

No. 632,781.

Patented Sept. 12, 1899.

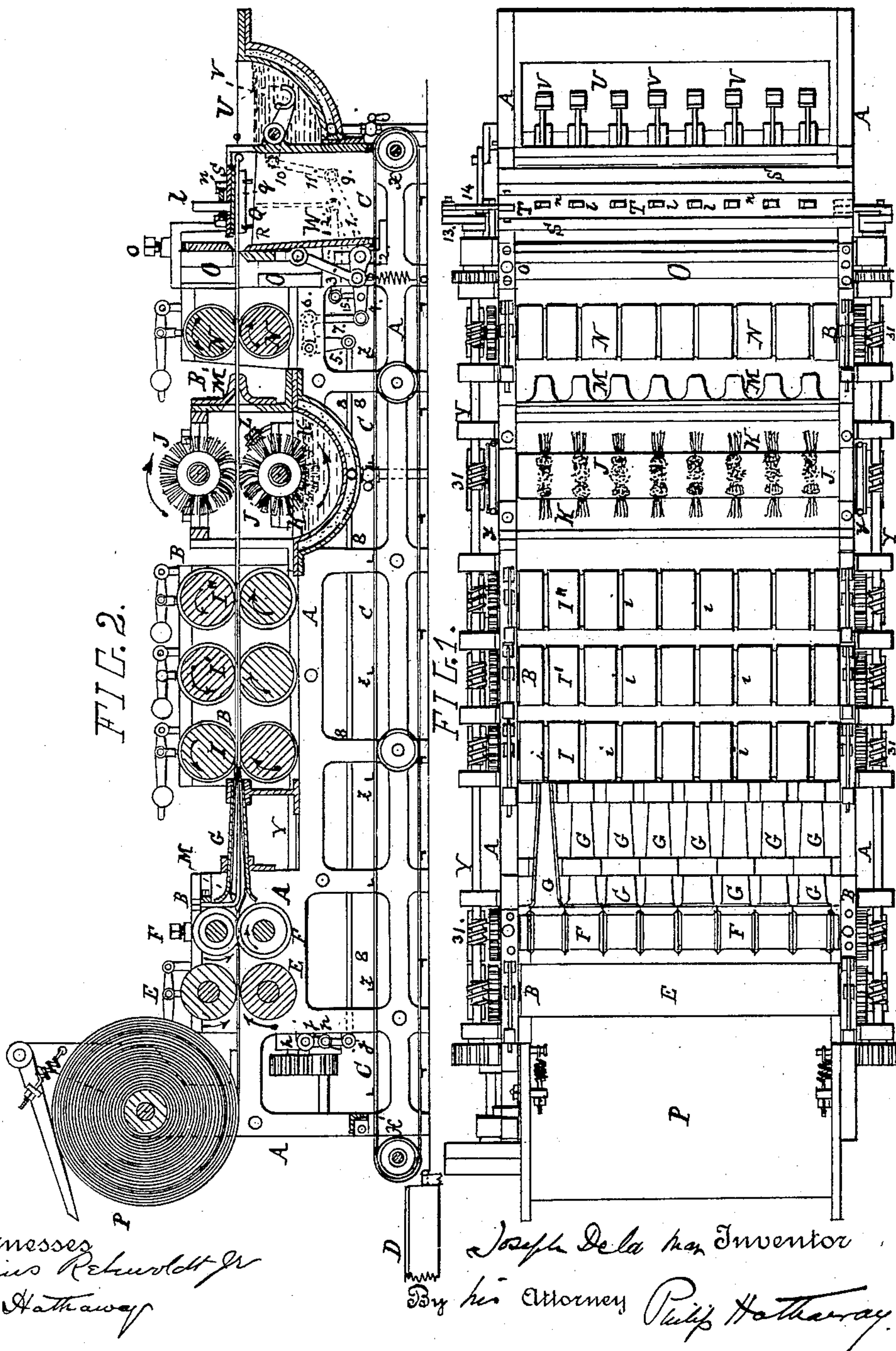
J. DELA MAR.

MANUFACTURE OF PAPER FRICTION MATCHES.

(Application filed Aug. 12, 1898.)

(No Model.)

