

(No Model.)

5 Sheets—Sheet 1.

F. BOMMARIUS & G. STAUNTON.  
MATCH MACHINE.

No. 407,718.

Patented July 23, 1889.

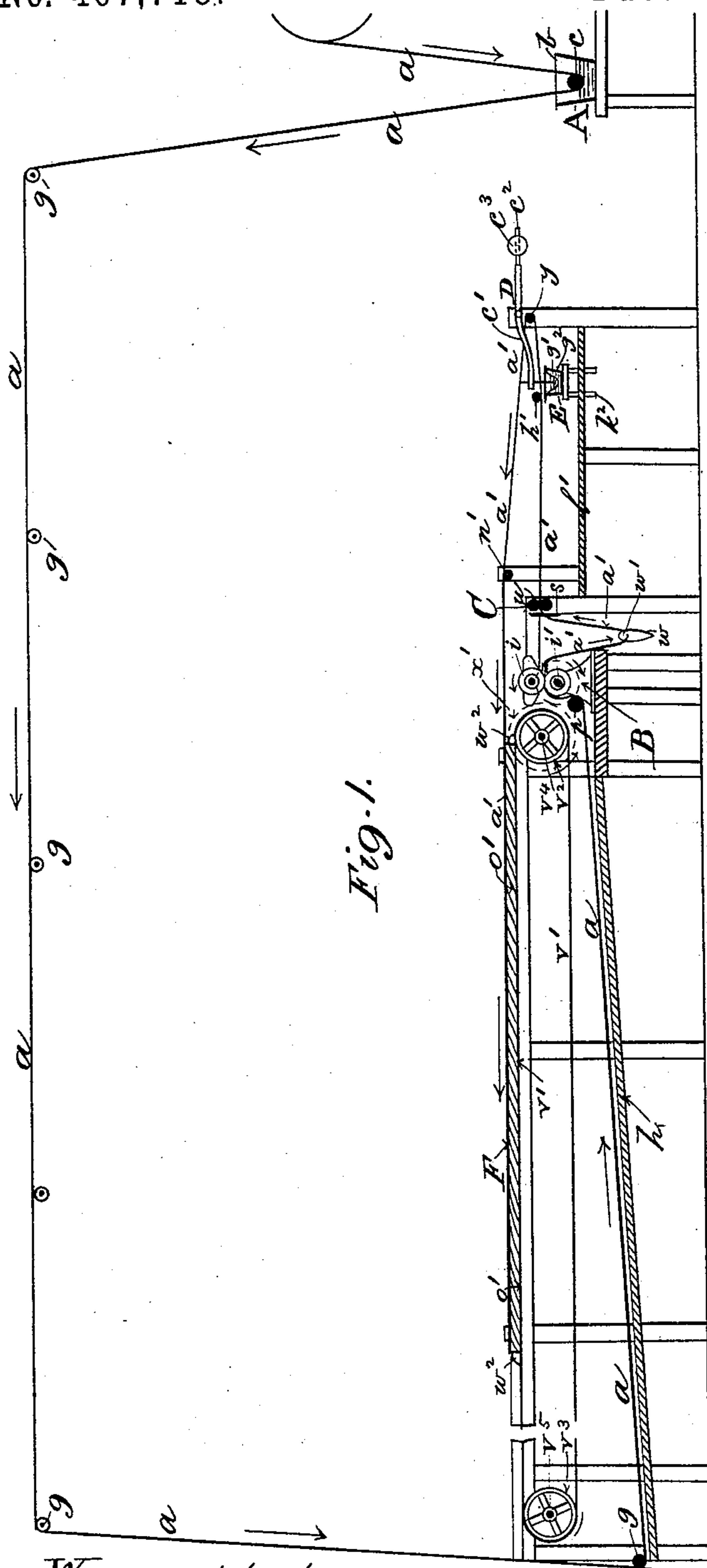


Fig. 1.

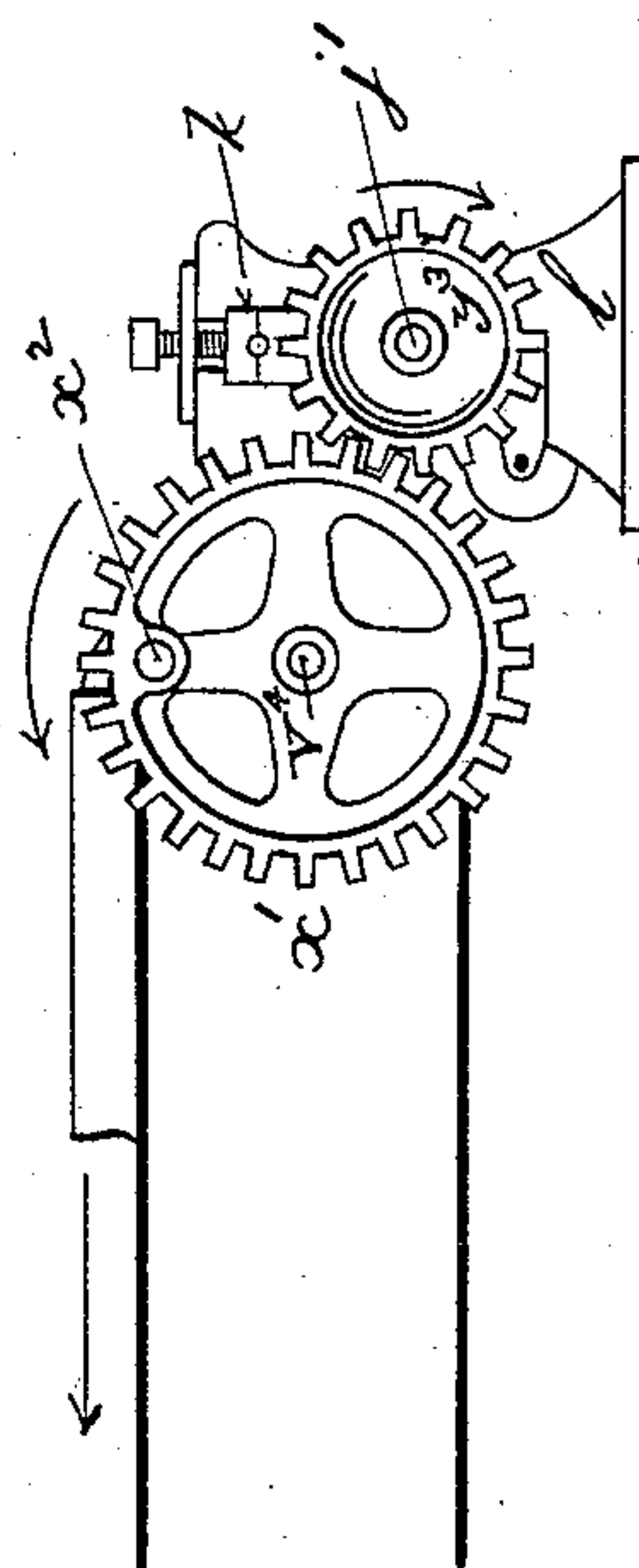


Fig. 18.

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Wm Byrne.

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Gray Staunton &  
Paul Bakewell  
their attorney

