This invention relates in general to strap tying machines, and more particularly to a gripping and tensioning mechanism for a strap tying machine, including in combination with means for tying the overlapped ends of a strap together when the strap is extended around a box or the like, gripping devices arranged on opposite sides of the tying means for engagement, respectively, with the two bights of the strap, and a tensioning mechanism cooperating with one of the gripping devices, whereby when the strap is positioned around the box or the like thru the operation of the tensioning means the strap may be tensioned in a step by step movement.

A more detailed object of invention is to provide in a strap tying machine, stationary gripping devices for gripping and supporting the strap in tying position, an oscillating gripping device for tensioning the strap preparatory to a binding operation, said oscillating gripping device adapted to automatically grip and tension one of the strap portions when moved in a direction away from one of the stationary gripping devices and to slide freely over the strap when moved in a direction toward such stationary gripping device, together with means whereby said stationary gripping device is adapted to automatically release the gripped portion of the strap when the oscillating gripping device is moved in a direction to tension the strap and to automatically grip the strap when the oscillating gripping device is not moved or when it is moved in a direction to slide freely over the strap.

Other objects may appear as the description progresses.

In the consideration of this invention it may be understood that the mechanism shown, described and claimed herein was originally filed as a part of my application for patent for Strap tying machines, on which Patent No. 1,897,650 was granted to me on Feb. 14, 1935, and the subject matter of the present application has been divided out of said original application in accordance with the requirements of the Patent Office.

While I have shown in the drawings of this application a complete machine of which the tensioning mechanism is but a part, I will not describe in detail the structure and operation of other and disassociated elements or parts of the machine, but reference to said pending application is made for a complete disclosure of the machine.

A preferred embodiment of my present invention is shown in the accompanying drawings, in which

Fig. 1 is a top plan view of a complete strap tying machine showing the relative position of my improved tensioning and gripping means with respect to the other elements of the machine.

Fig. 2 is a sectional elevation of a stationary gripping device associated with the tensioning means whereby when the tensioning lever is retracted at the completion of each operation for the beginning of a new tensioning operation or step, the strap will be held tensioned until a new operation of the tensioning means is begun.

Fig. 3 is a sectional elevation of the tensioning means on line 3—3 of Fig. 1.

Fig. 4 is a front elevation of the assembled machine shown in position on a box or the like, together with a strap extended around the box and tensioned.

Fig. 5 is a transverse section of the tensioning means on line 5—5 of Fig. 1.

Fig. 6 is a transverse section of the forming means on line 6—6 of Fig. 1.

Fig. 7 is a diagrammatic view of the machine mounted upon a box or the like with a strap extended around the box and engaged by the gripping device and tensioning means preparatory to tensioning the strap around the box.

Fig. 8 is a view similar to Fig. 7 at the completion of the tensioning operation with the strap completely tensioned around the box in readiness for an ensuing cutting and forming operation.

Fig. 9 is a section of the tensioning means on line 9—9 of Fig. 5.

Briefly described, the machine of which my improved tensioning mechanism is a part embodies a tie forming mechanism for metal straps adapted to be applied to boxes and the like, and includes a base 1 on which is mounted spaced gripping devices 2 and 3 for gripping opposite portions 4 and 5 respectively of a metal strap, a tensioning means 6 for tensioning the strap 7 around a box 8 or the like in a step by step movement while the strap is held against reverse movement and lateral displacement from tensioning position, a cutter 9 operable at the completion of the tensioning operation for cutting off a necessary length of metal strap from a roll or supply of material, and toggle connected forming jaws 10 and 11 for transversely crimping and interlocking the overlapped portions 4 and 5 of the strap so as to prevent the
disengagement of said portions when the machine is detached.

The forming means includes a primary lever 12 and a secondary lever 13. Lever 12 has a fulcrum at 14 on base 1, while lever 13 is hingedly connected at 15 to lever 12, and lever 13 is also hingedly connected at 16 to a toggle member 17 which carries one of the forming jaws, as at 10. A toggle link 18 is connected at 19 with the toggle member 17 and at 20 with lever 12, and the member 18 carries the other forming jaw 11. (See Fig. 6.) Lever 12 has an upwardly and downwardly movable arm 21 for engaging a handle 22 thereon and a sector 23 which is adapted to be engaged by a pinion 24 rotatably mounted on the upper end of lever 13.

The pinion 24 is operated by a ratchet controlled handle 25 so that when the pinion 24 is completely disengaged from sector 23 the jaws 10 and 11 will be completely spread apart and opened preparatory to placing a band, as at 7, in gripping and tensioning position in a machine. The rotation of handle 25 will rotate lever 12 when lever 13 is not engaged for initially engaging said pinion with sector 23, thereby causing the pinion to traverse the sector 23 from left to right, as seen in Fig. 6, so as to effect the closing of the jaws 10 and 11 in a forming operation.

