(No Model.)

6 Sheets—Sheet 1.

S. KIMBALL.

BALE TIE MACHINE.

No. 570,555. Patented Nov. 3, 1896.

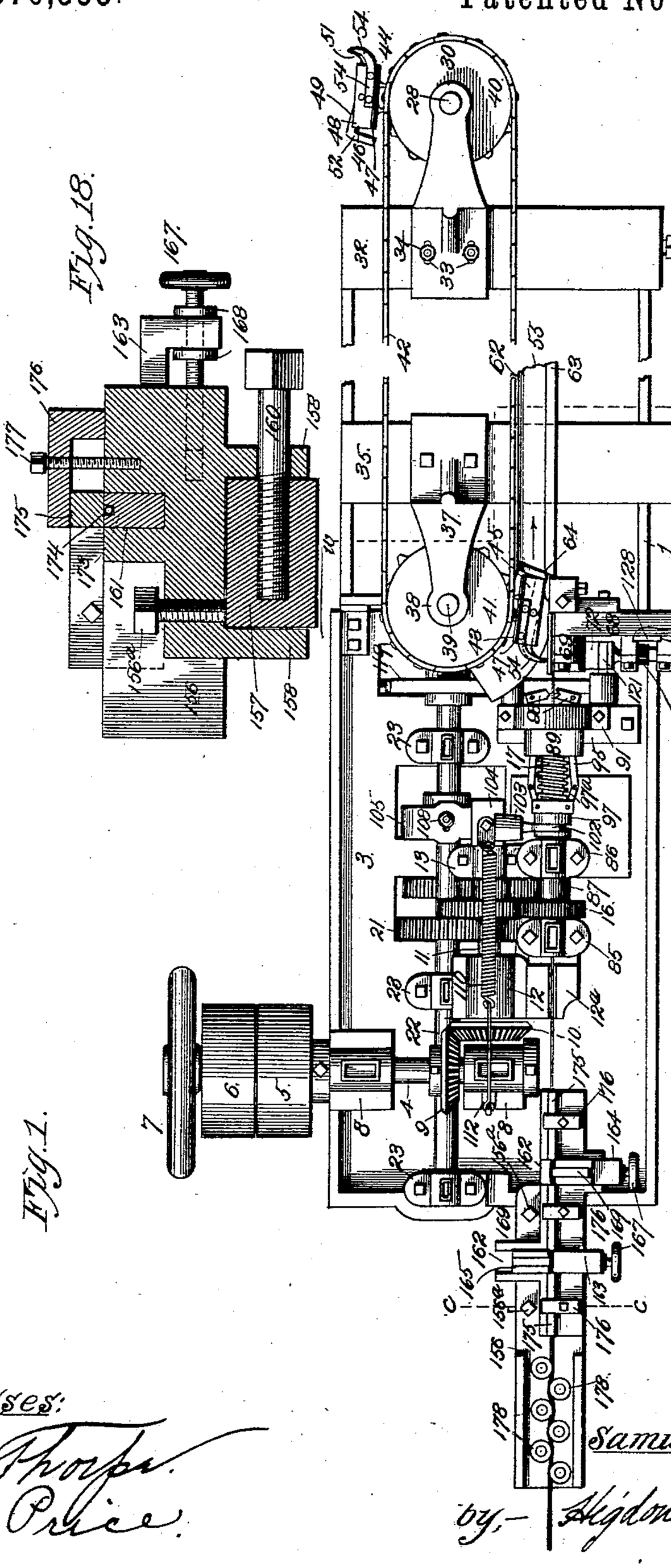


Fig. 1.

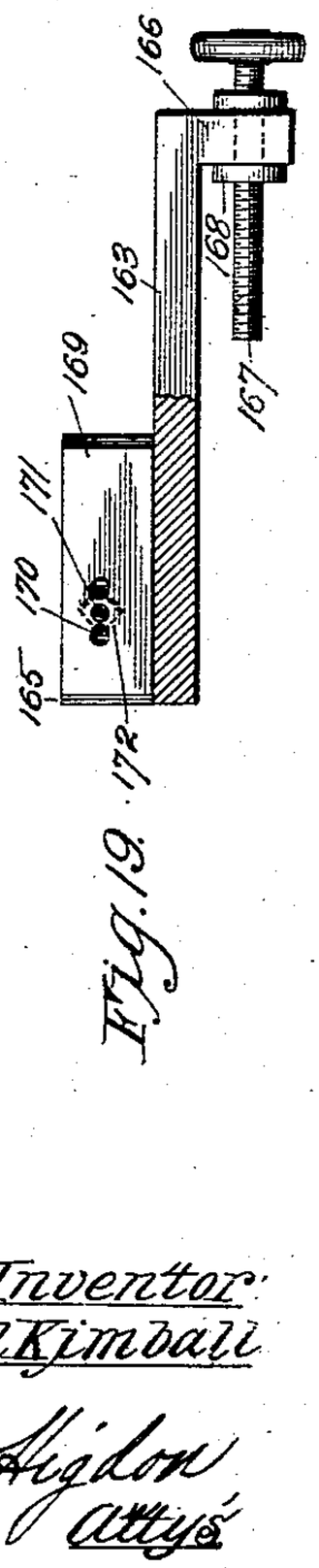


Fig. 19.

Witnesses:

G. F. Thorpe.

H. E. Price.

Inventor:

Samuel Kimball

by,— Higdon & Higdon

Attys

(No Model.) 6 Sheets—Sheet 2.

S. KIMBALL.

BALE TIE MACHINE.

No. 570,555. Patented Nov. 3, 1896.

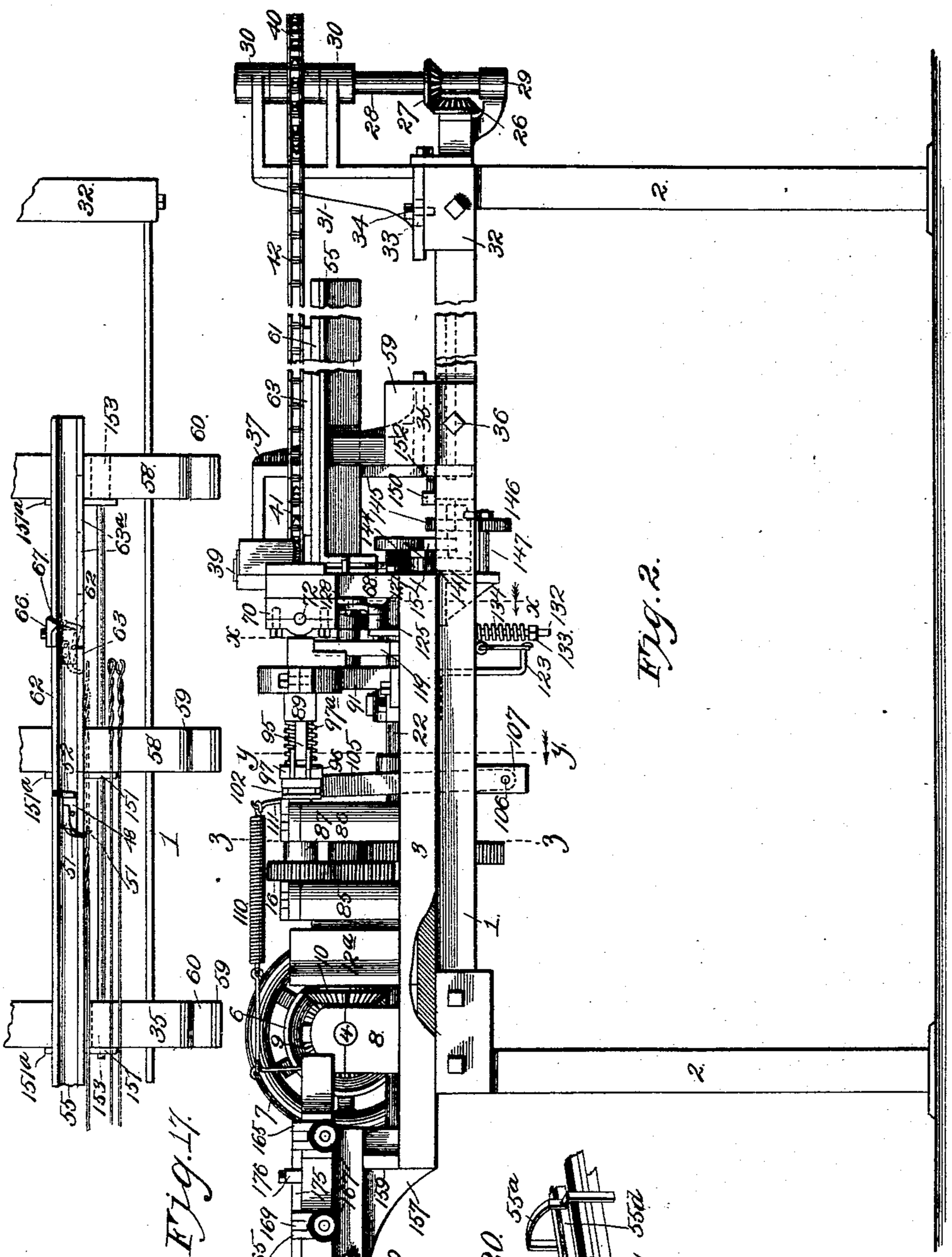


Fig. 1.

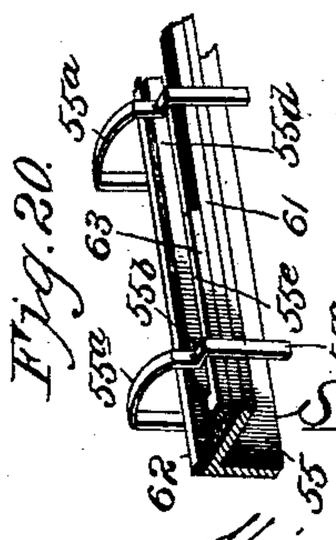


Fig. 20.

Witnesses:
Guy C. Hosford.
H. E. Price

Inventor:
Samuel Kimball,
by Higdon & Higdon
Attys.

(No Model.)

6 Sheets—Sheet 3.

S. KIMBALL.

BALE TIE MACHINE.

No. 570,555. Patented Nov. 3, 1896.

Fig. 3.

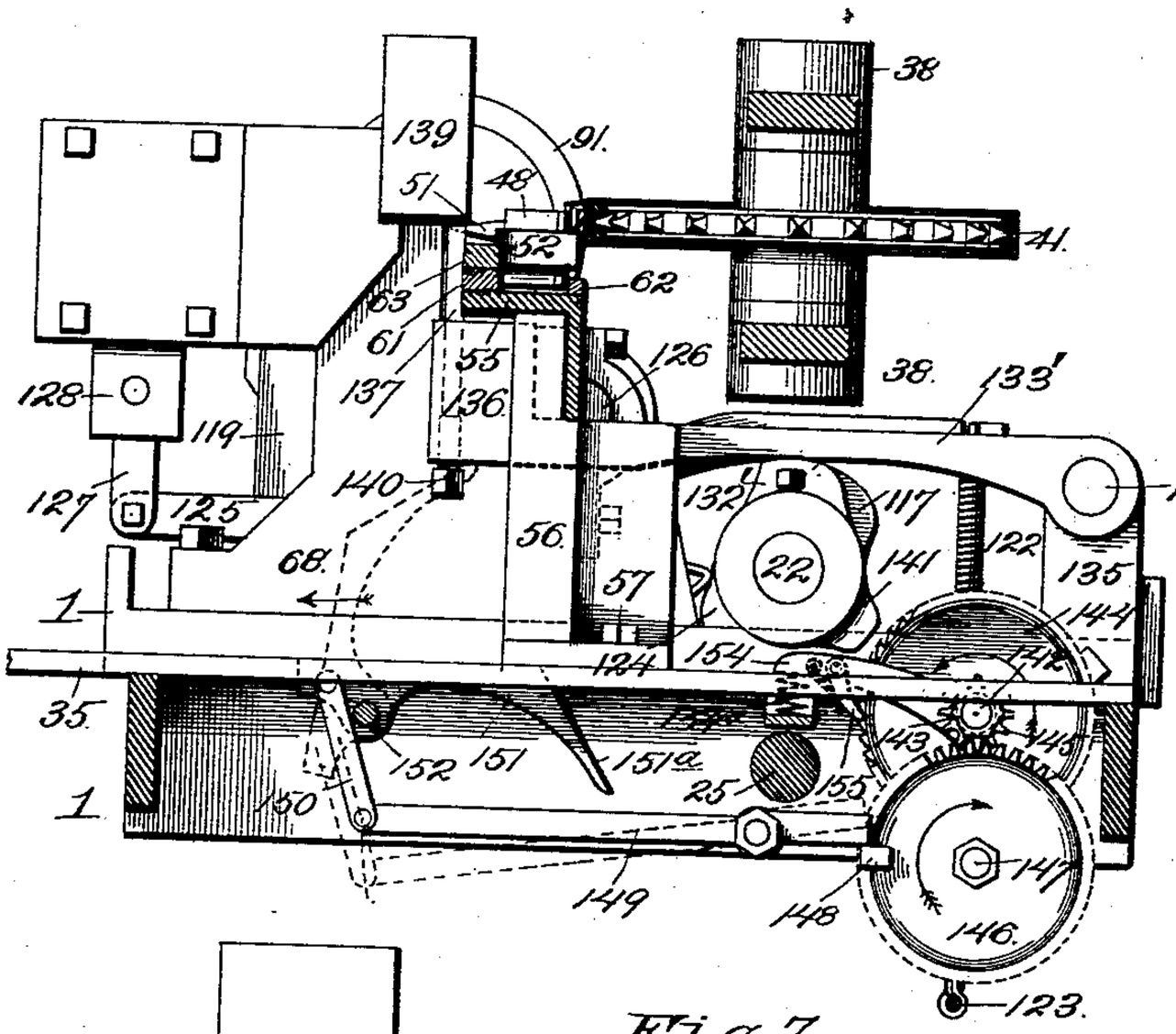


Fig. 21.

