

March 7, 1933.

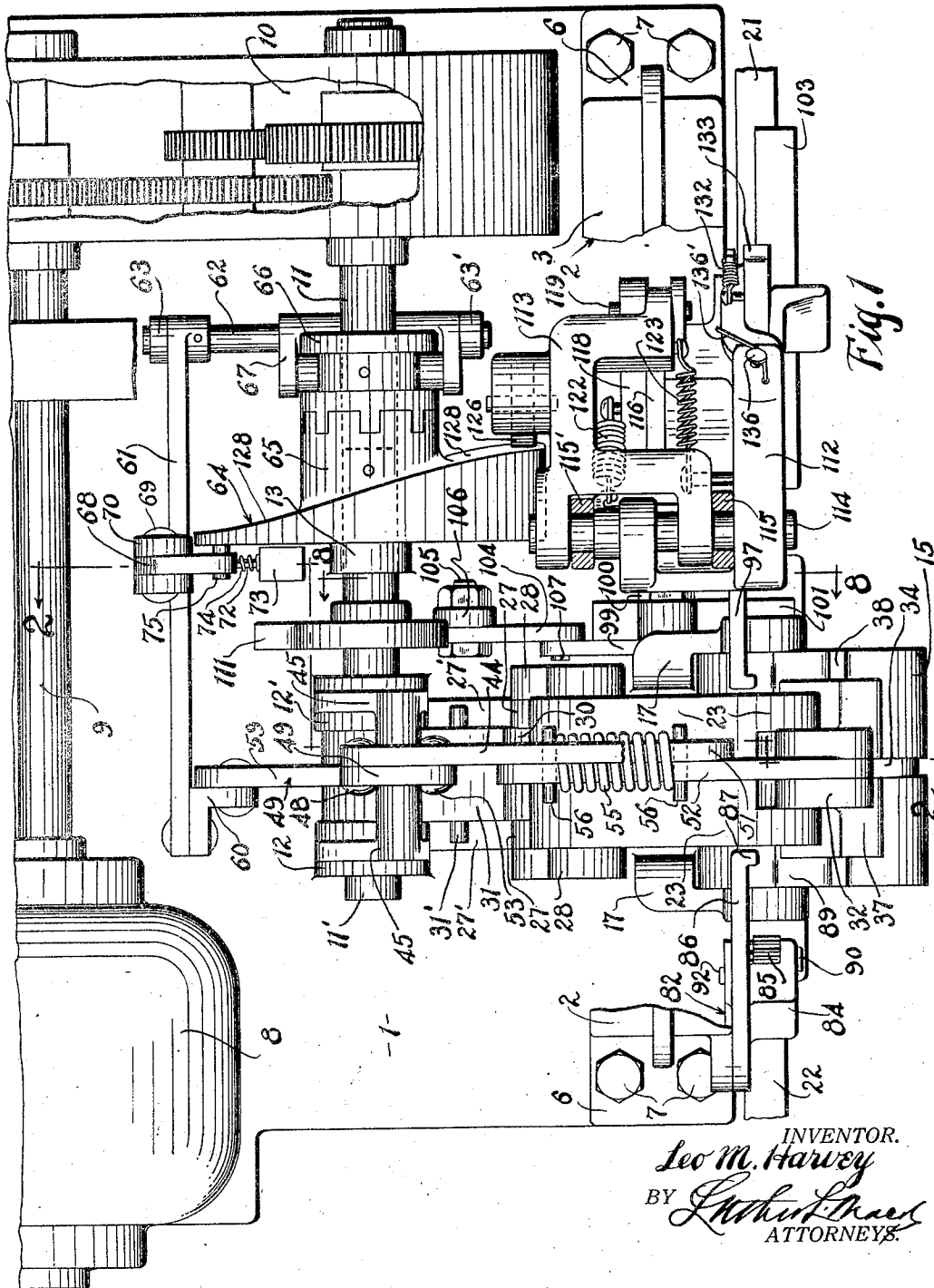
L. M. HARVEY

1,900,238

FLAT BAND TYING MACHINE

Filed Feb. 4, 1931

5 Sheets-Sheet 1



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