

No. 622,678.

Patented Apr. 11, 1899.

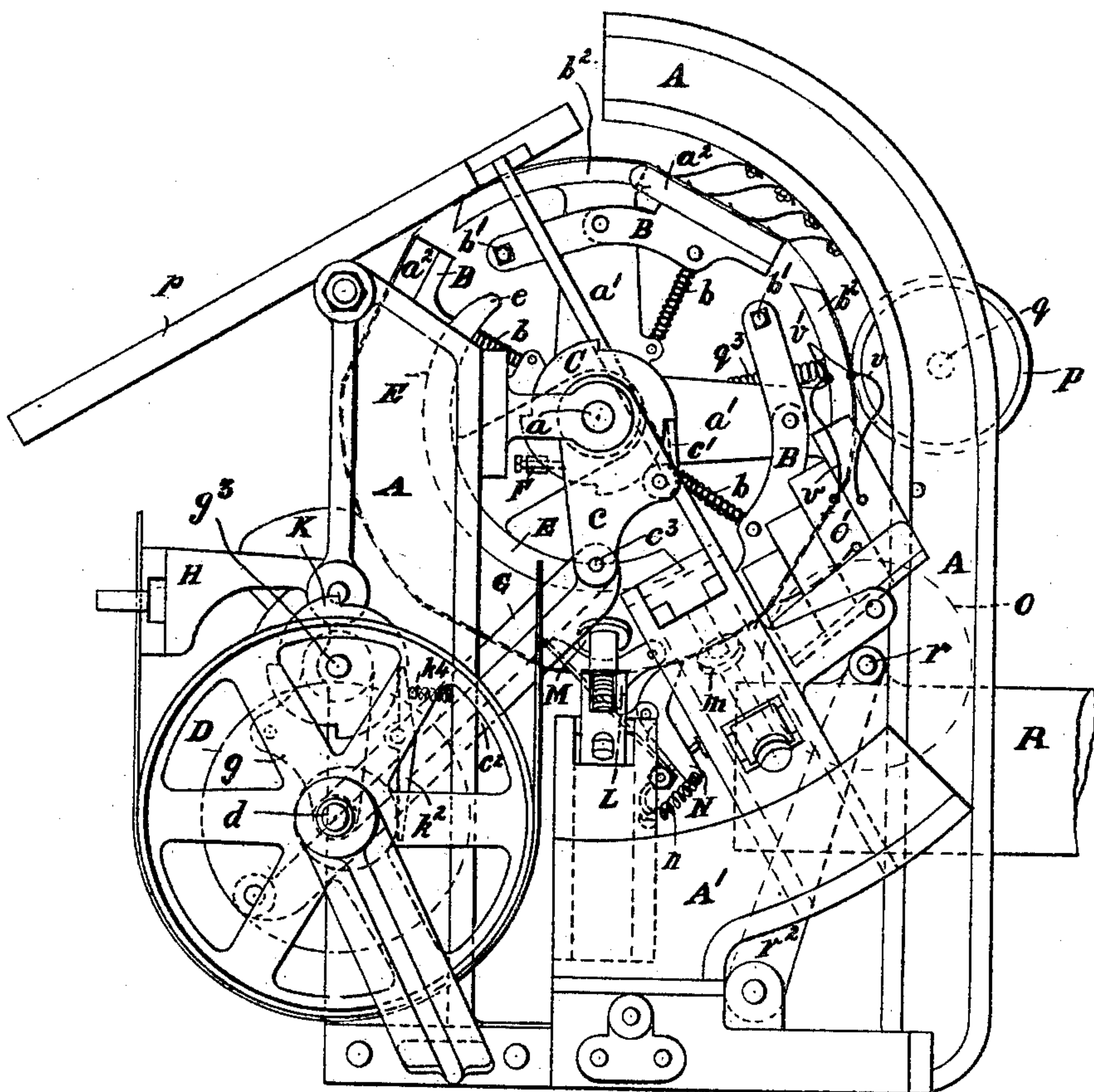
A. GODFREY.
PAPER BOX MACHINE.

(Application filed May 24, 1897.)

(No Model.)

10 Sheets—Sheet 1.

Fig. 1



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E. B. Cotton
O. D. Munn

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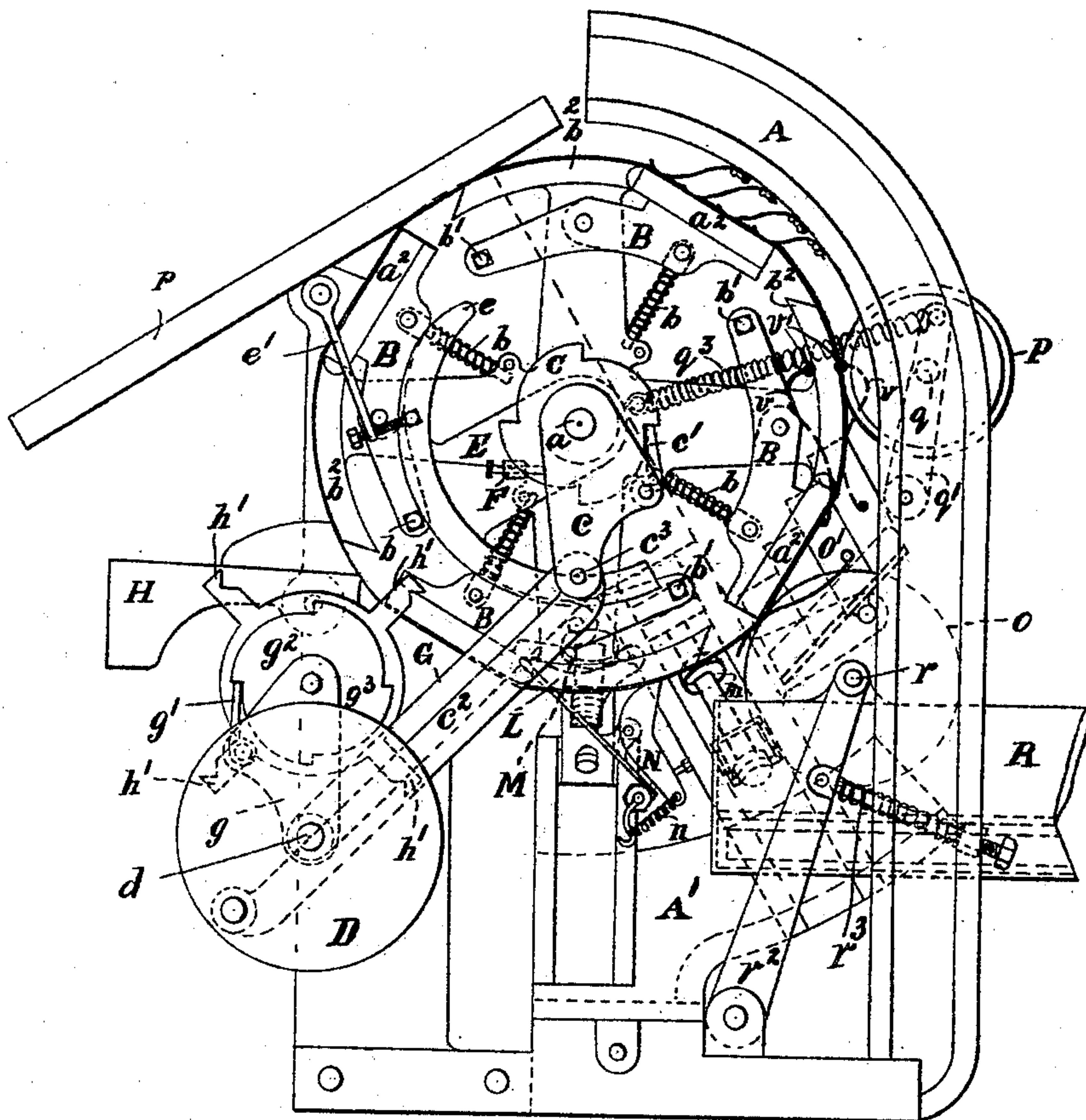
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10 Sheets—Sheet 2.

Fig. 1^a



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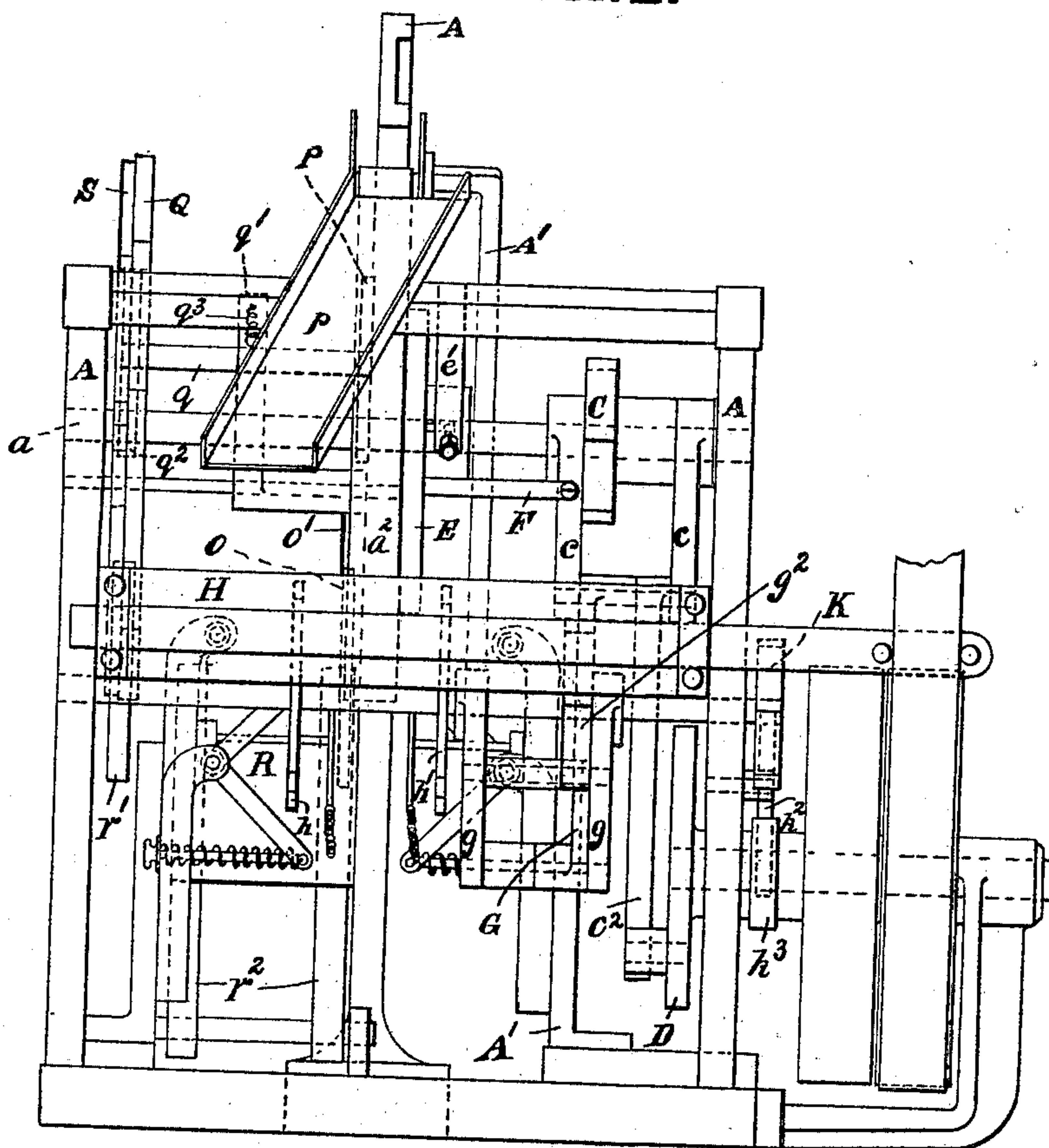
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10 Sheets—Sheet 3.

Fig. 2.



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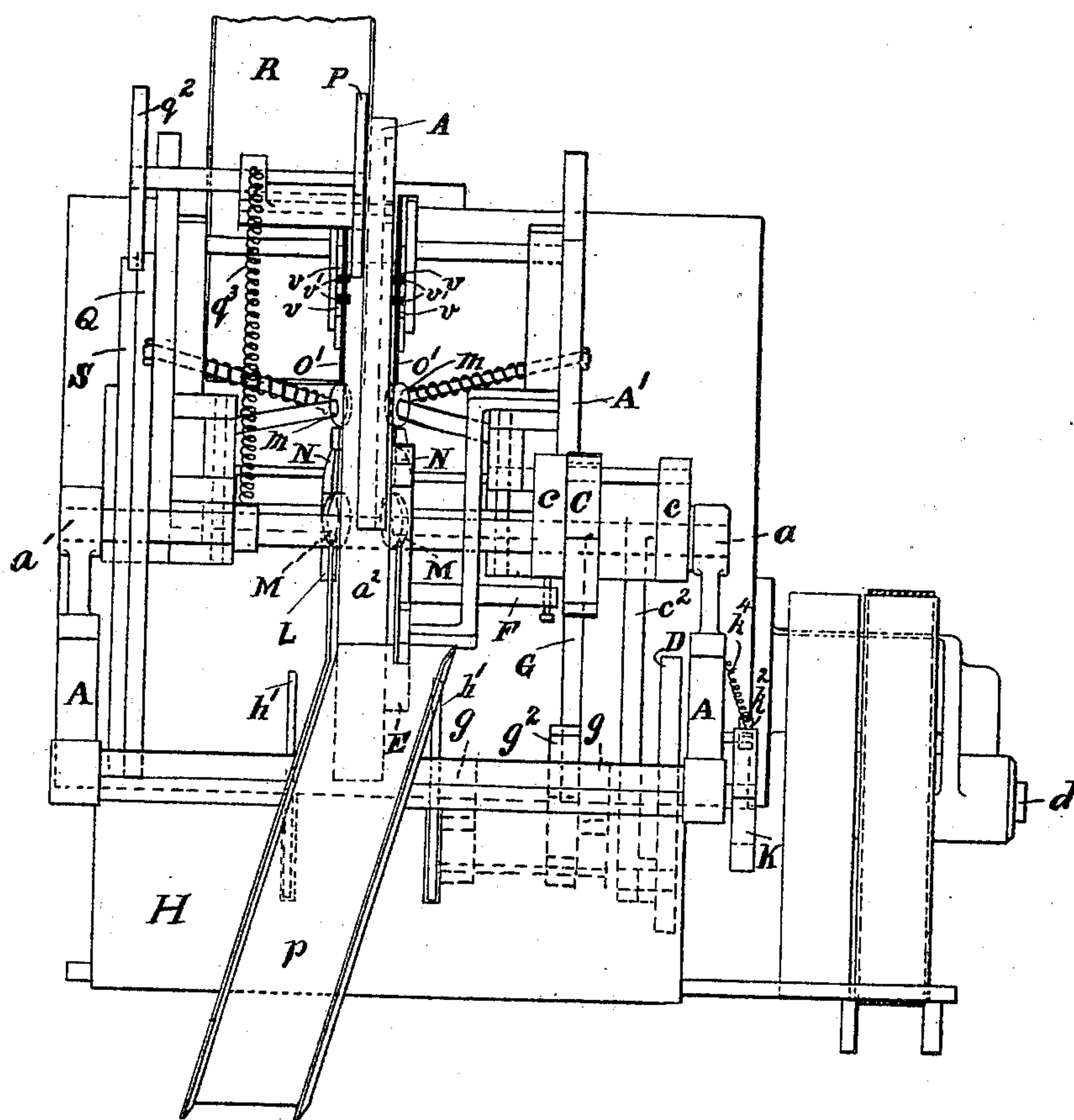
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10 Sheets—Sheet 4.

FIG. 2^a.



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FIG. 3.

