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ROUND WIRE TENSIONING MECHANISM

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Fig. 1

Fig. 2
This invention relates to a wire tensioning mechanism, and an object is to provide a suitable mechanism for tensioning wire around a box, package, or other article, and is designed particularly for association with a round wire tying mechanism whereby when a wire is extended around an object the two bights may be tied together while the wire is held in tension.

Another object is to provide a round wire tensioning mechanism adapted to be interposed between a source of wire supply and a wire forming or tying mechanism whereby when the free end of a strand of wire is gripped and held and the wire is looped around an object the wire may be tensioned at a point adjacent the source of supply without deforming that portion of the wire which has been gripped and tensioned during a tying or forming operation.

A further object is to provide a round wire tensioning mechanism comprising a rotatable drum having a V-shaped peripheral groove therein and a yieldable spring held presser member for holding a strand of wire in said groove, whereby during the rotation of said drum the round wire will be frictionally held in the groove of the drum as the wire is tensioned.

Other objects will appear as the description progresses.

In the accompanying drawings I have shown a preferred form of tensioning mechanism associated with a simple round wire tying and cutting mechanism for the purpose of illustrating the use and operation of the tensioning mechanism. In said drawings,

Fig. 1 is a front elevation of the mechanism mounted on and arranged for tensioning a wire around a box, package, or other article.

Figs. 3 and 4 are respectively transverse sections of the mechanism on line 3—3 and 4—4 of Fig. 2, showing means for cutting the two bights of wire at the completion of a tying operation.

Fig. 5 is a transverse section of the same on line 5—5 of Fig. 2, showing the wire tying means.

Fig. 6 is a transverse section of the wire tensioning means on line 6—6 of Fig. 2.

Fig. 7 is a sectional elevation of the wire tensioning means on line 7—7 of Fig. 2.

Fig. 8 is a longitudinal section of the wire tying means on line 8—8 of Fig. 5.

As generally constructed, the tensioning mechanism is associated with the wire tying and cutting mechanism as shown in Figs. 1 and 2, and to that end the mechanism is mounted on a suitable base 1, having an upright extension 2 at one end, as shown in Figs. 2 and 6, with a bearing 3 at its upper end, in which a shaft 4 is journaled in a suitable bushing 5. The rear end of said shaft has a tensioning handle 6 fixed thereto, and the front end of the shaft has a loosely held tensioning drum 7 thereon, which is held against displacement by means of an enlarged head 8 on the shaft or otherwise. Said drum is provided with a V-shaped peripheral groove 9 and a ratchet 10 on its inner side forwardly of the bearing 3, and said ratchet is engaged by a stop-pawl 11 pivotally mounted at 12 on a lug 13 extended upwardly from bearing 3. The pawl 11 is yieldably held in engagement with the ratchet 10 by means of a spring 14 suitably connecting the pawl with the lug 13.

Intermediate the drum 7 and the forward end of bearing 3 an arm 15 is mounted on and fixed to shaft 4, and said arm has a radial extension 16 which carries an operating pawl 17 pivotally held at 18 thereon and adapted to be resiliently held in engagement with ratchet 10 by means of a spring 19 suitably arranged for operably connecting the pawl with the arm. Thus when the handle 6 is employed for rotating shaft 4 in a clockwise direction, as seen in Fig. 1, the pawl 17 will rotate the drum 7 corresponding to the movement of the handle and the stop-pawl 11 will prevent the backward movement of the drum when the handle is retracted preparatory to a succeeding operation.

A presser member 20, preferably in the form of a loose roller with a beveled periphery corresponding to the angle of the groove 9 in the drum 7, is provided for frictionally holding a bight 21 of a wire W in the groove.
9 of said drum. Said roller 20 is pivotally mounted at 22 on an arm 23 of a lever 24, and said lever is pivotally held at 25 on the extension 13 of the base. Said lever has an arm 26 which extends to the right of its axis, as shown in Fig. 1, for purposes hereinafter described, and spring 27 is connected with the lower extremity of the arm 23 at one end and with a lug 29 on the base 1 at its other end for holding the presser roller 20 normally in frictional engagement with the drum.

The tying and cutting mechanism of the machine as shown is operated by means of an operating shaft 30 which is journaled in aligned bearings 31, 32 and 33 integral with or attached to the base 1, and said shaft has an operating handle 34 on its outer end. A counter shaft 35 is provided forwardly of and in parallelism with the operating shaft 30 and is journaled at its ends in bearings 36 and 37 integral with or attached to the base 1. The shaft 35 carries a gear 38 which is rotatable therewith and meshes with and is adapted to be driven by a pinion 39 fixed to shaft 30 between the bearings 31 and 32. The gear 38 also meshes with a wire tying pinion 40 which has hubs 41 and 42 which are journaled respectively in guide lugs 43 and 44 formed on or attached to the base.

