(No Model.)

4 Sheets—Sheet 1.

A. HENLEY.

BALE TIE MACHINE.

No. 414,410 Patented Nov. 5, 1889.

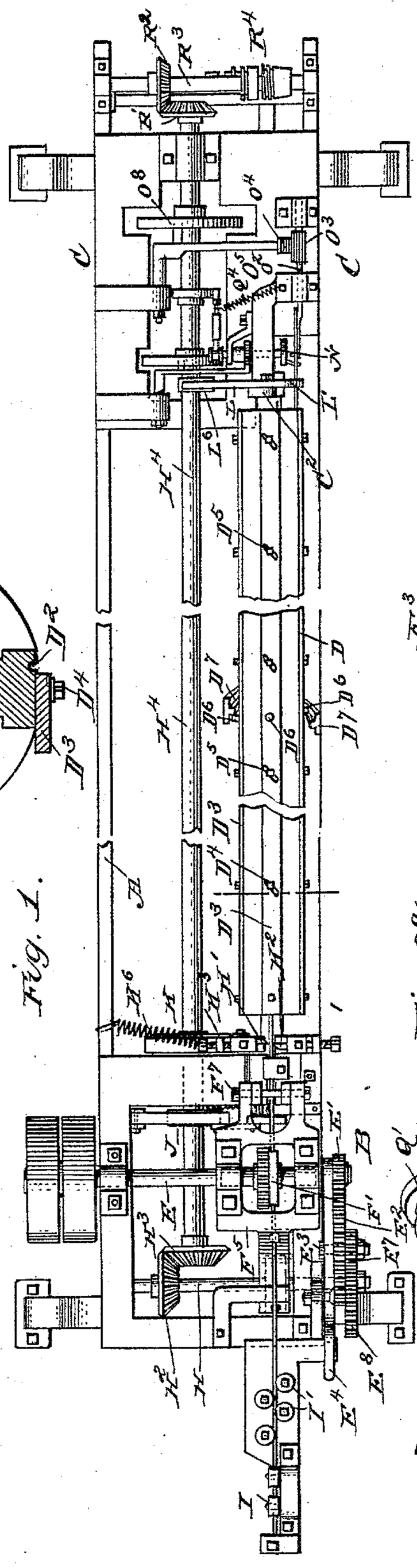

Fig. 1.

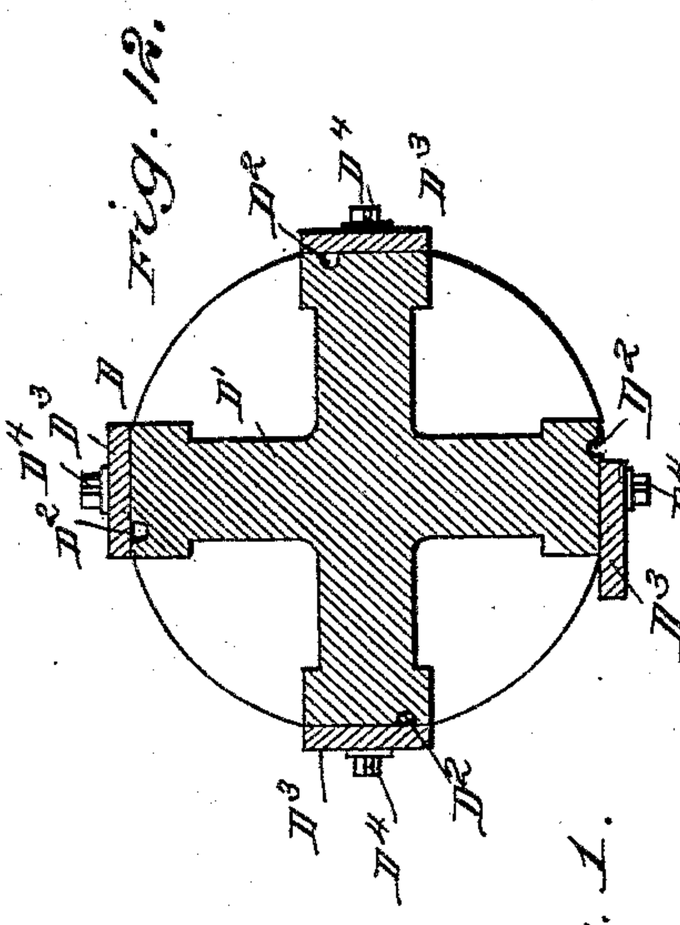

Fig. 12.

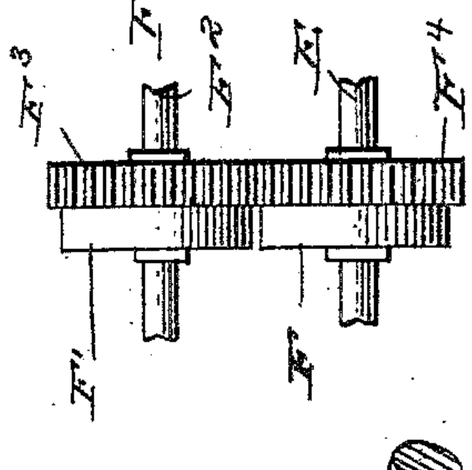

Fig. 13.

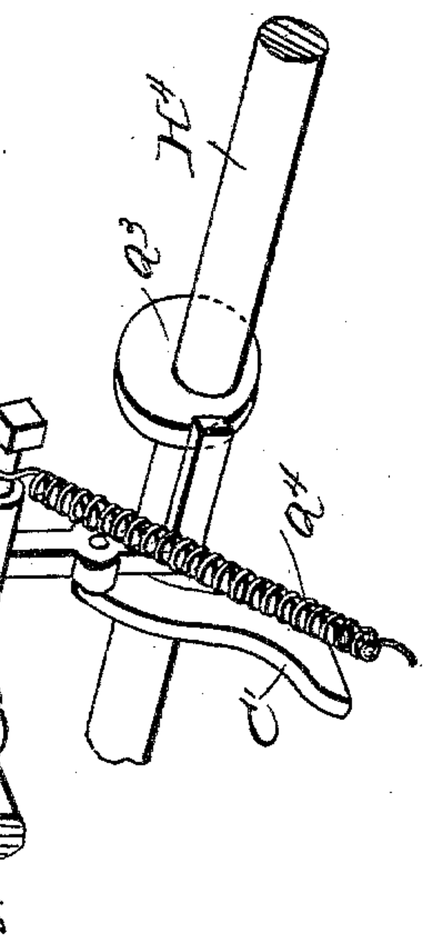

Fig. 9a

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4 Sheets—Sheet 2.

