

No. 794,602.

PATENTED JULY 11, 1905.

E. A. FRANTZ.

MACHINE FOR FORMING WIRE BALE TIES.

APPLICATION FILED MAR. 3, 1904.

6 SHEETS—SHEET 1.

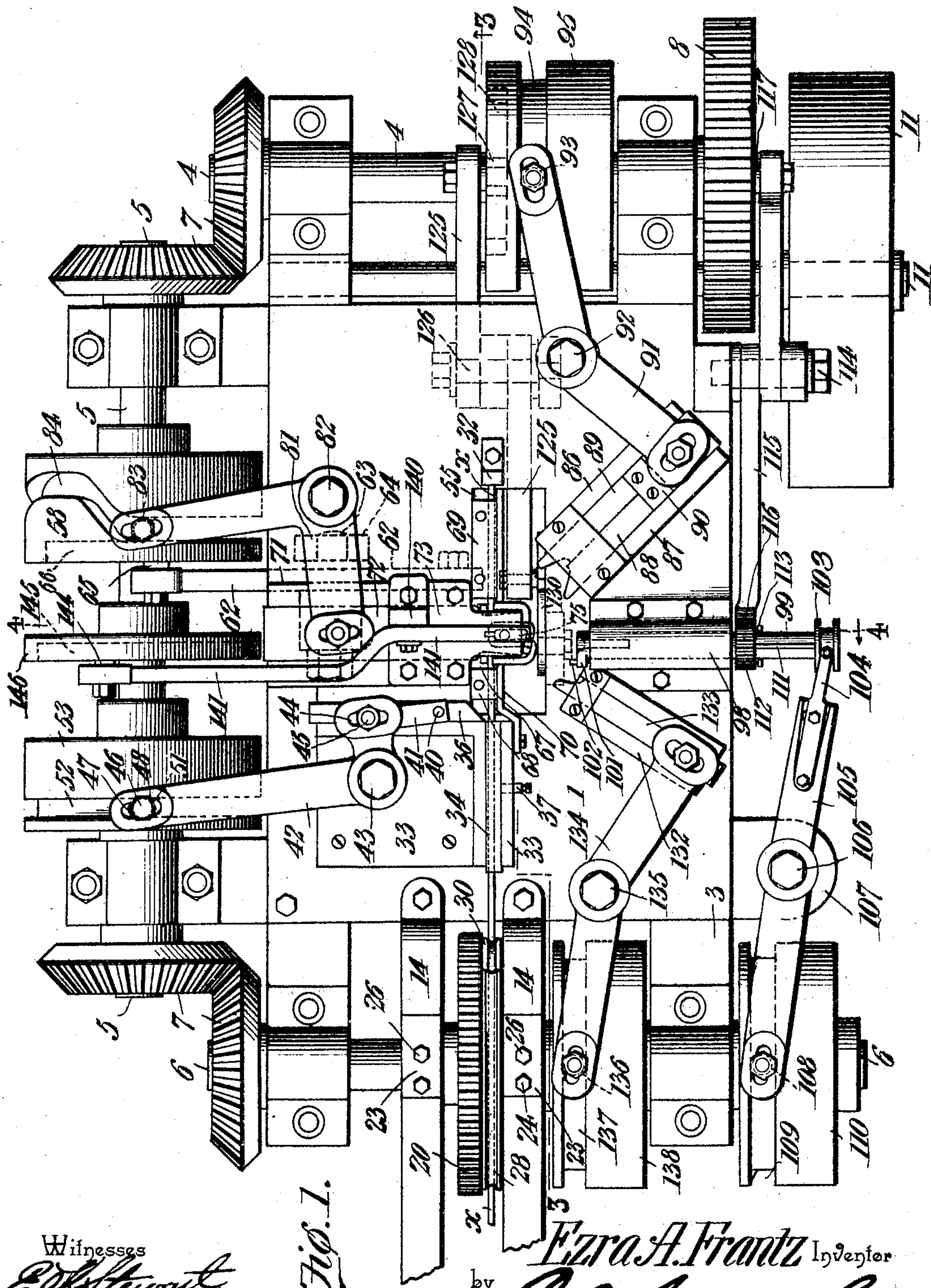


Fig. 1.

Witnesses

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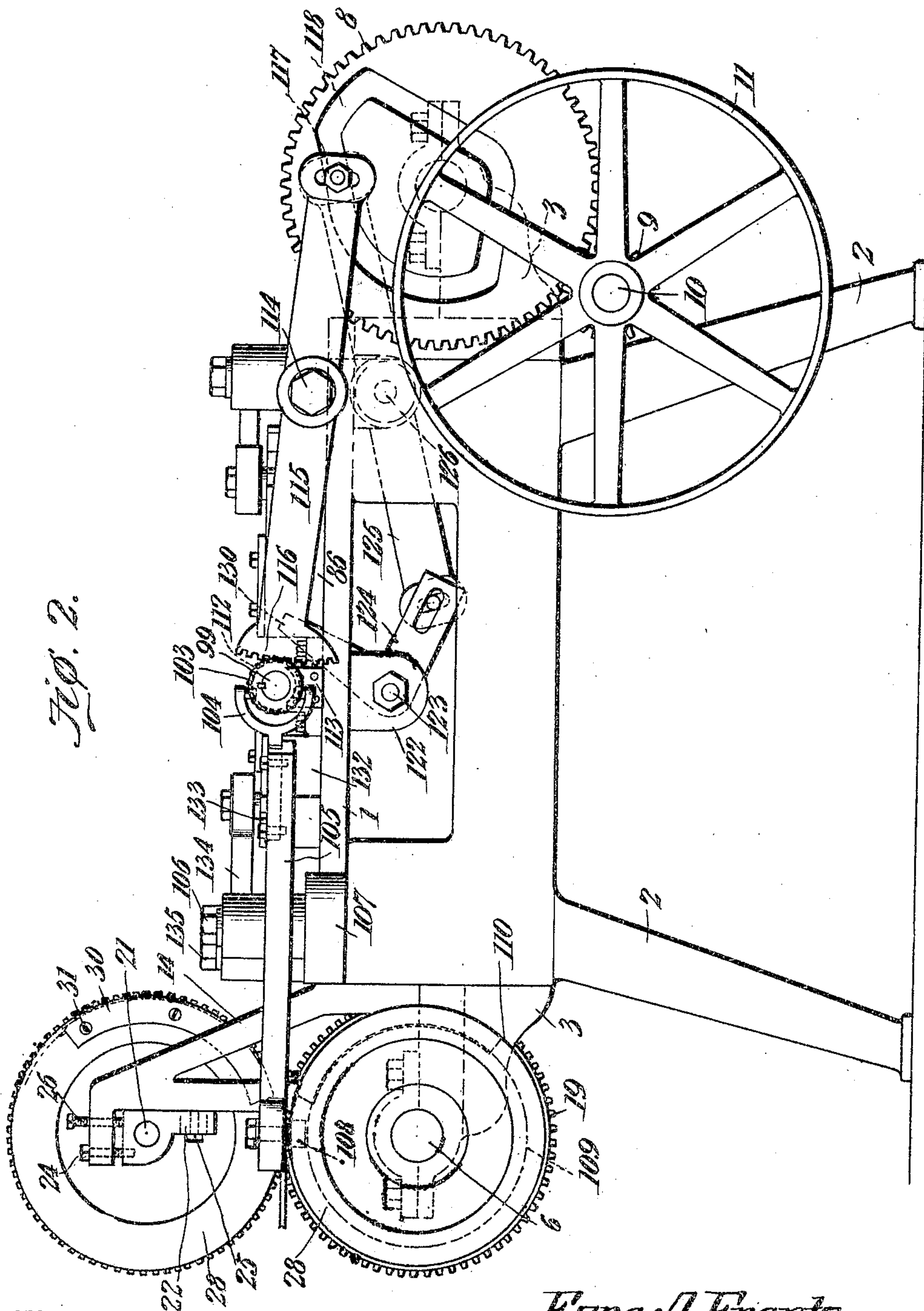
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6 SHEETS—SHEET 2.



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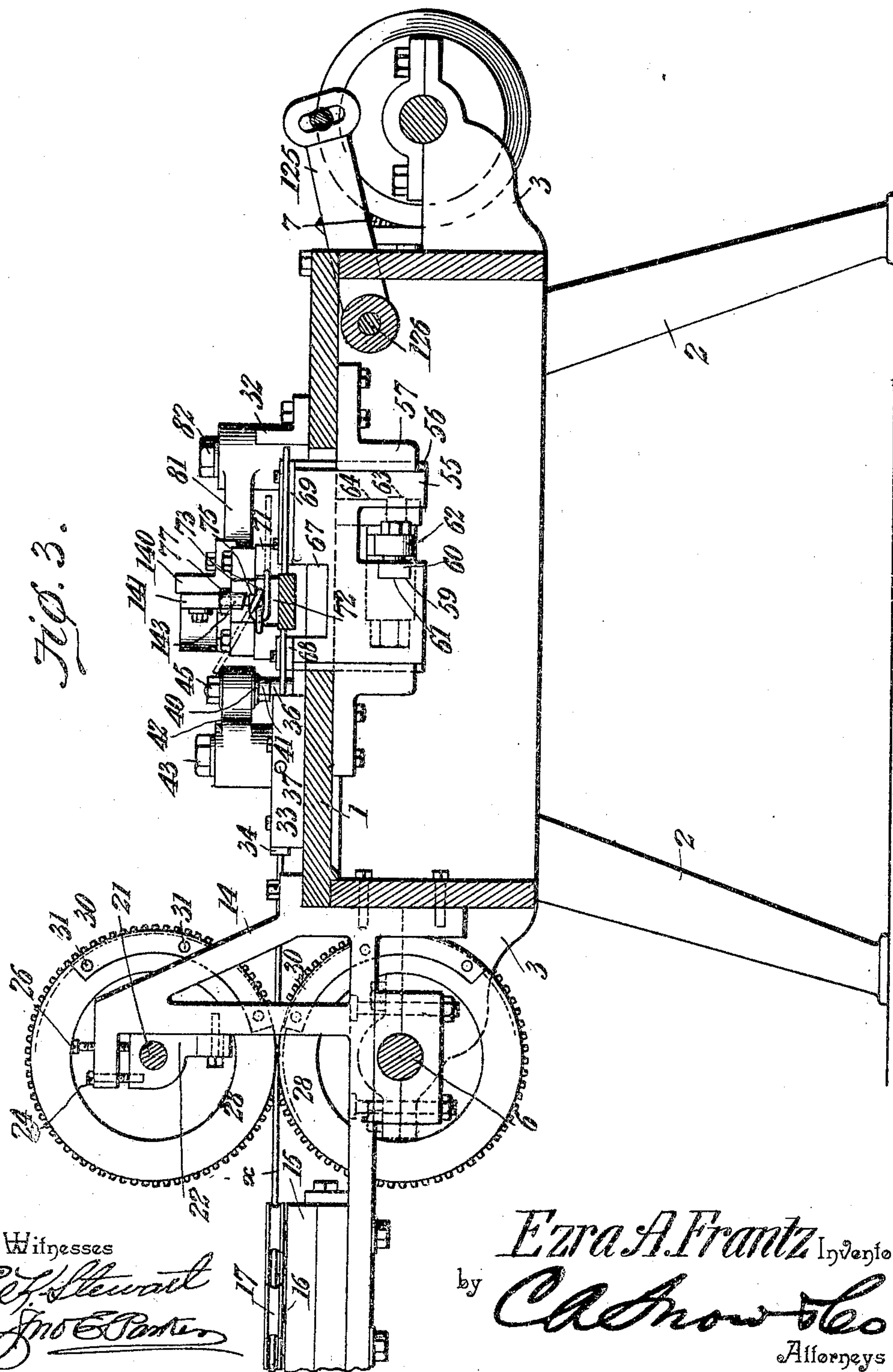
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6 SHEETS—SHEET 3.