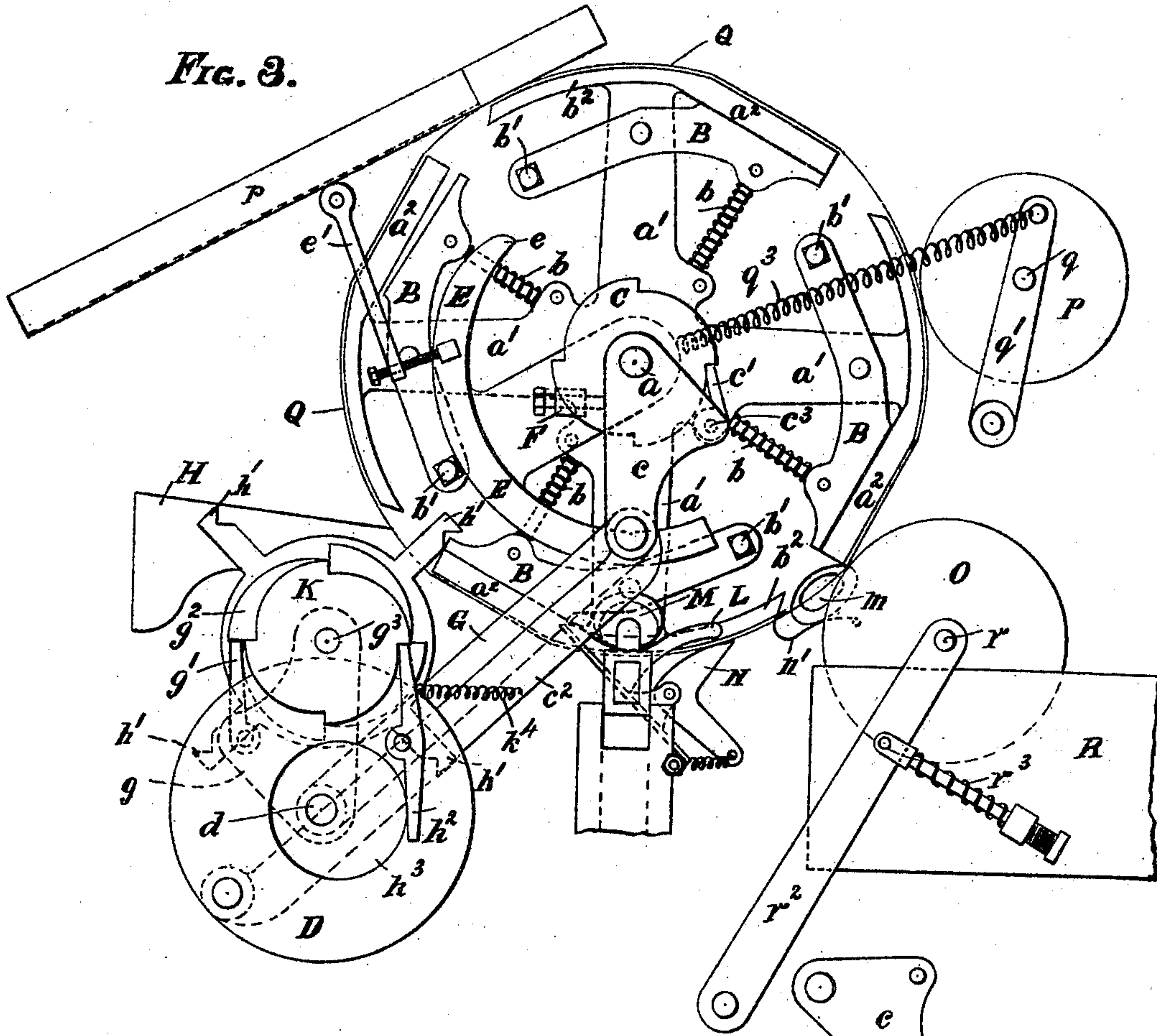
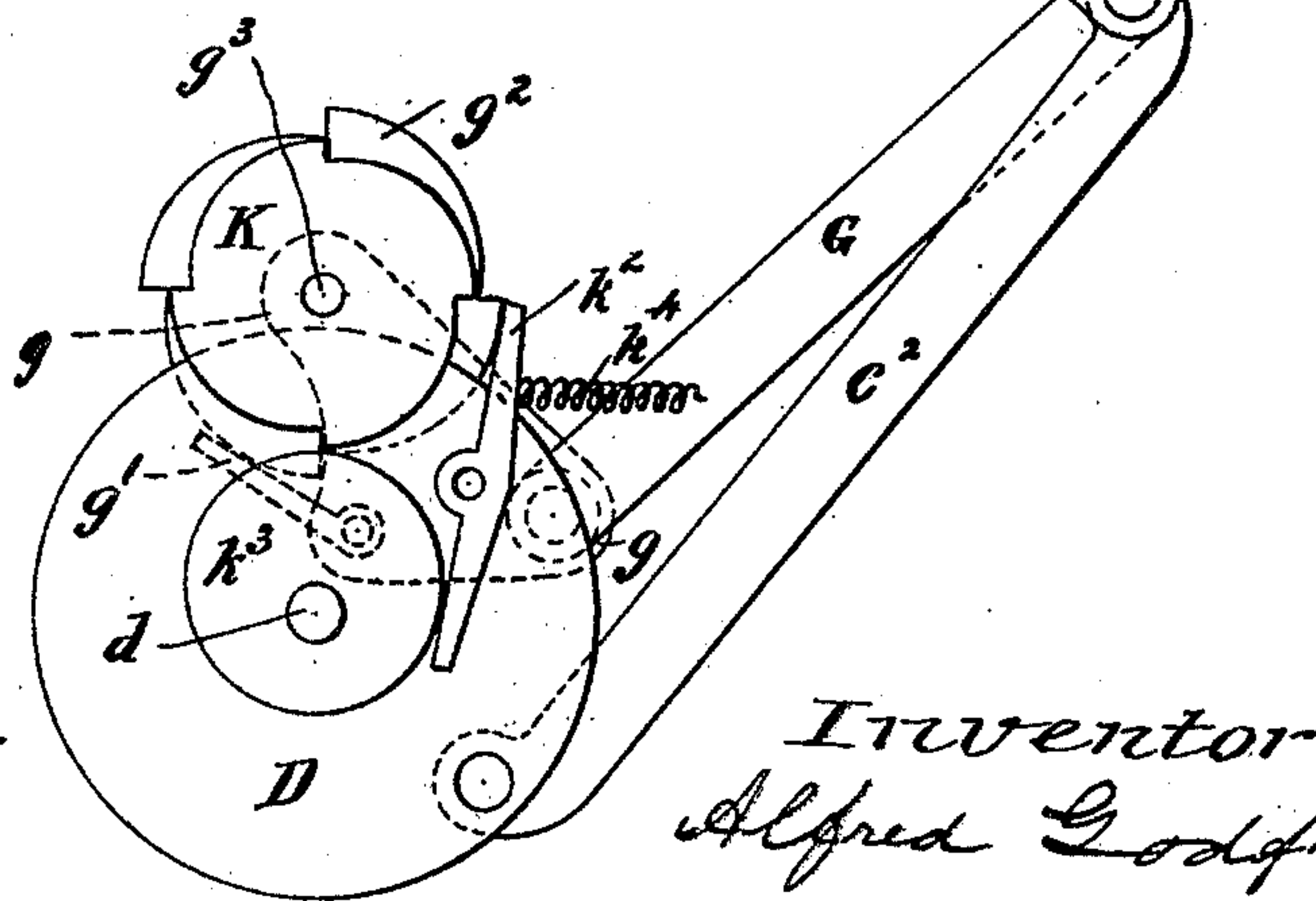


FIG. 4.



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10 Sheets—Sheet 6.

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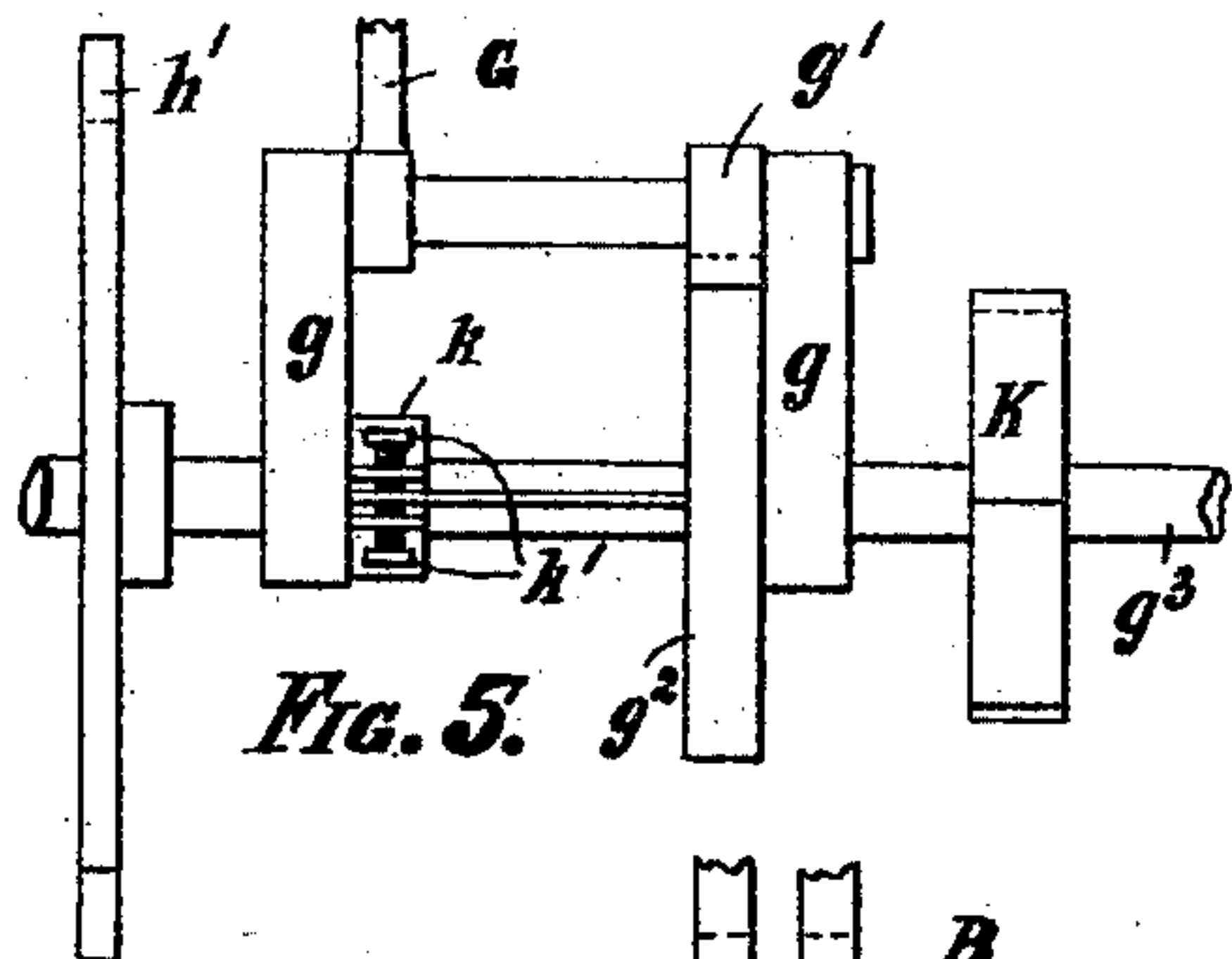


Fig. 5.

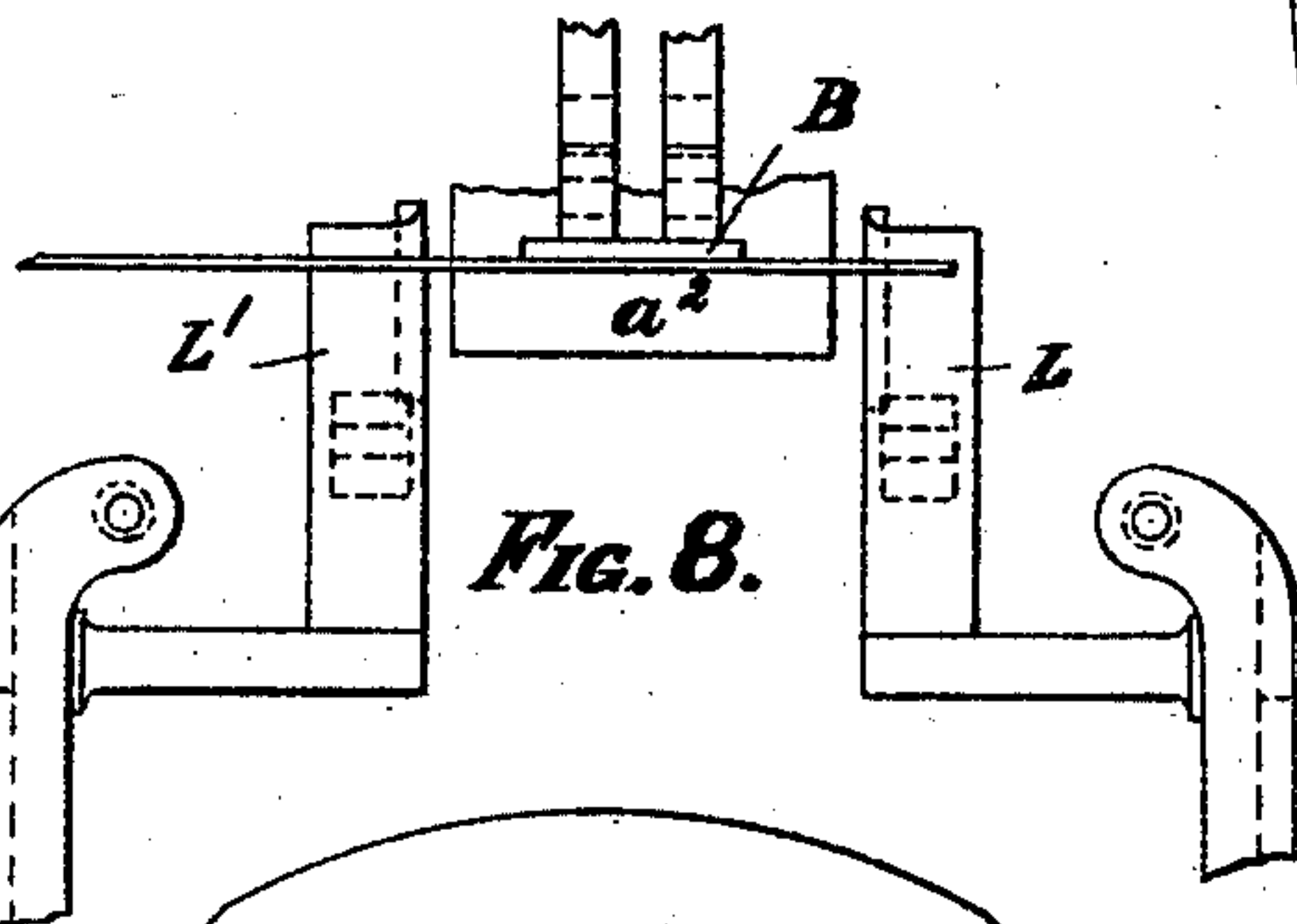


Fig. 8.

Fig. 7.

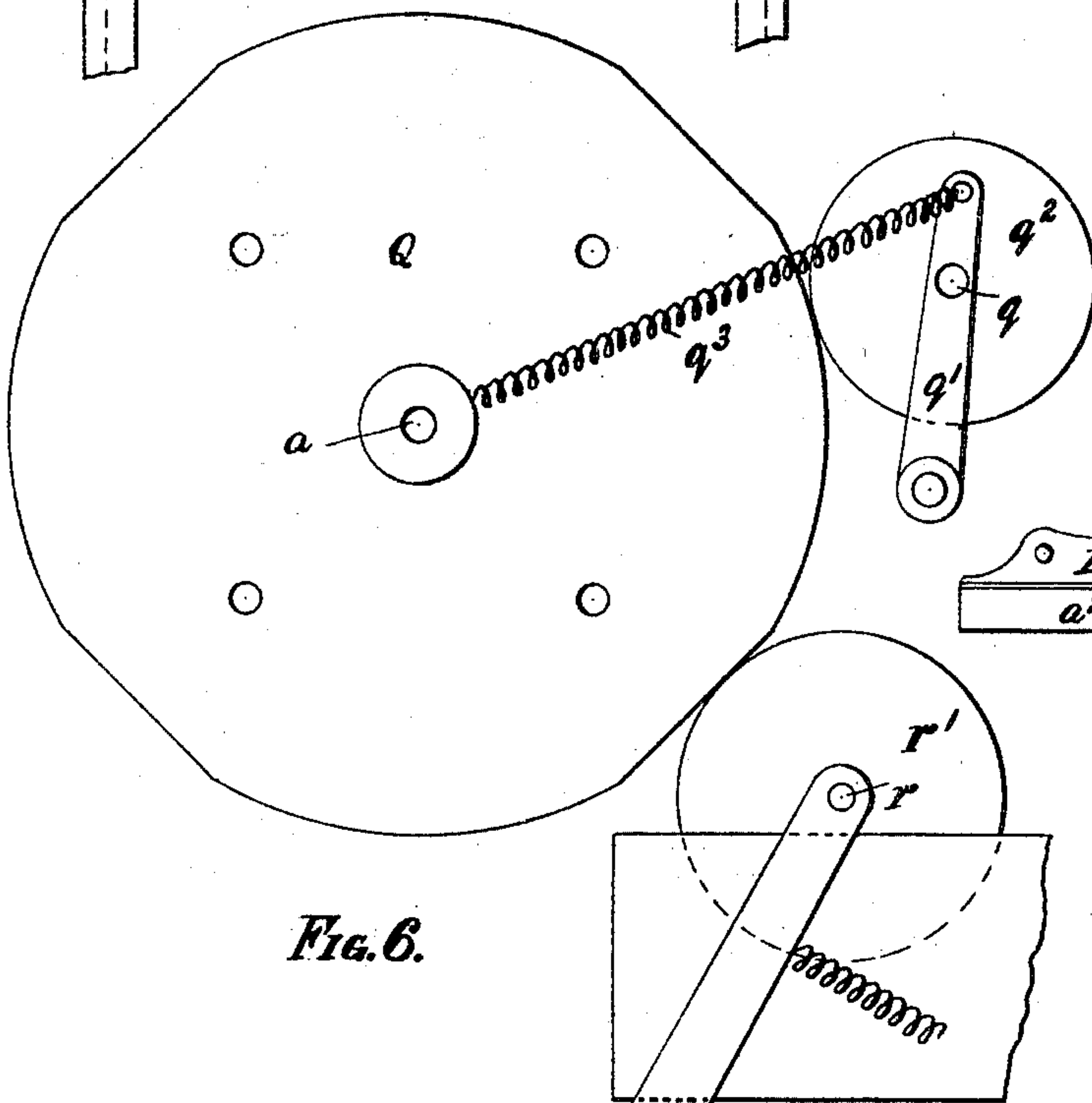
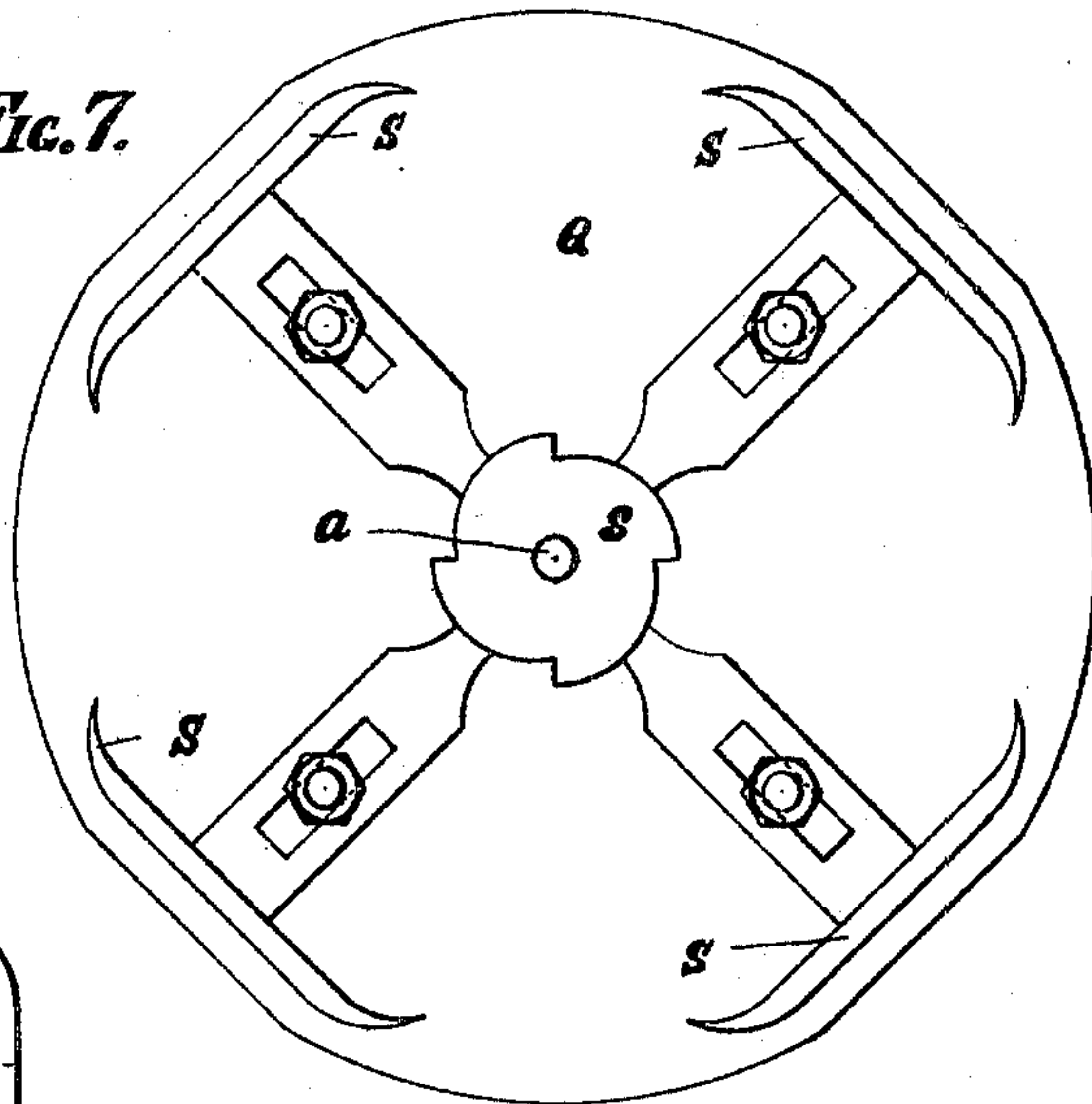
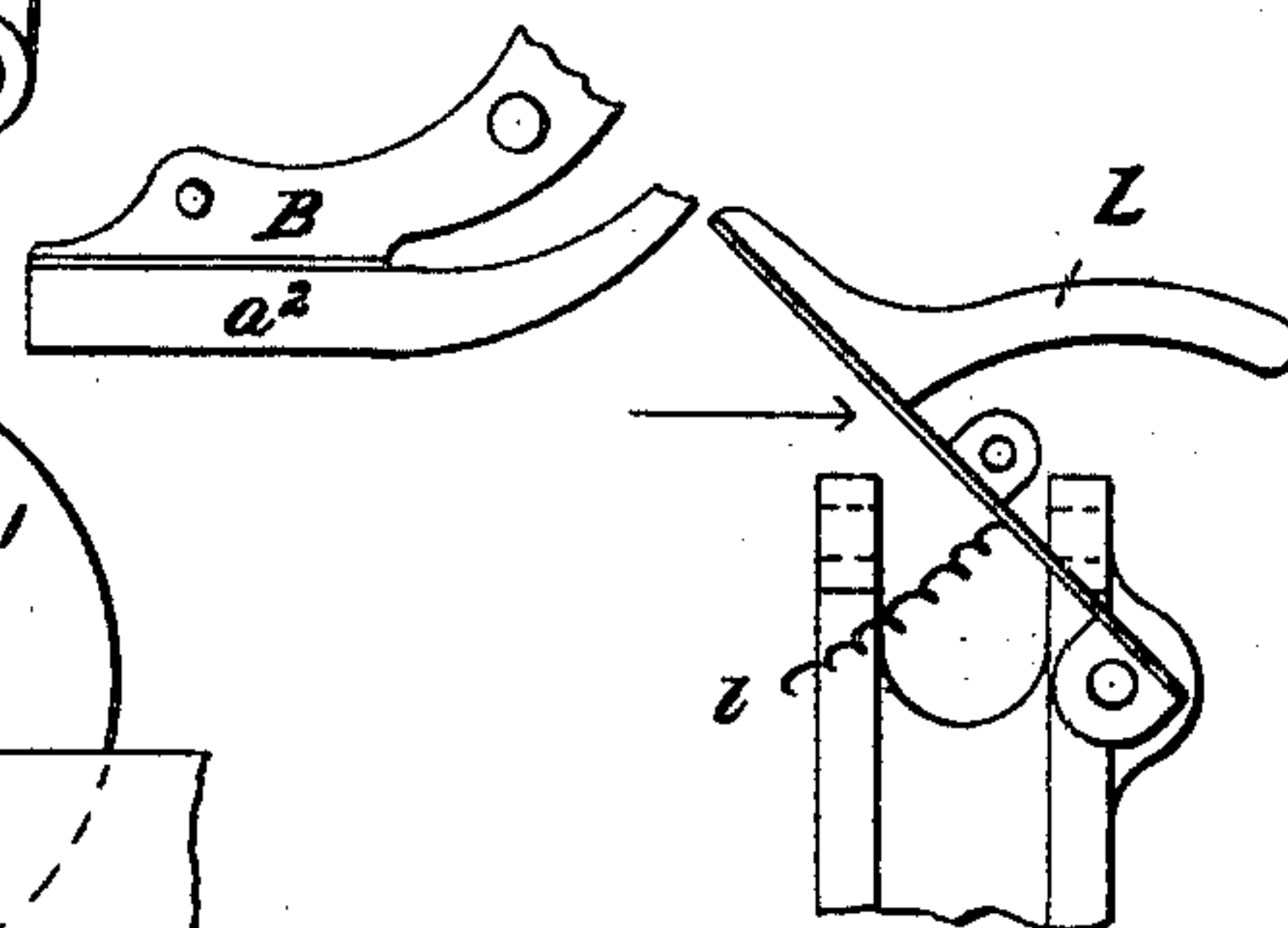


