(No Model.) 4 Sheets—Sheet 1.

W. LANCASTER.

MACHINE FOR SPINNING AND DOUBLING YARN.

No. 326,300. Patented Sept. 15, 1885.

fig. 1.

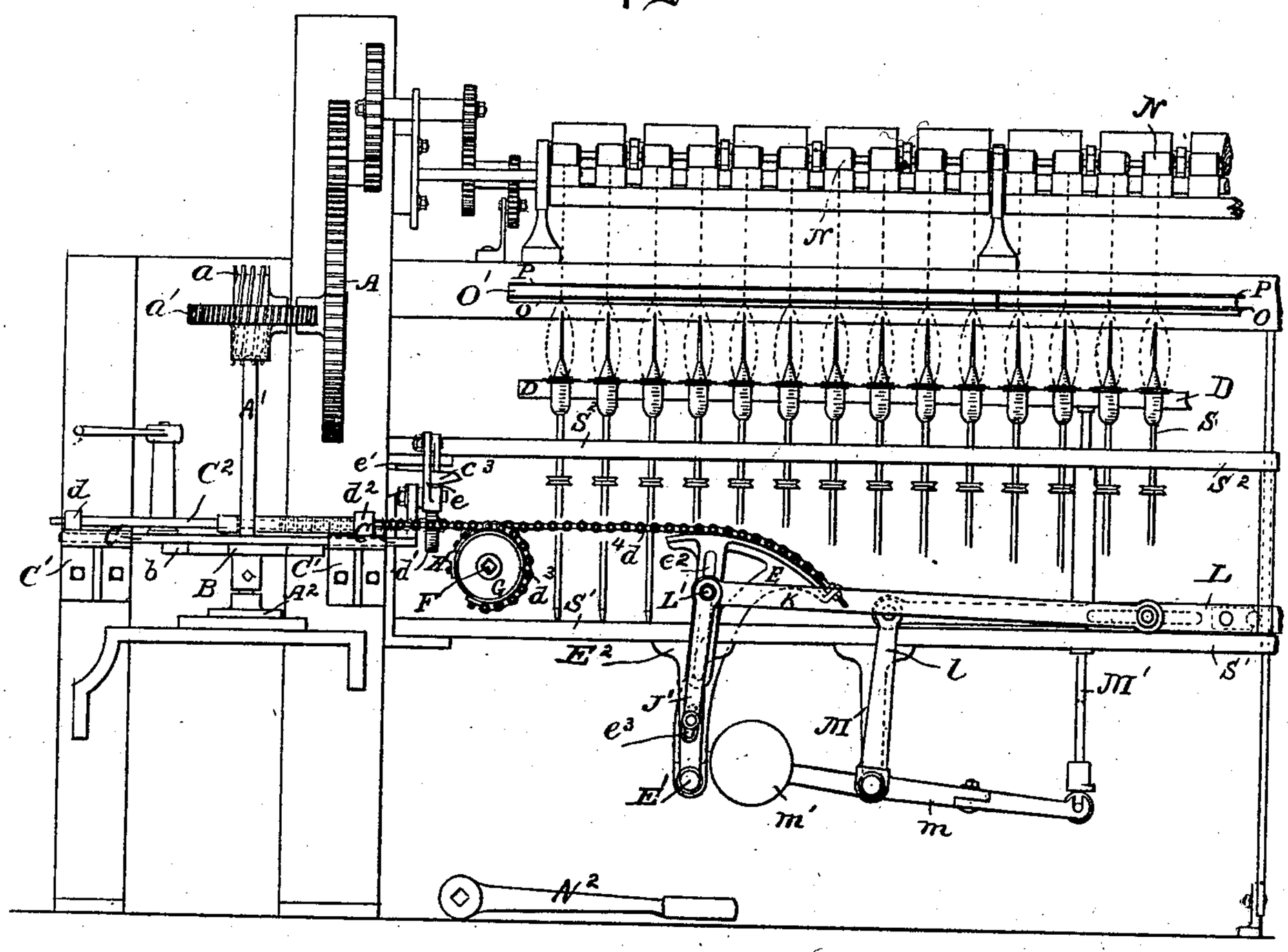
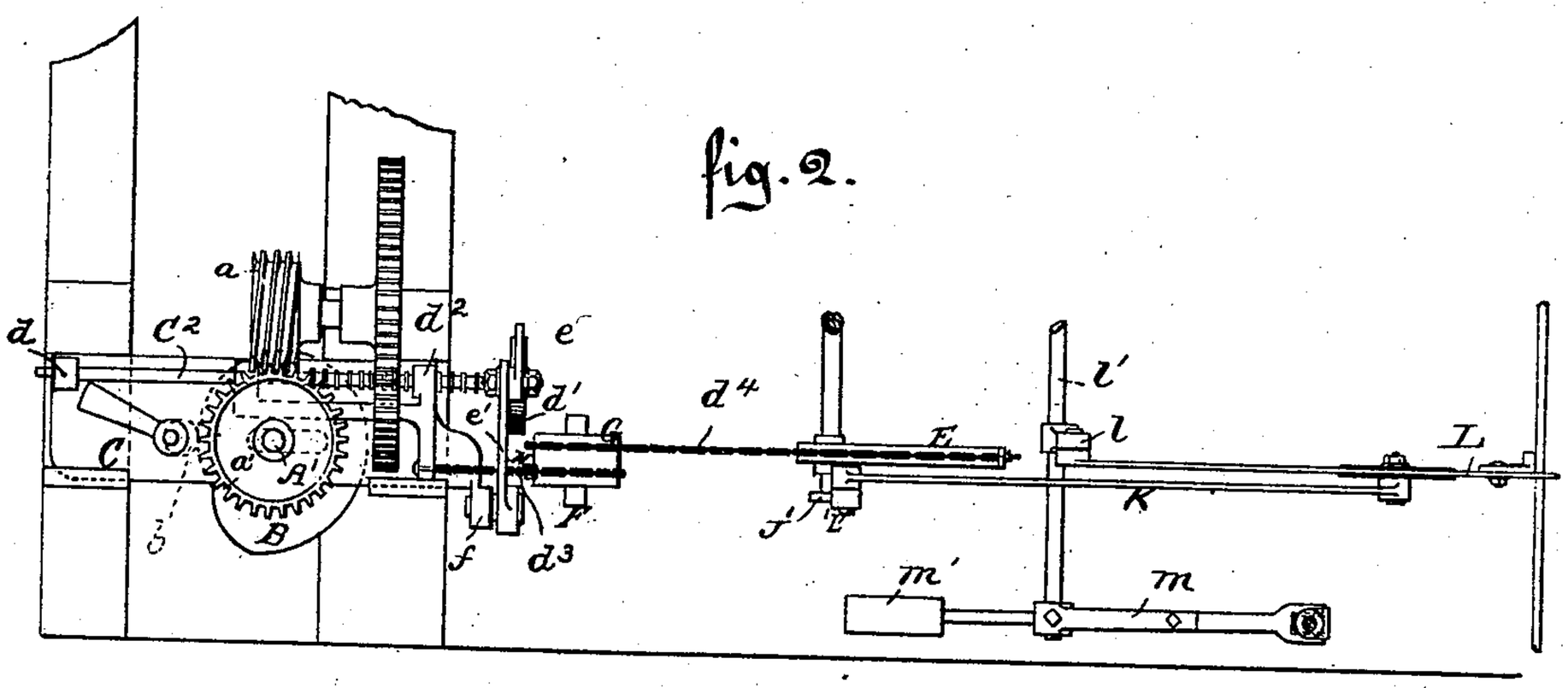


fig. 2.



WITNESSES

N. L. Collamer,

E. H. Bond.

INVENTOR

William Lancaster.

By his Attorney

Frankland Jarman.

(No Model.) 4 Sheets—Sheet 2.

W. LANCASTER.

MACHINE FOR SPINNING AND DOUBLING YARN.

