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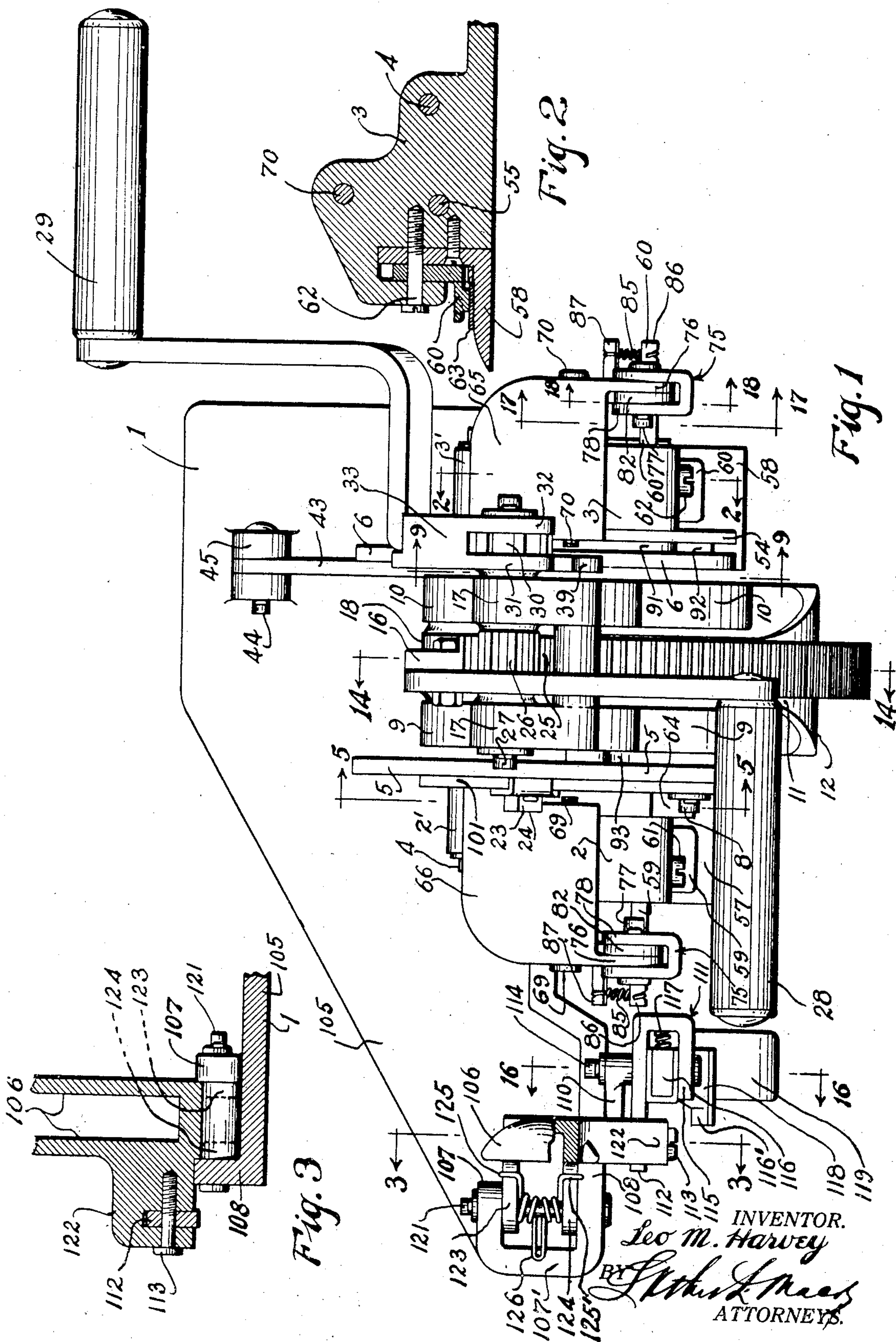
L. M. HARVEY

1,897,650

STRAP TYING MACHINE

Filed Dec. 7, 1929

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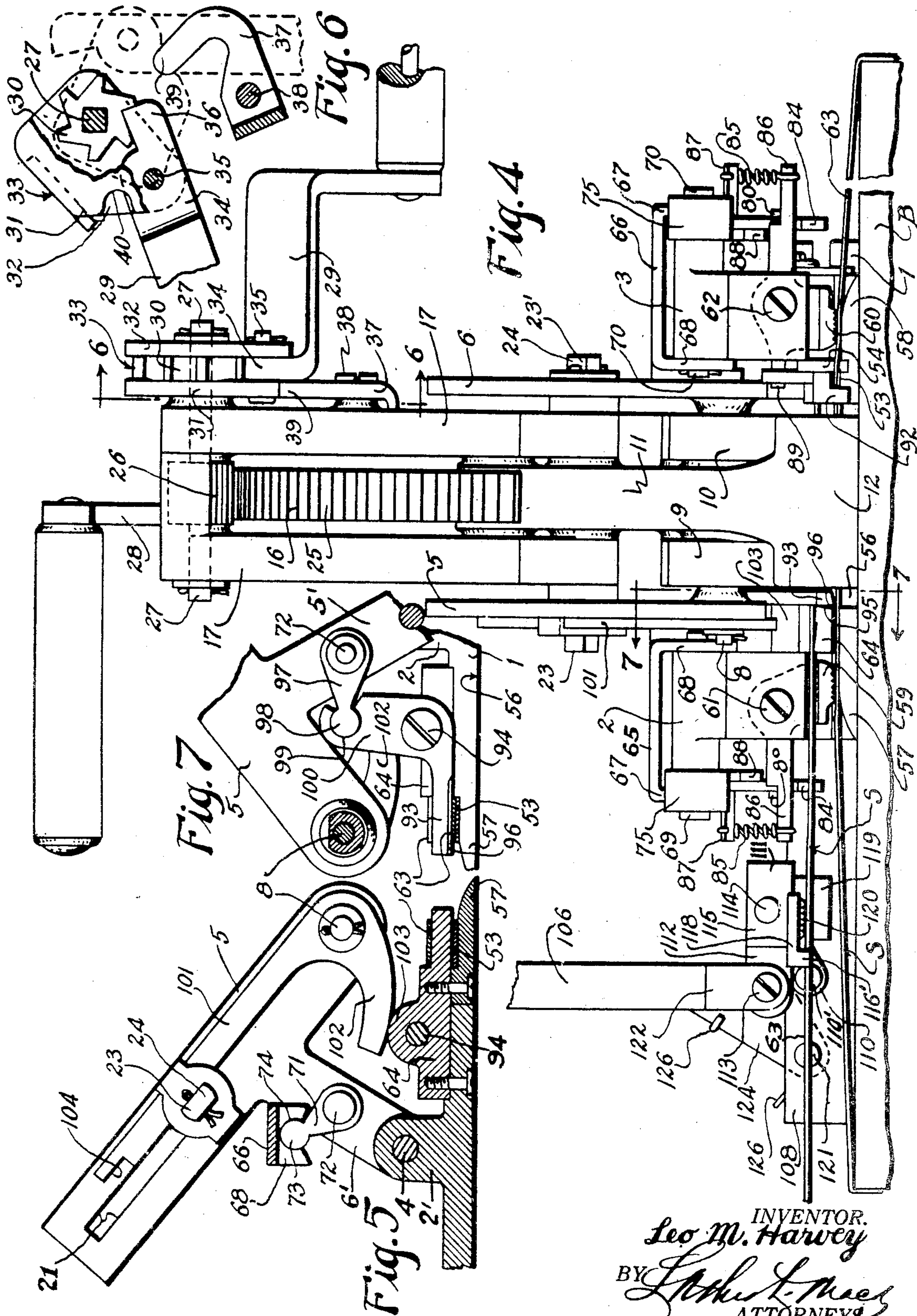
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4 Sheets--Sheet 2