Fig. 6.

Fig. 9.



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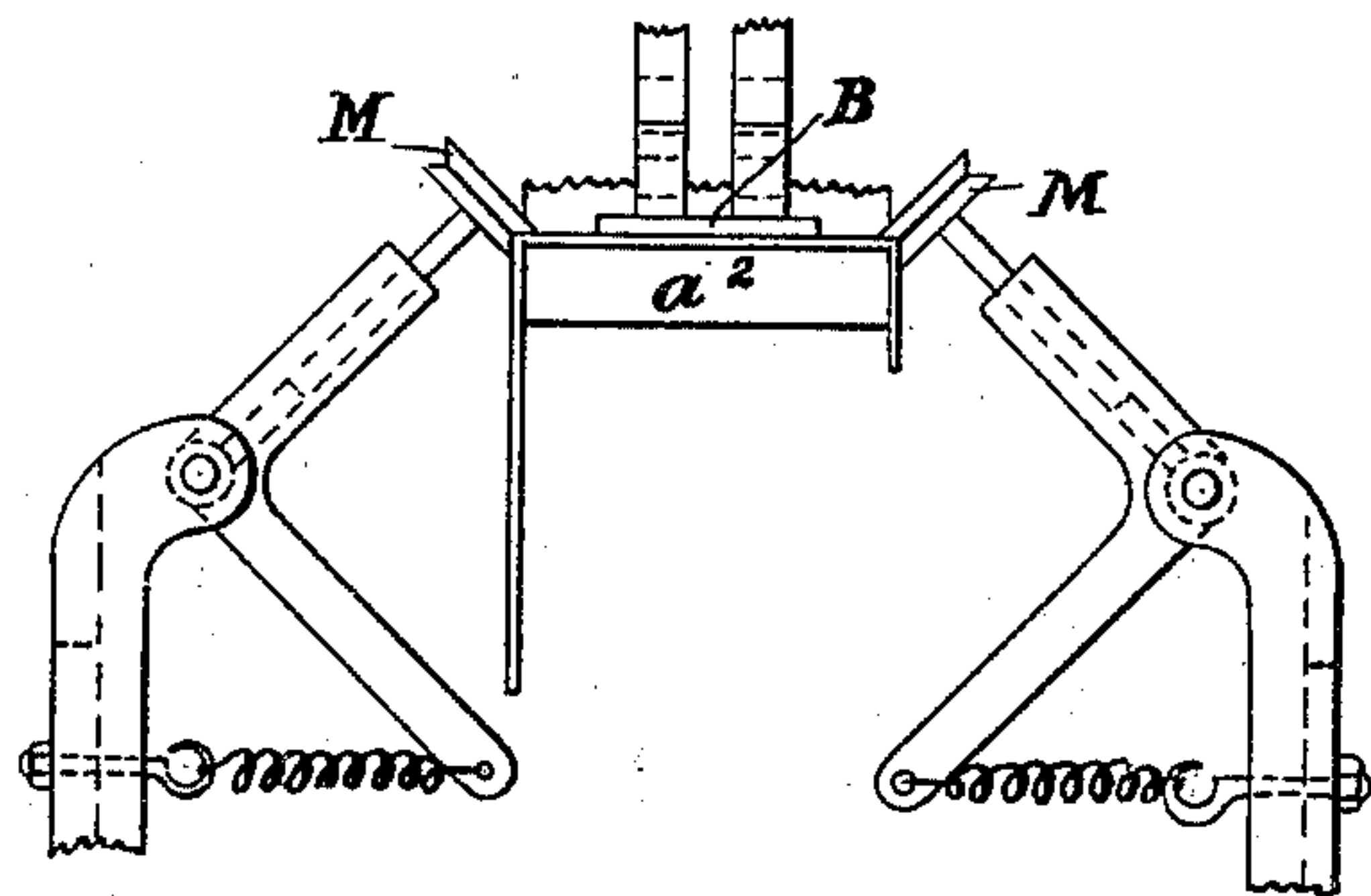


Fig. 10.

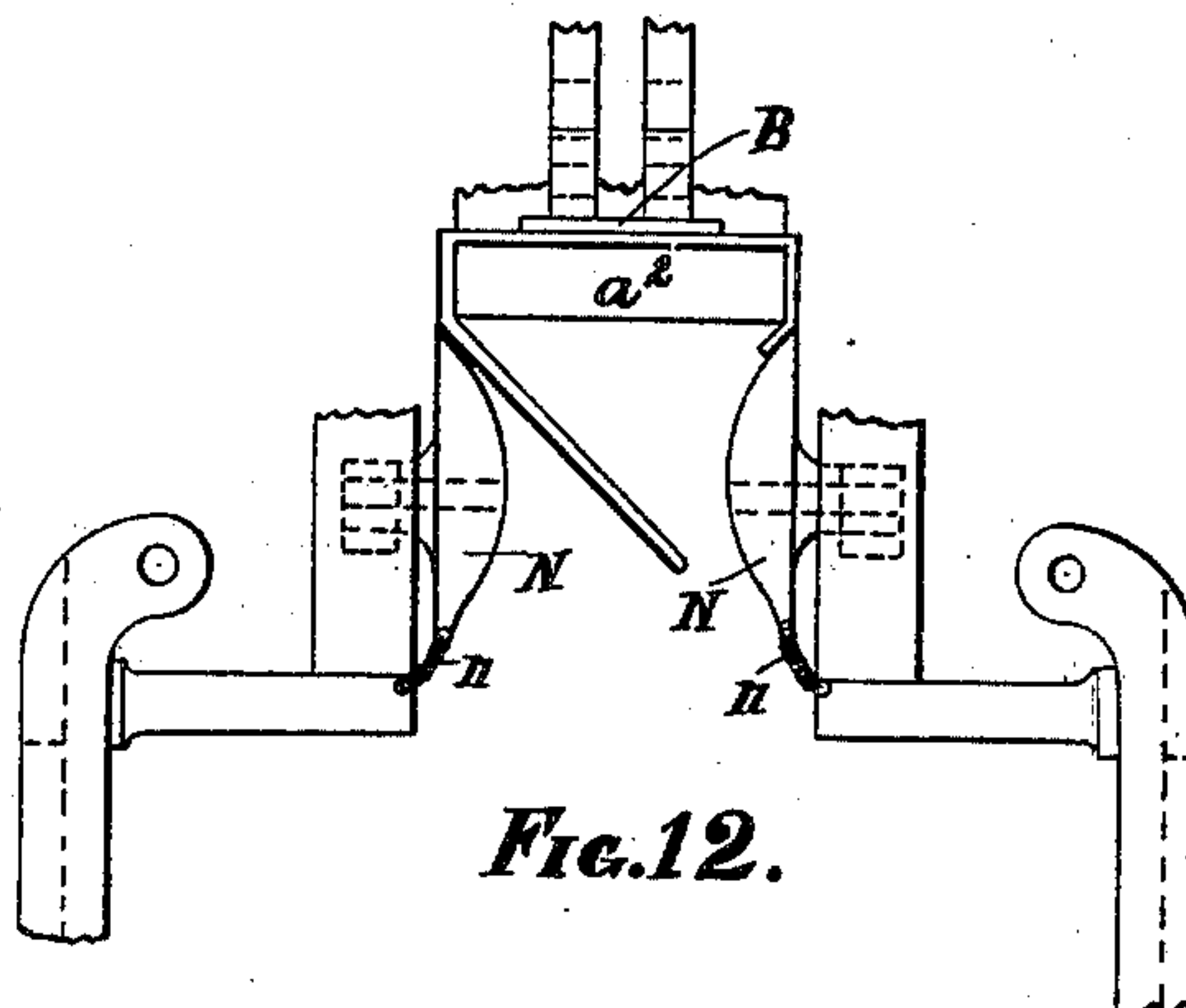


Fig. 12.

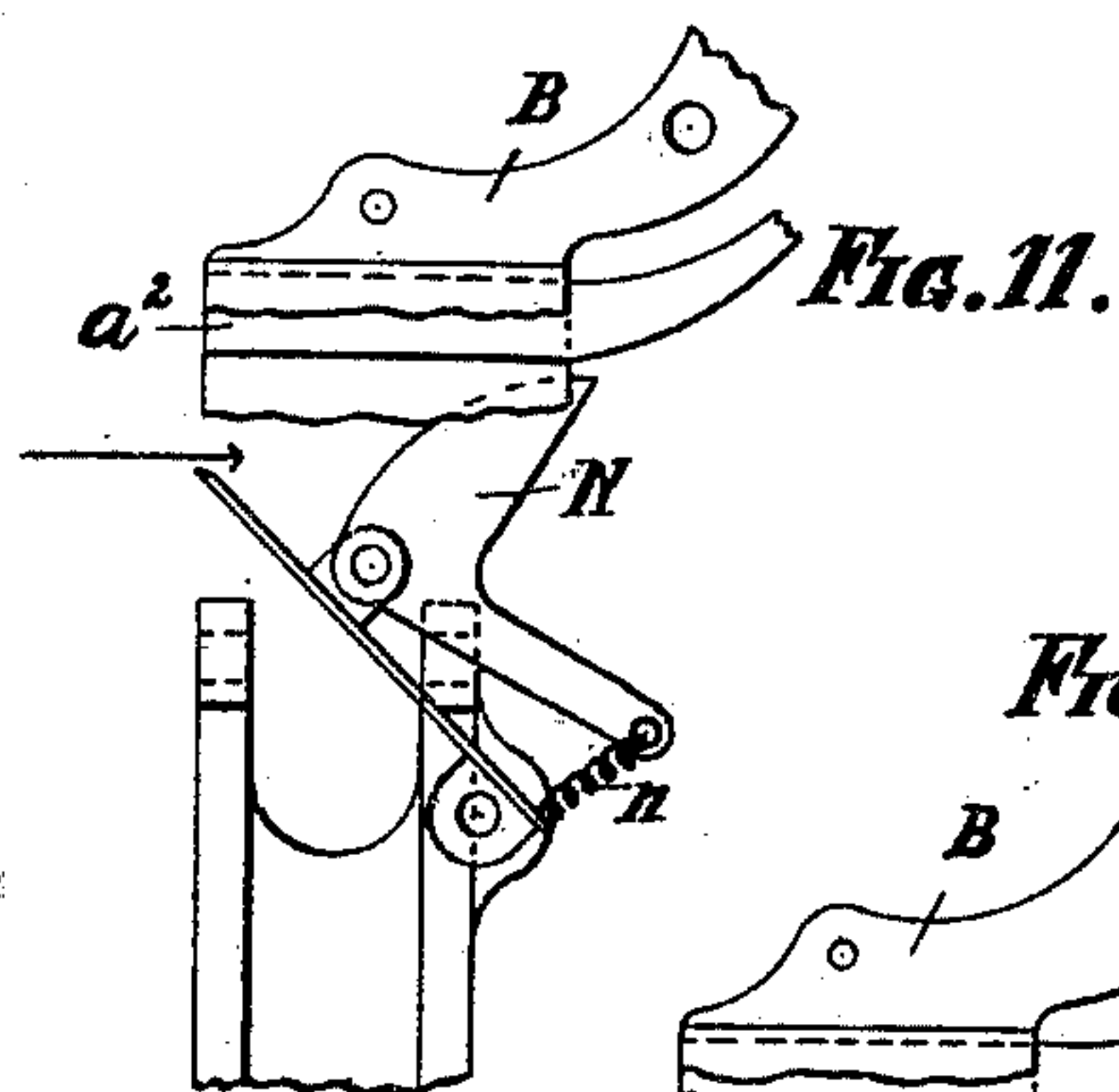


Fig. 11.

