No. 844,557. PATENTED FEB. 19, 1907.

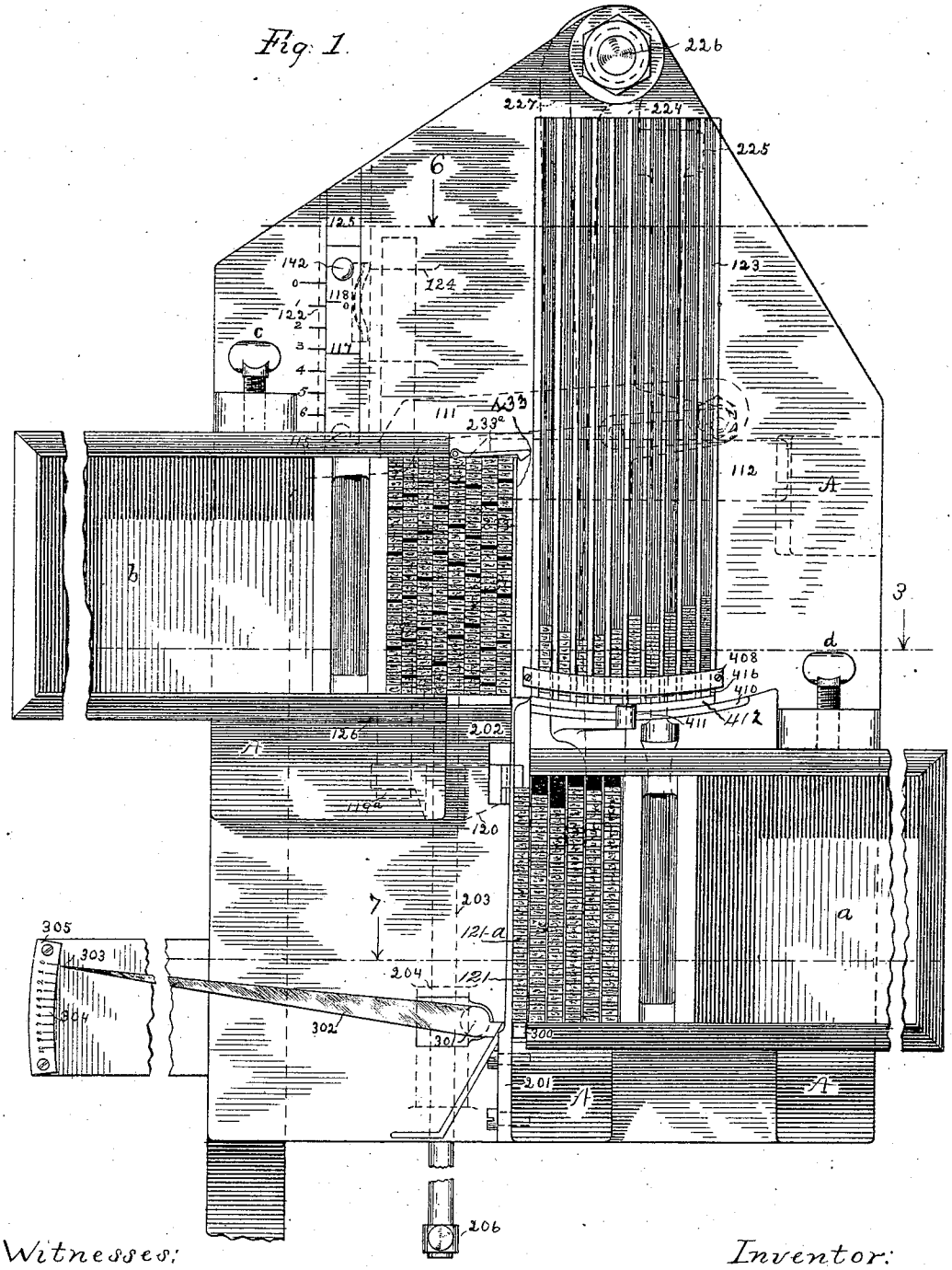
B. M. DES JARDINS.

TYPE JUSTIFYING MACHINE.

APPLICATION FILED MAY 20, 1895.

4 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

Eva S. Shelton

C. E. Buckland

Inventor:

Benj. M. DesJardins

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4 SHEETS—SHEET 2.

