

No. 613,724.

Patented Nov. 8, 1898.

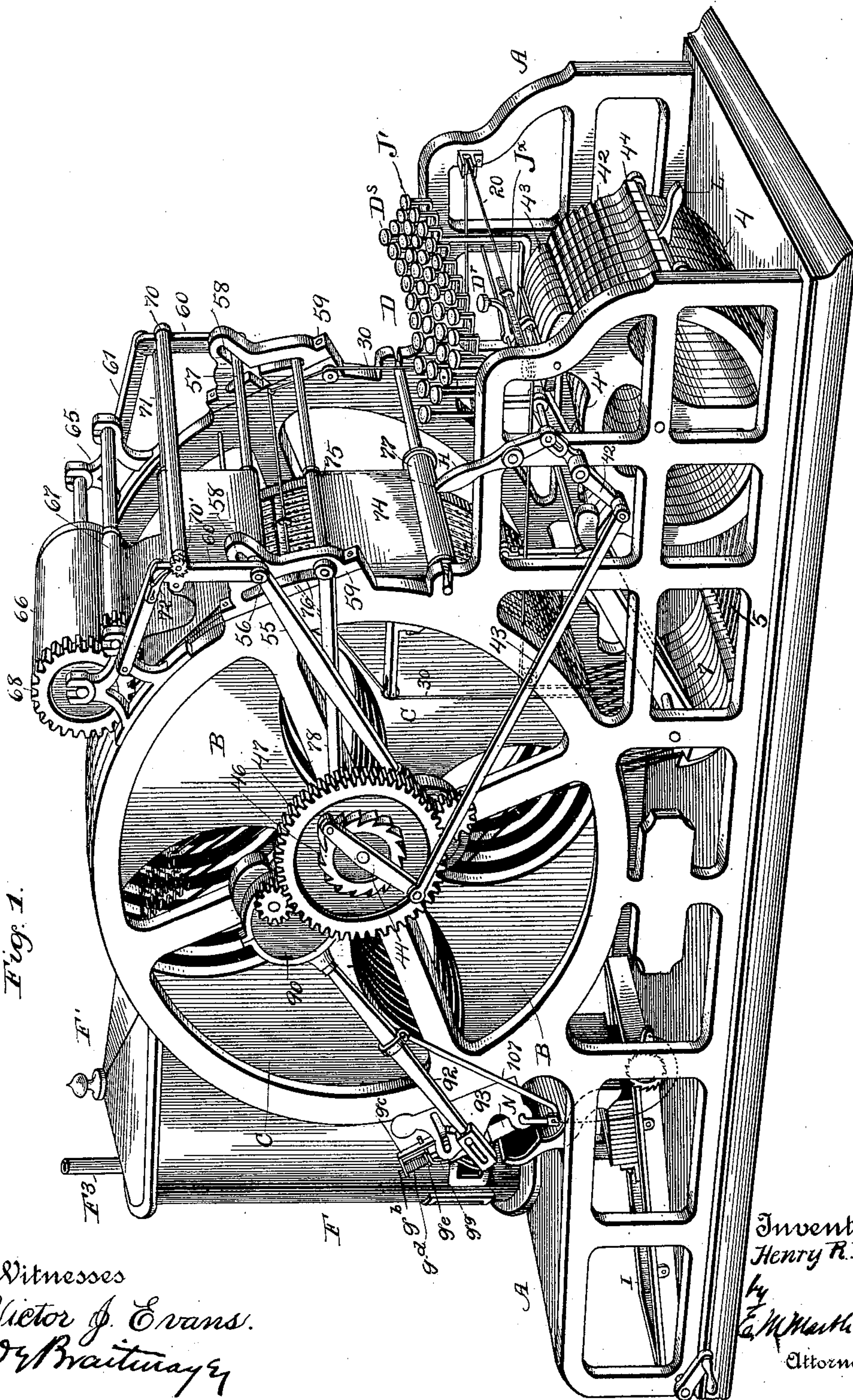
H. R. ROGERS.

PROOF TAKING AND TYPE BAR CASTING MACHINE.

(Application filed Apr. 3, 1896.)

(No Model.)

7 Sheets—Sheet 1.



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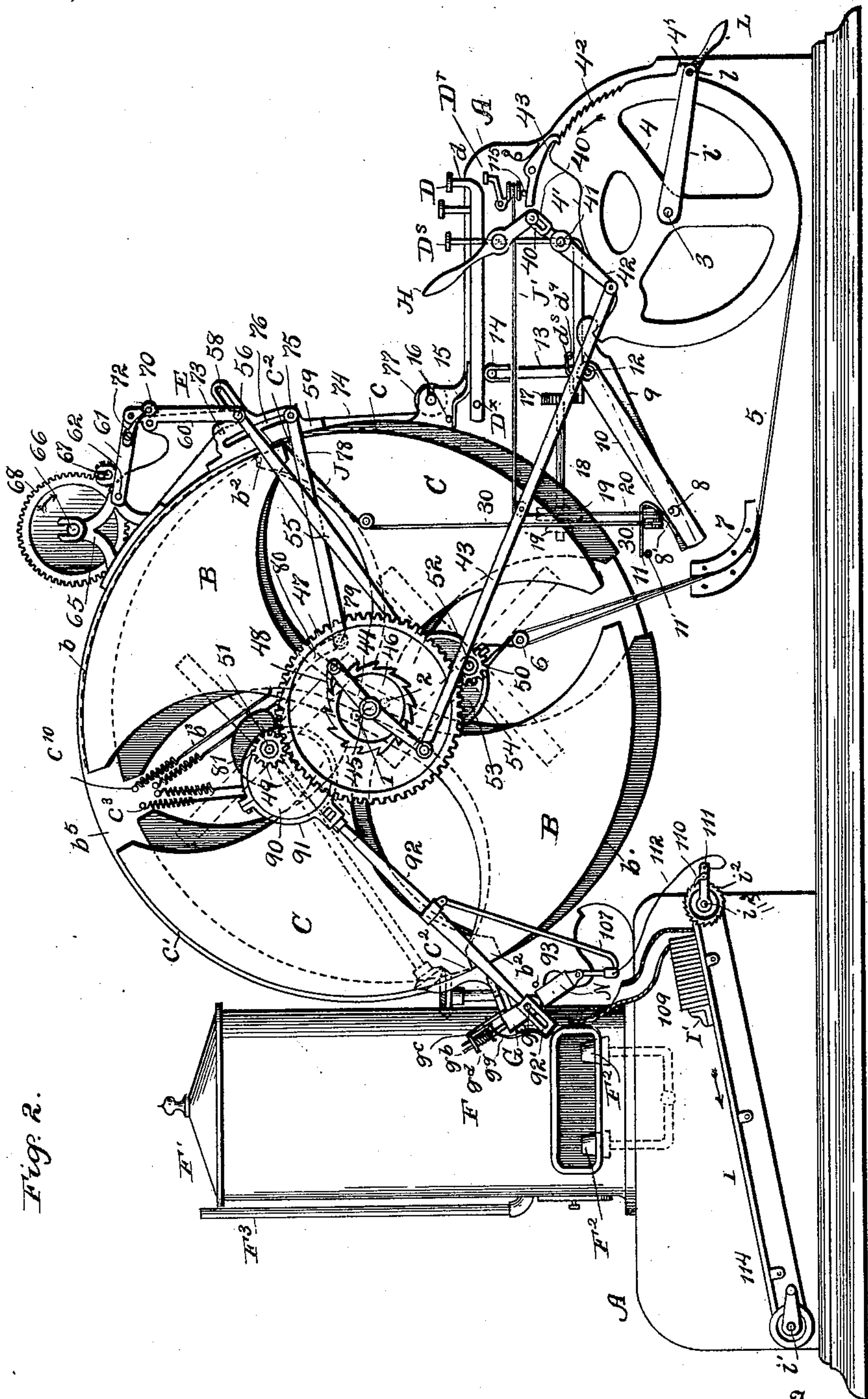


Fig. 2.

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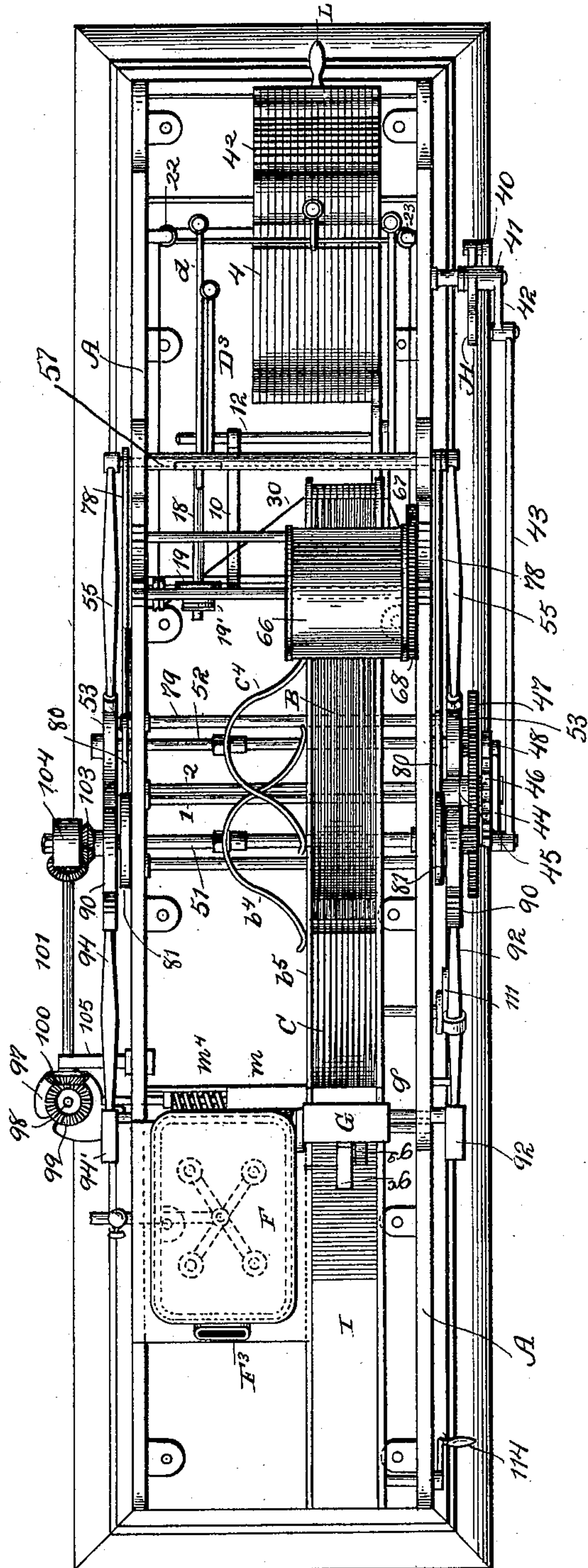
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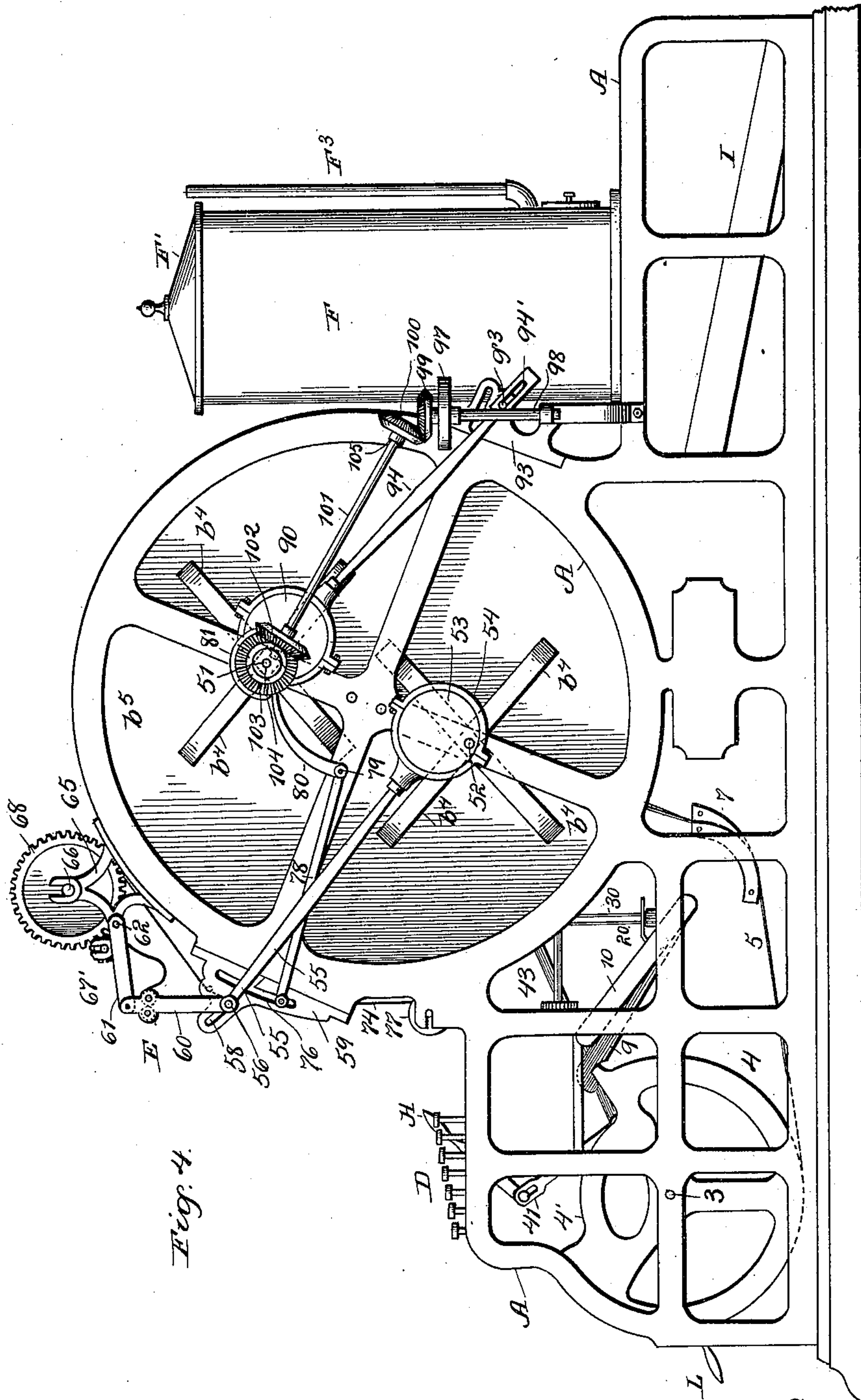


Fig. 4.