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BALE TIE MACHINE.

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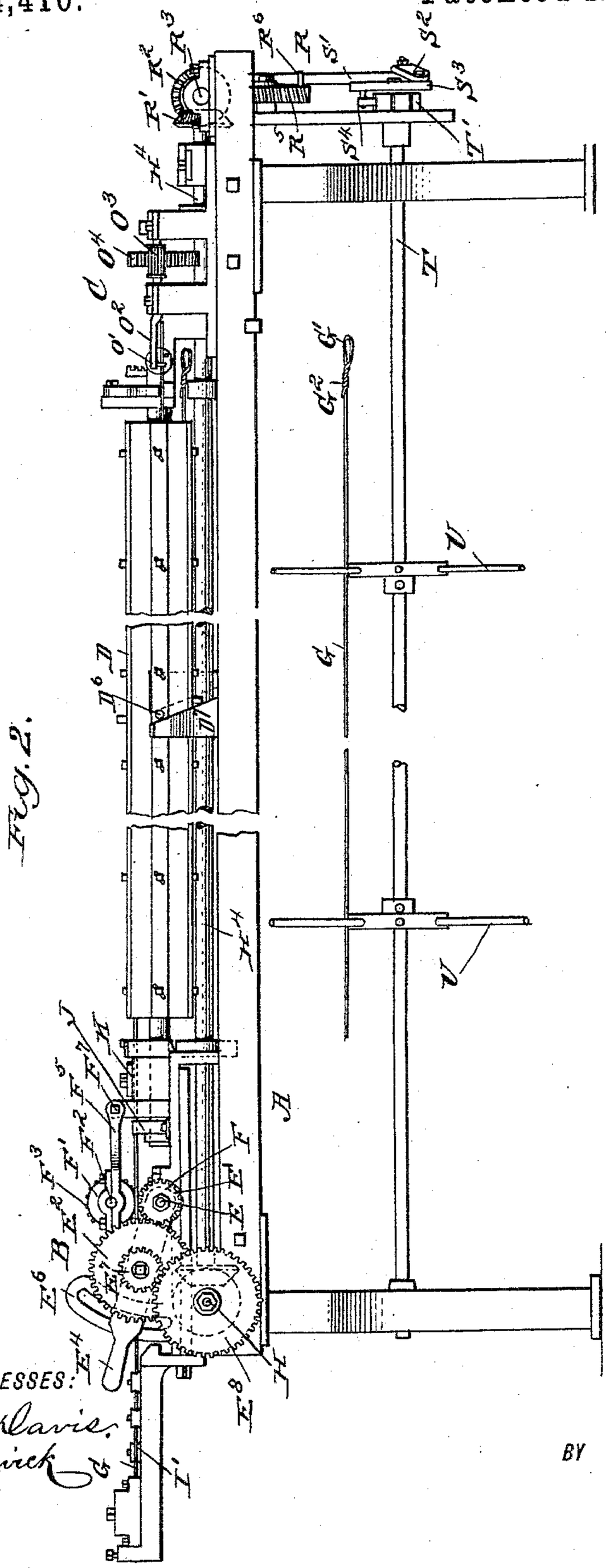

Fig. 2.

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4 Sheets—Sheet 3.

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Fig. 3.

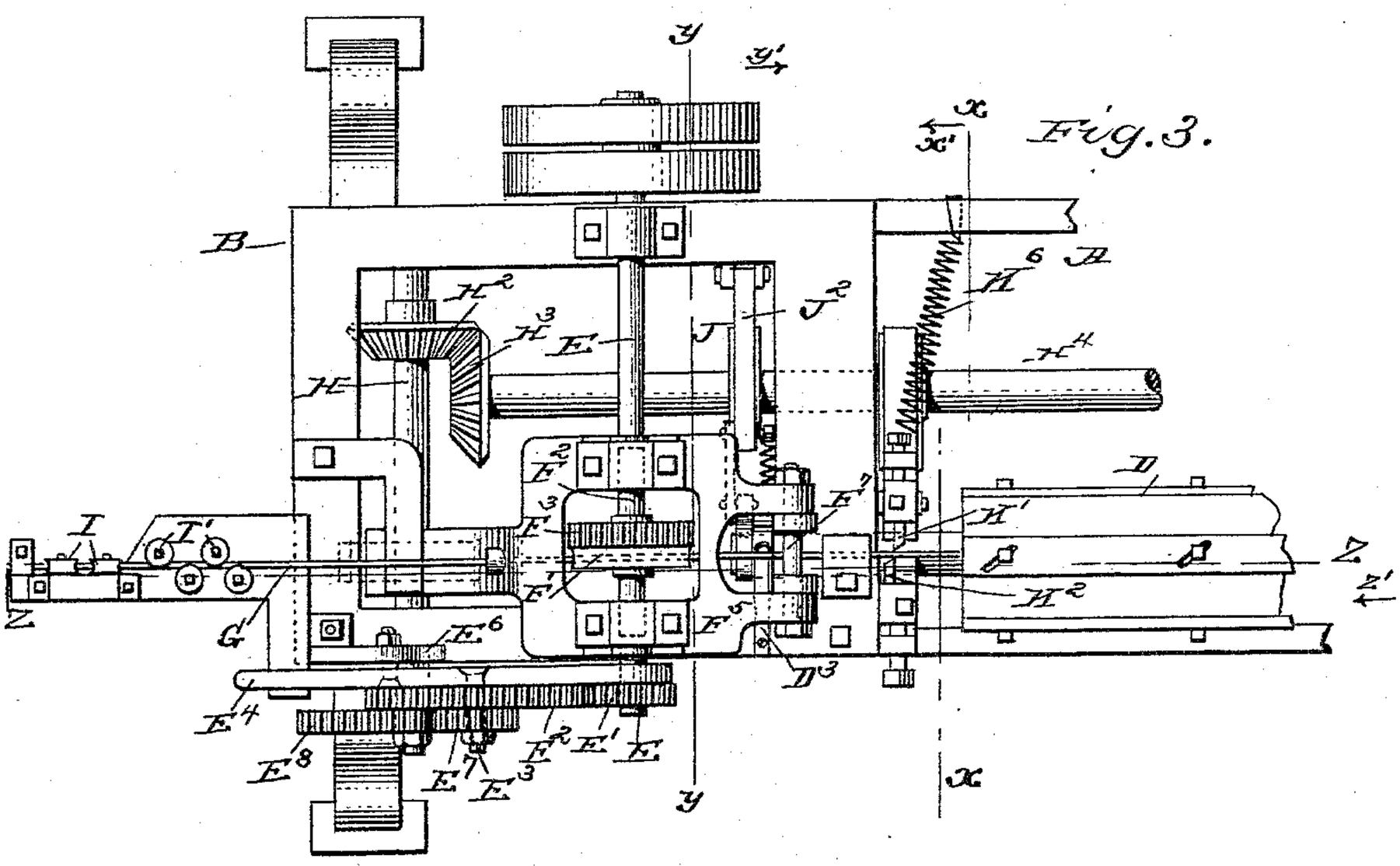


Fig. 4.