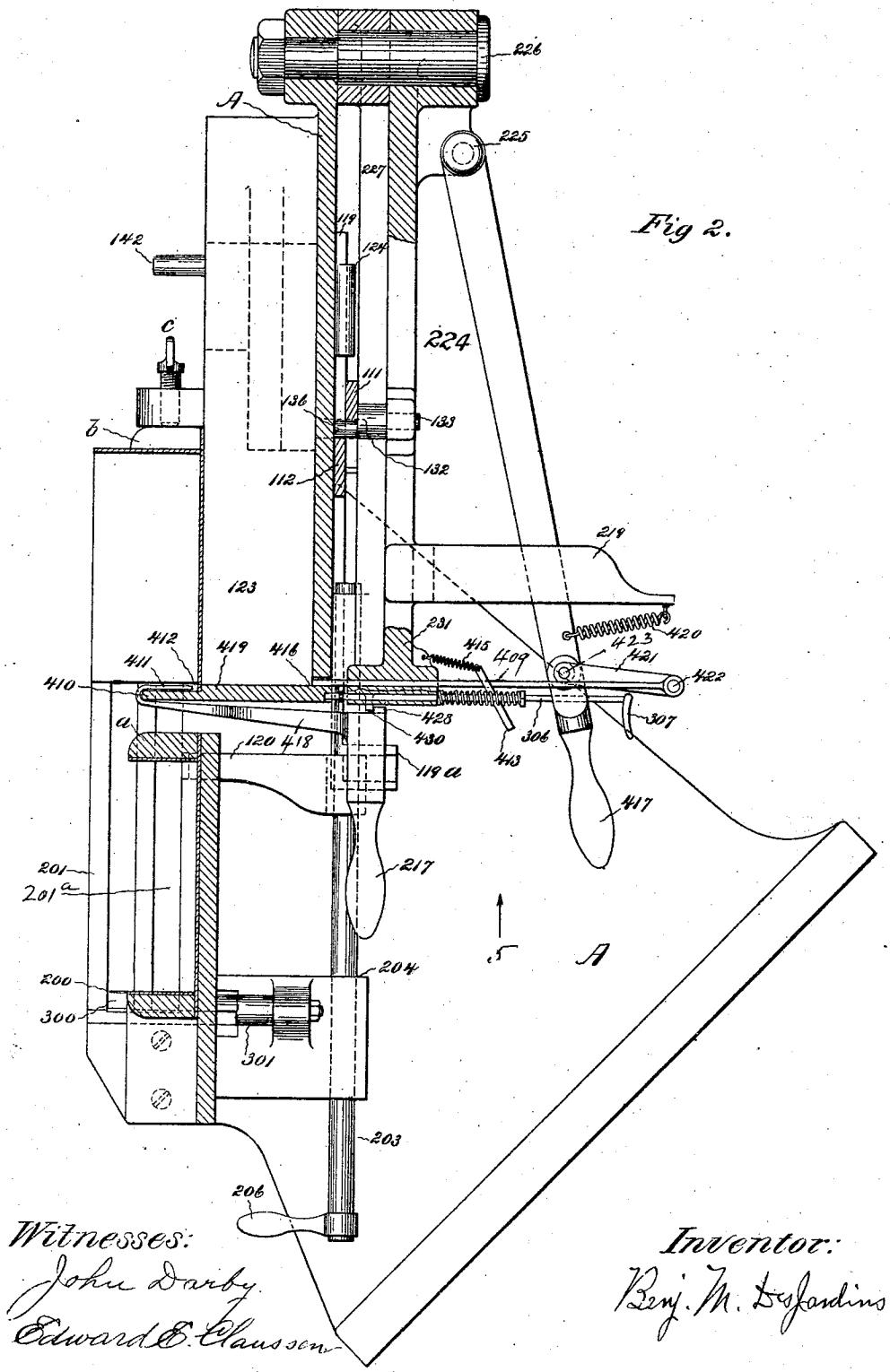

Fig 2.

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4 SHEETS—SHEET 3.

Fig. 3.