No. 326,300. Patented Sept. 15, 1885.

Fig. 3.

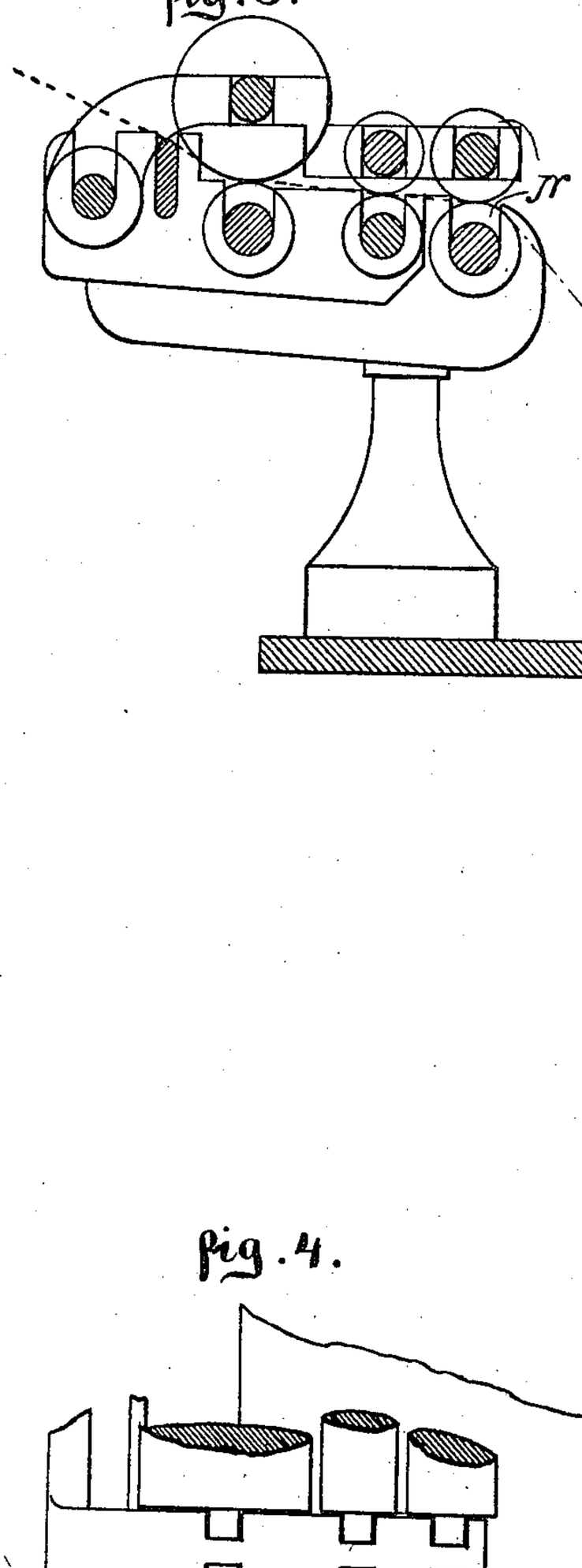


Fig. 22.

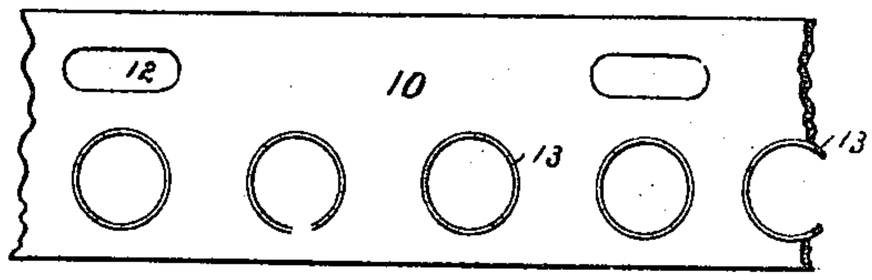
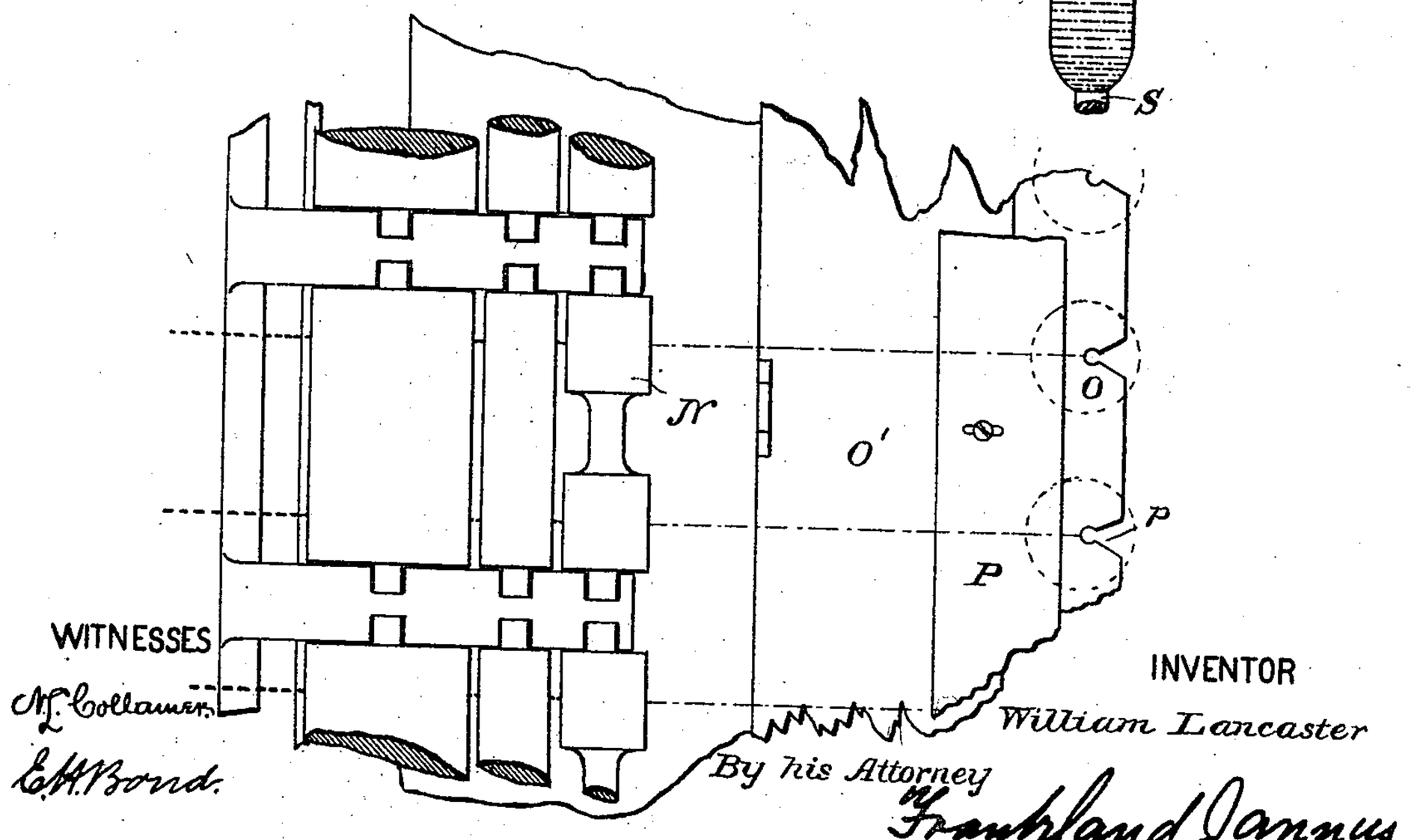


Fig. 4.



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W. LANCASTER.

MACHINE FOR SPINNING AND DOUBLING YARN.

No. 326,300. Patented Sept. 15, 1885.

fig. 6.

