(No Model.)

5 Sheets—Sheet 1.

O. MERGENTHALER.

MACHINE FOR CASTING STEREOTYPES.

No. 347,818. Patented Aug. 24, 1886.

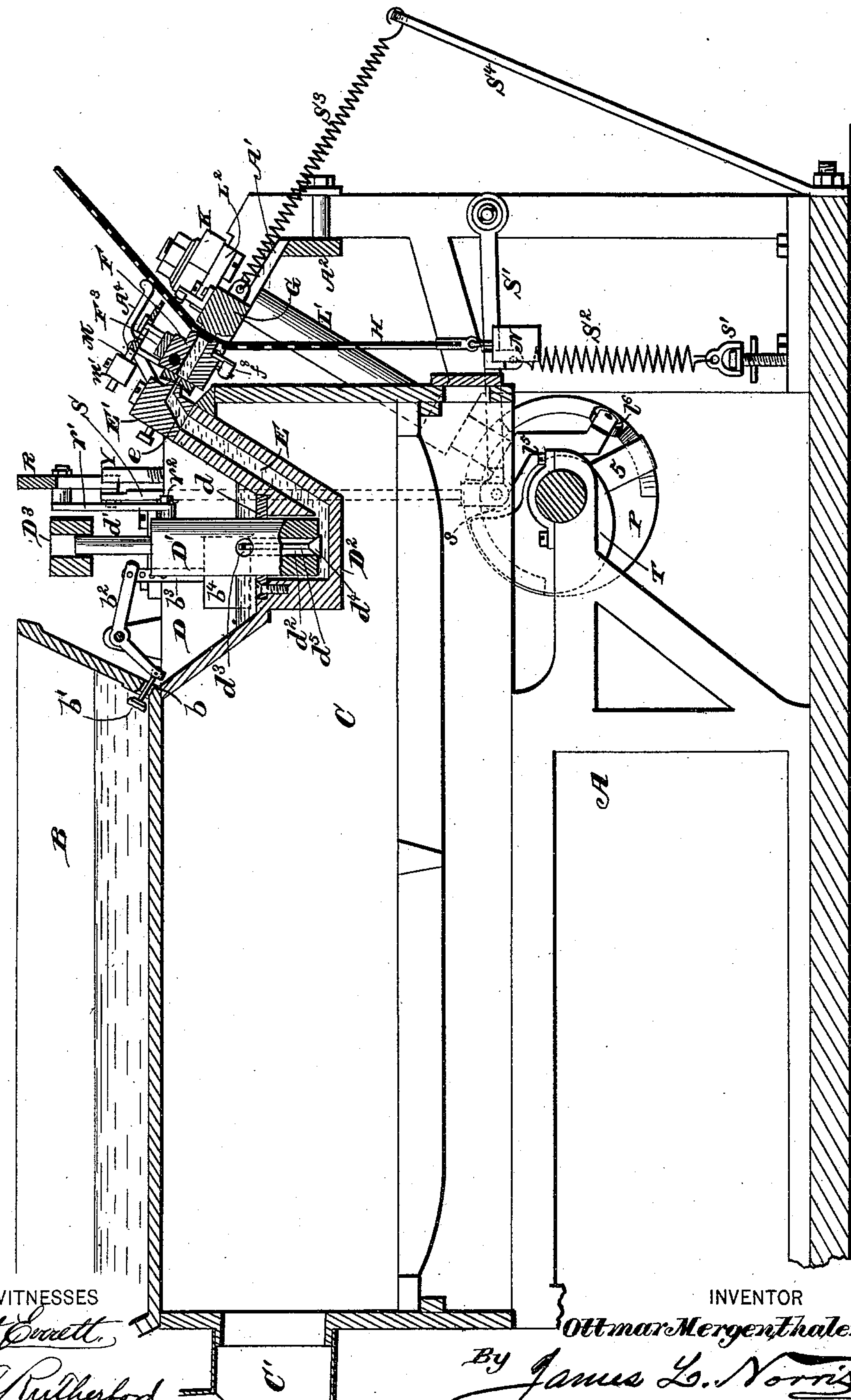

Fig. 1.

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(No Model.) 5 Sheets—Sheet 2.

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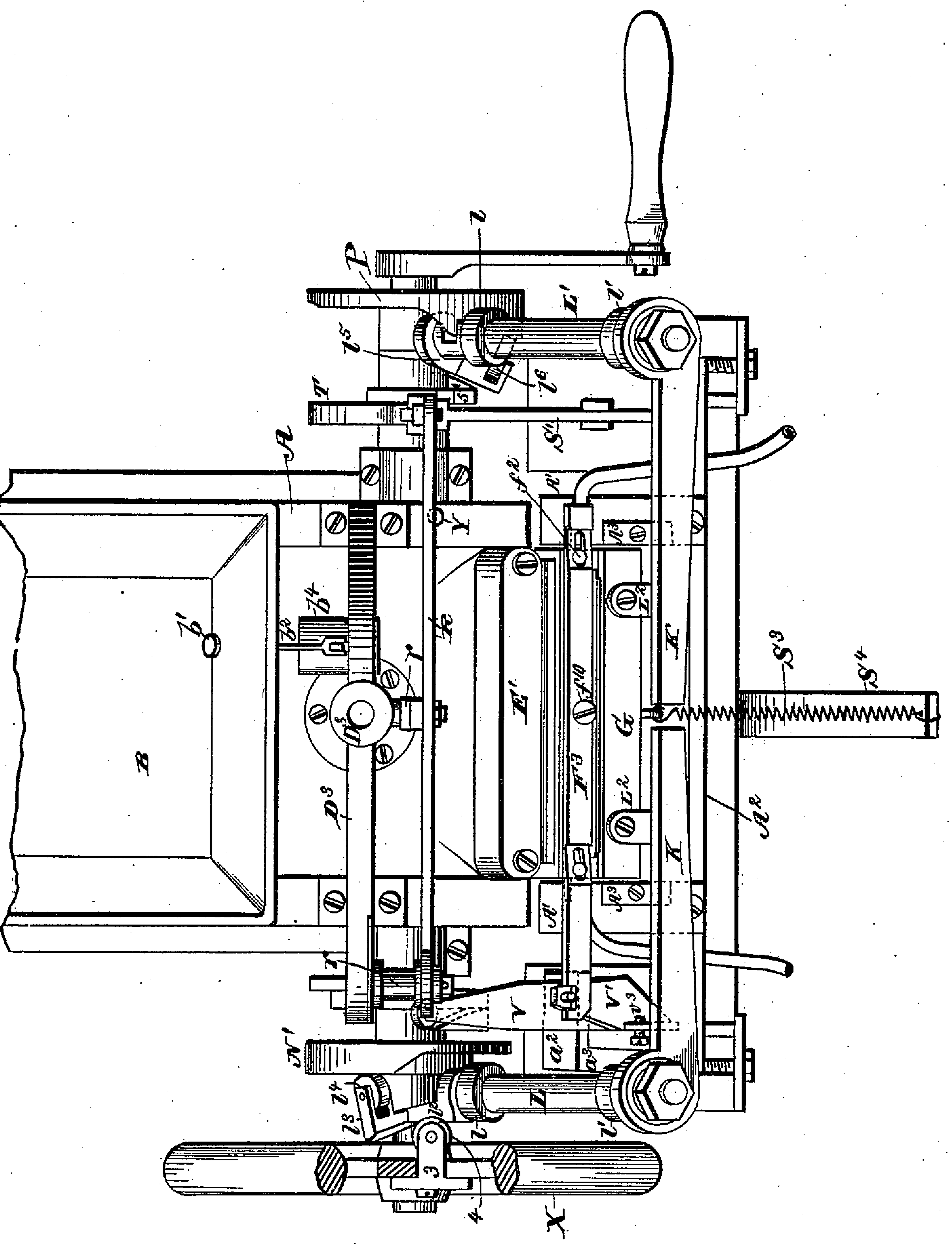
Fig. 2.



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O. MERGENTHALER.

MACHINE FOR CASTING STEREOTYPES.

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Fig. 3.

