No. 844,565. PATENTED FEB. 19, 1907.

W. J. ENNISSON.

TYPE JUSTIFYING MACHINE.

APPLICATION FILED AUG. 3, 1898.

19 SHEETS—SHEET 1.

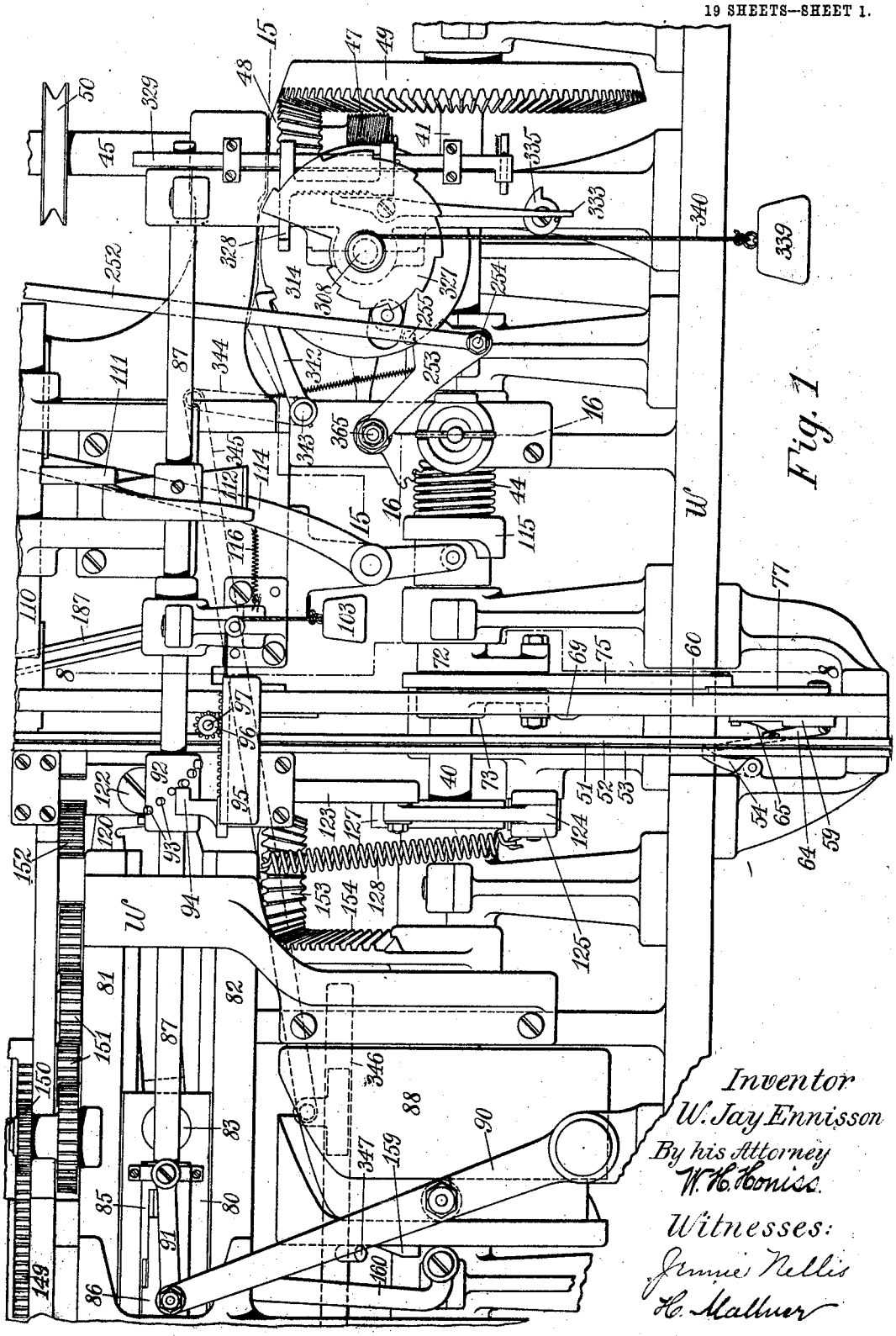

Fig. 1

Inventor
W. Jay Ennisson
By his Attorney
W. H. Bonisc.

Witnesses:
Jennie Nellis
H. Mallmer

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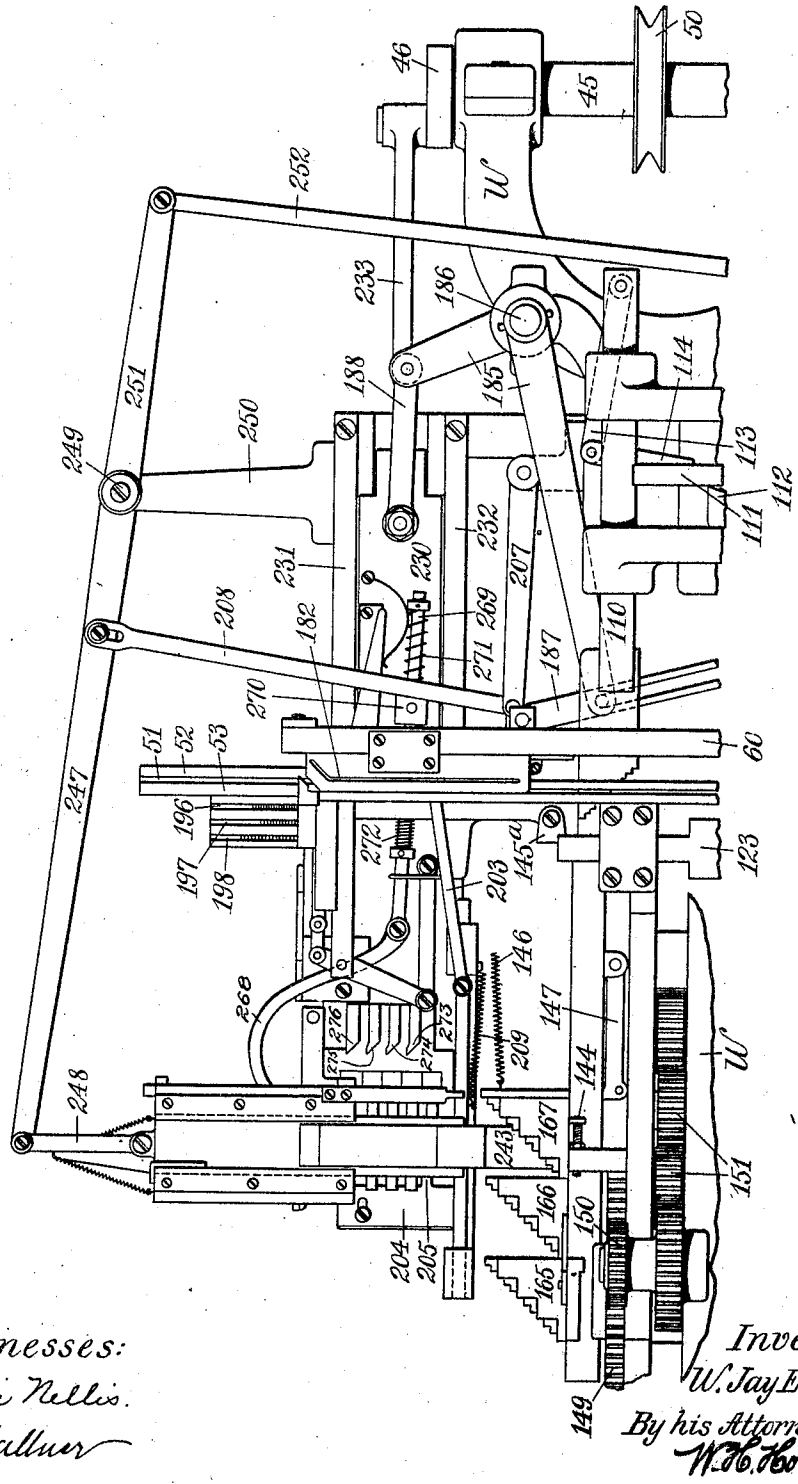
19 SHEETS—SHEET 2.

Fig. 2



Witnesses:
Jennie Nellis.
H. Mallner

Inventor
W. Jay Ennisson
By his Attorney
W. B. Konigs.

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19 SHEETS—SHEET 3.

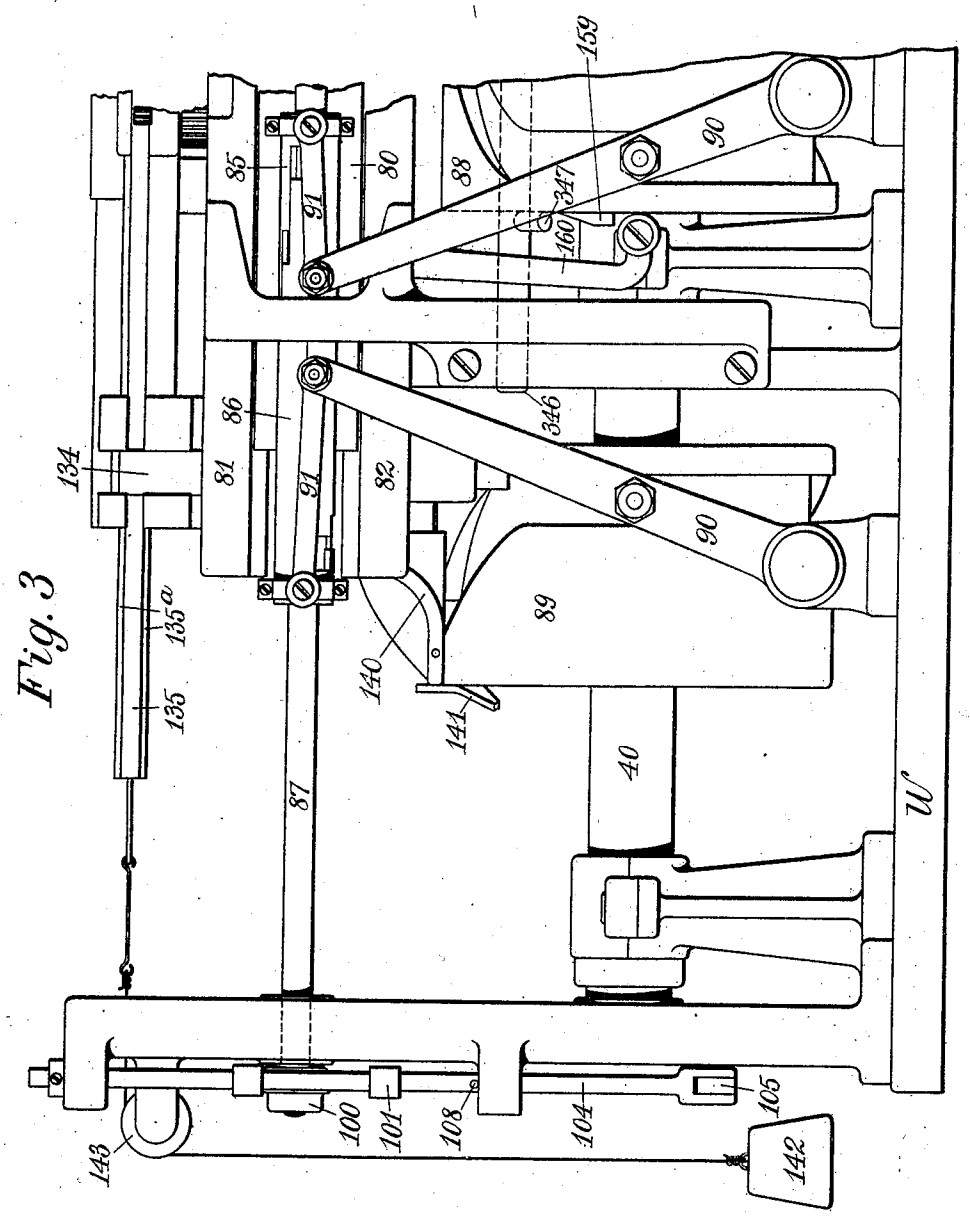

Fig. 3

Witnesses:
Jennie Nellis.
H. Mallmer

Inventor
W. Jay Ennisson
By his Attorney
W. H. Honiss.

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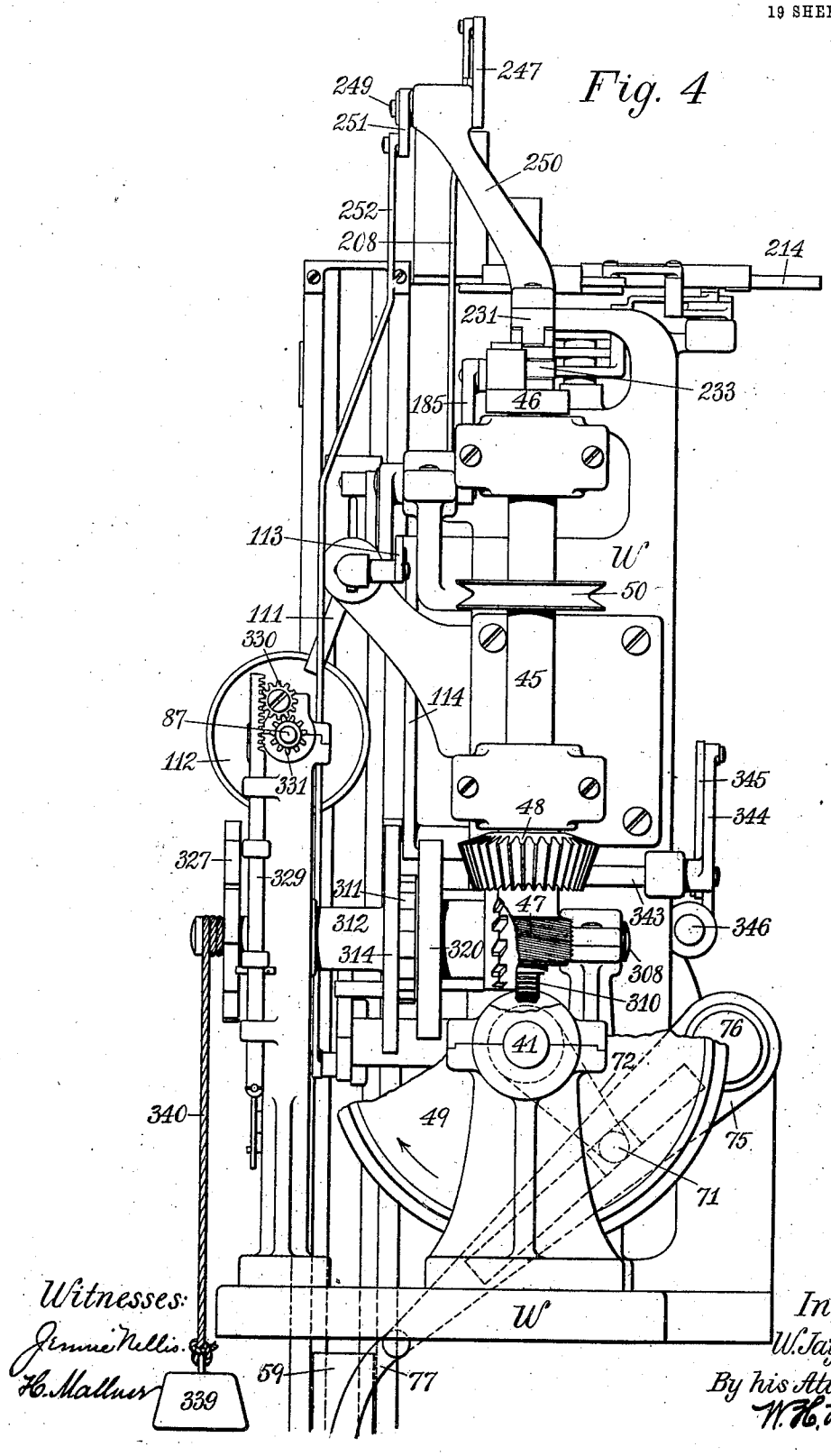
19 SHEETS—SHEET 4.

Fig. 4



Witnesses:
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H. Mallues

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By his Attorney
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19 SHEETS—SHEET 5.

Fig. 5

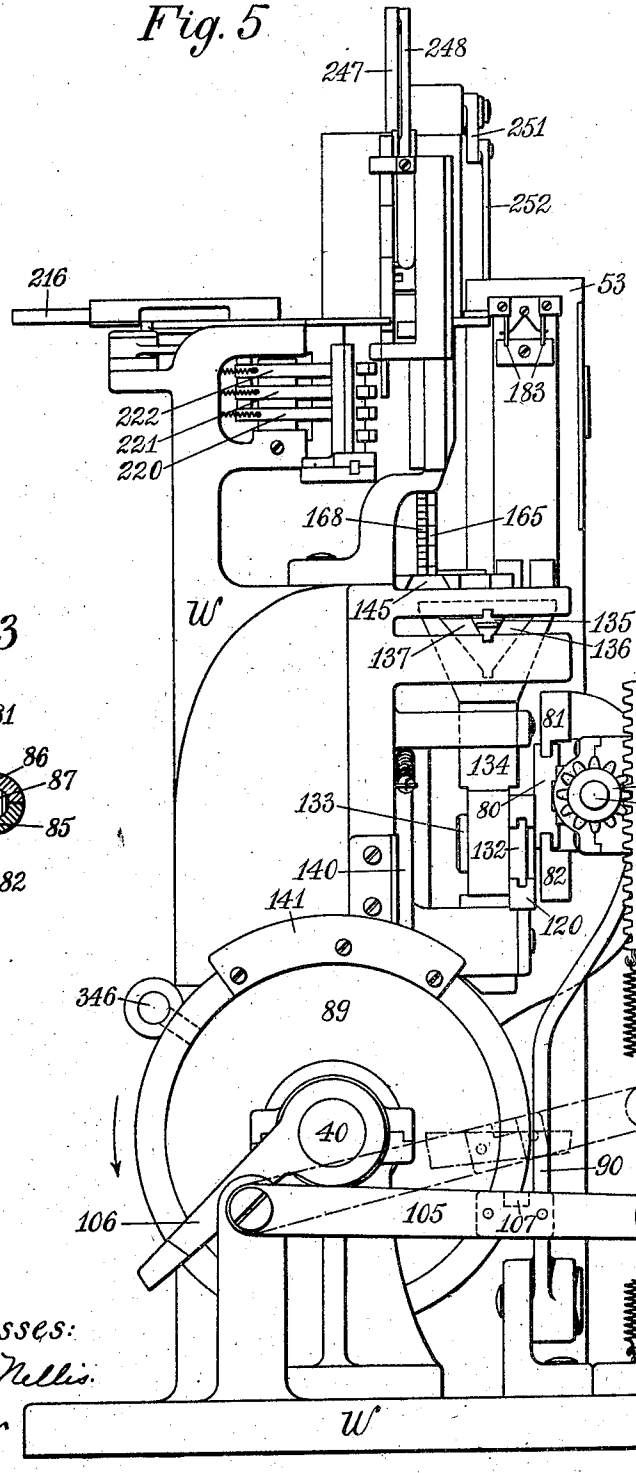
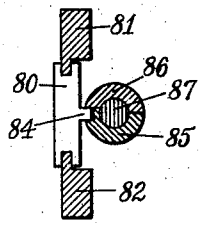


Fig. 33



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Inventor
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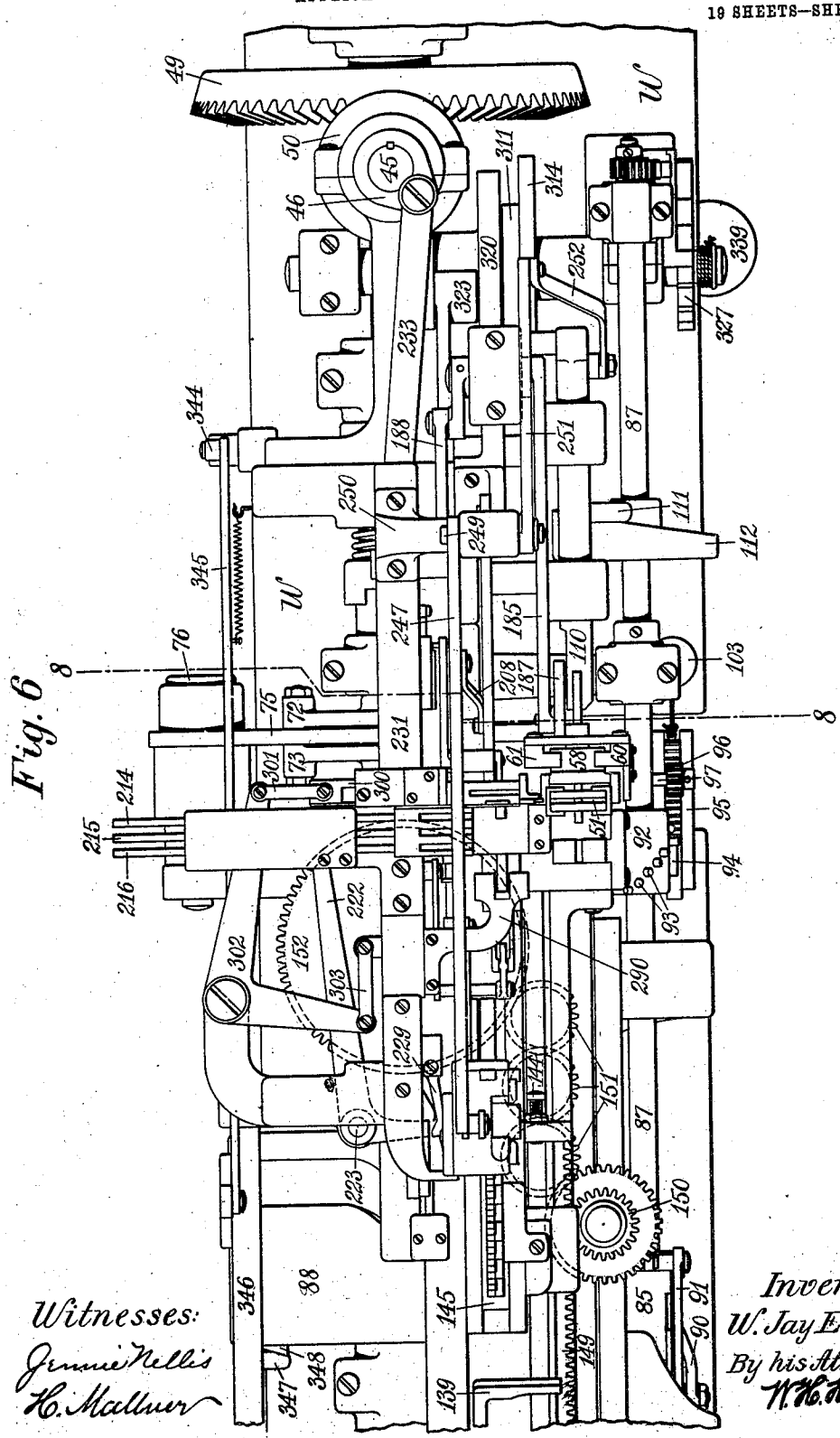
19 SHEETS—SHEET 6.

Fig. 6



Witnesses:
Jennie Nellis
H. Mallmer

Inventor
W. Jay Ennisson
By his Attorney
W. H. Ennisson.

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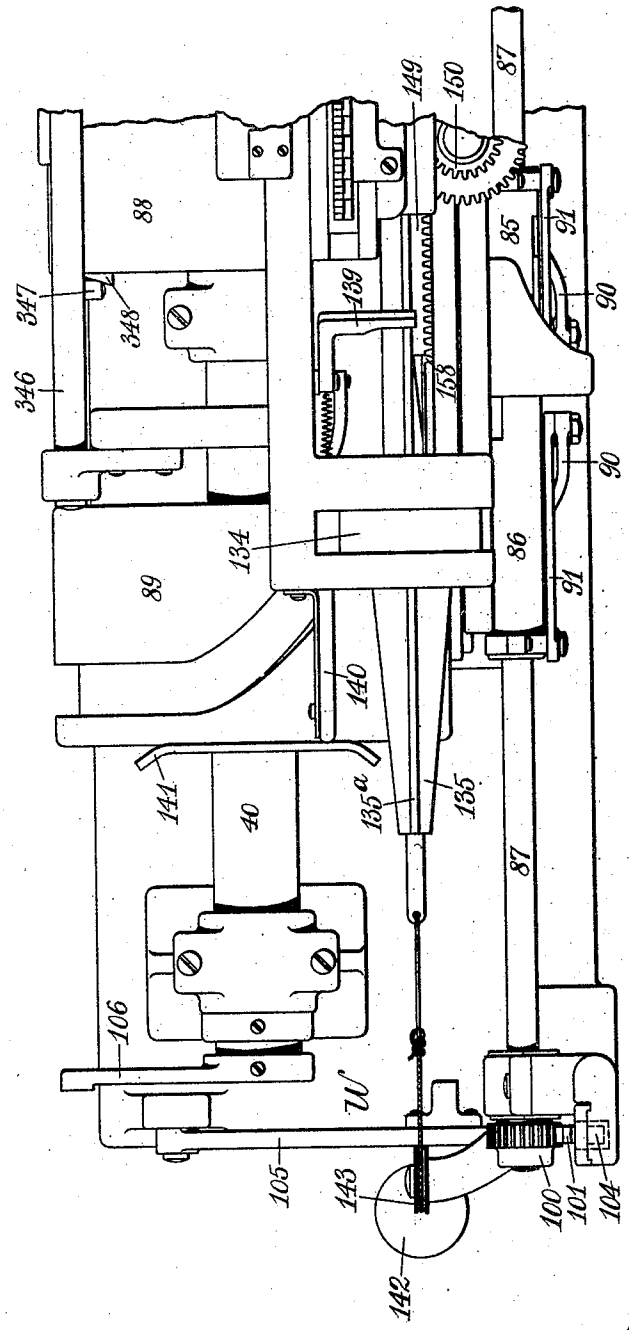
19 SHEETS—SHEET 7.

Fig. 7



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Jennie Nellis
H. Mallmer

Inventor
W. Jay Ennisson
By his Attorney
W. W. Ennisson.