The pinion 40 is provided with a radial slot 45 and the guides 43 and 44 are provided with slots 46 which register with the slot 45 of the pinion, as shown in Fig. 5. Normally the pinion 40 is positioned as shown in Fig. 5, with the slot 45 therein aligned with the inclined slot 46 of the guides 43 and 44 so that the two points 18 and 19 of the wire W may be inserted in said slots preparatory to a tying operation. The hubs 41 and 42 of the pinion 40 are recessed at 48 and 49 respectively so as to provide spaces for receiving twisted portions 50 and 51 of the wire W during and subsequent to a tying operation.

The gear 38 is provided with axial extensions 32 and 33 on opposite sides thereof, on which are formed or secured cams 54 and 55 respectively adjacent the bearings 36 and 37 for purposes hereinafter described.

The outer faces of the guides 43 and 44 are provided with cutter blades 56 and 57 respectively over which the points 18 and 19 of the wire are extended, as shown in Fig. 8, and cooperating movable cutters 58 and 59 are pivotally mounted on the outer faces of guides 43 and 44 by means of pins 60 and 61 respectively. It will be noted by reference to Figs. 3 and 4 that the cutters 58 and 59 are so disposed to the two points 18 and 19 of the wire that the cutter 58 is effective only for cutting the point 18, while the cutter 59 is effective only for cutting the point 19. Said cutters are normally urged upwardly by means of compression springs 62 and 63.

Said cutters have rounded extensions 64 and 65 respectively which are adapted to be engaged by the cans 54 and 55 on the downward movement of the cans when the shaft 35 is rotated in a counter-clockwise direction, as seen in Figs. 8 and 4 for the purpose of forcing the cutters into operative engagement with the bights of wire.

Outwardly of the cutters cooperating detents 66 and 67 are provided respectively for association with the cutters and are mounted on the pins 60 and 61. Said detents are spring held by means of compression springs 68 and 69 for engagement with the cans 54 and 55 respectively, as hereinafter described.

It will be observed that the arm 26 of lever 24 extends forwardly in the plane of the cam 54 so that the end of said arm will be engaged by said cam when shaft 35 is rotated in a counter-clockwise direction, for purposes to be hereinafter explained.

As shown in Fig. 4, I provide a manually operable release member 70 which is pivotally mounted at 71 on a lug 72 extended upwardly from the base 1 and is normally held in the position shown by means of a spring 73. Said member has an operating handle 74 and an arm 75 extending into the path of cam 55 for limiting the rotation of shaft 35.

In operation the machine is placed upon a box, bale, crate, package, or other article, as at B, and the wire M is fed from a reel R and is drawn loosely around the box B and the end portion of the bight 47 is moved beneath a yieldable grip 76, which is pivoted at 77 on a portion 78 of the frame, and has a serrated lower edge 79 adapted to grip and hold the wire during a tensioning and tying operation. The bight 21 adjacent the source of supply, i.e., the reel R, is threaded through the groove 9 of drum 7 and under the drum where it is frictionally held by means of the presser roller 20. The two points 18 and 19 of the wire are thus positioned in the twisting slots of the guides 43 and 44 and the pinion 45. Thereupon the handle 6 is moved backwardly and forwardly for a plurality of times or to the right and left alternately, as seen in Fig. 1. The forward movement of said handle operates to rotate the drum 7 in a step by step movement and in a clockwise direction, as seen in Fig. 1. Thus, the bight 47 of the wire being immovably held by means of the grip 76, the wire is tensioned around the box or article during the rotation of the drum. When the wire is sufficiently tensioned, the handle 34 is rotated in a clockwise direction, as seen in Fig. 5, and shaft 35 is rotated in a counter-clockwise direction, while the twisting pinion 40 rotates also in a clockwise direction.

It will be noted that the pinion 38 is sufficiently larger than the pinions 39 and 40 so as to provide a sufficient number of twists or turns in the tied sections 50 and 51 of the wire. The shaft pinion 40 is rotated for
a plurality of revolutions while the wire is still held in tension by means herein described, and near the end of the twisting operation the cam 54 will engage the arm 56 and retract the presser roller 20 from operative engagement with the drum 7, thus relieving the tension in the wire.

Following the above mentioned operation, the further rotation of cams 54 and 55 will simultaneously effect the engagement of said cams respectively with the portions 64 and 65 of the cutters, thereby depressing said cutters into operative engagement with the bights of wire.

Following the depression of the cutters as described, said cams respectively engage the members 66 and 67 and depress said members, thus slightly over-twisting the wire so as to provide against the untwisting of the tie beyond normal or desired extent. When the cam 55, however, engages the arm 75 of member 70, the further rotation of the twisting mechanism is prevented and a succeeding operation can only be effected by moving the member 70 to the left, as seen in Fig. 4, to permit the cam 55 to move over the arm 75. The restoration of the gear 38 and pinion 40 to normal position is effected by the engagement of the detents 66 and 67 with the cams 64 and 55 respectively, which urge said cams into position beneath the portions 64 and 65, as shown in Figs. 3 and 4.

