(No Model.)

7 Sheets—Sheet 1.

J. M. PARKER.

LOOP BANDING MACHINE.

No. 518,425. Patented Apr. 17, 1894.

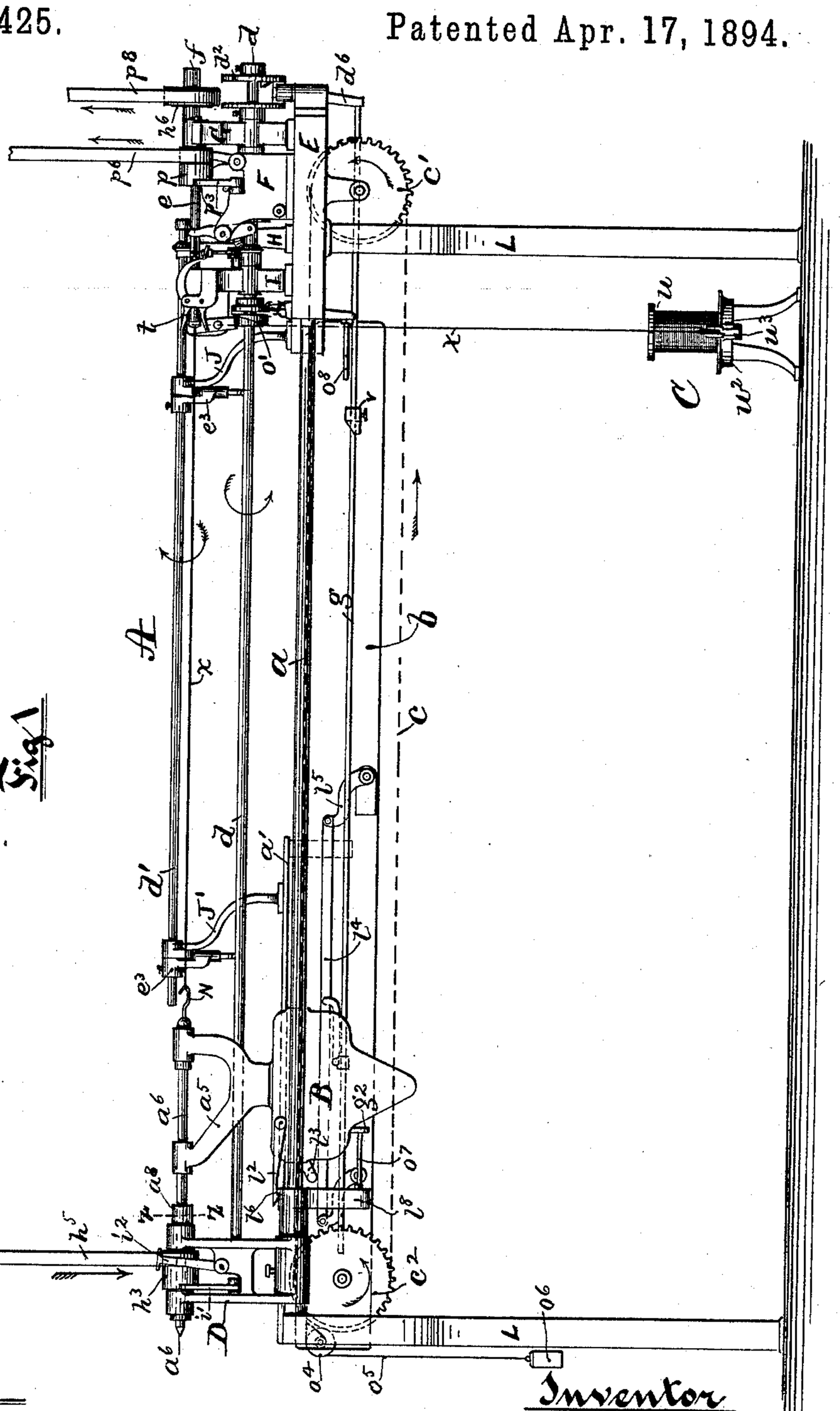

Fig. 1

Witnesses

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(No Model.) 7 Sheets—Sheet 2.

J. M. PARKER.

LOOP BANDING MACHINE.

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Fig 2.

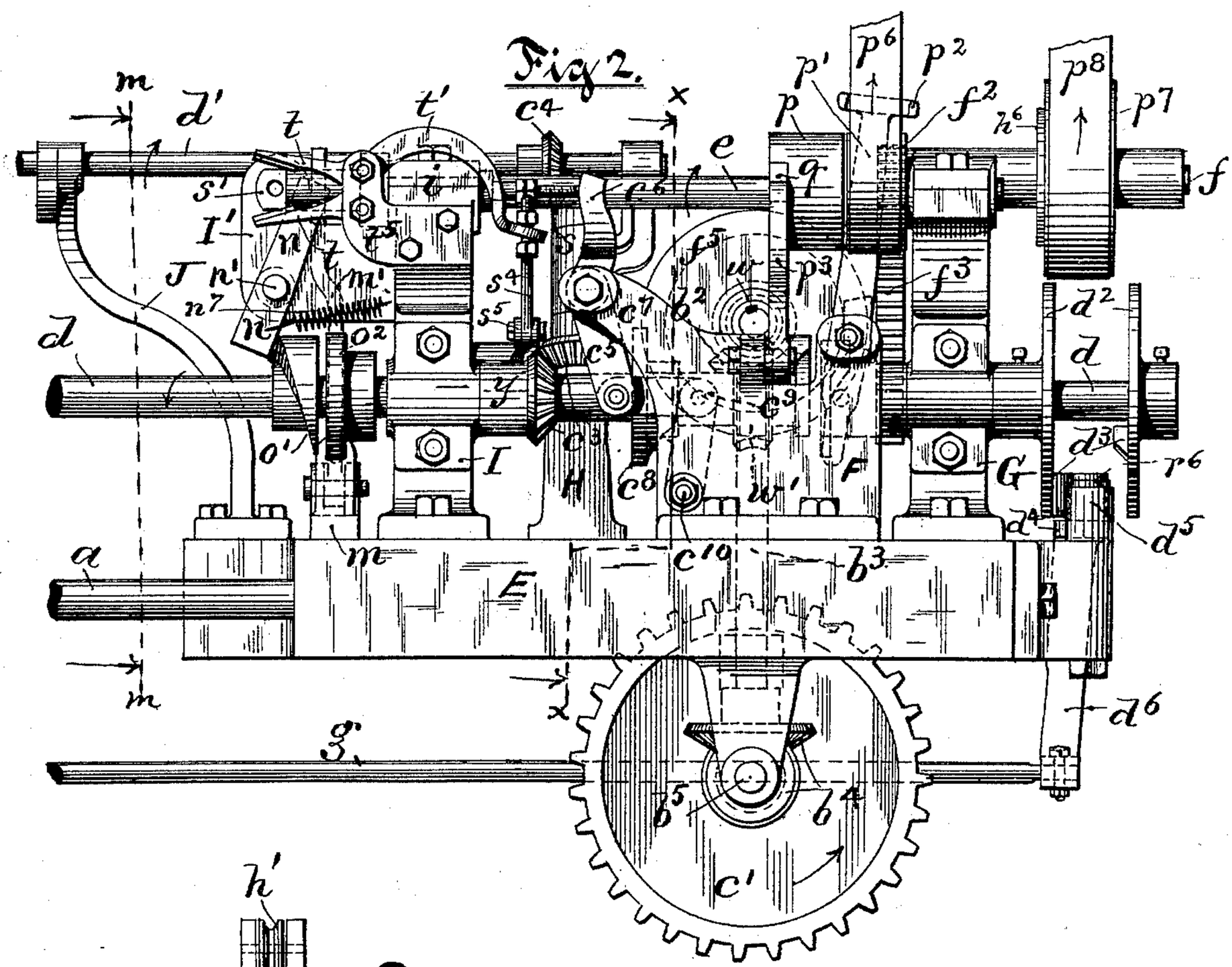

Fig 3.

Witnesses.

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(No Model.) 7 Sheets—Sheet 3.

