(No Model.) 5 Sheets—Sheet 1.

R. L. KIMBERLY.

JUSTIFYING MACHINE.

No. 342,364. Patented May 25, 1886.

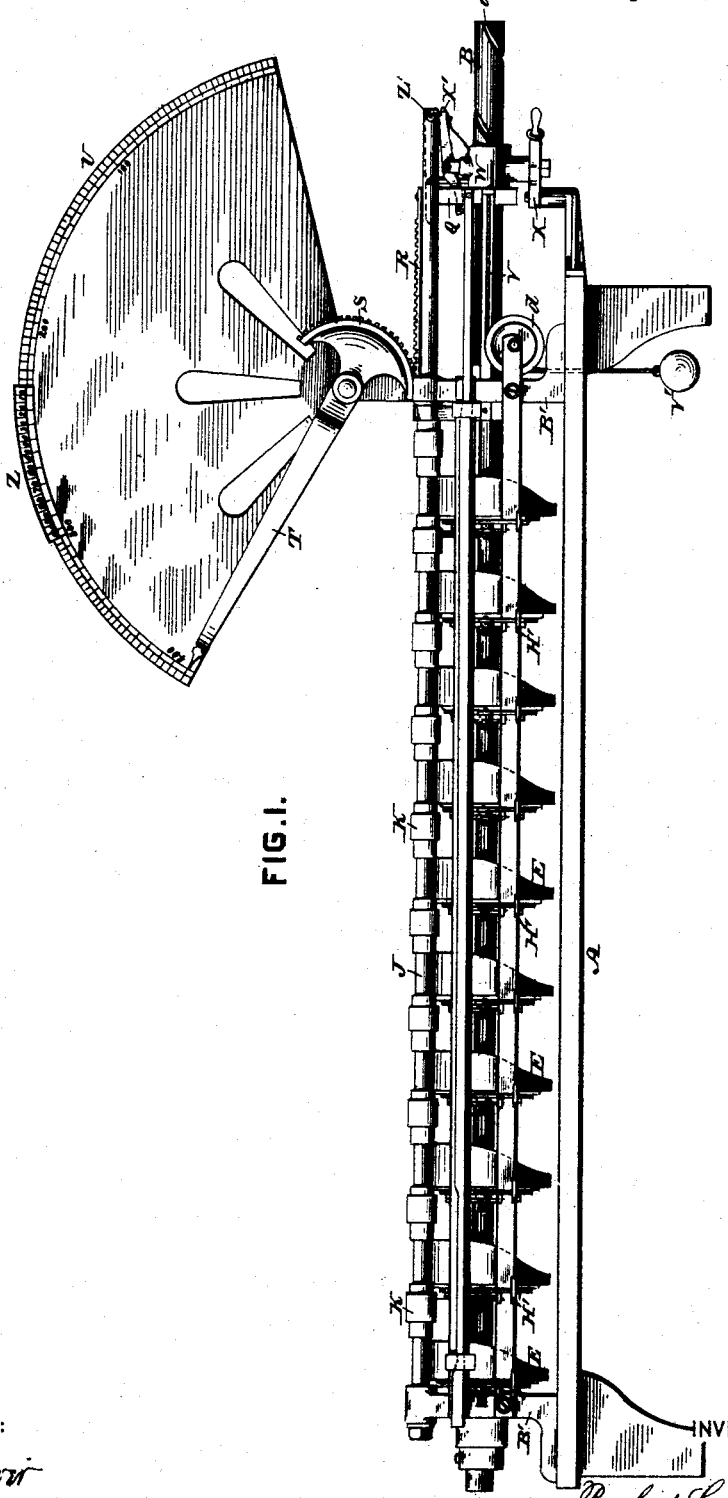

FIG. I.

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(No Model.) 5 Sheets—Sheet 2.