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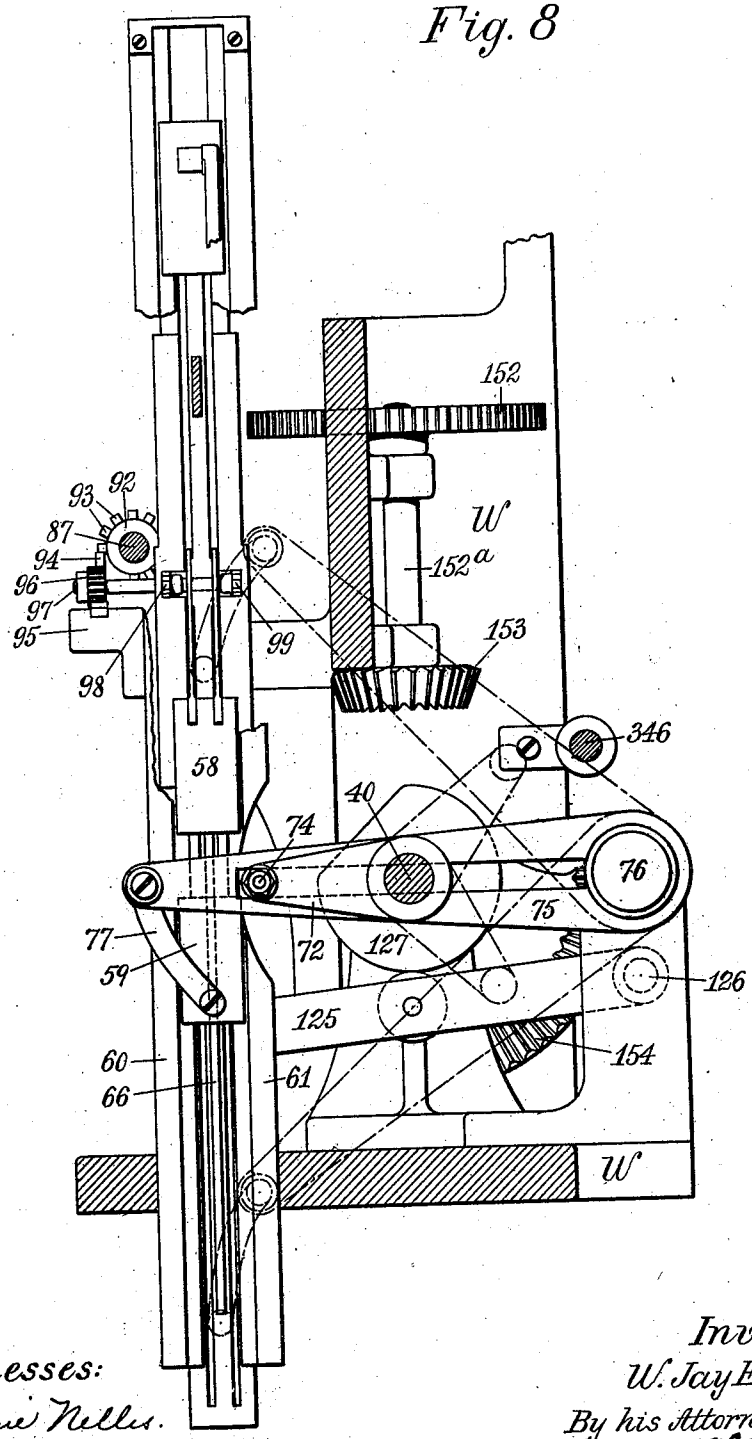
19 SHEETS—SHEET 8.

Fig. 8



Witnesses:
Jennie Nelles.
H. Mallmer

Inventor
W. Jay Ennisson
By his Attorney
W. B. Ennisson.

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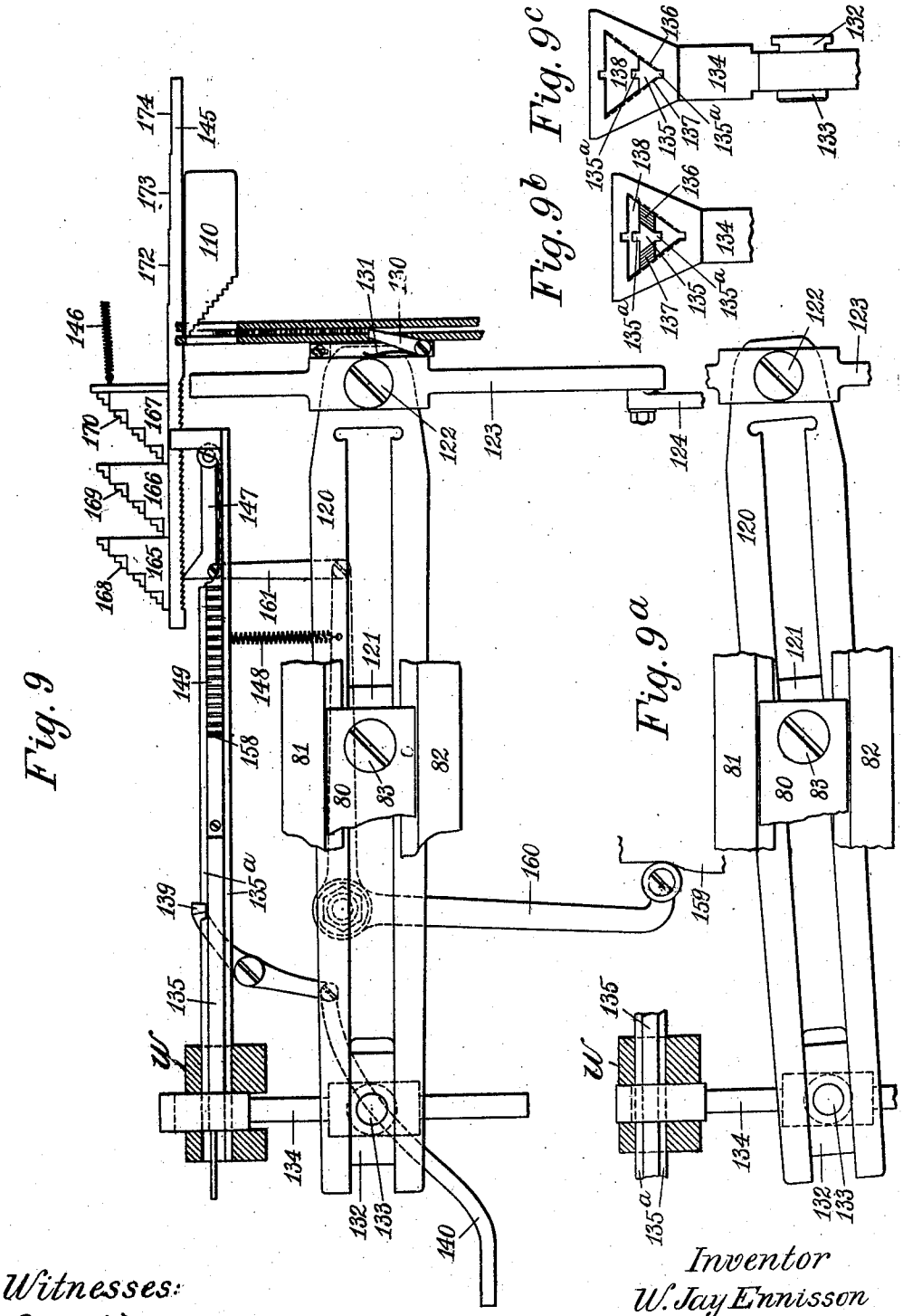
19 SHEETS—SHEET 9.



Witnesses:
Jennie Nellis
H. Mallmer

Inventor
W. Jay Ennisson
By his Attorney
W. B. Howes.

No. 844,565. PATENTED FEB. 19, 1907.

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19 SHEETS—SHEET 10.

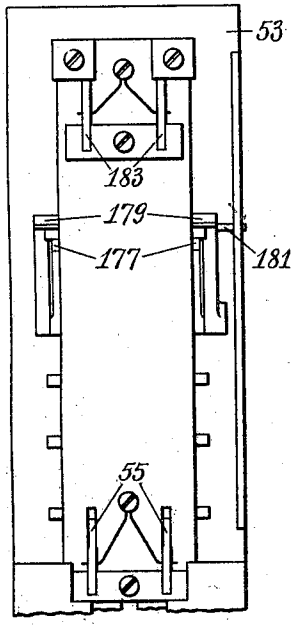


Fig. 11a

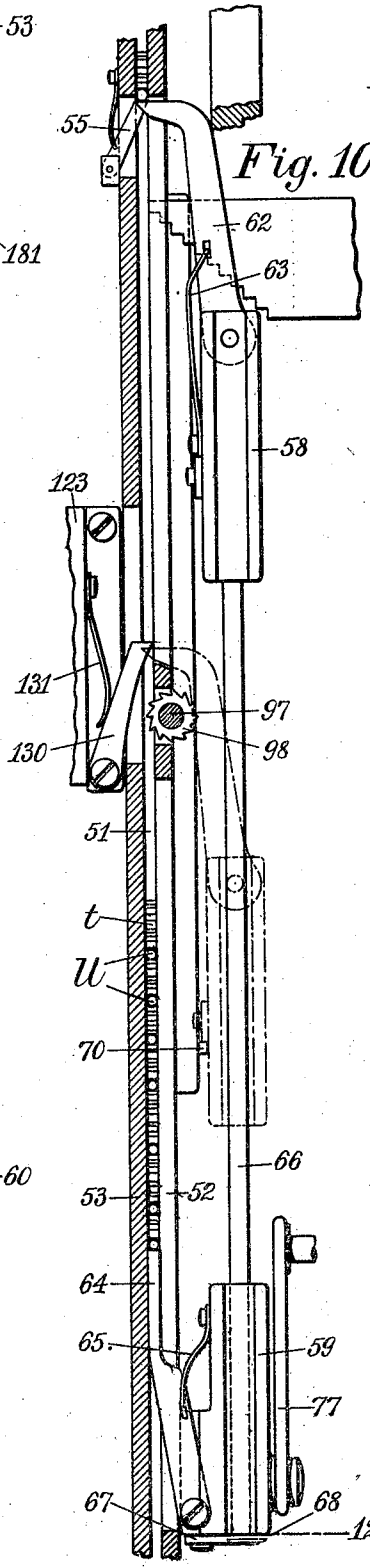


Fig. 10

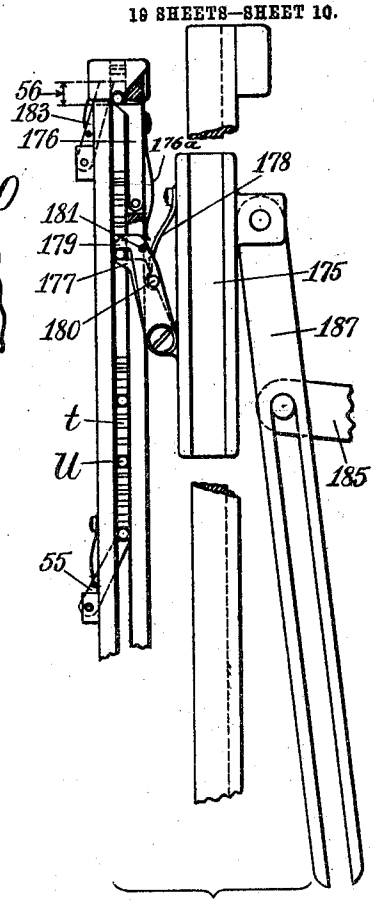
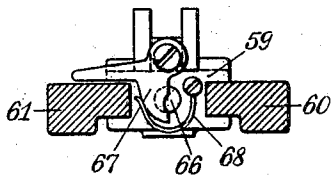


Fig. 11

Fig. 12



Witnesses:
Jennie Nellis
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Inventor
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No. 844,565. PATENTED FEB. 19, 1907.

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19 SHEETS—SHEET 11.

Fig. 13

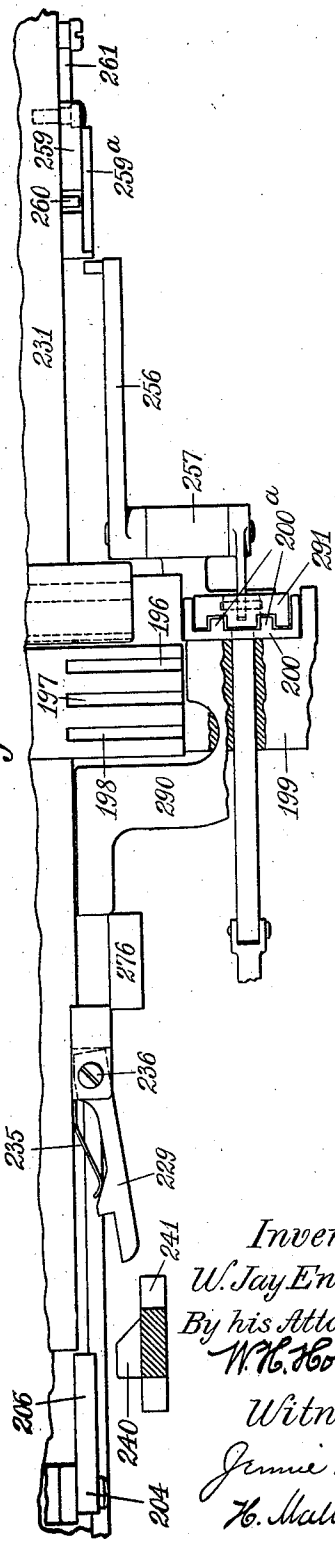
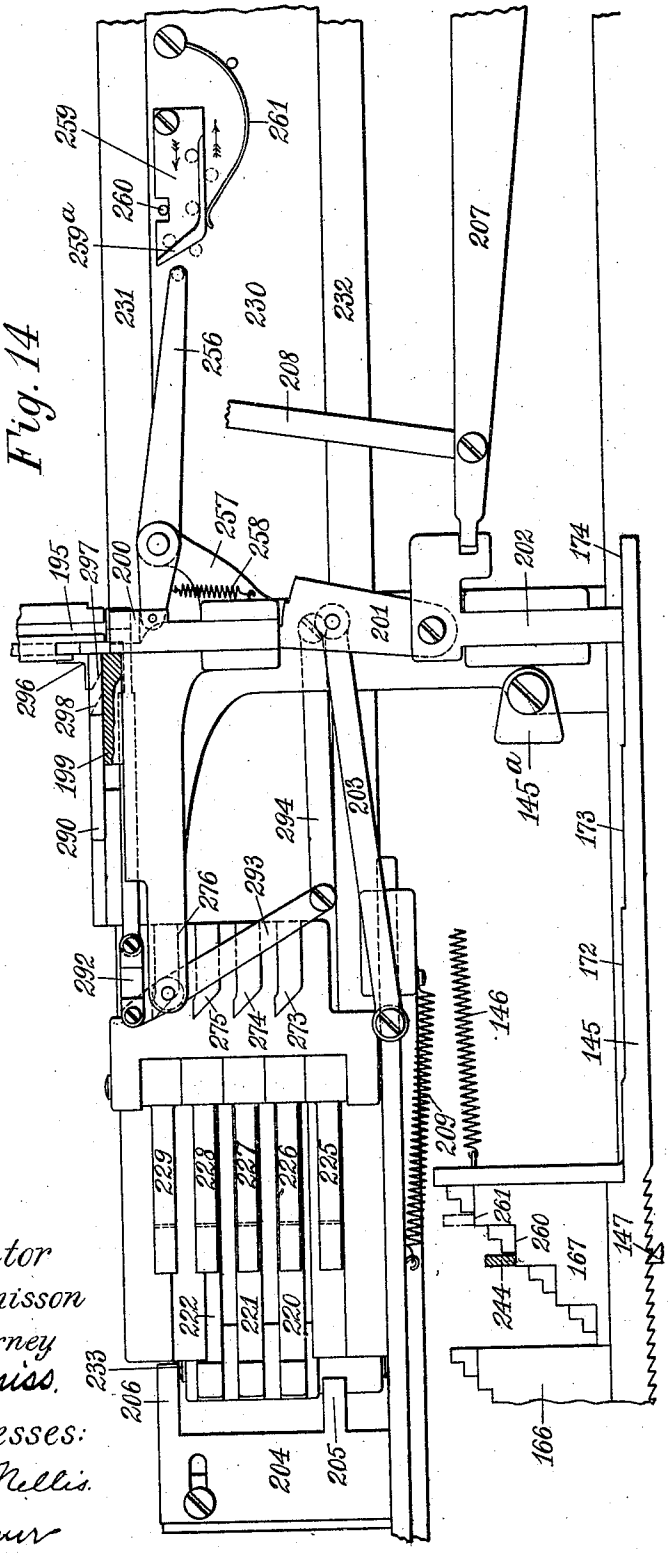


Fig. 14



Inventor
W. Jay Ennisson
By his Attorney
W. H. Honiss.

Witnesses:
Jennie Nellis.
H. Mallmer

No. 844,565. PATENTED FEB. 19, 1907.

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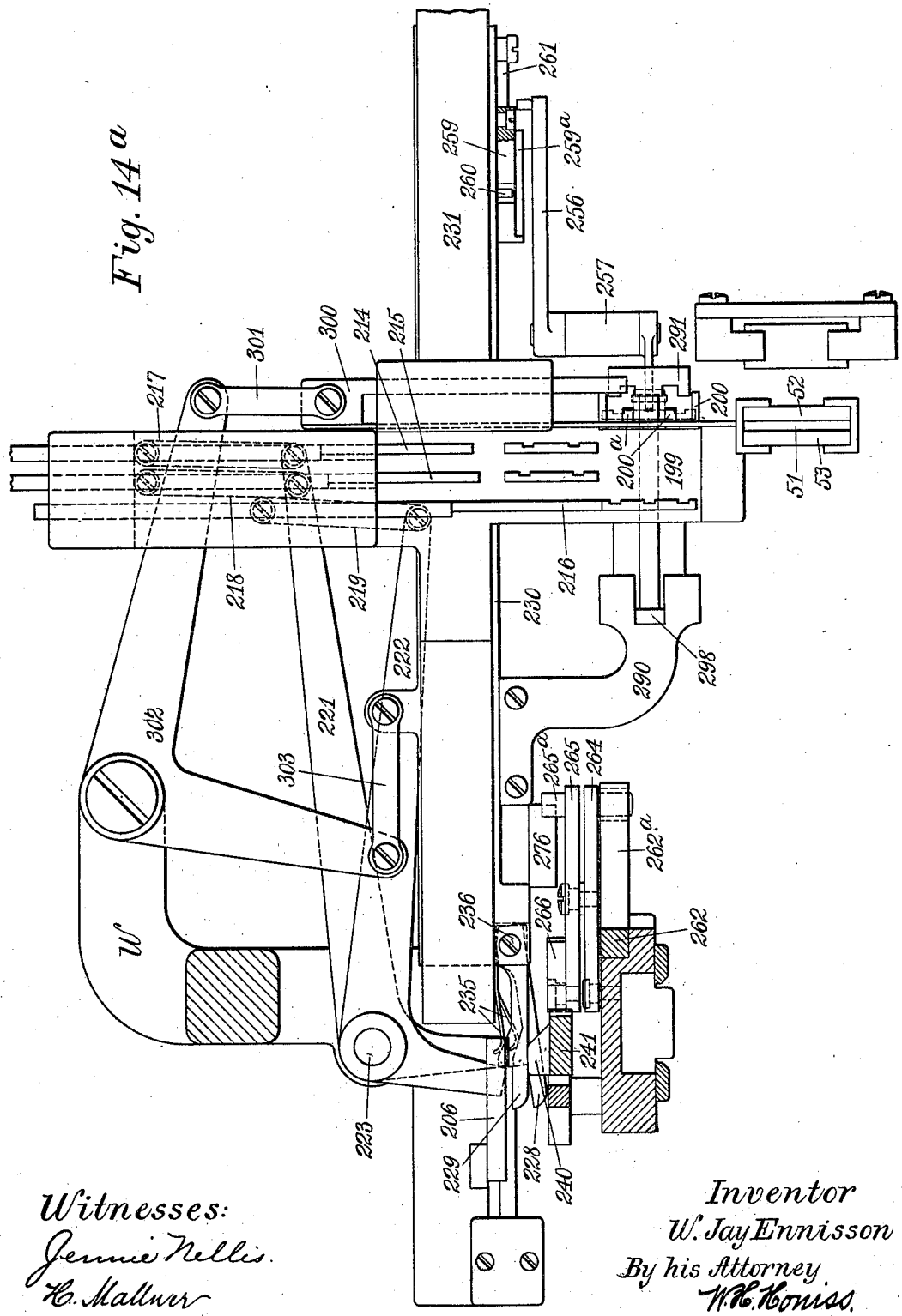
19 SHEETS—SHEET 12.

Fig. 14a



Witnesses:
Jennie Nellis.
H. Mallmer

Inventor
W. Jay Ennisson
By his Attorney
W. H. Honiss.

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19 SHEETS—SHEET 13.

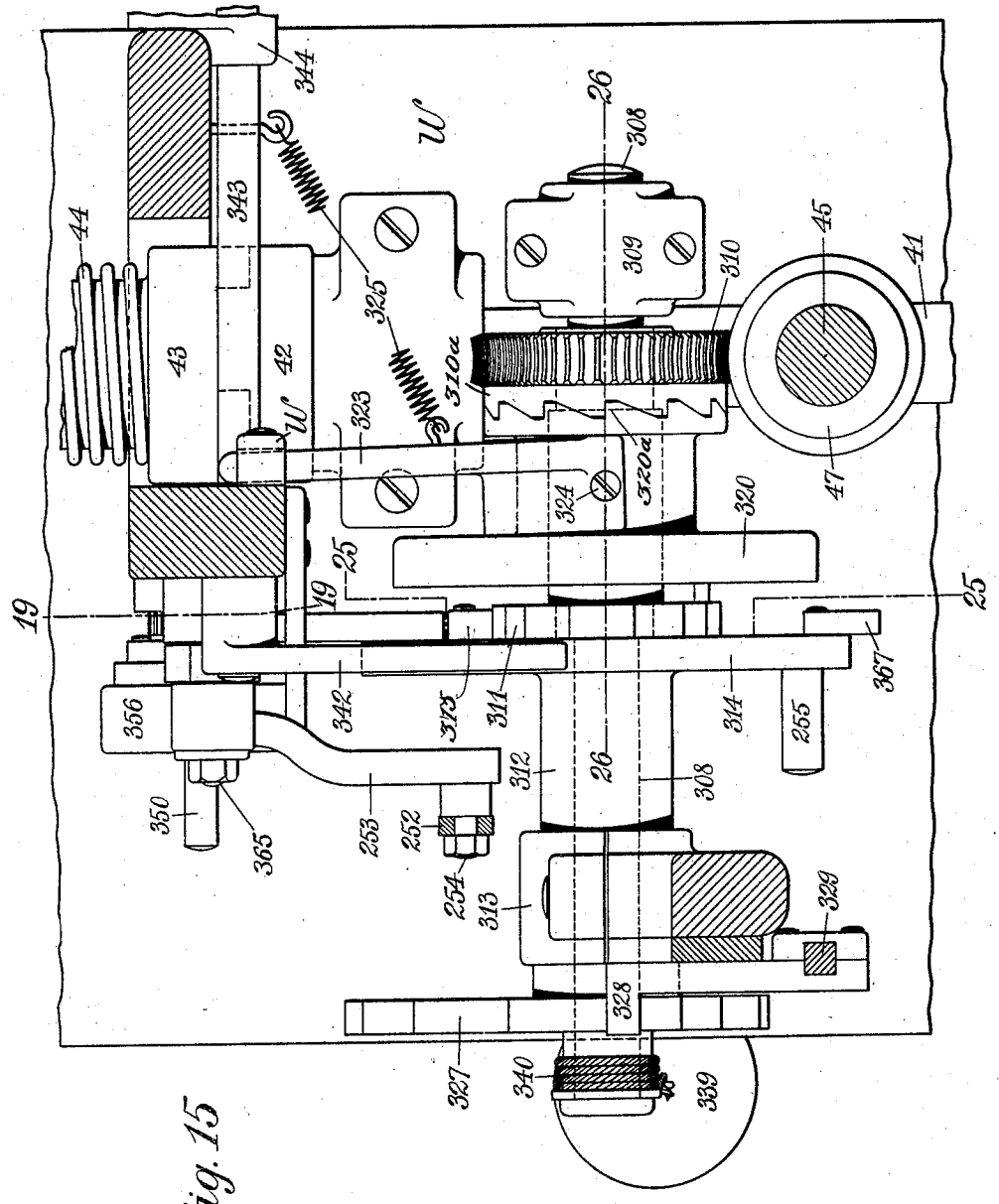

Fig. 15

Witnesses:
Jennie Nellis
H. Mallmer

Inventor
W. Jay Ennisson
By his Attorney
W. H. Ennisson

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W. J. ENNISSON.

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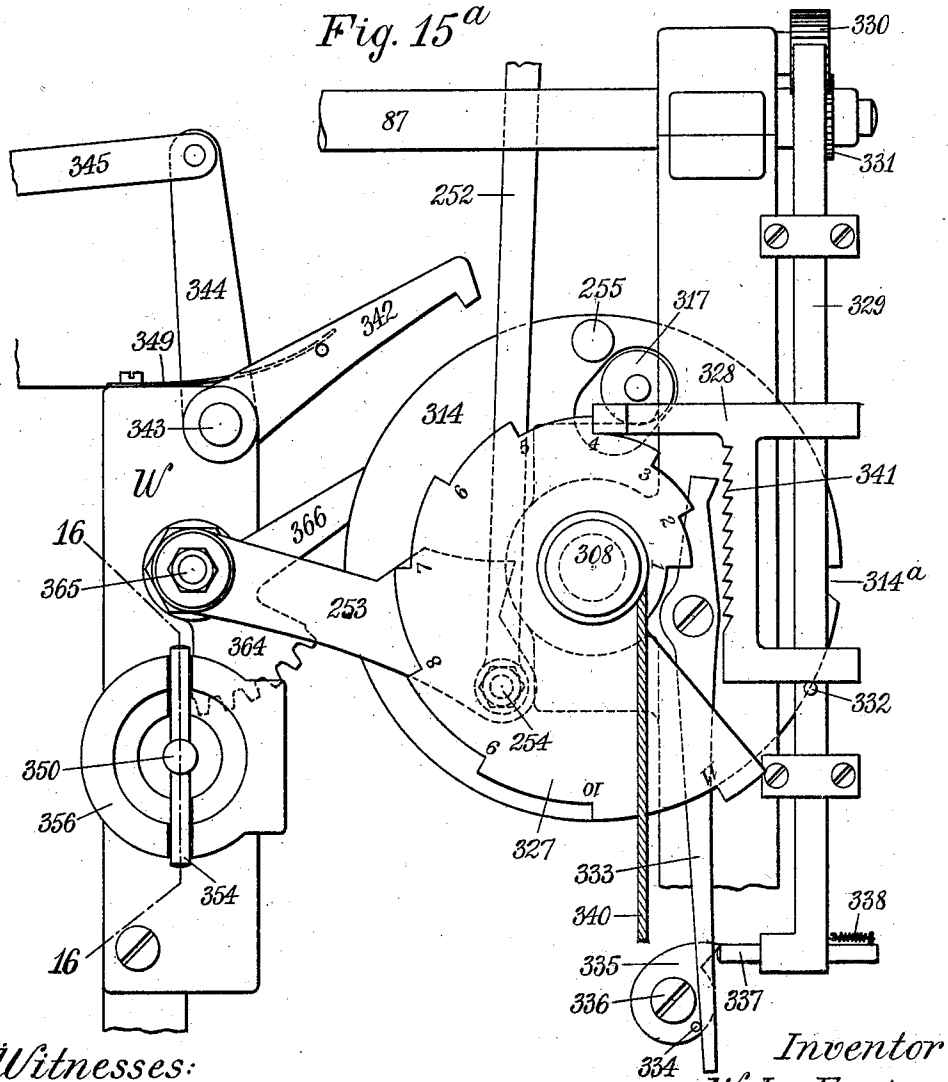
19 SHEETS—SHEET 14.

