(No Model.) 8 Sheets—Sheet 1.

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METHOD OF AND MACHINE FOR JUSTIFYING TYPE.

No. 521,039. Patented June 5, 1894.

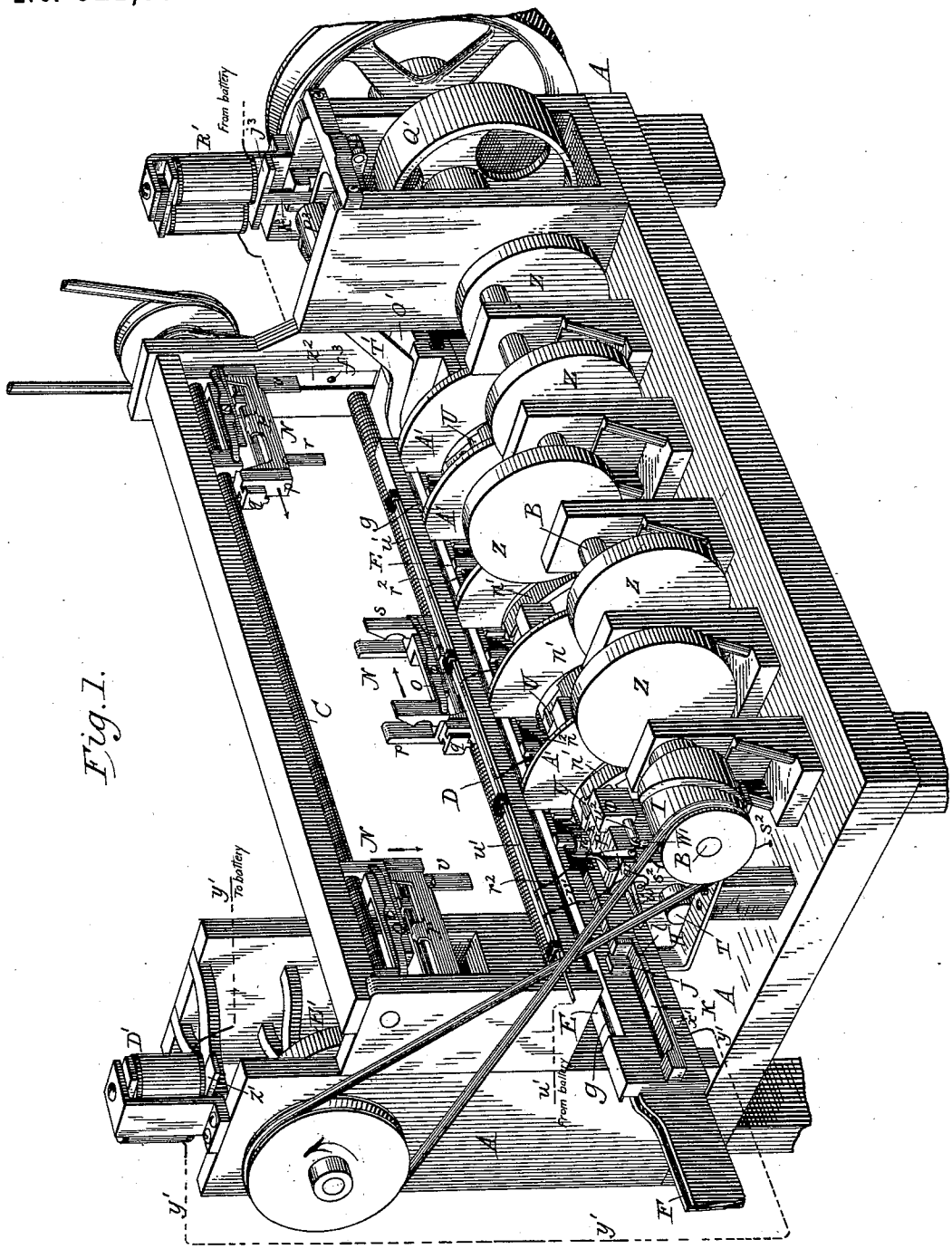

Fig. 1.

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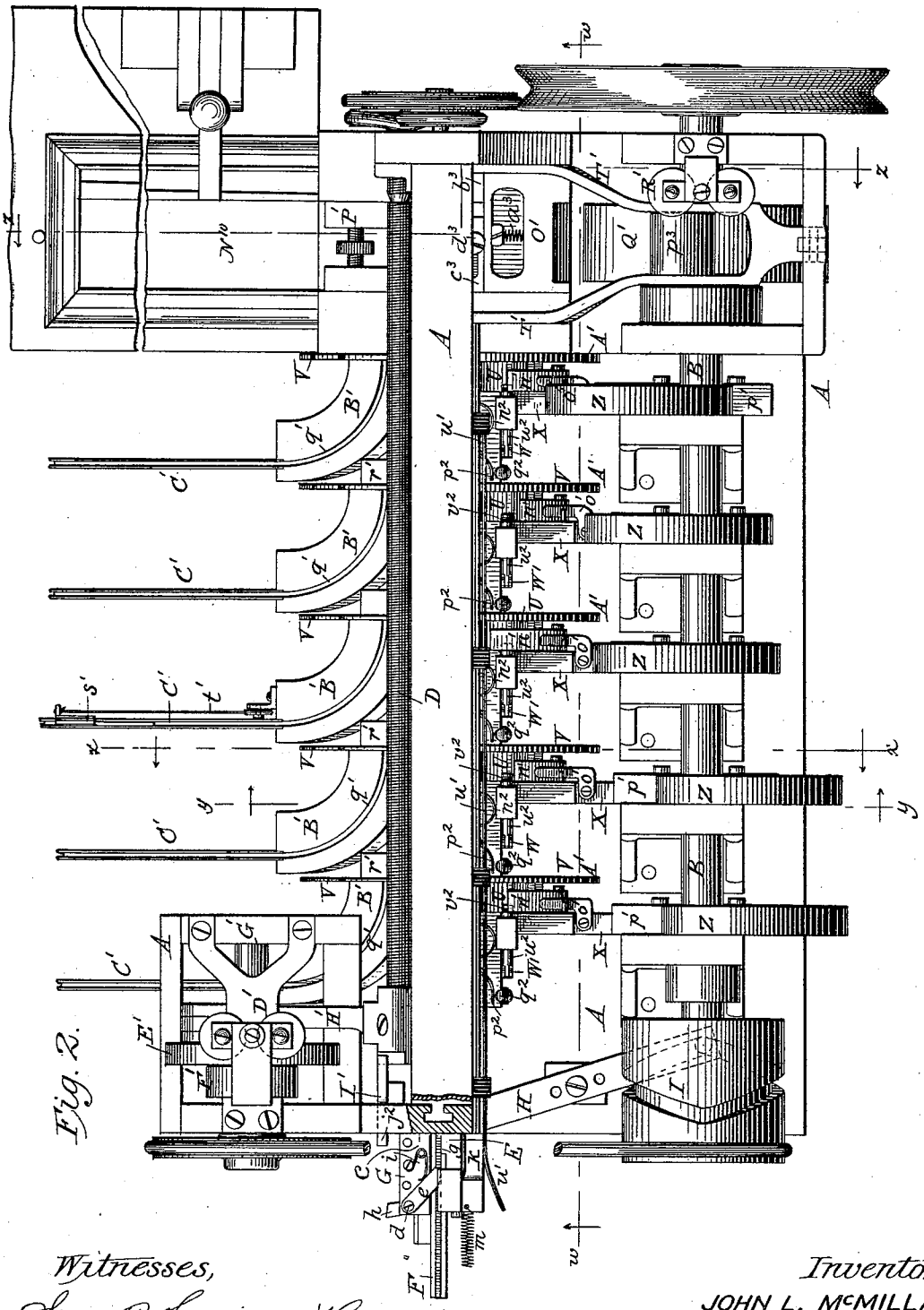

Fig. 2.

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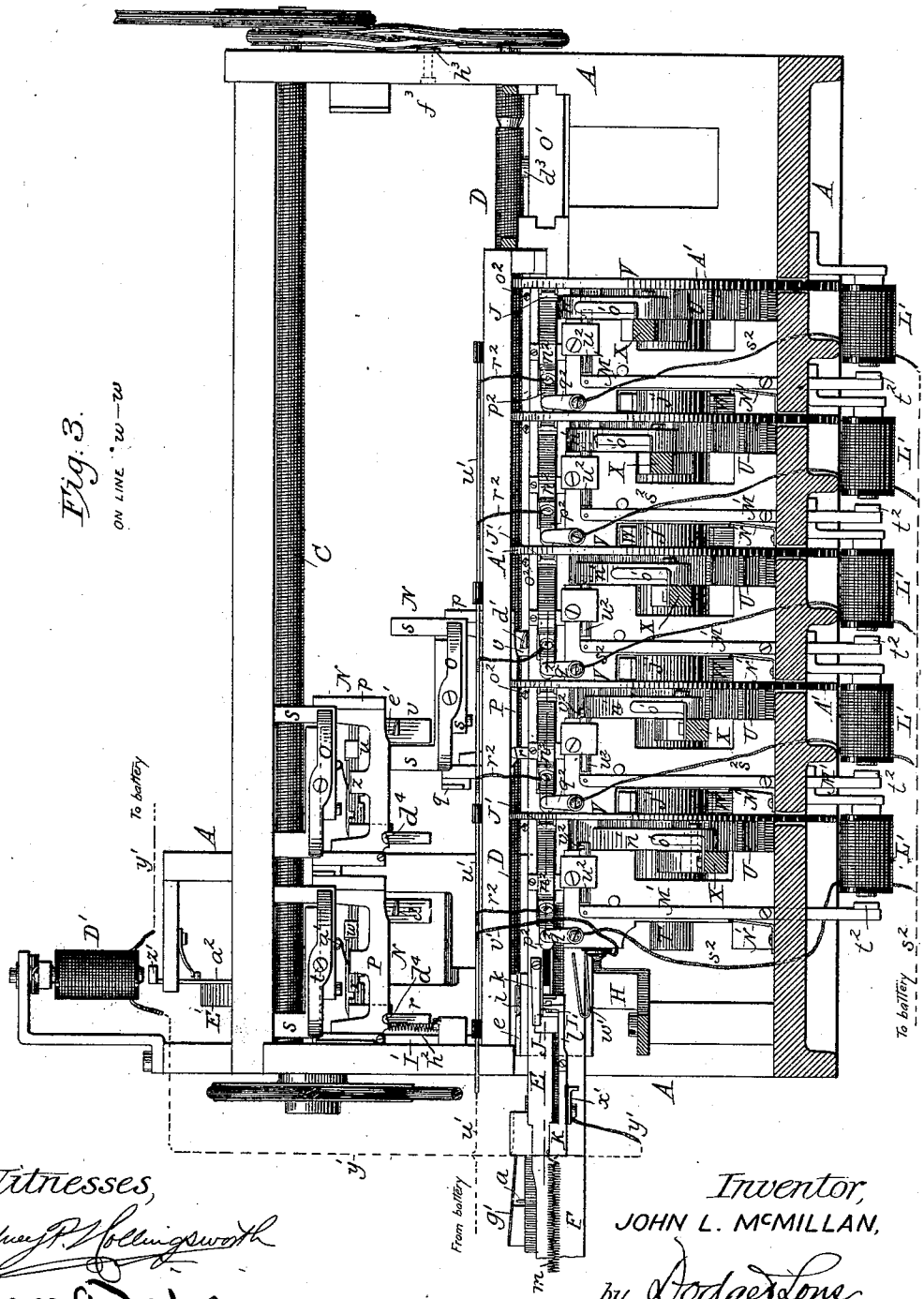
Fig. 3.