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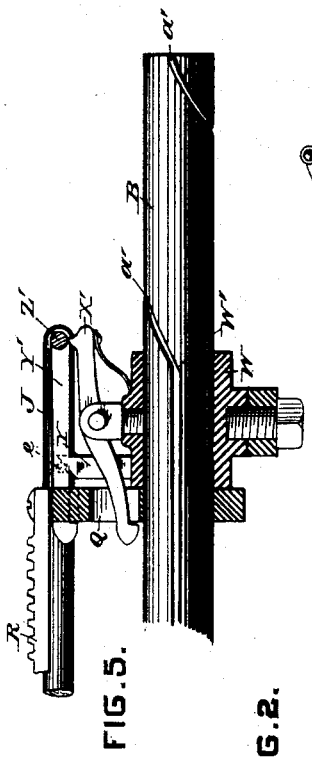

FIG. 5.

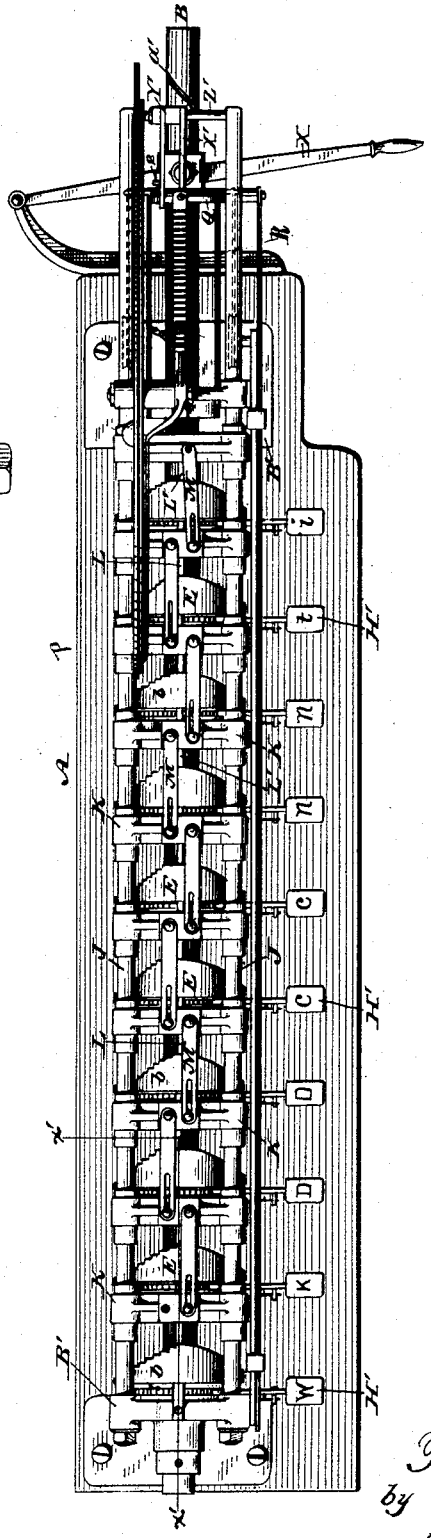

FIG. 2.

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(No Model.) 5 Sheets—Sheet 3.

R. L. KIMBERLY.

JUSTIFYING MACHINE.

