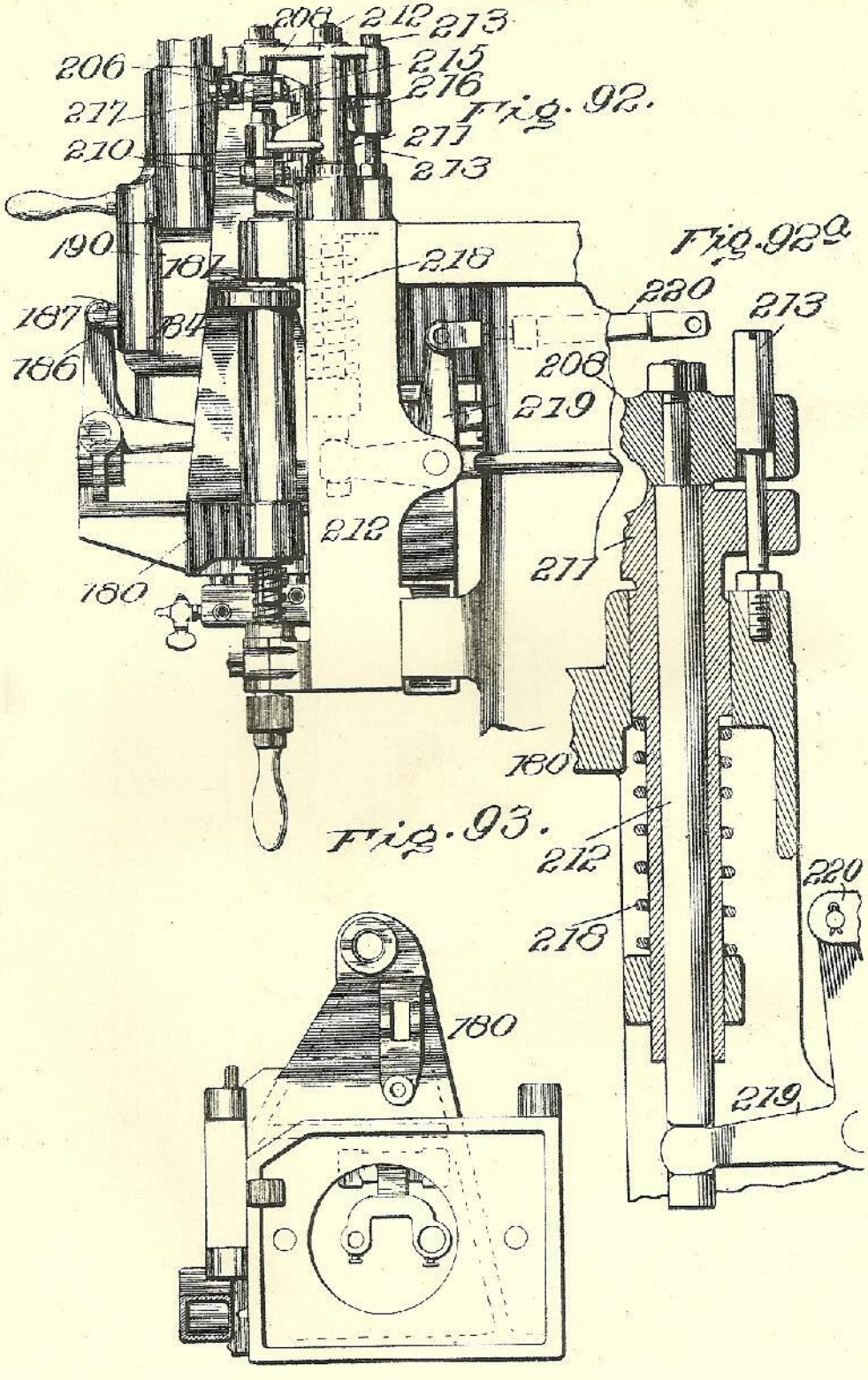

209
212
213
206
215
276
277
271
210
273
190
187
186
184
218
208
279
212
180
Fig. 92.
Fig. 92a.
220
273
271
180
Fig. 93.
212
220
218
180
279

Fig. 94.

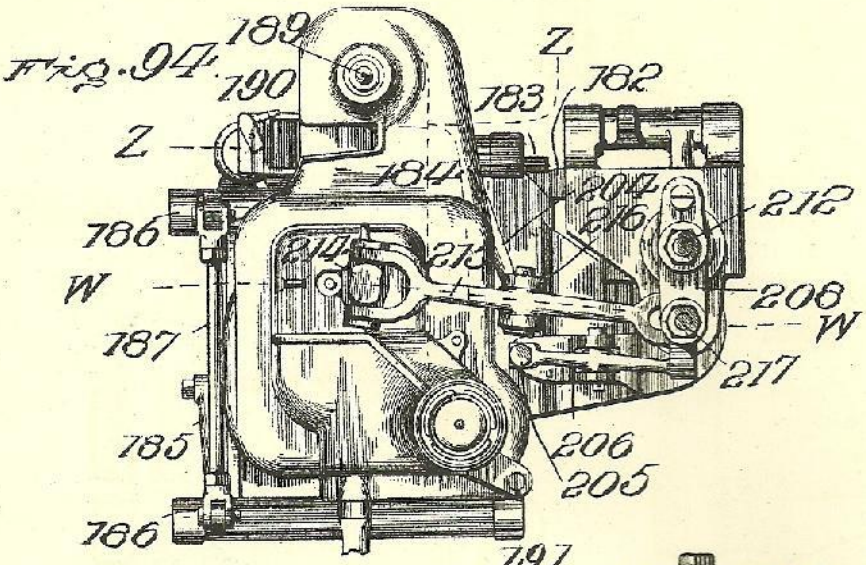
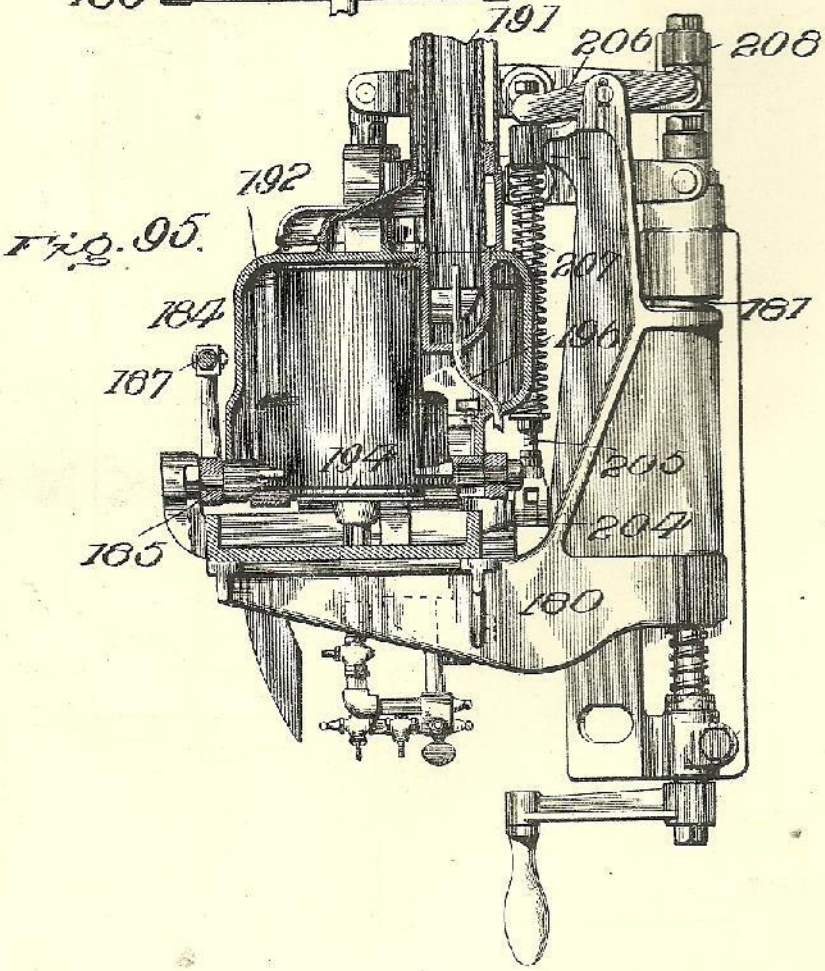


