Aug. 2, 1938. F. C. FROLANDER 2,125,671

TYPOGRAPHICAL COMPOSING MACHINE

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Fig. 1

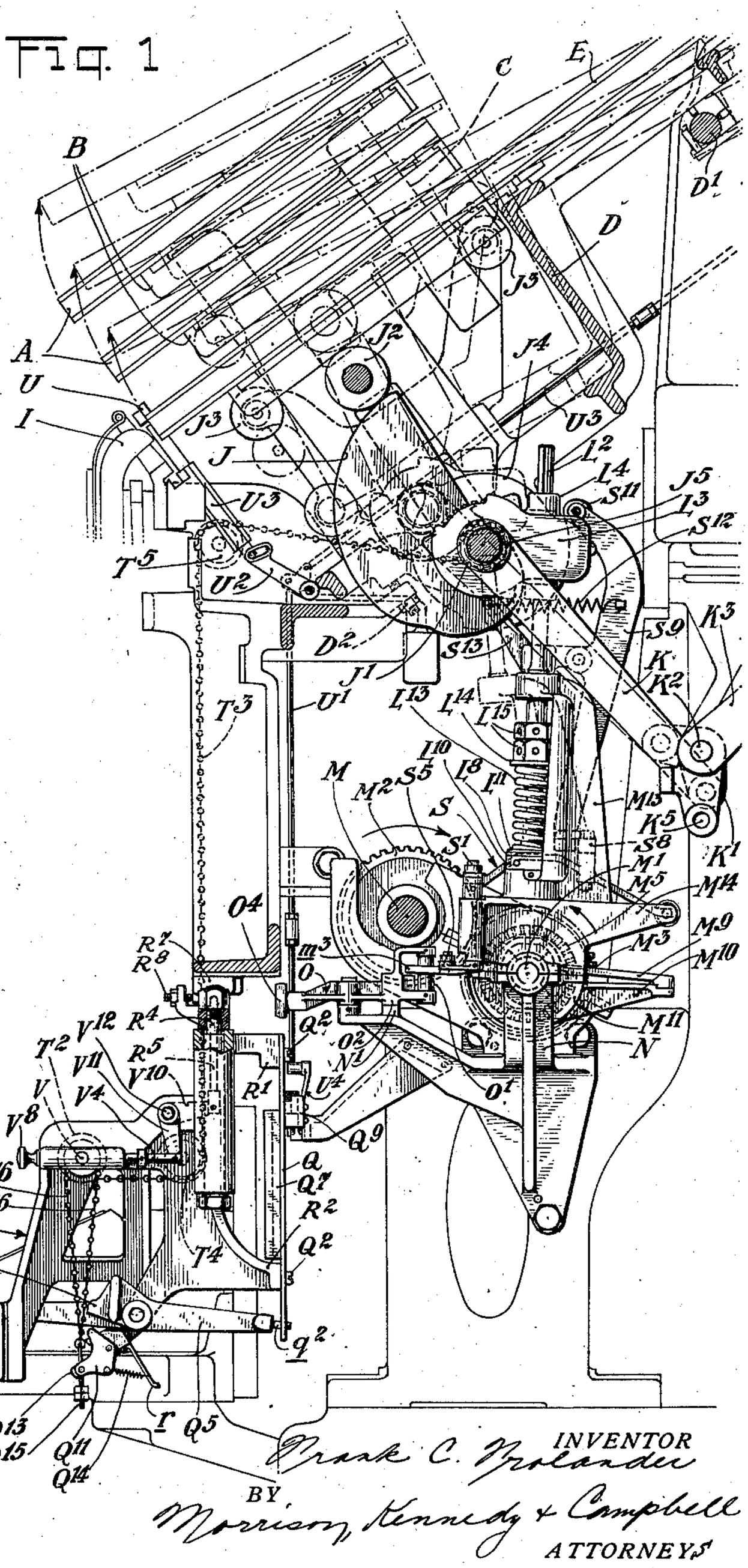


Fig. 1a

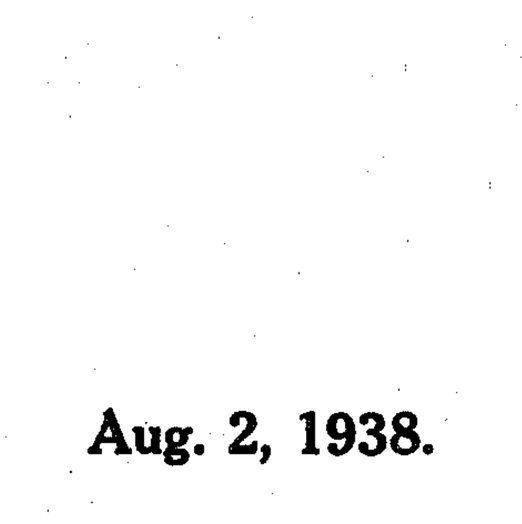


Fig. 1b

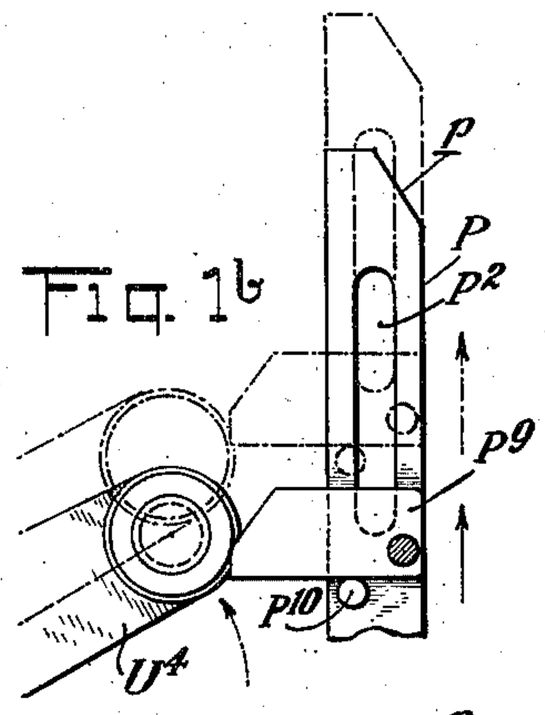
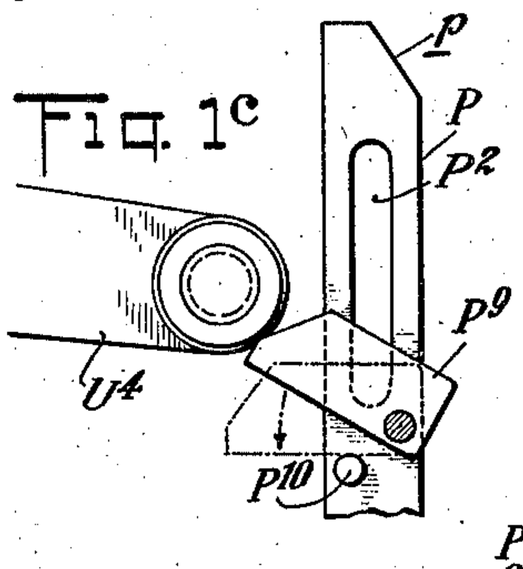


Fig. 1c



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TYPOGRAPHICAL COMPOSING MACHINE

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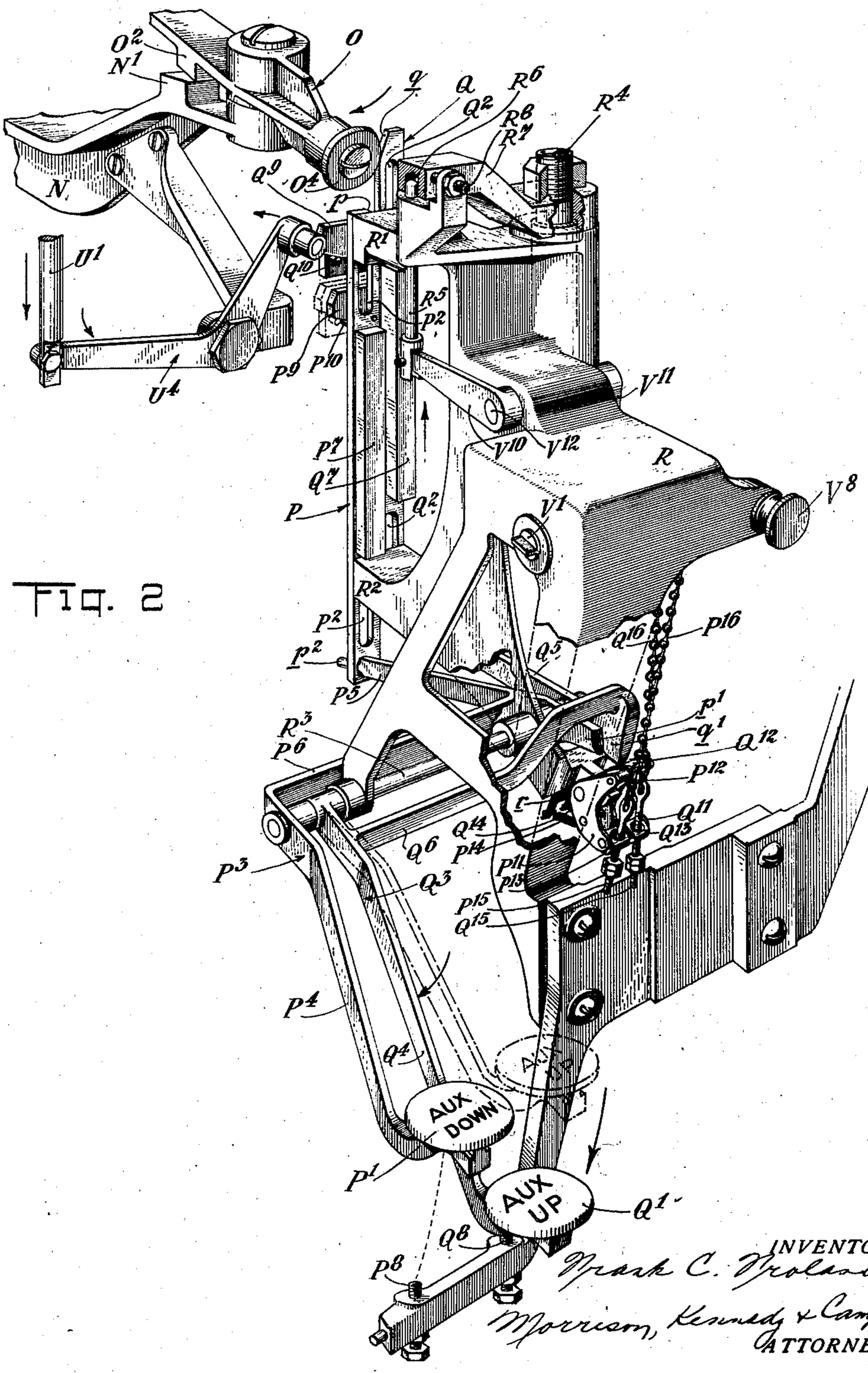