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6 SHEETS—SHEET 4.

Fig. 4.

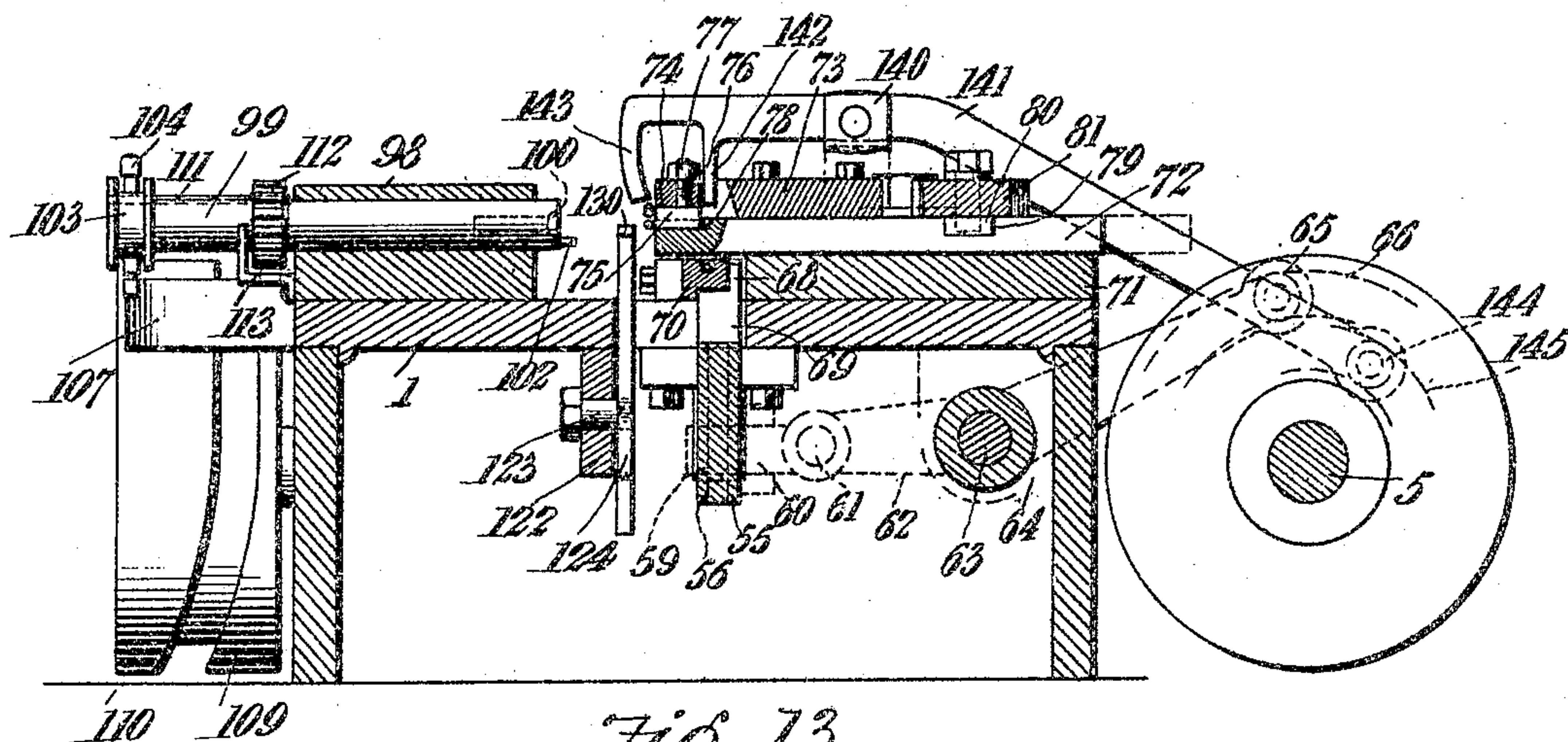


Fig. 13. x

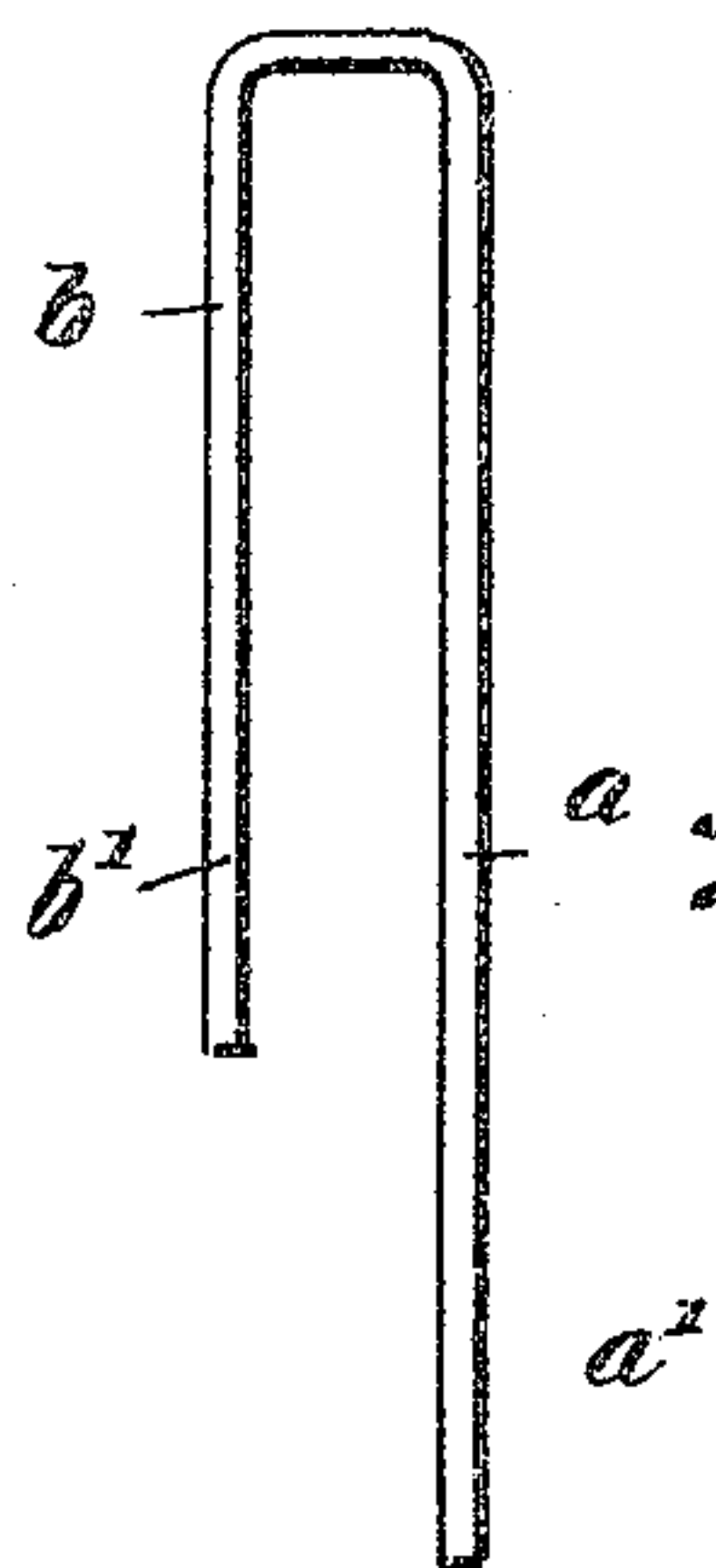


Fig. 14.