4 Sheets—Sheet 1.



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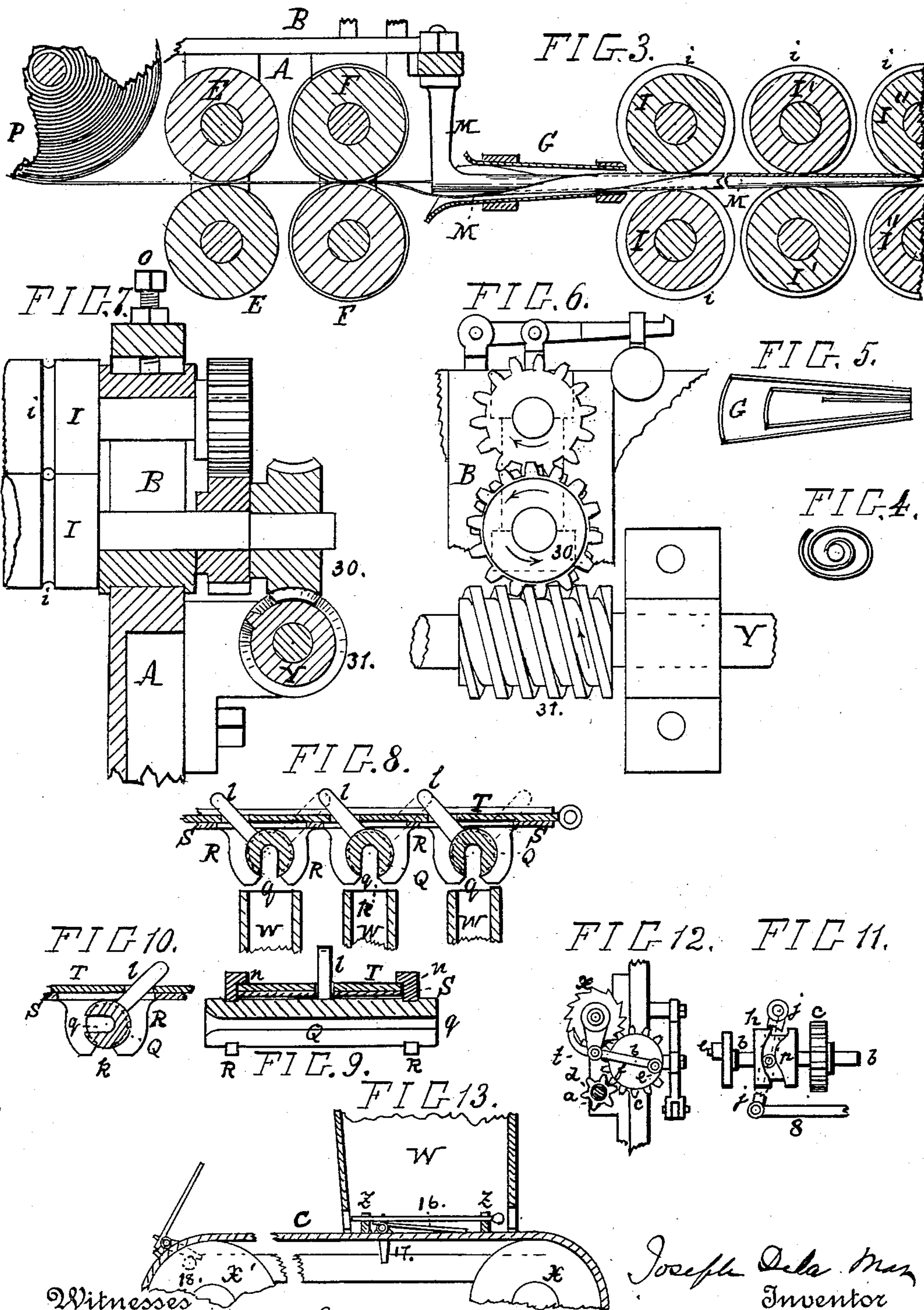
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FIG. 18.

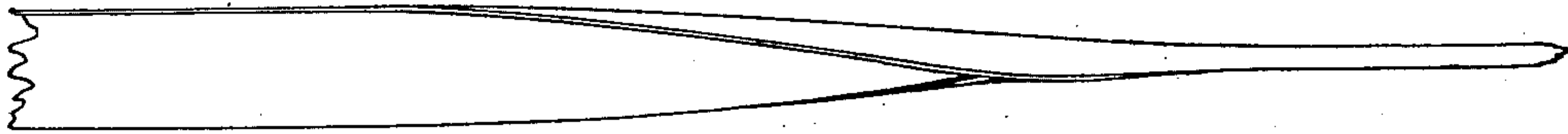


FIG. 19.



FIG. 16.
M'

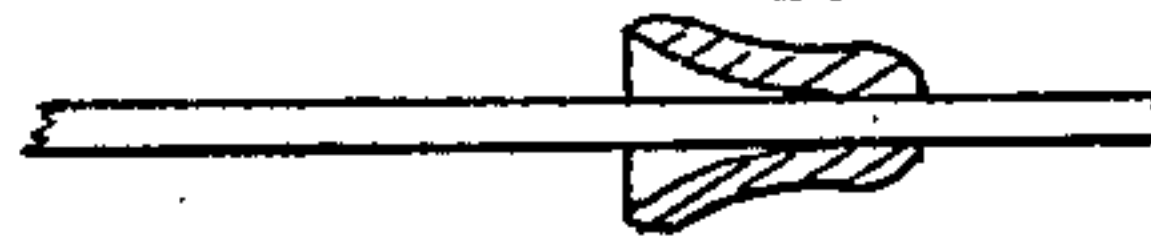


FIG. 14.