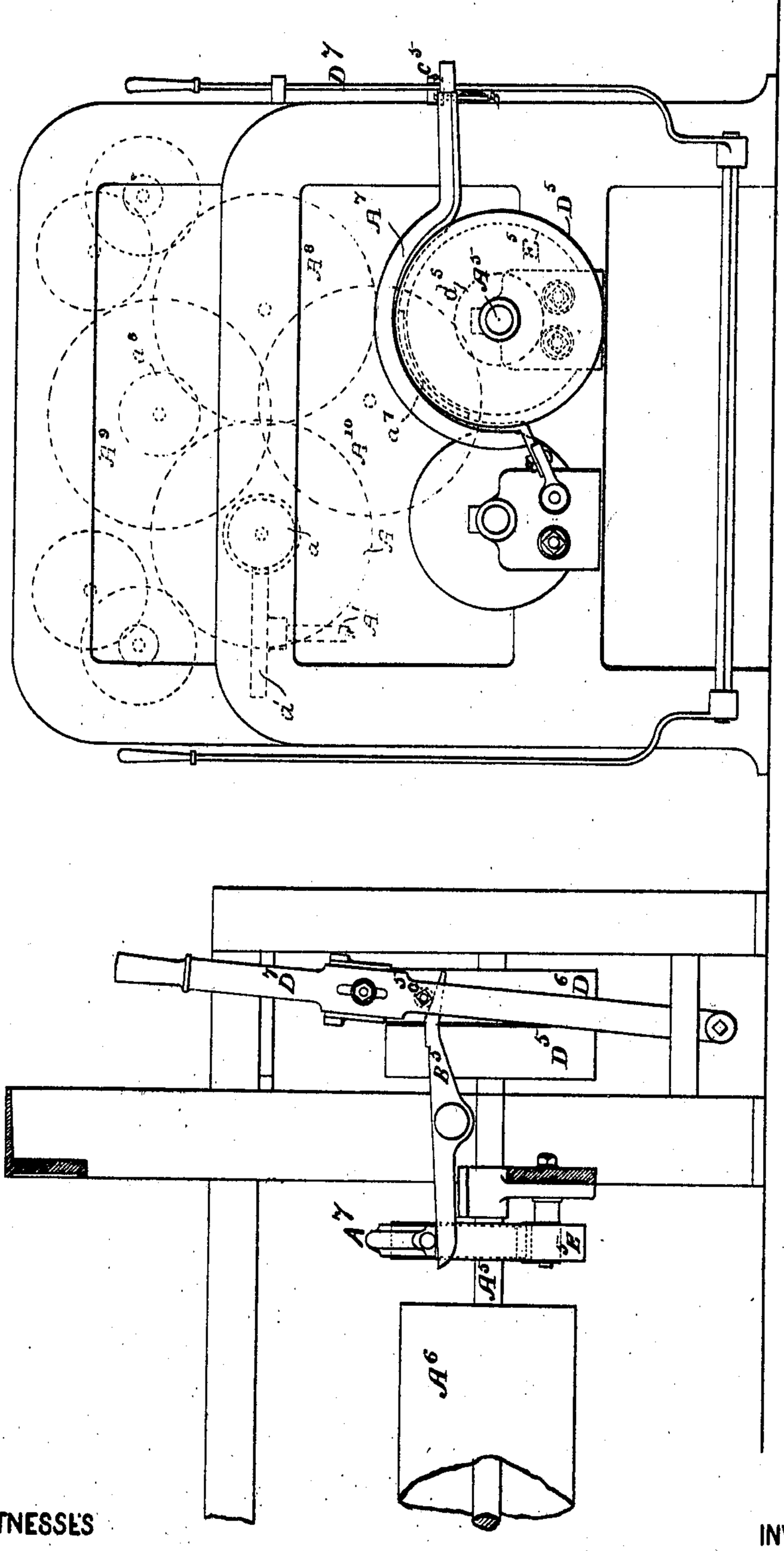

fig. 5.

WITNESSES

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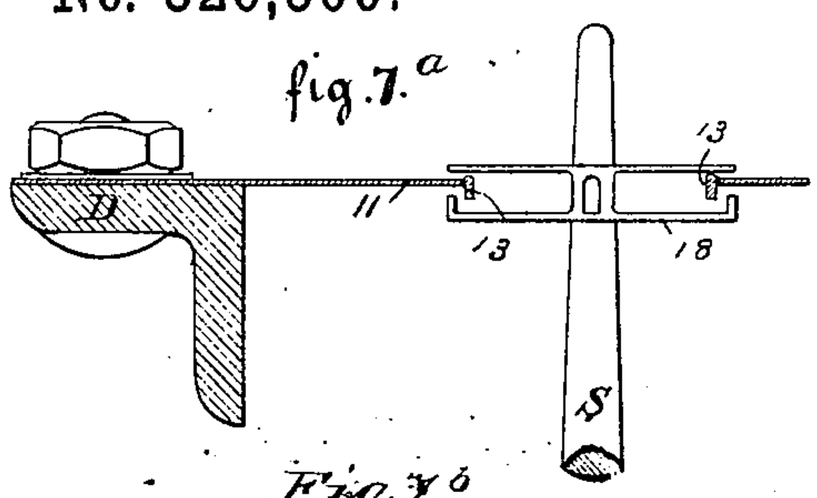
(No Model.) 4 Sheets—Sheet 4.

W. LANCASTER.

MACHINE FOR SPINNING AND DOUBLING YARN.

No. 326,300. Patented Sept. 15, 1885.

fig. 7.a



Fig, 7.b

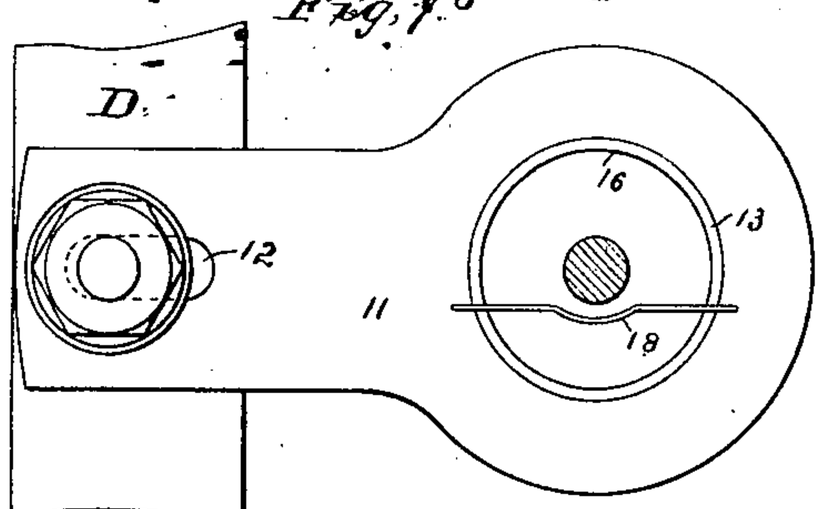
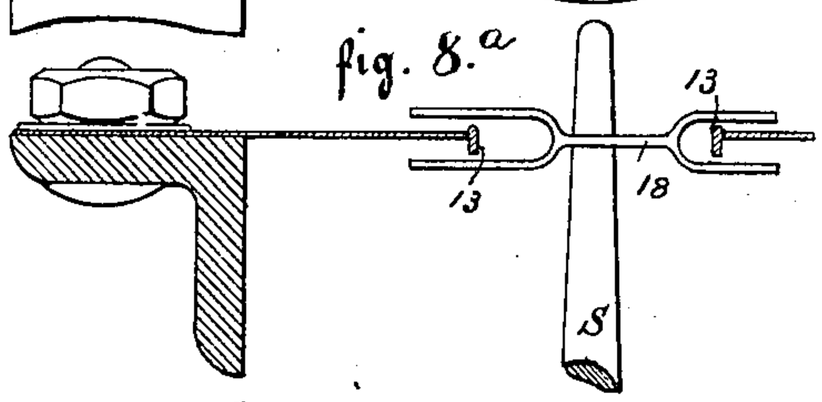