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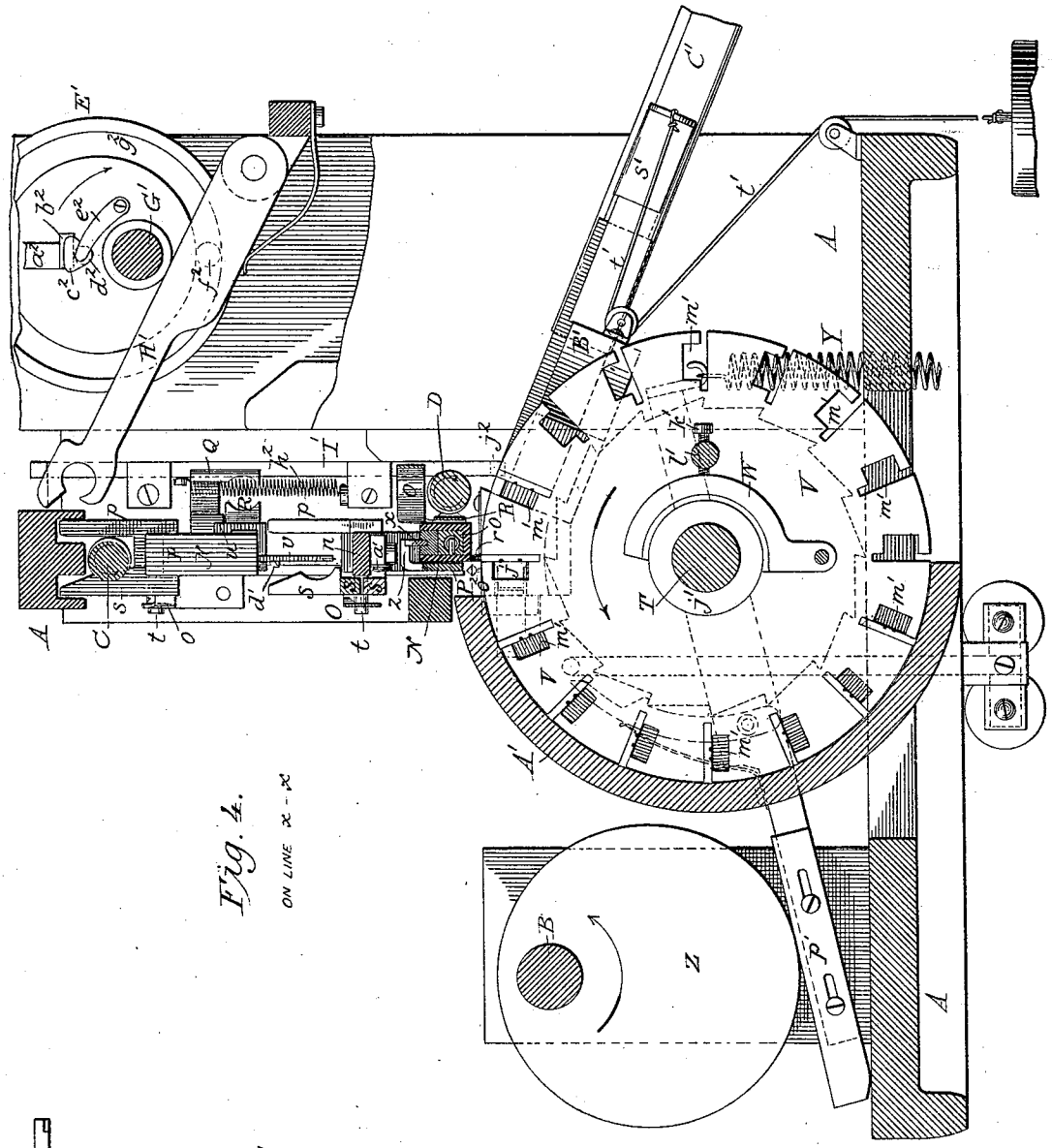

Fig. 4.

ON LINE x - x

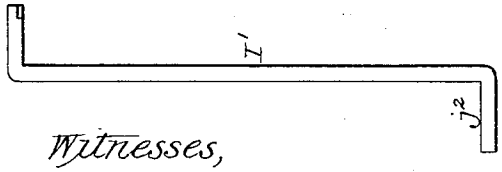

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Fig. 5.

ON LINE y-y

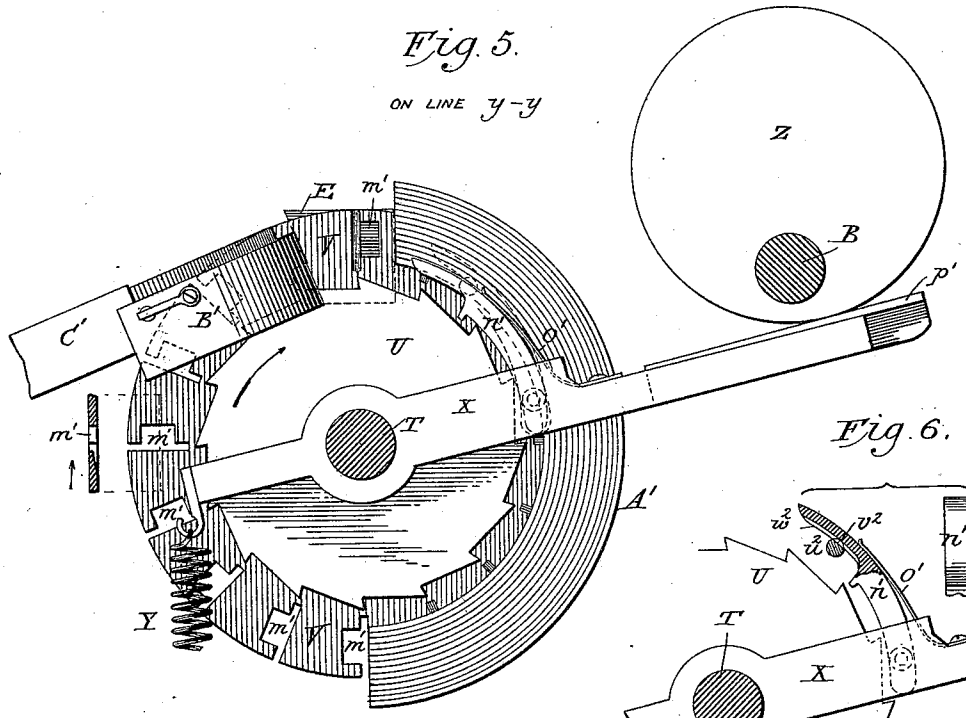
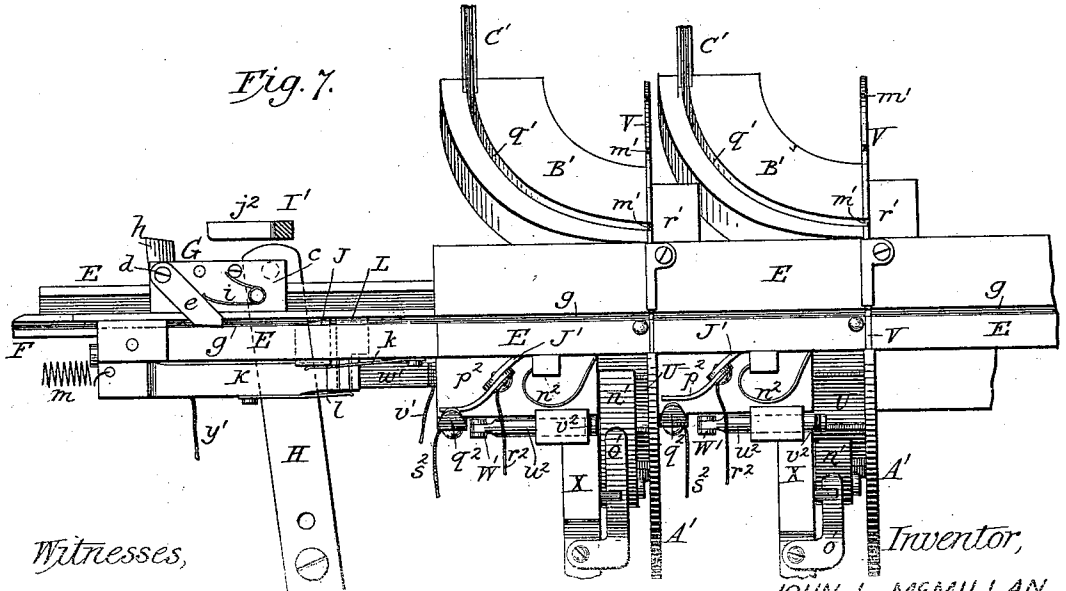


Fig. 6.

Fig. 7.



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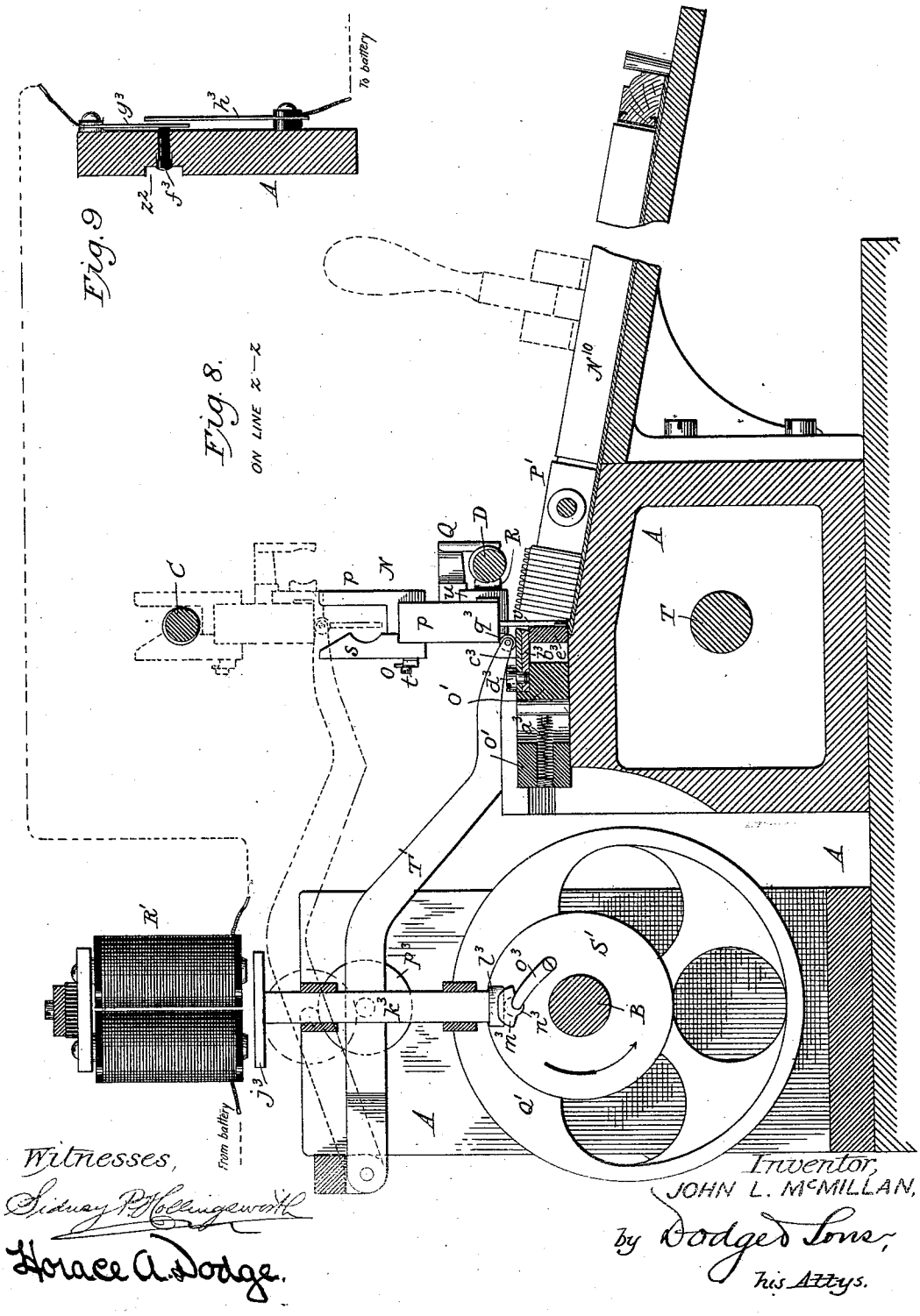

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Fig. 10.