Fig. 15a



Witnesses:
Jennie Nellis.
H. Mallier

Inventor
W. Jay Ennisson
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19 SHEETS—SHEET 15.

Fig. 18

A	= .024
B	= .030
C	= .036
D	= .042
2A	= .048
A + B	= .054
A + C	= .060
A + D	= .066
3A	= .072
2A + B	= .078
2A + C	= .084
2A + D	= .090
4A	= .096

Fig. 17

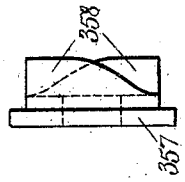


Fig. 20

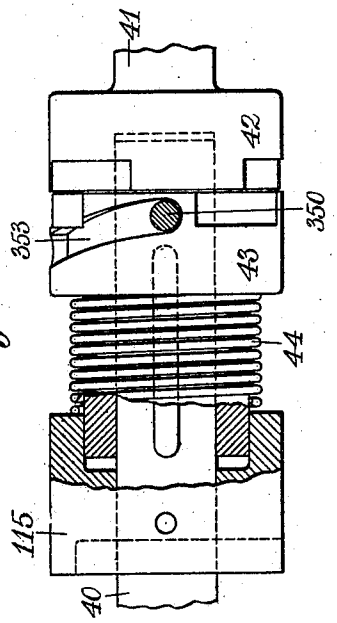


Fig. 16

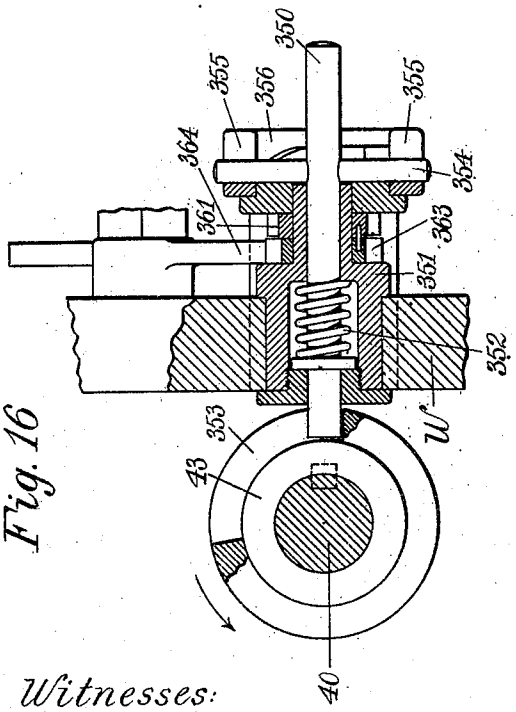
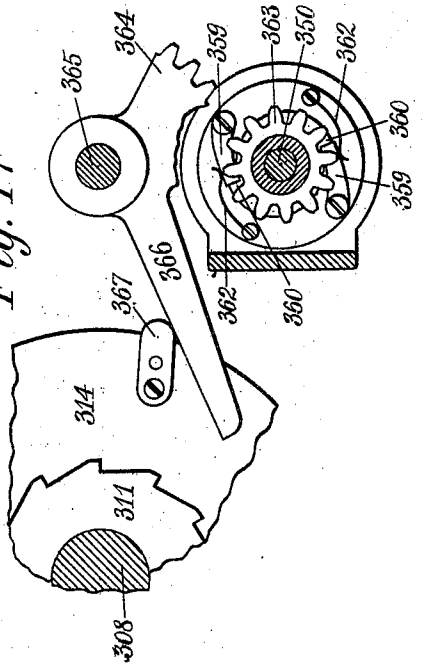


Fig. 19



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By his Attorney
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19 SHEETS—SHEET 16.

Fig. 23

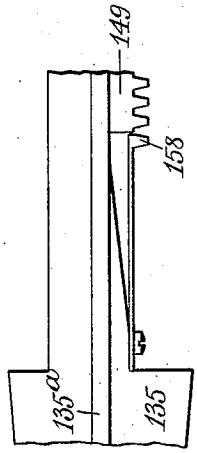


Fig. 22

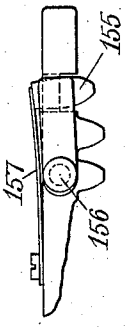
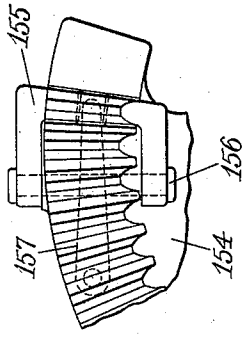


Fig. 21



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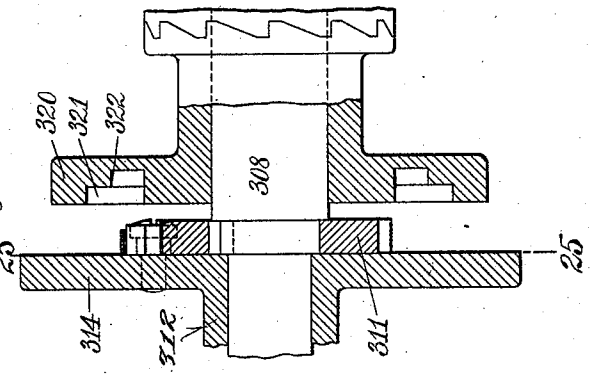

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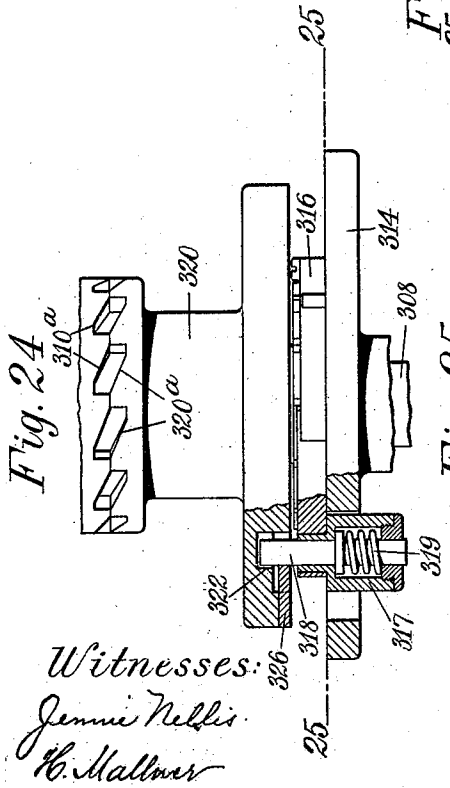
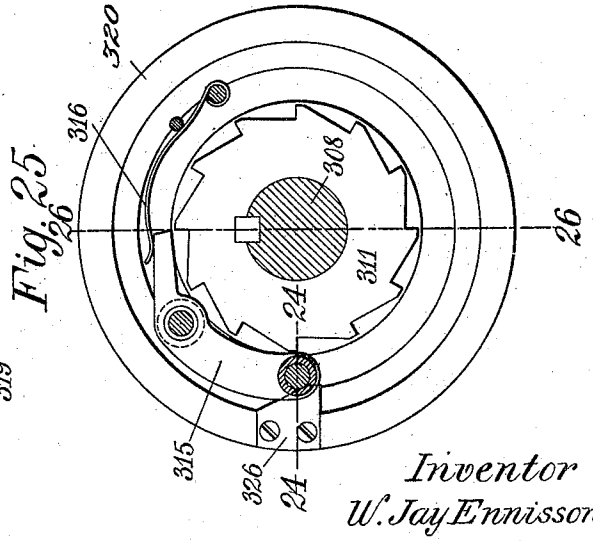


Fig. 25



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19 SHEETS—SHEET 17.

Fig. 29

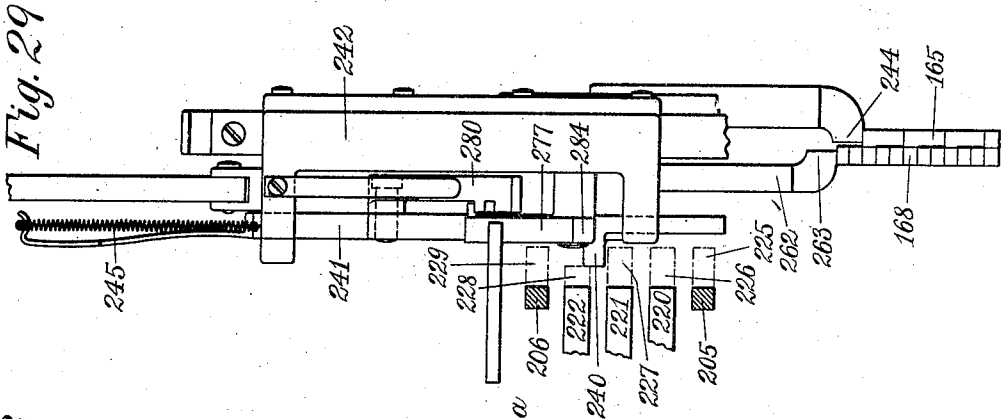


Fig. 28

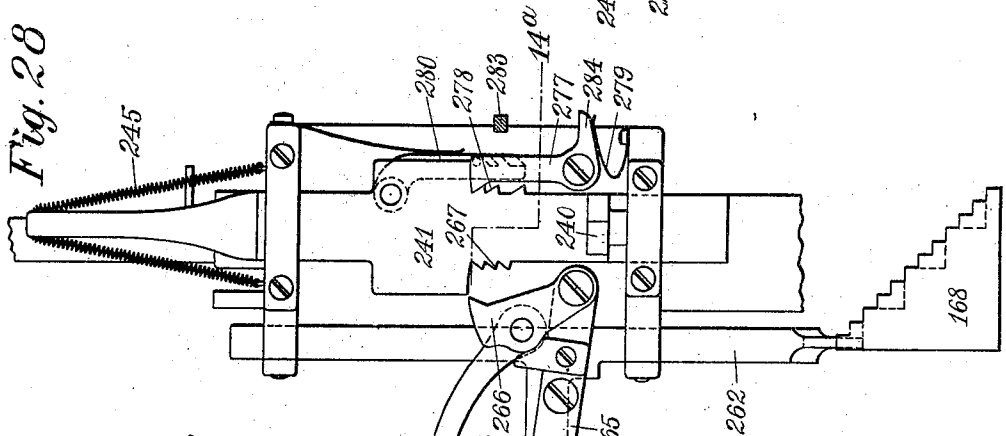
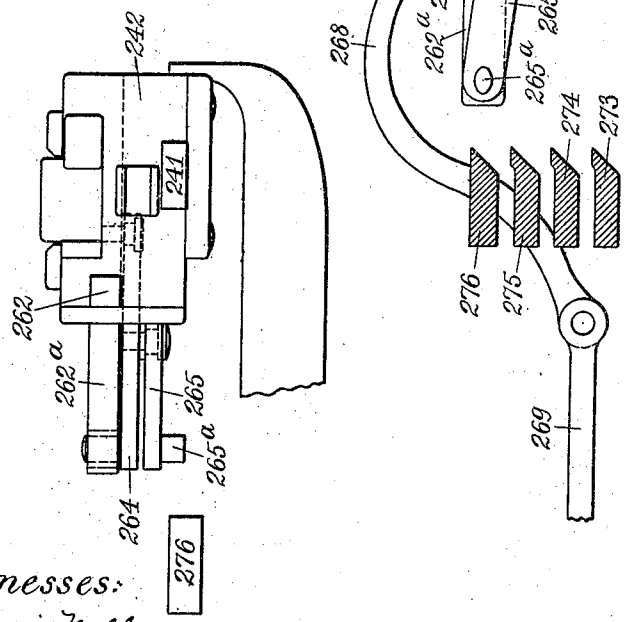


Fig. 27



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Jennie Nellis.
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19 SHEETS—SHEET 18.

Fig. 34

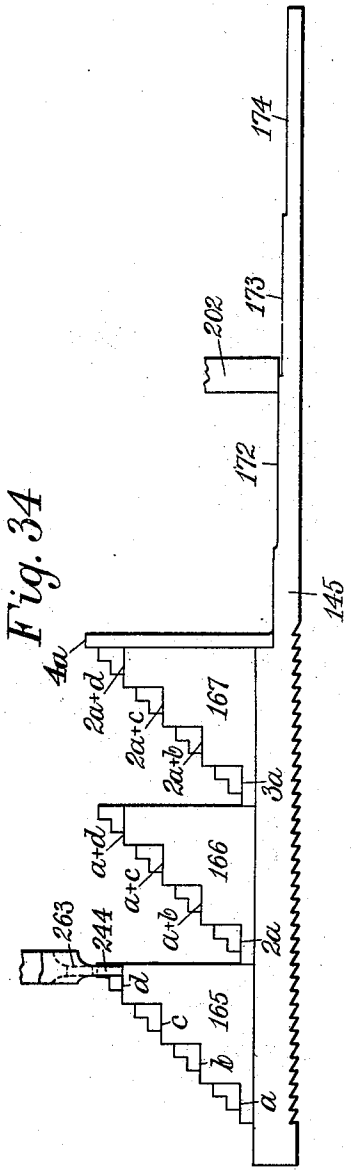
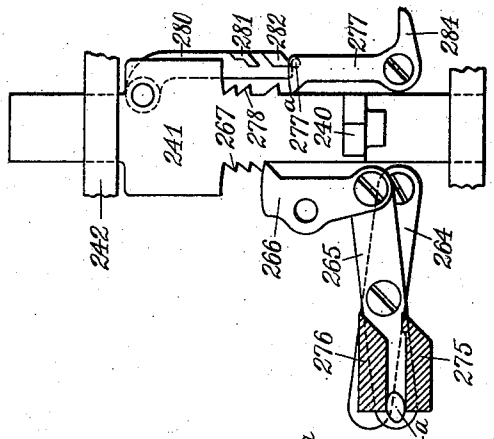


Fig. 32



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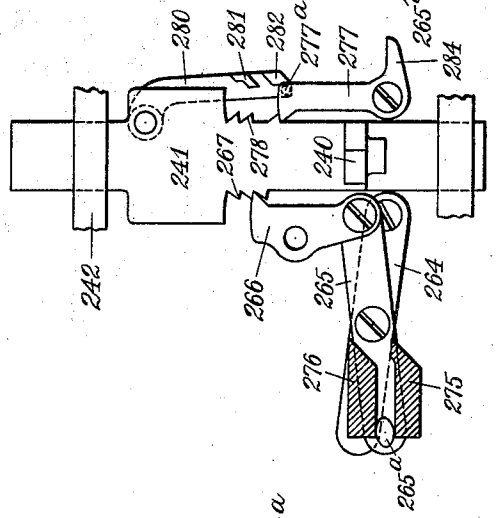
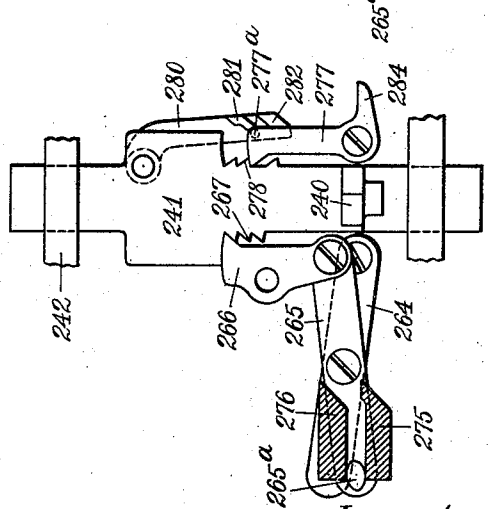


Fig. 30



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H. Mallmr

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W. Jay Ennisson
By his Attorney
W. H. Houss.

No. 844,565. PATENTED FEB. 19, 1907.

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TYPE JUSTIFYING MACHINE.

APPLICATION FILED AUG. 3, 1898.

19 SHEETS—SHEET 19.

Fig. 35

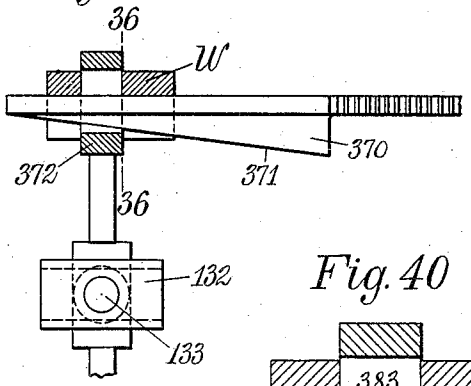


Fig. 36

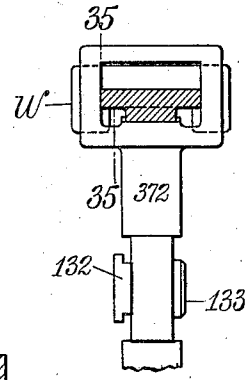


Fig. 40

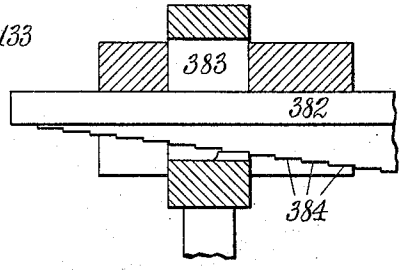


Fig. 37

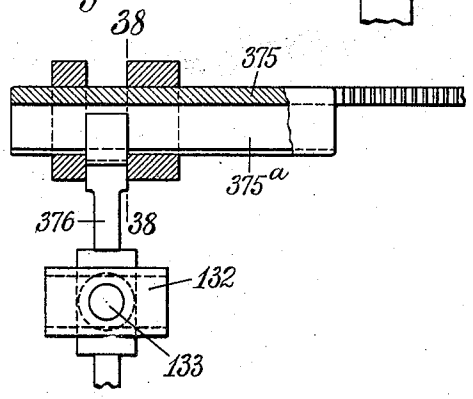


Fig. 38

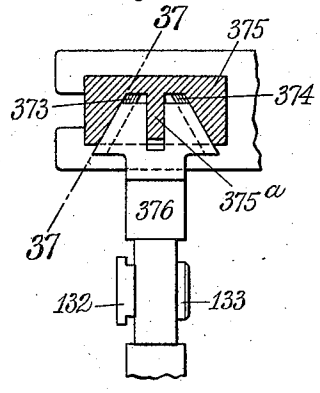
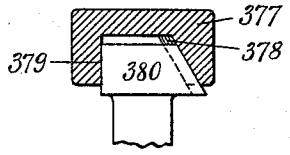


Fig. 39



Witnesses:
Jennie Nellis.
H. Mallner

Inventor
W. Jay. Ennisson
By his Attorney
W. H. Honiss

UNITED STATES PATENT OFFICE.

WALTER JAY ENNISSON, OF HARTFORD, CONNECTICUT, ASSIGNOR TO THORNE TYPE SETTING MACHINE COMPANY, A CORPORATION OF NEW JERSEY.

TYPE-JUSTIFYING MACHINE.

No. 844,565. Specification of Letters Patent. Patented Feb. 19, 1907.

Application filed August 3, 1898. Serial No. 687,639.

To all whom it may concern:

Be it known that I, WALTER JAY ENNISSON, a citizen of the United States of America, and a resident of Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Type-Justifying Machines, of which the following is a specification.

This invention relates to a machine for automatically justifying type or type-matrices into lines of uniform length or "measure" so as to enable them to be locked up in columns of the desired width for use in the ordinary and well-known processes of stereotyping or printing.

In a general way the present machine is similar to the machine shown and described in Patent No. 583,224, of May 25, 1897, granted jointly to myself and William H. Honiss. Many of the fundamental principles of that machine are embodied in the present machine mechanism, some of which is improved in form and arrangement, so as to better adapt it to its work. Some of the present devices, analogous to those of the machine of the patent above referred to, are improved by rearrangement, so as to combine them to better advantage or to secure greater simplicity or directness of action. Still other portions of the machine herein shown are entirely new devices, some of which are substituted for devices which in the machine of the patent above referred to performed the same or similar functions, while others of those new devices are adapted to perform functions not contemplated at all in the machine of the patent above referred to. Other features which in substantially equivalent forms are common to both machines are of my sole invention. Among these are the measuring-beam or justifying-lever for operating upon a composed line to ascertain its shortage and provided with means for pivotally supporting the beam at different fulcrum-points in accordance with the number of spaces in the line whereby the aforesaid shortage is divided into that number of spaces, also the devices which engage with the composed line for measuring and ascertaining the shortage thereof, consisting of a jaw or abutment movable transversely to the type-channel and arranged to be temporarily interposed in the path of the type and with a sliding head movable in the direction of the channel and adapted to compact the type against the set jaw or abutment, also the system of basic and fractional spaces to form justifying combinations.

The objects of this invention are in general to provide improved devices for use in justifying mechanisms and to embody these devices in an efficient and rapid type-justifying machine and, as compared with the machine of the above-mentioned patent, to provide a more perfectly-organized machine in which the devices and their respective functions shall be so combined and correlated as to reduce the number of operating parts, simplify their construction and mode of operation, reduce to a minimum the loss of time between the operations on successive lines, and to so organize and combine devices having similar or closely-related functions as to enable them to be operated and controlled on a direct and comprehensive plan.

Among the more specific objects of the invention may be mentioned the following: first, to hold each succeeding line in a waiting position close to the measuring zone, so as to follow its predecessor with the least possible loss of time; second, to so arrange the devices, and particularly those of them which perform the initiatory functions of measuring, gaging, and setting, as to permit them after operating upon a given line to be released therefrom for operation upon the succeeding line instead of requiring them to remain idle throughout the completion of each current line; third, to provide a simplified and improved setting-gage, stop, and selector-setting device, comprising in the present instance only three elements, two of which may be integrally united under certain designated conditions; fourth, to employ a constantly-running word mechanism with means for stopping the operation of the spacer-selecting devices at the necessary intervals between the lines.

Numerous other and minor objects are hereinafter more fully disclosed in connection with the description of the devices whereby they are attained.

This machine, like that of the above-mentioned patent, is primarily intended for use

as an auxiliary to a type-setting or composing machine, receiving the type therefrom, either divided into lines approximating the desired length or in a continuous line. In the latter case this machine may, and should, be provided with separating devices similar to those shown and described in the above-named patent for detaching from the advancing line a length of type approximating the width of the desired column, operating in conjunction with special line-separators which have been previously inserted at predetermined spaces between the lines by the composing-machine operator. The line of type is by means of a line-grab carried upward through the type-channel against the appropriate stop of a stepped measuring-jaw, which serves to eliminate from the subsequent measurement the aggregate thickness of the several separators in the line. The net measurement of the line is taken by means of a measuring-beam having a movable pivot which has been previously set to a fulcrum position suitably related to the number of spaces in the line to be measured. The measuring end of the beam moves an extent equal to the "shortage" of the line, which is the amount required to extend the line to its desired length or measure. The corresponding movement of the opposite end of the measuring-beam, thus diminished in a ratio directly proportionate to the number of spaces in the line to be justified, operates through the medium of a peculiarly constructed and arranged stop and setting gage to set the devices which select from conveniently-adjacent channels the proper spacer or combination of spacers, which when inserted in each of the spaces between the words of the line will space it out to the required length. The words which compose the line just measured are then lifted one at a time by means of the word-elevating mechanism, engaging successively with each of their underlying and projecting separators up to the injecting zone, in which the justifying-spacers are inserted, the corresponding temporary separator being pushed out of the line at the same time. Provision is also made, as in the patent above referred to, for "correcting" or varying the selection of spacers or combinations of spacers, because of the fact that few lines can be exactly spaced out to the measure by the unvaried repetition of any possible combination of fixed sizes of spacers.

Figures 1, 2, and 3 of the drawings, taken together, form a front elevation of the preferred embodiment of my present invention, Fig. 1 comprising the lower right-hand portion, Fig. 2 the portion lying immediately above what is shown in Fig. 1, and Fig. 3 the portion of the machine immediately adjoining the left-hand side of what is shown in Fig. 1. Fig. 4 is an end elevation looking at the right-hand end of what is shown in Figs. 1 and 2, and Fig. 5 is an end elevation looking from the opposite or left-hand ends of Figs. 2 and 3. Figs. 6 and 7, taken together, form a plan view of the machine, Fig. 6 being a plan of what is shown in Figs. 1 and 2, while Fig. 7 is a plan of what is shown in Fig. 3. Fig. 8 is an elevation in section taken on the line 8 8 of Figs. 1 and 6, showing the type-channel and the parts appurtenant thereto. Fig. 9 is a front view showing in detail the construction and arrangement of my measuring apparatus and the devices coöperating therewith for setting the spacer-selecting devices. In this figure the measuring-beam is shown in its normal horizontal resting position. Fig. 9^a is a front view of some of the devices of Fig. 9, showing the measuring-beam at the inclination to which it would be moved in measuring the line shown in Fig. 9. Figs. 9^b and 9^c are end views of the selector-setting gage and its stop in two different positions, Fig. 9^b being a projection from Fig. 9^a, showing the parts in the position occupied in that figure, while Fig. 9^c represents an end view of the same parts in the position occupied by them in Fig. 9. The succeeding figures of the drawings, excepting Fig. 40, are made to a scale substantially twice that of the preceding figures. Figs. 10 and 11, taken together, form a front view of the type-channel, showing in connection therewith the pawls of the elevating, measuring, and word-grab mechanisms, Fig. 10 being an elevation of the lower portion, and Fig. 11 an elevation of the upper portion, of the channel. Fig. 11^a is a left-hand end elevation projected from Fig. 11. Fig. 12 is an underneath view in section taken on the line 12 12 of Fig. 10, showing the devices for releasing the line-carrier from its grab when the former reaches the position shown in the latter figure after having carried the previously-measured line out of the measuring zone. Fig. 13 is a partial plan view of the spacer ejecting and assembling mechanism, showing the parts in the position occupied by them when the carriage and its attached parts are approximately at the right-hand end of their respective reciprocating movement. Fig. 14 is a front elevation projected from Fig. 13, showing the parts in a corresponding position. Fig. 14^a is a complete plan view of the spacer ejecting and assembling mechanism, showing the parts in the position occupied by them when the carriage is at the left-hand end of its stroke. Fig. 15 is a plan view in section taken on the line 15 15 of Fig. 1, showing the governing devices. Fig. 15^a is a front elevation projected from Fig. 15. Fig. 16 is a left-hand end elevation in section, taken substantially on the line 16 16 of Fig. 15^a, showing in detail the construction of the devices for releasing the line-shaft clutch. Fig. 17 is a view showing in detail the clutch-releasing cam.

