No. 844,569. PATENTED FEB. 19, 1907.

W. J. ENNISSON.

TYPE JUSTIFYING MACHINE.

APPLICATION FILED AUG. 23, 1904.

8 SHEETS—SHEET 1.

Fig. 1.

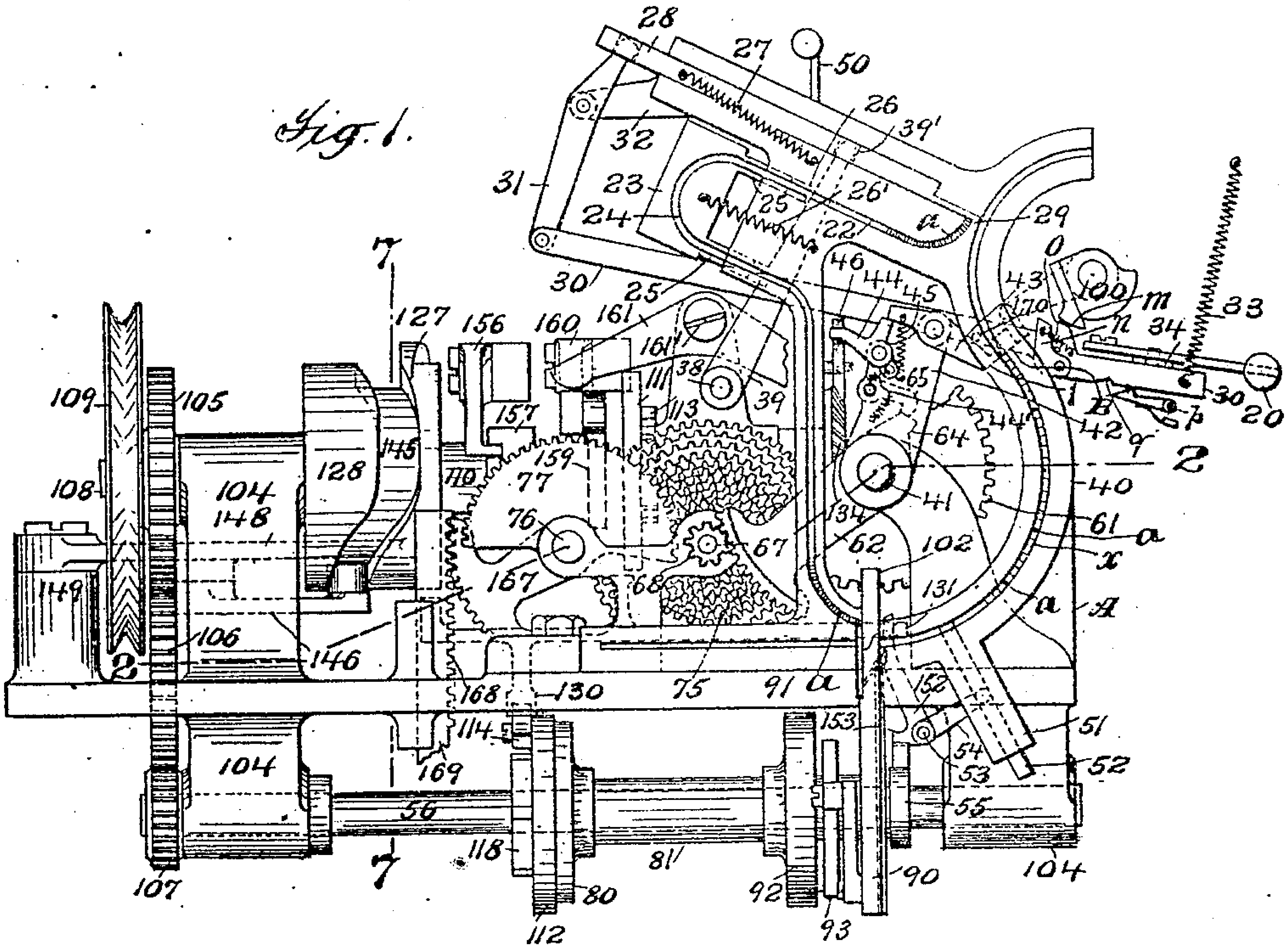


Fig. 15.

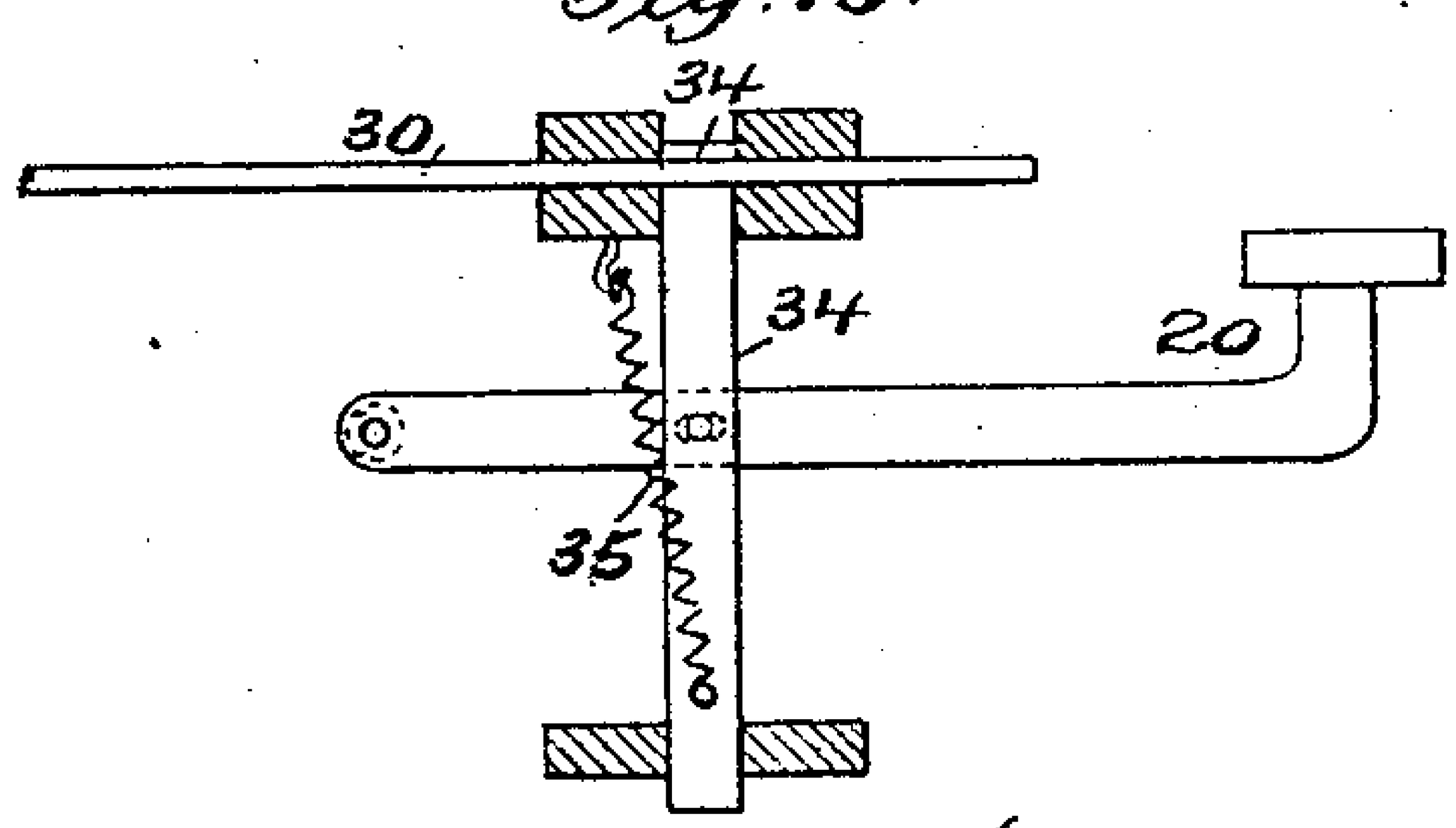
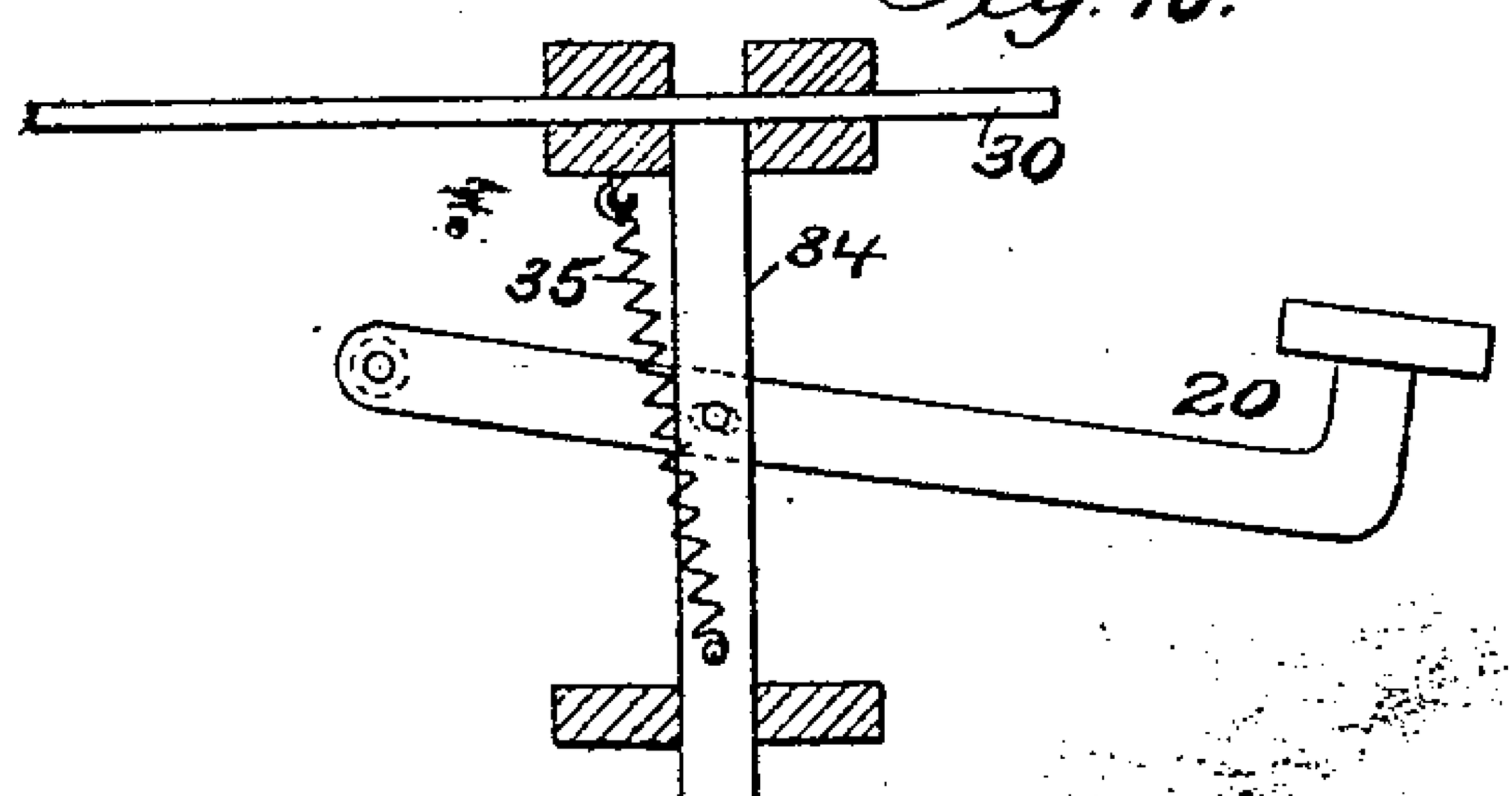


Fig. 16.



Witnesses
P. B. Philipp
J. McBorsh

Inventor
Walter Jay Ennisson
By his Attorneys
Philipp Sawyer Rice & Kennedy

No. 844,569. PATENTED FEB. 19, 1907.

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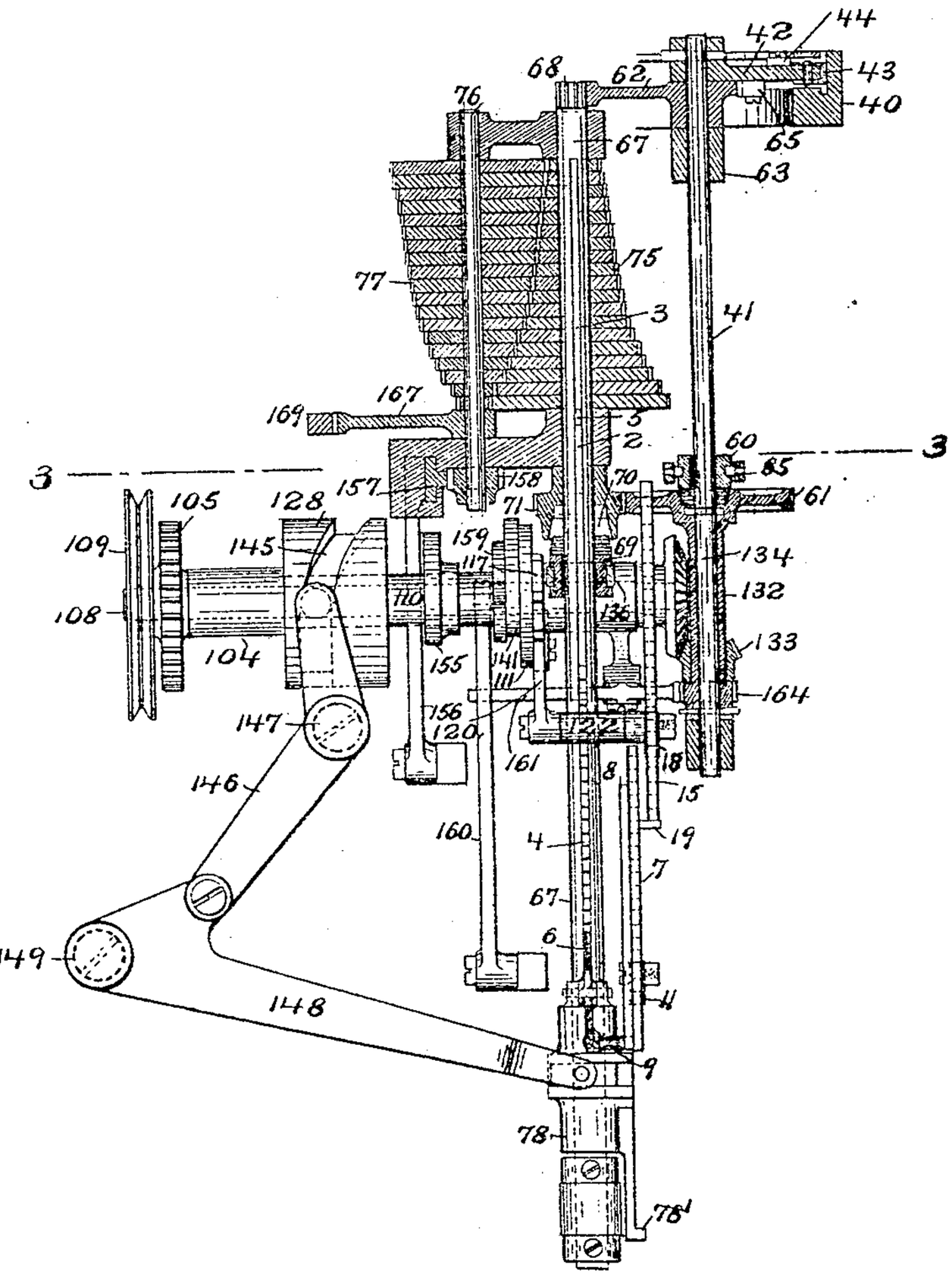
8 SHEETS—SHEET 2.

Fig. 2.



Witnesses
P. B. Philipps
G. M. Bond

Inventor
Walter Jay Ennisson
By his Attorneys
Philipp Thompson Rice & Kennedy

No. 844,569. PATENTED FEB. 19, 1907.