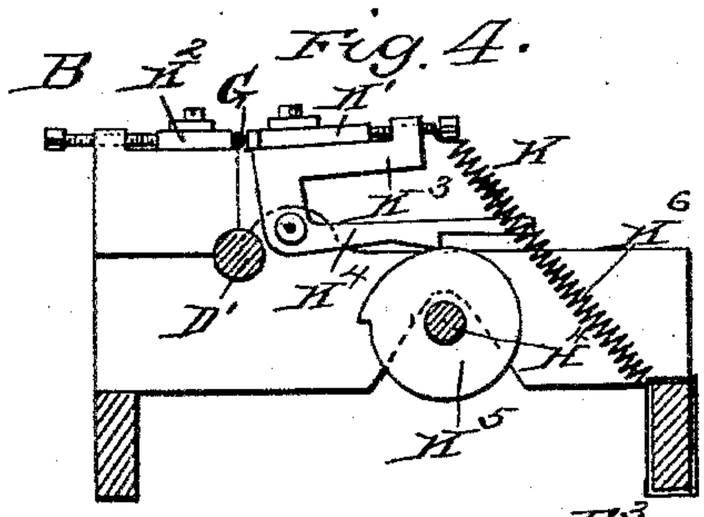


Fig. 5.

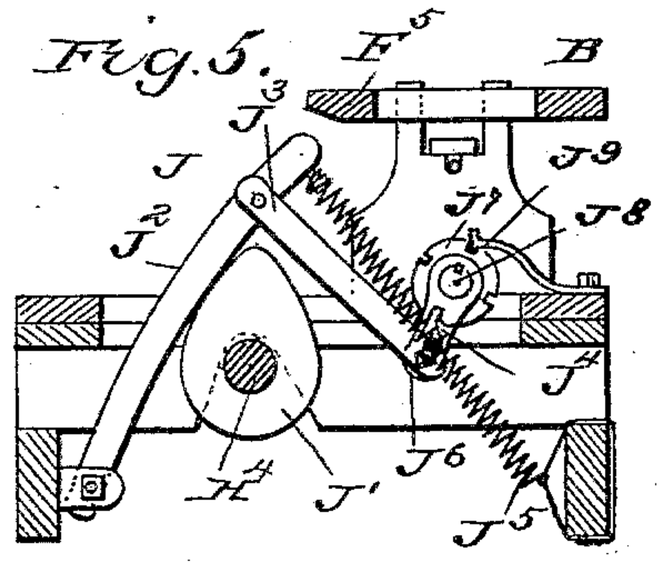
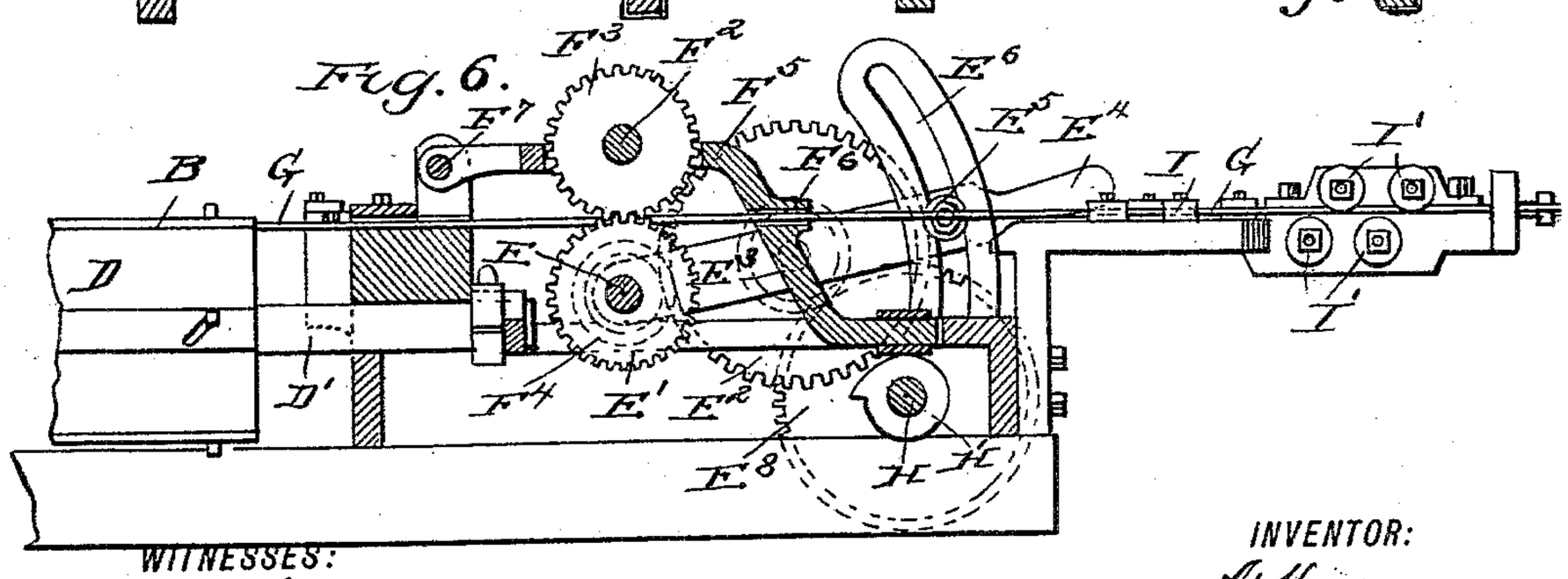


Fig. 6.



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(No Model.) 4 Sheets—Sheet 4.