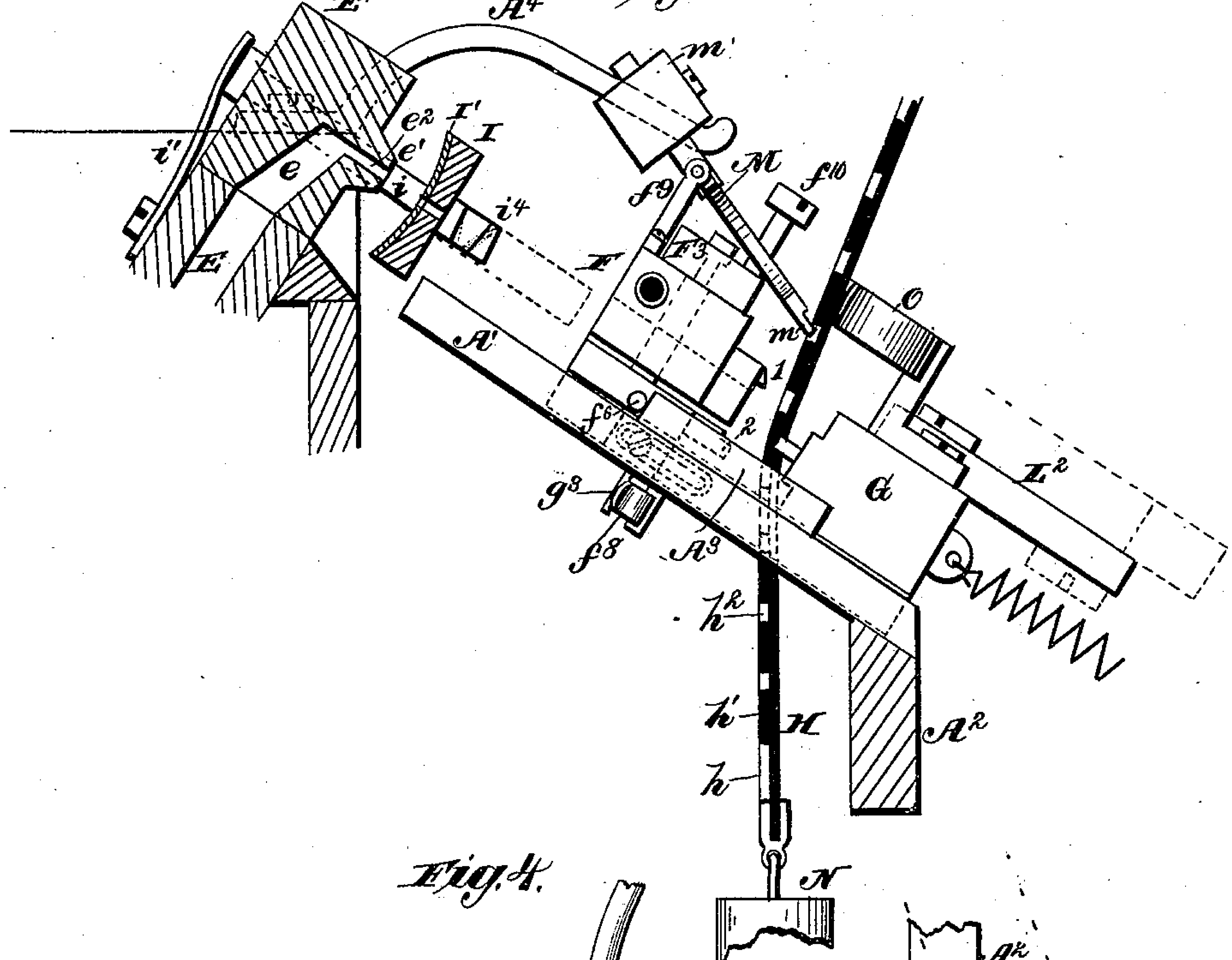
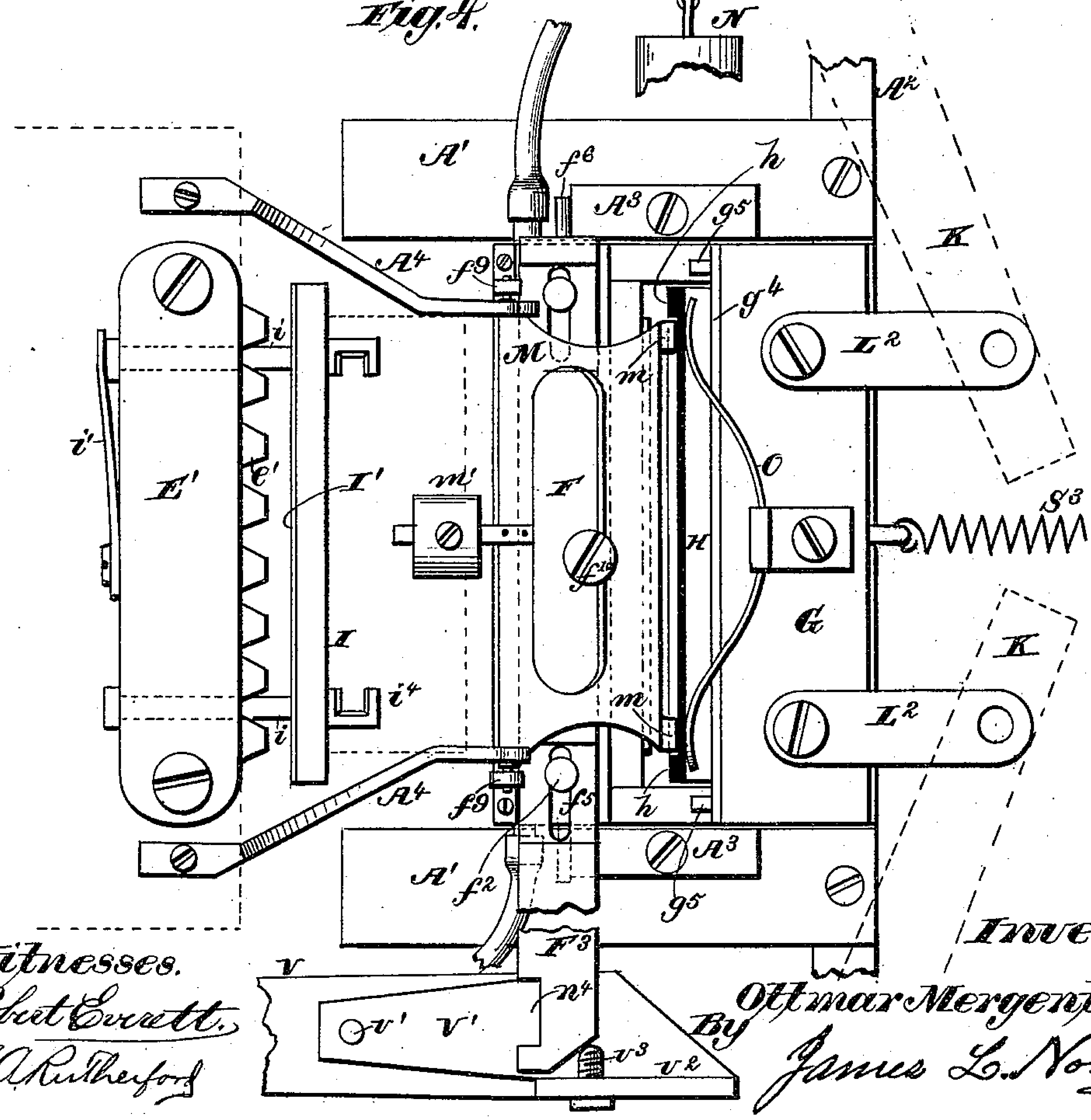


Fig. 4.



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O. MERGENTHALER.

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Fig. 5.

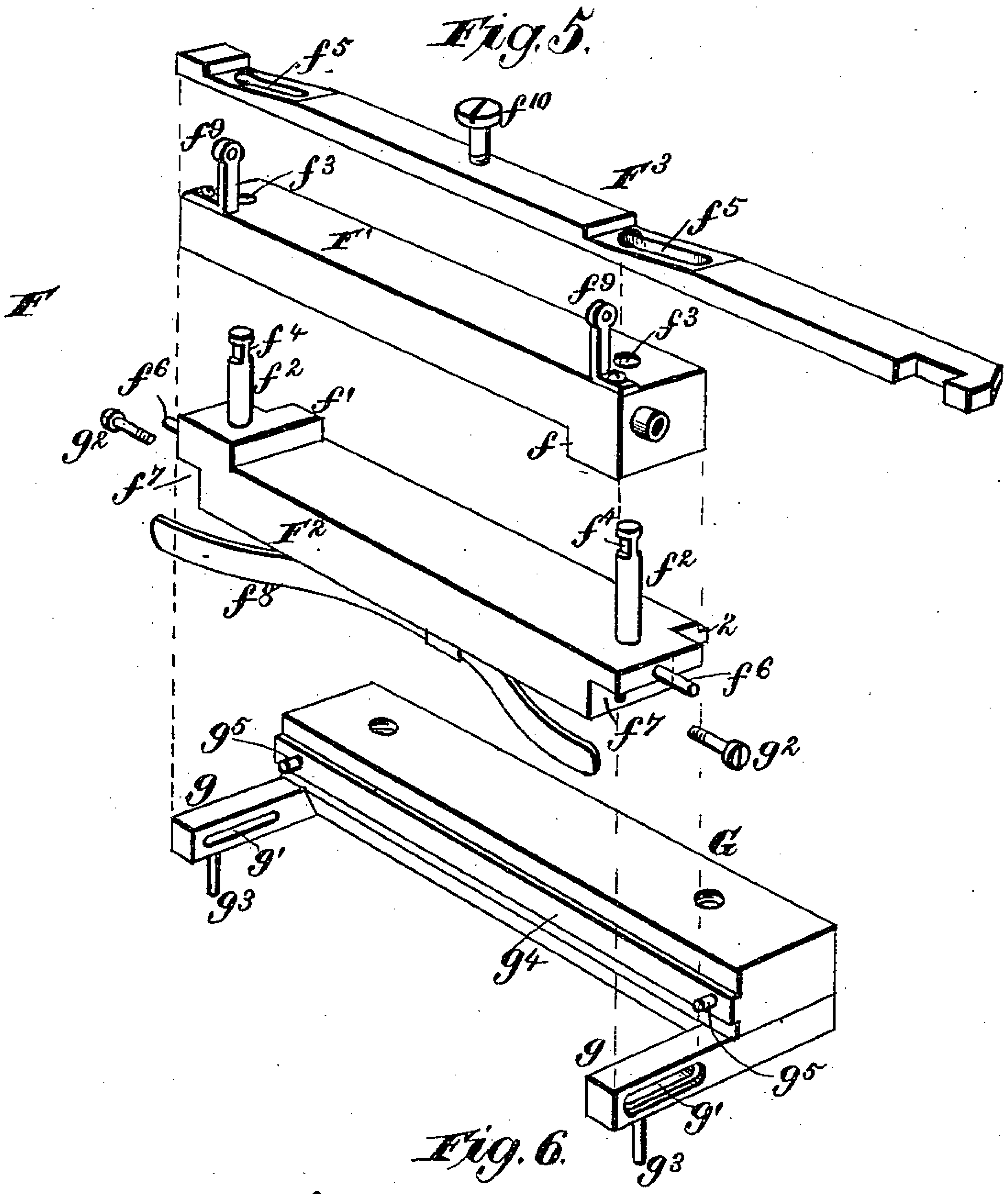

Fig. 6.