Fig. 2

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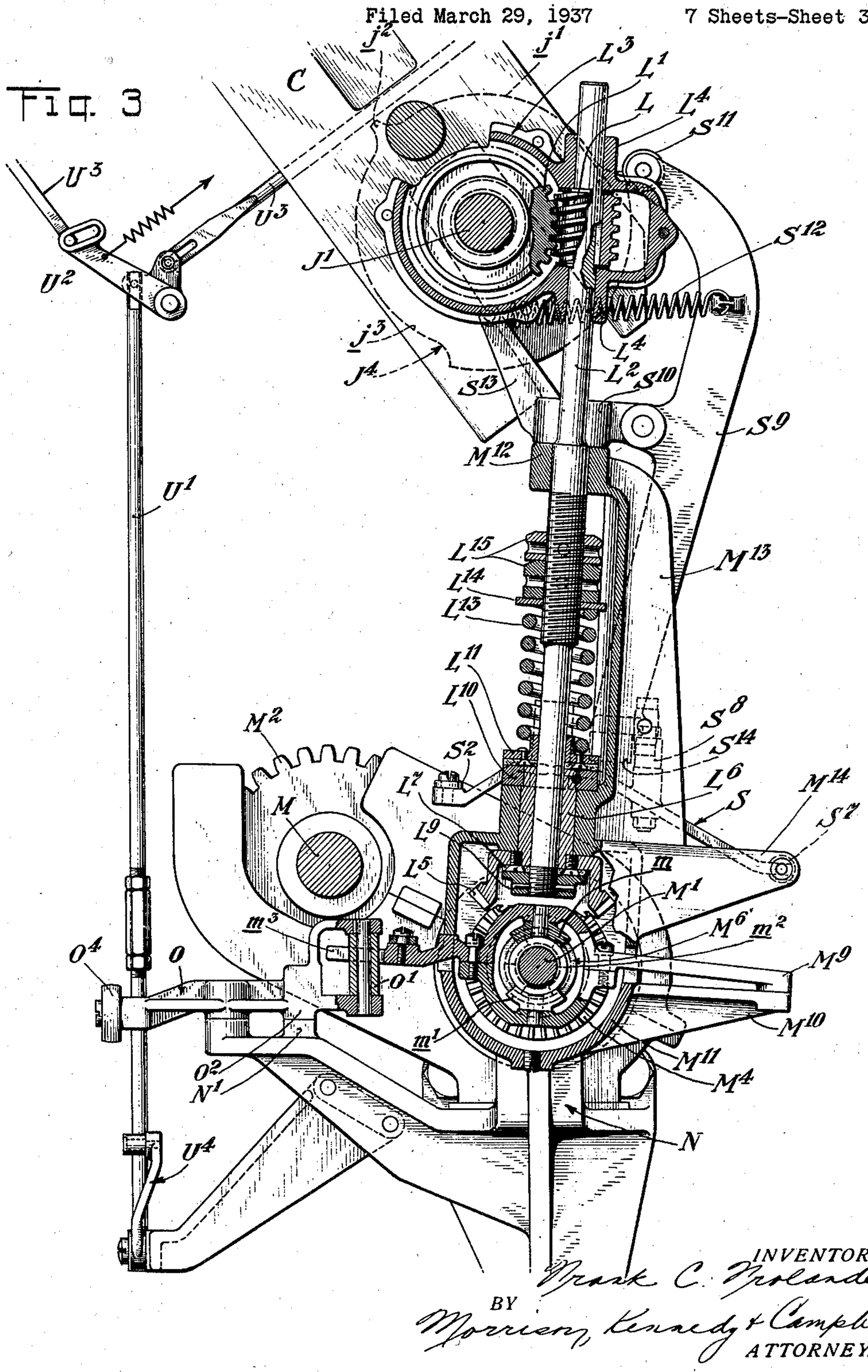
Fig. 3



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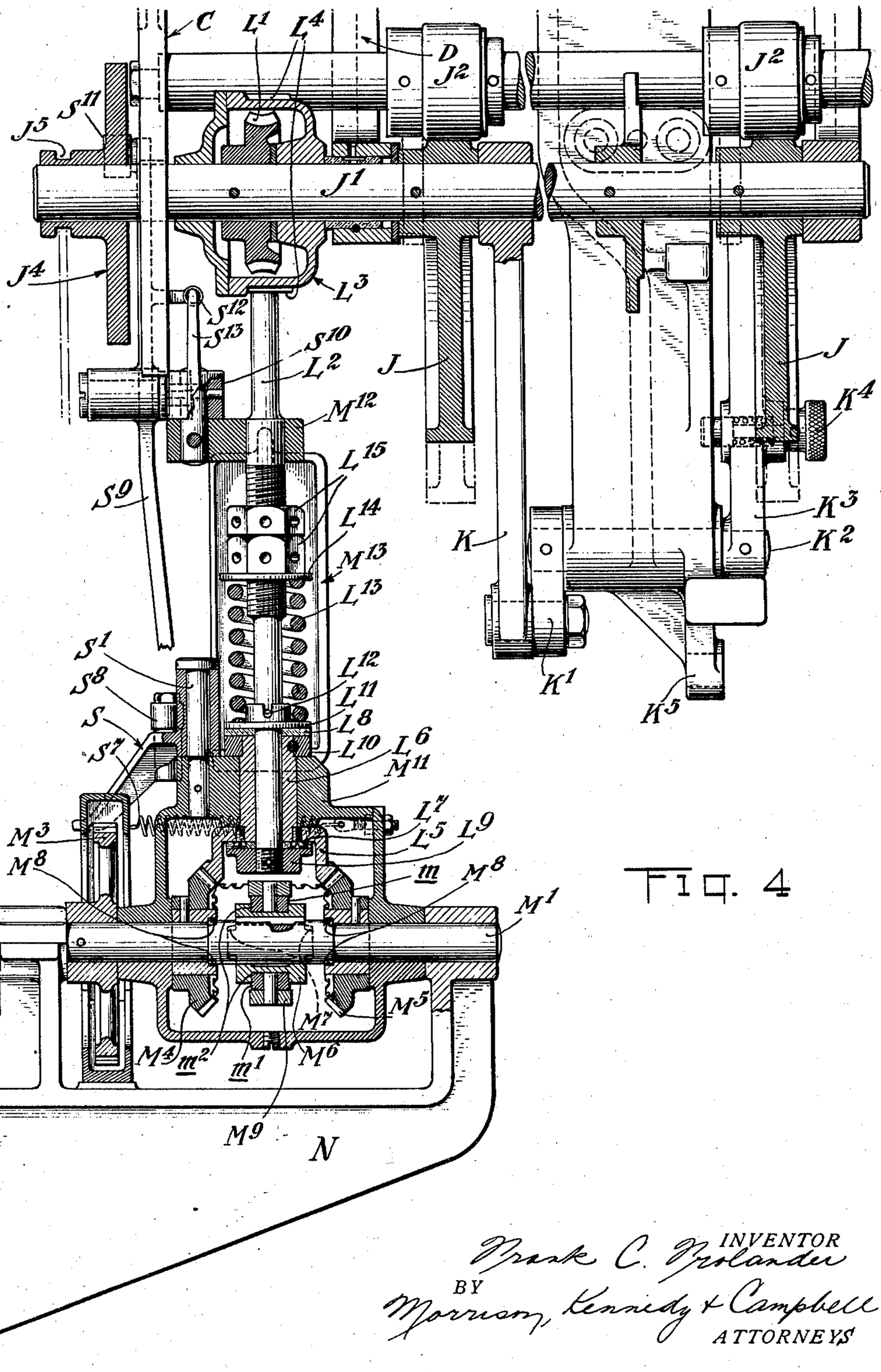