J. M. PARKER.

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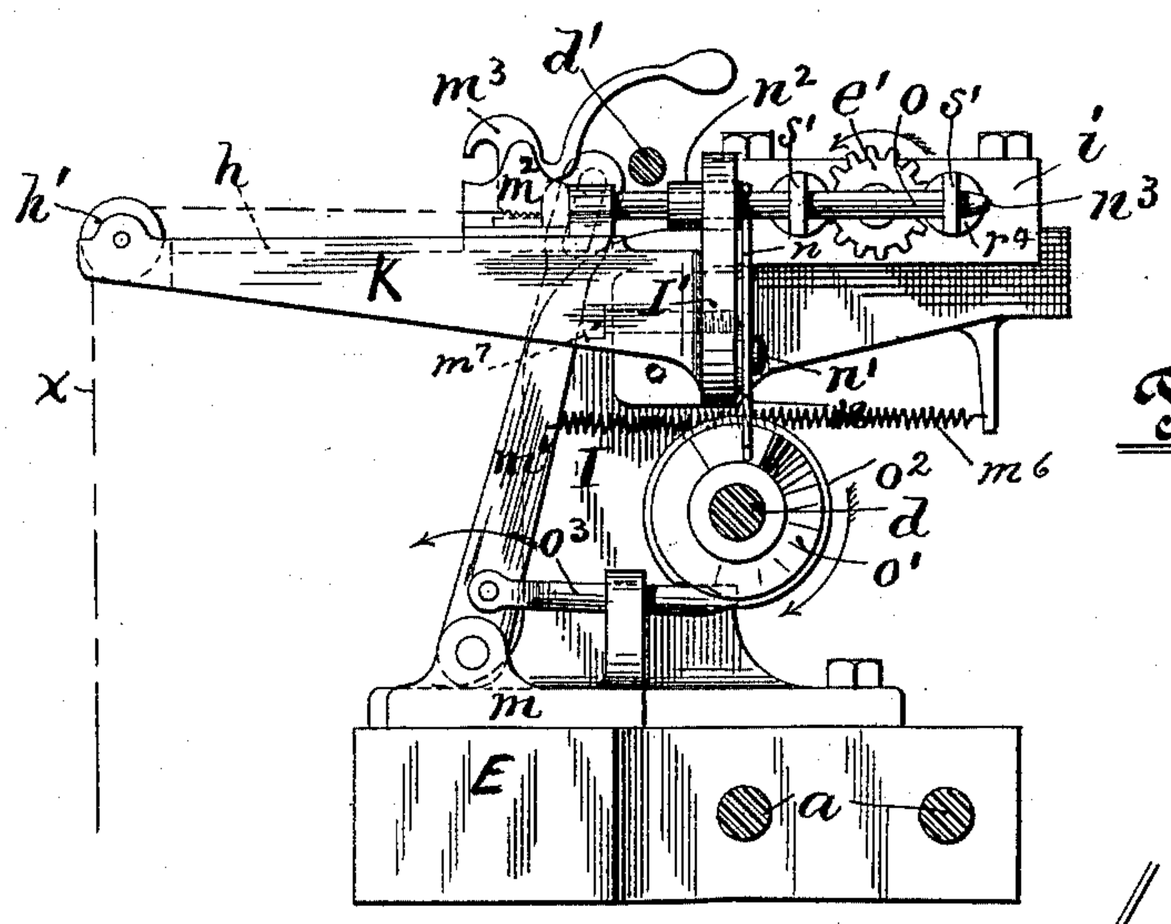

Fig 5

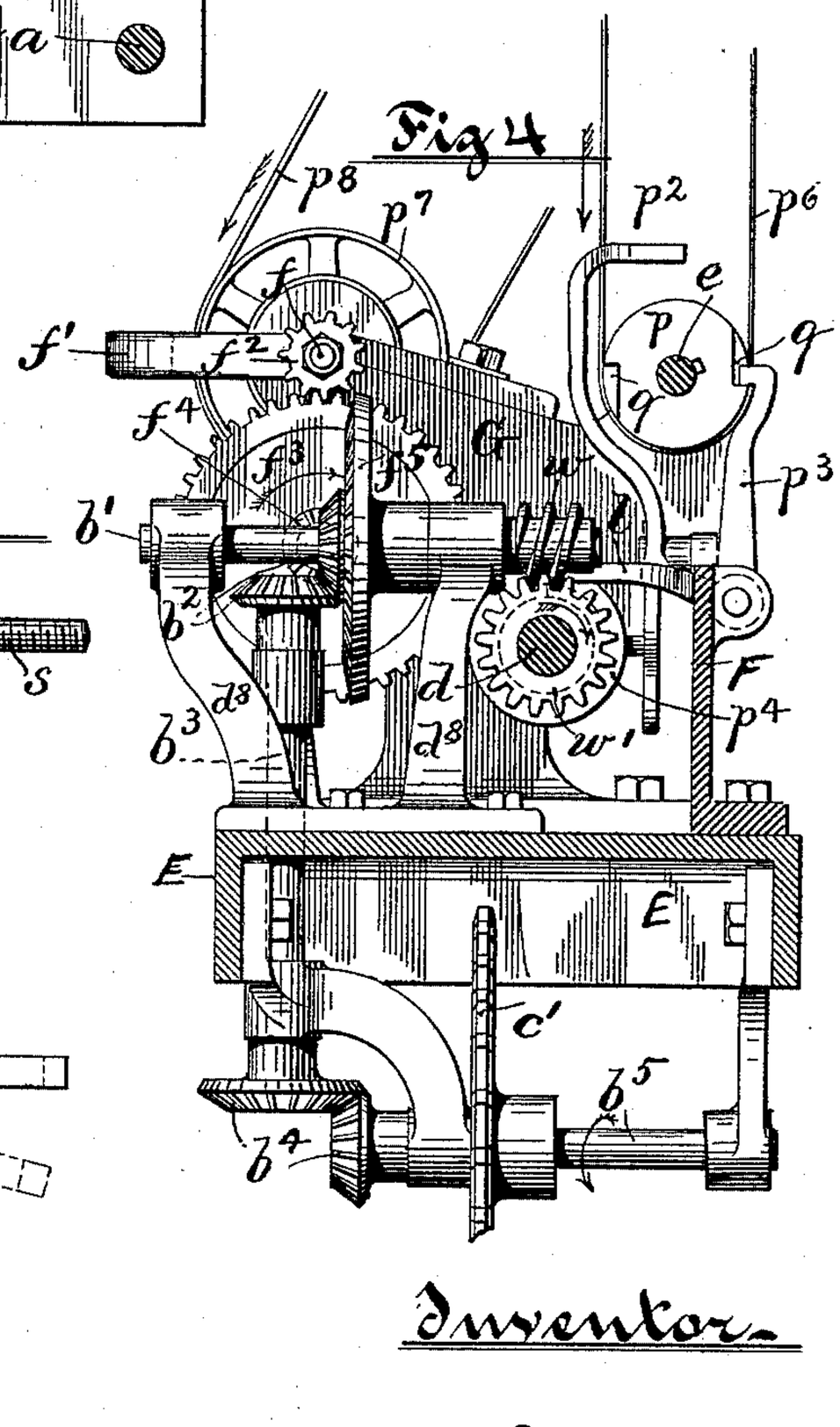

Fig 4

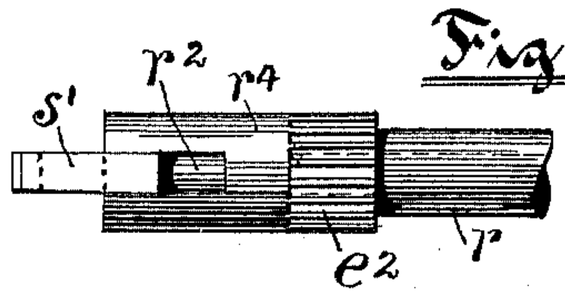

Fig 7

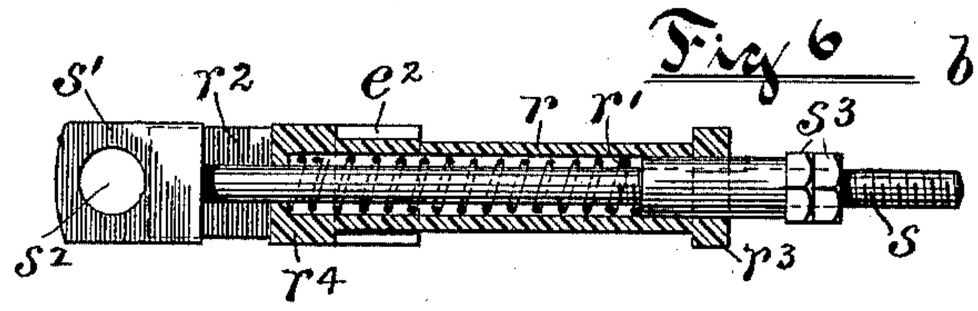

Fig 6

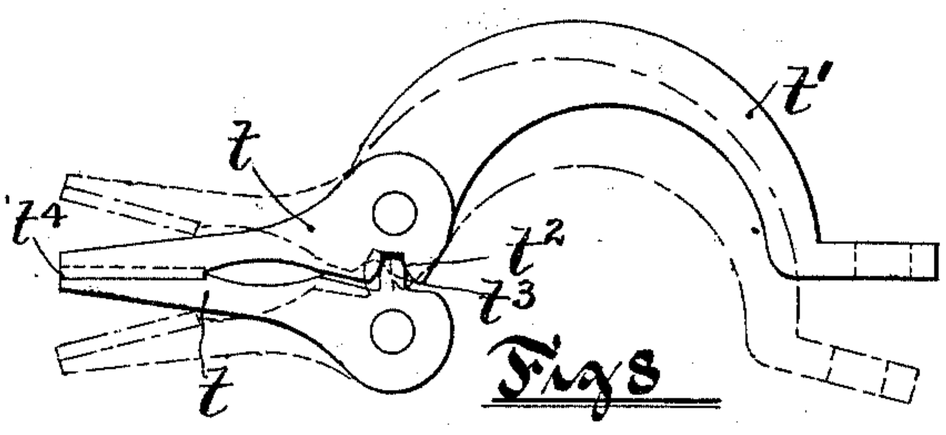

Fig 8

Witnesses

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J. M. PARKER.

LOOP BANDING MACHINE.

No. 518,425. Patented Apr. 17, 1894.