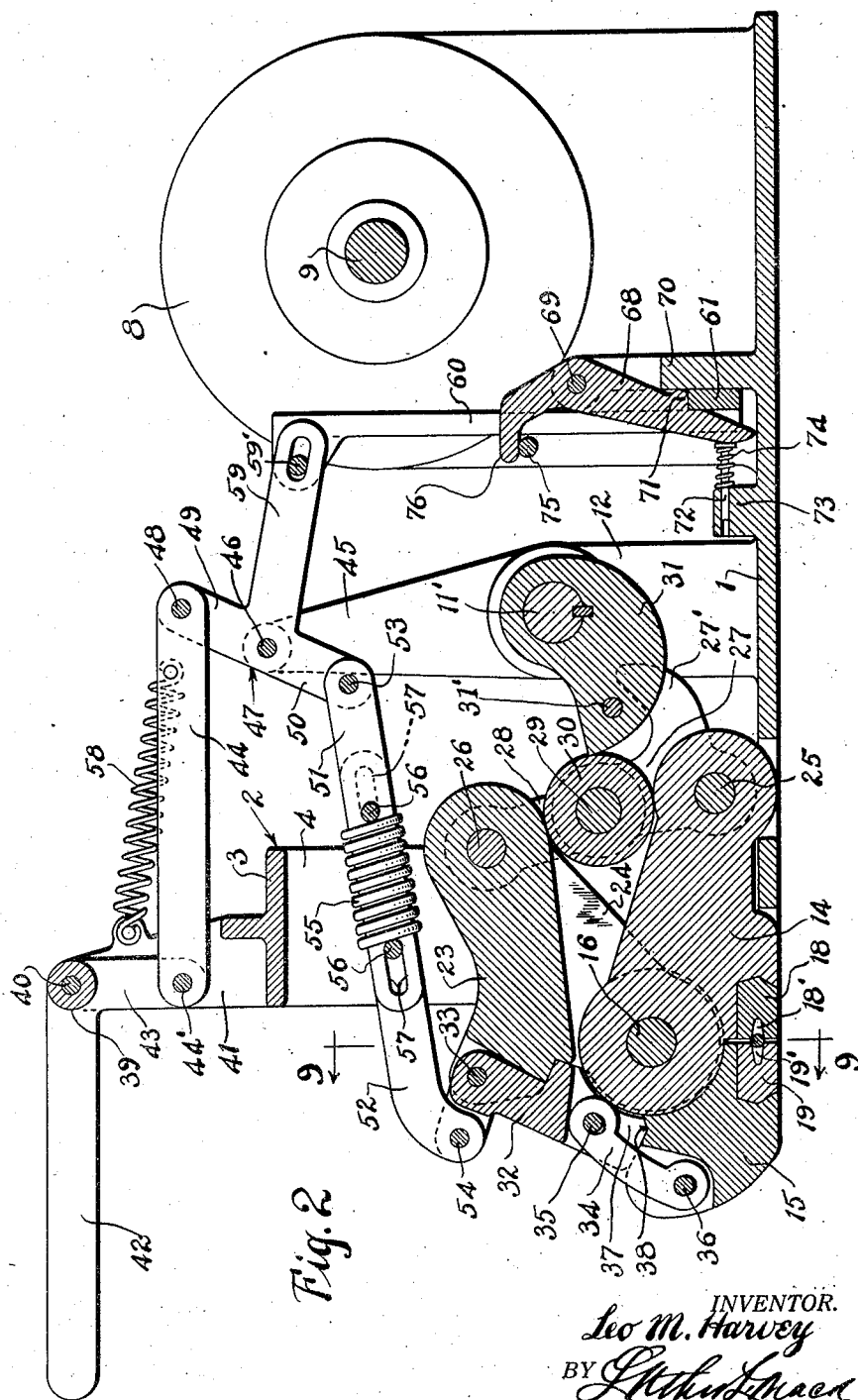
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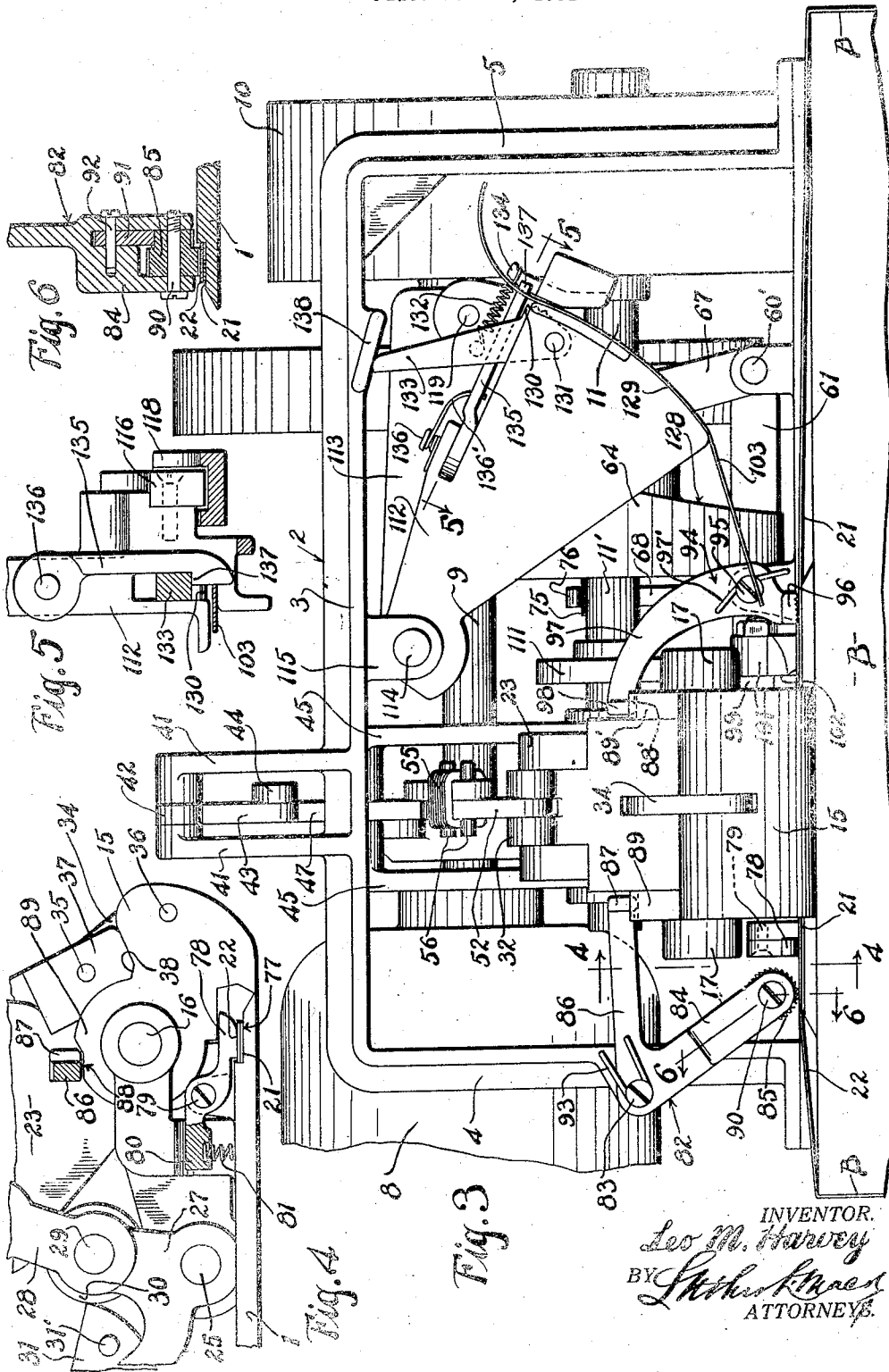
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5 Sheets-Sheet 3