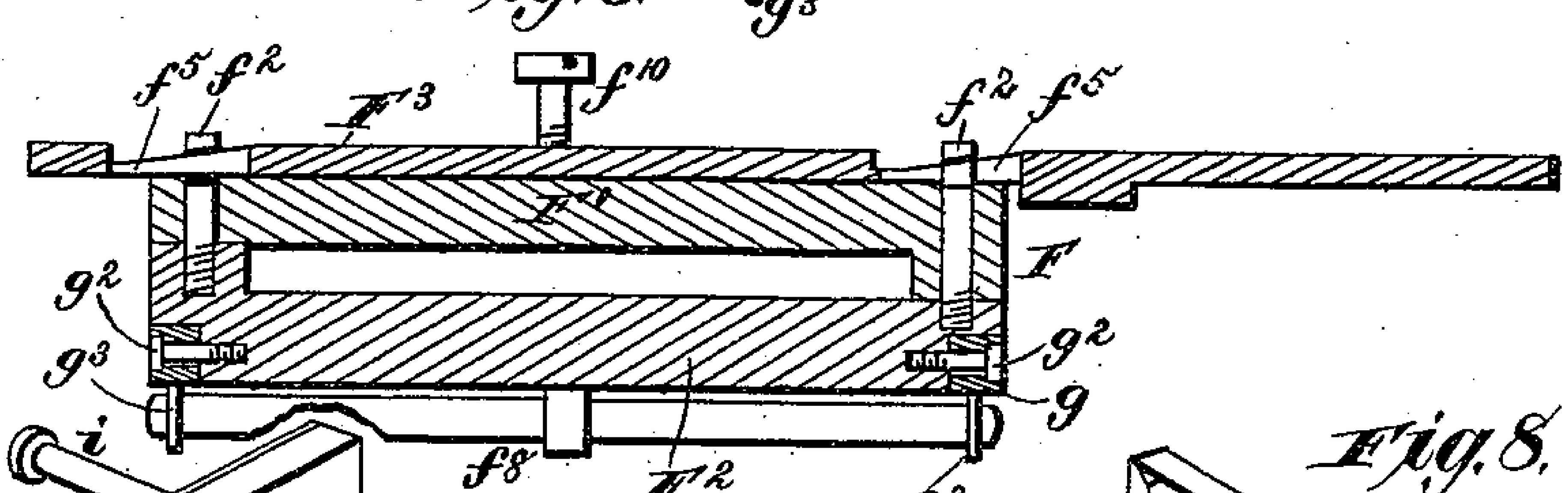

Fig. 7.

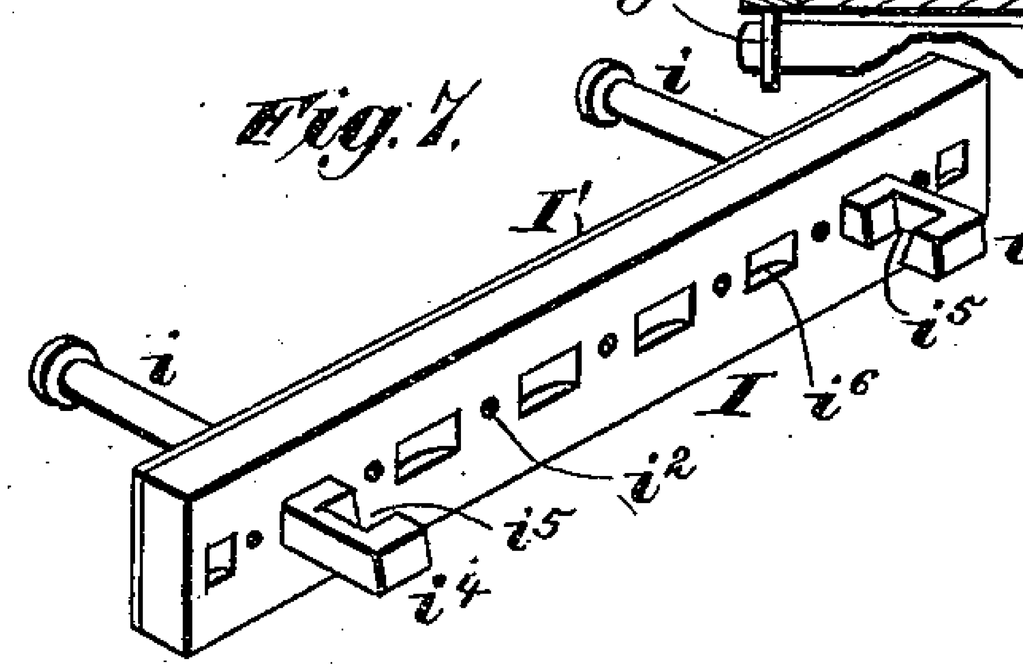

Fig. 8.

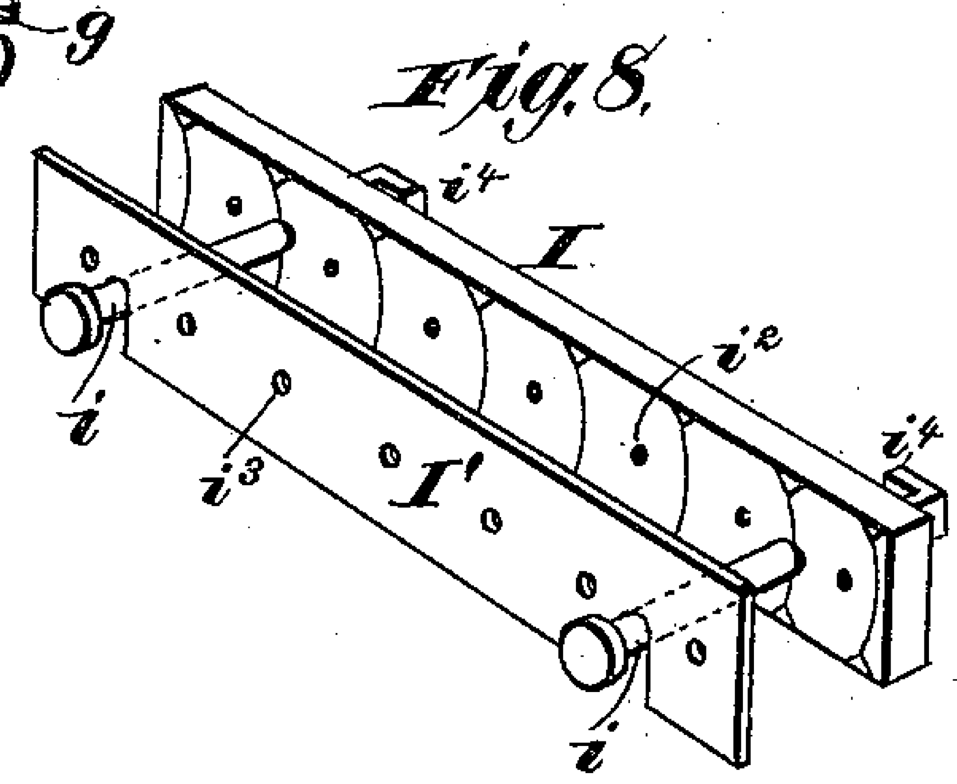

Fig. 9

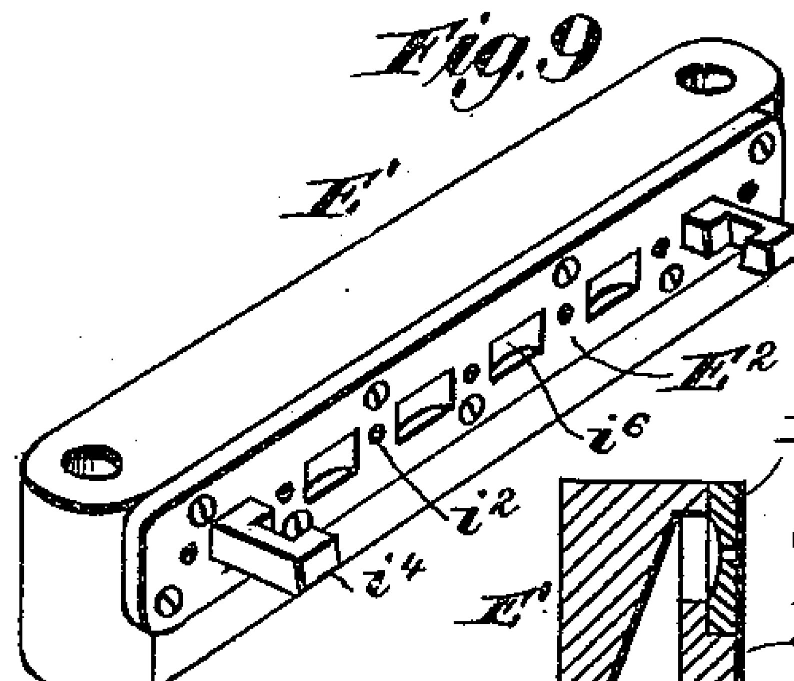

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Fig. 10.

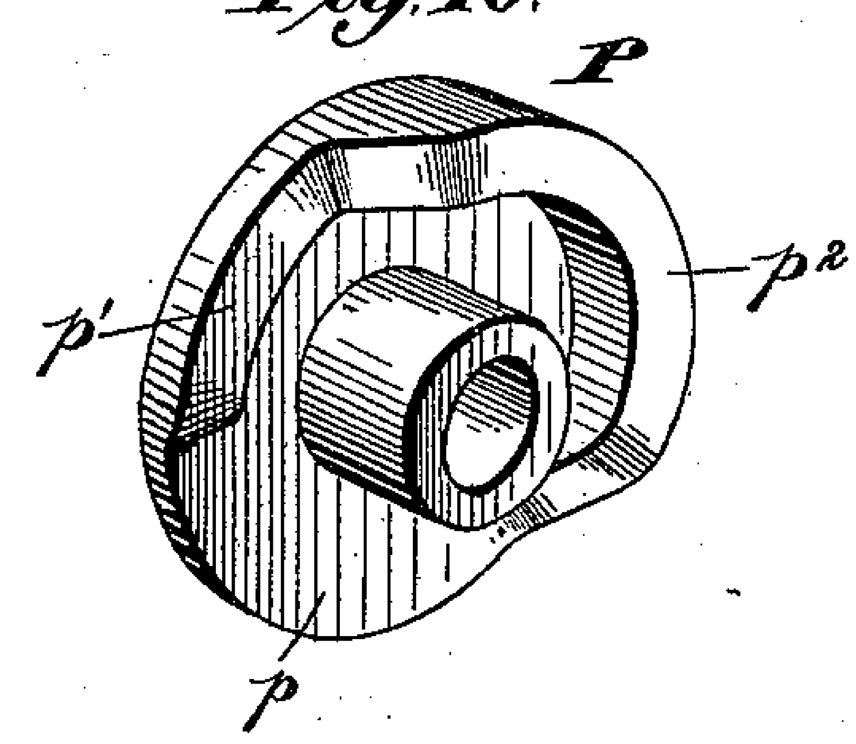


Fig. 11.

