My invention has for its object to provide an efficient, light-weight, readily portable, manually-operable bundle-tier machine.

The invention provides a bundle-supporting plate and a twine-cutter bar and knottor proximate to the plane of the surface of the plate, the plate having means for elevating the bundle to permit movement of the needle arm beneath the bundle.

The invention, also, consists in a simple, efficient means for causing timed operations of the needle-operating mechanism and the knottor and cutter-bar mechanism with respect to each other.

The invention consists in other features and advantages which will appear from the following description and upon examination of the drawings forming a part hereof.

The invention may be contained in structures of different forms and, to illustrate a practical application of the invention, I have selected a bundle-tier machine as an example of structures containing the invention and shall describe the machine selected hereinafter, it being understood that variations may be made in the structure without departing from the spirit of the invention, as presented in the claims hereinafter appended.

Fig. 1 illustrates a perspective view of the bundle-tier machine. Fig. 2 illustrates a perspective view of an upper part of the tier machine showing certain of the parts located in positions different from that in which they are shown located in Fig. 1. Fig. 3 is a side view of the bundle-supporting plate. Fig. 4 is a view of a section of the machine. Fig. 5 illustrates an end view of the machine with the cover plate removed.

The machine shown in the figures is provided with a base plate 1 having, preferably, a pair of vacuum cups 2, located at the rear corners and on the under side of the base plate 1, for elastically supporting and pneumatically securing the machine to a supporting part, in the manner well known in the art. Preferably, the base plate 1 is provided with a front flange part 3 for engaging a forward edge of a supporting part, on which the tier machine may be placed, such as a table or stand. A case 5, which encloses and/or supports the parts of the actuating mechanism, is secured to the base plate 1.

The actuating mechanisms of the tier machine are manually operated by the lever 7 that is pivotedly supported in the side wall of a part of the enclosing case 5. The lever 7 is provided with a suitable pivoted handle 8 that projects rightward for convenience of operation of the lever 7. The short arm 10 of the lever 7 is located within the enclosing case 5 and protrudes in a direction substantially parallel to the longer arm of the lever. The short arm 10 is formed broader than the longer arm, as viewed in Fig. 5, to form an end edge 11 having a considerable length. A chain 12, of the type commonly used in connection with sprocket wheels, is pivotally connected, at one end, to an ear 13 that protrudes from the lower right-hand corner of the shorter arm 10 of the lever 7, and the other end is connected to an ear 14 that protrudes from a cylindrical block 15.

The block 15 has a flange 16, from which the ear 14 extends. The chain 12 is formed of a plurality of pairs of flat links having spacer bushings 20, which are connected together by the usual pins 21. If desired, shouldered pins may be used for spacing the links. The end edge 11 of the lever 7 and the flange 16 of the block 15 are located in substantially the same plane, and the spacer bushings 20 engage the end edge 11 of the lever 7 and the edge of the flange 16. The inner of the pairs of links 22 are spaced from each other slightly greater than the thickness of the edge 11 of the lever and the flange 16. The links extend along the lateral peripheral surface portions of the flange 16 and the end of the lever to prevent the chain 12 from slipping from the flange 16, and to progressively guide the chain to and from the edge of the flange as the lever 7 is actuated.

The block 15 is rotatably supported on the shaft 24. A spiral spring 25 surrounds the block 15 and is connected at one end to the case 5 and at the other end to the block 15, biased to elastically press the block outward and rotate the block on the shaft when tensioned. The shaft 24 extends through the block 15 and an arm 27 is connected to the end of the shaft 24 for rotating the shaft. The cylindrical block 15 has a short play along the shaft and the outer end of the block 15 is provided with a cam surface 28 and a shoulder 30 located in the plane of the axis of the shaft 29, while the arm 27 is provided with a recess 31 having, on one side thereof, a plane surface extending radially from the axis of the shaft 29 in position to be engaged by the shoulder 30. When, therefore, the block 15 is rotated by the operation of the chain 12, the shoulder 30 engages the radially-extending surface 32 of the arm 27 and causes the arm 27 to rotate, which, in turn, causes a corresponding rotation of the shaft 24, to which the arm is connected.

The shaft 24 is connected to a sector gear 34,
and, at a certain point in the rotation of the shaft 24, the sector gear operates a knotty bill 35. Also, the sector gear has a suitable camway that, upon completion of the tying of the knot, operates a cutter bar 37. The sector gear 34, the knotty bill 35, and the cutter bar 37 are of the type well known in the art and are shown and described in the patent to Bachmayer, No. 1,062,703, granted June 12, 1919, for bundle tier machines.