Fig. 95.



[This Drawing is a reproduction of the Original on a reduced scale.]

Malby & Sons, Photo-Litho

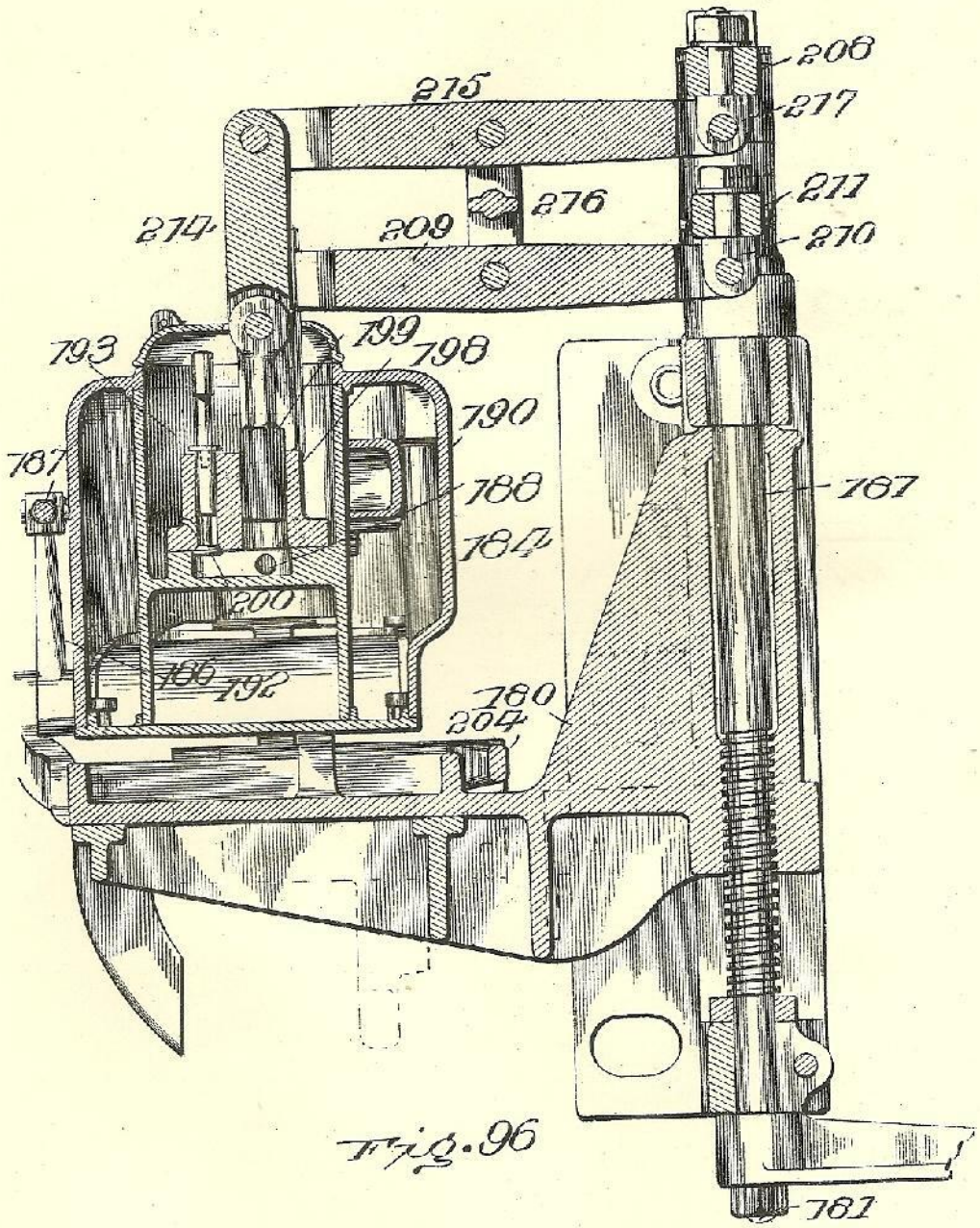

208
215
217
276
211
274
209
270
793
799
798
790
787
788
784
787
200
786
792
780
204
781