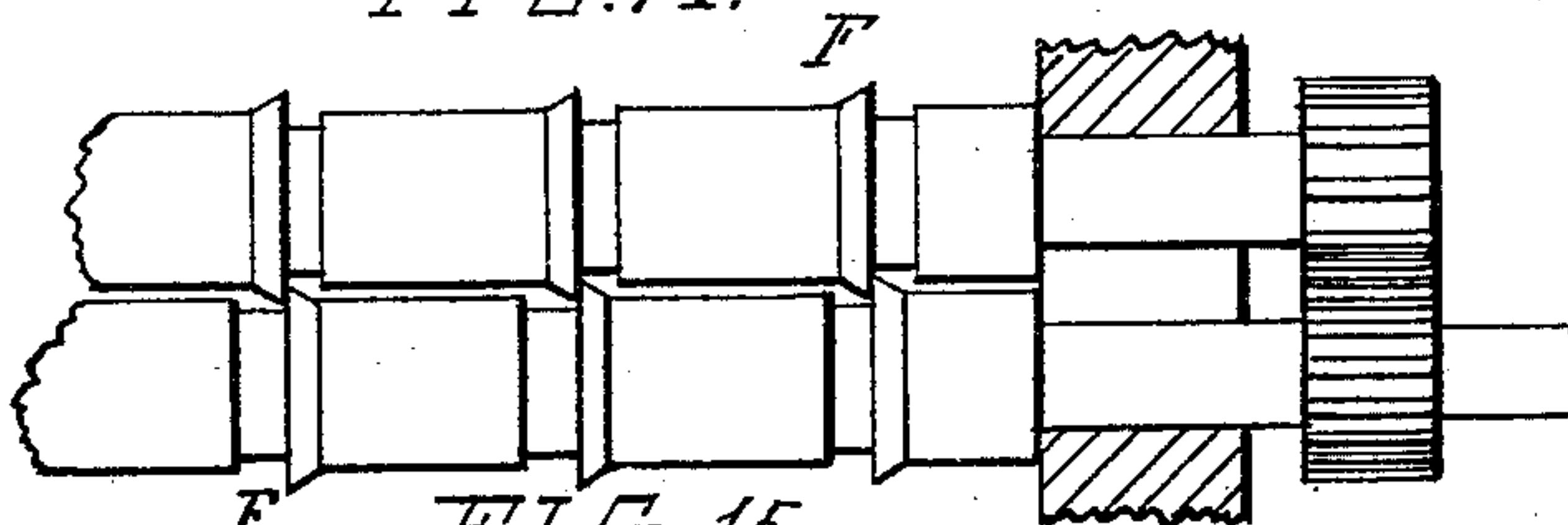


FIG. 15.

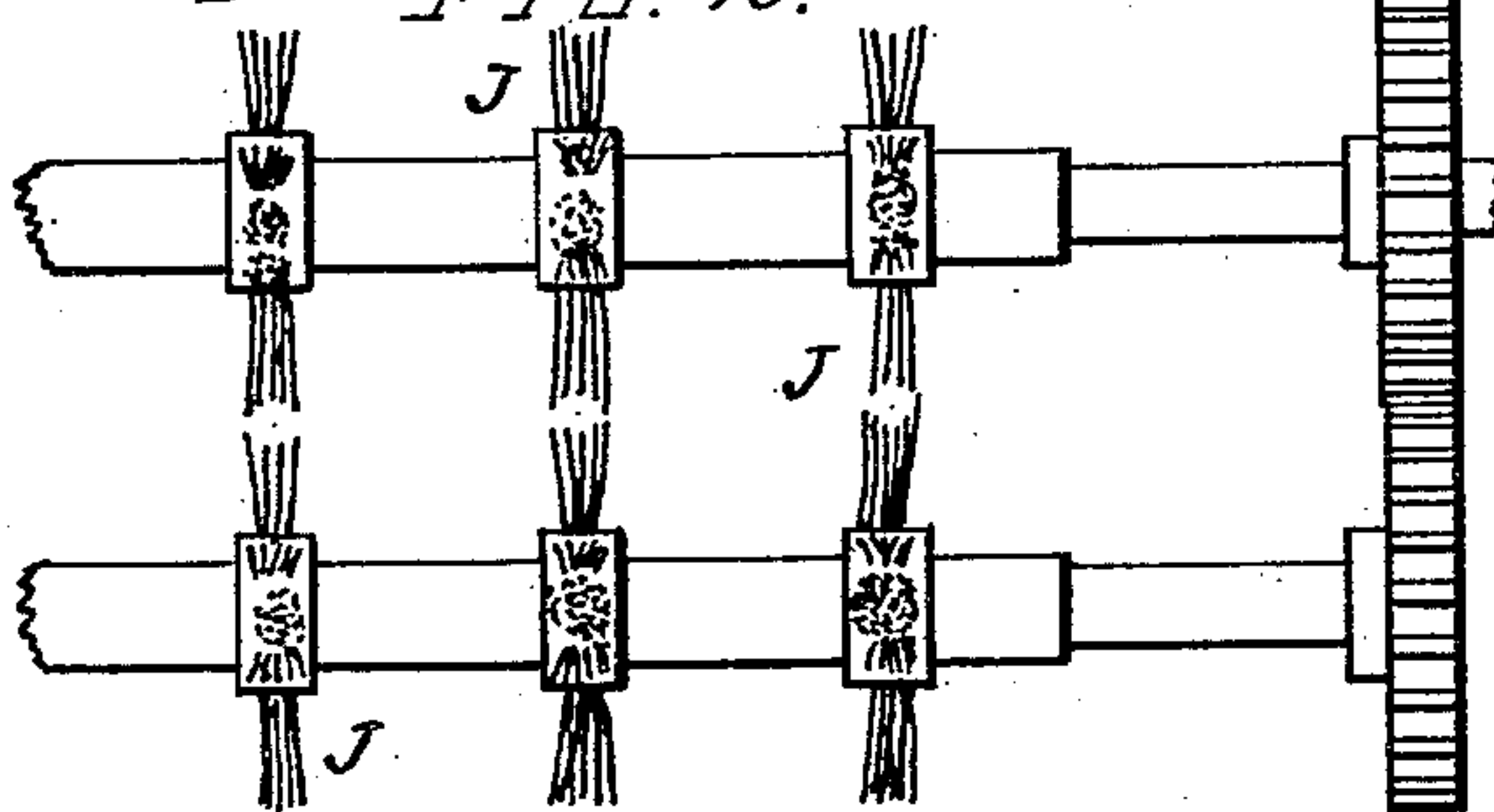
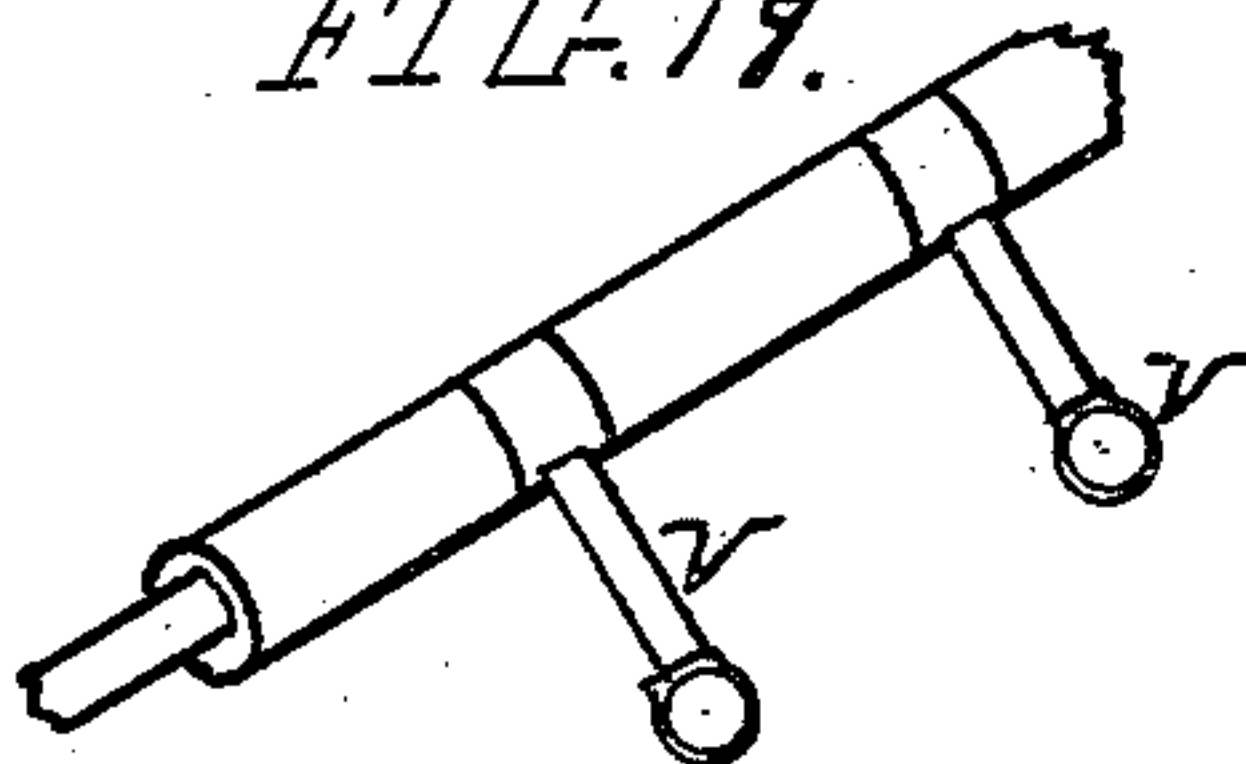