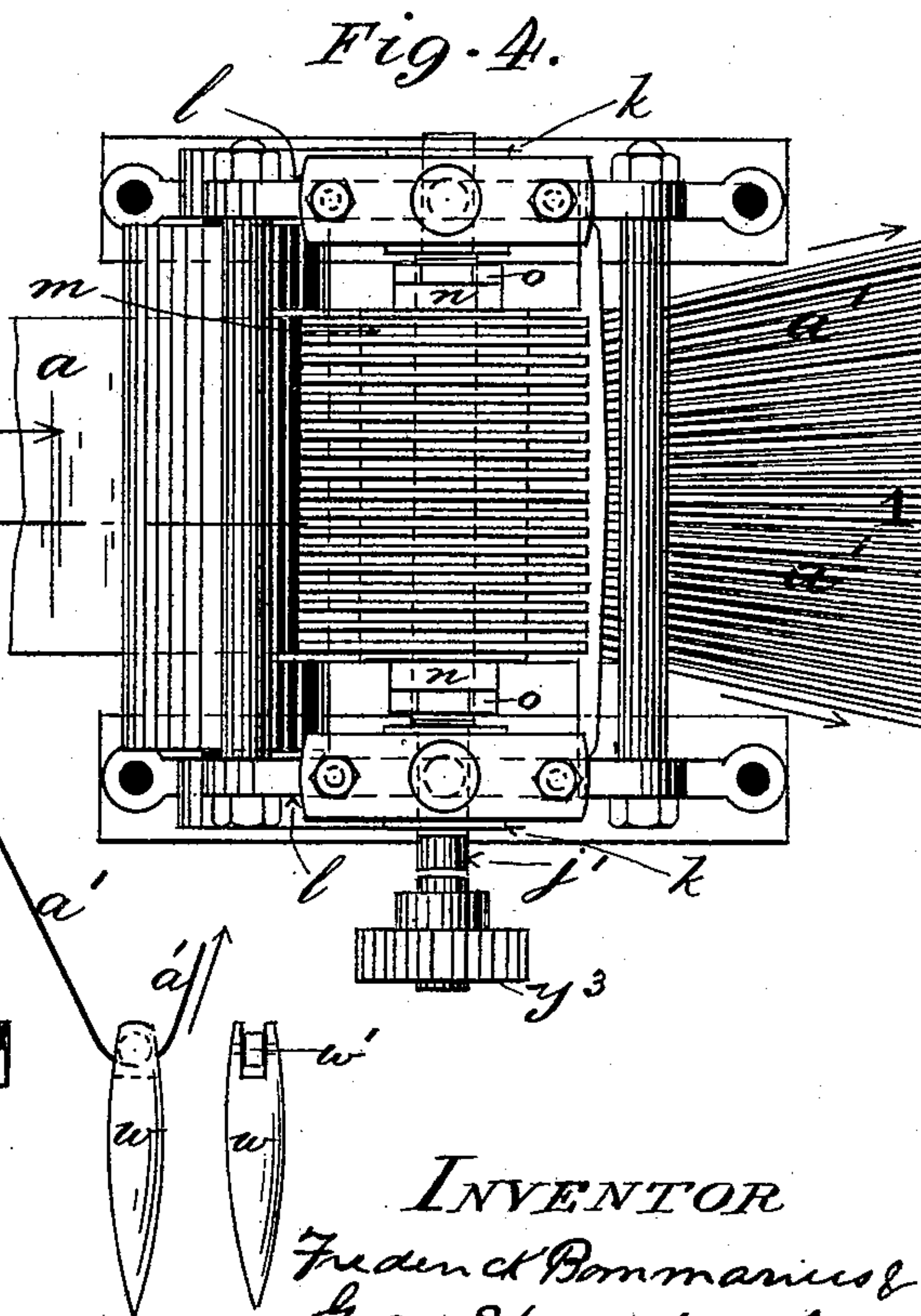
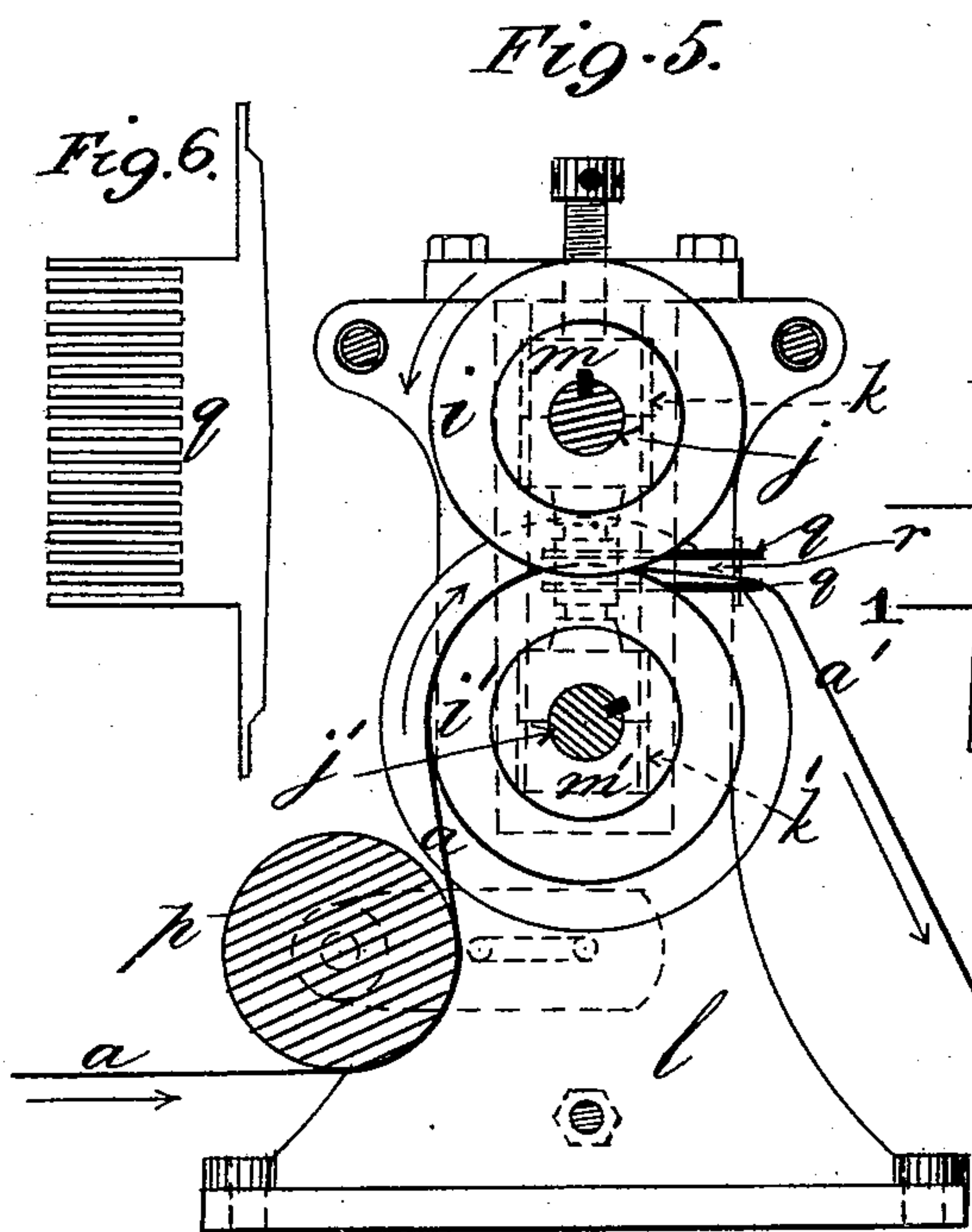
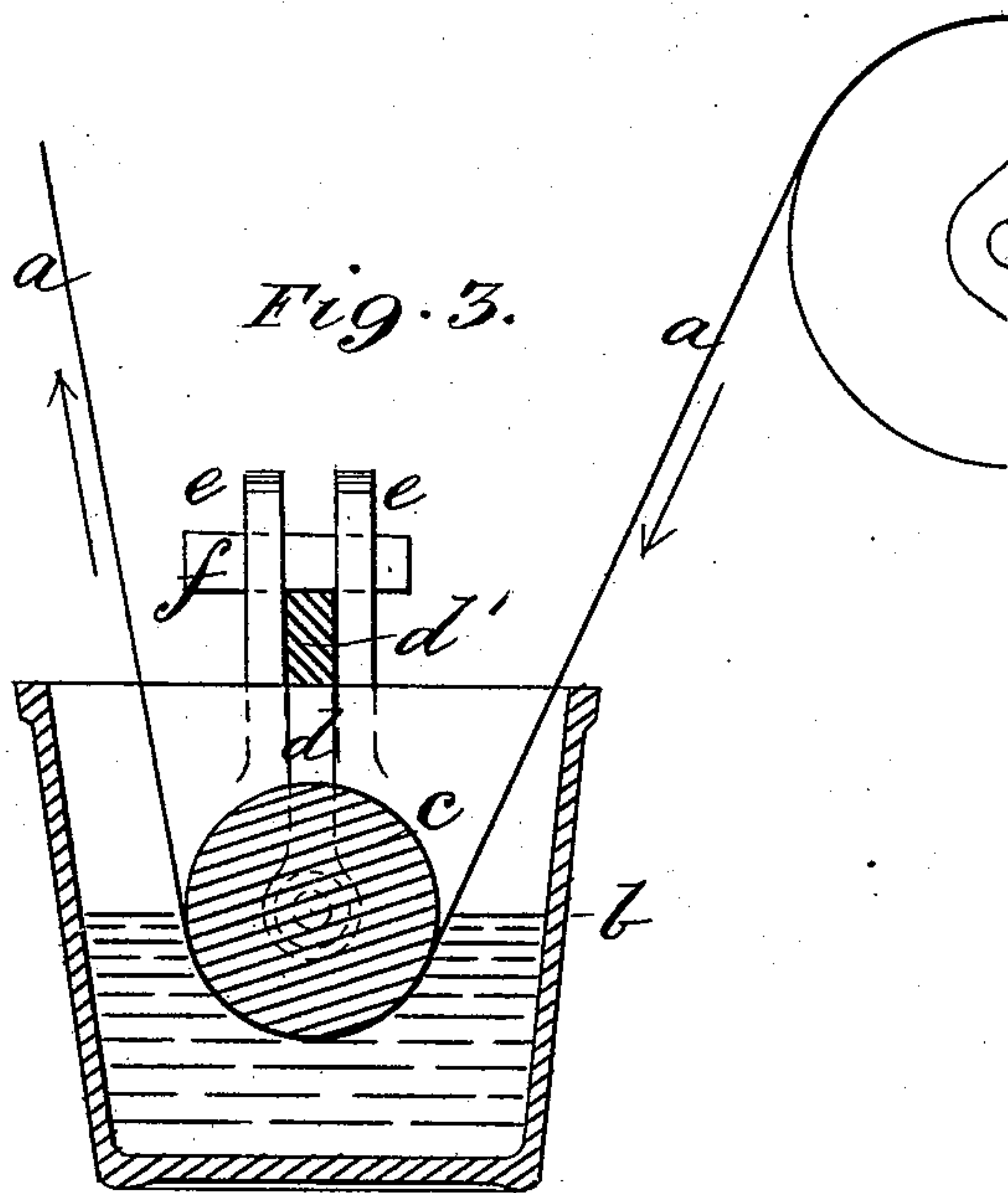
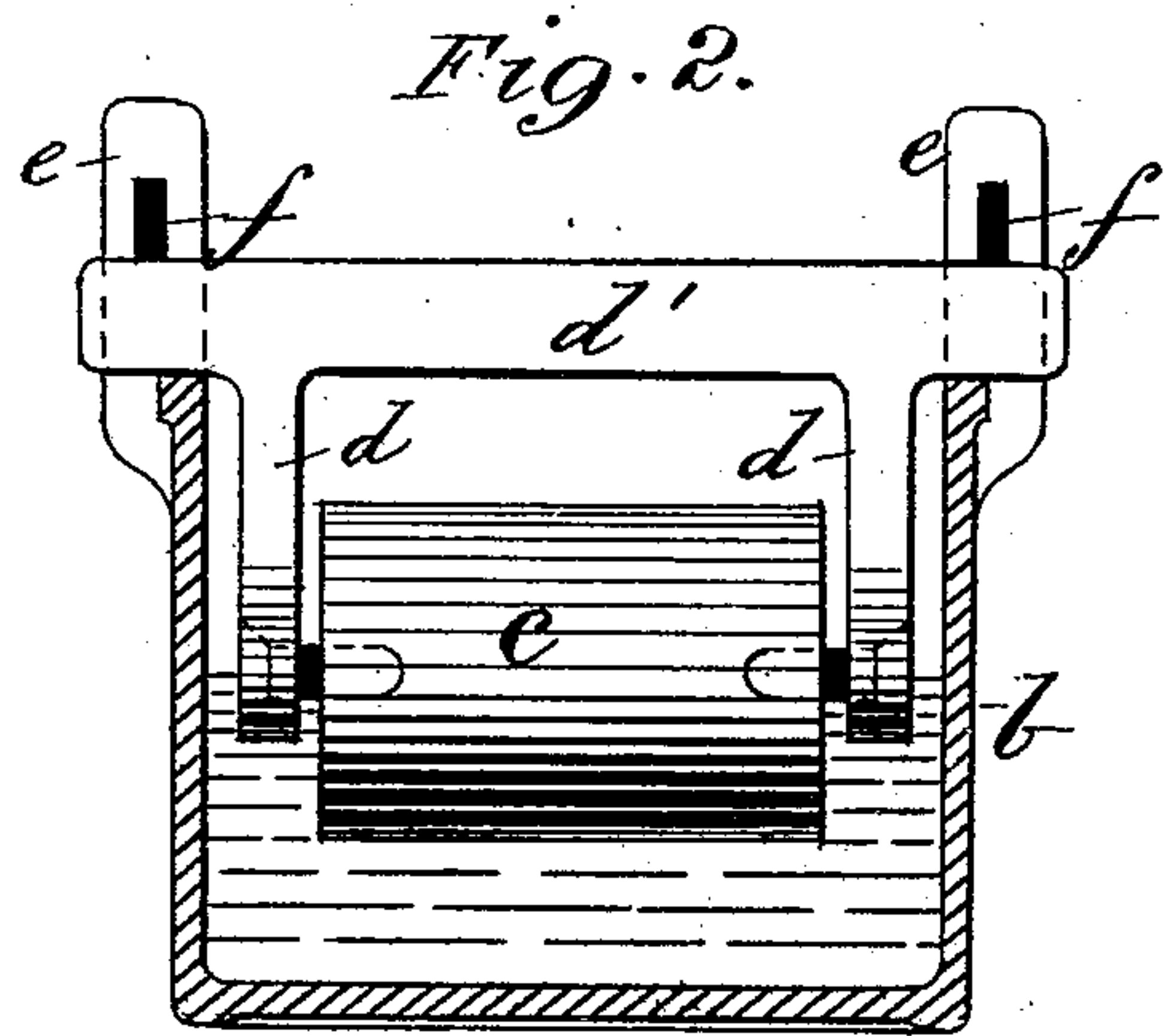
