

No. 652,342.

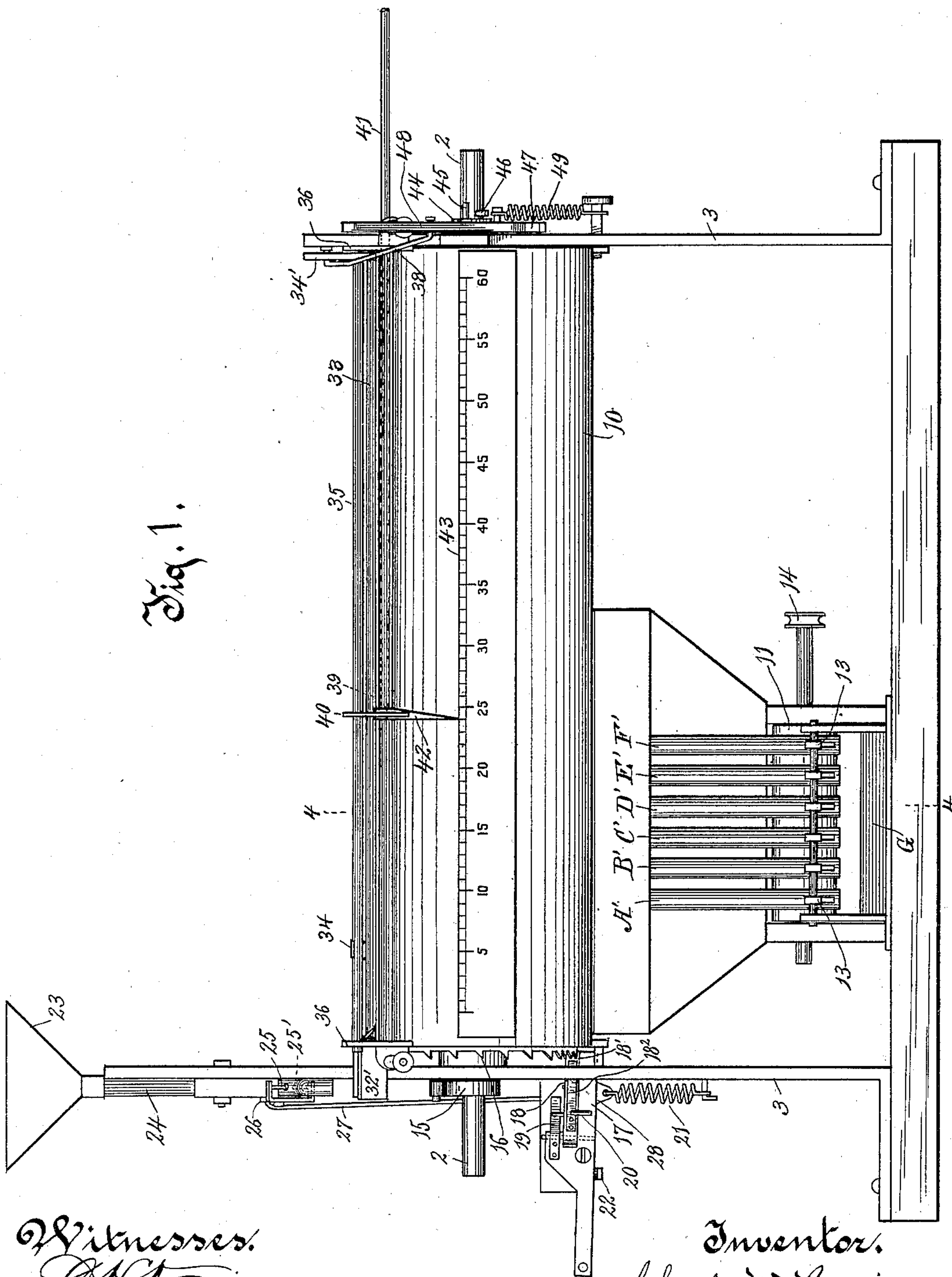
Patented June 26, 1900.

C. W. BOWRON.  
TYPE JUSTIFYING MACHINE.

(Application filed July 29, 1899.)

(No Model.)

5 Sheets—Sheet 1.



Witnesses:  
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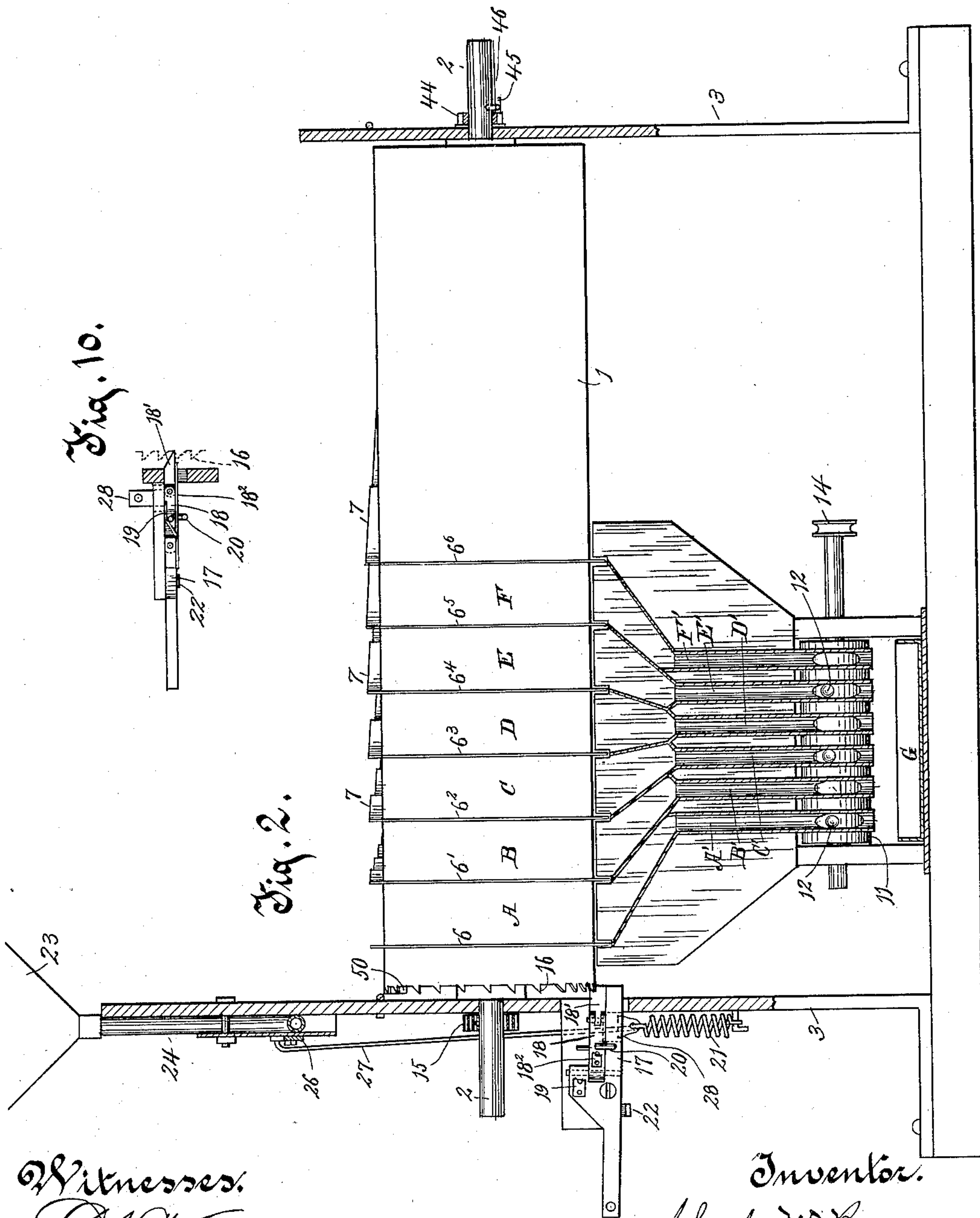
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5 Sheets—Sheet 2.