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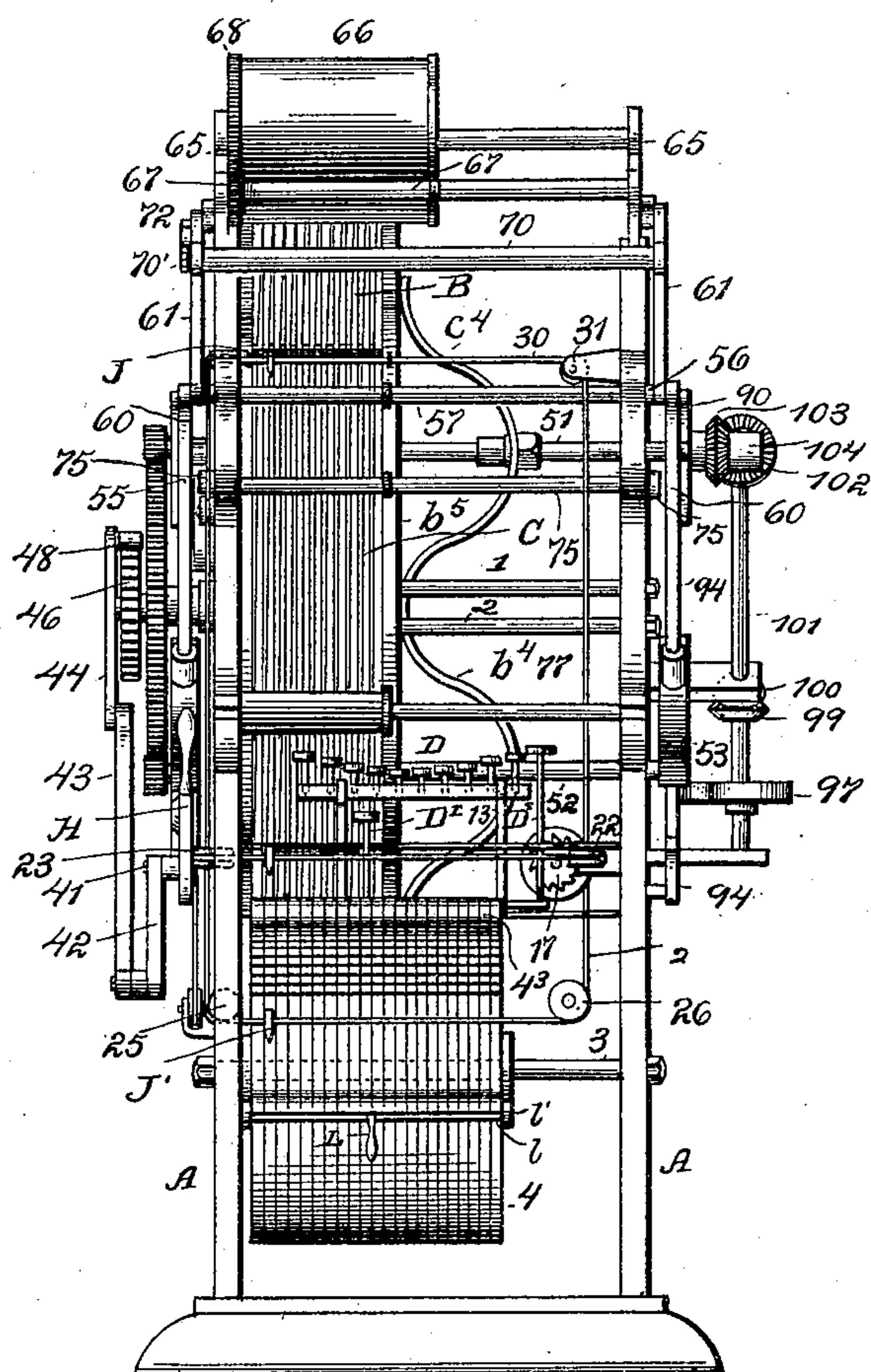
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Fig. 5.



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Fig. 6.

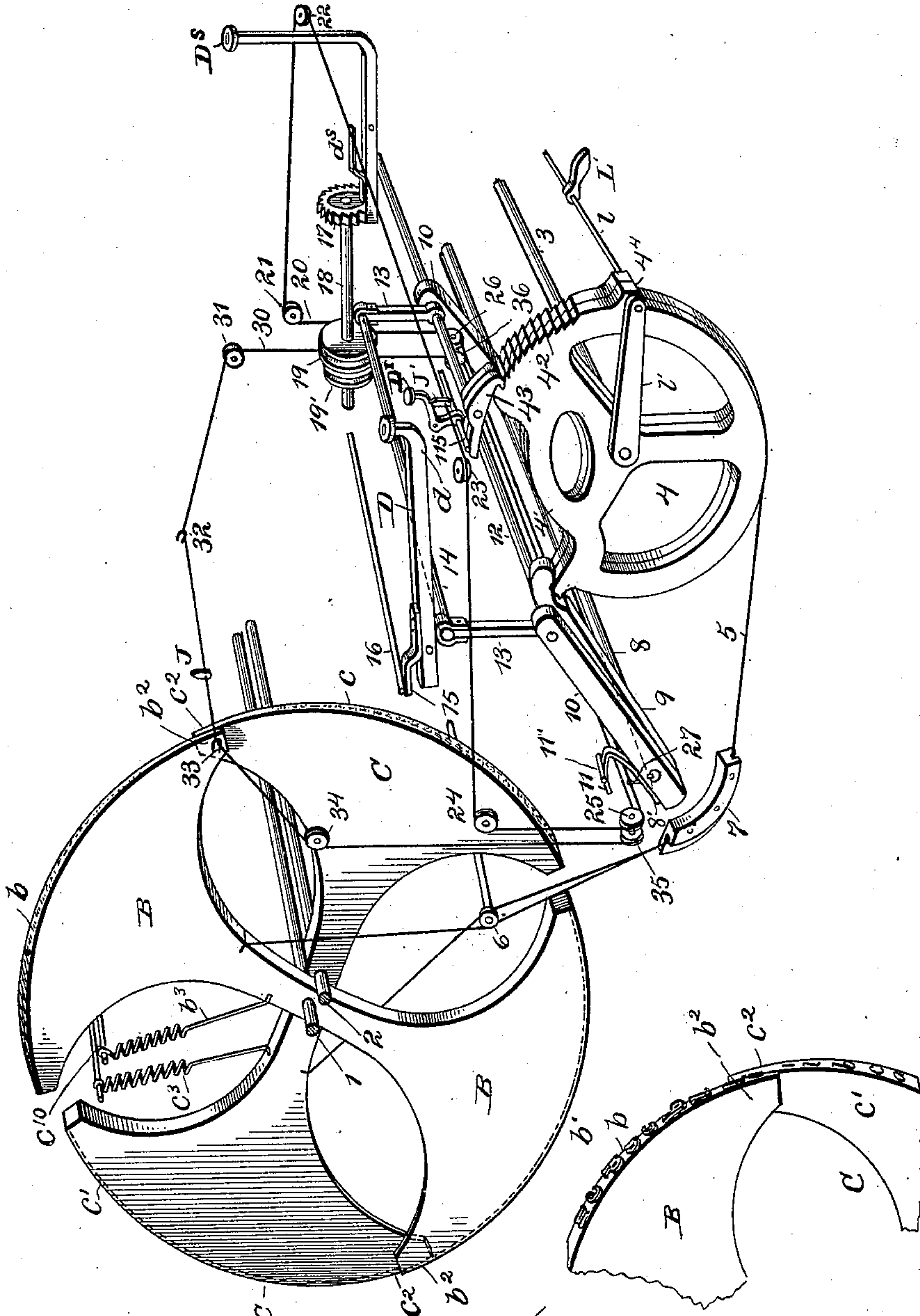


Fig. 12.