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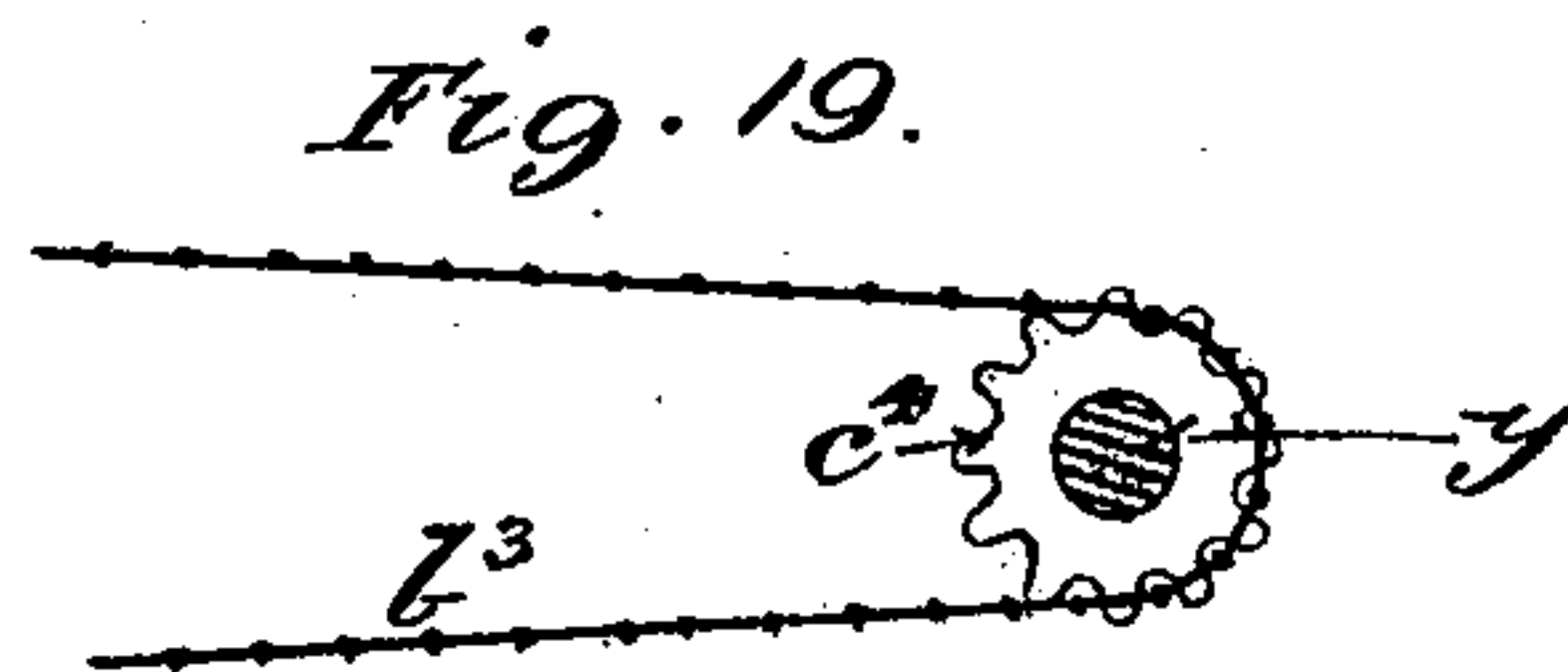
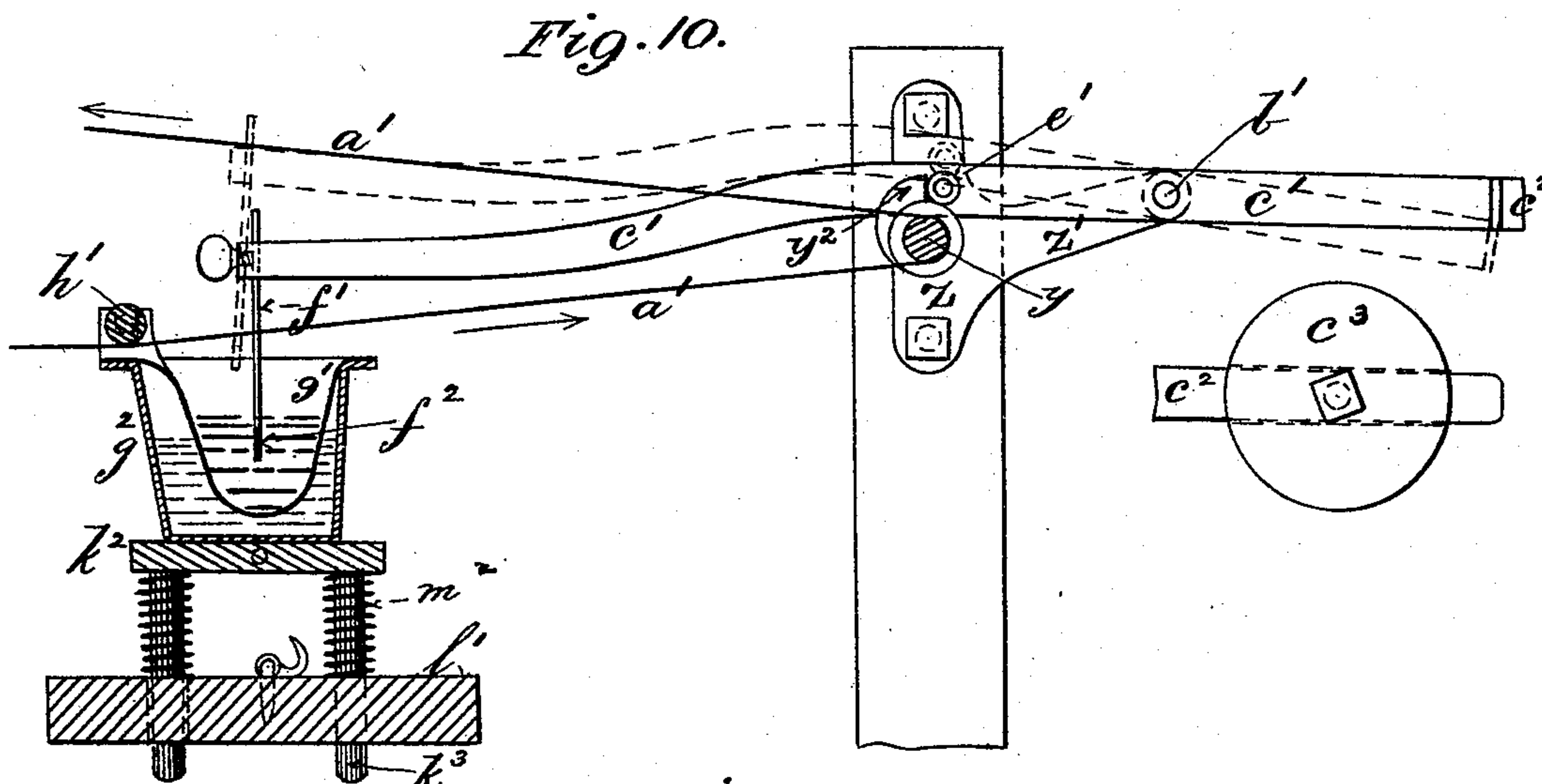
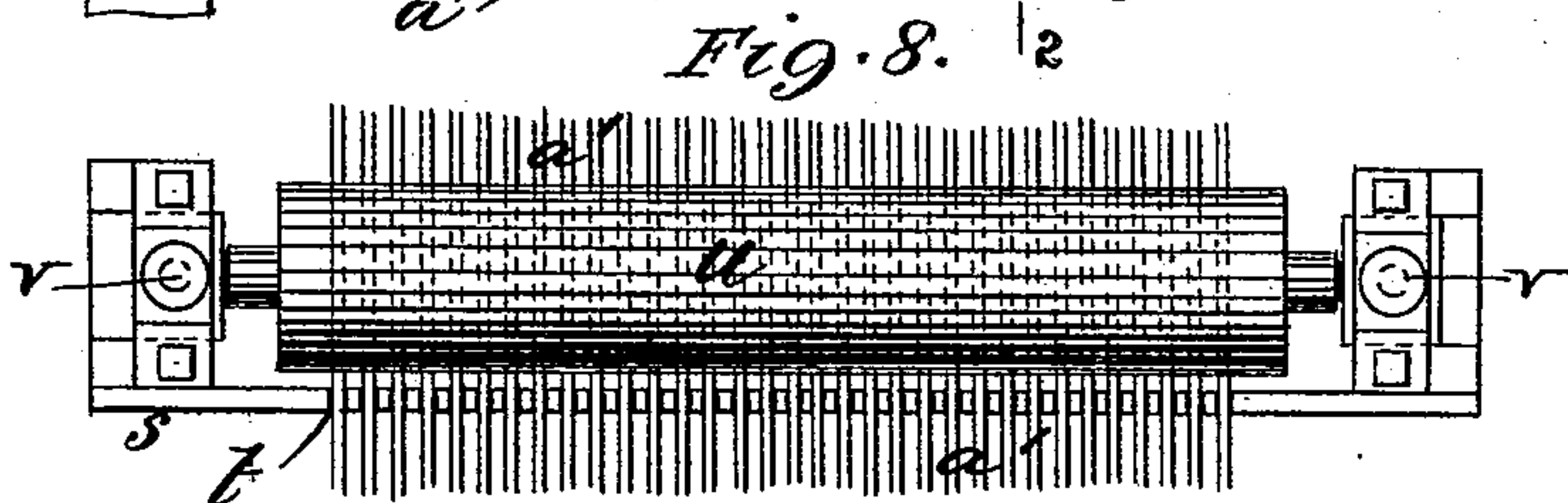