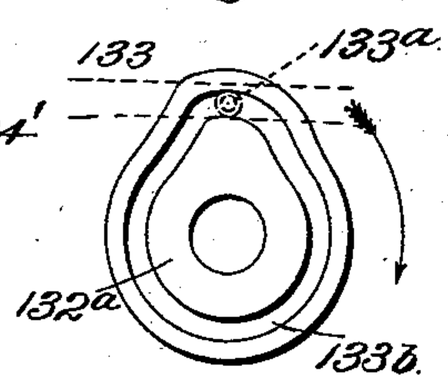


Fig. 7.

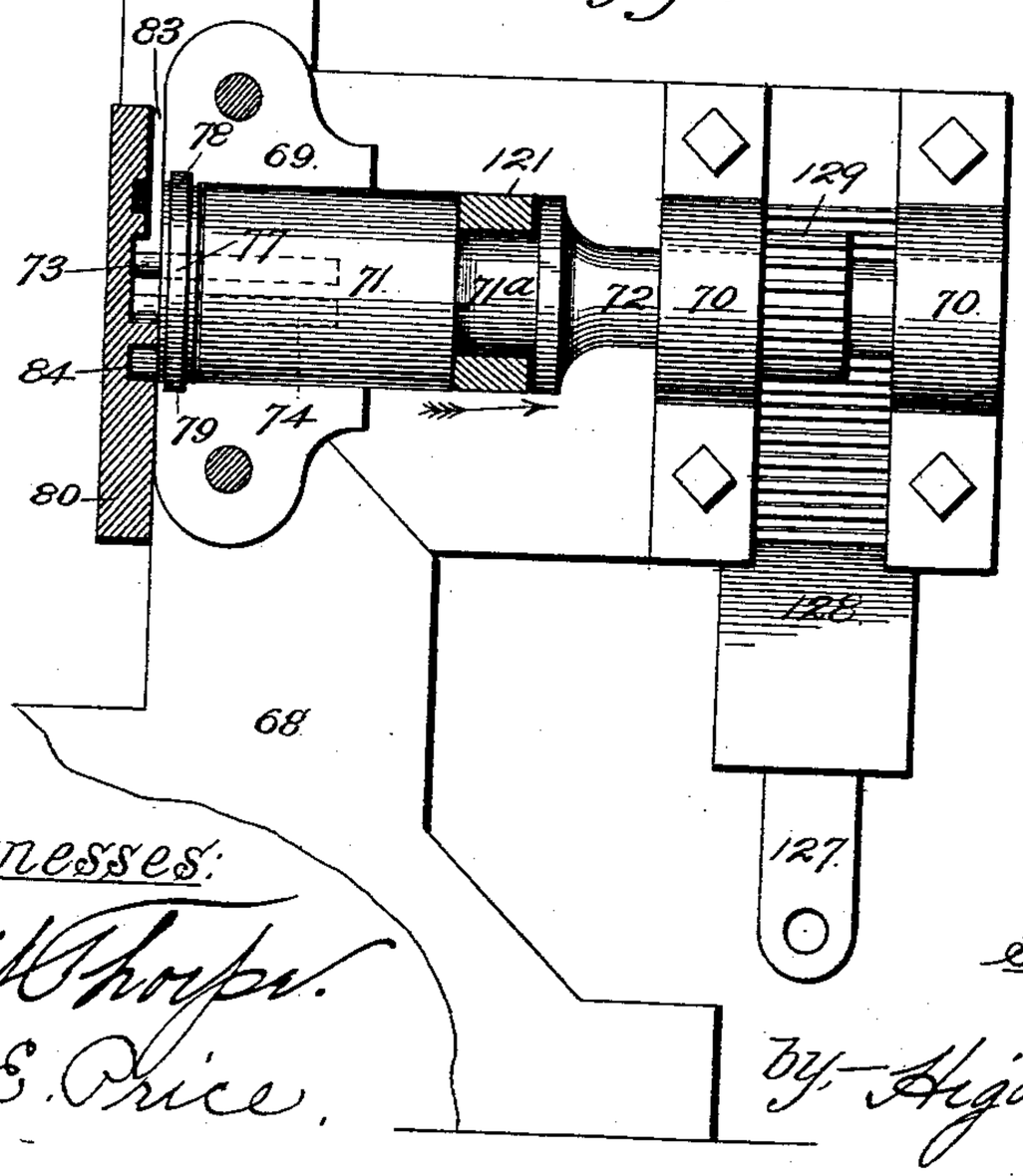
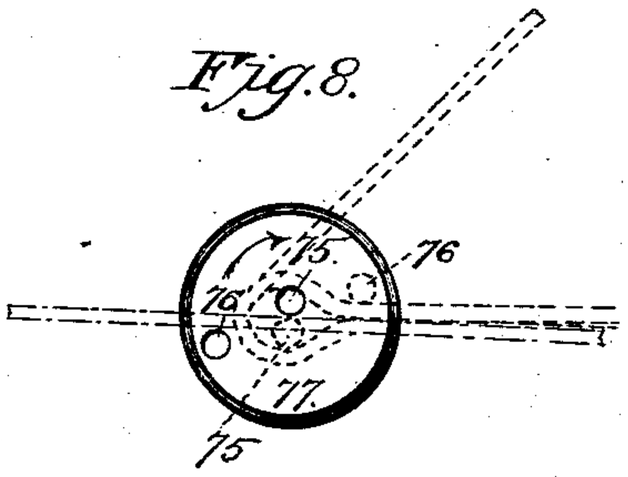


Fig. 8.



Witnesses:

G. H. Thorpe.

F. E. Price.

Inventor:

Samuel Kimball,

by Higdon & Higdon

Attys.

(No Model.)

6 Sheets—Sheet 4.

S. KIMBALL.

BALE TIE MACHINE.

No. 570,555. Patented Nov. 3, 1896.

Fig. 4.

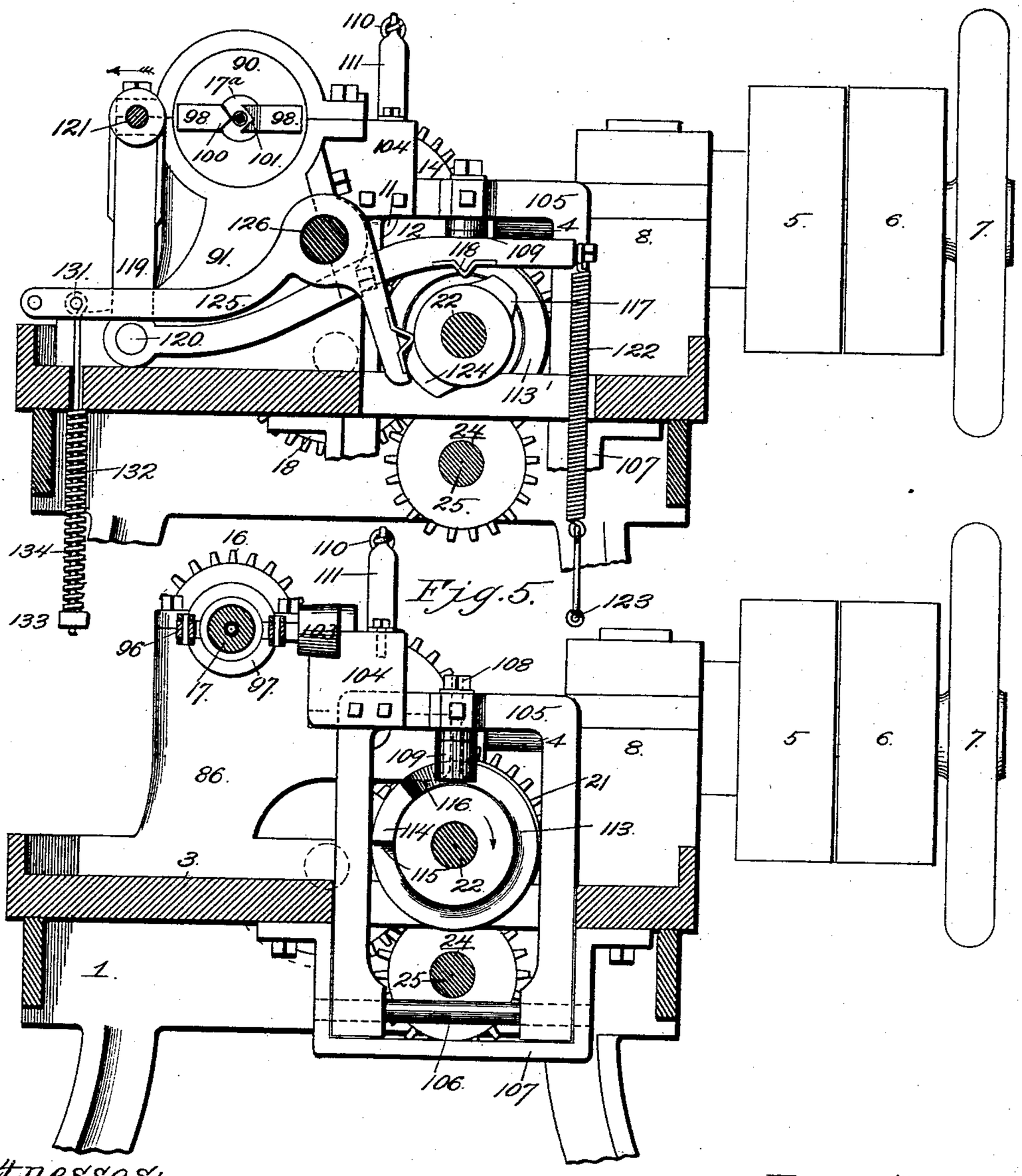


Fig. 5.

Witnesses:

G. F. Thorpe.

H. E. Price.

Inventor:

Samuel Kimball.

by, Higdon & Higdon.

attys.

(No Model.) 6 Sheets—Sheet 5.

S. KIMBALL.

BALE TIE MACHINE.

No. 570,555. Patented Nov. 3, 1896.

Fig. 6.

