No. 844,562. PATENTED FEB. 19, 1907.

B. M. DES JARDINS.

TYPE JUSTIFYING MACHINE.

APPLICATION FILED JUNE 2, 1898.

14 SHEETS—SHEET 1.

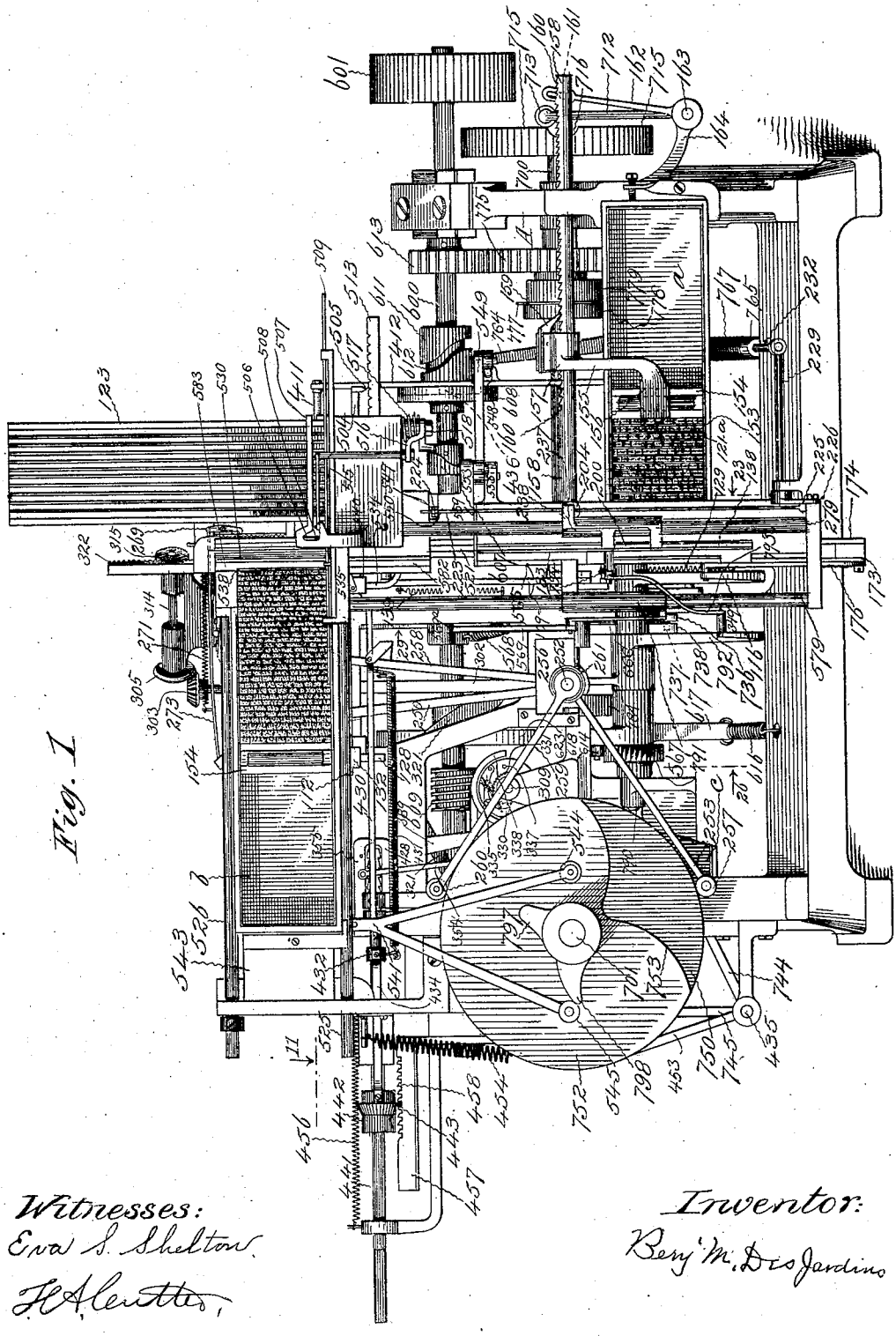

Fig. 1

Witnesses:
Eva S. Shelton.
H. A. Lentter.

Inventor:
Benj. M. Des Jardins

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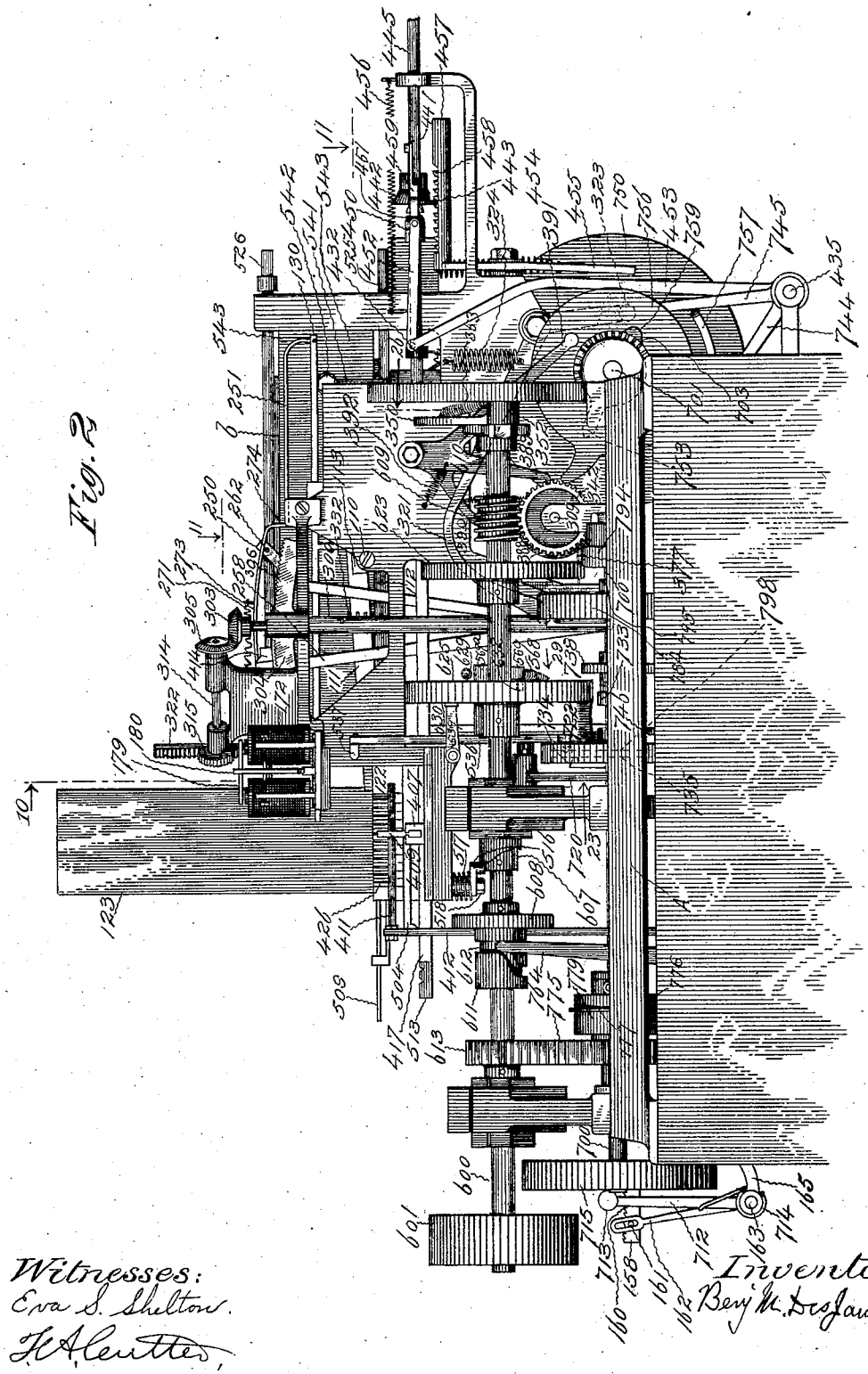
14 SHEETS—SHEET 2.

Fig. 2.



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H. A. Leuttes,

Inventor:
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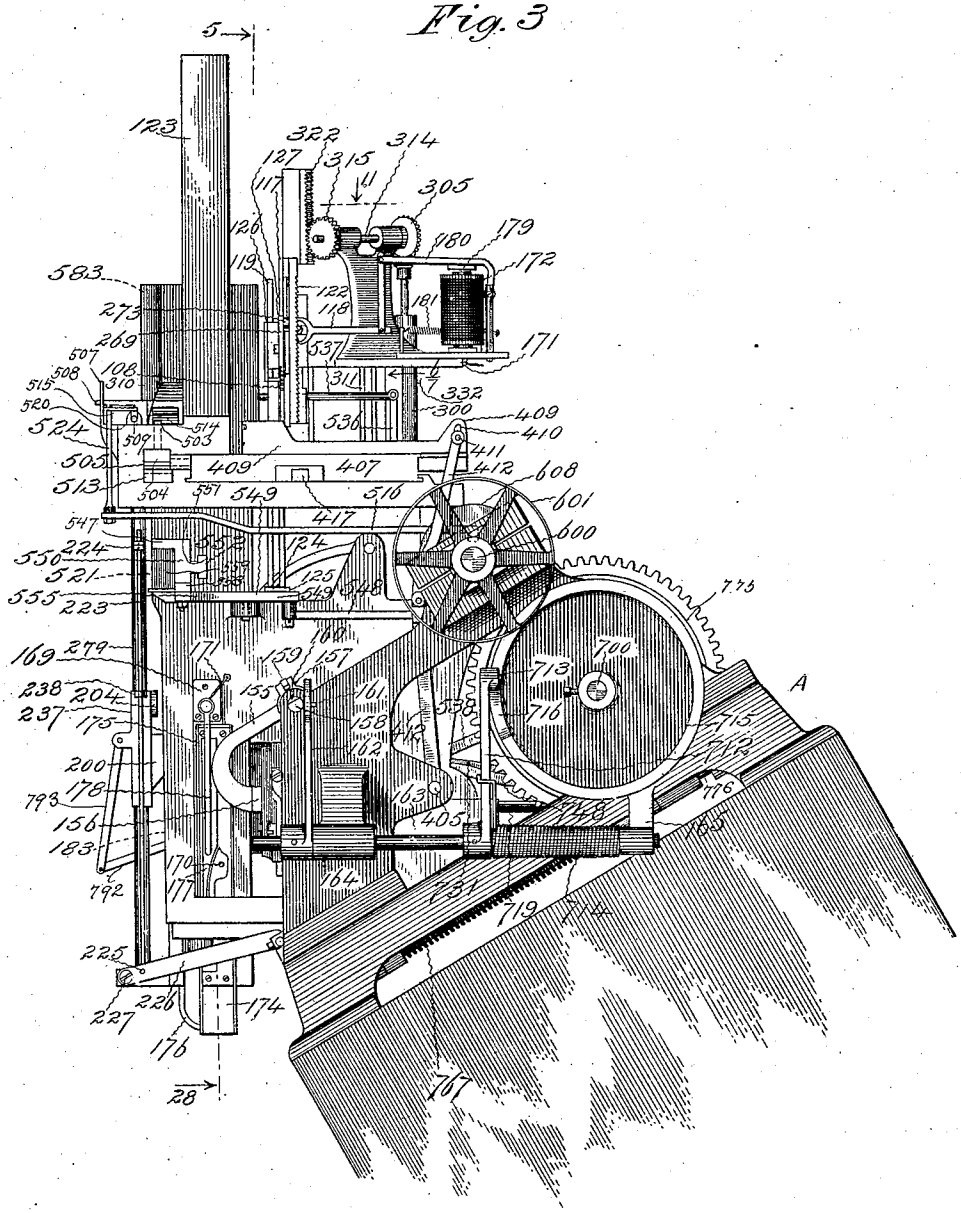
14 SHEETS—SHEET 3.

Fig. 3



Witnesses:
Eva S. Shelton.
F. A. Lentte.

Inventor:
Benj. M. DesJardins

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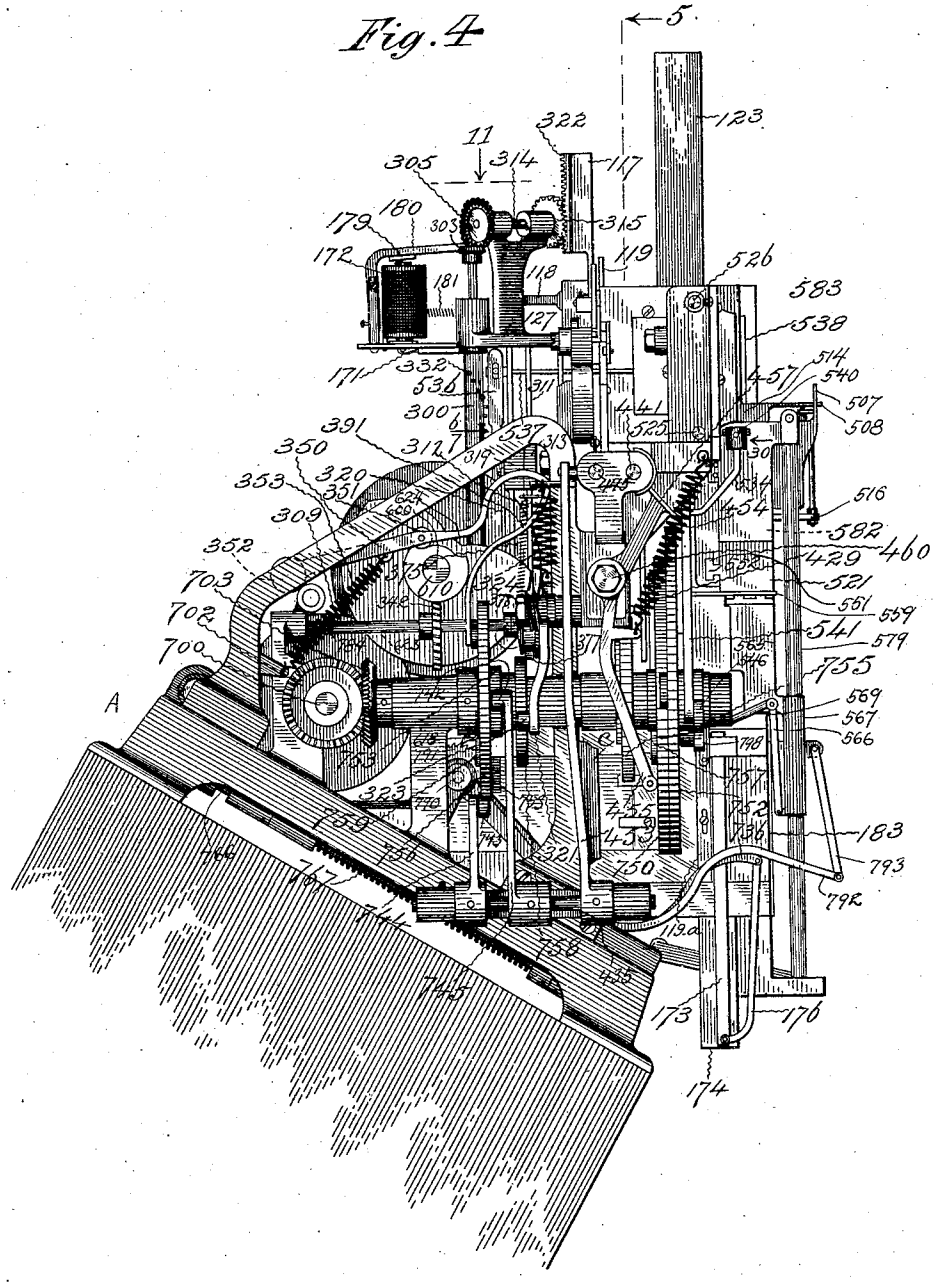
14 SHEETS—SHEET 4.

Fig. 4



Witnesses:
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Inventor:
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14 SHEETS—SHEET 5.

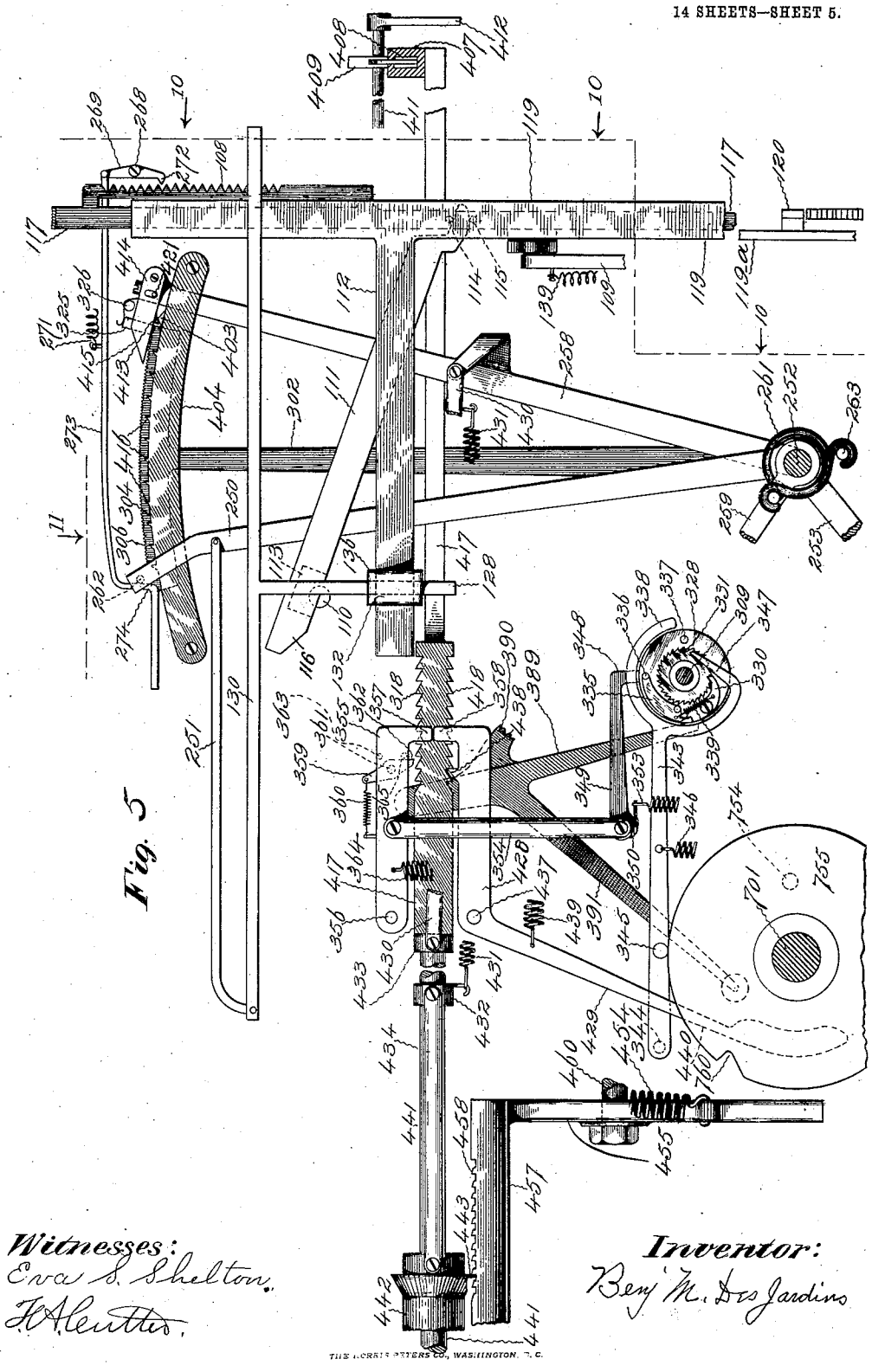

Fig. 5

Witnesses:
Eva L. Shelton.
H. A. Leuttes.

Inventor:
Benj. M. Des Jardins

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14 SHEETS—SHEET 6.

Fig. 8

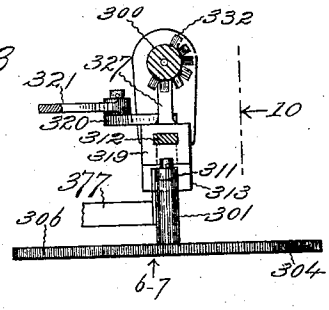


Fig. 9

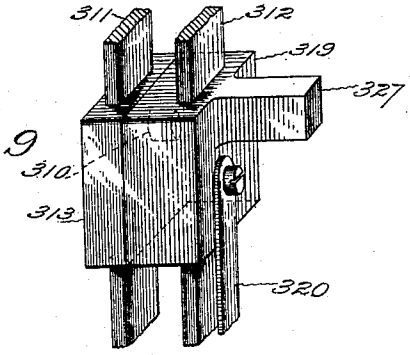


Fig. 6

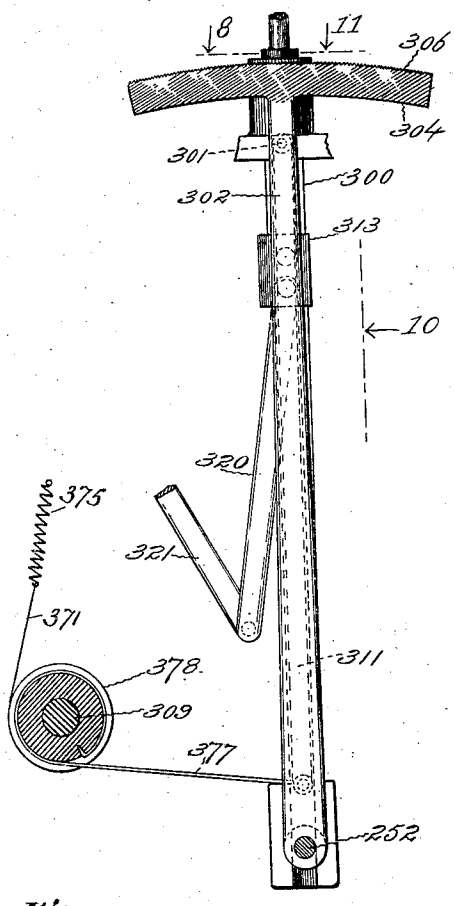
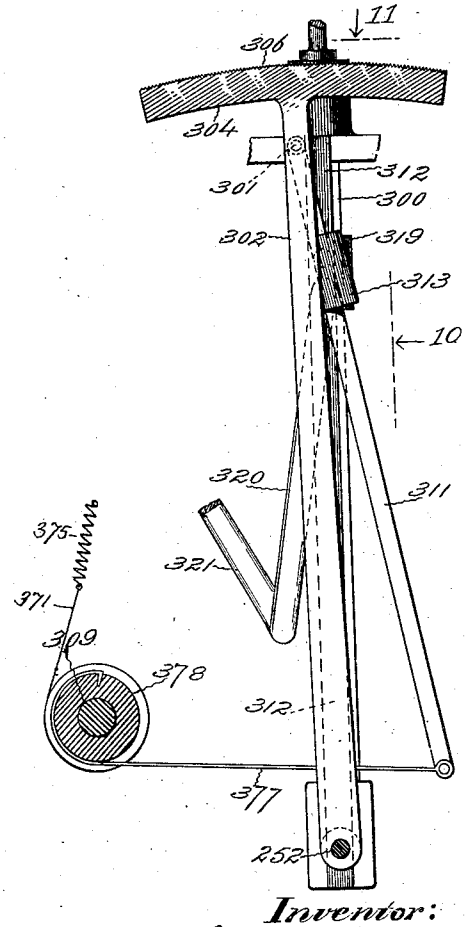


Fig. 7



Witnesses:
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H. A. Leuttes.

Inventor:
Benj. M. Des Jardins

No. 844,562. PATENTED FEB. 19, 1907.

B. M. DES JARDINS.

TYPE JUSTIFYING MACHINE.

APPLICATION FILED JUNE 2, 1898.

14 SHEETS—SHEET 7.

Fig. 12a

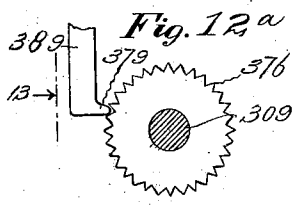


Fig. 13

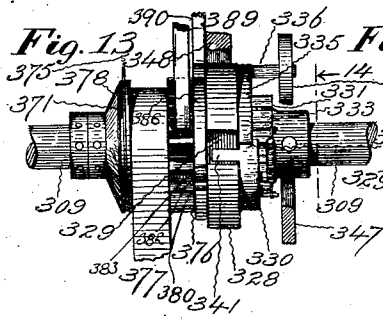


Fig. 14

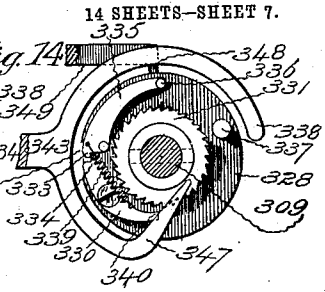


Fig. 12

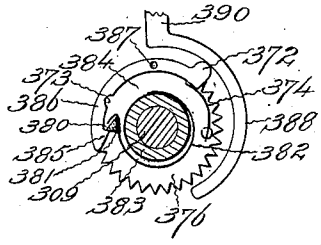
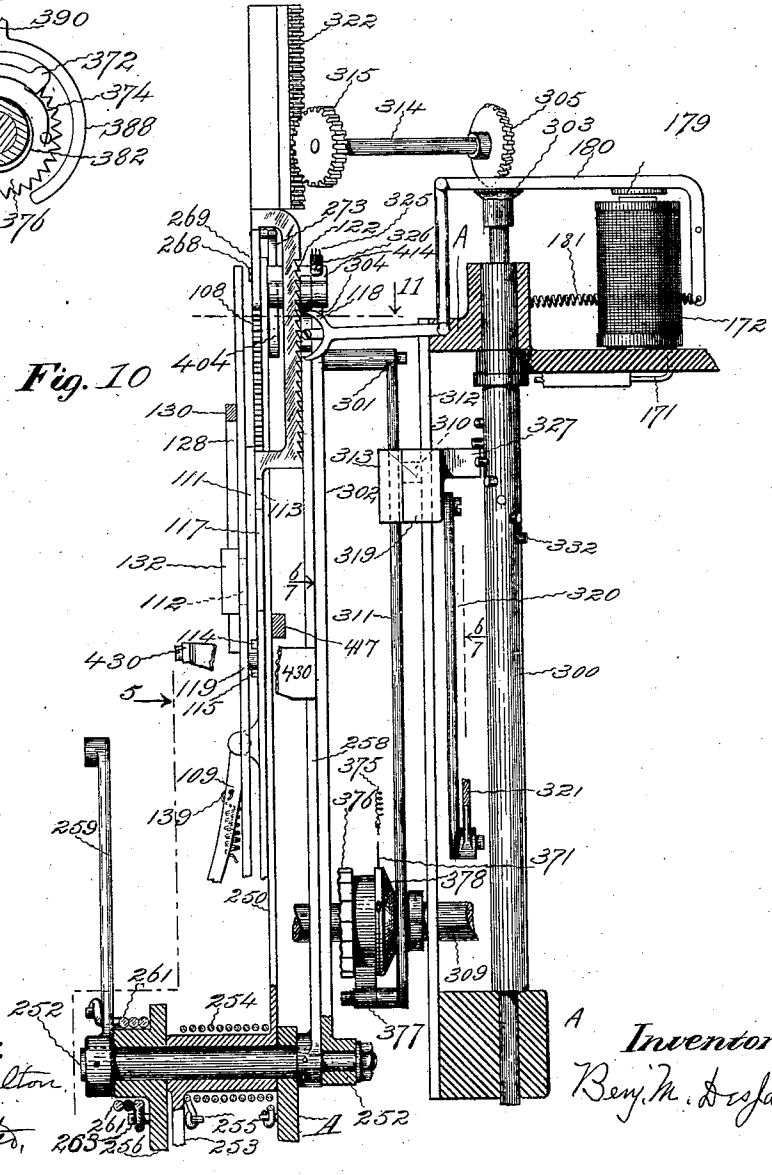


Fig. 10



Witnesses:

Eva S. Shelton.