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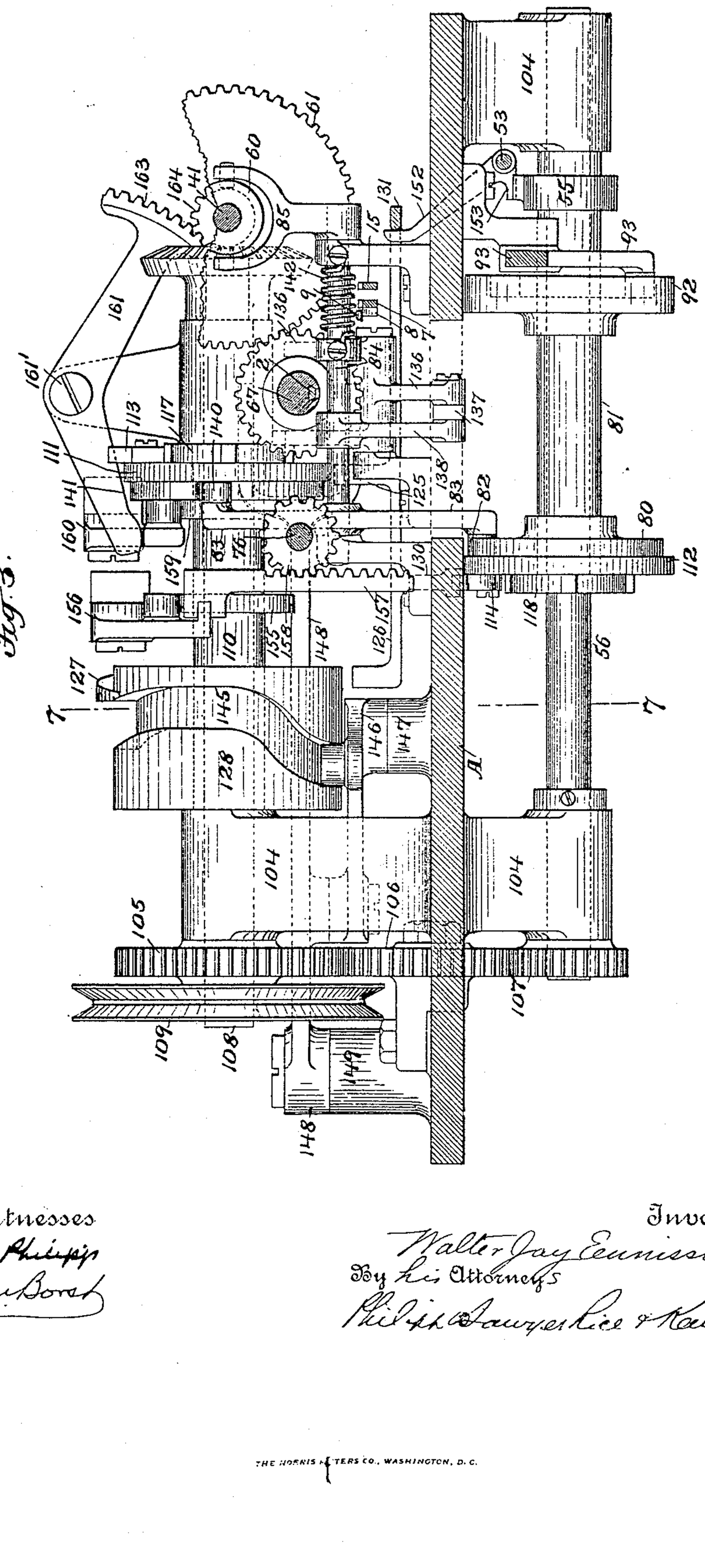
8 SHEETS—SHEET 3.

Fig. 3.



Witnesses
P. B. Philipps
G. McBoral

Inventor
Walter Jay Ennisson
By his Attorneys
Philipps Lawyer Rice & Kennedy

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8 SHEETS—SHEET 4.

Fig. 4.

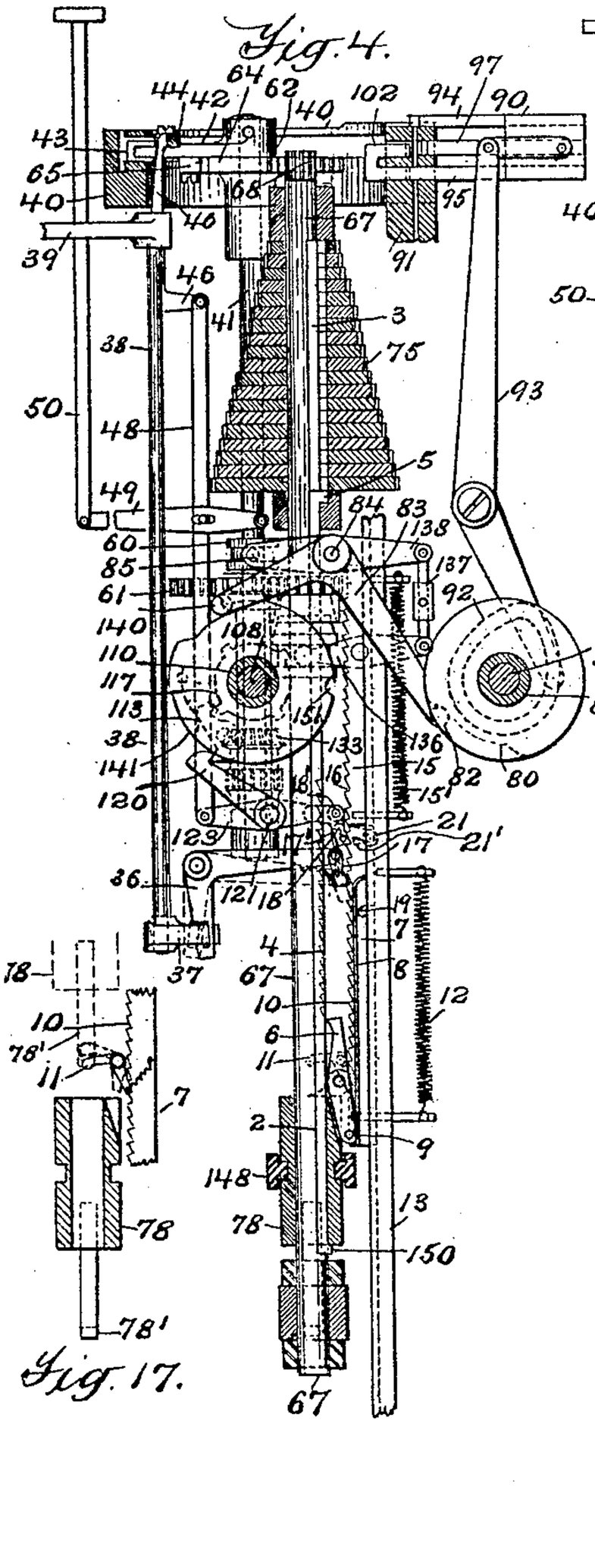
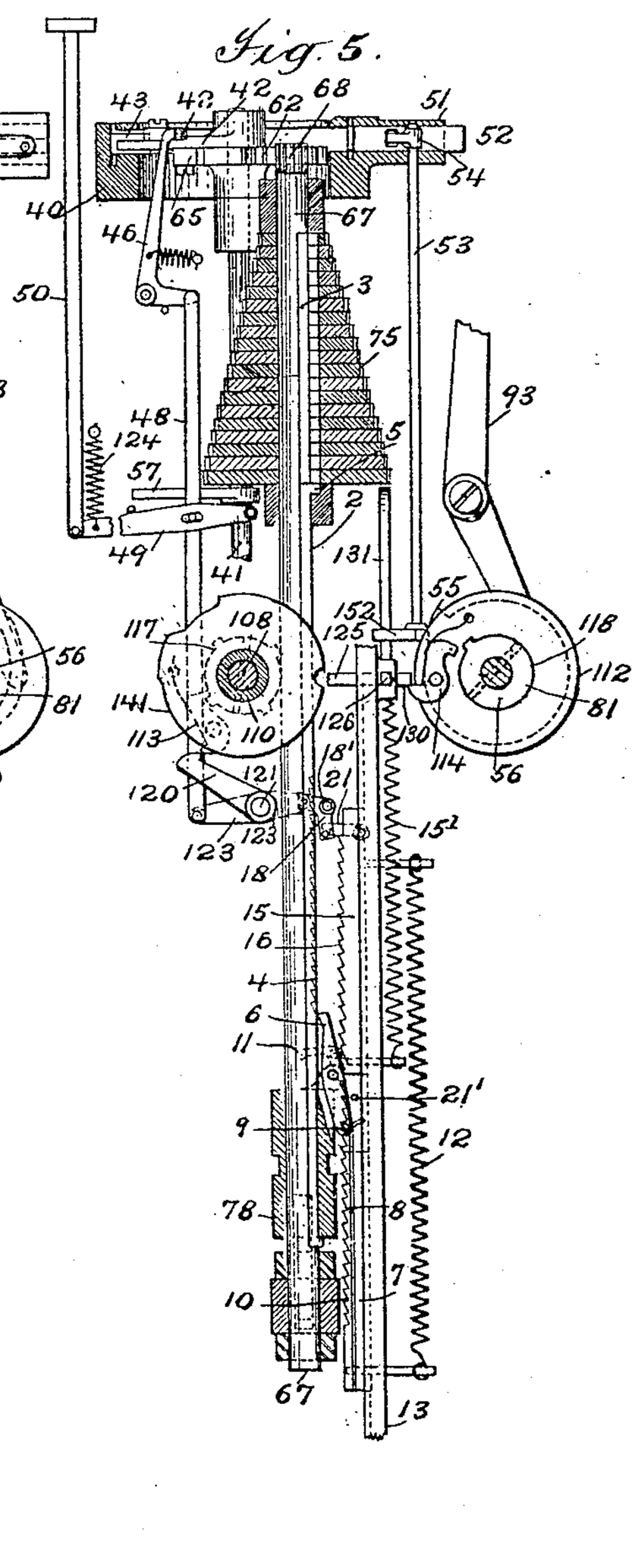


Fig. 17.

Fig. 5.



Witnesses
P. B. Philipp
J. M. Borst

Inventor
Walter Jay Ennisson
By his Attorneys
Philipp Sampson Lee & Kennedy

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W. J. ENNISSON.

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8 SHEETS—SHEET 5.

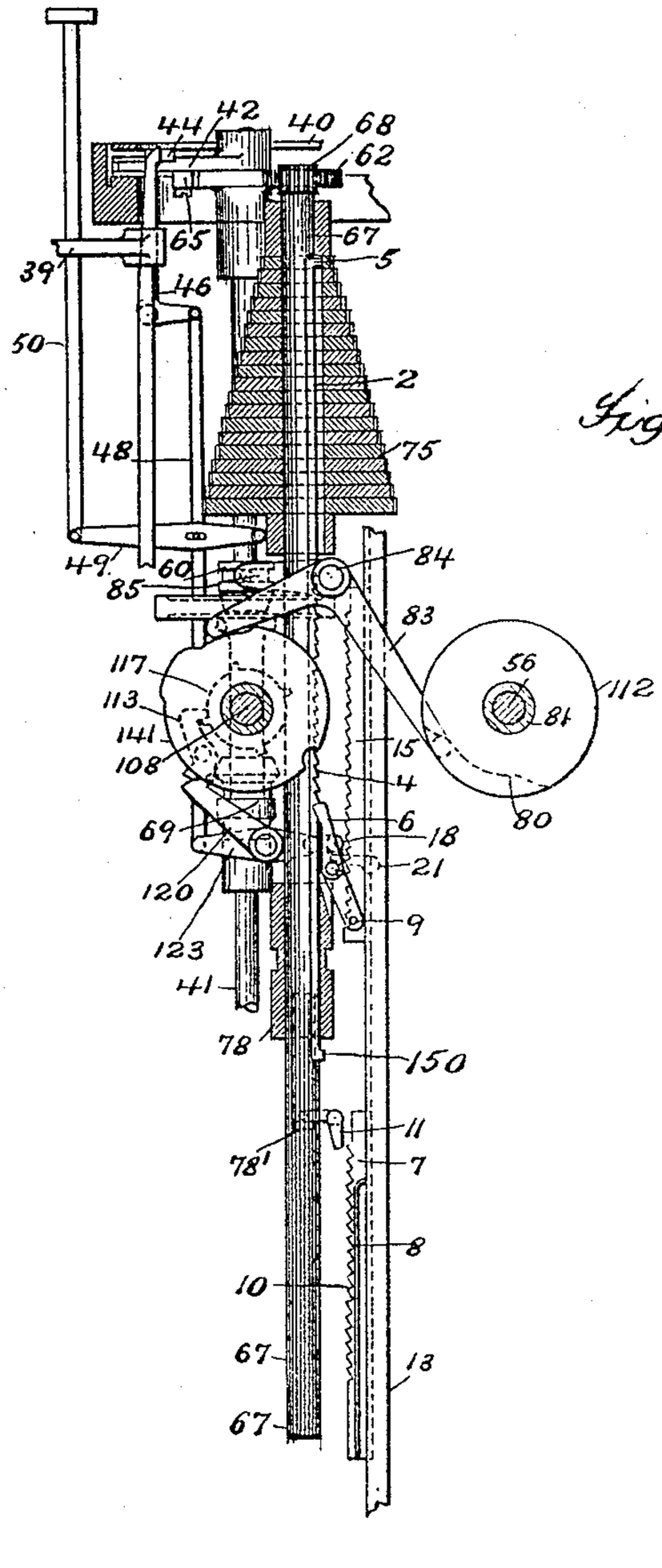

Fig. 6

Witnesses
F. B. Phipps
J. M. Borst

Inventor
Walter Jay Ennisson
By his Attorneys
Philip Sawyer Lee & Kennedy

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W. J. ENNISSON.

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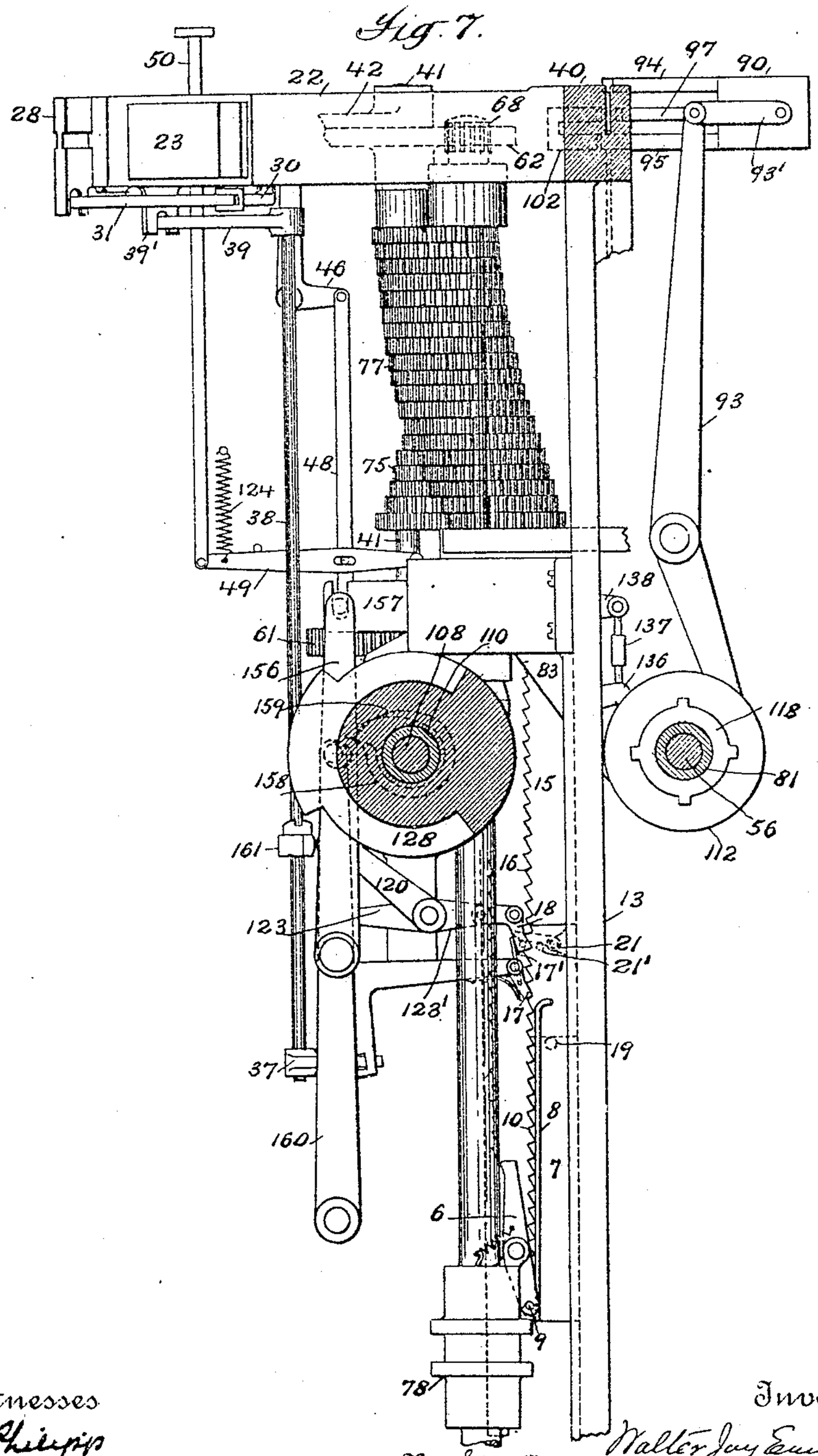
8 SHEETS—SHEET 6.

