No. 819,298. PATENTED MAY 1, 1906.

J. W. MARTIN.

SPINNING MACHINE.

APPLICATION FILED JUNE 20, 1904.

5 SHEETS—SHEET 1.

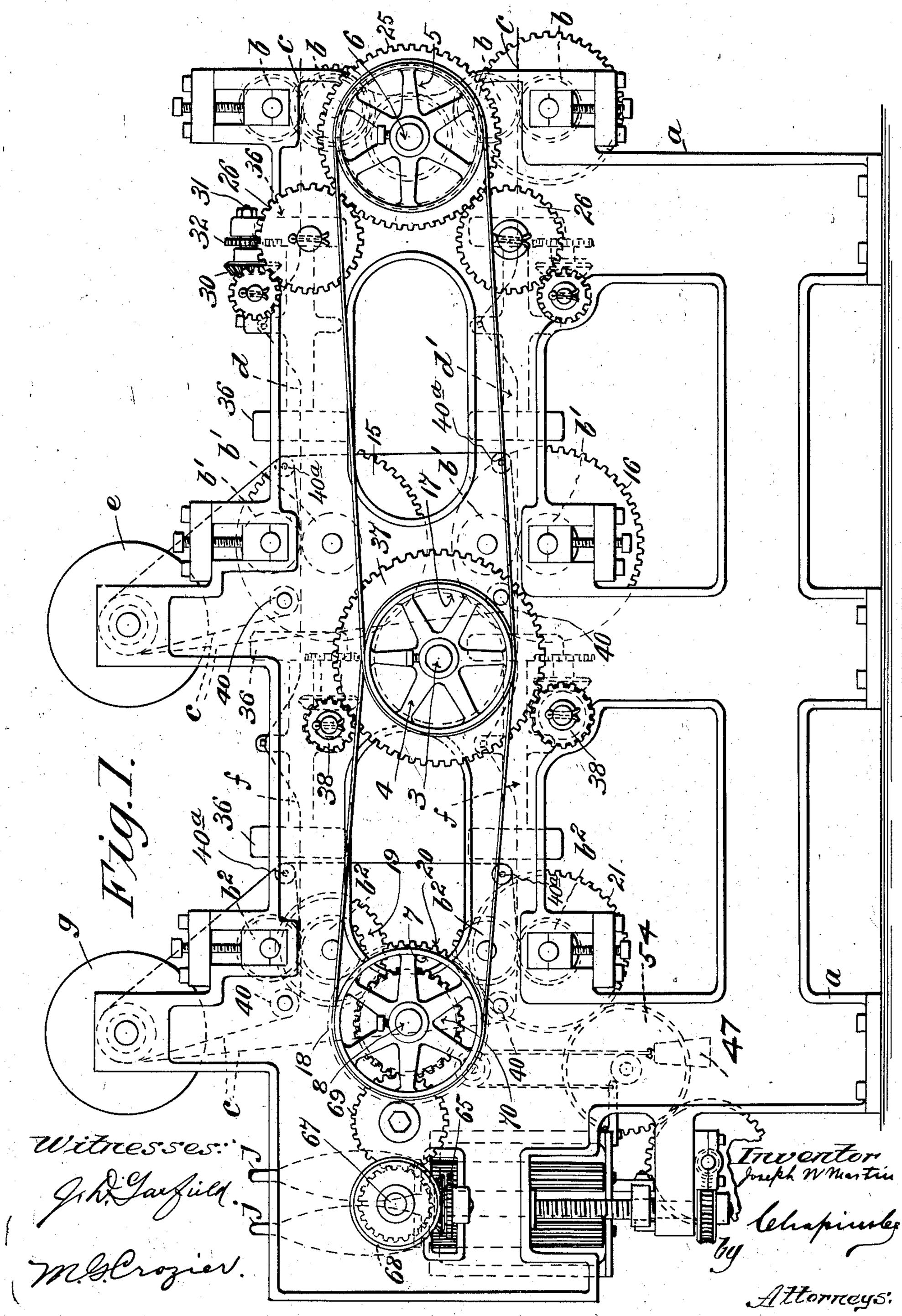

Fig. 1.

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5 SHEETS—SHEET 2.

Fig. 2.