F. A. Leutter.

Inventor:

Benj. M. Desjardins

No. 844,562. PATENTED FEB. 19, 1907.

B. M. DES JARDINS.

TYPE JUSTIFYING MACHINE.

APPLICATION FILED JUNE 2, 1898.

14 SHEETS—SHEET 8.

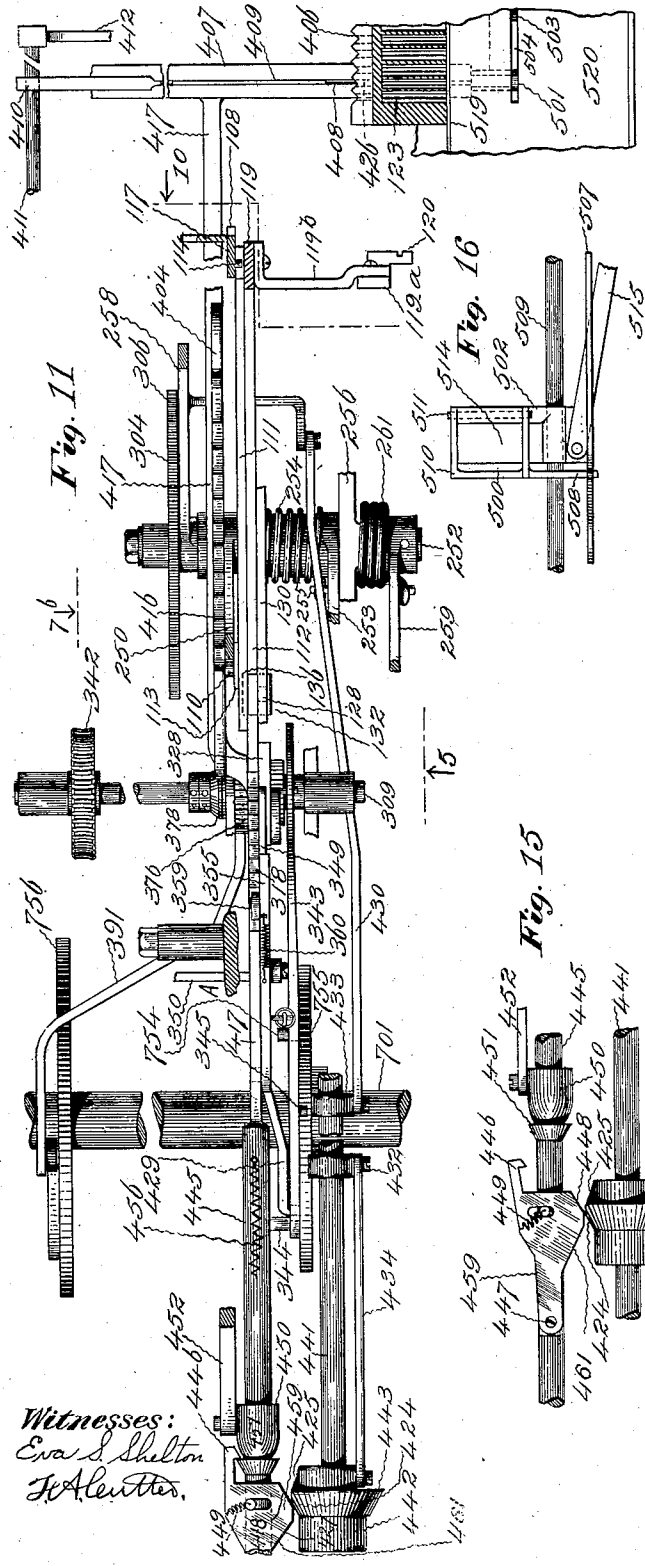


Fig. 11

Fig. 16

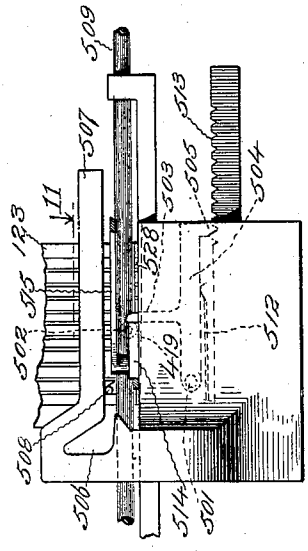


Fig. 17

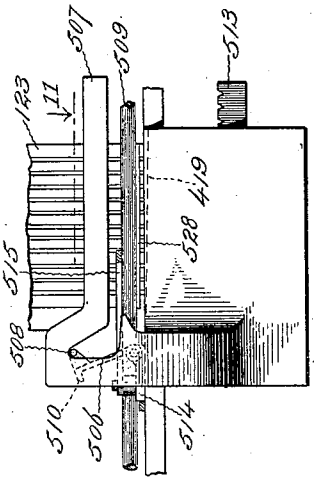


Fig. 18

Fig. 15

Witnesses:
Eva L. Shelton
F. A. Lewthes.

Inventor:
Benj. M. Des Jardins.

No. 844,562. PATENTED FEB. 19, 1907.

B. M. DES JARDINS.

TYPE JUSTIFYING MACHINE.

APPLICATION FILED JUNE 2, 1898.

14 SHEETS—SHEET 9.

Fig. 22

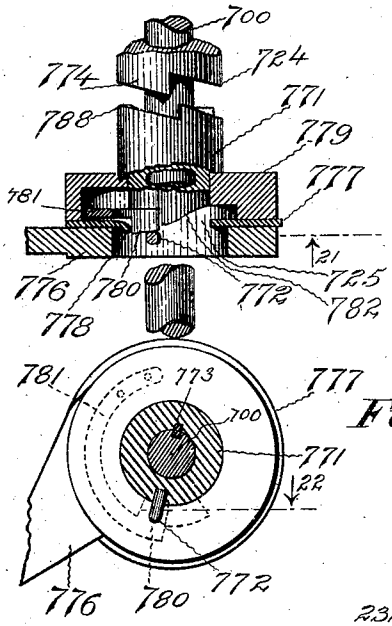


Fig. 21

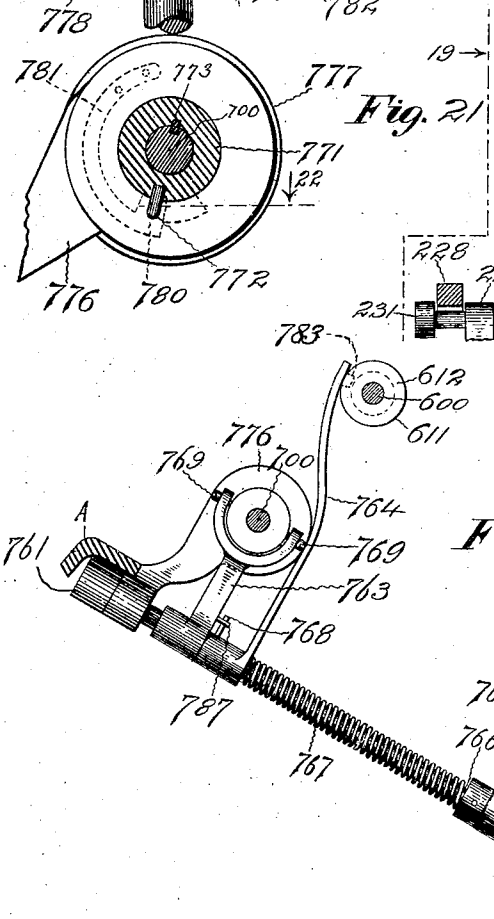
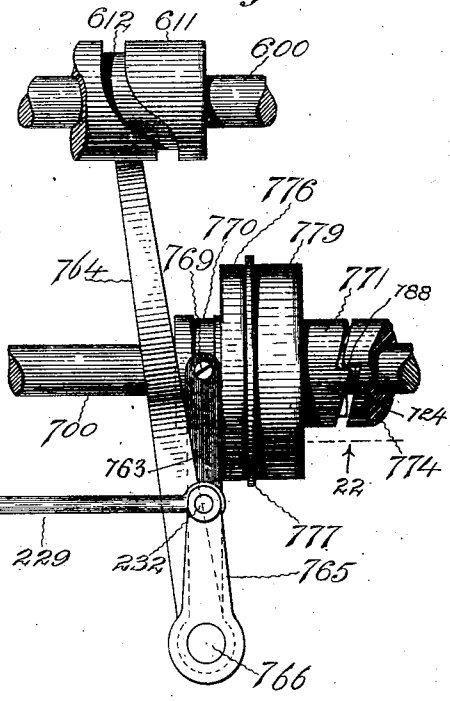


Fig. 19

Fig. 20



Witnesses:
Eva S. Shelton.
H. A. Leuttes.

Inventor:
Benj. M. Des Jardins.

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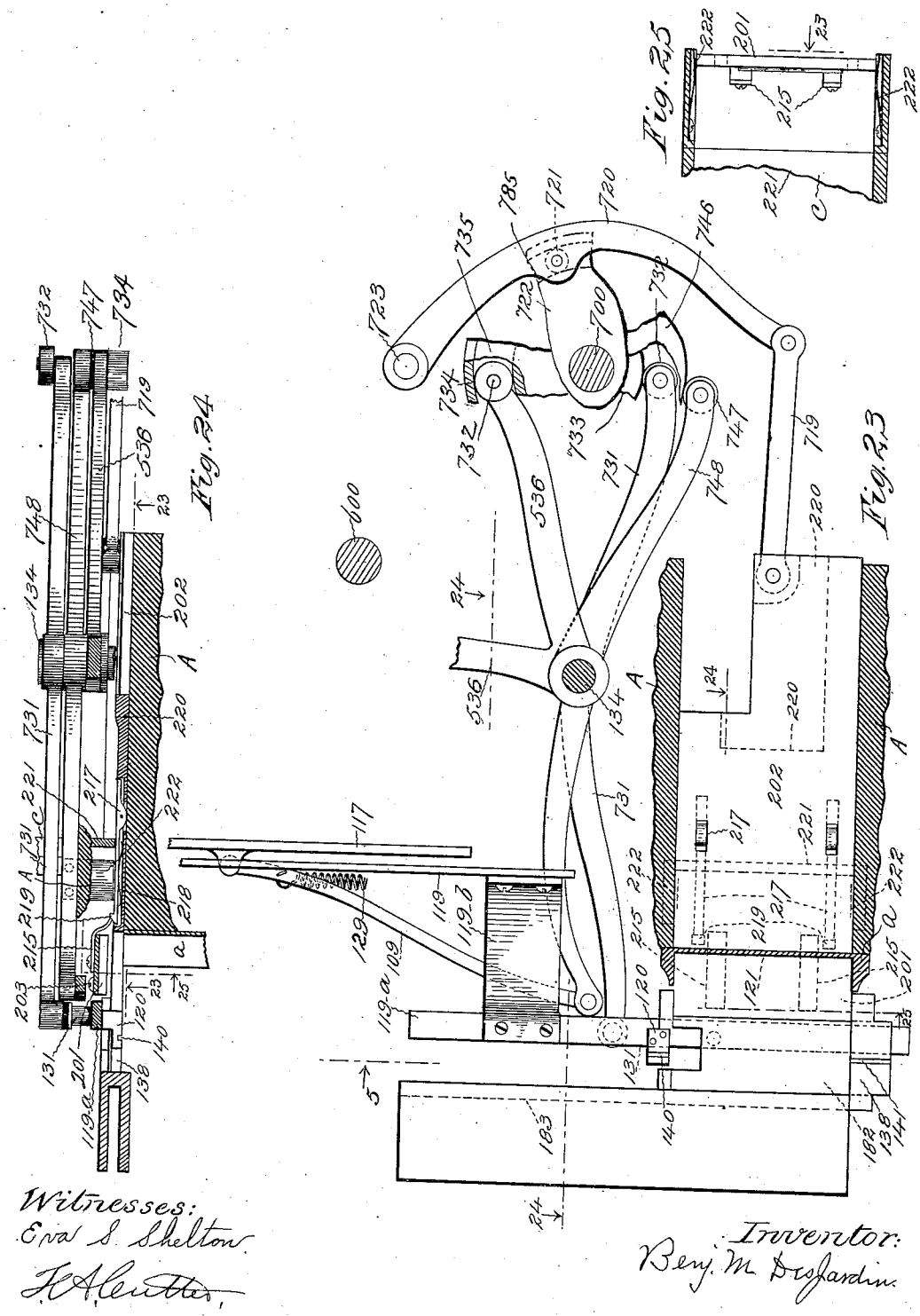
14 SHEETS—SHEET 10.



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APPLICATION FILED JUNE 2. 1898.

14 SHEETS—SHEET 11.

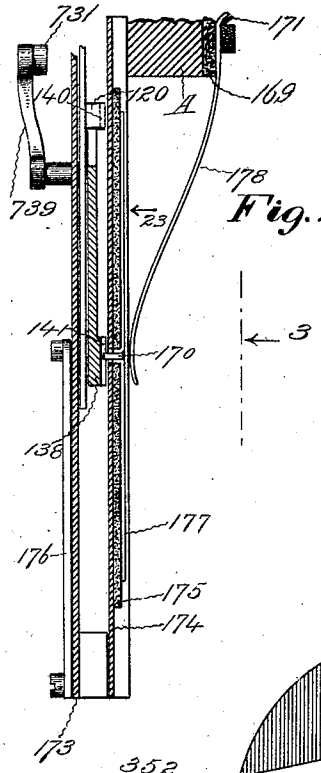


Fig. 28

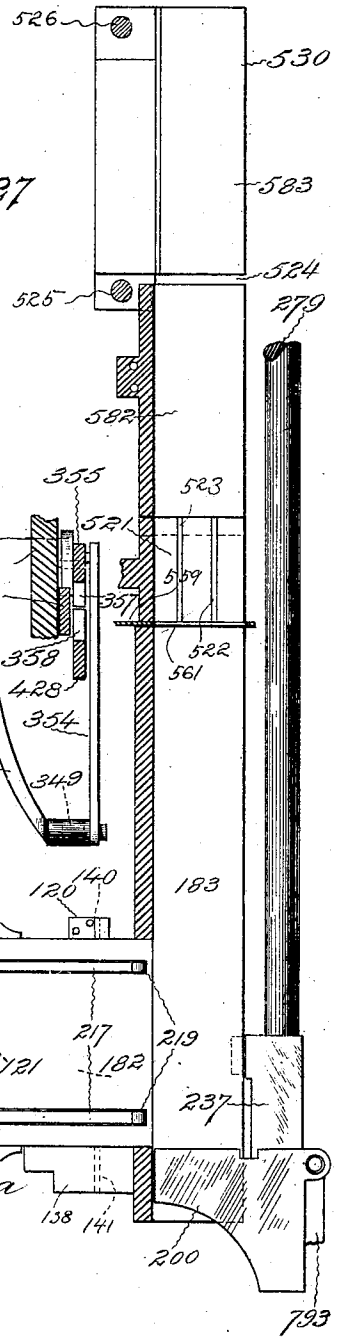
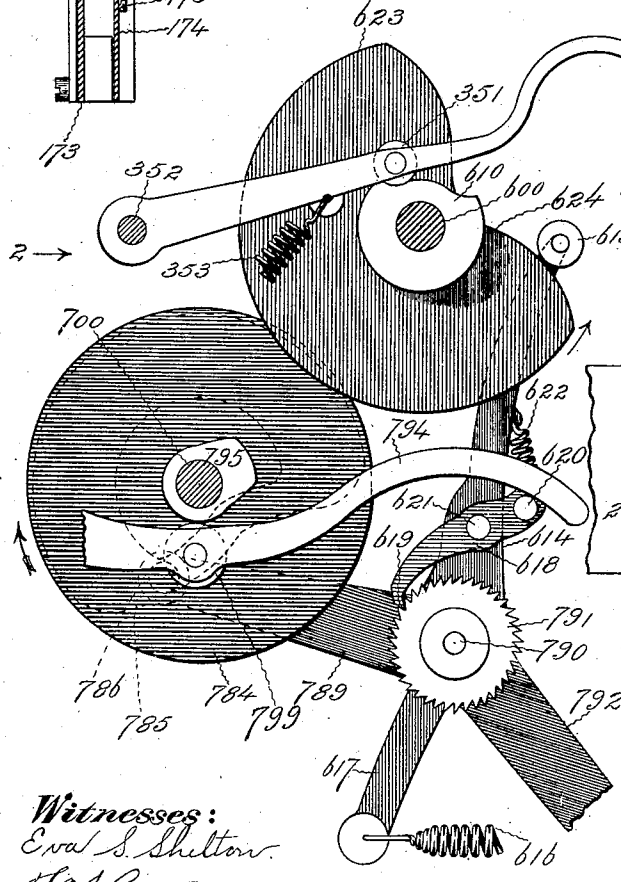


Fig. 27

Fig. 26



Witnesses:
Eva S. Shelton.
H. A. Leuttes.

Inventor:
Benj. M. DesJardins

No. 844,562. PATENTED FEB. 19, 1907.

B. M. DES JARDINS.

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14 SHEETS—SHEET 12.

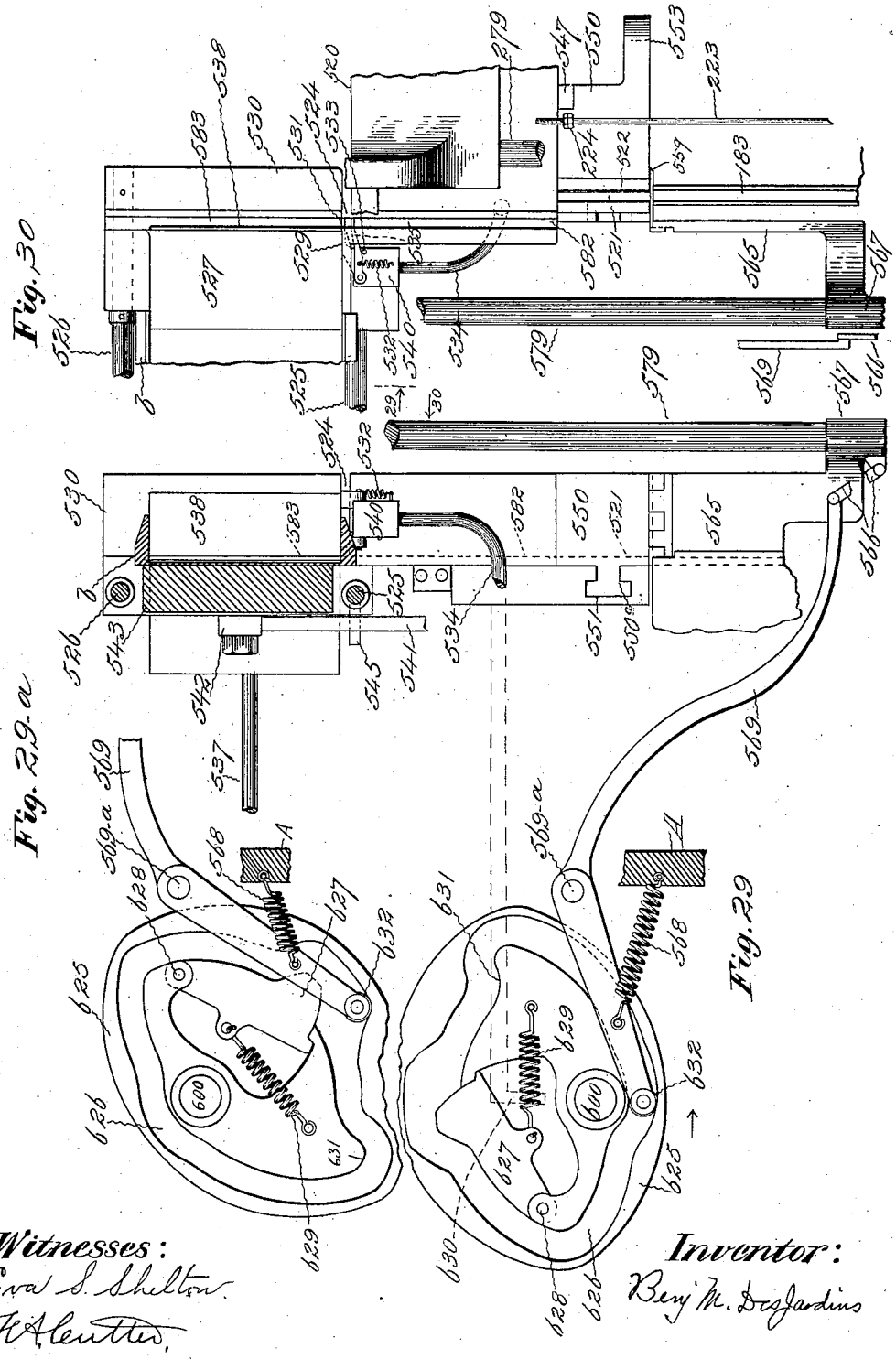

Fig. 30

Fig. 29.a

Fig. 29

Witnesses:
Eva S. Shelton
F. A. Leuttes.

Inventor:
Benj. M. DesJardins

No. 844,562. PATENTED FEB. 19, 1907.

B. M. DES JARDINS.

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14 SHEETS—SHEET 13.

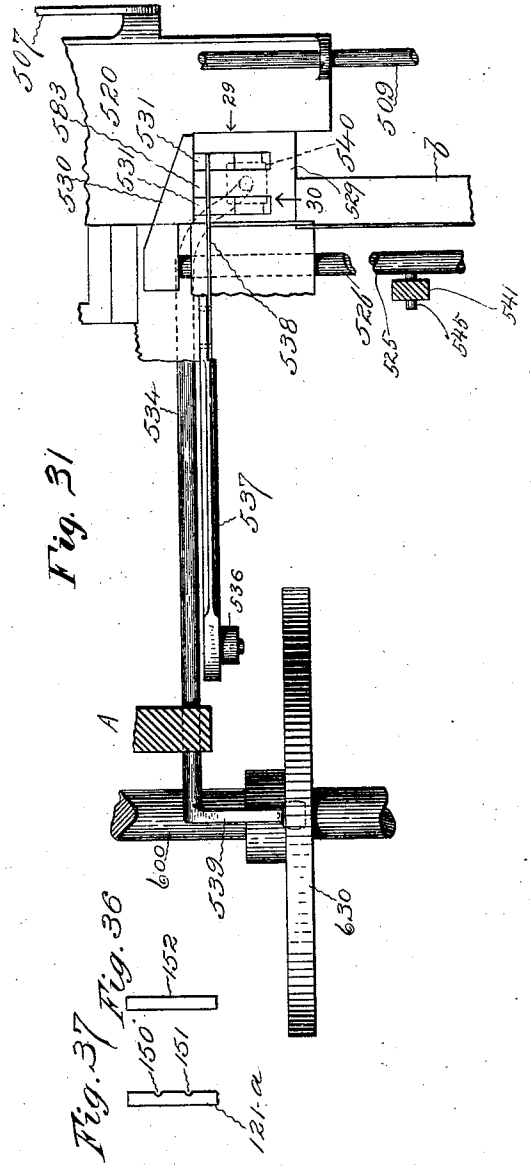

Fig. 31

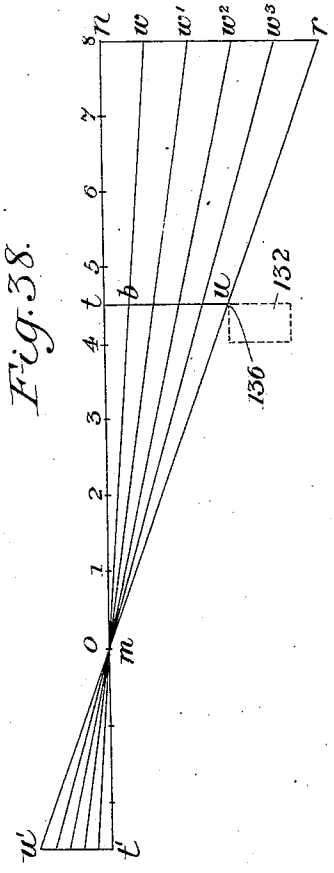

Fig. 38.

Fig. 36

Fig. 37

Witnesses:
Eva S. Shelton
H. A. Leuthen.

Inventor:
Benj'n DesJardins

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APPLICATION FILED JUNE 2, 1898.

14 SHEETS—SHEET 14.

Fig. 35

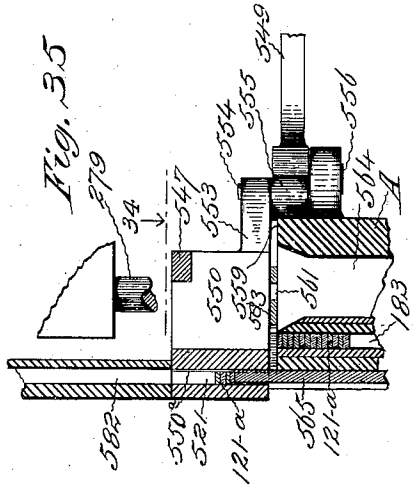


Fig. 34

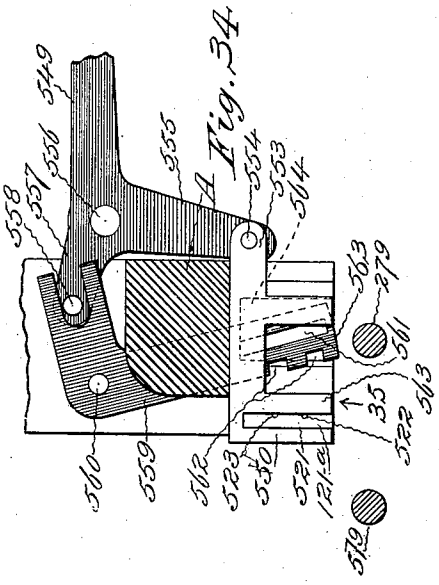


Fig. 33

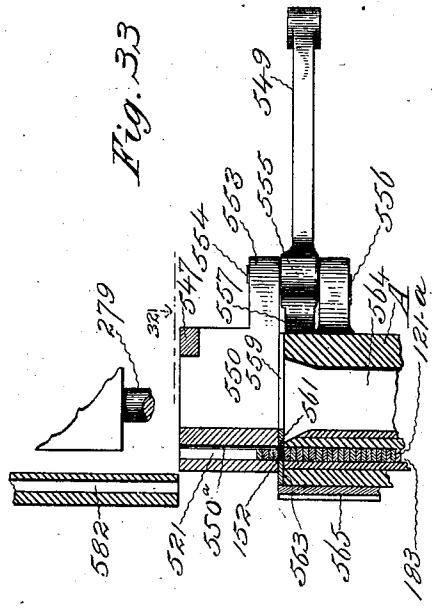
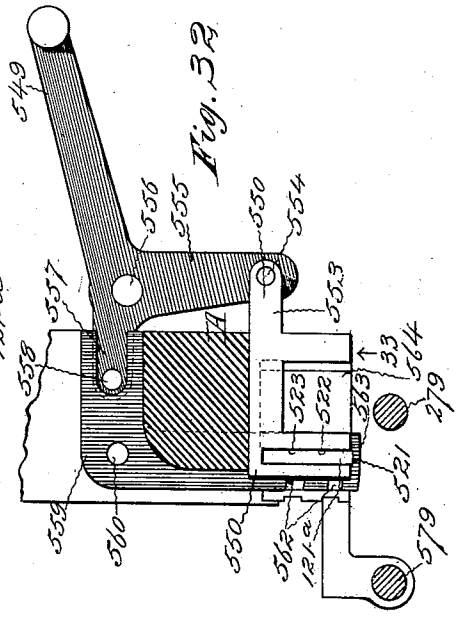


Fig. 32



Witnesses:
Eva S. Shelton.
H. A. Leuttes,

Inventor:
Benj. M. Desjardins

UNITED STATES PATENT OFFICE.