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FLAT BAND TYING MACHINE

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5 Sheets-Sheet 4

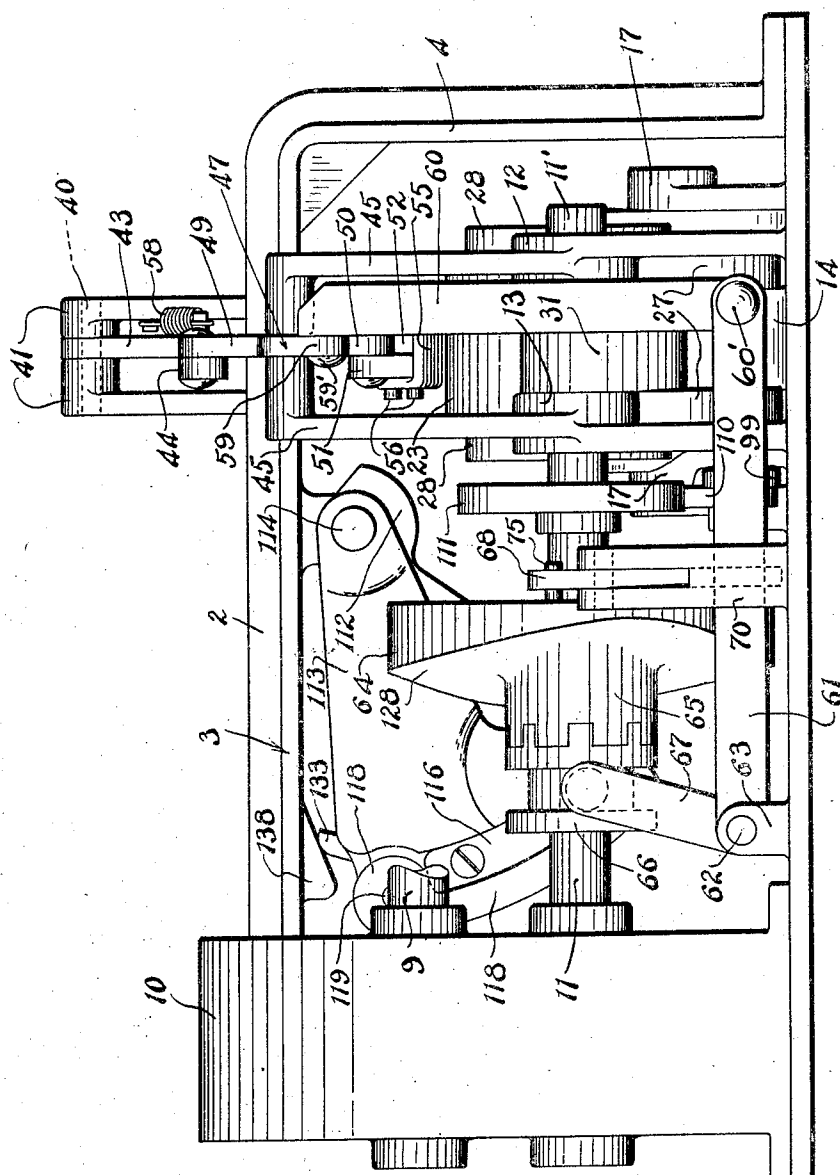


Fig. 7

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UNITED STATES PATENT OFFICE

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FLAT BAND TYING MACHINE

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This invention relates to and has for an object the provision of a light weight compact automatic machine for tying the overlapped ends of flat bands, which bands are employed for binding boxes, bales, crates, and the like.