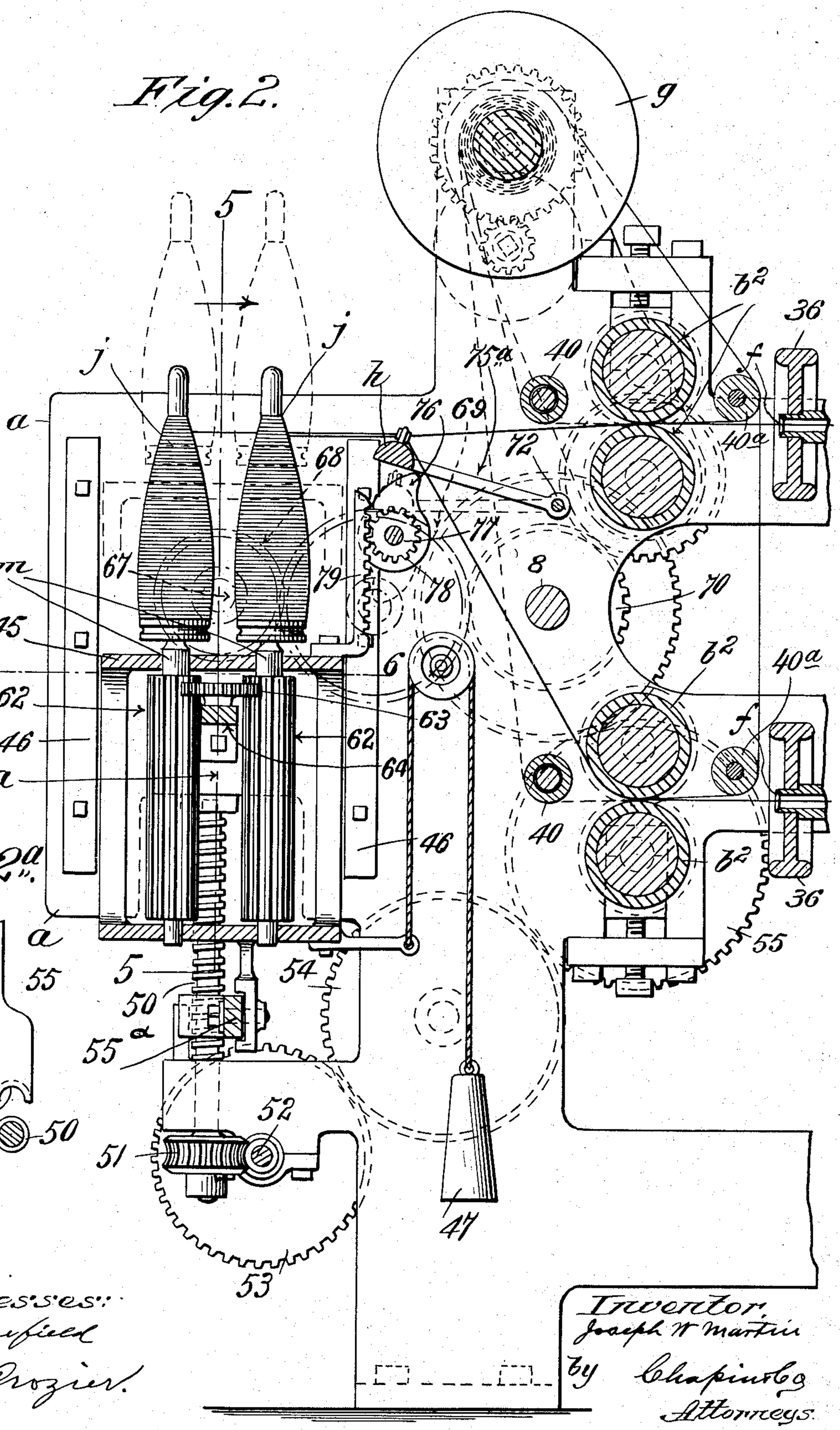

Fig. 2a.

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5 SHEETS—SHEET 3.

Fig. 3a.

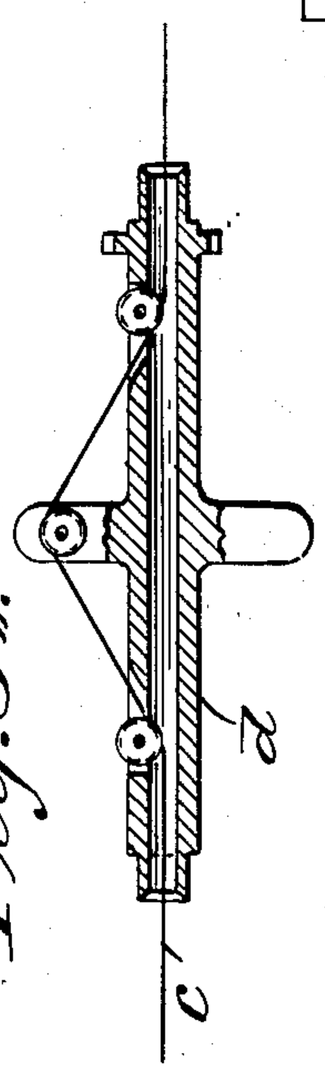

Fig. 3.