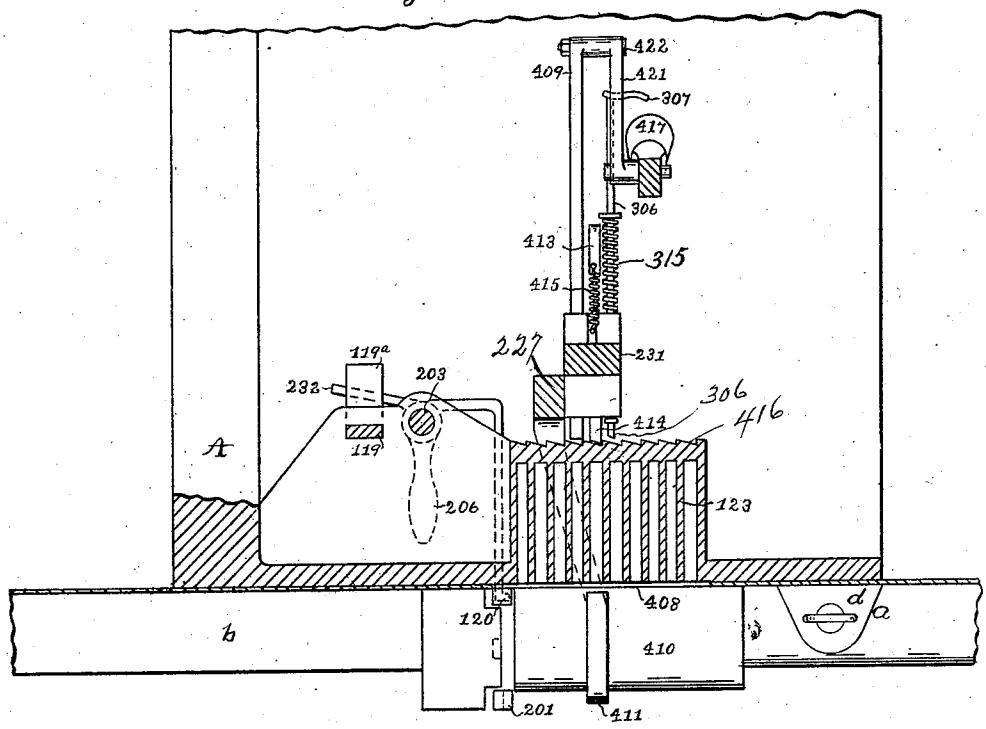


Fig. 7

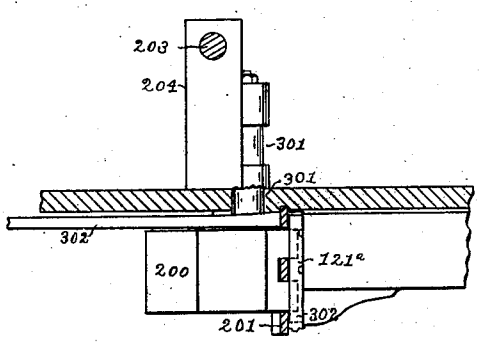
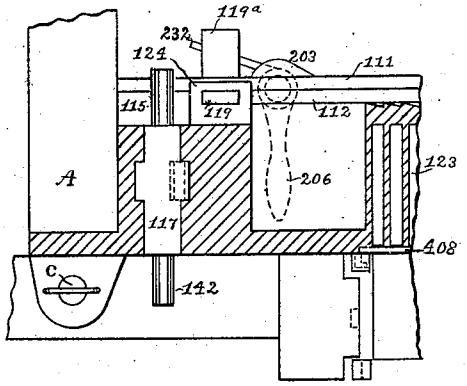


Fig. 6.



Witnesses:

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APPLICATION FILED MAY 20, 1895.

4 SHEETS—SHEET 4.

Fig. 5.

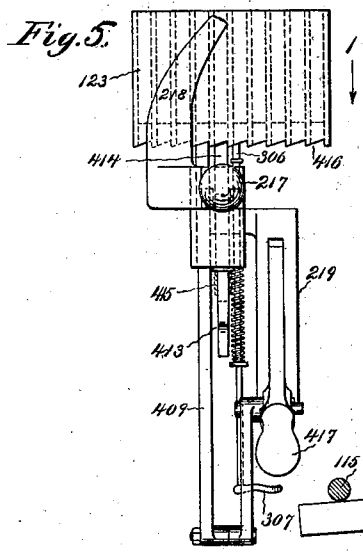

Fig. 4.

Witnesses:

John Darby.

Edward C. Claussen

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. 844,557. Specification of Letters Patent. Patented Feb. 19, 1907.

Application filed May 20, 1895. Serial No. 550,016.

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 a new and useful Type-Justifying Machine, of which the following is a specification.

The improvement relates to type-justifying machines, and consists of the mechanical embodiment of a method for determining upon the requisite combination of two neighboring sizes of spaces necessary to produce the most accuracy in justifying a line of type when a limited number of sizes of spaces are used.

The invention is particularly applicable to that class of type-justifiers employing ready-made spaces of different sizes, so that if only one size of justifying-spaces be inserted the accuracy of justification will be limited to the difference between the sizes, and any increase in accuracy involves increase in the number of sizes of spaces used. The spaces employed are preferably those which increase in size by the same amount, and I will designate this amount, or the difference between the successive sizes of spaces, by the term "unit."

In justifying type it is desirable that the difference between the lengths of the lines shall be reduced to a minimum amount, which must necessarily be within the difference between the succeeding sizes of single spaces, or the unit referred to. It is clearly obvious that one pile containing the requisite number of spaces may be considerably too small to fill out a given line shortage, while the pile containing the neighboring size will be too large. For example, if by measurement it is ascertained that the said smaller size makes a pile which falls short of filling out the line by four of said units a pile of the neighboring larger size will be as many units too long as there are spaces in the pile less four units. This improvement is designed to determine how many of the said units must be added to the said smaller spaces or substituted from a pile of the said larger ones to accurately fill the shortage. It follows that a pile containing a given number of one size of spaces, added to a small pile made up of a given number of the said units, will be equal to a combination pile of as many larger spaces as there are numbers of said units in said small pile added to the required number of the smaller spaces necessary to make up the full number. Having therefore determined how many of said units must be added to the said pile of smaller spaces in order to bring it up to the dimension required, the number of said units must indicate how many of the neighboring larger spaces are to be used.

In carrying out the present invention I use two computing elements, which I have termed a "computing-bar" and a "line-gage bar," the former element being controlled by the number of intervals between the words in the line and the latter element being controlled by the shortage of the line. These two elements jointly control the primary setting of the space-selecting device. The computing devices determine primarily what may be termed the "normal" justifying-space for the line—that is, the average width of space, which width is the quotient of the line shortage divided by the number of intervals between the words.

The machine is provided with spaces differing by units or multiples of a unit, and the justification is usually effected by using some spaces of less than the normal width and some spaces of more than the normal width. The proportion of the different sizes of spaces to be used is determined by the "difference device," which is adjunctive to the computing device.

By using this justifying mechanism any line of type can be justified to within a half-unit of the column measure, considering the difference between consecutive sizes of spaces to be a unit. Such justification, while not theoretically correct, is practically perfect.

The invention further consists of mechanism for transferring the action of the machine from one size of spaces to the neighboring size.

That my invention may be seen and fully understood by others, reference will be had to the following specification and annexed drawings, forming a part thereof, in which—

Figure 1 is a front elevation of the machine; Fig. 2, a right sectional view of said machine; Fig. 3, a sectional plan view of the same, taken on line 3, Fig. 1, in the direction of the arrow; Fig. 4, a detailed sectional front view; Fig. 5, a detailed plan view looking upward, the frame A being removed and showing the rack which locates the gaging-points of the measuring device; Fig. 6, a partial sec-

tion taken on line 6, Fig. 1, in the direction of the arrow; and Fig. 7, a partial section on line 7, Fig. 1, in the direction of the arrow.