fig. 8.a



Fig, 8.b

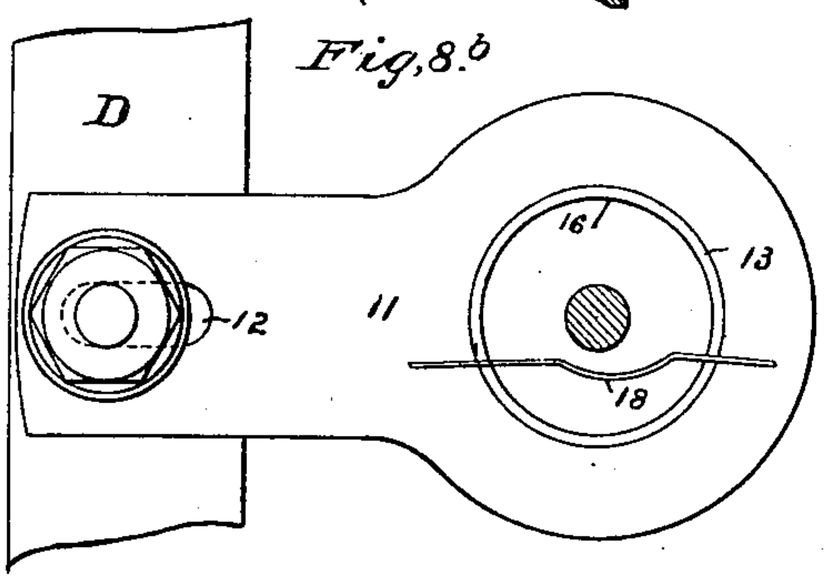


fig. 9. q'

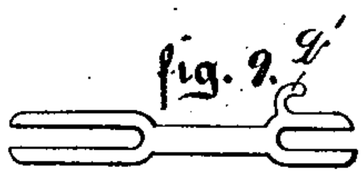
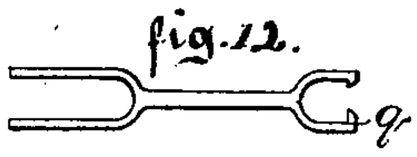


fig. 12.



q' fig. 10. q'

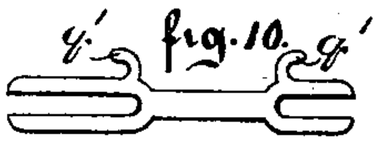


fig. 13.

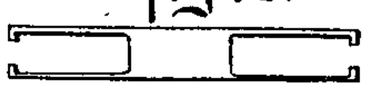


fig. 11.

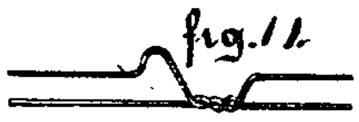


fig. 14

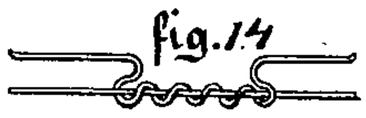
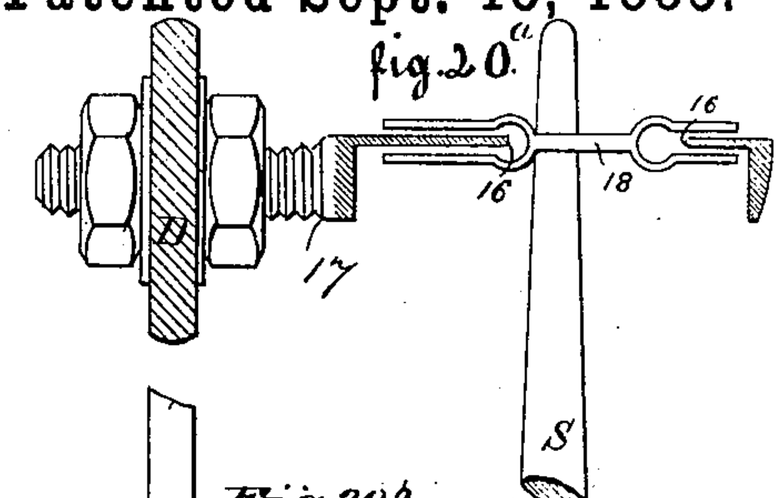


fig. 20.a



Fig, 20.b

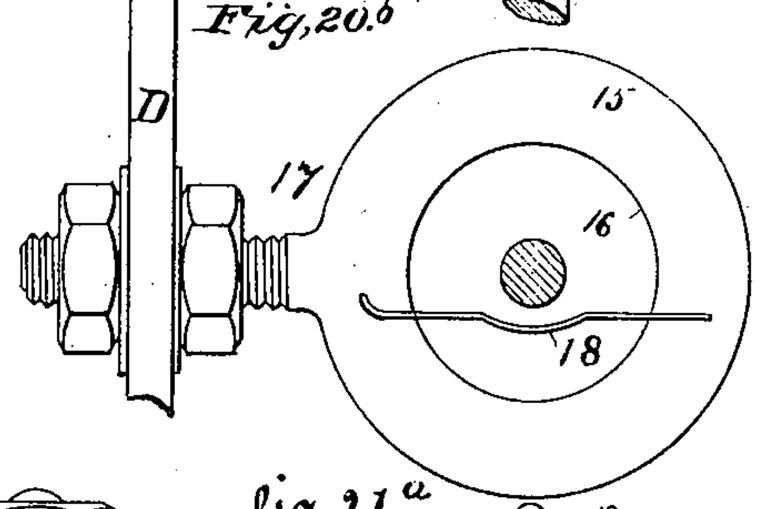


fig. 21.a

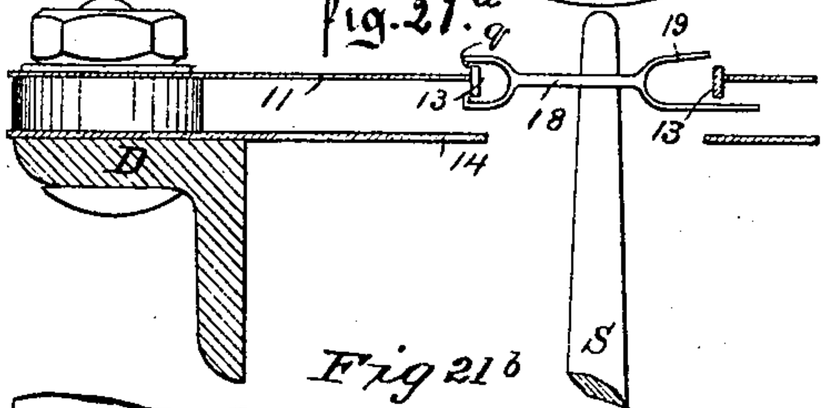


Fig 21.b

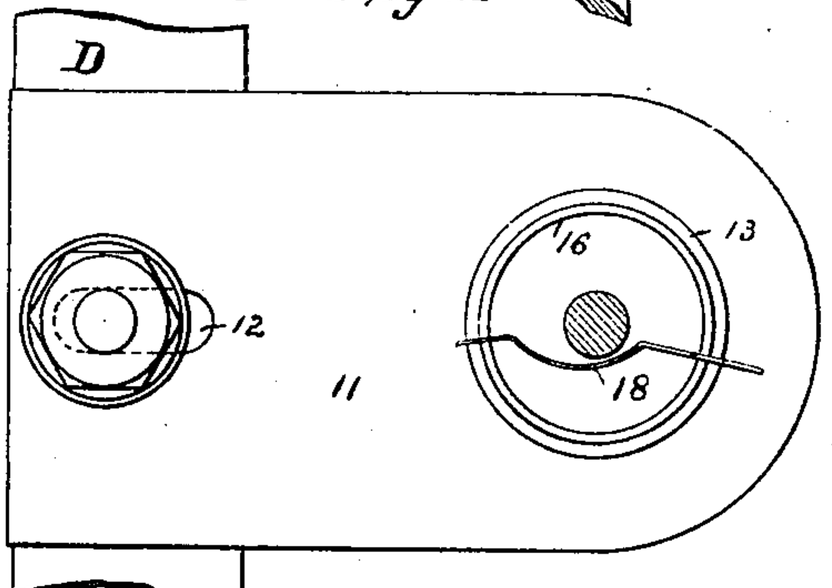


fig. 15 q'

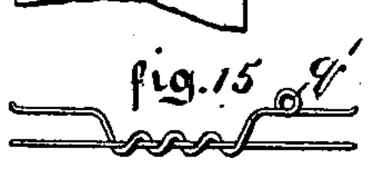


fig. 18.