Fig. 4

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Fig. 5

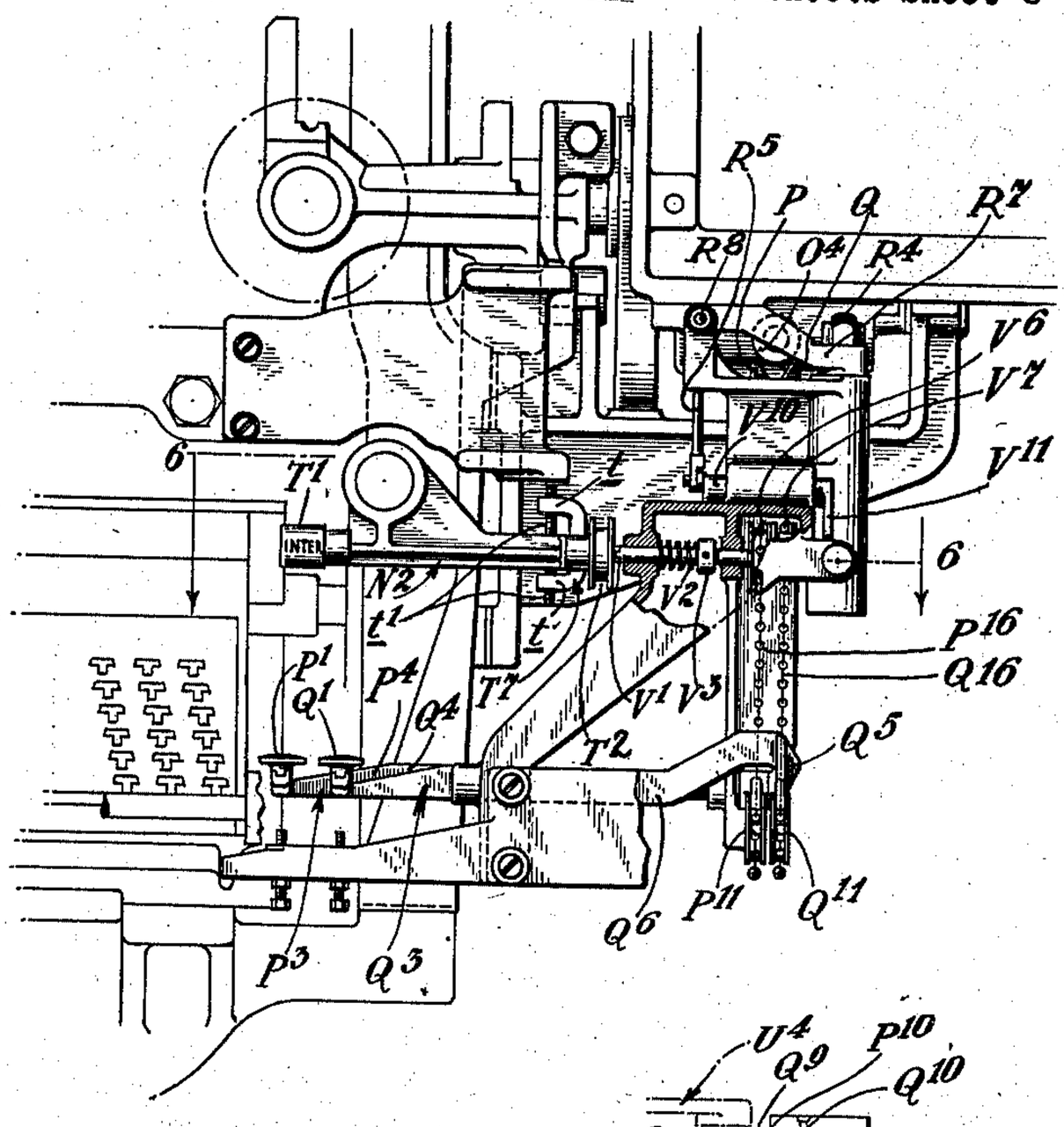

Fig. 6

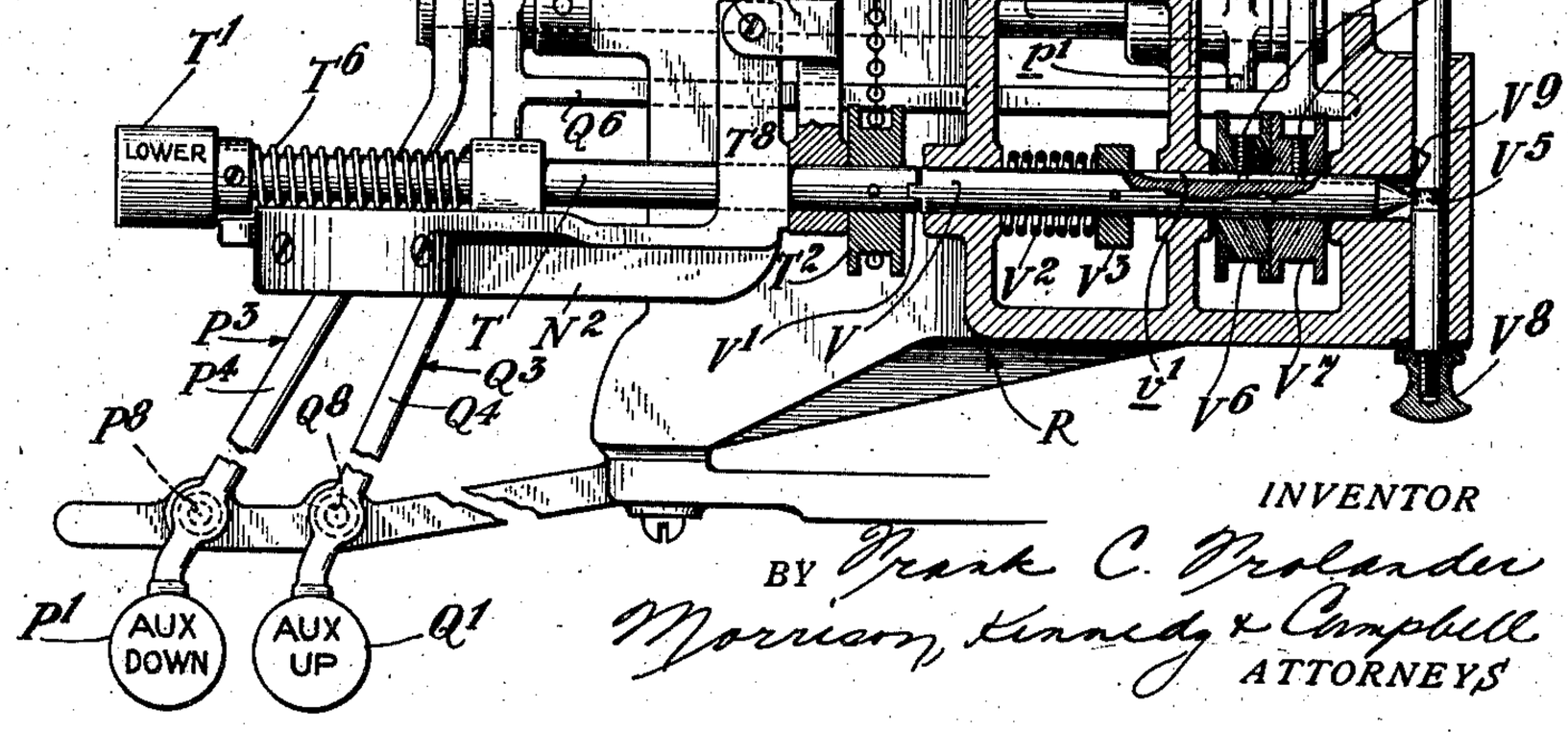

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Fig. 7

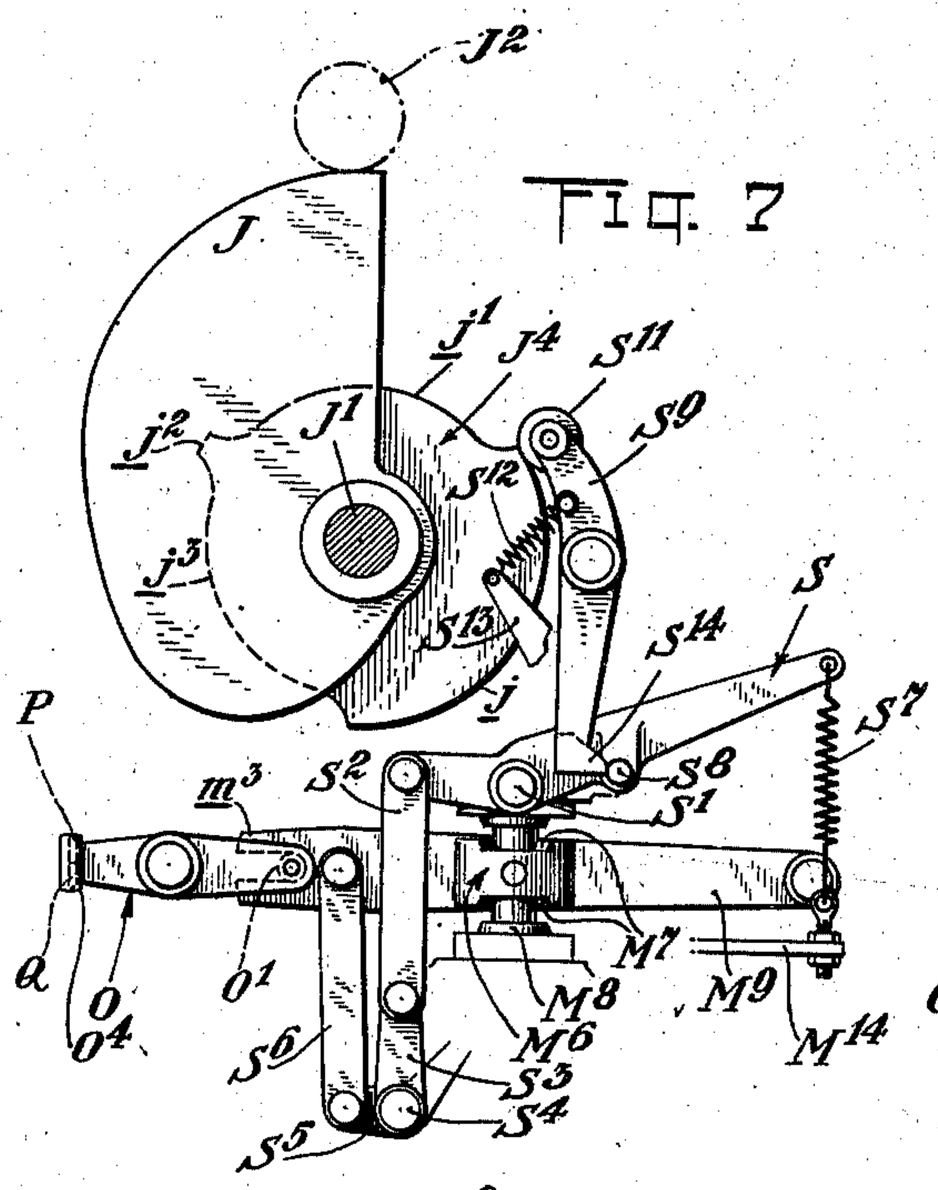


Fig. 8

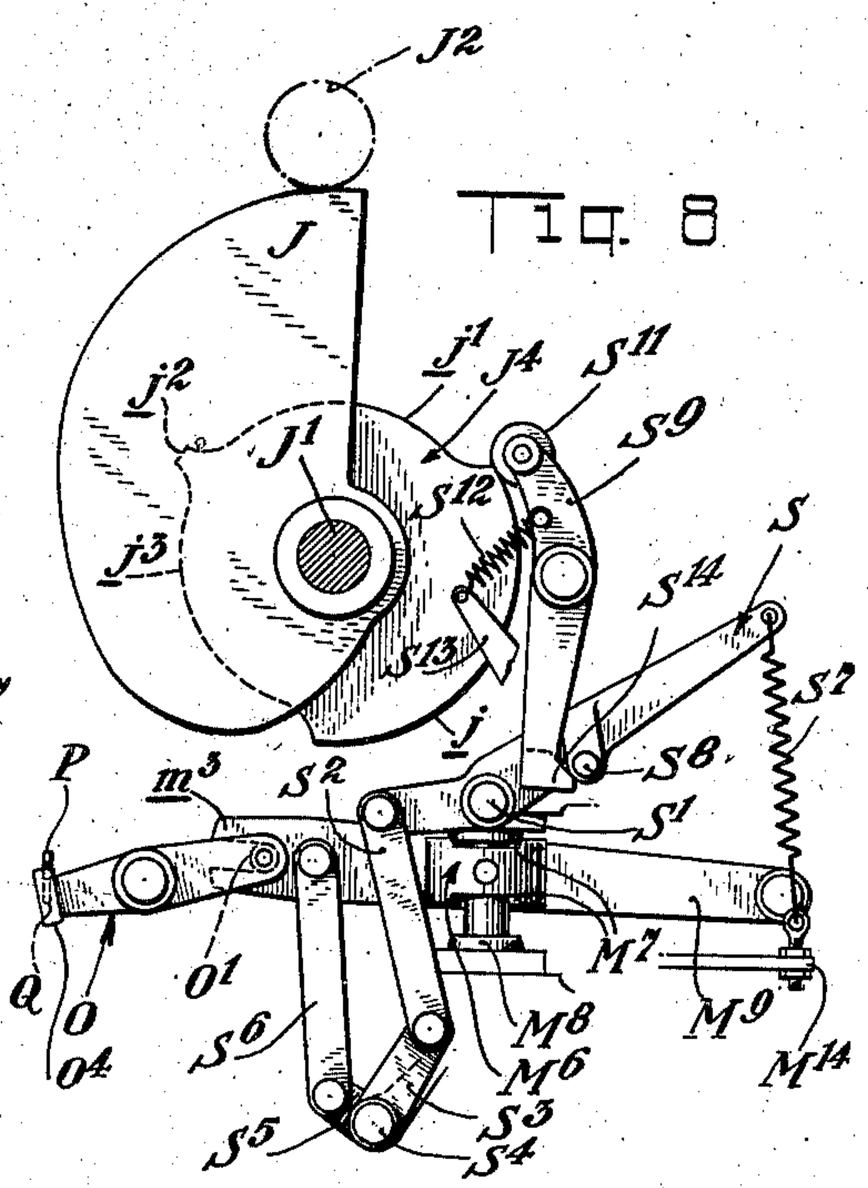


Fig 9

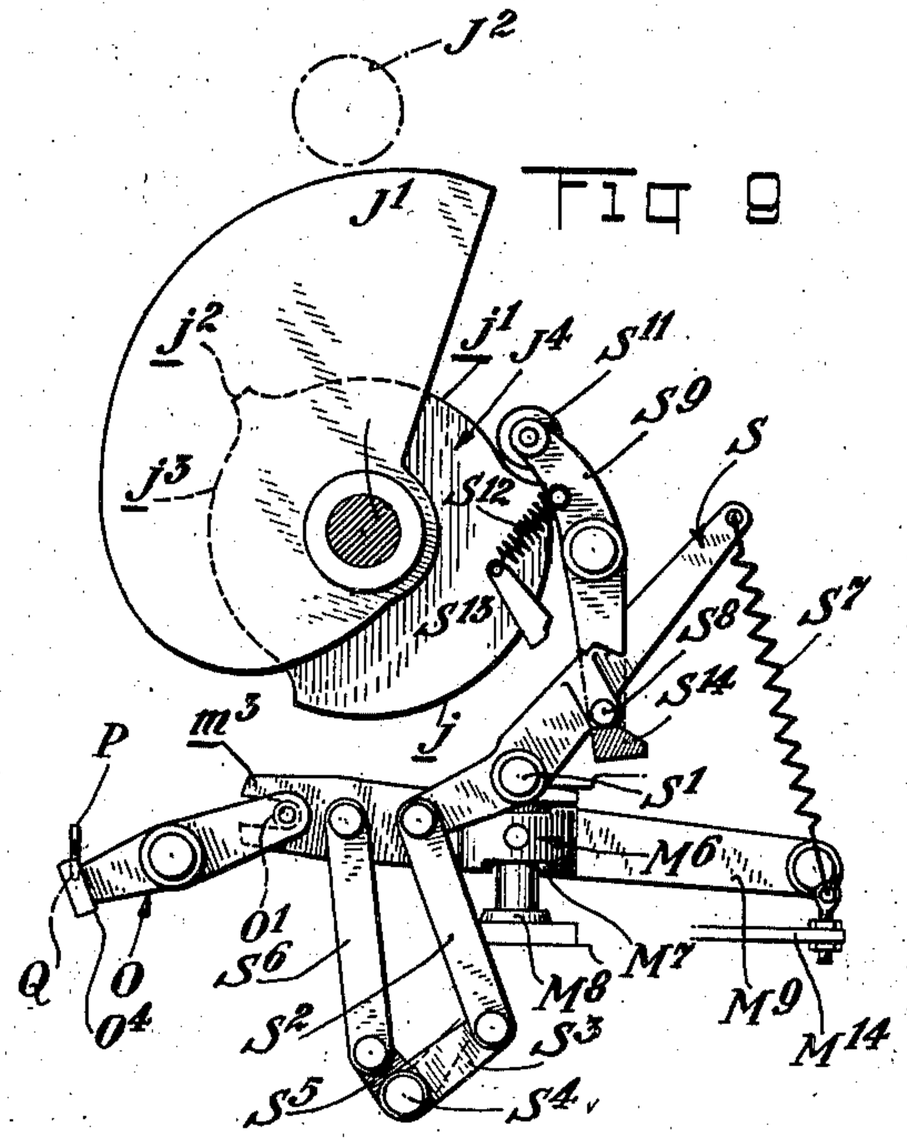
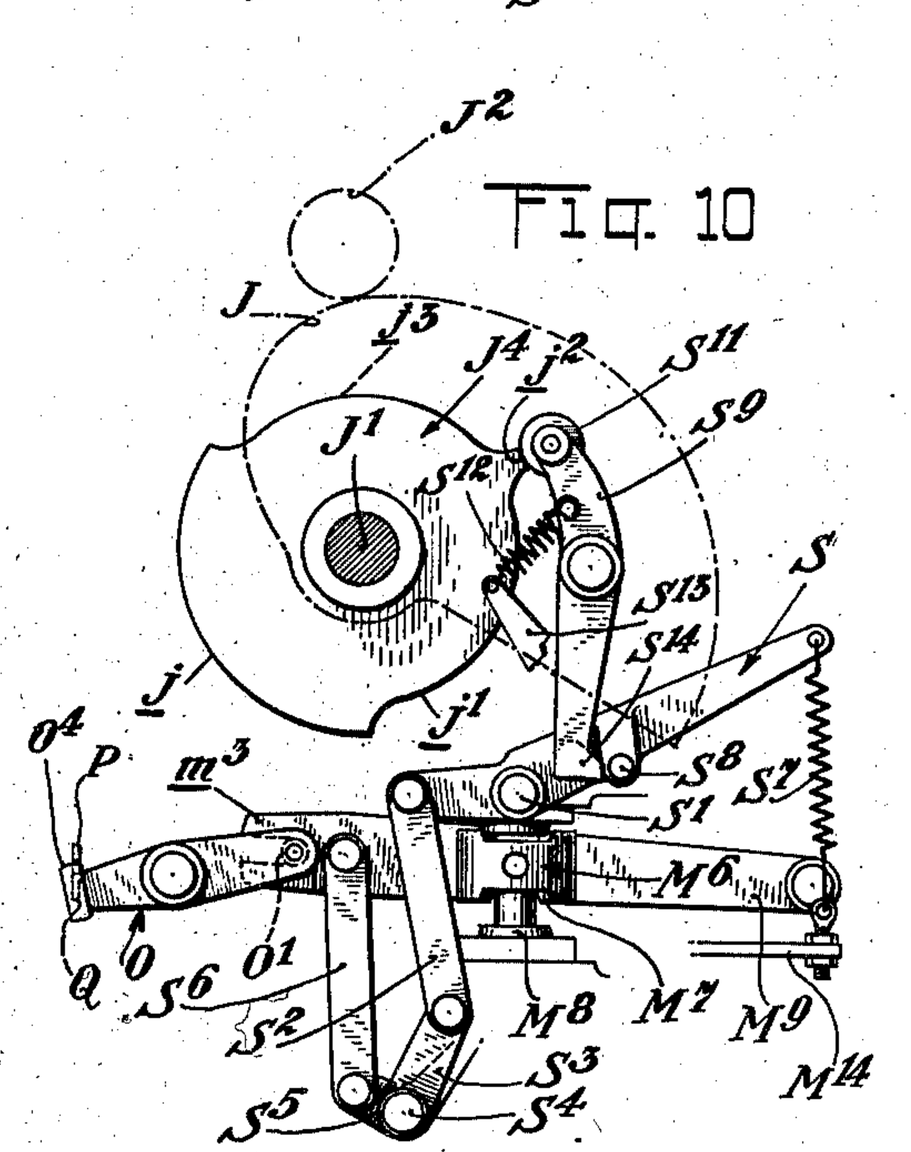


Fig. 10



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TYPOGRAPHICAL COMPOSING MACHINE

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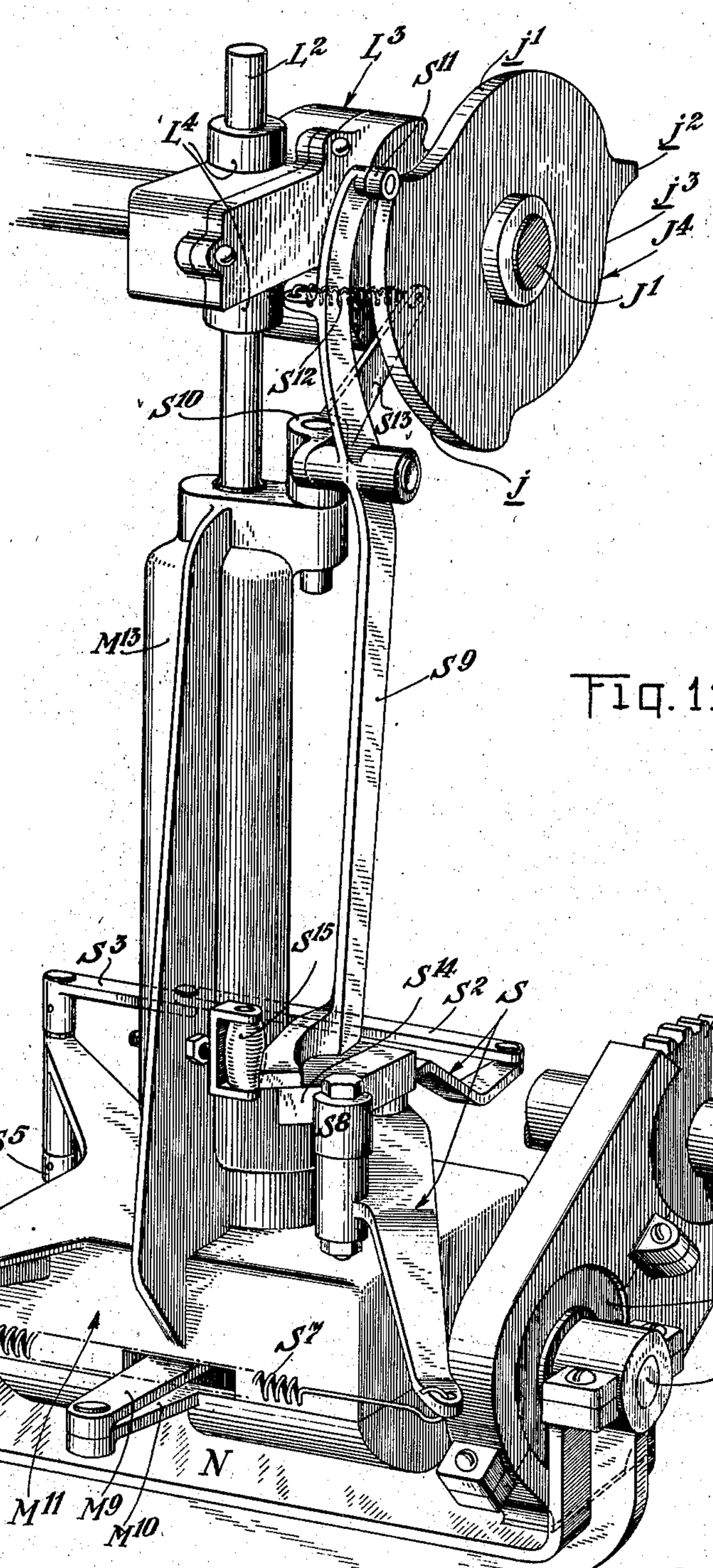

Fig. 11

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Patented Aug. 2, 1938 2,125,671

UNITED STATES PATENT OFFICE

2,125,671

TYPOGRAPHICAL COMPOSING MACHINE

Frank C. Frolander, Elizabeth, N. J., assignor to Mergenthaler Linotype Company, a corporation of New York

Application March 29, 1937, Serial No. 133,561

23 Claims. (Cl. 199—45)

This invention relates to typographical machines, such as Linotype machines of the general organization represented in Letters Patent of the United States No. 436,532, to O. Mergenthaler, wherein circulating matrices are released from a magazine in the order in which their characters are to appear in print and then assembled in line, the composed line transferred to the face of a slotted mold, the mold filled with molten metal to form a slug or "linotype" against the matrices which produce the type characters thereon, and the matrices thereafter elevated and returned through distributing mechanism to the magazine from which they started.