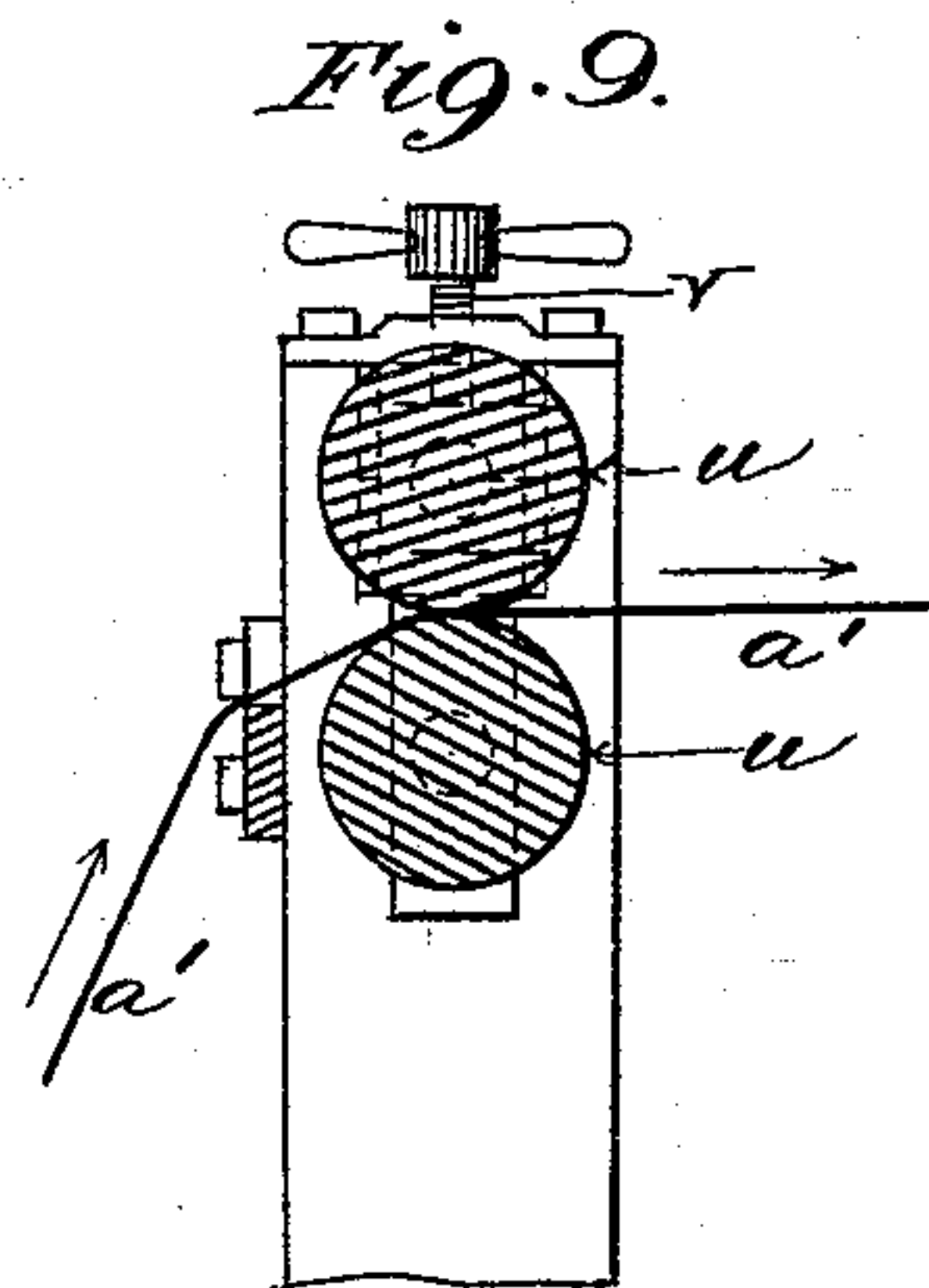
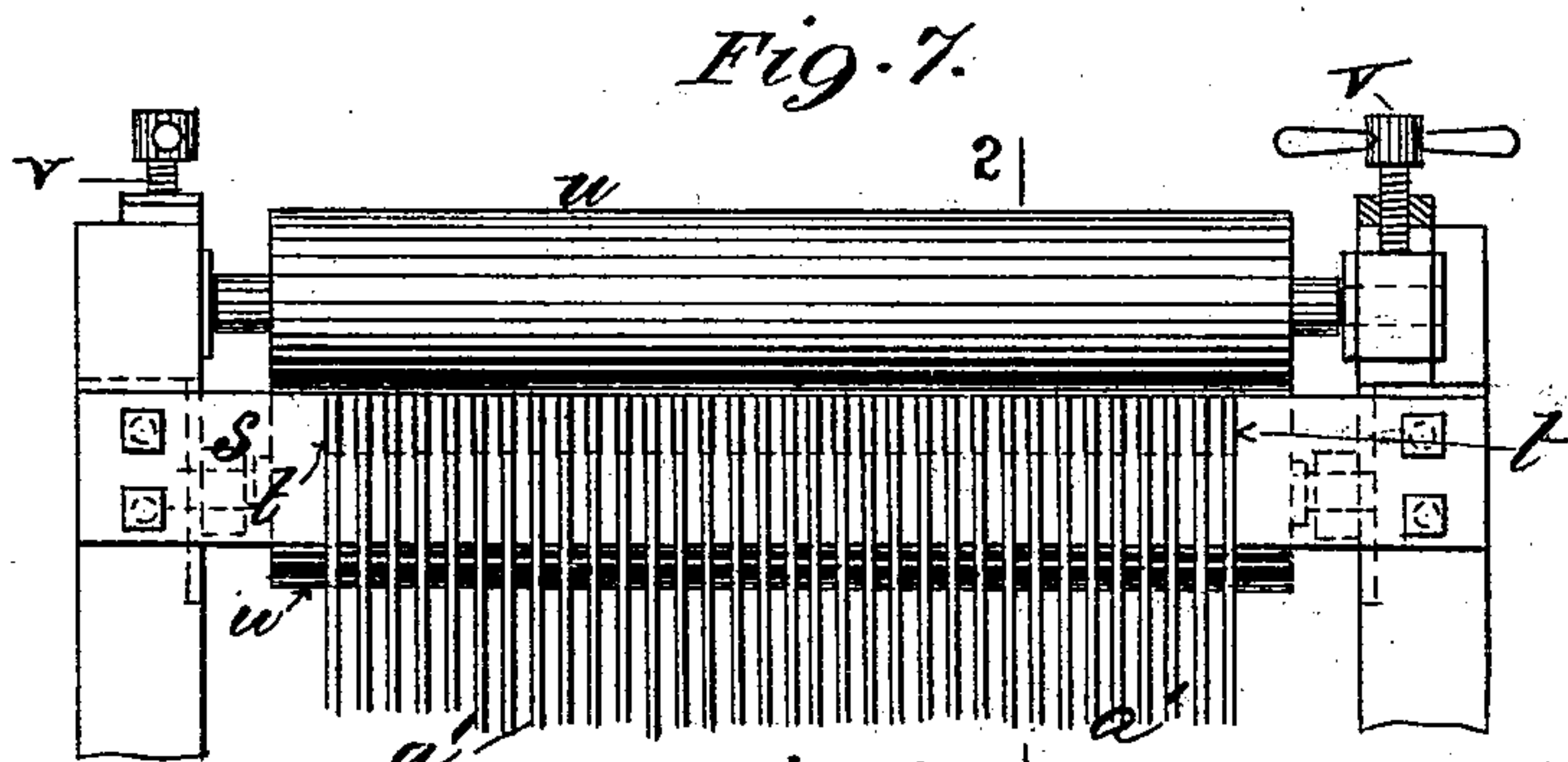
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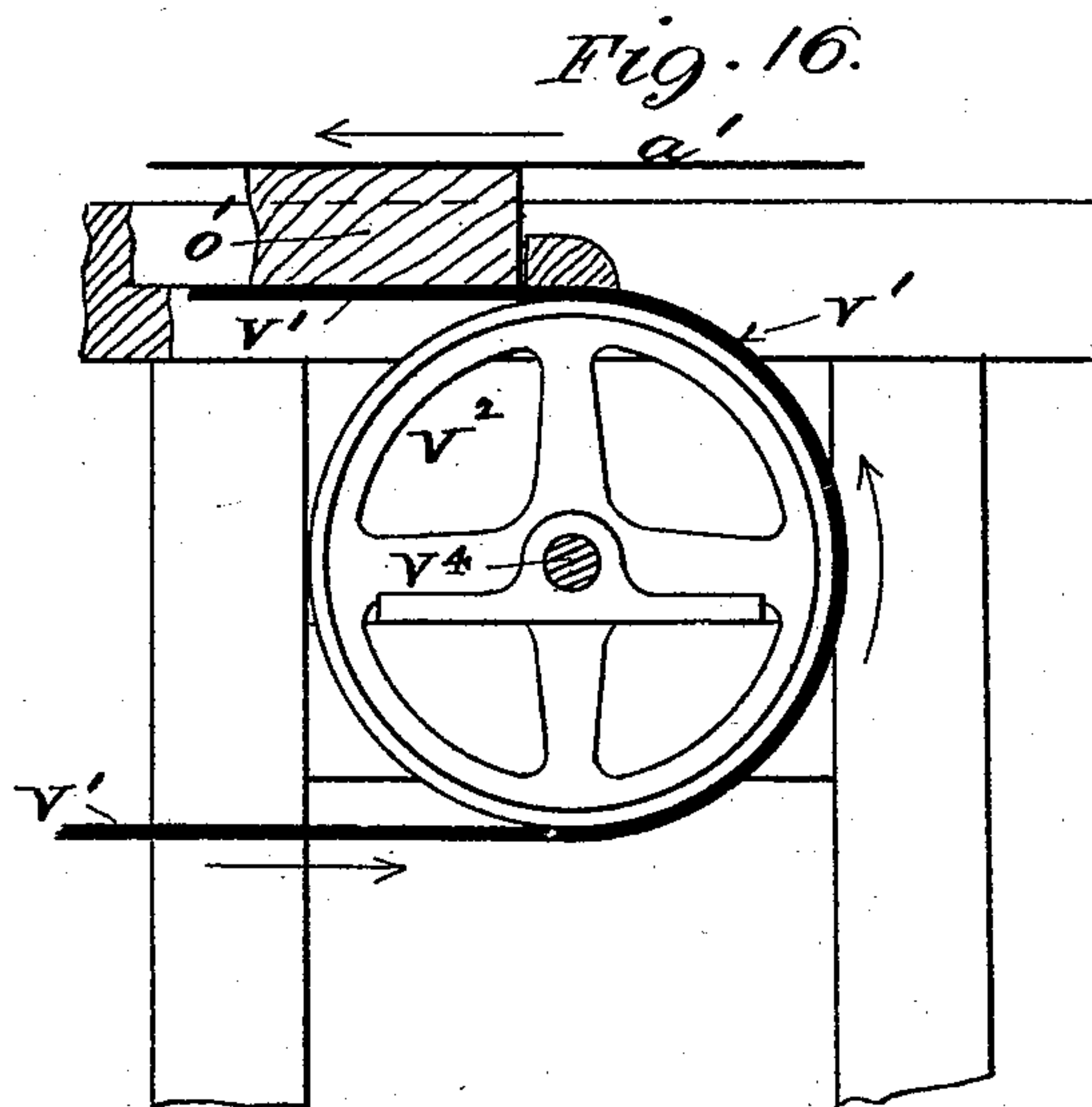
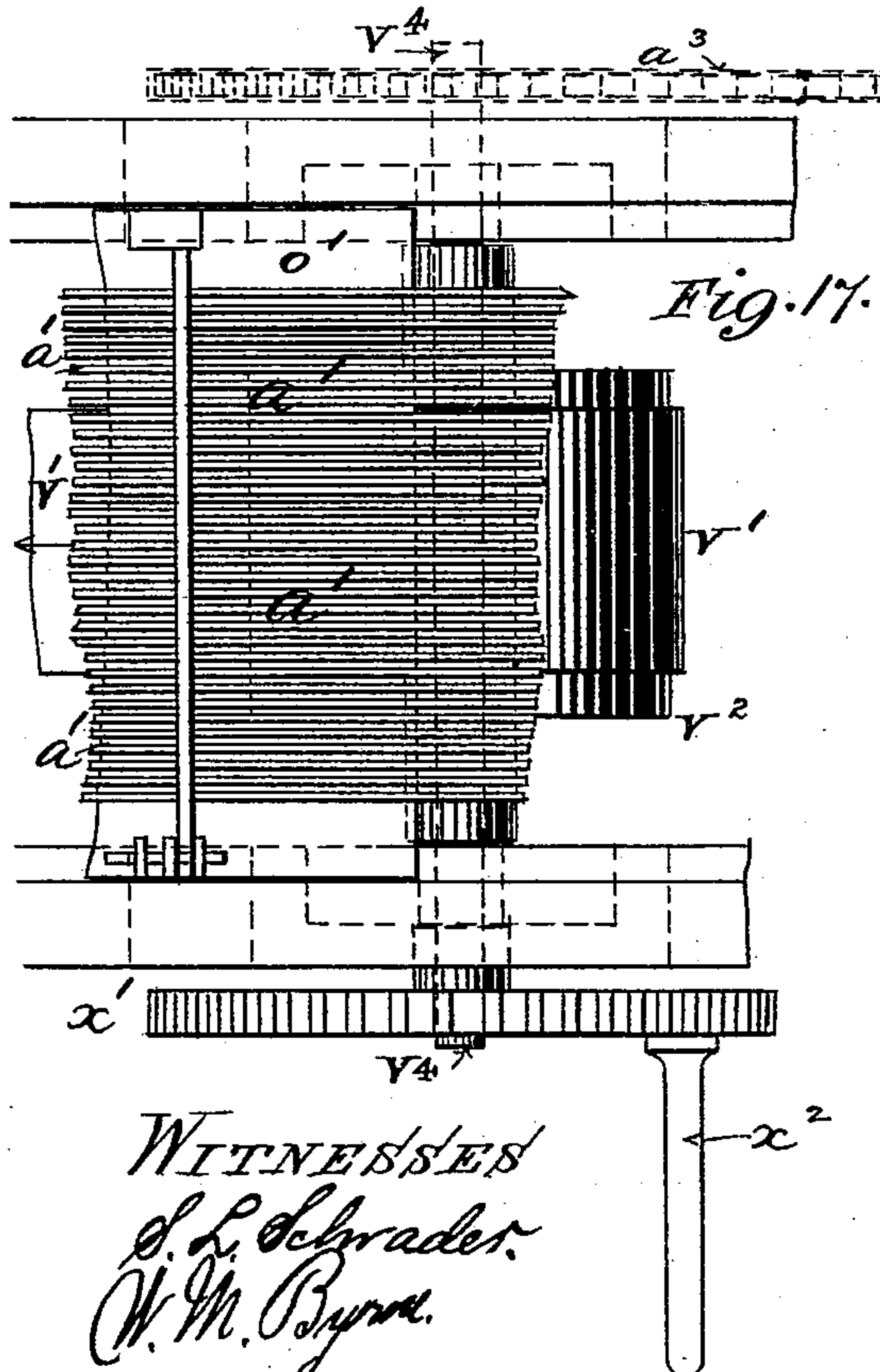