BENJAMIN M. DES JARDINS, OF HARTFORD, CONNECTICUT, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE UNITYPE COMPANY, A CORPORATION OF NEW JERSEY.

TYPE-JUSTIFYING MACHINE.

No. 844,562. Specification of Letters Patent. Patented Feb. 19, 1907.

Application filed June 2, 1898. Serial No. 682,855½.

To all whom it may concern:

Be it known that I, BENJAMIN M. DES JARDINS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented Improvements in Type-Justifying Machines, of which the following is a specification.

My invention relates to automatic justifying mechanism.

The particular embodiment of the invention hereinafter described, and illustrated in the accompanying drawings, is a machine for justifying lines of type composed with temporary spaces or separators. The basic principles of my justifying mechanism may, however, be utilized in connection with other forms of composing-machines, such as linotype and matrix-making machines, and it is to be understood that I desire protection for the invention commensurate with its utility.

In the following specification I shall term the difference between the amount of matter in an unjustified line and the required length of the line or column measure the "shortage" of the line. The shortage may be either a plus or minus quantity, depending upon whether the unjustified line is too short or too long. The places between words in which justifying-spaces are to be inserted I shall term "intervals" and the pieces utilized to separate the words in the unjustified lines I shall term "separators," the number of intervals and separators in a line being, of course, one less than the number of words. The final quads or pieces used to separate the words in the justified lines will be termed "justifying-spaces." The shortage of the line divided by the number of intervals will give the average width of the justifying-spaces, and this average width I shall term a "normal" space in contradistinction to the justifying-spaces, which may in some instances be partly less and partly greater in width than the normal. The term "type" as used herein will be understood to include matrices, such as are used in linotyping, as well as ordinary printers' type.

My invention contemplates justifying lines of type or composition by applying to the line justifying-spaces of sufficient aggregate value to fill the line to the contemplated length or column measure without affecting the space occupied in the line by the type or characters. This may be done by utilizing normal justifying-spaces equal to the quotient of the shortage divided by the number of intervals by utilizing a group of spaces of two or more different values equal in aggregate width to the shortage of the line and equal in number to the intervals in the line or by utilizing a still larger number of spaces equal in aggregate width to the shortage and adapted to be combined in subgroups to form justifying-spaces. In either case a device is necessary which will represent the number of intervals and which will distribute the shortage either equally or unequally among said intervals in the line under justification. My invention includes, broadly, the use of such a device, whether in the form illustrated and described or in any other form which will accomplish the result sought, by what may be termed a "mechanical selection" or "computation" governed by the number of intervals and the shortage of the line to be justified. My invention as applied to the justification of lines of type or matrices includes any device for automatically and mechanically combining the shortage and the number of intervals of a line to determine in advance of the insertion of the justifying-spaces—that is, to predetermine the widths of the justifying-spaces required to justify the line—and in a more limited sense it includes all automatic devices for ascertaining the shortage and the number of intervals and utilizing the resultant of these quantities to automatically predetermine and select justifying-spaces prior to their introduction into the line.

In the embodiment of my invention illustrated the first portion of the justifying mechanism comprises means for measuring or ascertaining the shortage of the unjustified line combined with means controlled by the number of intervals in the line to produce a resultant movement or effect representing the normal justifying-space for the line. Theoretically this movement or effect is obtained in the instance illustrated by constructing two similar triangles. One of the triangles is of known dimensions, one of its sides representing a known arbitrary space, another side the number of word intervals in the line under justification, and the inclosed angle being known, said angle in the case illustrated being a right angle. The shortage of the line is mechanically laid off across said

triangle parallel to the side corresponding to the number of intervals, thus forming with the other two sides a similar triangle having a known side and known angles, the remaining sides of which may be readily calculated. One of these remaining sides which is mechanically computed corresponds to the normal space for the line, and a part mechanically movable through this normal space is made to control the justification of the line.

In justifying composed lines of type it is impossible to provide in advance the number of different sizes which would be required to justify every line with normal spaces. I use instead a magazine provided with a limited number of spaces differing from each other by fixed amounts, which for convenience I shall term "units." It will be evident that any line may be justified by a combination of spaces comprising not more than two sizes differing from each other by a unit. Such justification is not absolutely correct, but in practice it always comes within a half unit of the column-measure, and the units may be made sufficiently small to effect practically perfect justification by the use of a sufficient number of space values. In practice six to twelve sizes of spaces will be found sufficient, depending upon the kind of matter under treatment. In the present machine I utilize the normal space value determined from the proportional triangles to govern a selecting device which selects justifying-spaces from a magazine containing a limited number of what may be termed "integral sizes of spaces." As above stated, it usually requires two sizes of spaces to justify a line. The selecting device may be set to select the larger size first and at the proper time shifted to select the next smaller size, or it may be shifted from the smaller size to the larger size. I provide a controller to effect this shifting, and I set the controller for the spacing of each line by what I shall term "remainder devices"—that is, devices which measure and are controlled by the portion of the shortage which would remain if the line were spaced with the largest size of justifying-spaces which could be inserted uniformly throughout. For example, if a given line had five intervals and twenty-three units of shortage the largest size of space which could be uniformly inserted would be the four-unit space. Five four-unit spaces would aggregate twenty units and the remainder would equal three units. The function of the remainder devices is to measure or gage the remaining three units, and these devices include a controller which is set automatically to effect the distribution of the three units equally in three of the intervals, the justification of the line being therefore accomplished by inserting two four-unit spaces and three five-unit spaces. In practice the larger spaces are first selected and inserted in the line, and the selecting device is then reset by the controller to select spaces of the next smaller size for the remainder of the line. The basic principle underlying my method of justifying consists in placing, either actually or figuratively, single units of space value successively in the intervals of the line under justification until the line is filled to within a fraction of a unit. Thus if a single unit in each interval will not fill the line a second unit is added, and so on, until the line is full. The resulting spaces will all be of one value or of two values, differing by a unit. In the present machine the justifying mechanism computes or ascertains the number of units of space value required for each interval, and the magazine provides integral justifying-spaces of the different values; but in some cases unit-spaces might be used, said spaces being inserted in the line either singly or in groups and the same result effected. It will be evident that the normal space value determined by the justifying devices might be used to select normal spaces if there were a sufficient number of sizes in the magazine. In other forms of justifiers where the spaces are cut or cast or where they depend upon the movement of a matrix or type-writer carriage normal spaces may be utilized, and my improved justifying devices are applicable to such machines.

The justifying devices which form the subject-matter of this invention compute the justifying-spaces independently for each line, and I shall use the term "compute" to distinguish the present mechanism from certain justifying mechanisms in which the justification for all possible lines is worked out and represented in the machine by a "key" or "register." In the latter class of machines no computation is effected by the mechanism, while in the present invention the mechanism computes the size of justifying-spaces required for each line from the line shortage and the number of intervals—that is, there are elements in the mechanism which represent the line shortage and the number of intervals and which represent the quotient of the shortage divided by the number of intervals, together with devices which are controlled by the quotient element to select proper justifying-spaces.

The machine hereinafter described in detail is designed to justify lines of type which are set up with provisional or temporary separators and protected by intermediate leads or rules to hold the uneven ends of the lines in position. The machine has a galley for such unjustified matter and a second galley for justified matter. Each line is removed separately from the former galley and transmitted through the justifying mechanism to the latter galley. The line rests for a moment while a measuring device takes the measure of its shortage, and a second device counts the intervals by contact with the sep-

arators. These two devices jointly set the space-selecting device. The line is then forwarded through a line-feed channel until the first word has passed into a word-cut-off channel which is capable of a transverse movement. The line is stopped in this position in the presence instance by the first separator encountering wards or projections in the cut-off channel, which projections correspond to the nicks in the type and permit the type to pass. Between the cut-off channel and the line-feed channel there is a short channel in a transversely-movable plate in which the separator lodges, the thickness of said plate being the same as that of the separators. The word-cut-off channel is moved to register with a word-feed channel which leads to the galley for justified matter, while the separator is removed from the line by the movement of the ejecting-plate. The cut-off word is then forwarded through the line-feed channel to a position opposite the galley, where it rests upon the upper jaw of a clip which moves into the upper end of the line-feed channel immediately after the word is elevated. The word-cut-off channel and the separator-ejecting plate then return to their original positions registering with the line-feed channel, and the line is forwarded until a second word has fully entered the cut-off channel. The operation of transferring this word to the galley and ejecting the separator proceeds as before; but before the word reaches the galley a justifying-space is taken from the magazine and placed in the clip above mentioned in line with the word-feed channel. As the second word is elevated the clip is withdrawn, and the justifying-space is lodged between the two words. These operations are repeated until the last word is forced up through the word-feed channel and the justified line stands opposite the upper galley. At this stage a line-shaft starts, and devices driven by a revolution of the line-shaft transfer the justified line into its galley. The operation of the line-shaft is made to begin in the present machine before the line under justification reaches the galley, and its first movement is to start the succeeding line through the above cycle of operations, which may be done simultaneously with the forwarding of the justified line, so that no time is lost.

In the drawings accompanying and forming a part of this specification, Figure 1 is a front elevation of the machine. Fig. 2 is a rear elevation. Fig. 3 is a right end elevation. Fig. 4 is a left end elevation. Fig. 5 shows the main computing mechanism with its computing-bar and attendant parts and also the remainder-controller escapement and the connection thereof to the space plunger-blade, the parts shown being taken on line 5, Figs. 3, 4, 10, 11. Figs. 6 and 7 show parts of the remainder-computing mechanism with its special proportional computing-bar. Fig. 8 is a plan view of Fig. 6. Fig. 9 shows the movable fulcrum of the remainder proportional computing bar. Fig. 10 is a right end view of the computing device, other views of the same being indicated by line 10 in Figs. 2, 5, 6, 7, 8, 11. Fig. 11 is a plan view showing most of the parts contained in Fig. 5, other views of said parts being indicated by line 11 in Figs. 1, 2, 3, 4, 5, 6, 7, 10, 17, 18. Fig. 12 shows the engaging or holding star record-wheel of the remainder-controlling and record device with other record devices thereof. Fig. 12[a] shows said star-wheel with its locking-arm. Fig. 13 is a left side view of the remainder-controller and record device. Fig. 14 is a front view of Fig. 13, the pawl-tripping finger 338 being left unbroken. Fig. 15 is an operation view of the quotient-record device shown in Fig. 11. Fig. 16 is a plan view of the space-pusher and its gate-guard device. Fig. 17 is a front view of the same, including the lower part of the space-channels 123. Fig. 18 is an operation view of Fig. 17. Fig. 19 is a left side view of the clutching mechanism. Fig. 20 is an enlarged front view of the same. Fig. 21 is a left side sectional view of the clutch, taken on line 21 of Fig. 22. Fig. 22 is a sectional view taken on line 22 of Fig. 21. Fig. 23 is a sectional view showing the line-lifting plate with its operating-arm, also the line-clamp and its operating-arm, the operating-arm for the return motion of the tangent counting-bar and the galley-rule-operating arm, other views of the same parts being shown as indicated by the arrow 23 in Figs. 1, 2, and 24. The positions of the shafts 600 and 700 are indicated in connection with the several parts herein shown. Fig. 24 is a plan view taken on lines 24 24 of Fig. 23. Fig. 25 is a view showing the separating-rule reservoir and the rule-galley *c*, taken on line 25 of Figs. 23 and 24. Fig. 26 shows the mechanism for operating and directing the clutch-controlling and line-feeding devices with their operating cams and arms and the remainder-device tripping-arm operating the escapement device, other views of the same parts being indicated by the arrow 26 in Figs. 1, 2 and the same view in part being shown in Fig 4. Fig. 27 shows the complete series of channels through which the type-line is fed from its passage adjoining the feed-galley *a* until it reaches its position in front of the receiving-galley *b*. Fig. 28 is a sectional view showing the electrical counting device. (Also indicated by the arrow 28 in Fig. 3.) Figs. 29 and 30 are respectively a left and front view of the secondary word-feeding plunger-cam, arm, and attendant mechanism, other views of these parts being shown as indicated by the arrow 29 in Figs. 1 and 2 and of the receiving-clip 540 by the arrow 30 in Fig. 4 and the arrows 29 and 30 in Fig. 31.

Fig. 29ª is an operation view of the word-plunger cam 625 shown in Fig. 29. Fig. 31 is a plan view showing the space-receiving clip and also the galley-rule and its operating-arm. Figs. 32 to 35, inclusive, show the movable word-cut-off channel, the space-cut-off blade, and the operation thereof. Fig. 36 is a side view of a separator without nicks. Fig. 37 is a side view of a type-body, showing the nicks; and Fig. 38 is a diagram illustrating the computing devices.

While the machine is inclined backward at a suitable angle to handle lines of loose type, in the description and especially in the drawings it is for convenience referred to and shown as standing in a vertical position. As far as practicable the description will follow the type-line in the order of its travel from one galley to the other. The fact is to be kept in mind that the machine simultaneously acts upon two lines at a time—that is, the column is moved along the lower galley and the end type-line is thrust forward and engaged and the calculating devices are adjusted while the spaces are being inserted in the preceding line.

As far as practicable the reference-numerals herein employed conform to the following order or arrangement, the numbers for the different grand divisions being taken from each one hundred figures respectively employed: The figures employed which are below 100 are the numbers in the drawings used in connection with the direction-indicating arrows, and broken lines are employed with said numbers and arrows to show approximately at what part of the figures the correlative figures or parts are taken, the reference-numbers being ample to identify the parts shown. The first one hundred figures employed above 100 refer generally to the primary measuring elements, accompanying type-engaging parts, and other miscellaneous mechanisms; those above and including 200, to the difference devices and accompanying parts; above and including 300, to the space-dislodging mechanism and parts generally relating thereto; above 400, to the mechanism which feeds the spaces into the line and such word-handling mechanism as is closely related thereto; above and including 500, to separator-handling mechanism and allied parts; above and including 600, to the automatic word-actuating mechanism and parts relating thereto, and above and including 700 to the automatic line-actuating mechanism. It will be understood that the several members of this machine are suitably journaled to or otherwise mounted on the frame A in all cases not specifically provided for. The word-shaft 600 is driven by a belt (not shown) around the pulley 601.

The lower galley *a* contains the unjustified lines of type 121ª, Fig. 1, the bodies of type contained therein having the regular foundry-nicks 150 and 151, Figs. 32 to 35 and 37. The words in the galley *a* are separated by the plain metallic separators 152, Fig. 36, which are of the same size as the type-body, but without nicks in their edges corresponding to said foundry-nicks of the type. The loose uneven type-lines are separated from each other by the regular printers' leads or brasses, herein termed "separating-rules," 315 to distinguish them from the separators 152.

The galley friction-blocks 154, such as are ordinarily used in type-setting machines, are inserted against the unprotected ends of the columns of type 121ª in the galleys *a* and *b*. The column of unjustified type in the galley *a* is moved to the left by the traveling pusher-arm 155. Said arm has its bifurcated projection 156 extending into the central opening of said friction-block, locking them into operative engagement with reference to each other.

To move the column of type in the galley *a* one line at a time and to cause the source of power to follow the constantly-diminishing column, a traveling feed device is employed comprising a longitudinally-movable column-feed ratchet-rod operatively connected to the traveling pusher-arm and actuated intermittently by the line-shaft through the medium of suitable connecting mechanism.

The column-feed arm 155 has a sliding hub 157, which is mounted on the ratchet-rod 158, said hub being provided with the pivoted spring-pawl 159, mounted in a slot in the top thereof and engaging the ratchet-teeth 160 of rod 158. The ratchet-rod 158 has its slide-bearings in the middle and right-end brackets of the frame A. It is provided with the rearward-projecting engaging pin 161, Fig. 2, operatively engaged by the reciprocating column-feed arm 162, the latter being rigidly fastened to the rock-shaft 163, through which said ratchet-rod is given a longitudinally-reciprocating motion. The rock-shaft 163 has its bearings 164 and 165 in the front and rear projections from the right-end bracket of the frame A, Figs. 1 and 3. Said rock-shaft is also provided with the rigid cam-operating arm 712, having the projection 713 operatively engaged against the surface cam 715 of the line-shaft 700, being pressed against its surface and into the depression 716 by means of the coiled spring 714, which has its rear end resting against the inner side of the bearing 165 and its front end against the outer edge of said feed-arm 712. The left motion of said ratchet-rod causes one of the teeth 160 to engage the feed-pawl 159 of the traveling feed-arm 155 and push the column in the same direction until the first line of type is in an engaging position within the machine. When said ratchet-rod is returned to the right, it passes under the pawl 159 through the hub 157

without disturbing the arm 155 or the friction-block 156, and said return motion also releases the pressure from behind the column of type. A repetition of the movements above described takes place for each line of type, and a succession of actuating engagements follows the friction-block wherever it may be. By means of the operation of the column-feed just described the left-end unadjusted line of the column in the galley *a* becomes located over the line-lifting plate 202, with the leftward separating-rule 153 against the stop or limiting block 201, forming the left wall of the line-measuring channel 182, Figs. 23, 24, 25, and 27. The line of type 121ª being released from the tension of the column-feed devices is now free to be moved forward by the line-pusher or lifting-plate 202 and then transferred into the channel 182, which is especially termed the "measuring-channel," where it is brought into engaging relation with the computing devices described farther on. The line-lifting plate 202 has its slide-bearings in the central bracket of the frame A and starts with its forward edge in line with the bottom of the galley *a*, forming a continuation thereof, and then serves as a suitable bottom for the column-feed channel 121. By being transferred forward the plate 202 forms a similar bottom for the measuring-channel 182 and again for the feed-channel 183. Said plate is operated through the connecting-rod 719 and the arm 720, the projection 721 of which is engaged by the grooved cam 722 on the line-shaft 700. The arm 720 is pivoted at 723 to the frame A.

The rule-distributer is described as follows: On its left side near the front end the lifting-plate 202 is provided with the rule-removing snap or spring hooks 217, the springs 218, Fig. 24, of which keep them continually pressed to the left. During the first part of the forward travel of said lifting-plate the spring-hooks 217 are thrust inward by the contact of their inclines 219 against the edge of the separating-rule 153, which lies against the stop-block 201 to the left of the type-line. Said stop-block is rigidly fastened to the central bracket A by the screws 203, by means of which it may be adjusted right and left to compensate for different thicknesses of the separating-rules which may be used. It has fastened thereon the detent-springs 215 215, the rear ends of which are offset to the right until they lie in the path of the inclines 219, said path being in a plane beyond the right edge of said stop-block 201. The lifting-plate 202 is further provided with the plate 220 rigid thereto, inclined or wedge-shaped at its front end, Fig. 24.

The separating-rule-galley abutment 221, forming a receptacle for the rules, is rigidly fastened to the central bracket of the frame A. The rule-galley *c* extends to the left as far as the left-end bracket A. (Shown in Fig. 4, also broken away in Figs. 1, 24, and 25.) The abutment 221 is provided with the flat friction-retaining springs 222 222, fastened to its upper and lower edges to hold the rules in position when thrust into the receptacle, and has accessory thereto the detent-springs 215 215. The right end of said rule-abutment which is adjacent to the lifting-plate 202 is cut away to allow of the passage of the inclined plate 220.

The operation of the line-lifting plate has been explained and it will not be necessary to indicate the operation of the rule-distributer and the functions of the rule-galley just described. The three divisions of the machine above designated—namely, the lifting-plate, rule-distributer, and galley—are in a measure coördinate, and their purpose or use is to remove the rule from the type-line acted upon and to transfer said line into the measuring-channel. In the forward movement of the lifting-plate 202 its inclined plate 220 passes to the right of the rule or rules contained in said receptacle and forces them along between the springs 222 thereby making room for the reception of the rule, which is now against the stop-block 201. Upon the return of the plate 202 the hooks 217 carry said rule backward beyond the detents 215 and between the springs 222 in the abutment 221, owing to the fact that the inclines 219 of said hooks snapped to the left over the front edge of said rule and engaged the same during the forward movement of said plate. The detents or springs 215 bear upon the rule while it is being actuated by the hooks 217 until contact is had with the springs 222 to prevent misplacement of the same during this part of its travel.

The computing devices into engagement with which the type-line is transferred when pushed forward into the measuring-channel 182 after leaving the column will next be described. The first step in the present mechanical operation consists in clamping the type-line in said channel by means of a gage, which is automatically moved from a given starting-point into contiguity with the end of said line by means directly to be explained. While the line of type 121ª is held in the channel 182 it rests against the end of the lifting-plate 202 and upon the base of said channel, which consists of the abutment-block 138, a plate rigidly fastened to the frame A. The type-line measuring-gage 120 is rigid with the line-measuring slide-bar 119ª, which is fastened to the measuring-bar 119 by means of the connecting-plate 119ᵇ, Figs. 5, 10, 23. The bar 119 has a longitudinal movement in the slide-boxes 124 and 126, fastened to the middle bracket of the frame A for a distance corresponding to the aggregate difference between the separators 152 and the spaces required to fill the type-line,

and it is held with a constant downward tension by means of the coiled spring 129. Said line-measuring bar is supplemental to the measuring-gage 120 and is provided with the projecting T-blade 112, described farther on.

The bar 119 through the medium of the connecting-rod 131, the releasing-arm 731, Fig. 23, and the roller 732 is operated against the action of the clamping-spring 129 by the surface cam 733, Fig. 2, on the line-shaft 700. The cam 733 causes the gage 120 to be removed from the path of the advancing type-line on the plate 202 and to occupy its highest position, which corresponds with one extremity of the longest unjustified line for which the machine is adapted. After the line has been introduced into the channel 182 the cam 733 allows the spring 129 to draw the gage 120 down onto the top of the line, thereby clamping it. In changing its position from the end of the required line to the end of the actual line the gage 120 traverses a distance equal to the difference between the present separators and their displacing-spaces or the actual line shortage. The arm 731 swings on the stud 134, which extends from the frame A.

After the type-line has been clamped by means of jaws adjustable with reference to the length of said line in the holding device, which agrees substantially in size with the height and width of type, all as elsewhere described, the counting mechanism comes into operation for determining the number of spaces required and supplying the divider for the quotient sought by automatically counting the intervals between the words in said line. Each separator corresponds substantially with the body of the type character, except that it has no nicks, as previously described. The separators must extend at some one or more points beyond the type-body in order to afford a place of contact for the counting mechanism, such contact portions being provided conveniently by the portions of the separators opposite the foundry-nicks of the type.

The electrocontact-point 170, the electroconductors 171, and the electromagnets 172 are embraced in the counting mechanism, together with other parts about to be mentioned, Figs. 3 and 28. The slide which carries the contact-point 170 over the type-line consists of the two sides 173 and 174, extending on either side of the lifting-plate 202 and sliding in suitable boxes projected from the middle bracket A. The arm 736 has its projection 737 in engagement with the box-cam 738, Figs. 1 and 2, on the line-shaft 700. Said arm, through its connecting-rod 176, operates the sliding sides 173 and 174. Said slide is movable in its bearings in the middle bracket of the frame A a distance slightly in excess of the length of the type-line. It is hollowed out somewhat in the form of the letter E to make room for the fiber plate 175, which insulates the contact-plate 177, fastened on the outside thereof. Said contact-plate is also somewhat longer than the type-line. The contact-plate 177 is split at one side to provide a spring projection integral therewith, Figs. 3 and 28, upon which the contact-point 170 is carried. The electropoint 170 is secured to the longitudinal center of the plate 177 and passes through a suitable opening in the insulation-plate 175 and the slide 174, extending a short distance beyond the latter into the measuring-line channel 182. Said point passes freely through the groove made by the foundry-nicks 151 of the type, the groove 140 of the measuring-gage 120, and the groove 141 of the abutment-block 138, Figs. 23 and 28. The cam 738 actuates said slide at the proper time through the intervening mechanism, causing it to move upward the full distance of its travel, or a distance slightly in excess of the length of the type-line 121^a, and the point 170 has a perfectly clear passage, as explained above, except where it encounters the metallic separators 152, in passing over which an electrical contact is made. The resiliency of the spring projection 178 enables the point 170 to pass the separators 152 without unnecessary friction, but at the same time furnishing the right amount of energy for proper electrical contact. The conducting-spring projection 178 is insulated from the machine by the fiber plate 169 and has fastened to its upper end one of the conductors 171. An electric battery (not shown in the drawings) has one pole connected directly to the frame of the machine and the other to the second conductor 171 from the magnets 172. The circuit over or through which the electrical current must pass from and to the battery every time said circuit is completed by the contact between the point 170 and a separator 152, is made up of the two conductors 171, the magnets 172, the projection 178, the plate 177, and the frame of the machine. Every time said circuit is completed in the manner designated an electrical pulsation is sent through the magnets 172. Each of said pulsations depresses the armature 179 on the magnet-arm 180 against the tension of the spring 181, Figs. 3 and 10, and operates the escapement-verge 118, thereby allowing the counting escapement-ratchet 122 and the slide tangent-bar 117 to move downward under the influence of the spring 139 one tooth at a time.

The mechanism and its operation just described has fully revealed the interrelation of the two vertical slide-bars 117 and 119, with the means whereby the former is displaced one step to represent each space which the line requires, and the latter an amount equal to the full shortage of the line, less the

temporory separators between the words. The remaining details of the computing devices will now be described, Figs. 5, 10, and 11, and a description of the mechanism and operation will be supplemented by an explanation of the underlying principles upon which they act.

The main computing element is comprised in the bar 111, which is inclined to form a common line in two similar triangles with reference to one of the known quantities in the type-line being measured, and in this particular instance I use the amount of inclination to designate the number of spaces used. This bar is a straight-edge attached near its left end by the pivotal support 110 to the frame A. The vertical distance from the contact-point 136 of the gage-block 132 to the center of the support 110 in this construction equals the shortage of the line under measurement. The upward and downward inclines of the bar 111, taken on either side of its pivotal center, are used for measuring the amount of difference existing between the unjustified type-line and the length required by the width of the column or page for which said line is being justified, and the relation of its position to the line-gage designates the amount of shortage, while the degree of its incline denotes the number of spaces required.