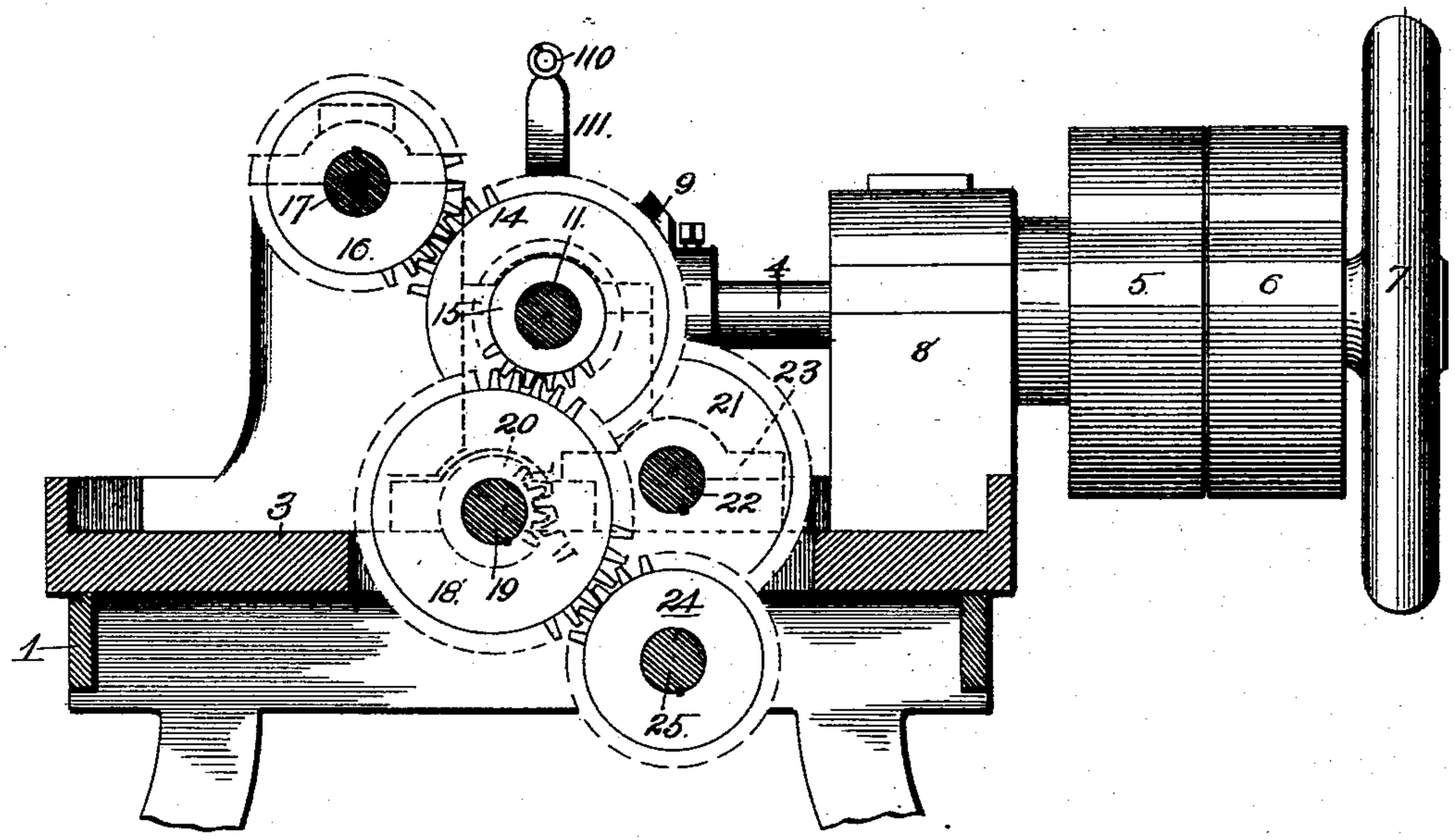


Fig. 9.

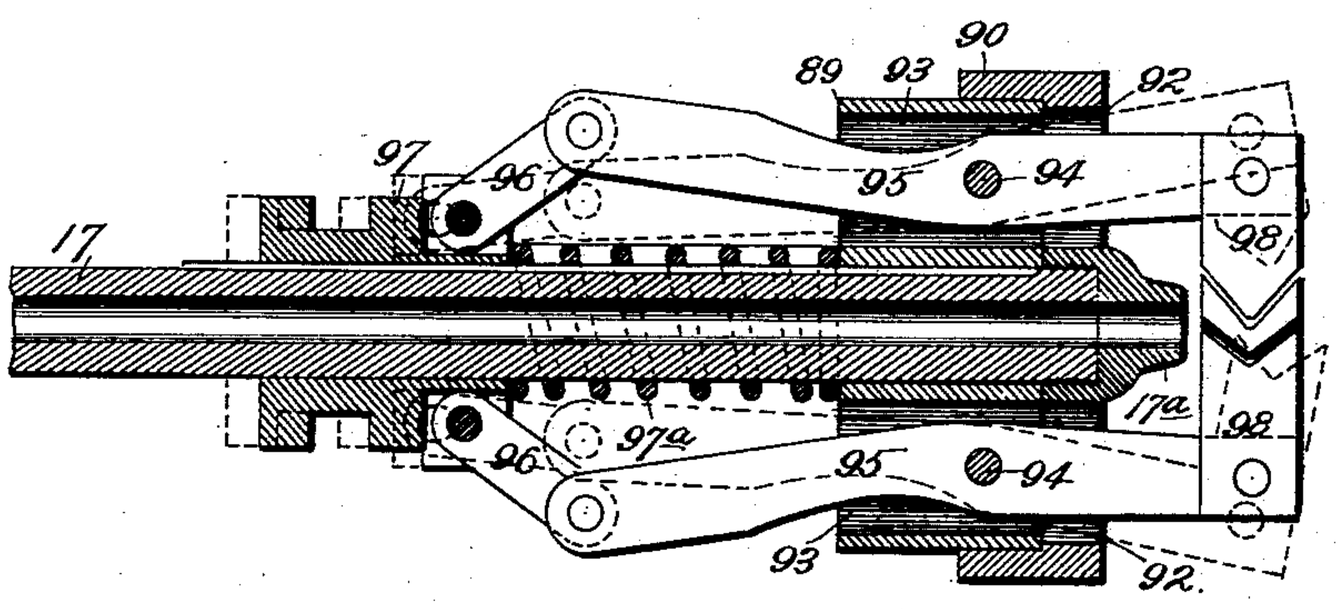
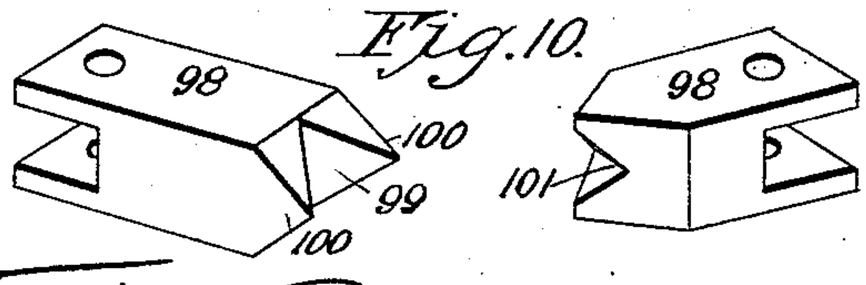


Fig. 10.



Witnesses:

G. H. Thorpe.

H. E. Price.

Inventor:
Samuel Kimball,

by Hyde & Hyde.
Attys.

(No Model.) 6 Sheets—Sheet 6.

S. KIMBALL.

BALE TIE MACHINE.

No. 570,555. Patented Nov. 3, 1896.

Fig. 11.

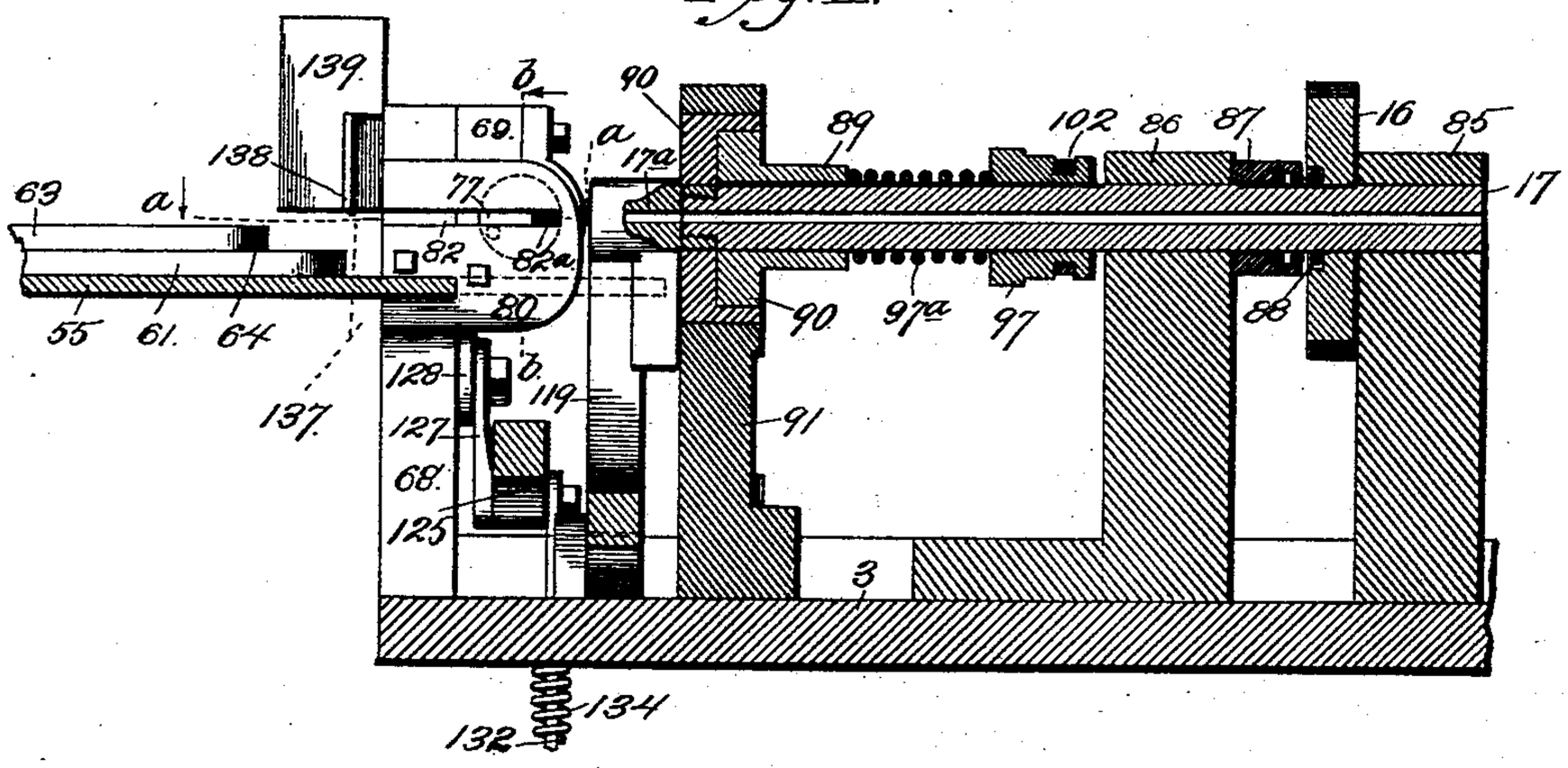


Fig. 14.

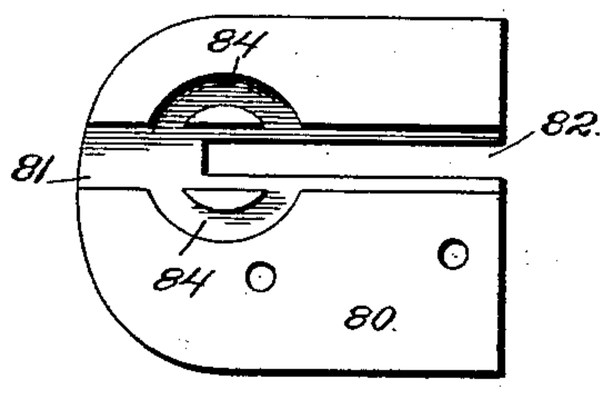


Fig. 13.

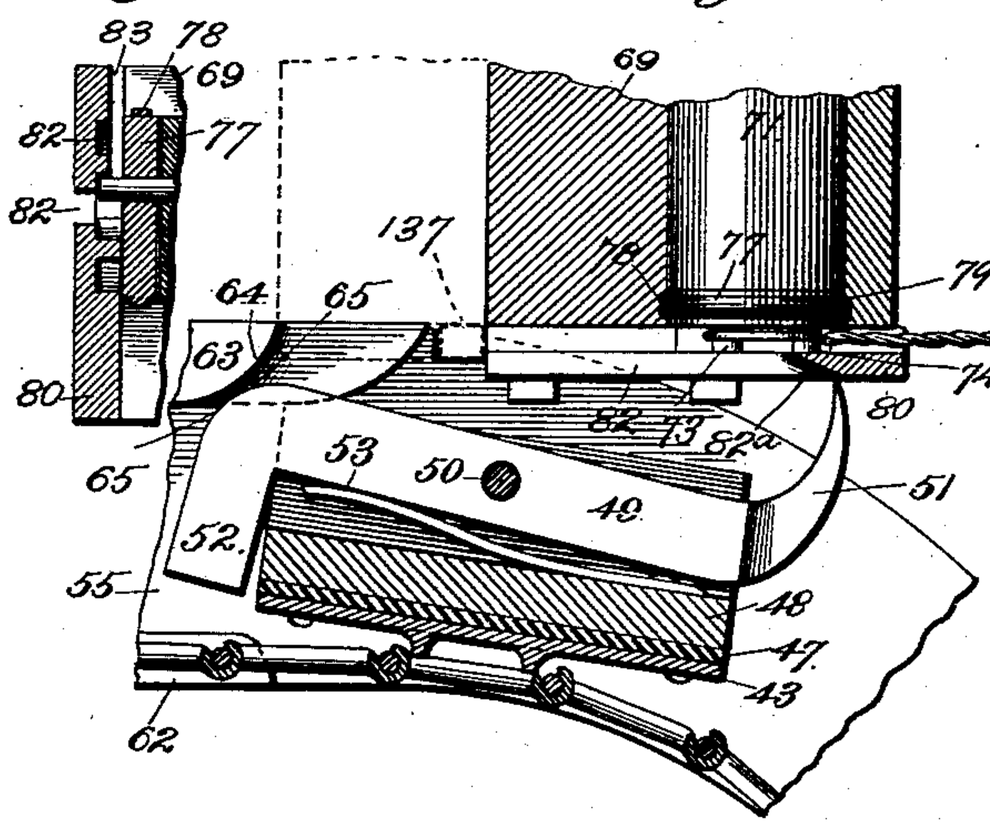


Fig. 12.