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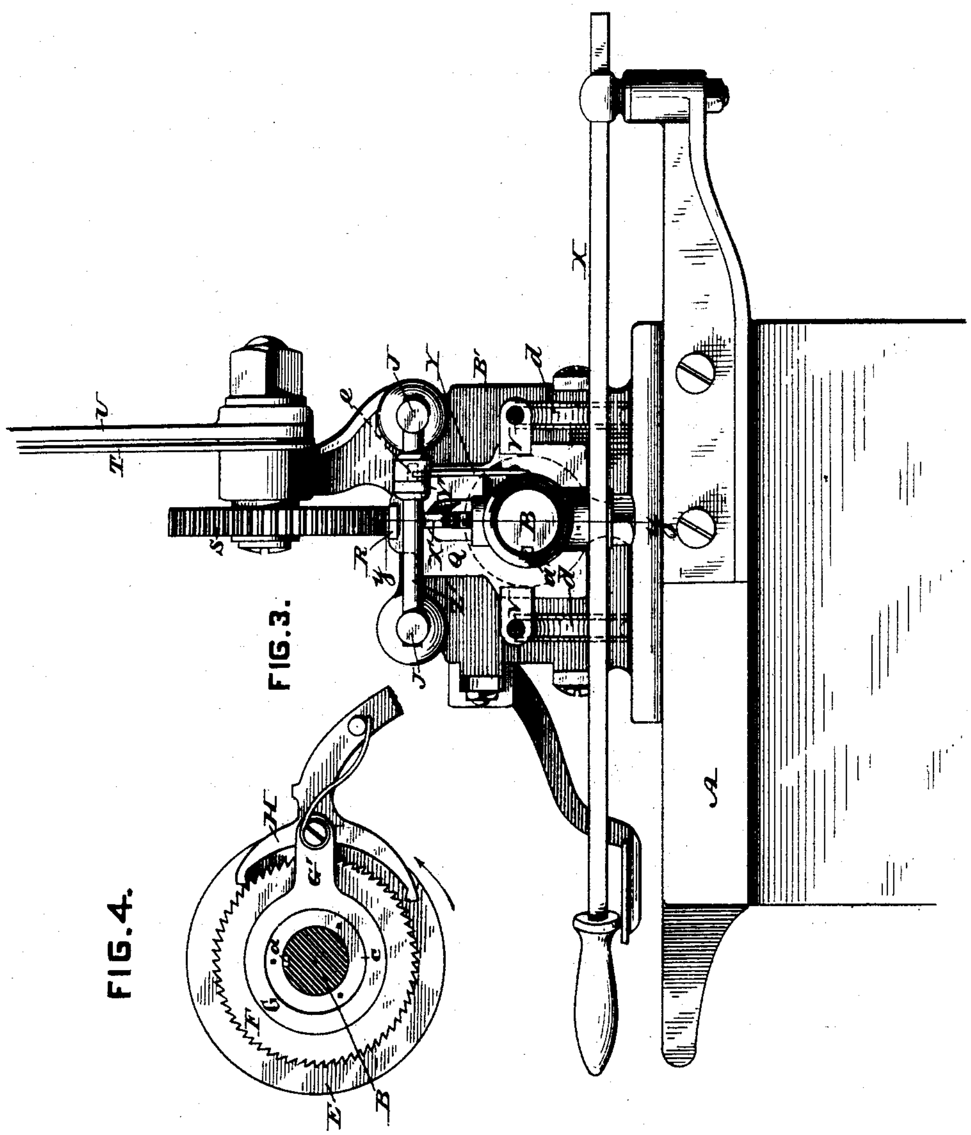

FIG. 3.

FIG. 4.

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(No Model.) 5 Sheets—Sheet 4.

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JUSTIFYING MACHINE.

No. 342,364. Patented May 25, 1886.