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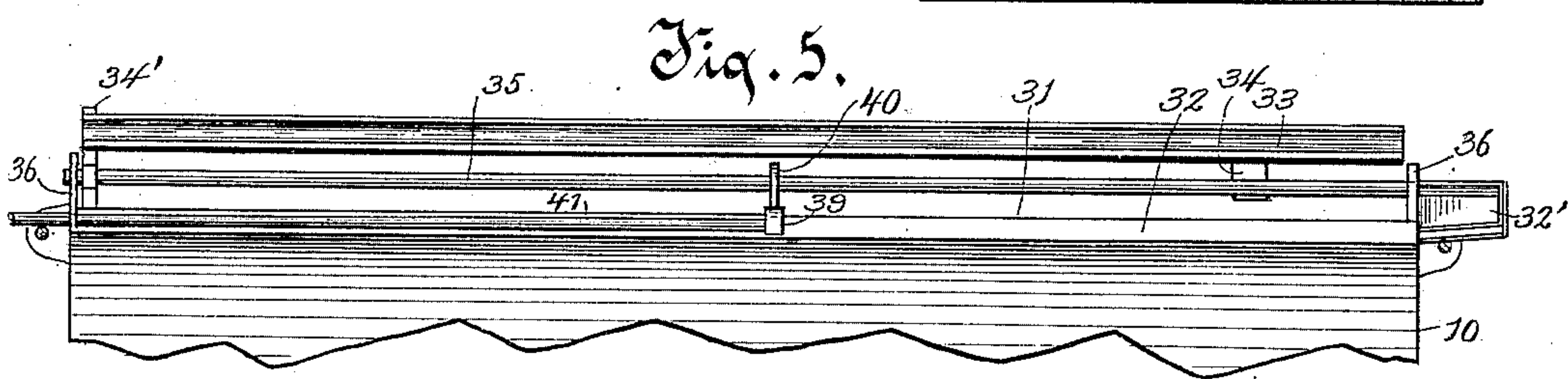
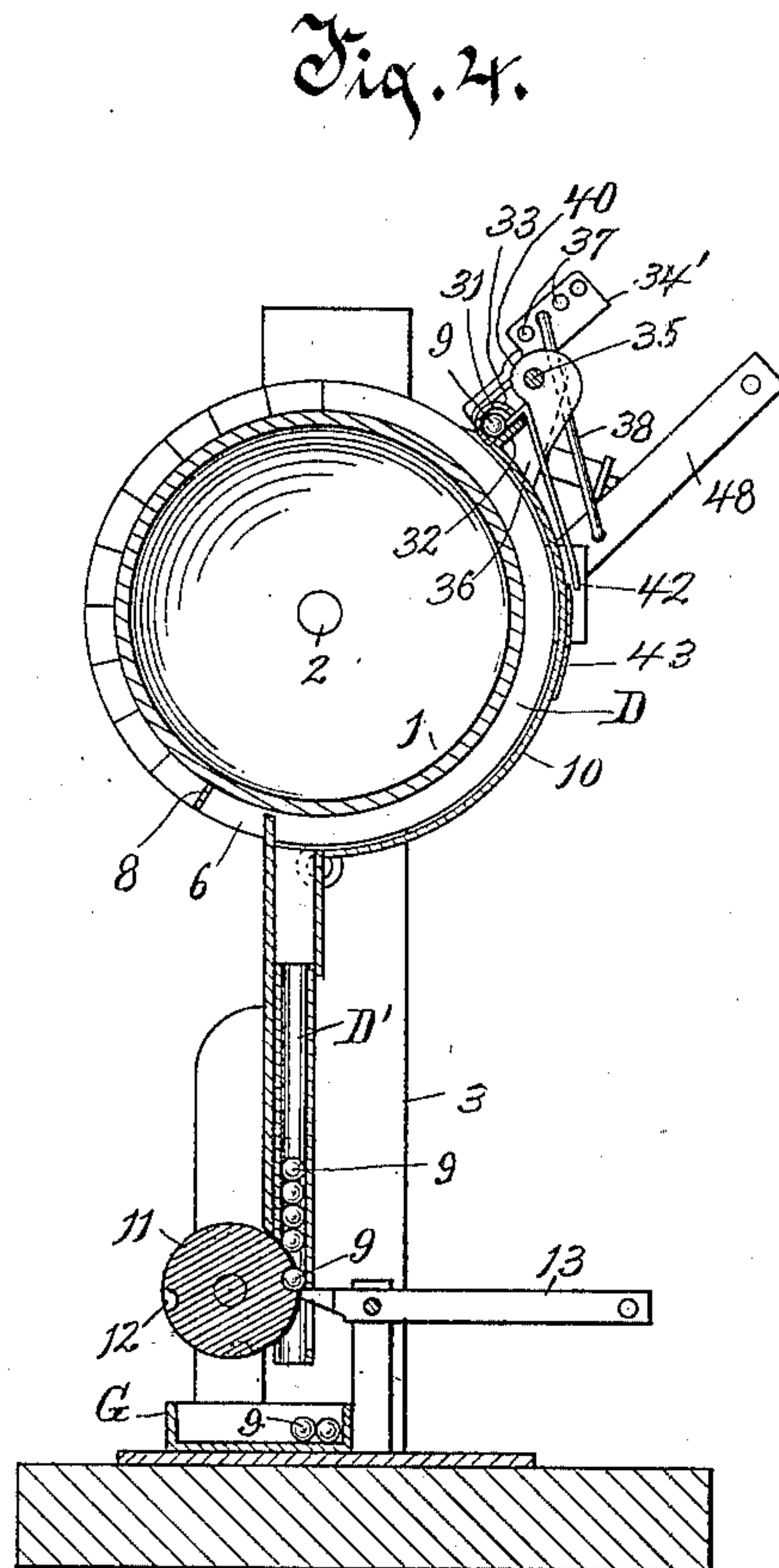
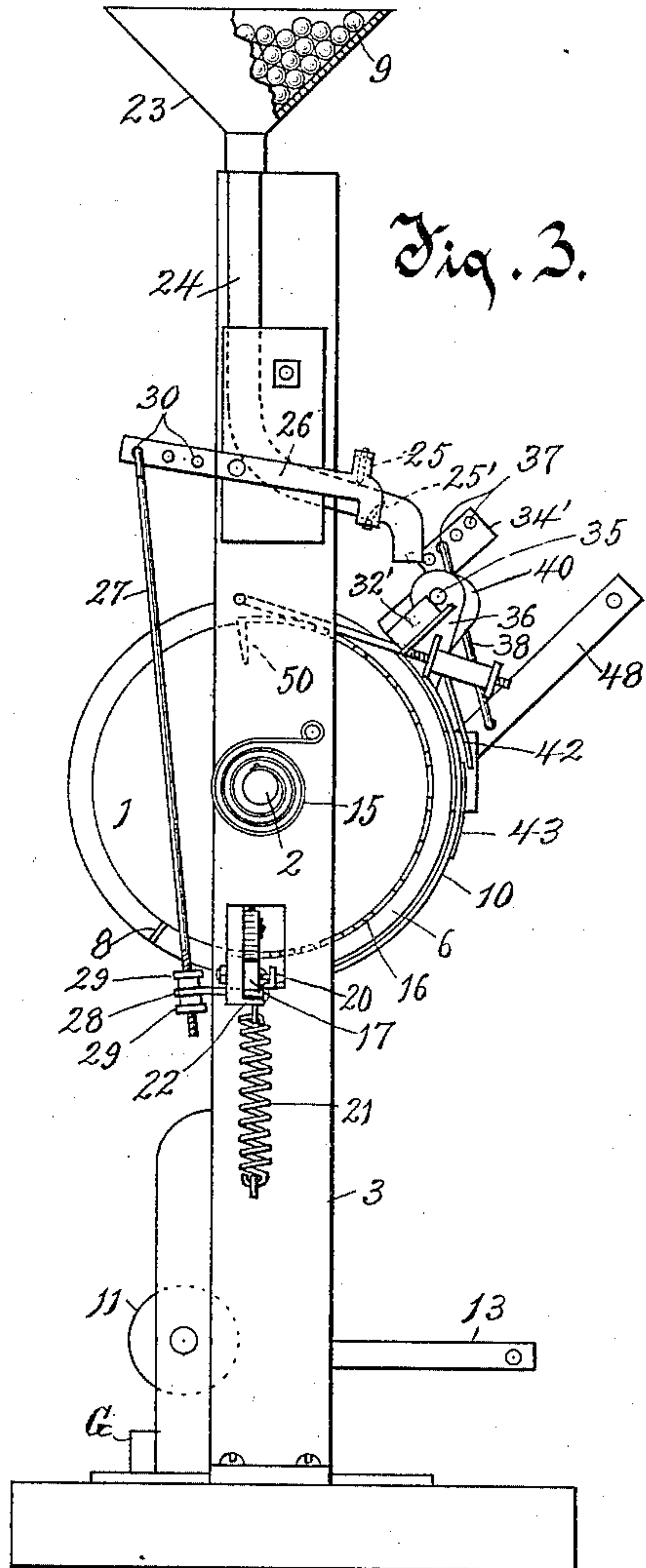
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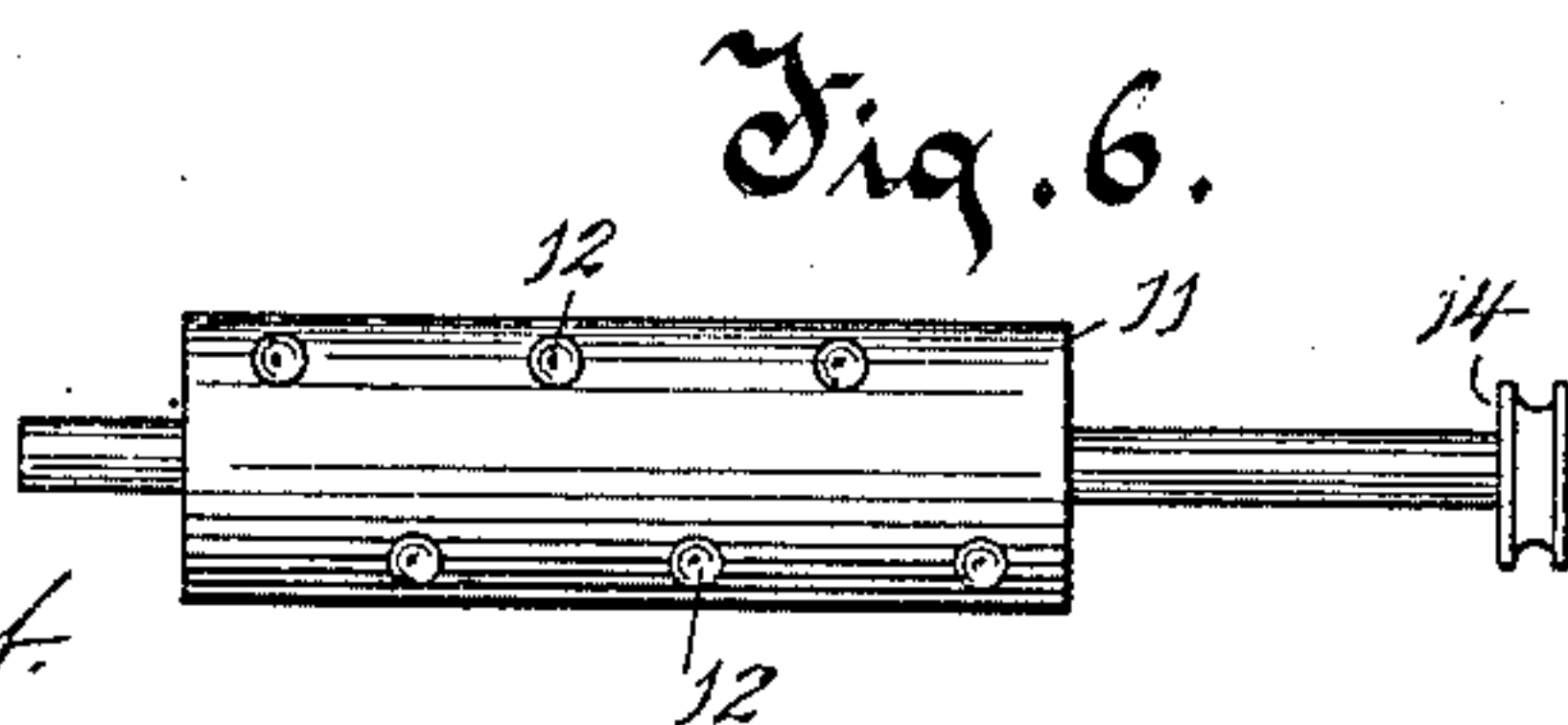
(No Model.)