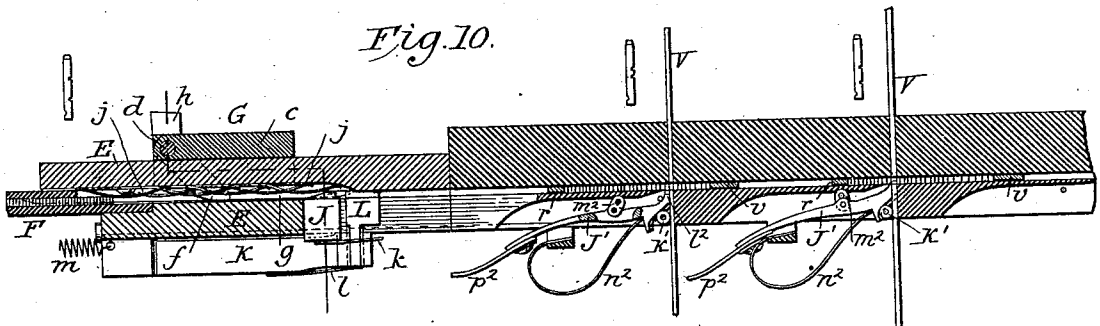


Fig. 11.

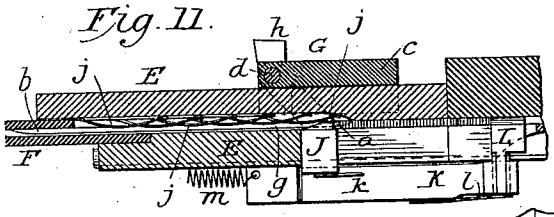
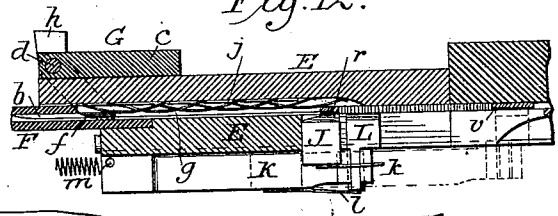


Fig. 12.



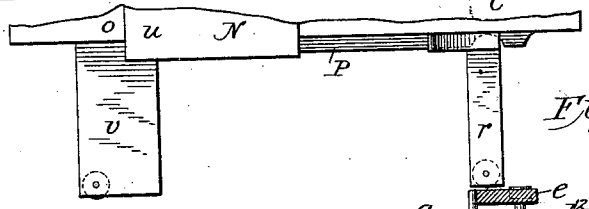


Fig. 13.

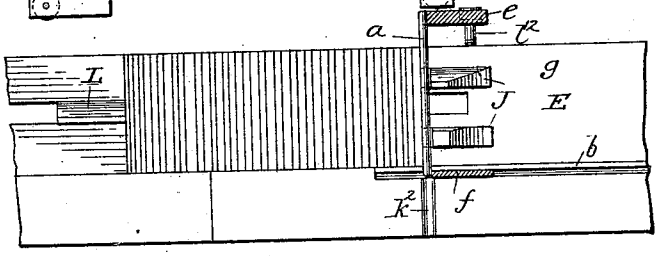


Fig. 15.

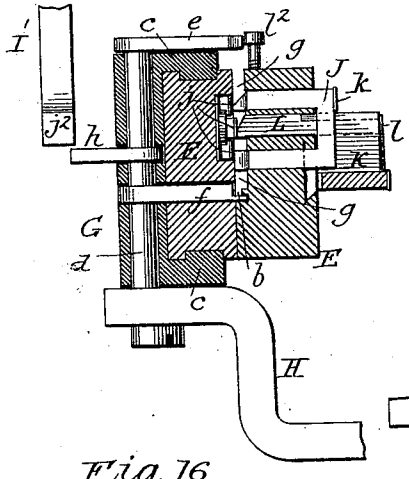


Fig. 14.

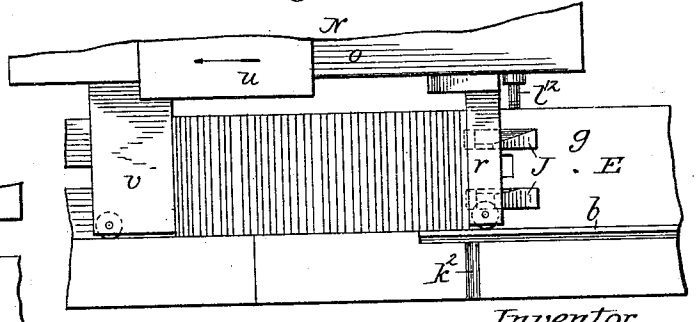
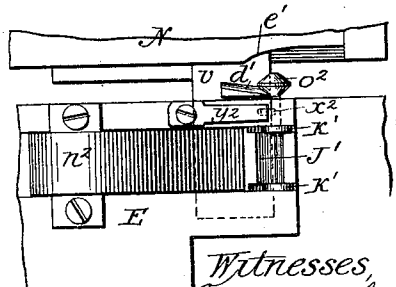


Fig. 16



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METHOD OF AND MACHINE FOR JUSTIFYING TYPE.

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Fig. 17

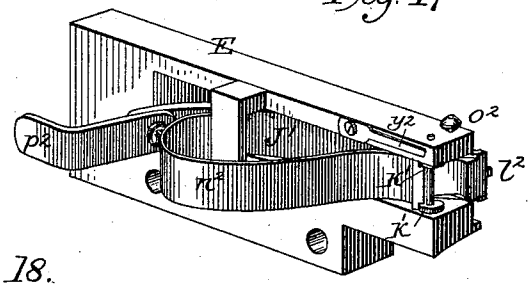


Fig. 18.

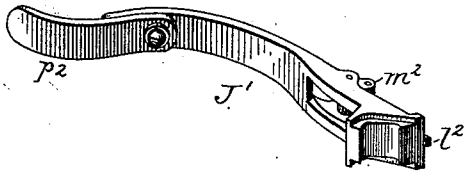


Fig. 19.

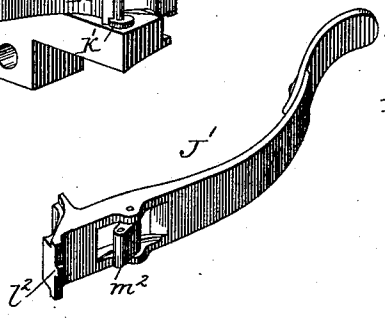


Fig. 20.

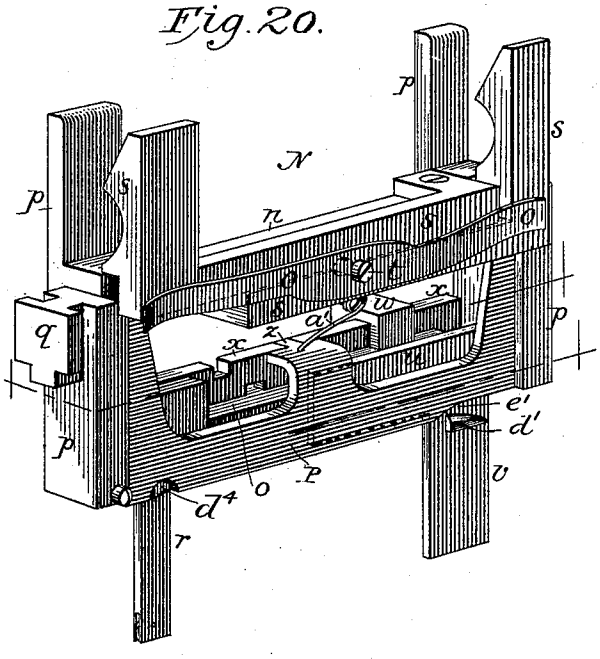


Fig. 21.

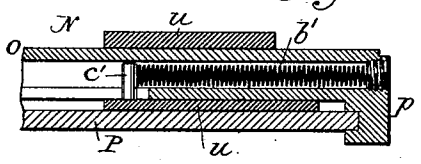
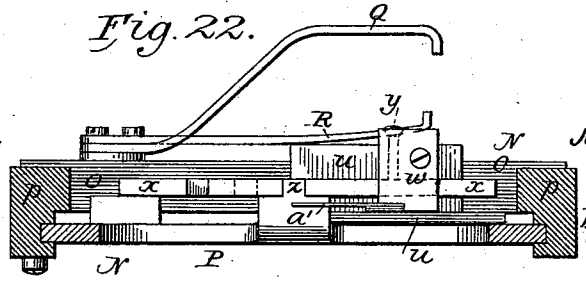


Fig. 22.



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UNITED STATES PATENT OFFICE.

JOHN LOUDON McMILLAN, OF ILION, NEW YORK.

METHOD OF AND MACHINE FOR JUSTIFYING TYPE.

SPECIFICATION forming part of Letters Patent No. 521,039, dated June 5, 1894.

Application filed November 28, 1892. Serial No. 453,412. (No model.)

To all whom it may concern:

Be it known that I, JOHN LOUDON McMILLAN, a citizen of the United States, residing at Ilion, in the county of Herkimer and State of New York, have invented certain new and useful Improvements in Methods of and Machines for Justifying Type, of which the following is a specification.

My invention consists in a novel method of and machine or apparatus for justifying type or printing matter, as hereinafter set forth.

Briefly stated, the method consists in introducing thin spaces in the act of composing or setting the type, essentially as ordinary spaces are now inserted,—and also introducing at intervals approximately equal to but never in excess of the required length of line, a distinctive separating piece, preferably a wire; clasping the portion included between two such separating pieces in a gage or holder capable of being spread or opened to the precise length of the required line, removing one at a time, the spaces contained in the line, and substituting others of slightly greater thickness,—repeating this operation with others of still greater thickness if need be, and so on until the holder is spread to the predetermined limit and the line is justified. These operations may be performed by hand, and however performed, will result in a far greater nicety and uniformity of spacing than obtains under existing methods, even with hand composition. It is apparent, however, that to replace the original spaces by a second set, and these perhaps by a third or fourth would involve too great consumption of time, if manual work were depended upon; and to obviate this loss of time and consequent increase of cost, I have devised a machine which is entirely automatic in its action, and which rapidly and accurately performs the several operations above mentioned.

Such machine is illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view of the machine complete; Fig. 2, a top plan view of the same; Fig. 3, a sectional elevation on the line *w w* of Fig. 2; Fig. 4, a vertical cross section on the line *x—x* of Fig. 2; Fig. 5, a vertical transverse section on line *y—y* of said Fig. 2; Fig. 6, a detail view of certain parts shown in Fig. 5; Fig. 7, a top plan view of the mechanism by which the type are delivered to the holders or gages, and of the first two stations at which the spaces are exchanged; Fig. 8, a vertical transverse section on the line *z—z* of Fig. 2; Fig. 9, a detail of the electrical contact by which the circuit is completed to set the lifter into action; Figs. 10, 11 and 12 are sectional detail views of the feeding or delivery mechanism by which the type are carried forward and supplied to the holders or gages; Figs. 13 and 14, elevations of the same; Fig. 15, a vertical cross section of the typeway, and the carrier slide, showing the carrier, and other parts; Figs. 16, 17, 18, and 19, detail views of the feelers or selecting mechanism by which the spaces in the line are located and the line brought to rest pending exchange of spaces; Fig. 20, a perspective view of the type holder or gage; Figs. 21 and 22, detail views of the same.