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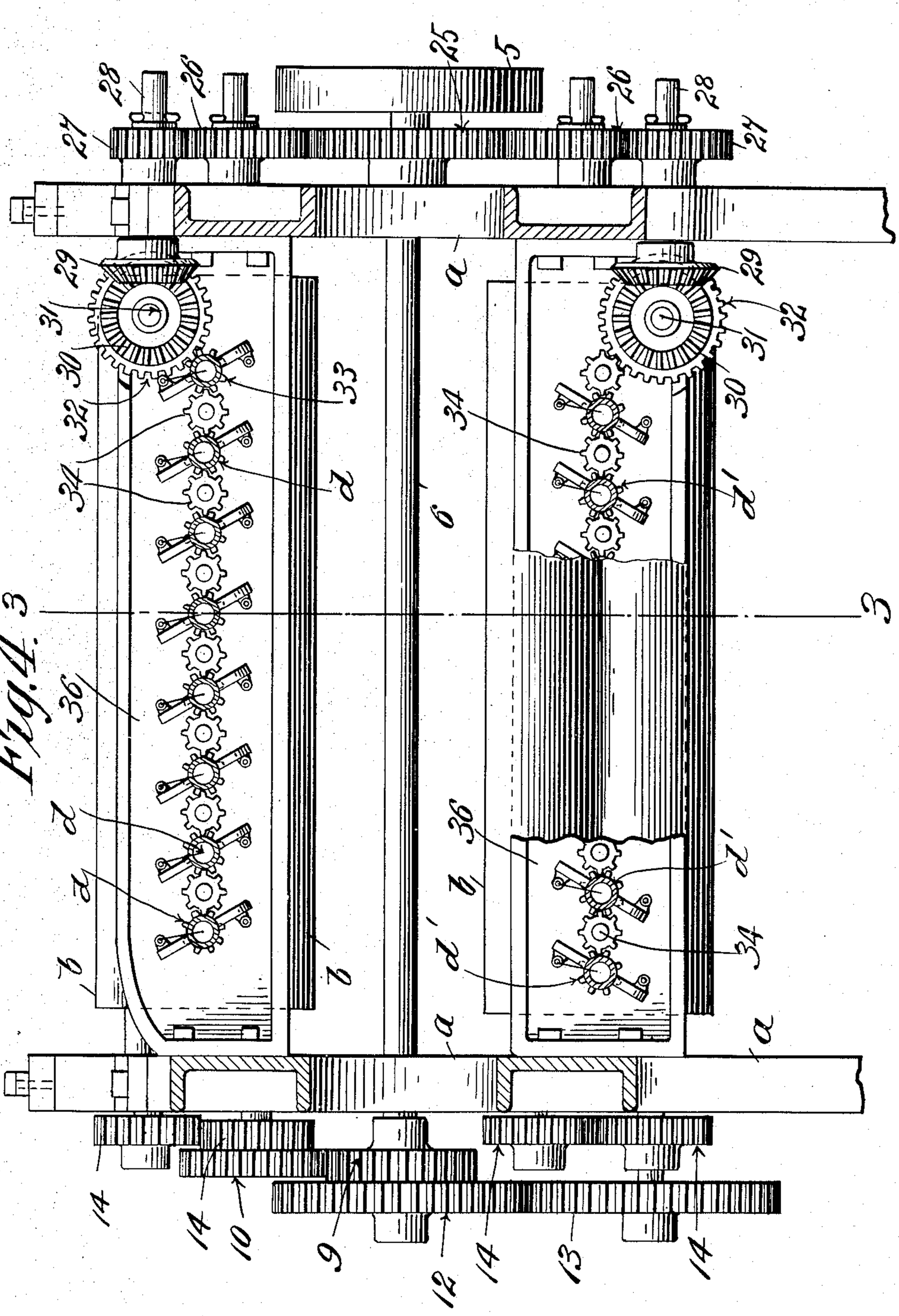
5 SHEETS—SHEET 4.

Fig. 4.



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5 SHEETS—SHEET 5.

Fig. 5.