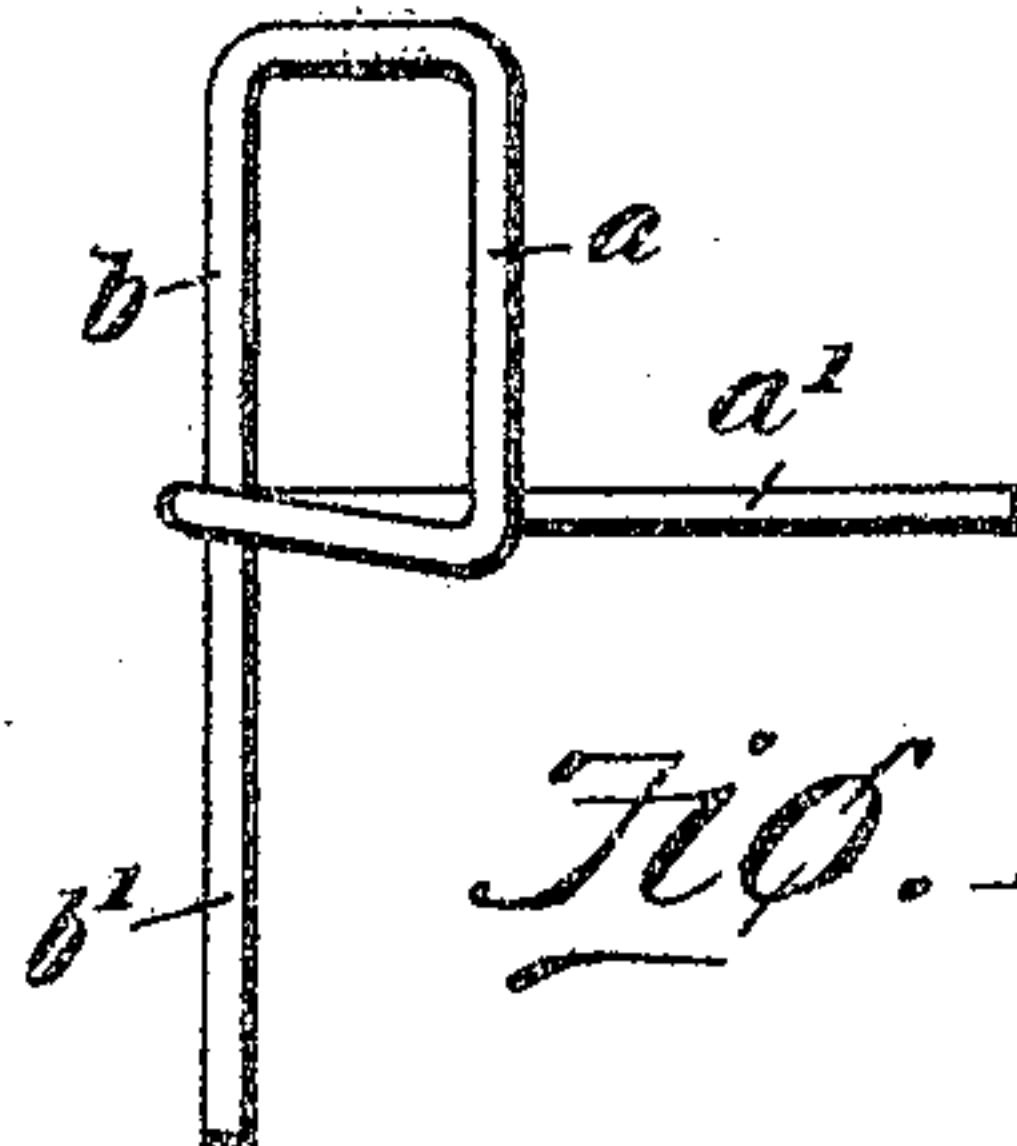


Fig. 16.

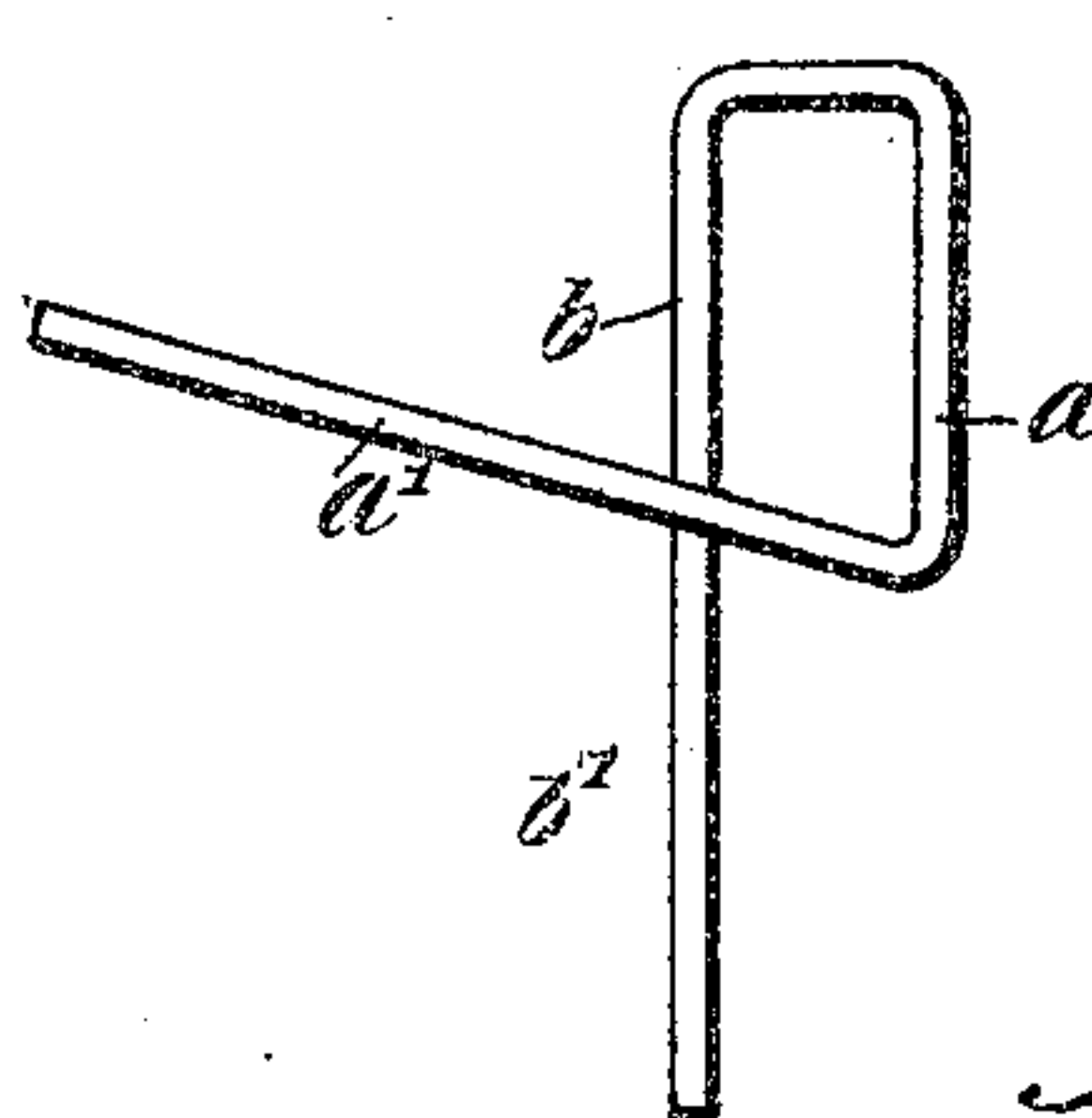


Fig. 15.

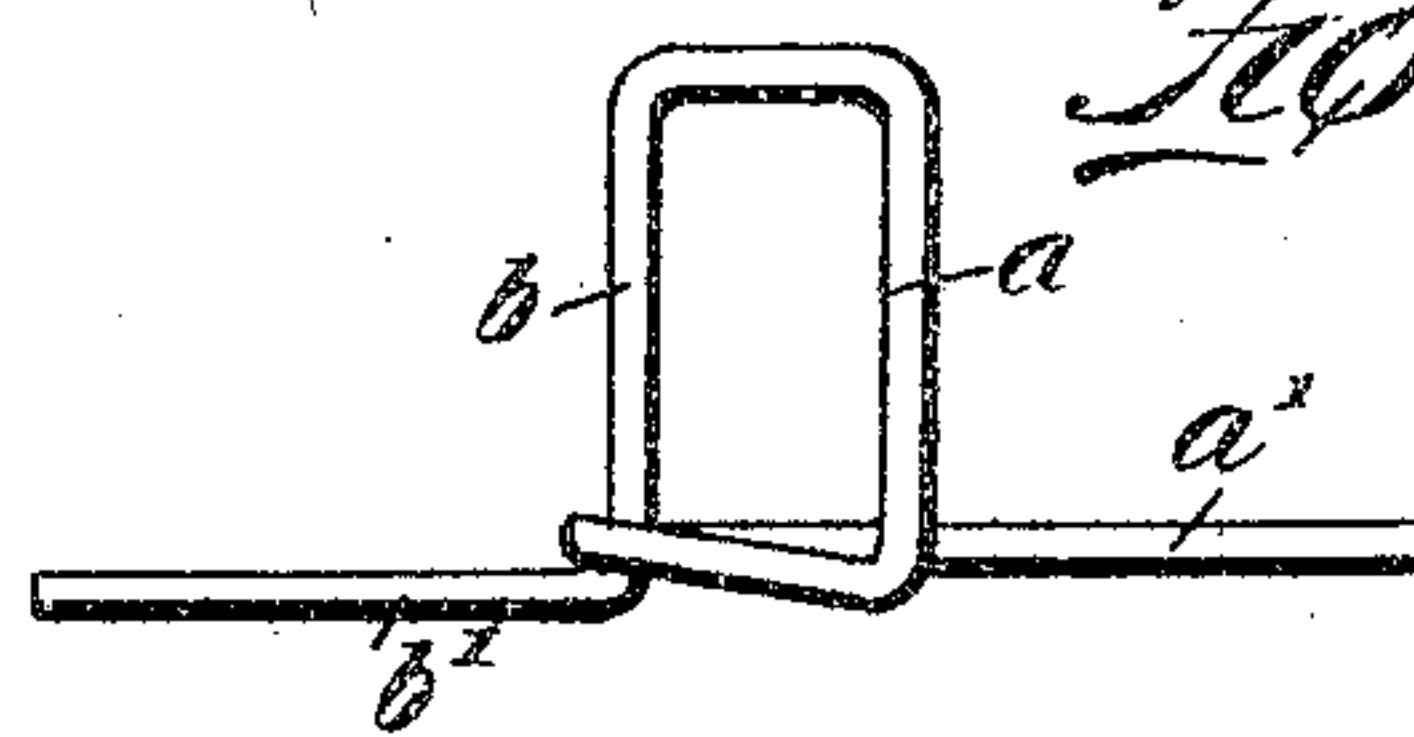


Fig. 17.