FIG. 17.



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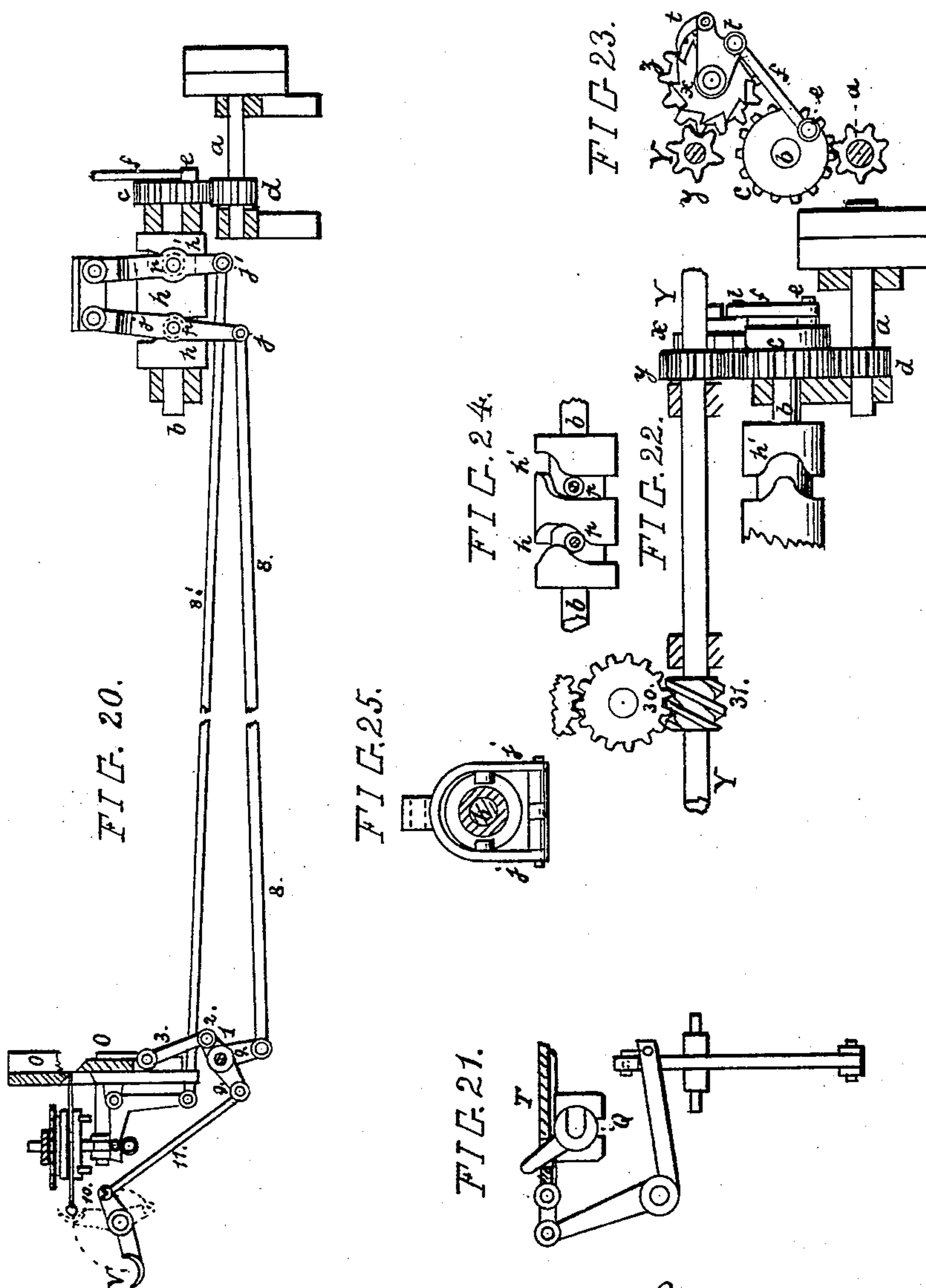
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(Application filed Aug. 12, 1898.)