5 Sheets—Sheet 3.



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No. 652,342.

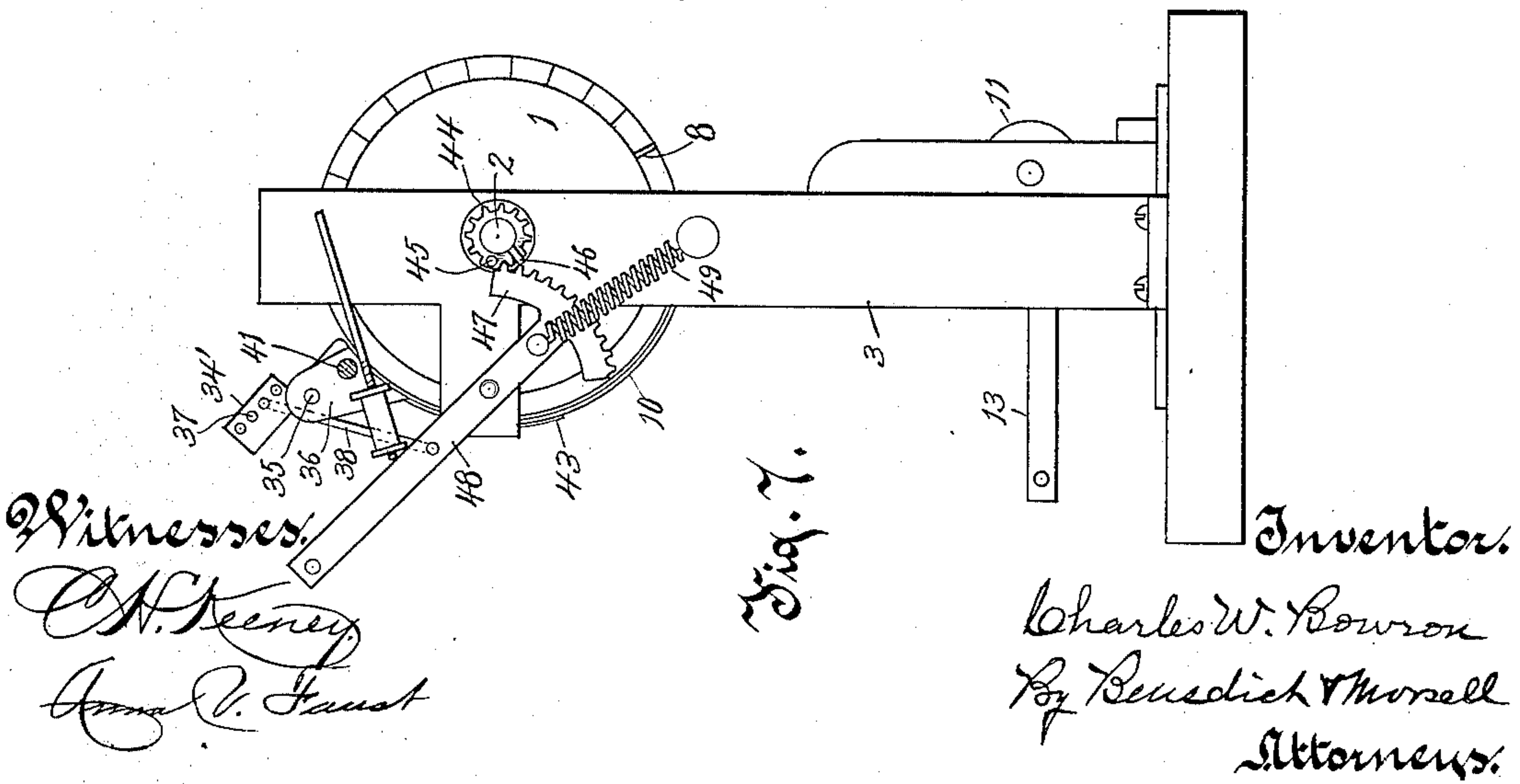
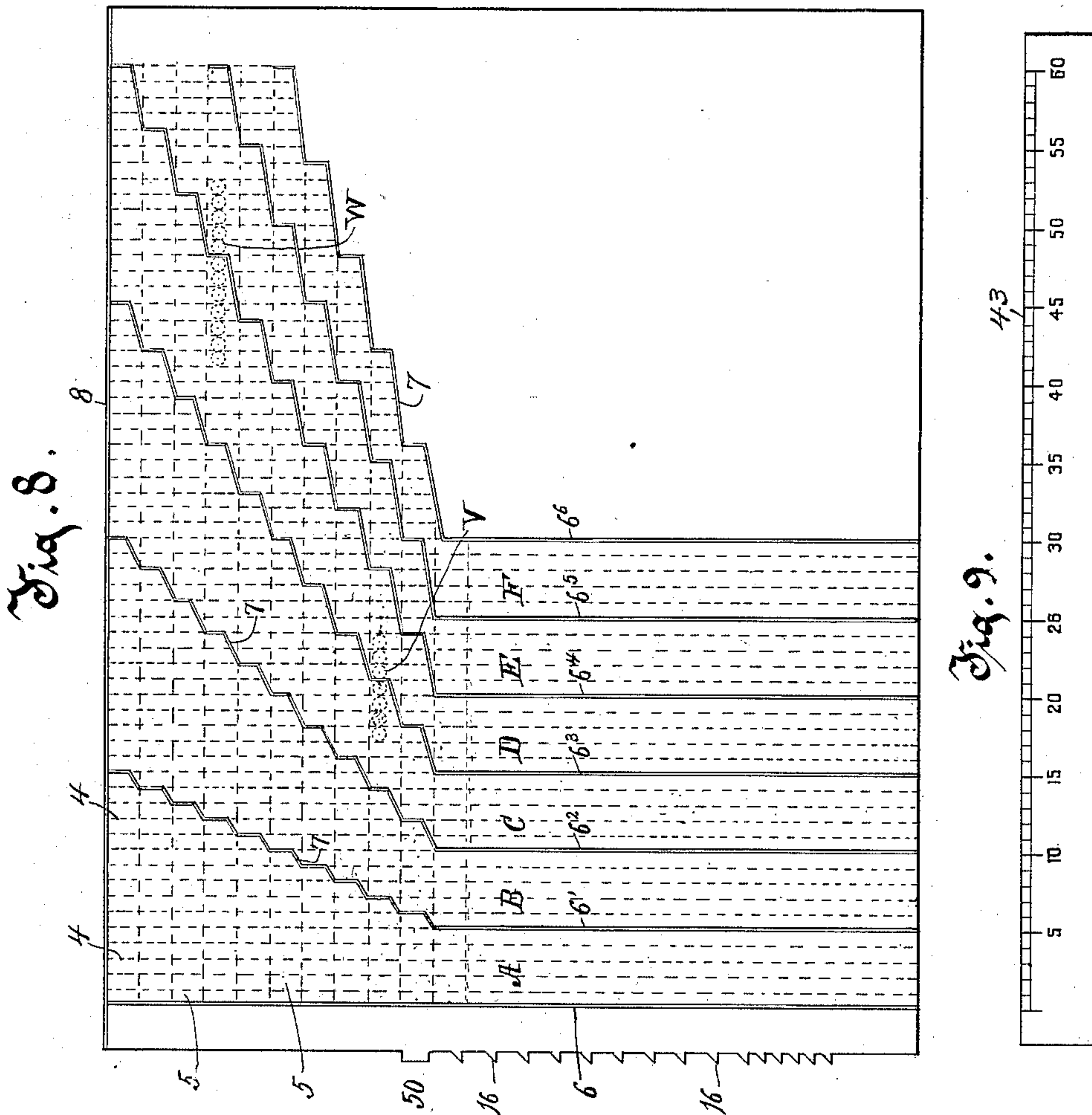
Patented June 26, 1900.

C. W. BOWRON.  
TYPE JUSTIFYING MACHINE.

(Application filed July 29, 1899.)

(No Model.)

5 Sheets—Sheet 4.



**No. 652,342.**

**Patented June 26, 1900.**

**C. W. BOWRON.**  
**TYPE JUSTIFYING MACHINE.**

(Application filed July 29, 1899.)

(No Model.)