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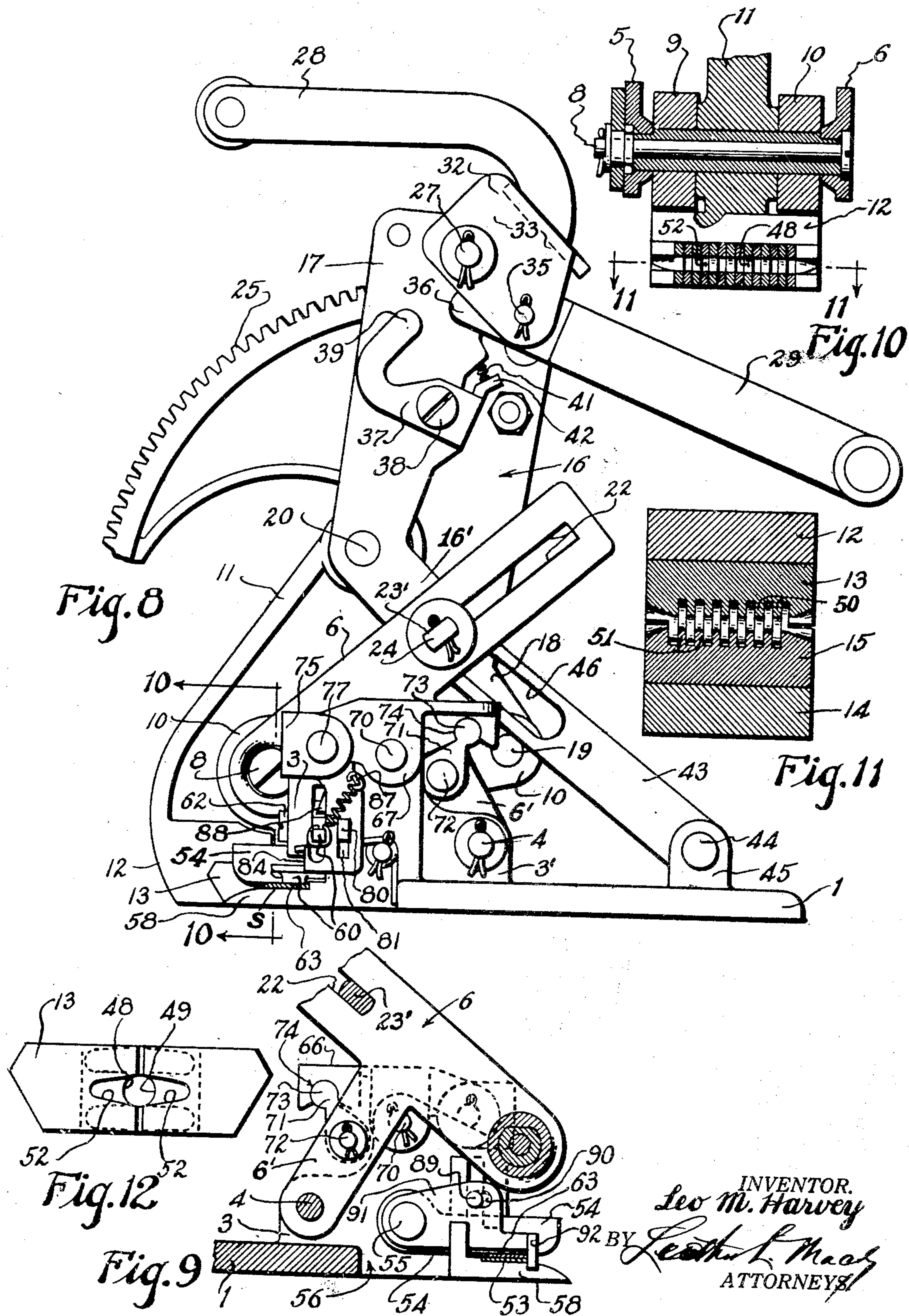
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STRAP TYING MACHINE