The amount of taper or incline in the gage is changed to suit the number of spaces required, so that the same indexes which designate the sizes of spaces required are employed to designate the full amount of deficiency, whatever may be the number of parts into which this deficiency must be divided. That portion of the bar 111 extending left of its pivot 110 constitutes an opposite gage to that employed to measure deficiencies and is employed for determining the amount of reduction which a line, with its separators, may need in case its length is slightly in excess of the measurement required. The pivot 110 projects rearwardly, and its front end is provided with the supporting-plate 113, to which said bar 111 is rigidly fastened. The pivot-center is located in the plane of the straight lower edge of said bar, which is the edge that is utilized as the operative gaging or computing edge. The left end of the bar 111 is tapered to form the incline 116, which assists the clamping-spring 129 in depressing the gage-block 132 on the T-blade 112 until the same is in line with the computing edge of said bar. The right end of said bar is offset downward in order to bring the resistance to the gaging action on the opposite side of the bar from the wedging force of the gage-block and still maintain the resisting-point in line with the lower computing edge, thereby bringing the two oppositely-faced operative points on a straight line, passing through the center of the pivot 110. The lower part of said right-end offset of the bar 111 is curved in order to maintain a constant dimension during the lowering of said bar on a vertical line between the resisting-pin 114 and the guard-pin 115, the position of which determines the angle of said bar. Said pins are fixed in the vertical tangent slide-bar 117, the path of the travel of which vertically being on a tangent with the arc described by the radial bar 111, and determining the tangent at whatever point its intersection may be, determines at its successive positions the amount of inclination in said computing-bar necessary to gage the line deficiencies which require different numbers of spaces. The bar 117 slides in the bearings 125 and 127, Fig. 3, rigidly fastened to the middle bracket of the frame A. The various positions of said slide-bar are determined by the teeth of the escapement-rack 122, the pitch of which is suitably related to the proportions of the bar 111, the index arc, and the difference between the successive spaces. When located, said bar is accurately held in position by means of the dog 269, which is pivoted to the frame A at 268 and has its projecting point 272 in engaging relation with the locking-teeth 108, also on the bar 117, said teeth corresponding with the teeth of the rack 122. The dog 269 is thrown out of engagement through the operating-bar 273, the right end of which is pivoted to the upper end of said dog and the left end permitted to slide in a suitable box in the frame A. Said operating-bar is shouldered at 274 to engage the projecting pin 262 on the back side of the locating-arm 250 when said arm is in its leftward position. The dog 269 is brought into engagement with one of said locking-teeth by the locking-spring 271, extending from the bar 273 to a suitable fastening-point on the frame A during the first part of the motion of the arm 250 to the right, Fig. 5. The bar 117 is tensioned downward by means of the coiled spring 139, which has its upper end fastened to the connecting-rod 109 of said bar and its lower end to the middle bracket of the frame A, and said bar is returned to its starting-point after the measuring operation has taken place by means of the surface-cam 746, Fig. 2, on the line-shaft 700, through the arm 748 on the stud 134, said arm being connected at one end to said rod 109 and having the projection or roller 747 in contact with said cam, Fig. 23. The amount of inclination given to said computing-bar by each of the teeth on the racks 122 and 108, or the pitch of said teeth, is directly governed by the sizes of the preconstructed spaces with which the machine is provided, as further explained.

The bar 119, which, through the plate 119^b and the bar 119^a, Figs. 5 and 11, virtually rests upon the type-line to determine its length, is provided, as stated, with the gage-

projecting blade 112 for designating the length of a line with reference to the bar 111, which indicates the amount of spacing needed. The blade 112 extends to the left beyond the pivot 110, parallel with the computing-bar 111, when the latter is located at its starting-point, is preferably at right angles with the bar 119 and determines the path of the gage-block 132 and its contact-point 136, said block being made to slide on said blade. The gage-block 132, sometimes herein termed "feeler-gage," having a movement in radial relation to the bar 111, represents or designates the length of the type-line to be justified and is movable to the right and left along the blade 112 to represent or designate the type-line length at all points along said bar. In its adjustment said blade is located a sufficient distance below the pivot 110, so that when the type-line is full the contact-point 136, at whatever place it may be along said blade, will be in the plane of the center of said pivot and tight against the lower edge of said computing-bar. The gage 120 being substantially integral with the blade 112, resting upon the type-line will locate the position of the gage contact-point 136 a distance below the center of the pivot 110 equal to the line-shortage measured with the separators. The gage-block 132 is provided with a horizontal slideway for it to slide horizontally over the blade 112 and with a vertical slideway, by means of which it may slide up and down on the engaging projection 128 of the locating T-bar 130, Fig. 5. The locating T-bar 130 is provided with the downwardly-projecting arm or T 128, by means of which the block 132 is thrust within the angle made by the bar 111 and the blade 112 and has its slide-bearings in suitable boxes rigid with the frame A. Said T-bar is operatively connected to the locating-arm 250 by means of the connecting-rod 251. The locating-arm 250 is loosely pivoted around the rock-shaft 252 and is provided with the operating cam-arm 253, rigid therewith, said cam-arm, through its roller 257, being in operative engagement with the surface-cam 750 on the line-shaft 701, Figs. 1, 5, and 10. The arm 250 carries the gage-block-operating connecting-rod 251, pivotally attached at one end thereto, and is also provided with rearwardly-projecting pin 262, before mentioned. The coiled spring 254 has its rear end fastened to the frame A and its front end around the pin 255 of the cam-arm 253. The arm 250 is thereby given a sensitive spring tension to the right when released upon the rotation of the operating-cam 750, the resiliency of the spring 254 causing the arm 250 and the intermediate parts to move the gage-block 132 sensitively to the right toward the intersection of the bar 111 with the blade 112, until its contact-point 136 is intercepted against the engaging edge of said bar 111, thus determining what size of space would accurately justify the line if the machine was able to provide any required size. The adjusting-arm 258 is fastened to the rock-shaft 252, which has its rear bearing in the frame A and its front bearing in the block 256, attached to said frame. The cam-operating arm 259 is rigidly fastened to the front end of the rock-shaft 252 forward of the block 256 and is in engaging relation with the surface-cam 752 on the line-shaft 701 by means of the roller 260. The arm 258 is provided with the connecting-rod 430, fastened to it about midway between its upper end and the pivotal point on said shaft 252, and it is further provided at its upper end with the adjusting-pawl 414, pivoted thereto. The coiled spring 261, which is about double the strength of the locating-spring 254, has its front end fastened to the arm 259 and its rear end to the pin 263, extending from the block 256, thereby giving said arm a constant tendency to swing to the left. At the proper time the pin 262 on the arm 250 and the pawl 414 on the arm 258 come into contact with each other, depressing the pawl 414 into engagement with the index arc 404. Then it is that the spring 261, being much stronger than the spring 254, returns the former arm to the left until intercepted by an engagement of said pawl with a point of the arc 404, all as fully set forth hereinafter. The left cam edge 415 of said pawl travels in the path of the pin 262, and its engaging point 413 has its path directly over the recurring steps or space index-teeth 416 of the index arc 404, which is rigid with the frame A. The teeth 416 are in engaging relation with the pawl-point 413 and indicate the sizes of spaces with which the machine is provided. The pawl 414 is limited in its upward movement by the pin 421, projecting from the arm 258, and is held in whatever position it may be located with reference to the latter by friction, being raised at the right end of its travel by the projection 403 on the arc 404 and remaining in an elevated position until again depressed by contact with the pin 262. The steps or teeth 416 on the arc 404 constitute a series of indicators having the same mechanical construction and value, but representing different space values.

The adjusting-arm 258 is indirectly connected to the space-plunger locating-bar 417 by means of the connecting-rod 430, through the collar 433, which is pivotally connected to its left end and other parts yet to be described, said collar being loose around the quotient record-rod 441. The record-rod 441 is suitably attached to the frame A. The connecting-rod 430 has attached to it the right end of the record-returning spring 431, and the left end of said spring is fastened to the collar 432, which is also loose around the record-rod 441, sliding thereon. The collar

432, which is supplemental to the record-engaging collar 442, is connected thereto by means of the intermediate connecting-rod 434. When the arm 258 swings to the left, the rod 430 forces the collar 433 against the collar 432 and actuates the latter, with the rod 434 and attached collar 442, to the left also by a positive movement; but when the arm 258 swings to the right the collars 433 and 432 separate, and the spring 431 permits the collar 442 to be held by the record-holding ratchet-arm projection 457, or, if released by said projection, said spring yieldingly draws said collar 442 to the right. The space-plunger bar 417 is provided with the shortage-index rack or ratchet-teeth 418, located toward the left terminal thereof, cut into its lower edge, and it is further provided with the corresponding remainder rack or escapement-ratchet teeth 318, cut into its upper edge. The purpose of these two sets of teeth is especially described in connection with the difference-controlling device further on. The space-plunger bar 417 is designed to enable the machine to locate and appropriate under the direction of the computing devices the sizes of spaces which it is required to insert in the line. The bar 417 is provided at its extreme right end with the space-plunger cross-piece or carrying-block 407, which is free to slide right and left with the longitudinal motion of said bar a distance slightly greater than that occupied by the series of space-channels 123. The space-plunger 409 is mounted in the longitudinal T-groove 408, cut into the upper surface of said carrying-block, and is free to slide therein back and forth a distance slightly greater than the length of a space-body. The space-plunger blade 409, Fig. 3, is provided at its rear end with the elongated slot 410, through which the operating-rod 411 passes, and said blade is reciprocated by said rod, along which it is also free to move right and left behind the space-channels 123. Said operating-rod is rigidly fastened to the upper end of the operating-arm 412, and the elongated slot 410 in said blade is provided to enable said rod to move up and down, thereby compensating for the arc-like path of said operating-arm. The arm 412 is pivoted around the shaft 405 and has its projection 436 in operative engagement with the groove of the box-cam 608, on the word-shaft 600, Figs. 1 and 3. The mechanism, as already generally described, makes provision whereby the space-plunger 409 may be given a lateral adjustment through the plunger locating bar 417, the connecting-rod 430 and the adjusting-arm 258, and a longitudinal motion at any position to which it may be adjusted, by means of the operating stud or rod 411. The connection in detail between the bar 417 and the arm 258 will be fully set forth hereinafter.

The largest spaces are contained in the channel at the right side of the magazine and the smallest spaces in the channel at the left side of the magazine, the different sizes being in a graduated series from the smallest to the largest. The smallest spaces are less in thickness than the separators, and they come into use to justify lines which exceed the common width and must be reduced in length. One of the intermediate channels of the magazine may have spaces exactly equal in thickness to the separators to be substituted for the separators in lines which are originally of the required length.

The space-plunger-engaging detent 428 is pivoted to the frame A at 437, and its engaging point 438 is given a constant upward tension by means of the coiled spring 439, having one end connected to the arm 429 of said detent and the other to the frame A. The operating-arm 429 of said detent is provided at its lower end with the inclined projection 440, against which the rearwardly-projecting pin 754 of the cam-plate 755 on the shaft 701 is adapted to operate for the purpose of swinging the engaging point 438 downward to release it from engagement with the teeth 418 of the bar 417, thereby leaving the latter free to be shifted to the left, as further explained. The connecting sliding collars 432 and 442 on the record slide-rod 441 are operatively associated with the computing device and indirectly with the space-value-locating device through the engaging point 443 on said collar 442, as follows: The locating-bar 258 is operatively connected by means of the rod 430, collars 433 432 and rod 434 to the record-engaging collar 442, since the record-returning spring 431 is fastened at one end to the collar 432 and at the other end to the connecting-rod 430, adjoining the point of union between said rod and adjusting-arm. Figs. 4, 5, and 11.

The record-holding arm 455 is pivoted by the stud 460 to the left bracket of the frame A and is provided with the leftwardly-extending record-holding ratchet-arm projection 457, on the upper edge of which are the record-teeth 458, corresponding in pitch to the space-plunger-bar teeth 418 and to the distance apart of the channels 123, also bearing a proportional relation to the index-teeth 416. The teeth 458 are adapted to engage the tooth 443 of the record-collar 442, being drawn into engagement therewith by the spring 454, extending from the arm 455 to a frame member. The lower projection of the arm 455 is located in engaging relation with the record-releasing cam 757 on the line-shaft 701, Fig. 4, by means of which the teeth 458 are drawn away from the record-holding tooth 443 against the tension of the spring 454.

The space-plunger-locating bar 417 terminates at its left end in the rod 445, Figs. 4, 11, and 15. The plunger-locating plate 459

is pivoted to the top of said rod at 447. It is held with a forward tension by means of the spring 449, one end of which is fastened to the rear edge of said plate and the other to a pin projecting from the rod 445 through a slot in the plate 459, whereby the movement of said plate is limited, Fig. 15. The plate 459 has the spring-pressed-engaging hook 446 extending forward toward the collar 450 on the rod 445. Said plate also has the clearance-incline 461 extending leftwardly from its front projection and the tripping-incline 448 extending rightwardly therefrom. The record-engaging collar 442 is provided on its rear side with the left tripping-incline 424 and the right clearance-incline 425. The space-plunger rod 430, collars 433 and 432, and rod 445 is engaged and released by the machine in the following manner: The sliding collar 450 is fitted loosely around the rod 445, so that it can slide freely back and forth thereon. It is provided at its left end with the rearwardly-projecting engaging tooth 451, which is shouldered on its engaging side toward the space-plunger mechanism with its incline toward the plate 459, said tooth being in engaging relation with the hook 446. When the collar 450 is moved to the left the full distance of its travel, it first slides freely on the rod 445 until it reaches the position at which the plate 459 was left during the justification of the previous line, whereupon it abuts against the said plate and pushes the same with said rod, including the space-plunger rod 417, to the left until the plunger 409 is located at the left side of the space-channels 123, but leaving said plunger-blade otherwise inactive—that is, in a condition of repose so far as relates to any forward reciprocal movement and in a position where it will not dislodge any spaces, being located outside of the adjacent space-channel. During this lateral left-hand movement the plate 459 may pass the record-collar 442, the clearance-incline 461 of said plate passing over the clearance-incline 425 without disturbing the position of said collar. As stated, the left plate-incline 427, Fig. 11, slides over the rear collar-incline 425 and said plate is permitted to drop down again on the left side of said collar, this motion taking place while the face of the collar 450 is against he right edge of said plate, there being no operative engagement with the hook 446 at this time, and this upward movement of the plate permits free travel of the rod 445 to the left. The tooth 451 is adapted to engage the hook 446 during the right motion of the collar 450 and pull the rod 445 until the tripping-incline 448 is brought into engaging relation with the now contiguous tripping-incline 424 on the record-collar 442, at which point the continued right motion of said rod and the plate 459 causes said incline 424 to force said plate, with its hook 446, rearward until the latter is disengaged from said tooth, thereby disengaging said rod in a position relatively located to that at which the measuring device located said record-collar. The rod 445, through its collar 450 and connecting-plate 459, is automatically operated longitudinally by means of the connecting-rod 452, the arm 453 and the connected operating-arms 744 and 745, which are pivoted at 435 to suitable brackets extending from the left end of the frame A and positively operated back and forth by the cams 756 and 753 on the shaft 701, Figs. 2, 4, 11, and 15. The arm 744 has the roller 743, adapted to bear on the cam 756, and the arm 745 has the roller 742 in operative relation with the cam 753, said arms being rigidly attached to the shaft 435, carrying the arm 453. From the description of the mechanism given thus far it will be seen that the space-plunger 409 is indirectly operative back and forth by means of the adjusting-arm 258 and its operating-cam 752 and directly by the arm 453 and its operating-cam 756 in the following manner: The adjusting-arm 258, through its connecting-rod 430, the collars 432 and 433, and the connecting-rod 434, first located the record collar 442 at the position indicated by the measurement of the line. The arm 453 next carries the collar 450 rightward, taking with it the space-plunger 409, until the tripping-incline 448 comes in contact with the incline 424 of the record-collar 442, when the latter throws the hook 446 out of engagement with the tooth 451, leaving said space-plunger located according to the setting of the record-collar 442, which corresponds to the position of the arm 258, the latter being located by the engagement of its pawl-point 413 with one of the index-teeth 416.

While the mechanism is in operative engagement with the spaces necessary for justifying the line which is being acted upon by the space dislodging and inserting devices and as a consequence of said arrangement of parts, the collar 442 is located at some one of its possible positions with reference to the teeth 458. The machine may at the time proceed with the operation of measuring a new line and of determining what spaces are needed therefor, and in doing so the record-collar 442 passes beyond the plate 459 without disturbing the position of the space plunger-rod 445 or the connected space plunger-bar 417. On the other hand, upon the completion of the line which is being justified and prior to the time for engaging the spaces required for the next line said plate passes to the left beyond said collar without changing it from its present record-holding position.

The devices heretofore described are adapted to mathematically divide the shortage of the unjustified line by the number of word spaces or intervals in the line to determine the exact width of the normal justifying-

spaces required to be inserted in the intervals to justify the line. As a matter of fact, it is impossible to provide the indefinite number of sizes of spaces which would be required for justification if all the spaces in the line were required to be equal, and for that reason I have provided mechanism, to be described hereinafter, which will select combinations of spaces from a limited number of sizes to justify the line with great exactness. The mechanism heretofore described, however, determines with mathematical correctness the quotient of the space to be filled divided by the number of intervals, which quotient of course equals the size of the uniform individual spaces which would be necessary to justify the line. In explaining this mechanism the presence of the separators in the line of type under treatment may be disregarded, as said separators are eliminated from the problem by simply increasing the width of the spaces indicated by the machine by an amount equal to the width of the separators which are ejected from the line before the spaces are inserted. In other words, if five-unit spaces are required to justify the line and the separators are equal to two-unit spaces then the justifier would indicate three-unit spaces as necessary for justification; but it would be made to select five-unit spaces, or three-unit spaces plus an amount equal to the width of one of the separators. In practice all of the spaces of the space-magazine are increased by a constant amount equal to the width of the individual separators used.

I obtain the quotient of the shortage of the line divided by the number of intervals by constructing mechanically two similar triangles. The dimensions of one of the triangles are known quantities, and one of the dimensions of the remaining triangle being known the remaining dimensions, one of which will be proportional to the quotient sought, are readily obtainable. Referring to Fig. 38, *m n r* indicates a right-angled triangle, in which the side *n m* represents a justifying-space, which, for instance, may be eight units, as indicated on the diagram. The side *n r* represents the number of intervals in the line and is equal to the number of intervals multiplied by eight-unit spaces. The side *m n* is always constant, and the side *n r* is a known quantity, determined by the number of intervals. In the second triangle, *m t u*, the side *t u*, which is parallel to *n r*, is equal to the measured shortage of the line under treatment. If now we indicate by *w w'*, &c., the eight-unit spaces on the side *n r* and draw lines from *m* to the points *w w'*, the shortage of the line *t u* will be divided into a number of equal parts, and each of these parts, as *t b*, will equal the quotient sought. It will also be evident that if *m n* represents eight units *m t* will represent the quotient sought in the same proportion. As shown on the diagram, the quotient of the shortage *t u* divided by the number of intervals equals four and one-half, and the line under treatment will be justified by inserting spaces of four and one-half units plus the thickness of the separators which are removed.

Comparing the diagram Fig. 38 with the mechanism in Fig. 5, the line *m n* corresponds to the lower edge of the computing-bar 111 when the latter is in its normal horizontal position. The line *n r* corresponds to the downward movement of the bar 117. The space *n w* corresponds to one division of said bar. The line *t u* corresponds to the downward movement of the bar 112, which equals the shortage of the line. The point *u* is the place of contact of the point 136 with the bar 111, and the distance *m t* is the amount of movement of the contact-point 136 when drawn over by the arm 128, provided said point starts from the vertical line through the pivot 110. The distance *m t* is simply proportional to the thickness of the quotient-space and is, in fact, very much greater. It will be evident that this movement in proportion to the desired space may be utilized in many ways in locating or selecting justifying-spaces.

If the line, including its separators, should be too long, then the point 136 would contact with the bar 111 at the left of the pivot 110, which case would be indicated on the diagram Fig. 38 by the triangle *m t' u'* proportional to the triangle *m r n*. The distance *m t'* indicates a minus quantity or a quantity required to be subtracted from the width of the separator to obtain the thickness of the justifying-space.

The teeth 418 of the space plunger-bar 417 bear a proportional relation to the index-teeth 416, and the amount of their distances apart is fixed by the position of the connecting-rod 430, which is attached to the arm 258 between the rock-shaft 252 and the pawl 414, the distance apart of said teeth 418 corresponding exactly with the distance apart of the space-channels. The position of the locating-arm 258 as its pawl 414 is engaged with any one of the index-teeth 416 causes the location of said bar 417 to be fixed so as to bring the space-plunger against that particular size of space which corresponds to the tangent representing the line shortage divided by the number of spaces required. It will then follow that if the required number of this size of spaces is inserted in the line the line will be properly justified.

I will now describe what I term the "averaging" mechanism—that is, the mechanism by means of which the selection of proper justifying-spaces is controlled—by which averaging mechanism the quotient and remainder of the division of the line shortage by the number of spaces is distributed so that the space-selecting mechanism is caused

to select spaces of the same or varying sizes, as may be necessary to justify the line, which mechanism may also be properly termed the "remainder" devices.

In the first process of measuring the type-line the position of the blade 112 as it practically rests upon the end of the line and the angle or inclination of the computing-bar 111 as it is inclined according to the number of spaces required will in all probability locate the contact-point 136 in such a position that the interlocking of the arm 250 and 258 will cause the pawl-point 413 to drop between two of the space index-points 416. The index-points 416 simply designate the locations, or rather the sizes, of the preconstructed space values with which the machine is provided, while the location of the gage-point 136 and the consequent position at which the incline 415 first meets the pin 262 and the resulting depression of the pawl-point 413 designates the exact space value which would result from a division of the line shortage by the number of spaces needed and indicates the size spaces which, if available, would accurately justify the line.

The device herein described for the purpose is employed to determine the proportional difference between the position along the arc 404 at which the pawl-point 413 was first depressed and the amount of distance it is located from the neighboring teeth on said arc between which the depression occurred first. Upon determining the amount of this proportion which in this case corresponds to the remainder in simple division suitable mechanism is employed to rejustify, as it were, this remainder by a process very much similar to the one used in first determining the size of the spaces wanted. The operation brought about by the resultant of this second computation causes in this particular construction the space-plunger to shift positions, and the final justification of the line is accomplished by the employment of as many of a larger size as there are units in the remainder, thereby utilizing two neighboring sizes of spaces.

The lever or proportional bar 311, which in its geometrical elements forms two similar triangles for the purpose of designating a similarity between the thing given it to compute and the resultant setting of its quotient devices, is located, with its direct accompanying mechanism, behind the main computing devices. The movable member by means of which the difference or remainder is mechanically traversed to determine its value is comprised in the remainder-arc 304, located directly behind the space-index arc 404. This arc is provided on its upper edge with a series of very fine indicator-teeth 306, cut on a circle having the rock-shaft 252 as a center, and said arc is herein employed to indicate and register the exact size of spaces which the line actually requires, Figs. 5, 6, 7, 8, 9, and 10. The arc 304 is mounted on the upper end of the swinging supporting-bar 302, the pivotal point of which is preferably the same as that of the arms 250 and 258, being around the rock-shaft 252. The proportional bar 311 is pivoted at 301 to the arc-supporting bar 302, which serves as a guide for said bar 311. The fine teeth of the arc are adapted to be engaged by the pawl 414, which is provided with the three engaging plates 325, pressed downward by the springs 326. The series of engaging teeth in the lower ends of the plates 325 are offset from each other so that those of only one plate can mesh with the teeth 306 at a time, each of said series being set behind the other a distance equal to one-third of the space between two of said teeth 306, thereby reducing to a minimum lost motion between the position fixed by the measurement and the point of engagement of the pawl 414 when it is depressed by the pin 262. The bar 302, with attached members, is displaced by one of the plates 325 engaging the arc-teeth 306 at the time the pawl 414 is depressed by the pin 262. The proportional bar 311 is further provided with the adjustable fulcrum-block 313, the corresponding slide 319 of which has its bearings around the rigid guide-bar 312, said bar being fastened at both ends to the frame A. The projection 327 extends from the back side of the slide 319, and said slide is pivoted at 310 to the block 313. The bar 311 is operatively connected at its lower end to the metallic tape 377, which is wound around the controller record-disk 378 on the controller-shaft 309. The fulcrum-locating shaft 300 is operatively connected by means of the miters 303 and 305 to the fulcrum gear shaft 314, to which is fastened the fulcrum shaft-gear 315, meshing into the fulcrum shaft-rack 322 at the upper end of the counting-bar 117, said bar being located vertically with reference to the number of spaces required in the line, as already described. The fulcrum-locating shaft 300 is provided with the steps or stop-pins 332, suitably arranged with reference to their positions around it, whereby a different pin is brought into the path of the projection 327 for every changed position of the computing and tangent bars 111 and 117, the rotation of said fulcrum-shaft being suitably timed to the movement of said tangent-bar through said rack and gears, thereby causing the presentation of a different number of spaces to the line. The distance apart of the pins 332 up and down with reference to the length of the shaft 300 is sufficient to locate the fulcrum-block 313 at whatever position is necessary to cause the pull on the tape 377 to rotate the controller record-disk as many teeth as there are spaces in the line, when the upper end of said proportional bar is moved its full amount of distance, which is the distance between two

of the index-teeth 416. For example, if the escapement-rack 122 has moved down five teeth, the number of spaces in the given line, a pin 332 on the shaft 300, adjacent to the projection 327, is above said projection whatever distance is necessary to locate the fulcrum in order that the displacement of the upper end of the bar 311 its full distance shall cause the record star-wheel 376 to rotate until five of its teeth are displaced. If, however, after the interlocking of the pawl 414 with the pin 262 the point 413 moves leftward only a portion of the full distance, the corresponding number of the teeth on the record star-wheel 376 will be displaced—that is, if in the case referred to said point moves three-fifths of the entire full distance of its travel, three of the record-star-wheel teeth will be displaced.

The arm 321, having the projection 323 in the path of the surface-cam 758 on the line-shaft 701, operates the fulcrum-block 313 through the connecting-rod 320, lifting it up until the projection 327 is in engaging position against one of the pins 332, said arm being given an upward tension by means of the coiled spring 324, one end of which is fastened to said arm and the other to the frame A, said arm being drawn down against the action of said spring by the action of said cam 758, Figs. 2, 4, and 10.

I will now describe the time-controlling device, which predetermines the time of a future required motion by means of certain qualities existing in the line to be justified. In this particular application this time-controller is employed to determine at what time the action of the machine shall change from its operation upon one size of space values to another size.

The controller-record device as a part of the main controller comprises means whereby the record of the requirements of one line may be satisfied during the time that the requirements of another line are determined. The record star-wheel 376 is loosely mounted around the controller-shaft 309 and is provided on its front surface with the record-hook 386, which is pivoted to said wheel at 387, Figs. 1 and 12 to 14. Said hook is normally pressed inward against the stop-pin 373 by the spring 374 and is provided with the projection 372 beyond or to the rear of its pivot engaging the releasing-finger 388 of the lock-arm fork 390. The star-wheel 376 is also provided with the forwardly-projecting sleeve 383, on the outside of which is fastened at 384 the spiral spring 383, having its outer end secured to the post 381, extending rearwardly from the controller-flange 328 and integral therewith. The flange 328 is further provided with the hook-pin 380, which is in engaging relation with the hook projection 385 of the record-hook 386 and may be integral with the post 381. The controller-disk 378 is provided with the returning-spring 375, one end of which is fastened to the metallic cord 371 and the other end to the frame A, the opposite end of said cord being fastened to said disk 378.