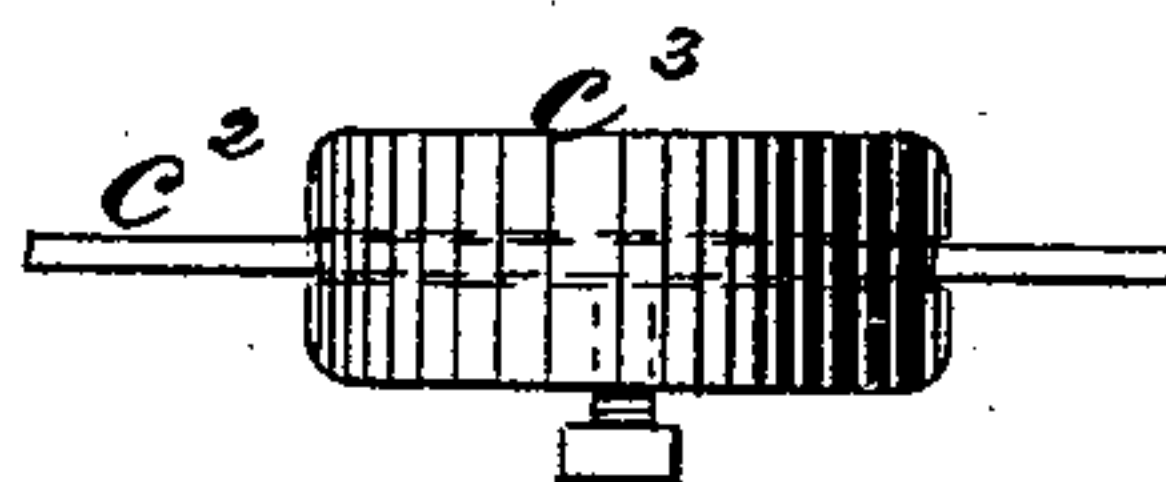
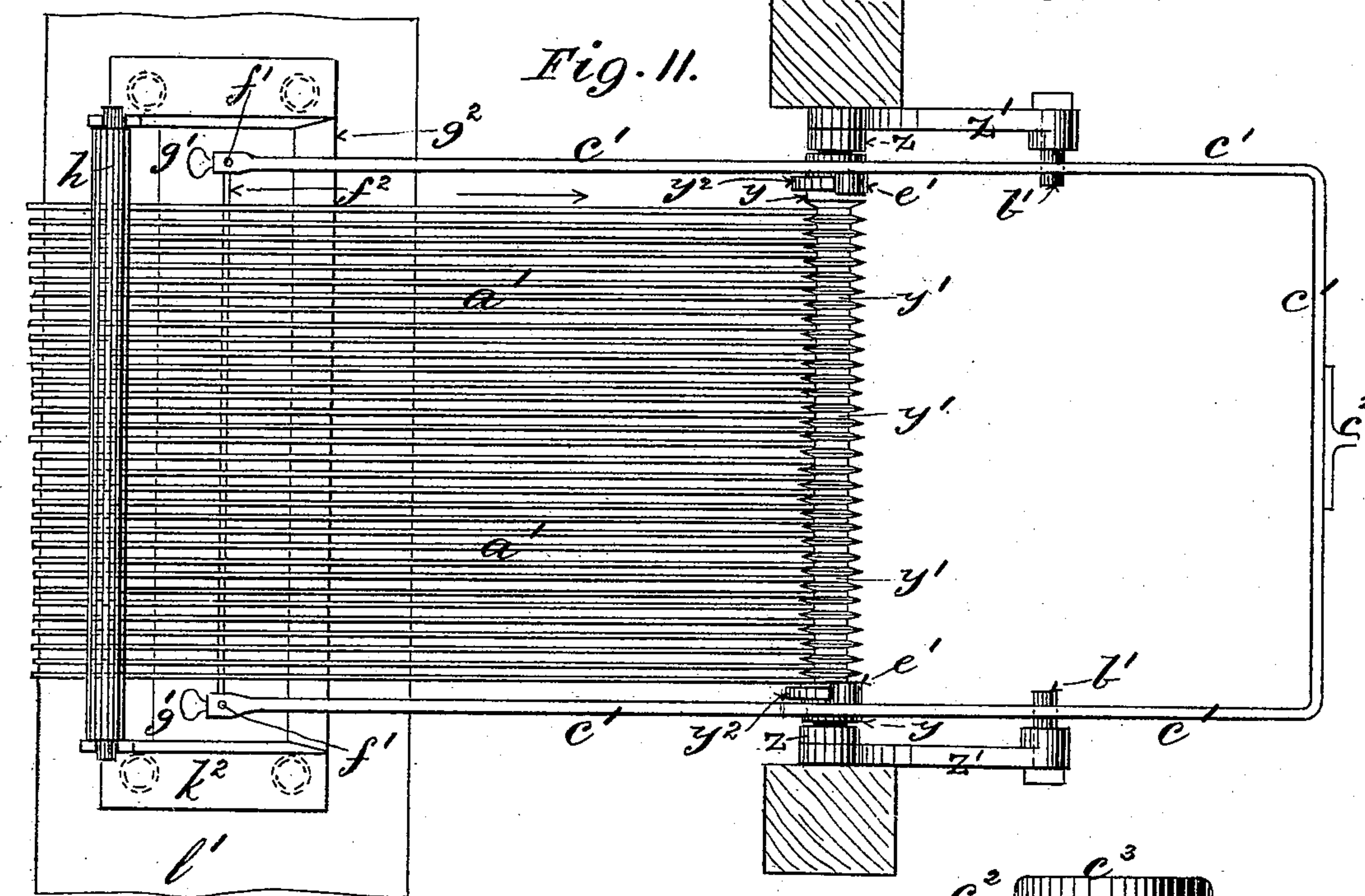
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Patented July 23, 1889.