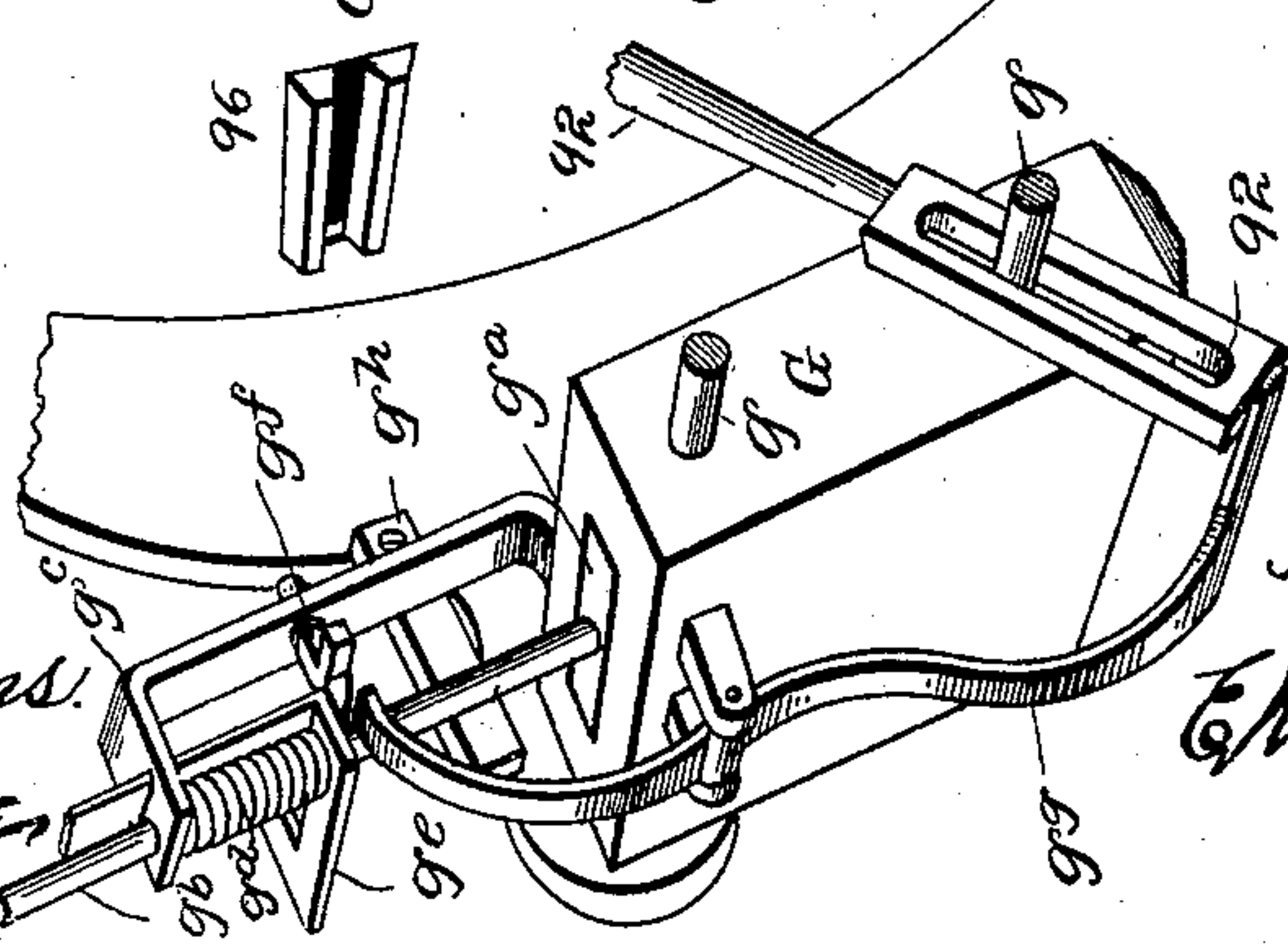
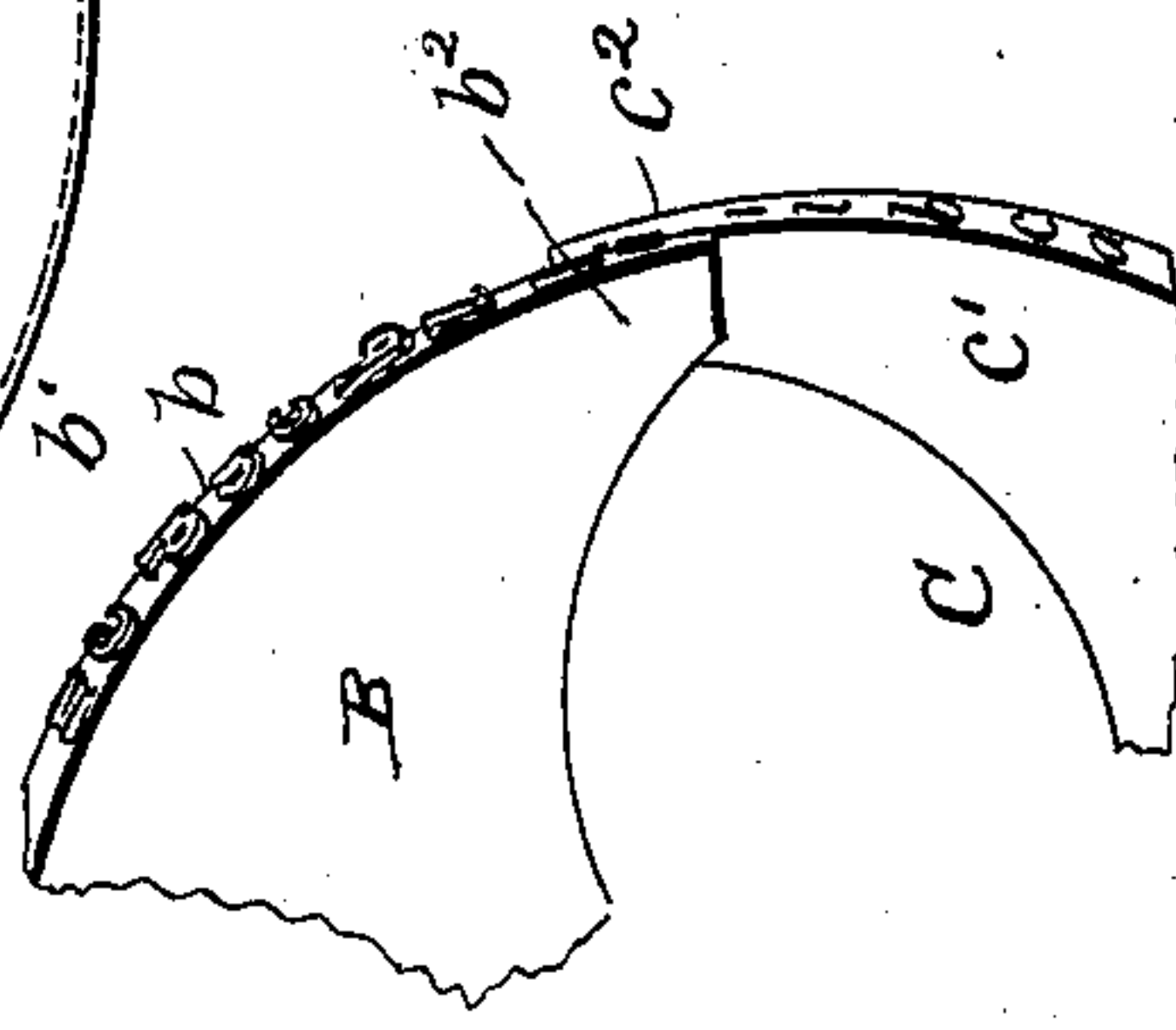


Fig. 6a.



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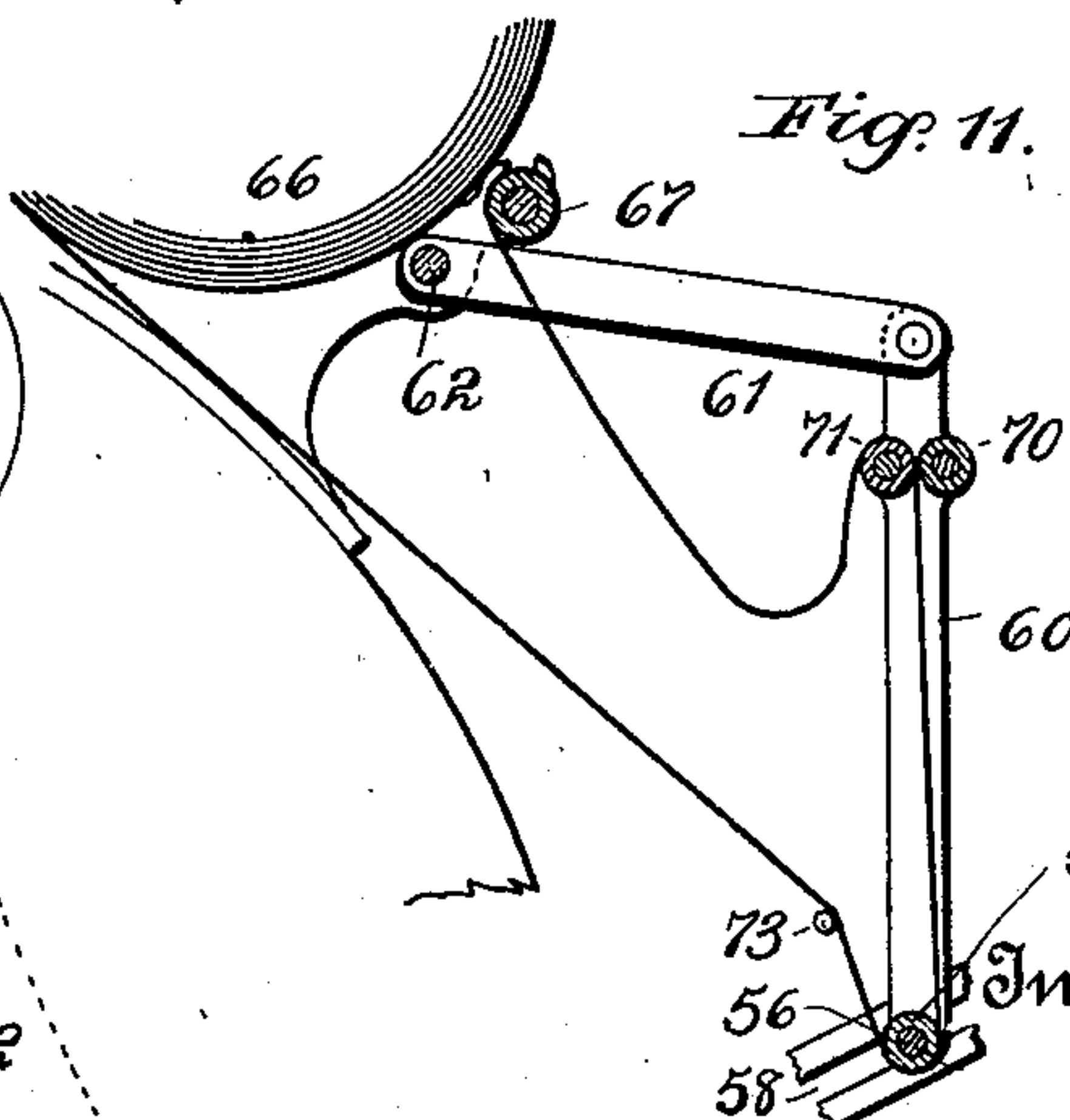
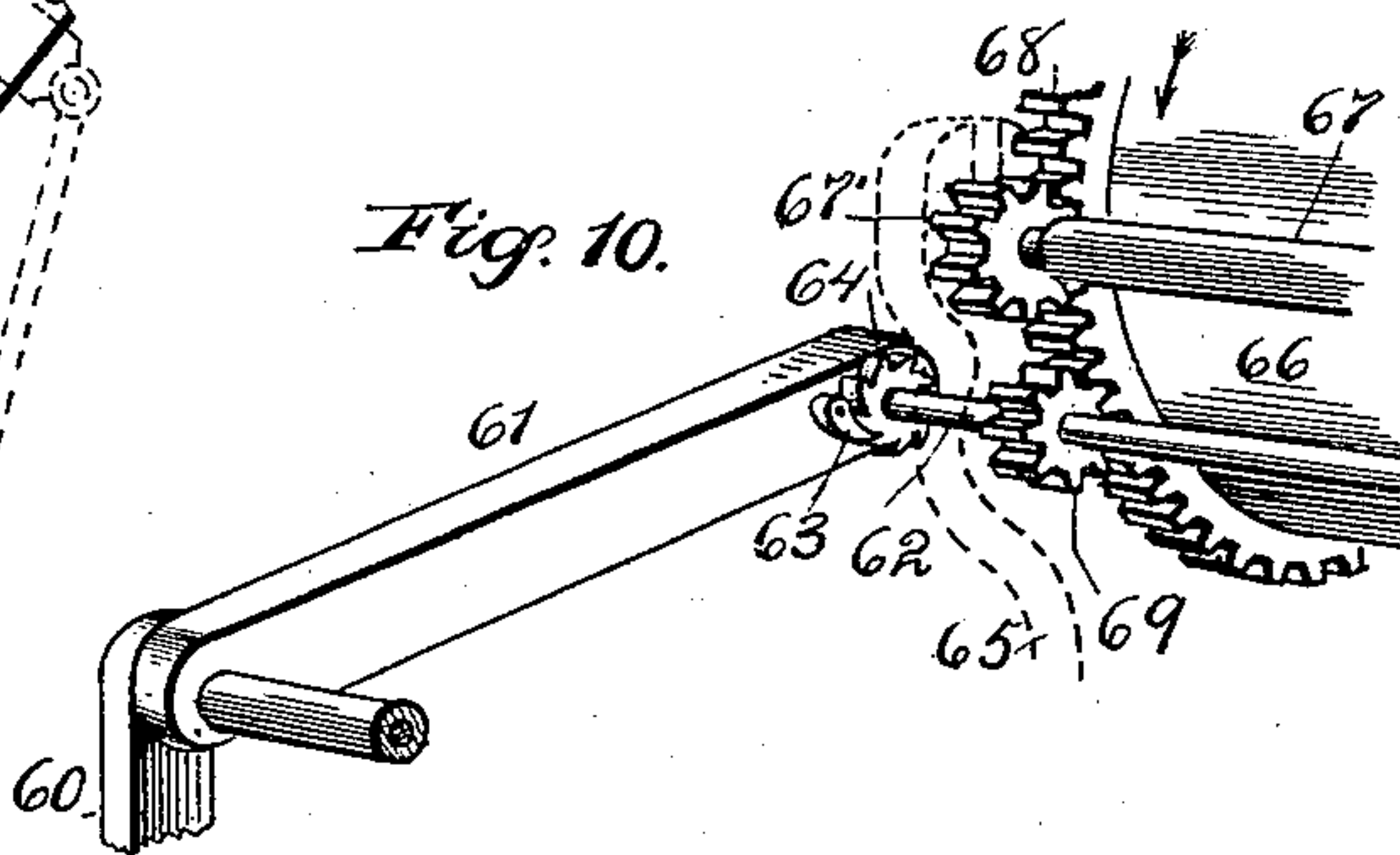
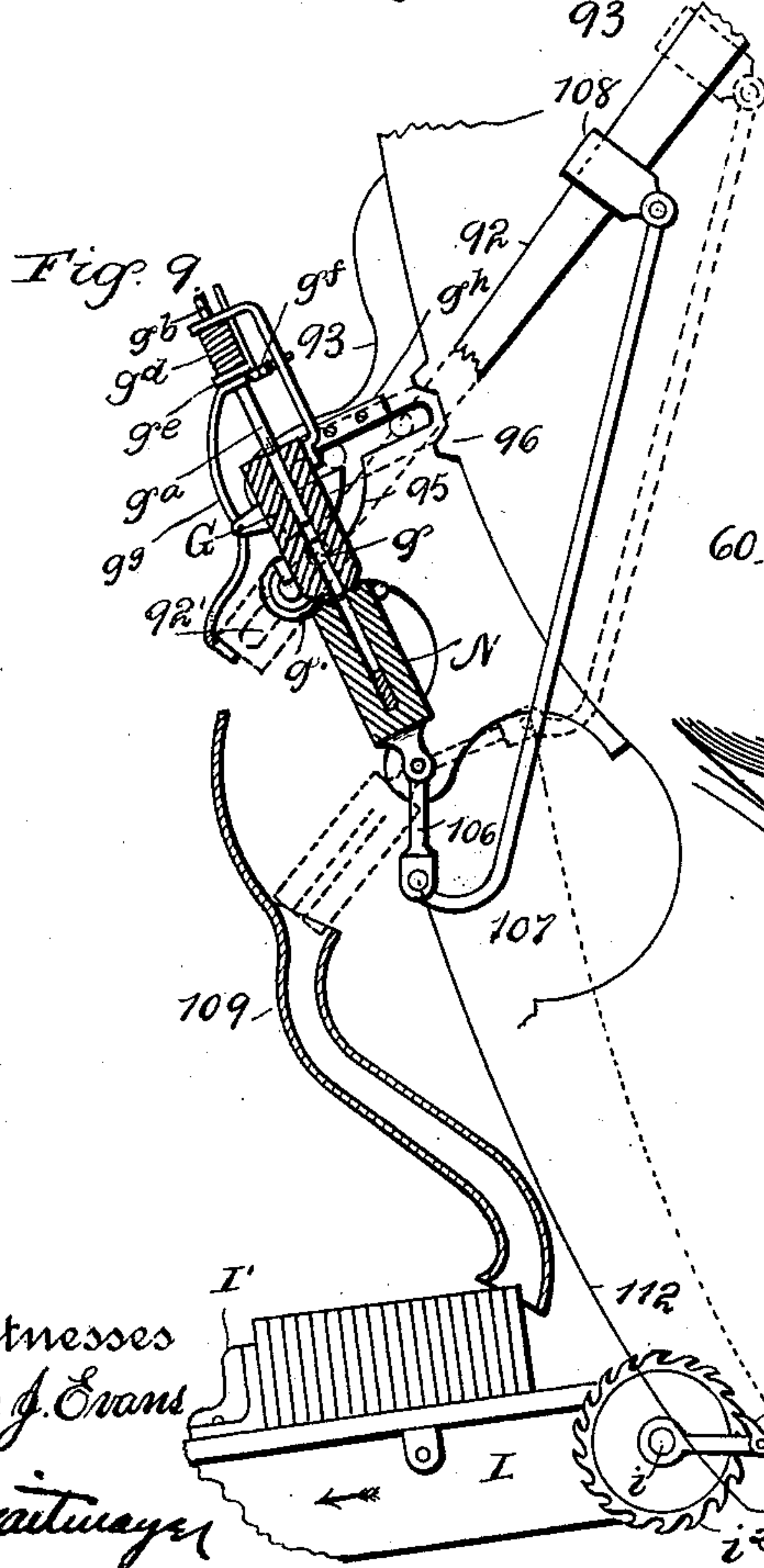
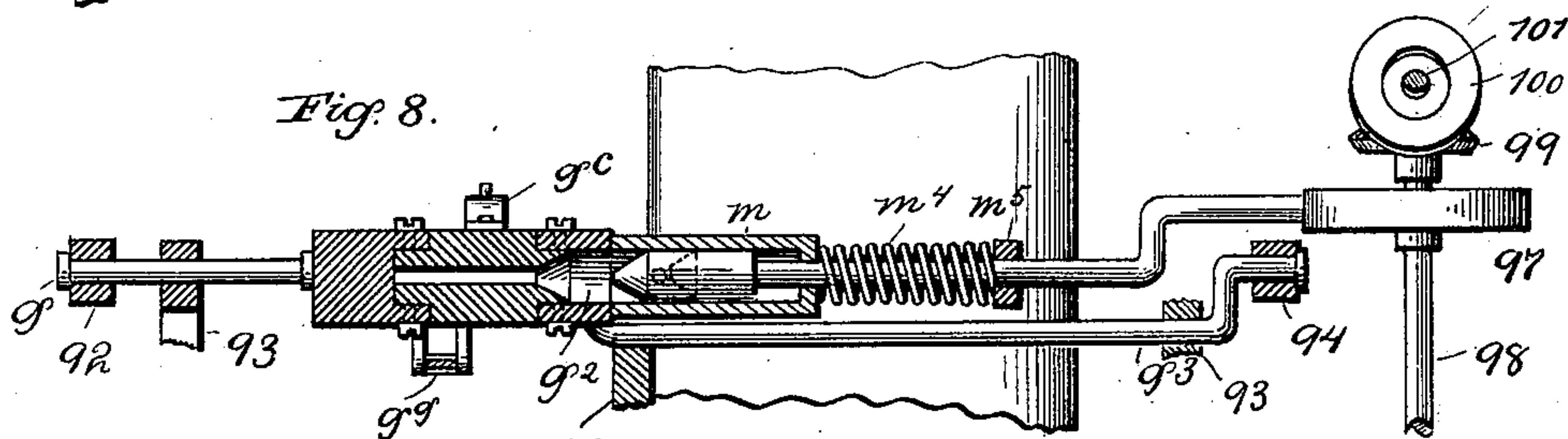
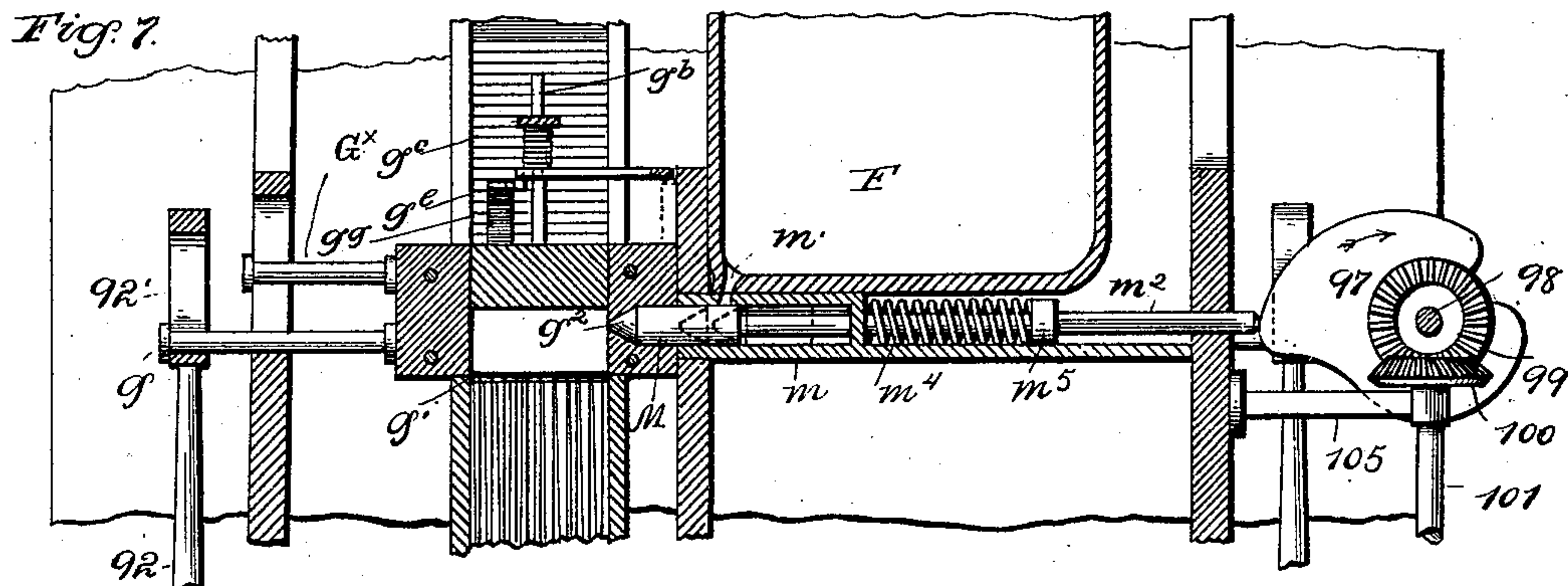
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UNITED STATES PATENT OFFICE.