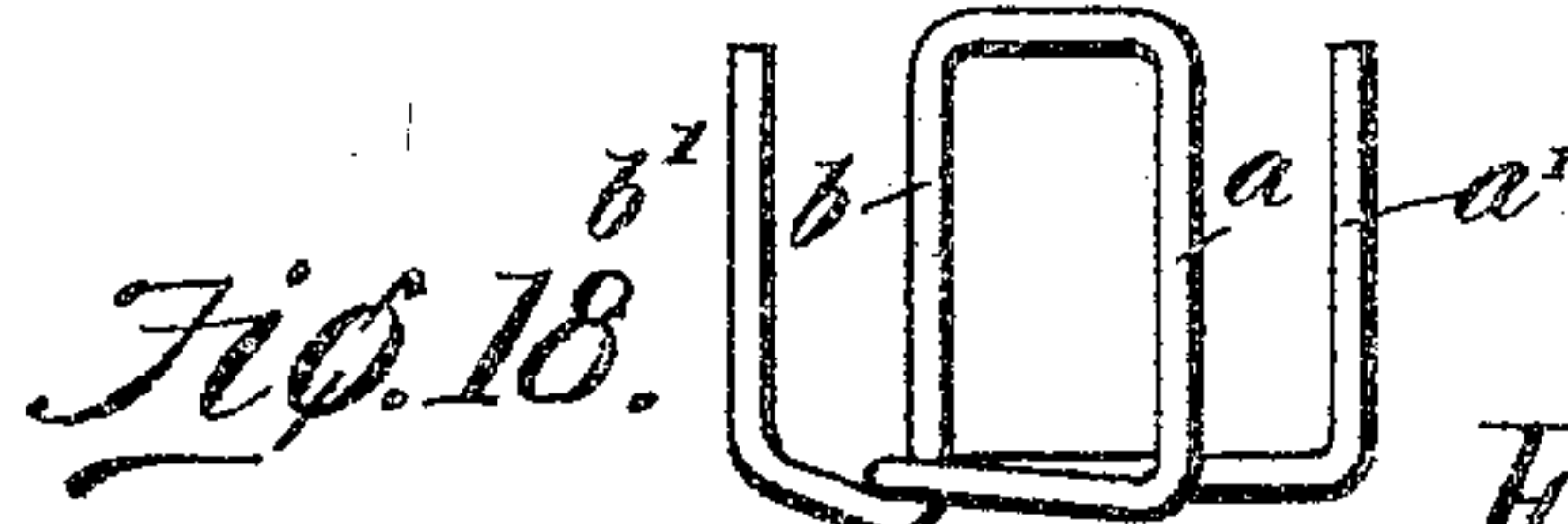


Fig. 18.

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6 SHEETS—SHEET 5.

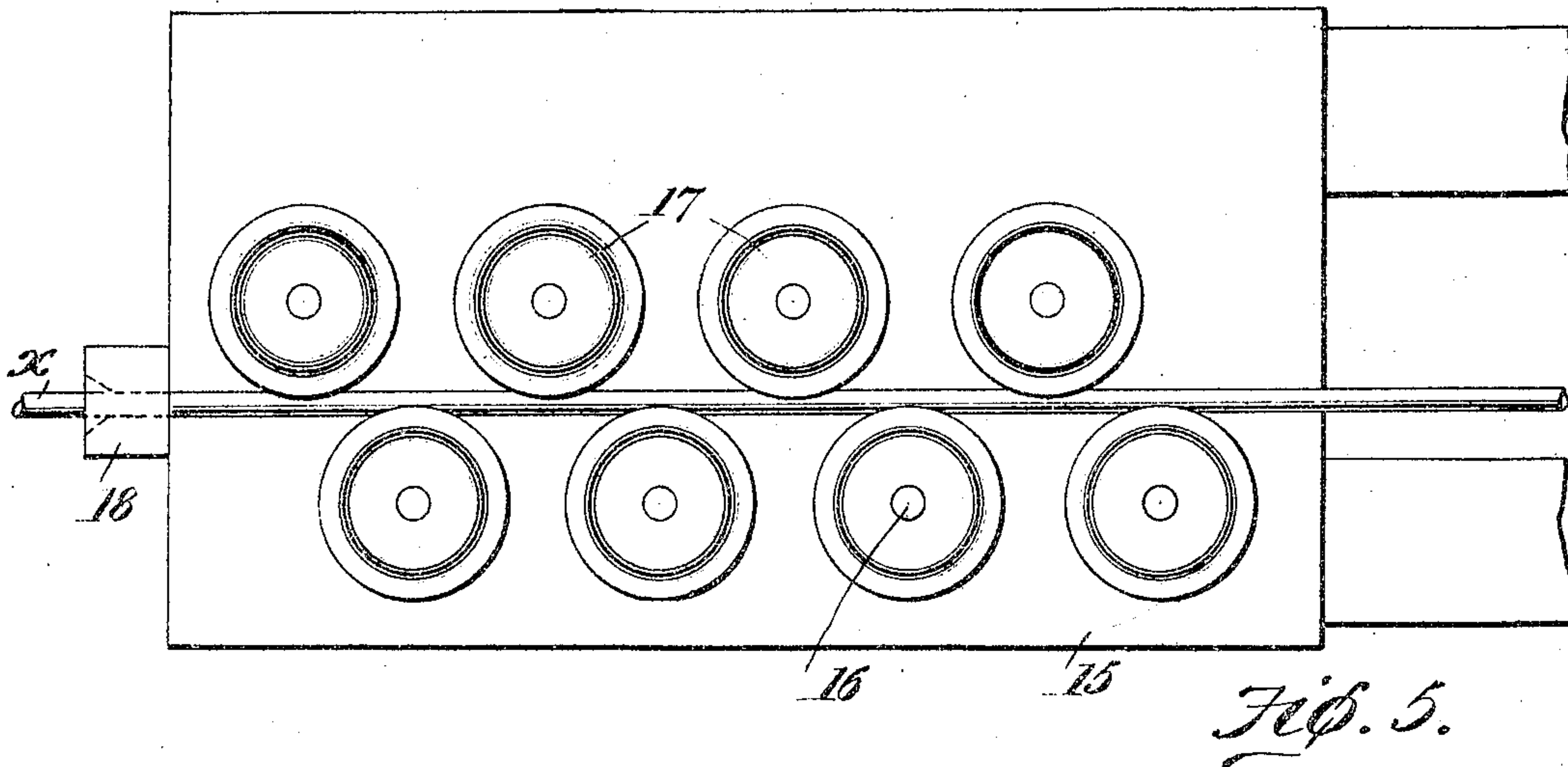


Fig. 5.

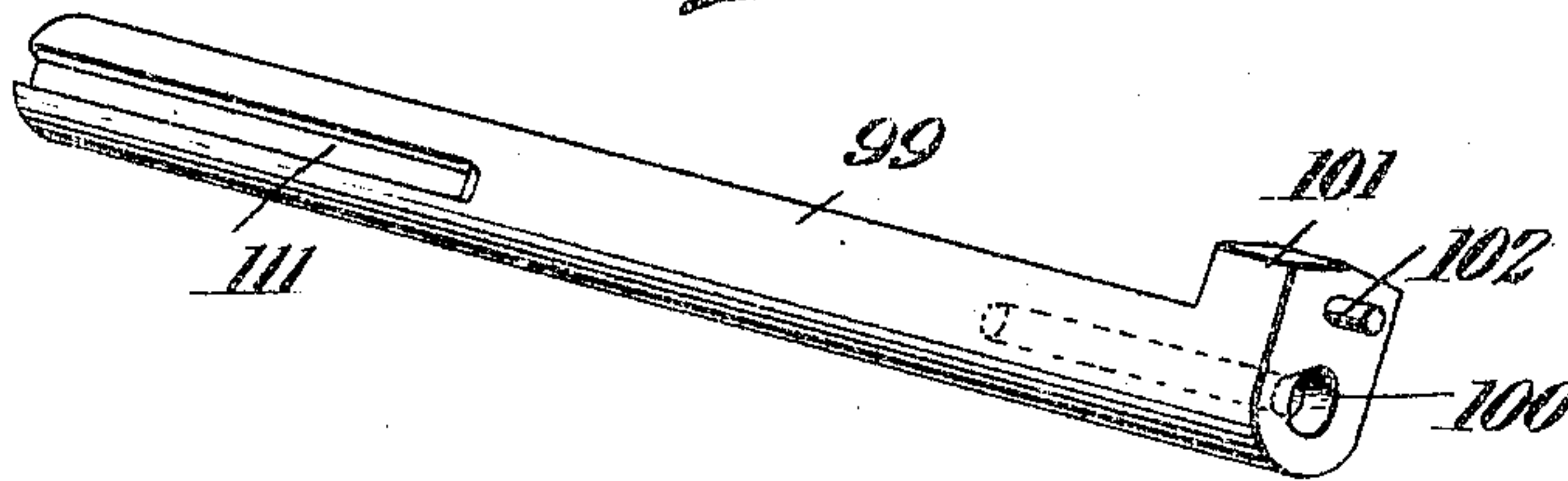


Fig. 7.