A further object is to provide in a machine such as described the combination of toggle connected tie forming jaws, means for gripping and holding the overlapped portions of a band in tie forming position during a tensioning operation, and automatically operable tensioning means for drawing bands tight around a box, bale, crate, or the like, whereby when the band is tensioned to a predetermined extent the tensioning means will become automatically inoperative.

Another object is to provide a pair of co-acting toggle connected jaws together with positive means for locking the jaws in tie forming position with the overlapped portions of the band to be tied held therein.

An object also is to provide means for opening the jaws substantially beyond the extent required to release the tie from the jaws, thereby permitting the insertion of the band in position for a tying operation.

Other objects include the provision of a suitable cutting means for severing the band subsequent to the tensioning operation, a continually rotating power driven means, means for manually controlled application of said power driven means to the tensioning, cutting and forming means, and a control means operated by the power means for automatically restoring the several elements of the machine to normal position at the completion of each forming operation and in readiness for another operation.

I have shown a preferred embodiment of my invention in the accompanying drawings, in which

Fig. 1 is a top plan view of the assembled machine.

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

Fig. 3 is a front elevation of the machine superposed on a box, bale, crate, or the like, in readiness for a tying operation.

Fig. 4 is a transverse elevation of the tie

forming means and associated mechanism on line 4—4 of Fig. 3.

Fig. 5 is a section on line 5—5 of Fig. 3.

Fig. 6 is a detailed section of the gripping device on line 6—6 of Fig. 3.

Fig. 7 is a rear elevation of the assembled machine.

Fig. 8 is a fragmentary transverse section of the machine on line 8—8 of Fig. 1.

Fig. 9 is a longitudinal section of the forming means on line 9—9 of Fig. 2.

Fig. 10 is a transverse section of the forming jaws on line 10—10 of Fig. 9.

Fig. 11 is a rear view of the tensioning means.

The mechanism is generally arranged as shown in Fig. 1 with a base 1 having an inverted U-shaped frame member 2 at the front edge thereof with a cross bar 3 longitudinally extended over and elevated substantially above the base, and legs 4 and 5 attached at their feet 6—6 to the base by means of bolts 7, 7.

On the rear of the base 1 I provide a motor 8 with a drive shaft 9 connected with a reduction gear unit 10. An operating shaft 11 is extended from the unit 10 and is adapted to be operated at a speed substantially reduced from the speed of the driving shaft 9. A shaft 11' is journaled in bearings 12, 12' and 13, and is alined with but independent of the shaft 11.

At the front side of the machine a pair of forming members 14 and 15 are mounted hinge like on a longitudinal shaft 16 held in spaced bearings 17, 17 on the frame and said members are provided with inset co-acting dies 18 and 19 respectively, as shown in Fig. 2. The dies 18 and 19 are provided with corresponding but oppositely formed recesses 18' and 19', which have interlocking alternately formed teeth 20 thereon as indicated in Fig. 10, whereby the overlapped portions 21 and 22 of a metal band B may be inserted in the recesses 18' and 19' preparatory to a tie forming operation. The dies are so formed that the tie will be crimped on its edges and sides so as to permanently hold the overlapped ends of the tie together, but are not necessarily of the

form shown and described. Such a tie is effective for holding the band B around a box, bale, or crate, as at B'.

Above the jaws or forming members 14 and 15 I provide a member 23 which is coaxial with jaws 14 and 15 and has diagonally depending portions 24, 24 pivoted on the shaft 16 and thus hingedly connected with the jaws. The rear extremities of the jaw 14 and member 23 are pivotally connected at 25 and 26 respectively with toggle links 27 and 28, and said links are pivotally connected together at their inner ends by means of a pin 29 which carries a follower roller 30 for purposes hereinafter described. The forward ends of the jaw 15 and the coaxially mounted member 23 are also connected as shown in Fig. 2 by means of a locking member 32 which is hinged to the member 23 on a pin 33, and a link 34 is pivotally connected at points 35 and 36 respectively with the locking member 32 and the forming jaw 15. As shown in Fig. 2, the jaws are in closed position and are held in such position against yielding relative to the material to be formed by means of the locking member 32. Said locking member has a lower portion 37 which engages a portion 38 of the jaw 15 so that when the jaws are closed and pressure is exerted on the overlapped portions of the band for forming a tie the thrust of the jaw 15 will be against the member 32 and the opening of the jaws will be prevented. When locking member 32 is in operative position it cannot swing outwardly, for in such event it would close jaw 15 on the band. The lower end of member 32 and the upper face of jaw 15 are correspondingly formed so that the outward movement of member 32 will swing jaw 15 inwardly on the band.