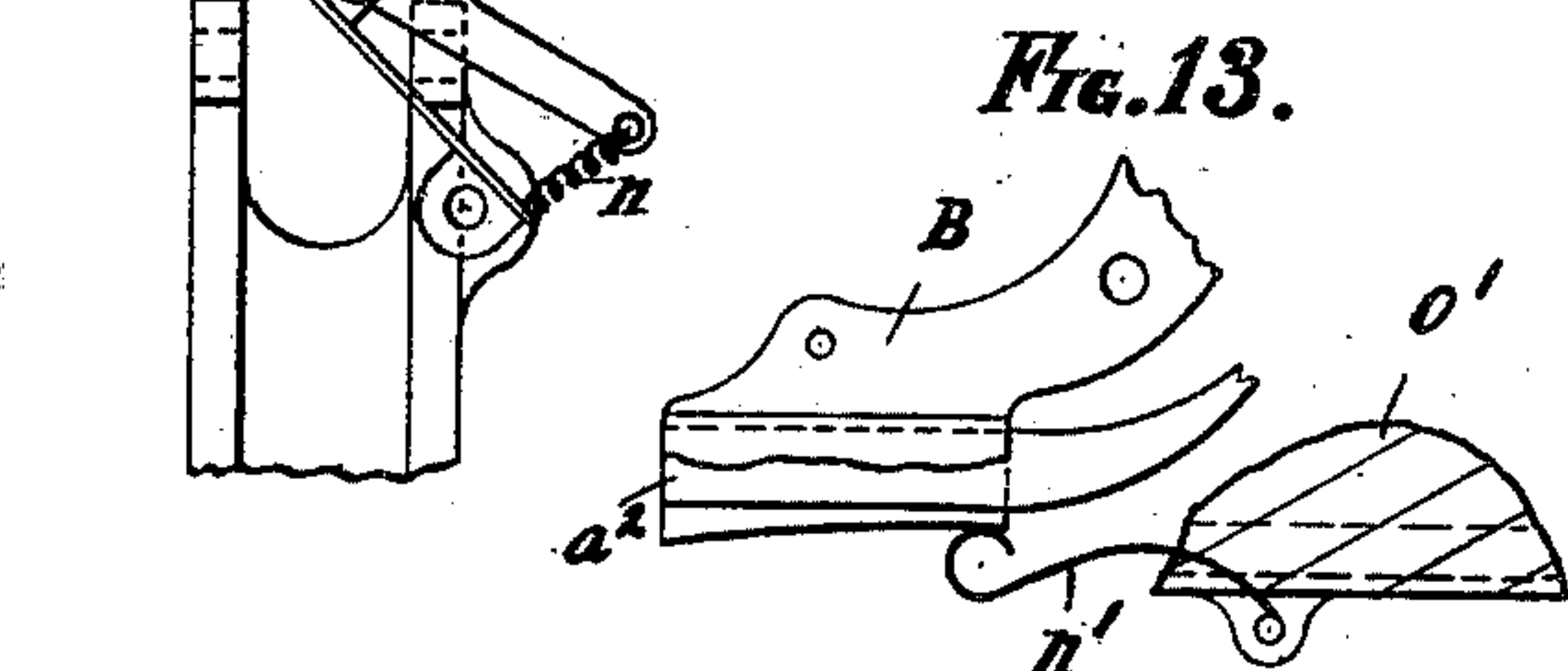


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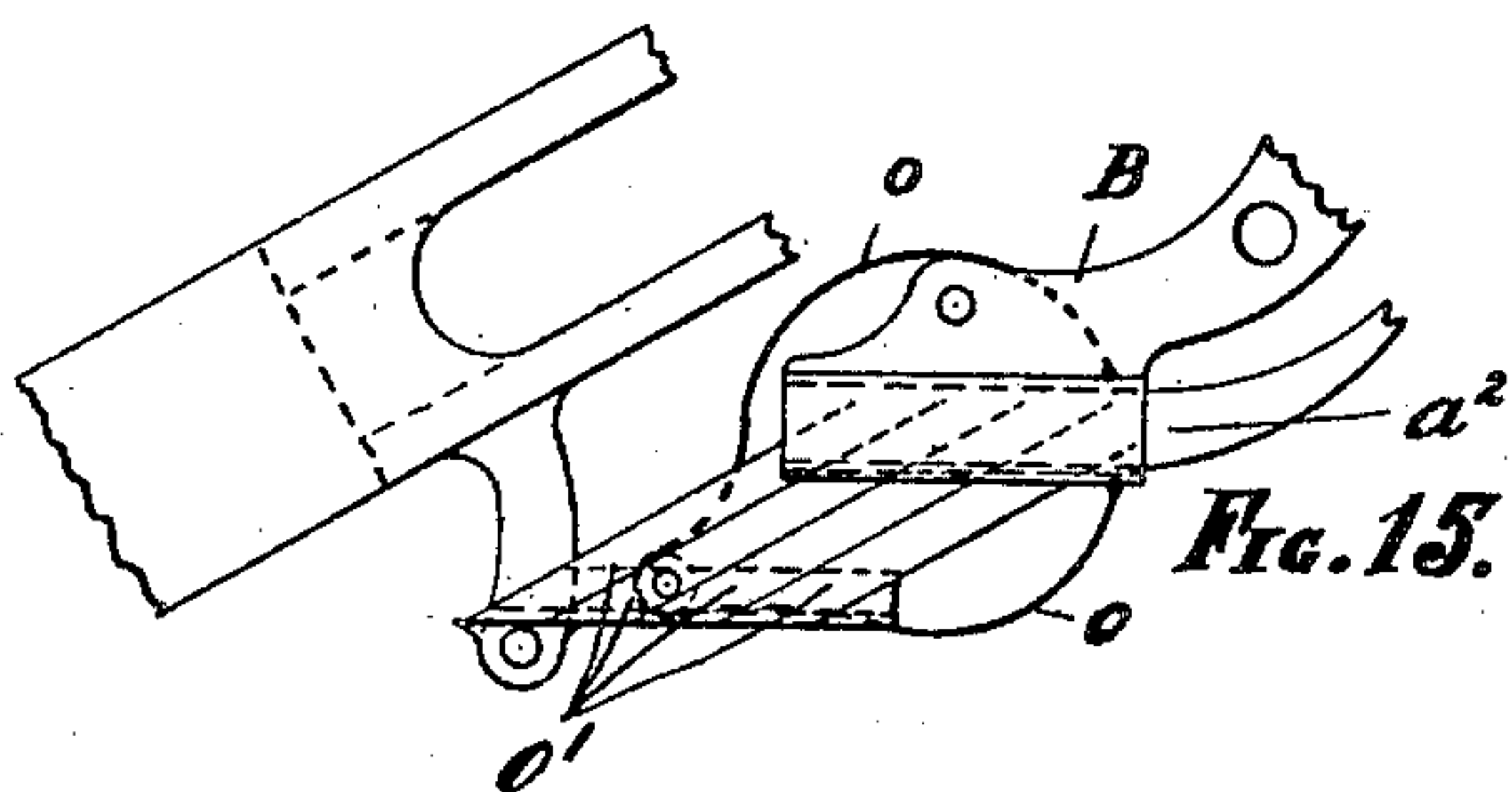


Fig. 15.

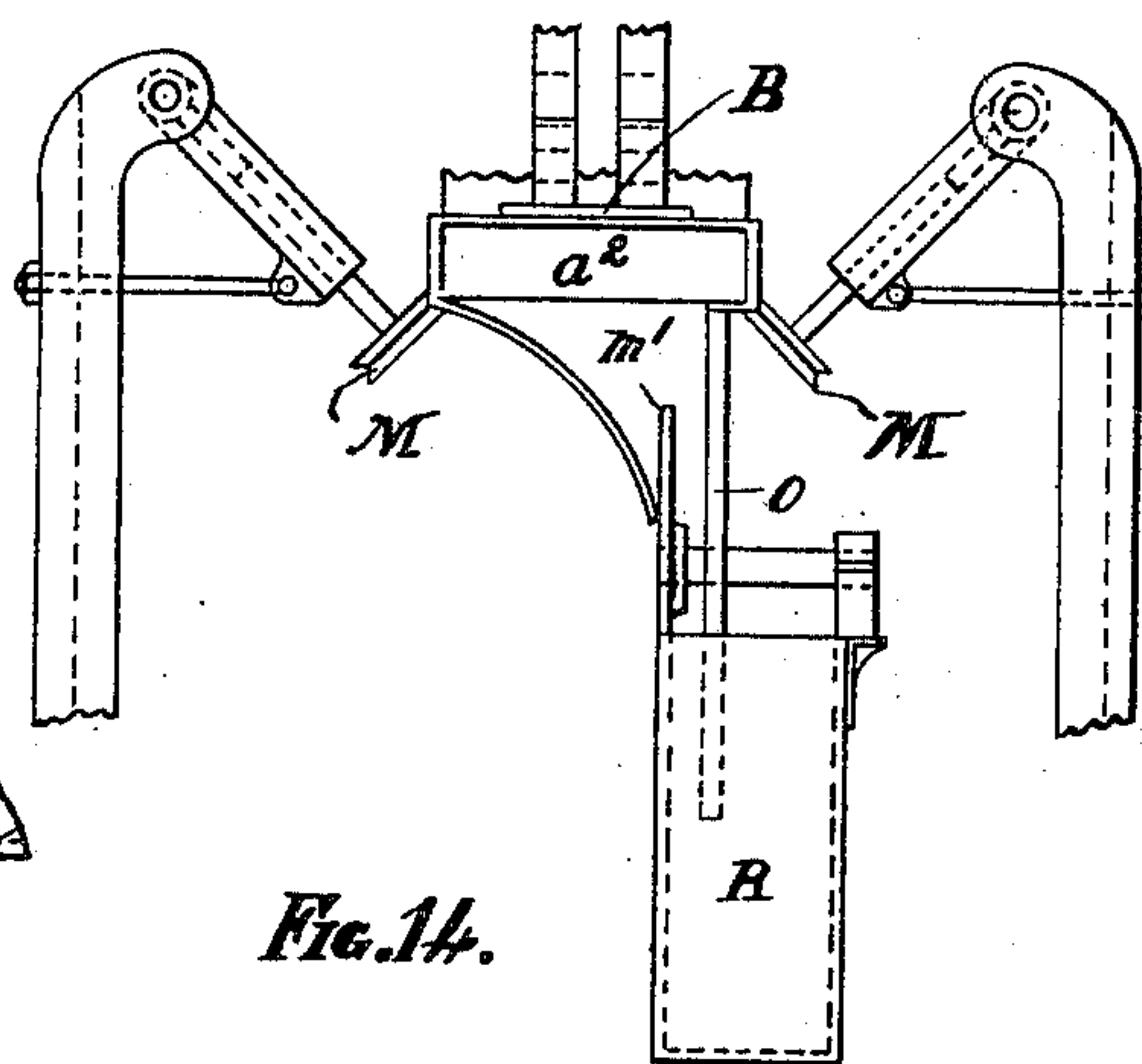


Fig. 14.

Fig. 16.

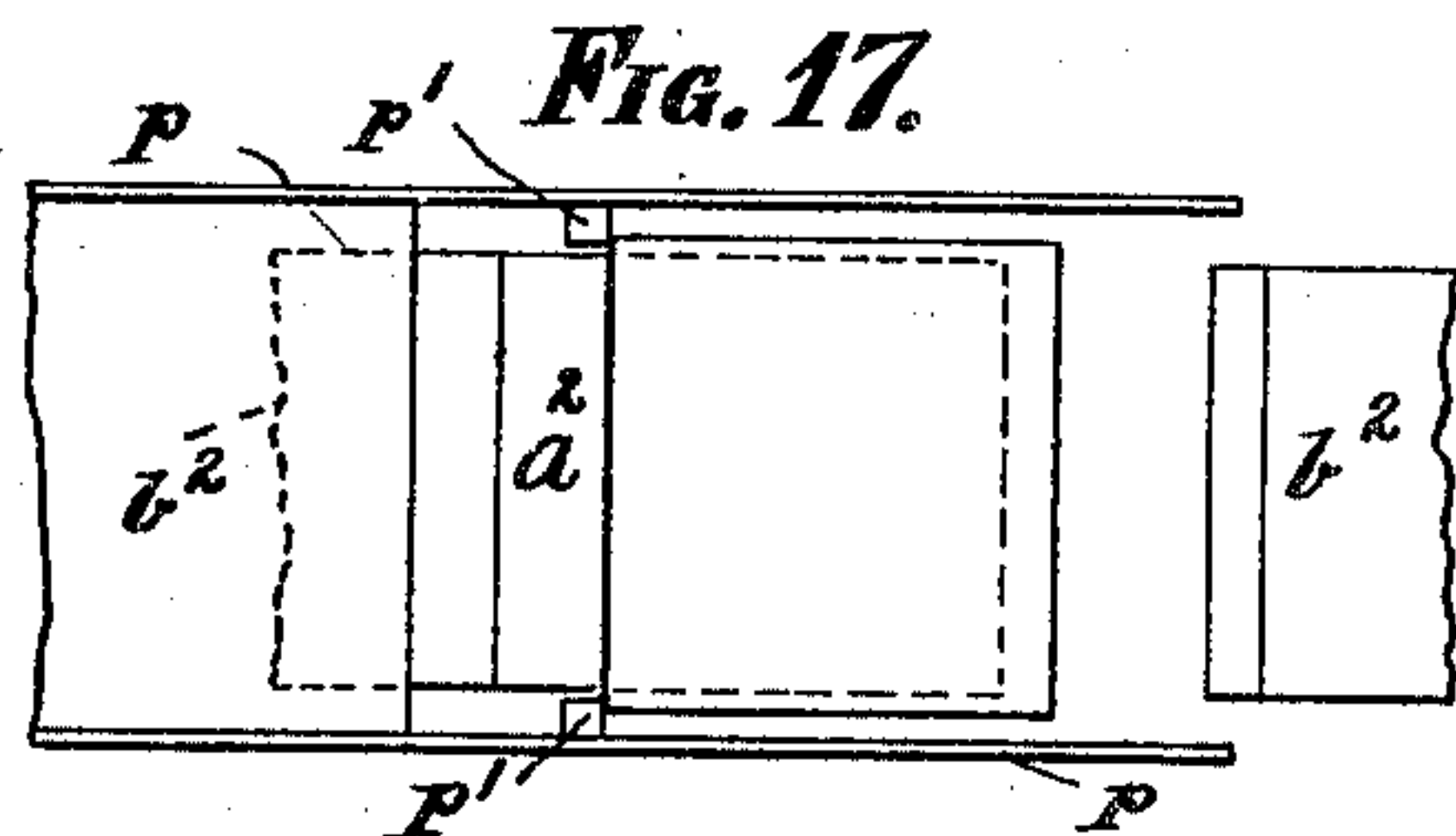
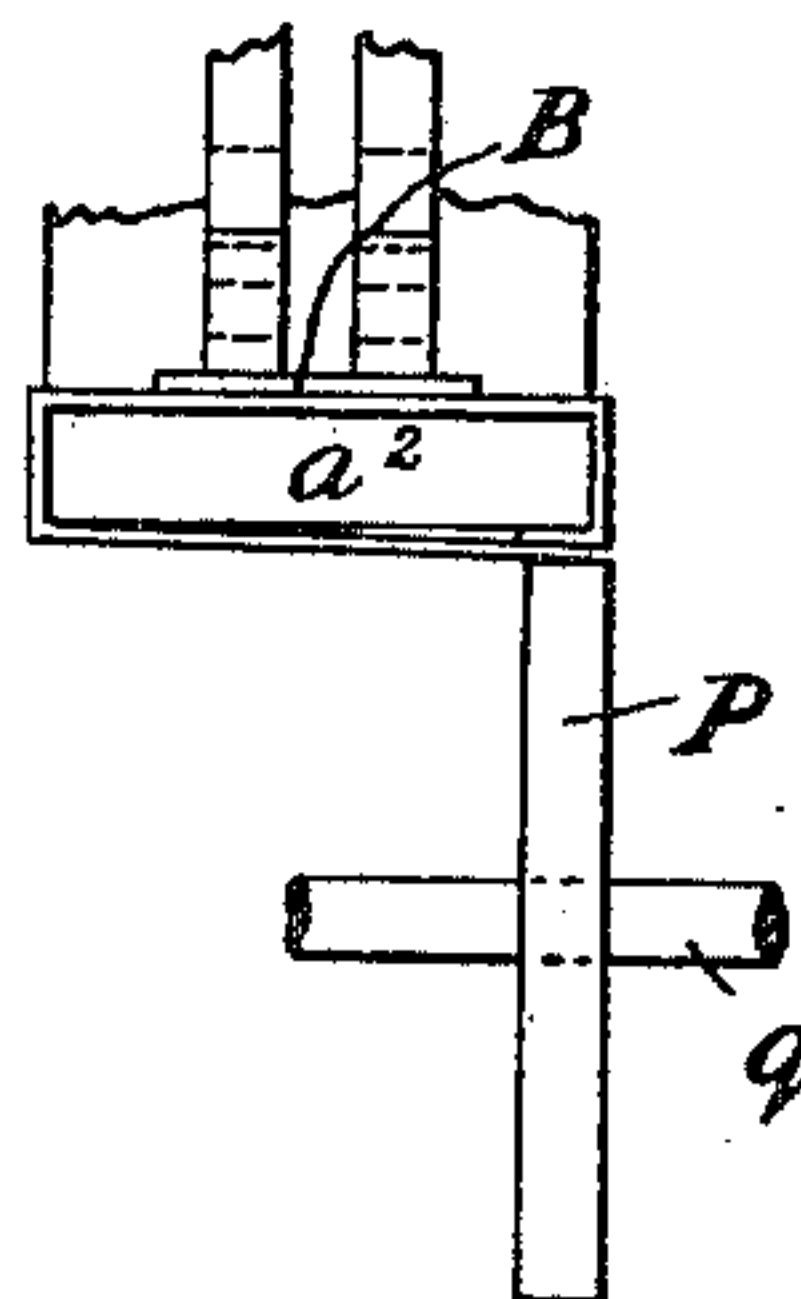


Fig. 17.

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Fig. 18.

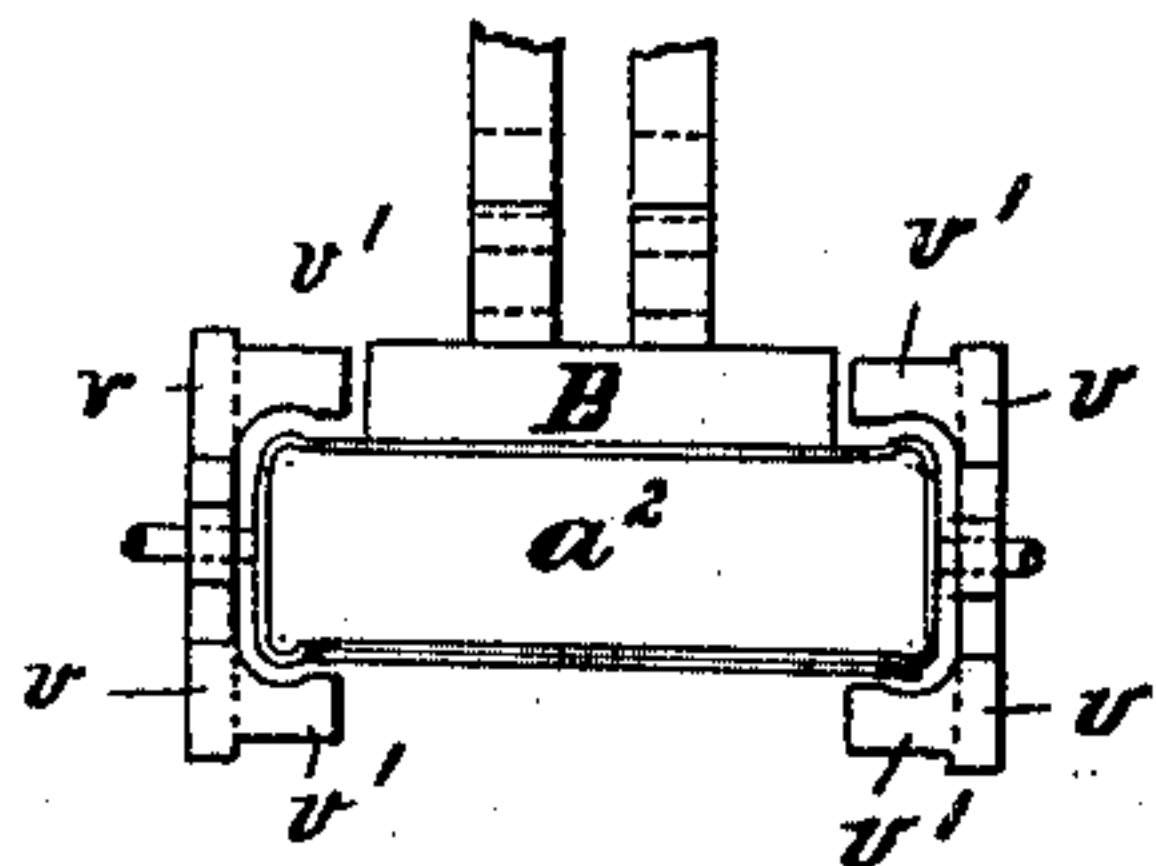


Fig. 19.