Fig. 96

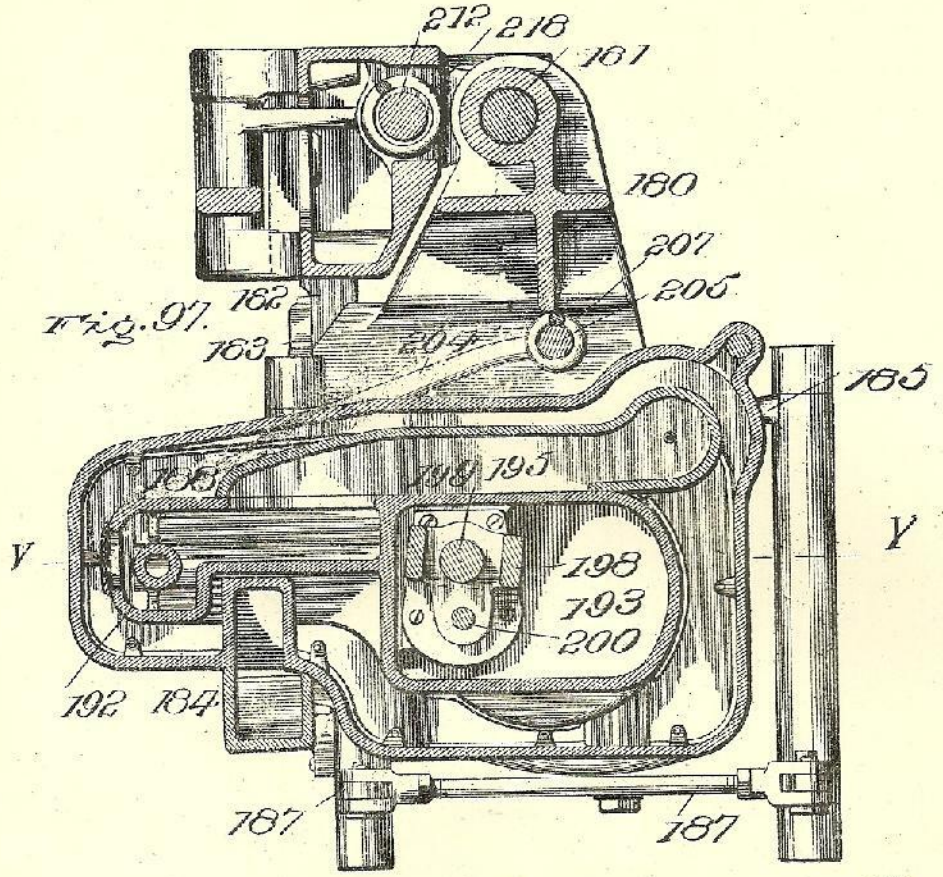


Fig. 97.

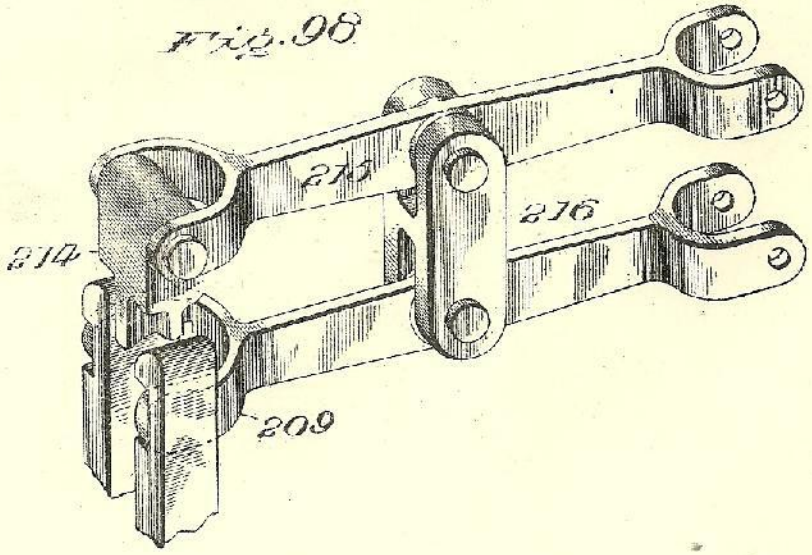


Fig. 98.

[This Drawing is a reproduction of the Original on a reduced scale.]

Mail by & Sons, Photo-Litho.

Fig. 99.

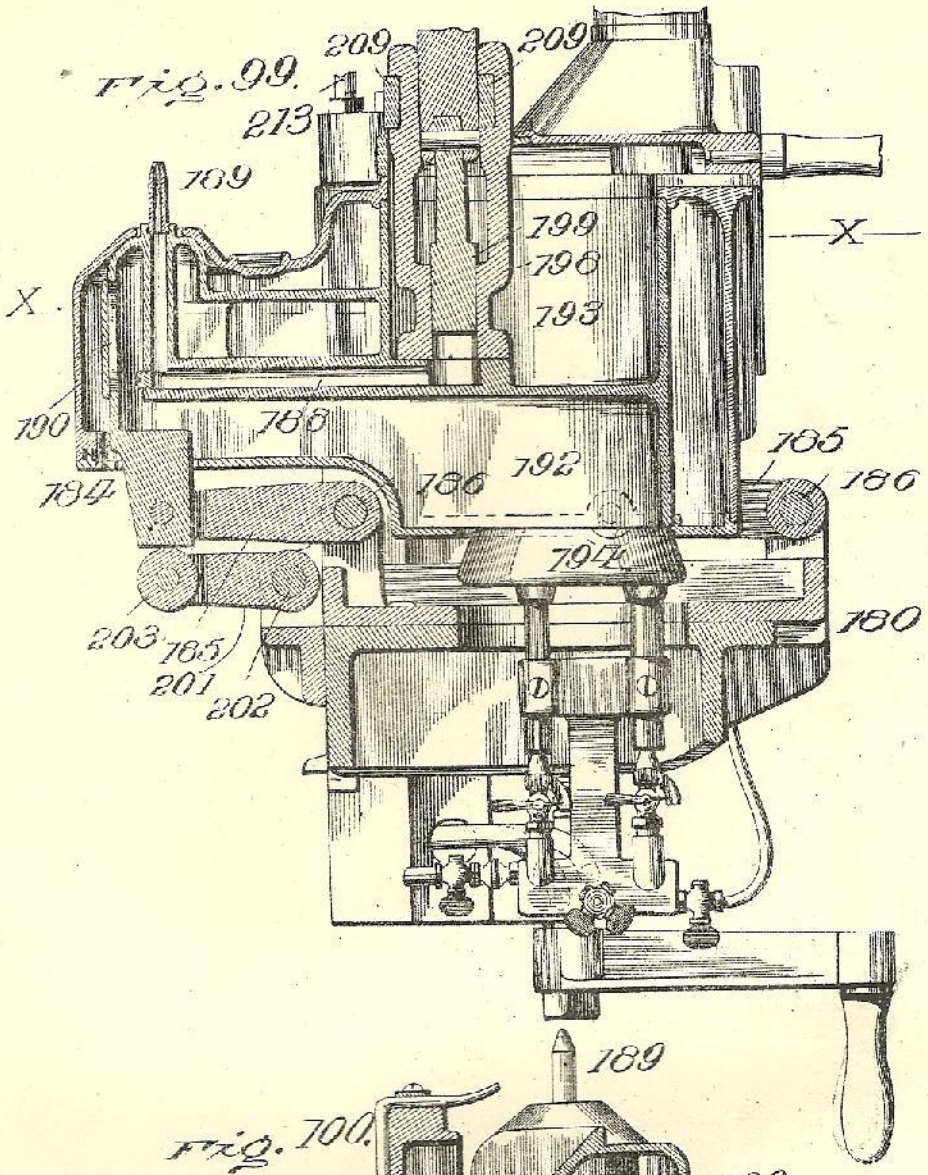
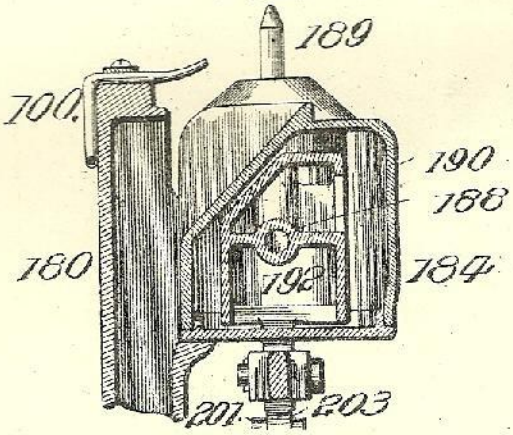


Fig. 100.