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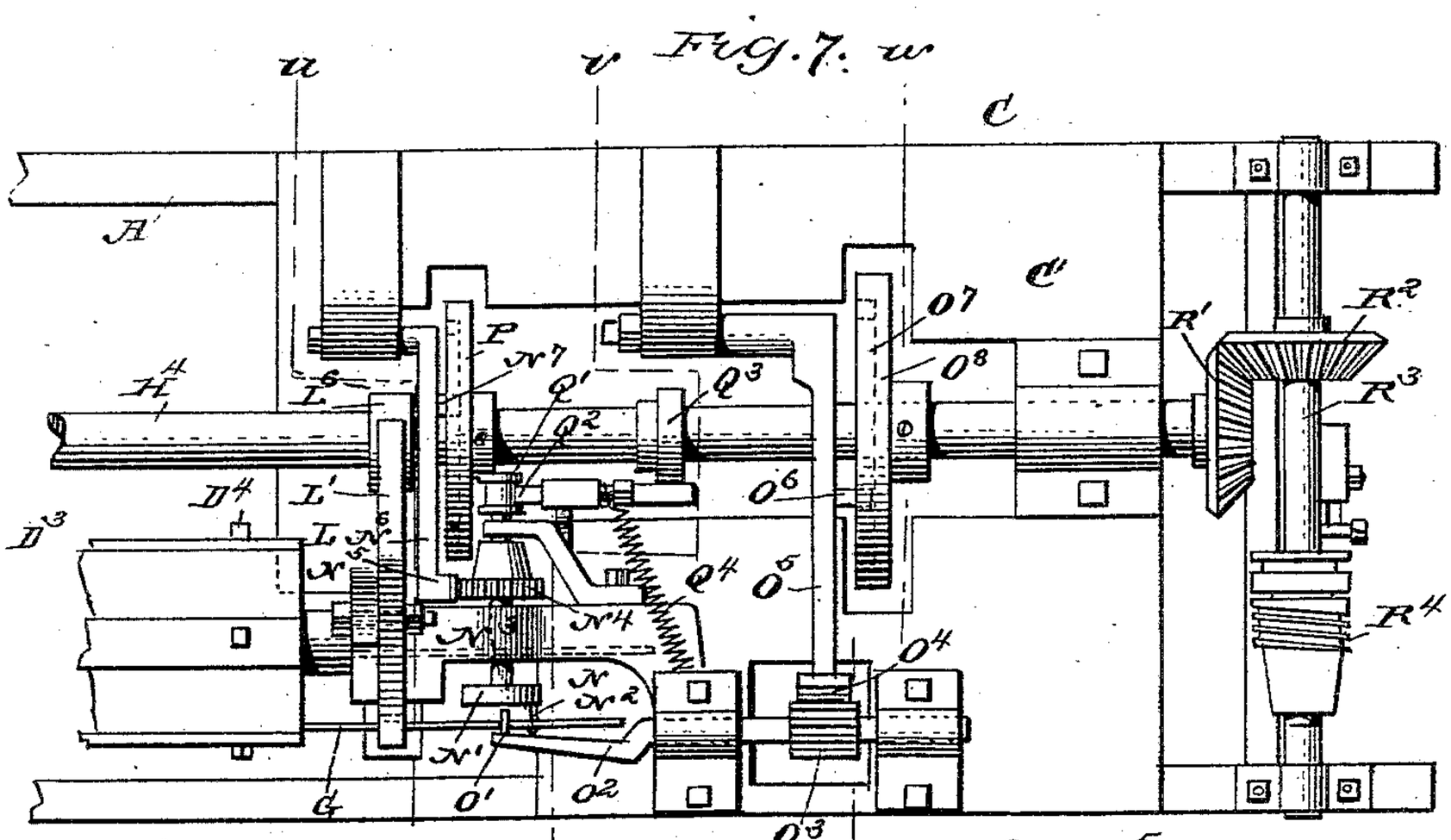
BALE TIE MACHINE.

No. 414,410. Patented Nov. 5, 1889.

Fig. 7.



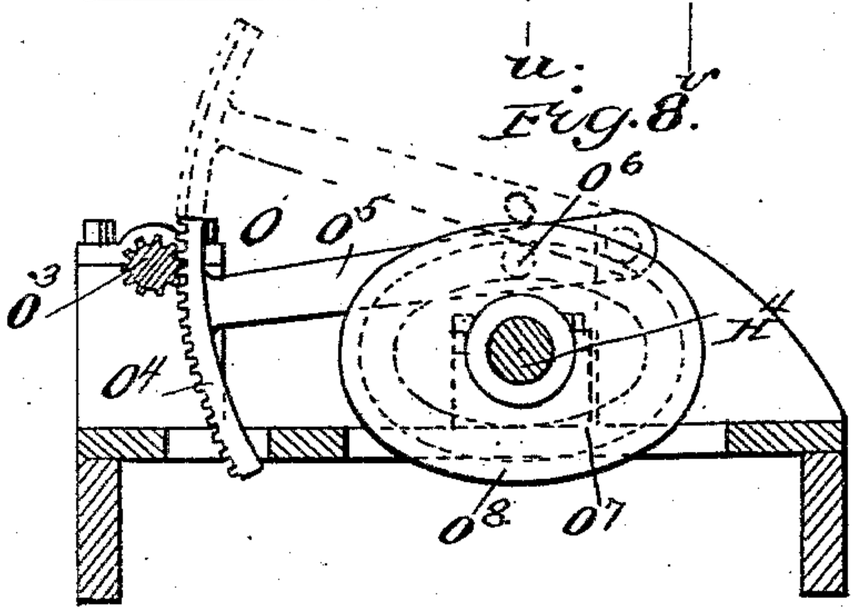


Fig. 8.