The local operation of the controller-record device is as follows: As soon as the finger 379 of the remainder-record lock-arm 389 is allowed to move away from the record-wheel 376 the releasing-finger 388 of the fork 390 actuates the hook projection 385 out of engagement with the pin 380 against the resiliency of the spring 374, leaving said wheel free to rotate. By reason of the action just described the spring 375 is enabled to rotate the disk 378, to which the record-wheel 376 is rigidly attached, until the tape 377 has been tightly wound around said disk. The maximum amount of movement of either the record-wheel 376 or the flange 328 is less than one-half of a complete revolution. Hence the hook-releasing projection 372 always lies in the path of the arc-shaped finger 388, and the hook projection 385 clears the pin 380 at whatever position the latter may be. The remainder-computing instrument is now free to act on the tape 377 and reset the record-wheel 376 for the line that is being measured, while the machine is engaged in inserting spaces in the previous line, which may occur prior to the action of the remainder-tripping device.

The disk 378 is loosely mounted on the controller-shaft 309 and connected in the manner described to the controller-tripping flange 328, and said flange has mounted on its front surface the spring-actuated controller-engaging pawl 330, the spring-actuated detent 335, and the starting-pin 337. The flange 328 presents an even periphery except at its stopping-place, where it is provided with the tripping depression or nick 329 in its edge. The shaft 309 has rigidly fastened thereto, in the rear of the disk 378, the worm-wheel 342 and at its front end the ratchet-wheel 331, both of which being provided with as many teeth as the record star-wheel 376. The worm-wheel 342 meshes into the worm 609 on the word-shaft 600 and actuates the controller-shaft 309, to which it is fastened, that part of a revolution commensurate with the arc represented by one tooth for every revolution of said word-shaft, or, in other words, a displacement of one tooth for the handling of every word and space, takes place. The pawl 330 is pivotally mounted on the front surface of the flange 328 in engaging relation with the ratchet 331 and is held out of engagement with said ratchet by means of the detent 335, also pivoted to said flange. The detent 335 is provided with the hook 333 to engage in the corresponding hook 334 of the pawl 330 to hold the latter out of engagement with the ratchet-wheel 331. The pawl 330 is kept

tensioned toward the detent 335 by the coiled spring 339, one end of which is fastened to said detent and the other to the engaging end 340 of said pawl. The end or point 340 of the pawl 330 is adapted to engage said ratchet, and the rear tripping projection 341 of said pawl registers with the nick 329 of the tripping-flange 328. The detent 335 has the frontwardly-projecting tripping-stud 336. The flange-pin 337 and the stud 336 both project into the path of the bifurcated tripping-arm 343. The tripping-arm 343 terminates at the right with the upward arc-shaped tripping-finger 338, which is located in engaging relation with the projecting pin 336 and in the lower cam-shaped starting-finger 347, located in engaging relation with the pin 337 when the tripping projection 341 is turned to its uppermost position under the tripping-arm finger 349, Figs. 5, 10, 11, 12, 13, and 14. The arm 343 is provided with the frontwardly-extending stud 345, which rides upon the edge of the cam-plate 755 and is adapted to trip into the nick 760 of said plate at the proper time. The arm 343 is pressed downward by means of the spring 346, which is fastened at one end to said arm and at the other to the frame A, and said arm is pivoted at 344 to said frame. The tripping-finger 338 is constructed approximately in the shape of an arc, so that it may engage the projection 336, while at its various operative positions resulting from the displacement of the flange 328 by a rotation of the disk 378, as already described. The arrangement of the lower cam-finger 347 is such that if the finger 338 is allowed to move downward by the tripping of the projection 345 into the cam-nick 760 when the flange 328 has not been displaced by any action of the proportional bar, said finger 347 will strike against the pin 337, impelling it rightward and rotating said flange a short distance for the purpose of causing the machine to immediately commence work upon the actual spaces selected by the main measuring device.

Upon the setting of the record-wheel 376 the locking-arm 389 thrusts its finger 379 into said wheel, thereby locking it, at the same time moving the releasing-finger 388 away from the releasing projection 372 and allowing the hook projection 385 to move into the path of the pin 380 by the action of the spring 374, Figs. 2, 12, and 12a. During this time the flange 328 may be returned by the engagement of the pawl 330 with the ratchet-wheel 331, and in this event the pin 380 passes freely under the hook 385. Upon the releasing of the pawl 330 from the ratchet-wheel 331 the spring 382 causes the flange 328 to fly backward until the pin 380 is intercepted by the hook projection 385, and said flange remains in that position until said pawl becomes reëngaged with said ratchet, after which the arm 389 is operated on by the cam 759, Fig. 2, through the fork 391 to release the record-wheel 376, as described. I will state here that the arm 389 and the forks 390 and 391 are rigidly attached to each other and all actuated by the cam 759 and the spring 392.

The description of the tripping mechanism so far given has disclosed the underlying action of a semiproblematical operation and also the means employed whereby the adjusting-bar 258 has caused the location of the space mechanism through the depression of the pawl-point 413 into operative relation with the index-teeth 416. These indexes represent in sequence the available spaces of the machine by their positions and all sizes of possible intermediate spaces by the distances between them. The amount of the remainder is made available by the synschronous engagement of said pawl through one of the plates 325 with the fine teeth 306 of the arc 304, representing in available and movable form the distances between said teeth 416. The remainder is communicated to the machine by the motion from the point at which said pawl meets the pin 262 of the locating-arm 250, moving until it reaches the next index-tooth 416. This motion causes the disk 378 and the record star-wheel 376 to rotate a distance equal to as many teeth of the latter as there are space units indicated by the relative displacement of the two arcs 304 and 404 with reference to each other. When the escapement-pawl 330, as further described, is released and allowed to engage in one of the teeth of the ratchet 331 at the time prior to the insertion of the first space into the line and by the time the number of inserted spaces corresponds to the number of units indicated by the two measurements, said ratchet will have returned said disk to its starting-point, indicating the time when the change of spaces is to take place.

The predetermining feature of the controlling mechanism will now be followed by a description of the tripping mechanism to which the controller's resultant action is transmitted and the means whereby the machine is made to change from one size of space values to another. As already stated, the flange 328 is provided with the nick 329, and the pawl 330 has the projection 341 extending into said nick. When the flange 328 is at its point of rest, the nick 329 is brought directly over the shaft 309 and the pin 337 against the right surface of the starting-finger 347. The downwardly-movable difference-trip 348 is integral with the right finger 349 of the tripping-arm 350, having the roller 351 in operative engagement with the surface-cam 610 on the word-shaft 600. The arm 350 is pivoted at 352 to the frame A and is continually pressed downward by

the coiled spring 353, one end of which is fastened to said arm and the other to the frame A, Figs. 2, 5, and 26. During the rotation of the flange 328 and also while the pawl 330 is engaged with the ratchet 331 the roller 351 is prevented from dropping into the depression of the cam 610 by the pressure of the trip 348 against the periphery of said flange; but when the tripping-nick 329 passes below said trip the arm 350 is allowed to drop downward by the action of the spring 353. Upon the next movement of the flange 328 the trip 348 falls on the projection 341 of the pawl 330 and thrusts it downward against the tension of its spring 339 and at the same time causes said pawl to be disengaged from the ratchet 331 and engaged by the detent 335, leaving said ratchet free to rotate without any further immediate displacement of said flange.

The arm 350 is connected, by means of the connecting-bar 354, to the escapement-lever 355. The escapement-lever 355 is pivoted to the frame A at 356 and is provided with the downward projection 357 at its right end, which meets the upward projection 358 of the plunger-detent 428, described in connection with the space-plunger bar 417. Said lever is further provided with the movable escapement-dog 359, which is pivoted thereto at 361. Its engaging end 362 is lightly pressed rightward by means of the coiled spring 360, the right end of which is fastened to the upper projection of said dog and the left end to the lever 355. The lower engaging end 362 of the dog 359 is limited in its leftward motion by the pin 363, while the spring 360 normally retains said end in contact with the pin 365. The escapement-lever 355 is tensioned downward by means of the coiled spring 364, having its upper end fastened to said lever and the lower end to the frame A.

The arrangement of the escapement mechanism just described is such that whenever the arm 350 is actuated by its cam no operative displacement of the machine takes place while the periphery of the flange 328 is under the projection 348; but when said flange has reached its starting-point and the projection 348 drops into the nick 329 the downward movement of the finger 349, through the connecting-bar 354, causes the escapement-lever 355 to move downward by the force of the springs 364 and 353 or either of them. The projection 357 of the lever 355 now comes into engaging contact with the projection 358 of the detent 428 and forces said projection downward against the action of its spring 439, while the end 362 of the dog 359 becomes engaged between two of the teeth 318 directly below it. The detent-point 438 is thus forced out of engagement with its tooth and allows the spring 456 of the space plunger-bar 417 to move said bar to the left against the movable dog 359 until the upper part of the latter is brought into engaging contact with the pin 363, thereby causing said plunger to move to the left from its position behind one size of spaces to its position behind the next. The spring 456 is connected at one end to the top of the plunger-bar 417 and at the other end to the top of the supporting-bracket for the left terminals of the rods 441 and 445.

The complete operation of the computing devices just described, including the operative setting of the actuating mechanism for justifying, takes place while the machine is simultaneously manipulating two distinct lines of type, and in the present construction for mechanical reasons the machine is so timed that while the line is within the measuring-clamps as many of these motions are allowed to take place as can conveniently operate without interference with those connected with the line into which the spaces are being inserted. During this time the line-shaft is disengaged from the driving mechanism and allowed to remain in a position of rest to compensate for the different numbers of words which occur in different lines, being in operation during the handling of the first and last end of the line for the proper commencement of the first space and the displacement of the space-actuating mechanism after the insertion of the last one.

The line-shaft controller and its clutching mechanism will now be described.

According to the organized structure of the present machine it may be stated that the time of action of the line mechanism is made to correspond with the beginning and ending of the handling of each line. The duration of said action must fall within the number of intervals between the words of the shortest lines, and as the lines increase said line mechanism is compelled to wait during all of the intermediate word actions, whatever number there may be. This is accomplished by throwing the line-shaft clutch into action at the right time during the operation of the machine and with relation to the requisite number of word-handling time actions counted by a suitable controlling device. For economy of parts in construction the clutch-controlling mechanism, with its backward and forward motions, which predetermines the number of word-shaft revolutions during the intermittence of the line-shaft for each particular line, is largely included in the twofold-function mechanism, (especially shown in Fig. 26,) which also controls the line-feeding devices, described farther on. The ratchet-wheel 791 is rigid with the arms 789 and 792. The operating-arm 789 and its connected controller-arm 792 are partially operated by the line-cam 784, but particularly operated in an intermittent manner by said controller-arm actuated by the spring

616 through the arm 614, the projection 617, and the cam 623, whereby a succession of motions and stops are produced coincident with the operation of the machine on the words and spaces, all as more clearly explained hereinafter. The backward setting of the word-controller is brought about by the action of the pawl 618 on the arm 614, after which said pawl is released from its engagement with the ratchet 791 by means of the arm 794, which is actuated downward against the pin 620 of said pawl by the line-cam 795, the time of said backward setting being according to the number of spaces contained in the line, as follows: The line-lifting blade 200 is intermittently operated by the arm 792 and projects from the sliding blade-mounting block 237, which has the projection 238 with a hole therein to pass around and slide along the tripping-rod 223, said arm being connected with said block by the rod 793, Figs. 1, 3, 19, and 20. The rod 223 is provided with the stop 224 at its upper end and is located at the right of the line-channel 183. Said blade and block move upward synchronously, as further described. The time of said motions occurring with the rotation of said word-shaft is determined in the following described manner: The roller 615 of the arm 614 drops into the depression 624 of the cam 623, leaving the spring 616 to rotate the ratchet 791 and raise the arm 792 until the blade 200 is obstructed, as described in connection with the line-feed, when the ratchet 791 stops and waits until a complete revolution of the word-shaft has taken place, said motions continuing regularly until the line is disposed of, when the last step of the upward movement of the block 237 thrusts the projection 238 under the stop 224 and raises the rod 223.

By means of the line-shaft clutch and co-acting parts described below I am able to transmit an intermittent rotary motion to the line-shaft 700 from the constant rotary motion of the word-shaft 600, said motion depending upon and varying in length of time with the number of spaces in each line, this result being obtained by introducing a locking-block at the proper time within the line of transmission of power. The lower end of the rod 223 referred to in the previous paragraph is connected by the pin 225 to the lock-bar 226, which is pivoted at 227 to a bracket extending from the frame A. The rear end of the bar 226 is provided with the locking-block 228, which is adapted to drop of its own weight into engaging relation with the clutch lock-rod 229, resting between the slide-bearing 230, rigid with the frame A, and the head 231 of said rod, thereby locking the latter to prevent any movement to the right. The rod 229 is pivotally connected by the pin 232 to the lock-arm 765, which is rigidly fastened to the forward end of the lock rock-shaft 766. Said rock-shaft has its bearings in the boxes 761 and 762, rigidly fastened to the frame A. The bifurcated clutch-operating arm 763 is also rigidly connected to said rock-shaft. The operating-arm 764 is loosely sleeved in the shaft 766 and has the projection 783 inserted in the groove 612 of the periphery cam 611 on the shaft 600. The coiled spring 767 on the shaft 766 has its front end rigidly fixed to said shaft and its rear end attached to the operating-arm 764. The hub of said arm 764 is provided with the upwardly-extending pin 768, adapted to come in contact with the pin 787 on the bifurcated arm 763 in such a manner as to leave said arm 764 in a neutral position relative to its attached spring 767 or to allow it to move away from said pin 787 when the shaft 766 is locked by the block 228 in the manner before described, and said arm 764 is moved to the right against the tension of said spring. The neutralizing functions of the pin 768 and 787 when in contact are to relieve the locking-block 228 from the pressure which would otherwise be exerted on it by the spring 767 at the time said block is in contact with the rod 229 and to retain the head 231 of said rod a sufficient distance from the bearing 230 to enable said block to freely engage said rod.

The sliding clutch-collar 771 is keyed to the shaft 700 by means of the spline 773, which leaves said collar free to slide laterally on said shaft while rotatably secured thereto, and the engaging pins 769 769 on the arm 763 register with the groove 770 in said collar. The collar 771 is provided at its right end with the three engaging teeth 788, while the pin 772 projects from the periphery of said collar near the left end. The idler 774 has the three engaging teeth 724, adapted to mesh with the teeth 788 on the collar 771 at any third of a revolution of said idler, motion to which is imparted from the shaft 600 through the intermeshing pinion 613 and spur-gear 775, said idler being rigidly attached to the latter. The clutch cam-block 776, securely fixed to the frame A, has a circular opening with a diameter sufficiently large to permit the collar 771, with projecting pin 772, to rotate therein. Fast to the right side of the block 776 is the plate 777, having an opening sufficient in size to allow the collar 771 to rotate therein, and said plate is cut away at 725 in its lower edge to allow for the passage of the pin 772. The rear edge of the plate 777 where it is cut away is curved, as shown at 778, to engage or receive the pin 772 when the same is pushed to the right and commences to revolve with the collar 771, as will appear more clearly hereinafter. This plate is also rigidly attached to the cam-block 779, which has an adjoining recess to provide a free passage for the pin 772. The clutch-block 779

is provided with the incline 782, adapted to push the pin 772 to the left, and thereby carry the collar 771 nearly out of engagement with the idler 774. Said block is further provided with the spring 781, on the thickened free end of which is the inclined surface or clutch spring-cam 780, supplemental to the incline 782 of the block 779. Now when the pin 772 near the end of its revolution passes from the incline 782 onto the spring-cam 780 it carries the collar 771 to its extreme left position, with the teeth 788 clear of the teeth 724, and the clutch is released. Since the spring 781 is more resilient than the spring 767, it is obvious that when the cam 611 actuates the arm 764 to the right and carries with it the bifurcated arm 763 through the medium of the rock-shaft 766 and said spring 767, the lock-bar 228 being displaced from between the bearing 230 and the head 231 of the rod 229, the pin 772 must displace the spring-cam 780 and ride onto the curved edge 778, thereby engaging the teeth 788 and 724 and rotating the shaft 700 until said pin passes into the clutch-block opening against the incline 782 and finally comes in contact again with the spring-cam 780, which completes the disengagement of the clutch at the end of the revolution.

After the measurement of the line has taken place by the contact of the gage-block 120 against the end thereof the temporary spaces have been duly counted and the measuring instrument set according to these two requirements, the automatic mechanism then proceeds with the operation until the primary record-collar 442 is located by one of the teeth 458 of the rack 457 and the difference-record star-wheel 376 has been rotated and locked into position by the lock-finger 379. These operations of the measuring device take place while the machine is inserting the first spaces in the line preceding the one which is being measured. The line mechanism now remains idle until the last spaces are acted upon, when the line-clutch is thrown into action for completing the remaining operations on the line which is in the measuring-clamp and for computing the next. Upon restarting the line mechanism the machine proceeds to unclamp the line from its position under the gage 120 by the action of the cam 733 against the arm 731, leaving the part of the channel 182 formerly occupied by said gage free for the passage of the lifting-plate 202. The action of the cam 722 upon the arm 720 then causes the line to be raised into the channel 183 and onto the lifting-blade 200. While the plate 202 is in its uppermost position in alinement with the bottom of the channel 183 the blade 200 is transferred with its type-line by means of the cam 784 from the position in front of said plate to a position above and beyond it, leaving the lifting-plate free to return for the next succeeding line.

After the rule has been removed from the type-line being acted upon and said line is thrust forward by the lifting-plate the next step is to elevate said line at intervals corresponding to the number of words contained therein. This operation is performed by a lifting-blade manipulated through the medium of cam-actuated members constructed and arranged in such a manner as to impart a positive upward movement to said blade at the beginning of its travel with a word-intermittent motion until the completion of the line, followed by a positive motion downward. Said intermittent motion depends upon a compensating device which causes the blade to mount in its channel while unopposed, but permitting the ascending blade to be stopped by an obstruction and held stationary. The obstruction referred to in the previous sentence consists of wards so arranged as to limit the upward movement of each word next below the leading word by stopping the separator 152, which has no nicks 150 and 151 to register with said wards, like the type.

The mechanism of the line-lifting device with its twofold function as partially outlined in connection with the clutch mechanism will now be described.

The line-lifting cam 784 is rigid with the line-shaft 700 and is provided on its right surface with the groove 785, which operates the roller 786 on the arm 789. Said cam-groove is approximately the width of the diameter of said roller for a short distance only, the other portion being wide enough to give said roller a certain amount of freedom. That part of the cam-groove 785 which passes nearest the shaft 700 is adapted to bring the line-lifting blade 200 into position in front of the plate 202, with its top flush with the bottom of said blade, while that part of said groove which is farthest away from said shaft is adapted to hold said blade beyond said lifting-plate by a positive action, at the same time giving the arm 789 a certain amount of freedom or play, owing to the increased width of said groove. A motion simultaneous with the one last described causes the type-line to advance until all of its words have passed within the cut-off channel 521, which is accomplished in the following described manner: The operating-arm 789 is rigidly fastened to the ratchet-wheel 791 and the lifting-arm 792. The arm 792, through the connecting-rod 793, operates the lifting-blade 200, which is fast in the sliding blade-mounting block 237, sleeved on the line-lifting guide-rod 279, Fig. 26. The arm 614 is loosely pivoted around the rock-shaft 790, to which the arm 789 and 792 and the wheel 791 are rigidly connected, and has its projecting roller 615

continually tensioned toward the shaft 600 by means of the spring 616, which has one end attached to the lower extension 617 of said arm 614 and the other end to the frame A. The arm is further provided with the pawl 618, pivoted at 621 to said arm, with its point 619 adapted to engage one of the teeth of the ratchet 791. The pawl 618 has the pin 620 projecting to the left and lying in the path of the arm 794. The line-lifting tripping-arm 794 is pressed upward by the spring 622, which connects the projection end of the pawl 618 with the arm 614 above said pawl, and said arm is positively operated downward by means of the cam 795 on the shaft 700. The rear end of the arm 794 is pivoted to the frame A, and said arm is provided with the roll or projection 799, which bears against the cam 795. The point 619 of the pawl 618 is kept in engagement with the teeth of said ratchet by means of the upward tension of the spring 622. The surface-cam 623 is fastened to the word-shaft 600 and is provided with the inclined depression 624.

The operation of the parts just described is as follows: The cam 784 by means of its groove 785 brings the line-lifting blade 200 into its lowest engaging position for the new type-line through the medium of the arms 789 and 792 and the rod 793 and as soon as said line is lifted into the channel 183 by the lifting-plate 202 transfers it beyond the opening through which it came, leaving said lifting-plate free to return. This action takes place while the projection of the cam 795 is in its downward position and the tripping-arm 794 has swung the point 619 out of engagement with the teeth on the wheel 791. Said projection on the cam 795 thereupon passes away from the arm 794 and allows said point 619 to become reëngaged with the ratchet-wheel 791, the spring 622 performing this office. Upon the next revolution of the cam 623 the roller 615 falls into the depression 624, thereby rotating the ratchet 791 through the medium of the pawl 618 and the arm 614, and consequently swinging the arm 792 upward as far as the line is free to move without any obstruction, the arm projection 786 playing freely in the wide part of the cam-groove 785; but upon being opposed by the contact of a separator 152 with the cut-off channel-wards 522 and 523 said cam 623 rotates away from its roller, leaving the latter separated from the depressed surface 624 on account of said obstruction, which prevents said arm 792 from continuing its upward motion, said obstruction temporarily meeting the resistance of said spring 616. The cam 623 and the arm 614, with the parts operating therewith, may be termed a "compensating device." The opposite or projecting side of the cam 623 coming into engagement with the roller 615 presses it forward and releases the tension on the arm 792, allowing the latter to remain in its last-placed position by means of the friction between the coacting parts. The forward return of the arm 614 causes said pawl to click on said ratchet and engage one or more forward teeth, thereby causing the arm 614 to take a new hold, as it were, relative to the arm 792 ready to again push it forward as soon as its obstruction is removed. The movements dependent upon the continuous revolution of the cam 623, above described, are repeated for every word in the line and until the operation of the line-clutch has taken place. The cam 795 depresses the releasing-arm 794 to allow the blade 200 to descend or return to its starting-point after said blade has performed its appointed work and sent the last word thereon through the opening 561 in the cut-off plate 559. The action of the cams 795 and 784 at this time is not quick enough to clear the continuous line action of the word-shaft 600. Hence the arm 614 with attached pawl 618 are rocked forward by the projecting portion of the cam 623, thereby permitting said pawl to make a new engagement with the ratchet-wheel 791 preparatory to a repetition of the previously-described movements of these and their coacting parts.

When the blade 200 thrusts the last word of the line through the opening 561 of the cut-off plate 559, as further described, and just prior to the clutch operation, the blade-roller 204, which is fastened to the lower or back side of the upper end of the block 237, is thrust downward a short distance by contact with the projection 547, extending from the movable channel-block 550, and thus removes said blade out of said opening 561 prior to the lateral movement of said plate.

Although the actuating mechanism which operates the blade 200 has started said blade on its downward course at the instant the roller 204 strikes the projection 547, the receding movement is not quick enough to remove the top of said blade from the opening 561 in sufficient time to permit the lateral movement of the plate 559 to take place. Consequently recourse is had to said roller and projection. The blade 200 enters the opening 561 a distance only equal to the thickness of the plate 559 in order to elevate the last word onto a level with the top of said plate. So it will be seen that the rebound of said blade caused by the contact of said roller with said projection need be very slight and insufficient to materially affect the cam mechanism.

It is now necessary to cut off each word from the ascending type-line in the word-feed channel, shift it into the galley-feed channel, and at the same time remove the separators from between the words. These two steps in the operation of my machine are

accomplished simultaneously and automatically by means of a movable channel-block and knock-off plate, both actuated by power transmitted from the word-shaft. A description of the special form of construction for the word and space-actuating mechanism employed in this machine will now be given.

As already stated, the channel 183 is approximately the size of the type 121[a] and also of the temporary space or separator 152, allowing both to slide freely therein. The movable channel-block 550 is provided with the T-slide 550[a], projecting from underneath, which registers with the T-groove 551 in the frame A. Said channel-block is provided on the right with the projection 553, having the pin 554, which connects said projection to the operating-arm 555, said arm being pivotally mounted at 556 to the frame A. The arm 555 is provided at the left with the projection 557, having the stud 558 to operate the cut-off plate 559 by means of its engagement within the bifurcated right projection thereof. The arm 555 is further provided with the right extension 549, connected to the plunger-operating arm 412 by the rod 548. The roller or projection 436 on the arm 412 engages the cam 608 on the shaft 600, and by this means with the other connecting parts the arm 555 is vibrated or oscillated. The pivotal and other connections of the arm 412, together with its functions, are elsewhere explained. The cut-off plate 559 is pivotally mounted to the frame A at 560 and is provided with the front opening 561, corresponding exactly in size with the channel 183 and located in alinement therewith when in its position to the extreme left; but it may be moved to the right beyond the right wall of said channel. Said plate is cut away at 562 to mesh into registering projections in the frame A, whereby a continuous or level support for the word is presented while the channel-block 550 moves to the right. The thinner end 563 of said cut-off plate is constructed approximately the same thickness as the separators 152. The channel-block 550 has the channel 521, which is provided on its right wall with the projecting wards 522 and 523, corresponding to the nicks 150 and 151 in the type 121[a]. These wards present an obstruction to the advancement of the line of type 121[a] as soon as the separators 152 come in contact therewith. The instant said obstruction takes place said channel-block is moved to the left by means of its arm 555, thereby removing the channel 521 out of alinement with the channel 183 and into alinement with the upper or word-feed channel 582. The corresponding and simultaneous movement of the projection 557 through its pin 558 causes the cut-off plate 559 to move to the right, carrying with it the separator 152, which was inclosed in the opening 561, to a position above the funnel-like receptacle 564 and allowing it to drop therein by gravity.

The word-lift mechanism is essentially a sensitive or yielding pusher having a positive motion at each end of its travel and depends in this instance for its proper movement and adjustment upon a cam on the word-shaft having a section of its track composed of a yielding member so arranged as to allow said cam to continue to rotate while said lift, with its word, is stationary. This construction is necessary to accommodate the mechanism to words of varying lengths. A detailed description of said mechanism follows.

The word-pushing block or lift 565 is operated upward through the word-cut-off channel 521 when said channel is at the left in line with the channel 582 by means of the connecting-rod 566, the arm 569, pivoted at 569[a] to the frame A, and the cam 625 on the word-shaft 600. Intermediate of the lift 565 and the lower end of the rod 566 is the long sleeve 567, reciprocating vertically on the rod 579, which is attached firmly to the frame A. The cam 625 is provided with the groove 626, the inner edge of which consists in part of the spring-block 627, pivoted at 628 to said cam. The free end of the block 627 is forced outwardly by the coiled spring 629, one end of which is attached to said cam and the other end to said block. The arm 569 has the light spring 568 extending from said arm back of its pivoted point 569[a] forward to the frame A, said spring being only sufficiently stiff to approximately counteract the weight of the arm 569 and attached members. The instant that the channel 521 comes into alinement with the lift 565 the word in said channel is carried upward by said lift into the channel 582 by the rotation of the cam 625 and the consequent depression of the rear terminal of the arm 569 and the elevation of its front end with attached parts. During the revolution of the cam 625 the arm projection 632 comes in contact with the spring-block 627, and the continued upward movement of the lift 565 becomes sensitive. The top of the advancing word on the lift 565 now strikes the movable jaw 535 of the clip 540 and closes said clip upon a space which is held between said jaw and the fixed jaw 531. During this time the upward movement of the lift 565 is completely obstructed, which obstruction is permitted to take place because of the yielding action of the block 627 against its spring 629 as the projection 623 traverses its path. After the block 627 is carried beyond the projection 632 the tension on the arm 569 is neutralized, as before stated, by the sensitive spring 568 and the lift 565 remains stationary while the clip 540 is drawn to the left, as elsewhere described, leaving the space upon the word on said lift with the passage unobstructed. The groove

626 is widened just beyond the head of the block 627 to provide clearance for the projection 632 and allow the arm 569 to assume the various positions required by words of different lengths. The elevation 631 of the cam 625 now comes in contact with the arm projection 632 and causes the lift 565 to rise to its highest point, with its upper edge on a level with the bottom of the galley *b*, and the word is in readiness to be transferred thereon.