The machine comprises in its construction a suitable frame-work,—a typeway or channel into which the line of composed type is delivered,—a reciprocating carrier, which, whenever a proper length or section of the line of type is brought within its reach, separates such section from the remaining line and delivers it directly beneath one of a series of holders or gages, which descend, one at a time, grasp the section thus separated, and move forward therewith; a series of stations each provided with a notched carrying disk or plate through the notches of which the printing characters freely pass but in which the spaces rest, and which disks or plates, rotating or moving across the line, remove one space and substitute another; and means for starting and stopping the several parts, for moving the disks or plates, and for causing the holders or gages to travel back and forth in non-interfering paths,—receiving the unjustified line at one end of their travel,—carrying it past the spacing stations in succession,—delivering the justified lines at the end of their travel, and then returning to the starting point for a fresh line. The construction of the mechanism by which these operations are performed can best be explained in connection with the drawings, in which—

A indicates a framework comprising a bed or table and a series of standards or uprights

in which are carried various working parts; B a horizontal driving shaft which receives motion from any convenient prime mover; and C and D two parallel horizontal shafts, preferably screw-threaded, which receive rotary motion either from shaft B, or independently thereof, from the prime mover, as may be found expedient.

E indicates a channeled or slotted bar, advisedly made of two longitudinally separable parts, forming a continuation of the "line galley" F of a type-setting machine, or of any form of holder capable of delivering a line of type to the justifying machine.

The operation of setting or composing the type is performed by a separate machine, that set forth in Letters Patent No. 465,876, granted to me December 29, 1891, being preferred, though any other may be employed.

In setting the type the operator, by the aid of an indicator or judging by eye, determines when a sufficient length of line has been set up to approximately constitute a line of the "form" being made up or composed, and at each such point inserts, by manipulation of a key, or otherwise, a straight wire *a*, Fig. 13, somewhat longer than the type, and in this way the continuous line of matter coming to the justifier is divided into sections of nearly equal length, but always a little less than the intended length of a justified line in the final "form." In traversing the line galley, the wires *a* rest at their lower ends upon the bottom of the galley F, but when they enter the channeled bar E the lower ends of said wires fall below the lower ends of the type, into a narrower channel *b*, Figs. 13, 14 and 15, too narrow to permit the lowering of the type, an inclined guide *g'*, Fig. 3, bearing upon the upper ends of the wires and insuring their descent. In this way, and as will be readily understood upon referring to Fig. 14, the wire *a*, which is of adequate length for the purpose, is caused to extend both below and above the ends of the type, in position to be acted upon by carrying devices which travel entirely clear of the type.

For the purpose of transferring the type from the line galley F to the channeled bar E, I employ a carrier G, shown in Figs. 2, 7, 10, 11, 12, 13 and 15. This carrier, which is constantly moved back and forth from the line galley to the channeled bar, consists essentially of a block *c*, having a longitudinal T-shaped slot or opening to receive a correspondingly shaped portion of the bar E, upon and by which it is guided as will be seen upon reference to Fig. 15,—which block carries swinging dogs, as presently explained. Passing vertically through the block *c* is a cylindrical stem or rockshaft *d*, from which two dogs *e* and *f* project inward toward the channel or type-way *g* of bar E, above and below the ends of the type, and an arm *h* projects outward, as shown in Figs. 2, 7, 10, 11, 12 and 15. A spring *i*, Figs. 2 and 7, acting upon the upper dog *e* tends to press the same inward toward the type channel *g*. The two dogs being rigidly secured upon the stem or rockshaft *d*, in the same radial position relatively thereto, and being longer than the distance from said stem or rockshaft to the farther wall of the channel, are limited in their inward movement by contact of dog *f* with the farther wall of said channel, as shown by dotted lines in Figs. 10, 11 and 12. The position is also shown in Figs. 2 and 7.

H, Figs. 1, 2, 3 and 7, indicates a lever, pivoted at a point between its ends upon a suitable support, and having one end slotted to receive a tap bolt or other proper device for connecting it with block *c* of the carrier G. At its other end the lever H is furnished with a stud or roller, which enters a cam groove in the circumference of a hub or cylinder I Figs. 1 and 2, made fast upon the driving shaft B, so that as the shaft rotates the lever is swung about its pivot and thus caused to move the carrier G back and forth a given distance. If desired, the fulcrum or pivot of the lever may be made adjustable to vary the travel of the carrier,—or the same result may be attained by substituting for cam wheel or hub I another, having a groove of different pitch.

In traveling back and forth, the carrier G clears the type, but whenever one of the wires *a* comes within the reach of the forward ends of the dogs *e* and *f*, said dogs ride over and engage behind the wire, and on the return or forward movement carrry the same before it, together with whatever type may be in advance of the wire.

To prevent the incoming type from falling forward, turning, or "getting off their feet," the receiving end of channel *g* is furnished on one side or in one wall with a series of light overlapping springs *j*, as shown in Figs. 10, 11 and 12, which springs offer sufficient resistance to the advance of the line to keep it in form while it is traversing that portion of channel *g* over which the carrier G travels. At or about the point where the series of springs *j* terminate, there is arranged a yielding catch, J, consisting of a block of metal arranged to pass horizontally through one side of channeled bar E and to extend across the type channel *g*, as shown in Figs. 10, 11, 13 and 15,—said block having two arms, as shown in Figs. 13, 14 and 15. The inner end of each arm of block or catch J is beveled or inclined both on the end and on the upper face, the long face of the end bevel being arranged toward the incoming type, as shown in said Figs. 10 to 15. A light spring *k*, bears upon the outer end of block or catch J and presses the same inward with force sufficient to insure its engaging behind a section of the line whenever such section is carried past it,—yet light enough to permit the type to force it out in going by it through the channel *g*. The play of carrier G and its dogs is just sufficient to carry a line section and wire *a* past the catch J with certainty, and the catch is necessary to hold the line section against mov-

ing backward or falling over as the carrier recedes. When the type pass from the portion of channel *g* which is furnished with the springs *j*, it again becomes necessary to provide a support for the forward end of the line, to prevent the type from falling forward, turning, or getting out of position. I accordingly provide a slide K, Figs. 1, 2, 3, 10, 11, 12 and 15, having a dove-tail portion to fit a groove or seat of like form in the bar E, as shown in Fig. 15, said groove extending lengthwise of the bar a sufficient distance to permit due play or travel of the slide. At its inner or forward end the slide K is perforated to receive the neck or stem of a block or detent L, Figs. 1, 3, 7, 10, 11, 12, 13 and 15, which is normally pressed inward and caused to reach across the channel *g*, by a light spring *l*, bearing upon the outer end of its stem, the inward movement of the detent being limited by contact of its forward end with the inner or farther wall of channel *g*, or otherwise.

The side face of the block or detent L is vertical, and presents a perpendicular stop or abutment against which the forward type of the line rests, as shown in Figs. 11 and 13. The slide K is held against movement with the type only by a light and highly elastic spiral or other spring *m*, one end of which is attached to the slide and the other to the line galley F, or other convenient fixed support. From this construction and arrangement it follows that as the type line passes the catch J it will come into contact with stop L, which is close to the catch J, and that as the line advances it will carry the stop K before it, though subject during such advance to the influence of the stop as controlled by the spring *m*. For the purpose of enabling it to be forced back at the proper time by the carrier or gage N, which descends from above as hereinafter explained, the upper face of block or stop K is beveled where it extends into or across the channel *g*, as shown in Figs. 10 to 15 inclusive, and this is the purpose also of beveling the upper faces of the inwardly extending arms of the catch J, as above noted.

Having thus far explained the construction of the machine itself, it will be convenient to examine the construction of the holder and gage N, which descends and clasps the line section fed in by the carrier G, when said section is carried past the catch J or to the position indicated in Figs. 11, 12, 13 and 14.

The purposes of the holder and gage are,—to receive and clasp the line section; to carry it past the spacing stations; to gage or determine the length of the finished or justified line; and to carry the line thus completed to the device which places it in the galley.

Referring now to Fig. 20, the holder N will be seen to consist of, first, a rigid frame or body, comprising two horizontal bars *n* and *o*, two vertical end bars *p*, both of which extend upward some distance above the upper bar *n*, and one of which is formed with a T-shaped lug *q*,—and lastly, a depending leg *r*. To the frame thus formed, there are hinged or pivotally attached, two levers, *s*, the free ends of which are pressed inward toward the body or frame of the holder N by a spring O, opposite ends of which bear against the respective levers, as shown in Figs. 1, 3 and 20. The spring is itself retained in position and its pressure is regulated by a screw *t*, which enters a hole suitably tapped in the bar *n*. The ends of levers *s* are carried upward to the height of the end bars *p*, or thereabout, and their inner faces or those opposed to the bars *p* are hollowed out or curved on an arc of a circle corresponding with that of shaft C. If the shaft be threaded, the curved faces of the levers *s* may be threaded or grooved to correspond,—as indicated in Fig. 4, though in practice a smooth face bearing against the threaded shaft is found to work about as well.

The purpose of the construction thus far explained is to permit the holder to be readily pressed or slipped into engagement with shaft C, to traverse the same, and to be readily removed therefrom.

Fitting around the bar *o* of the frame of holder N, as shown in Figs. 4 and 20, is a sleeve *u*, which is made in two or more pieces to enable it to be fitted about the bar, and from this sleeve depends a vertical leg *v*, Figs. 1, 3, 13, 14, 16 and 20. The sleeve *u* is formed with a raised portion *w* through which passes and in which is clamped a reversible notched bar *x*, as shown in Figs. 20 and 22. As shown in Fig. 20, both the upper and lower edges of bar *x* are notched, but the notches of one edge alternate with those of another, so that a considerable space is left between proximate notches of the same edge, while the actual distance between an upper and a lower notch, measured longitudinally of the bar, is slight. A clamping screw *y*, Fig. 22, holds bar *x* where adjusted. Obviously, bar *x* may be otherwise held and adjusted.

As best shown in Fig. 22, the end bars *p p* of the holder N are grooved vertically on their inner faces, and a vertically movable plate P, has its ends guided in the grooves mentioned. The plate P is formed with a laterally projecting arm, having at its end a finger *z* which is of a size to fit nicely within one or another of the notches of bar *x*, according to adjustment of the bar. A spring *a'*, carried by bar *n*, exerts a downward pressure upon plate P and causes finger *z* to drop into the notch beneath it whenever the finger and notch come into alignment.

As shown in Figs. 4 and 21, the bar *o* of holder N is bored or drilled longitudinally to receive a spiral spring *b'*, which, bearing against a pin *c'* projecting from the sleeve *u* through a slot in the wall of the spring chamber, tends to force the sleeve *u* and consequently the leg *v*, toward the fixed leg *r*. At the time that the holder N descends to grasp a line section its legs *v* and *r* are separated, and the finger *z* is seated in the notch of bar

x, so that the parts are locked in the position indicated, and this relation continues until the legs r and v descend to proper position to clasp the line section between them. Both legs are furnished with rollers at their lower ends, upon which they travel.

As shown in Figs. 16 and 20, leg v of the holder N is provided with a projecting rib or lug d' on its front face, the upper side of which is inclined, and just above this rib the lower edge of sliding locking plate P is cut away, leaving an incline e', as shown in said figures.

Q and R, Fig. 22, indicate two spring arms, attached at one end to the holder N, and having their opposite or free ends separated but bent inward toward each other.

If the shafts C, D, are threaded, the inwardly turned ends of the spring arms Q and R are fashioned to fit or seat themselves in the grooves of the thread of shaft D,—but if smooth shafts are employed, the bearing faces of the ends of the springs are merely made oblique to the axes of the shafts, which arrangement will cause a travel of the holder when the shaft upon which the ends bear is rotated.