**5 Sheets—Sheet 5.**

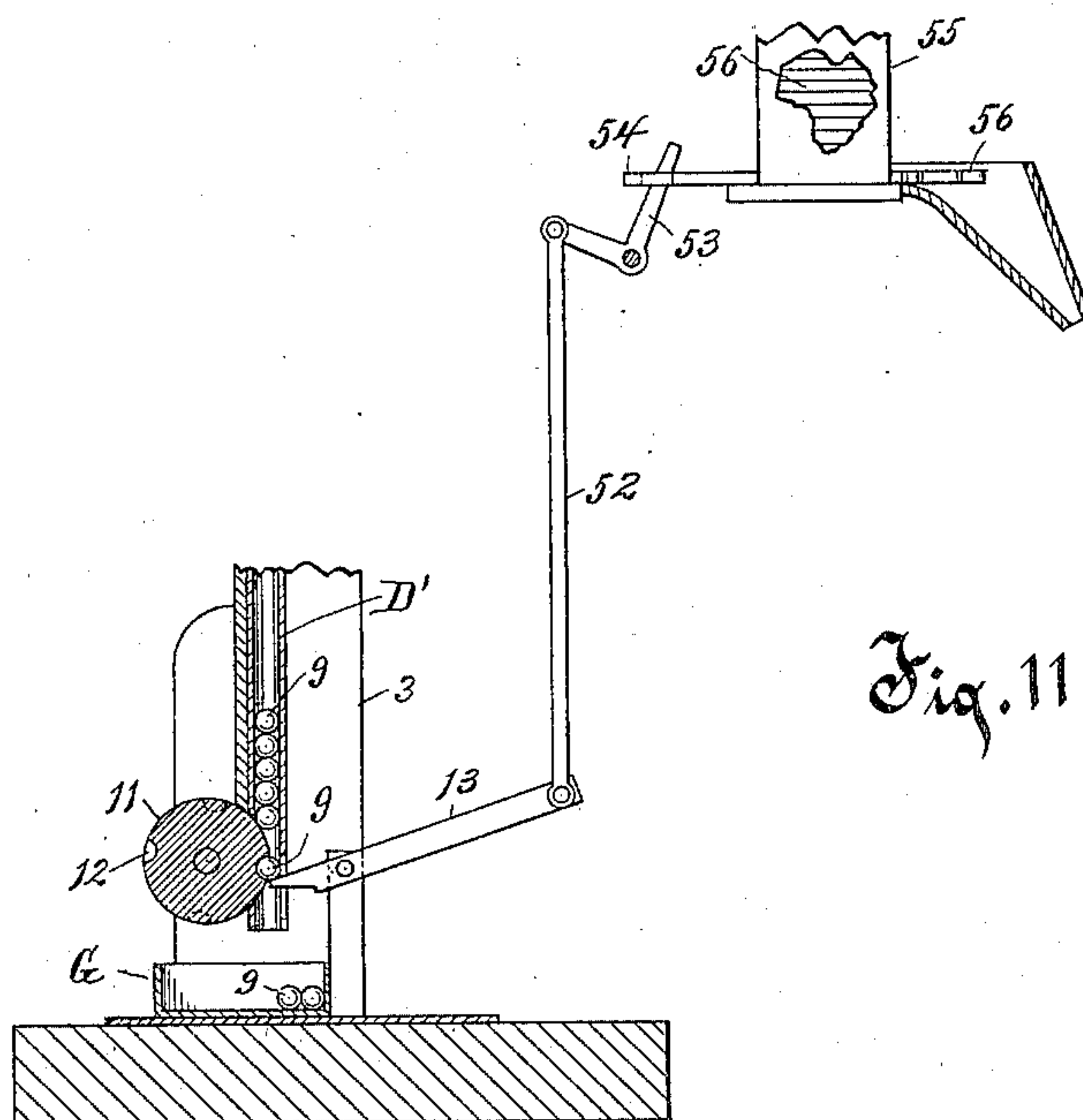


Fig. 11.

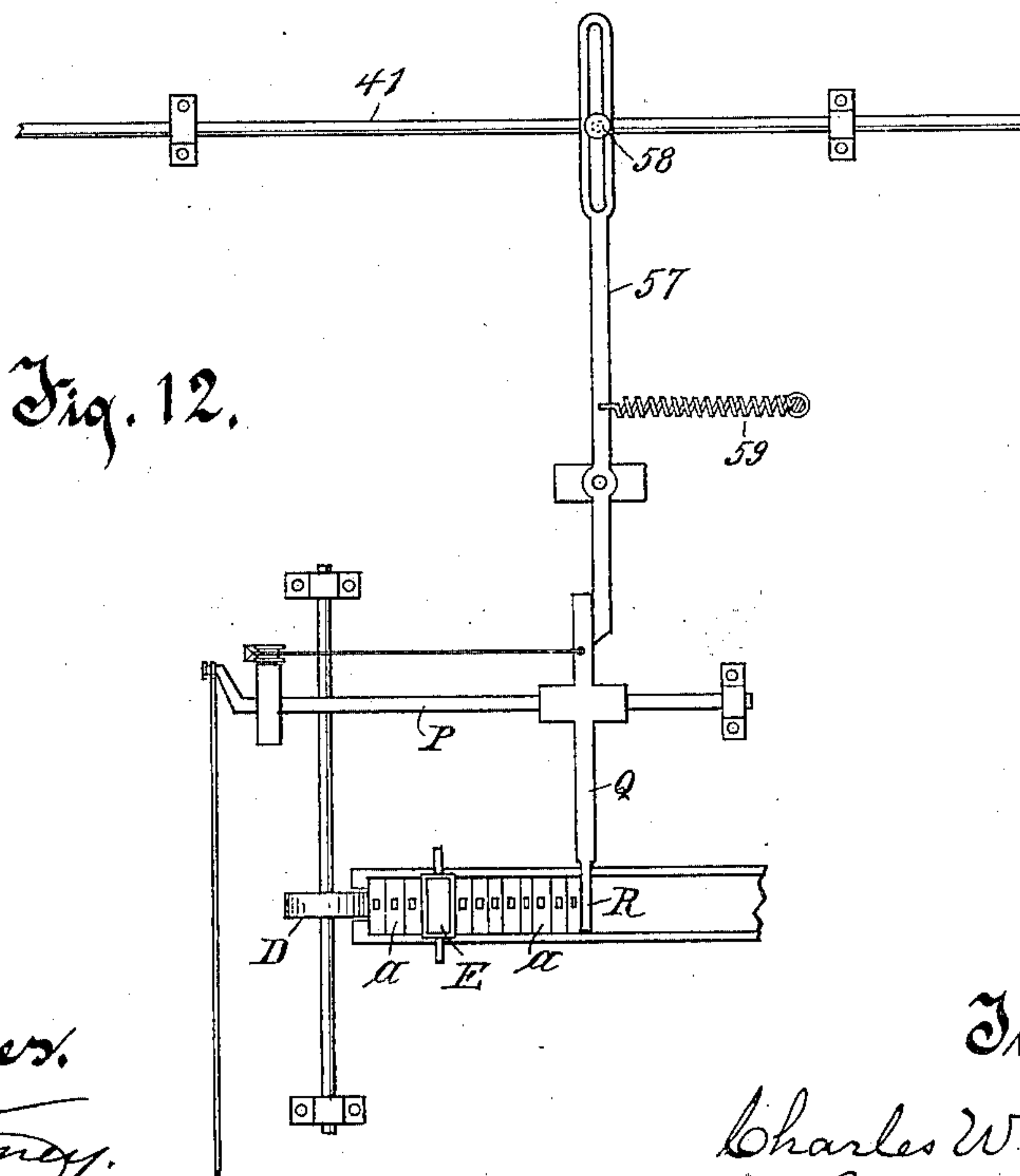


Fig. 12.

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# UNITED STATES PATENT OFFICE

CHARLES W. BOWRON, OF OSHKOSH, WISCONSIN.

## TYPE-JUSTIFYING MACHINE.

SPECIFICATION forming part of Letters Patent No. 652,342, dated June 26, 1900.

Application filed July 29, 1899. Serial No. 725,465. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES W. BOWRON, of Oshkosh, in the county of Winnebago and State of Wisconsin, have invented a new and useful Improvement in Type-Justifying Machines, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

Machines for setting type now in use are adapted to and do set up lines of type matter consisting of words of varying lengths, between which words there are spaces that are temporarily filled by false space-types or suitable devices whereby the lines are approximately filled temporarily, the interword-spaces so temporarily filled by false space-types or similar devices being required to be thereafter refilled by space types or quads of such size and in such number and order as to suitably and completely fill the line, thus justifying it to proper measure for final use in printing or in producing a type-mold therefrom. This work of justifying lines of type-set matter has commonly been done by hand by a printer, because the work involves a special selection for each line of a suitable number of space-types of the same or similar size to just fill the line, and where the interword-spaces vary in size, as is usually the case, it involves so arranging the interword-space types as not to have a regularity of larger or smaller interword-spaces in the same part of the line to meet the requirements of the art; also, as the length and number of words varies constantly in the several lines, so the number and extent of interword-spaces to be filled by space-types is a constantly-varying feature of the work that has usually required the direct and personal attention of a skilled printer.

The object of my invention is to provide improved automatic mechanism to be employed in connection with type-setting machines for justifying lines of type-set matter or matrices to any desired measure, including therein the measuring and ascertaining the total of the amounts of interword-spaces in a line to be filled by space-types, the determining the sizes and numbers of the space-types to fill the several interword-spaces with similar and substantially-equal space-types,

the selecting and assorting by initial mechanism therefor the ascertained number of space-types to fill the several interword-spaces in the lines with constant reference to the use of equal-size space-types when all the spaces of a line can be filled with space-types of the same size, and to the non-continuous but regularly-varying use of differential space-types for justifying the line of type-set matter in accordance with the demands of the art, and by auxiliary mechanism to put into operation the mechanism for releasing the space-types to be placed properly in the interword-spaces in the line.

My invention consists of the mechanism, its parts, and combinations of parts, as herein described and claimed and the equivalents thereof.