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4 Sheets-Sheet 3



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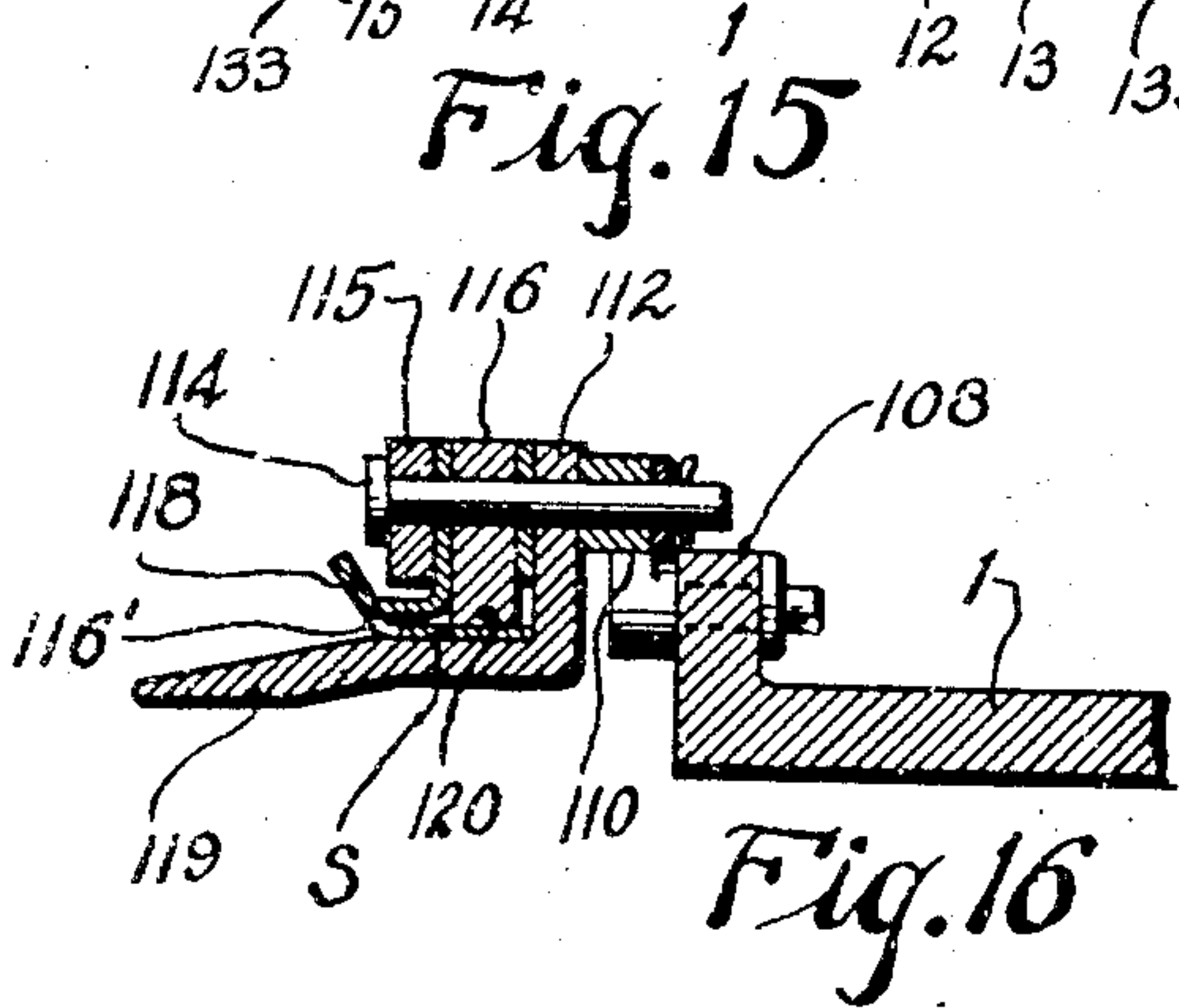
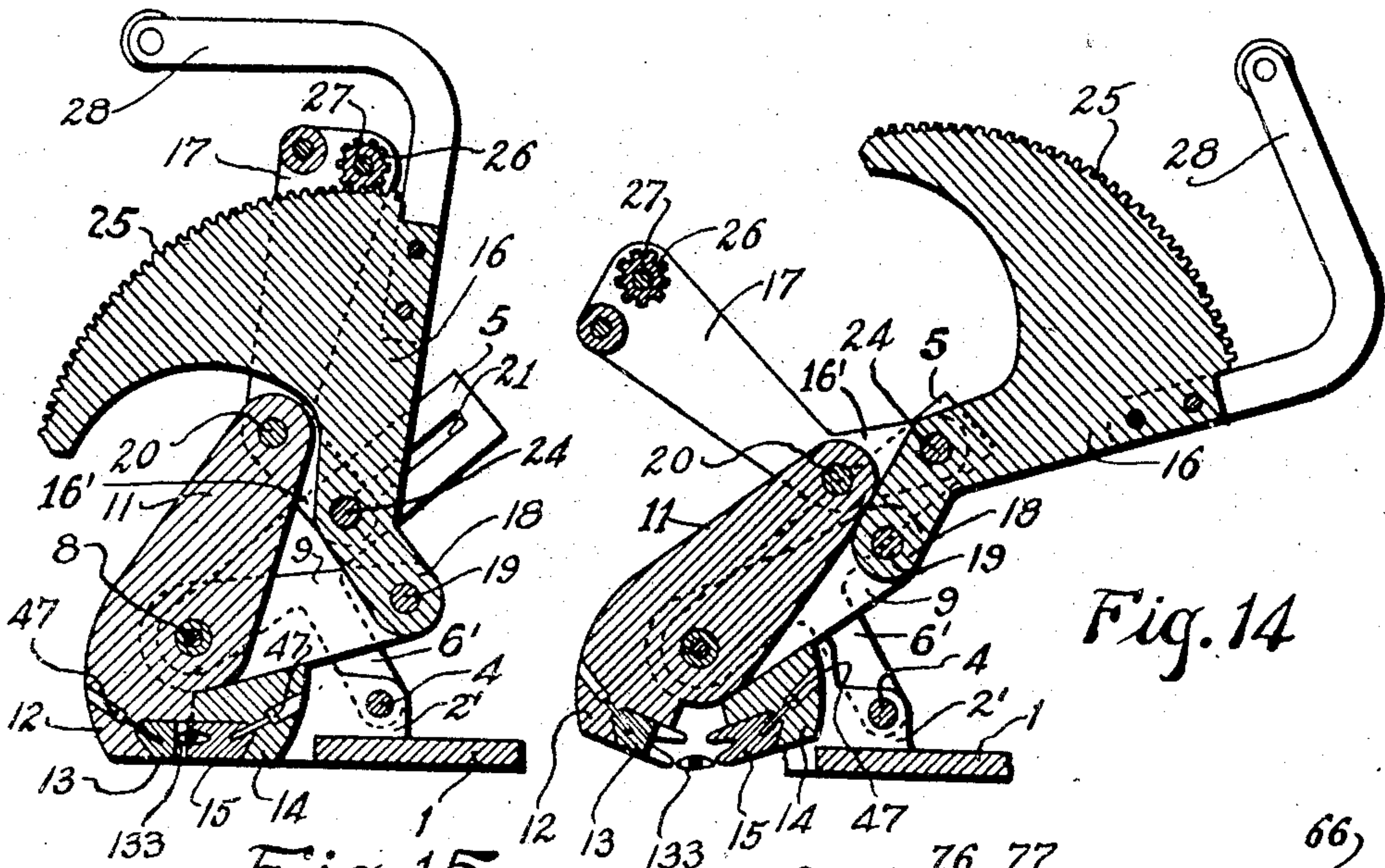
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STRAP TYING MACHINE

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UNITED STATES PATENT OFFICE

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STRAP TYING MACHINE

Application filed December 7, 1929. Serial No. 412,457.

This invention relates to and has for a principal object the provision of a box strap-
 5 ing machine embodying a tie forming mechanism whereby the overlapped ends of binding straps for boxes, bales, crates, and the like, may be rolled and crimped so as to form inter-locking portions whereby the overlapped ends of the binding straps will be tightly formed and held together and prevented from pulling apart under ordinary
 10 usage.

An object is to provide a simple and economical machine of light weight capable of being placed upon a box, bale, crate, or the like, and arranged so that the ends of a binding strap when extended around the box or the like may be gripped in the machine, tensioned, and thereafter tied for forming a permanent inter-locked joint.

Another object is to provide a strap tying mechanism which is capable of easy operation by manual effort when only a minimum of power is required, together with means consisting of a pinion and sector, capable of being instantly meshed for applying a substantially greater and necessary amount of power for effecting and completing the tying operation.

A further object is to provide in combination with the tying or forming means for the overlapped portions of the strap, and on opposite sides thereof, a pair of grippers and trigger-like actuating means therefor arranged so that prior to the insertion of a strap in the machine the triggers will project into the plane of the strap. Thus, as the overlapped portions of the strap are inserted, edgewise, into tying position, the inner edges of the strap portions will engage the forward edges of the triggers and cause the grippers which are associated therewith to drop into and remain in operative engagement with the strap portions until the completion of the tying or forming operation. Thereafter, when the forming jaws are retracted from operative engagement with the strap, the grippers are retracted from engagement with the strap, and the triggers are automatically set, or cocked, preparatory to another forming operation.

Still another object is to provide in a strap tying machine, in combination with the tying or forming means, a tensioning mechanism arranged to tension the strap around a box or the like, in a step-by-step movement by direct action on the strap itself.

Other objects may appear as the description progresses.

In the accompanying drawings I have shown a preferred embodiment of my invention with certain modifications and subject to further modification within the scope of the appended claims without departing from the spirit of my invention. In said drawings,

Fig. 1 is a top plan view of the assembled machine embodying an automatic tensioning mechanism.

Fig. 2 is a transverse section of the same on line 2—2 of Fig. 1.

Fig. 3 is a longitudinal section of the machine on line 3—3 of Fig. 1.

Fig. 4 is a front elevation of the machine positioned upon the top of a box, bale, crate, or the like.

Fig. 5 is a sectional elevation of the same on line 5—5 of Fig. 1.

Fig. 6 is a detailed view of a ratchet mechanism as seen on line 6—6 of Fig. 4.

Fig. 7 is a sectional elevation on line 7—7 of Fig. 4.

Fig. 8 is a right hand end elevation of the machine as seen in Fig. 1.

Fig. 9 is a transverse sectional elevation of the same on line 9—9 of Fig. 1.

Fig. 10 is a sectional elevation thru the tie forming jaws on line 10—10 of Fig. 8.

Fig. 11 is a sectional plan of the jaws on line 11—11 of Fig. 10.

Fig. 12 is an end view of the tie forming jaws.

Fig. 13 is a reduced end elevation of the machine in completely opened position prior to the insertion of the binding straps and tensioning the same in the machine.

Fig. 14 is a sectional elevation of the machine on line 14—14 of Fig. 1, showing the tie forming jaws still open but with certain of the machine elements operative to an initial extent in a tie forming operation.