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(No Model.)

5 Sheets—Sheet 5.

F. BOMMARIUS & G. STAUNTON.  
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Fig. 12.

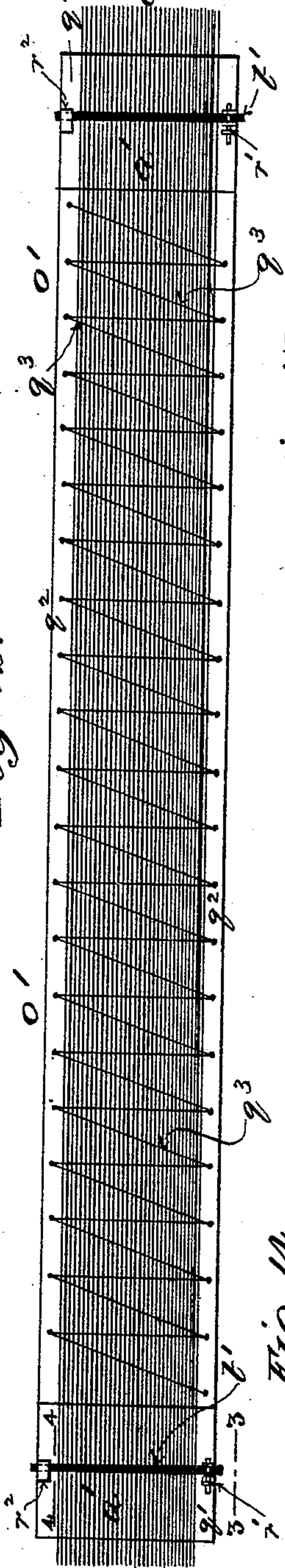


Fig. 15.

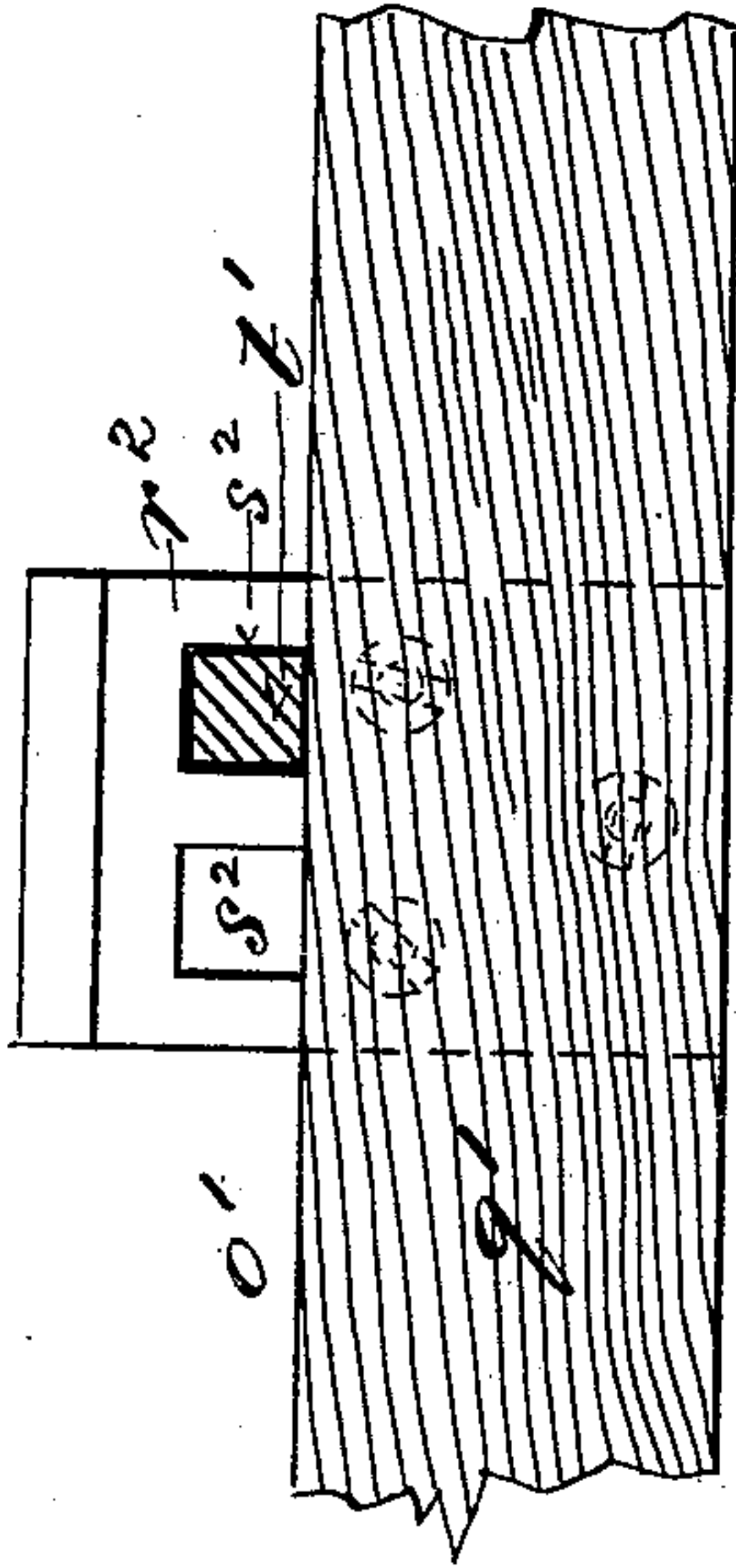


Fig. 14.

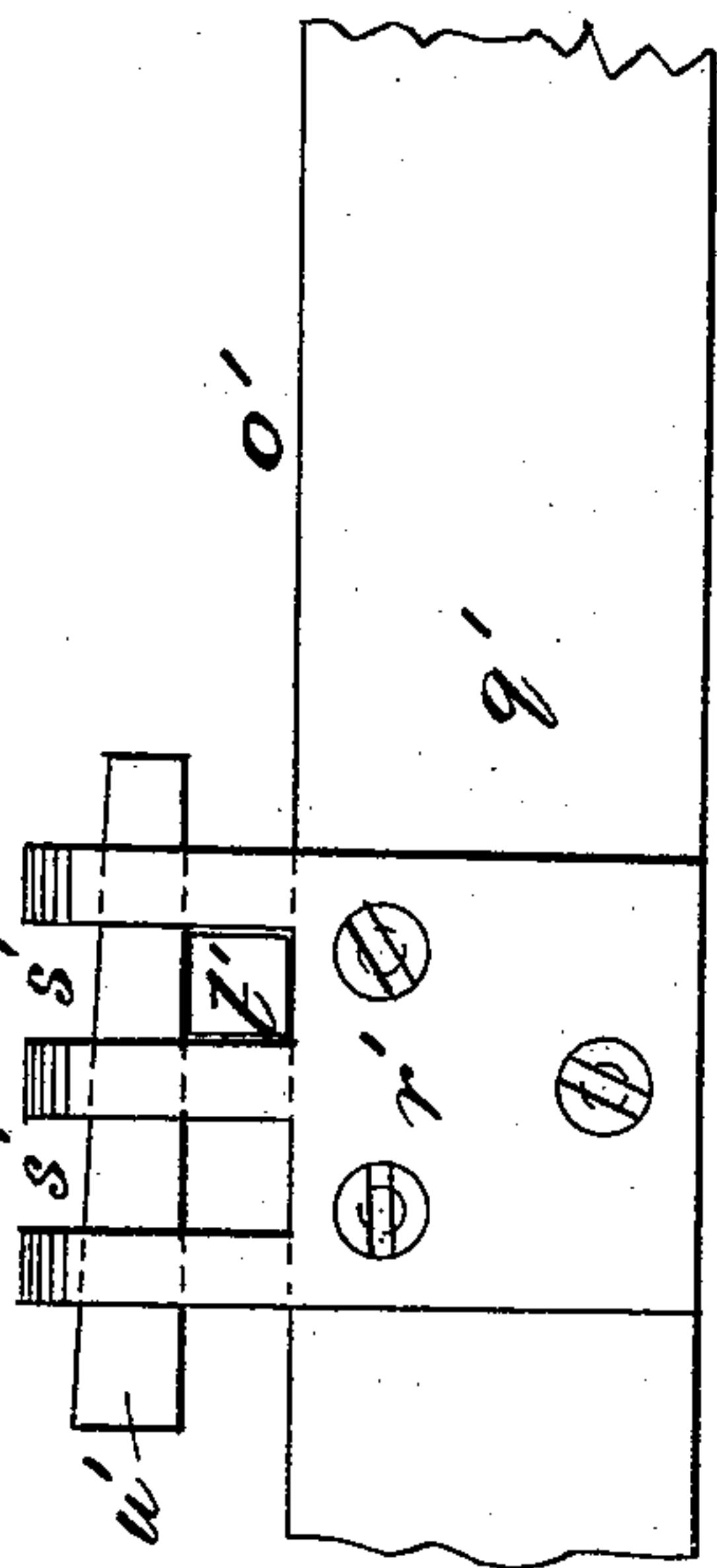
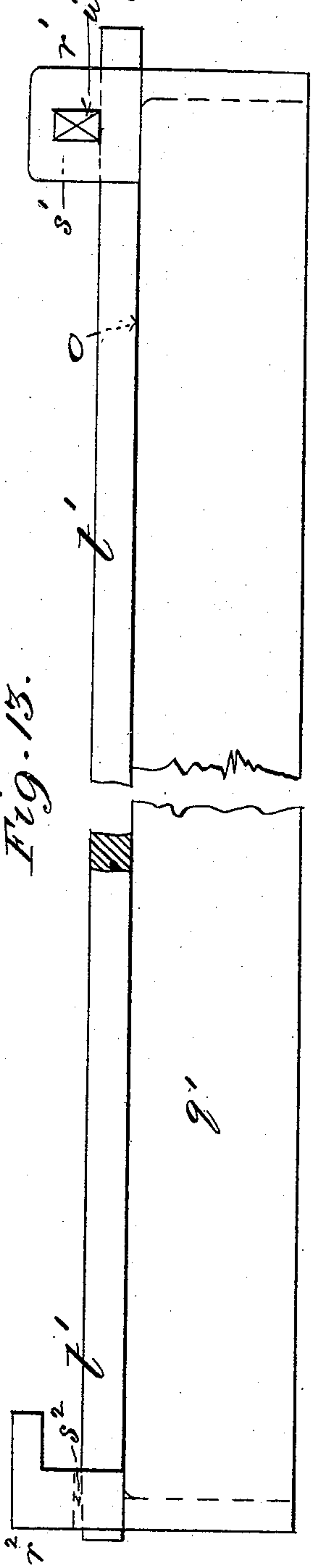


Fig. 13.