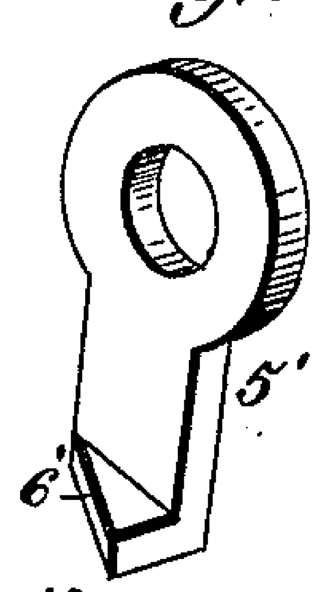


Fig. 12.

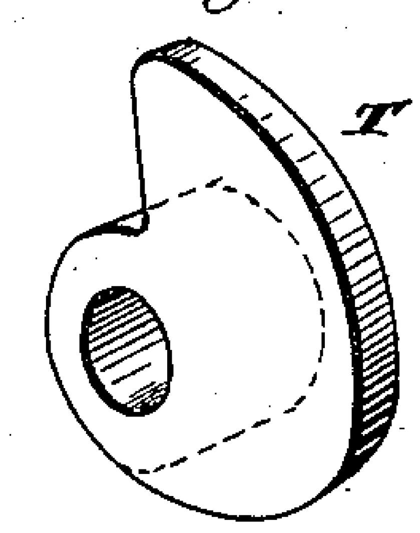


Fig. 13.

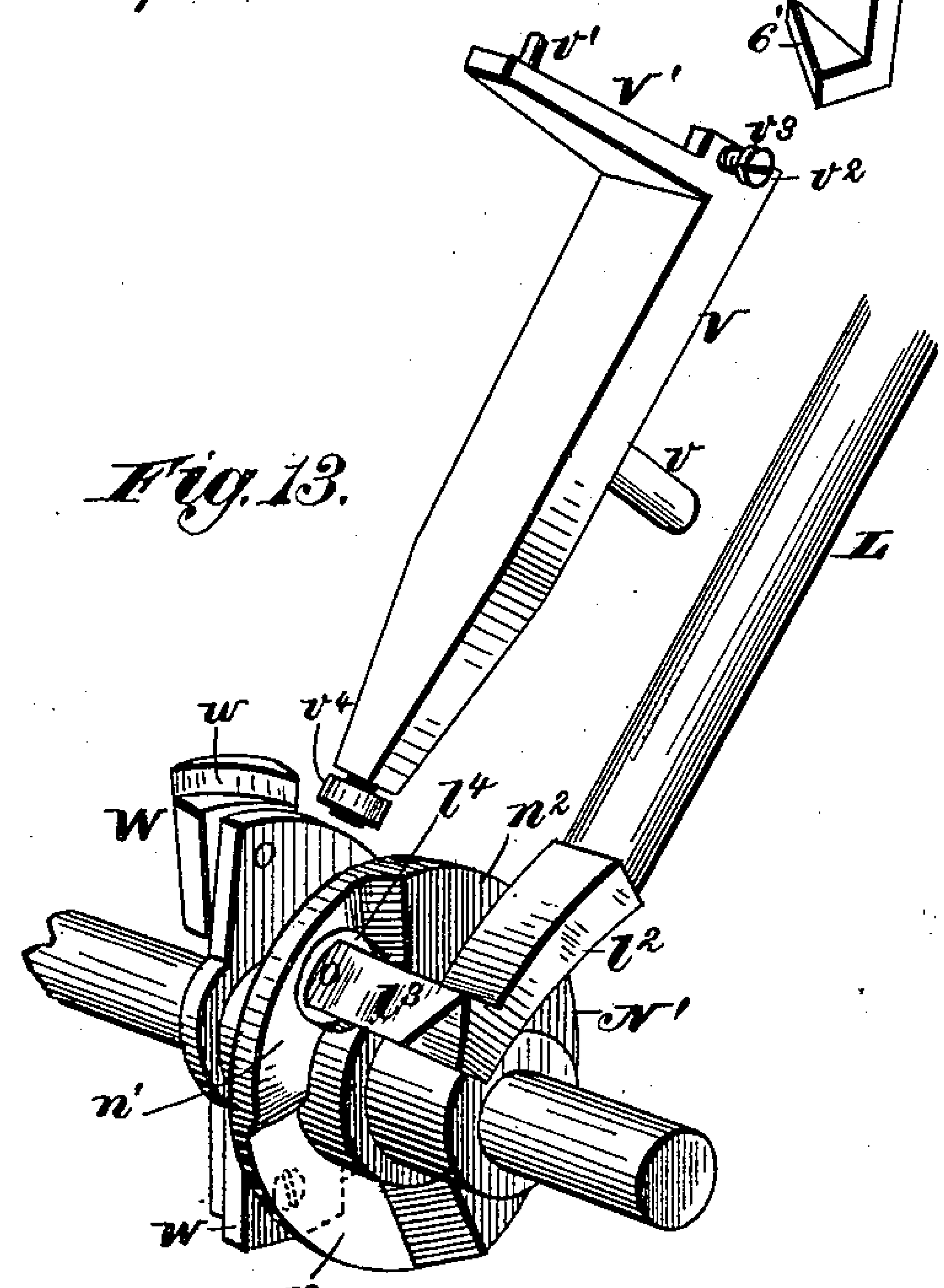
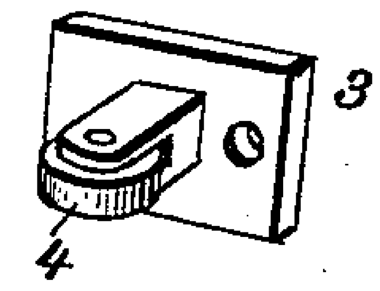


Fig. 14.



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UNITED STATES PATENT OFFICE.

OTTMAR MERGENTHALER, OF BALTIMORE, MARYLAND, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE NATIONAL TYPOGRAPHIC COMPANY, OF WASHINGTON, DISTRICT OF COLUMBIA.

MACHINE FOR CASTING STEREOTYPES.

SPECIFICATION forming part of Letters Patent No. 347,818, dated August 24, 1886.

Application filed June 16, 1883. Serial No. 98,269. (No model.)

To all whom it may concern:

Be it known that I, OTTMAR MERGENTHALER, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented new and useful Improvements in Machines for Casting Stereotypes, of which the following is a specification.

My invention comprises mechanism which relates in natural order to the subject-matter of applications for Letters Patent of the United States filed by me upon the 15th day of March, A. D. 1883.

The general object of my former inventions being to produce the matrix for a stereotype-mold by successive type-impressions upon a strip of plastic material in intaglio, my present invention has for its object, first, to provide automatic mechanism for casting separate single-line stereotypes so constructed that they may be locked up in a chase and used upon a press, like so many sticks of type; second, to provide an automatically-separable mold having its bottom closed by the matrix and adapted to move toward discharge spouts or nozzles to receive the cast, and to open and separate therefrom to discharge the molded stereotype-block; third, to combine with an automatically opening and closing mold mechanism for locking its separable parts in position to receive the flow, and for unlocking the same to permit the removal of the casting; fourth, to combine with a reciprocating mold a plate closing its upper side intermediate between it and the discharge-openings for the molten metal, and having orifices registering with said openings, through which the metal may enter the mold, said plate being automatically separated from the mold and from the discharge-nozzles between each flow; fifth, to provide said intermediate plate with devices for holding and withdrawing the casting from the mold as the latter opens and recedes and for sustaining said casting when wholly removed; sixth, to combine with an automatic mechanism a separable mold, a matrix closing the bottom of said mold, devices for reciprocating it toward and from discharge-nozzles communicating with a well of melted type-metal, and apparatus for forcing said metal at stated intervals into the mold; seventh, to combine with a well containing melted type-metal and having discharge-nozzles through which it is forced into the mold devices for automatically supplying said well with molten metal from a reservoir, and controlling the supply in such a manner as to constantly retain the same quantity of metal in the well; eighth, to combine with a reciprocating and and separable mold a matrix composed of a series of strips containing type-impressions, and mechanism for advancing the matrix between each flow, bringing the impressed strips successively into the bottom of the mold, and devices for locking the separable parts and advancing the mold to receive the flow of melted metal; ninth, to provide a mold for casting single-line stereotypes, having a separable plate closing its upper side, provided with orifices for the admission of the melted metal and intermediate recesses of exactly equal depth for forming a true bottom to the stereotype block or casting; tenth, to combine with the reciprocating mold and the discharge-nozzles an intermediate plate having orifices registering with said nozzles and provided with a separable protecting-plate of mica or similar material; eleventh, to provide positive mechanism whereby the operation of the devices for retracting the mold and discharging the casting therefrom is rendered certain; twelfth, to combine with a well containing melted type-metal and having a discharge-channel leading to the mold a plunger having an automatic valve, which opens to admit metal to a plunger-chamber communicating with the discharge-openings and mechanism for operating said plunger at stated intervals to force the melted metal through the discharge-channel into the mold; thirteenth, to provide an automatic apparatus in which melted stereotype metal is forced at stated intervals into a reciprocating separable mold, and having devices which advance said mold to the discharge-nozzles, locking its parts together to receive the flow of metal, and which open the mold and withdraw it, the casting being removed during the latter operation; fourteenth, to produce by automatic mechanism a series of stereotypes or stereotype-blocks, each representing a single line of justified type, and having supporting-lugs formed upon their bottoms during the operation of casting, and affording a true support for each block when placed upon the imposing stone.