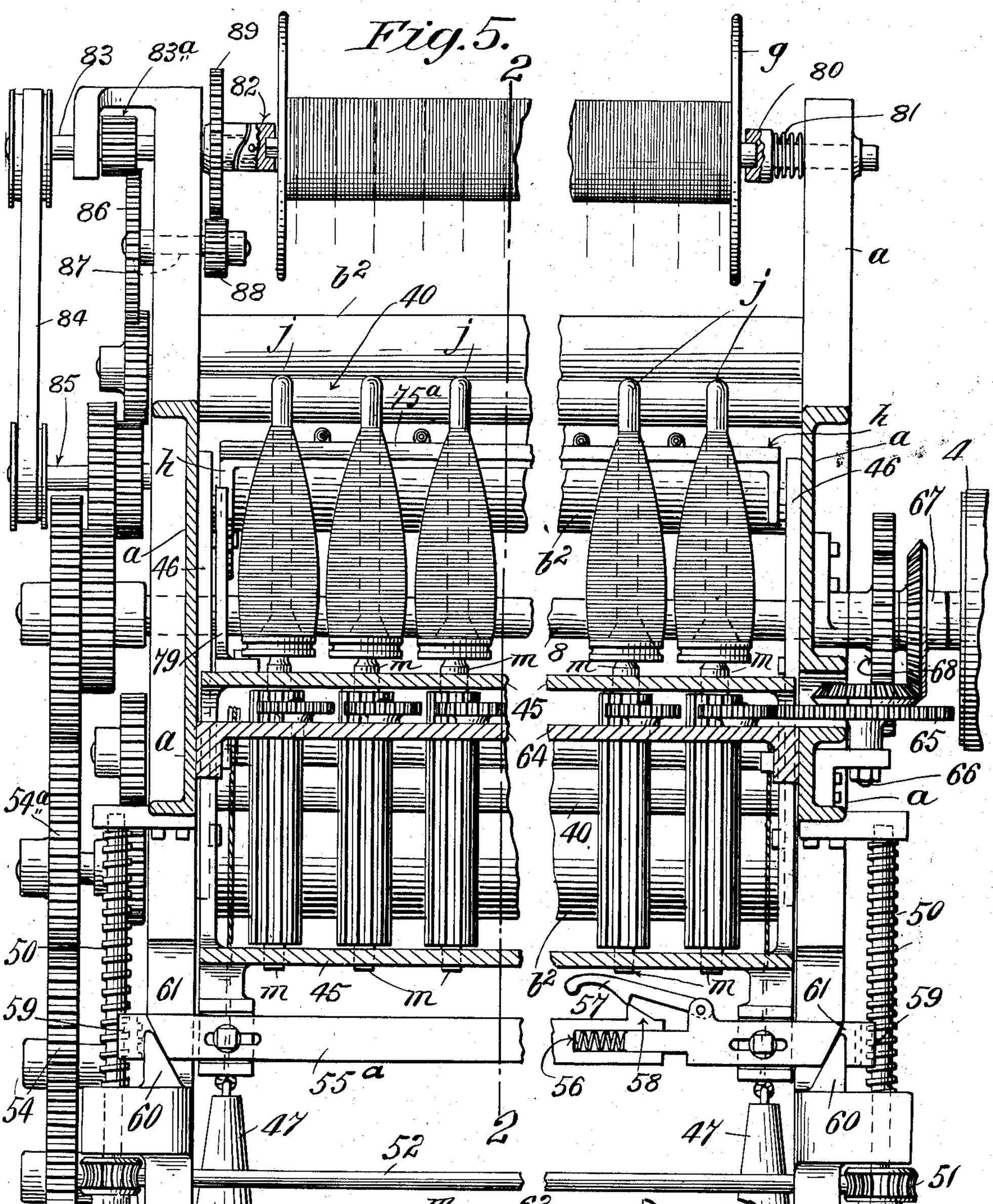
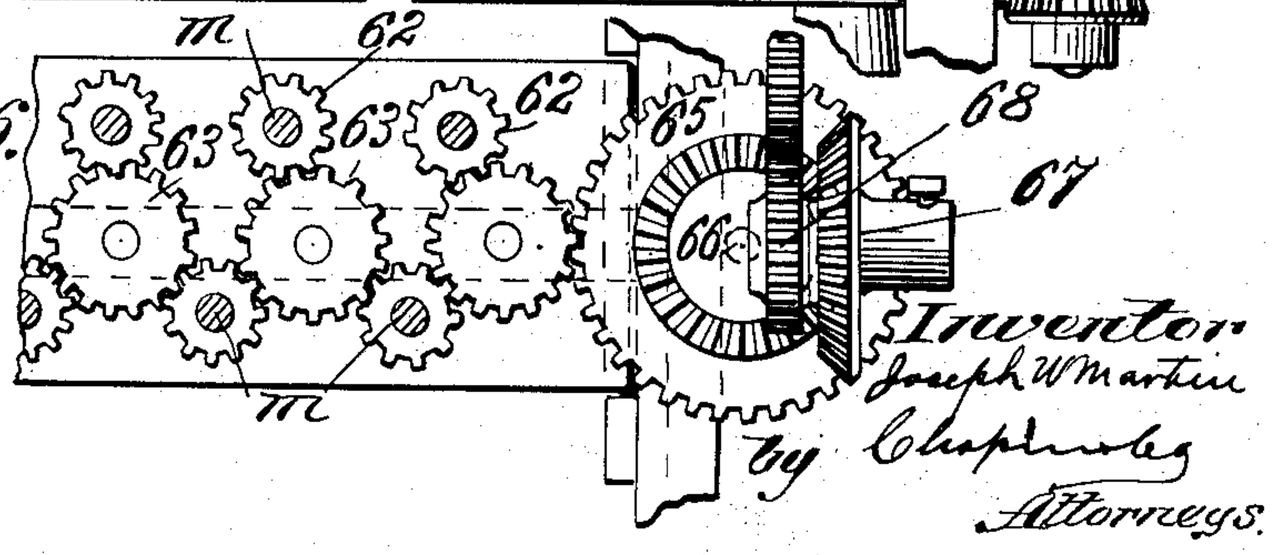


Fig. 6.



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UNITED STATES PATENT OFFICE.

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SPINNING-MACHINE.

No. 819,298. Specification of Letters Patent. Patented May 1, 1906.

Application filed June 20, 1904. Serial No. 213,315.

To all whom it may concern:

Be it known that I, JOSEPH WILLIAM MARTIN, a citizen of the United States of America, residing at Holyoke, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Spinning-Machines, of which the following is a specification.

This invention relates to textile machinery, the object thereof being to provide a machine in which are combined spinning, doubling, and twisting mechanism capable of being used separately or independently, the machine being adapted to receive the sliver as it issues from the carding-machine or drawing-heads, thereby obviating the break in the process of making yarn which is in common use at the present time, and the capabilities of the machine will be better understood by saying that it comprises in one construction mechanism for spinning two sets of slivers and doubling and winding the same on the bobbin or beam; second, mechanism to spin two slivers, with each of which another spun sliver may be doubled during the operation of the machine and twisted in the opposite direction, the two twisted strands, each made up of two spun yarns, being doubled together on a spool or beam; third, means to spin a single sliver and to double therewith during the operation of the machine another spun sliver and twist the same to form a yarn, each yarn so made being wound onto a separate bobbin; and the invention consists in the mechanism described in the following specification and carefully pointed out in the claims, the drawings illustrating an operative embodiment of the invention, in which drawings—