The mechanism for inserting the proper spaces in the type-line after they have been selected and ejected from the space-channels by the space-dislodging device or plunger and coacting parts comprises means for engaging each space in turn, conveying it to the locality of the word to which it belongs, and there depositing the same. As already stated, the space-plunger 409 is adjustable behind one or the other of the space-channels 123, Fig. 11. The bottom spaces lie in the channels 123 on an incline, as shown at 419, from left to right downward, since the thickest of said spaces are contained in the right-hand channel, and they grade down to the thinnest in the left-hand channel. The incline of the bottom 419 419 is sufficient to bring the tops of the lowest spaces on practically the same plane, which is what said incline is for. The stop-plate 528 is fastened on the front edge of said channel directly above the tops of the bottom spaces to prevent any but the latter from being forced from said channels. The space-plunger 409 at the proper time during the revolution of the word-shaft 600 is pushed forward by means of the arm 412, which is pivoted to the frame A at 405 and operated by means of the cam 608 on said word-shaft. The inclined channel-bottom 419 is provided with the grooves 426, the rear extremities of which are enlarged, as at 406, to aid in bringing the space-plunger 409 into alinement directly behind the spaces. The space-bottom 419 terminates in front of the space-channels 123 in the receiving-platform 520, said platform being provided adjoining the front edges of said channels with the projecting rib 519 to prevent the accidental return of the spaces into said channels after their ejection therefrom.

The space-pusher reciprocates in front of the space-channels 123 from a position directly at the right of the space designated by the measuring devices to a position at the left through a suitable opening in the right wall of the channel 582, with its left face in alinement with the inner surface of said wall, and back again after the next designated space. The pusher 514 is rigidly fastened to the pusher-rod 509, which serves as a guide therefor, being provided with bearings which permit it to slide. The connecting-bar 515 is pivotally connected to said pusher and the front end of the pusher-arm 516, which is in turn pivoted to the stud 518 and has a projection on its rear end in operative engagement with the cam 607 on the word-shaft 600. The spring 517 with one end fastened to the adjacent frame-bracket and the other to the arm 516 normally pushes the front end of the latter toward the right limit of the channels 123. The pusher-locating dog 504 is pivoted at 501 to the front end of the plunger-block 407. It is pressed upward by means of the flat spring 512. The dog 504 is provided with the engaging point 505 and the stop 503, which is in the path of the pusher-stopping projection 502. The locking-rack 513 is rigidly fastened to a bracket extending from the frame A and has its teeth in engaging relation with the point 505, being so disposed that any lateral pressure to the right against the stop 503 will thrust said point between whichever of said rack-teeth happen to be below, thereby preventing the spring 517 of the arm 516 from disturbing the pusher 514 when said pusher is thrust against said stop. To make the meaning of the last sentence more clear, I will state that the pusher 514 is forced to the extreme left end of its stroke by the positive action of the cam 607, while the return to the right depends upon the spring 517, and the dog 504 is designated to check and hold said pusher at any point in its spring-actuated return travel. The pusher 514 is provided with the protecting-gate 510, which is pivoted thereto at 511, the opening 500 between said pusher and said gate being sufficient to receive a space. The gate 510 drops after the pusher 514 is actuated to the right, and the plunger 409 forces the designated space between said gate and pusher. The gate 510 is provided with the opening projection 508, which extends beneath the cam-plate 507, the left operating guide-surface 506 of which is adapted to open said gate and swing it above said pusher, allowing the latter to continue its travel to the left beyond the gate and to push its space on through the right wall of the channel 582. The space is shoved through the opening 524 under the galley-plunger 530, between the open jaws 531 and 535 of the receiving-clip 540. The clip 540 has the upper surface of its fixed jaw 531 approximately in line with the top of the bottom edge 529 of the right permanent abutment 527 of the galley *b*. The lower jaw 535 of the clip 540 is normally held down by the light tension of the coiled spring 532. Said jaw is limited in its downward movement by means of the pin 533. The jaws of the clip 540 operate through suitable openings in the left wall of the channel 582 and the bottom edge 529 of the abutment 527, and this arrangement serves to prevent the space acted upon by said jaws from being laterally displaced when said clip is actuated to the left, as well as to provide a constant support for the words after they leave the pusher 565. The clip 540 is rigidly

fastened to the upper end of the rod 534, which enters the frame A, where it has its bearings in a plate affixed to said frame, thence extends to the rear of the machine and terminates in the left projection 539, Fig. 31. The projection 539 engages the right-hand groove of the box-cam 630, which is fastened to the word-shaft 600. The action of the cam 630 takes place after the space has been grasped by the jaws of the clip 540 and rotates the upturned end of the rod 534 to the left. This movement withdraws the clip 540 from the channel 582 and from above the word, leaving its passage unobstructed. As soon as the clip-jaw 535 is free from the pusher-block 565 its spring causes it to release the space and leave it on top of the now advancing word. The word-pusher block 565 at once fills the opening 524, having risen with its word until the top of said block is on a level with the bottom of the galley *b*.

I will now describe the upper galley devices, which consist of the means for receiving an advancing line of type, and when said line is complete of transferring it from the lifting-block, upon which the last word of the line rests, into the galley certain members arranged at right-angular reciprocal relation with each other are employed for the purpose specified above, as will appear from the following explanation: The last stage or section of the line-channel, designated as the "galley-feed channel" 583, has for its right wall the line-pusher 530 and for its left wall the galley-rule 538. The pusher 530 is rigidly fastened to the ends of the rods 525 and 526, the bearings of which are in suitable projections from the frame A. They are free to move the line-pusher 530 to the left from its position at the right of the type-line to a position beyond the rule 538, when the latter is withdrawn from the path of said pusher, as will be presently explained. The rod 525 is pivotally fastened at 545 to the operating-arm 541 and is thereby reciprocated to the right and left, carrying with it the pusher 530 and attendant members. The arm 541 is pivoted at 542 to the frame-plate 543, which supports the galley *b*, and it is double or bifurcated at its lower terminal, the right bifurcation having the roller 544 in the path of the cam 797 and the left bifurcation with its roller 645 in the path of the cam 798, both of said cams being on the line-shaft 701. The shaft 701 is driven from the line-shaft 700 by the intermeshing bevel-gears 703 and 702. The cam 798 actuates the galley line-pusher 530 to the left at the proper time for depositing the type-line in a position at the left of the rule 538, and the cam 797 returns said pusher to its position at the right of the galley-feed channel 583. The rule 538 has its sliding bearings in a rigid projection from the frame A and is provided with the rearwardly-projecting operating-rod 537, the rear end of which is engaged by the operating-arm 536, pivoted to the frame A at 134 and having the roller or projection 734 in engaging relation with the cam 735 on the line-shaft 700. The cams 722 and 735 are really grooves in opposite sides of the same member. The rule 538 is raised into its forward position to protect the advancing type-line or withdrawn to allow said line a free passage to the left into the receiving-galley through the medium of the cam 735 and other connecting parts just described. The operation of justifying the type-line is completed when said line reaches the galley *b* and the matter is ready to be removed from the machine as soon as said galley is full, or before, if desired. The friction-block 154 in the galley *b* serves to retain the advancing lines in a compact regular mass.

While the machine shown as embodying the invention is adapted for handling ordinary type and the invention is especially intended for such use, it will be understood that the invention is not limited to machines for justifying such ordinary type, but may be applied also in justifying type, matrices, or the like of any suitable material. Certain broad features of the invention also are applicable not only in machines for justifying composed lines of type or matrices, but in line-justifying mechanism of other classes, and the term "justifying mechanism" herein is used in this broad sense to include all classes of typographic work in which lines are to be justified for printing or the production of printing-surfaces. The calculating and space-determining devices in the machine illustrated and described herein are combined with a space-magazine and devices for supplying and inserting ready-made spaces; but it will be understood that the justifying-spaces may be provided otherwise than by using ready-made spaces, suitable space forming or supplying and inserting devices being combined with the calculating devices for this purpose.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A mechanism for justifying lines of type composed with temporary separators, comprising justifying devices constructed to compute from the line measurement and the number of separators the justifying-spaces for each line, means for removing the separators from the line, and means for inserting the justifying-spaces in lieu of said separators.

2. A mechanism for justifying lines of type composed with temporary separators, comprising devices for measuring the unjustified line inclusive of the separators, devices for registering the intervals in the line, and means controlled by said measuring and registering devices for computing the justifying-spaces independently for each line.

3. A mechanism for justifying lines of type

composed with temporary separators, comprising devices for measuring the unjustified line inclusive of the separators, devices for counting the intervals in the line after composition, means controlled by the measuring and counting devices for determining spaces to justify the line, and means for inserting said spaces in the line, in lieu of the separators.

4. A mechanism for justifying lines of type composed with temporary separators, comprising devices for measuring the lines inclusive of the separators, devices for registering the intervals in the lines, and means controlled by said devices for computing the spaces necessary to justify each line independently, means for ejecting the separators from the line, and devices for selecting and inserting the justifying-spaces in lieu thereof.

5. In a mechanism for justifying lines of type composed with temporary separators, devices for measuring the line inclusive of the separators, devices for counting the number of intervals in the line after composition, and means controlled by said devices constructed and arranged to determine justifying-spaces for the line equal in aggregate width to the shortage of the line when measured exclusive of the separators, whereby the separators are eliminated in the justifying operation.

6. A mechanism for justifying lines of type composed with temporary separators, comprising devices for measuring the line inclusive of the separators, means for predetermining the widths of justifying-spaces necessary in addition to the separators to justify the line, and a selecting device constructed and arranged to select justifying-spaces which are each larger than the spaces indicated by the measuring devices by the width of a separator.

7. In a mechanism for justifying lines of type composed with temporary separators, devices for computing the justification for each line independently comprising an element controlled by the number of separators or word-intervals in the line and an element controlled by the length of the unjustified line, in combination with mechanism for predetermining the justifying-spaces, said mechanism being controlled by said measuring devices.

8. A mechanism for justifying lines of type composed with temporary separators, comprising devices for measuring the line inclusive of the separators, devices for registering the intervals in the line, computing means controlled by the measuring and registering devices for computing the width of justifying-spaces independently for each line, the said determining means being so adjusted that the aggregate width of justifying-spaces for a line equals the shortage of the line measured exclusive of the separators, whereby the separators are eliminated in the justifying operation.

9. In a mechanism for justifying lines of type composed with temporary separators, devices for computing the justification for each line independently comprising a movable element controlled by the number of separators or word-intervals in the line and a movable element controlled by the length of the unjustified line, in combination with mechanism for predetermining the justifying-spaces, said mechanism being controlled by said computing devices.

10. In a mechanism for justifying lines of type composed with temporary separators, devices for computing the justification for each line independently comprising an element controlled by the number of separators or word-intervals in the line and an element controlled by the length of the line inclusive of the separators, in combination with mechanism for predetermining the justifying-spaces, said mechanism being controlled by said computing devices.

11. In a mechanism for justifying lines of type composed with temporary separators, the combination of an element having a parallel movement in proportion to the shortage of the line, an element having an angular movement controlled by the number of intervals in the line, and an adjustable part having its adjustment limited by the resultant of the movements of said elements, said adjustment being adapted to indicate the quotient of the line shortage divided by the number of intervals.

12. In a mechanism for justifying lines of type composed with temporary separators, mechanical means for obtaining the quotient of the line shortage divided by the number of word-intervals, comprising a bar having a parallel movement in proportion to the shortage of the line, a pivoted computing-bar extending in opposite directions from the pivot and having an angular movement from an initial position parallel with the first-named bar, said angular movement being controlled by the number of word-intervals in the line, and a part guided by the first-named bar and movable into contact with the computing-bar, the position of said part when in contact with the computing-bar being adapted to indicate the desired quotient.

13. In a mechanism for justifying lines of type composed with temporary separators, in combination with means to compute the justification for each line independently, an immovable abutment, and a movable part between which the line of type and separators is measured, and automatic means for measuring the line to determine its shortage, for the purpose described.

14. In a mechanism for justifying lines of type composed with temporary separators, in combination with means to compute the justification for each line independently, devices for measuring the line inclusive of the

separators comprising a channel in which the line is measured, an immovable abutment for one end of the line at a fixed point in said channel, a movable part operating upon the other end of the line, and means for automatically operating said measuring device, for the purpose set forth.

15. In a justifying mechanism, automatic means for determining the normal value of justifying-spaces for a line of composition, in combination with automatic mechanism controlled by said means for selecting from a limited number of space values a suitable combination of space values to justify the line.

16. In a mechanism for justifying composed lines of type, automatic means for determining the normal value of justifying-spaces for the line, in combination with means for selecting from a limited number of space values a suitable combination of spaces to justify the line.

17. In a justifying mechanism, automatic means for measuring a line and 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 fractional part of said quotient and adapted to reset the space-determining device during the operation of justifying, whereby the line may be justified by a combination of spaces having but two values.

18. In a mechanism for justifying composed lines of type, a space-selecting device, automatic means for measuring the line and determining the quotient of the line shortage divided by the number of intervals in the line, means for setting the space-selecting device in accordance with the integral part of said quotient, and means controlled according to the fractional part of said quotient and adapted to reset the space-selecting device during the operation of justifying, whereby a line may be justified by a combination of spaces having but two values.

19. In a type-justifying machine, the combination of a galley for unjustified matter, a galley for justified matter, means for transferring the lines from the former galley to the latter, automatic means intermediate the two galleys for measuring the shortage of the unjustified lines, automatic means for determining the justifying-spaces from said measurement, and automatic means for inserting justifying-spaces in the intervals between words.

20. In a machine for justifying lines of type composed with temporary separators, the combination with a galley for unjustified matter, a galley for justified matter, and means for transferring the lines from the former galley to the latter, of automatic devices intermediate the two galleys for measuring the unjustified lines, and means controlled by said devices for substituting justifying-spaces for the separators.

21. In a type-justifying machine, automatic means for measuring the shortage of an unjustified line and computing the space values to justify each line independently, in combination with automatic means for separating the words of the line and inserting between them justifying-spaces of the computed values.

22. In a type-justifying machine a galley for unjustified type-lines, a galley for justified type-lines, means for transferring a line from the former galley to the latter, automatic means for computing the space values necessary to justify the line, and automatic means for separating the words of the line and introducing between said words the justifying-spaces.

23. In a type-justifying machine a galley for unjustified matter situated at the lower part of the machine, a column-pusher for feeding the column toward the justifying devices, a galley at the upper part of the machine for justified lines, suitable type-channels leading from the lower galley to the upper, automatic means for breaking the lines into words as they pass through said channels, and means for inserting justifying-spaces between the words and reassembling the words into justified lines, substantially as described.

24. In a type-justifying machine, the combination of a line-measuring channel, a line-feed channel, a word-cut-off channel, means for raising the type from the feed-channel, means for operating the cut-off channel to separate the words, means for inserting justifying-spaces between the words, and a channel in which the words are reassembled in a justified line.

25. In a machine for justifying a line of type composed with separators, the combination of mechanism for counting and registering said separators after the line is composed, with mechanism for measuring the shortage of the line, for the purpose set forth.

26. In a type-justifying machine, a word-interval-registering device constructed and arranged to automatically count and register the word-intervals in a line of type after it is composed, for the purpose set forth.

27. In a type-justifying machine, means for holding a line of type and separators, a word-interval-registering device constructed and arranged to be operated by the word-separators, and means for moving said registering device relatively to said type-line.

28. In a type-justifying machine, means for holding a line of type composed with temporary separators, combined with a word-interval-registering device having a part

movable relatively to the type-line and adapted to be operated by exposed portions of the word-separators in the line.

29. In a type-justifying machine, means for holding a line of type composed with temporary separators, combined with a word-space-counting device having a part movable along said line, and adapted to be operated by exposed portions of said separators.

30. In a type-justifying machine, an electrically-operated counting device constructed to automatically count the intervals in an assembled line, said device having an operating-circuit and a controller for said circuit adapted to be operated at the intervals of the lines of type.

31. In a type-justifying machine, an element movable for each line in proportion to the number of word-spaces in the line, and means for moving said element, said means being brought into action by exposed portions of the word-separators in the line of type.

32. In a machine for justifying lines of type composed with temporary separators, a computing-bar having an angular movement, a slide connected to the free end of said bar, and means for moving said slide for each line a distance proportional to the number of separators in the line substantially as described.

33. In a justifying mechanism, the combination with the pivoted computing-bar and the slide or counting bar connected with the free end of said computing-bar, of the line-measuring bar movable parallel to the counting-bar, an arm extending at right angles from said measuring-bar and a gage-block movable on said arm and automatic means for measuring the line and setting the line-measuring bar.

34. In a justifying mechanism, the combination with devices for computing the normal justifying-space values for a line of type composed with temporary separators, of means controlled by said devices for selecting from a limited number of sizes a series of spaces having an average width substantially equal to said normal space value, and suitable to justify the line, and automatic means for inserting said spaces in the line.

35. In a justifying-machine, the combination with devices adapted to compute the normal justifying-space values, of the magazine provided with spaces of a limited number of values, a device for selecting spaces from said magazine, a part movable in proportion to the normal space value determined, and intermediate devices between said part and said space-selecting device whereby the latter is controlled to select spaces for the line having an average value substantially equal to the value of the normal space required to justify the line.

36. In a type-justifying machine, the combination with devices for determining the normal space value for the line, of the space-indexes corresponding to the several sizes of available spaces, a space-selecting device, means for bringing one of the indexes into action to set the space-selecting device at the beginning of a line, and a device movable in proportion to the difference between the selected space and the normal space and adapted through suitable mechanism to reset the selecting device to compensate for said difference during the process of justifying the line.

37. In a type-justifying machine, in combination, a pivoted computing-bar, means for counting the intervals occurring in a type-line and moving the free end of said bar in accordance with the number of intervals in the line, space-selecting devices, a feeler movable in one direction in accordance with the shortage of the type-line, means for moving said feeler in a second direction until intercepted by said bar, and means controlled by the latter movement of the feeler and adapted to set the space-selecting devices for the selection of justifying-spaces for the line.

38. In a justifying mechanism, a pivoted computing-bar having its computing edge in line with the center of its pivotal support and extending to both sides of said support in combination with means for giving said bar an angular adjustment in accordance with the number of intervals in the line under justification.

39. In a justifying mechanism, a pivoted computing-bar having a straight computing edge in line with the axis of the pivot and extending to both sides thereof, means for setting the bar in accordance with the number of word-intervals in the line under justification, and a feeler-gage movable in two directions in the plane of the computing-bar, one of said movements being controlled by the shortage of the unjustified line under treatment, and the second movement being limited by the computing edge of the bar and adapted to indicate the normal space value to justify the line.

40. In a justifying mechanism, in combination, a pivoted computing-bar and a slide engaging the free end of said bar, means for moving the slide a given distance for each word-space in the line under justification, a gage for coöperating with the computing-bar and means for locking the slide when the gage is in contact with the bar, for the purpose set forth.

41. In a justifying mechanism, the combination of a pivoted computing-bar, a slide engaging the free end of said bar and arranged at right angles to the bar when the parts are in their initial position, means for moving the slide in accordance with the number of word-spaces in a line under justification, and means for restoring the parts to their initial positions after their adjustment for each line.

42. 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 adjusting the selecting device to one of said space values, a difference device movable in proportion to the difference between the selected space value and the normal value, and means controlled by the difference device for resetting the selecting device during the justification of a line.

43. In justifying mechanism, an index corresponding to certain space values, and a part movable with relation to said index, in combination with a difference device adapted to be engaged by said movable part and moved relatively to the index a distance proportional to the difference between the space indicated on the index and the normal space value for the line.

44. In a justifying mechanism, a series of index-points, and an adjacent difference device having a series of fine teeth, in combination with a part movable along said index and difference device, and means for engaging said part with the difference device and moving both the part and the difference device until the former is intercepted by one of the index-points.

45. In a justifying mechanism, the combination with means for computing the normal justifying-space value, of a part such as 266 movable in proportion to said value, a series of space index-teeth, and a movable difference device having a series of fine teeth, an engaging pawl movable in the path of said part and adapted to contact therewith and be thrown into engagement with the index-teeth and difference device, and means for continuing the movement of said pawl until it is stopped by one of the index-teeth, whereby the difference device is given a partial movement, for the purpose set forth.

46. In a justifying mechanism, a fixed index-arc and adjacent movable difference-arc, a pawl carried by an arm and movable in proximity to said arcs, a second arm carrying an engaging pin in proximity to said arcs, means for setting the engaging pin in accordance with the normal justifying-space required for the line, and means for moving the pawl into engagement with the pin, thereby causing the pawl to be depressed and to engage the arcs, for the purpose specified.

47. In a justifying mechanism, devices for selecting justifying-spaces from a limited number thereof, comprising an index and cooperating devices for setting the selecting device, means for determining the difference between the spaces so selected and the normal justifying-spaces, means for multiplying said difference by the number of word-spaces to obtain the total difference, and means for resetting the space-selecting device during the operation of justifying the line to compensate for said total difference, for the purpose specified.

48. In a justifying mechanism, devices for selecting justifying-spaces from a limited number thereof, comprising a movable selector, automatic means for adjusting the selector for spaces of one size required to justify the line, a controller for resetting the selector to obtain spaces of a different size, and means for setting the controller to cause the shifting of the selector at the proper time.

49. In a justifying mechanism, a selecting device capable of selecting spaces from a limited number thereof, means for setting said device to one of the space values required, a controller governing the resetting of the selector if a second space value is required, a difference device movable in proportion to the difference between one of the space values required and the normal space value, and connections whereby the controller is set from the difference device.

50. In a justifying mechanism, the combination of a difference device, a lever having a movable fulcrum, means for setting the fulcrum in accordance with the number of word-intervals in a line, a controller, a connection between the difference device and one end of said lever, and a connection between the opposite end of said lever and the controller.

51. In a justifying mechanism, a lever, an adjustable fulcrum for said lever, means for counting the word-spaces in a line, and means for adjusting the fulcrum in accordance with the number of word-spaces, for the purpose set forth.

52. In a justifying mechanism, the combination of a lever, a shifting fulcrum therefor, a word-space-counting device, a shaft rotatable by said device, a series of stops on said shaft corresponding to the differenet numbers of word-spaces, and means for adjusting the fulcrum by said steps, for the purpose set forth.

53. In a justifying mechanism, a proportional lever, a movable fulcrum for the lever, a series of stops corresponding to the different numbers of intervals in lines of composition, and means for selecting a stop corresponding to the intervals of the line under justification and adjusting the fulcrum thereto, substantially as described.

54. In a justifying mechanism, a device movable in proportion to the difference between a normal justifying-space and one of the space values provided in the machine, a proportional lever connected to said device, a fulcrum for said lever adjustable in accordance with the number of intervals in the line under justification, a controller connected to said lever, a space-selecting device, and means governed by the controller for changing the selecting device from one space value to another during the justification of a line.

55. In a machine for justifying assembled

lines of type, devices for computing and selecting predetermined justifying-spaces, devices for separating the assembled words of a composed line and inserting said justifying-spaces between them, in combination with automatic mechanism for moving lines of type to and from said spacing devices.

56. In a machine for justifying composed lines of type, devices for inserting predetermined justifying-spaces between the words, line-handling devices, and automatic means for controlling the line-handling devices whereby they are automatically started and stopped and perform one cycle of operations for each line justified.

57. In a machine for justifying composed lines of type, devices for selecting predetermined justifying-spaces, devices for separating the assembled words and inserting said spaces between them, in combination with mechanism for shifting the type-lines to and from said spacing devices, and means for controlling said mechanism whereby it is automatically started and stopped at proper intervals and performs one cycle of operations for each line justified.

58. In a machine for justifying composed lines of type, a word-shaft and devices operated thereby for inserting justifying-spaces, in combination with a line-shaft and mechanism operated thereby for shifting the lines to and from the spacing mechanism, and means for automatically throwing said shaft into action at proper intervals.

59. In a machine for justifying composed lines of type, devices for inserting justifying-spaces between the words of a line, a line-shaft and connecting mechanism for shifting the lines to and from the spacing mechanism, a normally open clutch for bringing the line-shaft into action, and automatic means controlled by the spacing mechanism for closing said clutch at proper intervals.

60. In a machine for justifying lines of type, composed with separators, word-parting devices comprising a channel for the line of type, means for sensitively moving the line through said channel, and means for intercepting the word-separators, in combination with means for removing the separators, and means for substituting justifying-spaces in lieu thereof.

61. In a machine for justifying lines of type, a channel through which the line passes, a movable word-cut-off channel in connection therewith, means for stopping the progress of the line after each word enters said cut-off channel, whereby each word may be separated from the succeeding portion of the line, and means for inserting justifying-spaces between the words.

62. In a machine for justifying lines of type composed with temporary separators having portions projecting beyond the type, a channel and means for moving the line therethrough, means for successively intercepting the separators whereby each word may be separated from the succeeding portion of the line, and means for removing the separators and inserting justifying-spaces in lieu thereof.

63. In a machine for justifying lines of type composed with temporary separators having portions projecting beyond the type-bodies, a fixed channel and means for moving the lines sensitively therethrough, in combination with a movable word-cut-off channel having wards or projections to intercept the separators, means for ejecting the said separators and inserting justifying-spaces between the words, and means for reassembling the words and transferring the justified line to a galley.

64. In a type-justifying machine, means for feeding an unjustified line to the spacing devices comprising a pusher, a word-shaft, means for urging the pusher forward during part of each revolution of the word-shaft, and means for relieving the pressure from the line during part of each revolution, whereby the line is fed to the spacing devices word by word.

65. In a machine for justifying composed lines of type, the combination of a channel through which the line is fed to the spacing device, a pusher for the line, a line-shaft and connections whereby the pusher is returned to its initial position during each revolution of said shaft, a word-shaft, and connections between the word-shaft and the pusher arranged to forward the latter at each revolution of said word-shaft.

66. The combination with a galley for unjustified matter, of a measuring-channel, a line-feed channel, and a pusher and operating devices therefor, for transferring a line from the galley successively to the measuring-channel and the line-feed channel, for the purpose set forth.

67. In a machine for justifying lines of type, a channel through which the lines are caused to travel, means for separating the words and forwarding them separately, a clip or space-holder movable to and from the path of the words, means for inserting justifying-spaces in said holder, and means for withdrawing the holder and leaving each justifying-space in the channel to be carried forward by the succeeding word.

68. In a machine for justifying type, a channel, in combination with a clip or space-holder movable into and out of said channel and adapted to temporarily sustain the justifying-spaces, and means for inserting spaces in said holder at proper intervals.