To these ends my invention consists, essentially, in the several mechanical combinations and in the novel features of construction hereinafter described, and shown in the drawings forming part of this application, in which—

Figure 1 is a central vertical section taken longitudinally through the machine, illustrating the general arrangement and relation of the essential parts. Fig. 2 is a plan view of the front end of the machine shown in Fig. 1. Fig. 3 is a vertical section enlarged, showing a portion of the apparatus illustrated in Fig. 1, consisting of the discharge-nozzles, the separable mold, the intermediate plate with devices for withdrawing and sustaining the casting, and the matrix with its feeding mechanism. Fig. 4 is a top view of the parts shown in Fig. 3. Fig. 5 is a detail perspective of the parts composing the separable mold with the bar for locking said parts together, the several members being separated for purposes of illustration. Fig. 6 is a vertical longitudinal section of the parts shown in Fig. 5, assembled. Fig. 7 is a detail perspective showing the plate intermediate between the mold and the discharge-nozzles, with its devices for withdrawing and sustaining the casting. Fig. 8 is a detail perspective of the same part, taken from the opposite side of the plate and showing the separable protecting-plate. Fig. 9 is a perspective and transverse section showing a modified form of construction of the plate illustrated in Figs. 7 and 8. Fig. 10 is a perspective view of one of the actuating-cams upon the main shaft of the machine detached. Fig. 11 is a detail perspective of a cam-arm rigidly mounted upon the main shaft for insuring the action of mechanism which withdraws or retracts the mold. Fig. 12 is a detail perspective of a cam which actuates the plunger for forcing the melted metal into the mold. Fig. 13 is a detail perspective showing one of the cams which actuate the rock-shafts by which the mold is reciprocated, the shaft engaging with said cam, the elbow-lever for unlocking the mold and its actuating-cam. Fig. 14 is a detail perspective showing the friction-wheel mounted upon the fly-wheel, and bearing upon the angular extremity of the rock-shaft to insure its engagement with the cam in withdrawing or retracting the mold.

The purpose of the present invention is to produce stereotypes from matrices formed by a typographic machine, thereby avoiding the large expense for fonts of different type and the labor of the compositor, which are required by the methods heretofore in use. To this end I have shown and described in my former applications mechanism for producing upon a plastic surface successive type-impressions, having a proper arrangement and spacing and formed in a single line or narrow strip, which may be divided afterward into any number of lines of equal length, and which I propose to mount upon a pliable foundation in any suitable manner, with a suitable interval between the adjacent strips, the latter being adapted to serve as matrices for a stereotype-mold, with which they are caused to engage in the order of their arrangement. In this manner I produce a separate stereotype of the type-impressions in each separate strip, or, in other words, of each line of justified matter, said stereotype being in the form of a solid block, which is type high when locked in a chase, and having such dimensions that any desired number of them may be arranged in consecutive order, and when in form used upon a press in the usual manner.

The present application is confined to the mechanism for casting these single line stereotype-blocks.

A in the said drawings indicates the framework of the machine, in which the operative parts are supported. In the upper portion of this frame is arranged a reservoir, B, containing stereotype metal in a molten condition, the heat necessary to produce fusion be obtained from a furnace, C, beneath said reservoir, having a flue, C′, for the escape of the products of combustion, and provided with inclosing-walls with suitable doors to give access to the fire-chamber.

In front of the reservoir B is placed a well, D, having its top in the same plane with the bottom of the reservoir, and heated by the same furnace, C. This well is supplied with melted metal from the reservoir through a discharge opening, *b*, which is automatically closed and opened by a plug-valve, *b*′, lying within the reservoir and having its stem projecting through the opening *b*. To the end of this valve stem is connected one arm of a bell-crank lever, b^2, pivoted to a bearing upon the frame, and having its other end connected by a link-rod, b^3, to a float, b^4, within the well D. As melted metal is discharged from the reservoir into the well, this float is lifted, raising the arm of the bell-crank to which it is attached, and drawing down the opposite arm, whereby the valve *b*′ is seated in the discharge-opening and further escape of metal is arrested. By these devices the melted metal in the well D is constantly retained at the same depth. The quantity of metal contained in said well may be varied by means of the pivotal adjustment of the link-rod upon the arm of the bell-crank b^2. The upper end of said link is provided with several equidistant perforations, whereby the float may be set higher or lower with relation to the lever b^2, thereby allowing the metal to rise to a higher level in the well before the valve is closed in the reservoir B.

Within the well D is placed a plunger, D′, packed through a metallic diaphragm, *d*, in the bottom of the well, by which the latter is separated from a plunger-chamber, D^2, below it. The plunger, which is reciprocated vertically in said chamber, has a guide-rod, *d*′, moving in a guide-yoke. D^3, and is provided with a central channel, d^2, extending upward from its bottom to a point above the diaphragm d, where it opens into a transverse channel, d^3, which pierces the wall of the plunger. A valve, d^4, closes against the lower open end of the channel d^2, and has a stem. d^5, traversing said channel with a pin inserted in its end and entering the transverse channel d^3. As the plunger D′ rises in the chamber D^2, molten metal from the well D flows through the channels d^2 and d^3 into the plunger-chamber, the valve d^4 dropping until it hangs by the cross-pin in its stem from the channel d^3. When the plunger moves downward, however, the pressure of the metal in the chamber closes said valve, and prevents the metal from being forced back through the channels by which it has entered.

E indicates a channeled septum, forming the front inclined wall of the well D, and having its inner passage communicating with the lower part of the plunger-chamber D^2. This channeled wall, like the remaining parts of the well, may be constructed of cast-iron; but at its upper edge is attached a cap, E′, of some metal which is a good conductor of heat, such as copper. This cap has an oblique channel, e, forming a continuation of the channel in the septum E, and leading to discharge-nozzles e', formed upon the front inclined face of the cap E′. The latter, which is secured to the septum E by screws passing through its ends, as shown in Fig. 2, is coextensive with the top of the wall upon which it is mounted, and the discharge-nozzles are arranged upon its face at equal intervals, as illustrated in Fig. 4. Each of these nozzles is pierced by a small central opening, e^2, (see Fig. 3,) through which the melted metal is driven by the descent of the plunger D′.

Upon the forward end of the frame A are placed supports A′, inclined toward the channeled wall E, and forming a right angle therewith. These supports, which extend nearly but not quite to the outer face of the wall E, rest upon a plate, A^2, which is bolted to the end of the frame A, as shown in Fig. 1, and they support the reciprocating mold F, the construction of which will first be described. The separate parts composing this mold are shown in Fig. 5 detached from each other and in Fig. 6 assembled. The mold proper is composed of two halves—an upper, F′, and a lower half, F^2. Its ends are formed by an offset or shoulder, f, formed upon one end of the upper half, and a corresponding offset, f', formed upon the opposite end of the lower half, F^2. Upon the latter portion are placed two studs, f^2 f^2—one at each end—which engage with apertures f^3 f^3 in the upper half. These studs are arranged one upon the offset f' upon the lower half and the other in position to enter the aperture formed in the offset f upon the upper half. They are thus removed beyond the end walls of the mold, and the upper half, which is placed thereon, is guided and held in proper position relatively to the lower half, F^2. The studs f^2 project above the top of the part F′, as seen in Fig. 6, and near their ends notches f^4 are cut upon opposite sides of each stud, and running longitudinally with the mold. The upper edge of each notch is slightly inclined downward, and a bar, F^3, is placed upon the upper half of the mold, having slots f^5 f^5, enlarged at one end, as shown in Fig. 5, which receive the notched ends of the studs, the opposite edges of each slot lying within the opposite notches in each stud. The lower face of the bar F^3 lies flat upon the part F′, its upper surface being throughout a space coextensive with each slot f^5 slightly inclined by cutting the metal away, as shown in Figs. 5 and 6. This inclination corresponds with the inclination of the upper edges of the notches f^4 in the studs. It will be seen that by moving the bar F^3 longitudinally the upper and lower parts of the mold may be locked firmly together, or by movement in the opposite direction may be released in such manner as to allow them to separate slightly, for a purpose hereinafter set forth. The length of the mold-sections F′ and F^2 is a very little less than the distance between the inner edges of the inclined supports A′ A′, and they are supported upon the latter by pins or studs f^6 f^6, projecting laterally from the ends of the lower half, F^2, and resting upon said support, as seen in Figs. 3 and 4. It will be seen that when the two sections are placed together, as in Fig. 6, they form the side and end walls of a rectangular mold, the top and bottom thereof being entirely open.

In front of the mold F is arranged a matrix-supporting block, G, having a length equal to the length of the mold-sections and of about the thickness of both. It is connected with the lower mold section, F^2, by means of arms or bars g g, formed upon its ends parallel with each other and with the end walls of the mold. These bars, which are square, lie in rectangular recesses f^7 f^7, formed in the ends of the lower mold-section, F^2, and at the lower angles thereof. Each bar g is provided with a longitudinal slot, g', which receives a pin, g^2, having a threaded end engaging with a threaded perforation in the recessed end of the part F^2. The slots g' are reamed upon the outer faces of the bars g, to permit the heads of the pins to lie flush therewith.

Upon the lower faces of the bars g, a short distance from their extremities, are placed downwardly-projecting pins g^3 g^3, which have bearing upon the extremities of a leaf-spring, f^8, centrally attached to the lower surface of the mold-section F^2, and which normally tends to draw the matrix-block G toward the open bottom of the mold. Upon that face of the block G which is adjacent to the mold F is formed a longitudinal portion or strip, g^4, projecting from the face of the block, having a width equal to the distance between the side walls of the mold, and so located that if the block G were moved against the mold said projecting portion would close its open bottom without entering between the side walls. Near each end of said strip is placed a pin, g^5, projecting forward, by which the movement of the matrix block toward the mold is limited.