Figure 1 is a side elevation of a machine in which the invention has been embodied. Fig. 2 is an enlarged elevation of the left-hand end of Fig. 1, certain of the parts being shown in section, the plane of the section being substantially on line 2 2, Fig. 5. Fig. 2ª is a detail view of certain parts of the traverse mechanism for the bobbins. Fig. 3 is a sectional elevation on line 3 3, Fig. 4, showing only the right hand of the whole machine as drawn in Fig. 1, the scale being the same as in Fig. 2. Fig. 3ª is a sectional elevation of a spindle, showing slight changes in the construction thereof as compared with the spindle shown in Figs. 1 and 3. Fig. 4 is a transverse section through the machine on line 4 4, Fig. 3, looking in the direction of the arrow; and Fig. 5 is a transverse sectional view of the machine on line 5 5, Fig. 2, looking in the direction of the arrow. Fig. 6 is a sectional plan view showing the relations of the spindles one to another and driving means therefor, the plane of the section being on line 6 6, Fig. 2.

The general characteristics of the machine will first be described.

In a suitable frame *a* feed-rolls *b b* are supported, there being preferably two pairs in this machine located in the same vertical plane, as shown in Fig. 1. These rolls receive the sliver *c* from the card or drawing-heads, feeding the latter toward horizontally-disposed twisting-spindles *d d'*, arranged, as shown in Fig. 2, with their axes in line with the meeting line of the feed-rolls *b b*. These twisting-spindles are tubular, as shown, and the yarn is led into one end of them out through an opening in the side, thence through an eye in the flier-arm on the twisting-spindle, and thence through another opening into the twisting-spindle again, from whence it passes between two other feed-rolls *b' b'*.

If two spun yarns are to be doubled together without twisting, then from the rolls *b'* yarns from both sets of twisting-spindles *d d'* are carried up to a spool *e*, on which they are wound doubled together. If the single strands of yarn are to be doubled with another strand already spun and the two then twisted together, the yarn spun from the sliver *c* will be passed on through the feed-rolls *b' b'* to the twisting-spindles *f f'*, which are in all respects like the twisting-spindles *d d'*, the twisters, however, rotating in an opposite direction, and there is led down from a spool, as *e*, one or more spun yarns, which are carried through the feed-rolls *b' b'*, thereby being doubled with the yarns issuing from the twisting-spindles *d d'*, both being fed together into the twisting-spindles *f f'*, and from these twisting-spindles the yarn may be taken up to another spool *g*, the course of the yarns being shown in dotted lines in Figs. 1 and 3, or, if desired, the yarn from the twisting-spindles *f* and that from the twisting-spindles *f'* may be led through eyes on a suitable traverse-bar *h* and thence wound onto bobbins *j*, carried in the usual manner on spindles *m*.

Coming now to a more detailed description of the machine, the general driving-shaft thereof is located about centrally of the frame

and is indicated by 3, the driving-pulley thereof not being shown. On this shaft is a pulley 4, broad enough to carry two belts, one running to a pulley 5 on the shaft 6 at the forward end of the frame—that is, the right-hand end—and the other running over the pulley 7 on a shaft 8 at the opposite end of the machine. The shaft 6, as shown in Fig. 3, has a gear 9 thereon, which meshes with a gear 10 on the lower feed-roll *b* of the upper set of rolls, the rolls of each set being geared together. Another gear 12 on the shaft 6 meshes with a gear 13, which is on the lowermost roll of the lower set of rolls, the two rolls of this set being also geared together, the gears being shown in Fig. 4 and numbered 14. The gears which drive both the upper and lower set of these rolls are shown in Fig. 4 on the left-hand side of that figure, and it may be stated here that all of the other feed-rolls, of which there are three upper and three lower sets, *b b' b' b² b²*, are driven in like manner, the other two sets by the shafts 3 and 8, respectively, and they are all driven from the same side of the machine.

It is sufficient to say that both the upper and lower sets of the feed-rolls *b'* are driven by gears 15 and 16, secured, respectively, to the lower rolls of each set, which gears mesh with a gear 17,(shown only in dotted lines in Fig. 1,) it being secured on the shaft 3. Both the upper and lower set of the feed-rolls *b²* are driven by the shaft 8, a gear 18 on that shaft (shown only in dotted lines) serving to drive the upper set through its engagement with the gear 19, the lower set being driven by the gear 20 on said shaft meshing with the gear 21 on the lowermost roll.

One roll of each pair of feed-rolls is mounted in a box which is adjustable toward and from the other roll, this box being adjusted by the screw in the usual manner to hold these rolls in contact under whatever pressure may be desired. It is thus seen that the three sets of feed-rolls are driven by gears located on the left-hand side of the machine, as shown in Fig. 4, each set being driven by its particular shaft 3, 6, or 8.

The rolls *b' b'* may be rotated at a somewhat greater speed than the rolls *b b* to effect the drawing out of the yarn, if desired.

It is to be noted that a series of twisting-spindles is associated with each of the sets of feed-rolls hereinbefore described, which twisting-spindles are rotated by gear connections extending to that one of the three shafts 3, 6, or 8 contiguous thereto. The twisting-spindles *d d'* are located between the sets of feed-rolls *b* and *b'* and the twisting-spindles *f f'* between the sets of feed-rolls *b'* and *b²*. These twisting-spindles are horizontally supported with their axes at right angles to the feed-rolls and in the same plane as the point of contact of the latter, the twisting-spindles *d* being employed to impart the first twist to the sliver and the twisting-spindles *f* being employed to twist two or more spun yarns together in opposite directions.