Fig. 15 is a sectional elevation similar to

Fig. 14 except that the tie forming jaws are in closed position.

Fig. 16 is a transverse section on line 16—16 of Fig. 1.

5 Figs. 17 and 18 are, respectively, transverse sections on lines 17—17 and 18—18 of Fig. 1.

10 Figs. 19 and 20 are, respectively, transverse views in different forms of rolls or shapes assumed by the metal bands in one of the tie forming operations effected by means of my machine.

Briefly described, my invention embodies a tie forming mechanism for metal bands adapted to be applied to boxes, bales, crates, and the like, and includes a base on which is mounted spaced gripping devices for gripping the overlapped portions of a metal strap, means for tensioning the strap around a box or the like in a step-by-step movement when the strap is tightly held against reverse movement and lateral displacement from tensioning position, means operable thereafter for cutting off a necessary length of metal strap from a roll, and means thereafter operable for deforming the overlapped end portions of a metal strap longitudinally and for transversely crimping and interlocking said portions to prevent their pulling apart when the machine is detached.

As the machine is generally arranged, I provide a portable flat base 1 which is adapted to rest upon a box, bale, crate, or the like B, and which is provided with longitudinally spaced upright bearing lugs 2 and 3 having rearward extensions 2' and 3', respectively. A pin or shaft 4 is held in the portions 2' and 3' of said lugs and serves as a main axis for the device. A pair of plates 5 and 6 are provided with downwardly extended arms 5' and 6', respectively, which are pivotally held on said shaft adjacent the lugs 2 and 3, as shown in Fig. 9. The forward portions of plates 5 and 6 are connected by means of a bolt 8 which also extends thru a pair of arms 9 and 10 of a forming member 14 and thru an arm 11 of an associated forming member 12 intermediate said arms 9 and 10. The member 12 removably carries a forming die 13, as shown in Figs. 8 and 12, and is of itself movable about the axis of the bolt 8, and is additionally movable together with member 14 about the axis of shaft 4. Member 14 carries a tie forming die 15 which mates with the die 13 on member 12. Thus the two dies 13 and 15 are movable relative to each other about the axis of bolt 8 and are together movable about the axis of shaft 4 with plates 5 and 6.

60 The jaw members are toggle connected with a pair of operating levers 16 and 17 in the following manner: The arms 9 and 10 of jaw member 14 are pivotally connected to opposite sides of a central extension 18 from the lever 16 by means of a pin or bolt 19,

while the arm 11 of the jaw member 12 is pivotally connected to the lever 17 by means of a pin or bolt 20. This construction is clearly shown in Figs. 14 and 15.

The frame members 5 and 6 are rearwardly inclined and elongated and have elongated slots 21 and 22, respectively, therein adapted to receive the flattened ends 23 and 23' respectively of a pin 24, which is carried in the lever 16 and extends through the short arms 16', 16' of lever 17. The connection between the jaw members 12 and 14 and the levers 16 and 17 provides a toggle which operates to open and close the jaws when the levers 16 and 17 are operated in reverse directions.

The lever 16 is provided with a sector 25 of substantial radius which is formed concentric with the axis of shaft 24 and is periodically engaged by a pinion 26 carried on a shaft 27 in the lever 17. Said lever 17 is bifurcated so that the lever 16 and the jaw member 12 are intermediate the furcations of said lever. The pin 24 serves as a hinge for the levers 16 and 17 and is guided in the slots 21 and 22 of the frame members 5 and 6 as shown in Figs. 8 and 13. It will be observed that sector 25 of the lever 16 may be rocked on the pin 24 to a position beyond and substantially out of engagement with the pinion 26. The three pins 19, 20 and 24 provide the axes for the toggle connected jaws and levers.

The sector 25 is operated by means of a handle 28 which is attached by suitable means to the lever 16, as shown in Fig. 13, for instance. I provide ratchet means such as is shown in Fig. 6 for operably connecting a handle 29 with the pinion 26 in order that the pinion may rotate in a clockwise direction when meshed with sector 25, as seen in Fig. 15, for moving lever 16 forwardly, or freely in a reverse direction when the sector is retracted rearwardly and the handle 29 is disconnected therefrom. To this end a ratchet wheel 30 is fixed to one of the ends of the pinion shaft 27 and said ratchet is mounted between the spaced sides 31 and 32 of a fixture 33 which is loosely mounted to swing on the pinion shaft 27. The handle 29 is provided with an upturned end portion 34 which is mounted between the sides 31 and 32 of the fixture 33 on a pin 35, and said handle has an extension 36 on its upper end forming a pawl for engagement with the ratchet. As shown in Fig. 13, when the machine is at rest the handle 29 is so arranged that when the machine is in extremely opened position and the pinion 26 is disengaged from the sector 25 the pawl 36 on the handle will be disengaged from the ratchet 30, thus permitting the free rotation of the pinion when the sector is moved into engagement therewith, said pawl being held inoperative by gravity.

One side of the lever 17 is provided with a

detent 37 which is pivotally mounted on a screw 38 attached to the lever 17 and has a hook-like portion 39 extending upwardly into engagement with a recess 40 on the inner side 31 of fixture 33. Thus, when the handle 29 occupies the position shown in Fig. 13, the handle is prevented from counter-clockwise rotation and pinion 26 is free to rotate independently of the handle.

The detent is yieldably held in position by means of a spring 41 which compresses between a lug 42 on the detent and a portion of the lever 17, as shown in Fig. 8, so that the movement of the handle in a clockwise direction will disengage the fixture 33 from said detent.

The movement of the levers 16 and 17 together forwardly and backwardly on the axis 4 is limited by means of a link 43 which is pivoted at 44 to a lug 45 on the base 1. Said link 43 has an elongated slot 46 thru which an end of the pin 24 is extended. Thus, the engagement of the pin 24 with the upper end of slot 46 limits the forward movement of the levers, and the engagement of said pin with the lower end of said slot limits the rearward movements thereof. The forming dies 13 and 15 are preferably detachable from the members 12 and 14 respectively. To this end suitable grooves may be formed in the jaws into which the dies may be inserted and held by means of set screws 47, such as are shown in Fig. 15, or otherwise.

In order to transversely form and crimp the overlapped ends of the metal straps substantially into the forms shown in Figs. 19 and 20 inclusive, I provide the dies with semi-circular recesses 48 and 49 and with staggered teeth 50 and 51 alternating with the teeth or grooves 52, as shown in Fig. 12. As shown in my co-pending application for patent, filed Dec. 19, 1927, Ser. No. 241,037, any suitable form of tie may be formed by changing the dies.

As shown in Fig. 4, one of the ends 53 of a metal strap S is brought around the left hand end of and over the box B and over plates 57 and 58 on the base so that the end will abut a plate 54 which is pivotally mounted on a pin 55 against the inner side of the lug 3. The base 1 of the machine is provided with a central aperture 56 intermediate plates 57 and 58 within which the jaw members 12 and 14 operate. The plates 57 and 58 are rounded at their edges so that the bands may be readily threaded thereover and beneath spaced gripping devices 59 and 60 supported above plates 57 and 58 respectively. The gripping devices 59 and 60 are preferably formed of metal plates pivoted, respectively, on screws 61 and 62 and within the front portions of the lugs 2 and 3. The left hand portion of the strap is adapted to be engaged by the gripping member 59, and the right hand portion 63 of the strap is adapted to be

engaged by the gripper 60, as hereinafter explained.

A block 64 is provided above and spaced from the foot 57 sufficiently to permit the portion 53 of the band to rest between the block and the foot, while the portion 63 of the band rests upon the upper surface of block 64 and extends to the left, as shown in Figs. 4 and 5.