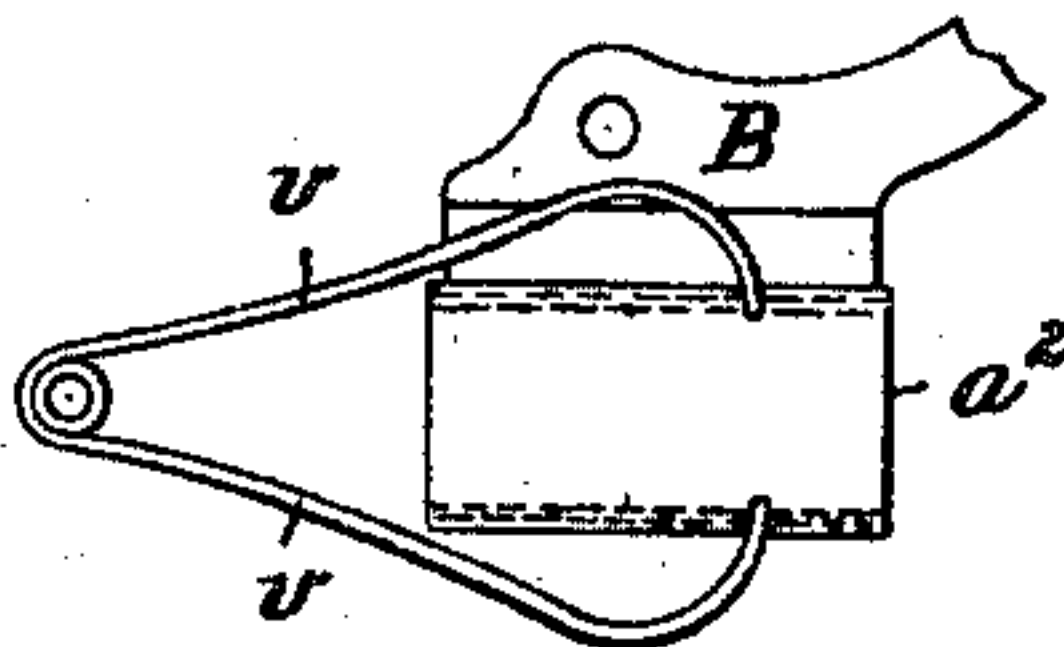


Fig. 19^a.

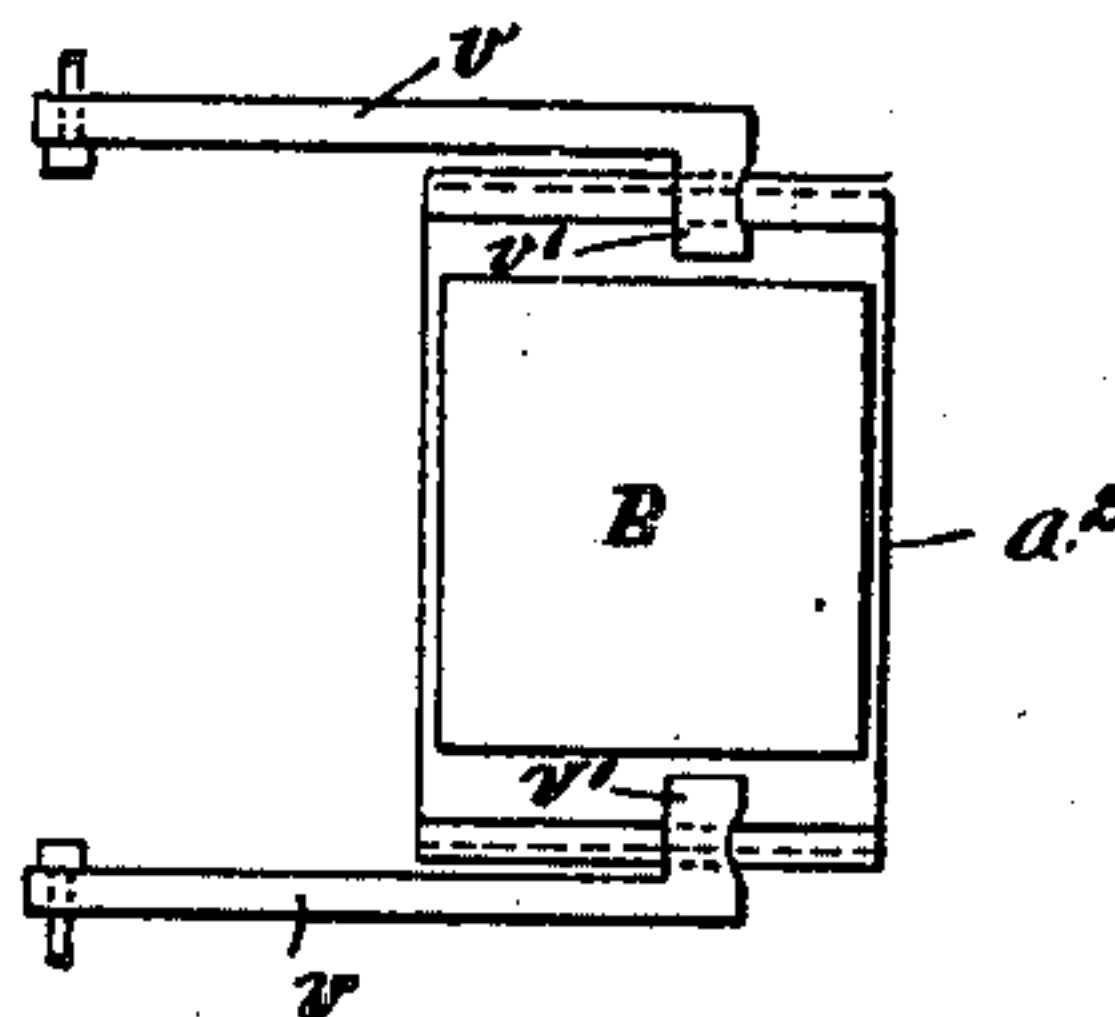


Fig. 20.

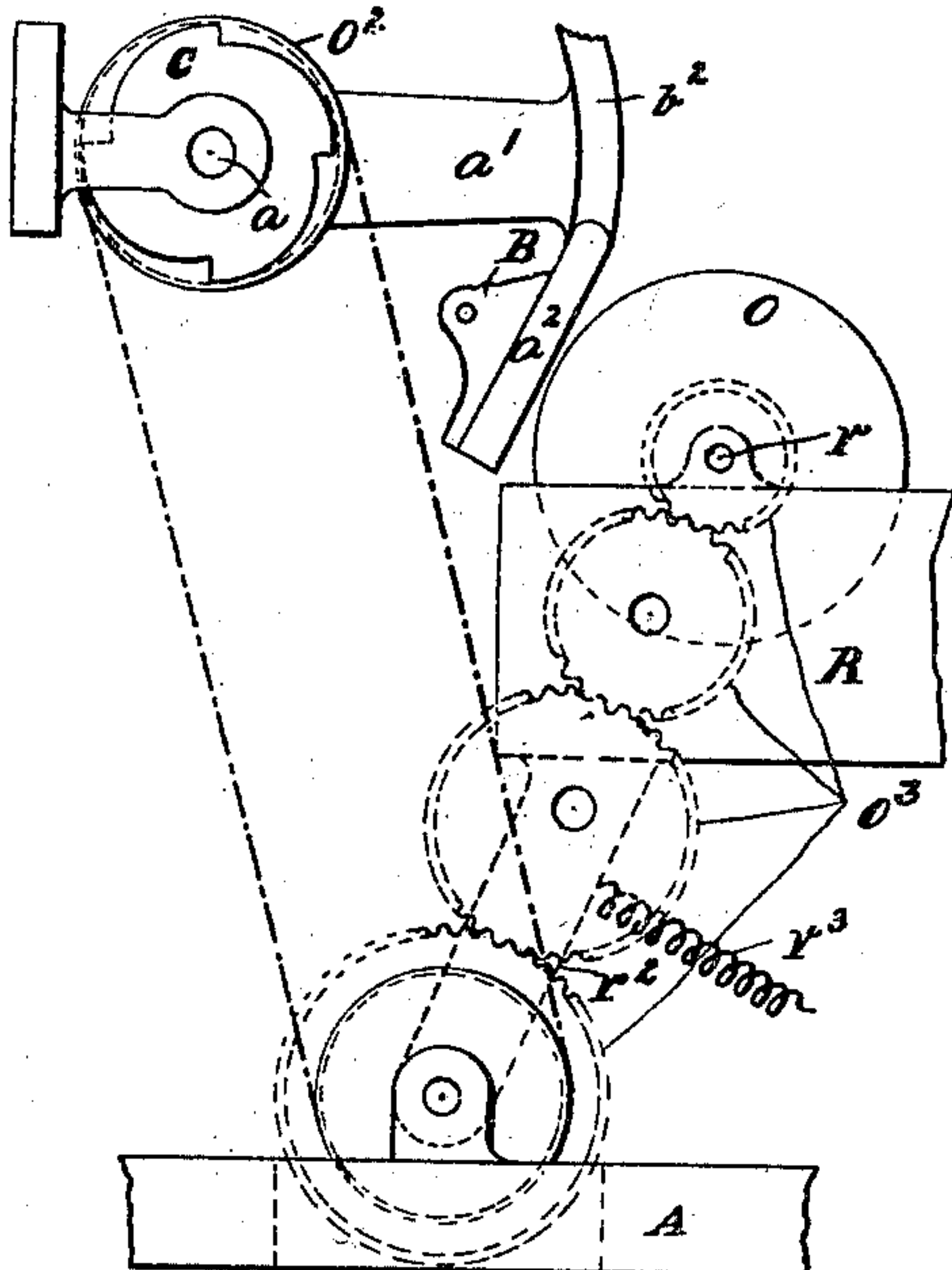


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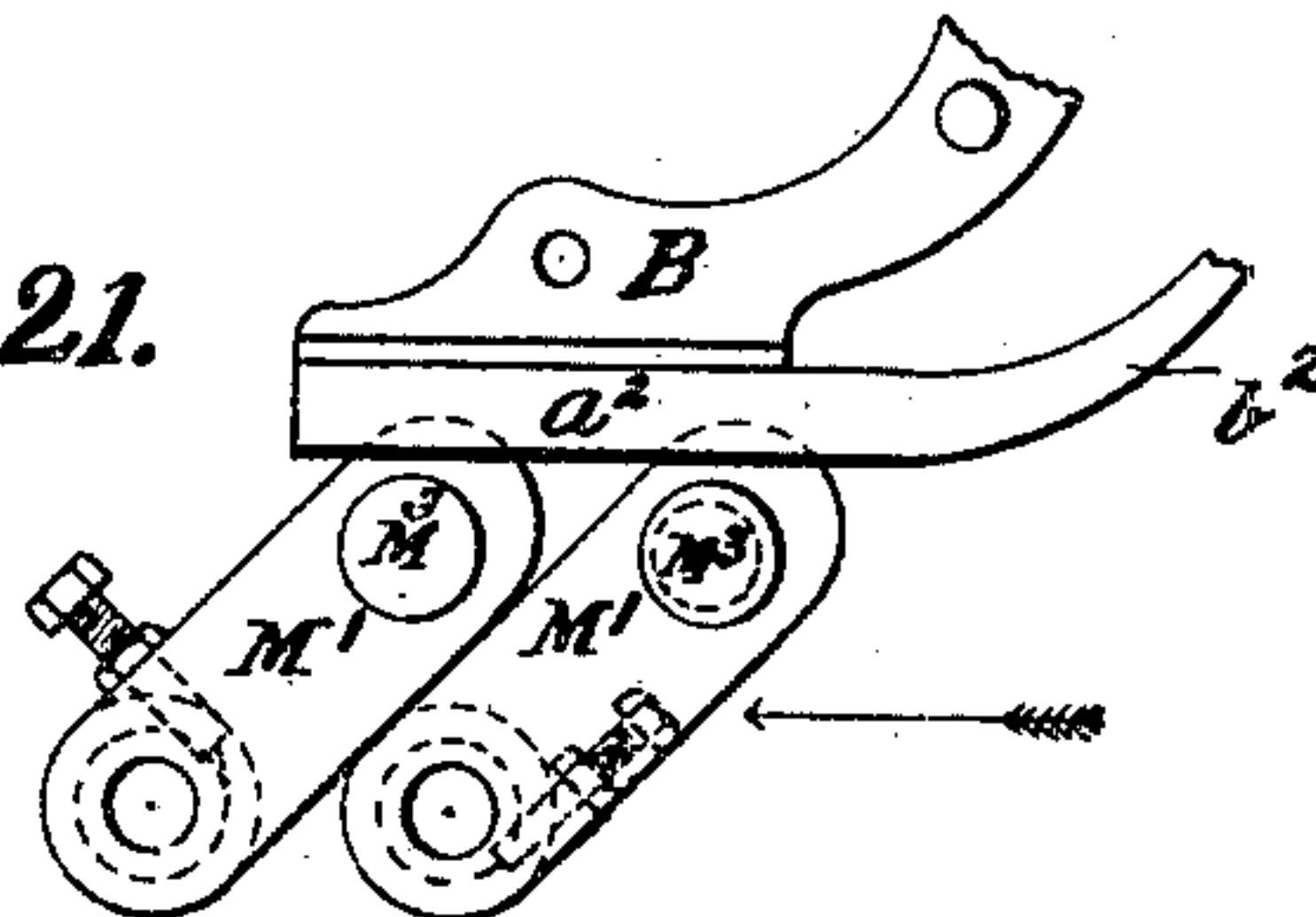


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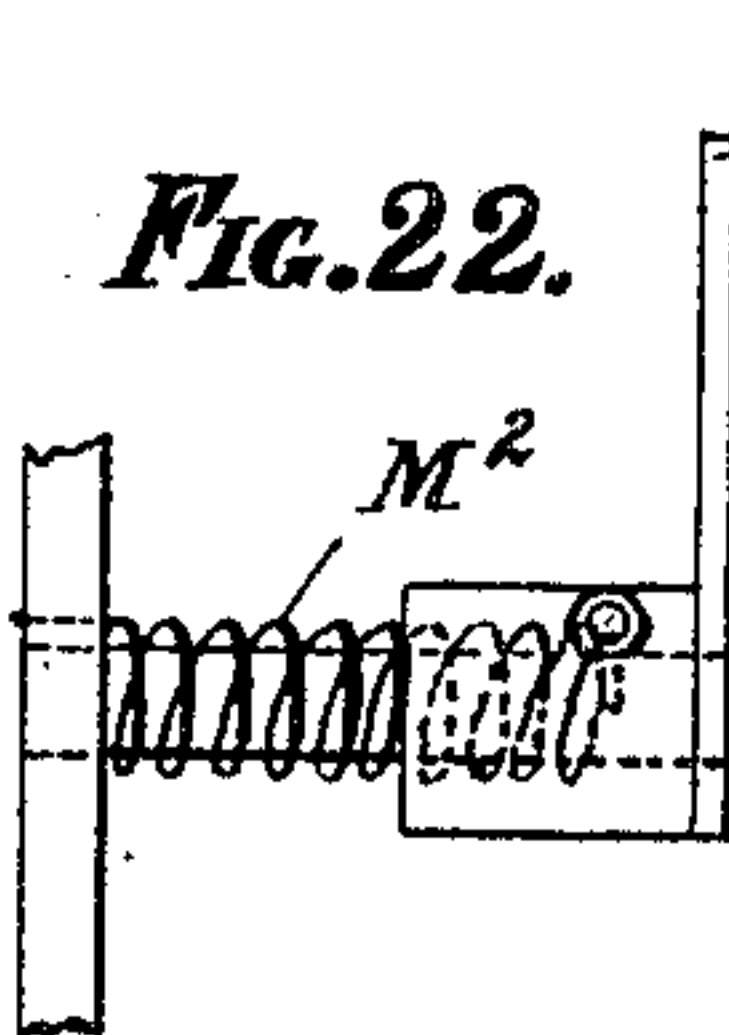


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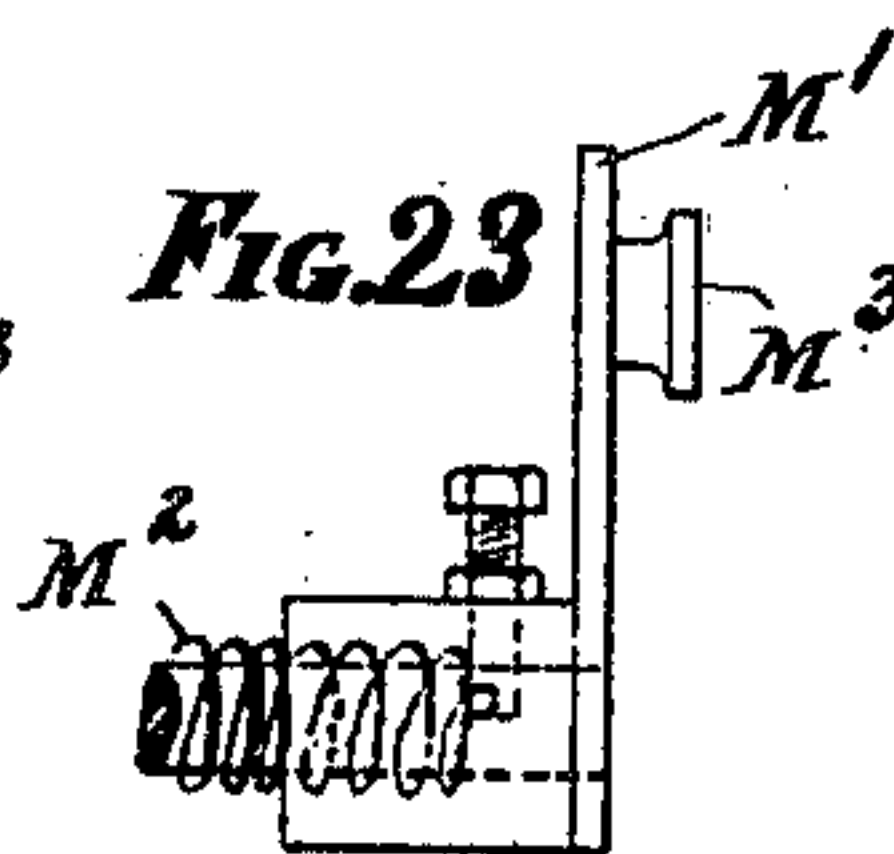