At the delivery end of the machine at the left of the last set of feed-rolls *b²* is a series of perpendicular twisting-spindles *m*, which are purely winding-spindles and of which a description will be given farther on. The horizontal twisting-spindles are, like the feed-rolls heretofore described, disposed in two parallel rolls one above the other, which are duplicates one of another, and but one of them therefore will be described in detail, the two sets of twisting-spindles *d d'* and *f f'* being driven, respectively, by similar gear connections between the shafts 6 and 3. These twisting-spindles are driven by connections located on the right-hand side of the machine, as shown in Fig. 4, the reference to this figure and to Fig. 1 clearly showing this driving connection, which consists of the gear 25 on the shaft 6, meshing with the gears 26 above and below it, which in turn mesh with the gears 27, fixed on the shafts 28, on the inner end of which is a beveled gear 29, meshing with another similar gear 30 on a vertically-disposed shaft 31, on which is fixed a gear 32, the latter, as shown in Fig. 4, engaging a pinion 33 on that one of the twisting-spindles *d* located at the end of one row of twisting-spindles.

Between each of the twisting-spindles *d* is an intermediate gear 34, whereby the next spindle may be driven, all of the twisting-spindles being similarly geared together. This arrangement is clearly defined in Fig. 4.

The twisting- spindles *d d'* and *f f'* are, as shown in Figs. 3 and 4, supported in cross-bars 36, extending transversely of the frame, these bars being pierced to receive the ends of the twisting-spindles, which are turned down to constitute suitable bearings, the driving-pinion 33 of the twisting-spindle being located, preferably near one end thereof, close to the face of one of these bars 36.

By a change of the proportions of the gears 26 and 27 it is clear that the speed of rotation of the twisting-spindles may be regulated as desired.

By means of an arrangement of gears similar to that described in connection with the twisting-spindles *d* and *d'* the spindles *f* and *f'* are rotated, and it is sufficient to say that the gear 37 constitutes, together with the gears 38 above and below it, the driving connection for the twisting-spindles *f* and *f'*, whereby they are rotated in a direction contrary to that of the twisting-spindles *d d'*.

Just above the feed-rolls *b'* and *b²* and extending transversely across the top of the machine are the two spools *e* and *g*, there being located in front of both the upper and lower sets of feed-rolls a guide-roll 40, under which the yarn may be run and carried up to

the spool, the yarn from the two sets of twisting-spindles being doubled and wound onto the spool, the product of each pair of twisting-spindles, located in the same vertical plane (one in the upper and one in the lower set) being doubled together and wound separately from other doublings on the spool in the manner well known in this art.

On the opposite side of the feed-rolls b' and b^2 and in the same plane as the guide-roll 40 is another guide-roll 40^a. These rolls are only for the purpose of permitting a sliver from the spools e or g to be carried over behind them and from thence through the feed-rolls b' or b^2 to be incorporated with the sliver just entering these rolls. If, therefore, it is desired to double the slivers on one of these spools, it is necessary to take out the latter and reverse it to permit the sliver to be drawn from that side shown in the various views referred to.

It is clear from a glance at Fig. 3 that this mechanism will permit yarn to be drawn through the twisting-spindles d or d', passing through the flier-arm 41, as shown, and from this twisting-spindle be carried up and wound on the spool e, and simultaneously it would be possible to run another strand axially through the twisting-spindles d d', through the rolls b', and into the twisting-spindles f f', which might be used in this case as spinning twisting-spindles, delivering the yarn onto the spool g, or a full spool e of single or doubled spun yarns may be supplied to the machine and fed down, back of, and between the feed-rolls b b', and carried through the twisting-spindles f f', together with a yarn issuing from the twisting-spindles d, all of the strands being twisted together in a reverse direction. In this case the yarns in passing through the twisting-spindles f f' and the feed-rolls b^2 would not be led up over the roll 40 to the spool g, but would pass from the said feed-rolls through suitable eyes on the traverse-bar h and from thence be wound onto the bobbins j on the spindles m. These spindles m are supported in a carriage 45, comprising a top rail and a bottom rail connected with suitable uprights at the ends thereof, which uprights, as shown in Fig. 2, run between the guides 46, bolted to the side, of the frame. The spindles j are mounted in this carriage 45 in two rows, (if the machine is provided with double sets of feed-rolls, as in this case,) and a suitable vertically-reciprocating movement is imparted to the spindles relative to the traverse-bar h, whereby a properly-shaped bobbin j may be built up. It is a matter of indifference, however, as far as the operation of the machine is concerned, whether the bobbins move relative to the bar h or the latter relative to the bobbins. It has been deemed best in the construction shown herein to adopt the former method and move the bobbin relative to the bar, and to that end means are provided to impart a vertical reciprocatory movement to the carriage 45, whereby the spindles j may be so moved relative to the bar h as to properly fill the bobbins thereon during the movement of the carriage from its lowest to its highest position, and this carriage movement is effected as follows: It has been stated that the carriage is supported between the guides 46. To this carriage weights 47 are suitably applied to counterbalance the same and render its vertical movements uniform, the weight slightly overbalancing the carriage, however, the latter being provided with feeding means whereby it may be drawn downward, and upon reaching the limit of its downward movement the feeding means are automatically thrown out of engagement with the carriage to allow the weight 47 to carry the latter upward again, whereupon the bobbins are doffed from the spindles j and others put on. Meanwhile during these movements of the spindle j they are continuously rotated by means of mechanism which will be described farther on.