The lugs 2 and 3 are provided with plates 65 and 66 which are similar, and each have downwardly turned outer end portions 67 and inner end portions 68. Said plates are pivotally mounted on pins 69 and 70, respectively, which extend thru the end portions 67 and 68 in each case, and the associated lugs 2 and 3. The portions 5' and 6' of the frame members 5 and 6 respectively carry arms 71 which are pivoted thereon by means of pins 72, and the upper ends 73 of said arms are curved and engage correspondingly formed recesses 74 in the inner depending portions 68 of the plates 65 and 66. Thus, as the frame members 5 and 6 are rocked on their axis 4 (see Fig. 9), the arms 71 are correspondingly rocked on their axes 72 so as to correspondingly rock the plates 65 and 66. Said plates are connected with and are effective for releasing the gripping devices 59 and 60 at the completion of a tying operation. This operation is accomplished by means of the mechanism shown particularly in Figs. 8, 17 and 18.

The gripping devices 59 and 60 are substantially similar in all respects and are controlled in their operation by means of the plates 65 and 66. To this end the plates 65 and 66 are provided with members 75 which have U-shaped bodies embracing and pivotally held on arms 76 which extend forwardly from and are formed on the plates 65 and 66. The members 75 are pivoted to the arms 76 by means of pins 77 and the inner sides 78 of the members 75 are provided with depending extensions 79 which have outwardly bent lugs 80 engaging elongated slots 81 formed in trigger plates 82 which are also pivoted on pins 77. Said triggers have elongated slots 83 for receiving the pins 77 and are held between the arms 76 and the sides 78 of the members 75. Thus the triggers 82 may reciprocate vertically on the extensions 79 and the pins 77, but also rock with the members 75 on said pins.

It will be observed, as shown in Figs. 17 and 18, that the lower ends of the trigger plates 82 have forward edges 84 which project normally forwardly into the planes of the strap ends. When the portions 53 and 63 of strap S are moved edgewise into the positions shown in Fig. 4 preparatory to a tying operation the rear edges thereof engage the forward edges 84 of the triggers 82 and force said triggers backwardly. The gripping devices 59 and 60 rock on screws 61 and 62 and are normally urged downwardly

into gripping positions by means of springs 85, 85 which are attached at their lower ends to the horizontal arms 86 of the grips, and at their upper ends are attached to lugs 87 which project outwardly from the triggers 82. The portions 79 of the members 75 are provided on their forward edges with shoulders 88 which normally engage the upper edges of the gripper arms 86 for normally holding the grippers 59 and 60 out of engagement with the straps S and substantially spaced from the feet 57 and 58.

When levers 16 and 17 are in retracted position as shown in Fig. 13, the grips 59 and 60 are held upwardly so as to permit the strap portions 53 and 63 to be inserted thereunder, and the triggers 82 are held downwardly so that their edges 84 will engage the strap portions as they are properly positioned in the machine preparatory to a tying operation. The movement of the triggers 82 backwardly by engagement with the strap also rocks members 79 rearwardly so as to disengage the shoulders 88 from the gripper arms 86, thus releasing the grippers 59 and 60 which are then urged downwardly by the tension of springs 85 into gripping engagement with the strap portions 53 and 63, respectively.

As shown in Figs. 4 and 9, the gripper 60 is provided with an inwardly extended arm 89 which extends thru a slot 90 in a plate 91 which is pivoted on a pin 55 in lug 3 inwardly of the stop plate 54. The plate 91 is provided with a right angularly bent depending end lug 92 at its outer end which normally rests above the strap S, but when the gripping 60 is released by the disengagement of shoulder 88 of member 79 therefrom subsequent to the positioning of the portions 53 and 63 of the band in the machine, the tension of the spring 85 is effective for dropping the plate 91 into the position shown in Fig. 9 with the lug 92 overlying the forward edges of the strap. Thus, during the subsequent operation of the machine the strap ends are prevented from displacement during a tying operation.

It may be noted at this point that the gripper 59, for instance, is arranged so that the portion 53 of the band S may be moved in a right hand direction into the machine, as seen in Fig. 4, but not in a reverse direction. Also the gripper 60 is arranged so the portion 63 of the band may be moved to the left thereunder but not in a reverse direction.

Adjacent the inner edge of foot 57 I provide a cutter blade 93 which is pivotally mounted by means of a screw 94 on the block 64. (See Fig. 7.) The inner face 95 of block 64 cooperates with the cutting edge 96 of the blade 93 for cutting the left hand portion 63 of the strap S, as seen in Fig. 4. The cutter blade is operated by means of a link 97 which is pivoted on a pin 72 carried by the portion 5' of the plate 5. The arm 97 has an

arcuately formed head 98 which seats in a correspondingly formed recess 99 in an upwardly extended arm 100 of the cutter. Thus, the cutter is actuated when the plates 5 and 6 rock forwardly at the completion of a tensioning operation for severing the binding strap of a box from a roll of material. The initial movement of levers 16 and 17 and plates 5 and 6, by means of handle 28, operates the cutter, and the continued operation thereof serves to hold the cutter downwardly on the severed portion 63 of the strap until the completion of a tying operation.

As shown in Fig. 5, and referring also to Fig. 13, when the machine is opened to a maximum extent and a band has been positioned in the machine preparatory to a tying operation, the levers 16 and 17 are moved forward simultaneously in order to cut off the band and to set the releasing triggers 82 for the grips 59 and 60 so that the grips will be released from the band at the completion of a tying operation, and also for the purpose of preventing the closing of the jaws on the band ends until the jaws have been moved into proper position. For this purpose I provide on a side of the machine, as shown in Fig. 5, a lever 101 which is pivoted on the bolt 8 and has a heel 102 which overlies the portion 103 of the cutter block 64. The free end of the lever 101 has a recess 104 therein which, when the levers 16 and 17 are positioned as shown in Fig. 13, will engage the end 23 of pin 24 for preventing the relative movement of levers 16 and 17, and will effect their operation together. When said levers have been moved together forwardly into initial position for closing the jaws the heel 102 of lever 101 engages the portion 103 of block 64, thus rocking lever 101 and disengaging the portion 104 from pin 24, thereby permitting the further forward movement of lever 16 and sector 25 into engagement with the pinion 26.

Thereafter, by turning the handle 29 in a clockwise direction, as seen in Fig. 8, the meshing of the pinion 26 with sector 25 will move lever 16 still further forwardly, and during the movement thereof the forming and crimping of the band ends into interlocked relation will be effected by the dies 13 and 15 of the jaw members 12 and 14 respectively, as hereinafter described.

Prior to the operation of levers 16 and 17, however, as described, it is necessary to properly tension the strap around the package. I accomplish this tensioning of the strap by means of a manually operable lever provided with a supplementary grip for the portion 63 of the band. The lever or handle 106 is pivotally held on the extension 105 of base 1 between a lug 107 and a front rib 108 on a pin 121 extended through lugs 123 and 124 on the bottom of the lever. The lever is tensioned and urged to the right, as seen

in Figs. 1 and 4, by means of a spring carried on the pin 121 and having its central loop 126 overlying a portion 107' of the base and its ends 125 and 125' overlying the lugs 123 and 124 of said lever, respectively, or otherwise suitably arranged.