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# UNITED STATES PATENT OFFICE.

FREDERICK BOMMARIUS, OF NEW ORLEANS, LOUISIANA, AND GRAY STAUNTON, OF ST. LOUIS, MISSOURI, ASSIGNORS TO THE CARROLL FLEXIBLE MATCH COMPANY, OF MISSOURI.

## MATCH-MACHINE.

SPECIFICATION forming part of Letters Patent No. 407,718, dated July 23, 1889.

Application filed November 23, 1888. Serial No. 291,705. (No model.)

*To all whom it may concern:*

Be it known that we, FREDERICK BOMMARIUS, a citizen of the United States, residing at New Orleans, Louisiana, and GRAY STAUNTON, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Machinery for Manufacturing Flexible Lighting-Matches, of which the following is a full, clear, and exact description.

Our invention relates to improved machinery or apparatus for manufacturing flexible lighting-matches; and it consists in the combination of various special devices comprising a paper roll from which a band of paper is supplied to the machine; a tank or vessel provided with a roller and containing a suitable inflammable composition, with which the paper band in passing under the roller is saturated; a series of rollers over which the paper from the saturating-tank is caused to travel, so as to become more or less dried; a series of cutting rolls or disks, between which the paper band is drawn and cut into strands or strips of suitable width; a device for guiding and separating fanwise the strands or strips in their passage to and between pressing-rolls; a running weight to each strand or strip located between the cutting and pressing rolls for producing an equal tension on the entire series of strips in their passage between the pressing-rolls; a front guide return-roller grooved on its circumference for directing the paper strips and provided with cams; a hinged frame having a bar arranged transversely beneath the paper strips and operated by the cams so as to alternately lower the bar into an igniting composition contained in a tank or vessel and lift the bar for depositing such composition onto the undersides of the paper strips at regular intervals along the same; a rectangular frame mounted horizontally on the table of the machine between guides in the side frame-work for receiving and holding the terminal portions of the paper strips, said frame being removably attached to and moved by an endless belt passing over front and rear pulleys mounted on their spindles between the sides of the machine; a toothed spur-wheel

fixed on one of said pulley-spindles and gearing into a spur wheel or pinion on one of the spindles of the cutting-rolls, the whole operating so that on rotating the spur-wheel of the endless-belt spindle the cutting-rolls are rotated and propel the paper strips forward, while at the same time they are drawn at an equal speed and tension over the front guide-roller and backward to the rear or delivery end of the machine by the rear movement of the endless belt and rectangular frame, along which the paper strips are laid and secured.

On the accompanying drawings, Figure 1 represents a longitudinal sectional elevation taken through the center of our improved machine, showing the general disposition of its various parts, as above referred to; Figs. 2 and 3, longitudinal and transverse sections, respectively, to an enlarged scale, of the saturating-tank, forming part marked A in Fig. 1; Fig. 4, a plan of the cutting-rolls, marked B in Fig. 1; Fig. 5, a vertical section thereof on line 1 1 in Fig. 4; and Fig. 6, a detached plan of parts of Figs. 4 and 5; Fig. 7, a front elevation of the guide-bar and pressing-rolls, marked C in Fig. 1; Fig. 8, a plan thereof, and Fig. 9, a section on line 2 2 in Fig. 7; Fig. 10, a side sectional elevation of the front guide-roller and dipper-frame, marked D in Fig. 1, with the dip-tank, marked E in Fig. 1, and Fig. 11, a plan of the same; Fig. 12, a plan of the rectangular frame, marked F in Fig. 1; Fig. 13, a left-hand end view thereof enlarged and partly broken away. Fig. 14 is a side view, and Fig. 15 a section, taken on lines 3 3 and 4 4, respectively, in Fig. 12; Fig. 16, a side view of the front pulley, carrying the endless belt and rectangular frame thereon; Fig. 17, a plan thereof; Fig. 18, a similar view to Fig. 16, showing the driving-gear for the cutting-rolls; and Fig. 19, a modification relating to Figs. 10 and 11, like letters of reference denoting like parts in the respective figures.

In carrying out our invention the paper band *a*, which may be of any suitable width, is fed from an ordinary paper roll or otherwise, if preferred, to a tank or vessel *b*, Figs. 1, 2, and 3, containing a mixture of fusel-oil, shellac, and rosin, or other suitable compound, for



imparting an inflammable nature to the paper, which becomes saturated with the mixture by passing under a roller *c* immersed therein. The roller *c* is pivoted horizontally to and between arms *d*, depending from a horizontal bar *d'*, which is mounted across the top of the tank *b*, the ends of the bar *d'* passing between upright jaws *e* and held in position, when the roller *c* is immersed in the tank *b*, by keys *f*, which are inserted through the sides of the jaws *e* at right angles to and against the top of the bar *d'*. When the roller *c* is not required for use, the keys *f* are withdrawn and the bar *d'* raised in the jaws *e* until the roller *c* is clear of the mixture in the tank *b*, when the keys *f* are again inserted and the bar *d'* supported on their upper edges, whereby the roller *c* is retained in the elevated position until again required for use.

From the tank *b* the saturated paper *a* is passed some distance over overhead rollers *g*, Fig. 1, or in any other circuitous manner, for the purpose of subjecting it to the drying influence of the atmosphere before reaching the rear of the machine, whence it is directed forward along a trough or bed *h* to the cutting-rolls, which consist, Figs. 1, 4, 5, and 6, of a series of circular steel plates or disks *i*, fixed vertically and parallel to each other at equal distances apart, according to the finished width of the flexible match, on a horizontal spindle *j*, having bearings *k*, which are vertically adjustable in the uprights *l* of the frame-work.

The plates or disks *i* are held at their proper distances apart by intervening washers *m*, and the entire series of disks *i* and washers *m*, rigidly secured together endwise by washers *n*, combined with nuts *o*, working over screw-threads on the spindle *j*, or by any other suitable means.

Beneath and parallel with the spindle *j* is mounted in bearings *k'* a horizontal spindle *j'*, carrying a second series of plates or disks *i'*, which are similar in form and construction to the plates or disks *i*, the two series of plates or disks *i i'* being so arranged that the plates or disks of one series slightly enter the spaces between the plates or disks of the other series, this lap being increased or reduced as desired by vertically adjusting the distance between the bearings *k* and *k'* of the spindles *j* and *j'*.

Below the spindle *j'*, diagonally behind and adjacent to the circumferential edges of the plates or disks *i'*, is mounted horizontally between the uprights *l* of the frame-work a roller *p*, beneath which the paper band *a*, coming from the rear of the machine, is directed and passes upward over the rear portion of the circumference of the combined series of plates or disks *i i'* and toward the lapping portions of the circumferences of the plates or disks *i i'*, by which on rotation being imparted to the latter, as hereinafter described, the band *a* is caught and propelled forward, and in so doing is cut into strands

or strips *a'*, Fig. 4, corresponding in number and width with that of the plates or disks *i* and intervening spaces. To prevent the strips *a'* from being caught or carried round by the cutters, as well as to insure their straight uniform delivery at the front side of the latter, a pair of combs *q* (see also Fig. 6) are inserted horizontally and parallel to each other from the front side of the cutters into the spaces between the disks *i i'* at an equal distance above and below the respective laps, the backs of the combs *q* being secured in this position to the uprights *l*, and thereby forming a cellular box-like channel *r*, through which the paper strips *a'* are directed forward from the cutters to a guide-bar *s*, Figs. 1, 7, 8, and 9, arranged transversely across the machine and having vertical slots *t* at suitable distances apart for separating the strips *a'*, which pass through and are guided by the slots *t* to the pressing-rolls *u*, between which the strips *a'* are flattened and adjusted for passing to the front of the machine. By means of the adjusting-screws *v* the pressure between the rollers *u* can be increased or diminished at will. Immediately on leaving the cutters the paper strips *a'* are contiguous, but become separated fanwise during their passage to the slotted guide-bar *s t*. For obviating the difference in tension which would thereby be caused on the respective strips *a'* between the pressing-rolls *u*, each strip *a'* is kept taut while passing from the cutters to the pressing-rolls by a weight *w*, (see Fig. 5,) having a roller *w'*, by which the weight *w* is enabled to roll on and adjust itself to the traveling strip *a'*, so that, the weights *w* being equal, the entire series of strips *a'* are thereby maintained at a uniform tension when drawn upon after their passage between the pressing-rolls *u*, as hereinafter referred to. From the pressing-rolls *u* the paper strips *a'* pass over a guide return-roller *y*, arranged horizontally across the front of the machine and having circumferential grooves *y'* corresponding with the number and distance apart of the paper strips *a'*. The roller *y* is formed or provided near each end with a cam *y<sup>2</sup>*, and is pivoted at the ends to side brackets *z*, having forwardly-projecting arms *z'* carrying pins *b'*, between which is pivoted a yoke or lever frame *c'*, the sides or arms of which extend backward and forward to a suitable distance from the fulcrum *b'*. The rear arms of the frame *c'*, being heavier than the front arms, normally tend to fall and rest at a short distance from the fulcrum *b'* upon the plain ends of the guide-roller *y*, whereat the rear arms of the frame *c'* are provided on their inside faces with small rollers *e'*, which cross the paths of the cams *y<sup>2</sup>* on the roller *y*.