In the drawings, Figure 1 is a side elevation of my improved machine. Fig. 2 is a vertical section of parts of the machine, other parts being shown in elevation in connection therewith. Fig. 3 is an elevation of the end of the machine at the left in Fig. 1. Fig. 4 is a transverse section on line 4 4 of Fig. 1 looking toward the right. Fig. 5 is a detail of the ball-runway, the cover being thrown up away from the floor of the runway. Fig. 6 is a detail of the cylinder having pockets that receive the balls therein that serve as teeth to actuate levers and which herein is denominated the "ball-toothed" cylinder. Fig. 7 is an elevation of the end of the machine at the right in Fig. 1. Fig. 8 is a view of the periphery extended on a flat surface of the cylinder having flanges thereon and adapted for receiving, assorting, and delivering the balls that have their mechanical function in connection with the ball-toothed cylinder. The cylinder the surface of which is illustrated in Fig. 8 is herein denominated the "ball-assorting" cylinder. Fig. 9 is a view of a unit-scale employed in connection with the ball-assorting cylinder. Fig. 10 is a detail of the dog employed in connection with the escapement for the ball-assorting cylinder. Fig. 11 shows a means in connection with the cylinder-actuated levers for ejecting space-types. Fig. 12 shows a means (substantially that shown in Fig. 1 of Patent No. 592,743, of October 26, 1897) for differentially controlling the ball-stop device herein.



The type-setting machines in common use assemble the types of the words in the lines with temporary or false interword-spacing devices, completing the lines, so far as words are concerned, but omitting to fill the interword-spaces to the extent necessary to properly separate them, leaving that work to be done subsequently in and by justifying the lines to desired measure. My improved type-justifying machine is adapted for use with any of these type-setting machines as auxiliary thereto or may be used also for justifying to proper measure the matrices in a line-casting machine.

The use of my improved mechanism for justifying lines of type-set matter involves the division of the complete line of desired measure into units of measurement. The number of units necessary to justify the line being registered on my device, through its connection, as hereinafter described, with any mechanism on the type-setting machine devised to indicate the progress of the line being set according to the units-scale, my improved mechanism is adapted for and is capable of selecting, assorting, and grouping representative devices and therewith putting in operation the mechanism for the delivery of the necessary space-types of proper size and in due order for suitably and completely justifying the lines of type-set matter or matrices to desired measure.

In my improved machine I employ balls of uniform size to represent the interword-spaces in the lines of type-set matter, and these balls are used in relation to each line of type matter in the same number as the interword-spaces therein, the balls being so employed in my machine as to put in operation the mechanism to select and deliver space-types of proper size and in proper order for filling the interword-spaces in the line.

My invention involves the employment of a suitably-channeled surface adapted for receiving, assorting, and delivering balls, and therefore I preferably employ a cylinder 1, (herein denominated the "ball-assorting cylinder,") which is provided with rigid journals 2 2, having their bearings in a frame 3 of suitable size and form for supporting the operative parts of the mechanism. The length of this cylinder stands for and represents an extent of interword-spaces more than equal to any amount of interword-spaces that would occur in any single line of type-set matter. This cylinder is theoretically divided by imaginary longitudinal lines into segmental divisions or tiers, and these tiers are divided by imaginary circumferential lines into longitudinal divisions or units of a scale, which scale in the drawings I have illustrated as containing sixty divisions or units, these representing a certain amount of interword-spaces in a line of the type-set matter—say one inch—and these longitudinal divisions or units of the scale are of a length equal to the diameter of the balls used in con-

nection with this cylinder. These theoretical tiers and scale units are observed in the arrangement and location of the flanges that form the walls of the channels on the surface of the cylinder dividing the tiers into longitudinal sections, as hereinafter more fully explained. The method of dividing the surface of the cylinder theoretically into longitudinal divisions equal to units of the scale and into segmental tiers is shown on Fig. 8, the divisions into units of the scale being shown as the spaces 4 4 between circumferential parallel dotted lines and the tiers being shown as the spaces 5 5 between the longitudinal parallel dotted lines. The surface of the cylinder is divided into ball-channels A B C D E F by the circumferential flange 6 and a series of correlated flanges 6', 6<sup>2</sup>, 6<sup>3</sup>, 6<sup>4</sup>, 6<sup>5</sup>, and 6<sup>6</sup>. These flanges for a considerable extent of their initial portions are straight on the circumference of the cylinder in planes cutting the axis of the cylinder at right angles, and in those portions are separated a distance of five units or the diameters of five balls apart, though this separation of the flanges from each other is not important, the arrangement of the flanges with reference to each other being such only as to form suitable channels for the delivery of the balls to chutes hereinafter described. At the same tier on the cylinder the flanges 6' 6<sup>2</sup>, &c., are initially offset toward the right to such extent as to make the channel-spaces on that tier each one unit wider, or, as in the construction shown in the drawings, six units wide, or, in other words, so as to divide the tier by the channel walls or flanges into sections of six ball-diameters or six spaces of the unit of the scale. The next succeeding tier on the cylinder is by the channel walls or flanges in a similar manner divided into tier-sections of seven ball-diameters or the width of seven units of the scale, and thus each succeeding tier on the cylinder to such number of them as is desired is by the walls of the channels or flanges divided into sections, which sections in the several succeeding tiers increase in length or width of the channels in each succeeding tier by one ball-diameter or unit space of the scale. In the machine shown in the drawings the channels have in their narrowest portion sections of five ball-diameters or units of the scale and in their widest portion sections containing fifteen diameters or units of the scale, as shown in Fig. 8; but it is obvious that the construction of the channels can be made to include sections of less than five units and more than fifteen units, if desirable. It will also be observed that more channels or fewer channels may be used, according to the number of sizes of space-types desired to be used in justification; also, that the scale may be increased beyond sixty units by lengthening the cylinder and prolonging the channels accordingly, or the scale may be curtailed below sixty units by shortening the cylinder



and channels accordingly. The channel walls or flanges intermediate the ends of the tier-sections are in oblique directions 77, forming inclined walls along and against which the balls used therewith will run by gravity on the surface of the cylinder. At their ends the channels A B, &c., are preferably closed by a longitudinal wall or flange 8 on the cylinder.

10 The balls 9 drop into the channels A, B, or C, &c., near the top and a little at one side of the cylinder and are retained in those channels as they run down on the surface of the cylinder by a curved apron 10, supported on the frame close to the flanges 6 6', &c. From immediately below the cylinder and conveniently from the lower edge of the apron 10 a series of chutes A' B' C' D' E' F' lead downwardly to the ball-toothed cylinder 11. The upper ends of the chutes A' B', &c., register with the channels A B, &c., and are adapted to receive the balls 9 as they fall from the channels into the chutes. The cylinder 11 is mounted in the frame 3 and is so disposed that its periphery enters the cut-away sides of the chutes A' B', &c., extending, substantially, across the chutes, forming a movable bottom thereto. This cylinder is provided with a number of ball-pockets 12, preferably two for each chute, the two pockets for the same chute being located diametrically opposite each other in the cylinder 11, all the pockets being so located as to register with the corresponding chutes, the pocket or pockets registering with one chute being out of the longitudinal radial plane, cutting the cylinder through the pocket or pockets registering with the adjacent chute. The pockets are of such depth that the balls 9 entering them are held therein projecting therefrom to such extent as to form teeth on the surface of the cylinder.

In front of the cylinder 11 a series of levers 13 13 are so mounted on the frame that their inner ends project into the corresponding ball-chutes through slots narrower than the balls and terminate close to the cylinder 11 and so as to be engaged and tilted by the ball-teeth formed by the balls 9 in the pockets 12, these temporary ball-teeth being adapted to engage and tilt the levers severally as the cylinder is rotated past the levers or past those of the levers in front of the pockets having balls in them. These levers, which I 55 denominate "space-type" levers, are adapted to be connected to mechanism in the type-setting machine for releasing or delivering space-types of the size or thickness as measured by the units of the scale for properly justifying the line of type-set matter. Thus the lever in front of chute A' is actuated by ball-teeth on the cylinder 11, formed of balls delivered from the channel A, which represent and are intended to cause to be delivered 65 space-types of one-unit thickness, or the thinnest space-type employed ordinarily in justifying type-set matter, and the lever in front

of chute B' is actuated by ball-teeth formed of balls from the channel B and is therefore intended to deliver or cause to be delivered 70 space-types of two units of thickness, and the other succeeding levers are actuated by ball-teeth formed of balls from the several succeeding channels and are intended and adapted to be connected to the mechanisms in the 75 type-setting machine for delivering correspondingly-thicker space-types to the extent of the number of such channels, chutes, and levers. Each lever 13 is connected with space-ejecting mechanism by a rod 52, Fig. 11, or other suitable means adapted to operate the 80 puncher for discarding the space-type from the hopper or holder in which the several spaces are stored.

55 is a space-holder, with a portion cut away 85 to show the space-types 56 within, and may be situated at any convenient place on the type-setting machine. Along the bottom of the space-holder and alongside the space-type the space-puncher 54 is located and operates, being actuated by lever 53, one arm of which is connected loosely through the space-puncher and the other arm of which is pivoted to rod 52, connecting with lever 13. As the revolution of the ball-ejecting cylinder 11 carries a ball 9 along in chute D past a lever 13 the lever is tilted by the ball which engages the lever as a temporary tooth in the cylinder. Through connecting-rod 52 the tilting of lever 13 actuates lever 53, and thus operates puncher 54 to eject the space-type 56 from the space-holder 55, as shown in Fig. 11. It will be understood that each one of the levers 13 is thus operatively connected with a separate type-holder, and each space-type 105 holder contains a different thickness of space-types, according to the units-scale heretofore described.