The machine is regulated in its operation by means of a lever 39 which is pivoted at 40 on a lug 41 extending upwardly from the frame member 2. Said lever has a handle 42 and a depending arm 43 to which is connected a link 44 at a point 44'. One of the bearing members 12 of shaft 11' is provided with an extension 45 to which is pivoted at 46 a bell crank 47, and the rear end of link 44 is pivoted at 48 to the upper arm 49 of said bell crank. (See Fig. 2.)

An arm 50 of said bell crank is yieldably connected with the forward end of the locking member 32 by means of a pair of overlapping and relatively slidable bars 51 and 52. Said bars are connected respectively with the arm 50 of the bell crank and the member 32 by means of pins 53 and 54, the forming member 23 being hinged to member 32 by pin 33. Each of the bars is provided with a pin 56 which slidably engages a slot 57 in the other bar. As shown in Fig. 2, the pins 56, 56 are spaced apart longitudinally of the bars and a coil spring 55 encompasses the overlapped portions of the bars and is held

in compression between said pins, thus providing a yieldable connection between the operating handle 42 and the member 23.

Bell crank 47 has an elongated arm 59 connected at 59' with an upright bar 60 and the lower end of said bar is connected at 60' with the horizontal bar 61 which operates a rock shaft 62 journaled in a pair of transversely spaced lugs 63 and 63' of the frame. The operating shaft 11' carries a cam 64 thereon provided with a clutch member 65 cooperating with a second clutch member 66 which is keyed to the shaft 11 and is slidable thereon by means of a yoke 67 fixed to the rock shaft 62 so as to be engaged with and disengaged from the member 65 of the cam, successively, during the operation of the machine.

Adjacent the bar 61 I provide a latch 68 which is pivoted at 69 on an upright lug 70 of the frame and is provided with a shoulder 71 adapted to overlie the upper edge of bar 61 when the jaws are initially closed and the clutch members are engaged, so as to prevent the restoration of member 42 and its associated parts and the disengagement of the clutch members.

Latch 68 is yieldably held in the locking position shown in Fig. 2 by means of a plunger 72 slidable in the lug 73 on the frame carrying a compression spring 74 whereby the tension of said spring will hold the latch in locking position relative to bar 61. A pin 75 extending from a side of the cam 64 is provided for engagement with the tongue 76 of and for releasing the latch, as herein-after described.

The base 1 is provided with a flat seat 77 for the overlapped portions 21 and 22 of the band B, and a friction grip 78 is pivotally mounted thereabove on a pin or screw 79 and has a heel portion 80 between which and the base 1 spring 81 is held in compression for the purpose of yieldably urging the grip 78 into engagement with the uppermost portion 22 of the band. To the left of the grip 78 a grip member 82 is pivotally mounted on a screw 83 secured to the leg 4 of the frame 2. The member 82 is in the form of a bell crank with an inclined depending arm 84 carrying a serrated gripping member 85, preferably of circular form, on its lower end for engagement with the portion 22 of band B.

The member 82 has another arm 86 with a right angularly bent end 87 which, when the mechanism is in the position shown in Figs. 2 and 4, rests in a seat 88 formed on the periphery of the hub portion 89 of jaw 15. The grip 85 is provided with teeth on its periphery and is pivotally mounted in the arm 84 and on a screw 90. The member 85 is engaged by a pawl 91 pivoted at 92 on arm 84 so as to permit the grip to rotate in a counter-clockwise direction, as seen in

Fig. 6, but preventing the rotation thereof in an opposite direction.

A spring, as at 93, may be suitably arranged for yieldably holding the member 85 in engagement with the band B. When the jaw 15 is opened, the concentric portion 89 of said member will move in a counter-clockwise direction, as seen in Fig. 4, and will serve to rotate the bell crank 82 in a counter-clockwise direction, as seen in Fig. 3, thus raising the grip 85 so as to permit the insertion of the overlapped portions 21 and 22 laterally into the seat 77 of the machine, after the tied strap is removed.

On the opposite side of the jaws from the grip 78 I provide another grip 94 which is pivotally mounted at 95 on the frame and has a serrated gripping portion 96 for engagement with the lowermost portion 21 of the band and an upwardly extended curved arm 97 with an end portion 98 overlying a seat 88' in a hub portion 89' of the member 15 similar to the arrangement of the portions 87 and 89 on the other side of the jaws. Thus when the jaws are closed, the grip 96 will cooperate with the grip 85 for holding the two portions 21 and 22 of the band in forming position.

A spring 97' may be suitably arranged for yieldably holding the grip 96 in engagement with the portion 21 of the band. Intermediate the grip 96 and the forming jaws, a cutter 99 is pivotally mounted at 100 on the portion 101 of the frame. Said cutter has a cutting edge 102 disposed adjacent a face of the member 101 whereby the surplus material, as at 103, may be cut away from the portion 22 of the band subsequent to a tensioning operation and prior to a forming operation.