The grips 2 and 3 are mounted on opposite sides of the jaws 10 and 11 on portions 26 and 27, respectively, of the base. The grip 2 is hingedly mounted on a pin 28 in a recess 29 of member 26 and is provided on its lower face immediately above the base 1 with a toothed gripping member 30. A tension spring 31, connected with an arm 32 of the grip 2 and with a suitable projection 33 from the base or frame of the machine, serves to hold the gripper 30 in operative engagement with the bight 4 of strap 7. In a similar manner the grip 3 is hingedly mounted at 34 in a recess 35 of frame member 27 and is provided with a toothed gripper 36 on its lower face adjacent base 1 for operative engagement with the bight 5 of strap 7, and arm 37 of grip 3 connects with a tension spring 38 which has its other end attached to a projection 39 from the machine frame for tensioning the grip in operative position.

It will be noted that the grips 2 and 3 are reversely positioned and are so formed and arranged that the grip 2 will prevent the slipping of the band 7 to the right, as seen in Fig. 8, and the grip 3 will prevent the slipping of said band to the left. The tensioning mechanism 6 includes a lever 40 which is pivotally mounted on a pin 41 held at its opposite ends in an upwardly turned flange 42 and a lug 43 rearwardly spaced therefrom and formed on or attached to the base 1.

Lever 40 is suitably tensioned by means of spring 44 coiled around pin 41 and having a portion thereof resting against base 1 and an opposite portion or portions resting against a portion of the lever 40. Said spring serves to urge lever 40 in a clockwise direction to a normally vertical position, as shown in Fig. 4, and permits the movement of the lever in a counter-clockwise direction against the tension of said spring for tensioning the band 7, as hereinafter described. Lever 40 is provided with a lug 45 on its front side with a slot 46 therein adapted to receive the inner leg 47 of a U-shaped member 48 which extends inwardly in the direction of grip 3 and is thence bent outwardly at 49 and thence backwardly to provide a leg 50 spaced from and parallel to leg 47.

Member 48 is attached to lever 40 by means of a screw 51 extending thru lug 45 of lever 40 and thru the leg 47 of member 48. By reference to Fig. 5 it will be noted that an extension 52 is formed on the member 48 by forming a continuation of side 47, and said extension is bent forwardly in a horizontal plane and further forwardly in an inclined plane to provide a portion 53 which extends substantially outwardly from the outer side 56 of member 48. The extension 52 thus provides a foot 55 on which the portion 4 of the band 7 is adapted to rest and immediately thereabove a grip 54 is hingedly mounted on a pin 55 which extends thru the sides 47 and 50 of the member 48.

Adjacent the side 47 of member 48 the upper end of a link 56 is hingedly carried on pin 55 while the lower end of said link is hingedly connected with the flange 42 of the base by means of a pin 57. As shown in Fig. 4, the pins 41 and 51 of lever 40 and the pins 55 and 57 of link 56 are uniformly spaced apart so that the member 48 will at all times assume a horizontal position, and lines cutting the axes of pins 51 and 55 and pins 41 and 57 will be parallel regardless of the position of lever 40.

The grip 54 has a toothed gripper 58 on its lower side immediately above the extension 52 for engagement with the portion 4 of band 7, and a spring 59 is held in compression between the upper portion of grip 54 and the portion 49 of member 48, but at all times effecting the operative engagement of the gripper 58 with the portion 4 of the strap.

The grip 54 has a guide member 60 associated therewith with an outwardly and upwardly bent foot 61 and a U-shaped upper portion 62 encompassing one edge and the opposite sides of the grip 54.

In operation the operating levers 12 and 13 are normally spread apart so as to elevate and open the jaws 10 and 11 and to disengage pinion 24 from sector 23 while the band is being positioned in the machine and subsequently tensioned. The machine is placed on the top of a box, crate, bale or the like, as at 8, and shown in Figs. 7 and 8. A metal strap or band 7 is then drawn from a source of supply into position between the grip 54 and the foot 52 of the tensioning means, and thence to the right as seen in Fig. 7 over the gripper 36 of grip 3, thru jaws 10 and 11 between gripper 30 of grip 2 and base 1, thence entirely around the box 7 and between gripper 36 of grip 3 and base 1 with the free end approximately positioned to the left of the member 26.

The grip 3 serves to prevent the slipping of the portion 5 of strap 7 to the left, as seen in Fig. 7, and when lever 40 is moved to the left the portion 4 of the strap will be gripped between foot 52 and gripper 54 of the tensioning device and a portion of the same slip or hang from the left between grip 2 and base 1. At the end of each stroke of lever 40, the lever is retracted to its normal vertical position, gripper 54 sliding over the portion 4 of the band into position for a new grip on the band.