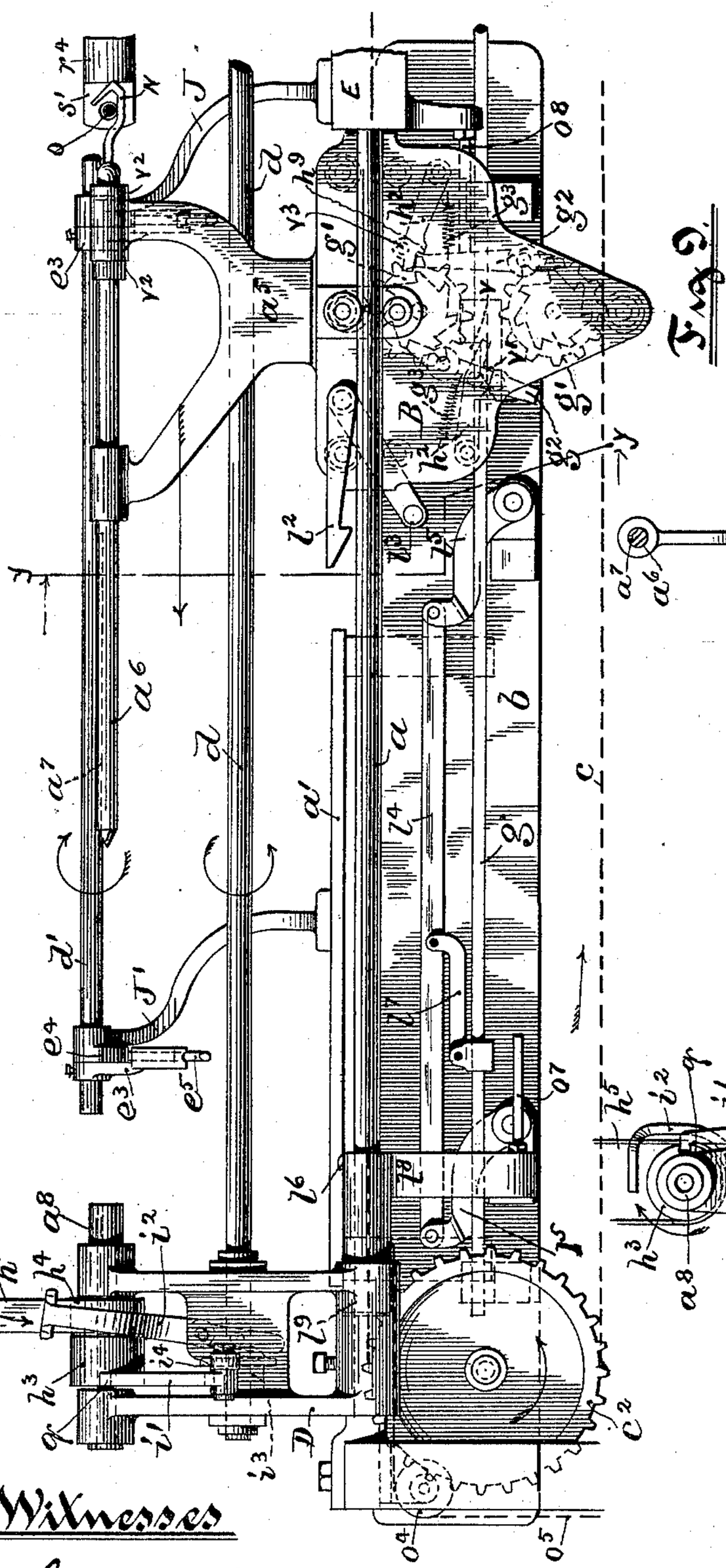

Fig. 9.

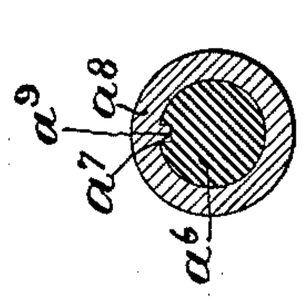

Fig. 12.

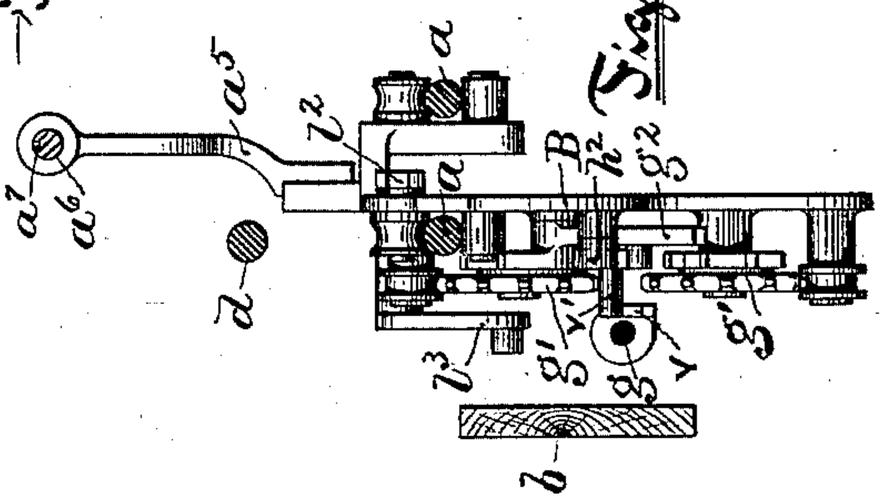

Fig. 11.

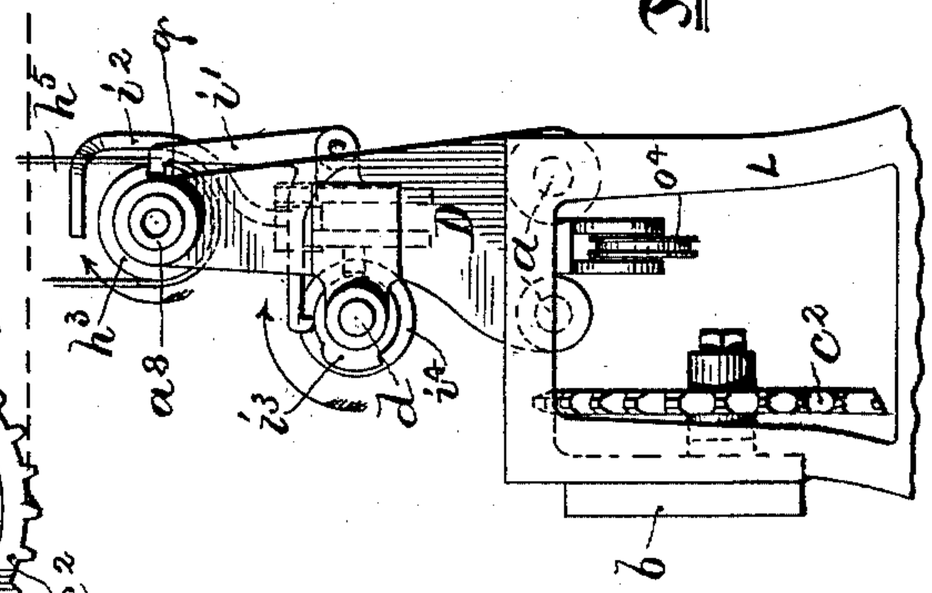

Fig. 10.

Witnesses

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J. M. PARKER.

LOOP BANDING MACHINE.

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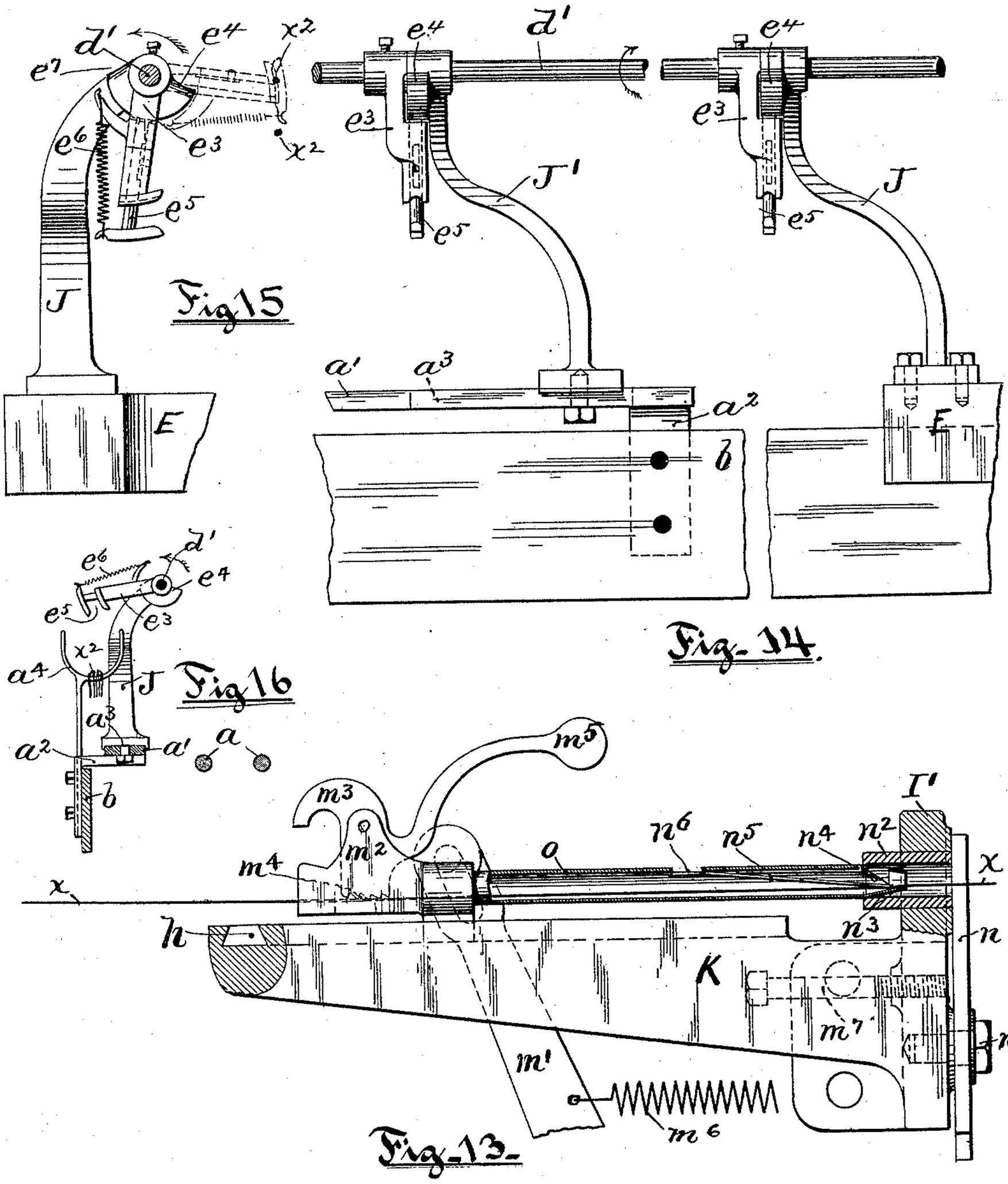

Witnesses.