The carriage-traversing mechanism consists of two screws 50, vertically disposed at each side of the machine, (clearly shown in Figs. 2 and 5,) their lower ends being provided with worm-gears 51, with which worms on a shaft 52 engage, there being a gear 53 on said shaft which, through an intermediate 54, is rotated by a gear 55 on the end of the shaft of the lowermost feed-roll of the lower set of the rolls b^2 b^2. (See Fig. 2.) These screws are continuously rotating, and on the carriage is a bar 55^a made in two parts, slidably connected and adapted to be separated by a spiral spring 56 placed between them. (See Fig. 5.) On one of said bars is a latch-lever 57, adapted to hook over a lug 58 on the other part and in the outer ends of this two-part bar a half-nut 59 is formed, these half-nuts, when the latch-lever 57 is thrown upward, being forced against the feed-screw 50 by the spring 56, the bar being slidably supported on the carriage 45.

On a portion of the frame beneath each of the two parts of the bar 55^a is an upstanding wedge 60 and on the bar portions are shoulders 61, adapted to engage these wedges, whereby when the carriage 45 approaches the limit of its downward movement the bar portions will be moved together and the nuts 59 will be moved out of engagement with the feed-screws 50, whereupon the weights 47 will move the carriage upward to the dotted position shown in Fig. 2, in which it will remain until the latch-lever 57 has been thrown upward, allowing the ends of the bar 55^a to engage the feed-screws 50 once more, whereupon the carriage will begin its slow descent.

The shanks of the spindles m consist of long gears 62 with which driving-gears 63, carried on a centrally-disposed bar 64, en-

gage. The spindles and the gears 63 are so connected that all the spindles will rotate in the same direction, the disposition of these parts being shown in Fig. 6 very clearly. The bar 64, as shown in Fig. 5, is bolted to the frame *a*, the open ends of the carriage 45 permitting this to be done. It is thus possible for the spindles to be continuously rotated during their traverse movement, rotative movements being imparted to the gears 62 (located close beside the frame) by means of a gear 65 meshing therewith. This is supported on a vertical stud 66, (shown in Fig. 5,) on the upper end of which is a bevel-gear meshing with another bevel-gear on a horizontal shaft 67, which carries another gear 68, which, through an intermediate 69, meshes with the gear 70 on the shaft 8.

It is desirable to build the bobbins *j'* on the spindles *m* cone-shaped, as shown in the drawings, and to this end means are provided whereby a quicker traverse movement is obtained when the bobbin starts to fill up at the top than is necessary at the bottom of the bobbin. This is attained as follows: The traverse-bar *h* is hinged at 72 on arms 75ª, (see Fig. 2,) and under one end thereof a cam 76 is located which is fixed on a shaft 77 on which is a pinion 78 in mesh with a vertical rack 79, secured to the carriage 45. As the latter rises it will, by means of the rack and pinion, rotate the cam 76, thus permitting the bar *h* to fall with a gradually-decreasing movement until finally, as the base of the bobbin rises at the end of the traverse movement in one direction and the beginning thereof in the opposite direction, it rests on the cylindrical portion of the cam. This movement of the bar *h* relative to the vertical movement of the bobbins in a contrary direction will give the bobbins their conical shape when filled. Of course this device forms no part of the invention, and some other mechanism whereby the same end may be accomplished may be substituted therefor, if desired. The same is true relative to the means shown herein for driving the spindles *m*.

When one of the spools *g* or *e* is to be filled with doubled yarn, it is of course necessary that the yarn delivered from the feed-rolls should be traversed back and forth transversely of the axis of the spool, and means have been provided to effect this traverse movement and are illustrated in Fig. 5. The spool *g* is hung in a collar 80 at one end, said collar being located on an endwise-movable shaft extending through the frame, a spring 81 being interposed between the collar and the frame. At the opposite end of the spool the shaft thereof is squared and enters a collar 82, secured on the end of a shaft 83, rotated by a belt or other driving connection running to the shaft 85, which constitutes the axis of one of the feed-rolls b^2 of the upper set. On the shaft 83 is a wide-faced gear 83ª in mesh with another gear 86 below it fixed on a shaft 87, on which is a pinion 88, meshing with a gear 89, loosely mounted on the inner end of the aforesaid shaft 83 and between the frame and the collar 82. The contiguous edges of the hub of the gear 89 and the collar 82 are cam-shaped, and the relative speeds of rotation of the spool *g* and the gear 89 are such that one will run somewhat faster than the other, whereby the cam-surfaces above referred to will have a different speed of rotation, thus slowly moving the spool *g* endwise, causing the shaft at the opposite end of the bobbin to move endwise through its bearing in the frame, thus compressing the spring 80, which serves to move the spool in the opposite direction at the proper time. The mechanism whereby this slow traverse movement is imparted to the spool does not form a part of the invention, and some other suitable traverse movement therefor may be substituted, if desired.