More particularly, it relates to that class of machines equipped with a series of three or more superposed magazines shiftable so as to bring one or another of the magazines into operative relation with the assembling and distributing devices, the improvements dealing specifically with a key-controlled power-operated mechanism for effecting the shifting movement of the magazines.

While the invention has been herein illustrated in connection with a series of auxiliary magazines, it is applicable equally as well to a main series of magazines. The magazines, as usual, are removably arranged in a movable shift frame which in turn is supported in a relatively fixed supporting frame pivoted in the main frame of the machine, the arrangement of the supporting frame being such that it may be rocked upwardly to permit a magazine selected for removal to clear the assembler devices. The raising and lowering of the shift frame is effected under the control of a set of cams mounted in the supporting frame and, when the cams are moved in one direction, they act to raise the shift frame, whereas when they are moved in the opposite direction, they act to lower the shift frame.

According to the present improvements, the cams just alluded to are operated by a power-drive from the continuously rotating "intermediate shaft", through mechanism which includes a reversible driving element and a clutch movable from a neutral position in different directions, to effect the different movements of the cams. The clutch in turn is operated by a pair of depressible finger keys arranged within easy reach of the operator sitting at the keyboard and which upon operation acting selectively to move the clutch to its different positions, mechanism being provided for automatically restoring the clutch to its neutral position when the desired magazine has arrived in operative position.

The finger key control mechanism is arranged in a frame pivotally mounted at the front of the machine, so that it can be swung bodily out of operative position to give access to the keyboard for repair, etc., the arrangement being such that, when the frame is swung bodily back into operative position, the finger key control mechanism is automatically located in cooperative relation with the clutch mechanism without the necessity of further connections or adjustments.

Incidental to the present improvements, devices are provided for automatically indicating to the operator the magazine which is in operative position, as well as means for locking the finger keys against movement when the magazine shift frame is in its extreme positions. That is, when the magazine shift frame is in its lowermost position, an automatic stop is interposed in the path of the key which controls the downward movement of the shift frame, so as to lock it against operation, whereas when the magazine shift frame is in its uppermost position, a similar stop is interposed in the path of the key which controls the upward movement of the shift frame, to lock it against operation in like manner.

Referring to the drawings:

Fig. 1 is a side elevational view of a portion of a "linotype" machine equipped with the present improvements;

Figs. 1^a, 1^b and 1^c are elevational views of a portion of the mechanism for operating the customary feeler plates, showing the parts in different positions of adjustment;

Fig. 2 is a perspective view of the finger key mechanism for controlling the operation of the gear shift lever;

Fig. 3 is a side elevation, partly in section, of a portion of the mechanism shown in Fig. 1, much enlarged, however, to illustrate the construction of the parts;

Fig. 4 is a front elevation, partly in section, of the mechanism shown in Fig. 3;

Fig. 5 is a front elevation of the finger key control machanism, showing its relation with respect to the main keyboard and the rest of the machine;

Fig. 6 is a horizontal sectional view on line 6—6 of Fig. 5;

Figs. 7 to 10, inclusive, illustrate in diagrammatical form, the construction and operation of the mechanism for restoring the gear shift lever to its neutral position when the selected magazine has arrived in operative position; and

Fig. 11 is a rear perspective view of the mechanism illustrated diagrammatically in Figs. 7 to 10.

The matrices are stored according to font or otherwise in the magazines A (Fig. 1), three of which are shown, but of which a greater number might be employed if desired. The several magazines are removably mounted upon separate base frames B which are all connected to a pair of side plates, thus constituting a rigid shift frame C for the magazines. The shift frame is in turn mounted in a relatively fixed supporting frame D pivoted at its upper end, as at D^1, to the machine frame and resting loosely at its lower end upon adjusting screws D^2 carried by the machine frame.

Since the magazines herein shown are of the short variety, there is employed in connection with the magazines, a channeled conductor E which serves to connect the active one thereof with the customary magazine entrance leading from the distributing mechanism (not shown), the channeled conductor E being mounted directly on the supporting frame D.

In selecting one or another of the magazines for use, the shift frame C is raised and lowered within the relatively fixed supporting frame D to bring the selected magazine into registration with the assembler entrance I at the front and the channeled conductor E at the back. The mechanism for raising and lowering the shift frame (see Figs. 1 and 4) consists in part of a pair of cams J arranged at opposite sides of the machine and mounted on a shaft J^1 extending horizontally beneath the magazines and journalled at its opposite ends in the supporting frame D. As the cams J are rotated, they cooperate with a corresponding pair of rollers J^2 carried by the shift frame C to raise or lower the latter into a position wherein the selected magazine will be operative, the shift frame, during the adjustment just mentioned, being guided by antifriction rollers J^3 with which the supporting frame D is equipped.

In order to remove or replace a magazine, the entire supporting frame D is rocked about its pivot from the position shown in solid lines in Fig. 1 to the position shown in phantom lines therein, to raise the magazines to a position wherein the one selected for removal (the operative magazine) will clear the assembler entrance I. The mechanism for raising the supporting frame D includes a toggle device, consisting of a pair of pivotally connected members K and K^1 (see Figs. 1 and 4), the member K being rotatably connected to the cross shaft J^1 and the member K^1 fastened to a rock shaft K^2 journalled in the main frame of the machine, the arrangement being such that, as the rock shaft K^2 is turned to straighten out the toggle members, the supporting frame D will be raised to its uppermost position, wherein the removal of the magazines can be effected. The rock shaft K^2 is operated by a crank handle K^3 pinned to said rock shaft and equipped with a spring-pressed detent K^4 arranged to engage in a recess K^5 formed in the bracket that supports the rock shaft K^2 when the supporting frame has been raised to its uppermost position, in order to maintain this adjustment of the parts. When it is desired to lower the supporting frame, the spring-pressed detent K^4 is manually withdrawn to permit such operation.

As thus far described, the parts and their mode of operation may be the same as shown and described in the Burt United States Patent No. 1,864,799.

As previously stated, the shift frame C is raised and lowered to move the magazines into and out of operative position by the rotation of the cams J which are fixed on the shaft J^1 journalled in the supporting frame D. The shaft J^1 is rotated to effect the operation of the cams through a drive consisting in part of a worm L and a worm wheel L^1, the wheel (see Figs. 3 and 4) being pinned to the shaft J^1, and the worm being splined to a vertical shaft L^2 through which motion in two directions is imparted thereto. The worm and worm wheel are arranged in a housing L^3 mounted for free rotation on the shaft J^1 and which presents a pair of spaced bearings L^4 in which the vertical shaft L^2 is journalled at its upper end and between which the worm L is located. According to this arrangement, when the vertical shaft is rotated in a clockwise direction (looking at the parts from the top), the cams will be turned in a direction to raise the shift frame; whereas, when the shaft is turned in the reverse direction (counterclockwise), the cams will be turned in a direction to lower the shift frame, the latter following the cams under the force of gravity.

The splined connection, previously referred to, will permit the worm and worm wheel housing, together with the worm and worm wheel, to move relatively to the shaft L^2 when the supporting frame D is raised and lowered in the manner previously described. This operation, which involves a slight movement of the vertical shaft in a fore-and-aft vertical plane, is permitted by the manner in which the worm and worm wheel housing is mounted on the shaft J^1 and the manner in which the shaft itself is mounted at the bottom, as will more fully appear hereinafter.

The vertical shaft L^2 is driven from the continuously rotating intermediate shaft M of the machine through the medium of a countershaft M^1 journalled at its opposite ends in a fixed bracket N secured to the machine frame (see Figs. 1, 3, 4 and 11), the intermediate shaft (which rotates clockwise, looking at the machine from the right) transmitting its motion to the countershaft through a pair of interengaging gears M^2 and M^3 fixed, respectively, on said shafts, and also through the medium of a reversing gear assembly and clutch arrangement which enables the vertical shaft L^2 to be rotated in one direction or the other, as desired.

The gear assembly includes a pair of spaced parallel bevelled gears M^4 and M^5, rotatably mounted on the countershaft M^1 and meshing each with another bevelled gear L^5 formed at the lower end of a sleeve L^6 encircling the vertical shaft and through which motion to the vertical shaft is imparted. The bevelled gears M^4 and M^5 are arranged to be selectively driven by the countershaft M^1 through the clutch which includes a sleeve M^6 movable along the countershaft, but splined thereto so as to rotate together with it, and which is formed at its opposite ends with segmental projections M^7 adapted to engage in corresponding segmental recesses M^8 formed in the inner opposed faces of the bevelled gears M^4 and M^5.

When the clutch sleeve is in neutral position, as shown in Fig. 4, the vertical shaft L^2 remains stationary. However, when the sleeve M^6 is moved to the right, the segmental projections at that end thereof will engage the complementary recesses in the gear M^5, so as to effect driving of

the latter by the countershaft M^1, the gear M^5 in turn (through the bevelled gear L^5 and other devices hereinafter described) driving the vertical shaft in a clockwise direction to raise the shift frame in the manner previously described. By the same token, when the sleeve M^6 is shifted to the left, the segmental projections at that end thereof will engage the complementary recesses in the gear M^4, so as to drive the gear L^5, and consequently the vertical shaft in the opposite direction to lower the shift frame.

The clutch sleeve M^6 (hereinafter referred to merely as the clutch) is shifted to its different positions by a lever M^9 (see Figs. 3 and 4) pivoted at its rear end on an arm M^{10} projecting rearwardly from a housing M^{11} enclosing the clutch and reversing gear assembly, this lever being formed within the housing in two parts, one passing over the clutch and the other, which is screwed thereto, passing under the clutch, the upper part having a section extending forwardly beyond the housing to serve as a medium through which the shift lever can be operated. Both the upper and lower parts of the shift lever are provided with opposed inwardly extending shoes m and m^1 pivotally mounted thereon and which engage in an annular recess m^2 formed in the clutch sleeve M^6, one above and the other below, said shoes constituting the means through which the shifting movement of the lever M^9 is imparted to the clutch.

In order that no breakage of the parts will occur in the event of interference presented to the movement of the shift frame, the drive of the vertical shaft L^2 by the gear L^5 is through the medium of a friction device which will allow slippage between said gear and shaft, should rotation of the latter be arrested. The friction device (see Fig. 4) includes a pair of friction discs L^7 and L^8, one secured to the sleeve L^6 (on which the gear L^5 is formed) at the bottom and interposed between said sleeve and a flange L^9 threaded to the shaft L^2 at its lower end, and the other located at the top of the sleeve between a collar L^{10} secured to the sleeve, and a flange L^{11} presented by a member encircling the shaft L^2 and secured to it by a pin and slot connection L^{12}, this connection anchoring the parts against relative rotation while permitting slight movement of the flange L^{11} linearly with respect to the shaft. Pressure sufficient to provide the necessary frictional force for the drive of the shaft by the gear under ordinary circumstances is exerted by a heavy spring L^{13} reacting between the flange and an overlying washer L^{14} encircling the shaft. The washer L^{14} is buttressed by a pair of adjustable lock nuts L^{15} threaded on the shaft, and which serves as a means for properly regulating the degree of compression of the spring. If ordinary load conditions are exceeded for any reason, slippage will occur at the faces of the friction discs L^7 and L^8, so that any damage which otherwise might occur will be avoided. Incidentally, it might be stated at this point that the collar L^{10} at the top of the sleeve bears against a flat portion presented at the top of the gear assembly housing M^{11}, and thus acts as a thrust bearing for the shaft L^2.