In the operation of the arm 15, by the lever 7, and the operation of the arm 27, by engagement of the cam surface 25 with the arm 27, the arm 27 operates a needle arm 39. The needle arm has, preferably, a part 40 extending at right angles to the axis of rotation of the needle arm 39, a part 41 extending at right angles to the part 40, a needle 42 located in a plane that is disposed substantially at right angles to the axis of rotation of the needle arm for completing the wrapping of the twine 43, and a twine-tucker plate 44 located beneath the needle 42 for locating the twine in a position such that it may be engaged by the knotty bill 35 and the cutter bar 37. The needle, the tucker plate, the knotty bill, and the cutter bar operate in the same manner as described in the said Bachmayer patent.

The needle arm 39 is rotatably supported on a shaft 45 that is suitably supported in bearings formed in or located in the case 5. A disc 47 is connected to the shaft 45. If desired, the shaft 45 may be formed integral with the needle arm 39. A chain 48, formed of pairs of flat links that are spaced by suitable shouldered pins or bushings 50, is connected at its ends to the disc 47, by means of a suitable pin 51. The disc 47 has a thickness slightly less than the distance between the inner of the pairs of links 52 and, consequently, the links 52, at the ends of the chain, dispose themselves on opposite sides of edge portions of the disc 47, in comparatively close fitting relation, whereby the chain 48 is, when held reasonably taut, retained in position with reference to the disc 47, and certain of the bushings 50 sequentially engage and ride on the edge of the disc 47 as the disc 47 is rotated in one direction or the other.

The chain 48 is retained in its belt-wise relation with respect to the disc 47, by means of a flanged roller or idler 54. The idler 54 is supported by means of the suitable ball bearings located on a fixed pin 55 that is secured to a part of the case 5 and is provided with a flange part 57, having a thickness slightly less than that of the distance between the inner pairs of links 52. The idler 54 is suitably spaced from the disc 47 to engage the bushings 50 of the chain 48 and the flange 51 of the idler 54 is substantially located in the plane of the disc 47 and, consequently, the idler 54 operates to maintain the chain 48 in position on the disc 47 and the idler.

Inasmuch as the needle 42, of necessity, operates synchronously with respect to the operation of the knotty bill 35, the disc 47 and the needle are caused to operate at a certain point in the operation of the shaft 24. The shoulder 30 of the cylindrical block 15 causes engagement with the surface 32 of the recess 31 formed in the arm 27 to produce the rotation of the needle arm 39. The arm 27 is connected, by an adjustable link 58, with the chain 48 at a point near the disc 47 by means of a gooseneck end 59 that is disposed between a pair of the links and secured in position by a suitable pin 61. The other end of the link 58 is connected to the arm 27 by means of the pin 62. When, therefore, the lever 7 is operated, the cylindrical block 15 is rotated and the shoulder 30, eventually, engages the radial surface 32 of the arm 27 and causes rotation of the arm 27, which operates the chain 48 and rotates the disc 47 and the needle arm 39 to cause the needle 42 to move to the knotty bill 35 and cause the tucker plate 44 to move along the under side surface of the package to position the twine in proper position for engagement by the knotty bill and the cutter bar. When the lever 7 is moved sufficiently to complete the movement of the knotty bill to the knotty mechanism, the arm 27 has then been rotated such that the pivot pin 62 of the link 58 is moved beneath the center of the axis of the shaft 24 and the lever may be released. The block 15 is then reversely rotated, relative to the shaft 24, by the spring 25, which causes the cam 23 to shift the block 15 along the shaft 24 by the engagement of the cam with the rear side of the arm 27 and the disengagement of the surfaces 30 and 32. The link 58 and the needle arm are then free to return. The arm 27, being connected to the end of the shaft 24 and to the link 58, the shaft 24 and its connected arm 27 complete the revolution which completes the movement of the knotty and cutter mechanism.

When the pin 62 of the arm 27, passes beneath the axis of the shaft 24, the disc 47 is caused to return, in its oscillatory movement, by means of a spiral spring 64, which is connected at one end to the disc 47 and at the other end to a part of the case 5. The spring 64 is resiliently distorted or tensioned during the first part of the rotation of the arm 27 and when the arm 27 is released by rotation of the pin 62 past the line of the axis of the shaft 24, the spring operates to return the disc 47 to its normal position and complete the rotation of the arm 27, as shown in Fig. 5. Thus, the shaft 24 and the sector gear 34 are caused to make a complete rotation, while the needle arm 39 is caused to oscillate about 180°.

When the needle arm 38 rotates, it carries the needle 42 to a point below the bottom side of a package-supporting plate 65. The cutter bar 37 is located approximately at the plane of the top surface of the body part 40 below the said plane about the thickness of the cutter plate 44. The plate 65 is provided with a front apron 67 and is supported on the case 5 by means of the bolt 68 that extends through the apron 67 and the pin 10 that extends through the lug 11 that protrudes downward from the rear end of the plate 65. The plate is provided with a slot 72 that upwardly and rearwardly extends from near the lower edge of the apron 67 to near the rear third of the plate, where it is materially enlarged, as at 74. The length of the parts 49 and 41 of the needle arm 38 are such as to cause the needle to enter the lower end of the slot, as formed in the apron 67, while the part 41 moves along a curved surface 75 formed on one side of the slot 72 of the plate, and the cutter bar 37 passes over the said curved surface 75 of the cutter bar 37 to move the twine 43 into proper relation with respect to the cutter bar to locate the twine 43 in position to be caught by the knotty bill and to be cut by the cutter bar by a lateral cutting movement of the bar when the knot has been formed.