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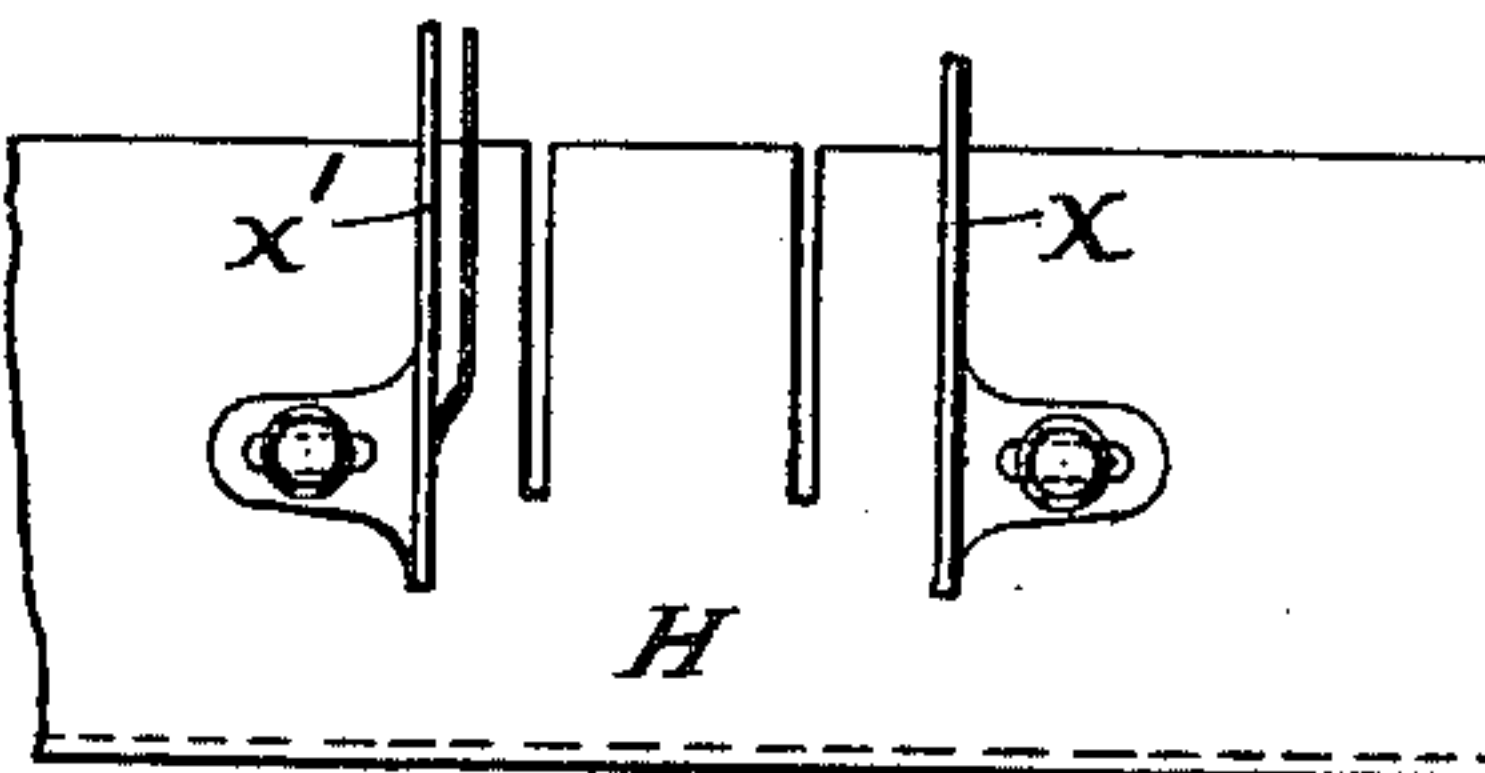


Fig. 24.

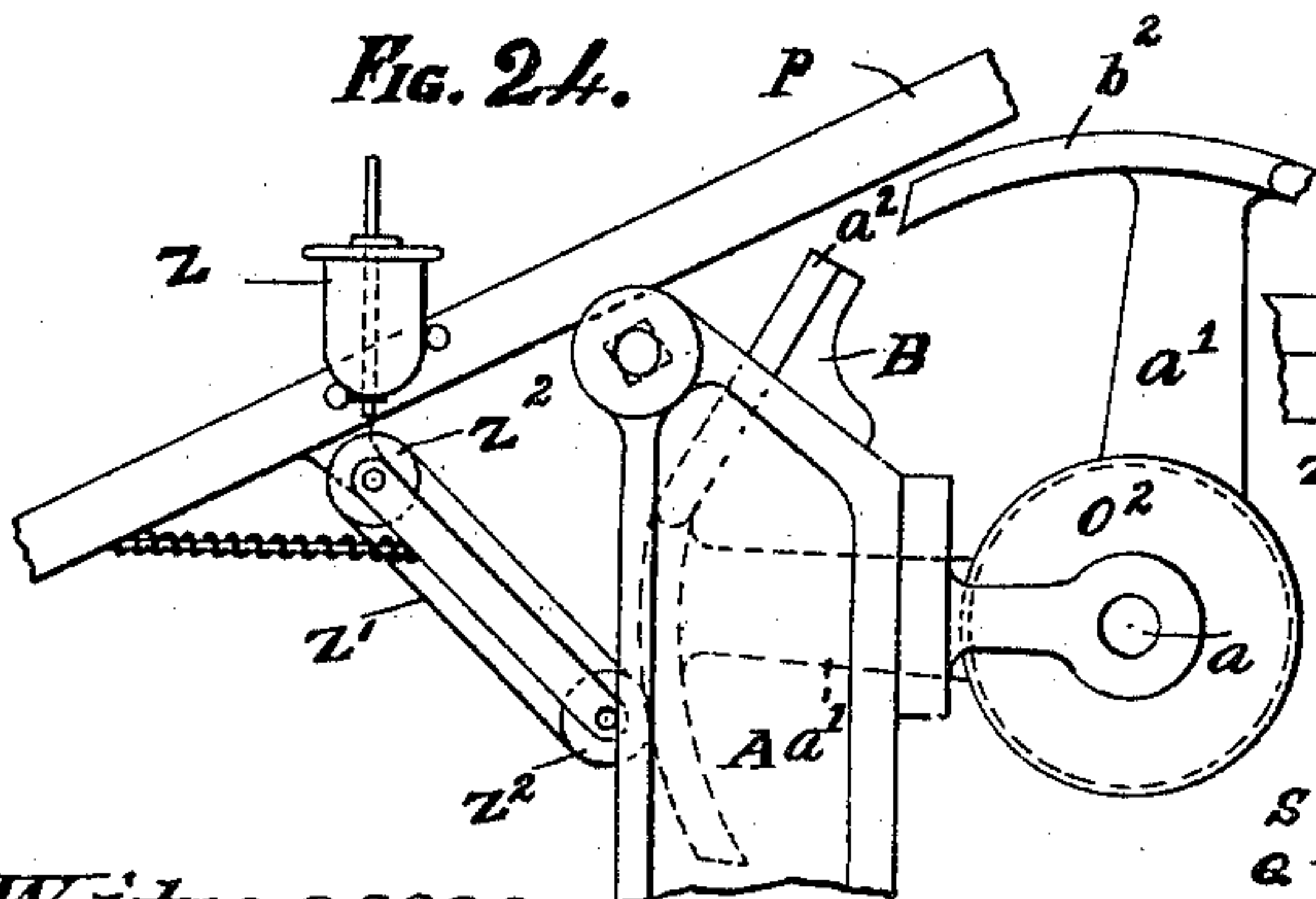
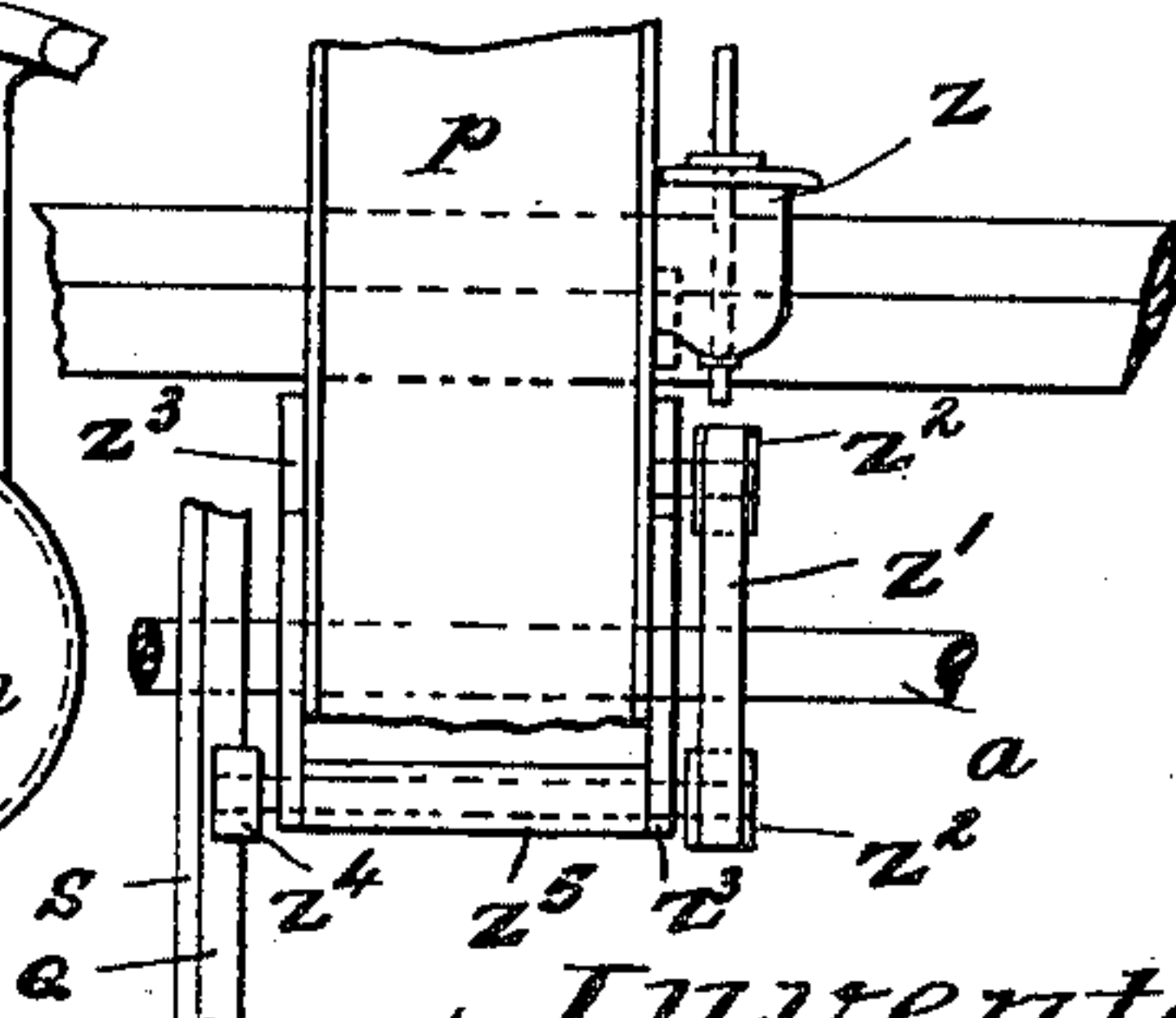


Fig. 25.



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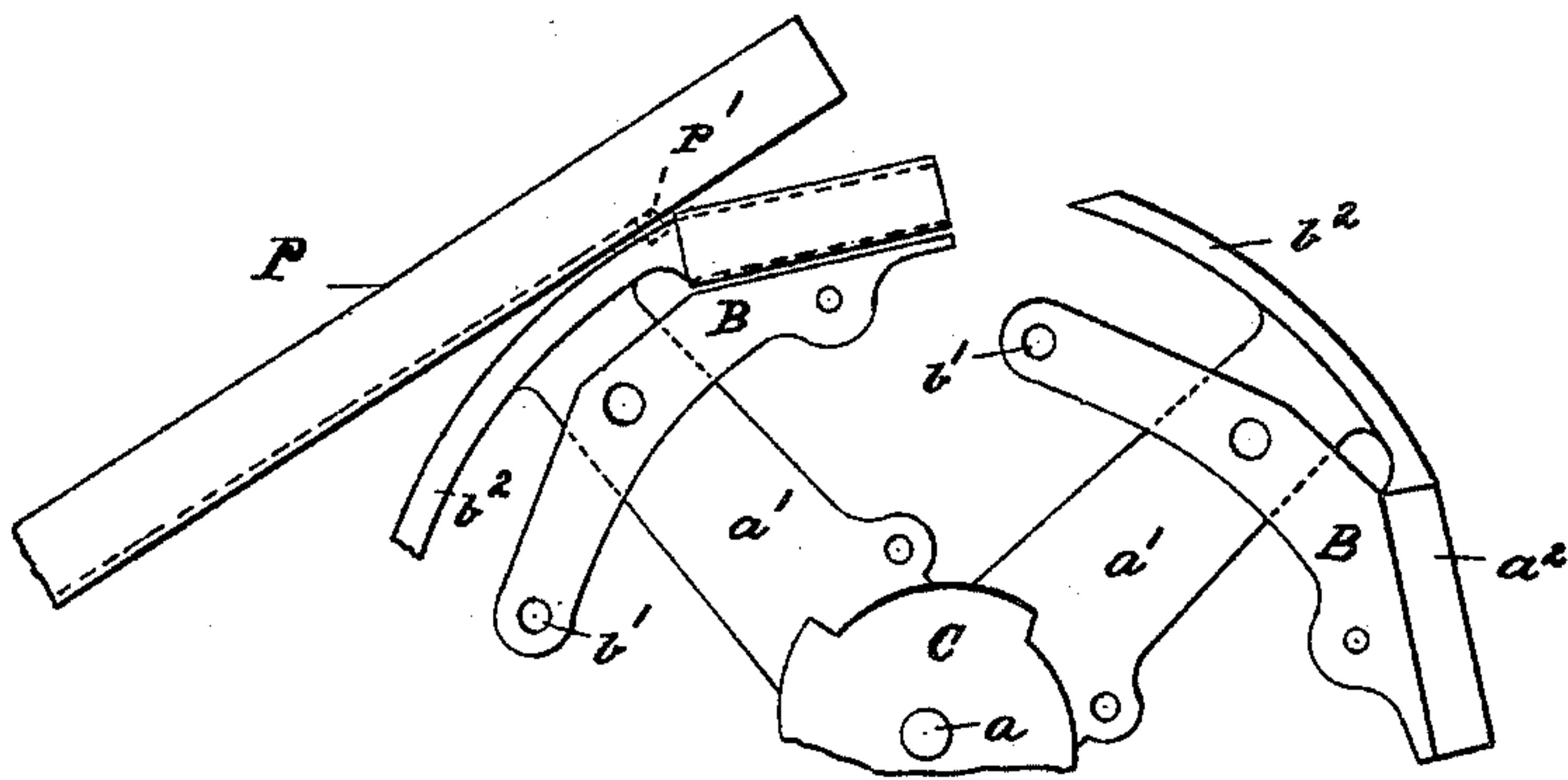


FIG. 27.

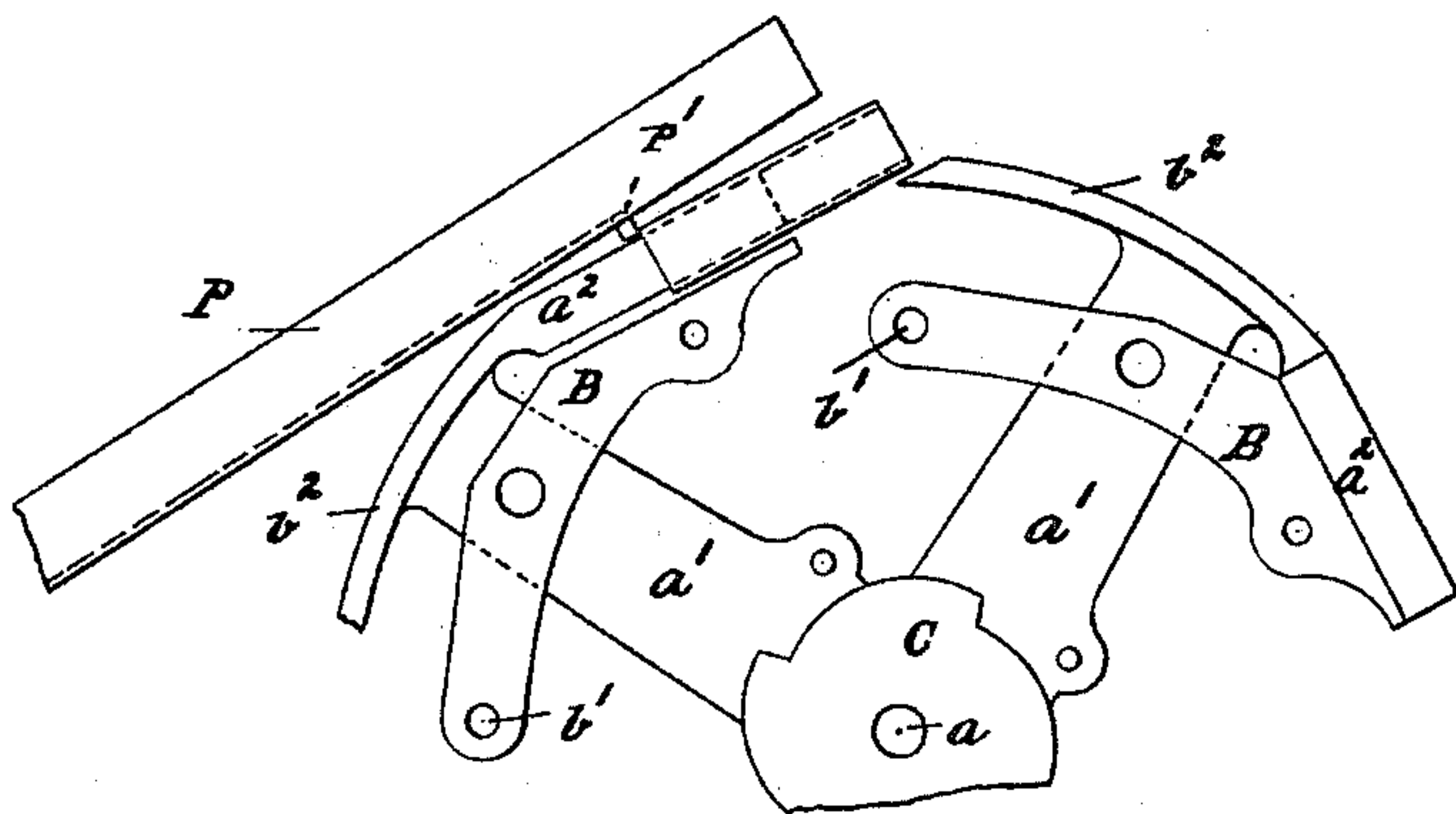
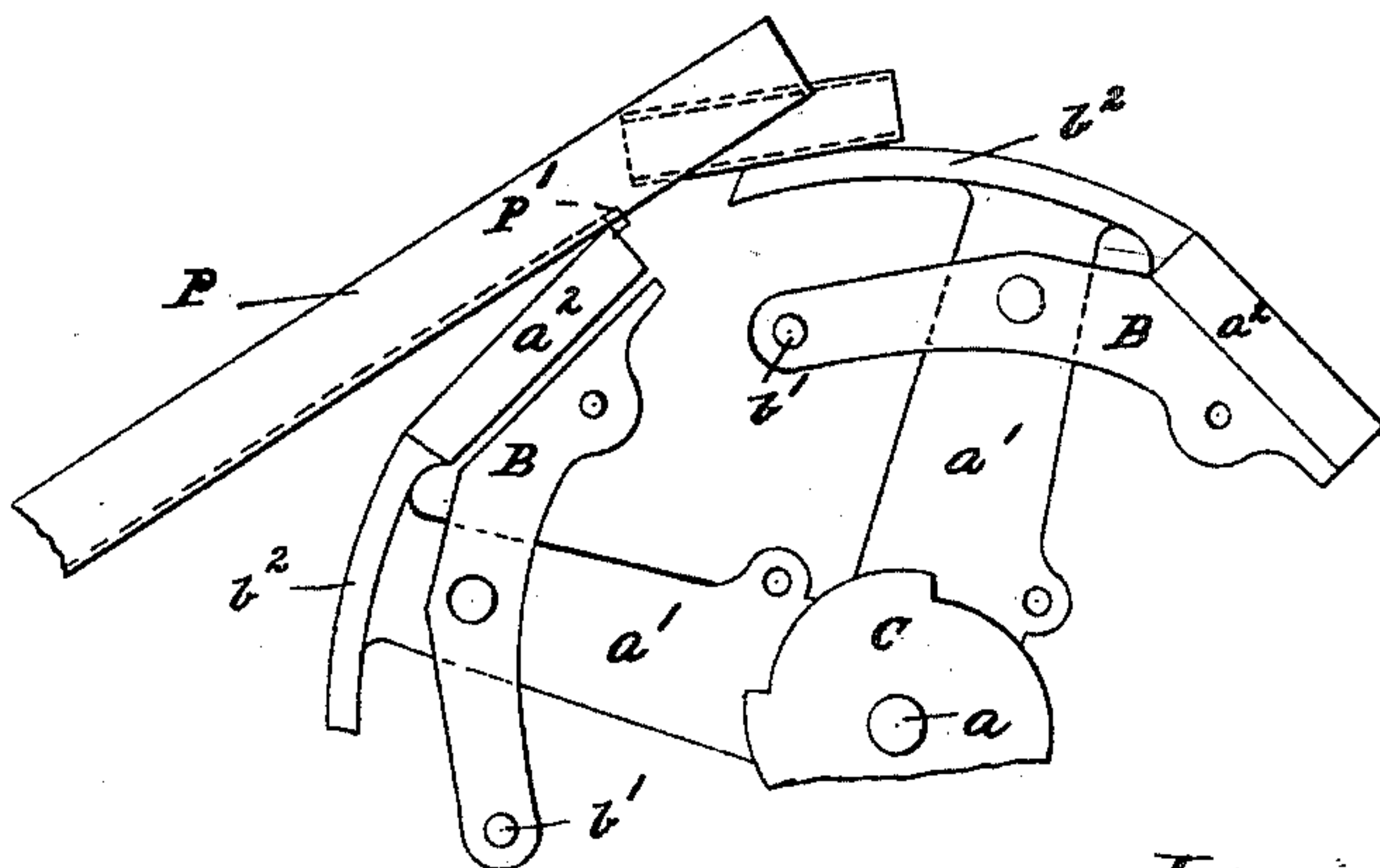