Fig. 7.



Witnesses
P. B. Philipp
J. Ralph Borst

Inventor
Walter Jay Ennisson
By his Attorneys
Philip A. Sawyer & Lee & Kennedy

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8 SHEETS—SHEET 7.

Fig. 8.

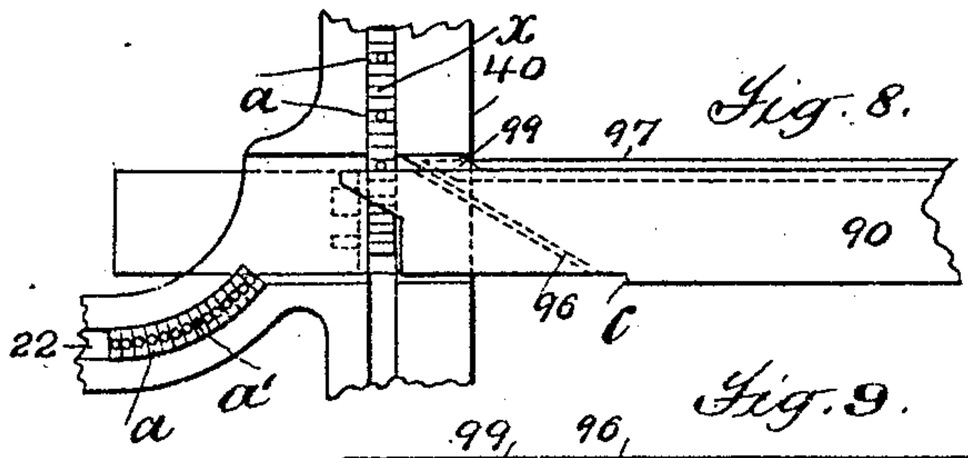
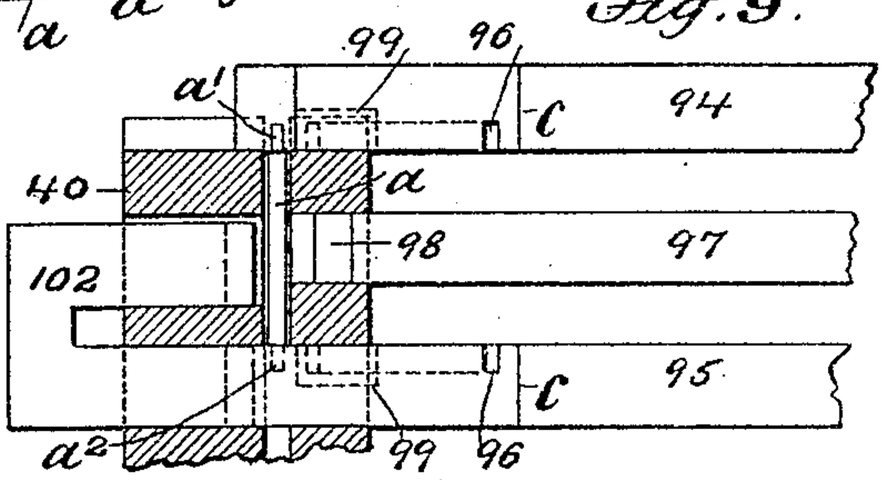


Fig. 9.



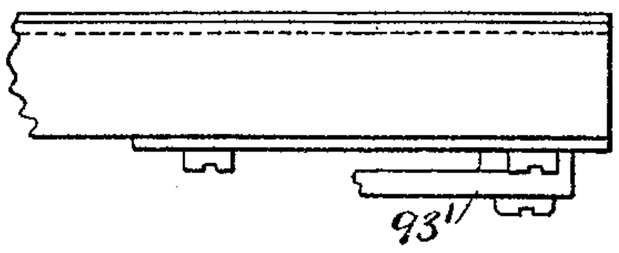


Fig. 10.

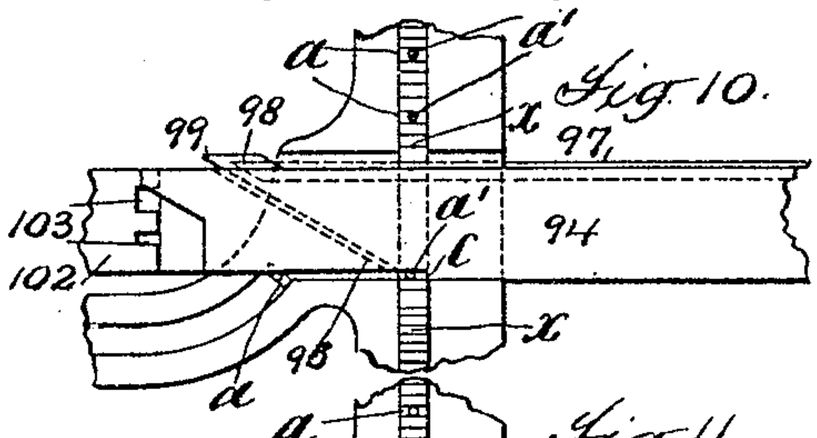


Fig. 11.

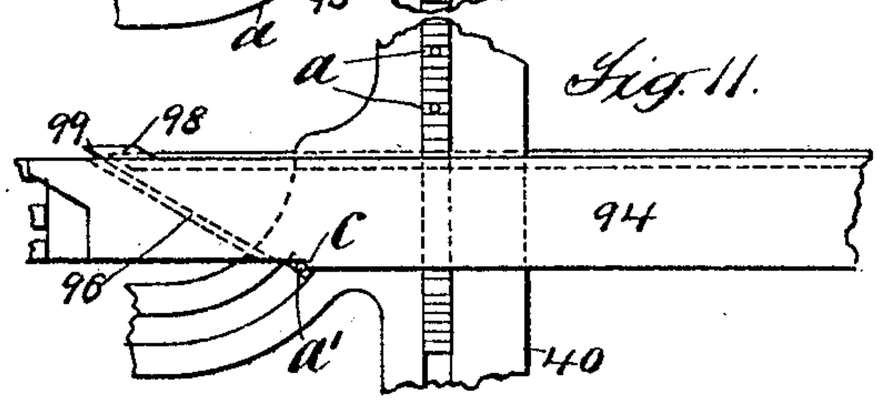


Fig. 12.

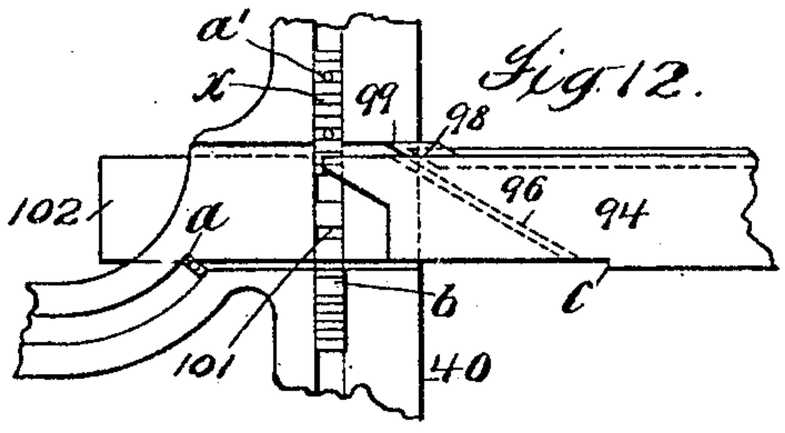


Fig. 13.

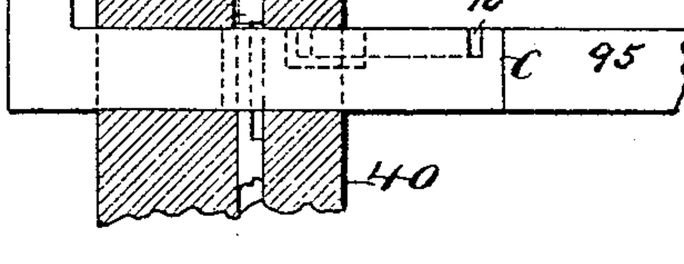
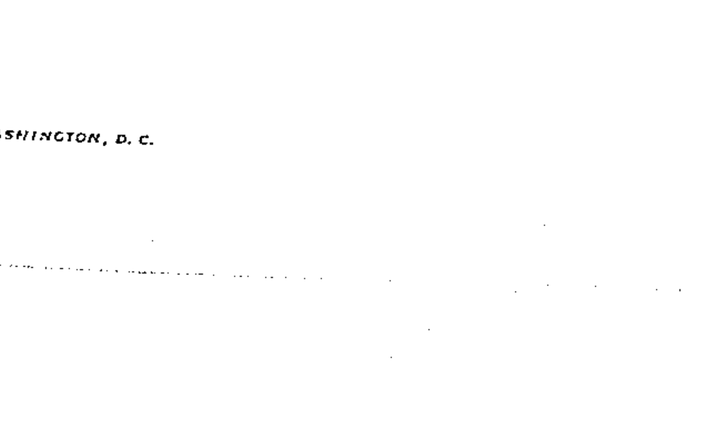


Fig. 14.



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8 SHEETS—SHEET 8.

Fig 18.

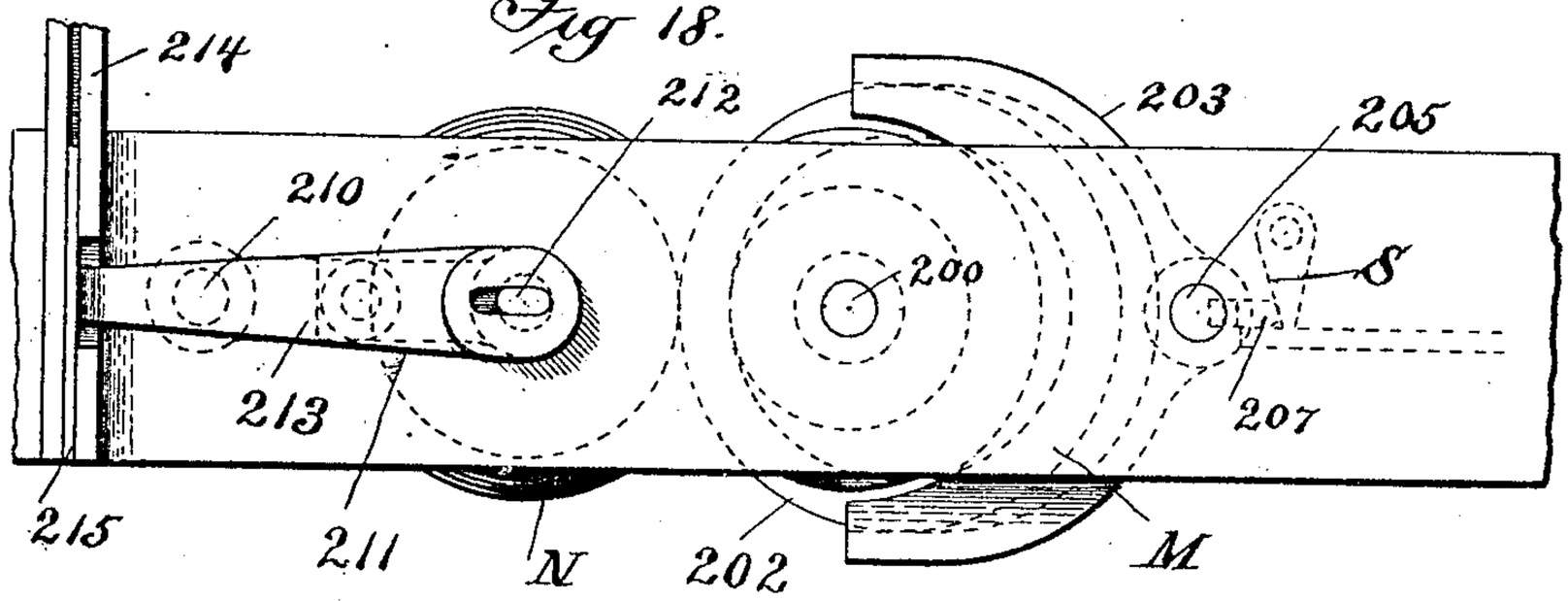


Fig 19.