Upon each inclined support A′ is placed a bracket or lug, A^3, which limits the movement of the mold F as it recedes from the discharge-nozzles by the pins f^6 upon the lower mold-section coming in contact with the ends of the brackets. The matrix block G is, however, permitted a still further movement, and being drawn downward between the inclined supports A′ it is separated from the mold against the tension of the spring f^8, until the parts are in the relative position shown in Fig. 3. The purpose of this separation is to permit the advance of the matrix which is suspended between the matrix-block G and the open bottom of the mold.

H indicates the said matrix, which is formed in the following manner: Upon a sheet of heavy card-board or other suitable material are glued or otherwise fastened border-strips $h\ h$, having a thickness equal to that of the separate strips of which the matrix is composed. Between these strips, which are arranged longitudinally, are placed transversely the several plastic strips, h', which have received the proper type-impressions in the manner set forth in the other applications filed by me heretofore. These strips are fastened to the board in any suitable manner, a proper and regular interval, h^2, being left between them. The impressed strips h' are each a little larger than the distance between the end walls of the mold, and a little wider than the thickness of the latter; but the type impressions upon said strip are wholly confined to the space represented by the open bottom of the mold. The matrix thus formed is suspended between the matrix-block G and the mold F, resting against the projecting strip g^4 and between the pins g^5. When first introduced, the lower strip is placed opposite the mold, the matrix being fed downward, by devices hereinafter described, in such manner that said strips h' may be caused to engage with and close the bottom of the mold in the manner following: Upon the rear face of the upper and lower sections of the mold are formed lips 1 2, respectively, having a length equal to that of the strips h', and separated from each other, when the mold is closed, by a distance equal to the width of the strip. These lips are adapted to enter the intervals between said strips as they are arranged upon the card-board, and as the matrix is carried toward the mold, and as the latter closes, they guide the strip which lies between them into such position that it closes the bottom of the mold and places the impressed or indented portion in position to form the matrix when the cast is made.

Between the mold F and the discharge-nozzles e' is placed a cooling-plate, I, mounted upon carriers $i\ i$, which slide in the head or cap E′, allowing the plate to approach and recede from the discharge openings, the latter movement being caused by a spring, i', bearing against one or both of the carriers i. The plate I, which is shown in detail in Figs. 7 and 8, is formed of steel, with orifices i^2 registering with the openings in the discharge-nozzles e', and its rear face is cupped or concaved slightly around each opening. Adjacent to this face is placed a separable plate, I′, of mica, or similar material capable of resisting great heat, said plate having openings i^3, corresponding with those in the plate I. The latter covers the top of the mold when it is in position for the cast, and the metal passes from the discharge-nozzles through it into the mold.

Upon the front face of the plate I, and between its ends, are formed two projecting lugs, $i^4\ i^4$, each having a notch, i^5, cut in its inner edge, the sides of said notch diverging upward. Each lug is of the same thickness as the casting to be formed in the mold, and when the latter is in position to receive the melted metal said lugs project within the top of the mold, and the casting is formed around and in the notches of the lugs. The purpose of these features is that as the mold is withdrawn after the cast the notched lugs will withdraw the casting from the mold and will sustain it, as shown in dotted lines in Fig. 3, whence it may be removed by simply turning the lower edge of the bar upward until it is disengaged from the notches i^5. These notches are tapered in such manner and to such extent that the casting of soft metal may be disengaged by the turning or tipping motion, notwithstanding the fact that its upper edge is seated in the recesses i^6, hereinafter referred to.

Referring to Fig. 7, it will be seen that upon the face of the plate I, and between the discharge-orifices i^2, are formed recesses i^6, having their curved side in the longitudinal line of the plate, and being of exactly equal depth throughout the series. The purpose of this construction is to give a true support to each single-line stereotype-block, for the reason that, as melted metal is forced into the mold F through the orifices i^2, it has been found that the casting will have formed upon its bottom opposite each discharge-nozzle either slightly-concaved depressions with a projecting fin of metal surrounding each, or teats of unequal length. In trimming off these projections not only is much time and labor expended, but the trimming-tool may cut away the metal of the block, and thereby produce an uneven bearing-surface, which, when placed upon the imposing-stone, will not give a true type surface. As these recesses i^6 are located between the said orifices, and as they form lugs upon the bottom of each casting of exactly equal height, no trimming of the block is necessary, as each will, when placed upon the imposing-stone, support the stereotype-face type-high and in position to be locked in the chase.

By interposing between the discharge-nozzles e' and the mold F the intermediate plate, I, with its separable protecting-plate I', both being automatically separated from the discharge-nozzles and from the mold, I am able to retain said plate at such a temperature as to avoid its injury by overheating, since between each cast the mold is withdrawn and the intermediate plate, I, is separated from it, as well as from the discharge nozzles, thereby allowing a certain interval during which the plate may cool to a certain degree.

The matrix-block G is reciprocated toward and from the discharge-nozzles e' upon the inclined supports A' by arms K, which are mounted upon the ends of rock-shafts L and L'. Each of these arms (shown in Fig. 2, and in dotted lines in Fig. 4) is connected by a link, L^2, with an end of the matrix-block G, both arms having, by the rocking of their shafts L and L', radial movement, whereby said block G is carried up upon the inclined supports A', and then, by the return movement of said arms, retracted.

I will first describe the arrangement of parts whereby the matrix H is advanced at stated intervals, bringing the transverse strips h' successively into engagement with the bottom of the mold, and will then proceed to describe the mechanism whereby the parts hereinbefore mentioned are actuated. Referring to Figs. 1, 3, 4, and 5, it will be seen that upon the upper mold-section, F', I attach standards f^9, one upon each end of said section, and having each an eye in its end, in which is journaled a weighted suspending-plate, M, provided at each end with nibs m, which may enter the space between the strips h'. This plate is overbalanced by a weight, m', placed behind the pivot-bearings f^9 of said plate, said weight being adapted, when the plate is not otherwise acted upon, to tilt the latter device upward until its movement is arrested by the head of a set-screw, f^{10}, centrally mounted upon the locking-bar F^3, as shown in Fig. 1. The matrix H has a weight, N, attached to its lower end, and when the nibs m of the plate M engage with the matrix the plate is drawn or tilted downward until it rests upon the locking-bar F^3, as shown in Fig. 3. In this position its nibs support the matrix H in such manner that one of its strips h' is directly in front of the bottom of the mold F. Upon the sides of the frame A are two forwardly-projecting arms, A^4 A^4, having their extremities carried toward the front some distance beyond the farthest point to which the nibs of the plate M are carried when the mold is moved up to receive the cast. Behind the matrix, and centrally mounted upon the matrix-block G, is a spring, O, having its ends extending laterally and bearing against the back of the matrix-board. By reference to Figs. 1 and 3 it will be seen that as the matrix-block G and mold F are moved forward toward the discharge-nozzles e' the matrix will be carried with the block G until that portion above said block strikes against the immovable arms A^3. When this takes place, the plate H will bend backward, as shown in Fig. 1, and will be thereby withdrawn from the nibs m of the supporting-plate. The moment this takes place the weight m' tilts the plate M upward until its motion is arrested by the head of the set-screw f^{10}. In this position the nibs of the plate are in place to engage with the interval h^2 next ensuing, and as the matrix-block G recedes the spring O will throw the matrix H forward until said engagement is effected. The simplicity of this arrangement depends upon the fact that as the matrix-block G moves toward the bottom of the mold F the latter remains stationary until the lips 1 and 2 upon the upper and lower mold-sections have made their engagement with the two intervals h^2 upon each side of the strip which is to close the bottom of the mold. After this engagement is perfected the parts move onward until the arms A^4 push the matrix out of engagement with the supporting-plate M, and allow the latter to to tilt upward, in readiness for its next engagement with the said matrix. As the latter is, during this disengagement, held between the matrix-block and the lipped mold, the support of the plate is not required. As the parts recede and the plate again comes into engagement with the plate M, the matrix-block separates from the mold F, by reason of the pins f^6 upon the lower mold-section coming into contact with the ends of the brackets A^3. This releases the matrix H from the lips of the mold-section, whereupon the weight N, attached to the lower end of the matrix, draws it downward until its supporting-plate M strikes the top of the locking-bar F^3, when, its movement being arrested, it sustains the matrix in position to close the bottom of the mold with the next succeeding strip h'. In this manner, as will be seen, after each cast the matrix is automatically advanced a single step, and thereby placed in position to be brought into engagement with the mold for the succeeding cast.