The cutter mechanism is shown in Fig. 8, and includes a locking member 104 pivoted at 105 on a portion 106 of the frame and pivotally connected at 107 with a yoke 108 on the rear end of the cutter. Members 99 and 104 are urged into normally inoperative position by means of a spring 109 adapted to be compressed between the base 1 and a heel 110 of member 104. Said spring thus serves to hold the cutting edge upwardly from engagement with the portion 22 of the band. The cutter is operated by means of a cam 111 fixed to shaft 11' and adapted to depress the portion 110 of member 104 and also the cutter 102 for rendering the cutter operative at a predetermined point in the rotation of shaft 11'.

Prior, however, to the operation of said cutter, it is necessary to tension the band B around the box, bale, crate, or the like, as at B', and this operation is accomplished by means of a tensioning mechanism, as shown particularly in Figs. 3 and 11. The tensioning mechanism includes a pair of co-axially pivoted sectors 112 and 113, which are piv-

otally held on a pin 114 supported in a pair of lugs 115 and 115', which depend from the frame. The member 112 carries an arcuate rail 116 which has an edge concentric with the axis of pin 114 and is provided in said edge with a single semi-circular notch 117. The member 113 carries an arm 118 which is pivoted at 119 and carries a rotatable roller 120 on a pin 121 at its free end.

The roller 120 is normally adapted to seat in the notch 117 of rail 116 and is held in such position by means of a tension spring 122 which is attached at its opposite ends to pins 114 and 121. The sectors 112 and 113 are yieldably connected by means of a tension spring 123 which is attached at its ends by means of pins 124 and 125 respectively to the members 112 and 113. The spring 123 urges the members 112 and 113 into their normal relationship, which is attained when roller 120 is seated in the notch 117. The sector 113 carries a rotatable follower roller 126 on an axis 127, and said roller is adapted to engage the inclined face 128 of cam 64 so that when said cam is engaged with the clutch member 66 and is rotated to a predetermined extent in a tensioning operation, the portion 103 of the band B will be frictionally held by means hereinafter described on the arcuate concentric surface 129 of member 112.

The members 112 and 113 are thus moved together as a unit in a counter-clockwise direction, as seen in Fig. 3, by means of cam 64, for the purpose of tensioning the band B around the box B'. When and if said band has been tensioned to an extent sufficient to overcome the tension of spring 122, the excess tension of a band will effect the disengagement of roller 120 from notch 117 while the cam 64 is still operative for rotating the member 113 by reason of the engagement of said cam with the follower roller 126. Notch 117 is so formed that it will readily permit the disengagement of roller 120 therefrom when a predetermined tension of the band is attained. Thus cam 64 may continue its rotation uninterruptedly for the completion of a forming operation even tho the tension in band B would not otherwise permit it, and a differential in operation is provided for members 112 and 113.

A grip 130 is pivotally mounted at 131 on the web of member 112 for engagement with the portion 103 of the band and is held in tension by means of a spring 132 connecting an upright arm 133 of the grip and a lug 134 on member 112.

The member 112 also carries an arm 135 which is pivoted at 136 to said member and has an axis at right angles to the axis of grip 130. Said arm is resiliently held in cooperative engagement with said grip by means of a spring 136' and is provided with a shoulder 137 which engages the outer edge of arm

133 of the grip and also forms an abutment into engagement with which the portion 103 of the band is moved laterally when the band is properly inserted in the machine for a forming operation.

The frame 2 is provided on its horizontal bar 3 with an inclined lug 138 which is adapted to be engaged by arm 133 of grip 130 at the completion of a tensioning and cutting operation so that the further movement of member 112 in a counter-clockwise direction will release the grip from the surplus portion of the band, and permit the restoration of member 113 to its normal relation with member 112, after the strap has been cut.

When the tensioning means, including sectors 112 and 113, have been operated to a maximum extent, the follower roller 126 will traverse the downwardly inclined face of cam 64 and members 112 and 113 will be restored downwardly in a clockwise direction to normal position in readiness for another operation.

The operation of the mechanism is as follows:

When the motor 8 is energized, shafts 9 and 11 and the connecting gear unit 10 are continuously operated, but shaft 11' and the cams carried thereby are at rest while the clutch member 66 is retracted from engagement with the member 65. Under such conditions the handle 42 is urged by the tension of spring 58 and normally elevated substantially above the position shown in Fig. 2, and the connections with said handle are correspondingly changed as to their positions.

While the handle 42 is held upwardly in normal position, portions 21 and 22 of a band B are manually moved laterally into forming position beneath the grip 78, the grip members 82 and 94 being held upwardly by the portions 89 and 89' of jaw 15 so as to permit the movement of the overlapped band portions thereunder, and the portion of the strap adjacent the source of supply is moved into engagement with grip 130 on member 113.