Similar letters and figures of reference designate like parts in the drawings and specification.

The frame that supports the mechanism, galleys, and space-channels is designated by A. The brackets and other parts of the frame A that carry the several operative members are tilted back at a suitable angle to safely hold for manipulation loose type-lines and spaces, as will be understood by referring to Fig. 2. In the drawings and specification, however, these operative parts which are inclined in practice are shown and described for the sake of convenience and brevity as standing vertically. The galley *b* for justified lines is located at the left of the machine over the main supporting-frame A. The space-channels 123 are in the center on a plate projecting to the right from said frame, and below said channels is situated the galley *a*, in which the column of unjustified lines is placed. The space-channels 123 have their bottoms convenient to the lower edge of the upper galley *b* and their front edges near the plane of the bottom of said galley. The guard 408 extends across the front of the channels 123 to prevent more than the bottom spaces from being disturbed by the ejector 409.

The plate 419, that forms a common bottom for the space-channels 123, takes the form of an arc struck from the center of the stud 226 in order to line up with the lateral path of the swinging ejector 409, which has its bearings in the enlarged part or lug 231 at the lower end of the oscillating arm 224. Said arc also designates the path of the lower terminal of the oscillating transferring-arm 227, both this and the arm 224 being mounted on the stud 226, which has its bearing in the top of the frame A. The spaces in the channels 123 increase in size toward the left—that is, the right-hand channel contain the smallest size and the left-hand channel the largest, with the intermediate sizes in the intermediate channels. The bottoms of the channels are preferably made thicker toward the right in order to cause the central plane of each of the bottom spaces to intersect an arc struck from the center of the stud 226, thereby keeping said spaces well in the path of the ejector 409. The space-receiving platform 410, which is a forward extension of the plate 419, is provided with the shoulder 412 to prevent the spaces from sliding back against the channel-partitions. The platform 410 projects in front of the channels 123 a little below the bottom spaces and occupies a position at the right of the lower edge of the upper galley *b*.

The lower galley *a* terminates in the open line-channel 121, the right wall of which is removed for a distance equal to the width of said galley for the reception of the first unjustified line from the adjacent end of the column. The engaging end 300 of the lever 302 forms the base of the channel 121, the top of said end when in its normal or depressed position being flush with or slightly below the lower edge of the galley *a* and serves as a support upon which the type-line rests for its first measurement. The gaging end 300 receives the lower end of the unjustified line as the latter slides from the galley *a* into the channel 121. The movement of said column to the left is limited by the slotted wall 201 of the channel 121. The wall 201 is supplemented at its upper terminal by the laterally-projecting flat spring-catches 202, one behind the other, the parts of said catches which extend across the channel 121 being square on top and tapered from above downward to the left to permit of the passage of the words and to support them after said passage has taken place. The catches 202 are designed to spring to the left when a space is pushed against them from the platform 410, being thereby thrust out of the channel 121 to allow the next word to pass as it is raised from the lower part of said channel to a position at the right of the galley *b*.

The rule 200, by means of which the operator manipulates the words, is slotted at its upper end to enter the slots 201ª in the wall 201 for insertion between said words. By the use of the rule 200 the words are raised in the channel 121 above the catches 202 in line with the bottom edge of the galley *b*.

The rocking supporting-rod 203 for the intermediate measuring-gage 120 has sufficient longitudinal play to adjust itself to the lengths of the various lines. The rod 203 is located at the left far enough to clear the transferring-arm 227 when said arm is at the left end of its stroke and is mounted in the lugs 204 and 205, extending from the frame A. The rod 203 is provided with the gage 120 and the projection 232 rigidly attached thereto and has the handle 206 by means of which said rod is rocked or rotated for the purpose of swinging the free end of said gage either onto or off of a type-line in the channel 121.

On the upper surface of an offset to the right from the arm 227 is the stop or lug 429, extending clear across, and the lug 428, extending from the rear edge to the center of said offset. The arm 227 is further provided with the depending handle 217 and the forwardly-projecting offset or finger 418, which passes beneath the plate 419 and the platform 410 and is then turned over the top of said platform to form the pusher 411, extending nearly to the shoulder 412. The function of the pusher 411 is to propel a space from its position in front of any one of the

channels 123 to the line-channel 121. The configuration of the finger 418 is such that a space when expelled from either channel 123 by the ejector 409 always comes between the pusher 411 and the channel 121. The arm 224 has a projection on its right edge provided with the stud 133, to which the connecting-rod 132 is pivoted. The free end of the rod 132 is equipped with the contact-stud 136, which bears on the upper edge of the bar 112 and moves up and down therewith. The slotted guide 219 extends to the rear from the arm 224, and the lever 417, pivoted at 225 to a lug on the arm 224, operates through the slot in said guide. The lower end of the lever 417 terminates in a handle. The lug 231 on the arm 224 forms a bearing for the latch 414 and the escapement-bolt 306, as well as for the ejector 409.