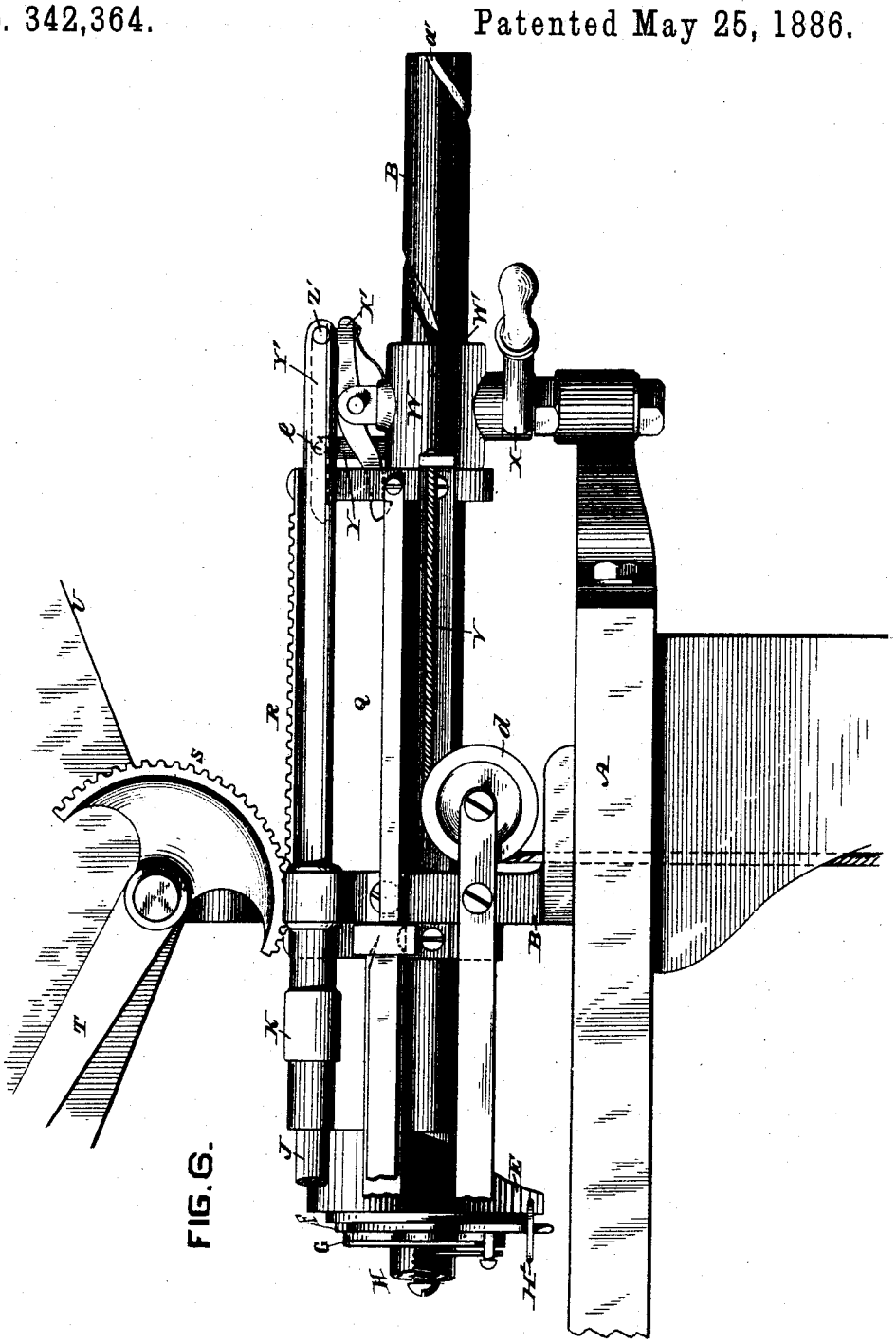

FIG. 6.

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(No Model.) 5 Sheets—Sheet 5.

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JUSTIFYING MACHINE.

No. 342,364. Patented May 25, 1886.

FIG. 8.