Fig. 18 is a table representing the system of spacer combinations, the first vertical column thereof being a graphic representation of the progressive combinations of type, the second vertical column being descriptive of those combinations in terms of the four sizes of spacers employed, which sizes are designated by the letters A, B, C, and D, respectively, while the third column expresses the comparative value of each spacer combination in units of the type measurement. Fig. 19 is a rear view in section, taken on the line 19 19 of Fig. 15, showing the devices for imparting intermittent partial rotation to the line-clutch-releasing cam. Fig. 20 is a front view, partly in section, showing a portion of the line-shaft with its shiftable clutch and the coengaging clutch of the driving-shaft. Figs. 21 to 26, inclusive, are views showing the details of various portions of the mechanism. Fig. 21 is a side view, and Fig. 22 an edge view, of a portion of the mutilated sector-gear employed for returning the setting-gage to its first position. Fig. 23 is a plan view of a portion of the setting-gage, showing a yielding end tooth of the rack thereof. Fig. 24 is an edge view in section taken on the line 24 24 of Fig. 25, showing the construction of the driving-pawl for the controller. Fig. 25 is a side view in section taken on the line 25 25 of Fig 15 of the controller ratchet-wheel, driving-pawl, and the releasing-cam therefor. Fig. 26 is an end view in section taken on the line 26 26 of Fig. 15. Fig. 27 is a plan view, and Fig. 28 is a rear elevation, of my improved correcting devices. Fig. 29 is a left-hand end view projected from Fig. 28. Figs. 30, 31, and 32 are rear elevations of my improved correcting devices, representing three different phases of its operation. Fig. 33 is an end view in section taken transversely through the adjusting-quills at the projection 84 of the fulcrum-block 80. Fig. 34 is a front elevation, drawn to full-size scale, of the selector-setting slide. Fig. 35 is a side view in section taken on the line 35 35 of Fig. 36, showing the simplest, though not preferred, form of the setting-gage and stop. Fig. 36 is an end view, partly in section, taken on the line 36 36 of Fig. 35. Fig. 37 is a side view in section taken on the line 37 37 of Fig. 38, showing a modified arrangement of my improved setting-gage and stop, in which the latter is fitted between inclined wings of the gage. Fig. 38 is an end view in section taken on the line 38 38 of Fig. 37. Fig. 39 is an end view showing another modification of my improved setting-gage and stop, the former being provided with wings for engaging on opposite sides of the stop, only one of the wings being inclined to the direction of movement of the gage, the other being parallel therewith. Fig. 40 is a side view, in enlarged scale, of a setting-gage similar to that of Fig. 35, having its gaging-surface disposed in an inclined series of steps, the longitudinal pitch of which is substantially equal to that of the steps of the selector-correcting racks 168, 169, and 170.

In order to show the operative parts of the machine as plainly as possible, I have herein shown only that portion of the framing W which is most intimately connected therewith, it being understood that that framework is intended to be supported on or incorporated with the frame of the type-composing machine with which it is to be employed.

For greater convenience in describing the different parts of this machine it will, as in the case of the patent above referred to, be herein considered as being somewhat arbitrarily divided into three principal groups of mechanism, designated as the "line mechanism," the "word mechanism," and the "governing mechanism." By the term "line mechanism" it is intended to designate those parts which are principally concerned in the manipulation of the lines as such, most of those parts performing their complete function once for each line justified. The term "word mechanism" is herein employed to designate the parts principally concerned in the manipulation of the succeeding words in the lines. Most, if not all, of these parts perform their complete function or cycle of movement once for each space between the words contained in the lines justified. The term "governing mechanism" is herein used to designate the devices located at the lower right-hand portion of the machine as viewed in Fig. 1, which upon being set to correspond with the number of spaces in the given lines serves to cause the devices of the word mechanism to repeat their operation once for each one of these spaces and serves also when each line nears its completion to start the line mechanism into operation upon the succeeding line.

The two groups of mechanism herein designated as the "line" and the "word" mechanisms are herein considered as being subdivided into sections or combinations of mechanism with reference to the particular function or functions performed by each. These subdivisions are herein designated as far as possible by names which are indicative or suggestive of their respective functions, and they will be described as nearly as possible in their natural and logical sequence.

The general division, herein designated as the "line mechanism," is assumed to be divided into the following sections or subdivisions: line-elevating mechanism, fulcrum-setting mechanism, stepped jaw-setting mechanism, measuring mechanism, selector-setting mechanism.

The principal division of the machine, which is herein included under the general designation of "word mechanism," is subdivided into the following sections: word-

grab mechanism, spacer-selecting mechanism, spacer assembling and injecting mechanism, selector-correcting mechanism.

The parts comprised in the general division called the "line mechanism" are nearly all connected with and receive their motion from the line-shaft 40, which extends horizontally through the machine, being mounted in suitable bearings in brackets attached to the frame W. At the right-hand end of the line-shaft and in line therewith is located the driving-shaft 41, which has fixed upon its left-hand end adjacent to the line-shaft the clutch 42, the line-shaft 40 being provided with a coengaging clutch 43, which is splined to the line-shaft so as to slide longitudinally thereon to an extent sufficient to enable it to be moved into and out of engagement with the driving-clutch 42. The line-shaft clutch 43 is normally held toward its right hand or engaging position (shown in Fig. 20) by means of the spring 44, the clutch being withdrawn therefrom against the pressure of the spring by means of the governing mechanism, as will be hereinafter described.

Motion is communicated to the word mechanism of this machine by means of the vertical word-shaft 45, which is journaled in suitable bearings of the frame W, and has at its upper end the crank 46, which drives the word mechanism. That shaft has also upon its lower end the worm or spiral gear 47, by means of which motion is communicated to the governing mechanism. The word-shaft has also fixed upon it the bevel-gear 48, which meshes with the bevel-gear 49, fixed on the driving-shaft 41. The relative size of these gears is herein shown to be substantially one to three, so that the word-shaft makes three revolutions to one of the driving-shaft, and consequently of the line-shaft when the latter is clutched thereto; but this ratio of the gearing may obviously be changed to suit the conditions peculiar to or desirable for each particular machine.

In employing this machine as an auxiliary to a type-composing machine it may be connected with the driving-shafts of the latter by means of a belt upon the grooved pulley 50 of the word-shaft, or the driving-shaft 41 may be extended toward the right from the position shown in Fig. 1 and be provided with any suitable driving-gear.

The type-channel 51, formed by and between the plates 52 and 53, is in a vertical position, its lower end (shown in Fig. 1) leading from the type-channel of the composing-machine, from which a line of type of approximately the desired length is separated by means which form no part of the present invention, but which may be similar to that described in the previous patent above referred to. The separations between the words in the lines are preserved by means of separators U, having ends projecting beyond the type and beyond the edges of the type-channel 51 far enough to be engaged by the word-grab devices, hereinafter described. These separators are cylindrical in form and are of a diamater substantially equaling the thickness of the type with which they are employed, so as to substantially fill the width of the type-channel. These cylindrical separators have the distinct advantages over spacers of rectangular section in that they are simple and inexpensive to manufacture, as they can be made accurately to size from drawn or rolled wire of proper gage by merely cutting the wire to the required lengths, and they also possess certain advantages in use, among which may be mentioned the readiness with which they are circulated in the machine, the lessened liability of wear to their own surfaces and to the channels of the machine and of becoming bent or twisted, also in the fact that they support the adjacent type centrally of their widths, even if slightly bent, thereby permitting the type to aline themselves with the channels even when considerable dirt is present, thereby improving the accuracy of measurement of the composed line.

In the machine of the previous patent above referred to two different lengths of separators were employed—one to preserve the separations between words and the other to preserve the separation between the lines, the ends of the latter separators projecting beyond the ends of the word-separators far enough to enable them to be engaged by the line-grab devices, and these differing lengths of separators may also be used in connection with the present machine if the means adopted for separating the independent lines from a continuous line render their employment necessary or desirable.

Near the lower end of the type-channel is located the pawl 54, which is pivotally mounted at the side of the channel with its end projecting across that channel, and each line of type delivered from the composing-machine is pushed up in the channel far enough so that its underlying separator rests upon the pawl 54, from whence it is taken by the line-elevating mechanism. A similar pawl 55 is located just above the measuring zone of the type-channel, upon the top of which the line of type after being measured is raised by the elevating-pawl 62.

Line-elevating mechanism.—This is best shown in Figs. 1, 4, 8, 10, 11, and 12, and consists of two principal portions carried by the upper slide 58 and by the lower slide 59, respectively. These slides are fitted easily between the vertical ways 60 and 61. The upper elevator is provided with one or more pawls 62, pivotally mounted thereon and provided with the spring 63, which serves to hold the upper end of the pawl across the type-channel. The lower slide 59 has pivot-

ally mounted upon it the pawl 64, which by means of the spring 65 is also normally held in the plane of the type-channel, the channel-plate 52 being suitably slotted to allow of the necessary amount of travel of the respective elevating-pawls. The two elevating-slides are connected by means of the rod 66, which, as herein shown, is fixed in the upper slide 58 and extends loosely through the hole in the lower slide 59, resting normally upon a latch 67, which is pivotally mounted upon that slide and is normally held by means of the spring 68 beneath the rod 66, as best shown in Fig. 12. The lower slide 59 while at rest occupies the waiting position shown in Fig. 10, with its pawl 64 supporting a line of type *t* in readiness to be carried past the measuring-pawl 130 into the measuring zone at the commencement of the succeeding operation of the elevating mechanism. When the lower slide is brought to this position, the pawl 62 of the upper slide extends to and slightly past the upper surface of the type-channel pawl 55, and upon reaching this position the latch 67 is withdrawn from beneath the rod 66 by riding over the cam 69 (best shown in Fig. 1) and the upper slide 58 is allowed to fall from the position shown in full line in Fig. 10 to the position shown in dot-and-dash lines in the same figure, in which latter position it is supported upon the projection 70, where it rests until again lifted by the succeeding movement of the slide 59, which when at its lowest position (shown in Fig. 1) allows the latch 67 to pass again beneath the rod 66.

The respective movements of the elevating-slides 58 and 59 are imparted from a crank on the line-shaft 40, which in this embodiment is a built-up crank consisting of the arms 72 and 73, connected by the pin 74, which engages in a radial slot in the elevating-lever 75, pivotally mounted upon the stud 76, fixed in the framing W, the forward end of the lever being connected, by means of the link 77, with the lower slide 59. The extent of movement of these parts is best represented in Fig. 8, in which the lever 75 is shown by dotted lines at its extreme positions, being represented in its intermediate or resting positions by full lines, coinciding with the position shown in Fig. 10.

At the beginning of each intermittent rotation of the line-shaft upon being engaged by the clutch 42 the lever 75 is carried from the full-line position (shown in Fig. 8) to its upper dot-and-dash position of the same figure, thereby carrying the line of type by means of the elevating-pawl 64 from the position in which it is shown in Fig. 10 into the measuring zone, leaving it upon the measuring-pawl 130. During this upward movement of the slide 59 the slide 58 rests in its lower or dot-and-dash position of Fig. 10, having, as above described, been disengaged from the latch 67 at the conclusion of its previous movement. The continued rotation of the crank 71 carries the lever 75 and its connected lower slide 59 to its lowest position, (shown in Fig. 1,) at which it picks up the succeeding line from the lower channel-pawl 54. At the same time the latch 67 engages again beneath the rod 66, so that both of the slides 58 and 59 are carried to their full-line position, (shown in Fig. 10,) at which point the latch 67 is by means of its cam withdrawn from beneath the rod 66, allowing the slide 58 to drop to its dot-and-dash position, the slides resting in these positions until the succeeding rotation of the line-shaft.

The fulcrum-setting mechanism.—The movable fulcrum 80 for the measuring mechanism is a block fitted to slide upon the ways 81 82, attached to or integral with the framework W. This block is provided with a pin upon which the measuring-beam is pivotally mounted, and the range of longitudinal movement of the block 80 upon its ways is sufficient to enable it to be pushed to any position required for the proper increase or reduction of the movement of the measuring-pawl, according to the number of spaces in the line to be measured, the position occupied by the fulcrum during the measurement of a given line depending upon the number of spaces in that line. The present machine is represented in the drawings as being capable of justifying lines having from two to ten spaces, it being obvious, however, that the principle employed is capable of extension to any desired degree. Therefore the fulcrum of this machine may require to be moved to any one of nine positions, being moved sometimes one, sometimes eight or nine spaces or intervals to the right or to the left, as the case may be, from its previous position.

A lug 84 (best shown in Fig. 33) extends from the fulcrum-block 80 into the path of movement of the adjusting-quills 85 86, splined upon the universal setting-shaft 87. The construction and mode of operation of the fulcrum-block-engaging portion of these quills is substantially like that of the Patent No. 583,224, above referred to, and is best shown in Figs. 14, 15, 32, and 33 of said patent, with the exception that the stepped openings between the quills are herein shown to be rectangular to conform to the shape of the rectangular lug 84. The quills of the present machine are, however, moved lengthwise by means of independent cams 88 and 89 through the medium of the arms 90 and the links 91, instead of being connected by gearing and operated by a single cam, as in the aforesaid patent.

The shaft 87 extends nearly the full length of the machine, being journaled upon portions of the framing W at suitable intervals in its length. At its extreme left-hand end it is provided, as shown in Figs. 3, 5, and 7, with a pinion 100, meshing with a vertical rack

101, fitted to slide upon the rod 104, being drawn downwardly by means of the spring 102. At a point adjacent to the type-channel the shaft has fixed upon or integral with it the enlarged collar 92, provided with index-pins 93. These pins are arranged spirally upon the collar, coinciding in circumferential position with the fulcrum-engaging steps of the quills and being spaced longitudinally of the collar at a distance apart substantially equal to the diameter of one of the pins. These pins engage with a stop 94, which is fitted to slide longitudinally in a bracket 95, a portion of the stop being provided with rack-teeth engaging with the pinion 96 on the shaft 97. That shaft is journaled in suitable bearings in the type-channel plates and extends transversely to and at one side of the type-channel. As best shown in Fig. 8, the shaft 97 is provided with ratchet-wheels 98 and 99, the teeth of which extend across the ends of the type-channel, so as to engage with the ends of the separators, as best shown in Fig. 10, and these ratchet-wheels are rotated a single step by each separator in the line of type as the latter is carried up into the measuring zone by the line-elevating mechanism. This step-by-step rotation of the shaft 97 moves the stop 94 from its normal resting position beneath the right-hand index-pin toward the left as viewed in Fig. 1, thereby bringing the stop beneath that pin which corresponds to the number of separators that have been carried past the ratchet-wheels 98 and 99. As the stop is moved from beneath each successive pin the shaft 87, with its adjusting-quills, is rotated by the force of the spring 102, thereby bringing the next index-pin down upon the stop, each pin serving also as it drops past the right-hand end of the stop to prevent the return movement of the stop toward the right under the influence of its weight 103. Therefore when a line having a given number of spaces has been carried by the elevating mechanism into the measuring zone the shaft 87, with its quills, will stand in a position so related to the number of those spaces as to carry the fulcrum of the measuring-beam to its proper relative position for that number of spaces.

During the time that the quills are being set to their suitable position by rotation, as just described, the two quills are drawn fully apart longitudinally, so as to permit of their rotation without interfering with the lug 84 of the fulcrum-block. At the conclusion of the rotative movement of the shaft 87 and its quills the latter are moved longitudinally together by means of their cams 88 and 89, thereby bringing them to the position shown in Fig. 1 and moving the fulcrum-block to its proper longitudinal position relative to the measuring-beam and to the number of spaces in the line to be measured. In Figs. 1 to 9, inclusive, the parts are shown in the position occupied by them when operating upon a line having six spaces. The quills remain in this position, holding the fulcrum in its proper place while the measuring movement of the beam takes place, when they are again separated longitudinally to allow the suceeeding setting of the quills. At the conclusion of each measuring operation the quills are rotated back to the first position by means of the rod 104, lever 105, and arm 106, fixed on the line-shaft 40. The arm 105 is provided with a lug 107, which projects into the plane of movement of the arm 106, by means of which it is lifted to the dot-and-dash position in Fig. 5, at which position, on account of the location of the pivot of the lever 105 with relation to the axis of the shaft 40, it is released therefrom and falls again to the position represented in full lines. The rod 104 is provided with a pin 108, which upon its forward movement engages with the rack 101, thereby rotating the shaft 87, its quills, and index-pins back to their first position ready to be set by the succeeding line. This movement of the shaft also enables the stop 94 to escape to the right past the index-pins, being actuated by its weight 103.

Stepped-jaw-setting mechanism.—This is clearly shown in Figs. 2 and 4. The stepped jaw 110, like that of the patent above referred to, is generally rectangular in form, excepting as to its front or left-hand edge, which is formed in steps each of a height corresponding to the thickness of the special separators employed in the line of type. This jaw is fitted to slide horizontally in suitable guides in the framing W toward and across the main type-channel 51 and substantially central thereof, the type-channel plates being slotted, so as to allow the jaw to pass transversely across the side of the type. The jaw is provided with the projection 111, which engages with the spiral cam 112 on the shaft 87, the contour of the cam being such as to move the stepped jaw toward the right a distance equaling the width of one of its own steps at each intermittent rotative actuation of the shaft. The right-hand end of the jaw is also connected, by means of the link 113 and cam-arm 114, with the cam 115 on the line-shaft 40. The spring 116, attached between the arm 114 and a fixed portion of the framing, serves to hold the cam-arm into engagement with the cam 115 and also presses the sliding stepped jaw toward the left against the cam 112. Thus it will be seen that the cam 112, controlled by the separators in the line to be measured, serves to bring into coincidence with the type-channel that one of the steps which is designed to measure that line or any line having the same number of spaces. The cam 115 serves at the conclusion of the measuring operation

to entirely withdraw the stepped jaw from the type-channel, so as to permit the line of type to be carried out of the zone by the pawl 62.

The measuring mechanism.—This is best shown in detail in Figs. 9 and 9ª. The measuring-beam 120 is provided with a longitudidal slideway in which is fitted the pivot-block 121, the latter being pivotally mounted upon the stud upon the fulcrum-pin 83. The measuring-beam normally rests between its measuring operations in the horizontal position, (shown in Fig. 9,) being thereby parallel with the ways 81 and 82, so as to permit the fulcrum and the pivot-block to be readily moved by the fulcrum-setting mechanism to a suitable position for measuring the succeeding line. The right-hand end of the measuring-beam is connected by the pivot-pin 122 to the vertical slide 123. That slide is fitted at its ends in a portion of the framing W, so as to allow of the required vertical movement necessary for measuring the lines, and the lower end of this slide is connected, by means of the link 124, with the cam-lever 125, pivoted at 126 to a fixed portion of the framing. The lever 125 is held into contact with the cam 127 on the line-shaft 40 by means of the spring 128, Fig. 1, the strength and tension of which is sufficiently great to perform the measuring operation, the function of the cam 127 being to return the measuring-beam to the horizontal position of Fig. 9 at the conclusion of the measuring operation.

The measuring-pawl 130 is pivotally mounted upon the slide 123 and extends across the type-channel substantially at its center, being yieldingly held in this position by means of the spring 131, so as to allow the succeeding lines of type to be carried past the pawl by the line-elevating mechanism.

It will be observed that the measuring-beam 120, being pivotally connected to the slide 123, must during its upward or measuring movement be drawn toward the right with relation to the pivotal blocks 121 and 132. This movement, like that of the corresponding measuring-beam of the patent above referred to, maintains a constant relation between the respective movements of the slide 123 and the setting-gage stop 134, to be hereinafter described, that constant relation being due to the fact that the slide 123 and the stop 134 move in planes parallel to each other and at similar angles to the plane of movement of the fulcrum, from which it follows that the movement of the slide 123 communicated to the measuring-beam and the movement transmitted by the measuring-beam to the setting-gage stop 134 sustain to each other the relation or ratio of similar sides of similar triangles.

Selector-setting mechanism.—This consists of three principal parts—a stop, operatively connected with the measuring mechanism; a setting-gage, which, by means of a weight or a spring, is brought into contact with the stop at the conclusion of the measuring operation, and a selector-setting slide, which is carried by the movement of the setting-gage into suitable relation to the spacer-selecting mechanism.

The setting-gage stop 134 is fitted to slide vertically in a portion of the framing W to the extent required by the maximum movement of the left-hand end of the measuring-beam, with which it is connected by means of the pivot-pin 133 on the slide-block 132, the latter being fitted in the longitudinal slideway at the left-hand end of the measuring-beam. The construction and mode of operation of this stop is best represented in Figs. 9, 9ª, and 9ᶜ. The upper end of the setting-gage stop 134 is provided with a peculiarly-shaped triangular opening 138, the inclined sides of which operate in conjunction with the correspondingly-inclined sides of the spear-shaped end of the setting-gage 135. This spear-pointed end is tapering in plan view, (shown in Fig. 7,) and its opposite sides 136 and 137 are inclined, as shown in Figs. 9ᵇ and 9ᶜ. The corresponding sides of the triangular openings 138 in the setting-gage stop are similarly inclined, so as to fit against the sides 136 and 137 at whatever position they may come in contact within their respective ranges of movement. In this embodiment of my invention the resultant ratio of movement of the setting-gage with relation to its stop, arising from this composition of the angles of their engaging surfaces, is substantially eight to one—that is to say, the lowering of the stop 134 to the extent of the eighth of an inch allows the setting-gage to move toward the left one inch. This particular ratio is, however, not essential, as any other ratio may be chosen which best suits the desired construction or permissible range of movement of the respective parts. It will be seen that this one-to-eight ratio of the vertical movement of the stop to the horizontal movement of its setting-gage is the same as though their coengaging surfaces were disposed in what may be termed a simple inclination to the direction of movement, as shown in Figs. 35 and 36, at an angle having the tangent 0.125; but by disposing those gaging surfaces in planes, each of which have the described compound inclination to the two directions of movement and which are oppositely and symmetrically disposed with relation to a plane passing through its longitudinal center, the utility of the device, considered with reference to the accuracy of its operation, is doubled, inasmuch as the variations of its successive stoppings or settings are diminished by one-half. In other words, the compound inclination of either one of the gaging sides of the setting-gage secures the

desired ratio of movement, while the doubling of the angle by adding a mated counterpart on the other side of its center line or plane of symmetry correspondingly diminishes or blunts the acuteness of the angle of contact between the setting-gage and its stop, thereby lessening to a corresponding degree the possible variation in the setting operations thereof.

The aforesaid ratio of one to eight may be varied to any desired extent by altering the angle of inclination of the coengaging surfaces of the stop and the setting-gage or by suitably altering the location of the fulcrum-points by correspondingly locating the stops of the adjusting-quills 85 86. It is found desirable in the machines which operate to select ready-made justifying-spacers to multiply the movement of the indicating and selecting end of the measuring-beam, so as to afford convenient working distances and dimensions for the selecting devices. The scope or capacity of this measuring-beam or justifying-lever is not, however, limited to the indication of the divided shortage of the line in an increased ratio. The beam may be employed for setting the gage, for cutting justifying-spaces of the required sizes from space-timber, or for setting an adjustable mold to cast the justifying-spaces of the sizes required, and in either of these cases it may not be desirable thus to multiply the shortage indication.

The stop-engaging end of the setting-gage is herein shown to be guided in its longitudinal movement by means of splines 135ª, sliding in corresponding splineways in the framing W, the stop 134 being similarly grooved to clear the splines.

During the measuring operation the setting-gage is held at the right-hand end of its movement, as shown in Fig. 9, by means of the detent 139, pivotally mounted upon the framing W, and is provided with a connecting-rod 140, which extends into engaging relation to the cam-strip 141 on the side of the cam 89, which at the conclusion of the measuring operation and while the measuring-beam and the stop 134 are in the position shown in Fig. 9ª lifts the detent out of its notch in the setting-gage, thus allowing the latter to be drawn toward the left by means of the weight 142 to the extent permitted by the position to which the triangular opening 138 of the stop has been set by the measuring movement of the beam. The weight is connected with the setting-gage by means of a cord passing over the pulley 143. This movement of the setting-gage toward the left at the conclusion of the measuring operation is transmitted to the selector-setting slide 145 by means of the adjusting-screw 144, fitted in an upwardly-projecting portion of the setting-gage. The slide 145 is fitted to slide horizontally in the framing W and is normally held toward the right against the buffer 145ª by means of the spring 146, the other end of which is attached to a fixed portion of the framing.

The slide 145 is provided with repeated series of steps of different heights, which constitute the setting-racks for the spacer-selecting and selector-correcting mechanisms. These racks are attached to or integral with the slide 145 and are herein shown to be arranged in three sections longitudinally thereof, the rack-sections for the spacer-selecting mechanism being herein designated by the numerals 165, 166, and 167, which are arranged side by side in pairs, with the corresponding sections 168, 169, and 170, respectively, for the selector-correcting mechanism.

The right-hand end of the slide 145 is provided with the steps 172, 173, and 174, which extend beneath and in engaging relation to the basic table mechanism, as best shown in Fig. 14. The function and mode of operation of these steps and of the selector-setting racks will be hereinafter described in connection with the spacer-selecting mechanism.

The under side of the slide 145 is provided with notches coinciding in pitch and horizontal position with the steps of the setting-rack sections 168 169 170. The detent 147, pivotally mounted upon the framing W, is pressed into engagement with these notches by means of a spring 148. The slide 145 is thus detained in the extreme position to which it is carried toward the left by each movement of the setting-gage, it being desirable to withdraw the latter to its resting position in order to allow also of the immediate return movement of the stop, measuring-beam, and the fulcrum-setting mechanism, so that those mechanisms may be set to the next position by the succeeding line, meanwhile leaving the slide 145, with its several series of steps, in its set relation to the spacer-selecting mechanism while the spacers are being inserted in the previous line. At the completion of that line and upon the succeeding intermittent rotation of the line-shaft 40 the slide 145 is released from its set position by means of the inclined lug 159 upon the side of the cam 88 colliding with the crank-arm 160, the opposite end of which is connected with the detent 147 by means of the link 161. Upon being thus released from its detent the slide is drawn toward the right to its resting position by means of the spring 146.