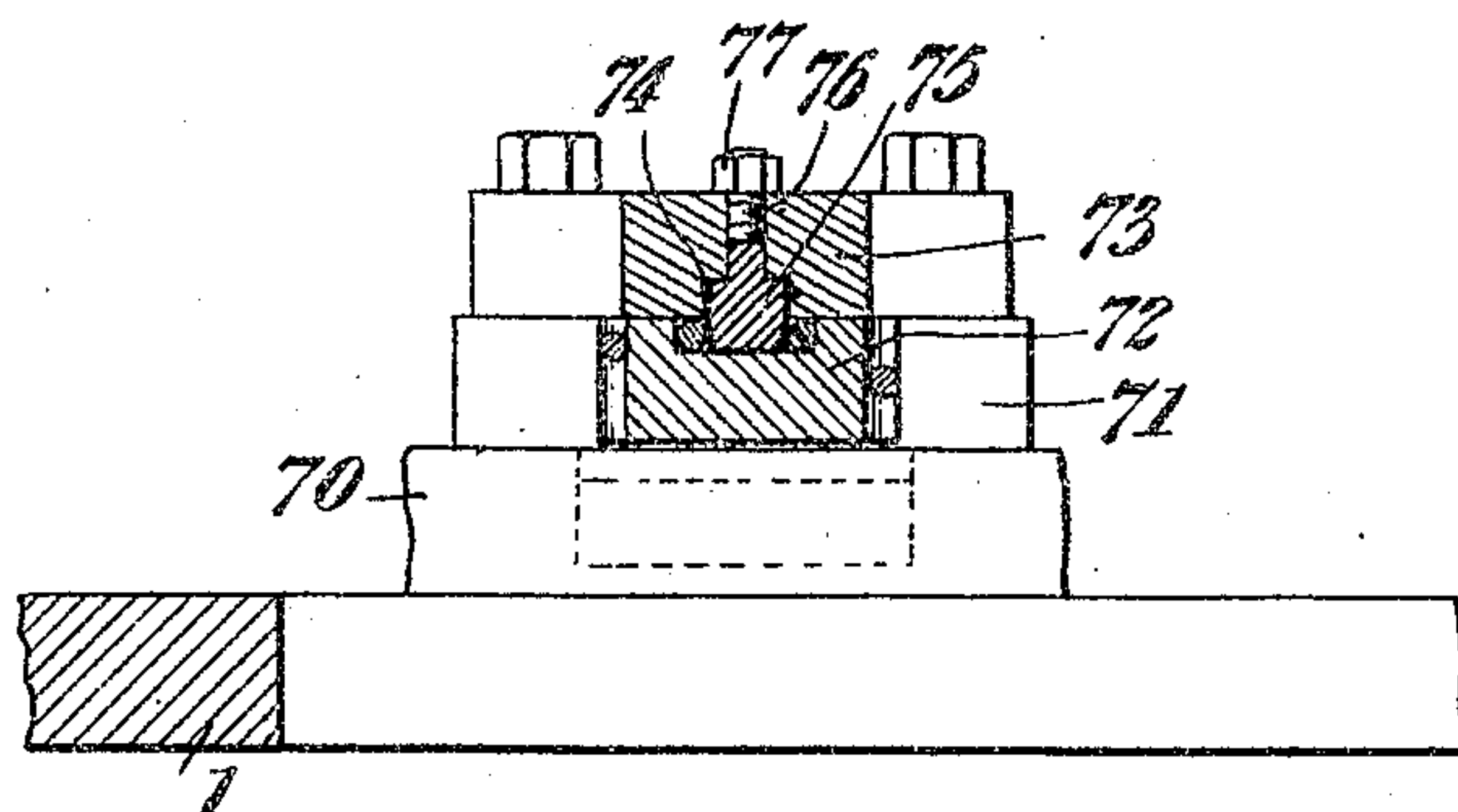


Fig. 6.

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6 SHEETS—SHEET 6.

Fig. 8.

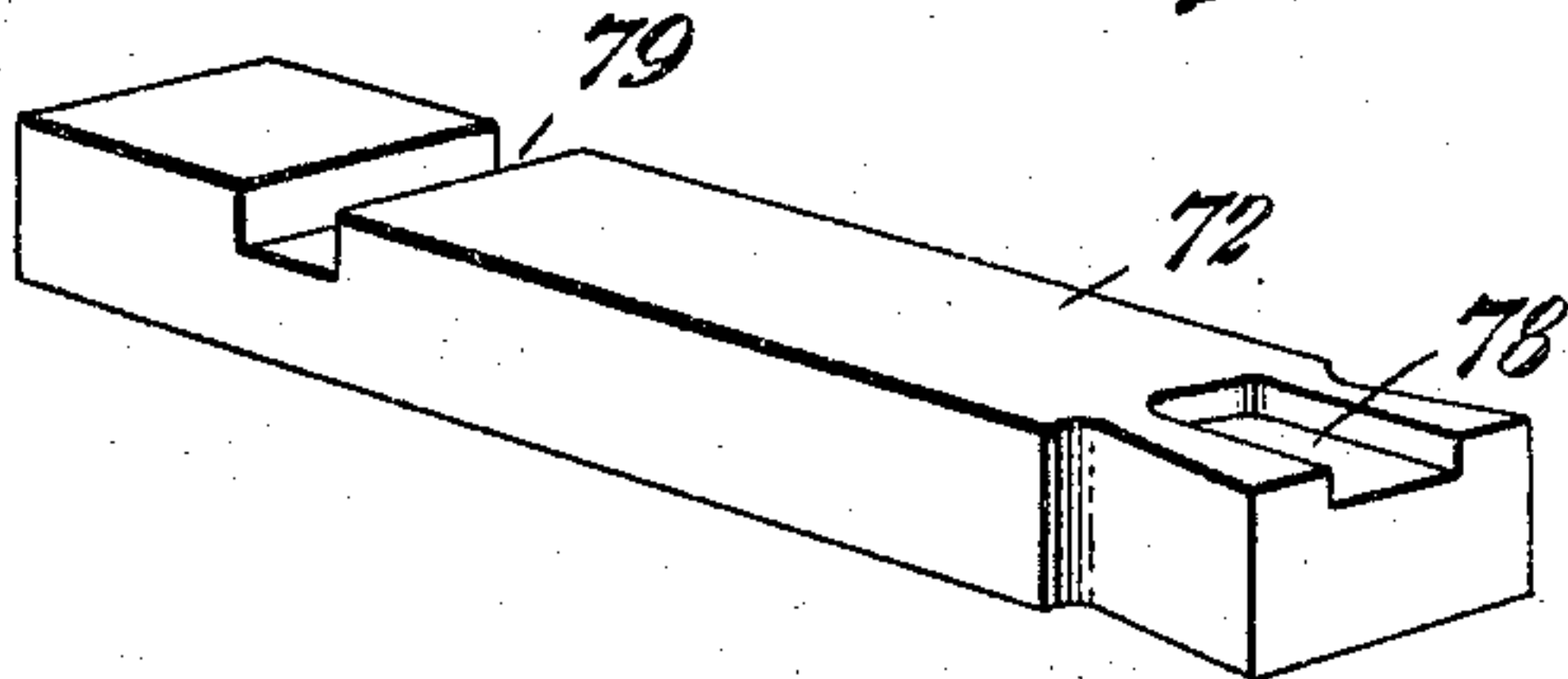


Fig. 9.

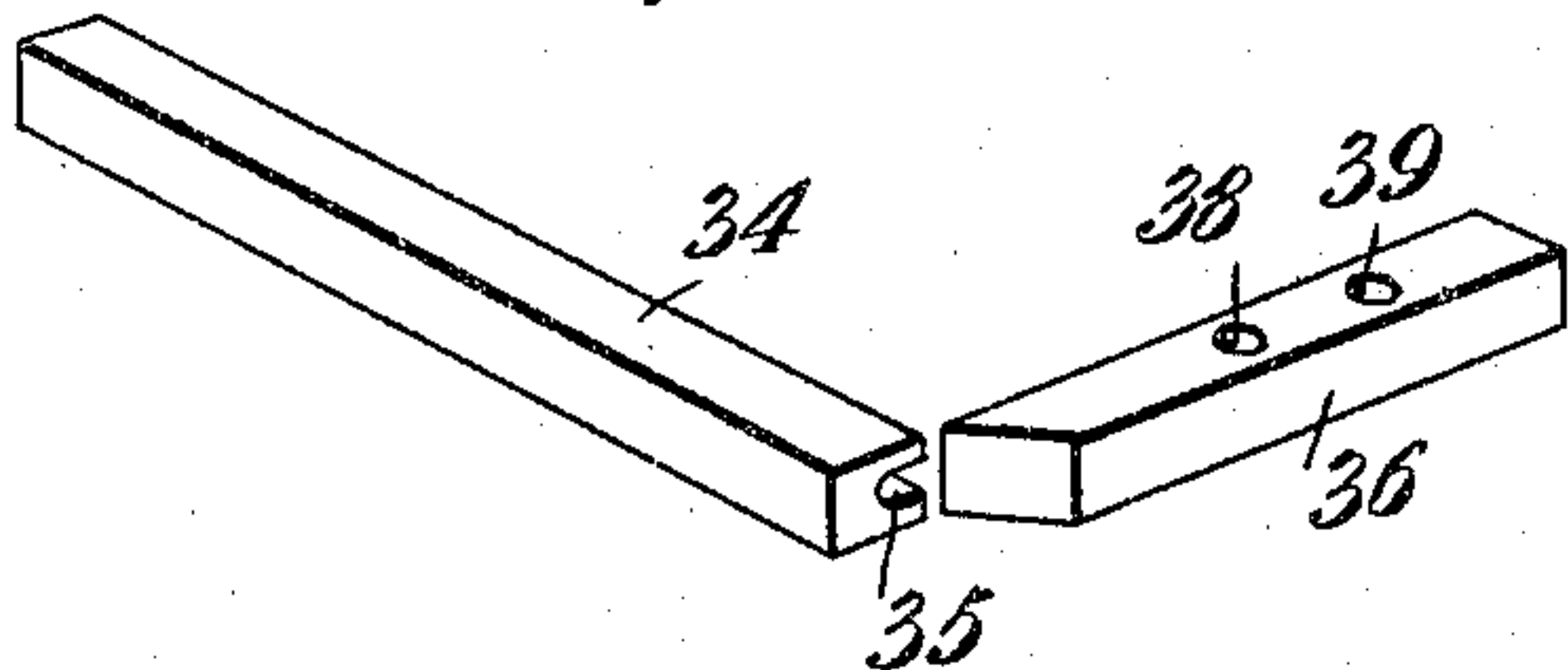


Fig. 10.