[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 702.

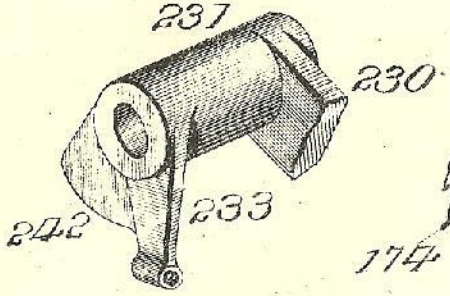


Fig. 701.

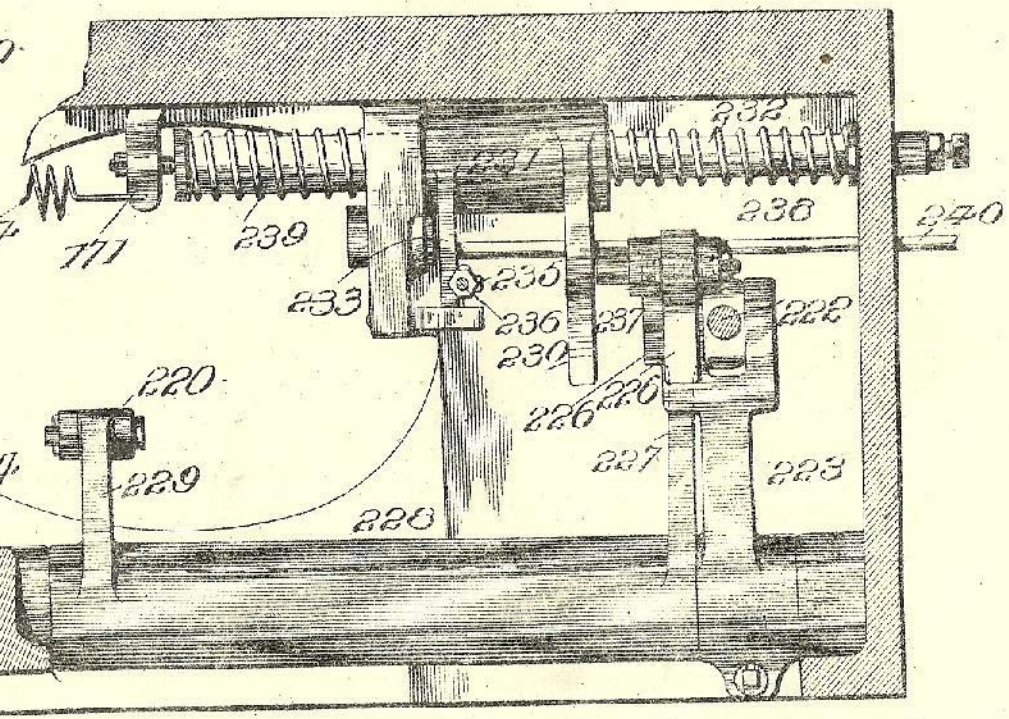
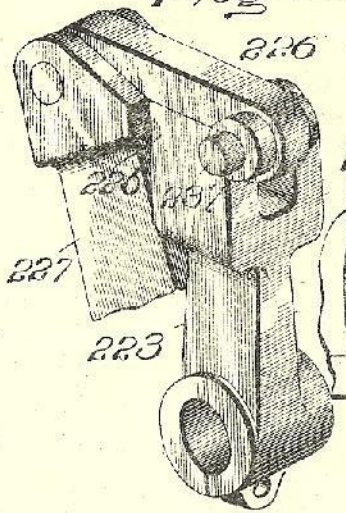


Fig. 703



SHEET 49.