69. In a machine for justifying lines of type, a line-feed channel and line-pusher, in combination with a word-feed channel, a

word-pusher, and a word-cut-off channel arranged to transfer the words from the line-feed channel to the word-feed channel.

70. In a machine for justifying lines of type, composed with separators, the combination with a line-feed channel, of a cut-off block movable transversely to said channel, said block having an opening through which the type pass, means for stopping the separators as they register with the cut-off block, and means for moving the block at proper intervals to remove the separators from the line.

71. In a machine for justifying type, the combination with the line-feed channel and word-cut-off channel movable transversely thereto, of the space-cut-off block between said channels, the word-feed channel, and means for moving the word-cut-off channel to separate a word from the line and moving the space-cut-off block to carry a separator out of the line.

72. In a type-justifying machine, in combination with means for measuring a line of type under justification and devices for selecting the spaces to justify said line of type, a rack provided with teeth corresponding in pitch to the location of the successive spaces with which the machine is provided, and means for engaging the space-selecting device with a tooth corresponding to the space value designated by the measuring device, for the purpose specified.

73. In a type-justifying machine, in combination with automatic means for measuring a line of type and registering the number of intervals therein, the computing device and the device for selecting the spaces, a member having channels for successive sizes of spaces, a rack having teeth corresponding in pitch to the separation of said space-channels, and means whereby the computing device effects the engagement of the space-selecting device with a tooth of the rack corresponding to the space value required by the line of type under justification, for the purpose set forth.

74. In a type-justifying machine, in combination, a space-pusher adjustable with relation to a series of space-channels a rack having teeth the pitch of which corresponds with the positions of said channels, automatic means for measuring a line of type and registering the number of intervals therein, a computing device to determine the space value required by a line of type under justification, and to indicate the result thereof by means of one of said teeth, and means interposed between said rack and said pusher whereby the latter may be located opposite the channel corresponding to said tooth so indicated, for the purpose specified.

75. In a type-justifying machine, in combination, a space-pusher adjustable with relation to a series of space-channels a rack having teeth the pitch of which corresponds with the positions of said channels, a computing device to determine the space value required and to indicate the result thereof by means of one of said teeth, and a pawl to engage said pusher to said tooth so indicated, for the purpose set forth.

76. In a type-justifying machine, in combination, a space-pusher adjustable with relation to a series of space-channels, a rack having teeth the pitch of which corresponds with the positions of said channels, automatic means for measuring a line of type and registering the number of intervals therein, a computing device to determine the space value required and to indicate the result thereof by means of one of said teeth, a connecting member between said pusher and said rack, and a pawl pivoted to said connecting member whereby it is engaged with said rack, for the purpose set forth.

77. In a type-justifying machine, in combination, a computing device, a selecting device, a setting-rack for the selecting device, a pawl adapted to engage with the teeth of said setting-rack, and means operatively connected with said pawl and adapted to permit said rack to shift one tooth from the position in which it was placed by the computing mechanism, for the purpose set forth.

78. In a type-justifying machine, in combination, a plurality of space-channels, a space-pusher in engaging relation thereto, means to cause said space-pusher to pass sensitively from one of said space-channels to another, a setting-rack having indexes corresponding to the positions of said channels, a pawl or detent in engaging relation with said setting-rack, and means operatively connected with the measuring device to cause said pawl or detent to engage the setting-rack tooth corresponding to the size of space required, for the purpose set forth.

79. In a type-justifying machine, in combination with the computing devices thereof, an arm having its path in the plane of the computing device and adapted to be intercepted thereby, a series of space-indexes in the path of said arm, a space-determining mechanism connected to said arm, and means to engage said arm with a space-index when it is intercepted by said computing device, for the purpose set forth.

80. In a type-justifying machine, in combination, a space-selecting device, a computing device to locate its position, a rack having teeth corresponding in pitch to the different space values to designate said position, a pawl or dog in coincident relation with said space-determining device, a friction device to hold said pawl or dog into position, and means to thrust it into engagement between said teeth and to thrust it out of engagement therefrom, for the purpose set forth.

81. In a type-justifying machine, in combination, a movable space-determining device, indexes to designate a series of space values adjacent the path thereof, a computing device in the path of said space-determining device, and a space-dislodging device movable in transverse direction from said space-determining device, all for the purpose set forth.

82. In a type-justifying machine, in combination with a series of space-channels, a space-determining device adapted to be set in operative relation therewith, a space-pusher blade, and a reciprocating arm operatively connected thereto, adapted to engage said blade at any of its positions, for the purpose set forth.

83. In a type-justifying machine, in combination, a plurality of space-channels, a bar movable transversely to the positions thereof, a cross-piece on said bar adjacent thereto, a slideway in said cross-piece a pusher in said slideway, and means to locate said cross-piece and to operate said pusher, all for the purpose set forth.

84. In combination in a type-justifying machine, indicators adapted to denote the different space values with which said machine is provided, a shortage-index adapted to denote the thickness of a space which inserted into each interval between the words of a line of type under justification would fill the shortage of that line, means for bringing said index (thus denoting said shortage) and one of said indicators into a coincident relation with each other, a device for inserting spaces into intervals between said words, and means adapted to cause said device to insert into said line, space values corresponding to the amount of motion had in bringing said index and said indicator last mentioned into said coincident relation, all as set forth.

85. In combination, in a type-justifying machine, a rack bearing a series of indexes respectively denoting the different space values with which said machine is provided, a second rack adapted to act as shortage-index denoting the thickness of a space which inserted into each interval of a line of type under justification would fill the shortage of that line, means for bringing said racks into relation with each other when said index coincides with one of said indicators, a device for inserting spaces into intervals between the words of said line, and means adapted to cause said device to insert into said line, space values equivalent to the amount of motion had in bringing said racks into said coincident relation, all as set forth.

86. In combination, in a type-justifying machine, a rack bearing a series of teeth or stops adapted to act as indicators respectively denoting the space values with which said machine is provided, a second rack arranged in a movable relation to said first-mentioned rack and provided with teeth or stops severally adapted to act as a shortage-index denoting the thickness of a space which inserted into each interval of a line of type under justification would fill the shortage of that line, means for bringing said racks into a relation with each other where one of said indexes coincides with one of said indicators, a device for inserting spaces into intervals between the words of said line, and means adapted to cause said device to insert into said line space values equivalent to the amount of motion had in bringing said last-mentioned index and said last-mentioned indicator into said coincident relation, all as set forth.

87. In combination, in a type-justifying machine, a rack bearing a series of teeth or stops adapted to act as indicators respectively denoting the space values with which said machine is provided, a second rack arranged in a movable relation to said first-mentioned rack and provided with teeth or stops each adapted to act as a shortage-index denoting the thickness of a space value which inserted in each interval of a line of type under justification would fill the shortage of that line, a pawl adapted to coöperate in a movable relation with a tooth on each of said racks and bring both into a coincident relation with each other, a device for inserting spaces into intervals between the words of said line, and means for imparting to the amount of motion had—in the coöperation of said pawl and teeth—in bringing said two teeth last mentioned in their said last-mentioned coincident relation, all as set forth.

88. In a type-justifying machine, in combination with indicators designating the space values with which said machine is provided and the differences between said values, a rack having a multiple of teeth for each of said differences, and a pawl in engaging relation to said teeth, whereby the remainder-rack may be engaged and moved with relation to an indicator an amount corresponding to the portion of one of said differences indicated by the computing device, for the purpose set forth.

89. In a type-justifying machine, in combination, a computing device to determine the line shortage, a remainder-computing device acting in conjunction therewith to determine the remainder, indicators designating a series of space values in engaging relation with said computing device, indicators designating differences between said values operatively connected to the before-mentioned remainder-computing device, means for engaging one of said remainder indicators or teeth at the point indicated by the shortage-computing device, whereby it is displaced a proper portion of said difference between said space values, and means for in-

dicating what larger spaces are needed to compensate for said difference, for the purpose set forth.

90. In a type-justifying machine, in combination, a space-determining device having a member corresponding to the amount of correction required, another member adapted to engage with said first-mentioned member and to adjust said space-determining device, and a detent to hold the same in its adjusted position to cause said space-determining device to move when the amount of the remainder is obtained, for the purpose set forth.

91. In a type-justifying machine, in combination with a series of space-indexes, a series of indicators coincident with each of said indexes, a pawl mounted in engaging relation with said indexes and said indicators, and means for moving said pawl while in engagement with said indicators, until intercepted by one of said indexes, for the purpose set forth.

92. In a type-justifying machine, in combination with a series of space-value indexes, a series of indicators coincident with each one of said indexes, a space-determining device, a pawl in engaging relation therewith and also in engaging relation with said indexes and said indicators, means for holding said pawl out of engagement therewith, and means for thrusting said pawl into engagement therewith at the proper time during the operation of said machine, for the purpose set forth.

93. In a type-justifying machine, in combination with a series of space-indexes, a series of indicators coincident with each of said indexes, an engaging device or projection movable in suitable relation to said indexes and indicators, a pawl in engaging relation with said indexes and indicators adapted to be put into engagement therewith by said projection, for the purpose set forth.

94. In a type-justifying machine, in combination with the space-indexes thereof and with a selector therefor, means for moving said selector from one index to another and for arresting it at the position indicated by the line of type being justified, a member having a series of teeth coincident with the positions of said index, means to displace as many of said teeth with said member a distance corresponding to the relative position of said selector and the succeeding space-index, and a detent to retain said member at the position so displaced, for the purpose set forth.

95. In a type-justifying machine, in combination with the space-index rack and the indicator-rack thereof, a member having a series of teeth corresponding to the difference between successive sizes of spaces, means to engage said rack at some point indicating an amount between successive sizes of spaces, and bring them into coincident relation, means for engaging said member and appropriating the number of teeth therein, corresponding to said coincident relation, and means to return said member one tooth coincident with the handling of each space until it is returned to its starting position, for the purpose set forth.

96. In a type-justifying machine, in combination with the measuring devices and the indexes and indicators thereof, a space-pusher-supporting device, a series of teeth to retain said support in coincident relation with the space values required, a controller, means to set said controller in accordance with the positions given to said indexes and indicators by the said measuring devices, and means to return said member and for causing it to shift said pusher device upon reaching its starting position, for the purpose set forth.

97. In a type-justifying machine, in combination with the computing devices thereof, an index-rack located in coincident relation with a series of space-channels, having teeth corresponding in position to the position of said channels, an indicator-rack movable with relation to the distances apart of said index-teeth, a pivoted locating-arm movable in engaging relation thereto, having means for engaging said computing devices and rack-engaging device, a pivoted adjusting-arm having means for engaging the space-determining devices and said racks, means for swinging said locating-arm until intercepted by said computing devices, and means for swinging said adjusting-arm until it engages said racks through its engagement by the locating-arm, for the purpose set forth.

98. In a type-justifying machine, in combination with the computing devices and the space-index and indicator, a locating-arm in engaging relation with said computing devices and said space-index and indicator, sensitive means for thrusting said arm against said computing devices, an adjusting-arm in engaging relation with said computing devices and said space-index and indicator, a stronger yielding means to thrust said adjusting-arm against said locating-arm and means to cause the meeting of said arms to engage said indicator and bring it into coincident relation with said index, for the purpose set forth.

99. In a type-justifying machine, in combination, a locating-arm, a sensitive spring to operate said arm, a space-index, an indicator, an adjusting-arm in engaging relation with said index and indicator, an engaging projection on said locating-arm, and a pawl on said adjusting-arm in engaging relation with said projection, having an incline in the path thereof, for the purpose set forth.

100. In a type-justifying machine, in combination with means for securing and handling a line of type and for inserting spaces

between the words thereof, a time-controller operatively connected with the actuating mechanism of said machine and means for setting said controller at predetermined starting positions, for the purpose set forth.

101. In a type-justifying machine, in combination with means for securing and handling a line of type and for securing and inserting spaces between the words thereof, a time-controller comprising a member having teeth, a pawl in engaging relation with said teeth, and means to engage and disengage said pawl and said teeth at the time required for the proper communication of said controller, for the purpose specified.

102. In a type-justifying machine, in combination with means for securing and handling a line of type and for inserting spaces between the words thereof, a time-controller comprising a ratchet, a pawl in engaging relation therewith, means for engaging and disengaging said pawl, and means operative at the proper time with relation to the movement of said controller, for the purpose set forth.

103. In a type-justifying machine, in combination with means for handling a type-line and for inserting spaces between the words thereof, a time-controlling device having a pawl, a rotary ratchet in engaging relation therewith, and means for engaging and disengaging said pawl, for the purpose set forth.

104. In a type-justifying machine, in combination with means for handling a type-line and for inserting spaces between the words thereof, a time-controlling device, a pawl, a suitable mount therefor, means connected therewith to impart motion to other mechanism, a rotary ratchet in engaging relation with said pawl, and means for engaging and disengaging said pawl, for the purpose set forth.

105. In a type-justifying machine, in combination with means for handling lines of type having different numbers of words, and for handling the individual words thereof, and for inserting the spaces between them, a time-controller composing a ratchet, a pawl in engaging relation therewith, a yielding means for engaging, and positive means for disengaging said pawl, and means operatively connected with said controller to produce a mechanical motion at a proper time during the operation of said machine, in accordance with the setting thereof, for the purpose specified.

106. The combination, in a type-justifying machine, of means for handling a line of type and for inserting spaces between the words thereof, and a time-controller for the purpose specified, operatively connected with an automatic action of said machine, with actuating means for moving said controller to predetermined starting positions, substantially as set forth.

107. In combination, in a type-justifying machine, of means for handling a line of type and for inserting spaces between the words thereof, and a time-controller for the purpose specified, operatively connected with members producing an automatic action of said machine, provided with teeth for engaging the backward setting of said controller, with means for setting said controller backward to the required tooth, substantially as set forth.

108. In a type-justifying machine, in combination, means for handling a line of type and for inserting spaces between the words thereof, a time-controller for the purpose specified, adapted to automatically engage members producing a periodical action of said machine, provided with serrations adapted to engage said controller at its backward setting, and a pawl or dog adapted to engage with the required serration, substantially as set forth.

109. In a type-justifying machine, in combination, means for handling a line of type and for inserting spaces between the words thereof, a time-controller for the purpose specified, adapted to engage members producing an automatic action of said machine, at the time required, provided with serrations adapted to regulate the backward setting of said controller, a tripping device, and means adapted to move said controller synchronously with the inserting of the spaces in the type-line, into an engaging position with relation to said tripping device, substantially as set forth.

110. In a type-justifying machine, in combination with means for handling a line of type and for inserting spaces between the words thereof, and periodical actuating devices provided with a pawl, a time-controller for the purpose specified, adapted to engage said devices, a ratchet located in engaging relation to said pawl, and means for moving said pawl out of engagement with said ratchet, substantially as set forth.

111. In a type-justifying machine, in combination, with means for handling a line of type and for inserting spaces between the words thereof, periodical actuating devices, a pawl pivotally mounted, a time-controller for the purpose specified, adapted to engage said devices, a rotary ratchet located in engaging relation to said pawl, and a member adapted to disengage the latter from the former when said controller is returned to its starting-point, substantially as set forth.

112. In a type-justifying machine, in combination with means for handling a line of type and for inserting spaces between the words thereof, and a time-controller for the purpose specified, a pawl pivotally mounted, a rotary ratchet located in engaging relation to said pawl, a yielding means adapted to press the latter into engaging relation with the former, a member adapted to disengage

said pawl at the desired position of said controller, and a detent to hold said pawl out of engagement while said controller is being reset, substantially as set forth.

113. In a time-controller for the purpose specified, and as a part of a type-justifying machine, means for handling a line of type and for inserting spaces between the words thereof, in combination with means for moving said controller backward the desired distance, and with means for moving it forward to its operating position, a pawl, an engaging ratchet, and means for actuating said pawl whereby it is moved out of and into engaging relation with said ratchet, substantially as set forth.

114. In a type-justifying machine, in combination with means for handling a line of type and for inserting spaces between the words thereof, and with the controller and with the setting mechanism therefor, means adapted to engage and hold said controller in its backward position, and means operatively connected with the actuating mechanism whereby said controller is returned to its operating or tripping mechanism, for the purpose set forth.

115. In a machine of the class specified, in combination, with means for handling a line of type and for inserting spaces between the words thereof, a movable controller, limiting points or stops operative therewith, a tripping device operative in the path of said controller, adapted to be retained thereby until the latter has reached a position related to the extent or limit of its travel, for the purpose set forth.

116. In a type-justifying machine, in combination with means for handling and computing a line of type and for handling the words thereof and inserting the spaces between them, a time-recorder connected in an operative relation to the computing and the word-handling devices thereof, and means for engaging and disengaging said recorder, for the purpose set forth.

117. In a type-justifying machine, in combination with means for handling the lines of type and independently-actuated means for handling the words and spaces thereof, a time-controlling member having teeth corresponding in pitch to the time of said words and spaces, space-indexes and indicators, a time-recorder having teeth corresponding to said indexes and indicators, means to engage one set of said teeth, for the purpose set forth.

118. In a type-justifying machine, in combination with the space-indexes and indicators thereof, said indexes and indicators being connected in an operative manner, one to the computing device of the machine and the other to the device indicating the space values required, means for engaging a tooth in the recorder corresponding thereto, with means for engaging the space-handling mechanism in accordance with the setting of the recorder, for the purpose set forth.

119. In a type-justifying machine, in combination with means for indicating the requirements of a line of type under justification, a rack having teeth thereon corresponding to said indicating means, an engaging dog therefor, means for setting said dog into engagement and out of engagement therewith, and means for locating said rack and said dog in coincident relation with said requirements, for the purpose specified.

120. In a type-justifying machine, in combination, a time-controller for the purpose set forth, space-handling mechanism in operative relation with said controller, and actuating means for setting said controller at predetermined starting positions, substantially as set forth.

121. In a type-justifying machine, in combination, space-handling mechanism, a time-controller operatively connected with said mechanism, a computing device for determining the backward setting of said controller, and actuating means for setting said controller backward to the predetermined step designated by said computing device, for the purpose set forth.

122. A time-controller for the purpose set forth, adapted to engage with the space-operating devices, provided with computing devices adapted to regulate the backward setting thereof, and a record device adapted to be moved into engaging relation therewith.

123. In a machine of the class specified, in combination space-handling devices, a time-controller adapted to be set into engaging relation with said devices and provided with computing devices adapted to regulate the backward setting of said controller, a record device adapted to be moved into engaging relation with said controller, and means for setting said record device back to the extent predetermined by said measuring device, for the purpose set forth.

124. In a machine of the class specified, in combination with the space-handling devices, a time-controller adapted to be brought into an engaging relation with said devices, provided with a pawl, a rotary ratchet in engaging relation to said pawl, and computing devices to regulate the backward setting of said controller an amount corresponding to the number of space units in the remainder, for the purpose set forth.

125. In a machine of the class specified, in combination with the space-handling devices, a controller having means to present a succession of places of contact or stops, and a tripping device operable in the path of said controller, adapted to be restrained thereby

until the latter has reached a position related to the extent or limit of its travel, for the purpose set forth.

126. In a machine of the class specified, in combination with a controller provided with a series of obstructions or stops, a trip operative in the path of said controller, and a space-handling device in operative connection thereto whereby the latter is shifted from one position to another at the required time during the insertion of the spaces, for the purpose set forth.

127. In a type-justifying machine, in combination with the space-handling devices, a controller adapted to engage with said devices, a pawl pivotally mounted thereon, a rotating ratchet located in engaging relation to said pawl, and means adapted to disengage said pawl from said ratchet at the time said controller operates said space-handling devices, for the purpose set forth.

128. In a machine of the class specified, in combination with a space mechanism acting to appropriate larger space values than those designated by its setting, a time-controller with means to determine the backward and the forward setting thereof, and independent means for setting said controller backward a fixed amount when no action of the regular setting device takes place, for the purpose set forth.

129. In a machine of the class specified, in combination with the controller comprising a rotary ratchet having a pawl pivotally mounted in engaging relation thereto and a series of stopping-points pivotally mounted in coincident relation to said pawl, a reciprocating finger to disengage said pawl, and an incline for the partial backward setting of said controller, for the purpose set forth.

130. In a machine of the class specified, in combination with a rotary ratchet having a pawl pivotally mounted in engaging relation thereto and a detent to hold said pawl out of engagement, a flange pivotally mounted in coincident relation to said pawl, having a depression therein, and a tripping-finger operative in said depression, for the purpose set forth.

131. In a machine of the class specified, in combination with the controller thereof having means to obstruct a finger to prevent its action, a reciprocating finger, means to cause a sensitive contact between said finger and said controller, a space-value-designating device having escapement-teeth, and an escapement device connected in an operative relation to said finger, for the purpose set forth.

132. In a type-justifying machine, in combination, means for automatically moving an unjustified assembled line of type into a position for measuring its shortage, and means for automatically measuring said shortage, and means operating in conjunction with the assembled line to automatically register the number of intervals therein, for the purpose set forth.

133. In a type-justifying machine, in combination, means for automatically moving an unjustified assembled line of type into a position for measuring its shortage, means for automatically measuring said shortage, means operating in conjunction with the assembled line to automatically register the number of intervals therein, and means for automatically justifying said line, for the purpose set forth.

134. In a type-justifying machine, in combination, a galley, a column-feed device, a member having a measuring-channel, a gage to determine the length of a line in said channel, and means operating in conjunction with the assembled line to automatically register the number of intervals therein, for the purpose set forth.

135. In a type-justifying machine, in combination, a column-feed device, a member having a measuring-channel, an automatic pushing device to displace the line from the end of said column, a gage to determine the length of said line, and automatic means whereby said gage may be brought against the end of said line and then returned out of the path of said pushing device, for the purpose set forth.

136. In a type-justifying machine, in combination with a device for measuring a line of type having temporary separators at desired intervals therein, a computing-bar, and means to bring said bar into engaging relation with the line-measuring device, comprising a toothed member in engaging relation with said bar, each tooth corresponding to one of the temporary separators of the line, a locking-dog for said member and an escapement-rack and verge rendered operative by said separators, for the purpose set forth.

137. In a type-justifying machine, in combination, a galley, an automatic column-feed mechanism therefor, a pair of measuring-jaws for engaging the opposite ends of a line of type, and automatic means to move said jaws toward and away from each other, for the purpose specified.

138. In a line-measuring device, in a type-justifying machine, in combination, a channeled member, a pair of measuring-jaws, automatic means for separating said jaws, a pusher to thrust the line of type between them, and means to impart a relative movement to the jaws to measure the line, for the purpose specified.

139. In a type-justifying machine, in combination, a type-galley, an automatic column-feed device in operative relation with said galley, means to give said feed device an intermittent traveling motion, a gage or block to limit the travel of the column, and automatic means for measuring the lines of the

column successively, for the purpose set forth.

140. In a type-justifying machine, in combination, an intermittently-actuated ratchet-rod means for reciprocating said rod, a type-column pusher-arm operatively connected to said rod and capable of automatic travel in one direction only, and automatic means for measuring the lines of the column successively, for the purpose set forth.

141. In a type-justifying machine, in combination, a ratchet-rod suitably mounted in the frame of said machine, means for imparting intermittent reciprocating motion to said rod, a type-column pusher-arm operatively connected to said rod, a pawl pivotally connected to the hub of said arm and adapted to engage the teeth on said rod, thereby limiting the travel of said arm to one direction, and automatic means for measuring the lines of the column successively for the purpose set forth.

142. In a type-justifying machine, in combination with a galley capable of holding a type column, a traveling feed device adapted to follow and actuate said column at whatever point it may be in said galley, and automatic means for measuring the lines of the column successively for the purpose set forth.

143. In a type-justifying machine, in combination with a galley capable of holding a type column, a traveling feed device adapted to follow and actuate said column at whatever point it may be in said galley means to intermittently impart motion to said feed devices, and automatic means for measuring the lines of the column successively for the purpose set forth.

144. In a type-justifying machine, in combination, a galley for carrying a type column, a source of power adapted to follow and feed forward the diminishing type column, and automatic means for measuring the lines of the column successively for the purpose set forth.

145. In a type-justifying machine, in combination, a galley carrying a type column, a feed device adapted to follow the diminishing type column, a line at a time, a source of power to so actuate said devices, and automatic means for measuring the lines of the column successively for the purpose set forth.

146. In a type-justifying machine, in combination with a feed-galley and column-feed device, a line-lifting plate, means for operating the same, and automatic means for measuring the lines of the column successively for the purpose set forth.

147. In a type-justifying machine, in combination, a feed-galley, a column-feed device, a line-lifting plate operating upon the ends of the type, and means for operating said plate to shift lines of type laterally from the galley, for the purpose set forth.

148. In a type-justifying machine, in combination, a feed-galley, a column-feed device, a measuring-channel member, a line-lifting plate, means for operating said plate, to shift a line to the measuring-channel, and means for measuring the line for the purpose set forth.

149. In a type-justifying machine, in combination, a feed-galley, a column-feed device, a measuring-channel member, a line-lifting plate operating on the ends of the type, and means for operating said plate to shift lines laterally from the galley to the measuring-channel, for the purpose set forth.

150. In a type-justifying machine, in combination, a stop-block, detent-springs on said block, a line-lifting plate provided with rule-removing snap-hooks and an inclined plate, a rule-galley abutment having retaining-springs, and means for operating said block, for the purpose set forth.

151. In a type-justifying machine, in combination, a stop-block, detent-springs on said block, a line-lifting plate provided with snap-hooks and means for operating said block, for the purpose set forth.

152. In a type-justifying machine, in combination, a measuring-channel member, a line-lifting plate adapted to introduce a type-line into said channel, a combined clamp and measuring-gage, and means for actuating said gage from a given starting-point into contiguity with one end of said line, for the purpose set forth.

153. In a type-justifying machine, in combination, a type-line-holding device, jaws therefor adjustable with reference to the length of the line, and means for automatically counting the intervals between the words of said line while the latter is held within said jaws, all as set forth.

154. In a type-justifying machine, in combination, a type-line-holding device agreeing in size with the type-body, jaws adjustable with relation to the length of the line held therein, separators having bodies corresponding substantially with the body of the type character, but projecting at some point or points beyond said type-body, and means for successively engaging said separators in the assembled type-line and automatically registering the word intervals, for the purpose set forth.

155. In a type-justifying machine, in combination with a type-holding device, separators projecting beyond the type-body, a transversely-movable slide adjacent thereto, a contact-point on said slide with means for bringing said contact-point successively against said separators, for the purpose set forth.

156. In a type-justifying machine, in com-

bination with a type-holding device agreeing in size substantially with the type-body, said body having a depression or depressions therein, separators having bodies corresponding with the body of the type character, but without depressions agreeing with said type-body depressions, and means for automatically engaging said separators in the assembled type-line at the points exposed by said depression, and for registering the corresponding word intervals, for the purpose set forth.

157. In a type-justifying machine, in combination with a type-holding device agreeing in size substantially with the type-body, said body having a depression or depressions therein, separators having bodies corresponding in height and width substantially with the bodies of the type character but having no depression therein corresponding with the depressions in said type-body, said separators constituting electroconductors, and means for making successive electric connections with said conductors, for the purpose set forth.

158. In a type-justifying machine, a device for holding a line of type and separators, in combination with a counting device in contact relation with said separators, and an electric circuit to operate said counting device, for the purpose set forth.

159. In a type-justifying machine, in combination with means for adjustably holding type-lines of varying lengths, means for automatically counting and registering the intervals between the words of any of said lines, for the purpose set forth.