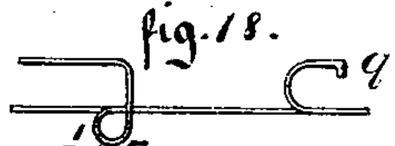


fig. 16. q

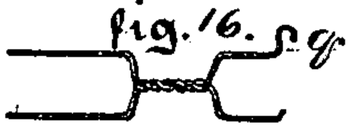


fig. 19.

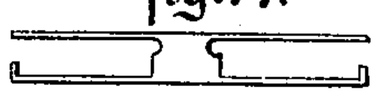
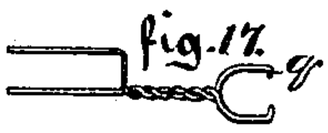


fig. 17. q



WITNESSES

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UNITED STATES PATENT OFFICE.

WILLIAM LANCASTER, OF ACCRINGTON, COUNTY OF LANCASTER, ENGLAND.

MACHINE FOR SPINNING AND DOUBLING YARN.

SPECIFICATION forming part of Letters Patent No. 326,300, dated September 15, 1885.

Application filed October 2, 1883. (No model.) Patented in England September 7, 1882, No. 4,263; in Belgium October 19, 1882, No. 59,324, and in France March 6, 1883, No. 154,133.

To all whom it may concern:

Be it known that I, WILLIAM LANCASTER, a subject of the Queen of Great Britain, residing at Accrington, in the county of Lancaster and Kingdom of England, have invented certain new and useful Improvements in Machinery for Spinning and Doubling Yarns of all Fibers and Forming the Same into Cops or Bobbins, (for parts of which I have a patent in Great Britain, No. 4,263, bearing date September 7, 1882; a patent in France, No. 154,133, bearing date March 6, 1883, and a patent in Belgium, No. 59,324, bearing date October 19, 1882,) of which the following is a specification.

My invention relates to machinery for spinning and doubling yarn continuously; and it consists in certain novel combinations and modifications in the construction of the well-known "ring-spinning" machine, and more especially in the means devised for spinning and twisting all kinds of fibers on the bare spindles of such machines, together with the various mechanical movements and details of construction incident thereto, as will be hereinafter fully set forth.

In the accompanying drawings, Figure 1 is an elevation, partly in section, showing a portion of the feed-rollers, guide-plates, ring-rail, spindles, and driving-gear of a spinning-machine embodying my improvements, together with the mechanism employed for controlling and varying the traverse of the ring-rail during the various stages of the formation of the cop. Fig. 2 is a plan view of the mechanism for controlling and varying the traverse of the ring-rail. Fig. 3 is a sectional elevation showing the rollers, guide-plates, and one spindle. Fig. 4 is a plan view of the rollers and guide-plates. Fig. 5 is an elevation, partly in section, showing a portion of one end of the machine, including the fast and loose pulleys, the main shaft, and brake mechanism applied thereto. Fig. 6 is an end view. Fig. 7^a is an elevation, partly in section, showing the ring-rail, ring, a spindle, and a traveler in position within or on the ring. Fig. 7^b is a plan view of the same. Fig. 8^a, 8^b, 20^a, 20^b, 21^a, and 21^b all show modifications of the ring and traveler illustrated in Fig. 7. Figs. 9 to 19, inclusive, show some of the various forms that the traveler used with my ring may assume. Fig. 22 is a detail view showing a strip of metal containing a series of rings.

Similar letters denote like parts.

In Fig. 1 of the drawings are shown the principal parts of one side of a ring-spinning machine constructed according to my invention, in which A is one of the driving-gears, that is suitably connected to the main shaft A^5, and thence to the source of power, by the intermediate train of gearing, consisting, as shown in Fig. 6, of the wheel A^8, pinion a^8, wheels A^9 A^{10}, pinion d^5, and belt-wheel D^5. A worm-wheel, *a*, is carried upon the shaft of wheel A, and a' is a worm-gear mounted upon a shaft, A′, which extends downward and is stepped into a suitable support, A^2. Upon shaft A′ is mounted a cam, B, above which is located a sliding plate, C, which, being supported upon suitable guides or brackets, C′, attached to the frame of the machine and provided at its under side with a stop, *b*, in the path of the cam B, will be driven in one direction by the rotation of said cam and retracted by the weight of parts connected thereto. This sliding plate is reciprocated horizontally by the action of the cam against its stop, and carries a movable bearing or fork, d^2, which is displaced as the formation of the "cop" progresses, the fork d^2 being gradually moved along the plate C toward the shaft A′ by mechanism (to be described) actuated at each reciprocation of the plate C.

At one end of the plate C is a fixed bearing, *d*, in which is mounted the outer end of a screw-shaft, C^2, which is provided at its opposite extremity with a ratchet-wheel, d', and a gravity-pawl, *e*, carried by a pivoted arm, e', mounted on a lug or projection, *f*, carried by the plate C.

The movable bearing or fork d^2 is mounted upon and adapted to slide freely along the plate C, which supports it, and it also affords additional support to the screw-shaft C^2, by the step-by-step rotation of which it is gradually moved toward the shaft A′.

A wedge or inclined surface, C^3, is fixed to the frame in the path of the arm e', and at each backward movement of the plate the said arm is forcibly raised, thereby rotating the screw-shaft to the extent of one tooth of

the ratchet and moving the bearing or fork d^2 rearward on the plate C.

From the fork d^2 extends a chain, d^3, which passes over and is secured to a drum, G, preferably located in the same plane as and near the inner end of the plate C, which, besides being rocked upon its axis as the plate C moves backward and forward, is gradually rotated by the retrograde movement of the part to which its connecting-chain is secured. The chain or band d^3 is connected to the fork d^2 by means of a hook or other suitable device which may readily be disengaged or detached therefrom, and this chain extends to and is secured upon the drum G, which is mounted upon axis F near the inner end of the plate C.

Upon the periphery of the drum G and directly in the line of the chain d^3 is placed an adjustable stop or projection, H, over which the said chain rides at each oscillation of the drum until said drum is rotated a sufficient distance to carry the projection H out of the way of the chain.

A second chain or band, d^4, is also secured upon the drum G but not in the path of the projection H, and it extends therefrom preferably in the same direction as the chain d^3, and its further end is secured to the periphery of the sector E, which is pivoted at E′ to a suitable support or pedestal, E^2, depending from the frame of the machine. The sector is formed with a slot, e^2, extending from its circumference toward its pivotal point.

A rod, L, which extends nearly the length of the machine starts from a point near the sector where its extremity is secured to the free end of the rock-arm l, extending from a shaft, l', mounted in suitable bearings on supports M, attached to the frame.

Upon the rock-shafts are secured other arms, m, provided at their outer ends with anti-friction rollers, above which move in suitable guides vertical rods M′, to the upper ends of which is secured the ring-rail D. A counter-weight, m', is also mounted upon the rock-shaft for the purpose of steadying and facilitating the movements of the parts. Only one rock-shaft and set of arms is herein shown, but in practice as many are used as may be necessary to properly support and control the movements of the vertical rods carrying the ring-rail, which latter may be of any desired length.