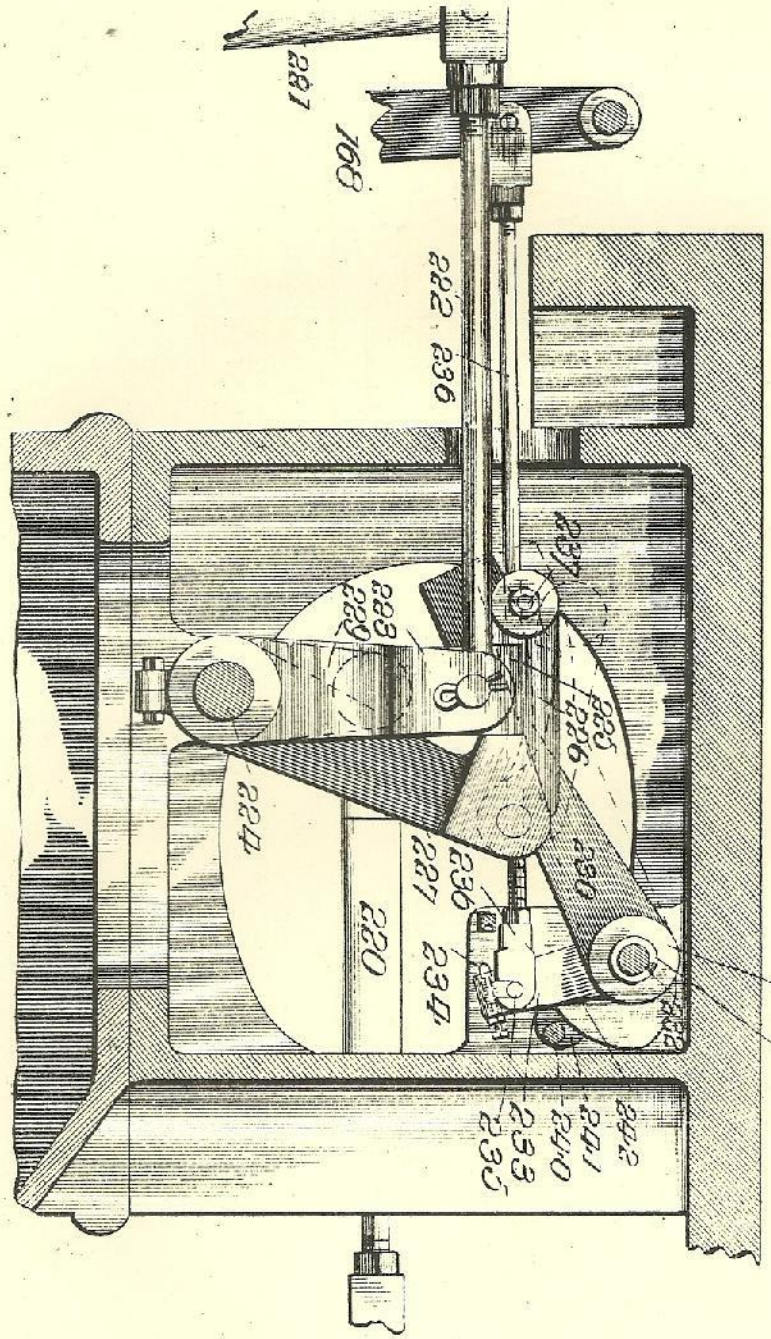


FIG. 104.

Fig. 105.

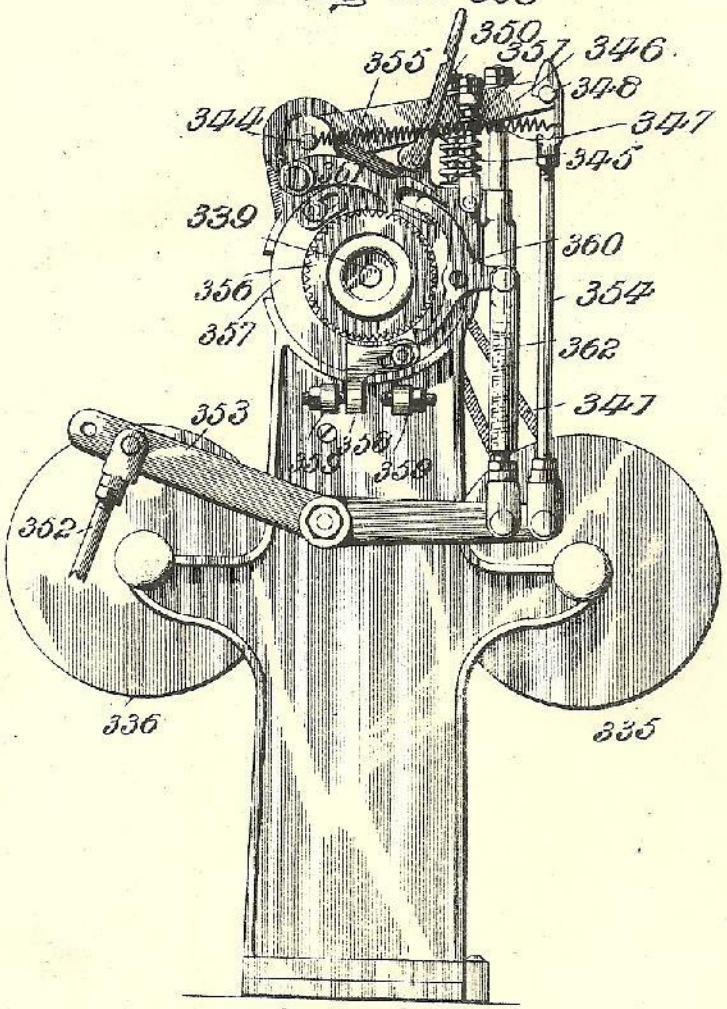
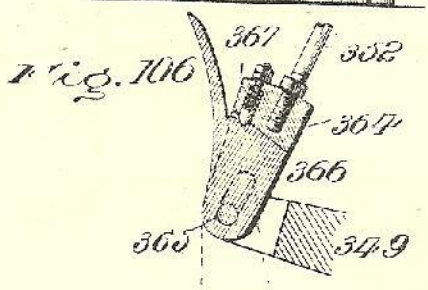


Fig. 106.



[This Drawing is a reproduction of the Original on a reduced scale.]

Malby & Sons, Photo-Litho.

Fig. 107.