Following the positioning of the band, the handle 42 is moved downwardly against the tension of spring 58, thus partially closing the jaws by lowering the jaw 15 into position prior to final closing. Such movement of handle 42 simultaneously engages the clutch member 66 with the member 65 and lowers the bar 61 into locking engagement with the portion 71 of member 68, as shown in Fig. 2, thus moving the tongue 76 of the latch into the path of the pin 75 on cam 64 for future release, and also lowering grips 84 and 94 into engagement with the strap. This engagement of the latch 68 with bar 61 also locks the member 42 and its associated parts so that the jaws are held in the initially closed position, which prevents the dislodgment of the overlapped portions of the band

from the jaws prior to the final closing thereof by the action of cam 31.

The rotation of shaft 11', therefore, is initiated by the engagement of the clutch. The initial operation of shaft 11' serves to tension the band B around the box B' by drawing the portion 103 of the band outwardly when said portion is gripped by the member 112 of the tensioning mechanism. When the tensioning member 113 has been operated to a sufficient extent by means of cam 64 to tension the band B to a maximum extent, the tension of spring 122 will be overcome and the member 113 will continue its movement upwardly while member 112 remains at rest, said members 112 and 113 having been disconnected by the disengagement of roller 120 from the notch 117.

Immediately following the tensioning of the band the cutter 102 is depressed against the uppermost lap 22 of the band by the engagement of cam 111 with member 104 effecting the cutting operation whereby the surplus material 103 is severed from band B. The jaw closing cam 31 then becomes effective by reason of its engagement with roller 30 for closing the toggles 27-28 and for finally closing the jaws 18 and 19. Then, as shown in Fig. 2, when cam 31 has been operated so as to close the toggle connections 27 and 28, thereby fully closing the jaws 18 and 19, and a forming operation has been completed, a pin 31' carried in the cam 31 will engage portions 27', 27' extending rearwardly from the member 27 so that when the cam is further operated in a counter-clockwise direction the toggle connections will be broken and the jaws opened thereby to an initial extent only. The operation of cam 31 for initially opening the jaws is desirable for the reason that when the teeth of the jaws are tightly compressed around the tie formed in the band, friction would tend to prevent the opening of the jaws unless power were applied thereto.

Simultaneous with the conclusion of this initial opening of the jaws, but as a continuation of the rotation of the power means, the latch 68 is automatically released from the bar 61 by means of a pin 75 extending from a side of the cam 64, which engages the tongue 76, thus permitting, by reason of the tension of the spring 58, a restoration of the lever 42 and the complete opening of members 14 and 15. Thus the jaw 15 will be swung upwardly on its axis out of the plane of the tied band or strap, permitting the removal of the machine to a new position for the permitted insertion of a new band or strap.

The release of the latch 68 also permits the disengagement of the clutch members 65 and 66 by reason of the tension of spring 58.

It will be apparent from the foregoing description of my mechanism that I have pro-

vided a simple, compact and effective machine which by the operation of a single member effects in a single revolution of the operating shaft the tensioning, cutting and forming operations in succession and the complete restoration of the several units of the machine to normal position.

I claim:

1. A flat band tying machine comprising the combination of means for forming a tie in the overlapped portions of a band, means for independently gripping said overlapped portions of the band and for supporting the same in tie forming position, and a tensioning device for gripping and holding one portion of the band during a tensioning operation and including a primary member and a secondary member differentially connected therewith, means for applying power to and for operating the primary member, means on the secondary member for gripping a portion of the band during a tensioning operation, and means for connecting said primary and said secondary members, whereby the secondary member will be operated by the primary member until the band is tensioned to a predetermined extent, and the primary member is thereafter operable to a greater extent than the secondary member, while the band is held in tension.

2. A flat band tying machine as characterized in claim 1, including a gripping device associated with said secondary member and engageable with the band to be tensioned, and means for releasing said gripping device from the band when the band is tensioned to a predetermined extent.

3. A flat band tying machine as characterized in claim 1, including means for cutting the surplus material from the band at the completion of the tensioning operation.

4. A flat band tying machine as characterized in claim 1, including manually operable means for controlling the application of power to the forming and tensioning means.

5. A flat band tying machine as characterized in claim 1, including power operated means for actuating said tensioning and forming means, and means operable at will for applying power to said means.

6. In a flat band tying machine, the combination with opposed forming jaws, of means permitting the opening of said jaws to permit the lateral movement of the overlapped portions of the band into forming position therebeneath, means for closing said jaws into operative engagement with the band, means for locking said jaws against opening in a forming operation, a rotatable power driven member, and means rotatable therewith for forcing said jaws into forming engagement with said band.

7. A flat band tying machine as characterized in claim 6, including tensioning means for said band, and means rotatable with said

power driven member for actuating said tensioning means to tension the band prior to the forming operation.

8. A flat band tying machine as characterized in claim 6, including tensioning means for said band, and means rotatable with said power driven member for actuating said tensioning means for tensioning the band prior to the forming operation, and a cutting means adapted to be actuated by said operating member for cutting the surplus material from the band subsequent to the tensioning operation.

9. A flat band tying machine comprising a pair of coaxial forming members having opposed forming jaws thereon, a third member coaxially mounted therewith, connections between one of said jaws and said third member, power operated means engageable with said connections for closing and operating the jaws in a forming operation, connections between the other of said jaw members and said third member arranged to prevent the opening of the jaws in a forming operation, and automatically operable means for operating said last mentioned connections for opening the jaws at the completion of a forming operation.