From the foregoing description it is clear that a sliver *c*, passing through the rolls *b b*, would enter the end of the hollow twisting-spindle *d* and would be carried through one of the apertures 41ª therein through the eye in the flier-arm 41, reëntering the spindle through similar apertures 41ª near the opposite end, and from thence pass on to the rolls *b'*, the rotation of the twisting-spindle *d* imparting suitable twist to the yarn. From the rolls *b'* the yarn would take a similar course through the twisting-spindles *f f'*, which rotate in the opposite direction, and if from a spool, as *e*, a yarn or roving passes down between the feed-rolls *b'* and is carried on through the twisting-spindles *f f'* with the yarn being made in the machine the two will be twisted together, the rolls *b b'* preventing the twist from running back.

There is no particular significance in making the machine with two lines of twisting-spindles *d d'* and *f f'* arranged vertically one over the other, but from an economical point of view the construction has many advantages.

In Fig. 3ª is shown a modification of the twisting-spindles *d* and *f*, in which the slots 41ª are provided with grooved rolls over which the yarn may run, whereby the friction on the latter may be reduced.

It is quite true that a twist in opposite directions will be imparted to the sliver from the flier-arm 41 of the twisting-spindles *d*. (See Fig. 3.) This twist will run forward toward the rolls *b'*, through which the sliver passes, and therefore whatever twist there may be will be retained. From the twisting-spindles *d* and *d'*, therefore, a separate sliver passing around the guide-rolls 40 will be wound together onto the spool *e*, and when so wound they may be drawn off together and passed through back of the rolls *b'* and incor-

porated with another sliver, which has received its initial twist from the roll *b*, or the separate slivers on the spool *e* may pass one through the upper set of rolls *b'* and the other through the lower set. If, however, the sliver passes from the rolls *b'* directly onto the twisting-spindles *f*, whereby a reverse twist is imparted to the sliver, the second twisting-spindle *f* would merely undo the work of the first roll *b* if the twisters run in opposite directions. If, however, the two slivers, or one of them which has previously been twisted and wound on the spool *e*, be incorporated with the sliver by being brought down back of the rolls *b'* and passing therethrough to the spindles *f*, the reverse twist imparted to the sliver thus doubled together, if properly proportioned relative to the initial twist, would constitute a likely twisted thread or yarn made up of two or more threads which have been twisted in one direction and doubled together and retwisted in the reverse direction and of a single sliver to which an initial twist has been given, which initial twist would be more or less taken out of it after it passed the rolls *b'*, and the relation of this sliver to the other twisted strands referred to would be that of a filler.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a spinning-machine, two twisting-spindles having a common axis, a pair of rolls located between the contiguous ends of the twisting-spindles, a second pair of rolls located beyond the end of one of the twisting-spindles, means to rotate the spindles in opposite directions, whereby a yarn may be twisted in one direction by one twisting-spindle and in the opposite direction by the other twisting-spindle, together with means to feed a spun yarn between the rolls located between the twisting-spindles whereby it may be doubled with the yarn being formed on the machine, and twisted therewith.

2. In a spinning-machine, two pairs of rolls, a twisting-spindle located between the rolls, the axis of the spindle being in the plane of the meeting edges of said rolls, and means to support the yarn at each end of the twisting-spindle axially thereof, and another support for the yarn located midway between the ends of the twisting-spindle, eccentrically of the latter, whereby the yarn advances toward the support and recedes from the same at the same angle with the axis of the head.

3. In a spinning-machine, three pairs of rolls in substantially the same plane, a twisting-spindle located at each side of the central pair of rolls in the plane of the meeting edges thereof, means of support for the yarn located on said twisting-spindles axially at each end thereof, and another support on each twisting-spindle located between the ends and eccentrically thereof, means to rotate the twisting-spindles in opposite directions, and means to rotate the rolls to draw yarn longitudinally of the twisting-spindles.

4. In a spinning-machine, two pairs of twisting-spindles located in the same plane one above the other, each pair having a common axis, a pair of rolls between the contiguous ends of each pair of twisting-spindles, another pair of rolls located at the end of the forward twisting-spindle of each pair, supports on the twisting-spindles for the yarn at each end of the same, and another support for the yarn located between the ends thereof eccentrically thereto, means to rotate the twisting-spindles in opposite directions, and means to rotate the rolls to draw the yarn longitudinally of the twisting-spindles, and a rotatable bobbin to take up the yarn from each pair of twisting-spindles.

5. In a spinning-machine, a twisting-spindle, a pair of rolls located at each end of the latter, means of engagement for the yarn on the twisting-spindle located axially at each end thereof, and a support for the yarn located midway between the ends of the twisting-spindle eccentrically to the axis of the same, whereby the yarn advances toward the support and recedes from the same at the same angle with the axis of the spindle, the rolls at the delivery end of the twisting-spindle being rotatable at a greater speed than the rolls at the opposite end whereby the yarn may be drawn down more or less during the spinning operation.

6. In a spinning-machine, a spinning and a twisting spindle, means to rotate the same in opposite directions, a pair of feed-rolls located between said twisting-spindles, and another pair of feed-rolls located beyond the twisting-spindles, to draw the yarn from the latter whereby the yarn may be spun and twisted at one operation, together with means to feed one or more spun yarns between the rolls located between the spinning and twisting spindles, to be twisted into the yarn being spun on the machine.

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