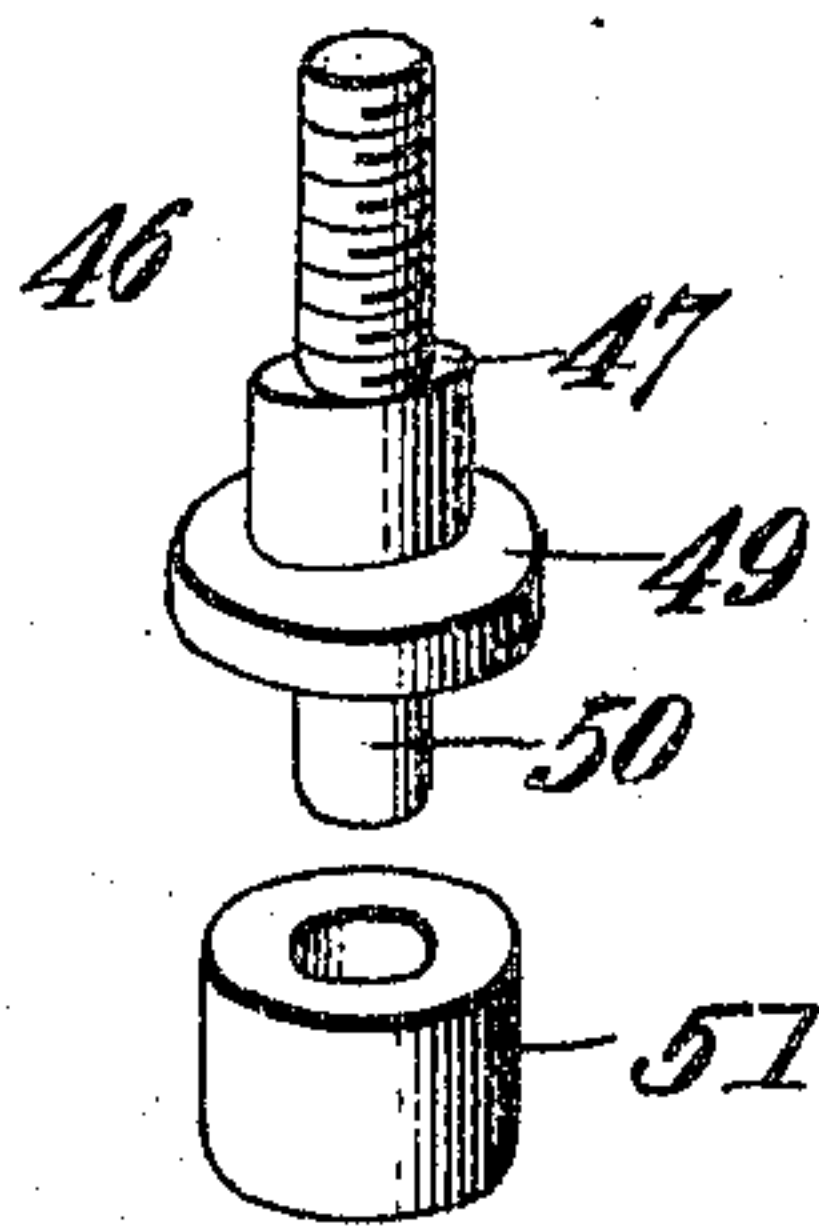


Fig. 11.

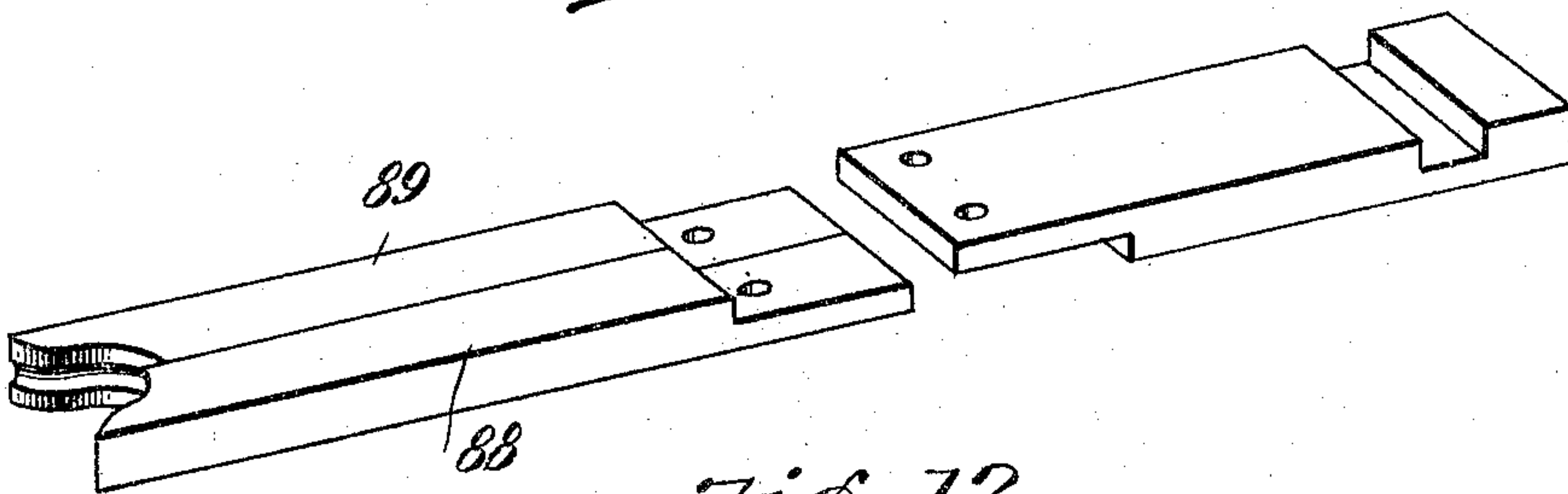
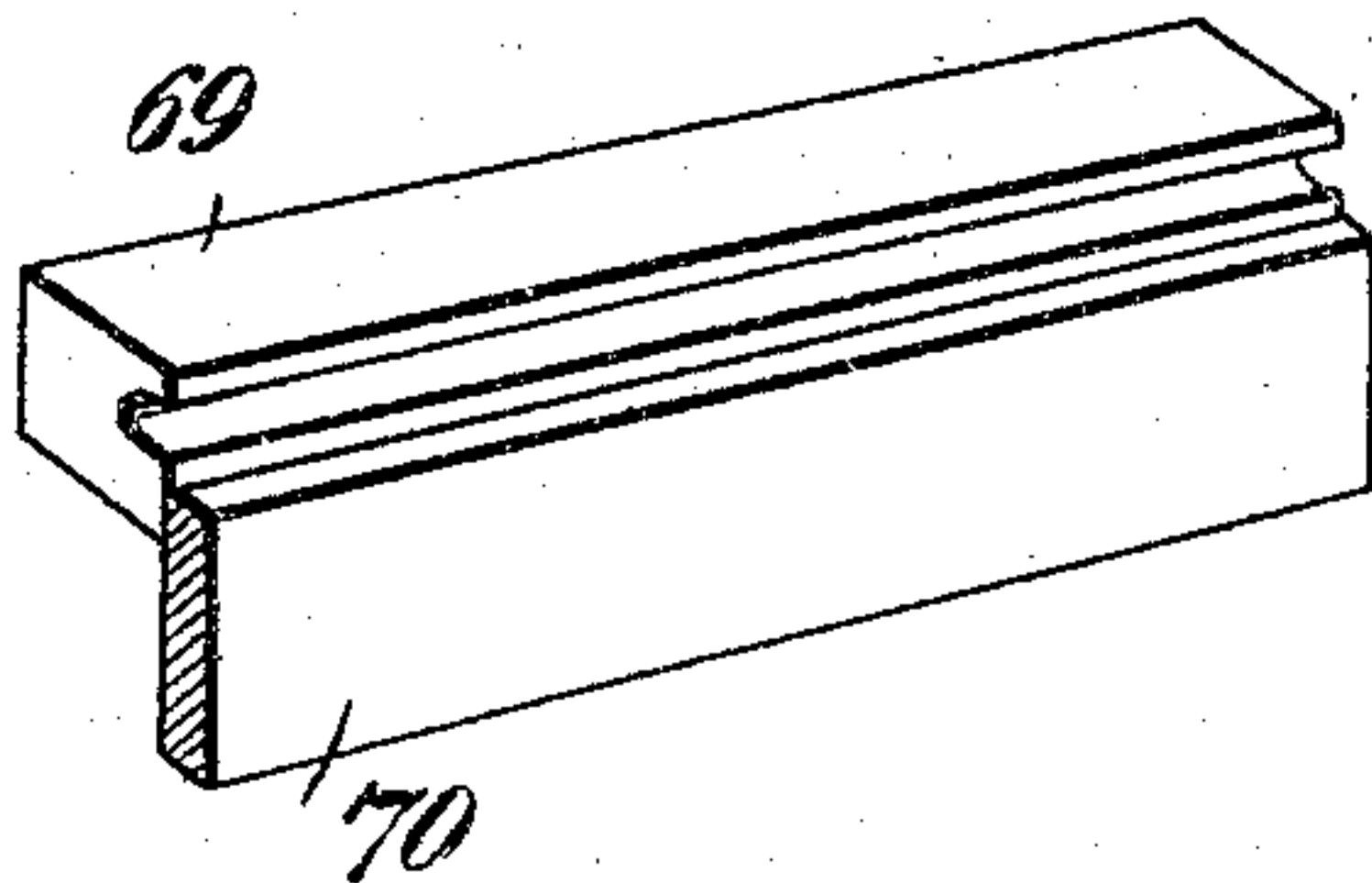


Fig. 12.



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UNITED STATES PATENT OFFICE.

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MACHINE FOR FORMING WIRE BALE-TIES.

SPECIFICATION forming part of Letters Patent No. 794,602, dated July 11, 1905.

Application filed March 3, 1904. Serial No. 196,423.

To all whom it may concern:

Be it known that I, EZRA A. FRANTZ, a citizen of the United States, residing at Weatherford, in the county of Parker and State of Texas, have invented a new and useful Machine for Forming Wire Bale-Ties, of which the following is a specification.

This invention relates to improvements in machines for forming bale-ties.

The principal object of the invention is to provide a novel form of machine into which wire may be fed from a reel, straightened and cut into lengths, and then bent automatically into the form of a tie.

A further object of the invention is to provide a machine of this character in which the parts are so arranged as to permit of the feeding and cutting of a section of wire during the formation of a tie from a previously-cut wire.

A still further object of the invention is to so arrange and construct all of the working parts as to permit accurate adjustment in case of wear.

A still further object of the invention is to provide a novel form of revoluble wire-feeder in which the feeder or feeders may be driven continuously and impart intermittent movement to the wire.

With these and other objects in view, as will more fully hereinafter appear, the invention consists in the novel construction and arrangement of parts hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportions, size, and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

In the accompanying drawings, Figure 1 is a plan view of a bale-tie-forming machine constructed in accordance with the invention. Fig. 2 is a front elevation of the same. Fig. 3 is a longitudinal sectional elevation of the machine on the line 3 3 of Fig. 1. Fig. 4 is a transverse sectional elevation of the machine on the line 4 4 of Fig. 1. Fig. 5 is a plan view of a portion of the mechanism

employed for the preliminary straightening of the wire before the bending operations. Fig. 6 is a transverse sectional elevation of a portion of the machine, drawn on an enlarged scale, illustrating the preliminary bending and clamping dies. Fig. 7 is a detail perspective view of one of the bending devices detached. Fig. 8 is a similar view of the preliminary forming and clamping dies. Fig. 9 is a similar view of the cutters. Fig. 10 is a detail perspective view of one of the adjustable connections between the several power-transmitting levers and the cam-actuated rollers which they carry. Fig. 11 is a similar view of a pair of bending-dies. Fig. 12 is a detail perspective view of a portion of the guides into which the wire is introduced preliminary to its introduction to the bending-dies. Figs. 13 to 18 are detail views illustrating the several steps of the bale-tie-forming operation.