From the rear ends of the frame *c'* depend vertical rods *f'*, which are connected at their lower ends by a horizontal dipper-bar *f<sup>2</sup>*, extending transversely beneath the paper strips *a'* and located immediately over or within a



tank or vessel  $g'$  containing a suitable igniting composition—such as phosphorus, glue, nitrate of potash, and calcined magnesia—which is maintained in a sufficiently liquid state for use by heated water surrounding the tank  $g'$  and contained in an outer casing thereto  $g^2$ , from which the tank  $g'$  can be removed when required.

On the rotation of the guide-roller  $y$ , either by the friction of the passing strips  $a'$  or by chain-gear, as hereinafter more particularly referred to, the cams  $y^2$ , riding on the rollers  $e'$ , thereby cause the rear ends of the frame  $c'$  to be raised, and with them the dipper-bar  $f^2$ , previously immersed in the ignition composition within the tank  $g'$ , is lifted from the latter and brought against the under side of the paper strips  $a'$ , as in dotted lines, Fig. 10, to which the igniting composition adhering to the bar  $f^2$  is transferred. On the cams  $y^2$  leaving the rollers  $e'$  the rear arms of the frame  $c'$  drop and again immerse the dipper-bar  $f^2$  in the igniting-mixture, ready for a fresh lift and deposit on the paper strips  $a'$ , and so on at regular intervals along the strips  $a'$ , according to the relative speeds of the cutters and front guide-roller  $y$ , which can be regulated to the different lengths desired between the igniting portions of the matches.

For insuring a uniform and simultaneous deposit of the igniting-mixture onto the entire series of strips  $a'$ , a roller  $h'$  is mounted over the side of the tank  $g'$ , within a short distance of its top edge, to depress and level the strips  $a'$  thereat and so present a firmer and truer surface to the impact of the dipper-bar  $f^2$ .

The tank  $g'$ , with its outer casing  $g^2$ , is supported on a movable table  $k^2$ , having on its under side projecting rods  $k^3$ , which pass freely through corresponding holes in the lower frame-work  $l'$ , between which and the table  $k^2$  are placed around the rods  $k^3$  spiral springs  $m^2$ , whereby, while the table  $k^2$  is normally retained at its proper level when the tank  $g'$  is in use, it may be lowered to the level of the lower frame-work  $l'$ , and the tank  $g'$ , with its casing  $g^2$ , removed therefrom when required to renew the igniting-mixture or water.

The front arms of the dipper-frame  $c'$  are connected by a cross-bar from which projects an arm  $c^2$ , provided with a balance-weight  $c^3$ , for regulating the action of the frame  $c'$ .

The paper strips  $a'$  being passed over the front guide-roller  $y$  are directed over one or more intermediate grooved guiding-rollers  $n'$ , Fig. 1, to the forward portion of the rear table of the machine, where they are laid along and clamped to the upper surface of a rectangular frame  $o'$ , Figs. 1 and 12 to 17, which is mounted in guides and capable of longitudinal movement between the sides of the machine. The frame  $o'$  is composed of two end pieces  $q'$ , united by side bars  $q^2$ , the open intervening space being crossed by wires  $q^3$ ,

or by canvas or other material on which the strips  $a'$  may be laid without sagging or injury.

To the side edges of the frame  $o'$  are secured, near each end, two opposite ears or brackets  $r'$   $r^2$ , which project above the end pieces  $q'$  of the frame  $o'$ , the brackets  $r'$  being formed with open slots  $s'$  and the brackets  $r^2$  with holes  $s^2$ , which are immediately opposite to the corresponding slots  $s'$ . The paper strips  $a'$  being laid along the frame  $o'$ , one end of a clamping-bar  $t'$  is inserted through one of the holes  $s^2$  of the bracket  $r^2$  at each end of the frame  $o'$ , and is then laid across the upper surface of the strips  $a'$ , so that its other end passes through the opposite slot  $s'$  of the bracket  $r'$ , in which position the bar  $t'$  is caused to press upon and tightly clamp the strips  $a'$  to the frame  $o'$  by keys  $u'$ , which are driven through keyways in the sides of the slots  $s'$  and wedge against the upper side of the bar  $t'$ .

Immediately beneath the frame  $o'$  and longitudinally therewith is an endless belt  $v'$ , which passes horizontally around front and rear pulleys  $v^2$   $v^3$ , mounted on their spindles  $v^4$   $v^5$ , respectively, between bearings at the sides of the machine.

Across the upper face of the belt  $v'$  are secured brackets or cleats  $w^2$  at intervals corresponding with the length of the overlying frame  $o'$ , which is confined endwise between the cleats  $w^2$ .

On the spindle  $v^4$  of the front pulley  $v^2$  is fixed a toothed spur-wheel  $x'$ , Figs. 17 and 18, which is provided with a handle  $x^2$ , or other suitable driving medium, and engages with a spur-pinion  $y^3$  fixed on the spindle  $j'$  of the cutting-disks  $i'$ .

On rotating the spur-wheel  $x'$  by its handle  $x^2$  to the left hand, as indicated by the arrow in Fig. 18, rotation is imparted through the pinion  $y^3$  to the cutting-disks  $i'$ , and by the latter to the disks  $i$ , whereby the paper band  $a$  is drawn from its guiding-roller  $p$  between the cutting-edges of the disks  $i$   $i'$ , and thereby cut into strips  $a'$ , which are propelled forward from the cutters toward the pressing-rolls  $u$ , as before mentioned. Simultaneously the upper portion of the endless belt  $v'$  is moved rearward at an equal speed to that of the delivery of the strips  $a'$  from the cutting-rolls by the rotation of its front pulley  $v^2$ , and carries with it the rectangular frame  $o'$ , to which the rear portions of the finished strips  $a'$  are secured. This causes the strips  $a'$  issuing from the cutters  $i$   $i'$  to be drawn by the frame  $o'$  through the pressing-rolls  $u$  and dipping apparatus over the front guide-roller  $y$  and intermediate guide-roller  $n'$ , until the frame  $o'$  reaches the limit of its travel rearward along the table of the machine, when a second frame  $o'$  is placed on the table in the position previously occupied by the first frame  $o'$ , and the strips  $a'$ , immediately over the second frame  $o'$ , being then clamped to the latter, the strips



$a'$  of the first frame  $o'$  are severed along the abutting-line of the two frames  $o'$  and removed with the first frame  $o'$  to the apparatus for winding the strips into matches, for which application for a patent has been made of even date herewith.

As shown in Figs. 10 and 11, the front guide-roller  $y$  is rotated by the tensional friction of the passing strips  $a'$ ; but in order to render its rotation more positive, and so insure an equal distance between each successive deposit of igniting composition on the strips  $a'$ , a chain-wheel  $a^3$  (see dotted lines in Fig. 17) may be fixed on the spindle  $v^4$  of the endless-belt pulley  $v^2$  for rotating by chain  $b^3$  a similar wheel or pinion  $c^4$ , fixed on the end of the roller  $y$ , the relative diameters of the wheels  $a^3$  and  $c^4$  being determined by the various speeds and distance desired between each deposit of igniting composition on the strips  $a'$ .

If desired, in lieu of the machine being operated by the handle  $x^2$ , as above described, steam or other motive power may be employed for the purpose.

We claim—

1. In machinery for making flexible lighting-matches, the combination of two series of circular plates or disks fixed vertically on parallel spindles having adjustable bearings, the disks of one series entering the space, respectively, between the disks of the other series, with two slotted bars or combs inserted horizontally and parallel to each other within the respective spaces of the disks for guiding and separating fanwise the strands or strips, and means for rotating one of said spindles, substantially as shown, and for the purpose described.

2. In machinery for making flexible lighting-matches, the combination of circular plates or disks  $i$   $i'$  and washers  $m$   $m'$ , fixed vertically on parallel spindles  $j$   $j'$ , having adjustable bearings  $k$   $k'$ , combs  $q$ , inserted horizontally and parallel to each other within the respective spaces of the disks  $i$   $i'$ , for guiding and separating fanwise the strands or strips, roller  $p$ , and spur-pinion  $y^3$ , rotating spindle  $j'$ , substantially as described.

3. The combination of a front guide-roller having cams on its circumference and pivoted horizontally between end bearings at the sides of the machine, a yoke or lever frame pivoted in advance of the front guide-roller and having rollers adjacent to the cams and having at its rear end a transverse dipper-bar with a tank or vessel, substantially as shown, and for the purpose described.

4. The combination of a front guide-roller  $y$ , having grooves  $y'$  and cams  $y^2$ , and pivoted at the ends in brackets  $z$ , having forwardly-projecting arms  $z'$ , carrying pins  $b'$ , a yoke or lever frame  $c'$ , fulcrumed on the pins  $b'$  and provided with rollers  $e'$  adjacent to the cams  $y^2$ , rods  $f'$ , depending from the rear end of frame  $c'$  and connected by dipper-bar  $f^2$  with tank or vessel  $g'$ , carrying top roller  $h'$ , substantially as shown, and for the purpose described.

5. In machinery for making flexible lighting-matches, the combination of frame-work  $l'$ , casing  $g^2$ , containing tank  $g'$  and supported on table  $k^2$ , roller  $h'$ , rods  $k^3$ , projecting from the under side of the table  $k^2$  and passing through holes in the lower frame-work  $l'$ , with spiral springs  $m^2$ , substantially as described.

6. The combination of a rectangular frame  $o'$ , mounted in guides on the table of the machine and having clamping devices, all constructed substantially as described, with endless belt  $v'$ , having cleats  $w^2$  and pulleys  $v^2$   $v^3$  on spindles  $v^4$   $v^5$ , rotated by handle  $x^2$  on spur-wheel  $x'$ , substantially as shown, and for the purpose described.

In testimony whereof we have affixed our signatures, in presence of two witnesses, this 2d day of November, 1888.

FREDERICK BOMMARIUS.  
GRAY STAUNTON.

Witnesses to signature of Bommarius:

JOHN MALLIER,  
H. S. LOOMIS, Jr.

Witnesses to signature of Staunton:

PAUL BAKEWELL,  
S. L. SCHRADER.