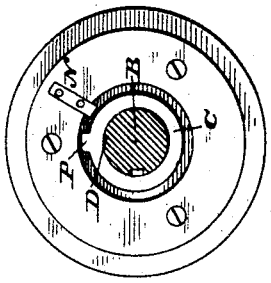
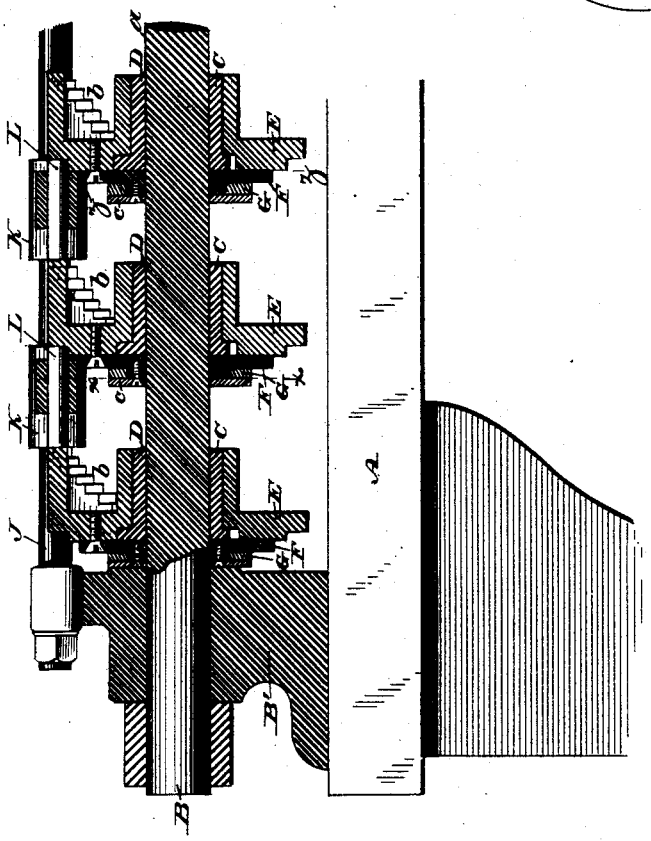


FIG. 7.



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UNITED STATES PATENT OFFICE.

ROBERT L. KIMBERLY, OF PHILADELPHIA, PENNSYLVANIA.

JUSTIFYING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 342,364, dated May 25, 1886.

Application filed January 12, 1884. Serial No. 117,300. (No model.)

To all whom it may concern:

Be it known that I, ROBERT L. KIMBERLY, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Justifying-Machines, which improvement is fully set forth in the following specification and accompanying drawings, in which—

Figure 1 is a front view of a justifying-machine embodying my invention. Fig. 2 is a top view thereof. Fig. 3 is an end view enlarged. Fig. 4 is a section of a portion in line *x x*, Fig. 7. Fig. 5 is a vertical section of a detached portion in line *y y*, Fig. 3. Fig. 6 is a side elevation of a detached portion. Fig. 7 is a longitudinal section in line *x' x'*, Fig. 2, enlarged. Fig. 8 is a section in line *z z*, Fig. 7.

Similar letters of reference indicate corresponding parts in the several figures.

My invention has for its object the laying off or charting of copy, in the subsequent composition of which a font of type or dies of known lateral dimensions are to be used, whereby the lines, when composed either in type or with dies in a matrix-machine, will be of a uniform and predetermined length, or, as it is called in the trade, "justified."

Referring to the drawings, A represents a table for supporting the working parts of the machine. B represents a horizontally-arranged rotary shaft, which is mounted on brackets B', which are secured to the table A, said shaft having a key seat or groove, *a*, which, near one end, is of spiral form, as at *a'*. Mounted on the shaft B is a series of collars, C, each of which is provided with a feather or spline, D, which enters the key-seat *a*, whereby the collars are adapted to rotate with said shaft B and slide thereon. Encircling the collar C is a flanged disk, E, the flange whereof has formed on it serrations of step form, as at *b*, the several flanges projecting in the same direction parallel with the shaft B. Attached to the back of the flanged disk is a ratchet-wheel, F, the hub portion whereof is encircled by an annulus, G, one portion whereof is formed with an arm, G', forming bearings for an anchor or double-pointed dog, H, the points whereof are adapted to move the ratchet-wheel F by said points being brought into action by the operation of the handle of the anchor, said handle being conveniently accessible at the side of the machine, and provided with a key-head plate, H', which is lettered or numbered. (See Fig. 2.) The anchor is retained in position by means of a cap or plate, *c*, which encircles the shaft B, and is bolted to the hub portion of the ratchet F, and the annulus is prevented from turning by having the arms G' in contact with the bars or other stops at the side of the machine.