HENRY RICHARDSON ROGERS, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, OF ONE-HALF TO MARY ELEANOR CAULDWELL, OF SOUTH ORANGE, NEW JERSEY.

PROOF-TAKING AND TYPE-BAR-CASTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 613,724, dated November 8, 1898.

Application filed April 3, 1896. Serial No. 586,082. (No model.)

To all whom it may concern:

Be it known that I, HENRY RICHARDSON ROGERS, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Proof-Taking and Type-Bar-Casting Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The machine in which my invention is embodied is adapted by the operation of a keyboard to cause the formation in a properly spaced and justified line of a series of intaglio type characters arranged to constitute any desired sequence of words and at the same time and by the same operation to cause a similar line of cameo type characters to be brought into a position where they can be observed by the operator and to cause a stereotype-bar to be cast from the line of intaglio type characters and a proof to be taken from the line of cameo type characters, thus combining in one machine proof-taking and type-bar-casting mechanisms.

One object of my invention is to simplify and compact the construction of machines for producing stereotype-bars.

A further object of my invention is to provide a machine of such character which can be operated entirely by hand.

A further object of my invention is to so construct a machine for producing stereotype-bars that a line of type characters exactly similar to that from which the cast is to be taken, except that the type characters thereon are cameo instead of intaglio characters, shall be brought into the sight of the operator while the line is being formed, so that mistakes can be instantly detected and corrected.

A further object of my invention is to provide a printing and proof-taking attachment by the use of which a proof of each succeeding line of type characters can be taken at the same time that the type-bars are cast, thus facilitating the making of any corrections or alterations and increasing the practical value of the machine.

The machine which I have devised to fulfil the objects of my invention has for its principal feature a number of disks arranged in two series mounted upon separate, but contiguous, shafts. The disks are formed with two arc-shaped segments diametrically opposite to each other, the remainder of the peripheries of the disks being cut away. The edges of the segments are inclined on one side, so that the width of each segment gradually increases from one end of the same to the other and the segments become wedge-shaped. The disks of the two series are so mounted upon their shafts that the inclined faces of the adjacent disk-segments of the opposing series face each other and so that normally the narrow portions of such segments are in contact. On the outer surface of each of the disk-segments are formed the characters of a single font of type, the characters being arranged so as to be read transversely of the edge and their position on the segment being regulated in accordance with their width, the narrowest character being at the narrowest portion of the segment. The extreme narrow end of each segment is, however, left blank in order that it may serve for the formation of spaces between words and sentences in the completed line. The type characters upon the series of disk-segments which are nearest the keyboard are raised or cameo characters, while the type characters formed upon the oppositely-arranged disk-segments are intaglio or depressed characters. This arrangement corresponds to the function which such characters are designed to perform, the cameo characters being intended to be in the sight of the operator as they are brought to a determined line, which may be termed the "line of sight," while the intaglio characters when brought to a corresponding line, which may be termed the "line of printing," are to serve as a mold for the formation of the type characters upon the stereotype-bars to be formed. The disks are rotated so as to present the desired characters in the line of sight by a suitable connection with the keyboard. The disks of the two series as they are brought into position move in opposite directions, the inclined sides thereof sliding against each

other until the proper character is in the desired line. The centers of movement of the two series of disks are so chosen that the adjacent disk-sections, as they move into position, form, in effect, successive parallelograms, which, having parallel sides, are adapted to be readily forced into exact position when locked and ready for printing and the casting of a stereotype-bar.

The level on the keyboard of the levers representing the various type characters which I use in my machine varies in accordance with the width of the characters represented thereon and the consequent amount of rotation which is to be imparted to the corresponding type-disks. The type-levers bearing wide type characters are raised, while the type-levers bearing narrow type characters are on a lower level, so that when depressed they will move through distances corresponding with the width of the characters which they represent. The actuating mechanism connecting the type-levers with the type-disks is so arranged that such type-disks are actuated in succession according to their arrangement upon their supporting-shafts and so that a disk can be rotated so as to bring any desired character into the line of sight without affecting the movement or position of the remaining disks. In this manner I am able to operate the entire series of disks with a single keyboard.

Suitable indicators are provided for showing the number of type-disks which have been brought into position in the line of type being assembled, and a corresponding indicator is employed over the mechanism connecting the type-levers with the type-disks, so that the condition of the line being formed can be constantly determined, and in case of any mistake being discovered in such line the actuating mechanism can be adjusted so as to correct the position of the disk presenting the wrong character without altering the position of the remaining disks.

Means are provided for justifying the line of type and for releasing the type-disks and causing them to return to their original positions after the casting of each type-bar.

Mechanism is further provided for bringing the mold-box into position over the intaglio type characters at the line of printing for forcing into said mold a charge of molten stereotype metal sufficient to form a single bar of type and for removing the mold-box from its proximity with the line of printing and discharging the type-bar formed upon a suitable endless carrier, and at the same time for bringing an ink-ribbon over the cameo characters arranged in the line of sight, causing a strip of paper fed from a suitable roll to be pressed against such cameo characters with sufficient force to leave a proof of such characters on the same, raising such strip of paper, and feeding the same forward, so as to provide a clear space for the next impression. It is after these operations have been per-

formed that the type-disks are unlocked from the positions in which they were held while the printing and bar-casting operations were taking place and brought back to their normal positions.