As a means for withdrawing the setting-gage from the stop to the position shown in Fig. 9 it is provided upon its side with rack-teeth 149, which engage with the pinion 150, and thence with the train of gears 151 to the gear 152 on the vertical shaft 152ª. (Best shown in Fig. 8.) The lower end of this

shaft has fixed upon it the bevel-pinion 153, which meshes with the bevel sector-gear 154, fixed upon the shaft 40, the sector being set in such a position upon that shaft as to engage with the bevel-pinion 153 at a suitable time in the intermittent rotation of the shaft, thereby moving the setting-gage 135 toward the right to the position shown in Fig. 9, where it is held by its detent 139.

In order that the sector-gear 154 shall properly mesh with its bevel without the liability of breaking the first engaging tooth 155, the latter is made in a separate piece, pivotally mounted at 156, being normally held in line with the other teeth by means of the spring 157, as shown in Figs. 21 and 22. If the point of this tooth happens to engage with the point of one of the teeth of the pinion 153, it will yield backwardly against the pressure of the spring 157 until the teeth come into proper mesh, thereby preventing possible breakage. The end of the tooth 158 of the rack 149 is also made to yield in a similar way, being formed on the end of a spring, which is attached to the setting-gage, as shown in Fig. 23.

Having now concluded the description of the parts comprising the line mechanism, a description will be given of those which comprise the word mechanism.

Word-grab mechanism.—This comprises the devices by means of which the words of the line resting upon the pawl 55 are carried therefrom one at a time above the injecting zone 56, leaving each underlying separator in that zone, at which point the separators are removed from the line and the final justifying-spacers substituted therefor.

The word-slide 175 is fitted to slide vertically in its ways in the framing W to an extent sufficient to carry the last and lowest word resting on the pawl 55, upon which the separator rests during ejectment. The slide is provided with the word-pawls 177, located at the opposite edges of the type-channel 51, so as to engage only with the projecting ends of the word-separators U of the line. These pawls are pivotally mounted upon the slide 175 and are yieldingly pressed toward the channel by their respective springs 178. The stop-fingers 179 are also pivotally mounted upon the word-slide, their pivots being preferably concentric with those of the word-pawls. These fingers are also arranged upon opposite edges of the type-channel and are preferably connected together, as by means of the pin 180, so that they operate as one. The separator engaging points of these stop-fingers face downwardly and are located immediately over those of the word-pawls 177, leaving between them a space slightly greater than the thickness of the separators. These fingers are provided near their upper ends with a pin 181, which during the vertical movement of the fingers slide in the slot 182. (Best shown in Fig. 2.) That slot is arranged parallel with the type-channel, excepting at its upper end, where it is inclined toward the right, so as to carry the stop-fingers clear of the separator before the latter reaches the injecting zone in order that the stop-fingers may clear the separator at the beginning of their return movement, after which the stop-finger is again carried by its guiding-slot into the plane of the type-channel, so as to engage with the uppermost word-separator. Upon the next upward movement of the word-slide the pawls 177 engage beneath the separator and carry it to the top of the detent 176. Thus at each succeeding stroke of the word-grab the uppermost word is lifted from the line and carried up to the injecting-plane, the upward movement of the slide being sufficient to carry the type-line above the separator upon the top of the pawls 183, the separator being allowed to fall slightly to its resting-place upon the pawl 176. The supporting-surfaces of the pawls 183 are located above that of the pawl 176 to an extent somewhat greater than that of the greatest required width of spacer combinations, so as to allow the widest combination to be readily inserted beneath the word. The pawl 176 is yieldingly held to its position shown in Fig. 11 by means of the spring 176^a.

The vertical movements of the word-slide are communicated by means of the cranked arm 185, pivotally mounted at 186 to the framing W. The longer end of this arm is provided with a cross-pin, which engages in the elongated slot of the link 187, while the shorter arm of the crank is connected, by means of the rod 188, with the carriage 230. Being thus driven, the cranked arm 185 has an unvarying range of movement; but its connection with the word-slide by means of the slotted link 187 allows the downward movement of the slide to be arrested by each succeeding separator of the line that is being carried up, the slot of the link allowing the cranked arm to make its full stroke.

Before describing the spacer selecting, assembling, injecting, and correcting mechanisms it is deemed advisable to give a brief explanation of the system upon which the spacers are arranged and combined, that system being substantially like that shown in the previous patent, No. 583,224. It is best represented in the table of Fig. 18, of which the first vertical column is a graphic representation of the progressive combinations of type. The second vertical column is descriptive of the respective combinations in terms of the four-lettered sizes of spacers, while the third column expresses the equivalents thereof in thousandths of an inch, it being assumed that the present machine is adapted to the justification of type of the size designated as "seven-point" or "minion." It is,

however, obvious that the system is equally applicable to any other size by a similar subdivision of the em thereof.

The justifying-spacers employed in this system are four in number, herein designated by the letters A, B, C, and D. As shown by the table, the setwise thickness of the smallest spacer A is assumed to be equal to one-fourth of the em of type which is being justified, which in the present case would be equal to twenty-four one-thousandths of an inch. The difference in size between these spacers is uniformly one-sixteenth of an em, or substantially six one-thousandths of an inch in the case of seven-point type. It will be seen that the spacers B, C, and D are never combined with each other and that no more than one of them is ever employed in a given combination; but the spacer A is repeated to any extent required to fill out the thickness called for. By reason of the fact that the A spacer is the smallest employed, and also because it is thus repeated in the different combinations, we designate it as the "basic" spacer, while the spacers B C D are given the general designation of "fractional" spacers. On account of this frequent repetition of the basic spacer A in the various combinations the devices employed for its selection differ considerably from those which are employed in the selection and ejection of the fractional spacers.

The supply of basic or A spacers is contained in the channel 195, situated immediately alongside the type-channel, while the fractional spacers B, C, and D are contained in the channels 196, 197, and 198, respectively, which are arranged side by side adjacent to a raceway 199, upon which they are ejected, as required.

Spacer-selecting mechanism.—The general construction, arrangement, and operation of this mechanism is substantially like that of the previous patent, No. 593,224. The present machine, like that of the said patent, is provided with a series of selecting-fingers mounted on a reciprocating carriage, the upper and lower fingers being adapted to select the basic or A spacers, while the three intermediate fingers communicate, respectivley, with the ejecting mechanisms of the channels containing the B, C, and D spacers. The selection of the desired spacer is determined by the position of a selector which is movable in the plane of the selecting-fingers, its position therein being determined by the horizontal position of the selector-setting slide 145.

That portion of the spacer-selecting mechanism which attends to the A or basic spacers will now be more particularly described. This mechanism is best shown in Figs. 13, 14, and 14ª. The basic table 200 is fitted to slide vertically in a portion of the framing W, the spur-like portions 200ª of the table extending beneath and supporting the column of basic or A spacers contained in the channel 195. Located beneath and supporting the basic table is the stop 201, which is pivotally mounted upon the shoe 202, the upper surface of the stop being provided with three steps for the support of the table, which differ in height by an amount equaling the thickness of one of the basic spacers. The shoe 202 is also fitted to slide vertically in ways of the framing W, and its lower end rests upon one of the stepped elevating planes 172, 173, and 174 of the selector-setting slide 145. Each of these steps, like those of the stop 201, equals the thickness of a basic spacer A, the parts being so proportioned and arranged that when the shoe 202 rests upon the highest plane 172, with the highest step of the stop 201 beneath the basic table, the spurs 200ª of the latter are close against the lower end of the spacer-channel 195, so that none of the spacers therein are exposed to the action of the extractor. Therefore the number of A spacers that may be simultaneously withdrawn from the channel 195 depends both upon the angular position of the stop 201 and the longitudinal position of the selector-setting slide 145.

From the foregoing description of the selector-setting mechanism it will be understood that the slide 145 remains in the position in which it is left by the measurement of the given line throughout the operation of inserting the justifying-spacers in all of the spaces contained in that line, so that the position of the shoe 202 remains constant during that operation, and if the stop 201 were also to remain in a constant angular position the same number of basic spacers would be inserted in each space of any given line; but for reasons which are apparent by reference to the table in Fig. 18, and also for other reasons, hereinafter explained, in connection with the selector-correcting mechanism, it is necessary to provide for the occasional insertion of one or two additional basic or A spacers. As a means for satisfying this occasional requirement the basic stop 201 is provided with its middle and lower steps, which by the angular adjustments of the stop are brought beneath the basic table, thereby obtaining, respectively, one and two additional basic spacers. The determination of the step to be brought beneath the basic table, and consequently the number of additional A spacers to be extracted, is controlled by the selector. The basic stop is connected, by means of the rod 203, with the frame 204, fitted to slide longitudinally in the framing W, being pressed toward the right by the spring 209, and that frame is provided with two spurs 205 206, located in the plane of the ends of the series of ejecting-levers, as best shown in Fig. 29. These spurs

are of different lengths, the shorter spur 205 being in the horizontal plane of the selecting-finger 225, so that the latter when deflected by the selector moves the frame far enough to bring the middle step of the basic stop beneath the basic table, thereby allowing one additional basic spacer to be extracted from its channel, while the longer spur 206, located in the plane of movement of the selecting-finger 229, is moved thereby when the latter is deflected by the selector far enough to bring the lowest step of the stop 201 beneath the basic table, thereby allowing of the extraction of two additional basic spacers, The means for extracting these basic spacers which by this movement of the basic table 200 are exposed to the extracting operation, will be hereinafter described in connection with the spacer assembling and injecting mechanism. The means for selecting the fractional spacers B, C, and D will next be described.

The spacers B, C, and D are contained in the channels 196 197 198, respectively, the lower ends of which open upon the raceway 199, which extends toward the left from the channel 195, the surface of the raceway being in the plane of the bottom of the latter channel. These channels are provided with the ejecting-plungers 214, 215, and 216, respectively, the latter being connected, by means of the links 217, 218, and 219, with the ejecting-levers 220, 221, and 222, respectively. These levers are pivotally mounted upon the vertical stud 223, fixed in a lug of the framing W. The range of movement of these levers and their connected plungers is sufficient to eject the spacers endwise from their respective channels onto the raceway 199 in front of the assembling-plunger. The front ends of these three ejecting-levers and the two spurs 205 and 206 are arranged in a series in a vertical plane parallel with and adjacent to the plane of movement of the selector 240.

The selecting-fingers 225, 226, 227, 228, and 229 are located in a vertical series adjacent to the spur 205, the ejecting-levers 220 221 222, and the spur 206, respectively. These fingers are pivotally mounted upon a vertical stud 236, fixed in the carriage 230, which is fitted to slide horizontally in the ways 231 232, being connected at its right-hand end, by means of the rod 233, with the crank 46, fixed on the upper end of the continuously-rotating word-shaft 45. The reciprocating movement of the carriage is sufficient to move the series of selecting-fingers from the position shown in Fig. 13 to that shown in Fig. 14ª, and the selecting-fingers are independently and yieldingly held in the position occupied by the finger 229 in Fig 13 by means of their respective springs 235, so as to hold them clear of their respective injecting levers and spurs, only a single finger of the series being deflected by the selector 240 into engagement with its lever or its spur, as the case may be, during any given reciprocation of the carriage.

The selector 240 is a projection preferably integral with the selector-slide 241, which is supported at its ends in bearings in the cross-head 242. That cross-head is fitted to slide upon fixed ways on opposite sides of the support 243, which extends upwardly from the framing W. The cross-head is provided with a foot 244, which extends downwardly in the plane of the steps of the selector-setting racks 165, 166, and 167, so as to rest upon that particular step thereof which is brought beneath it as a result of the operation of the measuring and selector-setting mechanisms. The selector (best shown in Figs. 13, 14ª, 28, and 29) is located in the general vertical plane of the selecting-fingers 225 to 229, inclusive, and has a range of vertical movement, due to that of the cross-head, corresponding to the width of the four lower fingers of the series. The selector has also a vertical movement upon and relative to its cross-head of an extent equal to the pitch or center distance between the selecting-fingers, which movement, added to that of the cross-head, enables the selector to be brought opposite to any one of the five fingers of the series, as may be determined by the position in which the cross-head rests at the conclusion of the measuring and selector-setting operation, modified in some instances by the operation of the selector-correcting mechanism; but unless thus modified the selector-slide rests at its lowest position relative to the cross-head, as shown in Figs. 28 and 29, being yieldingly held in this position by its gravity, aided by the spring 245, attached to the cross-head 242. Therefore in the description of this section the slide will be considered as remaining in its lowest position relative to the cross-head.

When the foot 244 of the cross-head 242 rests upon the lowest step *a* of the rack 165, the third or highest working plane 172 of the selector-setting slide 145 is beneath and supports the shoe 202. At this time, the highest step of the basic stop 201 being also beneath the basic table, the latter is held in its highest position against and entirely closing the bottom of the basic-spacer channel 195. The selector, being in its lowest position relative to the cross-head, stands in the line of movement of the leading rounded end of the selecting-finger 225, so that the latter when moved toward the left by its carriage is deflected by contact with the beveled side of the selector into engagement with the spur 205 of the basic-stop frame 204, thereby bringing the middle step of the basic stop beneath the basic table 200 and lowering the column of basic spacers far enough to allow one of them to be extracted therefrom. The pitch or vertical height between the centers of the

selecting-fingers of the carriage is equal to that of the respective steps of the setting-racks 165, 166, and 167, so that when the second step *b* of the rack 165 is set beneath the foot 244 of the cross-head the selector 240 will be held in the plane of the second selecting-finger 226, which upon being deflected by that selector engages with the ejecting-lever 220, thereby ejecting the lowest spacer B in the channel 196 upon the raceway 199. Similarly the cross-head foot 244 when resting upon either the third or fourth steps of either of the setting-racks 165, 166, or 167 presents the selector 240 in the plane of the fingers 227 or 228, respectively, thereby ejecting a C or a D spacer by means of their respective ejecting-levers.

The selector is only raised into engaging relation to the upper finger 229 for the extraction of two A spacers in addition to those called for by the planes of the selector-setting slide 145 by the operation of the selector-correcting mechanism, as will be hereinafter explained in connection therewith.

It will be noted that the length of each of the planes 172, 173, and 174 of the selector-setting slide 145 corresponds with that of each of the sections 165, 166, and 167 of the setting-racks, so that the same plane underlies the shoe 202 of the basic stop, whichever one of the steps in a given section is presented beneath the foot 244 of the cross-head. For example, some portion of the plane 172 remains beneath the basic shoe 202 during the time that either step of the section 165 is beneath the foot 244; but if the selector-setting slide is moved far enough to the left to bring either of the steps of the section 166 beneath that foot the corresponding plane 173 of the slide is simultaneously brought beneath the shoe 202, thereby lowering the basic table far enough to allow of the extraction of two A spacers. Thus the operation of the planes 172, 173, and 174 and their shoe 202 relative to that of the sections 165, 166, and 167 and the foot 244 is analogous to that of the ordinary arithmetical operation of adding up columns of figures, the passage of the foot 244 over the four steps of the section 165 indicating an increase in the measurement of an amount equaling one of the basic spacers, which amount, like the "tens" of the units-column in the arithmetical operation, is "carried" to the sum-total by the dropping down of the shoe of the basic table upon the next lower plane, thereby calling for an additional basic spacer, whereupon the foot of the selector cross-head in passing to the next section descends again to the first or lowest step thereof.

On account of the fact that the word mechanism of the machine runs continuously it is necessary in this embodiment of the invention to prevent the extraction of the spacer from their channels after the conclusion of each line and while the measuring and selector-setting operations are being performed upon each succeeding line. This is done in the present instance by elevating the selector entirely above the series of selecting-fingers by means of the elevating-lever 247, which is attached to the cross-head by means of the link 248. That lever is fixed upon the shaft 249, pivoted in the bracket 250, and has fixed upon its opposite end the arm 251, which is connected, by means of the rod 252, with the link 253, pivotally mounted on the stud 254. As a means for simultaneously stopping the further extraction of basic spacers the shoe 202 is connected with the cross-head-elevating lever 247 by means of the arm 207 and its connecting-rod 208, so that the elevating movement of the cross-head is communicated by means of the pin 255, fixed in the side of the controller 312, which being a part of the governing mechanism will be described in connection therewith, it being sufficient for the present purpose to note that by means of the elevating-lever 247 the cross-head and the basic table are moved to their highest positions, thereby carrying the selector above the series of selecting-fingers and also closing the basic table against the bottom end of the basic-spacer channel 195, these parts being again lowered into operative relation to their respective spacer-selecting devices at the conclusion of the operation of the measuring and selector-setting mechanisms upon the succeeding line. This elevation of the shoe and its attached parts from the stepped planes of the selector-setting slide 145 and of the feet 244 and 263 from their respective racks leaves the slide 145 free to be set to the position called for by the measurement of that succeeding line.

In order to allow of moving the basic stop 201 to the position shown in Fig. 14 from either of its lower steps, the basic table 200 is also lifted to its highest position at each actuation of the word mechanism. This movement serves also to elevate the spacers or assembled combination of spacers lying upon the basic table to the level of the injecting zone 56. This is accomplished by means of the lever 256, pivotally mounted on the bracket 257, attached to or integral with the framing W. The shorter arm of this lever is pivotally attached to the basic table 200, and both are drawn downwardly by means of the spring 258, attached between the shorter arm of the lever and the bracket. The longer arm of the lever 256 projects toward the right into engaging relation to the switch-cam 259, which is pivotally mounted upon the reciprocating carriage 230. The left-hand end of the switch-cam is yieldingly held to its upper position against the stop-pin 260 by means of the spring 261. Upon the movement of the carriage toward the left the outer and

lower side of the cam-rib 259ª engages with the inwardly-projecting end of the lever 256, thereby moving the basic table 200 to its uppermost position close against the bottom of the channel 195, thus permitting the angular position of the basic stop 201 to be changed during the justification of a line, if required, by the operation of the correcting mechanism. During the reciprocations of the carriage the lower end of the lever 256 moves around the cam-rib 259ª, as indicated by dot-and-dash circles in Fig. 14, the switch-cam yielding downward on its pivot to allow of its passing the end of lever 256 on the return movement of the carriage to the position shown in the latter figure.

Selector-correcting mechanism.—From the foregoing description it will be seen that the spacer-selecting mechanism is insufficient to effect justification in lines of type within the necessary limits of accuracy, inasmuch as it would seldom happen that the space to be filled out in any given line would be exactly filled by the unvaried repetition of any spacer or combination of spacers of a fixed size or fixed scale of sizes in all of the spaces of that line. The operation of the above-described devices is such that if the thickness of the required spacer called for by the measurement does not exactly equal that of any one of the spacers or combinations of spacers the selecting devices above described will insert the next smaller size. In this machine the steps of the setting-racks 165, 166, and 167 are so related in position to each other and to the measuring devices that the regular sizes of spacers or combinations of spacers will only exactly fill out the line when the outer corners of those steps happen to be set beneath the foot 244 of the cross-head, as shown in Fig. 14. Therefore if the position to which the selector-setting slide is carried by the movement of the setting-gage brings some other portion of any one of these steps beneath the foot 244 it indicates that the regular spacers or combinations of spacers will not exactly fill out the deficiency thus indicated. The function of the selector-correcting mechanism is to compensate for these deficiencies, keeping account of them until by accumulation they have amounted to .006, or the difference between the size of the selected spacer and the size of the next larger spacer. Having inserted that larger spacer, and thus supplied the deficiency, the selector is returned to its former position and again selects the smaller spacer until the continued or resumed accumulation of deficiencies calls for another insertion of the larger spacer.

The selector-correcting mechanism operates as an auxiliary to the spacer-selecting mechanism above described, being shown in the same figures of the drawings and also in Figs. 14ª and in Figs. 27 to 32, inclusive.

The correcting-racks 168, 169, and 170 are attached to or integral with the selector-setting slide 145 and are located beside the selector-setting racks 165, 166, and 167, respectively, the pitch of the teeth of the correcting-racks being one-third of the pitch of the teeth of the selector-setting racks, so that the teeth of the latter coincide with each third tooth of the correcting-rack. The devices which coöperate with the series of steps of the correcting-racks 168, 169, and 170 are carried upon the selector cross-head 242. The correcting-slide 262 is supported for vertical movement in suitable ways in that cross-head as best shown in Figs. 27 and 28 and is provided with a foot 263, which extends into the vertical plane of the correcting-racks and is adapted to rest upon the steps thereof, being in this embodiment located directly opposite to the corresponding foot 244 of the cross-head. The correcting-lever 264 is pivotally mounted at its inner or left-hand end upon the cross-head 242, as best shown in Fig. 14ª, its outer or right-hand end being provided with a pin which engages in a slot in the end of the extension 262ª of the correcting-slide. At a point midway of the length of the lever 264 is pivotally mounted the correcting-pawl lever 265, which in turn has pivotally mounted upon its inner end the correcting-pawl 266, which is located in engaging relation to a series of teeth 267 on the right-hand edge of the selector-slide 241. These teeth, as best shown in the full-sized drawings of Figs. 28, 30, 31, and 32, are of a pitch equaling one-third of that by which the selecting-fingers of the carriage are separated, and therefore corresponding to the pitch of the teeth of the correcting-rack. The upper end of the pawl 266 is connected, by means of the rod 268, with the horizontal rod 269, which slides freely in a hole bored in the lug 270 of the carriage 230. Upon either side of the lug 270 are located the coiled springs 271 and 272, which encircle the rod 269 and bear against collars fixed thereon, so as to move the rod and its attached pawl 266 yieldingly into contact with the teeth 267 upon the forward movement of the carriage and to move it away from those teeth upon the backward movement of the carriage.

The opposite end of the pawl-lever 265 is provided with a projecting lug or pin 265ª, which is located in engaging relation to the series of cam-pieces 273, 274, 275, and 276, fixed on the carriage 230. Each space between these cam-pieces is substantially equal to the thickness of the pin 265ª, so that when the latter is supported in either of the planes of these openings no vertical movement is imparted to the pawl 266, and consequently the selector-slide 241 remains in its lowest position with respect to the cross-head, as shown in Figs. 28 and 29, and the parts occupy this position whenever the spaces existing in a given line may be exactly filled by

the set sizes of spacers or spacer combinations, so that the cam-pin 265[a] is held in this position whenever the bottom surfaces of the feet 244 and 263 rest upon any of the coinciding levels of the teeth of the two sets of racks. One of these coinciding levels is brought beneath those feet whenever the measurement of the line is such that it can be exactly filled out by an unvaried series of the spacers or spacer combinations without the aid of the correcting mechanism. For example, in Fig. 14 the selector-setting slide 145 is in such a position as to bring the step 2^a+c of the rack 167 and the coinciding step of the correcting-rack beneath the feet 244 and 263, respectively, thereby indicating that the spaces of the line then being justified will be exactly filled by a series of combinations each comprising two A spacers and one C spacer. When, however, the line cannot be thus exactly filled, the position in which the selecting setting-slide is left by the measuring operation is such as to bring beneath the feet 244 and 263 a pair of non-coincident steps of their respective racks, thereby raising the correcting-slide 262 one or two steps, as the case may be, and bringing the correcting mechanism into operation. If, for example, the selector-setting slide 145 should be set to the left from the position shown in Fig. 14 far enough to bring its next notch into engagement with the detent 147, the foot 244 will rest upon the middle portion of the step 2^a+c, while the foot 263 of the correcting-slide would rest upon the second step of the correcting-rack, thus indicating that the last-named combination would be insufficient to fill the line, the deficiency in each space being equal to one-third of the difference between the C and D spacers, which deficiency would, in the scale herein assumed equal .002 of an inch. Therefore it would only be necessary to substitute a D spacer for the C spacer of the above combination in every third space of the line, and this is what is accomplished by the correcting mechanism. When the foot 263 of the correcting-slide is raised one step of the correcting-rack above the foot 244, the cam-pin 265[a] of the pawl-lever 265 is raised far enough into engaging relation with the inclined forward end of the cam-strip 275 so that each succeeding forward movement of the carriage will oscillate that lever to an extent sufficient to raise the correcting-slide a single tooth, the slide being prevented from dropping back upon the return movement of the carriage and of the pawl by means of the detent 277, pivotally mounted upon the cross-head and pressed into yielding engagement with the teeth 278 by means of the spring 279. A pin 277[a] projects from the upper end of the detent 277 into engaging relation to the lozenge-shaped cam projections 281 and 282 of the escapement-pawl 280, which is pivotally mounted upon the correcting-slide 262. In effecting the correction of a deficiency of .002 of an inch the correcting-slide is elevated to the position of one of its notches at each forward movement of the carriage, as above described. Therefore at each third movement of the carriage the correcting-slide is raised to its third notch, thereby raising the selector out of the plane of movement of the selecting-finger 227 into that of the finger 228, thus causing the ejection of one of the spacers D instead of a spacer C. At this position of the correcting-slide the cam projection 281 of the escapement-pawl is carried above the pin 277[a] of the detent, thereby upon its return movement camming the latter outwardly away from the teeth 278 and allowing the selector-slide to fall to its lowest position, (shown in Fig. 28,) the third tooth of the series 278 being omitted in order to facilitate the dropping of the correcting-slide.

The pitch or distance between the centers of the selecting-fingers 225 to 229, inclusive, is substantially equal to the height of each of the steps of the selector-setting racks 165, 166, and 167, and, as will be seen in Fig. 29, the width of the working face of the selector 40 is substantially equal to the space between the said fingers. Therefore the selector can never engage with but one of those selecting-fingers during any given stroke thereof. The parts are also adjusted so that with the selector-slide in its lowest position and the cross-head foot 244 resting upon one of the steps of its setting-rack the selector will be held so far below a position of exact coincidence with the corresponding selecting-fingers that only the upper edge of the selector engages safely with the lower edge of that finger. Hence the result that the selector remains in engaging relation to that finger even when raised two notches of its slide 241 and that an elevation of three of those notches is required to raise it into similar relation to the next higher finger.

The operation of these devices during the correction of a deficiency of .004 of an inch is illustrated in Figs. 28 to 32, inclusive, the three latter figures representing the devices at three different phases of that operation. In this case the slide 145 is assumed to be set so as to bring the fourth step *d* of the selector-setting rack 165 beneath the foot 244, while the foot 263 of the correcting-slide is elevated therefrom two steps of the correcting-rack, as shown in Figs. 28 and 29, thereby raising the cam-pin 265[a] into the plane of movement of the cam-piece 276 far enough so that the latter at its first forward movement elevates the correcting-slide two notches to the position shown in Fig. 30. This movement, however, is not sufficient to raise the selector out of the plane of the fourth selecting-finger 228, which therefore operates to select a D spacer for the first space of the line.