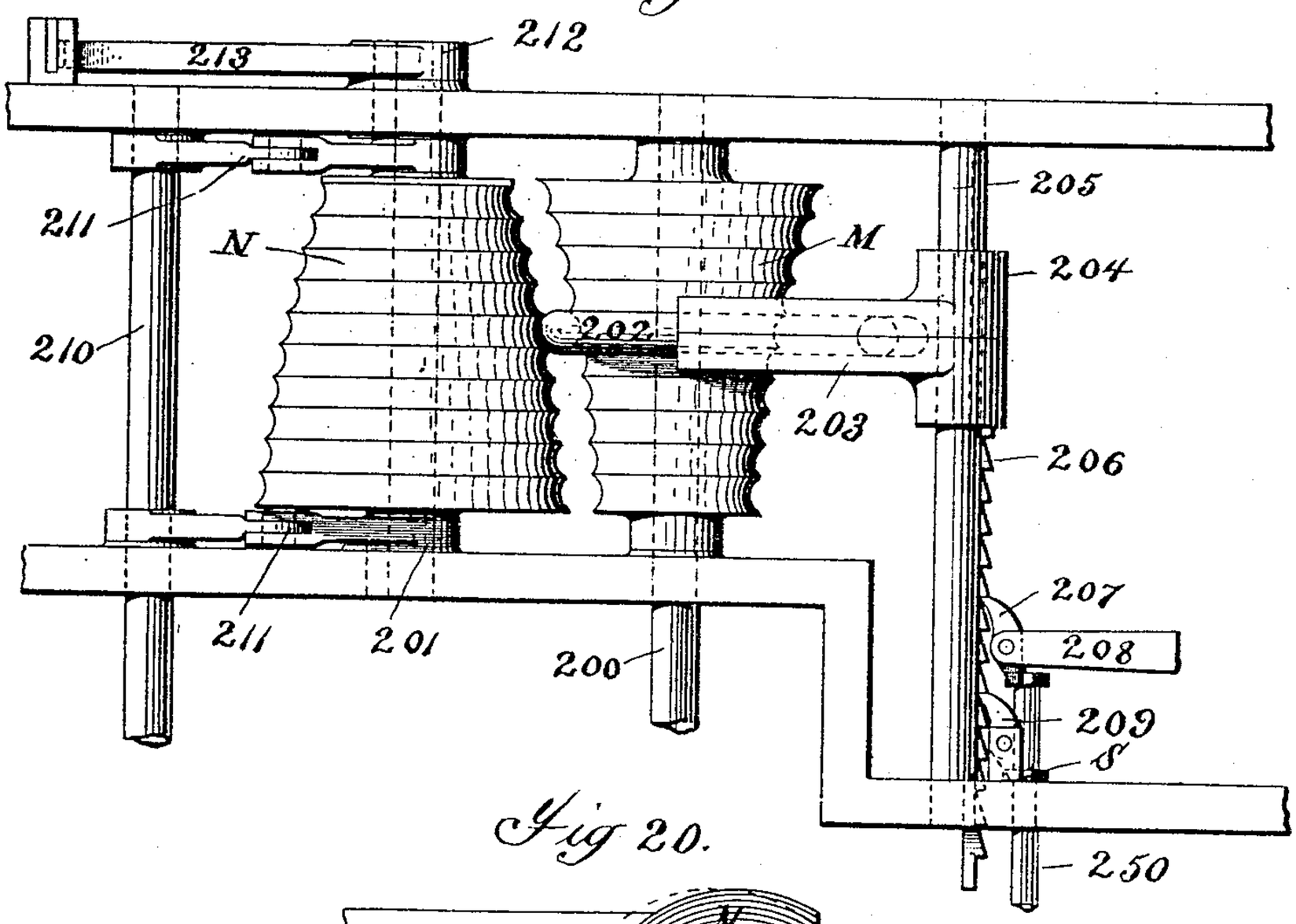
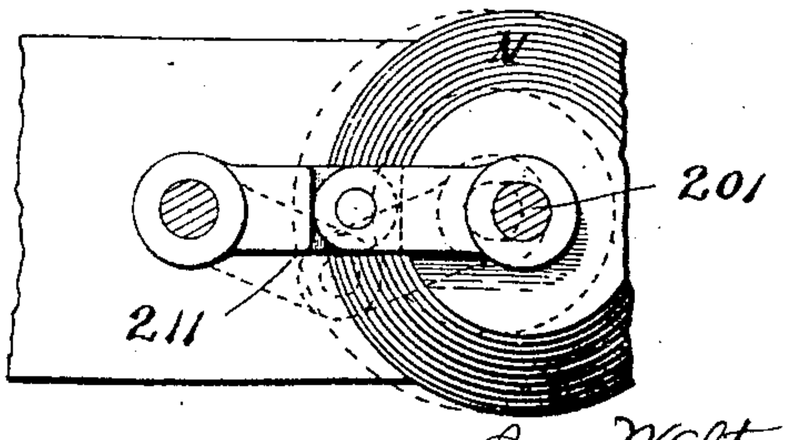


Fig 20.



Witnesses
P. B. Philipp
J. M. Borst

Inventor
Walter Jay Ennisson
By his Attorneys
Philipp Lawyer Rice & Kennedy

UNITED STATES PATENT OFFICE.

WALTER JAY ENNISSON, OF NEW YORK, N. Y., ASSIGNOR TO THE UNITYPE COMPANY, A CORPORATION OF NEW JERSEY.

TYPE-JUSTIFYING MACHINE.

No. 844,569. Specification of Letters Patent. Patented Feb. 19, 1907.

Application filed August 23, 1904. Serial No. 221,814.

To all whom it may concern:

Be it known that I, WALTER JAY ENNISSON, a citizen of the United States, residing at the city of New York, county of Kings, and State of New York, have invented certain new and useful Improvements in Type-Justifying Machines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to justifying mechanism, the especial object being to provide an improved mechanism for measuring unjustified lines of type and ascertaining in accordance with the measurement of the lines and the number of word-spaces therein the thickness of the individual spaces required to justify the lines measured.

The invention includes also improved means for handling and controlling the line of type in process of justification, for inserting space-markers or temporary spaces or word-separators, for substituting the permanent justifying-spaces for the temporary spaces or word-separators, and means for returning the temporary spaces to their magazine.

The general features of the mechanism illustrated herein as embodying the invention are as follows: first, a proportional measuring device for ascertaining the required thickness of justifying-spaces, which comprises a line-measuring device, a dividing mechanism composed of a series of gear sets or trains, with adjustable means for selecting the particular set thereof corresponding to the number of word-spaces in the line to be justified, and a gage set by action of said devices to determine the thickness of spaces required to justify the line measured; second, type-driving means for conducting the unjustified line of type within and through the machine, consisting of a circular typeway and a type-engaging arm adapted to swing concentrically with the curve of said typeway, which arm constitutes a part of the measuring mechanism of the justifier; third, means for opening the line between the several words thereof for the insertion of permanent justifying-spaces, including means for removing the temporary spaces composed with the unjustified line and returning the same to a magazine provided therefor, and, fourth, the parts employed in actuating the various mechanisms of the machine, consisting of constantly-moving shafts, with sleeves thereon upon which are grouped the cams and actuating parts of the word mechanisms and line mechanisms of the machine, and means for operably connecting the sleeves to the shafts as required.

For a full understanding of the invention a detailed description of the mechanism embodying the above general features and a modification thereof will now be given in connection with the accompanying drawings, forming a part of this specification, and the features forming the invention will then be specifically pointed out in the claims.

In the drawings, Figure 1 is a plan view of the mechanism. Fig. 2 is a sectional elevation on the line 2 of Fig. 1. Fig. 3 is a sectional plan view, on an enlarged scale, the view being taken on the line 3 of Fig. 2. Figs. 4, 5, and 6 are skeleton views of the machine, with parts thereof shown in section, the views being taken at right angles to Fig. 2 and looking to the right of Figs. 1 and 2. These three views taken together show successive stages in the operation of the gear-justifying mechanism—the clutch-operating mechanism and other parts of the machine. Fig. 7 is an enlarged sectional view taken on the line 7 of Figs. 1 and 3. Figs. 8 to 14, inclusive, are detailed views of the mechanism employed in separating the line for the reception of justifying-spaces and for removing the temporary separators therefrom. Figs. 15 and 16 are detail views of the word-key mechanism, shown in two positions. Fig. 17 is a detail of part of Fig. 4. Fig. 18 is a detail plan view of a modified form of dividing mechanism. Fig. 19 is a front elevation of the same. Fig. 20 is a detail horizontal view showing different positions of the register-shaft of Fig. 18.

In describing the various mechanisms I will first describe in detail the mechanism employed in ascertaining the size or thickness of the space or spaces required to justify the line of type, which mechanism comprises several independent devices, which will be given in the following order: first, those parts employed in measuring the unjustified line of type to ascertain its aggregate shortage, next the means by which that ascertained shortage is divided in proportion to the num-

ber of spaces in a line to be justified, and then the means whereby the dividing mechanism is set in accordance with the number of word-spaces in the line to be justified. The measuring and dividing means and the parts pertaining thereto having been described, the mechanism for advancing the line to the devices employed in separating the words for inserting justifying-spaces will be described, together with these devices. Then, finally, the various driving and actuating parts of the justifier will be described.

In the machine illustrated the unjustified line of type *x* is played into the justifier from a type-setting machine, in which it is composed, with temporary spaces or separators between the words. The separators *a* employed are preferably of the form shown, having their body portion of the pointwise width of the type with which the same are composed, but of a thickness of the minimum size of justifying-spaces employed therein. Extending from either end is a pivot-like projection which, as the separators are composed with the line, extend both above and below the line-type, the bottom of the type-channel having a longitudinal groove to admit of the projection of the separators.

The stick or line-channel 40 is a circular typeway adapted to hold the individual type composing the line each in a vertical position, at the center of the curve of which is the vertical type-driving shaft 41, upon whose upper end is fixed the type-driving arm 42, which is provided with a type-engaging jaw 43, preferably a spring-pressed pawl, as shown. The type are carried into the channel of the typeway 40 by the composing-machine, which may use any suitable devices to assemble the line at a point in advance of the pawl 43 in its rear or normal position. As illustrated, the type are advanced by the composing-machine to the swinging sweep or type-driver B, which assembles the line in advance of the pawl, the sweep being shown in dotted lines in Fig. 1. The pawl 43 is held normally out of the path of the type by means of a second pawl or detent 44, also carried by the type-driving arm 42, against one fork of which pawl 44 a projecting arm or pawl 43 is held by means of a spiral spring 45, suitably attached thereto. A slight outward turn of said detent 44 will give the type-driving pawl 43 perfect freedom to be carried by its spring 45 into engaging relation with the type in the typeway. Means for thus turning the detent 44 consist of a bell-crank lever 46, suitably mounted upon a fixed part of the justifier, to one arm of which is attached the link 48, which in turn, by means of a pin projecting therefrom about midway of its length, is adapted to be depressed by a lever 49 and line-key 50. It will be seen later on that by depressing the line-key 50 the line-advancing mechanism will be set in motion, and by reason of detent 44 being actuated by the line-key 50 and link 48 the pawl 43 will be released and drop into engaging position with the line of type that has been assembled in the typeway the instant the machine starts, so that the operator could immediately begin playing in a new line without waiting for the justifier mechanism to remove the preceding line longer than the time necessary for the spring 45, attached to pawl 43 to cause that pawl to snap into its position to engage the line, which is practically instantaneous. The type-engaging projection of the pawl 43 presents a square type-engaging surface 1 both forward and back, the forward surface coming into use when pressing the line forward, the rear surface being then in position to be engaged by a new line, which may be played into the justifier before the type-driving arm has had time to move forward out of the way of the new line thus forming. For this purpose it has been provided that when the machine stands normally at rest the shaft 41 and its type-driving arm 42 are free to be carried forward, in case they be engaged by the new incoming line, the type-driving pawl 43 and its shaft 41 standing normally at a point back of its theoretical zero line measuring position and not at the position from which the pawl would move merely to ascertain the shortage of an unjustified line.

Upon the outer wall of the circular channel 40 and extending radially therefrom is a bracket 51, in which is suitably constructed a guideway for a slide 52, said slide being adapted to be interposed across the channel of said typeway, thereby furnishing a rigid stop or abutment in the path of the advancing line. Means are provided for interposing said abutment across the channel-way and withdrawing the same in proper timing with the operations of the machine, consisting of the vertical shaft 53, upon the upper extremity of which is an arm 54, the swinging end of which enters a slot provided for the purpose within said abutment 52. Means for rocking said shaft 53 to alternately insert and withdraw said abutment is supplied by a cam 55 upon the word-shaft 56 and an arm 57 upon the type-driving shaft 41.

The pawl 43 on the type-driving arm 42 and the sliding abutment 52 constitute the measuring-jaws between which the unjustified line of type is calipered in the process of measuring the aggregate shortage thereof—that is, ascertaining the total width of the spaces that will be required in bringing the line up to its standard length. The pawl 43 may be called a "movable measuring-jaw" and is actuated by frictional yielding means, consisting of a sliding friction-clutch 60, splined upon the type-driving shaft 41 and adapted to be alternately thrown into and out of contact with the concave surface of a constantly-moving gear 61, also loosely

mounted upon said shaft 41. Means are employed to complete the measuring operation in connection with calipering the line between the two measuring-jaws and to transmit the result thereof to the dividing or space determining mechanism, this means comprising the gear-segment 62, loosely mounted upon said shaft 41 immediately beneath the arm 42 and resting upon the upper bracket 63 of the shaft 41. (See Figs. 1 and 2.) Upon the hub of this gear-segment 62 is the short arm 64, whose outer end is adapted to engage the hooked end of a connecting-detent 65, (see Fig. 1,) pivoted to the under surface of the type-driving arm 42, which carries the pawl or movable measuring-jaw 43. Adjacent to and parallel with the shaft 41 is a shaft 67 to the extreme upper end of which is secured a pinion 68, which meshes with the gear-segment 62 and is adapted to be rotated by the segment. Upon the shaft 67 is provided also a sliding friction-clutch 69, adapted to engage a corresponding concave frictional surface 70 in the hub of a constantly-moving gear 71, loosely mounted upon the shaft 67 in a manner similar to the gear 61 on shaft 41. Thus it will be seen that if the type-engaging surface 1 of the pawl 43 stands normally at a point in the typeway 40 removed from the type-engaging surface of the stationary measuring-jaw 52 a distance equal to the length of a standard line said pawl in fetching up against the line on its rotation from normal position will have traveled in its circumferential path an amount or the number of degrees representing the aggregate shortage of the unjustified line, and the shaft 41, with which said arm 42 revolves, will have been rotated an equal number of degrees. As explained above, the normal position of the pawl 43 is not at the theoretical zero position—that is, the length of a standard line from the abutment 42—but somewhat behind such zero position; but this is allowed for in the construction of the machine, and the measurement is the same as though the arm started at such zero position. To actuate the shaft 67 according to this measuring movement, the projecting arm 64 of gear-segment 62, which revolves upon the same center as the arm 42 bearing the movable measuring-jaw 43, is made to move until the arm 64 strikes the pawl 65, when the arm is stopped, and thus the pinion 68 in mesh with the segmental arm 62 will cause the shaft 67, upon which it is secured, to move in fixed ratio to the movement of the segment 62, so as to move proportionally to the shortage of the line which has determined the position of the stop-pawl 65. On the return of the shaft 41 and arm 42 the pawl 65 returns the segment 62 by engagement with the forward side of the arm 64 and then rides up on the arm 64 to the position shown in Fig. 1.

I will now describe the means employed for dividing the shortage shown by the measurement above described.

Upon the shaft 67, which it has been seen is made to rotate an amount directly proportional to the aggregate shortage of the line, is a series of gears 75, loosely mounted thereon, increasing in diameter from top to bottom, the same being arranged in a form similar to that of a cone whose axis will coincide with that of the shaft 67. Parallel with said shaft 67 is the register-shaft 76, upon which is a second series of gears 77, (shown as segments of the required lengths,) arranged in similar conical form, but in the inverse order to those on the shaft 67, so that the apex thereof points in the opposite direction to the other cone. These gears are arranged in pairs meshed together, one gear of each pair being loosely mounted upon the measurer-shaft 67, the other gear of the pair being secured to the register-shaft 76, means being provided, as hereafter described, for securing any one of the gears 75 to the shaft 41, so as to rotate therewith in measuring the line. The relative diameters of the gears constituting each pair is such as to cause the register-shaft 76 to rotate in a required fixed ratio to that of the other shaft 67. The relative diameters of these gear sets differ by fixed amounts in such manner that if the first pair (or bottom pair in the machine illustrated) should operate to cause the register-shaft to rotate an equal amount to that of the measurer-shaft the next upper pair would operate to rotate the register-shaft an amount one half that of the measurer-shaft, while the third, fourth, fifth, and succeeding pairs of gears would similarly cause the register-shaft to rotate, respectively, a third, fourth, fifth, or other correspondingly proportionate amount. It will be seen that the gears thus arranged in progressive pairs are adequately adapted to provide means for dividing the ascertained line shortage according to the number of word-spaces to be supplied. Each set or pair of gears is employed only in the justification of lines having a given number of word-spaces, and hence as many pairs are required as the largest number of word-spaces possible to occur in the lines to be justified therein. The present device is adapted to handle lines of twenty or less words or having nineteen or less word-spaces and, therefore, nineteen pairs of dividing-gear sets have been provided.

In using gear-cones to ascertain the width of required spaces where the same are to be cast or cut from space-timber the gage would be required only to be removed or displaced an amount equivalent to the required space, and in such cases the gears might be given such diameters as would rotate their corresponding shafts in equal $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$, &c., ratios, respectively; but in a machine em-

ploying ready-made or foundry spaces, to be selected from among fixed sizes, it is desirable to have the gaging mechanism move in multiplied ratios. In the present form of my invention I have made the relative diameters of the gears as of a machine of the last-named variety, which are designed to transmit a multiplied divided movement to the gage mechanism wherein the divided result is in each instance multiplied by a fixed or constant factor, the number "7" being used in the machine shown—that is to say, the first set of gears used in one-space lines instead of being of equal diameters are given diameters in the ratio of seven to one, so that the register-shaft is made to rotate through seven times as many degrees as does the measurer-shaft, and, similarly, the second pair for two-space lines instead of causing the register-shaft to rotate one-half as much as the measurer shaft in the machine shown drives the register-shaft three and one-half times as far as the measurer-shaft. Likewise the third pair instead of giving a division of one-third rotation for the register-shaft would rotate it two and one-third times as far; the fourth pair one and three-fourths times instead of one-fourth, and so on throughout the series.