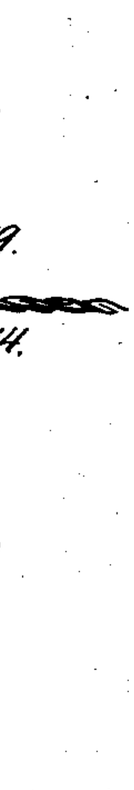


Fig. 15.

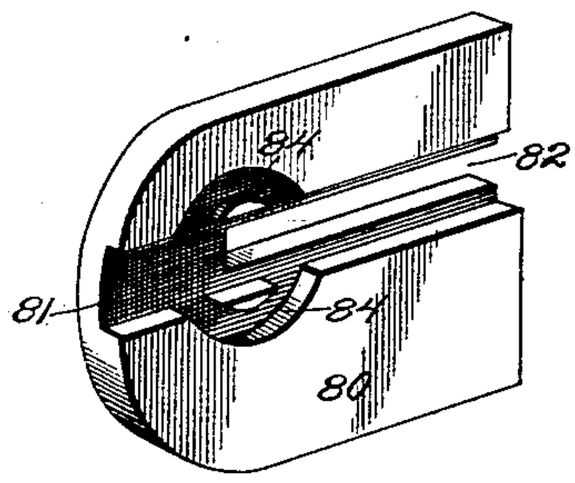
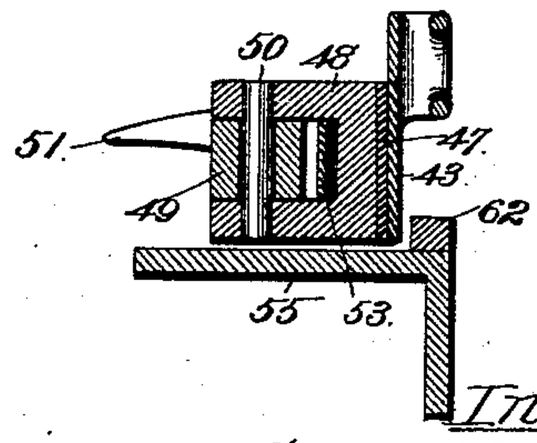


Fig. 16.



Witnesses:

G. G. Thorpe.

H. E. Price.

Inventor:

Samuel Kimball,

by Higdon & Higdon.

Attys.

UNITED STATES PATENT OFFICE.

SAMUEL KIMBALL, OF LAWRENCE, KANSAS.

BALE-TIE MACHINE.

SPECIFICATION forming part of Letters Patent No. 570,555, dated November 3, 1896.

Application filed April 25, 1896. Serial No. 589,137. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL KIMBALL, of Lawrence, Douglas county, Kansas, have invented certain new and useful Improvements in Bale-Tie Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to bale-tie machines; and my object generally is to produce a machine of this character which shall be strong and compact of construction and very rapid and reliable and entirely automatic in its operation. Other special objects will hereinafter appear, and be pointed out in the appended claims.

In order that the invention may be fully understood, I will proceed to describe it with reference to the said accompanying drawings, in which—

Figure 1 represents a plan view of a bale-tie machine embodying my invention. Fig. 2 represents a side elevation of the same. Fig. 3 represents, on an enlarged scale, a cross-section taken on the line *w w* of Fig. 1. Fig. 4 represents, on the same scale, a cross-section taken on the line *x x* of Fig. 2. Fig. 5 represents, on the same scale, a cross-section taken on the line *y y* of Fig. 2. Fig. 6 represents, on the same scale, a cross-section on the line *z z* of Fig. 2. Fig. 7 represents, on a much larger scale, an elevation of the wire-bending shaft and in section certain parts relating thereto. Fig. 8 represents a face view of a disk which operates in conjunction with said shaft. Fig. 9 represents a longitudinal section of the wire-twisting shaft and its connections. Fig. 10 represents detailed views of the wire-clamping jaws. Fig. 11 represents, on a smaller scale than Fig. 9, a view partly in elevation and partly in vertical section, the section being taken through the twisting-shaft and its connections. Fig. 12 represents, on a larger scale, a horizontal section taken on the line *a a* of Fig. 11, and also shows a horizontal section of one of the wire actuating or moving devices. Fig. 13 is a vertical section taken on the line *b b* of Fig. 11. Fig. 14 is an inner face view of the guide-plate for the wire where and when it is bent to form an eye or loop. Fig. 15 is a perspective view of the same. Fig. 16 is a cross-sectional view of one of the wire-carriers. Fig. 17 is a plan view of a portion of the machine not illustrated in Figs. 1 and 2, owing to the fact that the great length of the machine has made it necessary to show said figures as broken. Said figure also shows the means for automatically disconnecting the completed bale-tie from the carrier at a predetermined point. Fig. 18 represents a cross-section taken on the line *c c* of Fig. 1, but on a much larger scale. Fig. 19 represents, partly in section and partly in elevation, one of my adjustable wire-straightening devices. Fig. 20 is a sectional perspective of the table, and shows also a modified form of construction whereby the disconnection of the eye or loop of the bale-tie with the hook of the carrier is made positive and reliable. Fig. 21 is a face view of a grooved or double cam for raising and lowering the knife-carrying lever.

In the said drawings, where like parts are indicated by corresponding reference-numerals, 1 designates a longitudinal frame of suitable length, which is of skeleton form preferably. It is mounted upon supporting legs or standards at each end and carries superposed at one end a bed-plate 3.

4 designates the power-shaft, which with all other shafts hereinafter mentioned, is journaled in suitable bearings mounted upon either the bed-plate or the frame of the machine. Said shaft extends transversely of the front end and a suitable distance above the bed-plate, and carries at its outer end fast and loose pulleys 5 and 6, respectively, and a balance-wheel 7. Between its bearings 8 a beveled gear 9 is rigidly mounted upon it, and this bevel-gear meshes with a similar gear 10 upon the longitudinally-extending shaft 11, journaled in bearings 12 and 13 at its opposite ends. Said shaft in turn at a point adjacent to the bearing 13 carries a double gear consisting of a large wheel 14 and a smaller wheel or pinion 15. The wheel 14 meshes in turn with a smaller cog-wheel 16, keyed or otherwise secured upon the hollow wire-twister shaft 17, which shaft will be hereinafter more particularly described.

The pinion 15 meshes with a cog-wheel 18 of equal diameter, preferably with the cog 14, and mounted rigidly upon a shaft 19,

journaled in said bearings upon the bed-plate. Said shaft 19 is a short shaft, and is employed merely to carry the large cog-wheel 18, which projects downwardly through an opening in the bed-plate, and a very small pinion 20, indicated by dotted lines, Fig. 6. Said wheels 18 and 20 are preferably formed integrally, and the pinion meshes with the large wheel 21, mounted rigidly upon a longitudinally-extending shaft 22, journaled in bearings 23 upon the bed-plate. The large cog-wheel 18 meshes in turn with a slightly smaller cog-wheel 24, which is mounted rigidly upon the longitudinally-extending shaft 25, arranged below the bed-plate and journaled at its opposite ends preferably in the frame 1 or bearings thereto attached. At its rear end it carries a beveled gear 26, which meshes with a small gear 27 upon a short vertical shaft 28, journaled at its lower end in an extension or arm 29 of the rear-end bearing of the shaft 25, and at its upper end in the bearing-sleeves 30, of a vertical bracket 31, mounted upon a cross-bar 32, secured upon the rear end of the frame 1. Said bracket 31, at its lower end, is provided with a pair of longitudinal slots, and extending through the same and into the cross-bar 32 are the vertical clamping-bolts 34. By this means the bracket can be adjusted longitudinally upon the machine.

Arranged in longitudinal alinement with the bracket 31, and mounted either adjustably or rigidly upon a cross-bar 35, secured rigidly and transversely upon the frame by a bolt or bolts 36, is a similar but oppositely-disposed bracket 37, and journaled in corresponding sleeves 38 of said bracket is a short vertical shaft 39, which is disposed just above the rear end of the bed-plate 3. Mounted rigidly upon said shafts 28 and 39, and between the sleeves thereof, so as to prevent vertical movement, are the similar sprocket-wheels 40 and 41, respectively, and connecting said sprocket-wheels is the endless sprocket-chain 42. At points equally distant from each other said chain is provided with a pair of links, with which are cast integrally the outwardly-disposed plates 43 and 44, respectively, and secured to said plates are similar bale-tie-feeding devices 45 and 46, respectively. Each comprises a plate 47, secured to a plate 43, a slotted block 48, secured to plate 47, a bar 49, pivoted at 50 within the slotted block, and provided at its opposite ends with the oppositely-projecting hooks 51 and 52, and the spring 53, secured within said block and engaging said bar with a yielding pressure, so as to normally hold the hook 51 with its free or outer end retracted, for a purpose which will hereinafter appear, and about in the vertical plane of a rigid overhanging hook 54, secured to the upper side of the block, the object of said rigid hook being to strip or assist in stripping the eye or loop of each bale-tie from the hook 51 at a predetermined time, as will be more fully hereinafter explained. Arranged in the path of and just below these wire feeders or carriers is a table or plate 55. It is of length to extend from the front sprocket-wheel 41 toward the opposite or rear sprocket-wheel a distance slightly exceeding the length of the longest bale-tie to be formed, which in practice will be about nine and one-half feet, and this table or plate is arranged at the outer side of that portion of the sprocket-chain nearest to the longitudinally-extending twister-shaft, and the arrangement of the parts is such that the hook 51 of each wire feeder or carrier travels in the horizontal plane represented by the axis of the said twister-shaft. Said table or plate is preferably in the form of an angle-plate, and its vertical arm is bolted or otherwise rigidly secured to the upper ends of a number of standards or brackets 56, which are bolted, as shown at 57, upon the cross-bar 35, and a pair of similar cross-bars 58, which extend transversely of and are secured to the frame 1 at equal distance from each other and from the bars 32 and 35, preferably. Said bars 58, and also the bar 35, have their front ends, that is, the ends projecting toward the side of the machine where an operator stands, extended beyond the corresponding side of the frame 1 and formed with upwardly-projecting longitudinally-alined ribs 59, so as to provide between them channels 60, to receive the bale-ties while being bundled in the customary manner.

61 and 62 designate longitudinal strips which are secured upon the plate or table at its front and rear edges, its full length preferably, so as to provide a channel or way within which travel successively the wire feeders or carriers, which therefore must travel in a perfectly straight line and consequently keep the corresponding side of the chain in the same position. The upper sides of these strips, however, are below the plane of the pivoted bar 49, and therefore do not interfere with the operation of the same. In order to advance the hook 51 of said bar at the proper time, however, I secure upon the strip 61 a strip 63. The front end of this strip, and also the front end of the strip 61, is curved or formed as shown at 64, so that when the rounded end 65 of the bar 49 comes in contact with it, as indicated in Figs. 1 and 12, said bar will be pivotally operated and the hook 51 advanced and the spring 53 repressed simultaneously. Said bar will remain in this position until the rear or discharge end of the strip 63 is reached by the carrier, at which point the complete tie is discharged from the hook and dropped down upon the cross-bars 35 and 58, as hereinafter more particularly explained. This is accomplished owing to the fact that as soon as the heel or rounded end of the repressed hook 52 clears the rear end of the strip 63, the spring 53 being now unresisted by the positive pressure heretofore applied by the strip 63, throws said hook 52 outwardly and retracts the hook 51, occupying the plane just above, and in its advanced po-

sition projecting forwardly beyond the said strip 63, as indicated clearly by full lines in Fig. 17. When retracted, this point or outer end is brought back to the vertical plane of the front face of said strip, so that the eye or loop of the bale-tie which travels against the face of said strip and therefore cannot move rearwardly with the retracting-hook, is released, and the wire being cut at the same time, (as hereinafter to be explained,) the complete tie drops down upon the cross-bars 35 and 58.