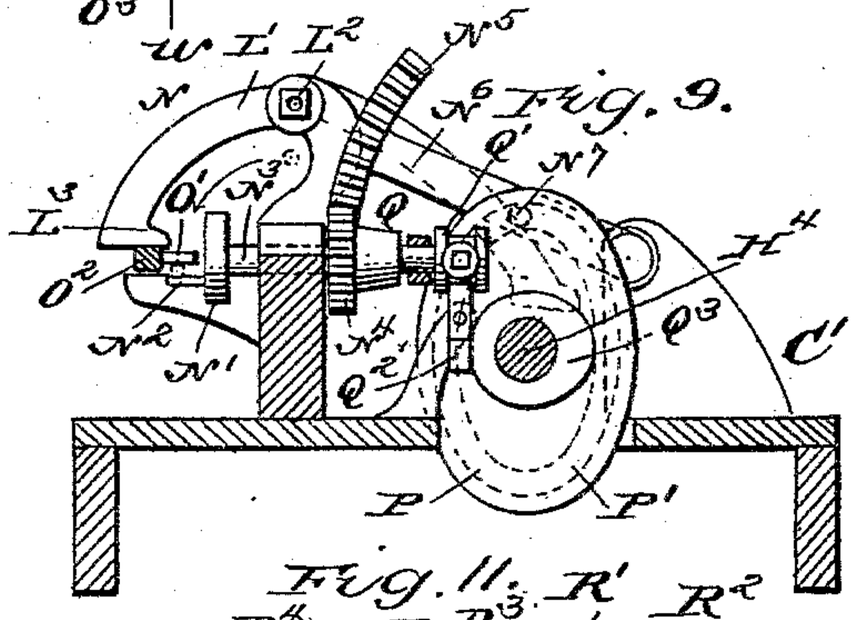


Fig. 9.

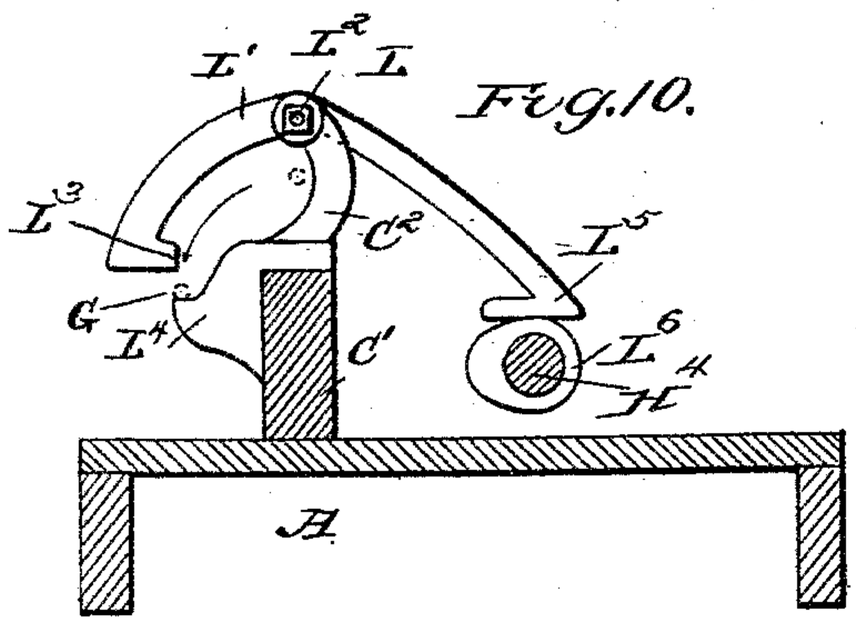


Fig. 10.

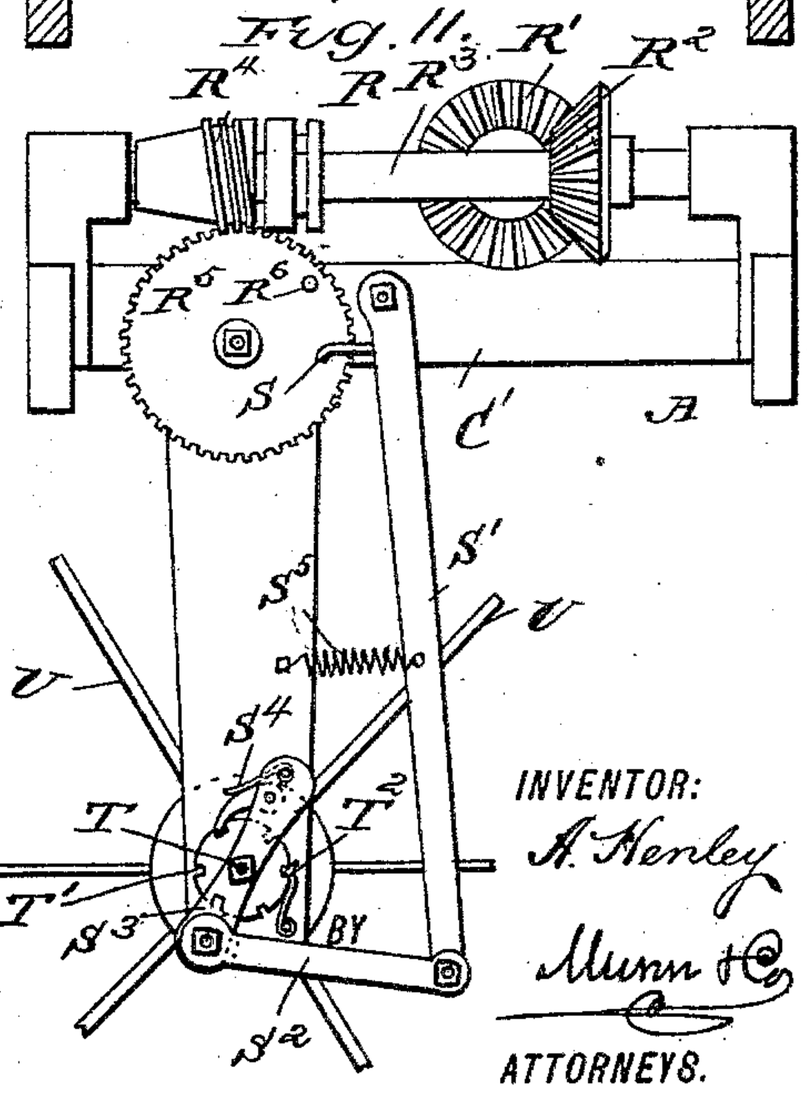


Fig. 11.

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UNITED STATES PATENT OFFICE.

ALBERT HENLEY, OF LAWRENCE, KANSAS.

BALE-TIE MACHINE.

SPECIFICATION forming part of Letters Patent No. 414,410, dated November 5, 1889.

Application filed August 22, 1889. Serial No. 321,583. (No model.)

To all whom it may concern:

Be it known that I, ALBERT HENLEY, of Lawrence, in the county of Douglas and State of Kansas, have invented a new and Improved Bale-Tie Machine, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved machine which is simple and durable in construction, very effective in operation, and specially designed to manufacture bale-ties of wire for baling hay, straw, &c.