The means provided for conveniently selecting the proper pair of gears to correspond with the word-spaces to be used consists of a sliding key 2, fitted into a longitudinal groove 3 in the shaft 67, upon the lower portion of which is a ratchet 4 of nineteen teeth corresponding in pitch to the thickness of the single gears 75 upon the shaft 67. At the extreme upper portion of the sliding key 2 is the key proper, 5, which engages suitable keyways cut in the gears 75. The key 5 is of a length slightly less than the thickness of an individual gear, so that it will secure to the shaft 67 only one of the gears 75 at a single operation. A spring-pressed pawl 6 is pivoted upon a slide 78 and is adapted to engage with the teeth of the ratchet 4, the slide 78 being mounted upon the shaft 67 and adapted to slide thereupon in order to carry the key 5 to whichever gear 75 may be required in the justification of the line. The means employed for determining the particular tooth in the ratchet 4 of the sliding key 2 into which said pawl 6 shall enter consists of a slide 7, provided with a flange 8, forming a fender and corresponding in length to the ratchet 4 of the key 2 and adapted to engage a pin 9 in the tail of the pawl 6 and hold the pawl out of the rack 4. Upon the slide 7 is a ratchet 10, whose teeth are the same in number and pitch as those of the ratchet 4, into which ratchet 10 a detent 11 is adapted to engage, holding the same against the action of a spiral spring 12 into whatever position the slide may be depressed, The slide 7 moves in suitable bearings 13 in a path parallel to the key 2 of the shaft 67 and is so disposed that the flange 8, by pressing against the pin 9 of the pawl 6, will hold the pawl out of engagement with the ratchet 4 of the sliding key 2 for the whole or a part of the distance of the travel of the ratchet 4, by means of which, in accordance with the extent to which said slide 7 has been depressed, the pawl 6 may be made to drop into the particular tooth desired of the ratchet 4 of the sliding key 2.

In a simple form of construction of the mechanism now under consideration the slide or rack 7 might be connected directly with the word-key 20 and form the setting-rack, so that the operator on coming to the end of each word where a space is required would move the slide 7 and fender 8 to a corresponding position for setting the machine in accordance with the number of separators inserted, in which case the operator would necessarily be delayed the length of time required for the mechanism to get under way before starting a new line, as the mechanism actuated by the space-key might not be released in time for the next line. In the mechanism shown, however, a supplemental setting-rack 15 is provided to slide longitudinally in the direction of the fender-slide 7 and is provided with a ratchet 16, whose teeth correspond in number and pitch to those of the slide 7 and likewise to those of the ratchet 4 of the sliding key 2. By means of the pawl 17, which is actuated each time a word-separator is inserted into the line to be justified, the rack 15 is moved a distance equal to the pitch of its teeth, in which position it is held by a detent 18. (See Fig. 4.) A pin 19, projecting from the side of the slide 7, carrying the flange 8, is engaged by the lower edge of the setting-rack 15, which when moved down by the pawl 17 positions the flange 8 to hold the pawl 6 out of engagement with the ratchet 4 of the sliding key 2. Thus it will be seen that by forcing the rack 15 down a given number of teeth the fender-slide 7 is thereby depressed a like number of teeth, which in turn will operate as described upon the key-driving pawl 6 to hold it out of engagement with the teeth of the rack 4 of the sliding key 2 until that tooth is reached which corresponds to the given number through which said setting-rack has been depressed in the manner described.

Means for actuating the pawl 17 may be conveniently supplied by connecting the same directly with the word-space key 20 in order that the rack 15 may be moved a distance of one tooth for each word-space in the line to be justified. In my present mechanism the same end is attained by connecting the actuating means of said pawl to the mechanism which inserts the temporary word-separators, so that when a separator is inserted the rack 15 will automatically be moved the distance of one tooth for each

separator inserted. The mechanism employed for inserting these separators and the connections between this mechanism and the setting-rack 15 will now be described, first describing briefly the reservoir for storing the separators.

A collapsible magazine-channel 22 (see Figs. 1 and 7) contains the separators *a*, which channel is adapted to hold a varying length of line of separators arranged vertically side to side, the channel being approximately the pointwise width of the type which the justifier is adapted to operate upon. One portion of said magazine is a sliding block 23, provided with a semicircular channel-groove 24 and projections 25, which slide in grooves 26, formed in the walls of the channel 22, against the action of the spring 26′ to lengthen the channel when a separator is forced into the line contained therein. Likewise when a separator is withdrawn the spring 26′ will draw the block toward the channels into which the same is fitted to slide, operating thus to shorten the channel length, keeping the channel 22 always of the exact length required to accommodate the separators therein. One end of this separator-channel is in convenient proximity to that portion of the justifier-typeway 40 in which the characters are assembled, and means are provided for ejecting the separators therefrom into the typeway 40 while the line is being composed. The opposite end of the channel 22 is similarly placed near the typeway 40 in convenient position to receive the separators as they are ejected from the line by the action of the word-slide, which will be more fully explained hereinafter.

The means for ejecting the separators from the reservoir into the typeway extension consists of a horizontal slide 28, which is held normally in a position wherein its ejecting-face 29 coincides with the adjacent inner channel-wall of the typeway 40 and whose side furnishes an abutment against which the separators in the collapsible channel 22 are firmly compressed by means of spring 26′ in the manner described. Any convenient means may be employed in connection with the composing-machine for moving the slide 28 back from its normal position sufficiently to allow the line of separators in the channel 22 to push the foremost separator therein into the space previously occupied by the ejector-slide 28, so that such actuating means being withdrawn the ejector-spring 27 will carry the ejector forward and transfer the separator from its channel into the line in which the type are being composed. In the present machine a bar 30 (see Figs. 1, 15, 16) is pivoted to one end of a lever 31, suitably mounted upon a bracket 32, secured to the framework A of the machine, and the other end of the lever 32 is provided with a rounded portion which is fitted into a suitable opening in the ejector-slide 28. Upon the outer end of this bar 30 is a spiral spring 33, adapted to hold said member against a vertical slide 34, suitably mounted in the frame of the machine, which is adapted to be forced downward by the word-space key 20 against the action of a spring 35 and out of contact with the bar 30, permitting the bar 30 to be drawn to one side by its spring 33 into position to be struck by a constantly-vibrating arm 100, which may be provided in any suitable manner, but is shown as carried by the sweep B, which moves the type into the channel.

The arm 100 has a lug *m*, having a square surface on one side, which on motion of the arm 100 to the right in Fig. 1 engages fixed catch *o* on bar 30 and moves the bar to the right, where it is held by the spring-detent *p*, entering the notch *q* in the bar. On the next movement of the arm 100 to the right the lug *m* engages the spring-catch *n* on the bar 30 and moves the bar farther to the right, so as to fully withdraw the ejector-slide 28 from the end of the separator-channel and allow a separator *a* to be fed out into position to be moved by the ejector 29 into the type-channel in front of the next type to be fed in. This insertion of the separator takes place on the return movement of the sweep and arm 100, the spring 27, which has been put under tension by the movement of the bar 30 to the right, actuating the ejector to insert the separator after the sweep has moved beyond the ejector on its return movement, and this movement of the ejector returning the bar 30 to the left and into normal position. As shown, the catch *p* and notch *q* are arranged so as to hold the bar 30 against the tension of spring 27 when it is put partially under tension on the first movement of the bar 30, but to yield and permit the return of bar 30 when the spring 27 is put under greater tension on the complete movement of the bar. A detent of any other suitable construction actuated positively by the machine or otherwise may be used in place of the detent device shown. The space-key having been released, the catch *m* on this second forward movement of the arm 100 with the sweep B moves the bar 30 outward against the tension of spring 33, and the bar 34, being thrown upward by the spring 35, will hold the bar 30 in its normal position, as shown in Fig. 1.

The pawl 17, employed for setting the rack 15, as has already been described, is carried upon an arm of a bell-crank lever 36, (see Figs. 4 and 7,) which is adapted to be rocked upon its pivot by means of an arm 37, secured to the lower end of a rock-shaft 38, which in turn has an actuating-arm 39 similarly secured to its upper end, the swinging end of which actuating-arm 39 is made to enter a slotted projection 39′, extending

downward from the ejector-slide 28, so that when the ejector-slide 28 is carried back in the manner described above it will cause the arm 39 to oscillate, thereby rocking the shaft 38, which, with the action of the arm 37 upon the downwardly-extending arm of the bell-crank lever 36, will operate to force the pawl 17 downward, carrying with it the setting-rack 15.

Although no means are shown in this application for selecting or supplying the justifying-spaces, provision is made for carrying the unjustified line into proper position for the insertion of justifying-spaces and separating the line at the points between words where temporary separators have been inserted to designate the proper places for inserting justifying-spaces.

The means employed for carrying the line along the typeway 40 consists of the shaft 41, the arm 42, and pawl 43, operated thereby, which have already been described. It only remains to point out that by providing suitable means for actuating the clutch which controls the movement of the shaft 41 it may be employed to carry the line on through the typeway for the purpose of inserting the justifying-spaces and removing the temporary separators. This has been accomplished in the present machine by means of the frictional clutch 60 upon the shaft 41, which is provided with means whereby it is thrown into contact with its driving-gear 61 by operation of a cam 80, fixed to the word-shaft sleeve 81, mounted on the shaft 56. Upon the surface of the cam 80 a cam-roll 82 of a bell-crank lever 83 contacts, the lever 83 being secured to a rock-shaft 84, to which is also secured the forked lever 85, (see Figs. 3 and 4,) that engages the friction-clutch 60 upon the type-driving shaft 41. The surface of the cam 80 is suitably constructed so that it will alternately throw the clutch 60 into engagement and release the same upon each full rotation of the word-shaft 56, thereby intermittently moving the type-driving shaft 41 and type-driving pawl 43 as may be required for the purposes of inserting the justifying-spaces into the lines and removing the separators therefrom.

The means provided for separating the line at the several points where temporary separators have been inserted preparatory to the insertion of permanent justifying-spaces and for removing these separators from the said unjustified line is what may be termed the "word-slide" 90, (see Figs. 1, 4 and 8 to 14, inclusive,) which is adapted to reciprocate transversely to the channel of the typeway 40 in suitable guides 91 in the frame A. The word-slide 90 is operated by means of a cam 92, secured to the word-shaft sleeve 81 through a cam-lever 93. The cam 92 is so constructed that it carries the slide 90 into four different positions in making its completed forward and return movements, where it is momentarily stopped to perform functions incident to its operation. The word-slide 90 comprises two parallel members 94 and 95, one directly over the other and separated by a little more than the height of a character type, the bottom member thereof having its upper surface coincident with the plane of the floor of the typeway 40. Into the opposite surfaces of the members 94 95—that is, the bottom surface of member 94 and top surface of member 95—similar diagonal grooves or cam-paths 96 are cut, extending at a convenient angle from one side to the other and cutting into the surface of each of the members 94 and 95 to a sufficient depth and width to admit of the free passage of the pivot-like extensions a' a^2 of the temporary word-separators a. The word-slide 90 stands normally with the grooves 96 wholly without the line of the channel of said typeway 40, as shown in Figs. 8 and 9; but upon the first movement thereof the grooves will be carried across the channel, as shown in Fig. 10. In the normal position of slide 90 it will be seen that the two members 94 and 95 supply stops above and below the type-line which are adapted to engage the two pivot-like extensions a' a^2 of the word-separators a as the line containing the same is pressed forward by the action of the type-driving arm 42 and its pawl 43, and thus stop the line. It will also be seen (see Figs. 8 and 9) that as the slide stands in its normal or stop position a bar 97, which forms a part of the word-slide and moves with bars 94 95, presents a wedge-shaped end 98 to the line that is being pressed up against the stops 94 95 of the slide 90, which end 98 as the slide moves forward will be carried between the separator a and the adjacent fragment of the line, so as to stop the rest of the line as the separator passes into the grooves 96, which carry the separator forward with the word in advance of it. Just at the entrance of the grooves 96 are inclined projections 99 on the members 94 95, which are adapted to engage the extensions a a' of the separators a and force them to enter the cam-grooves 96 as the slide moves forward.

In the position shown in Fig. 10 the line has been fully separated for the insertion of permanent justifying-spaces by the inclined grooves 96, carrying forward the separator and word ahead of it. The word-slide 90, however, does not come to a stop at the position shown in Fig. 10, but moves on to the position shown in Fig. 11, in which position shoulders c on the members 94 95, behind the grooves 96, have carried the separator a out of the typeway and has inserted it into the channel 22, provided for the separators. The word-slide 90 then returns immediately to its extreme opposite throw or position, as

shown in Figs. 12 and 13, in which position its port-holes 101 are brought into line with the channel of the typeway for the purpose of allowing the permanent justifying-spaces *b* to be carried up through the floor of the typeway into the opening that has just been made in the line, as described. Two port-holes are shown in accordance with the space system I prefer to use; but this is immaterial so far as the present invention is concerned. Fig. 13 shows the space moving up into the line. These spaces may be inserted by any convenient means—such, for example, as that described in the Patent No. 583,224, issued to W. H. Honiss and myself. After the justifying-spaces have thus been carried into the line an extra forward movement to an extent equaling approximately one-half the width of the spaces may be given the word-slide 90, so as to move it to the position shown in Fig. 14, in which case the floor member thereof will act as a detent for holding the separator into the line until the ejecting means can be wholly withdrawn, whereupon the word-slide is carried a step farther into its normal position, as shown in Figs. 8 and 9. It has been seen that while the word-slide was carried forward the bar 97 serves to hold the line back while the spaces are being inserted, and when the word-slide is carried to the opposite position, as shown in Figs. 12, 13, and 14, the bar 97 is withdrawn from the position in which it can act as a stop against the unjustified portion of the line. Therefore a projecting stop 102 is supplied carried by the word-slide on the opposite side of typeway 40 from the bar 97, into which stop 102 vertical grooves 103 are cut corresponding to the surface dimensions of the port-holes 101. These grooves assist in guiding the spaces as they are carried upward into the line. This stop 102 furnishes a surface which supplies practically a continuation of the type-engaging surface of the bar 97 on the opposite side of the typeway and acts as a stop against the unjustified line when it is carried back into the position shown in Figs. 12 and 13. The only point at which the line of type could pass through the word-slide 90 therefore is that presented to the typeway when the slide 90 is in its normal position, as shown in Figs. 8 and 9, and in this position the stop-surfaces of the members 94 and 95 present themselves to the extensions a' a^2 of the separators *a*, and progress of the line through the word-slide is checked at this time by the foremost separator in the line.

I will now describe the driving means and the various connecting parts employed therewith in actuating the various mechanisms of the justifier.

Two shafts horizontally disposed in brackets 104, extending out from either side of the frame-plate A and parallel one to the other, are connected by gears 105 106 107. (See Figs. 2 and 3.) One of these shafts 108, which I will call the "line-shaft," carries the driving-pulley 109, to which is transmitted the initial power required to operate the machine. Upon the shaft 108 is a loosely-fitting sleeve 110, upon which are carried the several cams which are employed in the operation of those parts brought into action once only for each line justified, such as measuring the line and returning to their normal condition thereafter those parts which have been directly or indirectly engaged in the operation thereof. In like manner the word-sleeve 81, previously referred to and loosely mounted upon the shaft 56, which I will designate the "word-shaft," has upon it those parts called into use in removing the temporary separators and replacing the same with permanent justifying-spaces and other operations relative thereto. Means for starting and stopping the word and line sleeves, respectively, at the proper times will next be treated. Upon each of said sleeves is a disk 111 112, having upon the faces thereof hooked clutch-pawls 113 114, which are moved by springs into position so that the hooked portion thereof will engage with a tooth (or in the case of the line-shaft 108 one of four teeth) upon wheels 117 118, secured, respectively, to line-shaft 108 and word-shaft 56. Thus it will be seen, taking one of the clutches—clutch 114 of the word-shaft 56, for example—that so long as the pawl 114 is held out of engagement with the toothed wheel 118, pinned to the constantly-moving word-shaft 56, the sleeve will not be affected thereby, but will remain in its normal position of rest.