In order to make the disconnection of the carrier and the wire more positive and reliable, and therefore to absolutely prevent any possible chance of the looped end of the wire being drawn upon the strip 63 by the retracting-hook, I have employed the overhanging hook 54, hereinbefore described. The front or outer end of said hook occupies the plane of the front face of the strip 63, so it is obvious that upon the withdrawal of the hook 51 the loop finds an unresisting bearing-surface both above and below the hook, and therefore must absolutely be disconnected with the hook. In order to make this withdrawal of the hook still more positive and reliable, so that entire dependence need not be placed in the spring 53, I have also secured to the rear strip 62 the adjustable block 66, from which projects forwardly into the path of the arm 52, overhanging the strip 62, the beveled shoulder or cam 67. This tripping-block is arranged just beyond the adjustable end of the strip 63, so that as the heel of said hook 62 clears the end of said strip 63 its free end comes in contact with said inclined shoulder 67 and is forced forward positively and reliably, as illustrated clearly in dotted lines, Fig. 17. It will thus be seen that the length of the strip 63 determines the length of the bale-tie turned out by the machine. In case it is desired to increase the length of the bale-tie, I may either replace said strip 63 with a longer strip or I may secure upon the strip 61 one or more additional short strips 63^a, which practically forms a continuation of the strip 63, of course adjusting the trip-block 66 accordingly.

In Fig. 20, I have provided other means for making positive the disconnection of the loop or eye of the wire from the hook of the carrier. When used in connection with the structure disclosed in said figure, the stationary or overhanging hook 54 of the carrier will be dispensed with, and in lieu thereof one or more arches 55^a will be secured by any suitable means in the position relative to the longitudinal table or plate 55. (Shown in said Fig. 20.) Said arch or arches at the front side of the table will be provided with an offset 55^b, that the vertical arm or arms 55^c, depending therefrom, may not be in the way of the hook of the carrier and the eye or loop of the wire engaged thereby. In other words, by thus offsetting these arches at the front side of the table a space is left between the latter and the arches through which the hook may have free and uninterrupted passage.

55^d designates a longitudinal bar which extends beyond the rear or discharge end of the strip 63 a suitable distance, and also is arranged slightly above and parallel with the same so as to provide a slot 55^e between them, through which said hook can barely pass, so that when the said hook is operated in the manner hereinbefore described in order to disconnect it with the eye or loop of the wire it is withdrawn through said slot 55^e without the corresponding movement of the eye or loop, because the latter finds a positive and unresisting bearing-surface in the faces of the strip 63 and the bar 55^d. This disconnection takes place a fraction of an instant before the bale-tie is severed from the wire at its opposite end, and the depending arms or portions 55^c of the arches insure its vertical descent upon the cross-bars 35 and 58.

At the working side of the table or plate 55, located vertically upon the rear end of the bed-plate 3, is a casting or standard 68, and said casting projects a suitable distance above the plane of the twister-shaft and sprocket-wheels. Its inner end is arranged about in the plane of the working or front face of the strip 63, and at its front side and side adjacent to the twister-shaft it is provided with bearings 69 and 70, the bearing 69 being arranged to receive the diametrically-enlarged end 71 of a shaft 72, journaled also in the bearings 70, and the axis of this shaft occupies the same plane as the axis of the twister-shaft. Projecting from the inner end of said shaft eccentrically of its center are the pins 73 and 74, which also extend loosely through registering openings 75 and 76 of a rotatable disk 77, journaled also in the bearing 69. The shaft 72 reciprocates at times, so as to alternately advance and retract said pins through said disk in order to receive the bale-tie wire and release it after the formation of the eye or loop, and as it is desirable that the loop be relatively immovable during the withdrawal of these pins, around which it is tightly clamped in its formation, I have provided the disk 77 with a peripheral annular or segmental rib 78, which engages the corresponding groove in the bearing 69. This arrangement permits the disk to rotate with the shaft, and at the same time affords a stationary surface against which the eye or loop of the wire bears when the pins are withdrawn. It is obvious, therefore, that this disk or its equivalent cannot be dispensed with by extending the enlargement 71 to the end of the bearing 69, owing to the fact that when it is moved longitudinally outward to withdraw the pins a cavity equal to the diameter of the enlargement (or at least equal to the diameter of the circle described by the pin farthest from the center of the shaft) would be left, and into which the eye or loop of the tie might be drawn by said pins, owing to their frictional relation. If this should happen,

the wire-feeding device or carrier secured to the chain might fail to engage the loop in its passage, and the operation of the machine would have to be suspended until the loop or eye was brought to its proper position in the path of said carrier. Its proper position is vertically between the opposing faces of said disk 77 and the plate 80, bolted or otherwise rigidly secured to the end of the casting or standard 68, as shown most clearly in Fig. 14. Said plate is provided at its inner side with a longitudinal groove 81, and communicating therewith with a longitudinal slot 82, extending from a point in advance of the axis of the shaft 72 clear through the opposite end of the plate, and said plate at the closed end of said slot is beveled, as shown at 82^a, in a line substantially concentric to the axis of the sprocket-wheel 41. Below said groove the plate is of uniform thickness, and rests against the bearing, but above said groove its thickness is diminished, so as to form between the bearing and the diminished portion of the plate a passage or space 83, in order to permit the free end of the wire to swing upward and around, as indicated by dotted lines, Fig. 8, as the eye or loop is being formed. This groove, which is horizontal, is opposite the axis of the shaft 72, and is of sufficient width to permit the eccentrically-disposed pin 73 to circulate within it. The plate is also provided with a circular groove 84, within which the other eccentrically-disposed pin 74 travels during the formation of the eye or loop. The pin 73 is in practice the fulcrum-pin, while the pin 74 performs the function of a lever to bend the wire round the fulcrum-pin, and by reason of the fact that said fulcrum-pin is eccentrically disposed relative to the axis of the shaft 72, it is obvious that the center of the loop or eye formed is in longitudinal alinement with the body, shank, or straight portion of the wire. In other words, by causing the fulcrum or pin around which the wire is bent to travel in a circle, the opposite sides of the loop are equal distances from the shank or straight portion of the tie, and not more at one side of the shank than at the other, as is the case where the end of the wire is fed in a straight line under a relatively fixed or immovable pin and bent round the same. To illustrate this more clearly reference is to be had to Figs. 7 and 8. In said figures the parts are relatively arranged in their proper positions to receive the wire which extends in a straight line below the pin 73 and above the pin 74.

It is obvious that when the shaft with the disk 77 rotates in the direction indicated by the arrow, Fig. 8, through about one hundred and eighty degrees, or half a circle, the pins consequently assume the position shown in dotted lines in said figure, the pin 73 at this time being as much below the axis of the shaft and the pin 74 being as much above the axis of the shaft as they were above and below the same, respectively, before such rotatable movement took place, and consequently it is obvious, owing to the fact that the pin 73 is now below the plane of the wire, which is the same as the axis of the shaft, that the loop or eye formed in said wire must project as much below it as above it. Therefore, a more symmetrical and durable loop or eye is formed in the end of the tie, as the strain upon it when in service will be equally distributed between the twisted portions of the wire.

Referring now to the tubular or hollow twister-shaft 17, which is arranged opposite the space between the casting or standard 68 and the plate 80, it will be noticed that at its front or receiving end it is journaled in a bearing 85, and that it is journaled a short distance rearward of said bearing in a similar bearing 86, between which bearings and upon said shaft are mounted the cog-wheel 16 and the collar 87, the former rigidly upon the shaft, and the latter slidingly but not rotatably mounted upon the shaft and bearing against the front side of the bearing 86, and said wheel 16 and collar 87 are held yieldingly a slight distance apart by means of the interposed spring 88, spirally encircling the shaft, for a purpose which will be hereinafter explained. The rear or discharge end of said shaft carries rigidly a collar or sleeve 89, which in turn is secured within the disk 90, which is journaled rotatably in a bearing 91 upon the bed-plate.

The bearing-disk 90 is provided at diametrically-opposite points with the elongated openings or slots 92, which register with slots 93 in the collar 89, and pivotally mounted upon bolts 94 which bridge said slots, are a pair of levers 95, and said levers are pivotally connected by the links 96 to a collar 97, connected to slide upon and rotate with the shaft 17, as shown clearly in Fig. 9, said collar being disposed when in its normal or inoperative position adjacent to the rear side of the bearing 86, as shown clearly in Fig. 1, and adapted in operation to reciprocate upon the shaft in order to operate the toggle consisting of the levers 95 and the links 96 and cause the clamping-jaws 98 at the proper time—that is, immediately after the mechanism hereinbefore described bends the free end of the wire back against the body portion or shank—to grasp said shank and end and clamp them firmly together, during the rotation of the twister-shaft in order to twist said portions of the wire upon each other and thus complete the formation of the eye or loop, said rotation of the shaft being caused by the gearing hereinbefore described. In order to absolutely insure against the slippage of the said portions of the wire, one of said clamping-jaws in plan view is V-shaped and the other provded with a V-shaped notch 99 to receive the V-shaped jaw. The notched jaw is in turn V-shaped when viewed in said elevation, so as to form the twin arms 100, and the first-named jaw is provided with a horizontally-arranged V-shaped notch 101, against the broad apex of which the pointed ends of

the twin arms 100 clamp the portions of the wire firmly and reliably, as will be readily understood.

102 designates a bifurcated clutch-arm which loosely engages an annular groove of the clutch-collar 97, and is secured at its opposite end to an arm or head 103 of a bracket 104, bolted or otherwise rigidly secured to an inverted U-shaped frame 105, which is pivotally mounted at its lower end upon a rod 106, secured to a bracket 107, bolted to and depending from the under side of the bed-plate, as shown clearly in Fig. 5. Said frame is hereinafter termed a "swinging" frame from the fact that it rocks back and forth in operation. In order to cause this motion, I project a bolt vertically upward through the slot in the middle of the bridge or horizontal portion of the swinging frame and engage its projecting end with a retaining-nut 108, and mounted rotatably upon the lower or headed end of said bolt is an anti-frictional roller 109, and said anti-frictional roller, by means of the retractile spring 110, connecting an arm 111, bolted to the bracket 104, with an arm 112, bolted to one of the fixed bearings 8, is held with a yielding pressure against the face of the cam-wheel 113, mounted rigidly upon the shaft 22, the face of said cam-wheel comprising a short vertical portion 114, terminating at its opposite ends in an abrupt shoulder 115 and a gradually-receding shoulder 116, which tapers gradually to the base of the shoulder 115. By this construction it is obvious that as the cam-wheel rotates in the direction indicated by the arrow, Fig. 5, the antifriction-roller rides up on the inclined shoulder or surface 116, and the swinging frame consequently is forced rearwardly. This operation in turn, owing to its connection with the clutch-collar, forces the latter rearwardly upon the shaft 17, and consequently, owing to the resistance of the stiff spring 97ª, advances the toggle and the collar to which it is pivoted rearwardly upon the shaft slightly. The continued movement of said cam, and consequently said clutch-collar, then overcomes the resistance of and compresses the spring 97ª, and thereby causes the clamping-jaws to come together upon the shank and the end of the wire, as hereinbefore explained, in advance of the detachable nozzle 17ª at the rear end of the shaft, said nozzle being made detachable owing to the fact that there is frictional contact of the wire with the end of the shaft and it may be easily replaced in case of undue wear. The wire is thus clamped firmly by the jaws at the same time that the anti-frictional roller rolls upon the portion 114 of the cam, and during the time the said surface and roller are in engagement the rapid rotation of the twister-shaft twists the wire and completes the formation of the eye or loop in the end of the wire. Immediately this is accomplished the roller clears the abrupt shoulder 115 of the cam, and the spring 110 being unresisted retracts and swings the frame back to its original position. All operations of said swinging frame are repetition of the one just described. Owing to the fact, however, that the wire is shortened very slightly by the twisting operation, it is obvious that the clamping-jaws must either slip slightly or else must move rearwardly to accommodate such retraction in the length of the wire between the point where it is clamped by said jaws and the opposite end of the relatively fixed eye or loop, which cannot move longitudinally, owing to the fact that it is twisted around the pins 73 and 74 of the wire-bending shaft 72. As the slippage of said jaws would make the twisting operation unreliable, I therefore have interposed between the cog-wheel 16, fixed relatively to said shaft, and the collar 87, fixed relatively to the bearing 86, the spring 88, which yields and permits the shaft to move longitudinally a sufficient distance only to accommodate the contraction of the wire.