10. A flat band tying machine as characterized in claim 9, including a clutch for applying power to said power operated means, and connections between said clutch and said jaw opening means whereby said clutch will not be effective until the jaws are closed preparatory to a forming operation.

11. A flat band tying machine as characterized in claim 9, including a clutch for applying power to said power operated means, connections between said clutch and said jaw opening means whereby when the jaws are closed said clutch will be effective for applying power to the jaws in a forming operation, and automatically operable means for disengaging said clutch at the completion of a forming operation permitting the restoration of said elements to normal position.

12. In a flat band tying machine the combination of means for gripping the overlapped portions of a band and means for tensioning said band around a box or the like, including a power operated member and a member differentially connected therewith and arranged to grip one portion of the band while said tensioning members are operated correspondingly, and means whereby said power operated member is movable independently of said differentially connected member, said power operated member permitting the stopping of the differentially connected member while the power operated member continues its movement, and a yielding connection between said members by which the band is tensioned to a predetermined extent.

13. In a flat band tying machine as char-

acterized in claim 12, means for cutting the surplus material from the band at the completion of a tensioning operation.

14. A flat band tying machine as characterized in claim 12, including means for cutting the surplus material from the band at the completion of a tensioning operation, and means for crimping and forming the overlapped portions of the band consequent to the cutting operation.

15. In a flat band tying machine, the combination with means for gripping and supporting the overlapped portions of a band when the band is extended around a box or the like, and a tensioning mechanism including a pair of differentially connected tensioning members, means for applying power to and for operating one of said members, means for operating one of said members to a predetermined extent by the power operated member, and means whereby a portion of said band may be gripped and held by said second member during a tensioning operation.

16. A flat band tying machine as characterized in claim 15, including means for cutting the surplus material from said band at the completion of a tensioning operation, and means for forming and crimping the overlapped portions of said band subsequent to a cutting operation, and means for applying power successively to said tensioning, cutting and forming means.

17. A flat band tying machine comprising in combination with tensioning and forming means for the band, means for gripping and supporting the band in forming position, said means including a movable gripping member and a cooperating stationary member between which members a band may be moved to forming position, an oscillatable arm supporting said movable gripping member, said movable gripping member having an axis remote from the axis of the arm and means carried on said arm and associated with said movable gripping member permitting the operation thereof in a direction corresponding to the movement of the band to forming position and preventing the reverse movement of said movable gripping member and the retraction of the band when the same is clamped between the movable and stationary gripping members.

18. A flat band tying machine comprising in combination with tensioning means and forming means, gripping means for supporting the band in forming position, means for opening and closing the forming means, and means controlled by the operation of the forming means for opening the gripping means to permit the insertion of a band in forming position and for closing the gripping means on the band when the forming means are positioned for a tying operation.

19. A flat band tying machine comprising

means for gripping and supporting the overlapped portions of the band in forming position, means for tensioning the band, forming means including relatively movable jaws for embracing the overlapped portions of the band in forming operation, means for opening the jaws to permit the movement of the overlapped portions of the band to forming position, means for initially closing and locking the jaws in initially closed position and means for finally closing the jaws for forming the tie in the band.

20. A flat band tying machine comprising tensioning, cutting and forming means, a normally stationary but movable operating member, means associated with said member for effecting the tensioning, cutting and forming operations in succession, a power driven member, and means for operably connecting said power driven member with said operating member for operating all of said means in a single revolution of the operating member and for restoring all of said means to normal positions.

21. A flat band tying machine comprising tensioning means, cutting means and forming means, said tensioning means including an operating member and an operated member differentially connected together, means for applying power to the tensioning, cutting and forming means, and means connecting the tensioning, operating and operated members permitting the continued operation of the operating member and the stopping of the operated member when the band is tensioned to a predetermined extent.

22. A flat band tying machine comprising means for gripping, tensioning and forming the overlapped portions of a band, and means cooperating with said other means for cutting the surplus material from the band while the band is held in tension around a box or the like and prior to the forming operation.

23. A flat band tying machine comprising means for gripping, tensioning, cutting and forming the overlapped portions of a band or the like, a power driven member common to all of said means, means associated with said power driven member for applying power to said other means, and a trip device for regulating the operation of said power application means whereby said tensioning, cutting and forming means will be operated successively to complete a single tie forming operation, and said power application means will remain inoperative until tripped for a succeeding operation.

24. A flat band tying machine as characterized in claim 23, including an operating handle connected with said trip device, and means automatically operable at the completion of a forming operation for restoring said operating member to normal position in readiness for a succeeding operation.

25. A flat band tying machine comprising means for tensioning, cutting and forming the overlapped portions of a band, a continuously rotatable power driven member, 5 and a manually operated member adapted to be engaged at will with said power driven member whereby one complete revolution of said power driven member will effect the successive operation of the tensioning, cutting 10 and forming means.

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