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(No Model.) 7 Sheets—Sheet 6.

J. M. PARKER.

LOOP BANDING MACHINE.

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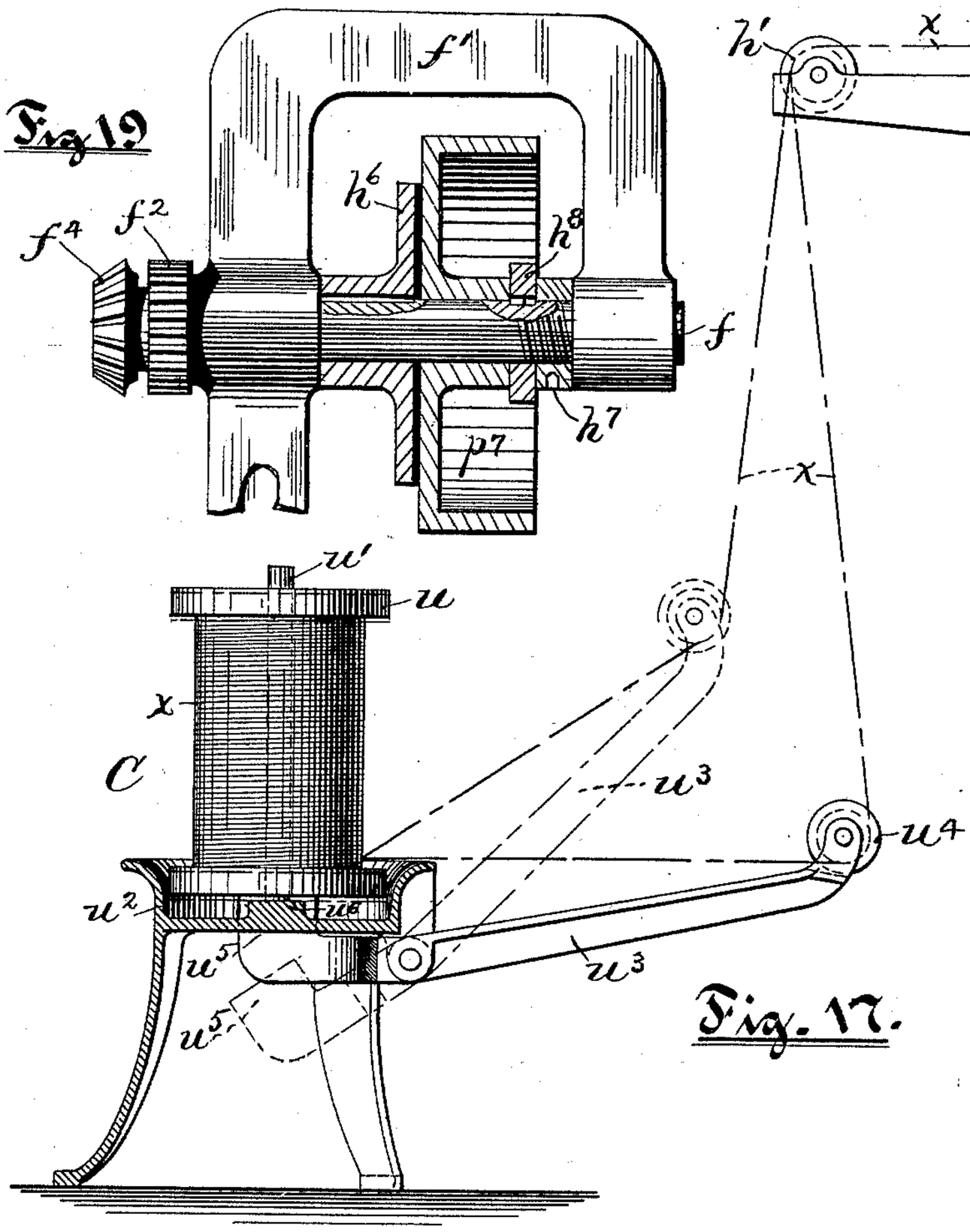

Fig. 19. Fig. 17.

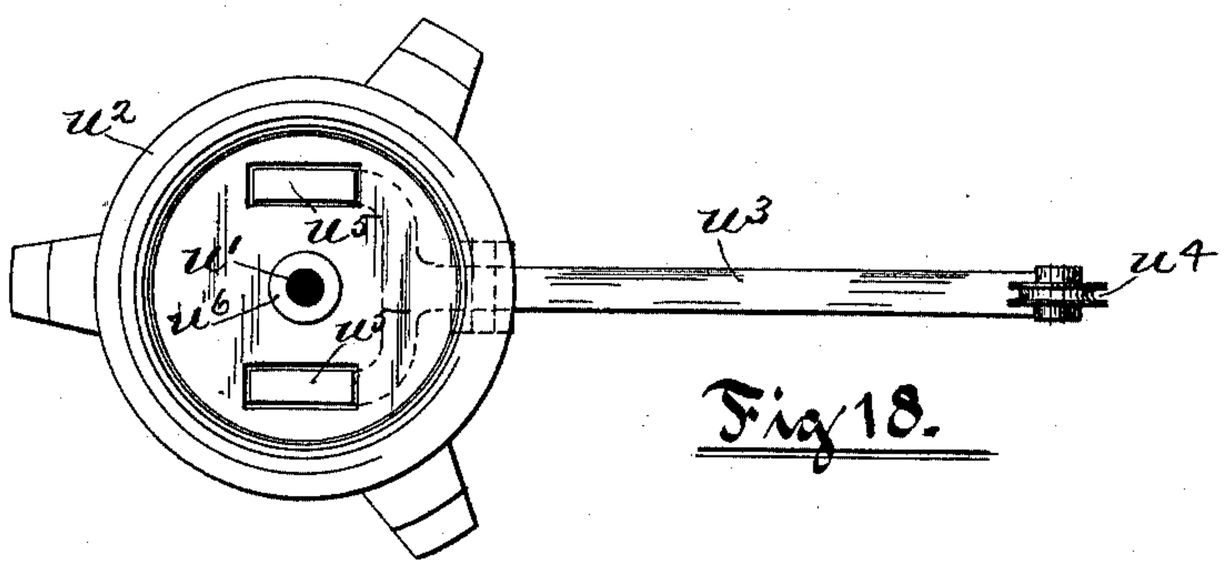

Fig 18.

Witnesses.

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(No Model.) 7 Sheets—Sheet 7.

J. M. PARKER.

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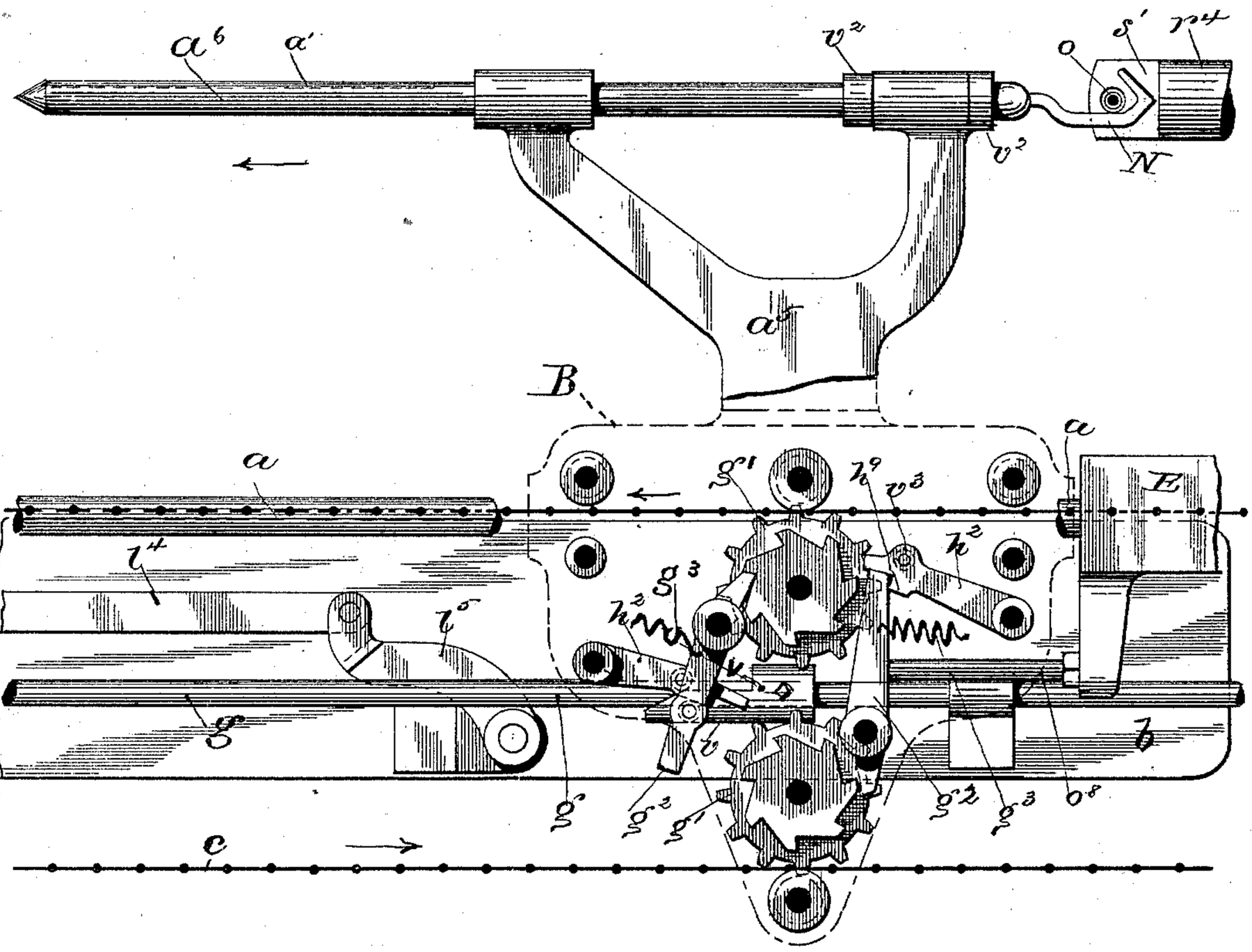

Fig 20.