The vertically-sliding guide-bar 119 has its bearings in the projections 124 and 126 of the frame A and supports the horizontal line-gage bar 112, the right end of which operates in the slot 137 in a projection from said frame. The bar 112 is constructed to register the heights of unjustified type-lines by the position of its upper edge, said edge when in its normal position representing a full type-line lying below the center of the pivot 110 a distance equal to the diameter of the stud 136. In other words, the top edge of the bar 112 is considered as being in the path of the top of the stud 136 and when figuratively resting upon a full type-line is even with the center of the pivot 110. The guide-bar 119 rests upon the intermediate gage projection 232, (best shown in Fig. 3,) being connected to said projection by the integral foot 119^a. The gage 120 is bent around and extends through a suitable slot or opening in a plate of the frame A, the internal end of said gage being adapted, as previously stated, to be swung onto and off of the line of type 121^a in the channel 121 by a rotary and longitudinal movement of the rod 203, whereby it engages said type while the line is undergoing measurement and disengages the same when the words are transferred to a position opposite the galley *b*.

The computing-bar 111 has its right end mounted on the pivot 110, extending from the frame A, and its free left end capable of adjustment at the required positions by the vertical movement of the space-counting **T**-slide 117 in the **T** groove or guideway 125 in the frame A. The slide 117 has a friction-spring to hold it in position and the screw 142 to clamp the same. The stud 115 projects from the slide 117 and extends above the upper edge of the left end of the bar 111 to hold the latter against the wedging action of the stud 136. The indicator-mark 118 registers with the graduations on the scale 122 to indicate the position of the stud 115. The free left terminal of the bar 111 is offset, so that the lower edge of the main body and the upper edge of said terminal are in the same plane and a straight line connecting them would pass through the center of the pivot 110, and the tangible elements represented by said straight line are adapted to assume a different position and form a different angle with the upper edge of the bar 112 for every changed position of the stud 115. The graduations on the scale 122 are equal distances apart to enable the stud 115, which is adjusted thereby, to locate said straight lines at positions necessary to describe one or more successive triangles. Said triangles have their common apices at the center of the pivot 110 and their lower bases on lines parallel with the slide 117 and the path of the stud 115, all measurements being made in lines parallel with the path of said slide.

As previously stated, the computing-bar 111 is located in angular relation to the bar 112 by means of the stud 115 on the slide 117, which has its path in a straight line fixed by the way 125. The stud 136 is moved by the bar 112 in a path practically parallel with the path of the stud 115. The deviation from a straight line in this travel of said stud 136 resulting from the fact that it moves in the arc of a circle is so slight as not to be deemed sufficient to materially affect the desired result. This device not only describes a number of independent triangles, but forms a mechanical triangle, or, rather, a series of similar triangles having their bases fixed by the slide 117 in accordance with the number of spaces needed, the hypotenuse in each case being the gaging edge of the bar 111. The altitude is determined by the path of the stud 136 on the bar 112 when at a position indicating a complete type-line, and the angle made by the altitude and base is fixed by the paths of said stud along said bar 112 and of the stud 115 when moved by the slide 117.

Another triangle is formed in which the base is described by the travel of the stud 136 from its position indicating a complete type-line to its position indicating an incomplete type-line. This is supposing the stud 136 to be located along the bar 112 prior to the downward movement thereof and then depressed for a distance equal to the line-shortage. The last-mentioned base of the triangle represents both the amount of shortage by its length and the number of spaces by the angle opposite. Different line-shortages will establish a series of similar triangles with their bases fixed by the amount of shortage and the angle opposite by the number of spaces needed. The position of the stud 136, therefore, has a fixed ratio to any series of points (or space-channels) in the machine, which, geometrically speaking, will be as the base is to the altitude of similar triangles, bringing the required size of space always in a fixed relation to the position of said stud.

To sum up the foregoing statements, the gages made by the inclination of the bars 111 and 112, although not delineated thereon, are actual successive gaging-points employed to measure the line-shortages, and the angle formed by said bars when the mark 118 registers with the first graduation on the scale 122 and the path of the stud 136 figuratively passes through the pivot 110 constitutes a mechanical triangle or tapered gage in which the successive gaging-points bear the same relation to the distances between the channels 123 as the distance of stud 136 below the stud 226 bears to the instance of the plunger 409 from said stud 226. Each successive movement of the slide 117 along the scale 122 to the extent of a graduation for every additional space needed increases the measuring capacity of the said angle-gage by the same amount. The stud 136, which actually represents the shortage, is thereby made to stop in the said gage at the point in its movement along the bar 112 indicating the size of spaces required, thus locating the plunger 409 opposite the particular size wanted. This angle between the bars 111 and 112 fixes a progression of measuring-points, as it were, which correspond to space-piles containing as many spaces as are represented by the position of the stud 115. These gaging-points or mechanical substitutes for space-piles are reckoned downward from a horizontal line passing through the center of the pivot 110 and extend to the lower or gaging edge of the computing-bar 111 at the point of engagement of the stud 136 and the incomplete line is reckoned as extending upward to meet one of said points, the two added together making the full or complete type-line.

According to well-known geometrical laws, if the parallels that bisect the said gage-lines through the points of contact representing the different sizes are also parallel with the path of the stud 115, said stud being considered as located successively equal distances along the scale 122, the segments of each of said parallels will be equal. Consequently a space which fits in one of said angle-gages at a given point will also fit in the other angles or gages on a line parallel with the slide 117 and passing through the same point. It will therefore follow that when the stud 115 has located the transversal or bar 111 coincident with a given graduation on the scale 122 the number of spaces corresponding to the position of the mark 118 relative to said scale in the particular channel 123, located by a given parallel representing the position of one of said spaces in its gage, will also be equal to the combined lengths of the said segments taken along the same parallel.