The cylinder 11 is provided with a belt-pulley 14 on its journal, on which a belt may be placed, running to any convenient source of power, whereby the cylinder 11 may be rotated constantly while the machine is in operation, the cylinder 11 being thus adapted to act on the levers 13 whenever balls are in the pockets 12 therein. When by the rotation of the cylinder 11 the balls 9 in the pockets thereof have passed below the levers 13, they fall from the cylinder into the removable pan G. 120

To rotate the cylinder 1 automatically, a spring 15, secured at one end to a journal 2 of the cylinder, is coiled about that journal, and the other end of the spring is anchored to the frame 3. To prevent the rotation of the cylinder 1, except at such times and to such extent as is necessary for its proper action, an escapement device is provided, which engages the teeth 16 on the cylinder, preventing rotation thereof, except limitedly, when the teeth are intermittently released one at a time therefrom. Any form of escapement may be employed therefor; but the one shown in the drawings consists of a vertically-tilting 130



lever or dog 17, pivoted medially on the frame. This dog includes the jointed swinging member 18 18' and its spring 18<sup>2</sup>, dog-actuating springs 19 and 21, and stops 20 and 22. In use this dog may be connected to a key, whereby the operator can manipulate the escapement device to permit the rotation of the cylinder intermittently. The teeth 16 properly are and may all be as far apart as the width of the tiers 5 on the cylinder 1; but by reason of the small size of the cylinder in the model from which the drawings in this application were made it became necessary to locate the first five teeth at half the distance apart that the others are, thus providing for depositing five balls in the ball-runway by the time the cylinder rotates, so that the tier of five unit-sections is brought opposite the runway; but this incident of the construction in this case is not of importance in the machine, as with a slight change in the size of the cylinder all the teeth 16 could be placed at distances apart equal to the width of the tiers.

For holding a supply of balls 9 and delivering them to the ball-runway in front of channels A B, &c., on the cylinder 11 a hopper 23 is provided, having a downwardly-extending ball-discharging tube 24, which terminates directly above the open end of a runway hereinafter described. The tube 24 is provided with a double gate 25 25', adapted to control the discharge of balls singly from the tube, which gate is conveniently made in the form of a pin 25, projecting loosely into the tube 24 from above, and another pin 25' at a distance of the diameter of a ball from pin 25, projecting into the tube from below, the pins being fixed in one arm of a lever 26, pivoted medially on the frame, the other arm of which lever is connected by a rod 27 to the dog 17 conveniently by means of a bracket 28, fixed on the dog, through which bracket the rod 27 is extended in an aperture therefor and to which it is secured adjustably by nuts 29 29', turning on the rod against the bracket. The lever 26 is provided with a series of apertures 30, each adapted to receive therein the hooked upper extremity of the rod 27, whereby the leverage on the lever 26 can be regulated as desired.

Near the top of the cylinder 1 and a little to one side of a vertical plane through its axis a ball-runway 31 is provided, extending the whole length of the cylinder, which runway preferably consists of a floor 32, inclined downwardly toward the cylinder, the floor being conveniently supported by being affixed to the apron 10, and a removable trough-like cover 33, fixed at a distance from their axes on arms 34 34', these arms being fixed on a rock-shaft 35, having its bearings in standards 36 36, fixed on the apron 10. A box-like extension 32' of the floor 32 forms a hopper below the mouth of the discharging-tube 24 and is adapted to receive the balls as they fall from the tube 24 and conduct them into the runway, in which the balls 9 are

adapted to travel freely. In use it may be desirable to elevate a little that end of the frame that is at the left in Fig. 1, so as to incline this runway downwardly toward the right, or the cylinder and the runway and related parts can be mounted in the frame at a slight inclination, so as to cause the balls to roll in the runway toward the right. The arm 34' projects beyond the rock-shaft 35 in the opposite direction from the cover 33 and is provided with a series of apertures 37, adapted to take therein a hook on the end of the link 38, by which the arm 34' is connected adjustably to the arm of the cylinder-retrieving lever hereinafter described.

A ball-stop 39, fitted and sliding freely in the ball-runway on the floor 32, is provided with an arm 40, extending to and sliding freely on the rock-shaft 35, whereby the ball-stop is held in position slidably in the runway. The ball-stop 39 is also provided with a stem 41, fixed thereto and extending in the runway toward the right and in a bearing therefor through the standard 36. This stem 41 is intended and adapted to be connected with that portion of the type-setting machine that indicates the amount of the type set in a line, and, as a consequence thereto, that indicates the amount of the interword-spaces to be filled in the line by space-types in order to completely justify the line to proper measure. In use the ball-stop 39 moves from the extreme right of the cylinder, as shown in Fig. 1, toward the left, and when the types of the words are completely set in the line of type matter the ball-stop 39 will have moved in the runway on the floor 32 toward the left to such locality as to hold the balls already dropped on the runway in such position in front of the channels on the ball-assorting cylinder 1 that when released the balls will fall into the channel or channels in such distribution as to be the means of operating the mechanism to deliver the correct number and sizes of space-types necessary for justifying the line. An index-finger 42, secured to the arm 40 of the ball-stop, points to a scale of units 43, fixed on the apron 10, and thereby indicates by the graduated scale and figures thereon the number of units of space-types necessary for justifying the line. Thus, as shown in Fig. 1, the scale is divided into sixty units, and the pointer indicates that twenty-four units of the scale and of the space-types are required for justifying the line.

The ball-stop 39 is differentially operated to determine the particular assorting-channels into which the balls shall be discharged by its connection with the line of type being set, as shown in Fig. 12. While any of several methods may be employed for imparting motion to ball-stop 39 by the advancement of a line of type being set, I preferably employ a lever 57, which I have illustrated in Fig. 12 as controlled by the arm Q and header R, found in the type-justifying mechanism for which Letters Patent No. 592,743 were issued



to me October 26, 1897, and to which this space-delivering device is applicable. Lever 57 is so pivoted medially that its short arm is engaged and moved by sliding arm Q, and its long arm is linked with stem 41. It should be understood that the adjustment of ball-stop 39, its stem 41, and lever 57 is such with reference to the line of type being set that the advancing line of type will begin to operate the ball-stop 39 at a point in the progress of the line being set where it would require sixty units more to complete the total units of a justified line. The ball-stop is at the right extremity of the ball-runway, which would be indicated by the finger 42 pointing to "60" on the scale of the ball-assorting cylinder 1. As the line of type *a* advances by its accumulation in the progress of assembling header R is pushed forward in the type-assembling channel, as described in my Letters Patent referred to. The forward movement of header R and its arm Q, slidable on rock-shaft P, actuates the lever 57, and through the link connection of lever 57 with stem 41 motion is imparted to ball-stop 39, which forms the head of stem 41. When the operations connected with the setting of a line are completed and the balls have been released into the ball-assorting channels, the ball-stop 39, stem 41, and lever 57 return to their initial positions by the action of a tension-spring 59, the arm Q having been raised and returned to its initial position, as described in said Letters Patent.

Hereinafter it is explained how the machine is made to deliver to the runway at the left of the ball-stop a number of balls corresponding with the number of interword-spaces to be filled with space-types and how these balls by the machine are so assorted and manipulated and made to actuate the mechanism as to cause the proper number of space-types of suitable size to be delivered for justifying the line.

At the other end of the cylinder from the spring 15 there is a pinion 44, loose on the journal 2, which pinion is provided with a laterally-projecting stud 45. The journal 2 is provided with a radially-projecting pin 46, located in the path of the stud 45. A segmental rack 47 on the extremity of a lever 48 meshes with pinion 44. The lever 48 is pivoted medially on the frame and is provided with a spring 49, secured thereto and to the frame, adapted to hold the segmental rack downwardly yieldingly. The lever 48 is connected to the arm 34' by the link 38. This cylinder-retrieving lever 48 may be operated directly by the hand of the operator or may be connected to a suitable key or mechanism in connection with a type-setting machine for actuating it. This cylinder-retrieving lever is normally in the position shown in Fig. 7, and the relation of parts is such that on depressing the outer end of the lever the runway-cover 33 is raised by the tilting of the arm 34', and any balls on the runway are

released and fall onto the cylinder, and at the same time the pinion 44 is rotated, bringing the pin 46 into engagement with the stud 45 and by the continued movement of the lever 48 rotating the ball-assorting cylinder 1 backward or retrieving it to its initial position, in which the escapement-dog 17 is in engagement with the first of the series of teeth 16 and the runway 31 is opposite straight portions of the channels A B C, &c. A radially-elongated stop 50 on the cylinder 1 at the rear of the teeth 16 is in the path of and cannot pass the dog 17 and being engaged by the dog prevents the further rotation of the cylinder in that direction, the cylinder when thus stopped being so disposed that the tier containing the longest unit-sections is in front of the runway 31.