It will be understood, however, that I have shown and described the operation of the specific twisting and cutting means employed in connection with my tensioning mechanism merely for the purpose of illustrating the use and effectiveness of the tensioning means in connection with any wire forming or tying means. It may be observed also that heretofore when rotatable tensioning elements have been used it has been necessary to deform portions of the wire which are employed in the production of the tie or of the loop to be tied so that the wire or tie is weakened and is easily broken.

The purpose of my invention, therefore, is to provide an effective tensioning mechanism which is interposed between the source of supply and the tie, and which will not impair or deform the wire so that the surplus material which has been subjected to the action of the tensioning means in a wire forming operation is capable of use in the production of a subsequent tie or loop.

What I claim is:

1. In a wire tensioning machine, the combination of a rotatable drum having a peripheral groove of gradually decreasing width inwardly from the face of the drum, and a presser roller tensioned relative to the drum and disposed in the plane of said groove, for frictionally wedging a wire in the groove of said drum so as to effect a movement of the wire when the drum is rotated.

2. A wire tensioning machine as characterized in claim 1 including means for rendering said presser roller inoperative at will, to permit the movement of the wire independently of the drum.

3. In a wire tensioning machine, the combination with a stationary gripping member for holding the free end of a wire when the wire is extended around an object, of a rotatable gripping member engageable with a portion of said wire adjacent a source of supply, said rotatable member having a peripheral groove, a presser roller tensioned relative to said rotatable member and in the plane of said groove for frictionally wedging said wire in said groove, said rotatable member being operative for tensioning the wire intermediate said gripped end and the source of supply without winding the wire on the rotatable member.

4. In a wire tensioning mechanism, the combination with a stationary gripping member for holding one portion of the wire, of a rotatable peripherally grooved roller, spaced therefrom, for gripping another portion of said wire, and a yieldable presser roller associated with said grooved roller for frictionally wedging the wire in the groove thereof, thereby causing the wire to be pulled in a predetermined direction when the grooved roller is rotated.

5. In a wire tensioning mechanism, the combination with a stationary gripping member for holding one portion of the wire, of a rotatable peripherally grooved roller spaced therefrom for gripping another portion of said wire, a yieldable presser roller associated with said grooved roller for frictionally wedging the wire in the groove thereof, thereby causing the wire to be pulled in a predetermined direction when the grooved roller is rotated, and means for rotating said grooved roller.

6. A tensioning mechanism for wire arranged at a source of supply with a loop extended from the source of supply around an article, including means for gripping and holding the free end of the wire, a rotatable tensioning roller interposed between the source of supply and said gripping means for tensioning the loop around said article and means associated with and for frictionally engaging the wire with said roller whereby the surplus from said loop, due to tensioning, is returned to the source of supply.

7. In a wire tensioning mechanism, a fixed gripping device adapted to grip and hold one end of a wire when the wire is extended from a source of supply and looped around an article to be bound, a rotatable gripping and tensioning member interposed between the fixed gripping device and the source of supply, and means for frictionally holding the wire engaged with said rotatable member whereby the surplus material when severed
from the looped portion will be returned to the source of supply.

8. In a wire tensioning mechanism, the combination of a rotatable drum having a tapered peripheral groove and a relatively yieldable presser roller cooperating with said drum for wedging a wire in said groove in a tensioning operation and means for rotating said drum in a step-by-step movement for pulling the wire in a predetermined direction when the drum is rotated.

9. In a wire tensioning mechanism, the combination of a rotatable drum having a tapered peripheral groove and a relatively yieldable presser roller cooperating with said drum for wedging a wire in a portion of said groove in a tensioning operation, and means for rotating said drum, so as to pull the wire in a predetermined direction over the periphery of the drum.

10. A wire tensioning mechanism comprising means for gripping and holding the end of a wire when looped around an article, a rotatable drum provided with a peripheral groove having a cross section of gradually decreasing width in the direction of its axis, and means associated with said drum for wedging an opposite bight of said loop of wire in said groove without deforming the wire.

11. A wire tensioning mechanism comprising means for gripping and holding the end of a wire when looped around an article, a rotatable drum provided with a peripheral groove having a cross section of gradually decreasing width in the direction of its axis, means associated with said drum for wedging an opposite bight of said loop of wire in said groove without deforming the wire, and means for rotating said drum.

12. A wire tensioning mechanism, comprising means for frictionally gripping and holding an end of a wire in a tensioning operation, a rotatable tensioning drum interposed between said first mentioned means and a source of supply, and means for frictionally engaging a portion of the wire adjacent the source of supply with the periphery of said drum, for pulling the wire in the direction of the source of supply when the drum is rotated.

13. In a machine of the character described, the combination with a wire twisting mechanism, of means for fixedly holding one end of a loop of wire against displacement during a tensioning and twisting operation when said loop is extended around an article, a rotatable tensioning drum having a peripheral groove for receiving an opposite portion of said loop, means for wedging the wire in said groove during a tensioning operation, and means for rotating said drum.

14. In a machine of the character described, the combination with a wire twisting mechanism, of means for fixedly holding one