A link 110 is pivoted to the rib 108 at 110' and at 114 to a U-shaped yoke 111 having sides 112 and 115 through which the pin 114 extends. The yoke 111 embraces a lever 116 which is yieldably held on pin 114 and is provided below the yoke with a foot 118 which projects forwardly over a guide bar 119 formed on the inner side 112 of yoke 111. The lower end of lever 116 has gripping teeth 120 thereon which are adapted to be urged downwardly into engagement with the portion 63 of strap S by a spring 117 compressed between the upper end of lever 116 and the end of yoke 111. The foot 118 may have a downwardly bent lug 116' for overlying the forward edge of the strap S so as to prevent displacement of the strap from the gripper. The side 112 of yoke 111 is pivotally secured to a lug 122 of operating lever 106 by means of a pin 113. (See Figs. 1 and 3.)

When the portion 63 of strap S is moved to the left, as seen in Fig. 4 over the bar 119 and beneath the foot 118 and the gripping teeth 120, the lever 116 will yield against the tension of spring 117 and the portion 116' will depend over the outer edge of the strap S.

When the strap is positioned in the machine and extended around a box or the like, as shown in Fig. 4, the grip 60 holds the portion 63 against movement to the right, the grip 59 holds the portion 53 against movement to the left, and the grip lever 116 is engaged with portion 63 preparatory to a tensioning operation. Whereupon, the movement of lever 106 to the left, together with yoke 111 and grip lever 116, will pull the portion 63 of the band to the left, correspondingly. The continued movement of the lever 106 backwardly and forwardly for a requisite number of operations will suffice to tension the strap around the box, the retraction of the lever at each movement serving to retract the grip lever 116 also, preparatory to a further movement of the strap.

Thus the strap is tensioned in a step-by-step movement.

One type of tie 133 is formed by rolling the intermediate portions of the overlapped ends of the strap transversely, the two overlapping portions of the strap being rolled about a common axis. In the formation of the tie 133 the initial operation would consist in rolling the overlapping portions of the strap, and finally the two rolls, when compactly formed as shown in Figs. 19 and 20, are crimped transversely of the rolls so as to inter-lock and retain the rolled portions in their tied positions. As shown in Figs.

19 and 20, the outer edges 134 and 135 of the rolled portions of the tie either substantially abut or overlap the opposite edges 136 and 137.

Of course the dies of the forming jaws may be altered to correspond to any particular form of tie desired.

Now in operation, the sequences are as follows: When viewed from the front of the machine, (Fig. 4), and the machine is as shown in Fig. 13, a metal strap S is drawn around the box with the left hand portion 53 thereof moved to the right over foot 57 and under grip 59 and block 64 until the end of the strap abuts the plate 54. In thus positioning the strap it is forced rearwardly against the edge 84 of left hand trigger 82 into correct position behind the lug 92 on plate 91. Similarly the right hand end of the strap is moved to the left thru the machine under the plates 54 and 91 and over the foot 58, thence over the cutting block 64 and under cutter 93, over the grip 59, thence over the bar 119, and under foot 118 and gripping teeth 120. The strap is forced rearwardly into position against edge 84 of right hand trigger 82, behind the lug 92 of plate 91 and behind the lug 116' on lever 116.

As hereinbefore described, the forward edges 84 of triggers 82 yield backwardly when engaged by the strap and release and drop the grips 59 and 60 into gripping engagement with the portions 53 and 63 of the strap. Thereafter the handle 106 is operated backwardly and forwardly for a sufficient number of times to properly tension the band in the machine, and when the proper tension of the band is attained a cutting and forming operation may be accomplished.

Assuming that the machine is at rest in the position shown in Fig. 13, with the strap positioned in the machine as shown in Fig. 4, and suitably tensioned preparatory to a tying operation, the levers 16 and 17 will be locked together by engagement of the portion 104 of bar 101 with the left hand end of pin 24. Therefore an ensuing counterclockwise forward movement of the handle 28 attached to lever 16 will rotate levers 16 and 17, together with plates 5 and 6, about the axis of their common fulcrum 4 until the jaw members 12 and 14 are initially positioned over the overlapping portions 53 and 63 of strap S. Such initial forward movement of levers 16 and 17 serves to actuate cutter 93 thru its connection with plate 5 by means of link 97 and the operation of the cutter will sever the surplus material from the strap at the inner edge of the cutter block 64. It must be understood in this connection that the severing of the strap is accomplished while the strap is held in tension around a box or the like and prior to the tie forming operation.

The cutter 93 remains depressed and held

in frictional engagement with the upper portion 63 of the strap during the ensuing tying operation so as to prevent the upward thrust of said portion and the possible distortion of the tie. The further movement, in a forward direction, of lever 16 first moves the sector 25 into mesh with the pinion 26, and thereafter the handle 29 is rotated in a clockwise direction, as seen in Fig. 13, for rotating the pinion in a corresponding direction and for advancing the sector 25 and lever 16 further forwardly for the purpose of forming the tie in the overlapped portions 53 and 63 of the strap as shown in Figs. 8 and 15. Thus, when a maximum effort or pressure is required for actually forming the tie, a substantial leverage is provided by the utilization of pinion 26 and sector 25. The handle 29 is rotated in a clockwise direction until the pinion 26 has traversed the entire sector 25 at which time the tie forming operation will have been completed. This final position is shown in Fig. 15.

The handle 29 is then disengaged from the ratchet 30 by turning the same in a counter-clockwise direction until the member 33 associated therewith is engaged with the detent 37 so as to prevent the counter-clockwise movement of the member 33 and handle 29 when the handle 28 is employed for quickly retracting sector 25 from engagement with pinion 26 and to the position shown in Fig. 14. The retraction of lever 16 disengages the jaws from the ties previously made and reengages bar 101 with shaft 24. Thereafter the further retraction of lever 16 will also retract lever 17 until the two levers assume their normal position of rest as shown in Fig. 13, in which position the jaws 12 and 14 are completely retracted from the strap S.

When the machine is in position as shown in Fig. 14, the further retractive movement of lever 16 and plates 5 and 6 serve to lower the triggers 82 into operative position preparatory to receiving another section of strap material for making a tie. These triggers remain in their lowered position until the initial forward movement of levers 16 and 17 elevate the same simultaneously with the operation of the cutter 93 for severing the strap and prior to the meshing of pinion 26 with sector 25. The triggers are held in their uppermost positions until the final movement of lever 16 is accomplished.

The movement of the triggers is effected thru their connection with the plates 5 and 6 by means of the members 65 and 66 and links 71.

It will be noted that the simultaneous forward movement of levers 16 and 17 about the axis of pin 4 continues until shaft 24 reaches the upper end of slot 46 in bar 43. Thereafter the further forward movement of lever 16 causes the pin 24 to move down-

wardly in the slots 21 and 22 of plates 5 and 6 respectively. While sector 25 moves forwardly, pinion 26 and lever 17 move rearwardly until and after the pinion is meshed with the sector. The further and final movement of levers 16 and 17 while pinion 26 is traversing the sector 25 operates the toggle connected jaws so as to close the jaws over and form the tie in the overlapped portions of the strap.

Particular attention is directed to the cooperation of the gripping devices 59 and 60 on opposite sides of the forming means and the grip 120 associated with the tensioning handle 106. It will be observed that the gripping devices 59 and 60 are yieldably disposed above the stationary feet 57 and 58 respectively, over which the lapped ends 53 and 63 of the strap S are adapted to be positioned for a forming operation.