Means in the nature of stops are provided for engaging the outwardly-projecting radial arms of the clutch-pawls 113 114, whereby the clutch-pawls are held out of engagement with their corresponding toothed wheels 117 118 until the stops are again withdrawn by the means which will be described in their order.

The means by which the clutch-pawl 113 (see Figs. 4, 5, and 6) is held out of engaging relation with its toothed wheel 117, while the line-sleeve 110, to which the pawl is attached, is in its normal position of rest, consists of the stop-detent 120, suitably attached to a short shaft 121, supported by a bracket 122 upon the frame-plate A and which is adapted to be rocked sufficiently to release the hooked end of said detent 120 from the projecting radial arm of pawl 113. To actuate the shaft 121, a lever 123 is secured to said shaft, to which lever is connected the link 48, which, as previously described, is provided with the pin which is inserted through a slot in the lever 49, to which is attached the key-stem 50, used by the operator in starting the mechanism. The stop-detent 120 is held normally in engaging relation to the pawl 113 by means of a spring 124, so that upon

being depressed against the action thereof and the pawl 113 having moved into engaging relation with its actuating-tooth on the wheel 117 the stop-detent is immediately returned to its normal position by action of the spring 124 in readiness to engage the clutch-pawl 113 on its finishing a complete revolution, the same pawl being thereby disconnected from the wheel 117.

A second stop 125 (see Figs. 3, 5) in its normal position of rest is adapted to act on the line-clutch pawl 113 to throw it out of engagement and bring the line-sleeve 110 to a position of rest at approximately two-thirds of its rotation. This stop 125 is a projection on a slide 126, which is operated from two sources—one, the word mechanism, which, it will be seen in another connection, removes the stop 125 as the word-shaft makes its last rotation, and the other by action of a cam projection 127 upon a cam-disk 128 on the line-sleeve 110, by action of which the stop-arm 126 is returned to its normal position.

In the rotation of the line-shaft means are provided consisting of the cam projection 127 upon the cam-disk 128, whereby the stop which is holding the clutch-pawl 114 of the word-shaft 56 out of engagement with its toothed wheel 118 is withdrawn, so that the word-shaft sleeve 81 is caused to rotate. The means employed for throwing the clutch-pawl 114 out of engaging position with its toothed wheel 118, as above described, consists of the stop-slide 126, which is adapted to slide longitudinally, so that a stop 130 on the slide 126 is drawn into the path of travel of the outward-extending arm of the clutch-pawl 114. The means employed for throwing the stop 130 into the path of the pawl 114 consists of the device which I will call the "governing-arm" 57 and which is fixed to the type-driving shaft 41 and which when the line has been justified and carried to the end of the typeway 40 strikes the upright member 131 of the slide 126, carrying the stop 130 upon the slide 126 into engaging relation with the radial arm of the clutch-pawl 114 and detaching the pawl from its actuating toothed wheel 118.

I will now describe the mechanism for operating the clutches employed in carrying the line along the typeway 40 and in operating the measurer-shaft 67.

Upon the type-driving shaft 41 and the measurer-shaft 67 are fitted to run loosely the two gears 61 71, meshed together, one of which, the large gear 61, is secured to a sleeve 132, which is fitted to revolve loosely upon the shaft 41, and at the lower end of which sleeve 132 is the small bevel-gear 133, which is in mesh with bevel-gear 134, secured to one end of line-shaft 108, so that gears 61 and 71 are in constant motion with the line-shaft 108. In the hubs of these two gears 61 and 71 are concave sockets to correspond with the bevel-surfaces of the friction-clutches 60 and 69, to which reference has already been made. Friction-clutch 60 is constructed to slide longitudinally upon its shaft 41, being splined thereon, and in a similar manner clutch 69 is adapted to slide longitudinally upon its shaft 67.

It has already been noted that the type-driving shaft 41 is first called into use in advancing the line in the typeway until the line meets the intervening slide or abutment 52, which has been interposed across the channel of the typeway for the purpose of measuring the unjustified line contained therein, and then the friction yields until the clutch-contact is released, and that immediately following this the clutch mechanism on the line-measuring shaft 67 is called into action to bring the measurer-arm 64 into contact with the connecting-detent 65 upon the type-driving arm 42. (See Figs. 1 and 2.) It is therefore desirable to have the clutch 69 on the measurer-shaft 67 engage at the same moment that the clutch 60 of the type-driving shaft 41 releases. This timing of the clutches 60 69 is accomplished by having the lever-arms which actuate the same connected with the rock-shaft 84 in such manner that when either releases the other is carried in the direction to engage. One of said lever-arms 85 connects directly with the clutch 60 of the shaft 41 by means of two pins extending from its forked arms into a groove in the periphery thereof. The other arm 136 (see Figs. 3 and 4) is connected with the shaft 84 by means of link 137 and lever 138, secured to the rock-shaft 84, the arm 136 being similarly provided with pins fitting to the circumferential groove of the clutch 69. The lever-arms 85 136 are actuated by means of the bell-lever 83, suitably secured to the outer end of the rock-shaft 84, to the opposite arms of which are attached the cam-rolls 82 and 140, which engage the peripheral surfaces of cam-wheels 80 and 141 upon the word and line shaft sleeves, respectively, being held against said cam-surfaces by a spring 142, against the action of which one or the other of the cams 80 141 may be required to operate the lever 83 in order to shift the friction-clutches. Thus as cam 141 rotates from its normal position, as shown in Fig. 4, and the cam-surface thereof recedes from the cam-roll thereon the clutch-actuating spring 142 forces fork-lever 85 down, thereby causing said friction-clutch 60 to engage and said shaft 41 to rotate, and simultaneously the clutch 69 through the action of link 137 and arm 136 is withdrawn or unclutched, causing the measurer-shaft 67 to cease to rotate. Then as the cam 141 continues to rotate a raised portion is provided thereon adapted to engage the roll 140 upon its arm of the bell-crank lever 83, whereby rock-shaft 84 is rotated in the opposite direction to that of the

spring action, so that clutch 60 is withdrawn or unclutched and shaft 41 ceases to rotate, and simultaneously clutch 69 is forced into its socket or clutched and said measurer-shaft 67 begins to rotate.

The mechanism for actuating the sliding key 2 consists of a cam-groove 145, formed in the cam-disk 128 on line-sleeve 110, which operates upon the lever 146, pivoted at 147 to the frame, and which in turn actuates the forked lever 148, pivoted at 149 to the frame, and in the forked end of which are two pins adapted to enter a circumferential groove in the slide 78 upon measurer-shaft 67, upon which is mounted the pawl 6, that engages with the teeth of the rack 4 of the key 2. The cam 145 is so laid out that after it has carried the slide 78 to its full height, and thus raised the sliding key 2 to its proper gear, a dwell is provided on the cam to hold the key in that position while the gear with which the key 2 engages is being brought to its normal place of rest, whereupon the slide 78 is withdrawn and by engagement with a lug 150 at the lower end of the sliding key 2 returns the key to its normal place of rest, as shown in Fig. 4. The cams upon the line-sleeve 110 are so constructed and arranged relatively to one another that immediately after the cam 145 has raised the key to its gear-selecting position cam 141 operates to throw the clutch 69 into engagement, whereby the dividing-gears 75 are set into operation to measure the line and at the same time ascertain the thickness of spaces required to justify the same, which operation brings the line-sleeve 110 to the completion of its first two-thirds rotation, where it is arrested by means already noticed. As the cam 141 finishes said two-thirds portion of the revolution of the line-sleeve it presents a notched portion 151 in the periphery thereof to the roll 140 upon the bell-crank lever 83, which permits the spring 142 to again shift the clutches, so that the type-driving shaft 41 will be thrown into operation and the line will be carried forward in the typeway until the cam-wheel 80 upon word-sleeve 56 operates upon the other arm of the bell-crank 83 to release the friction-clutch 60 on the line-driving shaft 41.

I will now describe the means employed for operating the slide 52, which, as has been seen, is employed to furnish an abutment against which the line is measured. It consists of the vertical shaft 53, on the upper end of which is the stop-engaging arm 54, which enters a suitable notch in the slide 52, the lower end of the shaft 53 being provided with a lever 152, which has a short arm 153 adapted to engage with the raised portion of the cam 55 upon the word-shaft sleeve 81, which as it begins to make its first rotation strikes said arm 153, operating to withdraw the slide 52 from its position across the channel of the typeway 40. The jaw 52 is again returned to its position across the channel by means of the long arm of the lever 152 upon the shaft 53, which is adapted to be engaged by the upwardly-extending member 131 (see Fig. 3) of the slide 126, which in turn is adapted to be engaged by the governor-arm 57 upon type-driving shaft 41. The governor-arm 57 is so placed upon the type-driving shaft 41 that it impinges upon said vertical member 131 of the slide 126 only after the line has been carried out of the typeway, so that it will, through the medium of shaft 53, force the stop-jaw 52 into position across the channel of the typeway for the measurement of the succeeding line.

I will now complete the description of the means employed for operating the clutch mechanism of the line and word sleeves 110 and 81, respectively.

I have already pointed out that upon the horizontal slide 126 is an arm 130, extending into the pathway of the radial arm of the spring clutch-pawl 114 (see Figs. 13 and 4) upon the word-sleeve 81, which may be moved out of the path of travel of said clutch-pawl and said sleeve started in motion by action of the cam projection 127 (see Fig. 3) striking against the end of said slide 126. The cam projection 127 is so placed upon the periphery of the cam-disk 128 that when it has actuated the slide 126 it has completed the first two-thirds of its revolution and operates to carry the stop-arm 130 out of the position in which it has been holding the clutch-pawl 114 from engagement with its actuating toothed wheel 118 upon the word-shaft 56. The slide 126 will remain out of engaging position with the clutch-pawl 114 until it has been brought back into such engaging position by means of the governor-arm 57 on shaft 41 striking the upright vertical member 131 of the slide 126 at the completion of the work of the word-shaft, which through the rotation of said shaft 41 has caused the line to be carried out of the typeway 40 into a galley or other means provided for its reception. The slide 126 as it is pressed to one side by the action of the cam projection 127 interposes its projecting arm 125 into the path of the radial arm of the spring clutch-pawl 113 (see Fig. 3) of the line-sleeve 110 as it withdraws its other projecting arm 130 from engagement with the word clutch pawl 114, the projecting arm 125 being placed, as I have already stated, circumferentially of the clutch-pawl disk 111 with reference to the rotation of said sleeve approximately at the two-thirds revolution thereof. It will therefore be readily understood that when the governor-arm 57 reverses the motion of said slide 126 it will operate to arrest the rotation of the word-sleeve by reason of interposing the stop 130 into the path of clutch-pawl 114, and will

simultaneously move stop-arm 125 out of engagement with line-clutch pawl 113, allowing the line-sleeve 110 to resume and complete its arrested rotation. At the point marking the complete revolution of the line-sleeve 110 is the stop-detent 120, which we have already seen arrests the action of the line-sleeve mechanism at the end of its first complete rotation.

While the line-sleeve is standing at the position of partial rotation, where it is left by reason of the line-clutch pawl having engaged with the stop-arm 125, the word-shaft sleeve 81 has been caused to rotate as many times as there are word-spaces in the line to be justified, and the measuring mechanism and all of the parts pertaining thereto have remained in the position to which they have been carried in measuring the line to be justified, except that stop-jaw 52 has been withdrawn; but immediately upon the word-shaft sleeve 81 coming to a stop the clutch-pawl 113 is allowed to engage with the toothed wheel 117 on the line-shaft 108, and the said sleeve completes its full rotation, returning to its normal position. I will therefore now describe the action of the cams which operate during this last third of the rotation of the line-sleeve 110. The cam 155 is employed to return the dividing-gear cones 77 to their normal position (see Figs. 2 and 3) through cam-lever 156, which forces the gear-returning rack 157 longitudinally in its slideway, the rack 157 engaging the pinion 158, secured to the lower end of register-shaft 76, causing the same to rotate the shaft 76 and likewise the measurer-shaft 67 through the gears back to their normal positions. The two shafts 67 and 76, it will be borne in mind, are still connected for this operation by means of the pair of gears connected by key 2, which have been used in dividing the measurement of shortage in the line. Synchronously with the action of the cam 155 returning the dividing-gears 77 75 the cam 159, also carried by the line-sleeve 110, operates to return the type-driving shaft 41, there being provided for that purpose the cam-lever 160, (see Figs. 1, 2, and 3,) and the lever 161, pivoted at 161′ and carrying gear-segment 163, which meshes with a gear 164, pinned to the type-driving shaft 41. The cam-groove 145 in the cam-disk 128 is so constructed that it operates to return the key-shifting slide 78 to its normal position after the gears 75 have been returned to their normal position of rest, thereby allowing freedom for the key projection 5 of said sliding key 2 to pass through the keyway of the series of gears upon the measurer-shaft 67. As the slide 78 reaches the uppermost point of its travel, it engages by projection 78′ with an outwardly-extending arm upon the detent 11, which allows the slide 7 and fender 8 to be returned to their normal position by the spring 12. Fig. 6 shows the detent 11 withdrawn from the teeth 10 of the slide 7 just as the same starts on its return to normal position.

It remains to describe the mechanism which is employed for operating those parts which are called into use to separate the line at the place where separators have been provided, to remove those separators and return them to their reservoir, to move the line along the typeway suitably for inserting the justifying-spaces, and to insert those permanent justifying-spaces as the same may be provided by suitable mechanism, whether it be that for selecting and inserting foundry-spaces, as provided in Letters Patent No. 583,224, issued to W. H. Honiss and myself, or for inserting spaces that may be manufactured in accordance with the setting of the gage herein provided, which spaces may be either cut from space-timber or cast to the required thickness, as determined by the position of the gage.

Upon the word-sleeve 81, (see Figs. 1, 3, and 7,) in addition to the disk 112, carrying the clutch-pawl 114, is a cam-disk 92, into the cam-path of which fits the roll upon one of the arms of the lever 93, the other arm of which is attached, by means of a link 93′, to the word-slide 90, so that the word-slide 90 is reciprocated within its guides 91 through whatever amount and in whatever timing may be required.