Having thus shown the construction of the two-part mold, the matrix with its feeding devices and support, and the apparatus for supplying melted type-metal to the mold at stated intervals, I will briefly describe the operation of these united parts without regard to any special actuating mechanism, which will be described hereinafter. Referring to Fig. 3, it will be seen that the mold F has opened and receded from the discharge-nozzles e', the casting being withdrawn and sustained by the notched lugs i^4 i^4, as shown in dotted lines. The open mold having been arrested in its retrograde movement by its pins f^6 coming in contact with the lugs A^3, the matrix-block G has receded from the mold, releasing the matrix H from its engagement with the lips 1 and 2, and allowing it to drop a single step, when its motion is arrested by the supporting-plate M, striking the locking-bar F^3. The casting having been removed from the notched lugs i^4, the operation of the parts begins with the advance of the matrix-block G, carrying the matrix H toward the bottom of the mold, the spring O behind it being compressed by the thrust of the supporting-plate M, thereby bending the matrix over backward and giving prominence to the strip which is to engage with the mold. The mold-sections F′ and F² during this movement are motionless, being held to await the approach of the matrix by the leaf-spring f^8, which bears against the pins g^3 upon the slotted bars g. As the matrix reaches the bottom of the mold, and just before the strip h' closes said bottom, the lips 1 and 2 engage with the intervals h^2 above and below the strip and guide it into its true position. An instant later the strip is brought against the bottom of the mold by the pressure of the supporting-strip g^4 upon the matrix block, and at the moment this engagement is made the locking-bar F³ is actuated, the two parts of the mold are forced tightly together, and simultaneously therewith the said mold begins to move upon the inclined supports A′ toward the discharge-nozzles. Just before reaching and engaging with them the matrix H is brought into contact with the arms A⁴, by which its upper part is bent still farther back against the tension of the spring O, the nibs m of the plate M are withdrawn, and the side plate tilts upward until arrested by the head of the screw f^{10}. Just previous to this the top of the mold has reached the intermediate plate, I, the notched lugs i^4 having entered the top of the mold, and by a short movement farther the plate is brought against the nozzles e' and is held against them with sufficient pressure to make a close joint. At this moment the plunger D′, which has in the meantime been raised, admitting metal to the plunger-chamber D², descends, driving the melted metal from said chamber through the channeled septum E, the copper head E′, and through the discharge-nozzles e' and the pierced plate I, into the mold F. As the molten metal enters with force, it is projected in jets against the matrix h' throughout its length, forming a cast of type-impressions and the body of the stereotype-block, and depositing the fused type-metal upon the matrix-strip simultaneously at each point. The stroke of the plunger is adjusted to such a length that its descent will completely fill the mold. The moment the cast is made the locking-bar F³ is thrown outward, releasing the mold-sections and allowing them to separate to permit the withdrawal of the casting as the mold recedes. As this retrograde movement begins, the intermediate plate, I, accompanies the mold a short distance and then stops, the carriers i i being arrested by the head or cap E′. The mold continuing to move, the matrix leaves the arms A⁴, and is by the spring O thrown forward into engagement with the nibs of the plate M. The casting is drawn from the mold, and as the supporting-pins f^6 of the latter reach the brackets A³ its movement is arrested. The matrix-block G separates from the bottom of the mold and is carried into the position shown in Fig. 3, and as the separation is effected the matrix H, being released from the lips 1 and 2, is carried down by the weight N until its motion is arrested by the plate M, in the manner already described.

I will now proceed to describe the mechanism by which the plunger D′ is operated, as well as that which advances and retracts the matrix-block G and the mold F and locks and unlocks the separable sections of the latter. Referring to Figs. 1, 2, 3, and 4, L² L² represent link-bars pivoted near the ends of the matrix-block G and to lever-arms K K, mounted upon the ends of rock-shafts L L′, one upon each side of the machine, said shafts being each supported by an upper and a lower bearing, l and l', respectively. These shafts are rocked simultaneously in their bearings, and in opposite directions, to throw the lever-arms K radially outward and inward, as indicated in dotted lines in Fig. 4. The construction of the operating devices of each shaft being somewhat different, they will be described separately. Upon the lower end of the rock-shaft L is formed an arm, l^2, (shown in detail in Fig. 13.) at an angle with the axis of the shaft, and having an inwardly-projecting end, l^3, in which is journaled a friction-roll, l^4. This roll has bearing upon a disk, N′, upon the main shaft, the face of said disk being divided into the several cam-surfaces n, n', and n^2, having such relation to each other that when the roll rests upon the surface n the arm K will be thrown outward in the position indicated in Fig. 4, whereas when the roll rests upon the surface n^2 the arm K will be turned inward, as shown in Fig. 2. The purpose of the intermediate cam-surface, n', will be explained shortly. The rock-shaft L′ upon the opposite side is operated by an angular arm, l^5, also provided with a friction-roll, l^6, which bears upon a disk P, (see Fig. 10,) having cam-surfaces p p' p^2, corresponding with those upon the disk N′. This disk P is shown in Fig. 10. It will be seen from Fig. 2 that the arm l^5, instead of being carried upward and backward, like the arm l^2, is extended forward and downward, and for this reason the cam-surfaces of the disks N′ and P are both faced in the same direction or toward the same end of the main shaft, and are so arranged or timed with relation to each other as to give an exactly simultaneous action to each shaft L and L′. The main shaft which carries the disks N′ and P, being rotated, the rolls l^4 and l^6 ride from the surfaces n and p, respectively, upon the surfaces n' and p', where they remain while the shaft revolves a part of a revolution, represented by the length of said surfaces as compared with the entire circumference traversed by said rolls. This causes a partial revolution of the shafts L and L′, by which the lever-arms K are swung inward far enough to advance the matrix-block G up to the bottom of the mold and bring the strip h' against it, causing the lips 1 and 2 to engage with the intervals h^2, as already described. During the time the rolls l^4 and l^6 are riding over the cam-surfaces named the shafts L L′ and their arms K remain motionless, and during this interval the locking-bar F^3 is actuated by mechanism presently to be described, and the two parts of the mold are thereby locked together with the matrix-strip, closing the bottom of the mold. The shaft having now revolved until the rolls l^4 l^6 reach the cam surfaces n^2 and p^2, the lever-arms K K are thrown in by one continuous movement, pushing the matrix-block G, which carries the mold F, before it up the inclined supports A′, until the parts are in the position shown in Figs. 1 and 2, when the mold and the intermediate plate, I, are in close engagement with each other and with the discharge-nozzles e', in readiness to receive the cast. During the time required for the operation last named the rolls l^4 l^6 are traversing the cam-surfaces n^2 p^2, holding the mold, as well as the matrix-supporting block G steadily in position until the process is completed. The plunger D′, by which the metal is forced into the mold while the parts are in the position last described, is actuated by a lever-bar, R, pivoted at one end to a horizontal bearing, r, upon the frame, and having a central connecting-rod, r', pivoted to the lever and to a stud, r^2, upon the plunger. To the other end of said lever R is pivotally connected a pitman, S, (shown in dotted lines in Fig. 1,) provided with a friction-roll, s, at its lower end, and pivoted to one end of a connecting-link, S′, the other end of the latter being pivoted to the frame A. The link S′ is normally drawn down by a powerful spring, S^2, having a turn-buckle, s', or similar device, by which its tension may be adjusted. The roll s rides upon a cam, T, upon the main shaft. (Shown in detail in Fig. 12, and in dotted lines in Fig. 1.) This cam raises the lever-bar R slowly, thereby lifting the plunger D′, as the shafts L and L′ are advancing the mold F toward the discharge-nozzles. When these parts are together, the roll s rides off the cam T, when the plunger is thrown downward by the tension of the spring S^2. In order to assist in the retrograde movement of matrix-block G, a spring, S^3, is attached to central lug upon said block and to a post, S^4, in front of it. This spring is stretched by the advance of the block toward the nozzles e', and exerts a constant tension, whereby the receding movement is rendered more certain and accurate. It should be noticed, also, that when this retrograde motion begins the mold F is drawn away from the nozzles e' by the pins g^3 g^3 upon the bars g g, projecting from the matrix-block and engaging with the spring f^8, carried by the lower mold-section, F^2. As I have already described, when the rolls l^4 and l^6 have reached the cam-surfaces n' and p', the matrix being thereby brought against the open bottom of the mold, the two sections of the latter are then locked together. This is effected by the following mechanism: The locking-bar F^3 projects over the inclined support toward the rock-shaft L, and has in its edge a square notch, n^4. Upon the inclined face a^2 of a bracket, a^3, upon the frame A is pivotally mounted a plate, V, by a pin, v, which enters a perforation in the bracket. (See Fig. 13.) Upon the upper end of the plate V is formed an arm, V′, at about a right angle with the plate, carrying a pin, v', projecting from its upper surface and provided with a lug, v^2, projecting from the outer longitudinal edge of the arm V′, and above its surface. A set-screw, v^3, passes through this lug and has its end projecting inwardly therefrom. The surface a^2 of the bracket a^3 is inclined at such an angle that the surface of the arm V′ lies in a plane parallel with that of the locking-bar F^3, and a very little below the latter. Upon the lower extremity of the plate V is mounted a friction-roll, v^4, and the plate is oscillated at intervals upon its pivot-bearing v by a cam, W, set upon the main shaft behind the cam N′, and having a lateral cam-surface, w, by which the lower end of the plate V is thrown outward, and a reverse cam-surface upon the opposite side of the cam disk or segment, by which it is returned to its former position or thrown inward. As the matrix is moved up to close the mold, the set-screw v^3, carried by the lug v^2, lies opposite and abutting against the end of the locking-plate F^3. At this moment the cam-surface w engages with the roll v^4 upon the end of the arm V, throwing it out toward the rock-shaft L, and consequently swinging the upper end inward. The set screw v^3, striking the end of the locking-plate F^3, drives it toward the opposite side of the machine, thereby causing it to lock the two mold-sections together, in the manner already described. As already intimated, these parts are timed in their operation so that the locking of the mold is accomplished while the rolls l^4 and l^6 of the rock-shafts L and L′ are riding upon the cam-surfaces n' and p', respectively. This timing is illustrated in Fig. 13, in which the roll l^4 is shown as approaching the end of the cam-surface n', while the roll v^4 of the plate V has just left the cam-surface w, by which the locking-bar F^3 has been actuated. As the roll l^4 rises to the cam-surface n^2, the locked mold is moved up to the discharge-nozzles e', as already described. This movement brings the notch n^4 in the locking-plate into engagement with the pin v' upon the arm V′. The cast being made while these parts are in such engagement, it is necessary to unlock the mold before it is retracted, in order to allow the removal of the casting. This is accomplished by the reverse movement of the plate V, its lower end being thrown inward, away from the shaft L, by means of a lateral cam-surface, w^*, which is the reverse of the cam-surface w, and which is indicated in dotted lines in Fig. 2 as just about to engage with the roll v^4. By this cam the upper end of the plate V, with its arm V′, is thrown outward, and the pin v' being in engagement with the notch n^4 of the locking-bar F^3 the latter is drawn outward with it, and the mold is thereby unlocked, this operation being effected an instant before the rolls l^4 t^4 leave the cam surfaces n^2 p^2, and therefore before the retrograde movement of the mold begins. The spring S^3, attached to the matrix-block, serves to draw the latter back and to keep the rolls l^4 l^6 upon the rock shaft arms in engagement with the cam surfaces, upon which they ride throughout the revolution of the shaft. In order, however, to insure the retraction of the matrix-block and mold should any obstruction be met which cannot be overcome by the tensile force of the spring, I employ the following devices: Upon the fly wheel X, which revolves outside the rock-shaft L, is mounted a bracket, 3, in which is journaled a roll, 4, (see Fig. 14,) projecting inwardly and having its shaft at right angles to the main shaft. The roll 4 is so arranged that it will be brought by the revolution of the fly-wheel into the position shown in Fig. 2 just as the roll l^4 is about to leave the cam-surface n^2 and return to the surface n. At the instant that it leaves the part n^2 the roll 4 abuts against the angular arm l^2 upon the end of the rock-shaft L, and in riding over the outer face of said arm forces the roll down from the cam-surface n^2, and causes the shaft L to rock in its bearings. This shaft L', which has its arm carried over the inner face of the cam-disk, is operated by a somewhat different device. A cam arm, 5', (shown in detail in Fig. 11,) is rigidly mounted upon the shaft, and, being provided with a laterally-projecting cam-flange, 6', the latter, as the arm 5' is swept around, is brought against the back of the actuating arm upon the rock-shaft at the instant when the roll l^6 is about to leave the cam surface p^2, and forces the roll down upon the cam-surface p. I thus provide positive mechanism for accomplishing the retraction of the matrix-block and the mold.