In explaining the operation of my improved machine I will assume that it is connected up to a type-setting machine in the manner hereinbefore stated or suggested. The hopper 23 is first supplied with balls, and the cylinder is then brought to such position that the escapement-dog 17 is in engagement with the first one of the teeth 16 and the runway 31 is opposite the straight portions of channels A B C, &c. Thereupon as the operator of the type-setting machine sets the type of words in his machine the ball-stop 39 will at sixty units from the end of the line be correspondingly moved on the runway 31 toward the left, Fig. 1, and as the operator touches a false-space-type key the dog 17 will be lifted, permitting a tooth 16 to escape and the cylinder 1 to rotate accordingly, while at the same time the lever 26 will be tilted, discharging a ball from the tube 24 onto the runway 31. On releasing the false-space-type key the dog 17 and the lever 26 will be retrieved by the action of the spring 21. As the operator continues to set the type of the line the ball-stop 39 will continue to move toward the left until the line is completed, when the ball-stop will have moved a distance on the runway 31 corresponding to the units of type in the words of the line, and the complementary distance or space on the runway at the left of the ball-stop will indicate the amount of the units of space-types that will be required to justify the line, while in the meantime as the false space-types between the words have been placed in position by touching the proper key therefor, a corresponding number of balls by the means before described will have been delivered from the tube 24 onto the runway 31, so that now there is a number of balls on the runway equaling in number the interword-spaces of the line of typeset matter, which balls, by reason of the incline of the runway, are resting in alinement against the ball-stop which is at a position that indicates conveniently to the sight by the scale 43 the total of the units of space-types required to justify the line. While the balls have been delivered to the runway, the



ball-assorting cylinder 1 will have so rotated that that tier 5 on the cylinder that is divided by the channel-walls into sections containing the same number of ball-diameters as the number of balls in the runway will be brought to and immediately in front of the runway—that is to say, if seven balls have been delivered into the runway the cylinder will be at such position that the tier 5, having sections of seven units between the walls of the channels, will be immediately in front of the runway. Thereupon the operator will by touching the proper key depress the outer end of the segment-rack lever 48, raising the cover 33 of the runway, permitting the balls to fall from the runway into a channel or channels A or B or A and B, &c., the balls always falling either into one or into two adjacent channels, while at the same time by the depression of the lever 48 the cylinder 1 will directly be retrieved to its initial position.

The action of the machine in properly assorting the balls to cause to be delivered the proper number and size of space-types can readily be understood by reference to the drawings. Thus on Fig. 1 the finger 42 shows that twenty-four units of interword-space are to be filled by space-types. Assume that there are seven interword-spaces to be filled by space-types, (which fact is at the same time shown by there being seven balls in the runway and by the runway being at the tier on the cylinder divided into sections of seven units each,) seven space-types must be provided that will just fill the twenty-four units of space to be filled in justifying the line. Now on raising the cover 33 of the runway and letting the seven balls fall onto the channels on the cylinder it will be found that they fall into two channels—thus, four balls into the channel C, leading to the chute C', the third of the chutes numbering from the left, and three balls into the channel D, leading to chute D', the fourth of the chutes from the left. This disposition of the balls in the channels C and D is indicated at V in Fig. 8. The levers 13, that extend into the chutes A' B', &c., are respectively (commencing at the left in Fig. 1) connected up to mechanism whereby space-types of one, two, three, four, five, and six units of thickness severally are released by the action of these levers, respectively. Hence, as above stated, four balls being in channel C, (the third in numeric order,) these balls will, through the lever 13 to chute C', actuate mechanism to produce four space-types of three units of thickness, or twelve units, and the three balls in channel D (the fourth of the series) will produce three space-types of four units of thickness, or twelve units, making up in seven types the twenty-four units of space-types required to complete the justification of the line and in accordance with the registration shown by the ball-stop and its finger. To accomplish this ultimate result, it will be understood that the balls being

delivered from the runway into channels C and D run by gravity down into chutes C' and D', where they are stopped temporarily by the cylinder 11, and that as the cylinder 11 rotates one ball at a time drops into a pocket 12 and serves as a tooth, engaging briefly the corresponding lever 13 and tilting it, whereby a corresponding space-type is released or delivered for filling an interword-space in the line. It will be noted that by reason of the pockets 12 registering with adjacent chutes, being arranged in the cylinder 11 in different longitudinal radial planes, the balls drop from the two chutes into pockets 12 and become temporary teeth on the cylinder alternately, resulting in the delivery of space-types of three and of four units of thickness alternately, thus better accomplishing the justification of the line of type-set matter with a non-uniformity in the interword-space filling that is desirable in the art. It should be stated that while Figs. 1, 2, 3, and 4 represent the machine in its initial position, or ready to commence work on the setting of type for a line of matter, yet so far as the finger 42 is concerned, Fig. 1, it is shown not at the initial position, but at a position to which it would come on the setting up of a line of type requiring twenty-four units of space-types to justify the line. After the balls have served their purpose as teeth in connection with the cylinder 11 for tilting the levers 13 they drop into the pan G, by means of which they can be put back into the hopper 23.

As a further illustration of the use of the balls and their method of assortment for causing the delivery of a predetermined number of space-types to fill a previously-ascertained amount of units of type-space twelve balls are indicated at W on Fig. 8 in the tier in which there are twelve units of the scale in each section of the tier. It will be observed that there are seven of these balls in the channel D and five of the balls in the channel E. From this disposition of the balls it can readily be calculated that the seven balls in the channel D will cause the delivery of seven space-types of four units of measurement, or twenty-eight units in all, and that the five balls in the channel E or the fifth channel will cause the delivery of five space-types each of five units of thickness, or twenty-five spaces, so that the twelve balls will in all cause the delivery of twelve space-types of such thickness as to fill fifty-three units of space-type measurement, which number "53" is that at which the finger 42 would have been on the scale, which also would indicate the point at which the stop-block stopped on the runway and against which the balls on the runway were grouped in alinement to be discharged therefrom into the channels D and E. It will therefore be understood that the location of the stop-block on the runway is always such as to determine the locality of the balls, from which they are to be discharged into the channels on cylinder 1 in order to secure their



proper arrangement and action on the levers 13 to cause a delivery of the proper space-types required.

The division of leverage of arm 57 is such that for the addition of every unit of type to the line of type being set the ball-stop is moved one ball-diameter or unit of the scale into which the ball-assorting cylinder is divided longitudinally. Thus for each unit of type set the alinement of balls in the ball-runway 31 is moved one ball-diameter to the left, as seen in Fig. 1, bringing the balls in such position in front of the ball-assorting channels that if released into those channels they would operate as described to release one less unit of space-filling in the total units of space-types released. It is obvious that on this principle of unit measurement and by the operation of the parts of my mechanism as described the movements of ball-stop 31 are kept in such relation to the accumulation of a line of type being set that the balls when released into the ball-assorting channel or channels will be so distributed as to operate to release space-types to the exact total number of units of space-filling necessary to justify the line. As the number of balls released into the ball-assorting channel or channels in one operation coincides with the number of space-types required between the words of the line and as each ball in its operation, as described, releases one space-type it is obvious that the result is the release of the total number of units of space-filling required divided into the exact number of space-types necessary between the words to justify the line of type.

What I claim as my invention is—

1. In a type-justifying machine, balls of uniform diameter, a movable surface provided with concurrently - widening ball-receiving channels the successive widths of which increase in longitudinal dimensions uniformly on a scale the unit of which is the diameter measurement of the balls used, a ball-runway in which the balls are assembled in alinement transversely to and in front of the channels, and a ball-stop adapted through differentially-actuating connections with an advancing line of type being set to determine by its position in the runway the channels into which the balls shall be released.

2. In a type-justifying machine, using balls of a uniform diameter of a unit of a scale for actuating purposes, a rotatable ball-assorting cylinder provided with projecting flanges which divide the surface of the cylinder on a scale into a plurality of circumferentially-disposed tiers of longitudinal ball-receiving sections, the sections in each succeeding tier being one unit of the scale greater in longitudinal extent than the sections in the tier preceding it, the flanges dividing the sections in each tier being connected by flanges with the corresponding ordinal flanges in the adjoining tier thereby forming channels transversely of the tiers.

3. In a type-justifying machine, a movable surface divided by flanges into adjacent ball receiving and discharging sections which are in longitudinal dimensions the multiples of a given unit of a scale, in combination with a plurality of balls of a uniform diameter equal to said unit of scale, means for delivering said balls into said sections, and means such as the inclination of said surface adapted to discharge the balls therefrom.

4. In a type-justifying machine, the division by parallel projecting flanges of a surface into tiers of longitudinal ball-receiving sections which in longitudinal dimensions are the multiples of a given unit, the sections in each succeeding tier containing one more unit than those sections in the tier preceding it, and all the sections so joined by connecting-flanges into channels transversely of the tiers that each channel will contain one section of every size, means for dropping balls severally into said variant sections and means for discharging them therefrom.

5. In a type-justifying machine, the combination of uniform balls, a cylinder provided with exterior ball-assorting sections as described, a runway in which the balls are assembled in alinement in front of and transversely to the channels, means for bringing each tier of sections successively into coincidence with the ball-runway by the intermittent rotation of the cylinder, and means for discharging balls from the runway into a section or sections.

6. In a type-justifying machine, the combination of uniform balls, a cylinder provided with exterior ball-assorting sections, a runway in which the balls are assembled in alinement in front of and transversely to the channels, means for bringing each tier of sections successively into coincidence with the ball-runway by the intermittent rotation of the cylinder, means for discharging balls from the runway into the section or sections, and means for retrieving the cylinder to its initial position.

7. In a type-justifying machine, a plurality of ball-receiving channels on a revolving cylinder, fixed chutes registering with and leading from the channels, and uniform balls adapted to enter the channels and be discharged therefrom into the chutes, in combination with a rotatable cylinder provided with pockets for said balls, and levers connected to space-type-ejecting devices, the levers being so located as to be contacted severally by a ball in a pocket of said cylinder when rotated.

8. In a type-justifying machine, the combination of a series of chutes in the same vertical plane, a rotatable pocketed cylinder located at one side of the chutes but so that one side of the cylinder extends nearly across the chutes in spaces therefor formed by cutting away the sides of the chutes, balls of uniform size adapted to pass through the chutes severally lying in the pockets therefor



in the cylinder while moving with and passing the cylinder and medially-pivoted levers extending into the chutes through slots therefor and into the paths of the pocketed balls so as to be contacted and actuated thereby.

9. In a type-justifying machine, a rotatable cylinder provided with a plurality of circumferentially-extending ball-receiving channels severally of varying widths multiples of a unit of ball-scale measurement, balls of uniform diameter of the unit of measurement, a ball-runway adjacent to and substantially paralleled with the cylinder, means in connection with the runway for alining the balls in the runway opposite one or more of said channels and in such positions that the balls gathered in the runway when discharged therefrom will fall into one or more and such of said channels as to cause the discharge of space-types of such number and size as exactly to fill a line and all the spaces of the line of type-set matter, and means for discharging the balls from the runway into the channels.