The operation of the machine.—From the above description of the various mechanisms constituting the justifier the operation of the machine will be readily understood with the following description of the movements in the order in which they occur. The operator having pressed the word-key 20 for each word-separator introduced into the line has caused the bar 30 to be carried by its spring 33, having been released by the action of said key into engaging relation with the actuating-arm 100, and the bar 30 has been actuated to withdraw the ejector and allow a separator to be fed out of the channel 22 by the pressure of spring 26′ into position to be carried into the typeway, and on its return movement the ejector forces the separator into the extension of the typeway 40, which forms a part of the assembling-channel of the composing-machine and in front of the sweep B. When the ejector-slide 28 is withdrawn, as above, for each operation of the word or space key 20, it carries with it the lever-arm 39 on the upper end of the vertical shaft 38, which in turn causes the lever 37 to turn laterally, thereby actuating the bell-crank 36, to the end of which is attached the pawl 17, adapted to engage the teeth 16 of the setting-rack 15, which is moved down against its spring 150′ a distance of one tooth each time the said actuating-pawl 17 operates. A detent 18, pivoted to the frame at 18′, is actuated by the lever

123 (see Figs. 4 and 5) to engage the teeth of said setting-rack 15, holding it in the position to which it is carried by the pawl 17. Thus the rack 15 is moved down as many teeth as there are word-separators composed with the line to be justified, which correspond to the number of word-spaces in the line. As the rack 15 is carried downward it strikes a pin 19, secured to the slide 7, having the fender 8, carrying the slide 7 down with it to whatever extent the setting-rack 15 may be depressed in the manner above described. A detent 11 is provided to engage the teeth 10 of the slide 7 and retain it in whatever position it may be carried until properly released thereby. As the said slide 7 is forced downward it carries the projecting flange 8 thereon into position to engage the pin 9 of the pawl 6, which operation concludes the setting of the gear-selecting mechanism. Fig. 4 shows the slide 7 in its normal position of rest, and Fig. 5 shows the same in its extreme position, as in the justification of a line requiring nineteen word-spaces. After having thus depressed the word-key 20 the last time and having finished composing the line the same is now ready for the justifier, and the operator depresses the line-key 50, whereupon lever 49 is carried downward from its normal position, as seen in Fig. 4, into the position shown in Fig. 5, and the link 48 is pressed downward, operating upon lever 123 on rock-shaft 121, to which is secured the hooked detent-stop 120, and said detent 120 is thereupon carried out of contact with the radial arm of the line-clutch pawl 113, which it normally held out of engagement with the toothed wheel 117, secured to the constantly-moving line-shaft 108. The detent 120, having thus been removed, the line-clutch pawl 113 drops into engaging relation with said toothed wheel 117 and the shaft begins to rotate line-sleeve 110. To the same rock-shaft 121 to which is attached the detent 120 is secured a lever-arm 123′, the outer end of which engages an arm of the pawl 18 in such manner that as the rock-shaft 121 is rotated to release the clutch-pawl 113 to start the line-shaft sleeve 110 arm 123′ moves said pawl 18 out of engaging relation with the setting-rack 15, and the pawl 18, by means of a pin 17′, throws the pawl 17 out of engagement with rack 15, in which position the pawl 18 is held by a dog 21, mounted upon the guide 13 of the rack 15, which drops behind a pin on the pawl 18, so that simultaneously with the starting of the line mechanism the said rack 15, which has now carried the slide 7 to its setting position, returns to its normal position by the action of its spring 15′ to be in readiness for the next ensuing line. The dog 21 holds both pawls 18 17 out of engagement with rack 15 until the rack 15 has reached its top or normal position and is then raised by a pin 21″ on the rack 15 to release the pawls for engagement with the rack, the dog 21 then resting on top of pawl 18 until the latter is again thrown out by arm 123′.

It remains to describe still another operation that is accomplished by the depression of the line-key 50—namely, the releasing of the type-driving pawl 43, which is being held out of the line of the channel of the typeway 40 by means of the detent 44. By referring to Figs. 4 and 5 it will be seen that by the depressing of the line-key 50 lever 49, which carries down the link 48, also causes the bell-crank lever 46 to oscillate, and the upwardly-extending arm of the lever 46 is thereby thrown against the longer arm of the detent 44, causing the same to turn upon its pivot and releasing the type-driving pawl 43 and by the action of the pawl-spring will instantly throw the pawl 43 into the line in position to engage the line which has been by the composing-machine carried past the pawl 43 into the typeway of the justifier, or if the succeeding line is being assembled at this point in the composing-machine before the justifier has carried the same forward the pawl will be engaged by such new line and carried forward. The line-sleeve 110 having started to rotate the cam 141, which in its normal place of rest has been holding an arm of the bell-lever 83 in such position that the friction-clutch 60 upon the type-driving shaft 41 is being held out of engagement with its driving counterpart, now moves forward, presenting a depression in the surface thereof, so that the spring 142, actuating the clutch 60, forces the same into the hub of the constantly-moving gear 61, and immediately the type-driving shaft 41 begins to rotate and through the arm 42 and pawl 43 advances the line within the typeway 40 until the same reaches the stop 52, which normally stands across the channel of said typeway, whereupon the friction-clutch slips until the cam 141 presents a raised portion, when the clutch 60 is relieved, and by the same action clutch 69 upon the measurer-shaft 67 is thrown into engagement to cause the mechanisms operated by the shaft 67 to perform their function, as previously described. While the cam 141 has been passing under the roll 140 of the arm 83 previous to presenting the raised portion thereof, and thereby starting the measurer-shaft 67, the cam-disk 128 has been acting upon the lever 146, which in turn has rocked the hooked forked lever 148 upon its pivot 149, thereby carrying the key-setting slide 78 upward along the lower end of said measurer-shaft 67, and with it the spring-pawl 6, which is adapted to engage with some of the teeth of the ratchet-rack 4 upon the sliding key 2, and in an arm of which pawl 6 is a pin 9, adapted to engage with the flange or fender 8, carried by the slide 7, the position of this flange de-

termining the tooth into which pawl 6 will take. As the fender or flange has been moved down one step for each separator, the pawl 6 will engage that tooth of the rack 4 which corresponds to the point at which the upper end of the fender 8 stands in relation to the pin 9, and the key 2 will be moved up by the slide 78 correspondingly. Therefore as the line has been carried forward to the stop 52 the slide-key 2 will have been carried upward within its guideway 3 in the shaft 67 to whatever gear 75 shall have been predetermined by the particular tooth of the rack 4 on the sliding key 2 which the pawl 6 has been allowed to engage by the position of the fender 8 of the slide 7, and thus a pair of gears is selected according to the number of spaces in the line. As the slide 78 reaches the upper limit of its stroke the hooked projection 78′ of the slide 78 engages the detent 11, extending into the line of travel of said hooked projection, and allows the slide 7 to return to its normal position by means of the spiral spring 12, by which it is actuated. The operation of setting the key 5 to select the proper gear 75 to be employed in justifying the line now being acted upon having thus been completed, the measurer-shaft 67 is started in rotation in the manner already described, and the particular gear 75 which has been selected will, through the gear 77 of the register-shaft 76 corresponding thereto, cause the shaft 76 to rotate, carrying with it the gear-sector 167, rack 168, and space-determining gage 169, thereby setting the same to determine the proper width of the justifying-spaces. Fig. 6 shows the parts with the key set for a line of nineteen spaces. At this point the line-shaft sleeve 110 by means of the cam 127 upon the cam-disk 128 forces the slide 126 into a position so that its extension 130 releases the spring clutch-pawl 114, secured to the disk 114 of the word-sleeve 81, so that the word-sleeve 81 begins to rotate. As the slide 126 is thus carried to release the clutch-pawl of the word-sleeve in the manner described it also carries a second arm 125 into the path of the radial arm of line-sleeve clutch-pawl 113, thus unclutching itself and causing the sleeve to come to a stop. The line-shaft sleeve 110 has now reached approximately the two-thirds point in its rotation, where it will remain until after the word-shaft sleeve 81 has completed its allotted number of rotations in spacing the line, when the line-sleeve will again be brought into operation, returning the various parts which have been operated thereby back into their normal position. As the line-shaft sleeve reaches its temporary stopping-place the depression 151 in the cam-wheel 141 has been brought directly under the cam-roll 140 of the bell-crank 83, and the sleeve 110 is held stationary thereby.

Previous to the point last described having been reached the clutch of the measurer-shaft 67 has been in engagement; but it is now allowed to be released by action of a spring 142, which will at the same time throw clutch 60 of the type-driving shaft 41 into engagement, thereby resuming the operation of advancing the line in the typeway in order that it may receive its permanent justifying-spaces as well as to make room for the new line that may be fed into the justifier. Before the line can proceed, however, the stop-jaw 52 must be withdrawn, which is accomplished by the action of the cam 55 upon the word-shaft sleeve 81, the cam 55 actuating the lever 152, secured to the lower end of the vertical shaft 53, thereby rocking the shaft to the extent necessary to move the arm 54, secured to the upper end of the shaft, and withdraw the said slide 52 from across the typeway. The stop-jaw-actuating cam 55 is so disposed upon the word-shaft sleeve 81 that it will operate upon the lever 152 immediately upon the said word-sleeve 81 being put into action and before the line-sleeve 110 has come to its first stop, and therefore does not present the depression 151, above referred to, on the surface of the cam 141 to allow the shifting of the clutches 113 114, as described, until after the word-shaft sleeve 81 has operated in the manner aforesaid to withdraw the stop-jaw 52. The unjustified line will therefore be caused to advance by means of the line-driving shaft 41 the instant the line-sleeve 110 stops.

As the word-sleeve 81 begins to rotate the line has either been carried up to the stops of the word-slide 90, or nearly so; but the clutch 60 upon the type-driving shaft continues in engagement, holding the line so that the extensions a' a^2 of the forward separator a composed therein is held against the stops 94 and 95 until the cam 80 presents the raised surface thereof to the lever 83, thereupon releasing the frictional engagement of the clutch 60 and relieving the pressure on the line by the pawl 43; but the raised surface of cam 80 is so constructed that it will only carry the lever-arm 83 to an extent sufficient to release the said clutch 60 without throwing into engagement the clutch 69 upon the measurer-shaft 67. Just before the pressure is released from the line as it is being held against the word-slide 90 the cam 92 upon the word-sleeve operates to throw the lower end of the lever 93 outward, thereby rocking the lever upon its pivot and thrusting the word-slide 90 forward into the position shown in Fig. 11 and then returning the lever 93 in the opposite direction until it reaches the position shown in plan view in Fig. 12 and in elevation in Fig. 13. The cam path of said cam 92 is constructed to now throw the said slide 90 slightly forward, as shown in Fig. 14, where a slight dwell occurs sufficiently long for the withdrawal

of the means which is employed to insert spaces through the bottom of said slide 90 while it is in the position shown in Figs. 12 and 13. After the slight dwell employed to permit the withdrawal of such space-ejecting means the slide moves forward to the position in which it rests normally. The word-sleeve 81 is caused to rotate continuously until all the type composing the line to be justified has been carried out of the typeway by the rotation of the type-driving shaft.

The word-shaft sleeve 81 is stopped from rotating by reason of the arm 57 upon the type-driving shaft 41 (see Figs. 5) having been carried around into position to strike the upright extension 131 of the slide 126, which moves the slide so that the projecting arm 130 is carried back into engaging relationship with the radial arm of the word-clutch pawl 114, thereby unhooking the same from its toothed wheel 118 and bringing the word-sleeve 81 to a standstill. This also moves the projecting arm 125 away from the position in which it has been withholding the line-clutch pawl 113 from engagement with its corresponding toothed wheel 117 upon the line-shaft sleeve 110, thereby permitting the line-shaft sleeve to resume its arrested rotation to be again stopped upon reaching the spring-pressed-detent stop 120, which stands at a position marking the completion of the rotation of the clutch-pawl 113 of the line-sleeve 110.

It remains only to describe the operations accompanying the completion of the rotation of the line-shaft sleeve, which, as we have seen, is concerned mainly in returning parts that have been displayed thereby to their normal position. As the line-sleeve resumes its rotation its first work is to return the type-driving shaft 41 and the measurer-shaft 67 to their normal position. Cam 159, through lever 160, swings the segment-lever 161 upon its bearing 161′, the segment 163 in turn being meshed with a pinion 164 upon the shaft 41, carrying that shaft back to its normal position, and as the shaft reaches its place of rest with its arm 42 and pawl 43 thereon a stop 170 upon the typeway 40 impinges against the pawl 43 thereon, causing the same to swing slightly against the action of its spring 45, allowing its associated detent 44 to be carried by action of its spring 44″ into the position shown in Fig. 1, where the pawl 43 is held out of engaging relation with the type. While the cam 159 is returning the shaft 41 and its accompanying parts to their normal place of rest, the cam 155 is simultaneously carrying the shaft 76 and the measurer-shaft 67 to their normal position of rest by means of a lever 156, (see Fig. 3,) provided with a roll resting against said cam and operating to move the rack 157 longitudinally within its guide, thereby rotating the pinion 158, which in turn is pinned to the register-shafts 76, and as the register-shaft is still operably connected with the measurer-shaft 67 by means of that pair of gears which were called into requisition in the justification of the line which has just been measured it will readily be seen that the two will return to their normal position together. Now being in their normal positions all the gears 75 upon shaft 67 are brought into position so that the several key-ways of the individual gears will be in alinement, and the sliding key 2 returns to its normal position by action of the cam-path 145 in the periphery of the cam 128, which is so constructed that it will rock the levers 146 148 in such manner as to return the slide 78 to the bottom of the shaft 67. The line-shaft having now completed its several functions, the radial arm of the clutch-pawl 113 will strike the hooked end of the detent-stop 120, thereby withdrawing the same from its engagement with toothed wheel 117, allowing the line-sleeve 110 to come to a stop.

The mechanisms described in the foregoing specification are not the only embodiment of my invention; but the invention, considered broadly, may be embodied in various other forms, although the construction above described is preferred and is specifically claimed. Thus while I preferably use the gear construction shown for dividing the shortage and transmitting the result to the gage it will be understood that other forms of cone mechanism may be used, the other parts of the machine being modified accordingly. For example, I have shown in Figs. 18 to 20 a simple form of cone-dividing mechanism, employing a pair of plain or grooved cones with a frictional connecting-ring, which is shifted to connect the cones on different lines according to the number of spaces in the line to be justified, the movement of the register-shaft relatively to the measurer-shaft being thus varied in the same way as by the gears and slide-key construction above described.

In the construction illustrated in Figs. 18 to 20, 200 is the measurer-shaft, and 201 the register-shaft, each having upon its surface a series of annular grooves, ten being shown for use in connection with lines not to exceed eleven words or ten spaces. The grooves in the two cones are arranged opposite each other, and a connecting-ring 202 is adapted to move along the cone M and be gripped between the cones in one of the corresponding pair of grooves, so as to connect the two cones and transmit the measuring movement of cone M to the cone N. This ring 202 is carried by a semicircular ring-holder 203 on a sleeve 204, mounted to slide on shaft 205, parallel with shafts 200 201. The sleeve 204 carries a ratchet-bar 206, moving in a slot in the shaft 205, this ratchet-bar 206 having the

same number of teeth as the pairs of grooves in the cones and being moved upward step by step, according to the number of spaces, by pawl 207, carried by the bar or lever 208, which may be the space-key or a part operated thereby or otherwise in accordance with the number of spaces in the line to be justified. A holding pawl or detent 209 engages the ratchet-bar 206 to hold it in position as advanced by the pawl 207, and a rocking trip-bar 250 carries trips *s*, which engage the tails of the pawls 207 209 to throw them out of engagement with the ratchet-bar 206 and allow the latter to drop to zero position for the next line. The shaft 201 is mounted to slide, so as to move the cone N toward and from the cone M, the shaft 201 being moved by rock-shaft 210, which is connected by toggles 211 with the shaft 201, so that by the rocking of shaft 210 the toggles 211 are broken to withdraw the cone N from cone M, so as to permit the ring 202 to move along cone M or straightened so as to press the cone N against the ring 202 on cone M and connect the two cones. The upper end of the shaft 201 has a stud 212, which moves in a slot in the hub of arm 213, so that the shaft 201 is free to be moved by the toggles 211 without moving or being disengaged from the arm 213. This arm 213 extends through an opening in the side of guides 214 and actuates the gage 215, which moves between said guides. As shown, the dividing-cones M N do not conform exactly to plane cones, being curved along their line of contact; but this construction is used only in order to allow the teeth of the ratchet-rack 206 to be constructed of uniform pitch, or the cone-surfaces might be straight by constructing the connecting-ring-shifting mechanism to move accordingly. The operation of this cone construction will be clear without extended description, it being understood that the cones M N are separated by rocking shaft 210 to break the toggles 211 into the position shown in dotted lines in Fig. 20, thus withdrawing the cone N into the position shown in dotted lines in that figure, and the connecting-ring 202 is set by ratchet-bar 206 and pawl 207 in accordance with the number of spaces in the line to be justified, while the cone N is thus withdrawn. The shaft 210 is then rocked to press the cone N against the ring 202 and connect the cones M N, as shown in Figs. 18 and 19. The shaft 200 is then rotated to measure or in accordance with the measurement of the line, and this motion is transmitted through the cone N to the gage 215, according to the position of the connecting-ring 202 along the cones M N and the shortage of the line thus divided at the gage in accordance with the number of spaces in the line. As shown, the connecting-ring 202 is positioned for a line of six spaces, the ring 202 being in the sixth ring-groove from the bottom of the cones.

It will be understood that the cone-dividing mechanism which forms one of the broad features of my invention may be used with devices of any suitable form for selecting the gears or portions of the cones in accordance with the line to be justified and with mechanism of any suitable character for actuating the cones and transmitting the division result. It will be understood also that other features of the invention are not limited to the specific form or arrangement of the devices illustrated, but that these may be modified while retaining the features defined by the claims.