Similar characters of reference are employed to indicate corresponding parts throughout the several figures of the drawings.

The several working parts of the machine are supported on a suitable bed-plate 1, having a plurality of legs or standards 2 and provided on three of its sides with bearing-blocks 3, which preferably are cast integral with the frame. The bed-plate proper may be formed integral with a part of the frame or may be secured thereto in any suitable manner.

On the several bearings 3 are supported shafts 4, 5, and 6, that are connected together by suitable bevel-gears 7, and all of the shafts revolve continuously and at the same speed. The shaft 4 is provided with a spur-gear 8, which intermeshes with a pinion 9 on a shaft 10, and the latter is provided with a belt-wheel 11, which may be driven from any suitable source of power, and the belt-wheel may be permanently secured to the shaft or may be provided with suitable clutching mechanism of any ordinary construction in order to start or stop the machine when necessary.

At one side of the machine is arranged a pair of brackets 14, which in part are supported by the shaft 6, and said brackets are

extended for some distance beyond the side of the machine and serve as supports for a plate 15, having a plurality of vertical spindles 16, on which are mounted sets of straightening-rollers 17, the rollers being all grooved to receive and hold the wire x , from which the bale-ties are to be made. The wire x passes through a guide 18 at the outer edge of the plate 15 and is drawn from a suitable reel through the series of rollers and straightened in the manner commonly practiced in the straightening of round bars or wires.

On the shaft 6 is secured a gear-wheel 19, which intermeshes with a gear 20, carried by a shaft 21, mounted in bearing-blocks 22, that are supported by the brackets 14. The brackets 14 are provided with overhanging arms 23, and through each arm passes a screw 24 for the support of the bearing-block, the block being further supported by a bolt 25, passing through a vertical groove in the bearing-block and entering a threaded opening in the bracket. The position of the bearing-block may be readily adjusted by means of the screw 26, and when so adjusted the locking-screws 24 and 25 are tightened in order to secure the block in adjusted position.

At one side of or secured to the gears 19 and 20 are grooved feeding-wheels 28, the grooves for the greater portion of the periphery of the wheels being of a width greater than the diameter of the wire to be fed, so that during the revoluble movement of these wheels no feeding movement will occur while the deeper and wider portions of the grooves are opposite the wire. One or both sides of each feeding-wheel is cut away to form a segmental slot for the reception of a segmental feeding-strip 30, which is provided with a groove of a diameter a trifle less than the diameter of the wire, and the length of each of these strips is a trifle greater than the length of the wire necessary to form a single bale-tie. The strips are secured in position by screws 31 and when worn may be readily renewed. The strips are arranged in such manner on the feeding-wheels as to contact in the feeding of the wire to the machine, and during the time they are in contact with the wire a sufficient length will be fed to form a single bale-tie; but, as before described, the feeding-wheels will be inactive during the remaining portion of the revolution and merely serve as guides for the wire. The wire is fed into the machine until it strikes the stop 32, secured to the bed-plate, being properly guided in the manner hereinafter described, and as the length of the strips 30 is just a trifle greater than the length of the wire necessary it follows that at each feeding movement a sufficient wire length will be fed into position.

On top of the bed-plate is secured a plate 33, that is grooved for the reception of a guiding-strip 34, and the latter has a wire-receiv-

ing groove 35, through which the strip passes. That end of the grooved strip 34 nearest the central portion of the machine forms a cutter which coacts with a reciprocatory cutter 36, adapted to a guideway formed in the plate 33, and as the strip 34 wears away from frictional contact with the wire it may be adjusted by means of one or more screws 37. The reciprocatory cutter 36 is provided with a pair of openings 38 and 39, and when the parts are primarily adjusted a pivot-pin 40 is placed in the opening 38 nearest the cutting edge. On this pin 40 is pivoted one end of a bar 41, the opposite end of which is secured to the shorter arm of a bell-crank lever 42, mounted on a stud 43, carried by the plate 33. The short arm of the bell-crank lever has an elongated slot 44, through which extends a locking-bolt 45 in order to lock the strip or bar 41 in any position to which it may be adjusted, and as the cutter wears away from contact with the wire and from resharpening the bolt-and-slot connection will permit its adjustment. After a time the cutter will be worn away to such an extent that the pivot-pin 40 may be placed in the rear opening 39, and partial adjustment may then be effected during gradual wearing away of the cutter, so that the greater portion of the length of the latter will be utilized. The longer arm of the bell-crank lever 42 is slotted for the reception of a stud 46. This stud has a substantially rectangular elongated portion 47, which fits within the slot in order to prevent turning movement of the stud, and at one end of said stud is a threaded portion adapted for the reception of a clamping-nut 48. Immediately below the extended portion 47 is a flange 49 for engagement with the under side of the bell-crank lever and which is clamped thereagainst when the nut is turned. From the flanged portion extends a pin 50, which receives an antifriction-roller 51, adapted to a cam-groove 52, formed in a revoluble cam 53, carried by the shaft 5. The construction of these parts is such as to permit of the most accurate adjustment in the case of wear, and this detail is followed in the construction of similar parts throughout the entire machine.

The central portion of the bed-plate is cut away for the passage of a vertically-movable slide 55, having edge ribs 56, that are received within the vertical grooves formed in brackets 57, secured to the under side of the bed-plate, and said slide receives vertical movement at suitable intervals from a cam 58, also secured on the shaft 5. The slide 55 is provided with a transverse slot 59 for the reception of a horizontally-slidable block 60, carrying a pivot-pin 61 for connection with one end of a lever 62 and is pivoted at a point intermediate of its length to a stud 63, carried by a lug 64 on the under side of the bed-plate. The rear end of the lever 62 is provided with an antifriction-roller 65, entering

a cam-groove 66 in the cam 58, the mounting of the antifriction-roller being similar to that of the roller carried by the bell-crank lever 42.

The upper portion of the slide 55 is cut away, as indicated at 67, for a purpose hereinafter described, and on top of the slide are rigidly secured a pair of guides 68 and 69, that are provided with edge grooves for the reception of the wire, and these guides are bolted to the slide so that they may be adjusted or renewed when worn away. The grooves are formed in the front edge of the guides, and in order to retain the wire in position during the cutting operation and during the bending of the previously-cut wire a strip 70 is employed. This strip is rigidly secured to a stationary portion of the machine and covers the front of the grooves when the slide is in its lowest position. The strip 70 lies close against the forward face of the slide 55 and closes the mouths of the two guides until the slide is raised to deliver the wire to the bale-tie-forming device, and each time the slotted faces of the guides are raised above the strip 70 the wire may be readily forced therefrom.

Secured to the bed-plate are two spaced blocks 71, forming a guide for a slidable bending-die 72, which effects the initial bending operation, and this die is held from displacement by the upper plate 73, that is secured to the blocks.

The plate 73 projects out over the slide 55 and is provided with an elongated slot 74 for the reception of an adjustable slide 75, which carries a bending-pin 76, which preferably is slightly tapered, its largest diameter being uppermost. The slide 75 permits of adjustment of the pin for wear, and when so adjusted it may be locked in position by a clamping-nut 77. In the forward end of the die is a recess 78 of a depth about equal to the diameter of the wire and of a width equal at least to twice the diameter of the wire plus the diameter of the pin 76. Near the rear end of the slidable guide 72 is a transverse slot or groove 79 for the reception of a block 80, to which is pivoted one arm of a bell-crank lever 81, that is fulcrumed on a stud 82, carried by the bed-plate, and the connection between the bell-crank lever and block 80 is similar to the connections previously described. The opposite arm of the bell-crank lever carries an antifriction-roller 83, adapted to a cam-groove 84 in the revoluble cam 58 of shaft 5, and at the proper time this cam will move the slidable die in such manner as to force the wire around the pin 76, the wire assuming the staple-like form indicated in Fig. 14. After the slide 55 has raised to move the wire up behind the pin 76 the die-slide 72 is moved forward and effects the preliminary bending operation, and immediately thereafter the slide 55 descends in position to receive another wire and to hold the same after being

cut in readiness to take the place of the wire being acted upon by the dies.

The wire which has been caught and bent between the pin 76 and slide 72 is retained in its position, and these parts remain stationary until the completion of the tie-forming operation.

Secured to the bed-plate of the machine and in part supported by a bracket 86 is a guide-way 87 for a pair of forming-dies 88 and 89, which while moving together perform different functions and operate successively in the formation of different bends in the wire. To the rear end of the dies is secured a block 90, and this block has a pivotal connection with one end of a bell-crank lever 91, that is mounted on a stud 92, carried by the bed-plate. The opposite arm of the bell-crank lever has an antifriction-roller 93 entering the cam-groove 94 in a cam 95 on the primary shaft 4. The connections of the opposite ends of the bell-crank lever 91 are adjustable in order to compensate for wear, as previously described.

The forward or active ends of the dies 88 and 89 have grooved faces for the reception of the wire and are of suitable shape for the work for which they are intended, and the cam-groove 94 is so shaped as to impart to the dies a double movement at each revolution of the cam—that is to say, each time the cam revolves it will move the dies in the direction of the tie being formed—and the first of these movements will be greater than the second. At the first or initial movement of the dies 88 and 89 the longer end of the wire is caught and bent, as indicated at *a* in Fig. 15, the die 88 being active, while the die 89 does not engage with the wire at this time.

At the central front portion of the bed-plate is secured a bearing 98 for a revoluble and longitudinally-movable shaft 99, at the inner end of which is formed an opening 100, of a diameter somewhat greater than that of the wire and adapted when moved inward to engage the smaller projecting arm *b* of the wire, being the shorter arm indicated in Fig. 14. The inner end of this shaft is provided with a projecting crank 101, carrying a pin 102 for engagement with the wire, and at the upper end of the shaft is rigidly secured a grooved collar 103 for the reception of the bifurcated end of an arm 104, that is adjustably secured to a lever 105, pivoted at a point intermediate of its length to a stud 106. This stud 106 is carried by a lug 107, projecting from the front of the frame. The opposite or outer end of the lever 105 is provided with an antifriction-roller 108, which enters a cam-groove 109, formed in a revoluble cam 110, carried by the shaft 6, the cam-groove being of such contour as to force the shaft inward in the direction of the bale-tie being formed until the arm *b* of the then staple-like wire is engaged in the opening 100, and to facilitate its en-

trance the mouth of the opening is preferably tapered or counterbored.