117 designates a cam-wheel which is mounted rigidly upon the shaft 22 vertically below an inclined shoulder 118 of the approximately horizontal arm of the bell-crank lever 119, said bell-crank lever being pivoted as at 120 just above the bed-plate near its working side and rearward of the bearing 91 of the twisting-shaft. At its upper end it is provided with a bifurcated clutch-arm 121, which engages loosely the annular groove 71ª of the enlargement 71 of the wire-bending shaft 72, in order that with each revolution of said shaft 22 said cam will engage and cause the bell-crank lever 119 to swing in the direction indicated by the arrow, Fig. 4, and thereby move the wire-bending shaft in the direction indicated by the arrow, Fig. 7, and consequently withdraw the pins 73 and 74 through the openings 75 and 76 of the disk 77, so as to positively and reliably release the eye or loop formed in the end of the wire upon them, as hereinbefore described, and then permit the retractile spring 122, (see Fig. 4,) attached at its opposite ends to the free end of said lever and to a rod or bracket 123, fixed to the frame or bed-plate of the machine, to cause said lever to resume its original position, and consequently again project said wire-bending pins through said disk.

Mounted rigidly upon the shaft 22, just rearward of the cam 117, is a similar cam-wheel 124, and said cam once in each revolution of the shaft engages a shoulder upon the depending arm of a bell-crank lever 125. Said bell-crank lever, like the lever 119, is also arranged to operate in a vertical plane, being mounted upon the short shaft 126, journaled at its opposite ends in the bearing-bracket 91 of the twister-shaft, and in the standard 68, erected upon the bed-plate. Said shaft is arranged sufficiently above the horizontal arm of the lever 119 so as not to interfere with its operation, as illustrated in Fig. 4. The opposite end of said lever is pivotally connected to the lower end of a bar 127, bolted in turn to a vertical rack-bar 128,

which engages a cog-pinion 129 on the wire-bending shaft 72, said pinion being arranged between the bearings 70 of said shaft and of less width than the intervening space between said bearings, in order to admit of the reciprocating movements of said shaft. The rack-bar is guided in its vertical movements in longitudinal grooves 130, formed in said bearings, so that it is at all times held reliably in engagement with said pinion. Said bell-crank lever is also pivotally connected, as at 131, to the upper end or rod 132, which extends vertically downward through an opening in the bed-plate. A retaining nut 133 is mounted at its lower end, and spirally encircling the rod is an expansive spring 134, which bears at its opposite ends against the bottom of the bed-plate and said retaining-nut, in order that said shaft may be rocked back to its initial position immediately the cog-wheel 24 becomes disengaged with the lever. Thus it will be seen that with each operation of the shaft 22 the wire-bending shaft not only reciprocates, but also oscillates, due to the mechanism just described, and it is to be observed by the relative arrangement of the cam-wheels 117 and 124 that the first-named cog-wheel does not cause the retraction of the pins until an instant after the wire-bending operation has been completed by the rotatable or oscillatory movement of the shaft in one direction, and it is also to be observed, and will hereinafter more clearly be shown, that during the interval of time between the retraction of the pins due to the action of the cam 117 and said oscillatory movement of said shaft the twisting operation takes place, and immediately after this operation the clamping-jaws release the wire, the pins are retracted, and the shaft rotated back to its original position, and immediately it reassumes this position, which is about the same instant as the withdrawal of the pins, the cam 117 releases the lever 119, and the spring 122 again advances the pins above and below the wire as it is being drawn through the machine by the carrier, which automatically engages the eye or loop the instant it was released by the clamping-jaws and by the retraction of said pins.

132′ designates another cam which is mounted rigidly upon the shaft 22, and said cam once in each revolution of the shaft comes in contact with and elevates the lever or arm 133′, pivotally mounted as at 134′ upon a bracket 135, bolted to the bed-plate. Said lever is arranged to swing in a vertical plane adjacent to the rear face of the casting or standard 68, and at its opposite end projects under the table or plate 55, being preferably provided with an upwardly-projecting head or enlargement 136 at this point, and said head or enlargement is provided with a longitudinal groove into which is adjustably and snugly mounted the upwardly-projecting knife 137, said knife being arranged at the working or front side of the table or plate 55 just at the rear or discharge end of the guide-plate 80, as indicated by dotted lines, Figs. 11 and 12, its upper or cutting edge in operation just lapping the cutting or lower edge of the upper or stationary knife 138, which is secured in a recessed block 139, bolted or otherwise secured to the casting or standard 68. Said knife may be adjusted longitudinally by means of a screw-bolt 140 to accommodate wear or for any other reason.

After each cutting operation, which takes place just after the advancement of the pins of the bending-shaft, in order to complete a tie disconnected an instant before from the carrier or feeder by means hereinbefore described, and to release the end which is to be bent back upon itself in the formation of the loop or eye of the next succeeding tie, the knife by gravity descends to its original position by reason of the disconnection with the lever of its actuating-cam.

As it has been found in practice that the gravity of, or spring pressure upon, the knife-carrying lever 133′ cannot always be depended upon when the machine is working at its highest capacity to depress the knife with sufficient quickness after each cutting operation, I contemplate employing in place of the cam 132′ a cam 132ª, provided with an annular groove 132ᵇ, which will be engaged at all times with the antifrictional roller or pin 133ª, projecting laterally from the knife-carrying lever 133′. By this construction it is obvious that the knife is returned to its depressed position positively and reliably. The cam 132′ or 132ª may also be employed, or an additional cam 141 may be mounted upon the shaft 22 in order to operate the counting mechanism, that is, the mechanism for separating each bunch of ties in predetermined or desirable numbers from the ties of the next succeeding bunch automatically. To accomplish this, I mount rigidly in the frame, below the bed-plate or the brackets depending from the same or secured to the frame, the short longitudinal shaft 142, and journaled loosely upon the same is a sleeve 143. (Shown in dotted lines, Fig. 3.) A large ratchet-wheel 144, in this instance containing fifty teeth, is mounted rigidly upon one end of said shaft, and a small cog-pinion 145 is mounted rigidly upon the opposite end of said sleeve and meshes with a large cog-wheel 146, journaled loosely upon the stub-shaft 147, suitably supported. Said wheel is provided in this instance with sixty teeth, and at one side with a fixed dog 148, which dog once in each complete revolution of said wheel pivotally operates the lever 149, and causes the same, through the medium of the link 150, to pivotally operate a tie-distributing lever 151, mounted rigidly upon a shaft 152, journaled at its opposite ends in bearings 153, secured to the under side of the cross-bars 35 and the rearmost cross-bar 58, as illustrated in dotted lines, Fig. 17.

The tie-distributing lever 151 is arranged adjacent to the front or left-hand side, preferably, of the cross-bar 35 and superposed standard 56, and mounted rigidly upon said shaft and also arranged in the same position relative to the cross-bars 58 are similar tie-distributing levers, whereby when one is operated the others are operated simultaneously. Each comprises, essentially, a body portion which normally occupies a horizontal position and projects beyond the plane of the front side of the table or plate 55, and an inclined arm 151ª, which, when the tie-distributing levers are elevated to the position shown in dotted lines, Fig. 3, project rearwardly and upwardly beyond the plane of the vertical face of the said table or plate, and thereby positively and reliably insures that any and all ties which may be formed and released while the disconnecting levers are in this position will be deflected outwardly and forwardly and go to complete the requisite number of ties in the bundle which is moved outwardly upon said cross-bars by reason of the changed position of the body portions of said levers; that is, the ties previously formed and lying upon the said cross-bars of the body portions of said levers just in advance of the standards 56 are by the pivotal operation of said levers shoved bodily forward. In practice these levers are raised so slowly that probably five or six ties, more or less, will be formed by the time they reach their elevated position and all these ties will be deflected forward, as described.

The counting mechanism is operated by means of a lever 154, which is journaled loosely upon the sleeve 143, and projects below and in the path of the cam 141, which once in each revolution of the shaft depresses said lever, and through the medium of the spring-actuated pawl 155, carried thereby, rotates the ratchet-wheel 144 the distance of one step. The relative number of teeth employed upon said ratchet, said pinion, and said cog-wheel is such that it takes two hundred and fifty revolutions of the shaft 22 to elevate the tie-distributing levers to the position shown in dotted lines, owing to the fact that one dog 148 only is employed, and consequently each bundle contains just exactly two hundred and fifty ties. In case two dogs 148 are employed and arranged at diametrically-opposite points each bundle would obviously contain one hundred and twenty-five ties. As the dog clears the heel or rear end of a lever 149, the latter and the elevated tie-distributing levers immediately by gravity assume their original position and the next two hundred and fifty ties successively formed are acted upon, as described. It is obvious of course that instead of the pawl-and-rachet mechanism shown the same object could be accomplished by employing its mechanical equivalent, a worm-shaft and connections. The spring 154ª elevates the arm 154 after each depression.

The device for straightening the wire as it comes from the reel (not shown) is constructed as follows; that is to say, 156 designates a plate which is arranged horizontally at the front end of the bed-plate, and is mounted upon an arm or extension 157 of the bed-plate. Said plate is provided with depending flanges 158, which embrace the opposite sides of the arm or extension 157 of the bed-plate, and rests near its rear or inner end upon flanges 159 of the bed-plate, and near each outer or front end is pivotally mounted to operate in a vertical plane upon the transversely-extending bolt 160, carried by the arm or extension 157, as shown clearly in Figs. 2 and 18. Said plate 156 is provided in its upper side with a groove 161, which extends in longitudinal alinement with the axis of the tubular or hollow twister-shaft 16 and with a similar groove in the upper end of the extension 12ª of one of the bearings 12. Said groove 161 is intersected at two points by the transversely-extending grooves 162, within which are mounted plates 163 and 164, provided each at one end with upwardly-projecting parallel guide-flanges 165, and at their opposite ends with depending arms 166, through which extend the adjusting-bolts 167, which are screwed into the plate 156, and are provided with fixed collars or enlargements 168 at opposite sides of the depending arm 166, whereby when the bolts are operated in one direction or the other the plates are moved back or forth upon the plate 156. Between the flanges 165 of said plates are fitted snugly tempered steel wear-plates 169, provided with longitudinal series of holes 170, through certain of which extend securing-bolts 171, engaged by clamping-nuts 172 at their projecting ends, whereby said wear-plates may be adjusted longitudinally and secured at any desired point.

The plate 163 is of greater length than the plate 164, so that its wear-plate may be disposed at the opposite side of the longitudinal groove 161 of the plate to the wear-plate of plate 164, in order that said wear-plates may bear upon opposite sides of the wire, and thereby insure the removal of all kinks or bends in the same, that it may pass to the twister-shaft perfectly straight.

The longitudinal grooves are occupied by the guide-strips 173, provided in their upper edges with narrow and shallow longitudinal guide-grooves 174, through which the wire extends, as illustrated most clearly in Fig. 18, and bearing upon the upper sides of said strips, and thereby capping and closing the open side of said groove or grooves are the capping-strips 175, and said strips are held firmly and reliably in position by means of the clamping-brackets 176, secured in position in turn by screw-bolts 177 engaging the plate 156, or in any other suitable manner. In order to straighten the wire preliminary to its passage through said closed groove, I arrange upon the plate 156 at its front end two series of grooved rollers 178, the rollers

of one series being arranged alternately or opposite the spaces between the others in the customary manner. This arrangement of rollers removes substantially all the kinks or bends from the wire as it is fed into the machine; but in order to be sure that the wire is perfectly straight, I have provided the narrow and shallow guide-groove intersected at two or more points by oppositely disposed wear-plates, and means for adjusting said wear-plates in the same or the opposite direction, in order that the wire may be perfectly straight and in the proper condition for after manipulation by the machine.

In order to maintain the plate 156 in its proper position relative to the axis of the twister-shaft, in case of faulty casting or any other cause which may tend to raise one end of the guide-groove 174 slightly higher or lower than the other, I have provided two bolts 156ª, which extend vertically downward through said plate and bear at their lower ends upon the arm or extension 157 of the bed-plate, in order that by adjusting these bolts or set-screws the said plate may be pivotally operated upon the bolt 160, carried by said arm or extension, and reliably and firmly secured in such position, as will be clearly understood by reference to Figs. 1 and 18.