The curved surface 75 of the plate forms a curved edge along the slot in conformation to the circular movement produced by the part 41.
of the needle arm when the shaft 49 of the needle arm 33 is rotated. The edge 17 of the slot 72 opposite the curved edge extending along the surface 75, is sharply inclined downward from the top of the apron and rearward to the plane surface of the top of the body part of the package-supporting plate 65. The highest point of the edge 17 is located markedly above the curved surface 75. The surface of the plate, in the region of the edge 17, slopes rearward and downward to the enlarged part 74 of the slot 72 and leftward and downward from the edge 17, as viewed in Fig. 1. Thus, when the package 73 is placed over the front edge of the top of the plate and moved rearward, the twine 43 is engaged by the rear side of the package and is moved with the package to any point that may be desired on the surface of the plate. The package 73 may be moved to a point such that its forward surface is located above the knotter bill, or it may be placed merely upon the sloping edge 77 but so that its rear edge is above or to the rear of the knotter bill. A part of the package should, preferably, be located in proximity to the cutter bar 31. Upon the operation of the lever 7, the needle 42 and the tucker plate 44 will pass beneath the package, and the part 41 of the needle arm 48 will move beneath the package, without interfering materially with the package, by reason of the difference in the elevation of the inclined edge 77 and the curved surface 75 and cause the needle and the tucker plate to advance to a position to produce the knot.

The twine 43 is fed from a suitable spindle that may be located, preferably, at the rear of the machine and through a suitable tension member, such as that indicated at 78, and through an eye 79 located on a bracket mounted on the case 8 and through an eye 80 of an elastic take-up 31. Thence, the twine is threaded through the eyes 82 located on the outer side edge and the end of the needle. The bracket extends upward to locate the eye 79 near the upper end of the part 40 of the needle arm. The elastic take-up is formed of a relatively long, light, elastic spring wire secured to the case 8 and normally extending at right angles to the part 40 of the needle arm. As the needle swings down to the knotter, it draws the twine and the eye 80 to a point opposite the eye 79 and prevents the formation of a loose dangling loop of the twine, upon the return of the needle arm. This keeps the twine reasonably taut and prevents entangle-ment of the twine by repeated operations of the lever 7, whether a package is positioned for wrapping on the plate or not.

1. In a bundle-tier machine, a needle, a knotter, and a cutter; a rotatable member for oscillating the needle and operating the cutter and the knotter; an oscillatable member for engaging and actuating the rotatable member so that the member, the oscillatable member having means for disengaging the rotatable member from the oscillatable member upon completion of a part of its rotation; and a spring tensioned by the rotation of the oscillatable member for completing the rotation of the rotatable member.

2. In a bundle-tier machine, a knotter, a cutter, and a needle arm; an oscillatable member for operating the needle arm; a chain connected to the oscillatable member; a rotatable member for operating the knotter and the cutter and connected to the chain for reciprocally moving a part of the chain for oscillating the arm; a second oscillatable member for releasably engaging and actuating the rotatable member to rotate the member a part of its rotation; a spring tensioned by rotation of the rotatable member during the operation of the said part of rotation of the rotatable member and operative to complete the rotation of the member to oscillate the needle arm and operate the knotter and the cutter; and a second spring tensioned by the rotation of the second oscillatable member in one direction to disengage the rotatable member and for returning the oscillatable member to a position of engagement with the rotatable member.

3. In a bundle-tier machine, a knotter, a cutter, and a needle; a rotatable member for operating the knotter and the cutter; an oscillatable needle arm for operating the needle; a cylindrical block oscillatably supported on the rotatable member; a manually-operable lever; a chain interconnecting the short arm of the lever with the block for oscillitating the block, the block having a shoulder for engaging and angularly moving the rotatable member; a disc; a chain connected to the disc at its ends; and an adjustable link for connecting the last-named chain to the rotatable member for reciprocally moving chain in one direction; and a spring for moving the chain in the opposite direction to oscillate the disc connected to the needle arm and complete the rotation of the rotatable member.

4. In a bundle-tier machine, a knotter, a cutter, and a needle; a rotatable member operating the knotter and the cutter; an oscillatable needle arm for operating the needle; an angularly oscillatable block; means for oscillitating the block, the block having a means for engaging and disengaging the rotatable member; a reciprocable means for connecting the needle arm to the rotatable member and a spring tensioned by the reciprocable means for oscillitating the needle arm and completing the rotation of the rotatable member.

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