The lever 417, which passes through the guide 219, is connected to the ejector 409 by the link 421, said link being pivoted at 423 to said lever and at 422 to said ejector. The forward end of the latch 414 is adapted to engage any one of the ratchet-teeth 416. The rack formed by the teeth 416 is cut into the rear of the channel-plate 419, and said teeth correspond in number and distances apart with the channels 123. The latch 414 is provided with the depending catch 430, adapted, when in its forward position, to form a stop for the lug 429 of the space-transferring arm 227. When the latch 414 is in its rearward position and withdrawn from the teeth 416, the catch 430 enters between the lugs 429 and 428 of the arm 227 and locks the latter to the arm 224. The latch 414 is further provided with the thumb-piece 413, situated so as to be readily grasped with the handle of the lever 417, to pull said latch out of engagement with the teeth 416, against the resiliency of the spring 415. The spring 415 extends between the latch 414 and the arm 224, and normally draws said latch into engagement with the teeth 416. The operator releases the thumb-piece 413 and allows the latch 414 to reëngage the teeth 416, when the stud 136 is arrested by contact with the angle-bar 111.

The space-ejector 409 is longitudinally operated by means of the lever 417, through the lug 231 on the arm 224, said lever swinging with said arm transversely to the channels 123. The lever 417 is tensioned to the rear by the spring 420, extending between said lever and the back end of the guide 219. When the lever 417 is located back of the selected channel 123, it is designed to be drawn toward the operator, against the resiliency of the spring 420 and at right angles to the locating motion of the arm 224. This action of the lever 417 pushes the ejector 409 against the bottom space of the channel 123, which happens to be in front of said ejector. The ejector 409 has a longitudinal movement sufficient to thrust a space from the channel 123 and lodge it on the front platform 410. Said ejector 409 is so situated by being set to one side as to operate on the channel 123, which contains the next larger size of spaces than that indicated by the measuring-point engaged by the stud 136, thereby causing the mechanism to operate upon said next larger size, in accordance with the measurement of the difference device, prior to changing to the next smaller size.

The escapement-bolt 306 is mounted in the lug 231 of the arm 224, parallel with and adjacent to the latch 414. The bolt 306 is provided with the thumb-piece 307 at its rear end, and the spring 315 encircling said bolt between a collar thereon and the lug 231 normally presses the bolt backward out of engagement with the teeth 416. The lever 302 is pivoted at 301 to a projection from the frame A, with its shorter gaging end 300 extending under the type-line 121^a and its point 303 registering with the graduations

304 on the scale 305. The lengths of the parts of the lever 302 on each side of the pivot 301 are proportional between the said units or differences between neighboring sizes of spaces and the distance between the graduations 304. The scale 305 is firmly affixed to a suitable plate conveniently extending to the left from the frame A. The long end of the lever 302 is normally pressed upward to the full extent of its travel in that direction by means of a spring, with the point 303 registering at the 0 graduation on the scale 305. The type-line rests upon the gaging end 300 of the lever 302, said gaging end constituting the base of the channel 121, which always occupies the same place during the primary measurement of said line, since the construction of parts locates the point 303 on the 0 graduation at this and all other times, unless changed for the purpose of measuring the difference, as will be presently described, and this position of said point fixes said gaging end for said primary measurement.

The operation of the machine is as follows: The column of loose unjustified type is first placed in the galley *a* with the top or beginning of the reading matter against the wall 201, and an ordinary spring-tensioned block is inserted against the opposite end of said column to keep the last lines from falling over. The operator removes the first lead with his left hand and pushes the column to the left tight against the wall 201 upon the gaging end 300 of the lever 306. By keeping the run of the reading matter in mind the operator is able to count the number of places for spaces or intervals between the words and sets the slide 117 opposite the graduation on the scale 122 that corresponds with said number and with a turn of the screw 142 secures said slide in place. The inclination of the bar 111 now corresponds with that of a series of space-piles, each containing the number which the line in question requires. While this latter adjustment is taking place the right hand of the operator grasps the handle of the lever 417 with the thumb on the thumb-piece 413. The latch 414 is drawn back, and its catch 430 enters between the lugs 429 and 428 as the point of said latch clears the teeth 416. The whole of this portion of the mechansim is now swung to the extreme right. The parts referred to include the handle of the lever 417, the handle 217, ejector 409, latch 414, bolt 306, pusher 411, and the stud 136. Meanwhile the operator seizes the handle 206 with his left hand and gives it a partial turn to the right to bring the gage 120 into the channel 121, above the short type-line therein. The partial rotation of the bar 203 to the right is followed by a downward movement of said bar, induced by pressure on the handle 206 in that direction until the gage 120 rests upon the type-line. Said downward movement of the rod 203 carries with it the sliding bar 119 and the horizontal line-gage bar 112. The location of the bar 112 fixes the height of the intercepting stud 136.

The operations thus far described have brought the parts of the calculating instrument into proper adjustment for performing the desired operation of division. While the handle 206 is held tightly downward the operator with his hand still on the handle of the lever 417 and his thumb on the thumb-piece 413 carries said lever and the connected members to the left until the stud 136 is intercepted in the angle formed by the bars 111 and 112, forcing said bar down solidly with the gage 120 on the type-line and said bar 111 up tightly against the stud 115. Upon the interception above alluded to taking place the operator allows his thumb to slip off of the thumb-piece 413 and allows the point of the latch 414 to engage the teeth 416.