FIG. 28.



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FIG. 29. Alfred Godfrey

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(No Model.)

10 Sheets—Sheet 10.

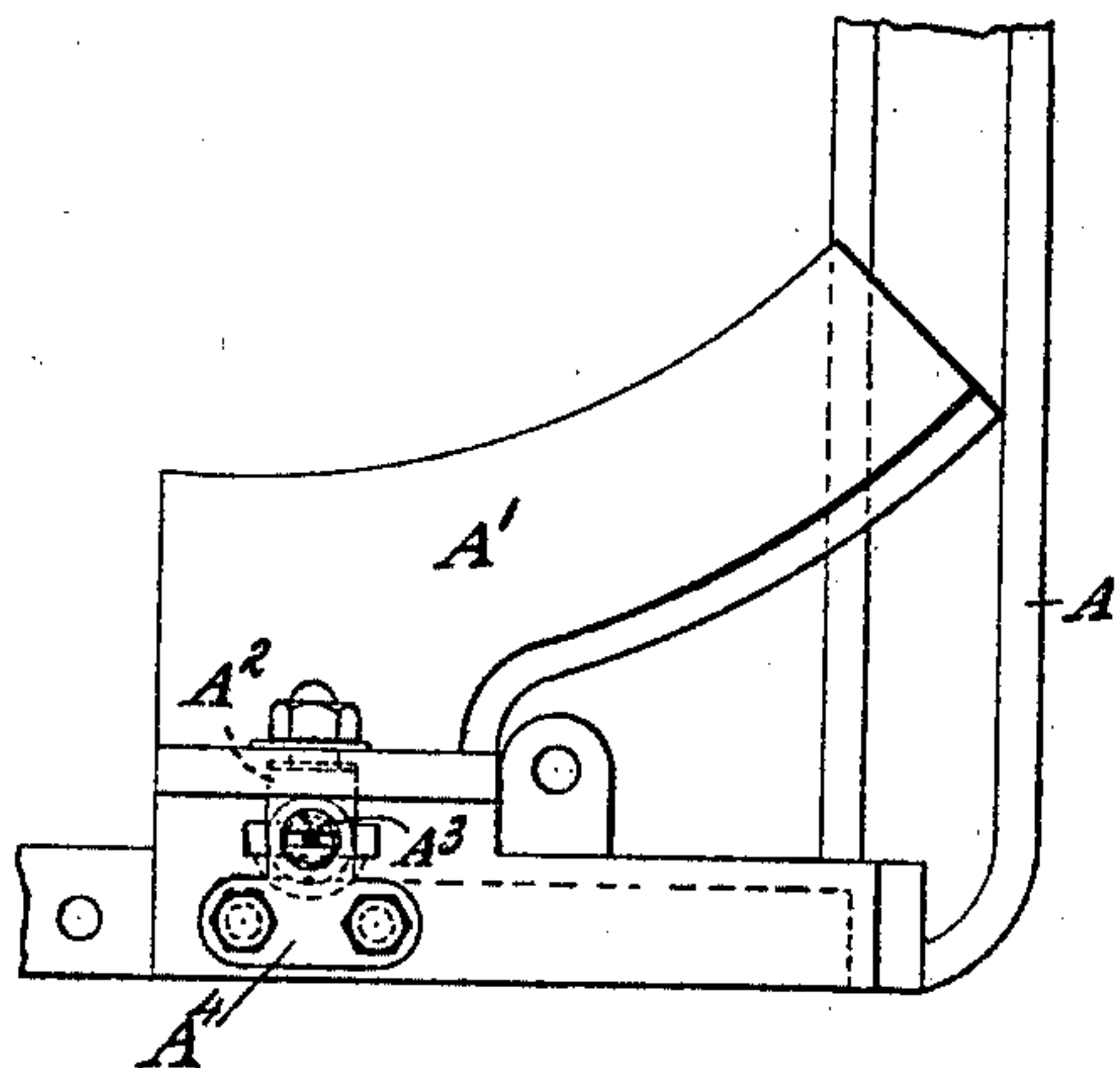


Fig. 30.

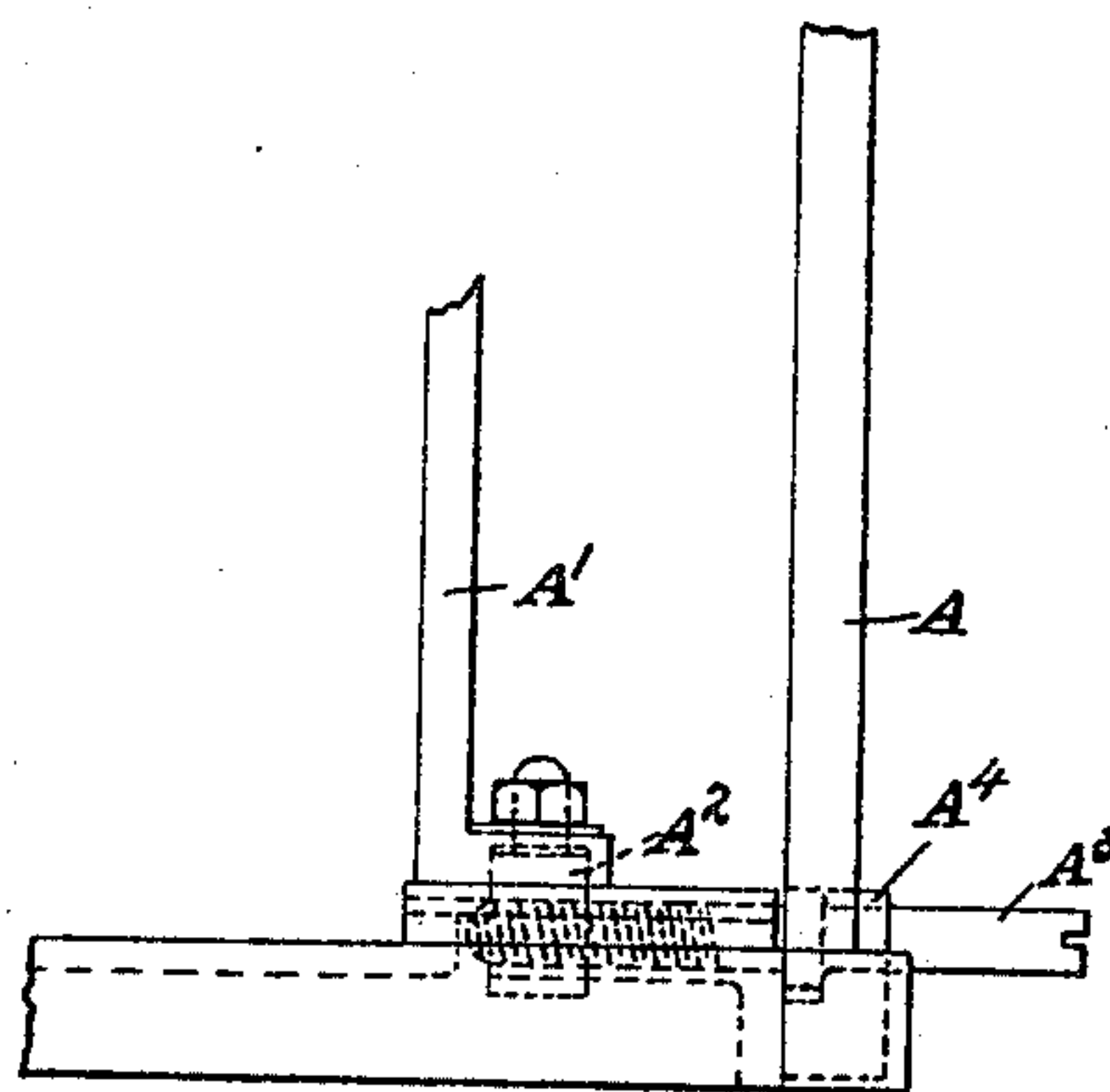


Fig. 31.

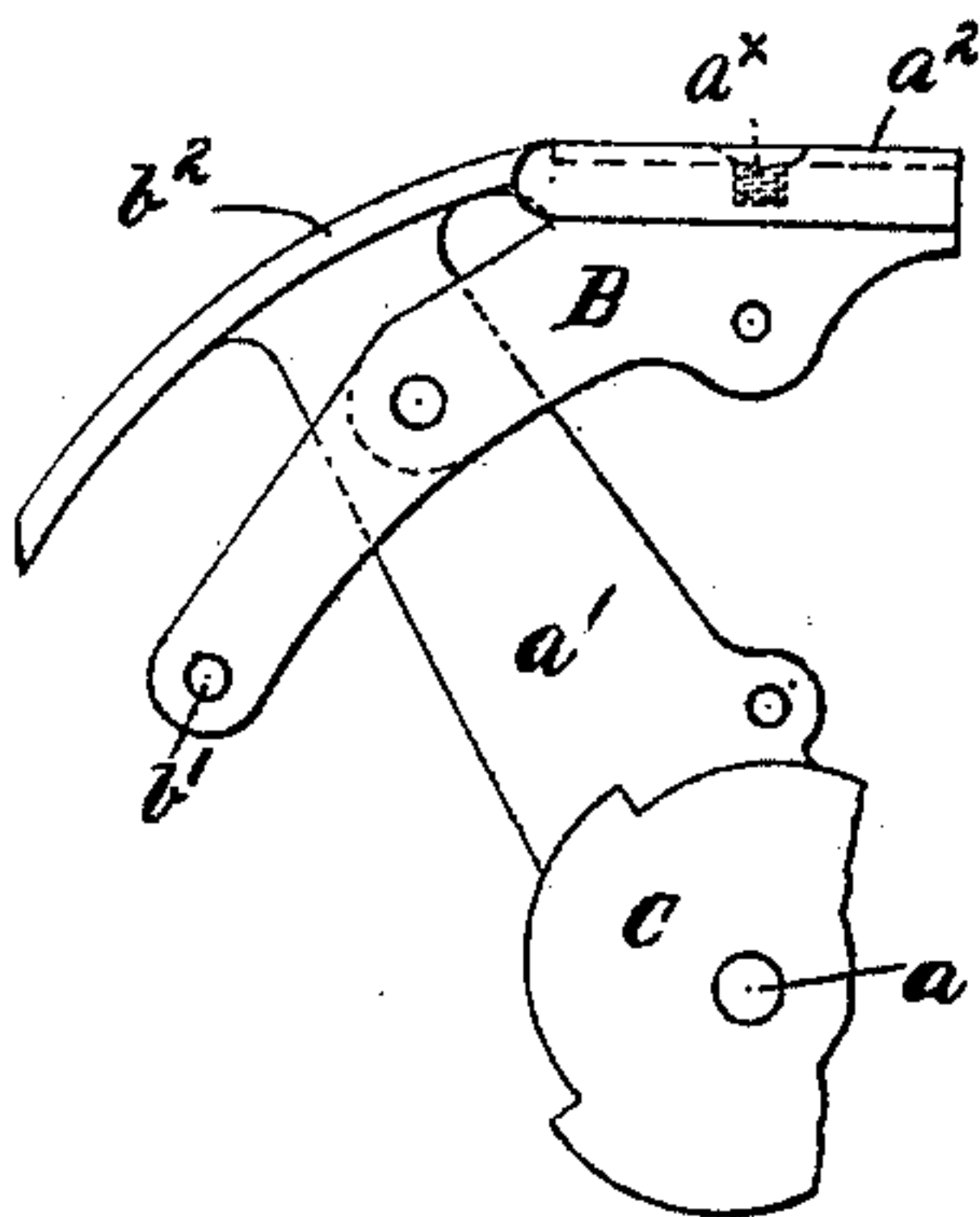


Fig. 32.

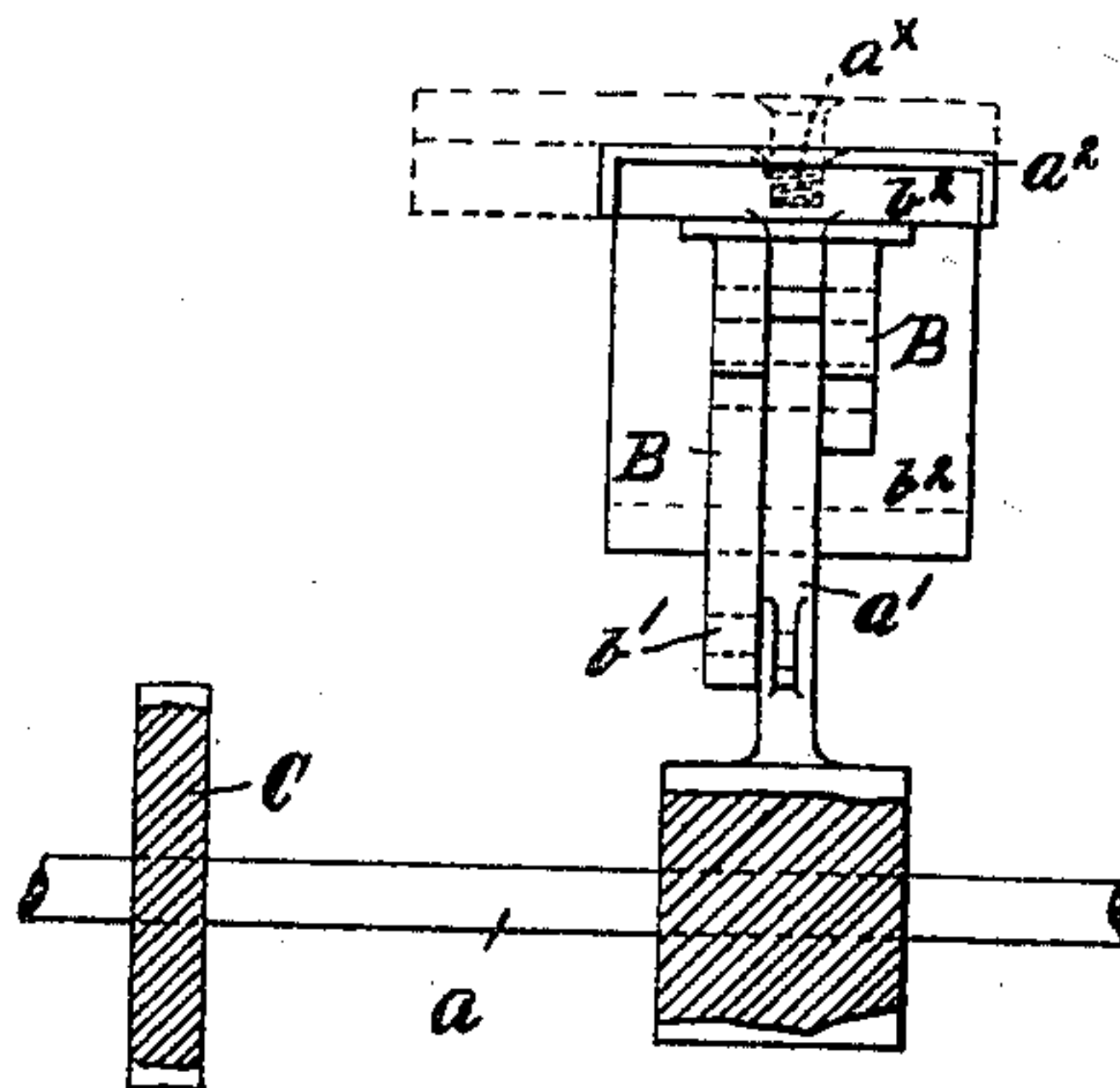


Fig. 33.

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UNITED STATES PATENT OFFICE.

ALFRED GODFREY, OF LONDON, ENGLAND.

PAPER-BOX MACHINE.

SPECIFICATION forming part of Letters Patent No. 622,678, dated April 11, 1899.

Application filed May 24, 1897. Serial No. 637,948. (No model.)