Upon the next forward stroke of the carriage the correcting-slide is raised two more notches to the position shown in Fig. 31, thereby bringing the selector 240 into the plane of action of the selecting-finger 229 and inserting two A spacers in the second space of the line, thus adding .006 of an inch to the line; but the deficiency of .004 in each space becomes .008 at the second space and .012 at the third space, so that it is necessary to also insert two A spacers in that third space, which fully satisfies the deficiencies thus far. The position of the devices for the selection of this third combination of the line is as shown in Fig. 32, the correcting-slide being raised high enough to bring the lozenge-shaped projection 282 above the pin 277ª of the detent, thus camming it away from the teeth 278 and allowing the correcting-slide to fall again to its first position, this operation being repeated throughout the justification of this line and others of similar deficiencies.

If the justification of any line should be completed before the deficiencies thereof are quite made up, thereby leaving the selector-slide raised above its normal position relative to the cross-head, it will be released therefrom by means of the projection 283, which extends from the framing into the plane of movement of the cranked arm 284 of the detent, so that the latter will be thrown away from its teeth 278 when the cross-head is elevated to its highest position at the completion of the line, thereby allowing the slide to drop to its lowest position. This is necessary at the completion of each line in order that the device may be at its normal starting-point at the commencement of each new line.

In the machine of the above-mentioned patent, No. 583,224, the correcting devices were adapted to correct deficiencies of one-sixth of the difference between the adjacent sizes of spacers, thus providing for five possible corrections. In the present machine, however, it is not deemed necessary for practical requirements to provide for the correction of deficiencies of less than .002, although it will be obvious that the system is capable of attending to smaller deficiencies.

Spacer assembling and injecting mechanism.—This is best shown in Figs. 13, 14, and 14ª. The A or basic spacers, which by the lowering of the basic table 200 have been allowed to emerge from the bottom of their containing-channel 195, are withdrawn from beneath that channel by means of the reciprocating extractor 291, which is fitted to slide in the framing W to an extent shown by a comparison of Figs. 13 and 14ª. The stem of the extractor extends through a vertical slot in the basic table far enough below the surface thereof to allow the greatest required number of A spacers to be withdrawn. The T-shaped right-hand end of the extractor extends upwardly, its upper surface fitting close against the bottom of the spacer-channel, so as to support the column of spacers remaining therein while extracting the others. The left-hand or extracting side of the T-shaped head of the extractor is cut away to clear the spurs 200ª of the basic table when the latter is at the forward or left-hand end of its extracting movement, as shown in Fig. 13.

The reciprocating movement of the extractor is imparted by means of the carriage 230, being connected therewith by means of the link 292, the lever 293, pivotally mounted upon the fixed portion of the framing W, and the connecting-rod 294. The amplitude of the movement of the extractor with relation to that of the carriage is reduced to the desired extent by the position of the pivot of the reducing-lever 293. This connection operates to impart to the extractor 291 a reduced movement contemporaneous with, but in the opposite direction to, that of the carriage 230 and of the assembling-plunger 290, which is attached to or integral with that carriage. The plunger 290 is fitted to slide upon the surface of the raceway 199, and as it moves toward the right it pushes before it whichever one of the fractional spacers has been selected and ejected upon that raceway by the immediately-preceding operation of the spacer-selecting mechanism. Inasmuch as the lower end of the channel 195 lies in the plane of the surface of the raceway, the upper surface of the extracted A spacer or spacers when brought against the end of the raceway is coincident with the surface thereof, so that the fractional spacer which happens to have been ejected from its channel is pushed by the plunger upon that A spacer or spacers. When no A spacer has been selected and extracted, the fractional spacer will be pushed by its plunger upon the surface of the basic table itself. The location in which the spacers are thus assembled is in the vertical plane of the type-channel 51, as best shown in Fig. 14ª, and the assembled combination is raised to the level of the injecting zone 56 thereof by means of the cam 259, as already explained. The assembling-spacers are held firmly together, so as to prevent them from becoming tipped or otherwise disarranged by means of the presser-foot 296, which is mounted just above this assembled position of the spacers, being fitted to slide in suitable ways in the side of the basic-spacer channel 195, as best shown in Fig. 14. This presser-foot is provided with a spur 297, which extends toward the left and is beveled on its under side. The assembling-plunger 290 is provided with a recess 298 to receive this spur, as shown in Figs. 14 and 14ª, the bottom of the recess being correspondingly beveled, so that the plunger in its forward or assembling movement elevates the presser-foot

far enough to allow the spacer B, C, or D to pass beneath it. The weight of the presser-foot may be made sufficient to hold the assembled combination of spacers securely in position, or it may be pressed downwardly by any suitably-arranged spring. The assembled spacers thus held beneath the presser-foot are injected therefrom into the type-channel 51 at the injecting zone 56 thereof by means of the injecting-plunger 300. This is fitted to slide horizontally in suitable bearings in the framing of the machine, as best shown in Fig. 14ª, and is connected, by means of the link 301, with the cranked arm 302, which is pivotally mounted upon a fixed portion of the framing W, the opposite end of the cranked arm being connected, by means of the link 303, with a lug on the reciprocating carriage 230, so that the latter upon its movement toward the left operates, through the parts just described, to inject into the type-channel the spacer or spacer combination which was assembled by the last previous right-hand movement of the carriage. The corresponding separator, at that time lying in the injecting zone, is simultaneously ejected therefrom by the entering spacers and falls into any conveniently-placed receptacle. (Not herein shown.) The leading end of the injecting-plunger or the coengaging portion of the presser-foot, or both, should be slightly beveled, so that the plunger upon its forward movement will remove the downward pressure of the presser-foot. This, however, need not be done unless a heavy presser-spring is employed.

Having now described the sections or the subdivisions of the line and the word mechanisms, we will next describe

The governing mechanism.—The functions of this mechanism are to take account, as it were, of the number of spaces in the line next to be justified; to arrest the operation of the spacer selecting, assembling, and injecting mechanisms when they have assembled and injected a corresponding number of spacers or spacer combinations, and at a suitable time in advance of the completion of each current line to start the line mechanism into operation upon the succeeding line, so as to reduce to a minimum the intervals of lost or idle time between the lines. The governing mechanism, as shown in the general front elevation of Fig. 1, is located at the lower right-hand portion of the machine. Its various parts are better shown in detail drawn at full-size scale in Figs. 15, 15ª, 16, 17, 19, 20, 24, 25, and 26.

The governor-shaft 308 is rotatably journaled at its rearward end in the bracket 309, its forward end extending through and being supported by the controller 312. This shaft has fixed upon it the worm-gear 310, meshing with the worm 47 upon the word-shaft 45, by means of which a continuous rotary movement is imparted to the governor-shaft. That shaft has also keyed upon it the ratchet-wheel 311, having on its periphery a series of teeth facing forwardly in the direction of rotation.

The controller 312 is rotatably journaled upon the shaft 308, being supported by the bearing 313, attached to or integral with the framing W, as best shown in Fig. 15. The rearward end of the controller is provided with the flange 314, which is located close against the ratchet-wheel 311 and has pivotally mounted upon its rearward face the pawl 315. (Best shown in Figs. 24 and 25.) One end of the pawl is adapted to engage with the adjacent teeth of the ratchet-wheel 311 during a certain period in the justification of each line, being yieldingly pressed into engagement at that time by means of the spring 316, which is also attached to the rearward face of the flange 314. The opposite end of the pawl 315 carries a hub 317, in which is seated a longitudinally-movable cam-pin 318, which is yieldingly held in the position shown in Fig. 24 by means of the spring 319. In order to allow of a suitable working length of the pin and of its spring, the hub 317 of the pawl extends through a clearance-slot in the flange 314, as best shown in Fig. 24. When the pin is in its innermost position, (shown in the latter figure,) its rearward end extends into the deepest portion of the annular groove 321 of the controller-releasing cam 320, so that the annular shoulder 322 thereof will hold the pawl out of engagement with the ratchet-wheel 311, as shown in Fig. 25, this being necessary while the controller is being reset, as hereinafter described, to a position which varies with and is controlled by the number of spaces in each line to be justified. The groove 321 extends annularly around the releasing-cam concentric with the axis thereof, the cam function being performed by the cam-piece 326, which, as shown in Figs. 24 and 25, extends across the groove 321 far enough to swing the pawl 315 out of engagement with the continually-rotating ratchet-wheel 311, thereby releasing the controller therefrom and allowing it to stop at the position shown in Fig. 1, in which position it is detained by its detent 342. This releasing movement of the pawl brings the inner end of its pin 318 into alinement with the deeper portion of the annular groove 321, into which the pin is then forced by its spring, so that the pawl is held out of engagement with the ratchet-teeth by means of the annular shoulder 322 during the resetting operation.

The controller-releasing cam 320 is mounted upon the shaft 308, so that the latter can turn freely within it, the cam being held from rotating by means of the lever 323, one end

of which is pivotally attached to the cam by means of screws 324, the other end of the lever being pivotally supported in a slot in the framing W. The rearward end of the cam 320 is provided with cam-inclines 320^a, having the appearance of ratchet-teeth, which engage with corresponding teeth 310^a upon the forward side of the worm-gear 310, the rotation of which thereby imparts to the non-rotating cam 320 a longitudinal movement upon the shaft 308 at each rotation of the word-shaft 45 equaling in extent the depth of the aforesaid ratchet-teeth, the cam being yieldingly pressed toward the rear and into engagement with the cam-inclines by means of the spring 325. The resetting operation of the controller takes place while the cam is held in its forward position (shown in Fig. 24) upon the points of the coengaging ratchet-teeth, and at the conclusion of the measuring and resetting operations the cam is enabled by the interlocking of the said teeth to move back to the position shown in Figs. 15 and 26, thereby withdrawing the shoulder 322 from behind the pin 318 and allowing the pawl to engage with an adjacent tooth of the ratchet-wheel 311, by means of which it is again carried forward to its releasing position of Figs. 1, 24, and 25.

The forward end of the controller 312 is provided with the flange 327, which is provided with a spiral series of steps equaling the maximum number of spaces in the longest line for which the machine is adapted, the number of steps shown in the drawings being eleven, which in Fig. 15^a are numbered from 1 to 11, inclusive. The stop 328 is fitted to slide upon a square rack 329 at the side of the stepped flange, the end of the stop being turned into the plane of that flange, as shown in Fig. 15. The plane of movement of the end of the stop is substantially radial to the axis of the controller, and its range of movement is great enough to enable it to be set in engaging relation to any one of the steps thereof. The upper portion of the rack 329 is provided with gear-teeth, which mesh with the pinion 330, the latter meshing also with the pinion 331 on the right-hand end of the shaft 87, and the stop 328 is raised in engaging relation to the proper step of the controller-flange 327 by means of the successive word-separators of the line as they are carried past the ratchet-wheels 98 and 99, thereby setting the stop for the controller coincidently with the setting of the fulcrum mechanism and the stepped jaw mechanism. The stop 328 is fitted to slide freely upon the rack 329, being supported during the setting operation by the pin 332.

In order that the rack 329 may at once be returned to its first or lowest position in readiness to be set for the succeeding line, leaving the stop 328 in the position in which it was set for the current line, the stop 328 is provided with a row of teeth 341, corresponding in number and pitch to the steps of the flange 327. The detent 333 is pivotally mounted upon the framing W in engaging relation to those teeth, the lower end of the detent projecting downwardly into engagement with the pin 334, placed in the side of the collar 335, which is pivotally mounted in the framing by means of the screw 336. The edge of the collar is cut away to form an engaging shoulder for the pin 337, which is fitted to slide transversely in the lower end of the rack 329, being held toward the collar by means of the spring 338. At the conclusion of each operation of the controller and as the rack is raised with the step-by-step motion imparted to the shaft 87 by the passing separators of the next line the collar 335 is turned by the pin 337 to the position shown in Fig. 15^a, thereby withdrawing the pawl from the teeth of the stop 328 and allowing the latter to slide downwardly upon the rack until arrested and supported in its proper relation thereto by the pin 332, by means of which the stop is then raised to its appropriate position and supported thereat by the detent 333, which is allowed to return to the teeth 341 after the pin 337 has passed by the collar 335, as shown in Fig. 1. The pin 337 is yieldingly mounted to enable it to spring over its shoulder of the collar 335 upon its downward or return movement.

It is conceivable that in some of the embodiments or modifications of this invention the parts may be so timed as to allow the proper step of the controller to be brought against the stop 328 before it becomes necessary to return the rack 329 to its lowest or initial position. In that case the stop would be supported in a suitable position by means of the flange of the controller itself falling step by step as the latter is moved toward its releasing position, and in that case the detent-pawl 333, its teeth upon the stop and their releasing devices connected with the lower end of the rack, may be dispensed with, it being only necessary to retain the stop in the position to which it is set for each line until the appropriate step of the controller is brought against it.

The controller is provided with means for imparting to it a nearly complete rotation in a direction opposite to that of the rotation of the ratchet-wheel 311. This is for the purpose of setting it with its appropriate step against the stop 328 after the latter has been set, as above described, by the passage of the separators of the line next to be justified, moving it thereto from the position shown in Fig. 1, to which it is returned by the ratchet-wheel 311 and at which its pawl 315 is released from that ratchet-wheel. The means for thus rotating the controller is herein shown to be the weight 339, which serves by means of its cord 340, coiled upon the hub of

the controller 312, to rotate the latter until its appropriate step collides with the stop. While the latter is being set to position by the passing separators the controller is held in the position shown in Fig. 1 by means of the detent 342, fixed upon the shaft 343 and engaging with the notch 314ª in the edge of the flange, being yieldingly pressed against that flange by means of the spring 349. That shaft is pivotally mounted in the framing of the machine and has upon its opposite end a lever 344, the latter being connected, by means of the rod 345, with the slide 346, which is fitted to slide longitudinally in the framing W and is provided with a cam-pin 347, extending into engaging relation with the cam-piece 348 on the side of the cam 88. (Best shown in Fig. 7.) That cam-piece is so located with respect to the time of rotation of the cam 88 as to move the slide 346 to the left, thereby lifting the detent 342 and releasing the controller after the controller-stop 328 has been set to its proper position.

It will be seen from the foregoing description that the controller having been automatically set to a position determined by the number of separators in the line next to be justified is so timed and arranged that it will, by means of its pawl 315, be picked up by the rotating ratchet-wheel 311 after the said line has been measured and transferred to the pawl 55 and as the first word thereof is being elevated to the injecting zone 56 by the word-grab, the controller being thereafter rotated to an extent equaling one angular separation of the steps of the flange 327 for each word thus elevated until the controller reaches its releasing position. (Shown in Fig. 1.)

As the controller approaches its releasing position its stud 255, engaging with the link 253, operates in the manner and for the purpose already set forth to raise the selector cross-head 242 and the basic table 200 to their highest positions, thereby preventing the further selection and extraction of the justifying-spacers. The parts are so timed as to elevate these parts just after the spacer or combination of spacers for the last space in the current line has been selected and assembled, so that the succeeding stroke of the carriage operates only through the grab to lift the final word from the pawl 55 up to its place, thereby completing the justified line.

The means which coöperate with the controller for releasing the clutch 43 of the line-shaft, so as to allow it to be forced by its spring into engagement with the continuously-rotating driving-clutch 42, will now be described. As already stated in the preliminary description of the line mechanism, the line-shaft clutch 43 is normally held toward its right-hand or engaging connection with the driving-clutch 42 by means of the spring 44, and the clutch 43 is withdrawn from that engagement at the conclusion of each of the intermittent rotations of the line-shaft by means of the clutch-pin 350, which is fitted to slide longitudinally in a bushing 351, fixed in the framing W, as shown in Fig. 16, being yieldingly pressed toward its rearward position (shown in that figure) by means of the spring 352. That pin is located in a substantially radial position to the line-shaft 40, so placed longitudinally thereof as to enter the inclined groove 353 of the clutch 43 and engage with the inclined side or shoulder thereof as that shaft approaches the completion of each of its intermittent rotations, the inclination of the shoulder being sufficient to cause the clutch to be forced toward the left to the position shown in Fig. 20 out of engagement with the clutch 42, to the position shown in Fig. 20, in which it is held against further rotation during the justification of the current line by means of the clutch-pin 350 until the latter is withdrawn by the controller at a time suitable for the commencement of the next rotation of the line-shaft.

The means adopted in the present embodiment of this invention for enabling the controller to withdraw the pin 350, and thereby to allow of the engagement of the clutches 42 and 43 and the subsequent rotation of the line-shaft, are best shown in Figs. 16, 17, 19, and 20. The clutch-pin 350 is provided with a cross-pin 354, the ends of which extend into the slots 355 of the guide 356, which is supported from the framing W, as best shown in Fig. 17. The clutch-pin 350, being thus held from rotation upon its own axis, is moved lengthwise at a suitable time by means of the clutch-releasing cam 357, which is fitted to turn freely upon a cylindrical extension of the bushing 351. The front face of this cam is provided with spiral wings 358, which engage behind the cross-pin 354 on opposite sides of the clutch-pin 350, so that the cam upon being rotated half-way around will move the clutch-pin longitudinally from the position shown in Fig. 16 to that of Fig. 17, thereby withdrawing the clutch-pin from the groove 353 of the clutch 43. The enlarged flange of the cam 357 has upon its rearward face the oppositely-disposed pawls 359, which, as shown in Fig. 19, are yieldingly pressed, by means of the springs 362, into engagement with oppositely-disposed shoulders or teeth 360 of the ratchet 361. That ratchet is rotatably mounted upon the aforesaid cylindrical extension of the bushing 351, being attached to or integral with the pinion 363, which meshes with the sector 364, pivotally mounted at 365 upon the framing W. The arm 366 of the sector projects into the circle of revolution of the lug 367, attached to or integral with the rearward side of the flange 314 of the controller, the latter as it approaches its releasing position (shown in Fig. 1) colliding with the arm

366, thereby turning the cam 357 from the position shown in Fig. 16 to that of Fig. 17 and withdrawing the clutch-pin 350, so as to release the clutch 43. At each of these actuations of the cam it is turned substantially one-half of a complete rotation upon its bearings, thereby presenting to the cross-pin 354 the space or interval between its wings 358, so as to allow the clutch-pin 350 to be again forced by its spring to the position shown in Fig. 16, when the rotation of the clutch 43 again presents the commencement of its spiral groove 353 opposite the end of that pin. On account of the necessity for leaving the pin 350 in the position shown in Fig. 16, so as to hold the clutch 43 in the disengaged position (shown in Fig. 20) during the intermissions in the operation of the line-shaft, it is desirable to impart to the cam 357 an intermittently forward rotation instead of allowing it to follow the return oscillatory movements of its sector 364. Hence the utility of the pawl-and-ratchet connection of that cam with the pinion 363. The latter, being positively geared with the sector 364, participates in the return oscillatory movement of the latter, due to the similar movement of the controller, the amplitude of these movements being sufficient, as above stated, to turn the pinion substantially half-way around, thereby bringing the pawls 359 into engagement with the opposite shoulders 360 of the ratchet ready for imparting the next forward half-rotation thereto.

In the present machine the time established for the releasing of the clutch 43, so as to enable the line mechanism to begin its work upon the succeeding line, is while two words of the current line still remain upon the pawl 55. Inasmuch as the word mechanism operates three times for each rotation of the word-shaft and as two of these operations are required to carry the two remaining words into the injecting zone, it follows that the word mechanism operates idly but once when there is no interruption in the supply of type-lines, its succeeding operation being in connection with the first word of the succeeding line. The governing mechanism as thus organized keeps the machine constantly in operation, even when no lines of type are brought within the reach of the line-elevating mechanism. In the latter case the shaft 87 remains in its initial position, which is appropriate for a three-word line having two spaces, that being the minimum line to which this particular embodiment of the invention is applicable. Therefore the controller after being released from its detent 342 is arrested with its second step against the stop 328, from which position it is returned to its releasing-point, as before, by the ratchet-wheel 311 again releasing the clutch 43 and causing another operation of the line mechanism, this operation being repeated until lines of type-matter are again brought within the reach of the line-elevating mechanism, after which the setting of the governing mechanism is controlled, as before, by the number of spaces therein.

A brief description will now be given of the complete operation of the entire machine under normal conditions. It will be assumed that the line to be justified, resting in the waiting position on the pawl 64, as shown in Fig. 11, contains seven words and six spaces, having an aggregate shortage or deficiency of .276, which, divided into the six spaces of the line, equals .046 for each. As there is no spacer of this size, the selection for the first space falls upon the next smaller or D spacer, which being but .042 requires a correction of .004. This D spacer, however, if repeated in all of the spaces of the line would still leave a deficiency of .024; but by the present system the .024 is distributed among four of the spaces of the line, adding .006 in each, by substituting a combination of two of the A or basic spacers for the D spacer. Therefore, following the system herein set forth, the line now under consideration would be justified by the insertion of the following series of spacers and spacer combinations D: 2A, 2A, D, 2A, 2A. The operation of the machine upon such a line is as follows: As the line is carried into the measuring zone by the line-elevating mechanism its separators move the stop 94 toward the left beneath the appropriate pin of the index 92 and by means of the successive partial rotations of the setting-shaft 87, which are thus permitted, the fulcrum-adjusting quills 85 and 86, the stepped jaw 110, and the controller-stop 328 are set to positions appropriate for the manipulation of a six-space line. By the continued rotation of the line-shaft the fulcrum-block 80 is moved by the cams 88 and 89 to its position determined by the quills, and the measuring-beam 120 is allowed by its cam 127 to be drawn upward by its spring 128, thereby raising the end of the measuring-pawl 130, with the line resting thereon, to the extent permitted by the appropriate step of the stepped jaw 110, which is .276, the herein-assumed shortage of the line, and moving downwardly the setting-gage stop 134 to a suitably-related extent. At the same time the setting-gage 135 is released from its detent 139 by means of the cam-piece 141, thus permitting that setting-gage to be drawn toward the left by its weight 142 to the extent permitted by the vertical position of the stop 134, as shown by a comparison of Figs. 9, 9^a, 9^b, 9. This movement toward the left of the setting-gage carries with it the selector-setting slide 145, thereby bringing beneath the foot 244 of the cross-head 242 the step *d* of the rack 165 and beneath the foot 263 of the correcting devices the highest step of the rack 168, while

the first plane 172 of the setting-slide remains beneath the shoe 202 of the basic table, as shown in Fig. 34. At this stage in the operation of the machine the controller 312 is released from its detent 342 and under the influence of the weight 339 is moved far enough to bring its sixth step against the stop 328, thereby carrying the stud 255 away from the link 253 and allowing the latter, with its connecting-rod 252, to rise to a position which permits the cross-head 242 of the selecting mechanism to settle down until its foot 244 and the foot 263 of the correcting-slide rest upon those steps of their respective setting-racks which have been brought beneath them, while the shoe 202 rests upon the plane 172 of the selector-setting slide 145. As thus set the selector is held in engaging relation to the selecting-finger 228 for the D spacer. The correcting-slide being held two steps of the correcting-rack above the level of the step *d* indicates the required correction of .004, while the basic table is held in its highest position, so as to close the channel 195 of the basic spacers, the basic stop 201 having at this time its highest step beneath the table. This setting movement of the cross-head and of the basic table to their respective positions is timed to take place while the carriage 230 is at or near the right-hand end of its stroke, so that the selecting-fingers 225 to 229, inclusive, and the cam-pieces 273 to 276 are withdrawn at this time, as shown in Figs. 13 and 28, from the vertical planes of movement of the selector 240 and the pawl-lever pin 265[a], with which those parts of the carriage are respectively to engage, thus leaving the latter free to be set vertically to position.

Following its measuring operation and during the setting operation just described the current line has been raised by the line-grab 58 out of the measuring zone and upon the top of the pawl 55, thereby bringing it within reach of the word-grab, which at each subsequent rearward stroke of the carriage 230 carries a succeeding word of the current line past the injecting zone 56 and upon the top of the pawls 183. Upon the first forward stroke of the carriage the selecting-finger 228 is deflected by the selector 240 into contact with the end of the ejecting-lever 222, thereby ejecting one of the spacers D from the channel 198 upon the raceway 199, along which during the succeeding return movement of the carriage it is moved by the assembling-plunger 290 beneath the presser-foot 296 and in front of the ejecting-plunger 300, which at that time is in its rearward or withdrawn position and which at its next stroke carries the spacer D into the type-channel at the injecting zone 56 thereof beneath the first word of the current line. During the first forward stroke of the carriage the cam 276 operates through the lever 265 and the pawl 266 to raise the selector to the position shown in Fig. 30, which, however, does not carry it above the plane of the selecting-finger 228 for the D spacer; but repetition of this action of the pawl 266 upon the second forward stroke of the carriage and of its cam 276 operates to carry the selector to the position shown in Fig. 31, out of the path of movement of the selecting-finger 228 into that of the selecting-finger 229, thereby deflecting the latter finger into contact with the spur 206 of the frame 204, thus bringing the lowest step of the stop 201 beneath the basic table and permitting the extraction of two basic spacers therefrom into the path of movement of the injecting-plunger 300, by means of which they are pushed into the second space of the line. The third forward stroke of the carriage operates through the cam 276 to raise the selector 240 to the position shown in Fig. 32, in which, however, it is still in engaging relation to the selecting-finger 229, which therefore operates, as before, to cause the extraction of two basic or A spacers for the third space of the line. Upon the return of the carriage from its third forward stroke the selector-slide 241 is released from its detent 277 and returns to its first position (shown in Figs. 28 and 29) in the manner already described in connection with the selector-correcting mechanism, so that the fourth forward stroke of the carriage operates to select and eject a D spacer for the fourth space in the line. Upon the fifth forward stroke of the carriage the selector is again carried into the path of movement of the selector-finger 229, where it remains during the sixth stroke also, so that the fifth and sixth spaces of the line each receive a combination of two basic or A spacers. Contemporaneously with the selection of the spacer for the first space of the current line the controller is started into operation by the release of the pawl 315 from the groove 321 of the cam 320, thereby permitting it to engage with the ratchet-wheel 311, the controller being thereby advanced to an extent equaling the angular separation of the steps upon its flange 327 for each of the words as they are carried up by the word-grab. This operation continues until in the case of the seven-word line now under consideration the fifth word has been carried up above the injecting plane 56, at which time by the operation of the lug 367 of the controller, the sector 364, and their associated devices the clutch-pin 350 is withdrawn from the line-clutch 43, which engages with the constantly-rotating clutch 42, and thereby inaugurates another operation of the line mechanism upon the succeeding line. The succeeding upward movement of the word-grab carries up the sixth word of the line and the spacer assembling and injecting mechanism insert its final combination of two A spacers beneath that word, at which time,

having completed the selection of spacers for that line, the cross-head 242 is, by means of its connection with the link 253, raised by the stud 255 of the controller, so as to stop the further selection and extraction of spacers until the devices have been reset for the succeeding line. The subsequent or seventh upward movement of the word-grab carries up the seventh or final word, so as to complete the line then resting above the injecting zone; but the associated movement of the spacer assembling and injecting mechanism makes an idle stroke, no spacers having been brought within their range of action. The eighth stroke of the word-grab is an idle movement, the conclusion of which is contemporaneous with the completion of the rotation of the line-shaft, which by the operation of its associated mechanism has brought the next line into the measuring zone, performed the measuring operation thereon, and reset the several devices in accordance with the requirement thereof, so that the succeeding movement of the carriage and word-grab becomes the first in the series operating upon the succeeding line.