If the stud 136 stops accurately upon one of the points corresponding to a size of spaces provided in the machine, the latch 414 will be tight against one of the teeth 416, and the line can be justified with one size of spaces or the first size to the right of the one behind which the ejector 409 is thereby located by transferring said ejector to the right in the manner hereinafter described; but usually the stud 136 is not checked at the position above noted, and the latch 414 becomes located between two of the teeth 416, in which event two sizes of spaces are required. It will be remembered that the lug 429 is always engaged by the catch 430. Hence the operator is able to change from the lever-handle to the handle 217 and with it carry the connected parts to the right, withdrawing the stud 136 from its wedging position in the angle until the latch 414 abuts the adjoining tooth 416. The stud 136 by its former position between two of the invisible measuring-points determined where the two sizes of required spaces are located, and the movement of the mechanism to the right causes the ejector 409 to take position back of the larger size of said spaces, at the same time producing a looseness between said stud and the bar 111, which is equal to the number of units the line would lack if justified with the size of spaces represented by the measuring-point for the smaller size. The looseness of the stud 136 is now ascertained by pressing the long end of the lever 302 downward, thereby proportionately displacing or raising the end 300 and with it the line, the gage 120, the rod 302, the bar 119, and the line-gage bar 112, which latter elevates said stud until it is tight against the angle-bar 111. The point 303 registers the number of units or space-differences on the scale 305, which gives the number of larger-sized spaces required. The lever 302 is now allowed to assume its former position and the mechanism is in readiness for transferring the

size of spaces just selected into the line, which operation is described below, the gage 120 being first turned away from the upper end of said lines by a partial rotation to the left of the handle 206. The handle of the lever 417 is pulled forward until the bottom space has been transferred to the platform 410 by the ejector 409. The space so ejected is prevented from sliding back by the shoulder 412. The operator now changes from the lever-handle to the handle 217 to operate the space-pusher 411. In the meantime he is manipulating the rule 200 with the left hand. Having thrust the working edge of the rule 200 under the upper word and raised the same above the catches 202 into a position in front of the upper galley *b* prior to inserting the first space, he raises the second word in a similar manner until the top of it is in line with the upper surface of the platform 410. By a movement to the left in Fig. 1 of the handle 217 the pusher 411 is caused to move the space on the platform 410 through a suitable opening in the right wall of the channel 121, against the catches 202 and over the second word in the channel 121. The handle 217 is kept pressed to the left and the pusher 411 extending through the opening in the channel wall through which the spaces pass holds the space being acted upon suspended between itself and the catches 202 under the new line until the operator raises the word above said catches and into that part of the channel 121 which is at the end of the galley *b*, carrying said space with it. The space is now incorporated with the new line, between the first and second words. As the second word reaches the plane above the catches 202 the latter snap back across the channel 121 to prevent the new line or the justified part of the original line from dropping when the rule 200 is withdrawn. These operations are continued until the designated number of larger spaces has been acted upon and it is time to change to the smaller size.

The change above referred to is made by the operator who places his thumb on the thumb-piece 307 and pushes the escapement bolt 306 forward until it enters between two of the teeth 416 and with his finger on the thumb-piece 413 withdraws the latch 414 from engagement with its tooth. He now moves the handle of the lever 417 with its connections to the right until intercepted by the contact between the bolt 306 and the adjoining tooth 416. The latch 414 is thereupon released and actuated against the teeth 416 by the spring 415, while the release of the bolt 306 allows the spring 315 to return it out of engagement with said teeth. A continued pressure to the right now exerted on the handle 217 swings the arm 224 and attendant members until checked by the contact between the latch 414 and the succeeding tooth 416. The operation just described is the one employed to relocate the ejector 409 when the line is to be justified with one size only.

By a repetition of the operations hereinbefore described for introducing the larger spaces into the line the smaller ones just selected are similarly dealt with until all of the words in the lower part of the channel 121 have been successively transferred into line with the galley *b*. The operator withdraws the rule 233 upon the completion of the line and inserts it on the opposite side thereof, pushing the same with the balance of the justified column to the left until said rule snaps back into place under the hooked spring 233[a]. By a repetition of the several operations previously explained the entire column of type in the galley *a* is transferred to the galley *b*, being justified during the passage from one of said galleys to the other. If it is desired to lead the new column, the operator simply transfers the lead which he removes from the end of the lower column to the end of the new instead of laying it aside.

While the mechanism 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, and that the word "type" is used in this specification and the claims in this broad sense. The devices for determining the sizes and number of spaces to be used are applicable also 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. These 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, and the invention is especially intended for such use; but it will be understood that the justifying-spaces, the sizes and number of which are determined by these devices, may be provided otherwise than by using ready-made spaces, suitable space forming or supplying and inserting devices being combined with these space-determining devices for this purpose.

The computing devices shown herein for dividing the shortage by the number of intervals to determine the normal justifying-space are claimed in my application, Serial No. 550,015, filed May 20, 1895.

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

1. In a mechanism adapted to justify lines

of characters with spaces of two consecutive sizes, the combination of means for determining normal justifying-spaces for a line comprising a pivoted computing-bar, and means for selecting the two required sizes of spaces from a limited number of sizes.