My invention is fully illustrated in the drawings which accompany and form a part of this specification, in which the same reference letters and numerals refer to the same or corresponding parts, and in which—

Figure 1 is a perspective view of my machine. Fig. 2 is a side elevation thereof, taken from the side on which the proof and matrix lever is stationed and showing parts of the frame broken away. Fig. 3 is a top plan view of my machine. Fig. 4 is a side view taken from the side opposite to that shown in Fig. 2. Fig. 5 is a front view of the machine. Fig. 6 is a detail perspective view showing the type-disks and the operative connections thereof. Fig. 6^a is a detail view of the face of one of the cameo and also one of the intaglio type-disks. Fig. 7 is a plan section of the casting mechanism, showing the parts in the position they assume when a type-bar is being cast. Fig. 8 is a vertical section of the mold-box, the plunger M, and the parts in direct connection therewith, showing the plunger in its normal position. Fig. 9 is a detail section showing the mold-box, the type-bar receiver, the endless carrier, and the parts in connection therewith. Fig. 10 is a detail perspective view of a portion of the proof-taking mechanism. Fig. 11 is a section of a portion of the proof-taking mechanism, showing the line of movement of the strip of paper on which the proof is to be taken. Fig. 12 is a detail perspective view of the mold-box, showing especially the slug-ejecting mechanism, the parts being shown in the position they assume just before the slug is ejected.

Referring to the drawings, A represents the machine-frame. This frame is oblong in shape. Its dimensions are regulated by the width of the stereotype-bar which it is the purpose and function of the machine to cast and by the size of the type used. The frame may be made of any suitable material, but is preferably made of steel. In this frame are mounted the series of type-disks B and C, the keys forming the keyboard D, the printing or proof-taking attachment E, the melting-pot F, the mold-box G, the proof and matrix lever H, and the mechanism connected therewith for actuating the printing or proof-taking and the casting mechanisms, the endless carrier I for receiving the type-bars as they are formed, and indicators J and J' for betokening the condition of the line being formed. In the following description these parts will be described in detail, as well as the various connecting parts which serve to make up the organized machine, after which the operation of the machine as a whole will be considered.

Type-disks.—The principal or fundamental

feature of construction embodied in my machine is the placing of the type characters which suffice for the formation of any desired sequence of words upon the peripheries or outer edges of two series of coacting disks B and C and in the use of type characters arranged reversely with reference to each other on diametrically opposite segments of the disks. One side of each of the disk-segments is inclined, so that the outer edge or periphery of such segment is wedge-shaped. The inclined faces of the two segments of each disk are on the same side of the disk. The inclination of the two sides of the two segments of each disk is further reversely arranged, so that the narrow and broad portions of the wedge-shaped segments occur at diametrically opposite points. The type characters of an entire font of type are formed upon the edge of each disk-segment, such characters being preferably cast with the disk-segment, though any other desired construction may be employed. The type characters are raised, or cameo, on the side of the type-disk toward the operator, as shown at b and c , and depressed, or intaglio, on the opposite side of the machine, as shown at b' and c' . This arrangement conforms with the functions which the parts are desired to perform, as the proof-taking attachment is stationed at the front of the machine and operates in connection with the raised or cameo type characters, whereas the type-casting mechanism is operated at the rear of the machine in connection with the intaglio characters. The type characters are arranged so as to be read transversely of the edge of the disk-segments and are placed in the order of their width, the narrowest characters being at the thin edge of the segments and the wide characters at the thick edge thereof. The characters are arranged at regular intervals over the curved face of the segments, so that the increment of rotation which is required to be imparted to the disks to bring the succeeding characters into a definite and predetermined line is the same for each of the type characters. No type characters are formed upon the extreme narrow portion of the edge of the wedge-shaped disk-segments, however, as shown at b^2 c^2 , but such portions are left blank to serve as spacers between words and sentences. The type-disks are mounted upon separate shafts 1 and 2, the disks on each shaft constituting a series of disks. The inclined faces of the adjacent disks of the two opposing series face each other and are normally held by the action of the springs b^3 and c^3 at such an angle to each other that only the extreme or blank portions of the disk-segments are in contact. The springs b^3 and c^3 are fastened at their upper ends to rods c^{10} , which extend transversely of the machine and are secured to the frame thereof. The rods c^{10} do not interfere with the action of the type-disks, as the type-disks in their operation move away from said rods. The lines of contact thus

formed on the opposite sides of the disks are those at which the printing and casting operations are arranged to take place. The disks are mounted loosely upon their shafts, so as to freely slide upon the same, but are normally held in close contact by the pressure of the springs b^4 and c^4 , against the pressure-plate b^5 , which presses against the end disk of that side on which lateral movement is permitted. The portions of the disks between the disk-segments are cut away, as shown, so as to permit the rotation of the disk-segments in the desired directions and to furnish space for the location and operation of other mechanisms connected with the machine.

In the assembling of the type characters which are to form any desired sequence of words the type-disks are moved forward in opposite directions, the inclined sides of the adjacent disks of the opposing series sliding against each other until the desired characters are in the predetermined line to be formed. The respective disks are operated in regular sequence, and as they take their place in the line to be formed the wedge-shaped segments thereof force the inactive disks to slide along upon their shafts until the disk which is being operated is brought into the proper position. When so operated, the cameo type characters arrange themselves into the line which is visible to the operator and which therefore may be appropriately termed the "line of sight," while the intaglio characters arrange themselves into the line from which the cast is taken and which may be termed, therefore, the "line of casting." Due to the relative arrangements of the disks of the opposing series upon their shafts, the straight sides of the disks lie in parallel lines and the disks themselves can be closely packed together, so that no space intervenes between adjacent segments.

It is to be noted that the springs b^3 and c^3 , which tend to oppose the rotation of the disks, act on different sides of the centers of such disks, so as to properly perform their function.

Type-disk connections, keyboard, and indicator mechanism.—At the front of the machine there are mounted upon a shaft 3 a number of mutilated disks or wheels 4, which are in direct connection through suitable intermediate mechanism with the keyboard and which are also in connection through the connecting-cords 5 with the respective type-disks. The mutilated disks, or, as they will hereinafter be termed, "operative" disks, are connected in regular order with a single type-disk. The connecting-cords 5 are attached on different sides of the centers of the disks belonging to the two series in order that the opposing disks may be caused to rotate in opposite directions when assembled. The connecting-cords 5 are preferably made of steel wire, although other material may be used, if desired, and pass through the opening formed

between the ends of the disk-segments, being guided by passing over the roller 6, which extends transversely of the machine, and between the curved guiding-plates 7. It will thus be seen that by varying the amount of rotation imparted to the operative disks 4 and by them to the type-disks B and C any desired type character can be brought into the line of sight and the line of printing.

The operative disks, as shown, are formed with a mutilated portion 4', which extends over a segment of their periphery equal to the greatest radial movement thereof which is necessary to be imparted in the operation of the machine. On their front edge they are also formed with a toothed section 4², which engages a spring-pressed pawl 4³, thus locking the disks and preventing their rotation. The inclination of the teeth of the toothed segments 4² of the disks is such as to permit rotary movement of such disks in the direction of the arrow, Fig. 2, or anticlockwise, but to prevent rotation of the disks in an opposite direction unless the pawls 4³ are raised from engagement with such notched segments.

The connection of the operative disks with the keyboard D, by means of which provision is made for their being operated successively to bring any desired type characters into the line of sight, is as follows: At the front of the machine, between the type-disks and the operative disks, there is journaled in the machine-frame a rotary shaft 8, which is formed with a feather 8', as shown. This shaft 8 extends parallel to the axis of the operative disks, and upon the same slides what I shall term the "actuator-arm" 9. The outer end of this arm contacts with the mutilated portion of the operative disks and is adapted to rotate said disks whenever the shaft 8 is rotated. Only one actuator-arm is provided for the entire machine, such arm being caused to travel along the shaft 8, upon which it is mounted, so as to successively act upon the respective operative disks. This construction has the advantage of permitting any one of the operative disks to be operated and any desired type character upon the surface of the type-disks with which said operative disk is connected to be brought into the line of sight without the necessity of providing positive locking means for retaining the remainder of the operative disks in position. The amount of rotation imparted to the shaft 8, and by that transmitted to the operative disk 4 and the type-disk with which it is connected, determines the type character which is brought into line, and as it has been heretofore stated that the type-characters are arranged upon the disk-segments in regularly-spaced intervals, so that the increment of rotation required to bring the successive characters into a predetermined line is the same for each character, it will be seen that by simply controlling the amount of revolution imparted to the shaft 8 in accordance with the position

of the type character on the segment which is to be represented in the line of sight such character can be definitely and certainly brought into line.

Before describing the mechanism by means of which the longitudinal movement of the actuator-arm 9 upon its shaft 8 is provided for I shall describe the connection of the shaft 8 with the keyboard D, whereby rotary movement is imparted to such shaft.

On both ends of the shaft 8 there are keyed levers 10. These levers are held normally inclined upward by the action of the springs 11, attached to the transversely-extending rod 11', which press against the short arms thereof. At the outer ends of their long arms they are connected by a transverse shaft 12. To the shaft 12 is keyed the links 13, which extend upward to a point just below the level of the keys *d* of the keyboard and which are connected at their upper end by a transverse rod 14. The type-keys *d* are arranged at the front of the machine, so as to be under the easy control of the operator. They are pivotally mounted at their inner ends to rods D^x, which extend transversely of the machine and are normally held upward or raised by the action of the springs 15. The type-keys are further so supported as to be on different levels and as, therefore, to require different amounts of depression before the limit of their downward movement is reached. A rod 16, extending transversely of the keyboard, serves to limit the downward movement possible to each lever. The level on which the different keys forming the keyboard are arranged is determined by the position on the segment of the type character represented thereby. The keys which represent narrow type characters are placed on a low level, so as to require a limited amount of depression, while the keys which represent wide type characters are raised and require a greater amount of depression.

As the connection of the type-levers to the revoluble shaft 8, the actuator-arm 9, and the operative disks 4 is such that these parts move through different angles in accordance with the amount of depression of the type-keys, it will be seen that an arrangement is here provided whereby the operative disks, and through the same the type-disks, may be rotated an amount strictly in proportion to the position on the segment of the type character which is being depressed, and therefore that any desired type character may be with certainty brought into a predetermined line.

The cameo type characters required to form any desired sequence of words are thus brought into the line of sight by the depression of the type-keys bearing the corresponding characters. As a result of this action it of course follows that the intaglio type characters from which the type-bar is to be cast are also assembled in the line of printing. It is necessary, however, to so devise and construct the mechanism by means of which word-

spaces are formed in the line of type that it will act without causing a movement of the actuator-arm or of the operative disk. This mechanism I shall now proceed to describe, and I shall also describe in connection therewith the indicator mechanism, as the parts are intimately related to each other.

In the drawings the spacing-key is shown at the extreme right of the keyboard. It consists in a pivoted lever D^s , one arm of which extends vertically upward and the other arm of which extends lengthwise of the machine and engages with the ratchet-wheel 17. The ratchet-wheel 17 is mounted upon a short shaft 18, suitably journaled in the machine-frame, and bears on the other end of the same the double pulley-block 19 19', around which pass the indicator-cords 20 and 30. The end of the spacing-lever D^s which engages with the ratchet 17 is sharpened, so as to enter the toothed periphery of such ratchet-wheel; but it is forced back into its original position after each engagement with the ratchet-wheel by the action of the spring d^s , attached to the transverse rod d^v . This portion of the spacing-lever is further located just above the transverse shaft 12, which connects the two arms 10. The indicator-cord 20, which, as I have stated, passes around the pulley-block 19, extends to the front of the machine just below the level of the type-keys, and the pointer J' thereon serves to indicate upon a suitable scale J^x the operative disk upon which the actuator-arm 9 is in position to act. The exact location of the indicator-cord 20 in the various parts of the machine through which it passes is as follows: After passing over the pulley-block 19 such cord extends upward, passing over a pulley 21, then to the front of the machine over a pulley 22, thence across the machine over a pulley 23, (the pointer J' being located on this section of the indicator-cord,) thence rearward over a pulley 24, thence downward over a pulley 25, thence across the machine to a pulley 26, and thence back to the pulley-block 19. The section of the indicator-cord extending between the pulleys 25 and 26 is connected to the actuator-arm 9 by the link 27, so that the position of the actuator-arm can be changed by moving the indicator-cord.

The indicator-cord 30 extends from the pulley-block 19' over a pulley 31, thence through the hook-eye 32 and across the machine through the hook-eye 33, (it being upon this portion of the indicator-cord that the pointer J is stationed,) thence downward over the pulleys 34 and 35, across the machine to a pulley 36, and back to the pulley 19'. Both indicator-cords are thus endless bands and are moved according to the direction of movement given thereto by the pulley-blocks 19 and 19'.