To all whom it may concern:

Be it known that I, ALFRED GODFREY, residing at London, England, have invented an Improved Machine for the Manufacture of
5 Cardboard Boxes or the Like, of which the following is a specification.

This invention relates to machines for the manufacture of boxes of cardboard or other equivalent material, and has for its object the
10 construction and arrangement of a mechanism whereby a blank of cardboard or other material is fed into the machine either by hand or automatically and is therein creased and folded. The edges to be joined are coated
15 with an agglutinant pressed into position and dried and the completed box delivered from the machine automatically by a continuous series of steps in the cycle of operations.

To carry my invention into effect, I arrange
20 a series of "formers" upon any suitable support adapted to revolve about an axis. To each of these I apply a gripper to receive and hold the blanks of cardboard or other material, so that as the formers revolve about the
25 said axis the blanks are first folded down on one or two sides by the action of curved plates or other similar and equivalent devices during the relative movement of the formers and plates to one another. The further rotation
30 of the said former then folds down the flap to be coated with the agglutinant by contact of the blank with a second series of curved folding-plates, after which the edge of the blank folded down comes into contact with a roller
35 carrying the agglutinant on its periphery. The further rotation of the said former folds the fourth flap down upon the adhesive edge, the two edges being pressed into contact by passing under a roller adapted with spring or
40 other pressure to force the two edges into intimate contact during their passage thereunder. This pressure-roller may, if desirable, be heated to accelerate the drying of the agglutinant. The further rotation of the
45 box-former causes the gripper to be released and brings the edge of the completed box against the end of a stripping device which retains the box, strips it from the box-former, and finally delivers it down a chute or other
50 equivalent arrangement. If it is desirable to crease the cardboard or other material to a sharp corner, I arrange one or more rollers

or pressing devices to press against the corner or corners of the box while in position on the former.

The grippers are controlled automatically
55 by a cam or other suitable device to grip the cardboard and release the complete box at the proper periods in the cycle of operations. As it may be desirable to make the grippers grip
60 the cardboard before the box-former moves, I may arrange for an independent movement of the cam or other device to effect this purpose, and I may also apply a spring or springs
65 to the grippers or feed-board to hold the cardboard in position until the grippers take firmly hold of the blank.

In order to remove the roller carrying the agglutinant out of the sphere of operation, except for a certain period when the box is
70 passing in proximity to it, I arrange the said roller so that it is drawn away from operative position automatically by a cam or other equivalent mechanism.

The feeding of the blanks to the box-formers
75 is effected by rotary feeding-arms or equivalently by a feeding device which reciprocates, so that the blank situated on the feed-table is pushed onto the formers under the gripper. I may, if desirable, arrange a traveling tape
80 or an inclined board to feed the blanks down onto the feed-board, from whence they are pushed into the grippers by the said rotary arms or reciprocating feed device.

To obtain accuracy of side lay, I may employ
85 a side-lay device, preferably operated automatically by the machine. These blanks can be placed onto the feed-board by hand, or, equivalently, they may be fed forward automatically by suitable mechanism from a pile
90 of boards.

A convenient method of operating the machine is by means of a ratchet-wheel and pawl, the wheel having a corresponding number of
95 teeth to the number of box-formers employed, the ratchet being carried by an arm or lever upon the axle of the support carrying the box-formers, so that the movement of the arm through a given arc produces the movement
100 of the former through its proper increment of revolution to produce each step in the cycle of operations. The movement of the feeding device may be effected in a similar manner, but in alternate intermittent movement with

the former, so that when the feeding takes place the box-former is still and when the said former moves the feeding device is not feeding blanks to the formers.

5 In order that my invention may be the better understood, I will now proceed to describe the same in relation to the accompanying drawings, hereunto annexed, reference being had to the letters marked thereon.

10 Like letters refer to like parts in the various figures.

Figure 1 is a side view of the machine. Fig. 1^a is a view similar to Fig. 1 with the side frame of the machine removed. Fig. 2 is an end view of same. Fig. 2^a is a plan view of the machine. Fig. 3 is a detailed view of the whole mechanism detached from its frame. Figs. 4 and 5 are similar views of the feeding mechanism. Fig. 6 is a side view of the mechanism for driving and controlling the gluing and pressing rollers. Fig. 7 is a view of the cam fitted with means for altering and adjusting its peripheral surface for making boxes of different depths. Fig. 8 is a diagrammatic view of the former, gripper, cardboard, and first-bending device ready to commence the first step in the series of operations. Fig. 9 is a side view of same, the direction of travel of box and former being shown by the arrow. Fig. 10 shows the card after the first step, the top corners of the box being pressed by rollers into proper shape against the former. Figs. 11 and 12 show the under bending device performing the second step. Fig. 13 shows a spring for bending down the narrow right-hand flap ready to receive the glue. Fig. 14 shows the bottom corners being pressed by rollers and the gluing-roller applying the glue to the flap. Fig. 15 shows the side springs which press the sides of the box against the former while the left-hand flap is pressed down upon the glued edge of the right-hand flap. Fig. 16 shows the jointed box passing under the pressing-roller. Fig. 17 shows the former being stripped of its formed box by the chute. Figs. 18, 19, and 19^a show views of a modified former, combined with special springs for forming the corners perfectly square and planishing them. Fig. 20 illustrates a modified form of gearing for rotating the gumming-roller. Fig. 21 is a side elevation of modified devices for bending over the cardboard about the former, the arrow indicating the direction of spring-pressure. Fig. 22 is an end view of the same as they appear behind one another. Fig. 23 is a separate view of the back device apart from the front device. Fig. 24 is a side elevation of a lubricating device for applying oil to the former to prevent any agglutinant which may come in contact with the former from adhering thereto. Fig. 25 is an end elevation of the same. Fig. 26 is a plan of the feed-table, showing the lay or guides. Figs. 27, 28, and 29 are detail views showing the formers in various positions. Fig. 30 is a detail view of the adjustable side frame A'.

Fig. 31 is an end elevation of the same. Fig. 32 is a detail view showing the method of detachably attaching the formers to their arms to allow the exchanging of the various-sized formers to suit various-sized boxes. Fig. 33 is an end elevation of the same, but with dotted lines indicating formers of increased width and depth.

Upon a suitable framework A, I mount a shaft *a*, which carries a series of arms *a'*, upon which formers *a''* are arranged. These formers are the devices upon which the boxes are made and in the present case are four in number. Each former has arranged in connection with it a pivoted gripper B, which is adapted to hold the cardboard on the former by means of a spring *b*. Each gripper B has an extending arm, on which is situated a tripper-stud *b'*, which is arranged to coact with a cam-surface E in order to control the grippers.

Upon the shaft *a* I fixedly mount a ratchet-wheel C, having as many teeth as there are formers or grippers. In connection with this ratchet-wheel I arrange a pawl-lever *c*, carrying a pawl *c'* to engage with the ratchet-wheel. The pawl-lever *c* is operated by a connecting-rod *c''* from a disk-crank D, mounted on a shaft *d*, the throw of the crank D being such as to move the pawl-lever *c* through an angle of ninety degrees.

The cam E for operating the grippers is in the form of a sector of a circle and is provided with a boss by which it is loosely engaged upon the shaft *a*. The upper or leading-on edge *e* is beveled off to permit of the gradual engagement therewith of the tripping-studs *b'* of the grippers B. The cam E is normally held in position by resting upon an abutment *e'*, carried by the framing A. This abutment can be provided with a screw for adjusting the normal position of the cam. It will be observed that as the arms *a'* rotate the tripping-studs *b'* engage with the cam E at the point *e*, thus opening the grippers and maintaining them in an open position until the studs *b'* trip over the end of the cam E. Upon the cam E, I mount a projecting arm F, which is adapted to come into contact with the pawl-lever *c*, so as to engage with the cam E and turn it about the axis of the shaft *a* when the lever *c* is reaching the left-hand end of its arc of movement on the return stroke in such a way that the tripping-stud of the gripper B which is at the time engaged by the lower end of the cam E shall when the cam is moved about its axis be tripped over the end of the cam, and thus allow the gripper to be closed by its spring. From the pin *c''* of the connecting-rod *c''* I take another connecting-rod G to a pawl-lever *g*, having a pawl *g'*, which is adapted to engage with a ratchet-wheel *g''*, situated on the shaft *g''*.

Above the shaft *g''* I arrange a feed-table H, which extends from the front of the machine down to the circular path of the grippers, and upon the shaft *g''* I mount a pair of cruciform devices, one on each side of the

table, each having four feeding-arms h' and each arm having a recess or notch situated at its outer end.

It will be seen that the ratchet-wheel C and the ratchet-wheel g^2 are disposed in the converse position to one another, by which it follows that when the one is being operated by its pawl the other is stationary, the pawl of the latter slipping up the inclined face of the ratchet-tooth ready to make the next movement in the opposite direction.

A blank of cardboard for forming the box is laid upon the feed-table H, and one pair of the feeding-arms h' pushes the cardboard off the feed-table into the gripper, which is held open by its tripping-stud engaging on the cam E, and in order that the feeding-arms h' shall not continue to move any farther after the gripper has closed I arrange special mechanism for restraining such farther movement. This mechanism consists of a restraining-cam K, fixedly attached to the shaft g^3 , as also are the feeding-arm h' and a driving-collar k . The ratchet-wheel g^2 is loosely engaged upon the shaft g^3 and drives the collar k through a spring carried thereon, the end of which spring engages with two adjusting-screws k' , carried by the collar k . (See Fig. 5.)

Upon a suitable part of the framework I pivotally mount a pawl k^2 , one end of which engages with a restraining-cam K, and the other end engages with an eccentric k^3 , carried by the shaft a , the pawl being kept in contact with the periphery of the eccentric by means of a spiral spring k^4 .

On the under side of the gripper when in its lowest position I arrange two inclined bending devices L, which are pivotally connected to the framework A and are spring-pressed by the spiral spring l , attached thereto. These devices are situated one on each side of the former and are adapted to bend the laterally-projecting parts of the cardboard blank down upon the former. This operation is illustrated diagrammatically in Figs. 8 and 9. Immediately to the right-hand side of the bending devices L, I arrange rollers M, which are preferably made of india-rubber or other equivalent material in order to compress the edges that have been formed by bending the sides down. This step is illustrated diagrammatically in Fig. 10. To the right of the roller M in Fig. 3 I arrange a second set of bending devices N, inclined in an opposite direction to the bending devices L. These devices N are also pivotally mounted and spring-pressed by the springs n . Their approximate form and function are illustrated diagrammatically in Figs. 11 and 12, from which it will be seen that they bend the downwardly-disposed flaps of cardboard around the bottom corners of the former. Two further rollers m , similar to the rollers M, are adapted to roll the lower corners of the box upon the former. As the former and gripper move in their revolu-

tion the narrow flap of the box on the right-hand side is further folded down by passing under the spring n' , which step is diagrammatically illustrated in Fig. 13. A gluing-roller O is arranged to apply liquid glue to the edge of the narrow flap, as illustrated diagrammatically in Fig. 14, the left-hand flap of the cardboard being held away from the gluing-roller by a guard m' . On the further movement the wide flap on the left-hand side is brought down upon the narrow glued flap by means of the spring o , mounted on the framing, the sides of the box being kept up against the former by side springs o' , also situated on the framework A. This is diagrammatically shown in Fig. 15. The box then passes under the pressing-roller P in order to force the flaps of the box into contact with one another, which is shown diagrammatically in Fig. 16. I arrange a series of springs upon the frame A, which maintain a pressure upon the jointed flaps after they have passed from beneath the roller m . The further movement of the box drives it up between the sides of the chute p , where it comes in contact with stops p' , arranged upon the chute. When the box arrives at this position, the gripper B opens by its tripping-stud b' , having engaged with the cam E, and as the former continues to move the box is stripped from it and finally rests upon the tail b^2 of the succeeding former, which by its curved form allows the leading end of the box to tilt itself up to clear the stops p' , so that on the next movement of the machine the completed box is sent down the chute p . The box being stripped from its former is diagrammatically illustrated in Fig. 17.

As it is desirable that the gluing and pressing rollers O and P should not come in contact with any part of the machine and only with the box when it is situated beneath them, I have devised a special mechanism to effect this purpose. This consists of a cam-roller Q, which is fixedly mounted upon the shaft a and which is provided with flats which coincide with the outer face of the formers. The shaft q of the pressing-roller P is carried upon a lever q' , pivoted on the frame A, and carries a wheel q^2 , which is adapted to engage with a cam Q. The lever q' is spring-pressed by a spring q^3 . The gluing-roller O is adapted to revolve in a tank R for holding liquid glue, the roller O being mounted upon a shaft r , carried in bearings on the tank R. Upon the shaft r I arrange another wheel r' , which is adapted to engage with and roll upon the cam Q, so as to control the position of the gluing-roller O.

The tank R is mounted upon a lever r^2 , pivoted to the frame A, and is pressed upward by a spring, so as to force the wheel r' against the cam Q. This arrangement is diagrammatically illustrated in Fig. 6, and it will be seen from Figs. 3 and 6 that this arrangement only allows the gluing and pressing rollers to en-

ter their sphere of action when and only when a former is situated or is moving in their proximity.

In Fig. 20 I show the gluing-roller O positively driven by means of a chain-wheel o^2 , carried fixedly by the shaft a and driving a train of wheels o^3 , which are geared with the gluing-roller O, the lowest wheel of the train being pivoted about an axis which is coincident with the axis of the lever r^2 , which carries the glue-tank R.

In order to provide a simple means of adjustment for varying the periphery of the cam Q, so as to deal with boxes of varying depth, I arrange movable pieces S with means for adjusting them outward at varying distances from the center, and in order that all four may be moved out simultaneously and to the same extent I fit a four-faced cam s upon the shaft a , the faces of which engage with the ends of the movable pieces S. When any definite position has been obtained, the movable pieces S may be rigidly fixed in their position.

The formers a^2 are, if desirable, detachably connected to the arms a' by screws a^x , so that formers for boxes of various sizes may be fitted to the machine.

In order to allow of formers of various widths being used, I arrange the various bending and holding devices so that those on one side are fixed on the main framework A, while those on the other side are fixed upon a part of the frame A'. The framework A', carrying one set of bending and folding devices, is adapted to slide upon the main framework A and to be adjusted in position by means of the nut A², carried by the framework A', which coacts with the adjusting-screw A³. The latter is held in position by means of the supporting-clamp A⁴, attached to the frame A.

In order to form the edges of the boxes perfectly square or with a projecting corner, I may construct the formers with sides having projecting edges, such as those shown in Fig. 18, or the formers may be made with the spaces of hollow formation, the object being to bend the cardboard to less than a right angle in order that when the box is complete its sides shall be flat and its corners right angles, and thus avoid a barrel formation. Further, this arrangement so sets up the corner as to conceal the edge of the flap at the joint. In conjunction with this former I arrange pressing devices which are elastically controlled and are adapted with contacts suitably shaped to compress the cardboard around the raised corners of the former. This is diagrammatically illustrated in Figs. 18 and 19.

In order to allow for variation in the size of cards cut and to maintain the register of the outside flap to be folded down with the gripper, I arrange on the feed-table a fixed lay X (shown in Figs. 3 and 26) to guide the edge of the outside flap of the box, and on the other side of the feed-table I mount a spring-

pressed lay X', so as to always maintain a fixed feeding position for the outside flap of the box.

In dealing with thick material I substitute the modified bending devices M' for the roller M, hereinbefore described. By reference to Figs. 21, 22, and 23 it will be seen that the devices M' consist of arms which are pivotally mounted on the adjustable frame A' and fixed frame A and are spring-pressed by the spring M² in the direction of the arrow shown in Fig. 21. These arms carry at their ends the bend-ers or folders M³, the first or forward one being a cone and the rearward one being a cylindrical stud with a recessed neck to conform to the shape of the raised edge on the former, as shown in Fig. 18. These devices are situated in pairs on each side of the path of the former, so that they engage the cardboard carried by the same during its passage thereby. A second set of these modified devices M' are arranged in substitution of the rollers m , their angular disposition and direction of spring-pressure being the opposite to that which obtains in the first set hereinbefore described. The relative position of the former a^2 and the angularity of disposition shown in Fig. 21 is that which is used for the devices M', which are substituted for the rollers m .

In Figs. 24 and 25 I have shown a lubricating device Z, which is mounted on the chute p and is adapted to deliver oil drop by drop or to an endless band Z', carried on pulleys Z² and spring-pressed, so as to contact with the former during its passage thereby. The control of the arm Z³, carrying the lower pulley Z², and the driving of the band are effected by a pulley Z⁴, mounted on the shaft Z⁵, carrying the lower pulley Z², the said pulley Z⁴ contacting with the cam-plate Q, so as to drive it and control the movement of the band relative to the former a^2 .

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

1. In a box-making machine, a former or formers adapted to revolve about an axis and having forming edges parallel with the plane of rotation, and a gripper in proximity to each former to grip the cardboard, in combination with stationary bending devices.

2. In a box-making machine, a former or formers adapted to revolve about an axis and having forming edges parallel with the plane of rotation, a gripper in proximity to each former in combination with means adapted to operate and control the grippers during their movement in a circular path and stationary bending devices adapted to fold the cardboard or other material about the former during its movement.

3. In a box-making machine, a traveling former or formers having forming edges parallel with the plane of movement, a gripper to each former in combination with means for controlling the grippers to hold and release

the blanks and stationary means for folding down and bending the blanks.

4. In a box-making machine, a rotating former or formers having forming edges parallel with the plane of rotation, a gripper to each former, means for controlling the grippers, stationary bending devices for folding down and bending the blanks during the movement of the former or formers, in combination with a feeding device adapted to feed the blanks into the grippers.

5. In a box-making machine, a rotating former or formers having forming edges parallel with the plane of rotation, a gripper arranged to each former, stationary bending devices adapted to fold and bend the blanks during the movement of the former, in combination with a gluing device and pressing device to joint the flaps of the box.

6. In a box-making machine, a former having projecting edges, a gripper to the former in combination with a bending device constructed to bend the blank to less than a right angle at the corners of the box around the projecting corners of the former.

7. In a box-making machine, a former or formers adapted to revolve about an axis, a gripper to each former, in combination with

a cam mounted to revolve with the former or formers and gluing and pressing devices.

8. In a box-making machine, a detachable former or formers, adapted to revolve about an axis, a gripper to each former adapted to grip the blank in combination with a cam having adjustable faces to correspond with the number of formers, and gluing and pressing devices adapted to be controlled by the said cam, in order to make boxes of various depths.

9. In a box-making machine, a former or formers, a gripper to each former, in combination with two sets of folding and bending devices, one set being fixed definitely on the main frame of the machine and the other set being mounted on a part of the framework adapted to be laterally adjusted relative to the main framework, to suit formers for making boxes of different widths.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ALFRED GODFREY.

Witnesses:

RICHARD A. HOFFMANN,
CHARLES H. CARTER.