160. In a type-justifying machine, in combination with means for adjustably holding type-lines of varying lengths, electromechanical means for automatically counting and registering the intervals between the words of any of said lines, for the purpose set forth.

161. In a type-justifying machine, in combination, means to suitably clamp a type-line, separators between the words of said line, a point reciprocated past said line by a sliding member and capable of forming a contact with said separators only, and means for producing an electrical current when said contact takes place, for the purpose set forth.

162. In a type-justifying machine in combination, a type-line having separators therein, a point, means for bringing said point into contact with said separators alone, and means for producing an electrical current upon the instant of said contact, for the purpose set forth.

163. In a type-justifying machine, in combination, a type-line having separators therein, a counting apparatus operated by a contact with every separator in said line, and means for registering the number of separators, for the purpose set forth.

164. In a type-justifying machine, in combination, a type-line having separators therein suitably clamped in position, a point, a sliding member carrying said point, means for reciprocating said member with said point past said line, whereby contact is had between said separators and point, and electrical means for recording every such contact, for the purpose set forth.

165. The combination, in a type-justifying machine, of a word-shaft, a line-shaft, and automatic means for imparting intermittent rotary motion to said line-shaft from said word-shaft, dependent upon the number of intervals in each line, for the purpose set forth.

166. The combination, in a type-justifying machine, of a word-shaft, a line-shaft, means for transmitting power from said word-shaft to said line-shaft, and a locking-block adapted to be introduced within and withdrawn from the line of transmission of said power whereby the rotary motion of said line-shaft is rendered intermittent, for the purpose set forth.

167. In a type-justifying machine, in combination with a line-shaft clutch, a cam-actuated arm loosely sleeved on a lock-shaft, a spring connection between said shaft and arm, a clutch-arm fast to said shaft in the rear of said cam-actuated arm, and a lock-crank arm fast to the front end of said shaft, connected to a lock-rod operating in a suitable bearing, for the purpose set forth.

168. In a type-justifying machine, in combination with a line-shaft clutch, a cam-actuated arm loosely sleeved on a lock-shaft, a spring connection between said shaft and arm, a clutch-arm fast to said shaft in the rear of said cam-actuated arm, a lock crank-arm fast to a lock-rod operating in a suitable bearing, and a lock-block adapted to engage and hold said lock-rod against the action of said cam-actuated arm and attached spring, and to release the same again, for the purpose set forth.

169. In a type-justifying machine, in combination with a line-shaft clutch, a cam-actuated arm loosely sleeved on a lock-shaft, a spring connection between said shaft and arm, a clutch-arm fast to said shaft in the rear of said cam-actuated arm, a lock crank-arm fast to a lock-rod operating in a suitable bearing, a lock-block adapted to engage and hold said lock-rod against the action of said cam-actuated arm and attached spring, and to release the same again, and neutralizing projections between two of said members capable of relieving said block from lateral pressure, for the purpose set forth.

170. In a type-justifying machine, in combination with a line-shaft clutch retained in its normal condition by a spring, a cam-actuated arm loosely sleeved on a lock-shaft, a spring connection between said shaft and arm, less resilient than said clutch-spring, a clutch-arm fast to said shaft in the rear of

said cam-actuated arm and a lock crank-arm fast to a lock-rod operating in a suitable bearing, for the purpose set forth.

171. In a type-justifying machine, in combination with a line-shaft clutch retained in its normal condition by a spring, a cam-actuated arm loosely sleeved on a lock-shaft, a spring connection between said shaft and arm, less resilient than said clutch-spring, a clutch-arm fast to said shaft in the rear of said cam-actuated arm, a lock crank-arm fast to a lock-rod operating through a suitable bearing, and a lock-block adapted to engage and hold said lock-rod against the action of said cam-actuated arm and attached spring, for the purpose set forth.

172. In a type-justifying machine, in combination with a shaft carrying a clutch-arm, and means for actuating or locking said shaft; a line-shaft, a sliding toothed collar keyed thereon, provided with a projecting pin and operatively connected with said clutch-arm, a spring-cam secured within a clutch-block provided with an incline, a supporting clutch-block, a plate between said blocks having a curved edge, said edge, incline, and spring-cam serving as guides for said pin whereby said collar is reciprocated during the revolution and a revolving toothed idler arranged to engage and rotate said collar when said clutch-arm is actuated against said spring-cam, for the purpose set forth.

173. In a type-justifying machine, in combination, a line-shaft, a toothed idler running loosely on said shaft, a sliding toothed collar keyed to said shaft and provided with a projecting pin, a clutch-block having a spring-cam secured therein, and an incline, a supporting clutch-block, a plate between said blocks with a curved edge, said edge, incline and spring-cam serving as guides for said pin whereby said collar is reciprocated out of engagement with said idler during a revolution of the same, and means for overcoming the resiliency of said spring-cam and reciprocating said collar into engagement with said idler, for the purpose set forth.

174. In a type-justifying machine, in combination with a line-lifting plate, a line-lifting blade, a channel member containing the same, and means for actuating said blade, for the purpose set forth.

175. In a type-justifying machine, in combination, a channeled member, a line-lifting blade therein, means for positively actuating said blade at the beginning, and end of its lifting stroke or travel, and automatic means for producing a yielding intermittent motion between the extremes of said stroke, for the purpose set forth.

176. In a type-justifying machine, in combination, a line-lifting blade suitably mounted in a channel, an operating-arm, a controller-arm, and a ratchet-wheel fast to a shaft, said controller-arm being operatively attached to said blade; a tensioned compensating arm loose on said shaft having a pawl normally engaging said wheel, a tripping-arm operatively connected with said pawl, a cam on the line-shaft engaging and operating said operating-arm and tripping-arm, the operating-arm cam being provided with a groove of varying width to permit freedom of motion to said operating and controller arms, and a cam on the word-shaft having a depression for operating said compensating arm, for the purpose set forth.

177. In a type-justifying machine, in combination with a cut-off blade and means for operating the same, a channel member, a line-lifting blade therein, means for positively actuating said lifting-blade at the beginning and end of its lifting stroke or travel, and means for producing word intermittent motion between the extremes of said stroke, for the purpose set forth.

178. In a type-justifying machine, in combination, a cut-off blade, means for operating the same, a line-lifting blade operating in a suitable channel, an obstruction in the path of said lifting-blade capable of arresting the movement of the same, and means for permitting said lifting-blade to be obstructed and to retain it in that condition while under the influence of said obstruction, and for continuing said movement upon the nullification of said obstruction by the withdrawal of a space, for the purpose set forth.

179. In a type-justifying machine, the combination of a member having a type-containing channel corresponding in dimension with the type-bodies, a second member having a type-containing channel corresponding with the first, one channeled member being movable with reference to the other, a ward or wards in said second channel registering with the nick or nicks in said type-bodies, word-separators having bodies corresponding to the bodies of the character-type, but without nicks therein corresponding to the nicks in said type, whereby the type-line with its separators may pass freely along one of said channeled members while said separators are prevented from entering the other, with means to displace one channeled member with relation to the other, for the purpose specified.

180. In a type-justifying machine, the combination of two members having channels corresponding in dimension with the type-bodies, a third member having a channel corresponding with the first-mentioned channeled members, a ward or wards registering with the nicks in the type in said last-mentioned channel, means to displace said channels with reference to each other, with one or more word-separators having bodies corresponding to the bodies of the character-type, but without nicks therein correspond-

ing to the nicks in said type, whereby the type-line with its separators may pass freely along the first two channeled members and said separators be prevented from entering the third, for the purpose specified.

181. In a type-justifying machine, the combination of two members having type-channels corresponding in dimension with the type-bodies, a third member having a type-containing channel corresponding with those first mentioned, a ward or wards in said third channel registering with the nicks in the type, means to move said channeled members with reference to each other, one or more word-separators having bodies corresponding to the bodies of the character-type, but without nicks therein corresponding to said nicks in the type, whereby the type-line with its separators may pass freely along the first two channeled members and said separators be prevented from entering the other, with a member having a fourth receiving-channel, for the purpose specified.

182. In a type-justifying machine, in combination, a movable channeled member adapted to receive one word at a time from a type-line, and means for automatically shifting said member, for the purpose set forth.

183. In a type-justifying machine, in combination, a channeled member adapted to receive one word at a time from a type-line, a knock-off plate having an opening for the passage of said word, and means for automatically actuating said plate and removing the separator under said word, for the purpose set forth.

184. In a type-justifying machine, in combination, a movable channeled member adapted to receive one word at a time from a type-line, a knock-off plate having an opening for the passage of said word, and means for automatically actuating said member and plate, thereby shifting the position of said member with the word contained therein, and removing the space beneath said word, for the purpose set forth.

185. In a type-justifying machine, the combination of automatically and simultaneously operating word-shifting and separator-removing members, with means for actuating the same for the purpose set forth.

186. In a type-justifying machine, in combination, a channeled block adapted to receive one word at a time from a type-line, a separator knock-off plate, both suitably mounted, an arm pivotally connected to said block and plate and adapted to actuate the two latter in opposite directions, and means for vibrating said arm, for the purpose set forth.

187. In a type-justifying machine, the combination of a type-containing channeled member having its wall projecting into the channel coincident with the nick or nicks in the bodies of type, with one or more separators having bodies corresponding substantially with the bodies of type characters, but without nicks corresponding to those in said type, whereby said separators are prevented from passing along said channel with said type, for the purpose specified.

188. In a type-justifying machine, the combination of a member having a type-containing channel, a ward or wards in said channel agreeing with the nick or nicks in the type-bodies, with one or more separators having bodies corresponding substantially with the bodies of type characters, but without nicks corresponding to those in said type-bodies, whereby said separators are prevented from passing along said channel with the type, for the purpose specified.

189. In a type-justifying machine, the combination of a member having a type-containing channel provided with a ward or wards agreeing with the nick or nicks in the type, one or more separators having bodies corresponding substantially with the bodies of type characters, but without nicks corresponding to those in said type-bodies, whereby said separators are prevented from passing in said first-mentioned channeled member, for the purpose specified.

190. In a type-justifying machine, the combination of a member having a type-containing channel corresponding with the first, a ward or wards in said second channel registering with the nick or nicks in said type-bodies, with one or more word-separators having bodies corresponding to the bodies of the character-type, but without nicks therein corresponding to the nicks in said type, whereby the type-line with its separators may pass freely along one of said channels and said separators be prevented from passing into the other, for the purpose specified.

191. In a type-justifying machine, the combination of two members having type-containing channels corresponding in dimension with the type-bodies, a third member having a type-containing channel corresponding with the first two, and a ward or wards registering with the nick or nicks in the type; means for displacing said channels with reference to each other, a sensitively-pressed pusher to advance the type-line into said channels, one or more word-separators having bodies corresponding to the bodies of the character-type, but without nicks therein corresponding to the nicks in said type, whereby said line with its separators may pass freely along the first two channels and said separators be prevented from passing into the other, a fourth member having a receiving-channel, and an independent pusher therefor, for the purpose specified.

192. In a type-justifying machine, the combination of two members having type-containing channels corresponding in dimension with the type-bodies, a third member

having a type-containing channel corresponding with the first two, a ward or wards in said third channel registering with the nick or nicks in the type, means for displacing said channeled members with reference to each other, a pusher to advance the type-line therein, one or more word-separators having bodies corresponding to the bodies of the character-type, but without nicks therein corresponding to the nicks in said type, whereby said line with its separators may pass freely along the first two channels and said separators be prevented from passing into the other, a second pusher, a channeled member to receive the words, and a detent or clip to retain them, for the purpose specified.

193. In a type-justifying machine, in combination with a channeled member and the line-pusher therefor, means for extracting the separators from the line of type consisting of a reciprocating knock-off adapted to engage with said separators and to move in a transverse direction across the channel, for the purpose set forth.

194. In a type-justifying machine, in combination, a channeled member, a pusher therein, a separator knock-off movable transversely thereto, and means for arresting the feeding of the type-line while said separator is in engaging relation with said knock-off, for the purpose set forth.

195. In a type-justifying machine, in combination, a channeled member, a pusher in the channel of said member, a movable plate having a passage-way for a line of type with its separators, means for obstructing each of said separators, and means for displacing said plate in a transverse direction from the channel, for the purpose set forth.

196. In a machine of the class specified, in combination with the separators therefor adapted to indicate the separations between the words, a channeled member, an extractor having an opening in coincident relation with said channeled member, means adapted to engage said separators, and means arranged in operative connection with said extractor and adapted to move the same across the channel of said member to the receiving-receptacle, for the purpose set forth.

197. In a machine of the class specified, in combination with the separators therefor adapted to indicate the separations between the words, a channeled member, a separator-receptacle, an extractor having an opening coincident with the channel in said member adapted to engage with said separators, a stop for the separators also in coincident relation with said channel, and means arranged in operative connection with said extractor and adapted to move the same transversely across said channel to a position adjacent to said receptacle, for the purpose set forth.

198. In a type-justifying machine, in combination with a word-lift, a cam on the word-shaft, a yielding or sensitive member forming a part of the cam-track, a follower or projection on said track, and intermediate connecting parts, for the purpose set forth.

199. In a type-justifying machine, in combination with a word-lift, a cam on the word-shaft, a yielding or sensitive member forming a part of the cam-track, a follower or projection in said track, a spring-controlled arm attached to said projection, and intermediate connecting parts, for the purpose set forth.

200. In a type-justifying machine, in combination with a reciprocating word-cut-off channel member, a word-lift, and means for elevating and depressing the same, for the purpose set forth.

201. In a type-justifying machine, in combination with a vibrating or oscillating space-receiving clip, a word-lift and means for elevating and depressing the same, for the purpose set forth.

202. In a type-justifying machine, in combination, a plurality of channel members, a word-lift operating in the channels in said members, and means for actuating said lift, for the purpose set forth.

203. In a type-justifying machine, in combination with a series of space-channels and a space-plunger, means for engaging and conveying each space ejected by said plunger laterally to its position in the type-line, and means including a receptacle to inclose the space during its lateral movement, for the purpose set forth.

204. In a type-justifying machine, in combination with a space-plunger, a space-pusher normally drawn in one direction by a sensitive means, and means for overcoming said sensitive means and retarding said pusher in its travel, for the purpose set forth.

205. In a type-justifying machine, in combination with a space-channel member and a space-plunger, a space-pusher normally drawn in one direction by a sensitive means, means for securely checking the travel of said pusher in said direction, a gate attached to said pusher and adapted to receive a space and release the same, and positive actuating means to reciprocate said pusher in the opposite direction, for the purpose set forth.

206. In a type-justifying machine, in combination with a space-grasping clip and means for operating the same, a reciprocating space-pusher adapted to carry a space into engaging relation with said clip, for the purpose set forth.

207. In a type-justifying machine, in combination with a space-grasping clip and means for operating the same, a space-channel member, a space-plunger, and a space-pusher reciprocating transversely to said channel member and adapted to engage a

space displaced by said plunger and convey it into operative relation with said clip, for the purpose set forth.

208. In a type-justifying machine, in combination, a sensitive word-lifting plate, a space-grasping clip, a space-channel member, a space-plunger and a space-pusher reciprocating transversely to said channel member and adapted to engage a space displaced by said plunger and convey it into operative relation with said clip to be thereby deposited on the word carried by said lifting-plate, for the purpose set forth.

209. In a type-justifying machine, in combination with a laterally-movable space-plunger, a space-pusher normally drawn in one direction by sensitive means, and a spring-actuated rack-engaging member attached to said plunger and extending into the path of the travel of said pusher, whereby the latter is checked and fixed upon coming in contact with said member, for the purpose set forth.

210. In a type-justifying machine, in combination with devices for separating the words of a line and inserting justifying-spaces therein, a word-lifting block, two members forming a channel in which the words are assembled by the word-lifting block, means for withdrawing one of said members from the path of another of said members, and means for actuating said last-designated member with said line over the track of the first member, for the purpose set forth.

211. In a type-justifying machine, in combination with devices for separating the words of a line and inserting justifying-spaces therein, a receiving-galley and a word-lifting block, a reciprocating member, a second reciprocating member having its travel at right angles to the first of said members, said reciprocating members forming a type-line channel in which the words are assembled by the word-lifting block, and means for actuating said members in their proper order, for the purpose set forth.

212. In a type-justifying machine, in combination with devices for separating the words of a line and inserting justifying-spaces therein, with an automatic word-pusher, a receiving-galley, two members adapted to form a type-line channel said members being movable in planes at right angles to each other, said word-lifting block being arranged to assemble a type-line into said channel, for the purpose set forth.

213. In a type-justifying machine, in combination, devices for separating the words of a line and inserting justifying-spaces therein, a receiving-galley provided with a laterally-reciprocating abutment-block, a rule reciprocating across the path of said block and forming therewith a temporary type-line channel, and automatic word-pusher below said channel, said word-pusher operating to assemble a line of type in said channel, for the purpose set forth.

214. In a type-justifying machine, in combination, a receiving-galley provided with an abutment-block, means for laterally reciprocating said block, a rule forming with the latter a temporary type-line channel, means for reciprocating said rule across the path of said block, and a word-pusher below said block, and operating to raise words successively to form a type-line in said channel, for the purpose set forth.

215. In a type-justifying machine, in combination with a controller connected in operative relation to the line-handling devices of said machine, means to give said controller a step-by-step motion coincident with the handling of the words in a line of type under justification, and means to set said controller backward prior to the beginning of each line, for the purpose set forth.

216. In a type-justifying machine, in combination, a controller for the purpose set forth, connected in an operative relation with the line-handling devices of said machine, provided with a ratchet, a pawl in engaging relation with said ratchet, a spring to engage said pawl, and a cam to disengage it from said ratchet after it has reached its operating position, for the purpose set forth.

217. In an organized machine for justifying a composed line of type, means for ascertaining the total difference between the length of said line and a standard line, means for dividing said difference by the number of word-spaces in the line, a space-determining device for supplying the line to be justified with true spaces, connections between said device and said dividing means whereby said device is moved to and left in a position determined entirely by the movement of said dividing means, this being primarily set for each line to be justified, combined with means for subsequently moving said device from the position in which it is so set to cause it to determine the proper number of spaces to justify the line.

218. In an organized machine for justifying a composed line of type containing false spaces, means for ascertaining the total difference between the length of said line and a standard line, a single mechanism for dividing said difference by the number of word-spaces in the line, and making the proper allowance for the false spaces contained in the line, a space-determining device for supplying the line to be justified with true spaces, connections between said device and said dividing mechanism whereby said device is primarily set for each line to be justified, combined with means for moving said device from the position in which it is so set to cause it to determine the proper combination of spaces to justify the line.

219. In an organized machine for justifying a composed line of type, means for ascertaining the total difference between the length of said line and a standard line, means for dividing said difference by the number of word-spaces in the line, a space-determining device for supplying the line to be justified with true spaces, connections between said device and said dividing means whereby said device is primarily set for each line to be justified, combined with means for moving said device from the position in which it is so set to cause it to determine the proper spaces to justify the line.

220. In an organized machine for justifying a composed line of type containing false spaces, means for ascertaining the total difference between the length of said line and a standard line, means for dividing said difference by the number of word-spaces in the line and making the proper allowance for the false spaces contained in the line, a space-determining device for supplying the line to be justified with true spaces, connections between said device and said dividing mechanism whereby said device is primarily set for each line to be justified, combined with means for moving said device from the position in which it is so set to cause it to determine the proper spaces to justify the line.

221. In an organized machine for justifying a composed line of type, means for ascertaining the total difference between the length of said line and a standard line, means for dividing said difference by the number of word-spaces in the line, a space-determining device for supplying the line to be justified with true spaces, and connections between said device and said dividing means whereby said device is set for each line to be justified.

222. In an organized machine for justifying a composed line of type containing false spaces, means for ascertaining the total difference between the length of said line and a standard line, means for dividing said difference by the number of word-spaces in the line, and making the proper allowance for the false spaces contained in the line, a space-determining device for supplying the line to be justified with true spaces, and connections between said device and said dividing mechanism whereby said device is set for each line to be justified.

223. In a machine for justifying lines of type composed with temporary separators having portions projecting beyond the type, a channel and means for moving the line therethrough, means for successively intercepting the separators whereby each word may be separated from the succeeding portion of the line, and means for removing the separators and inserting justifying-spaces in lieu thereof.

224. In a machine for justifying type, the combination of a mechanism for selecting a series of spaces of equal or different sizes for the purposes of justification, with an averaging mechanism in operative relation to the space-selecting mechanism for causing it to select spaces of the same or varying sizes as may be necessary to justify the line, and means for giving the said averaging mechanism a setting dependent upon the number of word-spaces in the line.

225. In a justifying mechanism, the combination of a series of magazines mounted an equal distance apart; said magazines containing spaces of different thicknesses, each size of said space differing from its adjacent space by approximately the same amount, the magazines being located in regular order, according to size of spaces, with a space-ejector mechanism, suitably mounted to travel the total distance between the extreme space-magazines, a mechanism for giving the space-ejector mechanism a primary setting opposite one of the space-magazines, dependent on the difference between the length of the set line and the standard and on the number of spaces to be inserted, and a mechanism for operating the space-ejector a number of times equal to the number of spaces to be inserted.

226. In a justifying-machine the combination of a space-ejector mounted upon suitable ways, and adapted to travel thereon, means for giving to the space-ejector a setting upon its ways, said means being capable of independent movement to return to its primary position after setting the space-ejector, and means for restoring the space-ejector to its primary position independent of the setting means.

227. In an organized machine for justifying a composed line of type, means for ascertaining the total difference between the length of said line and a standard line, means for dividing said difference by the number of word-spaces in the line, a space-supplying device capable of movement in two directions, connections between said device and said dividing means whereby said device is moved in one direction and set to select the proper size of space, and mechanism for moving said device in the other direction to cause it to supply true spaces to the line.

228. A mechanism for justifying lines of type composed with temporary separators, comprising justifying devices constructed to determine the justifying-spaces for a line, means for removing the separators from the line, and means for inserting the justifying-spaces in lieu of said separators.

229. In a mechanism for justifying composed lines of type, automatic devices constructed and arranged to mechanically measure an unjustified line, means to mechanically represent the number of intervals

in the line, and means to compute from said measurement and number of intervals the justifying-spaces for the line.

230. A mechanism for justifying lines of type composed with temporary separators, comprising devices for measuring the unjustified line inclusive of the separators, and means controlled by said measuring devices for determining the justifying-spaces.

231. A mechanism for justifying lines of type composed with temporary separators, comprising devices for measuring the unjustified lines inclusive of the separators, means controlled by the measuring devices for determining spaces to justify the line, and means for inserting said spaces in the line in lieu of the separators.

232. A mechanism for justifying lines of type composed with temporary separators, comprising devices for measuring the line inclusive of the separators, and means controlled by said devices for determining the spaces necessary to justify the line, means for ejecting the separators from the line, and devices for selecting and inserting the justifying-spaces in lieu thereof.

233. In a mechanism for justifying lines of type composed with temporary separators, devices for measuring the line inclusive of the separators and means controlled by said devices constructed and arranged to compute justifying-spaces equal in aggregate width to the shortage of the line when measured exclusive of the separators, whereby the separators are eliminated in the justifying operation.

234. In a mechanism for justifying lines of type composed with temporary separators, measuring devices comprising a movable element controlled by the number of separators or word intervals in the line and a movable element controlled by the length of the unjustified line, in combination with mechanism for determining the justifying-spaces, said mechanism being controlled by said measuring devices.

235. In a justifying mechanism, devices for selecting justifying-spaces from a limited number of sizes comprising line-measuring and separator-counting devices, means governed by said devices for selecting justifying-spaces of two sizes, and a controller adapted to be set by the justifying devices to determine the number of spaces of each size inserted in the line.

236. In a type-justifying machine adapted to justify lines of type with spaces of two consecutive sizes, a gage-block and means for setting the same to correspond with the normal justifying-space for a line, in combination with means for selecting and inserting spaces of one size next to the normal, means for governing the number of such spaces inserted in the line, and means for automatically selecting and inserting such spaces of the other size next to the normal as may be necessary to justify the line.

237. In a justifying mechanism, the combination with line-measuring devices and means for registering the number of word intervals in the line under justification, of computing devices controlled by said means to determine the size of justifying-spaces required to lengthen or shorten the line for justifying.

238. In a machine for justifying lines of type, composed with temporary separators, the combination with line-measuring devices and means for registering the number of intervals in the line, of computing devices controlled by said means to determine the size of justifying-spaces to lengthen or shorten the line for justifying.

239. In a justifying mechanism, the combination with a member to be positioned in accordance with the number of intervals in the line, of a shaft carrying a series of spirally-arranged projections, and means for rotating said shaft in accordance with the number of intervals in the line to bring the proper projection into action to position said member.

240. In a justifying mechanism, the combination of interval-registering devices, a shaft carrying a series of spirally-arranged projections, connections between said interval-registering devices and said shaft for rotating the shaft in accordance with the number of intervals in the line, and a lever for dividing a shortage by the number of intervals in the line controlled by the projection brought into action by the rotation of said shaft.

241. In a justifying mechanism, the combination of a lever for dividing a shortage by the number of intervals in the line, interval-registering devices, a shaft carrying a series of spirally-arranged projections, connections between said interval-registering devices and said shaft for rotating the shaft in accordance with the number of intervals in the line, and a member for varying the action of said lever positioned by the projection brought into action by the rotation of the shaft.

242. In a justifying mechanism, the combination with means for determining the quotient of the line shortage divided by the number of intervals in the line, of difference devices for distributing the remainder including a lever movable in accordance with the remainder, a shaft carrying a series of spirally-arranged projections, and means for rotating said shaft in accordance with the number of intervals in the line to position the proper projection for varying the action of said lever in accordance with the number of intervals.

243. In a justifying mechanism, the com-

bination with means for determining the quotient of the lineshortage divided by the number of intervals in the line, of difference devices for distributing the remainder including a lever movable in accordance with the remainder, a movable fulcrum-piece for said lever, a shaft carrying a series of spirally-arranged projections for setting said fulcrum-piece, and means for rotating said shaft in accordance with the number of intervals to position the proper projection for setting said fulcrum.

244. In a justifying mechanism, the combination with means for determining the normal justifying-spaces for a line including a rack having teeth corresponding to the spaces used in the machine, of difference devices for distributing the remainder including a rack having teeth at less distances apart than the first-mentioned rack.

245. In a justifying mechanism, the combination with means for measuring the line and registering the number of intervals therein, of computing devices for dividing the shortage by the number of intervals and distributing the remainder, including a coarse-toothed rack set in accordance with the quotient, and a finer-toothed rack set in accordance with the remainder.

246. In a justifying mechanism, the combination of means for measuring a line, a space-registering device, means for determining the justifying-spaces from the shortage and number of intervals, including devices set in accordance with the number of intervals in the line, and connections whereby the setting of all devices dependent upon the number of intervals in the line is controlled by said space-registering device.

247. In a machine for justifying lines of type composed with temporary separators, the combination with a space-counting device and the devices of the machine which must be set to positions varying in accordance with the number of spaces in the line, of connections between said space-counting device and said devices whereby all of the said devices to be set are controlled by the space-counting device.

248. In a justifying mechanism, the combination with line-measuring and justifying-space-computing devices, of a setting-rack connected with said devices and provided with teeth spaced in accordance with the sizes of justifying-spaces, and a detent adapted to engage with the teeth and hold the rack in the position determined by the computing devices.

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