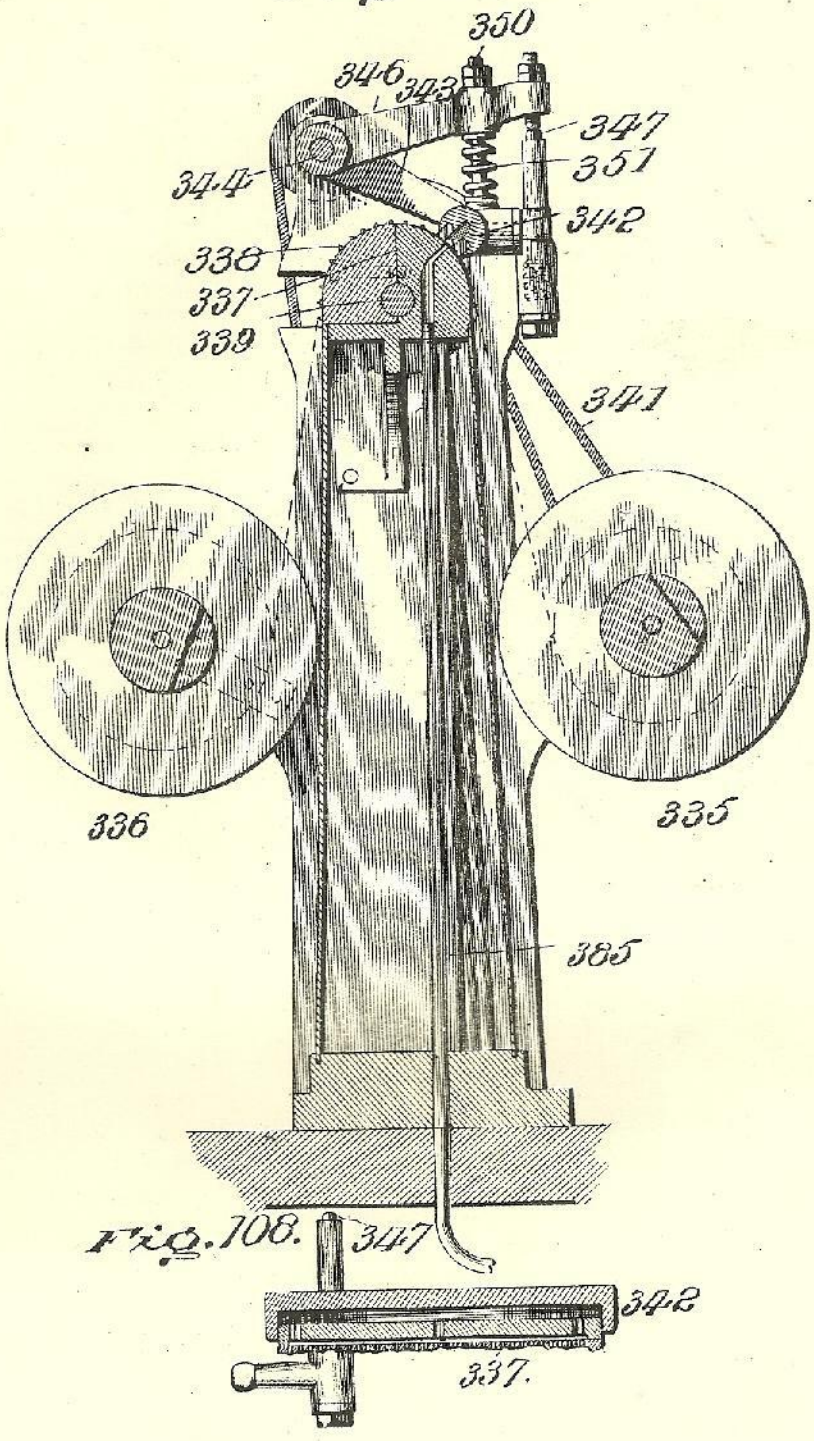


Fig. 108.

Fig. 109.

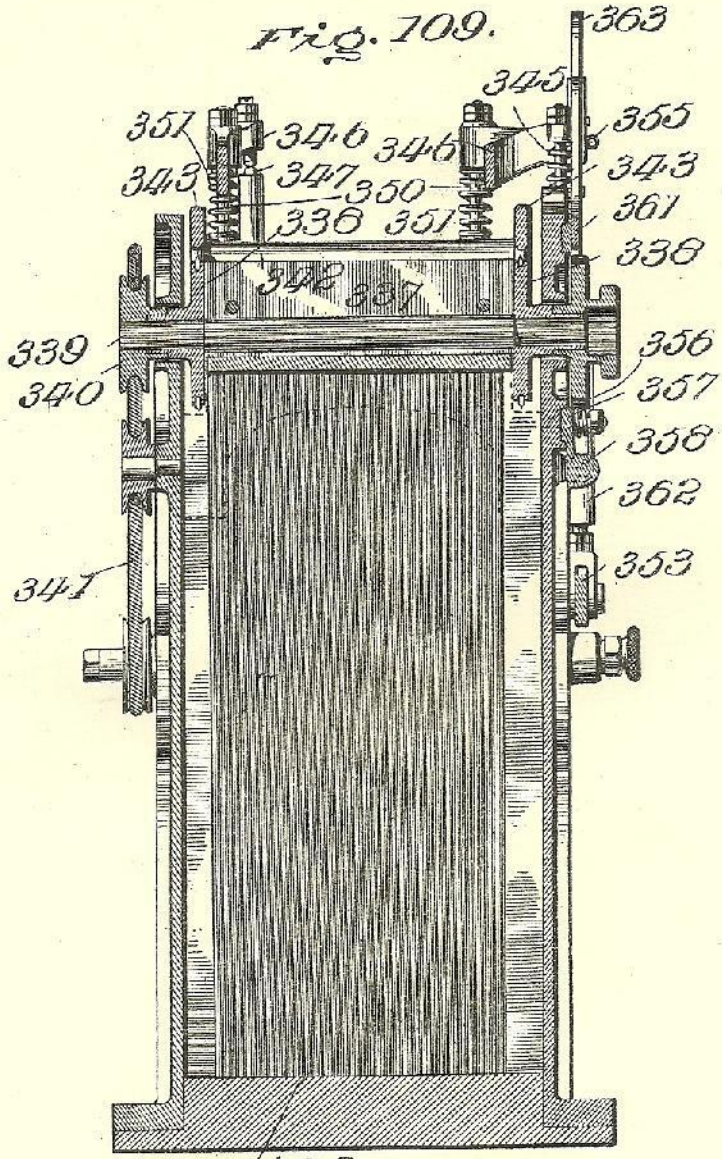
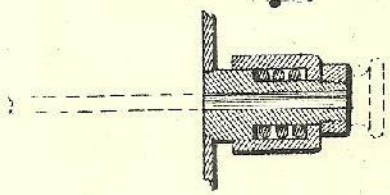


Fig. 110.



[This Drawing is a reproduction of the Original on a reduced scale.]

Malby & Sons, Photo-Lith.