To form a space in the line of type being formed, it is only necessary to depress the spacing-key D^s and through the same to move the ratchet-wheel 17, and thereby to carry the

actuator-arm, through the movement of the indicator-cord 20, past one of the operative disks 4 without depressing the same. As in its normal position each type-disk has the blank portion of its edge in the line of sight and the line of printing, no actuation of the type-disk is necessary to provide a space. It is only necessary to leave the type-disk stationary. If the space required in the line is greater than that afforded by the blank portion of a single one of the disks, the spacing-key may be operated successively until the desired space is present in the line. This can be ascertained by an examination of the line as it is being formed in the line of sight.

I have stated that the transverse shaft 12 extends just beneath the lower portion of the spacing-lever D^s . The relation of these parts is such that when such shaft rises after each depression through the operation of a type-key it strikes the lower portion of the spacing-key D^s and moves the same so as to rotate the ratchet-wheel 17, and thereby move the indicators and the actuator-arm from the disk just operated to the next in series.

In this manner I am able to assemble any desired sequence of type characters in the line of sight by depressing the type-keys of a single keyboard and am also able to carry the actuator-arm 9 step by step along the feathered shaft 8 without requiring any additional mechanism for such purpose.

Justifying mechanism.—After a line of type characters has been formed it is frequently necessary to justify the line or to increase the space between the words forming the line, so that they will take up the full width allotted thereto. The space which is required to be filled by the actuation of the justifying mechanism is not large and when skilful compositors are operating does not usually exceed the width of two or three type characters. The means which I employ in my present machine to justify the line of type are as follows: On the front of each of the operative disks there is a short stud or projection 4⁴. Directly beneath these studs there extends across the machine a shaft l , which is supported at either end by the arms l' , mounted upon the shaft 3. The shaft l has secured thereto the handle L , by which it is moved. When the operative disks are actuated to form a line of type, such of the operative disks as have been rotated to bring the type characters into the required line have been moved into such position that the studs 4⁴ no longer rest against the short shaft l . Such of the operative disks, however, as have remained stationary since the type-disks with which they are connected serve to provide the spaces in the line just formed still remain in such position that the studs 4⁴ of the same rest against the lever l . When, therefore, it is desired to justify the line, the handle L is grasped and moved upward until the wedge-like spacing-segments of the type-disks have increased the distance between the several

words forming the line sufficient to render the line even and to cause it to fill its allotted space. Each one of the type-disks performs only a small portion of this justifying operation, and the total amount of space which is filled by the action of the justifying mechanism is divided between the several spaces existing in the line of type, so that there is no undue enlargement or expansion between any two of the words forming such line.

Proof-taking and casting mechanism.—After the line of type has been formed and justified it is in condition to have a proof taken therefrom by the actuation of the printing mechanism and to have a type-bar cast therefrom by the action of the casting mechanism. In my present machine both of these operations are performed simultaneously through the actuation of the proof and matrix lever H. This lever, which, as shown, is pivoted on the outside of the frame, is connected at one end to the slotted lever 40, mounted upon the stud-shaft 41. On the shaft 41 is also mounted the short lever 42, to the lower end of which is pivoted the connecting-rod 43, such rod being pivoted at its other end to one end of the pivoted lever 44. The lever 44 is mounted upon a stud-shaft 45, which is supported centrally in the machine-frame between the shafts 1 and 2, upon which the type-disks of the two opposing series are mounted and which bear the ratchet-wheel 46 and the gear-wheel 47. The pivoted lever 44 bears on one end a pawl 48, which engages with the ratchet-wheel 46 and imparts movement thereto whenever the proof and matrix lever H is operated. With the gear-wheel 47 mesh gear-wheels 49 and 50, such gear-wheels being placed diametrically opposite to each other and being adapted to be turned throughout an entire revolution by the movement which the gear-wheel 47 receives from each actuation of the proof and matrix lever H. The gear-wheels 49 and 50 are mounted upon shafts 51 and 52, which extend across the machine and bear upon their opposite ends actuating-cams, which will be hereinafter described.

The printing attachment is operated by mechanism connected with the gear-wheel 50, and the matrix or casting attachment is operated by mechanism connected with the gear 49. For convenience of description I will first describe the printing attachment and the mode of operation of the same and then describe the matrix or casting attachment and the operation thereof.

Printing or proof-taking attachment.—Upon the shaft 52, on both sides of the machine, are mounted cams 53, which move inside and independent of surrounding rings or collars 54, which are attached to connecting-rods 55. The connecting-rods 55 extend toward the front of the machine and are cross-connected on their outer end by a shaft 56, upon which a roll 57 is mounted. The shaft 56 travels in slotted guideways 58, which

are formed in the brackets 59, provided on both sides of the machine-frame. To the ends of the connecting-rods 55 are further secured the lower ends of the connecting-links 60, to the outer ends of which are pivotally attached the levers 61. The levers 61 are loosely mounted upon a shaft 62 and bear pawls 63, which when the levers 61 are moved downward or clockwise engage with ratchet-wheels 64, mounted upon said shaft 62, and rotate said shaft. The shaft 62 is mounted in bearings formed in the bracket 65. In this bracket are also formed bearings for the paper-roll 66 and the proof-roll 67, these bearings being U-shaped, so as to permit removal of such rolls. The paper-roll 66 is provided at one end with a gear-wheel 68, which meshes with a gear-wheel 69, mounted upon shaft 62, so that whenever said shaft is rotated through the action of the lever 61 the paper-roll is likewise rotated in the direction of the arrow, Fig. 2. On the connecting-link 60 are formed journals for two rolls 70 and 71. These rolls contact with each other, so that whenever one is moved the other is likewise moved by frictional contact. On the roll 70 is mounted a ratchet-wheel 70', with which engages a pawl 72, mounted upon the lever-arm 61. When said lever-arm 61 is caused to move downward, so that its outer end moves in the arc of a circle in a clockwise direction, the pawl 72 acts to rotate the gear-wheel 70', and thereby the roll 70, as will be readily understood. The strip of paper upon which the proof is to be taken is drawn from the paper-roll 66 and passes over a pin-shaft 73, mounted in the brackets 59, thence over the printing-roll 57, which is mounted upon the shaft 56, thence upward between the pressure-rolls 70 and 71, and thence around the proof-roll 67. With each reciprocation of the connecting-rod 55, caused by the action of the cam 53 upon each revolution of the gear 50, paper is fed forward from the paper-roll during the downward travel of the connecting-rod, and at the same time the friction-rolls 70 and 71 are being actuated so as to feed the strip of paper upward just as rapidly as it is being fed from the paper-roll, so as to keep the strip of paper in the line of printing taut. The gear-wheel 67' upon the proof-roll 67, which meshes with the gear-wheel 68, is also being rotated through the movement of the paper-roll 66, and thus the paper on which the proof has been taken is caused to be wound upon such roll.

During the upward movement of the connecting-rod the printing-roll and mechanism connected therewith remain stationary as the pawl 63, which is pivoted to the lever-arm 61, slides over the teeth of the ratchet 64. Prior to the taking of the proof it is necessary, however, to bring a printing-ribbon over the line of cameo type characters which have been assembled in the line of sight, so that the impact of the paper passing around the roll 57 against the printing-ribbon and through the

same against the type characters will cause the imprint thereon of such characters. The mechanism by which this action is caused to take place is as follows: A printing-ribbon 74 is provided at the front of the machine, the upper end of which is attached to a roll 75, which is supported in a slotted guideway formed in the brackets 59, and the lower end of which is wound around a spring-controlled roller 77 at the front of the machine-frame, just above the type-keys. The slotted guideway 76 crosses the slotted guideway 58, which serves as a path for the connecting-rods 55, but is made smaller than such guideway, so that there will be no tendency for the shaft 56 to be diverged therefrom during the reciprocation of the same. The roll 75 is caused to reciprocate in the slot 78 at each actuation of the printing mechanism and to bring the printing-ribbon over the cameo type characters before the descent of the printing-roll 57.

At each end the roll 75 is connected to levers 78, which extend inward toward the center of the machine and are mounted upon a shaft 79. Upon this shaft are also mounted the curved lever-arms 80, whose inner ends travel upon the surface of the cams 81, mounted upon the shaft 51. The movement of the connecting-rods 55, caused by the cam 53, is first outward until the shaft 56 reaches the end of the slotted guideway 58, formed therefor, then inward through the entire limit of their travel, and then outward to the point at which they are represented in the drawings. The setting of the cams 53 upon the shaft 52 is such that while said cams are causing the connecting-rods to move outward to the end of their travel the cams 81 have been turned sufficiently to throw the curved lever-arms 80 out of the depressed portion thereof, thereby turning the shaft 79, and thereby causing an arc movement of the lever 78 sufficient to move the ribbon-roll 75 to the upper end of its travel in the cross-slot 76. During the downward movement of the connecting-rods, which results in the making of a proof of the assembled line of type characters upon the paper passing over the printing-roll 57, the ribbon-roll 75 remains stationary in the upper part of the slot 76, while the curved arms 80 travel over the dwell of the cams 81. The dwell of these cams is so adjusted that the ribbon-roll 75 will continue to be held in the upper part of its movement until the taking of the proof has been completed and the paper-roll 57 caused to move upward past the intersection of the two guiding-slots formed in the bracket 59. After the paper-roll has passed this point the cam 81 has been revolved, so that the lever-arm 80 falls into the depressed portion thereof and the ribbon-roll 75 is caused to travel backward to the lower portion of its guiding-slot in the position in which it is shown in Fig. 1. The spring-controlled roll 77 winds up the loose ribbon which is caused by the backward movement of the ribbon-roll 75 and keeps the printing-surface

taut. It will be noticed that that portion of the printing-ribbon which is over the type characters will lie very close to such characters on account of the position in which the ribbon-roll 75 is held during the proof-taking operation. A clean proof can thus be obtained, which, during the succeeding movements of the rollers in connection with the printing attachment, is brought into the direct view of the operator and into a position where it can be examined and any mistakes or defects therein at once ascertained.

Casting mechanism.—I will now proceed to describe the casting mechanism by the action of which type-bars are formed, ejected from the machine, and placed upon the surface of an endless carrier in regular sequence. The actuating mechanism for controlling the operations of the mold-box G is precisely similar to that by means of which the printing attachment is actuated—that is to say, the mold-box is caused to assume its various positions through the action of a cam-actuated connecting-rod. Upon the shaft 51, which is rotated through the gear 49, so as to describe a complete revolution with every operation of the proof and matrix lever H, is mounted a cam 90, which moves within an encircling ring 91. To the ring 91 is attached the connecting-rod 92, the outer end of which is slotted, as shown at 92', to receive the stud-shaft *g*, which projects from the mold-box G.

The mold-box G is pivotally supported on shaft G^x in a slotted guideway formed in brackets 93, which are attached to the frame on this side of the machine. The mold-box is hollowed interiorly, so as to form a mold of the exact size of the bar of stereotype metal which is to be formed therein. On its front face *g'* it is formed with a longitudinal opening of the width of the type characters, such opening being at the end of the hollowed interior of the mold-box. On the side of the mold-box toward the melting-pot F there is formed an opening g^2 . This opening is conical, so as to receive the end of the plunger M, by the action of which a charge of type-metal sufficient to form a stereotype-bar is forced into the mold-box. The parts forming the mold-box are tightly joined together, so that escape of the type-metal forced into the same through such joints cannot take place. On one side of the mold-box there projects a stud *g*, which, as has been stated, extends into the slot 92', formed in the connecting-rod 92. On the other side of the mold-box there extends from the same a shaft g^3 , which is made of the shape shown in Fig. 8 of the drawings, so as to escape the plunger-box *m* in its movement. The shaft g^3 engages with a slot 94', formed in a connecting-rod 94 on the opposite side of the machine, in the same manner that the stud-shaft *g* engages with the slot 92' in the connecting-rod 92. The connecting-rod 94 is a duplicate of connecting-rod 92 and is, like such rod, actuated by a cam 90, mounted upon the shaft 51.

The mold-box G has two movements in order to bring the front face thereof into proper position for the formation of a type-bar. Starting from the position of the mold-box 5 which is shown in Fig. 9, the mold-box is first turned on its axis until the front end thereof has moved out from the curved portion of the guideway 95, provided therefor, and lies in the straight portion of such guideway, and is then moved forward until the 10 front beveled cornered end of the mold-box enters between the guide-blocks 96, which are formed on the machine-frame on either side of the line of printing and fit snugly against the line of type assembled in the line 15 of printing. The length of the slots 92' and 94' formed in the connecting-rods 92 and 94 is sufficient to permit the arc movement of the mold-box and the forward movement of 20 the same without binding.

When the mold-box has been moved forward in position to receive a charge of type-metal, such charge is introduced by the action of the plunger M. The plunger M is 25 located transversely of the machine. It acts within a plunger-box or metal-receptacle *m*, which extends across the front face of the melting-pot F and is connected therewith through an opening *m'*. The plunger M acts 30 as a valve to close the opening *m'*, except at the moments at which a charge of metal is desired to be received in the plunger-box *m*. In its operation the plunger M first moves backward, uncovering the opening *m'* and 35 allowing a charge of metal to flow into the plunger-box *m*, (the size of the plunger-box being such that the charge of metal which is thus permitted to flow into the same is just sufficient for the formation of a single type- 40 bar,) then advances forward, closing the opening *m'* and forcing the type-metal into the mold-box, and then retracts to the position shown in the drawings, still closing the opening *m'* and preventing a flow of metal.