In a suitable slot, e^3, in the pedestal E^2 is pivoted a rock-arm, J′, provided at its upper end with a projecting pin or stud, L′, which enters the slot e^2 in the sector.

A rod, K, connected to the arm J′ and sector E by pin L′ is secured to the horizontal draft-rod L, and serves to communicate the motion of the sector thereto, and thence through the rock-arms and vertical rods, heretofore described, directly to the ring-rails.

The spindles S are of well-known form, consisting of short metal rods tapered at their upper extremities, provided with driving-pulleys, and suitably stepped and journaled into the supporting frame-pieces S′ S^2. At about the usual distance above the spindles are located the delivery-rollers N, from which the material to be operated upon is fed in the well-known manner.

In order to reduce the friction, and thereby to lessen the strain on the yarn between the rollers and the spindles, I replace the well-known "twizzle-wires" with a strip or plate, O, that is formed with notches p at suitable intervals, within which the yarn is held and guided while being spun. This plate may be in the form of a continuous strip or be made in short sections. With either construction it is to be mounted upon, and preferably upon the lower side of a rail, O′, that is attached to the frame of the machine by suitable hinges, so that the entire series may be simultaneously turned up out of the way of the spindles to allow the removal of the finished product or "doffing."

In many cases, for instance, when hard-twisted yarn is made, the guide-plate O is sufficient for all purposes; but when other varieties of yarn are to be produced a more extended bearing is found necessary, and the supplemental guide-plate P, which may or may not be recessed, as desired, is attached to the upper side of the rail O′. This second plate should project from the rail far enough to occupy a position that will break the straight line into an angle that would otherwise be formed in the yarn between the recesses in the plate O and the delivery-rollers.

These guide-plates are essential to my apparatus when it is desired to produce what are known as "soft yarns," used for weaving purposes and the manufacture of hosiery. In such cases I prefer to use two such plates, although a greater number may sometimes be used with advantage, by means of which the frictional strain upon the yarn between the delivery-rollers and the spindles is materially lessened, thereby allowing the twist imparted by the spindle to run more freely to the bite of the rollers, where the untwisted sliver issues, thereby reducing the risk of breakage in the yarn and enabling me to spin on a bare spindle a much softer yarn than it has ever before been possible to produce under such circumstances.

The notches p are flaring, and open directly forward, being widest at the edge of the plate P, as shown in Fig. 4, the advantage being that such notches produce much less friction upon the yarn, as they afford fewer points of contact therewith, and in piecing up the yarn is much more readily placed therein than in any other form of guide known to me. This is of great importance in spinning the soft yarns above referred to, as the risk of breakage is diminished by the use of my improved guide-plate, and it is possible to spin a softer yarn with than without it.

Machines of the class herein described will, when the power is taken off, usually run for some time before expending their momentum

and coming to rest, during which period the speed of the spindles is so much reduced that the centrifugal force developed is not sufficient to keep the yarn near the end of the spindle away from and out of actual contact therewith, the result being that before the machine stops several turns of yarn are wound around the point of the spindle, rendering it impossible to start the machine again without breaking a number of threads or previously winding up by hand the portion so coiled about the points of the spindles. In order to obviate this difficulty, I provide brake mechanism for more speedily stopping the machinery, which mechanism, as shown, consists in a pulley, E^5, secured to the main or to the most convenient horizontal shaft of the machine, preferably to the shaft A^5, carrying one of the tin drums, A^6, and the fast and loose pulleys D^5 D^6.

A curved lever, A^7, is pivoted to a suitable part of the frame on one side of the pulley E^5, and extending thereover is curved so as to correspond to and closely grasp the periphery of the said pulley from which its free end projects into the path of a lever, B^5, suitably pivoted to a fixed portion of the machine, and by means of which the brake-lever can be elevated. The lever A^7 is preferably provided at that portion which comes in direct contact with the pulley with a removable lining or shoe, a^7, which can be replaced when necessary.

The belt-shifting lever D^7 is provided with a stop or projection, c^5, which engages the outer end of the horizontal lever B^5, which may be beveled, sloped, or bent to facilitate its action. When the lever D^5 is moved, so as to shift the belt from the fast to the loose pulley, the stop c^5 is moved down the inclined end of the lever B^5, which rises, allowing the brake-lever A^7 to drop into its operative position on the pulley E^5, thereby bringing the entire mechanism speedily to rest. The reverse movement of the shifting-lever D^7 depresses the lever B^5, elevating its free end and raising the brake-lever A^7 clear of the pulley E^5. The action of the brake may be rendered faster or slower by a proper adjustment of the weight of the lever A^7, and it will be readily understood that the actual construction of the brake is capable of considerable modification without in any way departing from the spirit of my invention.

The general construction, arrangement, and operation of the spinning portion of my invention is as follows: A series of suitable rings or hoops are provided, which rings are mounted upon a horizontal rail adapted to be moved vertically to a greater or less extent by means of the cam B, sliding plate C, drum G, sector E, suitable connections, and the system of levers thereto connected. The spindles that twist the yarn and upon which the twisted yarn is wound are so placed that each passes vertically through its ring as the latter are moved up and down in the process of building the cop. The mere proximity of ring and spindle accomplishes nothing, and the well-known arrangement whereby a traveler mounted upon the periphery of a ring serves to guide the yarn to a bobbin on the spindle does not in any essential respect resemble my method, which, as before stated, enables me to wind a "mule cop" on the bare spindle of a continuous-spinning machine. The rings or hoops referred to are constructed of a strip of sheet metal or other suitable material, which may be continuous throughout either side of the machine, as indicated at 10, Fig. 22, or in separate sections or plates, 11, to be afterward separately secured to their supporting rail D by bolts passing through elongated adjusting apertures 12. The rail D is preferably a bar of angle-iron which is carried by the vertical rods M′, which impart an ascending and descending motion thereto, which motion is by said bar simultaneously communicated to all the rings of a series. The said bar may be of other material than iron, and of any preferred cross-section possessing the desired lightness and rigidity.

Within suitable apertures in the strip 10 and plates 11 are placed linings or ferrules 13, which may be of iron, steel, glass, porcelain, or any other material capable of presenting a smooth and durable surface. The ferrules may extend above, below, or both above and below the surfaces of their supporting-plates. The said ferrules or linings may be placed loosely in the apertures of the plates and held in position by pins or equivalent means; but usually I prefer to fix them firmly in position by shrinkage, brazing, or other well-known process, the ferrules themselves consisting of short sections of tube, which, when inserted, form narrow raised edges on one or both sides of the plates, as shown in Figs. 7, 8, and 21. In the latter instance, however, a plate, 14, similar to 11, but without the ferrule 13, is placed below the plate which carries the traveler, for a purpose hereinafter explained.

I sometimes prefer to substitute for the plate and ferrule a solid ring, 15, which is suitably apertured to receive the spindle, and countersunk or cut away until it presents an edge, 16, of the desired thickness, which edge may or may not be fitted with a ferrule, or may be formed so as to have sufficient of the material to answer that purpose. A shank, 17, projects from this form of ring, by which it is secured in position on the rail D.

In order to effect the spinning of the yarn, and also to cause it to be wound upon the rapidly-rotated spindle, it is necessary to interpose a frictional device between the spindle and ring, which device is to be traversed by the yarn being spun, and the tension or resistance of which varied according to the material operated upon, and the hardness to which the bobbin or cop is to be wound.

The tension device referred to consists, essentially, in a small strip of metal, 18, formed with bifurcated extremities, and of length

slightly exceeding the diameter of the ring. These travelers or "drag-forks" may be made of various materials and in an infinite variety of shapes, a few of the equivalent forms thereof being shown in Figs. 7ª to 21ª, inclusive, any of which will admit of the said drag-fork being sprung into position, with its ends embracing the periphery of the ferrule or ring, as, for instance, as shown in Fig. 8ª, and the bifurcations referred to should be sufficiently extensive, whatever their particular configuration, that the device may, as a whole, be capable of the greatest freedom of movement within its ring. One end of the drag-fork maintains about the same position with respect to the periphery of the ring and the yarn entering at that end on its way from the guide-plates to the spindle. It is called the "eye," from which the yarn passes along the central portion or ridge of the traveler, and thence between the prongs of the delivery end or fork, and inward to the spindle.