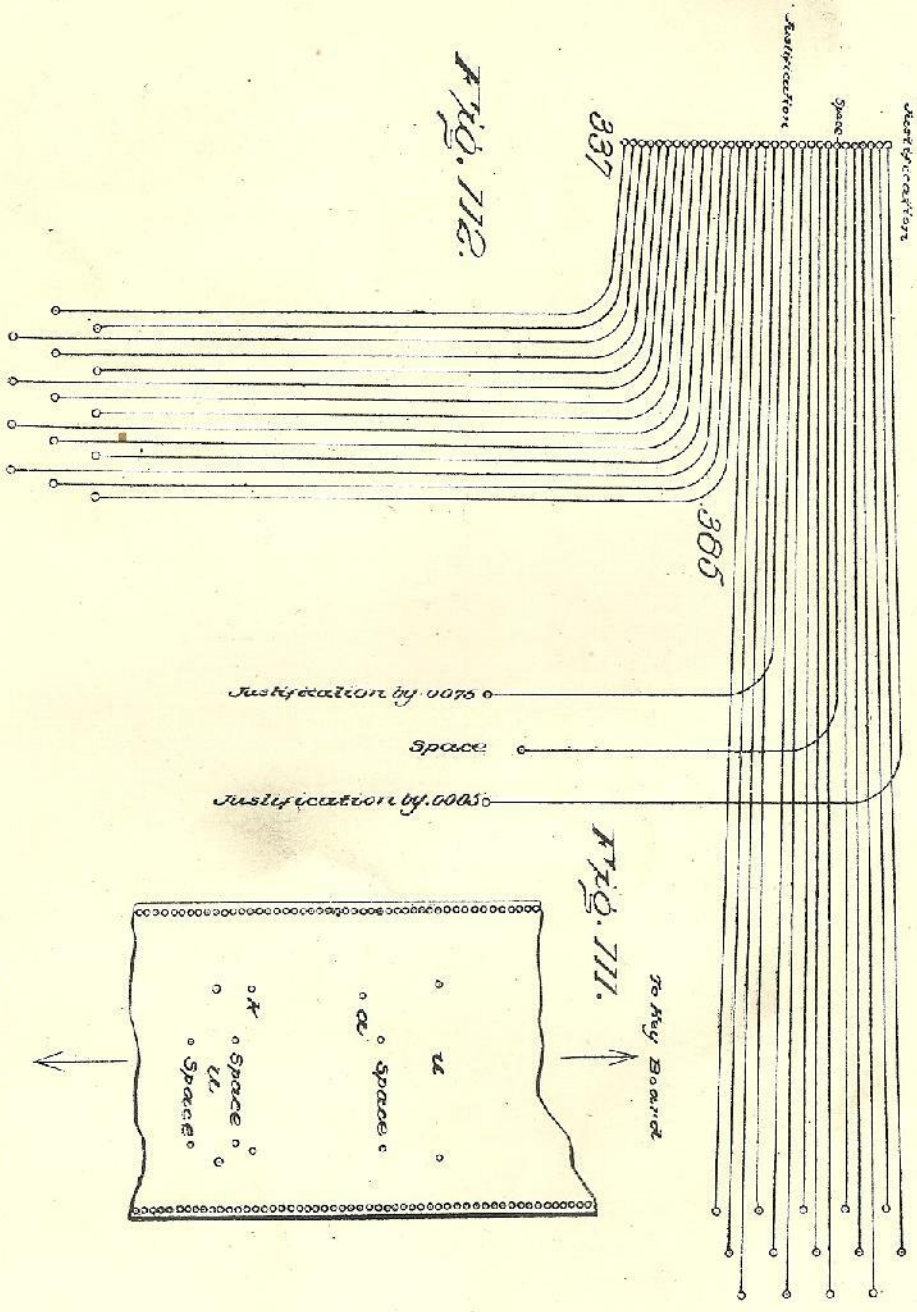
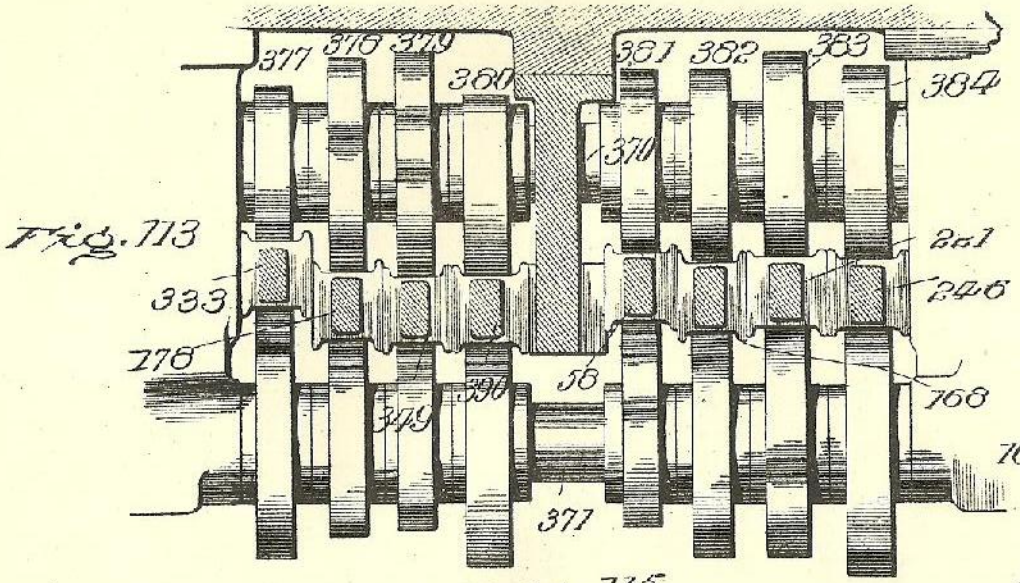
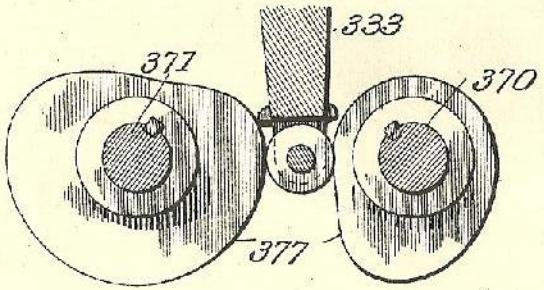


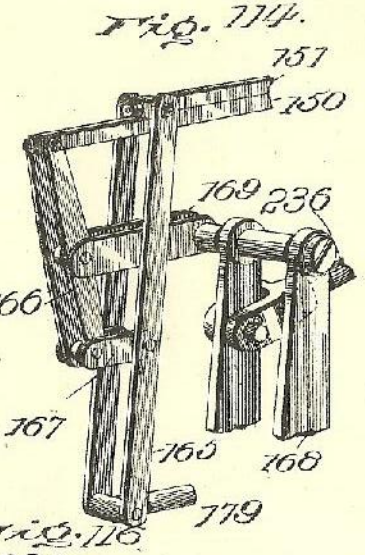
Fig. 112.
237
Justification
Space
Justification
235
Justification by .0075
Space
Justification by .0085
Fig. 111.
To Knife Board
To Casting Machine
Space
Space
Space
Space

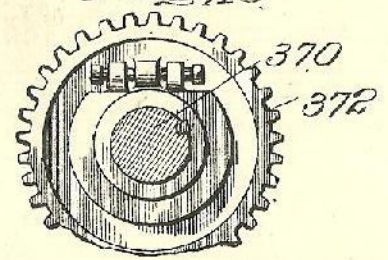
[This Drawing is a reproduction of the Original on a reduced scale.]

(56 SHEETS)
SHEET 54.









Maiby & Sons, Photo-Litho.

Fig. 117.