Witnesses.

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John M. Parker.

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Attorneys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN M. PARKER, OF PAWTUCKET, RHODE ISLAND.

LOOP-BANDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 518,425, dated April 17, 1894.

Application filed February 27, 1893. Serial No. 463,898. (No model.)

To all whom it may concern:

Be it known that I, JOHN M. PARKER, a citizen of the United States, residing at Pawtucket, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Loop-Banding Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

In a pending application for Letters Patent, Serial No. 456,465, filed by me December 27, 1892, in the United States Patent Office, on improvements in carriage-operating devices or holding mechanism for loop-banding machines I have made reference to an organized machine adapted to automatically produce loop-bands, which machine it was stated would "form the subject of a subsequent application for Letters Patent." The present application is the one therein referred to.

Although several banding machines have been devised previous to my inventions, yet so far as I am aware such former machines have without exception proved inadequate to meet the necessary requirements exacted from them in the production of loop-bands. The latter it may be well to state are used in certain classes of machinery, employed in the manufacture of textile products, to drive the cop or bobbin-carrying spindles. Such bands are composed of cotton cord, or "yarn" as it is sometimes termed, suitably twisted and doubled so as to form a loop at one end of the band. In the former patented machines the twisting and doubling, or "laying up" as the doubling process is termed, are accomplished at the head or working end of the machine while the carriage or holding mechanism provided with a non-rotating hook or holder adapted to engage the loop-end of the band is made to travel to and fro intermittingly by means of an intermittingly operated belt. There are objections to the use of such former loop-banding machines, as for example the bands produced are not sufficiently uniform in length and in the degree of twisting given to them; sometimes the holding mechanism fails to advance far enough to place the hook into position with relation to the holding-jaws, in which case the machine is liable to become broken; again the carriage may accidentally stop on its return stroke soon after it has seized the yarn, thereby causing delay and a possible disarrangement of the machine; moreover, in the machines referred to, the relation of the several devices to one another and to the driving mechanism are such that any disarrangement of the latter would necessitate its readjustment before the operation or the machine could be resumed.

As the average length of the loop-bands varies say from four feet to five feet, according to the requirements of the machines on which they are to be used, and also to the fact that in the operation of making the bands they are shortened, or "taken-up," by reason of twisting and doubling, some six inches to fourteen inches, it follows that the band-machines should be provided with adjusting means having a range of adjustability equal to the variations referred to.

My improved machine is well adapted to produce bands having varying lengths, as may be desired.

The object I have in view is to produce a loop-banding machine devoid of the disadvantages just referred to; such improved machine being provided with automatically operating devices having positive action; the whole being less complicated and more easily operated, as well as being more cheaply constructed than machines of this class hitherto in use.

In the accompanying seven sheets of drawings, Figure 1, Sheet 1, is a front side elevation of a loop-banding machine embodying my improvements; the parts of the machine being represented in the position preparatory to twisting the strands of yarn to form the band. Fig. 2, Sheet 2, is a similar view, in enlarged scale, of the head portion of the machine. Fig 3 is a plan view of the same. Fig. 4, Sheet 3, is a transverse sectional view, taken through the front head, substantially on line *x x* of Fig. 2. Fig. 5 is a similar sec-

tional view, taken on line *m m* of Fig. 2, showing the yarn-feeding mechanism, &c. Fig. 6 is a longitudinal sectional view, taken through the center of the holding-jaws, showing them in the normal position. Fig. 7 is a partial plan view of the same. Fig. 8 is a front side elevation of the nipping fingers. Fig. 9, Sheet 4, is a front side elevation of the carriage and the rear portion of the machine, and also showing mechanism for connecting and disconnecting the carriage to and from the driving chain. Fig. 10 is an elevation, showing a portion of the rear end of the machine. Fig. 11 is a transverse sectional view, taken substantially on line *y—y* of Fig. 9. Fig. 12 is an enlarged transverse sectional view, taken on line *z—z* of Fig. 1, or through the hook-spindle and the hollow tail-stock spindle. Fig. 13, Sheet 5, is a partial side elevation, in enlarged scale, showing the feeder and also showing, sectionally, the trumpet adapted to pass the free end of the yarn to the holding-jaws and nippers. Fig. 14 is a side view of the band-removing jaws, &c. Fig. 15 is an end elevation of the same. Fig. 16 is a similar view, in reduced scale, showing the manner of delivering the bands into the stationary receiving hooks. Fig. 17, Sheet 6, is a side view, in partial section, showing a manner of mounting the cord-carrying spool, including a tension device. Fig. 18 is a plan of the same, the spool itself being omitted. Fig. 19 is a plan view, in partial section, of the main driving shaft provided with a yielding driving pulley; and Fig. 20, Sheet 7, is a full line front view showing the means for locking the carriage to the traveling belt, the relation of the parts being substantially as represented in Fig. 9.

I would preface the description by a statement that the various sub-operations or steps employed to co-operate in my improved machine for the production of a loop-band from a strand of coarse-twisted cord or yarn leading from a spool or holder are performed in substantially the following order, viz: First—placing the carriage and loop-hook in position at the head end of the machine, the carriage then being stationary although the driving-chain or belt is in continuous operation; second—feeding the end of the yarn through the two holding-jaws and into the nippers, by means of a trumpet or carrier; third—closing the nipper-jaws upon the end of the yarn; fourth—returning the trumpet to its normal position; fifth—locking the carriage to the traveling chain and propelling it rearwardly to the predetermined limit, thereby at the same time causing the yarn to unwind from the spool, thus producing two connected parts or strands; sixth—detaching the carriage from the chain, the former automatically engaging a weighted catch or cross-head, at substantially the same instant; seventh—closing the holding-jaws; eighth—cutting off the yarn from the spool at or near the forward end of the trumpet; ninth—revolving both holding-jaws in one direction simultaneously to properly twist the said two strands of yarn, the carriage and catch at the same time automatically sliding forward in unison with the shortening of the strands due to such twisting operation; tenth—stopping the rotation of the holding-jaws, a lever at the same time engaging a suitably arranged notch whereby the jaws always stop in one position; eleventh—revolving the loop-hook for the purpose of doubling or laying-up the twisted strands to form the band; twelfth—stopping the rotation of said hook after the doubling has been effected, the hook always stopping in one position; thirteenth—revolving open removing-jaws into engagement with the standing band; fourteenth—closing said removing-jaws onto the band; fifteenth—opening the holding-jaws located at the front end of the machine; sixteenth—detaching the band from the hook and holding-jaws through the medium of the revolving removing-jaws; seventeenth—discharging the now completed band into stationary supporting hooks by opening the removing-jaws; eighteenth—locking the carriage to the traveling driving-chain and at the same time detaching the carriage from the catch, when the latter instantly returns to its normal position; a cushioned stop being used to receive the force of the blow; nineteenth—propelling the carriage to the head of the machine, as at first stated, and, finally, twentieth—detaching the carriage from the chain, thus completing the series of operations.

Although the former named steps have been thus segregated in order to more clearly indicate the scope and relation of the various devices, yet it is to be understood that practically they co-operate with each other with great rapidity; in fact during certain stages of the operation two or more of the devices are working simultaneously. I would state that I have successfully operated the machine in producing finished loop bands at the rate of two hundred per hour.

A more detailed description of my improved loop-banding machine is as follows:

A, again referring to the drawings, indicates the machine as a whole; the same being supported on end legs L, L, united by the back-board *b* placed edgewise and also united by the two horizontal guide-rods *a a* placed parallel with each other and secured to the front and back end portions of the machine.

At the front end of the machine is located the working-head mounted on the base E, carrying devices adapted to feed, cut and twist the cord or yarn.

At the back end of the machine is secured the tail-stock D, provided with intermittingly operating mechanism adapted to "lay up" or double the loop-bands. Between these two end portions the holding-carriage B is mounted; the same being supported on the guide-rods *a* and provided with means adapted to connect the carriage to or disconnect it from the continuously traveling chain or belt *c*,

thereby causing the carriage to be propelled to and fro, as desired.

In my improved loop-banding machine the power is received from any suitable source through the medium of the continuously traveling driving-belt p^8, the same operating a pulley p^7 mounted on a short shaft f adapted to rotate in bearings formed in a yoke f' adjustably secured to the vertical frame G, (see Fig. 3, &c.) I prefer to arrange the driving pulley, p^7, substantially as shown in Fig. 19, wherein a disk h^6 is represented as rigidly secured to the shaft, the pulley being loosely mounted thereon and having an end of the latter arranged to be forced into frictional engagement with the disk, its face being covered say with leather. The degree of frictional contact may be effected and controlled by means of a collar h^8 fixed to the shaft and bearing against the other end or face of the pulley and a forcing nut h^7 fitting a screw-threaded part of the shaft. By this arrangement the driving-pulley is adapted to automatically yield or slip in case the resistance of the machine becomes abnormal from any cause, thus to a great extent relieving the machine from liability of serious accident.