The shaft 99 is provided with a keyway 111 for the reception of a key by which the pinion 112 is held to and revolves with the shaft, while permitting independent longitudinal movement of said shaft. The pinion is held from movement by a bifurcated bracket 113, that is secured to the front of the frame. Projecting from the front of the frame is a stud 114, on which is pivoted a lever 115, carrying at one end a segment 116, which intermeshes with the pinion 112, and at the opposite end of said lever is an antifriction-roller 117, which enters a cam-groove 118, formed in the gear 8, that is rigidly secured to the primary shaft 4. In the operation of this particular portion of the mechanism, it being understood that the process of forming the bale-tie has been completed to the point shown in Fig. 15, the cam 110 advances the shaft 99 in the direction of its length until the shorter end of the wire enters the opening 100 and the pin 102 is immediately over the top of the arm *a*. The cam 119 then acts and through the arm 115 and segment 116 serves to rotate the pinion 112 and the shaft until the pin 102 winds one end of the arm *a* around the opposite arm and the partly-completed bale-tie is of the construction shown in Fig. 16, the wire being turned once around itself and being supported for this operation partly by the wall of the opening 100 and partly by the die 78 and pin 76. Secured to the bed-plate is a pair of guides 132 for the reception of a die 133, that is connected to one end of a lever 134, pivoted on a stud 135, carried by the bed-plate. The opposite arm of the lever carries an antifriction-roller 136, fitting within the cam-groove 137 of a cam 138, carried by the shaft 6. During the stationary movement of the cam-groove 94 and while the two dies 88 and 89 are advancing in the direction of the bale-tie being formed the cam 138 becomes active and the die 133 will be forced into engagement with the arm *b'* of the bale-tie and force the latter around to the finished position shown in Fig. 18, the end of the arm being forced into engagement with the side of the die 72 and this side of the die being cut away in the same manner as the opposite side with which the arm *a'* of the bale-tie engages. The movement of the two finishing-dies 89 and 113 is practically simultaneous, and as the latter are moving backward the operation is completed and it only remains to remove the finished bale-tie from the dies. Movement is then imparted by the secondary operation of the cam-groove 94 to the lever 91, and the dies 88 and 89 are again adjusted in the direction of the wire; but the movement at this time is of considerable less extent than the first movement, and the die 88 is inactive while the die 89 engages the arm *a* of the wire and bends the same around the end of the die 72 to the

completed position, and in order to permit the entrance of this portion of the wire the side wall of the die member is slightly inclined, as is shown in the detail perspective view of Fig. 7, and thus does not offer a straight solid wall to resist the bending movement of the wire, as otherwise the outer arm of the die would not be parallel with the remaining arms. To the fixed bed-plate of the machine is secured a dependent bracket 122, carrying a stud 123, on which is pivoted a bell-crank lever 124, the lower and approximately horizontal arm of which has an adjustable connection with a lever 125, pivoted on a stud 126, carried by the main frame. The outer end of the lever 125 has an antifriction-roller 127 engaging in a cam-groove 128 in the cam 95, and this cam acts at the proper time to elevate the approximately horizontal arm of the bell-crank lever and to force its vertical, or approximately vertical, arm 130 across the front of the die 72, and thus move the arm *b* of the wire to the position indicated at *b'* in Fig. 17.

To strip the finished bale-tie, the cam 58 operates through the lever 81 on the slide 72 and withdraws the die-face 78 from engagement with the bale-tie, the latter being held from rearward movement by means of the pin 76. To the rigid plate 73 is secured a bracket 140, to which is pivoted a stripper-arm 141, having a pair of dependent fingers 142 and 143, the finger 142 passing out through a suitable opening in the rigid plate 73 for engagement with the inner face of the bale-tie, while the finger 143 passes down in front of the plate for engagement with the outer portion of said bale-tie. The outer end of the lever 141 is provided with an antifriction-roller 144, entering a cam-groove 145 in a cam 146, secured to the shaft 5, and at the proper time this cam acts to raise the outer end of the stripper and force its inner end downward until its fingers 142 and 143 force the finished bale-tie from the pin 76. This completes the operation, and the slide 55, having received a fresh length of wire, may be again raised to present the wire to the rear of the pin 76.

The operation in brief is as follows: The wire from the reel passes between the two grooved feeding-wheels 28, and when the grooved segments 30 engage therewith a length of wire sufficient to form a bale-tie is fed forward to the groove 35 of the strip 34 and the guides 68 and 69 until the end of the wire abuts against the stop 32. The cutter then acts to sever the wire at the end of the guiding-strip 34. The slide 55 at this time is in its lowest position, and the wire is retained in the groove by means of the fixed strip 70. The slide 55 is now raised until an intermediate portion of the wire is introduced behind the pin 76, after which the die 72 is moved forward until the die-face 78 engages and bends the wire to the staple-like form illustrated in Fig. 14, the die 72 then remaining stationary

until the completion of the forming operation. After this is accomplished the dies 88 and 89 are advanced; but the die 88 acts alone and guides the arm *a* to the position indicated in Fig. 15. On the retreat of the die 88 the shaft 99 is advanced until the arm *b* of the wire is received in the opening 100, after which the shaft is turned until its pin 102 turns the wire around to the position shown in Fig. 16. The shaft then moves back toward its initial position, and the bell-crank lever 124 is operated to force the bending-arm 130 of the lever into engagement with the arm *b* of the wire and bend the same to the position shown at *b'* in Fig. 17. The bell-crank lever having been restored to its initial position, or nearly so, the two dies 89 and 133 bend the arms *a'* and *b'* to the finished position shown in Fig. 18. After this bending operation the die 72 is moved back and the stripper-fingers act to force the finished bale-tie from the pin 76 and through a suitable opening in the bed-plate to a suitable receptacle.

Having thus described the invention, what is claimed is—

1. The combination with forming-dies, of a guide for receiving lengths of the material to be operated upon, said guide being disposed adjacent to the dies, means for feeding the material to such guides, means for severing the material into suitable lengths while in the guide and during the operation of the forming-dies, and means for moving the guide to present the severed strips to said forming-die.
2. The combination in a wire-bending machine, of bending-dies, a grooved guide for the wire, a reciprocatory cutter coöperating with said grooved guide to sever the wire into lengths, a grooved slide for receiving the wire prior to the severing operation, and means for moving said slide to deliver the severed lengths of wire to the dies.
3. The combination in a wire-bending machine, of forming-dies including a pair of integral die members, means for moving one of said die members with respect to the other to clamp the wire and hold the same during the entire forming process, said dies forming a rigid support for the wire, a longitudinally-movable spindle having an axial opening for the reception of a projecting end of the wire, a crank carried by the spindle, a pin or lug projecting from the crank for engagement with the wire, a pinion feathered to the shaft to permit independent longitudinal movement of the latter, a segment intermeshing with the pinion, a cam for operating the segment, and a cam for longitudinally reciprocating the spindle.
4. In a wire-bending machine, a pin or lug forming an anvil, a reciprocatory die for engaging and bending the wire upon said pin, and auxiliary die members coöperating separately and successively with the pin and die for subsequent bending operations.

5. In a wire-bending machine, a pin or lug forming an anvil, a reciprocatory die for engaging and bending the wire around the pin, and auxiliary die members coöperating with the pin for effecting subsequent bending of the wire.

6. The combination in a wire-bending machine, of a pin or anvil, a reciprocatory die co-operating therewith and serving in connection with the pin as a rigid clamp or support for the wire during subsequent bending operations, and auxiliary die members coöperating with both the pin and reciprocatory die for effecting subsequent bending of the wire.

7. The combination with a wire-bending machine, of bending-dies, a grooved wire-guide open at one side, means for reciprocating the guide to deliver the wire to the bending-dies, and a stationary covering strip or plate for closing the groove during the insertion of the wire therein.

8. The combination in a wire-bending machine, of bending-dies, a grooved guide, means for moving said guide to deliver lengths of wire to the bending-dies, the guide being provided with an opening or recess at a point intermediate of its length to permit the passage of the dies, and a stationary strip or plate for closing the groove during the insertion of the wire therein.

9. The combination with a wire-bending machine, of an adjustable grooved strip forming a wire-guide, a reciprocatory cutter-block co-acting therewith to sever the wire into lengths, said block being provided with a plurality of connecting means which are successively brought to operative position as the block wears away.

10. The combination with a wire-bending machine, of a pin or lug, an initial bending-die coöperating therewith, and a pair of reciprocatory dies movable together and co-acting at the first movement with the pin or lug, and at the second movement with the initial bending-die.

11. The combination in a wire-bending machine, of a wire-clamping means, and a pair of movable die members operable successively and movable simultaneously through different distances at alternate operations.

12. The combination in a wire-bending machine, of a relatively stationary pin or lug, a movable die for bending the wire to staple-like form, a die for bending one of the arms of the staple over the other, a coiler for receiving the unbent arm and coiling the bent arm around it, a die for bending the second arm, and a pair of simultaneously-operating die members for bending both arms parallel with the original lines of said arms and completing the operation.

13. In a wire-bending machine, a relatively stationary pin or lug, a movable die member for effecting the initial bend of the wire, a pair of slidable dies connected for mutual move-

ment, means for moving said dies to cause operative engagement of one of them with the wire, and the bending of such wire with the pin or lug as an anvil, and means for effecting
5 the second and shorter movement of the dies to bring the second of said dies in operative engagement with the wire, the initial bending-die acting as an anvil during such second movement.

10 14. The combination with a plurality of bending-dies including a pin or anvil, of a

stripper having a pair of fingers adapted to engage the finished article on opposite sides of the anvil and strip the same therefrom.

In testimony that I claim the foregoing as 15 my own I have hereto affixed my signature in the presence of two witnesses.

EZRA A. FRANTZ.

Witnesses:

IRA B. TAYLOR,

EUGENE B. FERRELL.