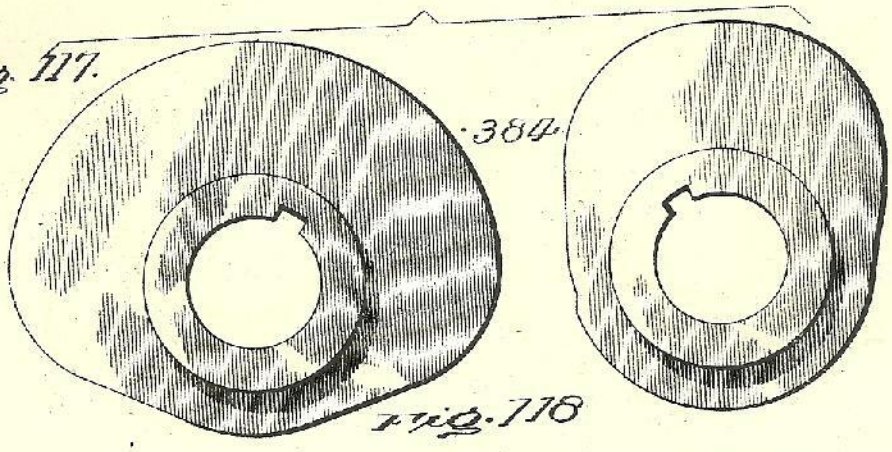


Fig. 118

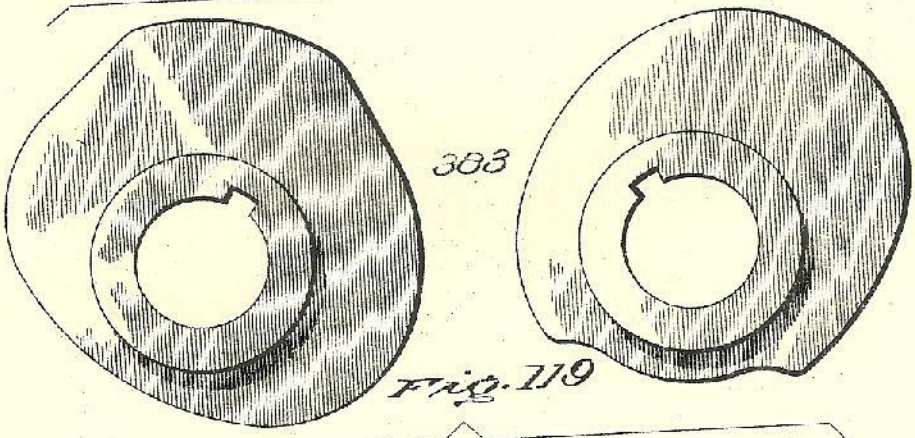


Fig. 119

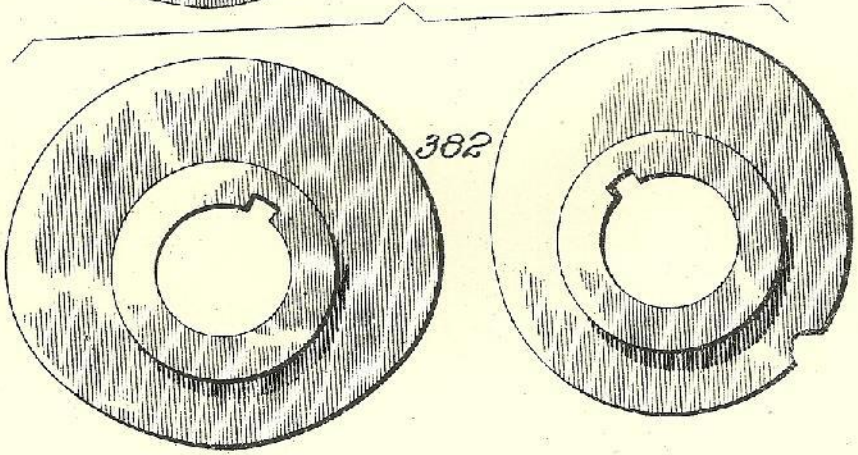


Fig. 120

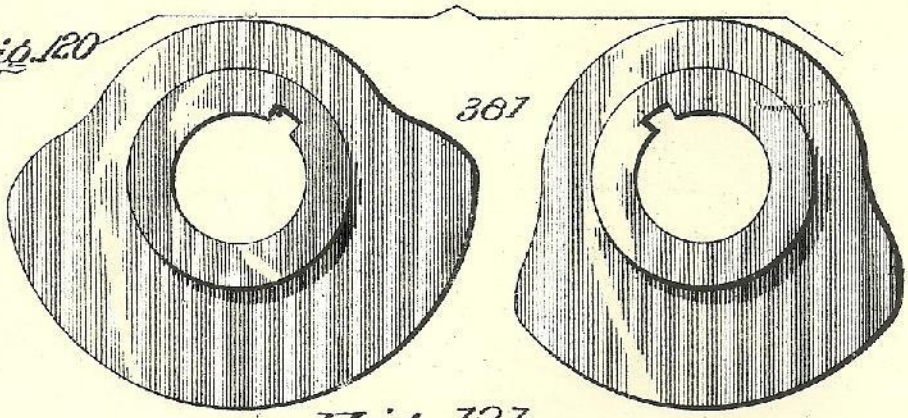


Fig. 121.

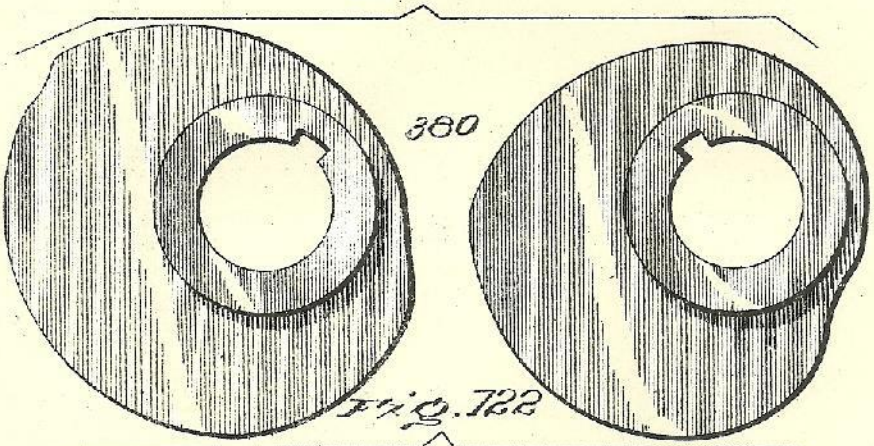
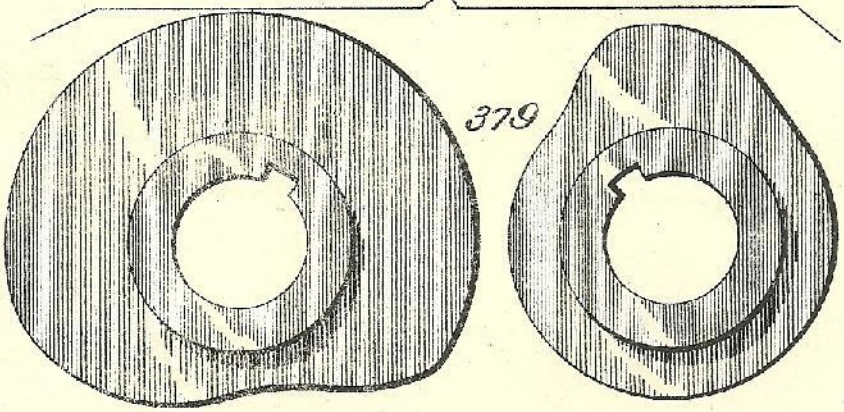


Fig. 122



[This Drawing is a reproduction of the Original on a reduced scale.]

Malby & Sons, Photo-Litho.