The novelty of this structure is two-fold. First, in that the grips 59 and 60 are normally held upwardly from the feet 57 and 58 respectively so as to permit the insertion of the strap portions 53 and 63 edgewise into forming position over the feet 57 and 58 respectively. As has been explained, the movement of the portions 53 and 63 into position actuates the triggers 82, thereby causing the grips 59 and 60 to drop downwardly into clamping engagement with the strap portions. The grips 59 and 60 are so fulcrumed on their pivots 61 and 62 respectively that they prevent the outward movement of the strap portions 53 and 63 from beneath the grips, yet permit the inward movement thereof. More definitely stated, the grip 59 prevents the movement of the portion 53 to the left, as seen in Fig. 4, but permits the movement of said portion to the right, whereas the grip 60 permits the portion 63 to be moved inwardly thereunder, but prevents the movement of said portion to the right. Thus, when the strap S is extended around a box or the like and the end portions 53 and 63 of the strap are gripped in the manner shown in Fig. 4 by the members 59 and 60 the strap is so positioned in the machine as to permit the subsequent tensioning of the strap around the box.

The tensioning of the strap, as hereinbefore described, is accomplished by means of the lever 106 and grip lever 116, the surplus portion of the strap forming a continuation of the end portion 63 being extended beneath the grip 120 and over the bar 119. Thus the portion 63 is free to move to the left when gripped by the member 120 and the lever 106 is swung in a counter-clockwise direction on its pivot 121. On the return stroke of the lever 106, however, the grip 120 will slide over the strap S so as to re-grip the strap at another point for further movement of the portion 63 to the left, the grip 60 permitting such movement of the strap at each

operation of the lever 106. Thus, the tensioning of the strap is accomplished in a step-by-step movement merely by operating the lever 106 with the grips 59 and 60 automatically operating to permit the tensioning of the strap and to hold the strap in successive stages of tensioning.

What I claim is:

1. A machine of the character described comprising a base, means for supporting the two ends of a binder in overlapping position on said machine preparatory to a tying operation, a pair of jaws pivotally connected together and together movable to and from operative position, a primary operating member connected to one of said jaws, a secondary operating member connected to the other of said jaws, means for locking said operating members together for moving the jaws into closing position, means for moving the primary operating and secondary operating members relative to each other for closing the jaws, and means operable on the retraction of said operating members for releasing the tied binder from the machine.

2. In a machine for tying the overlapped ends of a strap, the combination with tying means, of means for gripping and holding the strap ends during a tying operation, means for holding said gripping means out of gripping position prior to the insertion of a strap in the machine, and means associated with the gripping means and operable by the insertion of a strap in tying position for rendering the gripping means operative.

3. In a machine for tying the overlapped ends of a strap as characterized in claim 2, including devices controlled by the tying means for releasing the gripping means from the tied strap and for resetting the gripping means preparatory to another tying operation.

4. In a machine for tying the overlapped ends of a strap, the combination with means for supporting the strap ends in tying position, and tying means adjacent thereto, of normally inoperative gripping devices for holding the strap ends stationary during a tying operation, and means engageable by the strap ends when they are inserted in tying position for rendering the gripping devices operative on the strap for the purpose described.

5. In a machine for tying the overlapped ends of a strap, the combination of spaced means for supporting the strap in tying position, tie forming means intermediate the supporting means, means operable to move the tie forming means to and from operative position, gripping devices supported above said supporting means and inoperatively held relative to the strap when the tie forming means is retracted from operative position, and means associated with the gripping devices and engageable by and when the strap

ends are being operatively positioned, for rendering the gripping devices operative to hold the strap stationary during a forming operation.

6. In a machine for tying the overlapped ends of a strap, the combination of a pair of supporting members for operatively holding a strap in tie forming position, tie forming jaws intermediate said members, means operable to advance said jaws to and to retract the same from forming position, gripping devices adjacent said supporting members, means associated with and for releasing the gripping devices for engagement with the strap ends when said strap is positioned on the supporting members, and means controlled by the opening and retraction of said jaws for releasing the gripping devices from the strap ends and for resetting the same for another operation.

7. In a machine for tying the overlapped ends of a strap, the combination with a pair of tie forming jaws and means for supporting the strap ends in tie forming position relative thereto, of a pair of gripping devices for gripping engagement with the overlapped strap ends, respectively, means controlled by the positioning of the strap for releasing and rendering said gripping devices operative on the strap ends, means operable to open and close the jaws preparatory to and following a tying operation, and means controlled by the opening of the jaws for releasing the gripping devices from the strap ends and for resetting the same in normally inoperative positions.

8. In a machine for tying the overlapped ends of a strap, the combination with tie forming means and means for supporting the strap around a box or the like, of grippers normally held inoperative with respect to the strap ends, triggers operable by the movement of the strap ends to forming position for releasing and engaging the grippers with the strap ends, and means controlled by the forming means for releasing the grippers from the strap ends and for resetting the same at the completion of a forming operation.

9. In a machine for tying the overlapped ends of a strap, the combination of a frame, means for supporting a strap in tying position thereon, and tie forming means engageable with said strap and including a pair of levers hingedly connected together, a pair of plates pivoted to said frame and adjustably connected with said levers at their axis, a pair of forming jaws hingedly connected together and toggle connected at spaced points with said levers respectively, gears on said levers arranged for interengagement but normally disengaged, means for locking said plates to said levers whereby said levers, said plates and said jaws may be simultaneously moved about the axis of the plates to and from

jaw closing position, a handle on one of said levers for moving both of the levers on their axis subsequent to the moving of the jaws to jaw closing position for meshing the gears of said levers, and an operating member on said other lever for further moving both of the levers on their common axis and said jaws on their axis for closing the jaws, and means for disengaging said levers and opening said jaws subsequent to a tie forming operation.

10. In a machine for tying the overlapped ends of a strap, a pair of spaced stationary members over which the lapped portions of the strap respectively are adapted to be positioned, gripping devices mounted adjacent said members for engagement respectively with the lapped portions of the strap, each of said gripping devices permitting the associated portion of the strap to be moved in the direction of the other gripping device but preventing the movement thereof in an opposite direction, whereby the strap may be held at a predetermined tension around a box or the like during a tie forming operation, means associated with and for normally holding said gripping devices spaced from said stationary members so as to permit the movement of the lapped strap portions edgewise into position adjacent the gripping devices, said last mentioned means including members projecting into the path of and adapted to be engaged by said strap portions as said portions are moved into forming position for releasing and rendering said gripping devices operative on the strap, and means for yieldably supporting the gripping devices in clamping position on the strap portions when the gripping devices are so released.

11. In a machine for tying the overlapped ends of a strap, the combination with a base, of a pair of levers hingedly connected together, a pair of forming jaws hingedly connected together and toggle connected with said levers respectively, means connecting said jaws and said levers permitting the simultaneous movement of said jaws and said levers preparatory to and following a forming operation, one of said levers having a sector thereon, the other of said levers having a pinion rotatably mounted thereon, said sector and said pinion adapted to be swung on a common axis for moving said pinion and sector into mesh, and manually operable means for rotating said pinion on and causing the same to traverse said sector for rendering said jaws operative on the work, and means for rendering the manually operable means inoperative to permit the unmeshing of said pinion and said sector at the completion of a forming operation.

12. In a machine for tying the overlapped ends of a strap, the combination of a base, means for supporting the lapped strap portions in forming position, a pair of levers hingedly connected together and hingedly

mounted on said frame about different axes, a pair of forming jaws hingedly connected together and toggle connected with said levers respectively, means permitting the simultaneous rocking of said levers and said jaws on said frame preparatory to a forming operation, a leverage applying member connected with one of said levers, and means for rocking said levers relative to each other whereby said leverage applying member may be operatively connected with both levers and serve to further rock said levers together, and also to close said jaws for completing a forming operation.