(No Model.)

4 Sheets—Sheet 4.



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UNITED STATES PATENT OFFICE.

JOSEPH DELA MAR, OF NEW YORK, N. Y.

MANUFACTURE OF PAPER FRICTION-MATCHES.

SPECIFICATION forming part of Letters Patent No. 632,781, dated September 12, 1899.

Application filed August 12, 1898. Serial No. 688,460. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH DELA MAR, a citizen of the United States, and a resident of the city of New York, county of New York, and State of New York, have invented new and useful Improvements in the Manufacture of Paper Friction-Matches, of which the following is a specification.

My invention relates to a novel method of manufacturing tubular paper matches in large quantities from a roll of suitable paper in the following periodical progressions: drawing and unwinding in a single thickness paper by and between a pair of drawing-rollers, passing the paper between a pair of rotary cutters and cutting the paper in longitudinal strips, thereafter passing each of said strips through a spiral guide or conductor over an interior mandrel, thereby coiling the strip into a tubular form for the match-stick, and then passing the coiled strip between several grooved rollers with grooves of successive smaller diameter, thereby coiling and pressing the coiled strip closer and closer to a smaller diameter and so stiffening the such-coiled strip from which, as hereinafter shown, the match-sticks are cut. The coiled strip now forming an endless tube is then passed between rotary brushes or elastic rollers, of which one dips in a liquid compound of paraffin, wax, or other similar material with a suitable proportion of rosin, shellac, glue, starch, or other solidifying or stiffening material, and deposits a coating of such compound on the tube. The coated tube is then passed through an equalizing-gage, which scrapes any surplus compound therefrom. The tube is then passed between a pair of pressing and polishing rollers and is forwarded between open vertical cutters into a horizontal match-guide, when it comes to a momentary stop and is provided on its end with a friction-head for a match while its stick is cut from the tube, and thereupon the match-guide is turned vertically and delivers the match through a guide, under which passes a common drying-belt having upon it transverse tray-bars, which receive the matches upon them for drying, after which they are gathered and boxed.

The manner in which my invention is operated is set forth and described in the fol-

lowing specification and accompanying drawings, in which—

Figure 1 represents a top view of the machine for producing my improved match. 55
Fig. 2 is a vertical longitudinal section of the same. The remaining figures are detail views of parts of the machine shown on a larger scale. Fig. 3 represents a vertical longitudinal section of the portion of the machine by which the paper is unwound from the roll and passed through the rotary cutters to cut it into longitudinal strips and showing the spiral conductor and a central mandrel to coil the strip 60
and the successively closer pressing pair of rollers to form the strip into a hollow rod or tube. Fig. 4 is a detached cross-section of the hollow spiral conductor to coil the paper strip. Fig. 5 is a longitudinal section of the same. Fig. 6 is a face view of the paper-pressing and feed-roller-driving gear-wheels. Fig. 7 is a vertical central section of the same. Fig. 8 is a vertical lateral section of the match-guides and drop mechanism in position of dropping the matches therefrom. Fig. 9 is a longitudinal vertical section of one of the same guides in the same position. Fig. 10 is a vertical cross-section of one of the same guides in position while receiving the match 80
before being cut off. Fig. 11 is a detached side view of the mechanism for operating the cut-off or vertical cutters. Fig. 12 represents a face view of the main driving-gear mechanism of the machine. Fig. 13 is a longitudinal section of the end portions of the endless match-drying belt and showing the lateral strips or trays on the belt upon which each match is deposited for drying to keep clear of its head while yet soft from attaching to the belt and also exhibits the mechanisms for delivering the matches from the first to the second belt D. Fig. 14 represents a detached side elevation of a portion of the pair of cutting-rollers. Fig. 15 is a similar view 95
of a portion of the rotary brushes. Fig. 16 is a detached longitudinal section of the coat-equalizing guide. Fig. 17 is a perspective view of a portion of the friction-compound-distributing dippers and their arbor. Fig. 18 is a detached top view of the portion of the flat paper strips passing through the spiral guide and being coiled. Fig. 19 is a cross-section of the same at the coiled portion. Fig. 100

20 represents a detached side view of the mechanism for operating the cutting-shear, the match-guides, and the spoons for distributing the igniting compound to the matches.