While the machine shown as embodying the invention is adapted for handling ordinary type, and I have aimed especially at the production of a machine capable of justifying such type at high speed with accuracy and a minimum of wear on the type, it will be undertsood that the invention is not limited to machines for justifying such ordinary type, but may be applied also in justifying type, matrices, or the like, of any suitable material, and the word "type" is used in this specification and the claims in this broad sense. Certain broad features of the invention also are applicable not only in machines for justifying composed lines of type or matrices, but in line-justifying mechanism of other classes.

What I claim is—

1. In a justifying mechanism, a measuring and dividing mechanism including two cones in combination with adjustable means for operatively connecting said cones to divide the shortage by the number of spaces in the line to be justified.

2. A mechanism for justifying a composed line of type including devices for measuring an unjustified composed line, and dividing the shortage in the line by the number of word-spaces, said devices including two cones and means for operatively connecting said cones in accordance with the number of word-spaces in the line.

3. In a justifying mechanism, a pair of dividing-cones, means for rotating one of said cones in accordance with the measured shortage of the unjustified line and adjustable connections between the cones for moving the second cone an amount proportional to the thickness of the individual justifying-spaces of the line.

4. In a justifying mechanism, a pair of rotatable dividing-cones, adjustable connecting means whereby one of said cones is made to rotate in variable ratios to the rotation of the other cone, and means for setting said connecting means in accordance with the number of spaces in the line to be justified.

5. In a justifying mechanism, a pair of op-

positely-pointed dividing-cones with parallel spindles, in combination with adjustable means for rotating one of said cones in variable ratios to the rotation of the other cone.

6. In a justifying mechanism, a pair of cones one of which is rotatable in accordance with the measured shortage of the unjustified line and the other connected thereto to rotate in one-half, one-third, or other fractional part of the rotation of said measuring-cone in accordance with the number of spaces in the line.

7. In a justifying mechanism a line-measuring device, a space-determining device, and two parallel rotatable shafts, one of which shafts is suitably connected with said measuring device and the other with said determining device, in combination with two cones suitably supported upon said shafts, and adjustable means for connecting said cones on different lines along the cones to vary the movement of the space-determining device by the measuring device.

8. A mechanism for ascertaining the thickness of spaces required to justify a composed line of type comprising means for measuring the unjustified line of type, a gage, and means consisting of a set of dividing-cones for transmitting the measuring result to said gage, in combination with means for operably connecting said cones in accordance with the number of spaces in the line.

9. In a justifying mechanism, a rotatable cone, controlling means within said cone, and adjustable connecting means between said cone and said controlling means, and devices for adjusting said means in accordance with the number of spaces in the line to be justified.

10. In a justifying mechanism, a computing-cone operably connected with an arm adapted to revolve therewith, said arm being adapted to engage with the line to be justified.

11. In a justifying mechanism, a cone, a device in connection with said cone for measuring an unjustified line, and a second cone movable relatively to the first-mentioned cone in proportion to the number of spaces in the line.

12. In a justifying mechanism, a space-key, a justifying-cone, and a reciprocating slide coöperating with said cone and controlled by the action of said key, its operative position for each line depending upon the number of word-spaces in the line.

13. In a justifying mechanism, a justifying-cone comprising a plurality of gears loosely mounted upon a common shaft and a sliding key adapted to lock any one of said gears to the shaft in combination with means for adjusting said key and rotating said gears to divide the line shortage by the number of spaces.

14. In a justifying mechanism, a justifying-cone comprising a plurality of gears loosely mounted upon a common shaft, a sliding key adapted to lock any one of said gears to the shaft, and means for adjusting said key in accordance with the number of spaces in the line to be justified.

15. In a justifying mechanism, a rotatable justifying-cone, means for measuring an unjustified line and rotating said cone in accordance with the shortage, and a space-determining gage, in combination with means for adjustably connecting said cone and said gage in accordance with the number of spaces in the line to be justified.

16. In a justifying mechanism, a line-measuring mechanism, and a cone-dividing mechanism consisting of two sets of gears forming two gear-cones with the gears of one set in mesh with the corresponding gears of the other set, in combination with means whereby one of said cones may be actuated by one of the gears of the other of said cones according to the number of spaces in the line to be justified.

17. In a justifying mechanism, two gear-cones, each comprising a number of gears, with the gears of one cone fixed to a shaft and the gears of the other cone loose upon a shaft, in combination with means for selecting one of the gears of the second cone in accordance with the number of spaces in the line and rotating it in accordance with the shortage of the line.

18. In a justifying mechanism, a gear-dividing mechanism, having a pair of meshed gears for each number of word-spaces in a line, and means for selecting said gears and rotating them in accordance with the shortage of the line to be justified.

19. In a justifying mechanism, a line-measuring mechanism comprising a measurer-shaft and measuring-arm moving therewith, a register-shaft, and a gear connection between said shafts consisting of independently-operable sets of gears for each number of word-spaces in a line, in combination with means whereby one set of said gears is operated independently of the other sets to transmit the rotation of the measurer-shaft to the register-shaft.

20. In a justifying mechanism, a measurer-shaft and a series of independently-rotatable gears loosely mounted thereon, a register-shaft with corresponding series of gears fixed thereto, and means for locking some one of said measurer-gears to the measurer-shaft in accordance with the number of spaces in the line to be justified, whereby said register-shaft is caused to rotate in accordance with the measurement of the line and the number of spaces.

21. In a justifying mechanism, a measuring and dividing mechanism including a cone consisting of a plurality of gears loosely mounted upon the cone-shaft, and a movable

key adapted to slide on the shaft to lock one of said gears to the shaft for the dividing operation and means for adjusting said key and rotating said gears to divide the line shortage by the number of spaces.

22. In a justifying mechanism, a measuring and dividing mechanism including a cone consisting of a plurality of gears loosely mounted upon the cone-shaft, a movable key adapted to slide on the shaft to lock one of said gears to the shaft for the dividing operation, and means for adjusting said key in accordance with the number of spaces in the line to be justified.

23. In a justifying mechanism, a measuring and dividing mechanism including a cone consisting of a series of gears loosely mounted upon a shaft, means for operably connecting a single gear of said series to said shaft consisting of a sliding key, and detachable means for setting said key in its required position according to the number of spaces in the line to be justified.

24. In a justifying mechanism, a measuring and dividing mechanism including a measuring-shaft, a series of independently-rotatable gears similarly provided with keyways and loosely mounted upon said shaft, a key sliding in said keyways for locking some one of said series of gears to the shaft, means for securing the alinement of said keyways, and means for setting said key in accordance with the number of spaces in the line to be justified.

25. In a justifying mechanism, a measurer-shaft and devices operable thereby for measuring an unjustified line, in combination with a register-shaft and mechanism operable thereby for setting a gage to determine the thickness of justifying-spaces in accordance with the rotation of said measurer-shaft as communicated to the register-shaft, and means for varying the movement of the register-shaft by the measurer-shaft in accordance with the number of spaces.

26. In a justifying mechanism, a line-measuring mechanism comprising a spindle and an arm pivoted thereon adapted to engage a composed line of type, a cone rotatable by the movement of said arm, a space-determining mechanism, and means for operably connecting said mechanism at predetermined points longitudinally of said cone in accordance with the number of word-spaces in the line to be justified.

27. In a justifying mechanism, two rotatable shafts one of which is provided with means for measuring an unjustified line and the other is provided with means for setting a gage to determine the thickness of spaces required to justify said line, and adjustable means for connecting said shafts.

28. In a justifying mechanism, parallel shafts mounted in fixed bearings in combination with means for rotating one of said shafts in varying ratios to the rotation of the other according to the number of spaces in the line to be justified.

29. In a justifying mechanism, a measuring and a register shaft both mounted in fixed bearings with means for rotating said register-shaft in varying ratios to the rotation of said measuring-shaft, in combination with means whereby said connecting means is set in accordance with the number of word-spaces in the line to be justified.

30. In a justifying mechanism, two shafts mounted in fixed bearings and one of which is adapted to rotate proportionally to the aggregate shortage in an unjustified line, and a variable connection between said shafts whereby the other shaft is caused to rotate proportionally to the individual spaces required to justify the line.

31. In a justifying mechanism, two rotatable shafts with adjustable means for connecting said shafts according to the number of word-spaces in the line and a circular typeway concentric with one of said shafts provided with means for measuring the unjustified line of type within said typeway.

32. In a justifying mechanism, two parallel rotatable shafts, and adjustable means for operably connecting the same to actuate one of said shafts by the other thereof equally therewith or in the ratio of one-half, one-third, one-fourth, one-fifth, &c., of the rotation of the actuating-shaft in accordance with the number of word-spaces in the line to be justified.

33. In a justifying mechanism, two parallel rotatable shafts, in combination with line-measuring devices whereby one of said shafts is rotated in accordance with the shortage of the line, and adjustable connections between said shafts whereby the other shaft may be rotated in varying ratios by the measuring-shaft in accordance with the number of word-spaces in the line measured.

34. In a justifying mechanism, two parallel rotatable shafts with adjustable connecting means for rotating one of said shafts in different ratios by the other, and a circular typeway having at the center an auxiliary rotatable shaft provided with a type-measuring arm and connected so as to rotate one of said parallel shafts.

35. In a justifying mechanism, two parallel rotatable shafts with adjustable connecting means for rotating one of said shafts in different ratios by the other, a circular typeway, a type-measuring arm moving concentrically with said typeway and actuating one of said shafts, means coacting with said arm to measure a line in said typeway, and clutch-driving mechanism for driving and releasing said arm.

36. In a justifying mechanism, two parallel rotatable shafts with adjustable connecting means for rotating one of said shafts

in different ratios by the other, a circular typeway, a type-measuring arm moving concentrically with said typeway and actuating one of said shafts, means coacting with said arm to measure a line in said typeway, and clutch-driving mechanism for driving and releasing said arm and returning the shafts and arm to normal position when the arm is released.

37. In type-handling mechanism, a curved line-channel adapted to hold a line of type arranged side by side, in combination with a line-feeder for moving the type longitudinally of the line and moving in and concentrically with said channel.

38. In type-handling mechanism, a curved line-channel, in combination with a reciprocating line-feeder moving in and concentrically with said channel.

39. In type-handling mechanism, a curved line-channel, in combination with a line-feeder moving in and concentrically with said channel and a type-feeder moving concentrically with said channel for feeding type into said channel.

40. In type-handling mechanism, a curved line-channel, in combination with a reciprocating line-feeder moving in and concentrically with said channel, and a type-feeder moving intermittently and concentrically with said channel for feeding type into said channel.

41. In type-handling mechanism, a curved line-channel, in combination with a rocking shaft at the center of said channel, and a line-feeding arm on said shaft.

42. In type-handling mechanism, a curved line-channel, in combination with a reciprocating line-feeding arm moving concentrically with said channel, and a spring-pressed line-pawl carried by said arm.

43. In type-justifying mechanism, a line-measuring channel, in combination with an arm mounted to swing longitudinally of the channel, means for swinging said arm, and devices coacting with said arm to compact and measure the type-line in the channel by the swinging movement of said arm.

44. In type-justifying mechanism, a line-measuring channel, in combination with an arm mounted to swing longitudinally of the channel, and means for measuring the type-line and carrying the measured line out of the measuring-channel by the swinging movement of said arm.

45. In type-justifying mechanism, a curved line-measuring channel adapted to hold type with their pointwise dimensions radial to the channel.

46. In type-justifying mechanism, a curved line-measuring channel and means for measuring a line of type therein.

47. In type-justifying mechanism, a curved line-measuring channel in combination with a measuring-jaw moving in a path concentric therewith, an abutment against which the line is measured, and means for advancing the abutment into and withdrawing it from the channel.

48. In type-justifying mechanism, a rotary measuring mechanism comprising a rotatable shaft carrying a type-measuring arm, a rotatable dividing mechanism actuated by said shaft, and a circular line-measuring channel concentric with the path of movement of said arm.

49. In type-justifying mechanism, a curved line-channel, a stationary measuring-abutment and means for moving the abutment into and out of the path of the type, in combination with a line-measuring jaw moving in said channel.

50. In type-justifying mechanism, a curved line-channel, a stationary measuring-abutment and means for moving the abutment into and out of the path of the type, in combination with a line-measuring jaw moving in said channel, and means for moving said jaw to advance the measured line after the abutment is withdrawn.

51. In type-justifying mechanism, a curved line-channel, a stationary measuring-abutment and means for moving the abutment into and out of the path of the type, in combination with a line-measuring jaw moving in said channel, and yielding means for actuating said jaw to advance the type against the abutment for measuring and to advance the measured line when the abutment is withdrawn.

52. In type-justifying mechanism, a measuring mechanism including a movable spring-pressed measuring-pawl 43, and a second pawl 45 adapted to trip said pawl 43, in combination with means for withdrawing pawl 45 to release said pawl 43.

53. An extensible type-channel having its parts spring-pressed longitudinally of the channel to advance the type and to yield as type are fed in.

54. Channel 22 having a curved portion 24 carried by spring-pressed block 23, and stationary end portions from which the type are fed by the pressure on block 23, substantially as described.

55. Channel 22 having a curved portion 24 carried by spring-pressed block 23 and stationary end portions, means for feeding type into one of the end portions against the pressure on block 23, and means for closing and opening the other end portion for the delivery of type, substantially as described.

56. The combination with a space-ejector, of a sidewise and longitudinally moving bar for actuating said ejector, an actuating device for moving said bar longitudinally for space-ejecting when the bar is in one of its sidewise positions, and a space-key for holding said bar out of position to be actuated except when released by the space-key.

57. The combination with an ejector, of bar 30 connected to the ejector, stop 34 and space-key 20, a spring for moving the bar sidewise when released by stop 34, and an actuating device for moving the bar longitudinally when positioned by the spring, substantially as described.

58. The combination with the curved channel 40 and means for feeding type into said channel, of shaft 41, arm 42, pawl 43 on said arm and means for withdrawing said pawl from and returning it to the channel, substantially as described.

59. Curved channel 40, in combination with shaft 41 having arm 42, pawl 43 on said arm, trip 44, and means for actuating said trip, substantially as described.

60. Curved channel 40, in combination with shaft 41 having arm 42, carrying pawl 43, pawl 65 on said arm, and arm 62 loose on shaft 41 having shoulder 64 adapted to stop the arm 62 by engagement with pawl 65 and to be returned thereby, substantially as described.

61. The combination with the line-advancing shaft 41, of the measurer-shaft 67, a stop carried by said shaft 41 to limit the movement of shaft 67, and friction-clutches alternately operated to rotate shaft 41 to advance and compact the line, and rotate shaft 67 until stopped by the position of shaft 41, substantially as described.

62. The combination with the line-advancing shaft 41, of the measurer-shaft 67, a stop carried by said shaft 41 to limit the movement of shaft 67, friction-clutches alternately operated to rotate shaft 41 to advance and compact the line, and rotate shaft 67 until stopped by the position of shaft 41, and means for rotating shaft 41 to advance the line after measurement and for returning shaft 67 by shaft 41, substantially as described.

63. In justifying mechanism, a device adapted to be positioned in accordance with the number of spaces in the line, in combination with a reciprocating member for moving said device, a fender controlling the engagement of the device by said member, and means for setting said fender in accordance with the number of spaces.

64. The combination with slide 2 having teeth 4, of slide-actuating pawl 6, fender 8 controlling the pawl to determine the part of the pawl movement during which it shall actuate the slide, and means for setting the fender in accordance with the number of spaces.

65. The combination with the line-channel 40, of the word-slide having the top and bottom members 94, 95, having cams for advancing the word in the channel, and shoulders *c* for moving the separator out of the channel.

66. The combination with the line-channel 40 and separator-channel 22, of a word-slide having cams 96 for advancing a separator in channel 40, and shoulders *c* behind the cams for moving the separator into channel 22.

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

WALTER JAY ENNISSON.

Witnesses:
W. H. KENNEDY,
C. J. SAWYER.