Above the shaft B, and extending parallel therewith, are two rods J, on which is mounted a series of saddles, K, in the middle of each of which is a pin, L, one end of which bears against the back of one disk E, and the other end against one of the teeth of the serrated edge of the adjacent disk, the several saddles being coupled by slotted links, M, which prevent the flanged disks from being separated beyond a limited extent.

Referring to Fig. 8, N represents a finger projecting from the flanged disk inwardly toward the shaft B, so as to be struck or engaged by a toe, P, projecting outwardly from the collar C when the shaft B is rotated. On the shaft B, in the present case at the right hand thereof, is a sliding frame, Q, which carries a longitudinally-extending rack-bar, R, meshing with which is a toothed segment, S, of an index arm or pointer, T, whereby by the operation of said segment due to the motion of the rack-bar the index-arm is caused to sweep over a graduated disk or dial, U, which is properly supported on the table or frame of the machine. To the frame, at the end next to the flanged disks, is attached a pin, L', similar to the pins L, so disposed as to strike the first disk of the series when said frame is moved toward the same. This motion of the frame is accomplished by cords V, which pass over pulleys *d*, mounted on the frame or table A, and are provided with weights V', the power whereof at certain times is exerted on the frame Q. On the shaft B, adjacent to the spiral portion of the key-seat *a*, is a collar, W, which is provided with an inwardly-projecting pin, W', which enters said key-seat. Attached to the collar is a lever, X, which is fulcrumed at one end on the frame or table A, and provided at the

other end with a suitable handle, it being seen that when the lever is operated sliding motions are imparted to the collar W, and as the pin W′ enters the spiral portion of the key-seat of the shaft B rotary motions are imparted to said shaft, thus causing the toes of the collars C to strike the fingers N of the flanged disks, whereby the latter are rotated, this being occasioned when said disks are to be restored to their normal positions. On the upper side of the collar W is mounted a dog, X′, the nose of which points toward the frame Q and passes through a slot in said frame, and is adapted to engage with the wall thereof. (See Fig. 5.) Rising from the side of collar W is a post, Y, which is adapted to engage with a pin, *e*, projecting from the side of a dog, Y′, which is mounted on a stationary axis on the ends of the rods J. (See the right-hand side of Fig. 1.) The nose of the dog Y′ projects toward the frame Q, and is adapted to engage with the adjacent end or wall thereof. On the periphery or rim of the dial U is a segment, Z, which is adjustable on said rim and provided with finer gradations than those of the dial, and its purpose is to make possible a greater degree of accuracy than would otherwise be attainable in reading the travel of the index-arm T over the dial U.