2. In a mechanism adapted to justify lines of characters with spaces of two consecutive sizes, the combination of means for determining the normal justifying-spaces for a line comprising a pivoted computing-bar, means for selecting the two required sizes of spaces from a limited number of sizes, and means for determining the number of spaces of each size to be used.

3. In a mechanism adapted to justify lines of characters with spaces of two consecutive sizes, means for determining justifying-spaces comprising a pivoted computing-bar movable in accordance with the number of word-spaces, and a line-measuring device, in combination with means for selecting the two required sizes of spaces from a limited number of sizes.

4. In a mechanism adapted to justify lines of characters with spaces of two consecutive sizes, the combination of means for determining normal justifying-spaces for a line comprising a pivoted computing-bar, means for selecting the size of space provided in the machine which is next smaller than the normal, and means for measuring the difference between the aggregate of normal spaces and the aggregate of said smaller spaces, for the purpose set forth.

5. In a mechanism adapted to justify lines of characters with spaces of two consecutive sizes, the combination of means for determining normal justifying-spaces for a line, means for selecting the size of space provided in the machine which is next smaller than the normal, and means for measuring the difference between the aggregate of normal spaces and the aggregate of said smaller spaces, comprising a movable part engaging the line, and an indicator to show the amount of movement of said part.

6. In a mechanism adapted to justifying lines of characters with spaces of two consecutive sizes, the combination of means for determining normal justifying-spaces for a line, means for selecting the size of space provided in the machine which is next smaller than the normal, and means for measuring the difference between the aggregate of normal spaces and the aggregate of said smaller spaces, comprising a lever adapted to engage the line, and an indicator carried by the lever adapted to indicate the number of spaces next larger than the normal required to fill out the line.

7. In a justifying mechanism, the combination of means including a pivoted computing-bar for determining from a limited number of sizes the number and size of spaces that will enter the line shortage, and means for dividing what remains to be filled in the line into parts which correspond to the differences between the individual sizes of spaces, for the purpose set forth.

8. In a type-justifying machine, in combination, an adjustable member to support an unjustified type-line at a fixed, initial position, an adjustable gage adapted to rest upon said line, a line-gage bar located in conformity with the position of said gage, an angle-bar having the amount of its incline determined by the required number of spaces in said line, space-selecting mechanism capable of being located in accordance with the angle formed by the intersection of said bars, means for actuating said adjustable, supporting member, and connections between the several measuring parts for mechanically utilizing the measurements taken for the selection of two sizes of spaces, for the purpose set forth.

9. In a type-justifying machine, in combination with a series of channels designed to contain successive sizes of spaces and space-determining devices including a pivoted computing-bar, a member representing said successive sizes, acting in conjunction with a type-line and said space-determining devices, and a second member adapted to determine, in case said first-mentioned member registers between two of said channels, the proportional position of such registration relative to said channels and render the result in amounts corresponding to the difference between the sizes of spaces contained in said two channels, for the purpose set forth.

10. In a mechanism adapted to justify lines of characters with spaces of different sizes, the combination with means for determining normal justifying-spaces for a line, including a device for mechanically representing the line shortage and a device for mechanically representing the number of intervals in a line, said devices including a part having an inclination corresponding to one of said elements, of means for measuring the difference between the aggregate of normal spaces and the aggregate of the next smaller size of space.

11. In a mechanism adapted to justify lines of characters with spaces of different sizes, the combination with means for determining normal justifying-spaces for a line, including a device for mechanically representing the line shortage and a device for mechanically representing the number of intervals in a line, said devices including means for providing different angles or inclines for the justification of different lines, of means for measuring the difference between the aggregate of normal spaces and the aggregate of the next smaller size of space.

12. In a mechanism adapted to justify lines of characters with spaces of different

sizes, devices for dividing the line shortage by the number of intervals, said devices including a part having an inclination corresponding to one of said elements, in combination with means for measuring the difference between the aggregate of normal spaces and the aggregate of the next smaller spaces.

13. In a mechanism adapted to justify lines of characters with spaces of different sizes, the combination of a space-magazine, mechanism for dividing the shortage of a line by the number of intervals therein, said mechanism including a member having an inclination corresponding to one of said elements, a difference-measuring device, and means for selecting from the space-magazine the required sizes of spaces to justify the line.

14. In a mechanism adapted to justify lines of characters with spaces of different sizes, the combination of a space-magazine, mechanism for dividing the shortage of a line by the number of intervals therein, said mechanism including a member having an incline capable of being varied for different lines, a difference-measuring device, and means for selecting from the space-magazine the required sizes of spaces to justify the line.

15. In a mechanism adapted to justify lines of characters with spaces of different sizes, the combination of a space-magazine, mechanism for dividing the shortage of a line by the number of intervals therein, said mechanism including a member having an angular movement in accordance with one of said elements, a difference-measuring device, and means for selecting from the space-magazine the required sizes of spaces to justify the line.

16. In a justifying mechanism, a device for measuring an unjustified line, and a lever and coöperating devices constructed to divide the shortage of the unjustified line by the number of word-spaces in the line, in combination with a difference-measuring device, and means for selecting from a limited number of sizes spaces of one or more sizes required to justify the line.

BENJ. M. DES JARDINS.

Witnesses:

ISAAC A. ALLEN, Jr.,

EDWARD E. CLAUSSEN.