During the retractive movement of lever 40 after the grip 2 prevents the slipping of the band to the right, as seen in Fig. 7, and together with grip 3 holds the band in its previously tensioned position around the box 8. Lever 40 is oscillated for a sufficient number of times to tighten the band 7 in a step by step movement, and
when a proper tension has been attained the cutter 9 becomes operative for cutting the band at a point adjacent the cutter from the surplus material still held in the gripper of the tensioning lever 40. Thereafter the levers 12 and 13 are operated for first closing the jaws 10 and 11 on the overlapped portions 4 and 5 of the band and are subsequently operated for crimping and locking the overlapped portions of the band permanently.

As hereinbefore stated, the structure and operation of the cutting and forming means is immaterial to my present invention, and no detailed description thereof is deemed necessary to a comprehensive understanding of the structure and operation of the tensioning and gripping means.

It will be understood that the tensioning grip 58 grips that portion of the strap which is held by the remotest grip 30, and lever 40 being positively connected with grip 58 effects, at each operation, a movement of grip 58 which corresponds to the movement of the lever. In different tensioning operations the movement of lever 40 and grip 58 may differ in order to meet different requirements of a tensioning operation, in accordance with the judgment of and under the control of an operator.

What I claim is:

1. A strap tying machine comprising a pair of spaced gripping units for engagement with opposite ends of a strap when extended around a box or the like, a tensioning lever, and a supplemental gripping unit associated with said lever, said lever and said supplemental gripping unit being positioned between one of said pair of gripping units and a source of strap supply and adapted to engage and grip that portion of the strap engaged by the more remote of said pair of gripping units for tensioning said strap, said tensioning lever being manually operable for varying the tension on a strap in accordance with the requirements of each operation.

2. A strap tying machine comprising a pair of gripping units adapted to be arranged in opposite sides of a tying position and adapted to grip opposite bights of a strap when the same is extended around a box or the like, a tensioning lever, and a source of strap supply and adapted to engage the bight held by the more remote of said gripping units, and manually operable means for reciprocating said tensioning grip for tensioning said band in a step by step operation, whereby the tensioning of the strap may be varied to meet the requirements of different conditions.

3. A strap tying machine including a pair of primary gripping units adapted to be arranged on opposite sides of a tying position and to grip opposite bights of a strap when extended around a box or the like, a tensioning grip mounted adjacent a source of supply and adapted to engage the bight engaged by the more remote of said gripping units, and means positively connected with and for operating said tensioning grip in a step by step operation to variable extent in accordance with the requirements of different operations, said primary gripping units permitting the movement of the strap bights in a direction tending to tension the strap but preventing the movement thereof in an opposite direction.

4. A strap tying machine including a base, a pair of spaced primary gripping units adapted to be arranged in fixed positions on opposite sides of a tying position and adapted to grip and hold opposite bights of a strap in tension around a box or the like, a movable grip mounted on said base between said pair of gripping units and a source of supply and adapted to engage the bight engaged by the more remote of said fixed gripping units, and a manually operable lever connected with said movable grip to tension the strap in a step by step operation, said lever being mounted on said base adjacent said movable grip and movable at each operation to an extent corresponding to the movement of the associated grip.

5. A strap tying machine including a base, a pair of primary gripping units adapted to be arranged in fixed positions on opposite sides of a tying position and adapted to grip and hold opposite bights of a strap in tension around a box or the like, a movable grip mounted on said base between said pair of gripping units and a source of supply and adapted to engage the bight engaged by the more remote of said fixed gripping units, and a tensioning lever mounted on said base adjacent the source of supply actuating said movable grip to tension the strap in a step by step operation, each of said fixed and movable gripping units including a stationary and a relatively yieldable gripping member between which the strap is adapted to be moved and held.
A strap tying machine including a pair of fixed gripping units arranged on opposite sides of the tying position for engagement with opposite bights of a strap when extended around a box or the like, a base therefor, a manually operable lever oscillatably mounted on said base and positioned adjacent a source of supply, and a tensioning grip including relatively stationary and movable members connected for reciprocation by and with said lever and engaging the bight of the strap engaged by the more remote of said fixed gripping units for tensioning said strap in successive step by step operations, the fixed gripping unit adjacent said movable grip adapted to engage and hold the free ends of the strap against movement, the more remote of said fixed gripping units adapted to engage and hold the opposite bight of the strap while said movable grip is adjusted on the strap preparatory to a succeeding tensioning operation and permitting the movement of the strap thru said more remote gripping unit while the movable grip is operatively engaged with and for tensioning the strap.

A strap tying machine including, a pair of gripping units fixed in position on opposite sides of the tying position for engagement with opposite bights of a strap, a manually operable tensioning lever movable longitudinally of the strap and positioned adjacent a source of supply, a movable gripping unit mounted on and operable with said lever for engagement with the bight of the strap held by the more remote of said fixed gripping units, and means for rendering said movable gripping unit automatically operable for gripping and pulling the band in a given direction but inoperative on the band when said lever and said gripping device are moved in an opposite direction whereby the band may be tensioned in a step by step movement around a box or the like.

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