5 Fig. 21 is a detached face view of the levers for operating the match-guides of the same.

Fig. 22 is a detached side view of the gear and ratchet-lever connection from the driving-shaft to the worm-shaft Y of the ma-

10 chine. Fig. 23 is a face view of the same.

Fig. 24 is a detached side view of the cams for operating the cutting-shear, the match-guides, and compound-distributing spoons.

15 Fig. 25 is a cross-section of said cam, showing the lever operated by the cam.

My machine for making my paper match is constructed with two opposite vertical parallel longitudinal side frames A A, which are suitably connected solidly together by braces and cross-bars. Between these frames the paper from which the matches are made is guided to travel longitudinally from the rear to the front end of the machine and is drawn and forwarded between pressing-rollers guided in bearings B B in each frame. The motion of the paper is periodical. Each period feeds the paper a distance equal to the length of the match being made.

The paper-roll P is furnished mounted upon an arbor by the paper-mill and is placed into the bearings provided on the side frames A of the machine, so as to turn loosely thereon. Said roll of paper is of a suitable width to form the required number of matches together at one time, which number may be fifty, more or less, such number being regulated in practice by the number of matches which it is desired to pack in a single box. From the paper-roll the paper passes between a pair of pressing and feed rollers E and from them between a pair of cutting-rollers F, by which the sheet of paper is cut and separated longitudinally into strips, and each strip is required to be of a width sufficient to coil up to the diameter of the match-stick to be made. In front of said cutting-rollers is placed the hollow spiral conducting-guide G for each strip, having a fixed central cone-mandrel M, around which the paper in feeding forward passes and is wound in a tubular form, forming over one complete coil before leaving the guide G. The paper strip so coiled now passes between a pair of pressing-rollers I, having a circular groove *i* of a little less diameter than that attained by the coil in passing the guide G, thereby reducing the diameter of such coiled strip to that of the groove *i*. The coiled strip now passes between a secondary pair of pressing-rollers I', with a more reduced diameter groove *i'*, whereby the coil of the strip is again contracted, and it finally passes between a third pair of pressing-rollers I'', by which the strip is formed into a compactly-pressed rod or tube which may be still more or less hollow, but is sufficiently hard and stiff for its purpose. Forward, ahead of said last pair of grooved pressing-rollers I'',

are arranged a pair of rotary brushes J, revolving in contrary direction to said rollers I''. Below said brushes is arranged a trough K, constructed with a steam-jacket for heating the same, and in the trough K is contained a compound of paraffin, wax, or other suitable material, to which a small quantity of stiffening or solidifying matter—such as rosin, shellac, glue, or starch—is added, and the compound is kept liquid by the steam in the jacket. The lower brush touching the solution carries the same in proper quantity to the paper tube and to the upper brush, whereby the coating of the tube is successfully completed. By means of a take-off scraper or brush L applied on the lower brush nearly all surplus solution is dropped back into the trough. Ahead of the brushes is provided a stationary scraper or drawing-guide M' for each paper tube, which scrapes off any surplus coating. Forward of said guides M' are arranged a pair of grooved drawing-rollers N, which polish and draw the coiled strips or tubes and forward the same. Ahead of the drawing-rollers N are provided a pair of cutting-shears or cutters O, the plates of which extend completely across from one side frame A to the other to cut off all strips passing between the side frames A A at one time. Both shear-plates of the shear O are properly secured each to a guide-plate which passes and is guided in vertical guide-slots in the frames A A. The upper shear-plate is held stationary in the frames, but is made adjustable by vertical adjusting-screws *o*, and the lower shear-plate rises against the upper plate when cutting off the tubular strips. Ahead of the shear O are arranged longitudinal horizontal match-guides Q, one for each paper tube. Each match-guide Q is constructed with a cylindrical longitudinal body having a longitudinal radial slot *q* to receive the tube while in horizontal position and allow it to drop from the slot when cut off by the shears O and as soon as the guide is turned with the slot *q* to a vertical position, as shown in Figs. 8 and 9. Said match-guides are held in two vertical downward hangers R, each secured or formed on a common lateral cross guide-plate S, secured and extending from one frame A to the other opposite, and said hangers nearly circumscribe the match-guide Q, which is grooved to a smaller diameter at the portions engaged by the hangers to allow the guide to turn easily in the hangers, but being held from longitudinal motion. Each hanger has a central vertical slot or opening *k* to pass the match when the guide is turned vertically and to drop the match, as shown in Fig. 8. Each match-guide Q has a central upward arm *i*, which passes without engagement through the plate S; but upon said plate S is provided a lateral sliding bar T, held in lateral grooves *n n*, formed in upward rails attached to the top side of the plate S, (shown in Fig. 9,) and said bar T has a slot engaging the arm *i* of each match-guide, thereby causing by sliding the turning of the

match-guide from a vertical to a horizontal position to receive the tube for cutting it and to turn it vertically to deliver the cut match. Forward of the match-guides Q is provided a secondary common trough U, also furnished with a steam-jacket, and in it are contained the match-igniting or phosphorous compound and a series of compound-distributing spoons V, operated by a common oscillating arbor.