T, Figs. 1, 3, 4, 5 and 6, indicates a shaft or axle, supported at suitable intervals in posts or standards rising from the table or bed of the main frame A. Loosely encircling though nicely fitted upon this shaft, are ratchet wheels U, five such wheels being shown in the drawings, but the number being variable according to the character of the work to be performed by the machine, and like considerations. Made integral with or firmly secured to each ratchet wheel U is a disk V, concentric with the ratchet wheel and with shaft T, as best shown in Fig. 4. It is important that each disk and ratchet be free to turn independently of all others, for which reason they are separately and loosely mounted upon a fixed shaft as stated, and it is likewise important that each movement of every disk be precisely gaged and determined. To insure this latter result, the ratchet teeth are cut with nicety, and the throw of the actuating dogs is adjusted with precision, while a friction brake offers sufficient resistance to prevent the momentum of the parts carrying them beyond the proper points. Such brake is represented in simple form in Fig. 4, in which W indicates a semicircular friction block or yoke, pivotally attached to the frame A, and pressed against a collar j' on the ratchet wheel or the disk V, or against the disk itself, by means of a screw k' passing through a lug or stud l' projecting from the main frame A. The friction will of course depend upon the adjustment of the screw k'. By this provision all danger of over-movement is avoided.

All the disks V intersect the bar E, in which is the type channel g, and each disk has formed in it a series of openings m', which at their inner and outer ends are of just sufficient size to receive a space such as used in justifying, but which are enlarged between said ends, as shown in Figs. 4 and 7, the enlargement being on the forward side with reference to the direction of rotation of the disks. At the side of each disk, and fulcrumed upon the shaft or axle T, is a lever X, Figs. 2 to 7, the inner end of which has connected with it a spring Y, Figs. 4 and 5, which tends always to lift the outer end of the lever, and to hold it in contact with the periphery of a cam Z, carried by the shaft B, there being a separate lever for each disk and a special spring and cam for each lever. To enable the cams to act successively and thus to keep at a low limit the power required, they are advisably set at different angular adjustments about the shaft B, as shown in Fig. 1. Each lever carries a dog or pawl n', Figs. 1 to 6, which is pressed toward and into engagement with the teeth of the ratchet wheel beneath it, by means of a spring o', except when prevented from falling, as hereinafter described. The spring may be omitted, but its use gives certainty and promptness of action and is for that reason advisable.

It is important to regulate the throw of the levers X, and the consequent movement of the ratchet wheels U and disks V, with nicety, in order to insure coincidence of openings m' with the channel g. I accordingly provide each lever with an adjustable wearing plate p', Figs. 4 and 5, of wedge form or slightly varying thickness longitudinally. By moving these plates forward or backward upon their respective levers the rise and fall of said levers may be varied as required, the extent of movement remaining the same but the starting and stopping points being simultaneously and equally shifted in one or the other direction. Each plate is held at its proper adjustment by means of clamping screws, as shown in Fig. 4, or in any equivalent way. The forward edges of the disks are covered and protected by guards A', shown in Figs. 1, 2, 3, 4, 5 and 7, but omitted from Fig. 10, to facilitate illustration of construction and relation of parts. These guards cause the retention by the disks of the spaces removed from the line, until a point at the lower side is reached, where the spaces fall out and are gathered in suitable receptacles.

Just in rear of bar E is a series of blocks B', each having a channel or passage q' which curves through ninety degrees of a circle or thereabout, and which communicates with or forms a continuation of a space reservoir C', as shown in Figs. 2, 4 and 7. The mouth or end of each channel q' coincides in position with the first opening m' of the disk V back of the type channel g, and consequently will deliver a space into the opening m' whenever the line of spaces is urged forward. A block or stop r' on the opposite side of each disk from the block B' prevents the space from moving beyond the proximate face of the disk.

To advance the spaces and insure their

proper delivery into the openings m', I may arrange the space reservoir C' at such an angle as to cause the spaces to move forward by gravity, or I may employ a spring for the purpose. For convenience of arrangement, however, I find it preferable to place the reservoirs in the position indicated in Fig. 4, that is to say at an inclination downward from the delivery end; and to employ a follower s', which is urged against the rear end of the line of spaces by a weight, connected with the follower by a cord or band t', passing about a suitable pulley or pulleys, as shown in said figure. As shown by the small detached sectional view forming part of Fig. 5, the rear wall of each opening m' of the disks V, is cut away on one side, forming a wedge-shaped edge. The front face of this wedge-shaped edge, or in other words, the rear wall of opening m', speaking with reference to the direction of rotation of the disk, is no wider than, if as wide as, the space which it is to remove from the line of matter to be justified; but the body of the disk is as thick as the thicker space to be introduced in place of the one removed. The thin edge of the wedge shaped wall of the opening therefore serves to eject or push the thin space out from the line, and the wedging action of the gradually thickening portion serves to spread the type apart sufficiently to permit introduction of the thicker space.

As previously mentioned, the matter is spaced in the act of composing it, spaces being supplied in the same manner as the type themselves, that is to say by actuation of a finger key; but the spaces thus supplied are quite thin and are peculiarly nicked, that is to say have a nick of proper size located at a point different from that of the nicks of the type or of other spaces. So too, the spaces supplied by each space reservoir are nicked differently from those introduced in the act of setting the type and from those of other reservoirs. The nicking of the spaces determines the action or inaction of the disk V, as presently explained.

Assuming now, that the carrier G has engaged a wire a, at the end of a line section, and moved the said wire and section forward to the position shown in Fig. 11, a holder N will at once descend and clasp the same, owing to the construction and arrangement of parts illustrated in Figs. 1, 2, 3 and 4. In said figures u' indicates an electric conductor leading from a battery or other source of electrical energy, and carried along the framework A past the several spacing stations or points at which the disks V are located, but carefully insulated from the framework. From the line u', a branch v', Figs. 1 and 3, extends to and makes electrical connection with an insulated contact spring w'. Secured to the slide K and movable therewith is an insulated contact finger x', from which a covered wire or conductor y' passes to the helix of an electro-magnet D', the armature z' of which is made fast to a rod a^2, movable in proper guides, and carrying at its lower end an inclined or wedge-shaped block b^2. From the helix of the electro-magnet D' the conductor returns to the battery or other source of electric energy. The wedge-shaped block b^2 is normally held in the path of the head or enlargement c^2 of a clutch-pin or bolt d^2, passing through a cam wheel E', which bolt, when not thus withdrawn or held back, engages with a hub or boss F' made fast upon a shaft G'. The cam wheel E' is loosely carried upon the shaft G', which latter is continuously rotated by belt or other connection from shaft A or other source of motion. Owing to the fact that the cam wheel is free from the shaft, it follows that so long as the clutch pin is withdrawn the wheel will remain at rest, but whenever the pin is permitted to lock the cam wheel to the shaft or to the hub thereon, the parts will move as one. It will now be perceived that whenever slide K is carried far enough forward to cause contact of finger x' and spring w', which can only happen when a line section is advanced to the position indicated in Fig. 11, an electric circuit will be established or closed, in which the electro-magnet D' will be included, and that as a consequence the armature z' and the wedge block b^2 will be lifted, permitting the clutch pin to move forward under pressure of a spring e^2, and to lock the parts together. When thus clutched or locked together, cam wheel E^2 will rotate, and will impart an oscillating movement to a lever H', a stud or pin f^2 of which projects into the groove g^2 of the wheel, as shown in Fig. 4. Being thus carried downward from its normal position, indicated in Fig. 4, the lever H' engages a holder N, at that time supported by shaft C or otherwise in the position indicated at the left hand end of Figs. 1 and 3, and in Fig. 4, and carries said holder downward before it. The end of the lever H' is suitably fashioned to properly engage and bear upon the frame of holder N, and said holder is guided in its descent by the T-shaped block q, Fig. 20, traveling in a vertical guideway of like form in the framework A of the machine. In ascending, the lever H' engages a projection on a vertically movable slide I', Figs. 3 and 4, carrying said slide upward against the force of a light spring h^2, and removing its lower end or arm j^2 from its position directly in the path of the arm h of the carrier G, as will be better understood upon reference to Figs. 7 and 15. Under this arrangement, should the carrier G advance to carry forward a line section prematurely and before the preceding section should be duly clasped by the holder N, or while lever H' is depressed, the arm h of the carrier G striking against arm j^2 of the slide, would throw dogs e and f of the carrier outward and cause them to clear the wire a, Figs. 11 and 13, and line channel g, and this condition would continue until the lever H' again lifted. At the moment of descending, the holders N are always

spread or opened as in Figs. 20 and 22, that is to say, the slide u with its depending leg v is forced outward against the pressure of spring b' until finger z of sliding plate P drops into its proper notch in bar x and holds the parts in position, the separation of legs v and r being such as to permit them to readily pass down at opposite ends of the line section, as shown in Fig. 13. The positions of the parts are such too, that in descending, leg r strikes fair upon the upper end of wire a, pushing the same downward before it through a hole k^2 in the bottom of channel g. The legs r and v also engage the beveled upper faces of the upper arm of detent J and of support or block L, and force the same back, as indicated in Fig. 14. As the holder descends, and just before the lower ends of legs r and v, or the rollers with which they are furnished, reach a bearing at the bottom of type channel g, the lower edge of locking plate P comes into contact with the head of a screw l^{12} as shown in Fig. 14, and being arrested in its movement, while that of the body of the holder continues, a disengagement of finger z and bar x results, and leg v is forced by spring b^2 against the forward end of the line section. In thus moving forward or inward, the leg v carries with it the notched bar x, taking the notch which previously held the finger z, out of alignment with said finger, and consequently causing the finger z to rest upon the upper end of bar x and thus to maintain plate P in an elevated position, until, by justification, the line is so lengthened as to force the leg v and bar x outward, bringing the notch of bar x directly beneath finger z. When this occurs the plate P may descend, but not before. In dropping into position, the holder N is placed in engagement with screw shaft D through the spring arms Q R of Figs. 4 and 22, or equivalent means, and being free to advance by reason of having forced back the stop L, the holder at once starts forward with the line section lightly clamped between its legs r and v. At the commencement of operations all the disks V stand with one of their openings m' in alignment with the type channel g of bar E, as indicated in Fig. 10, so that the type line may pass through such openings without hinderance. As also shown in Fig. 10, there is located at each spacing station and with its forward end in close proximity to the disk V thereof, a "feeler," the peculiar form, construction and arrangement of which are better illustrated in Figs. 16, 17, 18 and 19. The office of the feeler is to detect the arrival of one of the spaces to be removed, within one of the openings m' of the disk V with which the feeler co-operates, and as the spaces introduced during composition and at each station are differently nicked, the feelers must be fashioned with reference to this difference, or with a nose so located as to coincide with the nick of the particular spaces on which it acts.

First examining Figs. 17, 18, and 19, the feeler J′ will be seen to consist of a flat bar or strip of metal or other suitable material, the forward or inner end of which is curved laterally, and is furnished at its extremity with a nose or projection l^2 designed to enter the nicking of the spaces between the type. At a point between its ends the feeler J′ is connected by a link m^2 with the bar E or other support, so that it is free both to rock or tip upon either pivot or pin of the link, and to move longitudinally. A spring n^2, secured to the bar E and bearing upon the feeler J′, serves to press its forward end inward toward type channel g, and forward into the opening m' of disk V at the time coincident with said channel, except when held back by a locking pin o^2. The pin o^2 is formed with a head or enlargement which is in the form of two cones with their bases together, or in other words is beveled above and below, as shown in Figs. 16 and 17.

As shown in Figs. 10, 16, 17, 18 and 19, the feeler J′ has the back or outer face of its forward end inclined relatively to the main body, and said face is pressed against and guided by an antifriction roller K′. The roller permits easy movement but insures accurate guidance.