The vertical shaft L^2, in addition to being journalled in effect at its lower end in the gear assembly housing M^{11}, is likewise journalled near its center in a bearing M^{12} presented at the top of a vertical bracket M^{13} formed integral with the housing. It will be recalled now that, during the raising and lowering of the supporting frame D, the vertical shaft L^2 partakes of a slight fore-and-aft movement in a vertical plane and, in order that it may do this, the gear assembly housing M^{11} is pivotally mounted adjacent its lower end on the countershaft M^1 (see Figs. 3 and 4), so that when the supporting frame D is moved, the vertical shaft, gear shift assembly, clutch and clutch lever will swing about the countershaft as a pivot in order to accommodate such movement.

The clutch operating lever M^9 is shifted to its different positions of adjustment by a horizontal lever O pivotally mounted adjacent its center on the fixed bracket N which supports the countershaft M^9. The lever is formed in its rear end with a forked portion, between which there is mounted a vertically arranged anti-friction roller O^1 fitting into a slot or bifurcated portion m^3 formed at the front end of the clutch operating lever. The lever O is also formed at the bottom and somewhat rearwardly of its pivot with a boss O^2 presenting a flat portion bearing upon a similar boss N^1 projecting upwardly from the bracket N, these bosses acting merely to provide additional bearing surface for the lever as it is moved to its different positions. According to this arrangement, when the lever O is swung from its neutral or central position in a clockwise direction (looking down upon it), the clutch operating lever M^9 will be shifted to effect the raising of the shift frame C; whereas, when the lever is turned in the opposite (counterclockwise) direction, the clutch operating lever will be shifted to effect the lowering of the shift frame. The anti-friction roller O^1 is made long enough to accommodate the full vertical rocking movement of the lever M^9 resulting from the raising and lowering of the pivotally mounted supporting frame D, as previously described.

The lever O is in turn actuated (see Figs. 2 and 6) through the medium of a pair of vertical slides P and Q arranged just below an anti-friction roller O^4 with which the lever is equipped at its front end, these two slides being adapted for selective operation by a pair of depressible finger keys P^1 and Q^1 arranged at the front of the machine within easy reach of the operator. The slides are formed at their upper ends with opposed bevelled surfaces p and q and, when the slide P at the left is raised, the bevelled surface p thereon will engage the anti-friction roller O^4 to swing the lever O in a counterclockwise direction to effect the connection of the power drive for lowering the shift frame; whereas, when the slide Q at the right is raised, the bevelled surface q thereon will engage the anti-friction roller O^4 to turn the lever O in a clockwise direction to effect the connection of the power drive for raising the shift frame, all in the manner previously described.

The slides P and Q are mounted at the rear of a relatively fixed bracket R presenting two vertically spaced rearwardly projecting portions R^1 and R^2 to which the slides are connected at their upper and lower ends by means of pin and slot connections P^2 and Q^2, the slots being of a length sufficient to permit the necessary vertical movement of the slides. The slides are operated by the depressible finger keys P^1 and Q^1 through the medium of a corresponding pair of key levers P^3 and Q^3. The key lever P^3 at the left is pivotally mounted on a cross shaft R^3 supported by the bracket R and including two spaced arms P^4 and P^5, one extending to the front where the key button P^1 is mounted, and the other extending to the rear where it is connected at its end with the

left hand slide P at the lower end of the latter, an intermediate bail portion P^6 located at the rear of the shaft R^3 rigidly connecting the arms P^4 and P^5 together. The key lever Q^3 at the right is likewise pivotally mounted on the cross shaft R^3 and includes two spaced arms Q^4 and Q^5, one extending to the front where the key button Q^1 is mounted, and the other extending to the rear where it is connected at its end with the right hand slide Q at the lower end of the latter, an intermediate bail portion Q^6 located at the front of the shaft R^3 rigidly connecting the arms Q^4 and Q^5 together. The bail portion Q^6, in the vicinity of the arm P^5 of the other key lever, is offset upwardly to clear a portion p^1 thereof which extends forwardly a short distance coextensive with a corresponding portion q^1 of the lever Q^3 for a purpose hereinafter to be described.

According to this arrangement, when the left hand finger key P^1 is depressed, it will, through the key lever P^3, actuate the left hand slide upwardly to effect the operation of the power drive to lower the magazines; whereas, when the right hand finger key Q^1 is depressed, it will, through the key lever Q^3, actuate the right hand slide upwardly to effect the operation of the power drive to raise the magazines. The operations effected by the finger keys are indicated on the keys themselves, the left hand finger key P^1 being designated "aux. down", and the right hand finger key Q^1, "aux. up", the abbreviation "aux." indicating the auxiliary magazines in connection with which the invention has been illustrated, and the words "down" and "up", of course, indicating the direction in which the magazines will move when the respective keys are depressed.

The key levers P^3 and Q^3 are formed at their rear ends with reduced rounded portions p^2 and q^2 which project into holes formed in the vertical slides, the holes being sufficiently over-sized to permit the angular movement of the levers without interfering with the linear movement of the slides. The slides and the key levers are returned to normal position when the keys are released by weights P^7 and Q^7 with which the slides are respectively provided in their front faces, the normal position of the parts being determined by the banking of the weights at their lower ends on the bottom projection R^2 of the bracket R. The downward movement of the keys (and consequently the upward movement of the slides) is limited by a pair of stops P^8 and Q^8 threaded into a portion of the bracket R which extends beneath the keys and against which the key levers bank, these stops being adjustable in order that the proper movement of the keys can be maintained.

Once a key has been depressed and the clutch actuated to effect the connection of the power drive to raise or lower the magazines, the key can be released but the clutch will remain engaged until the next adjacent magazine has arrived in operative position, whereupon the clutch is automatically restored to its neutral position, thereby rendering the power drive inoperative. The mechanism for restoring the clutch to neutral position will now be described.

At the top of the gear assembly housing M^{11} (see Figs. 1, 3, 4 and 11) there is a lever S pivotally mounted somewhat forward of its center on a stud S^1 and which at its front end is connected to a link S^2, which in turn at its opposite end is connected to an arm S^3 pinned at the top of a vertical shaft S^4 journalled in a bearing formed in the housing M^{11} at the right. At the lower end of the vertical shaft S^4, there is fastened another arm S^5 extending forwardly and connected at its front end by means of a link S^6 to the clutch operating lever M^9. The two arms S^3 and S^5 and the vertical shaft S^4 constitute in effect a bell crank lever with its arms extending substantially at right angles to each other and, when the parts are in normal position, the upper arm S^3 of the bell crank lever and the link S^2 connecting it with the lever M^9 are in alinement, the parts being held in this position by a spring S^7 connected at the rear end of the lever S and anchored to a rearwardly extending portion M^{14} of the housing M^{11}. Midway between the rear end of the lever S and its pivot is an anti-friction roller S^8 mounted on a vertical stud secured in the lever and which normally is located at the rear and near the lower end of a long vertical lever S^9. The lever S^9 is pivotally mounted adjacent its center in a bracket S^{10} secured at the upper end of the bracket M^{13} which lends support to the reversible shaft L^2 and is equipped at its upper end with a cam follower S^{11} urged by a spring S^{12}, anchored to a finger S^{13} projecting from the bracket S^{10}, into contact with the peripheral edge of a cam J^4 fixed at the left end on the cam shaft J^1.

The operation of the parts just described can best be understood by referring to Figs. 7 to 10, wherein they are diagrammatically illustrated, the lever S^9 and the cams J and J^4 having been turned into a horizontal plane for the sake of clarity. In Fig. 7, the parts are represented in their normal positions and with the lowermost magazine in operative position, that is, in registration with the channel conductor E at the back and the assembler entrance I at the front. Now when the lever O is moved to effect the engagement of the clutch with the gear M^4 at the left by the operation of the key marked "aux. down", the bell crank lever (consisting of the arms S^3 and S^5 and the shaft S^4) is turned in a clockwise direction by the clutch lever M^9 acting through the link S^6 and, in doing so, will swing the lever S against the tension of its spring S^7 to the position shown in Fig. 8, where the anti-friction roller S^8 stands clear of the end of the vertical lever S^9. When the clutch lever has been moved to the left, the power drive is rendered operative, causing the rotation of the shaft J^1, and consequently the cam J^4. As the cam J^4 starts to rotate, the cam follower S^{11}, which normally rests upon a high portion j of the cam J^4, rides down into a depressed portion j^1 on said cam under the action of the spring S^{12} pulling on the lever S^9 and, as it does so, the anti-friction roller S^8 will ride along a bevelled portion S^{14} at the lower end of the lever S^9, thus locking the levers against return movement, it being understood that the spring S^{12} actuating the lever S^9 is stronger than the spring S^7 actuating the lever S. In this way, the clutch operating lever M^9 is locked in active position even though the control button is released and allowed to return to normal position (see Fig. 9). The clutch remains engaged until the cam follower S^{11} rides up onto an intermediate high portion j^2 of the cam J^4, which high portion is so located that it arrives opposite the cam follower at the moment the middle magazine arrives in operative position. In this connection, it might be stated that the magazine moving cams J are so designed that the dwell is sufficiently long at this point to permit the clutch release mechanism to operate. As the cam follower rides up onto the intermediate high portion j^2 (see Fig. 10), the lever

S^9 is moved against the tension of the spring S^{12} out of the path of the anti-friction roller S^8 on the lever S, said lever, under the action of its spring S^7, straightening out the link S^2 and the arm S^3 of the bell crank lever and causing the clutch lever M^9 to return to its intermediate or normal position, i. e., back to the position shown in Fig. 7. Should the key marked "aux. down" be again depressed, the parts will operate in the same way, the cam follower S^{11} in this case riding off the intermediate high portion j^2 onto the depressed portion j^3 of the cam J^4, and again onto the high portion j^1, the leading end of which arrives opposite the cam roller S^{11} when the uppermost magazine arrives in operative position.