The paper tubes are forwarded by the drawing and polishing rollers N while the shears O are open, and the cut ends of said tubes enter into the match-guide while its guide-slot *q* is in horizontal position, as shown in Fig. 10, and said tubes pass on through said guides until their ends stop for a short period, during which the spoons V carry and place the required amount of igniting compound to form the friction-head on the ends of the tubes. The shears O thereupon close and cut match lengths off the tube, and the match-guides turn to a vertical position to drop the matches. Centrally below each match-guide is arranged a vertical guide-box W to conduct the fall of the cut-off matches upon the before-mentioned longitudinal endless drying-belt C, which passes over a lateral drum X, guided in bearings in the forward lower part of the frames A, and between said drums X and X' are also loose revolving drums employed to support said belt, as shown. Upon the receiving or top side of the belt C are provided lateral tray-rods Z. The belt C has the same periodical motion as that of the paper and tubes above it, and said motion is made to harmonize with the length of the match-stick. The tray-rods Z are located and secured upon said belt at the proper distances apart for each delivery, so as to receive and carry the match a little from the belt when delivered from the box-guide W upon the tray-rods and so that the match while not yet dry will be clear from the belt to prevent its attaching to the belt, as shown in Fig. 13. Said belt C is made to carry the match until dry and may extend beyond the machine. Wherever the belt C passes over its drum X', a secondary belt D, traveling in right-angular direction, is employed to receive the dry matches, and all matches delivered together upon the belt C are together delivered upon the belt D, and both move at the same time.

Each pair of feed, pressing, and cutting rollers is furnished with gear-wheels to engage one another to forward the paper with equal feed-motion and in like direction, while the motion of the brushes is in opposite direction. The bottom feed, cutting, and pressing roller arbor of each pair is furnished with a worm-gear 30, engaging in a worm-gear 31 for each upon one worm-shaft Y, causing their equal speed. For the motion of the brushes the worm-gear is on a separate stud below the worm of the shaft, and the motion of the brushes is caused by pulleys and a cross-belt *y* and pinion-gear on the brush-ar-

bor engaging a gear-wheel having worm-gear to engage the worm of said worm-shaft, whereby the brushes are moved with quicker speed in reverse direction to the feed-rollers. The rearward end of the worm-shaft Y is furnished with a fixed ratchet-wheel *x* (shown in Fig. 12) and with vibrating pawl *t*.

a, Fig. 12, represents the driving-shaft of the machine. It may be operated by pulleys or gear-wheels. It is arranged below the worm-shaft Y in suitable bearings attached to the same side of the frame to which the shaft Y is attached and between the said shaft *a* and worm-shaft Y is provided with a cam-shaft *b*, which is guided in suitable bearings secured on the same frame with those of the worm-shaft Y, as shown in Figs. 11, 12, 20, 22, and 23. Said shaft *b* has upon it a spur-gear *c*, which engages in a pinion *d* upon the driving-shaft *a*, and said shaft *b* has a crank-pin *e*, connected by the rod *f* with the stud of the pawl *t*, so that by the rotary motion of the driving-shaft *a* the spur-gear *c* and shaft *b* and crank-pin *e* are rotated and cause the pawl *t* to vibrate and periodically rotate the worm-shaft Y, which operates all the feed, cutting, and pressing rollers and the brushes. Thus it will be seen that the shaft Y has not a continuous but only an alternate motion from the pawl *t*, and, with the shaft Y, all parts therewith connected and forwarded have a stop while the pawl *t* is returning to get a new grip; but the cam *h* moves continuously and operates while the pawl *t* returns the cutting-shears *o*, the spoons V, and the match-guides Q. The shaft *b* is provided with a grooved cam *h*, and to the frame A is pivoted a lever-arm *j*, carrying a stud *p*, which is engaged in the groove of the cam *h*, said lever-arm *j* being operated by the shaft *b* and cam *h*. Below the shears O is arranged a lateral shaft 1, guided in bearings in the frames A A, and a crank 2. The crank-pins of said crank are connected by suitable links 3 to the bottom shear-plate. The same shaft 1 has on its outside end a fixed arm 4, and on the outside of the frame is pivoted a vertical bell-crank lever 5, the short arm 6 of which is connected with the fixed arm 4 by a link 7, and the long arm of said lever 5 is connected by a long rod 8 with the lever *j*, by which means the motion of the lower shear-plate of the shear O is operated. The same shaft 1 has also a fixed arm 9 on the outside, extending forward, and the oscillating arbor, carrying the distributing-spoons V, has outside of the respective frame A a short crank-arm 10, which is connected by a rod 11 with the arm 9 of the shaft 1, thus operating the distributing-spoons V. The arm 4 is also connected to one end of a two-armed lever 12 by a link 15 and the secondary arm-lever 12 is connected with a crank 13, and the sliding-bar T is connected by the link 14 with the crank 13. By these means the sliding-bar T and match-guides Q are operated.

In some cases I employ a separate cam *h'* to

perform the motions of the match-guides, as shown in Figs. 20, 21, 24, and 25.

For extra-long matches it may be preferable to pivot the ratchet-wheel on a separate stud and furnish the same with a gear-wheel x and the worm-shaft with a pinion-gear z to engage in said gear-wheel, as shown in Figs. 22 and 23, to provide the required motion for long matches by the gears and without making the pitch of the worm 31 too great and causing undue friction.

To deliver the matches after they are dry from the first belt C to the second belt D, I provide upon the belt C, between the strips Z, a hinged flap 16, and the arbor of the hinge is made solid with the flap and turns loose in the hinge. The arbor has an arm 17 on the edge of the band, projecting downward. Near the junction of the belt C with the belt D is provided a stationary projecting stud 18 to come in contact with the arm 17, thereby turning the flap upward, picking up the lateral row of matches together and causing them to drop together in row on the belt D.

When the machine is made for a large number of matches in one series in one row, the paper requires to be very wide, and the pressing and feeding rollers will be very long and liable to spring and twist by torsion. In such cases it is desirable to apply a worm shaft and gears on each side of the machine, as shown in Fig. 1.