10. In a type-justifying machine, balls of uniform size, channels adapted to receive the balls in suitable assortment and deliver them to actuating mechanism, actuating mechanism for releasing space-types so arranged that the balls passing thereto from the different channels and operating as described will release space-types of different thicknesses, and means for determining the number of balls that must be released into each channel to discharge the aggregate units of space-filling needed to justify a line divided into the number of space-types required.

11. In a type-justifying machine, the combination of channels terminating in chutes, said chutes, balls to be operated upon in the chutes, a ball-runway to aline the balls continuously in a single series in front of the channels from which runway the balls in the single series are released into the several channels, a revolving cylinder provided with pockets for receiving and holding the balls during a portion of their passage through the chutes, and levers extending into the chutes and actuated by said balls in said cylinder as keys, the levers being adapted for discharging space-types.

12. In a justifying-machine, a surface divided into channels coincidently and equally varying in width for receiving, assorting and delivering balls adapted for actuating mechanism for delivering varying space-types, means for delivering balls into said channels and means for discharging them therefrom.

13. In a type-justifying machine, a surface divided into channels having coincidently and equally varying widths for receiving, assorting and delivering balls of uniform size, said balls of uniform size and mechanism adapted to be operated by these balls in different positions for delivering space-types of varying thicknesses in accordance with the assorting of the balls in the channels.

14. In a type-justifying machine, a movable surface divided into channels having coincidently and equally increasing widths, the widths of all the channels being equal in the same tiers transversely of their length, the channels being adapted for receiving, assorting and delivering balls for actuating mechanism for delivering varying space-types, and means for alining the balls in front of the channels and discharging them thereon.

15. In a type-justifying machine, a surface adapted to carry balls thereon, said surface being divided by walls into adjacent channels which walls separate laterally in common transverse tiers step by step regularly, the widening of the channels being equal and coincident in all the channels and the walls being made continuous by oblique portions thereof between the laterally-separated step portions, means for alining balls in front of and discharging them into one or more of said channels, and means for moving said surface to bring different tiers of the varying channels in front of the ball-alining device.

16. The combination with a surface divided into adjacent ball-channels extending alongside in the same general direction, of a ball-runway transversely of the channels and adjacent thereto adapted to hold a line of balls and discharge them into the channels, said runway comprising a floor inclined toward the channels and a removable cover.

17. The combination with a surface divided into ball-receiving channels, of a ball-runway adjacent to and transversely of the channels and adapted to discharge balls into the channels, said runway comprising a floor inclined toward the channels and a trough-like cover mounted on a rock-shaft and parallel to but a distance from its axis.

18. The combination with a surface divided into ball-channels, of a ball-runway adjacent to and transversely of the channels, said runway comprising a floor inclined toward the channels, a removable cover, and a hopper-like initial extremity adapted to receive balls therein and discharge them by gravity onto the floor of the runway.

19. In a type-justifying machine, the combination of vertically-disposed ball-chutes in a common plane, a horizontally-disposed cylinder one side of which projects into the cut-away sides of the chutes, said cylinder being provided with pockets registering with the chutes adapted to receive balls therein during a portion of their passage through the chutes, and pivoted levers projecting into the chutes in front of the cylinder adapted to be tilted on the revolution of the cylinder by the balls serving as teeth on the cylinder to which they are held by said chutes.

20. In a type-justifying machine, the combination of vertically-disposed ball-chutes in a common plane, a horizontally-disposed cylinder one side of which projects into the sides of the chutes, said cylinder being provided with pockets registering with the chutes



adapted to receive balls therein in the chutes, the pocket or pockets registering with one chute being in a different longitudinal radial plane to the pocket or pockets of the adjacent chute or chutes, and pivoted levers projecting into the chutes in front of the cylinder and adapted to be tilted by the balls serving as teeth on the revolution of the cylinder.

21. In a type-justifying machine, the combination with a revoluble cylinder having a surface divided into ball-channels of regularly-varying widths, of ball-chutes adapted to receive balls from the channels, a pocketed cylinder obtruding into the chutes and adapted to take balls therefrom to form temporary teeth thereon, and levers projecting through the chutes into the paths of the ball-teeth on the cylinder.

22. In a type-justifying machine, the combination with a revoluble cylinder having a surface divided into a plurality of adjacent ball-transmitting channels, of a ball receiving and discharging runway extending continuously substantially horizontally in front of and adjacent to said channels adapted to discharge balls into one or more of said channels, and a movable ball-stop located in and adjustable of said runway.

23. In a type-justifying machine, the combination with a revoluble cylinder having a surface divided into adjacent ball-transmitting circumferentially-extending channels, of a ball receiving and discharging runway arranged opposite and substantially parallel to said cylinder and adjacent to said channels, a movable ball-stop in and adjustable of said runway adapted to limit and locate balls therein to be discharged into said channels, an index-finger secured to said ball-stop, and a scale graduating said runway and said channel-surface, the finger being arranged to indicate the location of said ball-stop with reference to said runway and to said surface.

24. In a type-justifying machine, the combination, with a ball assorting and delivering cylinder mounted revolubly on a frame, of an actuating-spring, escapement-teeth, and an escapement-dog.

25. In a type-justifying machine, the combination with a ball assorting and delivering cylinder mounted revolubly on a frame, of a spring attached to the frame and attached to and coiled about a journal of the cylinder adapted to rotate the cylinder, a series of teeth on the cylinder, and a tiltable escapement-dog provided with a spring-controlled swinging member, the dog being adapted under manipulation to permit the rotating of the cylinder step by step under the action of the spring.

26. In a type-justifying machine, the combination with a ball-assorting cylinder provided with rotating and escapement devices, and a ball-runway for delivering balls to the cylinder, of a ball-hopper provided with a ball-discharging tube having a ball-controlling gate and means connecting the escape-

ment-dog to the ball-controlling gate whereby the gate will be operated synchronously with the escapement device.

27. In a type-justifying machine, the combination with a rotatable ball-assorting cylinder having ball-channels widening regularly on succeeding tiers longitudinally thereof, and rotating and escapement devices by which the cylinder is rotated step by step a distance equal to the width of a tier, of a ball-runway for delivering balls to the cylinder, a ball-hopper having a ball-discharging tube provided with a ball-controlling gate, and means connecting the escapement devices to the ball-controlling gate whereby as the cylinder is permitted to rotate to the extent of one tier a single ball is discharged into the runway.

28. In a type-justifying machine, the combination with a rotatable ball-assorting cylinder provided with means for rotating it limitedly as balls are delivered thereto, and a cylinder-supporting frame, of means for retrieving the cylinder comprising a pinion with a stud, the pinion being loose on the journal of the cylinder, a pin in the journal in the path of the stud on the pinion, and a segmental rack mounted on the frame and meshing with said pinion, the rack being adapted by being oscillated to rotate the pinion and ultimately to rotate the cylinder.

29. In a type-justifying machine, the combination with a rotatable ball-assorting cylinder provided with means for automatically rotating it limitedly, and a cylinder-supporting frame, of means for retrieving the cylinder comprising a pinion with a stud loose on the journal of the cylinder, a pin in the journal in the path of the stud, a segmental rack mounted on the frame and meshing with said pinion, and a spring attached to the rack and to the frame adapted to hold the rack yieldingly to initial position.

30. In a type-justifying machine, the combination with a rotatable ball-assorting cylinder provided with means for automatically rotating it limitedly, and a cylinder-supporting frame, of means for retrieving the cylinder, and means connected with the retrieving device, and actuated synchronously therewith, for discharging balls onto the cylinder.

31. A type-justifying machine, comprising a frame, a revoluble cylinder provided with ball assorting and conveying channels, means for automatically rotating the cylinder, escapement devices for controlling the rotation of the cylinder, a ball receiving and discharging runway in front of the cylinder, ball-supplying devices adapted to deliver balls to the runway synchronously with the rotation of the cylinder, means for retrieving the cylinder rotatively and for discharging the balls from the runway onto the cylinder, chutes for receiving and holding the balls discharged from the cylinder-assorting channels, a lever-actuating cylinder with pockets projecting into the chutes, and pivoted levers arranged



to be engaged and tilted by the balls in the pockets of the lever-actuating cylinder.

32. In a type-justifying machine, balls of uniform size as mediums for actuating mechanism for the release of space-types of different thicknesses, a series of adjacent and uniformly-widening channels adapted for assorting and conducting the balls to the mechanism to be actuated, and means for governing the distribution of the balls into the different channels by the unit progression of a line of type being set.

33. In a type-justifying machine, balls of uniform size, adjacent ball-assorting channels varying in width on a scale the unit of which is the diameter of the balls, a runway for assembling the balls in alinement in front of and substantially transversely to the channels, a movable ball-stop for controlling the position of the alinement of balls in the runway, and means for registering by the movement of the ball-stop, in terms of the diameter of the balls, the unit progression of a line of type being set.

34. In a type-justifying machine, balls of uniform size, a series of adjacent and uniformly-widening ball-assorting channels, means for assembling the balls in alinement in front of and transversely to the channels, means for regulating the position of the balls in front of the channels according to the progression of a line of type being set, and other means for discharging the balls into the channels.

35. In a type-justifying machine, balls of uniform size, assorting-channels of varying width, means for assembling the balls and discharging them differentially into the channels, and other means for automatically determining by the progression of a line of type being set the channel or channels into which the balls are to be discharged.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES W. BOWRON.

Witnesses:

R. O. JASFRASON,  
F. C. WALKER.