When the machine first begins to operate, all the feelers are held back, and the noses l^2 are withheld from the type channel g, by the stop pins o^2, which pass down in front of the feelers as shown in Fig. 10, in which the feeler at the left is represented as thus held back. To release the feeler and permit it to go into action is the purpose of the wedge-shaped projection or incline d' on the leg v of holder N, best shown in Figs. 16 and 20. As the holder advances along the channel g under the influence or action of screw shaft D, the inclined projection d' passes beneath the head of each pin o^2 in succession, lifting said pins and releasing the feelers J′.

As stated, the locking plate P of each holder N is raised when the holder enters channel g, and remains elevated until the line section contained in it is justified, whereupon the plate drops and locks the parts fast. When this occurs, the lower edge of the plate P is brought to such level that the inclined face e' will bear upon the heads of any of the pins o^2 in its path, that may be elevated, and will force them down, thereby locking out of action the feelers which such pins control; but if the line is not justified, the plate remains at such height as to clear the pins o^2, and consequently the feelers are left free to act or move inward.

Another lug d^4 on leg r, Figs. 3 and 20, depresses the pins o^2 as the holder passes them.

In Fig. 16 the incline e' is shown as directly over the incline d', but it is to be kept in mind that in said figure the plate P is represented in its elevated position, and the leg v has not yet been forced back or outward by justification and consequent lengthening of the line. Such movement of leg v carries the

incline d' beyond and from under incline e', leaving the latter free to act when plate P assumes its lower position, which it does the instant the line is justified. Should there be any stations to pass after justification is thus performed, the pins o^2, of such stations will be lifted by the incline d' and immediately thereafter depressed by the incline e', because, as noted, the incline is then low enough to act upon the pin.

It will be seen upon referring to Figs. 16 and 20 that the action of inclines d' and e' begins and ends with the travel of leg v of the holder N past the pins o^2, and that consequently the action or inaction of the feeler following each pin is determined just before the forward end of the type line section reaches such feeler. As the type pass each feeler, the bodies of the type and spaces press back the nose of the feeler, until a space nicked to correspond with the nose l^2 of such feeler comes in front of said nose, whereupon the feeler springs forward, the noose entering the nick of the space. Owing to the employment of the link m^2 and to its location near the forward end of the feeler J', the relatively slight forward movement of the feeler causes a considerable lateral or facewise movement of the rear or outer end, to which is secured an insulated contact finger or spring p^2, Figs. 1, 2, 3, 7, 10, 17, 18 and 19. In thus moving, the contact finger p^2 makes electrical contact with a similar insulated finger q^2, secured to bar E or other suitable support, and thereby establishes an electric circuit, which is best illustrated in Fig. 3, and is as follows: Beginning with conductor u', which as already mentioned leads from a battery or other source of electric energy,—current passes by branch conductors r^2 to the several fingers p^2 of the feelers J', thence by such of the fingers q^2 as contact may at the moment be made with, and by branch conductors s^2, to the helices of electro-magnets L', and thence back to battery or source of supply, each electro-magnet being independent of all others, and brought into circuit only by contact of the fingers p^2, q^2 of its special branch r^2, s^2. Facing each electro-magnet L' is a soft iron armature t^2, carried by the lower end of an upright lever M', also best shown in Fig. 3. Pin-jointed or otherwise loosely connected with the upper end of each lever M' is a pin or bolt u^2, shown in Figs 1, 2, 3, 6 and 7, said pin being guided and supported in a suitable block, as shown.

The movement of the levers M' and consequently of the pins u^2 is advisably limited by suitable stops, and it is found expedient in practice to form a groove or notch v^2 in the upper side of the forward or free end of each pin, as shown in Figs. 2, 3 and 6.

So long as the respective electro-magnets L' remain inert or de-energized, that is so long as their respective circuits are not closed by contact of the fingers p^2, q^2, the levers M' will be controlled by light springs N' of insufficient strength to resist the pull of the electro-magnets when the latter are energized, but sufficient at other times to cause the pins u^2 to project through their supports or guides directly into the paths of the dogs n' of levers X, which as before explained, travel back and forth continuously.

As shown in Figs. 5 and 6, the forward end of each dog n' is beveled or rounded on the under side, and as a consequence the dog will ride upon and be lifted by the pin u^2 during forward movement, whenever said pin projects into its path; but when the pin is withdrawn the dog drops into engagement with the teeth of the ratchet wheel J beneath it, and will turn said wheel until again disengaged by pin u^2. To prevent possibility of premature movement of ratchet wheels U and their attached disks V, the under face of each dog is grooved near one edge, forming a rib w^2, which enters groove v^2 of the pin and precludes withdrawal thereof until the dog rides back clear of the pin.

From what has been stated it will be seen that when any feeler J' moves forward, which it does whenever a space to be removed reaches it, the circuit of the electro-magnet L' answering to or co-operating with such feeler is energized, withdraws the pin u^2 and permits the dog n' of that station to go into action and to advance the disk V of such station one step. The nose of the feeler engages the type next to said space and prevents any further advance of the type line, the perpendicular face of said nose preventing the type from forcing the feeler back. The disk V being thus caused to advance, the wedge-shaped rear wall or edge of opening m', which opening has previously remained in alignment with type-channel g, advancing, forces the type space before it, and against nose l^2 of feeler J', which latter is thus moved back, while the space removed is carried forward beyond the feeler. The movement of the disk continuing until the next succeeding opening m' is brought into alignment with type channel g, the thicker space contained in said opening is thereby brought into the place previously occupied by the one removed, and to this extent the justification is effected. The new space introduced being differently nicked from the one removed, and its nick not registering with nose l^2 of the feeler J' of that station, said feeler cannot move forward again until another space nicked to correspond with said feeler reaches it, and the line being consequently free, advances along the channel g until a space so nicked reaches the opening m' of disk V. In traveling forward again the type line passes through opening m' of the disk and carries the inserted substitute space along as part of the line. This operation is repeated at the first spacing station with each space contained in the line section carried by the holder N,—the spaces introduced at the first station being nicked to receive the feeler of the second station,—those introduced at the second being nicked for the third,—and so

on to the end of the series, or so long as the line requires further justification. When the line is completely justified, the leg v of holder N is forced away from leg r just far enough to bring a notch of bar x, Figs. 20 and 22, beneath finger z of locking plate P, which at once descends and carries finger z into said notch, locking the parts against movement. The plate P being thus lowered, its inclined face e' will depress any locking pins o^2 that may be elevated in advance of it, and consequently the disk V cannot go again into action even though other spaces nicked for that station should be contained in said line section and thereafter pass such station; but succeeding holders N will of course elevate the pins.

To prevent the locking pins o^2 from falling of their own weight and locking the feelers out of action when they should not do so, I provide a friction device for each, consisting of a sliding pin x^2, one end of which bears against the stem of pin o^2 and the other end of which is pressed by a light spring y^2 as shown in Figs. 16 and 17.

When the justified line section is finally locked in the holder N, said holder continues to travel uninterruptedly to the end of the channel g, and until its forward end enters a vertical slot or guideway z^2, formed in the upright of frame A at said point, as shown in Figs. 1 and 9.

As shown in Figs. 1 and 3, the bar E in which the type channel g is formed, terminates at a distance from the end of frame A equal to or somewhat greater than the greatest length of justified line for which the machine is designed, so that when the holder N reaches the end of its travel, the justified line may be pressed laterally or facewise from the holder N, into a galley N^{10} at that point. The galley N^{10}, as shown in Figs. 2 and 8, rests upon an inclined bed or support, to which it is clamped in any convenient manner, the edge of its bottom plate extending to a point just about in line with type channel g and directly in front of holder N when the latter is at the end of its travel. Facing the open space formed by the cutting away or omission of bar E, is a slide or bunter O', Figs. 1, 2, 3, and 8, which is normally pressed back from the line of the type channel g by a spring a^3, bearing at one end against a fixed support and at the other against the bunter, as shown in Fig. 2. The office of the bunter is to force the justified line from the holder N, and to lay the same against the previously justified line or other support in the galley N^{10}. A friction block P', made in two parts and provided with an intermediate right-and-left screw, or equivalent device, is employed to sustain the matter deposited in the galley, a lead or rule being laid against block P', which at first is placed close to the edge of the galley. The bunter is moved forward at proper times by a cam wheel or eccentric Q', loosely mounted upon shaft B, and is returned by spring a^3 as the cam recedes.

To provide for ejecting lines of different lengths, according to the adjustment of the holders N, the forward edge of the bunter is formed of two plates or parts b^3 and c^3, Figs. 2 and 8, one of which is slotted and adjustable relatively to the other, as indicated in Figs. 2 and 8, the adjustable member being held in its proper position by a clamping screw d^3, or equivalent means. The lip or edge formed by the two parts b^3 and c^3, rests upon or moves over a support e^3, which prevents the type line from falling inward or toward the bunter.

There is more or less variation in the time required to justify different lines, and consequently some irregularity in the periods of arrival of the holders in front of the galley, and the movements of cam wheel Q' must of of course be so controlled as to correspond with the arrival of holders at said point. To this end I employ in connection with cam wheel Q', a clutch mechanism, in all essential particulars the same as that used with cam wheel E', which mechanism is illustrated in Figs. 1, 2, 3, 8 and 9. As before mentioned, a vertical slot or guideway z^2, Figs. 1 and 9, is made to receive the end of holder N. The purpose of this guideway is to stay and support the holder during the removal of the type therefrom, and also to guide the holder in its transfer from shaft D to shaft C. Projecting at one end into the guideway z^2 is a sliding pin or stud f^3, the opposite end of which bears against a spring plate g^3 insulated from the framework of the machine,—the pin f^3 being made of non-conducting material or insulated from the spring plate g^3. A second insulated spring plate h^3 overlaps the plate g^3, but is slightly removed therefrom, so that normally, no contact is made between them; but when the holder N presses against the head of the pin f^3, the plate g^3 is forced against plate h^3 and an electric circuit is closed or completed, in which is included an electro-magnet R', Figs. 1 and 8. The armature j^3 of magnet R' is secured to the upper end of a sliding bar k^3, carrying at its lower end an inclined block or wedge l^3, which, normally engaging the head m^3 of a clutch pin or bolt n^3 passing through a disk S' fast to shaft B, withdraws said pin against the pressure of a spring o^3, and prevents said pin from entering into engagement with cam wheel Q' and causing said wheel to rotate with shaft B. When the electro-magnet R' is energized, however, that is to say whenever a holder N presses against pin f^3 and causes contact of the two members of the circuit closer, a current passes from the battery or other source of electrical energy to the helix of the magnet, thence through said circuit closer and back to battery. The magnet is thereby energized, attracts armature j^3, permits clutch pin n^3 to clutch cam wheel Q',

and causes the latter to rotate with the shaft B which turns in the direction indicated in Fig. 8. As the wheel or eccentric Q′ thus rotates it first bears against slide or bunter O′, and causes its plates b^3 c^3 to press evenly against the line of type in holder N, from end to end, and to force the same from the holder and over against the previously ejected line in the galley. The pressure of the bunter is applied near the upper ends of the type, which, resting against or coming first into contact with the preceding line at the lower end, are tipped over laterally and caused to take the same inclination as and to lie flat against the preceding line. Each line as it is placed in the galley, forces the entire body previously contained therein downward into the galley, the friction block P′ offering only sufficient resistance to prevent the type from falling over or getting out of shape. As the cam wheel or eccentric Q′ continues to rotate, it passes out of contact with bunter slide O′, which recedes under the action of spring a^3, and the wheel or eccentric then rises beneath and elevates a lifter T′, one end of which extends beneath the holder N, and in rising, carries said holder upward and places it in mesh or engagement with the upper shaft C, by which it is returned to position to be lowered by carrier H′ as before explained. To prevent undue friction, the lifter is furnished with a roller p^3 against which the cam wheel or eccentric Q′ bears, and with another roller q^3 at its free end, to bear against the under side of holder N. As soon as the lifter reaches the proper height to place the holder N in engagement with shaft C, it descends, and the cam wheel or eccentric Q′ being unclutched, owing to the removal of pressure from pin f^3 and the consequent de-energizing of magnet R′, the lifter rests upon the bunter, ready to rise beneath the next holder at the proper time.