The operation is as follows: When the flanged disks are in their normal positions, the serrations which are on the highest part of the flanges are in line with the pins L, and the pin L′ of the frame Q is pressed against the first of the series of flanged disks by the action of the weights V′. The operator strikes the proper key heads or plates relatively to the words, &c., it is desired to lay off. This operates the anchors in such manner as to cause the rotation of the flanged disks through the medium of the ratchets the distance of one tooth of said ratchets and consequently one step of the flanged disk. As the disks are rotated all in one direction, the steps on the decreasing parts of the flanges are brought around successsively in line with the pins L, whereby the disks are permitted to close one on the other. As the frame Q moves, the rack-bar R is carried with it and motion imparted to the segment S, whereby the index-arm travels over the dial U. The proper key-heads are struck or operated until enough words have been measured to form a line, and as the flanged disks are rotated to an increased extent it is evident that the pins L come in contact with the lower serrations of the flanged disks, whereby the latter continue to close on each other, and, owing to the further motion of the frame Q, the index-arm T travels over the dial U to increased extent. When a sufficient number of words have been thus measured to complete a line, it is necessary to return the flanged disks to their normal position, so that another line may be measured. For this purpose the lever X is operated, in the present case, to the right, thus moving the collar W over the shaft B. As the dog X′ is engaged with the frame Q, the latter is carried back with the collar W until the latter arrives at the commencement of the spiral part *a′* of the key-seat, when the heel end of the dog X′ strikes the axial rod Z′ of the dog Y′ and is depressed, thus clearing the nose of said dog X′ from the frame Q. Simultaneously therewith the nose of the dog Y′ drops into the frame Q, which has advanced toward it, and holds it against the pull of the weights V′, and the collar W is free to continue its travel over the spiral part *a′* toward the end of the shaft B. Furthermore, when the frame Q begins its motion it draws with it the first link M of the series, so that the several flanged disks are successively moved and separated one from the other the full extent allowed by the links M, and then when the collar W reaches the spiral part *a′* of the key-seat, and the pin W′ traverses said part, the shaft B is rotated, and, owing to the toes P of the collars C and fingers N on the flanged disks E, the latter are rotated and restored to their first position. The lever X is now partially operated in the reverse direction, whereby the shaft B is again rotated likewise in reverse direction, and the toes of the collar C are carried from in front of the fingers toward the rear thereof, so that said toes present no obstacle to the rotation of the flanged disks when again operated by the key-heads. As the collar W moves toward the frame Q, the dog X′ is brought into engaging contact with said frame, thus locking the collar and frame, the dog acting automatically in such locking action, owing to a suitably-arranged spring bearing against it or its front end being properly weighted. When the post Y reaches the pin *e* of the dog Y′, it raises the dog clear of connection with the frame Q, so that the frame Q is no longer controlled by said dog Y′, and may be moved by the weights V′ when the flanged disks are again rotated and close on each other.

Taking a standard font of type—say, brevier size—I find that the lateral space occupied by a small letter i is thirty-six one-thousandths of an inch; the lateral space occupied by a small letter t forty-four one-thousandths of an inch; small letter e, fifty-four one-thousandths; small letter n, sixty-four one-thousandths, and so on. All of the letters and characters of the font may be conveniently classed in seven sizes, and it is upon such a classification that the machine herein described is constructed; but for facility of manufacture all the flanges of the feed-disks are of uniform depth, and to those classes of letters which are most frequently used two disks are furnished. The serrations on the flanges of the disks correspond in depth to the lateral dimensions of the classes of letters to which they are assigned. For instance, that disk the key-head of which is lettered small "i" has serrations of precisely thirty-six one-thousandths of an inch in depth; that disk the key-head of which