The tendency of the loosely-hung drag-fork tension device is to lie close to the spindle, or whatever portion of the cop may be thereupon, and it must therefore be of such lightness that the strength of the yarn to be produced is sufficient to overcome its inertia, the result being that when the spindle is in motion the fork will be presented thereto and the bridge brought into actual contact therewith, (or with the cop,) and the said bridge affording the necessary fulcrum, the draft of the yarn passing through the fork will send the eye traveling around the ring at a speed not quite as high as that of the spindle, and the yarn coming to the said eye will receive rotary motion therefrom, and so be spun or twisted to the desired extent.

The rotary movement of the drag-fork being entirely due to the friction of the yarn traversing it from eye to spindle, the said traveler must be very light to be so affected; and one of the most important features of this part of my invention consists in so proportioning (adjusting) the weight (size) of the drag-fork to the work that the friction of the yarn thereupon will not be sufficient to propel it around the ring at the same speed as that of the spindle, and that it will lag behind to a predetermined and desired extent, the effect of which will be that during the process of spinning the yarn is also continuously wound upon the spindles in the ratio of the difference in speed between the spindle and traveler, making a harder or softer cop, according to the weight of the drag-fork used, or coils of yarn around the same, without breaking the yarn by excess of friction, and at the same time rendering continuous the operations of spinning and winding onto the bare spindles. This object I accomplish with travelers or drag-wires that are not necessarily incased in containers, or in a box or grooved ring or their substitutes, as is the case with other attempts made in the direction of spinning on the bare spindles on continuous spinning-frames. Moreover, our drag-forks or travelers are capable of radial, vertical, lateral, and rotary motion.

Some of my travelers (see Figs. 9, 10, 11, 13, 14, 15, 19) represent levers the fulcra of which is the spindle, and in these the bridge is shorter and the eye proportionately longer, to prevent the traveler falling out of the ring when not in motion. Some of these travelers—for instance, those shown in Figs. 9, 10, 15, and 18—are provided with additional projections, q', through or around which the yarn is passed on its way from the eye to the spindle, which will have the effect of increasing the tension between the traveler and the cop or spindle, thereby lessening it between the said traveler and the delivery-rollers.

A modified form of the above is shown in Figs. 12, 16, 17, 18. These latter do not take the spindle directly as their fulcrum; but they make the line of yarn or outer line of yarn serve that purpose. This takes place in travelers such as shown in Figs. 12, 17, and 18, one end thereof being loosely held by the ring or ferrule by means of small projections or hooks q at the extremity of the eye, and the bridge leading from this eye to the fork-shaped end of the traveler is so proportioned in length as to lead the yarn passing through the fork direct to the periphery of the spindle or cop.

In the building of the bobbins or cops upon the bare spindles it has been found advantageous to vary the traverse or chase of the ring-rail as the cops are being built, so as to dispose the coils or layers of yarn over a longer portion of the body of the cop, which variation of traverse causes the yarn to be more strongly united and bound together, producing a cop that will bear handling after it is removed from the spindle.

One object of my invention being to dispense entirely with the wooden bobbins ordinarily used in machines of the class described, the cops I produce must be, and are, self-sustaining, which result is attained by means of the mechanism already described, the operation whereof is substantially as follows:

The fork d^2 being moved to its starting-point at the extreme inner end of the plate C—that is, nearest to the drum G—by backward rotation of the screw-shaft C^2, the chain d^3 will be wound on the drum G to its fullest extent, passing at the latter portion of its stroke over the projection H, in passing over which the chain will be taken up to any desired extent, and the movement of the drum itself very much retarded. While the chain itself is moved similarly at each stroke during the time when it passes over the said projection H, the action of the drum G is retarded or delayed, thereby checking the downward movement of the ring-rail at the desired point, and causing more yarn to be there deposited. In practice, this effect upon the ring-rail is sought at the lower portion of the earlier part of its traverse, so as to form a neatly-rounded cop-

bottom containing a large quantity of yarn not inconveniently liable to slip and unravel in handling.

As the work progresses the step-by-step rotation of the screw C^2 pushes back the fork d^2 and gradually rotates the drum G, so that before the cop is quite half wound the extension H has, by the gradual rotation of the drum G, passed out of reach of the chain d^3 and entirely out of action, after which the movement of the ring-rail is even and regular; but for the purpose of distributing the yarn over a longer portion of the middle of the cop, the distance through which the sector moves, its system of levers, and through them the ring-rail, first gradually increases until the cop is somewhat more than half built, and then as gradually decreases until the cop is finished.

At starting, the sector E is in its extreme forward position—that is, farthest from the drum G—where it is rocked upon its bearing, through only a portion of its range of movement, by the reciprocations of the plate C, and as the sector changes position and moves more nearly in a vertical plane, its effect upon the system of levers and ring-rail through the pin L′, pivoted arm J, connecting-rods, and rock-arms increases, and becomes greatest when at the central portion of its stroke the arm J stands in a vertical position. Up to this point the movement of the system of levers and the traverse of the ring-rail is constantly on the increase, and after passing beyond this stage, which should include the central and otherwise weakest portion of the bobbinless cop, the angle at which the pin L′ moves in the slot e^2 becomes greater at each stroke, and a considerable portion of the effect of the movement imparted by the sector to the drum J and connections is thus intentionally neutralized, and thereby the movement communicated through the said system of levers to the ring-rail is gradually decreased until it becomes practically the same as at starting.

A hand-lever, N^2, is provided, having at its end a squared projection adapted to fit a corresponding aperture in the axis of the drum G, and when the cops are finished said lever is placed in position, the chain d^3 is detached, and by turning said drum the ring-rails are moved downward while the machine is in motion, whereby any desired number of turns of yarn can be wound obliquely onto the outside of the finished cop for the purpose of giving it additional strength and preventing injury thereto. Having thus brought the rails to their lowest point, a few turns of yarn are now allowed to accumulate upon the bare spindles to form the nucleus for the next cop. The machine can then be stopped and the finished product removed, leaving it in every respect ready for starting, when it will automatically repeat the above-described operations.

What I claim is—

1. The combination, with a ring-rail and rods and rock-arms for supporting and moving the same vertically, of means, substantially as described, for actuating said rock-arms and moving the ring-rail and automatically increasing and decreasing the extent of the movement imparted to the ring-rail during the operation of building a cop.

2. The combination, with a ring-rail, of rods and rock-arms for supporting and moving the same vertically, means, substantially as described, for actuating said rock-arms and moving the ring-rail, said means including a sector provided with a radial slot, a pin traveling in said slot, a pivoted arm supporting said pin, devices for vibrating said sector and shifting said pin in the slot of the sector during the operation of building the cop, whereby the said ring-rail is raised and lowered and the extent of the motion imparted thereto is automatically varied during the different stages of the work, substantially as described.

3. The combination, with a ring-rail, of rods and rock-arms for supporting and moving the same vertically, means, substantially as described, for actuating said rock-arms and moving the ring-rail, said means including a sector provided with a radial slot, a pin traveling in said slot, a pivoted arm supporting said pin, a constantly-reciprocated plate, means, as described, for reciprocating said plate, a fork mounted upon the plate, and means, substantially as described, for moving said fork farther away from the sector with each reciprocation of the plate, and connections between the fork and the sector, whereby the sector is vibrated and the ring-rail raised and lowered, and the extent of the motion imparted thereto automatically varied during the operation of building the cop, substantially as described.