The invention consists of certain parts and details and combinations of the same, as will be fully described hereinafter, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a plan view of the improvement. Fig. 2 is a side elevation of the same. Fig. 3 is an enlarged plan view of the head. Fig. 4 is a transverse section of the same on the line $x\,x$ of Fig. 3, looking in the direction of the arrow x'. Fig. 5 is a similar view of the same on the line $y\,y$ of Fig. 3, looking in the direction of the arrow y'. Fig. 6 is an enlarged sectional side elevation of the same on the line $z\,z$ of Fig. 3, looking in the direction of the arrow z'. Fig. 7 is an enlarged plan view of the tail-piece of the machine. Fig. 8 is a transverse section of the same on the line w w of Fig. 7. Fig. 9 is a like view of the same on the line $v\,v$ of Fig. 7. Fig. 9^a is a detail perspective view of the mechanism for sliding the shaft N^3, Fig. 9. Fig. 10 is a similar view of the same on the line $u\,u$ of Fig. 7. Fig. 11 is an end elevation of the same. Fig. 12 is an enlarged transverse section of the cylinder, and Fig. 13 is an enlarged end elevation of the feed-rollers.

The improved bale-tie machine is provided with a suitably-constructed frame A, on one end of which is mounted a head B, and on the other end is held a tail-piece C, between which and the said head B is held the cylinder D, carrying the bale-tie during the process of twisting one end thereof. On the head B is mounted to turn in suitable bearings the main driving-shaft E, carrying the usual pulleys connected by belts with other machinery for imparting a rotary motion to the said main driving-shaft E. On the latter is secured a grooved feed-roller F, above which is located a similarly-grooved feed-roller F′, and between the two feed-rollers is passed the wire G to be formed into a bale-tie. The feed-roller F′ is secured on a shaft F^2, which carries a gear-wheel F^3, adapted to mesh into a similar gear-wheel F^4, secured on the main driving-shaft E, so that when the latter is rotated the two feed-rollers F and F′ travel together and move the wire G forward. The shaft F^2 is mounted to turn in suitable bearings formed on a frame F^5, pivoted at one end, at F^7, to the frame of the head B. In the frame F^5 is also formed an aperture F^6, through which passes the wire G, and as the frame F^5 is mounted to swing it can be swung upward, so that the wire G is moved out of contact with the feed-roller F on account of passing through the aperture F^6 of the said frame F^5, whereby a forward feeding of the wire ceases.

On the outer end of the main driving-shaft E is secured a gear-wheel E′, which meshes into a larger gear-wheel E^2, mounted to turn on a stud E^3, secured on an arm E^4, fulcrumed on the main driving-shaft E and provided with a bolt E^5, adapted to be secured in any desired position in the slotted segment E^6, held on the frame of the head B. The larger gear-wheel E^2 carries on one face a pinion E^7, meshing into a gear-wheel E^8, fastened on a transversely-extending shaft H, mounted to turn in suitable bearings in the frame of the head B. On this transversely-extending shaft H is secured a cam-wheel H′, (see Fig. 6,) on the periphery of which rests the free end of the frame F^5, so that when the shaft H is rotated the said cam-wheel H′ alternately raises and drops the free end of the frame F^5, whereby the feed-rollers F and F′ are alternately thrown in and out of contact with each other. During the time the feed-rollers are thrown out of contact the wire G remains at a standstill, and during the time that the feed-rollers remain in contact the wire G is fed forward, as previously described. The speed of the shaft H can be increased or diminished by placing a different-sized pinion E^7 on the arm E^4 and changing the latter accordingly on the slotted segment E^6. The wire G, before passing into the frame F^5 and to the grooved rollers F and F′, passes through a se-

ries of vertically-arranged friction-rollers I and a series of horizontally-arranged friction-rollers I′.

On the transverse shaft H is secured a bevel gear-wheel H^2, meshing into a bevel gear-wheel H^3, secured on the longitudinally-extending shaft H^4, mounted to turn in suitable bearings in the frame A and extending from the head B to the tail C. The shaft H^4 operates the mechanism J (see Fig. 5) for turning the cylinder D one quarter-turn at certain intervals. The mechanism J is provided with an almond-shaped cam J′, secured on the said shaft and operating on a lever J^2, fulcrumed at one end to the main frame A. The free end of the lever J^2 is pivotally connected by a link J^3 with a crank-arm J^4, fastened on one end of the shaft J^8 of the cylinder D. A spring J^5 is also connected with the free end of the lever J^2 and serves to press the said lever into contact with the periphery of the almond-shaped cam J′.

On the crank-arm J^4 is held a spring-pawl J^6, adapted to engage one of four notches formed in a disk J^7, secured on the shaft J^8 of the cylinder D. The notched disk J^7 is adapted to be engaged by a spring J^9, serving to hold the cylinder D in the proper position until turned by the return movement of the mechanism J. When the shaft H^4 revolves, the cam J′ acts on the lever J^2 and throws the latter outward, so that a swinging motion is imparted to the crank-arm J^4, whereby its pawl J^6 turns the disk J^7, and the shaft J^8 of the cylinder D is turned one quarter-turn, the spring J^9 dropping at its free end into the next following notch. During the other half-motion of the cam J′ the pawl J^6 rides over the disk J^7, which latter is held in place by the spring J^9. The shaft H^4 also imparts motion at the proper time to the cutting mechanism K, provided with two knives K′ and K^2, located opposite each other, and of which the knife K^2 is stationary, being held in suitable bearings in the frame of the head B. The other knife K′ is held in a frame K^3, mounted to swing on the frame of the head B, and provided with an arm K^4, resting on the periphery of the cam K^5, secured on the shaft H^4. A spring K^6 presses against the frame K^3, so as to hold the arm K^4 of the latter in contact with the periphery of the cam K^5. When the latter is in the position shown in Fig. 4, the knives K′ and K^2 are apart and permit the free discharge of the wire G. When the shaft H^4, however, turns, the arm K^4 is swung outward by the cam K^5, so that the frame K^3 swings on its fulcrum and moves its knife K′ toward the knife K^2, so that the wire G between the knives K′ and K^2 is cut. During this operation the feed-rollers F and F′ are out of contact with each other, and the wire G remains stationary. The knives K′ and K^2 are preferably held adjustably in their respective bearings by suitable bolts or other means, so as to sharpen the knives whenever necessary and to compensate for the wear on the sharp edges of the knives.