When it is desired to raise the magazines, the key marked "aux. up" is depressed, which, as previously stated, causes the clutch lever M^9 to be moved to the right, whereupon the arm S^3 of the bell crank lever is turned in a counterclockwise direction, but so far as the lever S and the rest of the parts of the mechanism are concerned, these will be actuated in exactly the same way as they were when the "down" key was depressed and, when the various magazines arrive in operative position, the link S^2 and the arm S^3 of the bell crank lever will be straightened out as before, to effect the return of the clutch lever to normal position. In other words, with the exception of the direction of operation of the bell crank lever, the remaining parts of the clutch throw-out mechanism operate in the same way, irrespective of the direction of movement of the magazines and, for this reason, the mechanism can be made entirely automatic, regardless of the number of magazines in the series. If the operator desires to shift, say from the bottom magazine to the top magazine, without permitting the disengagement of the clutch, all that is necessary is to hold the proper key depressed until the intermediate high portion j^2 on the cam has travelled past the cam follower S^{11}, in which case the throw-out mechanism will not function when the intermediate magazine arrives in operative position, but will remain inoperative until the top magazine has arrived in operative position.

Because of the force exerted by the lever S laterally against the lever S^9, the latter is formed at the bottom with a portion S^{14} which bears against an anti-friction roller S^{15} supported by the fixed bracket M^{13} so as to prevent distortion of said lever S^9.

The invention further contemplates a device within easy view of the operator to indicate which of the magazines is in operative position. As shown in Figs. 5 and 6, this indicator includes a shaft T journalled in a fixed portion N^2 of the machine and provided at its left end with a cylinder T^1 fast on the shaft and marked at intervals around its peripheral surface with the words "lower", "inter" and "upper", indicating, respectively, the lower, intermediate and upper magazines. At the right end of the shaft T, there is fixed a pulley T^2, to which there is secured one end of a chain T^3. The chain leaves the pulley T^2 at the bottom, is threaded around another pulley T^4 mounted just to the rear of the first mentioned pulley, thence (see Fig. 1) over a pulley T^5 located at the top of the front frame to a pulley J^5 formed as part of the cam J^4 on the cam shaft J^1, the chain being threaded around this pulley in a counterclockwise direction (looking at the machine from the right) and has its end fastened in the surface thereof. Wind-up tension is maintained on the chain T^3 by a torsion spring T^6 (Fig. 6) encircling the shaft T and anchored at one end in the cylinder T^1 and at its opposite end in the fixed bracket N^2. According to this arrangement, when the cam shaft J^1 is rotated in a counterclockwise direction (looking at the machine from the right), the chain will wind up on the pulley J^5 and, in so doing, will turn the shaft T against the action of the torsion spring T^6 to bring the indication on the cylinder T^1 corresponding to the magazine in operative position into the view of the operator, the chain, of course, in the meantime unwinding from the pulley T^2 at the end of the shaft T. On the other hand, when the cam shaft J^1 is turned in the opposite or clockwise direction during the lowering of the magazines, the chain will be unwound from the pulley J^5 and will in turn be wound up on the pulley T^2, this wind-up action being brought about by the action of the torsion spring T^6, the amount of chain wound up being the same as that unwound from the pulley J^5. In other words, the shaft T on which the indicator is located, turns in synchronism with the cam shaft J^1, so that there is a corresponding position of the indicator shaft for each position of the cam shaft. Thus, for those positions of the cam shaft J^1, which determine the operative positions of the respective magazines, the indicator shaft T will have positions wherein the marks or indications on the cylinder T^1 corresponding to the magazine will be visible to the operator. In order to maintain the proper degree of tension on the chain T^3 at all times, the pulley T^4 located at the rear of the pulley T^2 on the indicator shaft is mounted at the end of an arm T^7 pivoted on the indicator shaft and which is formed with a pair of arms t extending one above and the other below a fixed portion T^8 extending rearwardly from the bracket N^2 in which the indicator shaft is mounted (see Figs. 5 and 6). Adjustable set screws t^1 are threaded through these arms, one engaging said portion at the top and the other at the bottom, so as to permit the necessary angular adjustment of the arm T^7 to regulate the chain tension.

The machine is equipped with the usual feeler plates U (only one of which is shown) between the assembler throat I and the front end of the magazine in operative position and between the magazine entrance and the channeled conductor E at the back, these plates being operated from a vertical rod U^1 at the front of the machine (see Figs. 1, 2 and 3) through a bell crank lever U^2 and intermediate links U^3, the purpose of the feeler plates being to determine whether or not there is any interference that will prevent movement of the magazines. According to the present invention, these plates are operated by the depression of the finger keys P^1 and Q^1, the vertical slides P and Q for this purpose being equipped each with a dog P^9 and Q^9 pivotally mounted thereon and arranged to cooperate with one end of a bell crank lever U^4 fulcrumed adjacent its center on the fixed bracket N and at its other end pivotally secured at the lower end of the vertically movable rod U^1. The dog P^9 associated with the left hand slide is pivoted on a block p^3 fast thereon and is spring-pressed against an underlying pin P^{10} extending rearwardly from said block, and in like manner the dog Q^9 associated with the right hand slide is pivoted on a block q^3 fast thereon but somewhat thicker than the block p^3 in order that the dog Q^9 will clear the other dog P^9 on the left hand slide. The dog Q^9 is likewise spring-pressed against an underlying

pin Q^{10} extending forwardly from the block q^3 on which it is mounted. Consequently, when the vertical slides P and Q are raised, the respective dogs associated therewith will engage the bell crank lever U^4 and swing it in a counterclockwise direction, with the result that the vertical link U^1 will be pulled down and the feeler plates operated. If no interference exists to the movement of the magazines, the dogs P^9 and Q^9 will slide up past the lever U^4 and will operate the clutch in the manner hereinbefore described, but in the event some interference does exist, the slides will be arrested in their upward movement and the clutch locked against operation.

The normal operation of the slides P and Q, i. e., in a case where the feeler plates encounter no resistance, carries the dogs P^9 and Q^9 (from the normal position shown in Fig. 1^a) up past the lever U^4 (dotted line position Fig. 1^b) and, when the slides return to normal position, the dogs will again engage the bell crank lever, but the slides will not be arrested, since the dogs merely turn against the tension of their springs (Fig. 1^c) to clear the bell crank lever after which they are immediately restored to normal position against their respective pins P^{10} and Q^{10}.

In order to forestall any inadvertent attempt on the part of the operator to move the magazines beyond their upper and lower extreme positions, means are automatically interposed in the path of the respective key levers when the magazines are in such extreme positions. In other words, when the magazine shift frame is in its lowermost position, i. e., with the upper magazine in operative position, the automatic means referred to will prevent the operation of the "down" key P^1, while leaving the "up" key Q^1 free for operation, so that the magazine shift frame can only be actuated upwardly; and likewise when the shift frame is in its uppermost position, i. e., with the lowermost magazine in operative position, said means will prevent the operation of the "up" key Q^1 while leaving the "down" key P^1 free for operation, so that the magazine shift frame can only be lowered. Referring to Figs. 1 and 2, it will be observed that beneath the forwardly extending portions p^1 and q^1 of the key levers, there are located a pair of pivotally mounted dogs P^{11} and Q^{11}, one for each of the key levers, and which includes each a pair of side plates arcuate in shape and pinned together at the top and bottom in spaced relation by transverse members P^{12} and P^{13} and Q^{12} and Q^{13}, the dogs being mounted on forwardly extending portions of the frame R on pivots offset rearwardly from the transverse members at the top and bottom just alluded to. Normally these dogs are held out of the path of the key levers by tension springs P^{14} and Q^{14} connected to transverse pins extending between the side plates of the dogs, below the pivot and anchored to a plate *r* depending from the frame. When the shift frame C is moved into its extreme lowermost position, the dog P^{11} associated with the "down" key is turned about its pivot to bring the transverse member P^{12} at the top thereof into the path of the forwardly extending portion p^1 on the key lever P^3 and, as long as the shift frame remains in its lowermost position, the depression of the down key will be prevented thereby. And likewise, when the shift frame is moved into its extreme uppermost position, the dog Q^{11} associated with the "up" key is turned about its pivot to bring the transverse member Q^{12} at the top thereof into the path of the forwardly extending portion q^1 on the key lever Q^3 and, as long as the shift frame remains in its uppermost position, the depression of the "up" key will be prevented thereby.

The dogs P^{11} and Q^{11} (see Figs. 1, 2, 5 and 6) are operated from a horizontal shaft V journalled in the frame R and arranged in coaxial alinement with the indicator shaft T. The shaft V is arranged for operation by the indicator shaft through the medium of a tongued and grooved connection V^1, which is normally maintained against the action of a spring V^2 reacting between a portion of the frame and a collar V^3 pinned to said shaft, by a fore-and-aft rod V^4 formed with an annular recess V^5, into which the shaft V at the end opposite the tongued and grooved connection extends, the shaft at this end being pointed for the purpose. The shaft V has a limited movement longitudinally of itself for a purpose hereinafter described.

On the shaft V there is located a pair of pulleys V^6 and V^7 held against rotation with respect to the shaft by screws *v* threaded diametrically through the pulleys and engaging in a relatively long slot v^1 formed in the shaft, the arrangement being such that the pulleys will not interfere with the longitudinal movement of the shaft. The dogs P^{11} and Q^{11} at their lower ends, are connected, respectively, with the pulleys V^6 and V^7 by chains P^{16} and Q^{16}. The chain P^{16}, associated with the left hand dog corresponding to the "down" key, is threaded around the top of the left hand pulley from the front; whereas the chain Q^{16}, associated with the right hand dog, corresponding to the "up" key, is threaded around the top of the right hand pulley from the rear, both chains being fastened at their ends in the peripheral surfaces of their respective pulleys. According to this arrangement, when the indicator shaft T is turned in a clockwise direction, looking at the machine from the right (which is the direction corresponding to the downward movement of the shift frame), the pulley at the left will take up on the chain connected to the dog associated with the down key and, as the uppermost magazine arrives in operative position, the take-up on the chain P^{16} will have been sufficient to move the dog P^{11} into a position to prevent further depression of the "down" key. And in the same manner, when the indicator shaft T is turned in the opposite or counterclockwise direction (corresponding to the raising of the shift frame), the pulley V^7 at the right will take up on the chain Q^{16} connected to the dog associated with the "up" key and, when the lowermost magazine arrives in operative position, the take-up will have been sufficient to move the dog Q^{11} into a position to prevent further depression of the "up" key. As soon as the shift frame is moved out of either of its extreme positions, the unwinding of the chain associated with the dog that has been active will release the dog, allowing it to be returned to normal position out of the path of its key lever by the tension of its associated spring, the normal position of the dogs being determined by the banking of their transverse cross members P^{12} and Q^{12} against the portions of the frame R on which they are mounted.

It will be noticed (see Fig. 2) that the chains P^{16} and Q^{16} are connected at their lower ends to the dogs P^{11} and Q^{11} by means of eye pins P^{15} and Q^{15} extending through over-sized holes in the lower transverse members P^{13} and Q^{13}, and which have lock nuts threaded on the ends there-

of beneath said transverse members. The location of the lock nuts is such that there will be a certain amount of free movement of the chains before the dogs are actuated, the reason for this being that the chains will move at all times during the movement of the shift frame, whereas movement of the dogs is desired only when the shift frame has closely approached its extreme positions.