A modification of the setting-gage in what may be considered its simplest form is shown in side and end view in Figs. 35 and 36, respectively. In this modification the gaging-surface 371 of the setting-gage 370 is represented as having with relation to its direction of movement what may be termed a "simple" instead of a "compound" inclination. While this arrangement would secure the desired ratio of movement between the setting-gage and its stop 372, it does not allow of doubling the angle of contact therewith or repeating it symmetrically with relation to the direction of movement. It is in this respect inferior to the other and preferred form herein shown and is shown in this simple form mainly for the purpose of affording a comparison, by means of which the characteristics of the compound type of setting-gage may be more fully and readily comprehended.

The modified setting-gage and stop shown in side and end views in Figs. 37 and 38, respectively, will by analysis be seen to be practically but an inversion as to form of the preferred form shown in the principal figures of the drawings, the inner inclined surfaces 373 374 of the setting-gage 375 engaging with correspondingly-inclined surfaces on the opposite outer sides of the stop 376. It will be seen that these surfaces, like those of the gage shown in the principal figures of the drawings, are doubled or repeated symmetrically with relation to the direction of movement of the gage, and thereby secure the advantage of accuracy of setting alluded to in the preceding description.

The arrangement of setting-gage and stop shown in end view in Fig. 39 is a further modification of that shown in Figs. 37 and 38, lacking, however, the feature of the repeated or symmetrically-doubled angle of contact. The compound-inclined inner surface 378 of the setting-gage 377 engages with a correspondingly-inclined side of the stop 380, while the opposite inner surface 379 thereof and its coengaging surface of the stop are parallel with the direction of movement of the setting-gage. It will be observed that either one of the gaging-surfaces 136 137 of the setting-gage 135 or the surfaces 373 374 of the setting-gage 376 would, in connection with their respective guiding-splines 135^a and 375^a, secure the desired ratio of their movement with relation to that of their respective steps; but for the purpose of increasing the accuracy with which the gage is stopped at its desired positions the double form is preferred, and of the double forms herein shown that of the gage 135 is again preferred, having in cross-section the outline of a truncated **V**, the compound inclinations of which are disposed symmetrically on both sides of the plane of its longitudinal center.

The setting-gage and stop shown in side view in Fig. 40 is still another modification, having the general form of the gage of Fig. 35. The gaging-surface of this modified form is, however, disposed in an inclined series of steps 384 instead of an inclined plane. The longitudinal pitch of these steps coincides with that of the steps of the correcting-racks 168, 169, and 170, so that after the stop 383 is set by the measuring mechanism the end of the appropriate step 384 is stopped against the right-hand face of the stop 383, thereby holding the corresponding step of the correcting-racks beneath the foot 263 of the correcting-slide. The accuracy of measurement would not be materially affected by the use of such a stepped gaging-surface, which may obviously be applied to each of the other forms of setting-gage herein shown and described.

Various mechanical equivalents may obviously be substituted for many of the devices herein shown and described and different forms or applications of actuating springs and weights may be substituted for those herein shown without materially altering the function or practical operation of the parts in their relation to the machine as a whole. For example, the several devices may be rearranged in differing relative positions, their connections being modified by the addition or omission of connecting rods and links or modified as to amplitude by levers of suitable lengths or as to direction by means of bell-cranked levers. The terms "horizontal," "vertical," "right," "left," "front," "rear," and others of similar import are herein used in their relative instead of their absolute sense, inasmuch as many of the parts may,

as above remarked, be transposed as to position or direction or sequence of operation as may best suit the conditions of each particular case. The term "current line" is herein employed to designate the line of type-matter which at the given period has passed into or through the measuring zone and is being justified. The terms "space," "separator," and "spacer" are herein used advisedly to avoid confusion of terms and of ideas which otherwise might occur in referring to these three particular things. In the ordinary printers' parlance the term "space" is commonly applied to all three without any distinction, excepting such as may be ascertainable by context. As herein used the word "space" refers to the actual division or interval between adjacent words. The term "separator" designates the pieces U, which are herein shown to be cylindrical and which are temporarily placed between the words by the compositor or are "played" in by the composing-machine operator, so as to temporarily maintain the separation between them, and by the term "spacer" we herein designate the final type-body, which singly or in combination is substituted for the "separators" in the respective "spaces." The term "shortage" or "deficiency" of the line is herein applied to the net amount by which a given line is short of the required measure, that shortage or deficiency being therefore equal to the aggregate measure of the justifying-spacers required to accurately fill that line out to its measure, while the term "correction" is used to designate the extent, if any, by which the selected spacer falls short of its due proportion to the entire shortage of the line. The general term "basic" is herein applied to that spacer which is specifically designated by the letter A, while the general term "fractional" is applied to the spacers B, C, and D, since they form with the basic a series increasing in size by a repeated increment which is a fractional part of the size of the basic. As herein employed the increment is one-fourth the size of the basic, the fractional or B C D spacers being respectively one and one-fourth, one and one-half, and one and three-fourths times the size of the basic spacer. It is obvious, however, that this fraction and the consequent number of the fractional spaces may be increased or diminished to any desired extent. As, for example, four fractional spacers may be employed, representing, respectively, the size of the basic spacer plus one, two, three, and four fifths thereof. Such modifications of the number and size of the justifying-spacers would of course involve a corresponding modification of the mechanism.

The line-elevating mechanism herein shown and described is by virtue of its arrangement in two detachably-connected sections adapted to perform functions ordinarily requiring three independently-driven grabs operating at different times, but which by this arrangement are performed by a single cam or driver on the line-shaft. Those three functions are, first, to bring the line from the waiting position into the measuring zone; second, to carry it therefrom after measuring; third, to bring the succeeding line to the waiting position. It may be noted in passing that the rod 66, connecting the two grabs of the line-elevating mechanism, may be permanently attached to the lower grab and detachably connected with the upper grab by means of a latch 67, like that herein shown upon the lower grab.

It will be noted that the spirally-stepped index formed by the index-pins 93 in the collar 92 of the setting-shaft is in the present machine arranged for lines having a minimum of three words or two spaces, that being well within the requirements of actual practice. Therefore the stops associated with the setting-shaft 87 are set for such a minimum line when the stop 94 rests beneath the right-hand lower index-pin, (shown in Fig. 1,) the setting-shaft being turned back, so as to allow that stop to return beneath that first pin at the conclusion of each setting operation. The upper surface of the stop upon which the pins rest is extended far enough so that it is not withdrawn from beneath the first pin until the fourth separator in the line is carried past the ratchet-wheels 98 and 99. Inasmuch as there is in each of the lines one more separator than the number of spaces to be justified—namely, the separator which follows the last word in each line—it is evident that the actuation by this extra separator must be compensated for, which is done by extending the top of the stop, as above stated, so that four actuations are required to bring it beneath the third index-pin, and so on.

By the employment of a shaft which extends transversely behind the type-channel and has fixed thereon two ratchets operable by the ends of the separators the type are kept from tipping and positive action of the setting devices is assured, both of which are highly-desirable features.

The arrangement whereby the setting of all the stops for the various devices in the line and governing mechanism are controlled by the universal setting-shaft 87 is a feature of great utility, since all these parts are thus brought under a definite, invariable, and unitary control.

In order to permit of the immediate resetting of some of the devices comprising the line mechanism, they are herein shown and described as being separable. Many of these, however, may be united or be made integral in case the releasing and immediately-resetting feature is dispensed with or accom-

plished in some other way. For example, the setting-gage 135 and the selector-setting slide 145 may be thus united in a permanently-connected or integral piece if the resetting feature may be dispensed with or otherwise provided for. The same comment applies equally to the connection of the controller-stop 328 with its rack 329 and to the rack 101 and its rod 104 for the universal setting-shaft 87. An analogous instance of the advantages of organizing all of the devices comprising a group or section of the mechanism so as to enable them to be operated in proper and unvarying time, relation, and sequence is afforded by the arrangement herein shown of the word mechanism, all parts of which are connected with and driven by the reciprocating carriage 230.

Although the measuring-beam turns on its fulcrum and its ends therefore appear to describe circular arcs struck from the various positions of that fulcrum, yet all of the measurements, however varied by the position of the beam-fulcrum, are transmitted in the proper and desired ratio to the setting-gage stop 134. This is due to the circumstance that the right-hand end of the beam is pivotally attached to the measuring-slide 123 and must move toward the right with relation to its fulcrum-block 80 during the measuring movement to an extent equaling that by which the secant exceeds the radius of the arc of its movement. Therefore the measured deficiency of the line and the resultant movement of the setting-gage stop are always to each other as the similar sides of similar triangles.

The setting-racks, basic stop, selector-setting slide, and similar parts herein shown as having stepped inclines may instead be each provided with corresponding plane inclines, the coengaging surfaces of their respective feet, stops, &c., being in such cases preferably inclined to correspond therewith.

The selecting devices of this machine may, as previously noted, be operated either with or without the correcting mechanism, according to the accuracy of the work required, and hereby is suggested other examples of the almost infinite permutations possible in the arrangement of such an intricate piece of mechanism. In associating the correcting mechanism with the selecting mechanism it is by no means essential that their respective feet 244 and 263 shall be oppositely disposed, as herein shown, inasmuch as they may be placed in any desired relative position. In that case, however, their respective racks must be correspondingly located. Their coincident position herein shown is not only constructively convenient, but it also enables their relative operation to be readily understood.

In dispensing with the use of the correcting mechanism the cross-head 242 may also be dispensed with, and in that case the selector 240 may be provided with a foot corresponding to the foot 244 of the cross-head, which may rest directly upon the steps of the selector-setting racks.

No galley mechanism is herein shown or described for receiving the justified lines as they are successively completed. Any suitable mechanism may be employed for this purpose and may be applied to this machine by any workman exercising a fair degree of skill in this art.

The governing mechanism, either wholly or in part, is capable of application to other machines of this general class, whether wholly or partially automatic. In the latter case the releasing-detent 342 may be connected to the keyboard of the composing-machine, so as to be released by the operator at the conclusion of the measurement of each line. The clutch-pin 350 may be similarly connected, so as to enable the line-shaft to be put in operation at the will of the operator.

The pinion 363 and its driving-sector 364 are herein employed merely as convenient devices for enabling the controller to act upon the clutch-releasing cam 357, it being desirable to multiply the concluding movement of the controller sufficiently to cause a half-rotation of that cam. The latter may, however, be provided with four or six of the wings 358 instead of two, as herein shown, thereby correspondingly diminishing the extent of its required angular movement, which could be then imparted by extending the arm or lug 367 of the controller into engagement with the pinion 363, which in that case would be provided with an arm like that of 366 instead of with the gear-teeth for the sector, as herein shown.

The herein-described operation of the measuring and selector-setting devices may be varied and in some instances improved by altering the timing of the cam 141, so that the latter will withdraw the detent 39 from the setting-gage simultaneously with the commencement of the upward or measuring movement of the measuring-beam, thereby permitting the setting-gage to rest against and follow the downward movement of its stop. This timing of the respective parts may in some instances be considered preferable to that of releasing the setting-gage after the stop has reached its set position, inasmuch as the force of impact of the setting-gage against its stop may conceivably vitiate the accuracy of that operation by compressing the line to varying extents in accordance with the varying leverages at the different positions of the fulcrum.

In these and many other obvious ways the features of this invention are susceptible of a considerable degree of modification and of a far more extended application than is or can be herein shown, since a description and

illustration of the diverse applications that might be made of them would unduly extend this specification. They may, for example, be applied to type-writing, type-casting, matrix-making, and linotype machines, and the claims should be read in the light of this applicability of these devices to other branches of the art.

I claim as my invention—

1. A line-carrying device, consisting of two detachably-connected sections, with means for detaching the connection at a suitable or desired point in their line-carrying movement, whereby one section may continue without the other.

2. A line-advancing device made in two sections with a detachable connection, means for moving one of the sections through its desired stroke, and means for detaching the connection at a desired point in its movement, whereby the detached section is released from further movement.

3. A line-elevating device made in two sections detachably connected, each section being provided with means for engaging a separate line of type, means for moving one of the sections through the longest stroke required for its line of type, and means for detaching the other section when its line arrives at its desired position.

4. In combination with a type-containing channel, a line-elevating device located adjacent thereto and fitted to travel substantially parallel therewith, consisting of two detachably-connected sections, each provided with devices for engaging with the type in the channel, means for moving one of the sections through the longest stroke required for the line of type carried by it, and means for detaching the other section therefrom when its line of type arrives at its desired position.

5. In combination with a type-containing channel, an advancing device for the type-lines thereof, consisting of two detachably-connected line-grabs fitted to slide adjacent to and substantially parallel with the type-channel, each grab being provided with type-engaging devices, a crank operatively connected with one of the grabs, for moving it through a reciprocating stroke of an extent required by its line, and means for disengaging the other grab therefrom when its line arrives at its desired position.

6. In combination with a type-containing channel provided with the desired measuring zone, a line-elevating device for advancing the succeeding lines of type into and out of that measuring zone, consisting of two detachably-connected line-grabs, provided with pawls for engaging with their respective succeeding lines of type, a crank connected with the lower or rearmost grab and imparting to it a reciprocating stroke extending from the measuring zone rearwardly along the channel to the point at which it receives its lines of type, with means for detaching the upper or foremost grab when its line of type is carried out of the measuring zone, whereby the foremost grab is enabled to return to its rearward position while the other grab is completing its more extended stroke.

7. In a type-justifying machine, in combination with the type-containing channel thereof, having the described measuring zone, a line-elevating device, consisting of two detachably-connected line-grabs, each provided with pawls for engaging with their respective succeeding lines of type, a crank attached to an intermittently-rotating line-shaft and operatively connected with the lowermost or rearward grab, and imparting thereto a reciprocating movement extending from the measuring zone rearwardly along the type-channel to the position at which it receives its succeeding type-lines, the foremost grab being moved by the following grab far enough to carry its line of type out of the measuring zone, with means for releasing it from the following grab when its desired stroke is completed, the crank being so located upon the line-shaft as to hold a line of type immediately below the measuring zone during each intermission in the rotation of the line-shaft in readiness to be immediately carried into the measuring zone at the commencement of the next rotation.

8. In combination with the line mechanism of a machine of the class specified, comprising all the devices which must be set to positions varying in accordance with the number of spaces in the line to be justified, a universal setting-shaft operable by the separators, and operatively connected with each of the stops for the aforesaid devices, whereby the latter are all set simultaneously to their respective positions for that line.

9. In combination with line mechanism comprising the described devices which must be varied in position in accordance with the number of words in each line to be justified, a setting-stop for each of said devices, and a universal setting-shaft operatively connected with each setting-stop and operable by the passing separators of the current line, with means for returning the setting-shaft to its initial position before the completion of the current line, to allow it to be set by the succeeding line.

10. In combination with line mechanism comprising the described devices which must be varied in position in accordance with the number of words in each line to be justified, a setting-stop for each of said devices and a universal setting-shaft operatively connected with each setting-stop and operable by the passing separators of the current line, with means, operable with the line-shaft, for posi-

tively returning the setting-shaft to its first position before the completion of the current line.

11. In combination with a type-channel adapted to guide a line of type and its endwise-projecting separators, a shaft journaled transversely to the channel, with its axis substantially parallel with the longitudinal position of the type thereof, a pair of ratchets attached to or integral with the shaft, located upon opposite edges of the channel with their teeth projecting into the path of movement of the projecting separators, whereby the ratchet-shaft is positively and equally actuated by the opposite ends of the separators.

12. The combination of a type-containing channel adapted to guide character type in alinement, and having openings in its end walls for the passage of projecting type-separators, a shaft 97 journaled adjacent to the channel, and substantially parallel with the type and separators therein, the ratchets 98 and 99 fixed to or integral with the shaft, and located upon opposite ends of the channel with their teeth projecting into the path of movement of the ends of the type-separators, for the purpose specified.

13. An index for the rotative position of the setting-shaft, consisting of a collar attached to or integral with the shaft, and provided with the series of indexing pins or projections arranged spirally upon the collar and substantially radial thereto, and a stop fitted to move parallel with the axis of the shaft, in engaging relation to the index-pins.

14. In combination with the setting-shaft, provided with spirally-arranged index-pins, a stop fitted to move substantially parallel with the shaft so as to engage with the successive pins of the spiral series, and means as a spring, for rotating the shaft so as to bring the successive pins of the spiral series into engagement with the stop as the latter is moved.

15. A setting-shaft, provided with a spiral series of indexing pins or projections, a stop located in engaging relation to the pins and movable longitudinally of the shaft so as to bring the stop successively beneath the pins of the spiral series, a type-channel for guiding a line of type and its separators, and means operable by each passing separator to move the stop longitudinally of the shaft to an extent equaling the longitudinal separation of the index-pins.

16. A setting-shaft, provided with a spiral series of indexing pins or projections, a stop located in engaging relation to the pins and movable longitudinally of the shaft so as to bring the stop successively beneath the pins of the spiral series, a type-channel for guiding a line of type and its separators, means operable by each passing separator to move the stop longitudinally of the shaft to an extent equaling the longitudinal separation of the index-pins, and means, as a spring, for rotating the shaft so as to bring each succeeding pin against the stop as the latter is moved from beneath the preceding pin.

17. In combination with a setting-shaft, provided with spirally-arranged index pins or projections, a stop located in engaging relation to the pin, and movable longitudinally of the shaft, a type-channel for guiding a line of type and its separators, a shaft mounted adjacent to the channel and having thereon a ratchet with teeth which project into the path of movement of the separators, the shaft having also fixed thereon a pinion engaging with the rack-teeth upon the stop, whereby each passing separator operates to move the stop longitudinally of the shaft to an extent equaling the longitudinal pitch of the index-pins.

18. A setting-shaft provided with a spirally-arranged series of indexing pins or projections, a stop located in engaging relation to the pins and movable longitudinally of the shaft, the pin-engaging surface of the stop being of a length exceeding the longitudinal pitch of the index-pins, whereby the stop remains in engagement with the first index-pin during a plurality of its actuations.

19. In a line-measuring device, a movable jaw provided with steps adapted to compensate for and eliminate from the resultant measurement the extraneous matter contained in the line, a spiral cam operatively connected with the movable jaw, and operable by the extraneous matter, for moving into engaging relation to the line the proper step of the jaw.

20. In the line-measuring mechanism of a type-justifying machine, a movable jaw provided with steps, each corresponding in height to the thickness of the separators contained in the line, a setting-shaft operable by each of the special separators, and a spiral cam operable with the setting-shaft, engaging with the movable jaw, and moving into engaging relation to the line the step thereof which is suitably related to the number of separators contained in each line.

21. In a type-justifying machine, the combination of a measuring-beam, a setting-gage, a single fulcrum-piece for pivotally supporting the beam, and movable longitudinally thereof to different positions relative thereto, and a stop for the setting-gage operatively connected with one end of the beam, and mounted to move in tangential relation thereto.

22. In a type-justifying machine, the combination of a measuring-beam, a fulcrum for pivotally supporting the beam, and movable longitudinally thereof to different positions relative thereto, a setting-gage stop connected with one end of the beam and mounted to move in tangential relation thereto.

23. In a justifying device, the combination of a gage for determining the widths of

justifying-spaces, a lever having one end operating on the gage, a device arranged to measure the line and to operate upon the other end of the lever, and means for applying different fulcrums to said lever, depending upon the number of spaces in the line, substantially as described.

24. In a justifying device a measuring-beam and means for supporting the beam at different fulcrum-points, in accordance with the number of spaces in the lines to be justified.

25. In a justifying device the combination of a measuring-beam and means for supporting the beam at different fulcrum-points located at fractional portions of the full length of the beam in accordance with the fractional subdivisions into which the shortage of the line is to be divided.

26. In a justifying device the combination of means for determining the widths of justifying-spaces, a beam having one end operatively connected with the width-determining means, a device for measuring the composed line of type and operating upon the other end of the beam, and means of supporting the beam at the different fulcrum-points in accordance with the number of spaces in the line to be justified.

27. In a justifying device, the combination of a measuring-beam, means for supporting the beam at different fulcrum-points, and a rotatable shaft provided with a spirally-arranged series of indexing-stops for determining the required fulcrum-point for each line in accordance with the word-spaces thereof.

28. In a justifying device, the combination of a measuring-beam, means for supporting the beam at different fulcrum-points, a rotatable shaft provided with a spirally-arranged series of indexing-stops for determining the required fulcrum-point, and means for setting the indexing-stops in accordance with the number of word-spaces in the line to be justified.

29. The combination with ways, of devices for measuring a line of type for justification consisting of an abutment movable in a plane transverse to the ways and arranged to be temporarily interposed in the path of said type, a sliding head movable in the direction of the ways and adapted to compact the type against said abutment, means for forcibly pressing the head against the line, and means for interposing the abutment before and for withdrawing the abutment after the line has been measured, substantially as described.

30. In a type-justifying mechanism, the combination with ways and means for feeding a line of type and temporary spaces along said ways, of devices reciprocating longitudinally of the ways for parting the line at each temporary space, and means for inserting a justifying-space into the opening formed in the line, substantially as described.

31. In a type-justifying mechanism, the combination with ways and means for feeding a line of type and temporary spaces along said ways, of a device reciprocating longitudinally of the ways arranged to engage and move each temporary space, thus parting the line, means for ejecting said space from the line, and means for inserting justifying-spaces into the opening formed in the line, substantially as described.

32. In combination with measuring devices, a stop operable therewith, and a setting-gage coengaging with the stop by means of surfaces which are disposed upon the stop and the gage in diverging V-shaped relation to their respective directions of movement.

33. In combination with a movable stop, a setting-gage movable transversely thereto, and having a gaging-surface disposed in a plane which is inclined both longitudinally and transversely to a plane common to the respective directions of movement of the gage and its stop.

34. A setting-gage having gaging-surfaces which are inclined to each other both longitudinally and transversely with relation to its plane of movement.

35. In combination with the measuring devices, a longitudinally-movable setting-gage, having oppositely-disposed gaging-surfaces which are inclined to each other in substantially a V-shaped form in transverse section, and which also diverge longitudinally of the setting-gage.

36. In combination with the measuring devices, a longitudinally-movable setting-gage, having oppositely-disposed gaging-surfaces which are inclined to each other in substantially a V-shaped form in transverse section, and which diverge symmetrically with relation to the direction of movement of the gage.

37. In a type-justifying machine, in combination with the measuring devices thereof, a selector-setting gage therefor, means for moving the setting-gage to the extent determined by the measuring operation, and means for returning the setting-gage to its first position immediately thereafter to permit of an immediately-succeeding operation of the measuring devices.

38. In combination with line-measuring devices, a stop operable therewith, provided with a stopping or gaging surface, inclined to the direction of its movement, and a selector-setting gage movable transversely to the direction of movement of the stop and engaging with the said inclined surface thereof.

39. In a type-justifying machine, in combination with the selector-setting mechanism, and the line-measuring devices, a setting-gage for the selector-setting mechanism, and a stop operable with the measuring de-

vices, the coengaging surfaces of the setting-gage and the stop being inclined to their respective directions of movement, whereby the gage is set to positions having a constant relation to the measured shortage of the lines.

40. In combination with line-measuring devices, a stop and means operable therewith for moving the stop to a position having a constant relation to the aggregate shortage of the line divided by the number of spaces therein, and a setting-gage having an inclined surface for engaging with a correspondingly-inclined surface of the stop, whereby the varied settings of the latter serve to stop the gage at correspondingly-varied positions.

41. In combination with line-measuring devices, a stop operable therewith, and selector-setting means movable transversely to the direction of movement of the stop, and engaging therewith, by means of surfaces which are inclined to the direction of movement of each part and to their common plane of movement.

42. In combination with line-measuring devices, a stop operable therewith, and a setting-gage for the selecting mechanism, movable transversely to the direction of movement of the stop, and engaging therewith by means of oppositely-disposed gaging-surfaces which are inclined to each other in substantially a V-shaped form, in transverse section, and which diverge with relation to the direction of movement of the setting-gage.

43. In combination with line-measuring devices, a stop and means operable with the measuring devices for imparting to the stop movements bearing a constant relation to the measured deficiency of each space in the line, and a selector-setting gage movable transversely to the direction of movement of the stop and engaging therewith by means of oppositely-disposed gaging-surfaces, which are symmetrically inclined to each other in substantially a V-shaped form both transversely and longitudinally of the direction of movement of the setting-gage.

44. In combination with the line-measuring devices, the stop 134 and the setting-gage 135, provided with the gaging-surfaces 136 and 137 symmetrically disposed in opposite compound inclinations to the common plane of movement of the stop and the gage.

45. In combination with line-measuring devices, a stop operable therewith, a selector-setting gage, and means for moving the gage into contact with the stop at the conclusion of each line-measuring operation.

46. In combination with the line-measuring devices, a stop operable therewith, a selector-setting gage, means for holding the gage away from the stop during the line-measuring operation, and for bringing it against the stop at the conclusion of that operation.

47. In combination with the line-measuring devices, a stop operable therewith, a selector-setting gage for coöperating with the stop, means for bringing the gage against the stop at the conclusion of the line-measuring operation, and for removing it therefrom to permit of the succeeding line-measuring operation before completing the current line.

48. In combination with line-measuring devices, a stop and a setting-gage operable therewith, and a selector-setting slide operable with the setting-gage.

49. In combination with line-measuring devices, a stop and a setting-gage operable therewith, a selector-setting slide and adjustable means between the setting-gage and the slide for moving the latter to its required position.