The cylinder D, into which the wire G is fed, is provided with four longitudinally-extending arms D′, each provided on its outer edge with a groove D^2, extending longitudinally and adapted to receive the wire G. Each groove D^2 is covered by a plate D^3, held to slide on the outer end of each arm D′ and secured in place by a series of bolts D^4, passing through inclined slots D^5 in the said plates D^3. In the middle of each plate D^3 is held a pin D^6, adapted to engage a cam D^7, secured on the main frame A, and serving to shift the cover-plates D^3 when the respective arm D′ is in its lowermost position, so as to uncover the respective groove D^2 to permit the dropping out of the wire, as is plainly shown in Fig. 12. When the lowermost arm D′ again moves upward on the turning of the cylinder D, the cam D^7 again shifts the respective cover-plate D^3 until the respective groove D^2 is again closed.

The wire fed into the cylinder D projects a suitable distance—about six inches—and passes through a clamping device L to a bending device N and a twisting device O, which double the outer end of the wire to form a loop G′ and a twist G^2 in the wire G, as shown in Fig. 2. The three devices L, N, and O are located on the tail C and are actuated from the shaft H^4, previously mentioned.

The clamping device L (see Fig. 10) is provided with a bent lever L′, fulcrumed at L^2 on a bracket C^2, secured on the frame C′ of the tail C. One end of the lever L′ is provided with an inwardly-extending offset L^3, adapted to clamp the wire G on a fixed anvil L^4, formed on the bracket C^2. The other end L′ rests on the periphery of a cam L^6, secured on the shaft H^4, so that when the latter is rotated the lever L′ is swung and its projection L^3 moves inward and downward, clamping the wire G on the anvil L^4.

The bending device N (see Fig. 9) is provided with a disk N′, from which projects a crank-pin N^2, adapted to double up the end of the wire projecting beyond the cylinder D. The disk N′ is secured on a shaft N^3, mounted to turn and to slide in suitable bearings formed in the frame C′ of the tail C. On the shaft N^3 is held to turn and to slide a gear-wheel N^4, meshing into a segmental gear-wheel N^5, fastened on an arm N^6, fulcrumed on the tail-frame C′. Near the middle of the arm N^6 is held a pin N^7, engaging an elliptical cam-groove P′, formed in the cam P, fastened on the shaft H^4. When the latter is rotated, said cam P imparts a swinging motion to the arm N^6, so that its segmental gear-wheel N^5 turns the gear-wheel N^4 forward and backward, whereby the shaft N^3, with its disk N′, is turned for doubling the wire end. The shaft N^3 is mounted to slide transversely, so as to disengage the pin N^2 from the doubled end after the loop is made. For this purpose

the mechanism Q is provided, comprising a grooved collar Q′, secured on the rear end of the shaft N^3 and engaged by one end of a lever Q^2, fulcrumed on the tail-frame C′, and engaged at its other end by a cam Q^3, secured on the shaft H^4. A spring Q^4 serves to hold the lever Q^2 in contact with its cam Q^3. When the shaft H^4 is turned, the cam Q^3 imparts a swinging motion to the lever Q^2, whereby the collar Q′ is moved transversely, and a similar motion is imparted to the shaft N^3, so that the pin N^2 is drawn out of contact with the wire G.

The twisting device O operates in conjunction with the bending device N, and is provided with a pin O′, located in front of the pin N^2, which latter bends the end of the wire G over the pin O′ when the disk N′ is turned. The pin O′ is secured on a shaft O^2, extending longitudinally and mounted to turn in suitable bearings on the tail-frame C′.

On the shaft O^2 is secured a pinion O^3, (see Figs. 7 and 8,) in which meshes the segmental gear-wheel O^4, fastened on an arm O^5, fulcrumed on the tail-frame C′ and provided with a pin O^6, engaging an elliptical cam-groove O^7, formed on one face of the cam O^8, secured on the shaft H^4. When the latter is rotated, the cam O^8 imparts a swinging motion to the arm O^5, so that the segmental gear-wheel O^4 turns the gear-wheel O^3 forward and backward, whereby the pin O′, having hold of the loop of the bent wire, forms the twist G^2 when the shaft O^2 turns in one direction. When the shaft O^2 is at the end of its movement in one direction, the pin O′ stands downward, so that the loop G′ of the wire G can drop off of the pin O′, after which the shaft O^2 is returned to its former position.

At the end of the tail C is located a registering or counting device R, provided with a bevel gear-wheel R′, secured at the end of the shaft H^4 and meshing into a bevel gear-wheel R^2, fastened on the transversely-extending shaft R^3, mounted to turn in suitable bearings on the tail-frame C′.

On the shaft R^3 is secured a worm R^4, meshing into a worm-wheel R^5, mounted to turn on a stud secured on the tail-frame C′. On the outer face of the said worm-wheel R^5 is held a crank-pin R^6, adapted to engage a pin S, fastened on a lever S′, fulcrumed at its upper end on the tail-frame C′ and pivotally connected at its lower end by a link S^2 with a lever S^3, fulcrumed on a shaft T, mounted to turn in suitable bearings on the frame A and extending longitudinally under the cylinder D, as is plainly shown in Fig. 2. The other end of the lever S carries a spring-pawl S^4, engaging a notched disk T′, secured on the said shaft T and held in place by a spring T^2, as is plainly shown in Fig. 11. A spring S^5 presses on the lever S′ to hold the same in an innermost position.

On the shaft T are secured two or more sets of hubs carrying radial arms U, adapted to receive the finished bale-ties after the same are discharged from the cylinder D.