is lettered small "t" has serrations exactly forty-four one-thousandths of an inch in depth, and so on through all the classes. Now, referring to the description herein of the construction and operation of the flanged disks and connected parts, it will be seen that if the disk which has a key-head lettered small "i" be rotated so that, say, three of its serrations come successively into line with the pin L′ on the inner end of the sliding frame Q, said frame will move to the left, closing up on the flanged disk by the pull of the weights V′ exactly one hundred and eight one-thousandths of an inch, which is precisely the lateral space which would be occupied in a line by three of the small letters i. The movement as above of the frame Q will of course carry with it the toothed segment S, which is engaged with the rack-bar R, and the index-arm T will travel over a certain space of the graduated rim of the dial U. If any other disk is rotated, a like result follows. It is apparent, then, that to ascertain the space which will be occupied in a printed line by any given word it is necessary to strike the key-heads of the disks appropriated to the letters in such words. Illustration: Take the word "disc." Small d belongs to the disk the key-head of which is lettered "n." Small i belongs to the disk marked "i," and small s and c belong to the same class and to the disk marked "c" on its key-head. To get the measure of the word "disc," therefore, the operator strikes once the key-head marked "n," once that marked "i," and twice the key-head marked "c," it being understood that each stroke of a key-head rotates its disk only so far as to bring the next lower serration on the flange in line with the pin L. When the operator has thus struck the key-head named, the frame Q, with its rack-bar R, will have moved to the left sixty-four one-thousandths of an inch for the small d, thirty-six one-thousandths of an inch for the small i, fifty-four one-thousandths of an inch for small s, and fifty-four one-thousandths of an inch for small c, or a total movement of two hundred and eight one-thousandths of an inch, which is the precise lateral space that will be be occupied by the word "disc" in the printed line. Having in this way measured one word, the operator proceeds with others until he has measured as many as can be contained in the printed line, with the spaces necessary to separate the words. The whole object of the measurement is to determine what those spaces shall be in order to make the line of the predetermined length. How this determination is arrived at will now be explained. In this case the movement of the index-arm over one graduation on the rim of the dial U represents a movement of the frame Q and rack-bar R of nine one-thousandths of an inch. For the word "disc," taken above for illustration, the index-arm T would move over twenty-three graduations of the rim of the dial and one-ninth of a graduation more—that is, the measure of the word was two hundred and eight one-thousandths of an inch—$208 \div 9 = 23\frac{1}{9}$. This and other like fractions may be disregarded. Now, suppose it is desired to lay off a line one inch long—or, to avoid fractions, say, nine hundred and ninety-nine one-thousandths of an inch long. That length of line would make the index-arm T travel over one hundred and eleven graduations of the rim of the dial U. The right end of the movable scale Z is set, therefore, at the eleventh graduation to the right of the number "300" on the dial. (See Fig. 1.) The operator then proceeds as with the word "disc" above. Suppose the word "disc" to be the first word of his copy. He measures it, as above described, and the index-arm T marks off twenty-three graduations on the rim of the dial U. Suppose the next word of the copy to be "dies," to measure which requires the striking of the same key-heads as in the word "disc." When these are struck, the index-arm T will mark twenty-three additional or in all forty-six graduations. Suppose the two words next in the copy to be "side" and "dice," each of the same value as "disc." When the proper key-heads have been struck for these words, the index-arm T will have moved over ninety-two graduations of the rim of the dial U, and will stand at the graduation numbered "19" on the segment Z. The operator perceives that no more words can be contained in that line, and that in order to spread the four words he has measured so that they will make the line full, the space represented by the nineteen graduations remaining out of the total measure of one hundred and eleven graduations must be divided between the four words to separate them from each other—that is, there being four words in the line, there must be three spaces to separate them one from the other, and two of these spaces must be six graduations each, and the remaining one seven graduations, making nineteen. In other words, as each graduation of the rim of the dial U represents a lateral space in the printed line of nine one-thousandths of an inch, the above spaces will be, two of them, fifty-four one-thousandths each, and of one of them sixty-three one-thousandths. To indicate this to the compositor the operator marks the copy thus: "disc dies side dies 19 3," the number "19" to show the total number of graduations, and the number "3" to indicate the number of spaces into which they are to be divided.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a justifying-machine, the combination of a series of disks connected substantially as described, each provided with a serrated flange, and each having rotary and longitudinal motion.

2. In a justifying-machine, the combination of a series of serrate-flanged disks having rotary and longitudinal movement and a frame

taking up the longitudinal movement of the disks, substantially as described.

3. The combination of the serrate-flanged disks, a frame taking up the longitudinal movement of said disks, and an indicator connected to said frame, substantially as described.

4. The combination of the serrate-flanged disks, the keys for turning the disks, a frame taking up the longitudinal movement of said disks, and an indicator, substantially as described.

5. The combination of a series of serrate-flanged disks connected substantially as described, the depth of the serrations corresponding to the spaces occupied in a printed line by the several letters and characters of a font of type or dies.

6. The combination of a series of disks, each provided with a serrated flange, and having rotary and longitudinal motion, a shaft supporting the same, and a lever engaging said shaft, for restoring said disks simultaneously to their normal position, substantially as described.

7. A series of serrate-flanged disks having rotary and longitudinal movement and a series of longitudinally-movable rods or pins interposed between the disks, substantially as described.

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