The machine is provided with two sets of holding-jaws mounted to revolve in capped-bearings i formed in the upper portion of the vertical frame I. Each of said jaws consists of the sleeve r and the holder s; the latter having an enlarged and flattened head s' provided with a transverse hole s^2 to receive the feed-trumpet; the opposite or front end of the holder is screw-threaded and provided with check-nuts s^3. The head portion of the sleeve r is cut through transversely to form a seat r^2 for the head s' of the holder, the stem s of the latter passing longitudinally through the sleeve; the sleeve is counterbored to receive a spring r' arranged to automatically close the jaws, the nuts s^3 being employed to regulate the force of the spring. Each sleeve is further provided with a fixed collar r^4 and a series of gear-teeth e^2, all as clearly shown in Figs. 6 and 7. When mounted in the bearings, as indicated in Fig. 3, the teeth and collars further serve to maintain the sleeve in position longitudinally. The holding jaws are rotated by means of a gear e' located intermediate of and intergearing with the teeth e^2 of the holder sleeves. Said gear is secured to the rear end of a suitably mounted shaft e and adapted to be rotated intermittingly through the medium of fast and loose pulleys p, p', respectively, and the continuously running driving-belt p^6; a belt-shipper p^2 operating to shift the belt at fixed intervals by means of mechanisms (soon to be described) actuated by the first-named driving-belt, p^8. As drawn the ratio of the gears e' e^2 is such that the jaws make one complete revolution during each semi-revolution of the shaft e; the fast pulley p having two oppositely arranged notches q (Figs. 2, 3 and 4) adapted to receive an end of the cam-actuated bell-crank lever or latch p^3. As thus arranged a properly timed continuously, but slowly, revolving cam p^4 operates to shift the belt p^6 from the loose pulley onto the fast pulley p, and vice versa; another portion of the same cam acting upon the horizontal arm l of the bell crank-lever p^3 and lifting the latter from the notch q just in advance of the shipper's action; when the rotation of the shaft e and jaws have been sufficiently continued, as may be regulated by the position of the said cam, the belt is reshipped onto the loose pulley, the cam at the same time permitting the latch to drop into a notch q and thus check and stop the shaft's movement, thereby also stopping the rotation of the holding-jaws, the seat or slot r^2 of the latter then being in the vertical or normal position.

The following is a description of the mechanism employed by which rotation of the main cam-shaft d is effected. This shaft extends from end to end of the machine and is mounted to revolve in the vertical frames G, I, of the head stock and frame D of the tail-stock. To the rear end of the said primary driving-shaft f is secured a small gear-wheel f^2 intergearing with a stud-gear f^3 carrying a small bevel-gear f^4 which in turn actuates a larger bevel-wheel f^5 secured to a horizontal shaft b' supported in uprights d^8 (Fig. 4) arranged transversely of the machine. To the front end of shaft b' a worm or screw w is fixed which in turn meshes into the worm-wheel w' secured to the cam-shaft d.

From the foregoing it is obvious that a comparatively quick running driving-shaft, as f, if continuously operated would, through the medium of said gearing, continuously rotate the cam-shaft, although much more slowly.

The holding-jaws are opened and closed automatically through the medium of the following described mechanism: By referring to Figs. 2 and 3 it will be seen that a cam c^8 is fixed to the shaft d in such manner that as the cam rotates its front end or side bears against and actuates a truck-roll c^9 jointed to a horizontal link, the latter being supported at its forward end by a vertical link pivoted to the lower part of the frame F, at c^{10}. The rear end of the roll-link is jointed to the lower end of a lever c^5 fulcrumed to an upwardly extending arm c^7 of said frame; from this point the lever is forked or U-shape and terminates in arms c^6 which bear each against the forward end of the adjacent holder-stem s. Thus it will be apparent that a certain part of the revolving cam c^8 will operate simultaneously to force the holders rearwardly (against the resistance of the said springs r') out of the sleeve-head until the opening s^2 is fully exposed, thereby opening the jaws; after remaining thus opened the desired length of time, corresponding with the shape and relative adjustment of the cam,

the latter allows the springs r' to reclose the jaws, the springs also maintaining the roll c^9 in continuous contact with the cam.

To the front side of the working-head at the upper end of the bearing-frame I is secured a bracket t^5, having an upwardly extending ear on which are pivoted the upper and lower jaws t of the nipping mechanism, (see Figs. 2 and 3.) These jaws are employed to receive the free end of the strand of yarn x from the feeder-trumpet and hold it immovably while the length of yarn to form the loop-band is being unwound from the spool or bobbin. The upper jaw-member is provided with a bent arm t' terminating in an eye through which latter a vertical link s^4 freely passes; the upper portion of this link is screw-threaded and nutted, the nuts serving as collars for the jaw-arm and also affording means for adjusting the relation of the several parts as desired. A horizontal arm or lever s^5 (see Fig. 3) is jointed to the link s^4, the opposite or rear end y' of the lever being fulcrumed to the frame I. The jaws are closed by means of a cam y secured to the revolving shaft d; its action being to lift the lever, thereby closing the jaws. The weight of the arm, &c., is utilized to automatically open the jaws immediately following the disengagement of the cam from the lever. The jaws are illustrated more in detail in Fig. 8. The nipping portion may be roughened, as indicated at t^4. I prefer to provide the lower member with a tooth t^3 and the adjacent side of the upper member with a space t^2, so arranged that upon vibrating the arm t' the two jaws will work simultaneously; or in a manner analogous to gear-action. The broken lines indicate the relation of the jaws when open.

I will next describe the mechanism for introducing the yarn to the feeder. The coarsely twisted yarn x is first wound upon a spool or bobbin u (Fig. 17, &c.,) and then placed loosely upon a holder u' extending upwardly from a base u^2 resting upon the floor at the rear side of the machine. To the base portion is fulcrumed a lever u^3, the latter carrying a guide-roll u^4 at its outer end and having its other end forked and provided with lugs u^5 extending upwardly through an opening s formed in the base; the top faces of these lugs are adapted to frictionally engage the end of the spool to prevent the latter from turning, when in its normal position or as indicated by full lines in Fig. 17; the weight of the arm, &c., operating to lift the spool from the small center hub u^6. The device as a whole is indicated by C. While the yarn is being drawn off to produce a loop-band the tension upon it operates to lift the arm, (see dotted line position,) thereby withdrawing the lugs from the spool and permitting it to rest upon the hub on which it is adapted to freely turn. The construction serves as a combined brake and "take-up" device, since the arm in falling operates to take up any slack yarn that might result from the feeding operation.

The "feeder" proper is shown more in detail in Figs. 5 and 13. It consists of a guided tube or trumpet o secured to the feeder-carriage m^2 mounted to slide in a dovetailed groove h formed in a rearwardly-extending bracket K. The base or foot I' of this bracket is knee-shape and bolted to the frame I; the trumpet lies horizontally, its axis being at right angles with the axes of the holding-jaws and arranged to freely enter the holder-heads s'. The forward portion of the trumpet is mounted in a steel guide-bushing n^2 fixed into and extending through the bracket-foot; the front end of the bushing forms a shear-plate adapted when combined with the intermittingly moving cutter n to sever the yarn. The free end n^3 of the trumpet is contracted and provided with a flat spring n^5 arranged to frictionally engage the yarn and hold it in position and thus prevent it from being untwisted and drawn rearwardly into the tube, as would be the case if the spring or some other equivalent holding device were omitted, since the natural tendency of the yarn is to contract or shorten. The movable jaw m^3 of the feeder-carriage is roughened, as at m^4 (Fig. 13), at the point of engagement with the yarn and so pivoted that the yarn cannot slip back toward the spool although it can be freely drawn through the carriage from the opposite direction, the lightly weighted arm m^5 serving to insure its engagement with the yarn. The trumpet-carrying carriage is adapted to be reciprocated to and fro upon the bracket K by means of a cam o^2, secured to the continuously rotating shaft d, which in turning engages the free end of a link or guided rod o^3 jointed to the operating lever m' fulcrumed to the stand m; the latter being bolted to the base E, (see Figs. 2 and 5.) m^7 indicates an adjustable stop for limiting the forward movement of the carriage. By this arrangement of the parts the carriage is forced rearwardly to its normal position (see Fig. 13) where it remains until at the proper time the cam permits the carriage to again advance; for the latter movement a spring m^6 is employed.

From the foregoing description it is evident that the trumpet is adapted to pass through the eyes s^2 of the two holding-jaws and place the free end of the yarn into the nipping-jaws. (Fig. 3 shows the corresponding position;) after the latter have closed upon the yarn the action of the said cam o^2 returns the trumpet, &c., to the normal position, (Fig. 13.)

I would state that prior to passing the yarn into the nipping-jaws the holding-carriage B, soon to be described, is advanced to its limit for the purpose of placing the loop-hook N in position, as shown in Fig. 9. Now, upon reversing the carriage's (B) movement, after the trumpet has been withdrawn from the holding-jaws, the strand of yarn is caught by the hook N, thus causing the yarn to be drawn freely from the spool; the resulting pull or tension upon the yarn operating to lift the

lever u^3, as shown in Fig. 17. The yarn passes from the guide wheel u^4 up to and over the wheel h', at the end of the bracket K, thence past the tension-arm m^3 and through the trumpet, the yarn continuing to unwind until the retreating carriage B is stopped. After the length of yarn has been thus drawn from the spool and the holding-jaws closed, as before described, the next operation is to sever the length of yarn from the spool before the twisting of the band is effected. The means for cutting off the yarn consists of a knife n fulcrumed at n' to the side of the bracket-foot I', as shown in Figs. 2, 5, and 13. The lower arm of the knife is adapted to engage a suitably shaped cam o' secured to the shaft d. At the proper time the rotation of the shaft carries the cam past the corresponding end of the knife-arm when a spring n^7 instantly vibrates the knife across the face or end of the steel bush n^2 and shears off the yarn; the continued movement of the cam returning the knife to its normal position.