The operation is as follows: The wire G first enters the straightening-rollers I and I′, and then passes between the feed-rollers F and F′, which feed the wire forward past the knives K′ and K^2 in the groove D^2 on the uppermost arm D′ of the cylinder D. The wire G passes through the entire length of the cylinder D and projects at the tail C about six inches. At this moment the cutting mechanism K cuts off the wire by means of the knives K′ and K^2, and at the same time the frame F^5 is swung upward by the action of the cam H′ on the shaft H, so that the wire G remains at a standstill. The piece of wire held in the cylinder D now turns with the latter, said cylinder making one quarter-turn by the action of the turning device J, previously described. The projecting end of the wire in the cylinder D and tail C now passes onto the top of the pin N^2 of the disk N′, and at the same time the shaft O^2 turns, so that its pin O′ passes over the projecting end of the said wire, as is shown in Fig. 7. The disk N′ now turns so that the pin N^2 bends the wire over the pin O′ and passes the end of the wire between the lever L′ and the anvil L^4 onto the wire already on the anvil L^4, as shown in Fig. 10. The cam L^6 now acts on the lever L′, so that the offset or foot L^3 clamps the two parts of wire onto the anvil L^4. The mechanism Q, after imparting a transverse sliding motion to the shaft N^3, is now actuated by the cam Q^3, so that the said shaft N^3 slides rearward and the pin N^2 is disengaged from the doubled-up end of the wire. A rotary motion is now imparted to the shaft O^2 from the shaft H^4 by means of the cam O^8, the arm O^5, the segmental gear-wheel O^4, and the pinion O^3, so that the pin O′ twists the end of the doubled wire, so as to form the loop G′ and the twist G^2. (Shown in Fig. 2.) During this time a new piece of wire G fed into the top arm of the cylinder D is cut off by the cutting mechanism K, and a quarter of a revolution is again imparted to the cylinder D, so that the first finished wire passes with the arm D′ of the cylinder D into its lowermost position, and during this quarter movement of the cylinder D the cam D^7 opens the cover-plate D^3, so that the finished bale-tie drops out of the arm D′ and falls between two corresponding radial arms of the sets of arms U. The above-described operation is then repeated—that is, the wire is fed into the uppermost arm, cut off, the cylinder is turned one-quarter of a revolution, the loop and twist G′ and G^2 of the cut-off wire in the cylinder D are formed, a new piece of wire is inserted into the top of the cylinder, and the lowermost finished bale-tie is dropped out of the cylinder, as above described.

The registering device R is so arranged that the sets of arms U remain in position until, say, one hundred bale-ties have been dropped between two corresponding arms.

Then the pin R^6 acts on the pin S, so that the lever S′ actuates the lever S^3, which latter, by means of its spring-pawl S^4, turns the shaft T so as to bring the next following set of arms U directly under the cylinder D. Thus one hundred bale-ties are always placed between the corresponding arms U of a set and dropped simultaneously on the floor or are otherwise removed from the said arms.

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

1. The combination, with the clamping device L, comprising the stationary anvil L^4 and the vertically-movable lever L′, of the rotary twisting-shaft O^2, provided with the inwardly-extending pin O′, across which the wire extends from the said anvil, a transverse shaft having a rotary and sliding movement and provided with a disk having a bending-pin projecting toward the shaft O^2 to engage the end of the wire and bend it over the pin O′ and upon the anvil, and mechanism for forcing the lever L′ upon the looped wire on the anvil, sliding the shaft N^3 inward to withdraw its pin, and rotating the shaft O^2 to twist the loop, substantially as set forth.

2. The combination, with the clamp for the loop and the loop-twister, of an intermediate bending mechanism for engaging the wire with the twister and clamp, and comprising a shaft N^3, having a disk N′, provided with a pin N^2, a pinion N^4, splined on the shaft, a grooved collar Q′ on the inner end of the shaft, a lever Q^2, engaging said collar, a lever N^6, provided with segmental gear N^5, engaging said pinion, and cams for first operating the lever N^6 and then the lever Q^2, substantially as set forth.

3. The combination, with the upper and lower feed-rolls, of a vertically-movable frame carrying the upper roll and provided with a guide for the wire and means for raising the frame, whereby when the frame and roll are raised the strand will be lifted from the lower roll, substantially as set forth.

4. In a wire-working machine, a longitudinally-grooved wire-carrying cylinder provided with sliding plates covering the said grooves, substantially as set forth.

5. The longitudinally-grooved wire-carrying cylinder provided with cover-plates having inclined slots and securing-bolts passing therethrough, substantially as set forth.

6. The rotary wire-carrier comprising a cylinder having arms D′, provided with grooves D^2, plates D^3, extending longitudinally along the outer faces of the said arms across the grooves and provided with inclined slots D^5, the bolts D^4, passing through the slots into said arms, and an operating-pin projecting from each plate, substantially as set forth.

7. The combination, with the rotary wire-carrying cylinder having longitudinal wire-receiving grooves, sliding cover-plates thereon for the grooves, and pins projecting from said plates, of a cam in the path of said pins for operating the cover-plates to open and close the grooves, substantially as set forth.

8. The combination, with the feeding mechanism and a cutter past which the wire from the feeder extends, of a rotary cylinder having a series of longitudinal grooves into which the wire is fed, covers for said grooves, and mechanism below the cylinder for successively operating the covers to permit the wire to fall from the lowermost grooves, substantially as set forth.

9. The combination, with the rotary wire-carrier, of a shaft thereunder provided with arms to receive the wires from the carrier, substantially as set forth.

10. In a bale-tie machine, the combination, with a cylinder carrying the finished bale-tie, of an automatic mechanism, substantially as described, for releasing the bale-tie and sets of arms located under the said cylinder to receive the dropped bale-ties, substantially as described.

11. In a bale-tie machine, the combination, with a cylinder carrying the finished bale-tie, of an automatic mechanism, substantially as described, for releasing the bale-tie, sets of arms located under the said cylinder to receive the dropped bale-ties, and a registering device adapted to turn the said arms when a certain number of ties have accumulated in the said arms, substantially as shown and described.

12. In a bale-tie machine, a cylinder comprising grooved arms and covering-plates held adjustably on the said arms, substantially as shown and described.

13. In a bale-tie machine, a cylinder comprising grooved arms and covering-plates held adjustably on the said arms, and a cam for shifting the said covering-plates to alternately uncover and cover the grooves in the said arms, substantially as shown and described.

14. A bale-tie machine comprising the frame having a head B and a tail C, a rotary longitudinally-grooved cylinder D between the head and tail, a shaft H^4, extending from end to end of the frame, and provided at the head end with cams J′ K^5 and at the tail end with cams L^6 P′ Q^3 O^8, the feed-rolls, a frame carrying the upper roller, a cam for operating the frame, a cutter between the feed-rolls and cylinder D and operated by the cam K^5, a pawl-and-ratchet mechanism for rotating the cylinder D and operated by the cam J′, the clamping, bending, and twisting mechanisms on the tail part C and operated by the cams L^6 P′ Q^3 O^8, and a longitudinally-extending shaft under the cylinder D and provided with radial arms, into which the finished ties are dropped, and mechanism for rotating the said shaft from the shaft H^4, substantially as set forth.

ALBERT HENLEY.

Witnesses:
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J. W. ALDER.