The construction hereinbefore set forth may be varied somewhat. For example, the intermediate plate, I, may be dispensed with and a perforated steel plate may be mounted in the copper cap or head E' in place of the discharge-nozzles e'. This modification in construction is shown in Fig. 9, which presents both a perspective and cross-section, in which E' indicates the copper cap, and E^2 the steel plate fastened thereto and provided with the notched lugs i^4 i^4 and the curved recesses i^6. Orifices i^2 are formed in the plate at the points where the discharge-nozzles would have been. This plate closes the top of the mold, like the plate I; but it is not separable from it between the casts, and has no intervening isinglass plate. The upper mold-section, F', may be cooled, if desired, by a current of water carried through it by tubes in the usual manner, as shown in Figs. 4 and 5.

The well in which the plunger operates, as also the plunger-chamber below said well, is heated by the same furnace by which the metal is fused in the main reservoir. The top of the channeled septum E, being removed above the influence of said heating mechanism, is crowned with a cap of some metal—as copper—which is a good conductor of heat, as already described.

Having thus described my invention, what I claim is—

1. A mold consisting of the parts F' F^2, the connecting guides or pins, and a locking-bar, F^3, provided with inclined surfaces, said parts combined for joint operation, as described.

2. As a means of casting separate single-line stereotypes, the combination of a mold open on the side, a bar or clamp, G, opposite the open side of the mold, and an intermediate sheet provided with parallel-line matrices, said sheet mounted between the mold and clamp, and adapted, as described, to be advanced to present its lines successively opposite the mold, whereby separate line bars are cast from a single matrix-sheet.

3. The combination, with a separable mold having its open bottom closed by a movable matrix, of a movable matrix supporting block separably connected with said mold, substantially as described.

4. The combination, with the two-part mold, of a matrix-supporting block connected with the lower mold section by slotted arms, substantially as described.

5. The combination, with the separable mold, of a plate intermediate between the top of said mold and the discharge nozzles, said plate being provided with notched lugs adapted to enter the mold and withdraw and sustain the casting, substantially as described.

6. The combination, with the separable mold, of a plate closing the top of the mold, said plate being provided with openings to admit the molten metal, and with segmental recesses intermediate with said openings, whereby standing lugs are formed upon the bottom of the casting, substantially as described.

7. The combination, with a separable mold, of a matrix-supporting block having a raised strip or rib against which the matrix rests, and pins or studs near each end thereof, whereby the approach of said block to the mold is arrested, substantially as described.

8. The combination, with the two-part separable mold, of pins passing from the lower section up through the upper section, said pins being notched at their upper ends and engaging with a slotted locking-bar having inclined surfaces, whereby said mold is locked and unlocked, substantially as described.

9. The combination, with the two-part separable mold, of a matrix-supporting block arranged below the bottom of said mold, connected with its lower section by means of slotted arms having pins which bear against the ends of a leaf-spring carried by the lower mold-section, whereby said matrix-block is normally drawn into contact with the mold, substantially as described.

10. In an automatic mechanism for casting single-line stereotypes, a plate intermediate between the mold and the discharge-nozzles by which the melted metal is delivered to the

mold, said plate having an intervening filament of mica or equivalent material, substantially as described.

11. The combination, with the separable mold, of a matrix composed of successive strips containing type-impressions, a matrix-supporting block connected with said mold, and feeding mechanism, substantially as described, whereby the matrix is advanced between each cast to bring the said strips successively into engagement with the open bottom of the mold, substantially as described.

12. The combination, with the separable mold, of a matrix-supporting block connected therewith, a matrix intervening between the latter and the mold, and lips formed upon the mold-sections, which are adapted to engage with the intervals between the matrix strips, substantially as described.

13. The combination, with the reciprocating mold and matrix block, of a weighted matrix supported by a weighted plate having nibs engaging with the intervals between the matrix-strips, arms rigid upon the frame for pushing the matrix out of engagement with its supporting-plate as the mold advances, and a spring supporting said matrix from behind and restoring its engagement with said supporting-plate as the mold recedes, substantially as described.

14. The combination, with the two-part mold having lips upon each section, of a matrix-block connected therewith, a spring normally drawing the mold and matrix-block together, a matrix composed of successive type-impressed strips intervening between the two, mechanism for advancing the matrix until it engages with the open bottom of the mold, and devices for locking the mold after said engagement is effected, substantially as described.

15. The combination, with the separable mold, of a matrix-supporting block connected therewith, lever-arms linked to said block, and rock-shafts carrying said arms and actuated by cam-disks upon the main-shaft, which engage with arms upon said rock-shafts, substantially as described.

16. The combination, with the lever-arms reciprocating the matrix-supporting block, of rock-shafts carrying said arms, and cam-disks upon the main shaft, whereby said rock-shafts are actuated, said cam-disks having each three separate cam-surfaces, by which the lever-arms are caused to advance the matrix into engagement with the open mold, hold it while the mold is locked, and finally advance the mold to the discharge-nozzles, substantially as described.

17. The combination, with the two-part separable and reciprocating mold, of a locking-bar having a projecting notched end, an elbow-lever pivoted upon a bracket on the frame and provided with a locking-lug and set-screw, and an unlocking-pin, said lever being oscillated by a cam upon the main shaft, substantially as described.

18. The combination, with the reciprocating two-part mold carrying a locking-bar upon the upper mold-section, said bar having a projecting notched end, of an automatic locking and unlocking lever having an arm lying in a plane parallel with the plane of reciprocation of the mold, and being operated by a double reverse cam upon the main shaft, substantially as described.

19. In an automatic machine for casting stereotypes, the combination, with inclined supports, of a separable mold riding thereon, lugs rigid upon said supports and limiting the retrograde movement of said mold, a matrix-supporting block connected with the lower mold-section, and a spring carried by the latter and bearing against pins upon the former, and mechanism for retracting the matrix-support after the mold has been arrested by said lugs, substantially as described.

20. The combination, with the lower mold-section having notched studs projecting through perforations in the upper mold-section, of a slotted locking-bar lying upon the upper mold-section and engaging with the notches in the said studs, a matrix constructed substantially as described, engaging with the open bottom of the separable mold, and mechanism for actuating the locking-bar after said engagement is effected and before the mold is moved up to the discharge nozzles, substantially as described.

21. The combination, with the well for containing melted type-metal, of a plunger-chamber beneath said well and a channeled septum forming one side of said well and having a cap formed of copper or other metal of good conducting quality, substantially as described.

22. The combination, with the channeled septum forming one of the walls of the metal-well, of a copper cap-piece provided with discharge-nozzles and a perforated plate mounted thereon by pins sliding in said cap and having one or more springs acting upon said pins, substantially as described.

23. The combination, with the upper mold-section, of a weighted plate pivotally mounted thereon, having nibs which engage with the matrix, and a stop adjustable upon the mold and adapted to arrest the upward movement of said plate, substantially as described.

24. The combination, with the plate intermediate between the mold and the discharge-nozzles, of lugs projecting from the face of said plate and having notches formed therein, the sides of said notches diverging upwardly, substantially as described.

25. The combination, with the reciprocating matrix-block, of lever arms linked thereto, rock-shafts actuating said arms, cams upon the main shaft, rocking the shafts upon which said arms are mounted, and a roll journaled in a bracket upon the fly-wheel and brought at each revolution into engagement with the arm upon the end of one of the rock-shafts, substantially as described.

26. The combination, with the separable

mold having notched studs projecting from the lower mold-section up through the upper section, of a slotted locking plate engaging with said studs, a plate pivoted to the main frame and having a set-screw which comes against the end of the locking-plate when the plate is oscillated, said plate having one arm carrying a pin engaging with the notched end of the locking-plate, and a double cam for oscillating the plate in both directions, substantially as described.

27. The combination, with the inclined supports A′, having stop-lugs A^3, of the mold F, having pins f^6, and the matrix-block G, connected with the mold by the slotted bars *g g*, having pins g^3, which engage with a leaf-spring, f^8, carried by the mold, substantially as described.

28. The matrix-block G, having slotted arms *g g*, by which it is connected to the mold, and provided with a longitudinal raised strip, g^4, having pins g^5 g^5 near each end, substantially as described.

29. In combination with the mold F, the movable lugs i^4, provided with notches i^5, and adapted to enter the mold, substantially as described, for the purpose of withdrawing the casting.

30. The combination, with the reciprocating mold and matrix-block, of the rock-shafts L L′, having arms at their lower ends which engage with cams N′ and P, each having three cam-surfaces, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

OTT. MERGENTHALER.

Witnesses:

JAMES L. NORRIS,

J. A. RUTHERFORD.