The mechanism for propelling the holding-carriage B to and fro in producing the loop-bands consists of an endless flexible belt or chain c mounted upon the front and rear carrier or sprocket-wheels c', c^2; the carriage being adapted to be intermittingly secured to and detached from the chain automatically. As drawn the chain is arranged to travel continuously in one direction by means of gearing, &c., as follows: To the continuously rotating worm-shaft b', before described, is secured a bevel-gear b^2 intergearing with a similar gear secured to the upper end of the vertical shaft b^3 mounted in the working-head portion of the machine. Motion is imparted from this shaft to the chain-carrying shaft b^5, located below and transversely of the bed E, by means of a pair of bevel-wheels b^4, see Fig. 4. The lugs or spurs of the sprocket-wheels just referred to are adapted to engage the chain-links in any well-known manner, or as commonly employed where link-belting is used for power-transmitting purposes.

From the foregoing description it will be seen that the travel of the chain is coincident with the rotation of the primary driving-shaft f.

The holding-carriage B, as drawn (see Figs. 9 and 11), is supported by the two main ties or guide-rods a a so as to slide freely thereon. It is provided with upper and lower loosely mounted sprocket-wheels g', shown by dotted lines, adapted to engage the chain and further provided with ratchet-teeth. When the carriage and its attached parts are to be propelled toward the working head of the machine the former is secured and locked to the lower part of the chain or belt c, assuming the latter to be traveling in the direction indicated by the arrow. By securing the carriage to the top part of the chain it is propelled in a reverse direction, or toward the tail-stock D of the machine.

As the mechanism for operating the carriage forms the subject of another application for Letters Patent now pending in the Patent Office, and filed by me as hereinbefore stated, I do not deem it necessary to enter into a minute description of said mechanism. The following is, however, a brief description of the device represented in the drawings: Each wheel g' is provided with a locking device consisting essentially of a pawl or lever g^2 pivoted to the carriage-apron, a notched latch h^2 pivoted to the apron and means for disengaging the latch from the pawl. A spring g^3 automatically engages the pawl with the ratchet whenever the latch is lifted from the pawl, thus locking the carriage to the chain, the two then moving in unison until the pawl is tripped or released from the corresponding wheel g'. By referring to Fig. 9 it will be seen that the carriage has been advanced to its limit, the forward pawl being at the same time tripped and detached from the lower wheel g' by means of its engagement with the stationary stop o^8 adjustably secured to the bed E. The action of thus detaching the pawl forces its upper end (resisted by the spring g^3) past the shoulder h^9 formed near the free end of the latch when the latter instantly falls and engages the pawl, the notch serving to lock it in place.

While the carriage, &c., are in the position just described, the yarn is passed through the holding-jaws and into the nipping-jaws and the "feeder" then returned to its normal position. The next operation is to automatically lock the carriage to the upper portion of the traveling chain c thus propelling the carriage rearwardly for the purpose of drawing off the length of yarn to be converted into a loop-band. The following is a description of the device for thus locking the parts together:—At the extreme front end of the machine is fulcrumed, at d^5, (see Figs. 2 and 3,) a horizontal lever d^4 whose rear or free end d^6 is bent downwardly and jointed to a rod g mounted below and extending from end to end of the machine, see also Fig. 1. The rod is adapted to be moved endwise intermittingly through the medium of the lever d^4 provided with a roll r^6 arranged to be engaged by cam-lugs d^3 formed on disks d^2 secured to the continuously revolving cam-shaft d; from this it will be seen that each revolution of the disks will vibrate the lever back and forth once. The several parts are so arranged and timed that the rod g is pushed rearwardly after the trumpet has been withdrawn from the holding-jaws; such movement of the rod operating through the medium of a cam or wedge v, secured to the rod, to engage a pin v' of the rear latch h^2 and detach the latter from the corresponding pawl, after which the spring vibrates it (the pawl) into contact with the ratchet-teeth of the upper chain-wheel thus stopping the rotation of the wheel and causing the carriage to travel in unison with the chain. Fig. 9 shows the re-

lation of the parts at the instant the pawl engages the wheel to propel the carriage rearwardly. The carriage now travels to its limit, or until the last-named pawl is tripped by contact with the rear stop o^7 adjustably secured to a movable cross-head l^8 mounted on the tie-rods a. Just previous to being thus tripped a hook-latch l^2 fulcrumed to the upper portion of the carriage slides over a lug l^6 of the cross-head, thereby locking the latter to the carriage. Fig. 1 shows the parts thus locked. The rear end of the cross-head is fitted to enter a socket l^9 (shown dotted, Fig. 9) formed in the base of the tail-stock D. Attached to and leading rearwardly from the cross-head is a cord o^5, the same passing over a guide-wheel o^4; a weight o^6 suspended from the cord (Fig. 1) serves to automatically return the cross-head to its normal position after it has been released from the carriage; the socket referred to forms an air cushion thereby permitting the cross-head to arrive at a state of rest gently, and without jar or noise.

The tail-stock D is adjustably secured to the rods a, thereby adapting the machine to produce loop-bands having varying lengths as desired. The tail-stock is provided with bearings in which the cam-shaft d revolves. It is also provided with a normally stationary hollow tail-spindle a^8, the latter carrying a loose-pulley h^4, and a spindle-driving pulley h^3; the continuously running driving-belt h^5 being shifted from pulley to pulley through the medium of an automatically operated shipper i^2 actuated by a suitably timed cam i^4, (Figs. 9 and 10.) The fixed pulley h^3 is provided with a notch q adapted to receive an end of a two-arm lever i' actuated by a cam i^3, substantially as hereinbefore described with respect to the mechanism for revolving the holding-jaws; the notch and lever being employed to so stop the rotation of the tail-spindle (after the belt has been shifted from the pulley h^3) that it will be in position to freely receive the hook-spindle.

To the upper portion of the carriage B is secured a vertical yoke-shaped bracket a^5 in which the hook-spindle a^6 is mounted to revolve; the spindle extends quite a distance beyond the rear bearing and is provided with a longitudinal groove or spline a^7 adapted to receive a fixed tongue or key a^9 of the tail-spindle. To the opposite end of the spindle the loop-hook N is rigidly secured. The spindle is prevented from moving endwise in its bearings by means of collars v^2 (Fig. 9). When the hook-spindle and tail-spindle are engaged and the latter is rotated it is evident that the loop-hook N will be made to revolve. Figs. 1 and 12 show the two spindles thus connected. The arrangement of the mechanism is such that the open eye of the hook N is say always uppermost except when the two spindles are being rotated. After the carriage has arrived at the end of its rearward stroke and has been disconnected from the chain, as before stated, the two strands of yarn held by the stationary hook N and separated by the two holding-jaws are next twisted individually, although simultaneously, by rotating the holding-jaws, as previously described. The act of twisting the yarn obviously shortens the strands, corresponding to the degree of twisting given to them, thereby causing the carriage and counter-weighted cross-head to advance along the guide-rods a, the hook-spindle at the same time sliding forward through the then stationary tail-spindle. When the twisting of the yarn has been practically completed and the rotation of the holding-jaws discontinued by the means before described, the revolving tail-stock cam i^3 forces the stop lever i' from the notch q of the fixed pulley h^3, the cam i^4 at substantially the same time operating through the medium of the shipper i^2 to shift the belt onto the said pulley, thereby rotating the hook N and laying-up or doubling the strands together to form the loop-band. The direction of rotation is the same, both for twisting and doubling. After the doubling process has been sufficiently continued the belt h^5 is reshipped onto the loose pulley by means of said cam and shipper; the stop-lever i' now automatically engages the notch q of the driving-pulley and arrests the rotation of the spindles. After the band has been thus completed it must be removed from the now stationary hook and holding-jaws. In order to effect such removal of the bands I have provided what I term removing-jaws adjustably secured to a continuously revolving shaft d' extending from the head-stock rearwardly to or nearly to the tail-stock. This shaft is actuated by means of the cam-shaft d through the medium of bevel-gears c^3 and c^4 (Figs. 2 and 3), one of each being secured to a short upright shaft mounted in a frame H. The upper portion of the frame is provided with an arm forming a bearing for the forward end of the shaft d'. An upwardly extending bent bracket J is firmly secured to the bed E and also forms a bearing for the shaft; a similar bracket J' being adjustably secured to a slotted plate a' which in turn is bolted to knees a^2 secured to the tie-board b; the said plate a' and bracket J' being located near the rear end portion of the machine. The relation of the brackets may be changed by loosening the holding-down bolt of the bracket J' and moving the latter nearer to or farther from the fixed bracket, the bolt meanwhile sliding along the slot a^3 (shown dotted in Fig. 14) after which the bolt is re-tightened. As drawn these brackets J, J' are provided each with a fixed cam-shaped flange, on the periphery of which the inner end of a radially movable jaw-member e^5 bears. The other or fixed member e^3 (Figs. 14, 15 and 16) is adjustably secured to the shaft d' and is adapted to receive and support the member e^5; the two are provided at their outer ends with lateral extensions arranged to form jaws adapted to receive the band. It will be seen, referring to Fig. 15, that