In the foregoing description I have confined myself to the precise form and arrangement of parts shown, which, except as to occasional unimportant details, are such as I have employed with very satisfactory results in a full sized operative machine. It is, however, manifest that in many particulars the details may be modified,—that other well known mechanical movements may be substituted for some of those shown and described,—that the form and construction of circuit closers, contacts, &c., may be varied within the large field of such contrivances now common and well known,—and that generally the mechanism set forth is merely one approved embodiment of my invention. In other words, I believe myself to be the first to justify printing matter by first introducing thin spaces between words,—next removing said spaces successively and substituting others of slightly greater thickness, and repeating this operation until the line is brought to the required length, and this method I mean to claim broadly. So too, I believe myself to be the first to devise automatic mechanism for removing one set of spaces; mechanism to introduce other spaces; mechanism to carry a line section successively to different spacing stations or devices; mechanism for removing a justified line from its holder and for placing the same properly in a galley,—and these and various other novel features and combinations I mean to claim broadly and without restriction to specific details.

It is particularly to be observed that under the peculiar method of justification herein set forth, the spacing between words is uniform throughout the line, and the appearance of the work is therefore materially better than even careful hand work.

Manifestly, mechanically controlled clutches may be substituted for the electro-magnetic clutches shown.

Having thus described my invention, what I claim is—

1. The method of justifying type, which consists in producing a line of type matter of slightly less than the required length, and with thin spaces between words; replacing each thin space in succession with another of the next greater thickness; and then replacing the substituted spaces in succession with others of the next greater thickness,—such substitution being continued until the line is brought to the required length.

2. The herein described mode of justifying type matter, which consists in the following steps: first, producing a line slightly shorter than the intended length of the justified line, with thin spaces between words; next, placing such line in a holder capable of expansion to the required length of line but incapable of further expansion while in use; and lastly, removing the thin spaces successively and substituting others of slightly greater thickness until the line is brought to the requisite length and the limit of expansion of the holder is reached.

3. The preliminary steps in the process of justifying type matter, which consist in separating a line of composed type into sections each slightly less in length than the contemplated length of the justified line, placing at the end of each such section a wire or stem longer than the type, and adjusting said wire or stem so that its ends project both above and below the type,—whereby the ends of the sections are marked and a hold is afforded above and below the type for a feeding or carrying device.

4. The method of justifying printing matter, which consists in first producing a line of composed type slightly less in length than the contemplated length of justified line, with thin spaces at the points requiring spaces, clasping said line or section in a holder capable of expansion to the contemplated length of line; forcing the thin spaces successively from the line and introducing thicker ones in their places, and repeating this operation until the line is lengthened and the holder is ex-

panded to the predetermined length; locking the holder against further expansion—moving the holder to a position in line with a receiving galley,—and forcing the justified line from the holder into the galley.

5. In a type-justifying machine, the combination of a channel; automatic feeding mechanism for introducing into said channel a type line to be justified; an automatic ejecting device for removing spaces from said line; and an automatic carrier for inserting thicker spaces in lieu of those removed.

6. In a type-justifying machine, the combination of feeding mechanism for introducing a line section to be justified; a gage or holder to determine the length of the finished line; a locking device for said gage, adapted to lock it against expansion beyond the predetermined length of line; means for effecting a travel of the gage and line section; an ejector for removing spaces from said line section; a carrier for introducing thicker spaces in lieu of those removed; and mechanism for delivering the justified line into a receiving galley.

7. In a type-justifying machine, the combination of a channeled bar or type-way, adapted to receive and guide a line of composed type, a gage or holder movable along said way and serving to hold the type line and to determine and limit its length, and an ejector movable across the channeled bar or way and serving to force from the line the spaces contained therein, said parts being automatic in their action.

8. In a type-justifying machine, the combination of a channeled bar or typeway adapted to receive and guide a line of composed type, a gage or holder moving along said way and serving to determine and limit the length of the line, and an ejector movable across the typeway and serving to remove spaces therefrom and to open the line for insertion of a wider space.

9. In a type-justifying machine, the combination of a channeled bar or typeway adapted to receive and guide a line of type, a gage or holder movable along said typeway and serving to hold the line of type and to determine and limit its length, a plate movable across the typeway and provided with a wedge-shaped or beveled edge and with a recess in rear thereof to contain a type-space; and automatic mechanism for moving said plate; whereby the thin edge is caused to eject from the line a space contained therein, the wedge shaped portion is caused to open the line for a thicker space, and said thicker space is carried into the line.

10. In a type-justifying machine, the combination of a channeled bar or typeway provided with an opening at right angles to the type channel, and a rotatable disk extending into said opening and across the type channel, and provided with openings for the passage of the line of type through the disk.

11. In a type-justifying machine, the combination of a channeled bar or typeway provided with an opening at right angles to the type channel, and a rotatable disk extending into said opening and across the type channel, and provided with a series of openings through which the type line may pass, the rear wall of each opening of the disk being of wedge shape with the thin edge forward, substantially as and for the purpose set forth.

12. In a type-justifying machine, the combination of a channeled bar or typeway, provided with an opening at right angles to the type channel; a rotatable disk extending into said opening and across the type-channel, and provided with openings through which the type line may pass, and a space-reservoir communicating with one of the disk openings in rear of the typeway.

13. In combination with a channeled bar or typeway, a disk movable through the same across the type-channel, and provided with openings through which the type line may pass, and means for rotating said disk.

14. In combination with a channeled bar or typeway, a disk movable through the same across the type channel, and provided with openings at uniform intervals through which the type-line may pass; and means substantially such as described for imparting a step-by-step rotation to the disk.

15. In a type-justifying machine, the combination of a channeled bar or typeway; a series of disks intersecting the typeway, and provided with openings to permit the passage of the type-line; space-reservoirs communicating with the openings in the disks; and means for rotating the disks independently.

16. In a type-justifying machine, the combination of a channeled bar or typeway; a gage or holder movable along said typeway, adapted to hold a line of type and to determine and limit its length; and a plate or carrier movable across the typeway, and adapted to remove a space therefrom, to open the line, and to introduce a thicker space in lieu of the one removed.

17. In a type-justifying machine, the combination of a channeled bar or typeway; a gage or holder movable along the typeway, adapted to grasp a line of type, and expansible to the contemplated length of line; a disk extending across the typeway and provided with a series of openings each adapted to contain a type space; and means substantially such as described and shown for imparting a step-by-step rotation to the disk.

18. In a type-justifying machine, the combination with a channeled bar or typeway, of an expansible holder movable along said typeway and adapted to hold a line of type; means for effecting the travel of said holder; and a series of carriers movable across the typeway and adapted to remove spaces from the line as it passes the disks, and to substitute thicker ones for those removed.

19. In combination with a channeled bar or typeway, a type-holder movable along said way, adapted to hold a line of type and to

limit and determine the length of said line; a detent located at the side of the typeway and adapted to move forward into the same and to arrest the line of type in the holder whenever a space nicked to correspond with the detent comes into line with said detent; and a plate or carrier adapted to remove the nicked space and force back the detent.

20. The combination with a channeled bar or typeway, of a type holder movable along said way,—an arresting device adapted to arrest the travel of the holder whenever a properly nicked space comes under its action; and an ejecting device adapted and arranged to remove such space from the line and to force back the arresting device.

21. In combination with a channeled bar or typeway, a series of plates movable across said typeway and provided with openings for the reception and passage of type; a series of reservoirs communicating with the openings of said plates and adapted to deliver differently nicked spaces to said openings; and a series of detents, each adapted to enter the nicking of one class of spaces only, and to arrest the travel of a line of type along the channel or typeway whenever a space of its class comes opposite such detent.

22. In combination with a channeled bar or typeway; a plate movable across the typeway and provided with an opening through it to permit the sidewise passage of a type, the rear wall of said opening being beveled or wedge-shaped;—and a detent adapted to move forward into said opening and to enter a notch or nick in a type space in the typeway whenever a properly nicked space comes opposite said detent; whereby the line is arrested during the removal of said space from the line, and the detent is forced back by the advance of the plate across the typeway.

23. The combination in a type-justifying machine, of the following elements: a channeled bar or typeway; means for moving a line of type along said way; a yielding support for the forward end of the type-line; a holder to clamp the line of type; a carrier to move said holder to the typeway; mechanism for actuating said carrier; an electro-magnetic controlling device for bringing said mechanism into or throwing it out of action; and a circuit closer adapted to complete the electric circuit of said controlling device when the yielding line support reaches a prescribed position.

24. In a type-justifying machine, the combination of a channeled bar or typeway; a plate movable across the typeway; mechanism for moving said plate; a detent for holding said mechanism out of action; an electro-magnet for withdrawing said detent; a feeler adapted to enter a nick in a type space of the line to be justified whenever such space comes into alignment with the plate; and a circuit closer adapted to complete the circuit of the electro-magnet when the feeler enters the nick of the space; whereby the plate is caused to move and eject the space when the latter comes into alignment therewith.

25. In combination with a channeled bar or typeway, a type-holder movable along said way, and automatic mechanism substantially such as described and shown for justifying the type in said holder; a galley located by the side of the typeway; a bunter movable across the typeway and adapted to deliver the type from the holder to the galley; mechanism for actuating said bunter; and a clutch controlled by the holder and adapted to throw the bunter into operation when the holder brings the type properly in front of the galley.

26. The combination in a type-justifying machine, of the following elements: a channeled bar or typeway; means for moving a line of type along said way; a yielding support for the forward end of the line; a holder to clamp the line of type; a carrier to move said holder to the typeway; mechanism for actuating said carrier, and a clutch controlling said mechanism, and in turn controlled by the yielding line-support.

27. In a type-justifying machine, the combination of a channeled bar or typeway; a plate movable across said way; mechanism for moving said plate; a detent for holding said mechanism out of action; means for withdrawing said detent; and a feeler adapted to enter a nick in a type space of the line to be justified, whenever such space comes into alignment with the plate, and also to control the action of the mechanism by which the detent is withdrawn.

28. In combination with a channeled bar or typeway, a type-holder movable along said way, and means substantially such as described and shown for justifying the type in said holder; a galley located by the side of the typeway; a bunter movable across the typeway and adapted to deliver the type from the holder to the galley; mechanism for actuating said bunter; a clutch controlling the action of said mechanism; an electro-magnet controlling said clutch; and a circuit closer located in the path of the holder and serving to complete the circuit of the electro-magnet when the holder reaches the end of its travel along the typeway.

29. The herein described type-justifying machine, comprising the following elements in combination: a suitable framework; a channeled bar or typeway; a series of type-holders movable along said way; means for moving said holders along the way and returning them to the starting point; plates intersecting and movable across the typeway and provided with openings for the passage of the type line; means for moving said plates; and feelers, one for each plate, controlling the action of the mechanism by which said plates are moved.

30. In a type-justifying machine, the combination of a suitable framework; a channeled bar or typeway E; a series of disks V

intersecting said typeway and provided with ratchet wheels U, levers X provided with dogs n', feelers J', and detents u^2 for holding the dogs n' out of action—, said detents being controlled by the feelers J', substantially as set forth.

31. In combination with a channeled bar or typeway, a carrier G having arms e and f movable above and below the typeway; and means for moving said carrier along the typeway; whereby the carrier is adapted to engage a wire or device introduced into the type-line and projecting above and below the same, and thereby to carry forward the type in advance of said wire, but is enabled to clear the type.