13. In a machine for tying the overlapped ends of a strap, the combination of a base, means for supporting the lapped ends of the strap in tying position, including stationary members and grips yieldable relative thereto, a cutter for severing the surplus portion of the material from the strap, forming jaws hingedly connected together and adjustable on their hinge so as to open and close relative to the lapped portions of the strap, a pair of operating levers hingedly connected together and toggle connected with said jaws respectively, and members hingedly supported on said base and connected with said jaws and with said levers whereby the movement of one of said levers in a given direction will effect the movement of said other lever, said jaws, and said members to an extent sufficient to position the jaws for closing over the strap, and will also operate said cutter, one of said levers having a sector thereon, said other lever having a driving pinion thereon, and a handle for operating said pinion, means for thereafter moving said levers on a common axis to mesh said pinion with said sector and to close said jaws on the lapped portions of the strap, said handle being effective for applying power to said first mentioned lever thru said sector for forming the tie.

14. A machine for tying the overlapped ends of a strap as characterized in claim 13, including a ratchet device connecting said handle with said pinion wherewith to close said jaws, and means for disengaging the handle from said pinion to permit the disengagement of the pinion from the sector when the levers and jaws are restored to normal position.

15. In a machine for tying the overlapped ends of a strap, the combination of a base, means thereon for supporting the lapped portions of the strap during a forming operation, and forming means on said base, including a pair of members hingedly connected to said frame, means for limiting the rocking of said members on the frame, a pair of jaws hingedly connected together and to said rocking members, a sector hingedly and slidably connected to said rocking members, a lever hingedly connected to said

sector and having a pinion rotatably supported thereon for mesh with the sector, said jaws being toggle connected respectively with said sector and said lever, an operating member connected with and adapted to rotate said pinion in a given direction but permitting the free rotation of the pinion in an opposite direction, the movement of said sector forwardly serving to simultaneously move said jaws to closing position and said rocking members, said lever and pinion correspondingly about the axis of said rocking members, the further movement of said sector forwardly serving to mesh said pinion with and cause the same to traverse said sector for forming a tie in the lapped portions of the strap.

16. A machine for tying the overlapped ends of a strap as characterized in claim 15, including a cutter operatively connected with one of said rocking members and adapted to be actuated for severing the surplus material from the strap when said rocking members, said jaws, said sector and said lever are moved on the axis of the rocking members.

17. In a machine for tying the overlapped ends of a strap, the combination of a base having means for supporting the lapped strap ends in tying position, grips cooperating therewith for gripping and holding the strap against longitudinal movement during a tying operation, a pair of forming jaws intermediate said grips hingedly connected together, and means connected with and for advancing and retracting said jaws bodily to and from closing position around said strap ends, and for additionally opening and closing said jaws subsequent to and during a forming operation respectively, and means associated with said grips and operative when said jaws are bodily advanced and retracted for engaging said grips with and disengaging the same from said strap portions respectively, for the purpose described.

18. A machine for tying the overlapped ends of a strap as characterized in claim 2, including a device associated with and operative when the gripping means becomes operative for overlying the outer edge of the strap to prevent the displacement thereof from operative position in the machine.

19. A machine for tying the overlapped ends of a strap as characterized in claim 2, including a device associated with and operative when the gripping means becomes operative for overlying the outer edge of the strap to prevent the displacement thereof from operative position in the machine, said device including a lever operatively connected with the gripping means and provided with a depending lug inoperative with the gripping means to permit the movement of the strap thereunder into operative position and operative with the gripping means

so as to drop into position over the edge of the strap.

20. In a machine for tying the overlapped ends of a metallic binder, the combination of a base, means for supporting the ends of the binder in overlapped position preparatory to a tying operation, a pair of jaws hingedly connected together and together movable to and from operating position, means for locking said jaws apart against relative movement each to the other, a primary operating member and a secondary operating member connected to the jaws whereby one single continued movement of the primary operating member will move the pair of jaws together over the overlapped ends of the binder, and unlock the jaws for relative movement, and initiate the movement of the jaws toward each other, and render the secondary operating member operative for applying leverage to the jaws to complete the tie forming operation.

21. In a machine for tying the overlapped ends of a strap, a pair of spaced stationary members over which portions of the strap are to be positioned, gripping devices mounted adjacent said members for engagement respectively with the strap portions supported by the members, holding means associated with and for normally holding said gripping devices spaced from the stationary members so as to permit the movement of the strap portions edgewise into position adjacent the gripping devices, said last mentioned means including members projecting into the path of and adapted to be engaged by said strap for releasing and rendering said gripping devices operative on the strap, and means for yieldingly supporting the gripping devices in clamping position on the strap portions when the gripping devices are so released.

22. In a machine for tying the overlapped ends of a strap, a pair of spaced stationary members over which portions of the strap are to be positioned, gripping devices mounted adjacent said members for engagement respectively with the strap portions supported by the members, holding means associated with and for normally holding said gripping devices spaced from the stationary members so as to permit the movement of the strap portions edgewise into position adjacent the gripping devices, said last mentioned means including members projecting into the path of and adapted to be engaged by said strap for releasing and rendering said gripping devices operative on the strap, means for yieldingly supporting the gripping devices in clamping position on the strap portions when the gripping devices are so released, means for tying the gripped strap, and means associated with the tying means operative upon the completion of the tie for re-engaging said gripping devices with said holding means.

23. In a machine for tying the overlapped ends of a strap, a pair of spaced members over which portions of the strap are to be positioned, gripping devices mounted adjacent said members for engagement respectively with the strap portions supported by said members, holding means associated with and for normally holding said gripping devices spaced from the members so as to permit the movement of the strap portions edge-wise into tying position, said last mentioned means including members projecting into the path of and adapted to be engaged by said strap for releasing and rendering said gripping devices operative on the strap, a strap tensioning means, one of said gripping devices permitting the associated portion of the strap to be moved by said tensioning means in the direction of the other gripping device but preventing the movement thereof in the opposite direction, whereby the strap may be tensioned by said tensioning means, means for tying the strap, and means associated with the tying means operative upon the completion of the tie for re-engaging said gripping devices with said holding means.

24. In a machine of the character described a base, means for supporting the two ends of a binder in overlapping position on said machine preparatory to a tying operation, a pair of jaws pivotally connected together and movable together to and from operating position, a primary operating member connected to one of said jaws, a secondary operating member connected to the other of said jaws, means for locking said operating members together for moving the jaws into closing position, and means for moving said primary and secondary operating members relative to each other for closing the jaws.

25. In a machine of the character described a base, means for supporting the two ends of a binder in overlapped position on said machine preparatory to a tying operation, a pair of jaws connected together and movable to and from operating position, a primary operating member connected to one of said jaws, secondary operating member connected to the other of said jaws, means for locking said operating members together for moving the jaws into closing position, means for automatically releasing said locking means when the jaws have been moved into the closing position, and means for moving said primary and secondary operating members relative to each other for closing said jaws.

26. In a machine of the character described a base, means for supporting the two ends of a binder in overlapped position on said machine preparatory to a tying operation, a pair of jaws connected together and movable to and from operating position, a primary operating member connected to one of said jaws, secondary operating member connected to the

other of said jaws, means for locking said operating members together for moving the jaws into the closing position, means for automatically releasing said locking means when the jaws have been moved into the closing position, means for moving said primary and secondary operating members relative to each other for closing said jaws, and said locking means being operative for relocking said members as the same are actuated for returning the jaws from their closing position.

27. In a machine for forming a tie in the overlapping ends of a metal binder, gripping devices for supporting the binder in tying position, a gripper locking means for retaining the gripping devices in an open position, means for automatically releasing the gripper locking means for rendering the gripping devices operative when binder is inserted in tying position, a binder tying means normally retained in a retracted position, a cutter means operatively associated with said tying means and arranged to be actuated thereby to sever the binder, and means associated with the tying means operative upon the return of the tying means to its retracted position to automatically return the gripping devices into locking engagement with said gripper locking means.

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