while the arm e^3, &c., are revolving around the concentric portion of the cam the jaws remain open and receive the band x^2 between them, immediately after which the jaws close upon the band; the last-named movement being effected by a spring e^6 attached to the member e^5 in such a manner that as the latter passes onto the front abrupt inclined edge e^4 of the cam the spring is brought into action, as stated. The corresponding relation of the parts are indicated in Fig. 15 by dotted lines. Both sets of removing-jaws are operated simultaneously. At about the same instant that the removing-jaws are closed upon the band the revolving cam c^8, located at the head of the machine, acting through the agency of the links, &c., before described, vibrates the arms c^6 rearwardly, thereby simultaneously forcing open the two holding-jaws and thus uncovering the openings s^2 and freeing the ends of the yarn. The removing-jaws in revolving detach the now finished band from the holding-jaws and hook and carry it over to the rear side of the machine where it is discharged into hook-shaped receivers a^4 secured to the back-tie or board b, (see Fig. 16.) The removing-jaws are opened by means of the engagement of the sliding member e^5 with the inclined rear surface e^7 of the cam as the former passes over it. While the operation last described is taking place the carriage B is detached from the cross-head l^8 followed by locking the carriage to the chain which then propels it ahead to its limit, immediately after which the carriage is detached from the chain and the yarn fed into the holding-jaws and nipping-jaws through the agency of the trumpet o, &c., as before described preparatory to drawing off a length of yarn to be converted into another loop-band. The carriage is released from the cross-head and locked to the traveling chain by means of the cam-actuated lever d^4, its action then being to move the rod g endwise (toward the front) thereby at the same time, through the connection l^7, lifting the horizontal tripping-bar l^4 jointed to end arms l^5, as clearly shown in Figs. 1 and 9. In thus moving the bar l^4 it operates to lift a lever l^3 secured to the latch l^2 and raise the latter from the lug l^6, thereby freeing the cross-head, the weight instantly returning it to the normal position; its rear end entering the socket l^9 formed for it in the tail-stock. It will be seen by referring to Figs. 9 and 20 that the tripping-bar in its upward movement also engages a pin v^3 of the forward latch h^2 and releases the latter from the pawl, its spring then vibrating the pawl into engagement with the ratchet of the lower chain-wheel, thus for the time being stopping the rotation of the wheel and locking it to the chain and causing the carriage to travel ahead until the pawl is tripped by contact with the forward stop-pin o^8, when the latch again drops into engagement with the pawl, thus detaching the carriage from the chain. The relative positions of the parts then are substantially as indicated in said Figs. 9 and 20.

I would add that the tripping-rod g is returned to its normal rearward position by the action of the cam-disks d^2 which impart a corresponding movement to the lever d^4; such movement of the rod at the same time operating to trip the latch from the rear pawl, and thus permitting the spring to vibrate it into engagement with the ratchet of the upper chain-wheel and relocking the carriage to the chain, followed by a repetition of the several operations hereinbefore described, whereby a length of yarn x is drawn from the spool and converted into a finished loop-band x^2. Fig. 3 shows the relation of the lever d^4 to the tripping-bar and said rear pawl when they are in the rearward normal position represented in Fig. 9.

My improved loop-banding machine is entirely automatic in its action,—after the three driving-belts p^8, p^6 and h^5 have first been set in operation and the free end of the yarn x, leading from the mounted loaded spool has been introduced to the feeder. The machine is adapted to convert the entire yarn-load upon the spool into loop-bands and deposit them into a holder or receiver without the presence or aid of an attendant, it simply being necessary for a person to replace the empty spools, with filled ones.

Since I have hereinbefore set forth the consecutive order of the operations of the various devices employed by me in the production of loop-bands automatically (see the statement immediately following the description of the several figures of the drawings) I do not deem it necessary to repeat the statement. The operation of the devices have been, however, fully set forth in connection with the preceding description of the construction and arrangement of the parts entering into the various combinations.

Although I have shown and described but one form of my invention, I do not thus limit myself to the precise construction and arrangement in matters of detail, as various changes or modifications of the same may be made without departing from the spirit of the invention.

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

1. The combination of a pair of combined holding and twisting jaws, each consisting of a tubular member and a longitudinally movable spring-resisted member or head s' perforated to receive and clamp the cord against the end of said tube, means for intermittingly rotating the jaws and means for opening and closing the jaws at pre-determined intervals, substantially as described.

2. The combination with combined holding and twisting jaws constructed and arranged substantially as described, means for opening and closing the jaws, means for simultane-

ously revolving the jaws intermittingly in non-revoluble boxes and mechanism for introducing yarn into said jaws, of an intermittingly revolving loop-hook and means for moving it to and fro with respect to said twisting mechanism, substantially as described.

3. Combined holding and twisting-jaws, means for revolving the same, nipping-jaws, and means for opening and closing them, feeding mechanism for passing a strand of yarn through the said twisting-jaws and into the nipping-jaws and a knife for severing the strand of yarn, in combination with a loop-hook, means for moving it to and fro with respect to the twisting-jaws and mechanism for intermittingly revolving the loop-hook to double the loop-band, substantially as described.

4. In a loop-banding machine, a combined holding and twisting jaw, consisting of the hollow spindle provided with an external gear e^2, a spring-resisted stem, as s, seated in and passing longitudinally through the spindle having a head s' provided with an eye to receive the yarn and mechanisms for rotating and opening the jaw, substantially as described.

5. The combination with yarn-feeding mechanism and combined holding and twisting jaws and means for revolving the jaws, of nipping-jaws for holding the free end of the yarn while a length of the latter is being drawn off, a longitudinally movable loop-hook, means for revolving the hook and a knife located between the said feeding and twisting mechanisms for severing the yarn, substantially as described.

6. In a loop-banding machine, the combination with yarn feeding, cutting, twisting and band-removing mechanisms and an endless belt traveling continuously in one direction, of a suitably mounted holding carriage, a loop-hook mounted in the carriage and means for detachably securing the carriage to the traveling belt to propel it to and fro intermittingly, substantially as described.

7. In a loop-banding machine, twisting mechanism, a reciprocating yarn-feeding device having a tube or trumpet through which the yarn extends provided with a yielding mouth or outlet to prevent the free end of the yarn from retracting into the tube, and an auxiliary yarn-check located at or near the opposite end of the tube, substantially as described.

8. In a loop-banding machine provided with yarn-holding and twisting mechanisms, a yarn-carrying tube or trumpet, as o, provided at its free or delivery end with a yielding checking device, means for reciprocating the tube to and fro transversely of the machine, a yarn holder or supply spool, as u, and a pivotally mounted tension device or brake in frictional contact with the spool, substantially as described.

9. In a loop-banding machine, an endless chain or band, means for driving it continuously in one direction, in combination with a holding carriage connected to the said belt to be propelled to and fro longitudinally of the machine, means for locking the carriage to the chain and detaching it therefrom, a spindle provided with a loop-hook mounted in bearings secured to the carriage, and an intermittingly revolving hollow tail-stock spindle arranged to receive and rotate said hook-spindle, substantially as described.

10. A holding carriage, means for propelling it to and fro at pre-determined intervals, a loop-hook mounted on the carriage, means for revolving the hook, and a latch, as l^2, pivoted to the carriage, in combination with a counterweighted cross-head mounted to slide on fixed ways adapted to be locked to the carriage by means of the latch, and means for tripping the latch, substantially as described.

11. The combination with a hook-carrying holding carriage and mechanism for propelling it to and fro, of a counterweighted cross-head mounted to slide on fixed ways, means for attaching the carriage to the cross-head and detaching it therefrom, and a cushioned stop for arresting the cross-head in its rearward movement after it has been detached from the carriage, substantially as described.

12. In a loop-banding machine, the driving chain, as c, means for propelling the chain continuously, the holding carriage provided with a loop-hook, means for revolving the hook, means for locking the carriage to the chain and detaching it therefrom, a counterweighted cross-head and means for attaching it to the carriage, in combination with a tripping-bar, as l^4, and a cam-actuated rod connected therewith to operate the tripping-bar for the purpose of detaching the carriage from the cross-head, substantially as described.

13. In a loop-banding machine, a suitably mounted holding-carriage and means for propelling it to and fro, in combination with fixed ways, a tail-stock adjustably secured thereto, a counterweighted cross-head mounted to slide on said ways, means for attaching the carriage to the cross-head and detaching it therefrom and having the tail-stock counterbored to form a cushioned stop for the cross-head, substantially as described.

14. In a loop-banding machine, a holding carriage, means for propelling it to and fro and a hook-spindle mounted in the upper portion of the carriage, in combination with a hollow tail-spindle arranged to receive and rotate said hook-spindle, means for intermittingly rotating the tail-spindle and a mechanically operating stop-lever for arresting the rotation of the tail-spindle, whereby the latter when at a state of rest will be in position to properly receive the hook-spindle, substantially as described.

15. In a loop-banding machine, suitably mounted fast and loose head-stock pulleys, p, p', the continuously running belt p^6, mechanisms actuated by said belt for twisting the two strands of yarn drawn off to be converted

into a loop-band, fast and loose tail-stock pulleys, h^3, h^4, the continuously running belt h^5, a loop-hook rotated by the said belt h^5 for doubling the said strands together, in combination with the yielding initial driving-pulley p^7 the continuously running driving belt p^8, and mechanisms for shifting the said belts p^6 and h^5, said belt-shifting mechanisms being actuated and controlled by the initial driving-belt p^8, substantially as described.

In testimony whereof I have affixed my signature in presence of two witnesses.

JOHN M. PARKER.

Witnesses:

GEO. H. REMINGTON,

IDA M. WARREN.