In the practical operation of the machine the power-belt is shifted from the loose to the fast pulley, and thereby rotating the power-shaft 4, imparts motion through the medium of the beveled gears 9 and 10 to the shaft 11, and from said shaft through the train of gearing hereinbefore described to the twister-shaft 16, cam-shaft 22, and the "wire-feeding" shaft 25, as the shaft which through the medium of the vertical shaft 28 operates the endless chain will hereinafter be termed, the wire preliminary to this operation, however, being first passed through the wire-straightening device, the twister-shaft, and between the pins of the wire-bending shaft until its end is adjacent to the stationary knife 138. (See Fig. 11.) The arrangement of the cams upon the shaft 22 is such that the knife-lever is first caused to assume its operative or cutting position, as shown in Fig. 3, then the cam-wheel 124 operates bell-crank lever 125, and through the medium of the rack-bar 128, connected to the same, rotates the wire-bending shaft 72 and causes the pins of the latter to bend the projecting end of the wire back toward the twister-shaft and upon its body portion or shank. Immediately this operation is completed the cam-wheel 113 swings the frame 105, and thereby advances the clutch-collar upon the twister-shaft and causes, through the operation of the toggle, the clamping-jaws to bind firmly between them and upon each other the shank and the free end of the wire, as hereinbefore described, and this operation being completed, the rotation of the twister-shaft and the clamping jaws twists the said portions of the wire upon each other between said clamping point and the pins of the bending-shaft, and thereby completes the formation of an eye or loop in the end of the wire, the shaft 17 during this operation automatically adjusting itself as hereinbefore described to a slight longitudinal contraction of the wire. Immediately this twisting operation is completed the clamping-jaws release the wire, and about the same instant the cam-wheel 117 operates the lever 119 and withdraws the clamping-pins from engagement with said loop or eye, as hereinbefore set forth, and simultaneously with this operation one of the tie-carriers has assumed the position shown in Fig. 1, and the heel of the arm 52 coming in contact with the alined end of the strip 63 represses the spring 53 and projects the hook 51 through the longitudinal slot 82 of the guide-plate 80 and also through the adjacent eye or loop at the end of the wire. The relative position of said hook and said loop just previous to their arrangement is shown most clearly in Fig. 12. The carrier continously moving in the direction indicated by the arrow, Fig. 1, now feeds the wire positively and reliably from the reel and through the intervening devices, and at the instant it reaches the position shown in dotted lines, Fig. 17, the cog-wheel 132 again lifts the knife and severs or cuts the wire, and a complete bale-tie drops down upon the cross-bars 35 and 58, as indicated in said figure, where they accumulate successively as the operations described are repeated until the requisite number for a bundle has been made and have been shoved bodily forward by the distributing-levers. The operator then grasps this loose bundle of ties and places it in the longitudinally-alined grooves 60, where the ties are bunched and securely tied together by wire bands in the customary manner.

In practice the operation of this machine is so rapid, so positive, and so reliable that from thirty-five to forty ties per minute are manufactured, each tie-carrier successively engaging the eye or loop in the end of the wire and drawing the same from the reel. Owing to the friction with which the wire passes through the straightening device, it is obvious that immediately the wire is cut by the knife to complete a bale-tie the movement of the wire instantly ceases and the projecting end thereof remains in the proper position relative to the pins of the bending-shaft.

While I have described and illustrated a particular mechanism, it is obvious that slight changes in form, proportion, or arrangement of parts may be made, or mechanical equivalents employed, without departing from the spirit and scope or sacrificing any of the advantages of my invention.

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

1. In a bale-tie machine, a plate provided with longitudinal wire-guides, and slotted plates provided with wear-plates for bearing

against opposite sides of the wire between said wire-guides, for the purpose specified.

2. In a bale-tie machine, a plate provided with longitudinally-alined wire-guides, transverse sliding plates between said guides and provided with wear-plates at opposite sides of the wire, and means to adjust said sliding plates to cause the wear-plates to exert more or less pressure upon the wire extending through said guides, for the purpose specified.

3. In a bale-tie machine, a plate provided with longitudinally-alined wire-guides, transverse sliding plates between said guides and provided with wear-plates at opposite sides of the wire, means to adjust said sliding plates to cause the wear-plates to exert more or less pressure upon the wire extending through said guides, set-screws engaging the plate and extending through the sliding plates, and collars upon the set-screws embracing the sliding plates, for the purpose specified.

4. In a bale-tie machine, a plate provided with longitudinally-alined grooves and intersecting transverse grooves, grooved tubes fitted in the longitudinal grooves through which the wire for forming the bale-tie extends, sliding plates arranged in the transverse grooves and provided with upwardly-projecting wear-plates, and set-screws for causing said sliding plates to bear more or less firmly upon opposite sides of the wire where it bridges the transverse grooves, substantially as described.

5. In a bale-tie machine, a plate provided with longitudinally-alined grooves and intersecting transverse grooves, grooved strips fitting in said longitudinal grooves, cap-strips upon the grooved strips, clamping-plates bearing upon said cap-strips, sliding plates in the transverse grooves provided with upwardly-projecting parallel flanges, wear-plates adjustably secured between said flanges and bearing against opposite sides of the wire where it bridges the transverse grooves, and set-screws for adjusting the sliding plates, substantially as shown and described.

6. In a bale-tie machine, the combination of a suitable supporting-frame or bed-plate provided with an arm or extension, with a plate pivotally mounted upon said arm or extension, and provided with longitudinal guide-grooves and with eccentrically-arranged grooved rollers through which the wire passes, and means to pivotally adjust said plate, substantially as described.

7. In a bale-tie machine, the combination of a suitable supporting-frame or bed-plate provided with an arm or extension, with a plate pivotally mounted upon said arm or extension, and provided with longitudinal guide-grooves and with eccentrically-arranged grooved rollers through which the wire passes, and screw-bolts extending through said plate and bearing upon said arm or extension, substantially as described.

8. In a bale-tie machine, a wire-bending shaft provided with a pair of pins projecting from its end eccentrically of its axis, and means to partially rotate said shaft and cause one pin to bend back the free end of the wire over the other, substantially as specified.

9. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings, and a guide-plate, secured to one end of said plate and opposite one of the bearings so as to form an intervening space, of a wire-bending shaft journaled in said bearings, and provided with pins projecting from its end into said intervening space, and means for partially rotating said shaft and thereby causing the free end of the wire interposed between said pins in said spaces to be bent by one back over the other, substantially as described.

10. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings, and a guide-plate opposite the same and one of said bearings; said plate being longitudinally and circularly grooved at its opposing side, and a wire-bending shaft journaled in said bearings and provided with pins which project from one end of the shaft into the grooves of said guide-plate, substantially as described.

11. In a bale-tie machine, the combination of a suitably-supported plate, provided with bearings, a guide-plate secured to said plate at one end and opposite one of said bearings; said plate being of diminished thickness above the axis of said bearing in order to provide an intervening space of just sufficient width for the bale-tie wire to be vertically bent, and provided also with a longitudinal and a circular groove, and a wire-bending shaft journaled in said bearings and provided with pins which project from one end across said intervening space and into the grooves of the guide-plate, substantially as described.

12. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings, and a guide-plate arranged opposite one end of the same and one of its bearings, of a wire-bending shaft journaled in said bearings and provided with pins projecting from its end across the intervening space between the same and said guide-plate; one of said pins forming the fulcrum and the other the lever for bending the free end of the bale-tie wire back upon itself in the process of forming the loop or eye, and means after the formation of the loop or eye is completed, to withdraw said pins from engagement with the loop, substantially as described.

13. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings, and a guide-plate arranged opposite one end of the same and one of its bearings, of a wire-bending shaft journaled in said bearings and provided with pins projecting from its end across the intervening space between the same and the said guide-plate; one of said pins forming the fulcrum and the other the

lever for bending the free end of the bale-tie wire back upon itself in the process of forming the loop or eye, means, after the formation of the loop or eye is completed, to withdraw said pins from engagement with the loop, and means for again advancing said pins across said intervening space one above and the other below the plane of the wire extending longitudinally through, substantially as described.

14. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings, and a disk rotatably mounted in one of said bearings, of a wire-bending shaft journaled in said bearings and provided with pins projecting from one end and through said disk whereby and whereon the wire is bent in the process of forming the loop or eye, and means for adjusting said shaft and thereby withdrawing the pins through said disk, for the purpose set forth.

15. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings, and a disk rotatably mounted in one of said bearings, of a wire-bending shaft journaled in said bearings and provided with pins projecting from one end and through said disk whereby and whereon the wire is bent in the process of forming the loop or eye, means for adjusting said shaft and thereby withdrawing said pins through said disk, and means for readjusting said shaft and thereby again projecting said pins through said disk, at the proper time, substantially as described.

16. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings and with an opposing guide-plate, of a wire-bending shaft journaled in said bearings and provided with pins projecting from its ends across the spaces between it and said guide-plate, a cog-pinion upon the shaft, a rack-bar engaging the same, a lever suitably mounted and connected at one end to said rack-bar, a rotatable shaft, and a cam-wheel thereon for engaging and pivotally operating said lever once in each revolution, and thereby partially rotating and causing the wire-bending shaft to bend the wire by means of said pins, and a second cam-actuated lever connected to said shaft for longitudinally moving it once in each revolution of the cam and thereby withdrawing said pins from engagement with the loop or eye in the wire after its formation is completed, substantially as described.

17. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings and with an opposing guide-plate, of a wire-bending shaft journaled in said bearings and provided with pins projecting from its end across the space between it and said guide-plate, a cog-pinion upon the shaft, a rack-bar engaging the same, a lever suitably mounted and connected at one end to said rack-bar, a rotatable shaft, and a cam-wheel thereon for engaging and pivotally operating said lever once in each revolution, and thereby partially rotating and causing the wire-bending shaft to bend the wire by means of said pins, a second cam-actuated lever connected to said shaft for longitudinally moving it once in each revolution of the cam and thereby withdrawing said pins from engagement with the loop or eye in the wire after its formation is completed, means for reversing the operation of the first cam-operated lever and thereby rotating the shaft back to its original position, and means for reversing the operation of the second cam-operated lever, and thereby again projecting said pins across said intervening space between the end of the shaft and the guide-plate, substantially as described.

18. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings, a wire-bending shaft journaled therein and provided with pins upon and by which the wire is bent in the formation of the loop or eye, of means for operating said shaft to bend said wire back upon itself, a rotating tubular twister-shaft through which the wire extends, clamping-jaws connected to said shaft to rotate therewith, and means to cause said clamping-jaws to engage the body and the free end of the wire when thus bent back by the bending-shaft and twist the same together, substantially as described.

19. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings, a wire-bending shaft journaled therein and provided with pins upon and by which the wire is bent in the formation of the loop or eye, of means for operating said shaft to bend said wire back upon itself, a rotating tubular twister-shaft through which the wire extends, clamping-jaws connected to said shaft to rotate therewith, means to cause said clamping-jaws to engage the body and the free end of the wire when thus bent back by the bending-shaft and twist the same together, and means to longitudinally adjust said bending-shaft and thereby withdraw said pins from engagement with the complete eye or loop in the end of the wire, substantially as described.

20. In a bale-tie machine, the combination of a suitably-supported plate provided with bearings, a longitudinally-slotted guide-plate arranged opposite one end of said plate and one of the bearings, pins extending from the corresponding end of the shaft which are engaged by the eye or loop formed in the end of the bale-tie wire, an endless chain and a carrier secured thereto and provided with a hook for passing through said slot and engaging the eye or loop of the bale-tie wire to draw the wire longitudinally through the machine, substantially as described.

21. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings, a shaft journaled therein provided with pins projecting from one end, a slotted guide-plate arranged opposite the bearing beyond which said pins project whereby the eye or loop of the bale-tie wire will be arranged

vertically, an endless chain, a carrier secured thereto and provided with a hook which entering said slot engages the eye or loop and draws the wire longitudinally through the machine, and a knife to sever the wire at the rear end of said slotted plate at the proper time in order to complete the formation of the bale-tie.

22. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings, a shaft journaled therein provided with pins projecting from one end, a slotted guide-plate arranged opposite the bearing beyond which said pins project whereby the eye or loop of the bale-tie wire will be arranged vertically, an endless chain, a carrier secured thereto and provided with a hook which entering said slot engages the eye or loop and draws the wire longitudinally through the machine, a knife to sever the wire at the rear end of said slotted plate at the proper time in order to complete the formation of the bale-tie, and means to disengage the hook of the carrier from the loop or eye of the bale-tie at the instant before it is cut by the knife, substantially as described.

23. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings, a shaft journaled therein and provided with pins projecting at one end and engaged by the eye or loop of the wire, a slotted guide-plate arranged adjacent to said bearing to hold the eye or loop vertical, an endless traveling chain, a carrier secured thereto and provided with a spring-repressed hook, and a strip arranged in the path of said carrier to repress said spring and advance said hook through the slot of the guide-plate and the registering eye or loop that the wire may be pulled or fed longitudinally by the carrier through the machine, and a knife for cutting said wire at the instant after the said strip releases the pressure upon said spring and permits it to withdraw the hook from engagement with the eye or loop of the completed bale-tie.

24. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings, a shaft journaled therein and provided with pins projecting at one end and engaged by the eye or loop of the wire, a slotted guide-plate arranged adjacent to said bearing to hold the eye or loop vertical, an endless traveling chain, a carrier secured thereto and provided with a spring-repressed hook, and a strip arranged in the path of said carrier to repress said spring and advance said hook through the slot of the guide-plate and the registering eye or loop that the wire may be pulled or fed longitudinally by the carrier through the machine, a knife for cutting said wire at the instant after the said strip releases the pressure upon said spring and permits it to withdraw the hook from engagement with the eye or loop of the completed bale-tie, and a trip-block for actuating and making positive the withdrawal of the hook from engagement with the eye or loop, substantially as described.

25. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings, a shaft journaled therein and provided with pins projecting at one end and engaged by the eye or loop of the wire, a slotted guide-plate arranged adjacent to said bearing to hold the eye or loop vertical, an endless traveling chain, a carrier secured thereto and provided with a spring-repressed hook, and a strip arranged in the path of said carrier to repress said spring and advance said hook through the slot of the guide-plate and the registering eye or loop that the wire may be pulled or fed longitudinally through the machine, a knife for cutting said wire at the instant after the said strip releases the pressure upon said spring and permits it to withdraw the hook from engagement with the eye or loop of the completed bale-tie, and a hook secured to the carrier and superposed relative to the first-named or movable hook whereby when said hook is withdrawn said last-named hook will in conjunction with the said strip prevent the withdrawing of the hook from pulling the loop or eye of the completed bale-tie with it but will absolutely insure their instantaneous disconnection, substantially as described.

26. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings, a shaft journaled therein and provided with pins projecting at one end and engaged by the eye or loop of the wire, a slotted guide-plate arranged adjacent to said bearing to hold the eye or loop vertical, an endless traveling chain, a carrier secured thereto and provided with a spring-repressed hook, and a strip arranged in the path of said carrier to repress said spring and advance said hook through the slot of the guide-plate and the registering eye or loop that the wire may be pulled or fed longitudinally by the carrier through the machine, a knife for cutting said wire at the instant after the said strip releases the pressure upon said spring and permits it to withdraw the hook from engagement with the eye or loop of the completed bale-tie, the trip-block for actuating and making positive the withdrawal of the hook from engagement with the eye or loop, and a hook secured to the carrier and superposed relative to the first-named or movable hook whereby when said hook is withdrawn said last-named hook will in conjunction with the said strip prevent the withdrawing of the hook from pulling the loop or eye of the completed bale-tie with it but will absolutely insure their instantaneous disconnection, substantially as described.

27. In a bale-tie machine, the combination of a suitably-supported plate provided with bearings, a slotted guide-plate arranged opposite one of said bearings and one end of said plate, a wire-bending shaft journaled in said bearings to form the loop between its

corresponding end and said guide-plate a longitudinally-extending table or plate suitably supported, longitudinal strips projecting upwardly from its opposite margins, a longitudinal strip secured upon one of said strips to determine the length of the bale-tie to be formed, a longitudinally-extending traveling chain, a carrier secured thereto and guided between the first-named strips of said table, and consisting essentially of a block, and a bar pivoted therein and terminating at one end in an outwardly-projecting hook and at its opposite end in an inwardly or rearwardly projecting arm, said arm being in the plane of the strip which determines the length of the bale-tie, and the hook occupying the plane of the axis of the wire-bending shaft and above said strip, whereby when said carrier comes opposite said slotted plate, its arm engages and is pivotally operated by said strip and its hook is thereby advanced through said slotted plate and the registering eye or loop of the wire which is thus fed longitudinally through the machine against the front or working face of said strip, and a spring secured to the block and bearing against said pivoted bar, in order to advance its arm when it clears or is no longer opposed by the strip and thereby withdraws the hook end from engagement with the eye or loop of the bale-tie, which bearing against the front or working face of said strip is easily and reliably accomplished.

28. In a bale-tie machine, the combination of a suitably-supported plate provided with bearings, a slotted guide-plate arranged opposite one of said bearings and one end of said plate, a wire-bending shaft journaled in said bearings to form the loop between its corresponding end and said guide-plate, a longitudinally-extending table or plate suitably supported, longitudinal strips projecting upwardly from its opposite margins, a longitudinal strip secured upon one of said strips to determine the length of the bale-tie to be formed, a longitudinally-extending traveling chain, a carrier secured thereto and guided between the first-named strips of said table, and consisting essentially of a block, and a bar pivoted therein and terminating at one end in an outwardly-projecting hook and at its opposite end in an inwardly or rearwardly projecting arm, said arm being in the plane of the strip which determines the length of the bale-tie, and the hook occupying the plane of the axis of the wire-bending shaft and above said strip, whereby when said carrier comes opposite said slotted plate, its arm engages and is pivotally operated by said strip and its hook is thereby advanced through said slotted plate and the registering eye or loop of the wire, which is thus fed through the machine against the front or working face of said strip, a rigid hook above the movable hook and having its front end in the plane of the front or working face of said strip and thereby against the upper portion of the eye or loop of the wire, and a spring secured to the block and bearing against said pivoted bar, in order to retract the hooked end of said bar from engagement with the eye or loop of the wire immediately the rear end of the strip is cleared by the arm of said bar, substantially as described.

29. In a bale-tie machine, the combination with a suitably-supported plate provided with bearings, and a guide-plate arranged opposite one of said bearings and longitudinally slotted from its rear end to a point opposite or in advance of the axis of said bearing, of a wire-bending shaft provided with pins which project across the intervening space between said bearing and said guide-plate at opposite sides of the wire extending therethrough, means to rotate said shaft and bend said wire back upon itself, means to clamp the body and the free end of the wire thus bent back together, and twist the same, means to withdraw said pins from engagement with the completed eye or loop thus formed, and a traveling carrier provided with a hook which passes through the slot of the guide-plate and engaging the loop or eye feeds the wire longitudinally through the machine, substantially as described.

30. In a bale-tie machine, the combination of a suitably-supported frame and mechanism for manufacturing bale-ties carried thereby, with a series of transvere bars secured to the frame and upon which the completed ties fall, a longitudinally-extending rod journaled below said cross-bars, a series of tie-distributing levers mounted thereon, and means for periodically operating said levers and thereby forcing forward upon said cross-bars all the ties which have previously dropped thereon, in order to automatically distribute said ties in separate bunches, each bundle containing a predetermined number of ties, substantially as described.

31. In a bale-tie machine, the combination of a suitably-supported frame and mechanism for manufacturing bale-ties carried thereby, with a series of transverse bars secured to the frame and upon which the completed ties fall, a longitudinally-extending rod journaled below said cross-bars, a series of tie-distributing levers mounted thereon, and comprising a body portion which is normally horizontal, and an arm which normally extends downwardly and rearwardly, and means for periodically causing said levers to assume a position approximately vertical and with said arms extending upwardly and rearwardly therefrom to the plane of or rearward of the point from which the completed ties fall, substantially as and for the purpose set forth.

32. In a bale-tie machine, the combination of a suitable framework, a rotating shaft thereon, a cam-wheel thereon, cross-bars secured to the frame a longitudinal rock-shaft below said cross-bar, tie-distributing levers mounted rigidly upon said rock-shaft, a lever suitably mounted, a link connecting said

lever to one of said tie-distributing levers, which thus forms a crank-arm for the shaft upon which it is mounted, a stub-shaft, a sleeve journaled thereon and provided at one end with a large ratchet-wheel and at the other with a small cog-pinion, a spring-elevated arm mounted loosely thereon and in the path of the cam-wheel, a spring-actuated pawl carried by said lever and engaging said ratchet, a second stub-shaft, a large cog-wheel mounted thereon and meshing with said pinion, and one or more dogs projecting from said wheel and adapted to engage and operate the said lever, and thereby operate the tie-distributing levers, substantially as and for the purpose set forth.

33. In a bale-tie machine, the combination of a suitable framework, a rotating tubular twister-shaft journaled in bearings thereon, a clutch-collar mounted to slide upon and rotate with said shaft, a second collar mounted to slide upon and rotate with said shaft, a toggle connecting said collars and provided with clamping-jaws beyond the corresponding end of the shaft, and a spring surrounding said shaft and bearing against said collars so as to hold the toggle normally expanded and the clamping-jaws open, and means at times, that is after the wire is bent back in the process of forming the loop or eye, of sliding said clutch-collar upon the shaft and causing the clamping-jaws to engage the wire and twist it by the rotation of the shaft, substantially as described.

34. In a bale-tie machine, the combination of a suitable framework, a rotated tubular twister-shaft journaled in bearings thereon, a clutch-collar mounted to slide upon and rotate with said shaft, a second collar mounted to slide upon and rotate with said shaft, a toggle connecting said collars and provided with clamping-jaws carried thereby and beyond the corresponding end of the shaft, a spring surrounding said shaft and bearing against said collars so as to hold the toggle normally expanded and the clamping-jaws open, means at times, that is after the wire is bent back in the process of forming the loop or eye, of sliding said clutch-collar upon the shaft and causing the clamping-jaws to engage the wire and twist it by the rotation of the shaft, and a spring for repressing said clutch-collar and thereby opening the clamping-jaws to release the wire, substantially as described.

35. In a bale-tie machine, the combination with a suitable framework, a rotating twister-shaft journaled in bearings thereon, a clutch-collar mounted to slide upon and rotate with said shaft, a second collar mounted to slide upon and rotate with said shaft, a toggle connecting said collars and provided at one end with clamping-jaws, an expansion-spring interposed between said collars and holding them normally apart and the clamping-jaws open, a swinging frame suitably mounted and connected to the clutch-collar, and means to rock it back and forth in order to alternately cause the clamping-jaws to engage and release the wire before and after the twisting operation respectively, substantially as described.

36. In a bale-tie machine, the combination with a suitable framework, a rotating twister-shaft journaled in bearings thereon, a clutch-collar mounted to slide upon and rotate with said shaft, a second collar mounted to slide upon and rotate with said shaft, a toggle connecting said collars and provided at one end with clamping-jaws, an expansion-spring interposed between said collars and holding them normally apart and the clamping-jaws open, a swinging frame suitably mounted and connected to the clutch-collar, a pin or antifriction-roller depending from said frame, a rotating shaft, and a cam-wheel mounted thereon and comprising an inclined face which terminates at one end in a short vertical face and at its opposite end in an abrupt shoulder; which cam engages said pin or antifrictional roller and thereby at times swings the frame and causes the clamping-jaws to engage the wire and hold it firmly while being twisted, and then permit said jaws by the action of the expansion-spring to release the wire, substantially as described.

37. In a bale-tie machine, the combination with a suitable framework, a rotating twister-shaft journaled in bearings thereon, a clutch-collar mounted to slide upon and rotate with said shaft, a second collar mounted to slide upon and rotate with said shaft, a toggle connecting said collars and provided at one end with clamping-jaws, an expansion-spring interposed between said collars and holding them normally apart and the clamping-jaws open, a swinging frame suitably mounted and connected to the clutch-collar, a pin or antifriction-roller depending from said frame, a rotating shaft, and a cam-wheel mounted thereon and comprising an inclined face which terminates at one end in a short vertical face and at its opposite end in an abrupt shoulder; which cam engages said pin or antifriction-roller and thereby at times swings the frame and causes the clamping-jaws to engage the wire and hold it firmly while being twisted, and then permit said jaws by the action of the expansion-spring to release the wire, and a retractile spring suitably connected to the fixed pin at one end and to the swinging frame, whereby when said roller clears the abrupt shoulder of the cam, the swinging frame is brought back to its original position, substantially as described.

38. In a bale-tie machine, the combination with a suitable supporting-frame, a rotating tubular twister-shaft journaled therein, a gear-wheel mounted rigidly thereon to which motion is imparted to operate said shaft, a collar slidingly mounted upon said shaft at one side of said gear-wheel and bearing against one of the bearings of the shaft, a clutch-collar mounted to slide upon and rotate with said shaft, a second collar mounted to slide upon

and rotate with said shaft, a toggle connecting said collar and provided with clamping-jaws at one end to engage the body and free end of the wire which is bent back upon the body in the process of forming the loop or eye, a spring interposed between said collars to normally hold the clamping-jaws apart, and means to advance said collars and thereby cause the clamping-jaws to tightly impinge upon or clamp between them the body and free end of the wire, and then to twist the same by the rotation of the shaft, and a spring interposed between the first-named collar and the gear-wheel, whereby the slight contraction in the length of the wire due to the twisting of the same, may be accommodated by a slight longitudinal movement of the twister-shaft, substantially as and for the purpose set forth.

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

SAMUEL KIMBALL.

Witnesses:
J. C. CLAYPOOL,
JOHN P. ROSS.