32. The combination with a typeway or channel, of a carrier G comprising a rockshaft d and arms e, f, the latter extending above and below the typeway or channel, and a spring i serving to hold the arms normally across said typeway.

33. In combination with a typeway or channel, a carrier for advancing type along said channel, comprising a rockshaft, an arm projecting from said rockshaft across the type-channel, an arm projecting from said rockshaft away from said channel; and a movable stop adapted to be placed in the path of the latter arm, and, by arresting the same, to throw the carrier out of action.

34. In combination with a typeway or channel g, carrier G comprising rockshaft d and arms $e\,f$ and h; and sliding bar I^2 having stop j^2 adapted to arrest the arms h and to swing arm e away from channel g as the carrier G moves forward.

35. In combination with carrier G having arms $e\,f$ and h; slide or bar I^2; and carrier lever H' adapted to depress said slide and to carry it into the path of arm h of carrier G.

36. In a type-justifying machine, the combination of a channeled bar or typeway, a carrier adapted to move a line of type along said way, a holder to receive said line of type, and a series of overlapping springs, extending along one side of the typeway throughout that portion of its length through which the carrier moves the type, whereby the line is subjected to light and even pressure at numerous points, and disarrangement of the line is prevented.

37. In combination with typeway or channel g, slide K; block L carried by and movable at right angles to slide K; spring l bearing against block L and serving to keep its beveled forward end normally within the channel g; spring m, attached to slide K; and a holder or gage adapted to enter the type channel to bear upon the beveled end of block L, and thereby to force back the latter.

38. In combination with type channel g, yielding support L; catch or detent J; and holder N provided with legs r and v adapted to bear upon and force back the support and the detent, substantially as set forth.

39. In combination with channel g having reduced lower channel b; carrier G, provided with arms e and f, the latter extending into the lower channel b.

40. In combination with channel g, having opening k^2, holder N, provided with leg r.

41. In combination with channel g provided with opening k^2; detent J; and holder N provided with leg r.

42. The combination of channel g provided with opening k^2; detent J, and yielding support L extending into said channel and having their ends beveled substantially as set forth; and holder N provided with legs r and v adapted to move downward directly over the detent and opening k^2, and over support L, substantially as and for the purpose explained.

43. In combination with type-channel g, a plurality of feelers J', each having a nose or extension l^2 to enter a properly located nick in the type spaces passing through said channel and to hold the type line against movement, the nose or extension l^2 of each feeler being out of line with that of the next, whereby each is adapted to enter a space nicked to correspond with its location but is prevented from entering spaces not so nicked.

44. In combination with type channel g; a feeler J' movable into and out of said channel; and a locking pin o^2 adapted to pass in front of the feeler and withhold it from the channel.

45. In combination with channel g, a feeler J' movable into and out of said channel; a stop pin o^2 to prevent the inward movement of the feeler; and a friction device to prevent the accidental displacement of the pin.

46. In combination with a typeway or channel g; a feeler movable to and from said channel; a stop pin o^2 to prevent the advance of the feeler, provided with a head or enlargement; and a type-holder N adapted to traverse the typeway and provided with an inclined rib d' to pass beneath the head of the pin and elevate the same.

47. In combination with a typeway or channel g; a feeler movable to and from said channel; a stop pin o^2 to prevent the advance of the feeler, provided with a head or enlargement; and a type-holder N adapted to traverse the typeway and provided with an inclined rib d' to pass beneath the head of the pin and elevate the pin, and with incline e' to depress the same.

48. In combination with typeway or channel g; feeler J'; link m^2; and roller K' forming a bearing and guide for the feeler.

49. In combination with typeway or channel g; feeler J'; and link m^2 connecting said feeler with its support; whereby the feeler is adapted to rock or to tip and to move bodily forward and backward.

50. In combination with typeway or channel g; plate V movable across said typeway and provided with openings m'; and feeler J' adapted to move forward into the openings m'.

51. In combination with typeway or chan-

nel *g;* plate V movable across said channel, and provided with openings *m'*, having their rear walls beveled substantially as described; and feeler J' provided with nose l^2, adapted to move forward into the openings *m'*.

52. In combination with typeway or channel *g;* feeler J' provided with nose l^2; link m^2 connecting said feeler with its support; and spring n^2 bearing upon the feeler and pressing its nose forward toward channel *g*.

53. In combination with typeway or channel *g;* feeler J' provided with an insulated contact finger p^2, whereby it is adapted to serve also as a circuit closer.

54. The combination of a typeway or channel; a yielding support extending into said channel to sustain the incoming type; an insulated contact finger movable with said support; a second contact finger in the path of the first; a holder to clamp and hold the type in the channel; a carrier to move said holder to the channel; a clutch controlling the movement of the carrier; and an electro-magnet controlling said clutch and included in the circuit with said contact fingers; whereby the carrier is brought into action when said fingers meet.

55. In combination with a typeway or channel *g;* a disk V movable across said channel and provided with openings *m';* a ratchet wheel U fast to the disk; a dog *n'* adapted to engage and move said ratchet wheel; a pin or bolt u^2 movable to and from the path of the dog and adapted to hold the latter out of action; an electro-magnet for withdrawing the pin from the path of the dog; a feeler J' movable to and from the opening *m'* of the disk; and a circuit closer carried by said feeler and adapted to close the circuit when the feeler advances, and thereby to cause the withdrawal of the pin, the engagement of the dog, and the advance of the disk.

56. In combination with channel or typeway *g*, and disk V provided with ratchet wheel U; dog *n'* adapted to impart motion to the ratchet wheel, and provided with rib w^2; and pin or bolt u^2 movable into and from the path of said dog, and provided with groove v^2 to receive the rib w^2, substantially as and for the purpose set forth.

57. In combination with typeway or channel *g*, carrier G provided with arm *h;* carrier H' for delivering the type-holder N to the channel; and slide or bar I^2 arranged in the path of carrier H' and serving to arrest arm *h* of carrier G.

58. In combination with typeway or channel *g*, a plate, as V, movable across said typeway and provided with openings *m';* a reservoir to contain type spaces; a guide B' extending from the reservoir to one of the openings *m';* and a block or body *r'* placed in line with the mouth of guide B' but on the opposite side of plate V therefrom, to prevent the spaces passing through or beyond the plate.

59. The carrier G, comprising a guiding bar, a slide movable upon said bar; a rockshaft mounted in said slide and provided with arms *e, f,* and a spring *i* serving to turn said rockshaft in one direction.

60. In combination with channel or typeway *g*, a carrier G constructed substantially as shown and described, and a lever H and cam I for imparting a reciprocating motion to said carrier.

61. In combination with typeway or channel *g*, disk V provided with openings *m';* ratchet wheel U connected with said disk; lever X; dog *n'* carried by said lever; spring Y attached to lever X; and cam or eccentric Z bearing upon the lever, all substantially as described and shown.

62. In a machine for justifying type, the combination with a typeway or channel *g*, of ratchet wheel U and disk V, lever X provided with dog *n'* and with adjustable plate *p'*, and cam or eccentric Z, arranged to bear upon said plate, substantially as and for the purpose explained.

63. In combination with channel or typeway *g*, and disk V provided with openings *m';* space reservoir C'; guide B'; follower *s';* and means substantially such as shown and described for advancing the follower.

64. In combination with a typeway or channel *g*, a type holder movable along said channel and adapted to contain a line of type and to determine and limit its length; a bunter O' movable across the typeway and serving to remove type from the holder; a galley to receive the type; mechanism for actuating said bunter, and a clutch controlled by the type-holder and serving to start the bunter-actuating mechanism when the holder comes directly opposite the receiving galley.

65. In combination with typeway or channel *g*, a holder N movable along said way, a galley or receiver N^{10} for the type, a bunter to deliver the type from the holder into the receiver, a cam or eccentric Q to move said bunter, a clutch m^3 to connect the cam or eccentric with a driving shaft, an electro-magnet R', to move said clutch, and a circuit closer located in the path of holder N and serving to complete the circuit of the electro-magnet when the holder comes opposite the galley or receiver.

66. In a type-justifying machine, the combination of a type-way or channel, a type-holder movable along said channel, a supporting way for the return of said holder, out of line with the typeway; a carrier for moving the holder from the typeway to the return-way; a second carrier for moving the holder from the return-way to the type-way, and automatic mechanism substantially such as described for imparting motion to the holder and the carriers.

67. The combination in a machine for justifying type, of a typeway or channel; two shafts in different planes, parallel with said channel; a type-holder movable along said channel and provided with devices to engage

with said shaft; and shifting or transfer devices adapted to transfer the holders from one shaft to the other at each end of the line of travel.

68. In combination with a typeway or channel *g*, shafts C D; holder N provided with a yielding device to engage with one or the other of said shafts according to the position of the holder; a carrier H′ for lowering the holder from shaft C to shaft D; a lifter T′ to elevate the holder from shaft D to shaft C; and means substantially as described for imparting motion to said parts.

69. The herein described holder and gage for use in a type-justifying machine, consisting of a main frame provided with arms *p p;* a fixed leg *r;* a movable leg *v;* a spring *b′* tending to move leg *v* toward leg *r;* a notched bar *x;* a locking plate P provided with a finger to enter a notch of the bar *x;* levers *s s;* and spring *o*, combined as shown.

70. A holder or gage for use in a type-justifying machine, comprising the following elements in combination: a main frame provided with a fixed leg; a movable leg; a spring to cause the approach of said legs; and a locking device to hold the movable leg when moved a given distance from the fixed one.

71. The holder N, comprising a main frame; a fixed leg *v;* a sliding leg *r;* a reversible notched bar *x* movable with leg *r;* and a locking plate P, adapted to engage the notched bar, all substantially as shown and described.

72. In combination with the framework of a type-justifying machine provided with a guideway, a type-holder N provided with a head *q* to enter said guideway and direct the holder to the typeway or channel.

73. In combination with shaft C of a type-justifying machine, a type-holder N provided with arms *p p*, and yielding arms or levers *s s* to clasp said shaft.

74. The combination of a typeway or channel, a detent adapted to enter said channel, a pin o^2 for holding back the detent, a type-holder having a depending leg *v* to enter the channel, and an inclined rib *d′* upon said leg, to move the pin o^2.

75. The combination with a typeway or channel, a detent adapted to enter the same, and a pin to hold said detent out of the channel, of a type-holder comprising a main frame, a fixed leg *r*, and movable leg *v* provided with inclined rib *d′*, and a locking plate P provided with an inclined face *e′*, substantially as and for the purpose explained.

76. In combination with the typeway or channel of a type-justifying machine, a type-holder provided with legs *v* and *r*, and with rollers in the lower ends of said legs to rest upon the bottom of the channel.

77. In a type-holder or gage for use in a type-justifying machine, the combination of a main frame provided with a fixed leg; a movable member provided also with a leg; a notched bar carried by the movable member; and a locking plate adapted to engage in a notch of said bar.

78. In a type-holder or gage for use in a type-justifying machine, the combination of a main frame provided with a rigid leg; a movable member provided also with a leg, a reversible bar carried by the movable member and provided with alternating notches in its opposite edges; and a locking plate adapted to engage with one or another of the notches when the legs are forced apart, substantially as described.

79. In combination with typeway or channel *g* and with feelers J′ adapted to enter said typeway, stop pins o^2 provided with heads or enlargements and serving to hold back the feelers, and type-holder or gage N provided with inclined rib *d′*.

80. In combination with typeway or channel *g*, a feeler J′ adapted to enter said channel, a stop pin o^2 to prevent the forward movement of the feeler, and a type-holder N provided with inclined rib *d′* and inclined face *e′* respectively, serving to elevate and to depress the locking pin.

In witness whereof I hereunto set my hand in the presence of two witnesses.

JOHN LOUDON McMILLAN.

Witnesses:
THOS. RICHARDSON,
A. D. RICHARDSON.