In order that the main keyboard, which is of the swinging variety, can be swung outwardly to gain access to the parts, the frame R which carries the shift frame control key levers P^3, Q^3, the slides P, Q, etc., is likewise pivotally mounted, in order that it, too, may be swung to the right to allow for such swinging movement of the main keyboard. To this end, the frame R is pivotally supported at the right (see Figs. 2, 5 and 6) on a hinge pin R^4 and is located in its normal position by a vertical locking pin R^5 slidably arranged in the frame and engaging at its top in a recess R^6 formed in a bar R^7 secured to the front frame of the machine, and also to the hinge pin just alluded to. There is a slight amount of play between the locking pin and the recess, in order to permit proper adjustment of the frame, such adjustment being effected by a set screw R^8 threaded through an upstanding portion of the frame and banking against the bar R^7. In order to allow the frame to be swung outwardly from its normal position, it is necessary to disconnect the locking device just mentioned, by withdrawing the vertical locking pin R^5 from the recess R^6 in which it engages, and also to disconnect the pulley shaft V from the indicator shaft T at the tongued and grooved connection. Both these operations are effected simultaneously by pulling forwardly the rod V^4 against which the shaft banks, the rod being provided at its forward end with a knob V^8 for the purpose. As the rod is pulled out, a recess V^9 therein is brought into register with the end of the shaft V, allowing the shaft to move to the right under the action of the spring V^2, thereby disconnecting the shafts V and T. At the same time, the rod also withdraws the vertical locking pin R^5 through the medium of a bell crank lever which includes a pair of arms V^{10} and V^{11} fastened at the opposite ends of a shaft V^{12} extending through the frame R, the arm V^{10} at the left being pivotally connected at the lower end of the locking pin R^5, and the arm at the right being pivotally connected at the rear end of the fore-and-aft rod V^4. When the frame is swung back into normal position, locking engagement is again effected by pushing inwardly on the rod V^4, this action causing the locking pin R^5 again to engage in the recess R^6, and the shaft V to move to the left against the compressional force of the spring V^2 until it is again connected with the indicator shaft at the tongued and grooved connection V^1, the side wall slope of the recess V^9 in the bar being of a character suitable for the purpose.

The arrangement of the vertical slides P and Q in the swinging frame R is such that they are moved out of operative relation with the clutch operating lever O and back into operative relation therewith automatically without the necessity of disconnecting or reconnecting any of the parts.

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

Having thus described my invention, what I claim is:

1. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines shiftable in opposite directions to bring any selected one thereof into operative position, a reversible power drive for shifting said magazines in both directions, and means having a fixed setting for all magazines of the series and operable automatically for disconnecting the power drive upon the arrival of the selected magazine in operative position irrespective of the direction of movement.

2. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines shiftable in opposite directions to bring any selected one thereof into operative position, a power drive for shifting said magazines in both directions, means including a clutch movable from a neutral position in one direction or another depending upon the desired direction of movement of the magazines for rendering said power drive operative, and means having a fixed setting for all magazines of the series and operable automatically to restore the clutch to neutral position upon the arrival of the selected magazine in operative position.

3. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines shiftable in opposite directions to bring any selected one thereof into operative position, a reversible power drive for shifting said magazines in both directions, and means operable under a fixed setting automatically to disconnect the power drive upon the arrival in operative position of an intermediate magazine irrespective of the direction of movement.

4. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines shiftable in opposite directions to bring any selected one thereof into operative position, a power drive including a reversible driving element for shifting the magazines in both directions, a clutch movable from a neutral position to one or the other of two different operative positions depending upon the direction of movement of the magazines for rendering the power drive operative, and automatic means including devices operable in the same direction for restoring the clutch to neutral upon the arrival of the selected magazine in operative position irrespective of the direction of movement of the magazines.

5. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines, a shift frame wherein the magazines are mounted, cam means for raising and lowering the shift frame to bring any selected one of the magazines into operative position, a power drive including a reversible driving element for operating the cam means, a clutch for rendering the driving element operative, and devices controlled from the cam means for rendering the driving element inoperative upon the arrival of the selected magazine in operative position.

6. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines, a shift frame where-

in the magazines are mounted, cam means for effecting the raising and lowering of the shift frame to bring any selected one of the magazines into operative position, a shaft on which the cam means are mounted, a power drive including a reversible driving element for rotating the cam means, a clutch movable from a neutral position to one or the other of two different operative positions depending upon whether the shift frame is to be raised or lowered to render the power drive operative, and means controlled from the cam shaft for restoring the clutch to neutral position upon the arrival of the selected magazine in operative position.

7. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines, a shift frame wherein the magazines are mounted, cam means for effecting the raising and lowering of the shift frame to bring any selected one of the magazines into operative position, a shaft on which the cam means are mounted, a power drive including a reversible driving element for rotating the cam means, a clutch movable from a neutral position to one or the other of two different operative positions depending upon whether the shift frame is to be raised or lowered to render the power drive operative, and means controlled from the cam shaft for restoring the clutch to neutral position upon the arrival of the selected magazine in operative position, said means including devices operable in the same direction irrespective of the direction of movement of the clutch.

8. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines, a shift frame wherein the magazines are mounted, means for raising and lowering the shift frame to bring any selected one of the magazines into operative position, a power drive for operating the shift frame, a clutch movable from a neutral position to one or the other of two different operative positions depending upon whether the shift frame is to be raised or lowered to render the power drive operative, and means for locking the clutch in its different operative positions.

9. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines, a shift frame wherein the magazines are mounted, means for raising and lowering the shift frame to bring any selected one of the magazines into operative position, a power drive including a reversible driving element for operating the shift frame, a clutch movable from a neutral position to one or the other of two different operative positions depending upon whether the shift frame is to be raised or lowered to render the power drive operative, and means for locking the clutch in its different operative positions and for automatically restoring the clutch to neutral position upon the arrival of the magazine in operative position, said means including devices operable in the same direction irrespective of the operative position of the clutch.

10. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines shiftable in opposite directions to bring any selected one thereof into operative position, a power drive for shifting said magazines in both directions, and means including a pair of depressible finger keys controlling the power drive and operable selectively to determine the direction of movement of the magazines.

11. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines shiftable in opposite directions to bring any selected one thereof into operative position, a power drive for shifting said magazines in both directions, a pair of depressible finger keys controlling the power drive and operable selectively to determine the direction of movement of the magazines, and automatic means for rendering the power drive inoperative upon the arrival of the selected magazine in operative position.

12. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines shiftable in opposite directions to bring any selected one thereof into operative position, a power drive for shifting said magazines in both directions, a clutch controlling the power drive and movable from a neutral position to one or the other of two different operative positions depending upon the direction of movement of the magazines, and a pair of depressible finger keys for selectively effecting the different movements of the clutch.

13. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines shiftable in opposite directions to bring any selected one thereof into operative position, a power drive for shifting said magazines in both directions, a clutch controlling the power drive and movable from a neutral position to one or the other of two different operative positions depending upon the direction of movement of the magazines, a pair of depressible finger keys for selectively effecting the different movements of the clutch, and means for automatically restoring the clutch to neutral position upon the arrival of the selected magazine in operative position.

14. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines shiftable in opposite directions to bring any selected one thereof into operative position, a power drive for shifting said magazines in both directions, means including a pair of depressible finger keys controlling the power drive and operable selectively to determine the direction of movement of the magazines, and an automatically operated indicator remote from the magazines and within view of the operator for indicating the magazine in operative position.

15. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines, a shift frame wherein the magazines are mounted, cam means for effecting the raising and lowering of the shift frame to bring any selected one of the magazines into operative position, a shaft on which the cam means are mounted, a power drive for the cam shaft, means including a pair of depressible finger keys controlling the power drive and operable selectively to determine the direction of movement of the magazines, and an indicator remote from the magazines and within view of the operator for indicating the magazine in operative position, said indicator being automatically operated from the cam shaft.

16. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines shiftable in opposide directions to bring one or another thereof into operative position, a power drive for shifting said magazines in both directions, means controlling the power drive and operable selectively to determine the direction of movement of the

magazines, and means operable when the magazines have reached an extreme position travelling in one direction to prevent further movement of the magazines in the same direction.

17. A typographical composing machine including, in combination, a series of at least three superposed matrix magazines shiftable in opposite directions to bring one or another thereof into operative position, a power drive for shifting said magazines in both directions, means controlling the power drive and operable selectively to determine the direction of movement of the magazines, and means operable through the control means and when the magazines have reached an extreme position travelling in one direction to prevent further movement of the magazines in the same direction.

18. A typographical composing machine including, in combination, a plurality of superposed matrix magazines shiftable in opposite directions to bring one or another thereof into operative position, a power drive for shifting said magazines in both directions, means including a pair of depressible finger keys controlling the power drive and operable selectively to determine the direction of movement of the magazines, and means operable when the magazines have reached an extreme position travelling in one direction to prevent operative movement of the finger key which controls the movement of the magazines in said direction.

19. A typographical composing machine including, in combination, a plurality of superposed matrix magazines shiftable in opposite directions to bring one or another thereof into operative position, a power drive for shifting said magazines in both directions, means including a pair of depressible finger keys controlling the power drive and operable selectively to determine the direction of movement of the magazines, and means operable selectively when the magazines have reached an extreme position travelling in either direction to prevent operation of the finger key which controls the movement of the magazines in the same direction.

20. A typographical composing machine including, in combination, a series of superposed matrix magazines, a shift frame wherein the magazines are mounted, cam means including a cam shaft operable to move the shift frame in opposite directions to bring one magazine or another into operative position, a power drive for the cam shaft having a reversible driving element, means including a pair of depressible finger keys operable selectively to connect the power drive for driving the cam shaft in one direction or another, and means controlled from the cam shaft and operable selectively when the shift frame has reached an extreme position travelling in either direction to prevent operation of the finger key which controls the movement of the shift frame in the same direction.

21. A typographical composing machine including, in combination, a series of superposed matrix magazines shiftable to bring one or another of the magazines into operative position, a feeler plate movable across the mouth of the magazine in operative position, a power drive for effecting the movements of said magazines, means including a pair of depressible finger keys controlling the power drive and operable selectively to determine the direction of movement of the magazines, and devices actuated by the depressible finger keys for operating the feeler plate.

22. A typographical composing machine including, in combination, a series of superposed matrix magazines movable in opposite directions to bring one or another of the magazines into operative position, means including a power drive for effecting the movement of the magazines, finger key devices for controlling the power drive, said devices being mounted on a swinging frame movable into and out of operative position, and connections between the power drive means and the finger key devices arranged to be automatically moved into and out of operative relation as the frame is moved into and out of operative position.

23. A typographical composing machine including, in combination, a plurality of superposed matrix magazines shiftable in opposite directions to bring one or another thereof into operative position, means for moving said magazines in both directions, key devices for controlling said magazine moving means, a movable frame wherein the key devices are mounted, means for locking the movable frame in normal position, means carried by the movable frame for locking the keys against operation under certain conditions, mechanism mounted on a fixed part of the machine frame for operating the key locking means, and means acting automatically to disconnect the key locking means from its operating mechanism when the frame locking means is rendered inoperative.

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