45 The means for causing the described movement of the plunger M is as follows: One end of this plunger is provided with a plunger-rod *m*², (formed with a shoulder, as shown, to escape the connecting-rod 94,) the outer end of 50 which contacts with the surface of the cam 97. This cam is supported on a shaft 98, mounted in suitable bearings on the machine-frame and provided on its upper end with a beveled gear-wheel 99, which meshes with a 55 correspondingly-beveled gear 100, secured to one end of the shaft 101. The shaft 101 is provided on its other end with a beveled gear 102, which meshes with a correspondingly-beveled gear 103, mounted upon the shaft 51, 60 which is caused to rotate with every actuation of the proof and matrix lever H through the action of the gear-wheels 49 and 50. The end of the shaft 101 on which the gear-wheel 103 is mounted is suitably supported in a bearing-block 104, mounted upon the shaft 51. A 65 suitable bearing 105 is provided for the opposite end of the connecting-rod of the shaft 101,

so that said shaft is securely held in position and may impart movement to the beveled gear 99. The cam 97 is so formed that upon its rotation in the direction of the arrow, Fig. 7, it 70 will first permit the plunger-rod *m*² to move backward a sufficient distance to uncover the opening *m'*, leading from the melting-pot into the plunger-box *m*, will then thrust the plunger-rod, and thereby the plunger M, rapidly 75 forward until the coned end of such plunger-rod has entered into the corresponding cone *g*² in the mold-box, and thus delivered its charge of stereotype metal into such mold-box, and will then allow the plunger-rod, and thereby the plunger, to recede until it has 80 reached its original position. The plunger M is drawn backward after it has delivered its charge of metal into the mold-box through 85 the action of the coiled spring *m*⁴, which surrounds a portion of the plunger-rod *m*² and is attached at one end to the collar *m*⁵, through which the plunger-rod *m*² passes.

The timing of the movement of the mold-box G and of the plunger M is so adjusted 90 that the movement of the plunger does not commence until the mold-box is in position to receive its charge of metal. After a bar of type-metal has been cast and has formed on 95 its outer surface a series of cameo type characters corresponding to the intaglio type characters which were assembled in the line of printing, such mold-box is moved backward in the Y-shaped guideway 95 provided there- 100 for and is turned through the curved portion of such guideway until the mouth of the mold-chamber is inclined downward and is in the position shown in Fig. 9.

The mechanism by the action of which the 105 slug is discharged from the mold-box into the receiver N is as follows: The rear or bottom end of the mold-box is formed by a spring-pressed plate which works within the mold-chamber and fits sufficiently closely to the 110 sides thereof to prevent escape of metal. Referring especially to Fig. 12, the spring-pressed bottom mold-plate is shown at *g*^a. To the mold-plate is rigidly secured a rod *g*^b, which passes through a guide *g*^c, secured to the 115 mold-box, and is spring-pressed by the spring *g*^d. This spring in its action normally tends to force the mold-plate *g*^a inward or to a position in which it occupies the forward end of the mold-chamber. The mold-plate *g*^a is held 120 in its backward position or that in which it forms the rear end of a mold-chamber of suitable size to receive the slug which is to be formed by the engagement of the spring-pressed locking-bolt *g*^f with the plate *g*^c, 125 which is secured on the rod *g*^b and travels therewith. The plate *g*^c is angle-shaped, as shown, so that the backwardly-extending end thereof may be engaged at the proper time by the stop *g*^h, which is fastened to the machine-frame. The spring-pressed locking-bolt *g*^f is tripped by the action of the double 130 lever *g*^e, pivoted to the mold-box and operated by the end of the connecting-rod 92. The

spring-pressed locking-bolt g^f is also angle-shaped, so as to be readily engaged, as described. The operation of these parts is as follows: With the parts in the position shown in Fig. 12 the connecting-rod 92 as it reaches the end of its movement and thereby brings the open end of the mold-box G directly over the mouth of the receiver N strikes one end of the double lever g^s , and thereby causes the upper end of said lever to withdraw the locking-bolt g^f from engagement with the plate g^e . The action of the spring g^d now causes the mold-plate g^a to move forward to the front end of the mold-chamber, and thereby discharge the slug into the receiver N. The mold-plate g^a is brought back into suitable position for the reception of a slug in the mold-chamber during the succeeding movement of the mold-box into position between the guides 96, for as the mold-box after passing through the arc portion of its movement commences its forward travel through the straight portion of the slotted guideway the stop g^h , which is fastened to the machine-frame, will strike against the projecting end of the plate g^e , and thereby hold the end plate g^a stationary while the remainder of the mold-box moves forward. The forward movement of the mold-box equals the height of the slug which is to be formed, so that when the mold-box has reached its extreme forward position and is in readiness to receive a charge of type-metal the mold-plate g^a is in its extreme backward position. It is caught and held in this position by the engagement of the spring-pressed locking-bolt g^f with the angle-plate g^e .

The receiver N is pivotally supported, as shown, in the bracket 93 and is hollowed so as to form a receptacle for the bar of type. The bottom of the receptacle formed in the receiver N is padded, so as to avoid injury to the sharp edges of the type formed on the type-bars. To the lower end of the receiver N is attached a lever 106, to which is attached one end of a lever 107, which is carried by the connecting-rod 92, being pivotally secured to a collar 108, mounted on such connecting-rod. With each reciprocation of the connecting-rod 92 the receiver N is caused to turn on its pivot and incline downward, so that the bar of type-metal which was last received therein will be ejected therefrom, and falling through the guideway 109 will take its position upon the surface of the endless carrier I. The side of the type-bar on which the type characters are cast will be uppermost, so that injury thereto will be avoided. The endless carrier I is mounted upon two rollers i and i' and moves, when in normal operation, in the direction of the arrow. On its upper surface there is formed a cleat or bracket I' , which supports the first bar of stereotype metal received on the endless carrier in upright position. The endless carrier is caused to move forward step by step, so as to give room for the reception thereon of the successive type-bars through the action

of the ratchet-wheel i^2 , secured to its upper roller i . With this ratchet-wheel engages a pawl 110, which is pivoted to a lever-arm 111, mounted upon the axle which supports the roller i and connected by the cord 112 with the lever 106. With each actuation of the proof and matrix lever H and the consequent reciprocation of the connecting-rod 92 the receiver N is caused to incline downward, so as to discharge a bar of type-metal received therein, and by the same movement the pawl 110 is caused to engage the ratchet-wheel i^2 and move the same forward a sufficient distance to permit the reception on the surface of the endless belt of a new type-bar. The weight of the lever-arm 111, which carries the pawl 110, is sufficient to cause such pawl to fall back to its original position after each actuation of the receiver N, a stop 113 limiting its downward movement. To the axle of one of the pulleys i' of the endless carrier I there is attached a crank 114, by means of which the endless carrier can be brought into any desired position at the commencement of its operation.

The melting-pot F is provided with a cover F' , by means of which stereotype metal can be introduced therein and is heated through the burners F^2 , supplied with gas, or in any other desired manner. The products of combustion pass off through an escape-pipe F^3 at the side of the melting-pot. It is to be noted that in this machine the casting operation takes place at some distance from the operator, so that the operator does not breathe the fumes of the metal and is not subject to the deleterious effect thereof.

Releasing-key.—After the proof of the line of type characters assembled in the line of printing has been taken and a type-bar has been cast the type-disks are released or unlocked from the position in which they are assembled and resume their normal positions. The unlocking of the disks is effected through the action of the releasing-key D^r , which bears on its lower end a rod 115, extending across the rear ends of the spring-pressed pawls 43. When the key D^r is depressed, the pawls 43 are raised from engagement with the notched or ratchet portions of the actuating-disks 4, and the springs b^3 and c^3 , which are attached to the type-disks B and C, draw such type-disks back to their original position. The machine is now in condition to have a new line of type assembled and a proof and type bar cast therefrom.

Operation of the machine.—In the operation of the machine the compositor depresses in succession the type-keys representing the type characters which are to be assembled into the line of type. Each depression of a type-key d turns the actuator-arm 9 through intermediate mechanism through an angle corresponding with the position on the segment of the type character depressed and thereby rotates the operative disk 4 and the type-disk B or C with which such operative

disk is in connection, an amount sufficient to bring the desired character in the line of sight. As in this machine the cameo and intaglio characters are located diametrically opposite to each other, both sets of characters are assembled into the respective lines of sight and of printing by the same operation. The operative disks are acted upon by the actuator-arm in regular sequence.

The type-disks of the two series as they are actuated move in opposite directions, the inclined faces of the opposing series of disk-segments sliding against each other until the desired characters are in the line of sight.

Each disk as it is assembled in position acts to force outward the disks not yet called into position against the pressure of the springs b^4 and c^4 until it has reached its proper position. With each actuation of a type-key d the indicators J and J' are moved forward a single space and the actuator-arm 9 is correspondingly moved forward, so as to engage with a new disk when next depressed. Whenever it is desired to form a space between adjacent words or characters, the spacing-key D^s is depressed and the actuator-arm 9 thereby caused to travel over one of the operative disks without acting upon the same, so that the blank portion of the type-disk connected to such operative disk is left in the line of sight to serve as a space. Varying widths of spaces are obtained by depressing the space-key one or more times. As the operator can observe the line of type being formed during its entire period of formation, he can readily detect any mistakes and correct the same. The correction of the line of type is effected by moving the pointer J so that it will be directly over the erroneous character, and as a necessary consequence of the position and operation of the indicator-cords 20 and 30 the actuator-arm 9 will be over the corresponding operative disk. Such disk may then be unlocked by raising the corresponding pawl 43 and the proper type-key depressed, causing the desired character to appear in the line of sight. This correction can all take place before actuation of the proof and matrix lever. Should the line require justifying in order to make it a perfect line, the justifying-lever L is raised until the inactive or spacing operative disks 4 have been moved sufficiently far to cause the corresponding type-disks to move their wedge-shaped edges to spread the line until it attains the desired width. As the amount of space required to be filled through the action of the justifying-lever is relatively small, rarely exceeding the width of two or three type characters, and as this amount of space is divided among the spaces formed between the successive words formed in the line, it will be seen that the line is properly spaced in the manner described. After a line of type has been formed and justified it is ready to have a proof taken thereof and a type-bar cast therefrom. This action is ef-

fectured by the movement of the proof and matrix lever H, as before described.

It is obvious that changes may be made in the construction which I have described herein which will be included within the scope of my invention, so that I do not restrict myself to the precise form of the parts shown herein; but

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

1. The combination with two series of wedge-shaped forms, curved to the arc of a circle, and having the type characters arranged in the order of their width thereon, said forms being revolubly supported with the inclined faces of the adjacent forms of the opposing series in contact, of means for rotating said two series of forms in opposite directions, and thereby assembling the desired characters in line, substantially as described.

2. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said disk-segments being reversely placed with the inclined faces of the adjacent segments of the opposing series in contact, of means for rotating said two series of disk-segments in opposite directions, and thereby assembling the desired characters in line, substantially as described.

3. The combination with two series of wedge-shaped disk-segments, having the type characters arranged in the order of their width thereon, and having portions of their surfaces left blank, said two series of disk-segments being reversely placed with the inclined faces of the adjacent segments of the opposing series in contact, of means for rotating said disk-segments in opposite directions, and thereby assembling the desired characters in line, substantially as described.

4. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, and having the extreme narrow portion of the edge thereof left blank, said two series of disk-segments being reversely placed with the inclined faces of the adjacent disk-segments of the opposing series in contact, of means for rotating said disk-segments in opposite directions, and thereby assembling the desired characters in line, substantially as described.

5. The combination with two series of disks having cameo and intaglio type characters arranged reversely on diametrically opposite portions of their peripheries, of means for rotating said disks in opposite directions, and thereby assembling the desired characters in lines, printing mechanism acting in connection with the line of cameo characters, and type-casting mechanism acting in connection with the line of intaglio characters, substantially as described.

6. The combination with two series of disks having diametrically opposite portions of their peripheries wedge-shaped and having

cameo and intaglio type characters arranged in the order of their width on reverse sides thereof, such disks being revolubly mounted with the inclined faces of adjacent disks of the opposing series in contact, of means for rotating said two series of disks in opposite directions, and thereby assembling the desired characters in lines, substantially as described.

7. The combination with two series of disks having diametrically opposite portions of their peripheries wedge-shaped and the remainder thereof cut away, and having cameo and intaglio type characters arranged in the order of their width on reverse sides thereof, each of said series of disks being revolubly mounted on separate shafts with the inclined faces of adjacent disks of the opposing series in contact, of means for rotating said two series of disks in opposite directions and thereby assembling the desired characters in lines, substantially as described.

8. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said disk-segments being reversely placed with the inclined faces of the adjacent segments of the opposing series in contact, of means for rotating said two series of disk-segments in opposite directions, and thereby assembling any desired characters in line, and means for forcing said disk-surfaces together, substantially as described.

9. The combination with two series of disks having diametrically opposite portions of their peripheries wedge-shaped, and having cameo and intaglio type characters arranged in the order of their width on reverse sides thereof, said disks being revolubly mounted with the inclined faces of adjacent disks of the opposing two series in contact, of means for rotating the disks of said two series in opposite directions, and means for forcing said disk-surfaces together, substantially as described.

10. The combination with two series of disks having diametrically opposite portions of their peripheries wedge-shaped, and the remainder cut away, and having cameo and intaglio type characters arranged in the order of their width on reverse sides thereof, said two series of disks being loosely mounted on separate shafts with the inclined faces of adjacent disks of the opposing two series in contact, of means for rotating said two series of disks in opposite directions, and thereby assembling the desired characters in lines, and a pressure device bearing against one of the end disks, substantially as described.

11. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said two series of disk-segments being reversely placed with the inclined faces of the adjacent disks of the opposing series in contact, of means for rotating the disk-segments of said two series in op-

posite directions, means for locking said disk-segments with the desired characters in line, and means for releasing the same, substantially as described.

12. The combination with two series of disks having diametrically opposite portions of their peripheries wedge-shaped, and having cameo and intaglio type characters arranged in the order of their width on reverse sides thereof, said two series of disks being revolubly mounted with the inclined faces of adjacent disks of the opposing series in contact, of means for rotating the disks of said two series in opposite directions, means for locking the same with the desired characters in lines, and means for releasing the same, substantially as described.

13. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said two series of disk-segments being reversely placed with the inclined faces of the adjacent segments of the opposing series in contact, of a series of operative disks, connections between said disks and said disk-segments, and means for rotating said disks varying amounts in accordance with the type characters desired to be assembled in line, substantially as described.

14. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said two series of disk-segments being reversely placed with the inclined faces of the adjacent segments of the opposing series in contact, of a series of operative disks, connecting-cords between each of said operative disks and one of said operative disk-segments, and means for rotating said operative disks varying amounts in accordance with the type characters desired to be assembled in line, substantially as described.

15. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said two series of disk-segments being reversely placed with the inclined faces of adjacent segments of the opposing series in contact, of a series of operative disks, connections between said operative disks and said disk-segments, means for rotating said disks varying amounts in accordance with the type characters desired to be assembled in line, means for locking said disks in position, and means for releasing the same, substantially as described.

16. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said two series of disk-segments being reversely placed with the inclined faces of adjacent segments of the opposing series in contact, of a series of operative disks, having portions of their peripheries notched, connections between said operative disks and said disk-segments, means

for rotating said operative disks varying amounts in accordance with the type characters desired to be assembled in line, pawls engaging with the notched portions of said disks, and means for disengaging said pawls, substantially as described.

17. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said two series of disk-segments being reversely placed with the inclined faces of adjacent segments of the opposing series in contact, of a series of operative disks, having portions of their peripheries toothed, connections between said operative disks and said disk-segments, means for rotating said operative disks varying amounts in accordance with the type characters desired to be assembled in line, pawls engaging with the toothed portions of said disks, a bar extending across the disks above the free ends of said pawls, and a type-key adapted when actuated to depress said bar, disengage said pawls, and release said disks, substantially as described.

18. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said two series of disk-segments being reversely placed with the inclined faces of adjacent segments of the opposing series in contact, of a series of operative disks, connections between said disks and said disk-segments, means for rotating said operative disks varying amounts in accordance with the type characters desired to be assembled in line, means for locking said operative disks in position, means for releasing the same, and means for returning said disk-segments to their original position, substantially as described.

19. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said two series of disk-segments being reversely placed with the inclined faces of adjacent segments of the opposing series in contact, of a series of operative disks, connections between said operative disks and said disk-segments, means for rotating said operative disks varying amounts in accordance with the type characters desired to be assembled in line, means for locking said operative disks in position, means for releasing the same, and springs for returning said disk-segments to their original position, substantially as described.

20. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said two series of disk-segments being reversely placed with the inclined faces of the adjacent segments of the opposing series in contact, of a series of operative disks, connections between said operative disks and said disk-segments, a shaft parallel to said operative disks, an arm mounted there-

on adapted to engage said operative disks in succession and rotate the same varying amounts in accordance with the type characters desired to be assembled in line, and means for operating said arm, substantially as described.

21. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said two series of disk-segments being reversely placed with the inclined faces of the adjacent segments of the opposing series in contact, of a series of operative disks, connections between said operative disks and said disk-segments, a shaft parallel to said operative disks, an arm adapted to travel thereon, engage said operative disks in succession and rotate the same varying amounts in accordance with the type characters to be assembled in line, levers keyed to said shaft, springs for normally elevating the ends of the same, a rod connecting the free ends of said levers, type-keys arranged to be depressed varying amounts in accordance with the position on the disk-segments of the type characters thereon, connections between said levers and said type-keys whereby said levers will be depressed by the type-keys distances varying in accordance with the width of the characters thereon, and means for moving said arm on said shaft, substantially as described.

22. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said two series of disk-segments being reversely placed with the inclined faces of adjacent segments of the opposing series in contact, of type-keys arranged to be depressed varying amounts in accordance with the position on the disk-segments of the type characters thereon, and connecting mechanism between said keys and said segments for communicating a degree of rotation thereto corresponding with the depression of the type-key, substantially as described.

23. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said two series of disk-segments being reversely placed with the inclined faces of the adjacent segments of the opposing series in contact, of a series of operative disks, connections between said operative disks and said disk-segments, a shaft parallel to said operative disks, an arm adapted to travel thereon, engage said disks in succession and rotate the same varying amounts in accordance with the type characters to be assembled in line, indicator mechanism connected with said arm, and adapted to follow the same in its movement, and means for operating said arm, substantially as described.

24. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said two series of disk-seg-

ments being reversely placed with the inclined faces of adjacent segments of the opposing series in contact, of a series of operative disks, connections between each of said operative disks and one of said disk-segments, a shaft parallel to said operative disks, the actuator-arm 9, adapted to travel on said shaft, engage said disks in succession and rotate said disks amounts varying in accordance with the type characters to be assembled in line, the levers 10, the connecting-rod 12, the lever 13, the connecting-rod 14, the spacing-key D^s, having an extended arm passing above said rod 12, the ratchet 17, the indicator-cord 20 attached to said actuator-arm, and the type-keys D adapted to be depressed amounts varying in accordance with the width of the type character represented thereon, substantially as described.

25. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said two series of disk-segments being reversely placed with the inclined faces of adjacent segments of the opposing series in contact, of a series of operative disks having mutilated peripheries, connections between said operative disks and said disk-segments, a shaft parallel to said operative disks, an arm adapted to travel thereon, engage with the mutilated portion of said disks and rotate the same varying amounts in accordance with the type characters to be assembled in line, and means for operating said arm, substantially as described.

26. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged thereon in the order of their width, and having portions of their edges left blank, said two series of disk-segments being reversely placed with the inclined faces of the adjacent segments of the opposing series in contact, of a series of operative disks, connections between said operative disks and said disk-segments, a shaft parallel to said operative disks, an arm mounted thereon adapted to engage said disks in succession and rotate the same varying amounts in accordance with the type characters to be assembled in line, means for moving said arm on said shaft, and mechanism for communicating the movement of said keys to said shaft, substantially as described.

27. The combination with two series of wedge-shaped disk-segments, having the type characters arranged in the order of their width thereon and having portions of their edges left blank, said two series of disk-segments being reversely placed with the inclined faces of the adjacent segments of the opposing series in contact, of a series of operative disks, connections between said operative disks and said disk-segments, a shaft parallel to said operative disks, an arm mounted thereon adapted to engage said disks in succession and rotate the same varying

amounts in accordance with the type characters to be assembled in line, type-keys, intermediate mechanism for communicating the movement of said keys to said shaft, and means for moving said arm on said shaft, said means being in the line of movement of said intermediate mechanism, so as to be actuated either independently or by the actuation of said intermediate mechanism, substantially as described.

28. The combination with two series of wedge-shaped disk-segments, having the type characters arranged in the order of their width thereon, and having portions of their edges left blank, said two series of disk-segments being reversely placed with the inclined faces of the adjacent segments of the opposing series in contact, of a series of operative disks, connections between said operative disks and said disk-segments, a shaft parallel to said operative disks, an arm mounted thereon adapted to engage said disks in succession and rotate the same varying amounts in accordance with the type characters to be assembled in line type-keys, intermediate mechanism for communicating the movement of said keys to said shaft, means for moving said arm on said shaft, said means being in the line of movement of said intermediate mechanism, so as to be actuated either independently or by the actuation of said intermediate mechanism, an indicator mechanism operated in connection therewith, substantially as described.

29. The combination with two series of wedge-shaped disk-segments, each having the type characters arranged in the order of their width thereon, said two series of disk-segments being reversely placed with the inclined faces of the adjacent disk-segments of the opposing series in contact, of means for rotating said disk-segments in opposite directions, and thereby assembling any desired characters in line, and means for justifying the line formed, substantially as described.

30. The combination with two series of wedge-shaped disk-segments, having the type characters arranged in the order of their width thereon, and having portions of their edges left blank, said two series of disk-segments being reversely placed with the inclined faces of the adjacent segments of the opposing series in contact, of a series of operative disks, connections between said operative disks and said disk-segments, means for rotating said operative disks varying amounts in accordance with the type characters desired to be assembled in line, and means for justifying the line formed, substantially as described.

31. In a machine for casting type-bars, the combination with two series of wedge-shaped disk-segments, having the type characters arranged in the order of their width thereon, and having portions of their edges left blank, said two series of disk-segments being reversely placed with the inclined faces of the adjacent segments of the opposing series in

contact, of a series of operative disks having studs projecting therefrom, connections between said operative disks and said disk-segments, means for rotating said operative disks
 5 varying amounts in accordance with the type characters desired to be assembled in line, a suitably-mounted shaft extending across the surface of the disks under the studs projecting therefrom, and means for raising and lowering the same, substantially as described.
 10

32. The combination with two series of forms having cameo and intaglio type characters arranged thereon, and means for assembling the desired characters in lines, of
 15 printing mechanism operating in connection with the lines of cameo characters, and type-casting mechanism acting in connection with the lines of intaglio characters, substantially as described.

33. The combination with two series of forms having cameo and intaglio type characters arranged thereon in separate series, and means for assembling the desired characters in line, of printing mechanism operating
 20 in connection with the lines of cameo characters, and type-casting mechanism acting in connection with the lines of intaglio characters, substantially as described.
 25

34. The combination with two series of forms having cameo and intaglio type characters arranged thereon, and means for assembling the desired characters in line, of printing mechanism acting in connection with
 30 the lines of cameo characters, type-casting mechanism acting in connection with the lines of intaglio characters, and means operating said printing and said type-casting mechanisms simultaneously, substantially as described.
 35

35. The combination with two series of forms having cameo and intaglio type characters arranged on opposite sides thereof, and means for assembling any desired characters in line, of printing mechanism acting in connection
 40 with the line of cameo characters and type-casting mechanism acting in connection with the lines of intaglio characters, substantially as described.
 45

36. The combination with a line of cameo
 50 type characters, an inking attachment, and

means for operating the same, of a paper-supply roll, a printing-roll, a suitable guideway therefor, gearing connection between said paper-supply roll and said printing-roll
 55 operated by the reciprocation of said printing-roll, whereby feed of paper is assured at each reciprocation of said printing-roll, and mechanism for operating said printing-roll, substantially as described.

37. The combination with a line of cameo
 60 type characters, an inking attachment, and means for operating the same, of a paper-supply roll, a printing-roll, a suitable guideway therefor, a shaft parallel to said paper-supply roll and in gearing connection there-
 65 with, intermediate mechanism connecting said shaft and said printing-roll for causing rotation of said shaft during the downward movement of said printing-roll, and mechanism for reciprocating said printing-roll, sub-
 70 stantially as described.

38. The combination with a line of cameo
 75 type characters, an inking attachment, and means for operating the same, of a paper-supply roll, a printing-roll, a suitable guideway therefor, gearing connection between said paper-supply roll and said printing-roll
 80 operated by the reciprocation of said printing-roll, whereby feed of paper is assured at each reciprocation of said printing-roll, a proof-roll, means operated by the reciprocation of said printing-roll for winding paper
 85 from said printing-roll upon said proof-roll, and means for reciprocating said printing-roll, substantially as described.

39. The combination with a line of cameo
 90 type characters, guideways 58 having cross-slots 76, the printing-roll 57, the inking-roll 75, an inking attachment in connection therewith, a paper-supply roll, mechanism for feeding paper from said paper-supply roll to
 95 said printing-roll, and means for conjointly operating said printing-roll, paper-supply roll, and inking-roll, substantially as described.

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

HENRY RICHARDSON ROGERS.

Witnesses:

VICTOR J. EVANS,

L. M. MARBLE.