50. In combination with line-measuring devices, a stop, a setting-gage and selector-setting slide operable therewith, with means, as a pawl, for retaining the selector-setting slide in substantially the extreme position to which it is moved by the setting-gage.

51. In combination with the measuring and selector-setting devices, a selector-setting slide provided with a stepped selector-supporting rack, and provided with detent-teeth spaced in coincident relation to the steps of the rack, with a detent-pawl engaging with the teeth and retaining it in substantially the farthest position to which it is moved as a result of the measuring operation.

52. In combination with a series of selecting-fingers, a selector and a setting-rack therefor provided with a series of steps corresponding in pitch with the selecting-fingers, for supporting the selector in operative relation to the desired selecting-finger.

53. In combination with a series of selecting-fingers, a selector, means as a cross-head on which the selector is mounted, and a setting-rack provided with a series of steps corresponding in pitch with the selecting-fingers for supporting the cross-head and its selector in operative relation to the desired selecting-finger.

54. In a constantly-running spacer-selecting device, a selector, and means for moving the selector out of operative position at the desired intermissions in the selecting operation.

55. In combination with the selecting-fingers, a selector therefor, and means for moving the selector out of operative relation to the selecting-fingers, at predetermined intervals to arrest the selecting operation.

56. In combination with continuously-operating spacer selecting and ejecting mechanism, a selector therefor, and means for moving the selector out of operative relation to the mechanism at the desired intermissions in the selecting and ejecting operations.

57. In combination with continuously-operating spacer selecting and ejecting mech-

anism, a selector, and a movable cross-head on which the selector is mounted, with governing mechanism for moving the selector out of operative relation to the spacer selecting and ejecting devices at the desired intermissions in their operation.

58. In a combination of continuously-operating spacer selecting and ejecting mechanism, a series of selecting-fingers, a selector for moving the selecting-fingers singly into engagement with their respective ejecting devices, and means for moving the selector out of operative relation to the fingers at the desired intermissions in the selecting and ejecting operations.

59. In combination with a series of selecting-fingers, a selector therefor, movable along the series of fingers, a selector-setting rack movable in a direction transverse to that of the selector, and provided with a series of steps corresponding in pitch to that of the selecting-fingers, and means intermediate the rack and the selector for supporting the latter upon one of the steps of the rack.

60. In a type-justifying machine, in combination with the spacer-selecting devices, comprising a series of selecting-fingers, and a selector therefor, a setting member, as the slide 145, having a direction of movement transverse to that of the selector of an extent determined by the measuring devices of the machine, provided with a repeated series of setting-racks, each consisting of an inclined series of steps corresponding in height with the series of selecting-fingers, the corresponding steps of the repeated series lying in coincident planes parallel to the direction of movement of the setting member.

61. A selector-setting device, as the slide 145, comprising in a unitary element a series of stepped selector-setting racks, and a corresponding series of stepped basic table-supporting planes.

62. In a type-justifying machine, in combination with the selector and the basic table thereof, a series of stepped supporting-racks for the selector, and a corresponding series of stepped planes for setting the basic table, arranged and operating to lower the basic table to an extent equaling the thickness of one of the basic spacers thereof, as each succeeding setting-rack of the series is brought beneath the selector.

63. In a type-justifying machine, in combination with the selector and the basic table thereof, a selector-setter, as the slide 145, movable transversely to the line of movement of the selector and the basic table, comprising a series of setting-racks for the selector and a corresponding series of supporting-planes for the basic table, arranged and operating to bring the successively lower planes beneath the basic table as the corresponding setting-racks are successively brought beneath the selector.

64. In a type-justifying machine, in combination with the measuring devices, and with the spacer-selecting mechanism thereof, the latter comprising a selector and a basic table, a selector-setting rack operable with the measuring devices, and provided with a series of stepped setting-racks for the selector, and with a correspondingly-spaced series of stepped supporting-planes for the basic table, the succeeding lower planes of which are beneath the basic table when the corresponding succeeding setting-racks are beneath the selector.

65. In a type-justifying machine, in combination with the spacer-selecting mechanism thereof, comprising selecting-fingers, a selector therefor, and a basic table, a series of selector-setting racks each provided with a series of steps, corresponding in number and height with the selecting-fingers, for supporting the selector in operative relation to the desired finger, and a series of basic table-supporting planes of differing heights.

66. In a type-justifying machine, in combination with the spacer-selecting devices thereof, comprising selecting-fingers, a selector therefor, and a basic table, a selector-setting device, as the slide 145, movable in a direction transverse to that of the selector and of the basic table, provided with a repeated series of selector-setting racks, each rack comprising a series of steps corresponding in number and height to the selecting-fingers, and with a corresponding series of stepped supporting-planes for the basic table, the length of each supporting-plane being substantially equal to that of its setting-rack, whereby the succeeding lower supporting-planes are brought beneath the basic table, as the correspondingly-succeeding series of setting-racks are brought beneath the selector.

67. The combination in spacer-selecting mechanism, of a basic table, and of a stop therefor operatively connected with the selecting devices, a cam for raising the basic table at each operation of the selecting devices to allow of the resetting of the stop, and for lowering the table to its stop immediately thereafter.

68. The combination, in spacer-selecting mechanism, of a basic table, and a stop therefor operatively connected with the selecting devices, and a reciprocating cam for engaging with the basic table, operating to close it against its channel upon the forward stroke of the cam, and to lower it again to its stop at the conclusion of said forward stroke.

69. The combination in spacer-selecting mechanism, of a series of selecting-fingers, a basic table, a stop therefor, operable with the selecting-fingers, a reciprocating carriage upon which the selecting-fingers are mounted, and a switch-cam for engaging with and raising the basic table upon the forward movement of

the selecting-fingers to allow of the resetting of the stop, operating at the completion of the said forward movement to let the basic table drop again to the position determined by its reset-stop.

70. In a type-justifying machine, in combination with the basic table, means for elevating or closing the basic table against its channel at the conclusion of each line.

71. In combination with continuously-operating spacer-selecting devices, a basic table and means for holding the basic table out of operation at the conclusion of each line, and until the succeeding spacer combination is wanted for the next line.

72. In a type-justifying machine, in combination with continuously-operating spacer-selecting devices, a basic table and means for holding the basic table closed against its channel and out of operation at the conclusion of the justification of each line, and until the appropriate period in its operation upon the succeeding line.

73. In a type-justifying machine, a basic-spacer-containing channel, a basic table therefor, a continuously-operating basic-spacer extractor, and means for closing the basic table against the channel so as to hold the spacers therein above the reach of the extractor during the operations thereof which intervene between the completion of one line and the commencement of the next.

74. In a type-justifying machine, a basic-spacer-containing channel, a basic table therefor, a continuously-operating basic-spacer extractor, governing mechanism, and means operable therewith for closing the basic table against the channel so as to hold the spacers therein above the reach of the extractor during the operations thereof which intervene between the completion of one line and the commencement of the next.

75. In a type-justifying machine, in combination with the measuring and spacer-selecting mechanisms thereof, a basic table, a setting-slide therefor operable with the measuring devices, and a stop operable with the selecting devices, means for relieving the slide and the stop from the basic table while the slide is being reset by the selecting devices.

76. In a type-justifying machine, in combination with the measuring and spacer-selecting mechanism thereof, a basic table, a stop therefor operatively connected with the selecting devices, a shoe for the basic table and a setting-slide operable with the measuring devices, provided with a series of stepped planes for supporting the basic-table shoe, with means substantially as described for raising the basic table away from its stop at each operation of the selecting devices to allow of the possible resetting of the stop, and means for raising the basic-table shoe above the highest stepped plane of the setting-slide at each measuring operation to allow the slide to be reset thereby.

77. In a type-justifying machine, the combination of spacer-selecting mechanism, a raceway, a basic table adjacent thereto, means for assembling the selected spaces upon the basic table, and a yieldingly-mounted presser-foot located above the basic table, for engaging with and holding together the assembled spacer combination.

78. In a type-justifying machine, in combination with the spacer assembling and injecting mechanisms thereof, a basic table for supporting the spacer combination in proper relation to the injecting zone, and a yielding presser-foot for resiliently pressing the spacer combination against the surface of the table during the injecting operation.

79. In a type-justifying machine, in combination with the selector-setting mechanism thereof, comprising a stepped setting-rack, a correcting-rack provided with a series of steps corresponding to, but relatively finer than, those of the selector-setting rack, a selector operable with the steps of the setting-rack, and a correcting device, operable with the steps of the correcting-rack.

80. In a type-justifying machine, in combination with the selector-setting devices thereof, comprising a stepped rack and a selector-foot engaging therewith, a correcting-slide, and a correcting-rack therefor attached to or integral with the selector-setting rack.

81. In a type-justifying machine, the combination in the spacer selecting and correcting devices thereof, of a selector, a supporting cross-head therefor, a correcting-slide mounted upon the cross-head, and determining by its displaced position releative thereto the desired amount of correction, and a pair of stepped racks movable in a direction transverse to that of the cross-head and the correcting-slide, and provided with a series of steps for supporting the cross-head and the correcting-slide respectively, arranged to support them without relative displacement when no correction is required, and otherwise to displace them to extents directly proportional to the required correction.

82. In a type-justifying machine, in combination with the measuring devices and with the spacer-selecting devices thereof, a setting-rack provided with a series of steps of a number and height corresponding with the selecting-fingers, and a correcting-rack provided with steps of a number equaling a multiple of the number of steps in the selector-setting rack, and arranged serially in relation to each of the steps thereof, a selector, operatively connected with the steps of the selecting-rack, and held thereby in operative relation to the required selecting-fingers, and a correcting device operatively connected with and supported by the finer teeth of the correcting-rack in a relation to

the selector which remains constant when no correction is required, and which when a correction is required, is displaced to an extent directly proportional to the amount of that required correction.

83. In a type-justifying machine, in combination with the selector cross-head and the correcting-slide, a setting member, as the slide 145, provided with a series of stepped setting-racks for the cross-head and a corresponding series of setting-racks each provided with a series of steps for each single step of the selector-setting rack, and adapted to support the correcting-slide in a constant relation to the cross-head when no correction is required, and in a displaced relation thereto when correction is required, that displacement being directly proportional to the extent of required correction.

84. In a type-justifying machine, in combination with the spacer selecting and correcting devices thereof, a setting member as the slide 145, provided with repeated series of stepped inclines for setting the spacer-selecting devices, and provided with a corresponding series of stepped inclines for setting the correcting devices, having a series of its steps in substantial coincidence with each of the steps for the selector setting devices.

85. In combination with a continuously-running driving-shaft, a line-shaft, coengaging clutches therefor, means for disengaging the clutches at the completion of each rotation of the line-shaft, a controller and means intermediate the driving-shaft, the line-shaft and the controller for starting the line-shaft on its succeeding rotation at or near the completion of each operation of the controller.

86. The combination of a continuously-rotating driving-shaft, an intermittently-rotating line-shaft, a controller detachably operable with the driving-shaft, means intermediate the line-shaft and the controller for engaging the latter with its driving-shaft before the completion of each rotation of the line-shaft, and means intermediate the controller and the line-shaft for starting the latter upon its succeeding rotation at or near the completion of each operation of the controller.

87. The combination of a continuously-running driving-shaft, a line-shaft provided with a shiftable clutch for engaging and disengaging with the driving-shaft, means for disengaging the said clutch at the completion of each rotation of the line-shaft, a controller, and means intermediate the controller and the clutch for moving the latter into engagement with its clutch at the desired times.

88. In a type-justifying machine, comprising a continuously-running driving-shaft and word mechanism, a line-shaft provided with a shiftable clutch for engaging with and disengaging from the driving-shaft, means for disengaging the clutch at the conclusion of each rotation of the line-shaft, and a controller for releasing the clutch from disengagement and permitting it to reëngage with the driving-shaft before the completion of the justification of the line.

89. The combination with a driving-shaft and an intermittently-rotating line-shaft, of a longitudinally-shiftable clutch mounted thereon and provided with an inclined shoulder and a shoulder-pin for engaging with the clutch to shift it longitudinally on its shaft, and thereby disengage it from the driving-shaft at the desired intermissions.

90. The combination with a continuously-rotating driving-shaft, and an intermittently-rotating line-shaft, of a longitudinally-shiftable clutch mounted upon the line-shaft and provided with an inclined shoulder, a retractable clutch-pin for engaging with the inclined shoulder of the clutch to disconnect it from the driving-shaft at the desired intermissions, and a controller for retracting the pin so as to disengage its clutch and allow it to reëngage with the driving-shaft.

91. The combination with a continuously-rotating driving-shaft, and an intermittently-rotating line-shaft, of a clutch carried by the line-shaft and shiftable into and out of engagement with the driving-shaft, a retractable clutch-pin for shifting the clutch out of engagement with the driving-shaft at the desired intermissions, and a controller operable with, and set by, the number of spaces in the line to be justified, arranged and operating to retract the clutch-pin, and start the line-shaft upon its succeeding rotation at a predetermined point in the justification of the current line.

92. In combination with the driving-shaft, the line-shaft, and a shiftable clutch therefor, a retractable clutch-pin for shifting the clutch out of engagement to cause the desired intermissions in the line-shaft, and a cam operable with the controller for retracting the pin and starting the line-shaft upon its succeeding rotation for operation upon the succeeding line, at the desired period in the justification of the current line.

93. In a type-justifying machine, in combination with the driving-shaft, the line mechanism, and a shiftable clutch therefor, a retractable clutch-pin for shifting the clutch to stop the line mechanism, a controller set to positions directly related to the number of spaces in the current line, and a cam operable with the controller for retracting the clutch-pin and starting the line mechanism into operation upon the succeeding line at the desired period in the justification of the current line.

94. In a type-justifying machine, in combination with the line mechanism, a driving-shaft, and a shiftable clutch therefor, a retractable clutch-pin for shifting and for releasing the clutch, a retracting-cam for the

clutch-pin journaled concentrically therewith, and a controller operable with the spaces in the line, and operably connected with the retracting-cam for rotating the latter and thus starting the line mechanism into operation upon the succeeding line at the desired period in the justification of the current line.

95. The combination of a retractable clutch-pin, a clutch-releasing cam therefor journaled in substantial concentricity with the pin, and engaging therewith by means of oppositely-disposed spiral wings, having a recess between them for the return movement of the pin, and means for imparting a half-rotation to the cam when it is desired to retract the pin.

96. The combination of a retractable clutch-pin, mounted to slide without rotating, a clutch-releasing cam journaled substantially concentric with the pin, and provided with oppositely-disposed spiral wings for engaging with and moving the pin longitudinally to the desired extent, and means for imparting forward intermittent half-rotations to the cam at the desired intervals.

97. In combination with the controller, a stop therefor operable with the word spaces or separators, and provided with detent notches or teeth, a detent for engaging with the notches and supporting the stop at the succeeding positions to which it is moved in its setting operation, and means operable with the word separators or spaces for withdrawing the detent from the stop at the commencement of each succeeding stop-setting operation.

98. In combination with the controller, a stop therefor, provided with detent teeth or notches, a stop-rack operable by the word separators or spaces, and upon which the stop is loosely supported, a detent for engaging with the teeth of the stop and supporting it in the highest position to which it is set for the current line, and means operable with the stop for withdrawing the detent from its teeth at the commencement of each setting operation, whereby the stop is permitted to fall to its lowest position, for the purpose specified.

99. The combination of a controller, a pawl mounted thereon, a rotating ratchet-wheel journaled concentrically with the controller in engaging relation to the pawl, and a non-rotatable, longitudinally-movable cam adapted to disconnect the pawl from its driving-ratchet at the desired stopping position of the controller, the cam being provided with a shoulder substantially concentric with the axis of the controller, and engaging with the pawl thereof to hold it out of engagement with its driving-ratchet during the backward or setting movement of the controller.

100. The combination of a controller, a pawl mounted thereon, a rotating ratchet journaled in engaging relation to the pawl, a non-rotating cam mounted to reciprocate toward and from the pawl, provided with a cam portion for releasing the pawl from its driving-ratchet at the desired stopping position of the controller, and provided with a concentric annular shoulder 322 for holding the pawl out of engagement with its ratchet during the resetting operation, the reciprocation of the cam being timed so as to engage and release the pawl at the desired periods.

101. In combination with the word mechanism of a machine of the class specified, comprising all the devices which repeat their operation for each word of the line to be justified, a universal driving device therefor, as the carriage 230, mounted to reciprocate to the desired extent, and operatively connected with each of the said devices.

102. A mechanism for justifying a composed line of type comprising a device for measuring an unjustified line to ascertain the total shortage, and lever devices for dividing the said shortage by the number of word-spaces in the line including means for varying the position of the fulcrum relatively to the other lever elements and means for rocking the lever after the fulcrum is positioned.

103. In a justifying mechanism a device for measuring an unjustified line, and lever devices constructed to divide the shortage of the unjustified line by the number of word-spaces in the line including means for varying the position of the fulcrum relatively to the other lever elements and means for rocking the lever after the fulcrum is positioned.

104. In a justifying mechanism a device for measuring an unjustified line, and lever devices constructed to divide the shortage of the unjustified line by the number of word-spaces in the line according to the position of the fulcrum relatively to the other lever elements.

105. In a mechanism for justifying composed lines of type, a justifying-lever, a device in connection with said lever for measuring an unjustified line, and a fulcrum-piece movable relatively to the lever in proportion to the number of spaces in the line.

106. In a mechanism for justifying lines of type, devices for measuring an unjustified line, in combination with a lever operatively connected to said devices, and a fulcrum-piece coöperating with said lever and means for adjusting said fulcrum-piece relatively to the lever in accordance with the number of word-spaces in the line.

107. In a machine for assembling and justifying type, in combination with the composed line of type, a series of cylindrical separators of a diameter substantially the thickness of the type for temporarily preserving the separations between the words.

108. In a machine for assembling and justifying type, in combination with a com-

posed line of type, a series of cylindrical separators for temporarily preserving the separations between the words, having ends projecting beyond the type, for engaging with the devices operable by or in accordance with the number of spaces in the line.

109. In a machine for assembling and justifying type, and having devices controlled or operable in accordance with the number of spaces in each line to be justified, a series of cylindrical separators for temporarily preserving the spaces between the words, having their ends projecting beyond the type, for engaging with the said devices.

110. In combination with means for supporting a composed line of type, a measuring-beam, means for moving one end of the beam to measure the line, and means for applying a fulcrum to the beam at a suitable location thereof, for dividing the movement of the measuring end of the beam, in accordance with the number of spaces in the line.

111. The combination, with means for supporting a composed line of type, of a measuring-beam, means for applying one end of the beam to measure the shortage of the lines, and means for applying different fulcrums to the beam at suitable locations thereof, for dividing the respective shortage measurements in accordance with the number of spaces contained in the lines.

112. In a justifying device, the combination of a gage for determining the widths of justifying-spaces, a measuring-beam having one end operating on the gage, a device to measure the line and to operate upon the other end of the beam, means for applying different fulcrums to the said beam, depending upon the number of spaces in the line, and means for multiplying the movements of the gage in relation to its coöperating end of the beam.

113. In a justifying device, the combination of spacer-selecting devices, a measuring-beam, having one end operating on the spacer-selecting devices, means for controlling the opposite end of the beam by the measurement of the line, means for applying different fulcrums to the beam, according to the number of spaces in the line, and means for multiplying the movement transmitted to the spacer-selecting devices from their coöperating end of the measuring-beam.

114. In a type-justifying machine, in combination with means for measuring a composed line of type having temporary separators therein, and with justifying-space-determining devices, an eliminating device set by the separators for eliminating from the measurement and the operation of the space-determining devices a predetermined portion of the line length occupied by the temporary separators.

115. A series of spacers for forming type-justifying-space combinations, comprising a basic spacer and a number of fractional spacers progressively differing in size from the basic by an increment equaling a fractional part of the basic, the largest fractional spacer being one of the said increments smaller in size than two of the basic spacers.

116. A series of spacers for forming type-justifying-space combinations, comprising a basic spacer and fractional spacers of sizes progressively increasing by an increment equaling a fractional part of the basic, the entire number of spacers in the series equaling the number of fractional parts into which the basic is assumed to be divided as a basis for the said increment.

117. A series of spacers for forming type-justifying-space combinations, comprising a basic spacer, and three fractional spacers, which progressively increase in size by an increment equaling one-fourth the size of the basic.

118. A series of spacers for forming type-justifying-space combinations, comprising a basic spacer of a size equaling a fractional part of the size of the em of the type to be justified, and fractional spacers of sizes progressively increasing by an increment also equaling one of the said fractional parts.

119. A series of spacers and type-justifying-space combinations comprising a basic spacer and a number of fractional spacers progressively differing in size from the basic by an increment equaling a fractional part of the basic, and space combinations formed by combining one or more basic spacers with only one fractional spacer.

120. In a type-justifying machine, a measuring-beam provided at one end with type-engaging means movable to an extent represented by the shortage or required spacing of the line, and provided with a pivot adjustable to different fulcrum positions relative to the beam in accordance with the number of spaces occurring in the line, whereby the measured shortage of the line is converted into a suitably-related movement of the opposite end of the beam.

121. In a type-justifying machine, the combination of a measuring beam or lever, a fulcrum on which the beam is pivotally mounted, adapted to be moved to different positions with relation to the beam, a measuring-slide pivotally connected with one end of the beam, and a measuring-pawl mounted upon the slide and adapted to engage with the line of type.

122. In a type-justifying machine, the combination of a measuring-beam, means for determining the sizes of justifying-spacers and means intermediate the measuring-beam and the space-determining devices for multiplying the measuring movement of the beam.

123. In a type-justifying machine, the combination of a measuring-beam, a gage for

determining the width of justifying-spacers and means intermediate the beam and the gage for multiplying the measuring movement of the beam.

124. In a line-measuring device, the combination of a pair of jaws for engaging the opposite ends of the line, one of the jaws being movable laterally of the line, and provided with stepped engaging surfaces, for the purpose specified.

125. In a type-justifying machine, in the line-measuring devices thereof, a movable jaw provided with steps each corresponding in height to the thickness of the special separators contained in the line, whereby the measurement of the said separators is eliminated from the resultant measurement.

126. In a type-justifying machine, in combination with the measuring and spacer-selecting devices thereof, a selector-setting rack operatively connected with the measuring devices, provided with teeth spaced in coincident relation to the location of the spacer-selecting fingers, and with a detent adapted to engage with the teeth and support the rack in the position determined by the measuring devices.

127. In a type-justifying machine, a spacer-selector, provided with teeth suitably related to the amount of the desired correction, a pawl adapted to engage with the teeth, and to actuate the selector, and a detent adapted to detain the selector in its intermediate positions, and adapted to release the selector when the desired amount of correction is obtained.

128. In a machine of the class specified, in combination with the spacer-selecting fingers and with a selector therefor, means for moving the selector from one finger to another for the purpose specified, the selector being provided with teeth suitably related to the desired amount of movement, a pawl adapted to move the selector to the extent determined by the measuring operation, and a detent adapted to retain the selector in its intermediate positions and to release it when the desired correction is secured.

129. In a machine of the class specified, in combination with a series of spacer-selecting fingers, a selector adapted to be moved into coincident relation to either of the fingers, correcting devices, and a series of cams arranged in corresponding relation to the fingers and adapted to actuate the correcting devices, all arranged and operating to advance the selector to the next selecting-finger.

130. In a machine of the class specified, in combination with a series of selecting-fingers, and a series of cams, a reciprocating carriage on which the fingers and the cams are mounted, a selector adapted to be moved into operative relation to each of the fingers, and a correcting device adapted to engage with the adjacent cam of the series whereby the selector is advanced into engaging relation with the next higher finger of the series in accordance with the required correction.

131. In a justifying mechanism, in combination with a series of spacer-selecting members, a selector adapted to be moved into position to coact with either of said members, correcting devices, and a series of cams, all arranged and operating to advance the selector from one spacer-selecting member to the next.

132. In a machine for justifying a line of type composed with separators, means for advancing the line, in combination with a word-interval-registering device including a member moved by projecting portions of the separators in the line, as the line is advanced.

133. In a type-justifying machine, the combination with means for measuring a line of type and dividing the shortage by the number of intervals in the line, and spacer-selecting devices, of a multiplying device between the dividing device and spacer-selecting devices for multiplying the dividing movement in transmission to the spacer-selecting devices.

134. In a type-justifying machine, line-measuring devices provided with a member formed to eliminate by different portions corresponding to the number of separators a predetermined portion of the thickness of the separators in the line.

135. In a justifying mechanism, means for determining the quotient of the line shortage divided by the number of intervals in the line, means for setting a space-determining device in accordance with the integral part of said quotient, and means controlled according to the remainder part of said quotient and adapted to reset the space-determining device during the operation of justifying for spaces of another size and to return the space-determining device to its first setting after a portion of the remainder has been distributed in spaces of such other size.

136. In a justifying mechanism, devices for selecting justifying-spacers from a limited number thereof, comprising a movable selector, means for setting the selector for spacers of one size, means for resetting the selector to obtain a spacer of a different size, and means for returning the selector to position for selecting a spacer of the first size after one or more spacers of the different size have been selected.

137. In a justifying mechanism, means for computing the normal justifying-space value for a line, in combination with a selecting device arranged to select space values of given sizes, means for setting the selecting device to one of said space values, a difference device and means controlled by the difference device for resetting the selecting device during the justification of a line for the selection

of one or more of the next larger space values and returning the selecting device to continue the selection of space values of the size for which it was first set.

138. In a justifying mechanism, the combination with computing devices for computing justifying-space values from the line shortage and number of intervals, of means for selecting and combining spacers from a limited number of spacer sizes to form said justifying-space values.

139. In a type-justifying machine, the combination with computing devices for computing justifying-space values from the line shortage and number of intervals, of spacer-channels containing different sizes of spacers, means controlled by the computing devices for selecting and combining spacers from said spacer-channels to form said justifying-space values, and means for inserting said justifying-space values in the line.

140. In a type-justifying machine, the combination with computing devices for computing justifying-space values from the line shortage and number of intervals, of spacer-channels containing basic spacers and fractional spacers, means controlled by the computing devices for selecting and combining said basic and fractional spacers from said spacer-channels to form said justifying-space values, and means for inserting said justifying-space values in the line.

141. In a machine for justifying lines of type composed with temporary separators projecting from opposite sides of the line of type, a word-interval-registering device having members on opposite sides of the line of type actuated by engagement with the projecting portions of the separators.

Signed by me at Hartford, Connecticut, this 30th day of July, 1898.

WALTER JAY ENNISSON.

Witnesses:
H. MALLNER,
W. H. HONISS.