The driving mechanism may be easily changed and substituted, and I do not limit myself to any particular mechanism of the driving and operating gear and mechanism.

Having thus described my invention and the mode in which it is operated, what I claim, and desire to secure by Letters Patent, is—

1. In a machine for making paper matches the combination comprising means for unrolling from a paper-roll the amount of paper for each of a series of matches made together; means for drawing said paper in single thickness through cutters and separating the sheet of paper in strips to make the match-sticks in tandem rows of a series of sticks; means for passing and drawing each paper strip through a spiral guide and coiling the paper strips into tubes while advancing, and for drawing the same between grooved pressure-rollers for the purpose of reducing the diameter of such coils or tubes, means for passing such tubes between rotating brushes or elastic rollers over a tank containing liquid paraffin or wax compound and thereby coating such tubes; means for removing the surplus compound from the tubes, and means for pressing and polishing the tubes when coated, means for distributing igniting compound on the ends of such tubes, and means for cutting off the tubes to the required length so forming completed tubular paper matches coated and polished and provided with igniting-heads, substantially as herein set forth and described.

2. In a machine for making paper matches

a combination of means for unrolling the paper and cutting it in strips, means for coiling such strips by spiral guides, and pressing them between grooved rollers, means for coating and polishing them consisting of brushes or rollers, equalizing-guides, and polishing-rollers, means for applying the igniting compound to form friction-heads consisting of vibrating spoons or dippers, and means for cutting the coated paper tubes into match lengths substantially as described and for the purposes herein set forth.

3. In a machine for making paper matches the combination comprising means for unrolling paper from a roll a pair of feed-rollers for unrolling the paper, a pair of rotary cutters for cutting the sheet of paper in longitudinal strips, spiral guides or conductors for coiling the strips to a tubular form, grooved rollers for drawing and compressing the coiled strips, and means for coating the tubular strips with a paraffin or wax compound, substantially as and for the purpose set forth.

4. In a machine for making tubular paper matches, the combination comprising, means for unrolling paper from a roll, a pair of drawing-rollers, a pair of cutting-rollers, a series of spiral coiling-guides having each an interior mandrel, a series of sets of grooved rollers, an equal number of circular brushes or soft rollers, with a heated tank containing a liquid paraffin or wax compound for coating the paper tubes, substantially as and for the purpose herein set forth.

5. In a machine for making tubular paper matches, the combination comprising, means for unrolling paper from a roll, a pair of drawing-rollers a pair of cutting-rollers, a series of spiral coiling-guides, having an interior mandrel inside of each one, a series of sets of grooved rollers, an equal number of circular brushes, and a heated tank with a heated equalizing-gage, substantially as herein set forth.

6. In a machine for making tubular paper matches, the combination which consists of, means for unrolling paper from a roll, a pair of drawing-rollers, a pair of cutting-rollers, a series of spiral coiling-guides, having interior mandrels inside, a series of grooved rollers, an equal number of circular brushes or soft rollers, a heated tank, and a heated equalizing-gage, and a pair of grooved polishing-rollers, substantially as herein set forth.

7. In a machine to make tubular paper matches, the combination comprising, means for unrolling paper from a roll, a pair of drawing-rollers, a pair of cutting-rollers, a series of spiral coiling-guides, having an interior mandrel inside of each, a series of sets of grooved rollers, series of circular brushes or soft rollers, a heated tank, a heated equalizing-gage, a pair of grooved polishing-rollers, a pair of shears, and an equal number of tubular slotted vibrating match-guides, substantially as set forth.

8. In a machine to make tubular paper

matches, the combination comprising, a roll of paper, a pair of drawing-rollers, a pair of cutting-rollers, a series of spiral coiling-guides, having an interior mandrel, a series of sets of
 5 grooved rollers, a series of circular brushes or soft rollers, a heated tank, a heated equalizing-gage, a pair of grooved polishing-rollers, a pair of shears, a series of slotted vibrating match-guides, an equal number of vibrating
 10 spoons or dippers, and a secondary heated tank, with the vertical guide-boxes W to conduct the matches when discharged from the vibrating guides upon the lateral strips fastened upon the longitudinal endless drying-
 15 belt, substantially as set forth.

9. In a machine to make paper tubular matches, the combination comprising, means for unrolling paper from a roll, a pair of drawing-rollers, a pair of cutting-rollers, a series
 20 of spiral coiling-guides an interior mandrel, a series of sets of grooved rollers, a series of circular brushes or soft rollers, a heated tank, the heated equalizing-gages, a pair of grooved polishing-rollers, a pair of shears, a series of
 25 slotted vibrating match-guides, an equal number of vibrating spoons or dippers, a secondary heated tank, the boxes W, the lateral

trays Z, the longitudinal belt C with the lateral drums X and X', with the hinged flaps 16, substantially as specified. 30

10. In a machine to make tubular matches, the combination comprising means for unrolling paper from a roll, a pair of drawing-rollers, a pair of cutting-rollers, a series of spiral coiling-guides provided with interior
 35 mandrels, a series of sets of grooved rollers, a series of brushes or soft rollers, a heated tank, a heated equalizing-gage, a pair of grooved polishing-rollers, a pair of shears, a series of slotted vibrating match-guides, an
 40 equal number of vibrating spoons or dippers, a secondary heated tank, the vertical guide-boxes W, with the longitudinal drying-belt C, substantially as described and for the purposes specified. 45

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 27th day of June, 1898.

JOSEPH DELA MAR.

Witnesses:

M. E. STODDART,

JULIUS REHWOLDT, Jr.