4. The combination, with the ring-rail, of vertical supporting-rods, rock-arms connected thereto for communicating motion to said ring-rail, a pivoted sector formed with a radial slot, a pin traveling in said slot, a pivoted arm supporting said pin, and connecting-rods extending therefrom to the rock-arms, a constantly reciprocating plate, means, as described, for reciprocating said plate, a fork carried on said plate, a chain connecting the pivoted sector and the fork, and means, substantially as described, whereby the ring-rail is raised and lowered, and at each movement of the plate the fork is carried further from the sector, thereby gradually altering the relative positions of the parts and lengthening or shortening the traverse of the ring-rail, as set forth.

5. The combination, with a ring-rail, of the vertical supporting-rods, rock-arms connected thereto for communicating motion to said rail, a connecting-rod attached to said rock-arms, a pivoted sector formed with a radial slot, a vertical pivoted arm adapted to support said connecting-rod, and provided at its free end with a pin, said pin passing through the end of the connecting-rod and moving in said slot, a constantly-reciprocated plate, and means, as described, for reciprocating the

plate, a movable fork carried on said plate, and means, substantially as described, for causing said fork to gradually recede from its starting-point, and connections between said forks and the periphery of the sector, whereby the reciprocations of the plate are communicated to the sector, and the oscillations of the sector are gradually brought nearer to the sliding plate, altering the relative positions of the sector and levers, substantially as described.

6. The combination, with the ring-rail, of vertical supporting-rods, rock-arms connected thereto for communicating motion to said ring-rail, a pivoted sector, connections between said sector and the rock-arms, a fork, d^2, a drum or roller mounted between the fork and sector and formed to receive a hand-lever, and connections extending from the sector to the drum, and from the drum to and detachably secured to the fork, and a hand-lever adapted to engage the drum, and whereby when in position the connection between the drum and fork can be detached, and the ring-rail raised or lowered during the operation of the machine, as set forth.

7. The combination, with a ring-rail, of vertical rods and rock-arms for supporting and imparting vertical motion thereto, a horizontal connecting-rod attached to said rock-arms, a pivoted sector formed with a radial slot, a vertical pivoted arm adapted to support the connecting-rod, and provided at its free end with a pin passing through and connecting the horizontal rod and vertical arm and traveling in said slot, a constantly reciprocated plate, and means, as described, for imparting motion thereto, a movable fork carried on said plate, a ratchet and screw for gradually moving the fork away from its starting-point, a drum mounted between the fork and its sector, a chain extending from the sector to the drum and from the drum to the moving fork, and an adjustable projection upon the periphery of the drum in the path of the chain, as described.

8. The combination, with the ring-rail D, its vertical supporting-rods, and rock-arms, substantially as described, for imparting motion thereto, of the pivoted sector E, formed with a radial slot, e^2, and means, substantially as set forth, for imparting motion thereto, the pivoted arm J′, the connecting-rod K, and the fulcrum-pin L′, adapted to move in the slot e^2, substantially as described.

9. The combination, with the ring-rail, its vertical supporting-rods, of the pivoted sector E, formed with radial slot e^2, the pivoted arm J′, the rod K, and connections, substantially as described, between the said rod and the rail-supporting rods, and the fulcrum-pin L′, adapted to move in the slot e^2, and mechanism for imparting a gradually-receding reciprocating motion to the sector, and thereby altering the traverse of the ring-rail, consisting of the sliding-plate C and fork d^2, and means, as described, for reciprocating said plate and moving the movable fork d^2, carried thereon, shaft C^2, pawl e, supporting-arm e', the wedge C^3, chain d^4, the drum G, and the chain d^3, substantially as described.

10. The combination, with the ring-rail and its vertical supporting-rods, of means for communicating motion thereto, consisting of the pivoted sector E, formed with a radial slot e^2, and pivoted arm J′, rod K, and connections, substantially as described, between the said rod and the rail-supporting rods, and fulcrum-pin L′, adapted to move in the slot e^2, a drum, G, a chain, d^4, extending from the sector to the periphery of said drum, and a chain, d, also secured to said drum and extending therefrom to the moving fork d^2, and the sliding plate C, and fork d^2, and means, as described, for reciprocating said plate, and moving the fork d^2, supported thereon, substantially as described.

11. The combination, with the ring-rail and its vertical supporting-rods, of the pivoted sector E, arm J′, provided with pin L′, and rod K and connections, substantially as described, between the said rod and the rail-supporting rods, a chain, d^4, a drum, G, to which said chain is attached, a hand-lever, N^2, fork d^2, a chain, d^3, detachably secured to the fork d^2, and attached to the periphery of the drum G, and adapted to be readily detached to allow independent movement of the drum G, and the raising and lowering of the ring-rail while the spindles are in motion, substantially as described.

12. The combination, with the ring-rail and its vertical supporting-rods, of the pivoted sector E, formed with a radial slot, e^2, the pivoted arm J′, rod K and connections, substantially as described, between the said rod and the rail-supporting rods, and fulcrum-pin L′, adapted to move in the slot e^2, and thereby to vary the traverse of the ring-rail, a drum, G, and chain d^4, extending therefrom to the sector, and a chain, d^3, also attached to said drum, the movable fork d^2, to which said chain d^3 is also attached, means for moving the said fork d^2, and an adjustable projection, H, extending from the periphery of the drum G into the path of the said chain, whereby the oscillation of the drum and the movement of the sector is temporarily delayed during the formation of a portion of the cop, substantially as described.

13. The combination, with the belt-shifting lever, of a friction-pulley, a pivoted brake-carrying lever normally resting upon the periphery of said pulley, and a lever pivoted to the frame and supporting the free end of the brake-lever at one end, and having its opposite extremity in the path of the shipping-lever, and adapted to be elevated or depressed by the movements of the same, and thereby to raise or lower the brake-lever, substantially as described.

14. The combination, with the shaft A^5 and pulley E^5, of the pivoted brake-lever A^7, the belt-shifting lever D^7, provided with the stud

or roller c^5, and the horizontally-pivoted lever B^5, substantially as described.

15. The combination, with the herein-described plates suitably apertured to receive the spindle, of a traveler having bifurcated extremities formed integral therewith, said extremities extending above and below the plate and supporting the traveler thereon, and adapted to allow horizontal, radial, and circular motion to be imparted to the said traveler, substantially as set forth.

16. The combination, with the herein-described ring-holding plates, suitably apertured to receive the spindle, of rings or flanges of a width exceeding the thickness of the ring-supporting plates inserted within and forming lining for said apertures, and a traveler having bifurcated extremities formed integral therewith, said extremities embracing the ring and supporting the traveler thereon and adapted to allow horizontal, radial, and circular motion to be imparted to the said traveler, substantially as set forth.

17. The herein-described ring-holding plates, having a series of apertures for the reception of the spindles, each aperture being provided with a thin ring or flange, 13, projecting above and below the surface of the ring-supporting plate, as set forth.

18. A traveler or drag-fork, having bifurcated extremities formed integral therewith, substantially as set forth.

19. A traveler or drag-fork, having bifurcated extremities formed integral therewith, and provided with projections or hooks for retaining the same in position on the ring, substantially as described.

20. A traveler or drag-fork having bifurcated extremities and provided with projections q for retaining or holding the same in position on the ring, and also with additional projections q', adapted to support more or fewer coils of yarn, whereby to increase the tension between the traveler and the cop or spindle and to lessen it between the said traveler and the delivery-rollers, substantially as described.

21. The combination, with a spinning-ring, of a spindle and a traveler mounted upon the ring and having bifurcations for retaining it in position thereon, and provided with projections for guiding the yarn to the spindle, the said spindle and the yarn forming the fulcra from which the rotation of the traveler is communicated, substantially as set forth.

22. The combination, with two spinning-rings secured in position one above the other, of a traveler, 18, having a portion of its delivery-fork 19, removed, so as to reduce its weight and facilitate the piecing up of broken ends, substantially as described.

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Witnesses:
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JOHN THOMAS HAWORTH.