Oct. 22, 1963 B. H. BUNN ETAL 3,107,603

HOLD-DOWN AND FORMING MECHANISM FOR TYING MACHINE

Filed Oct. 11, 1960 3 Sheets-Sheet 1

FIG. 1

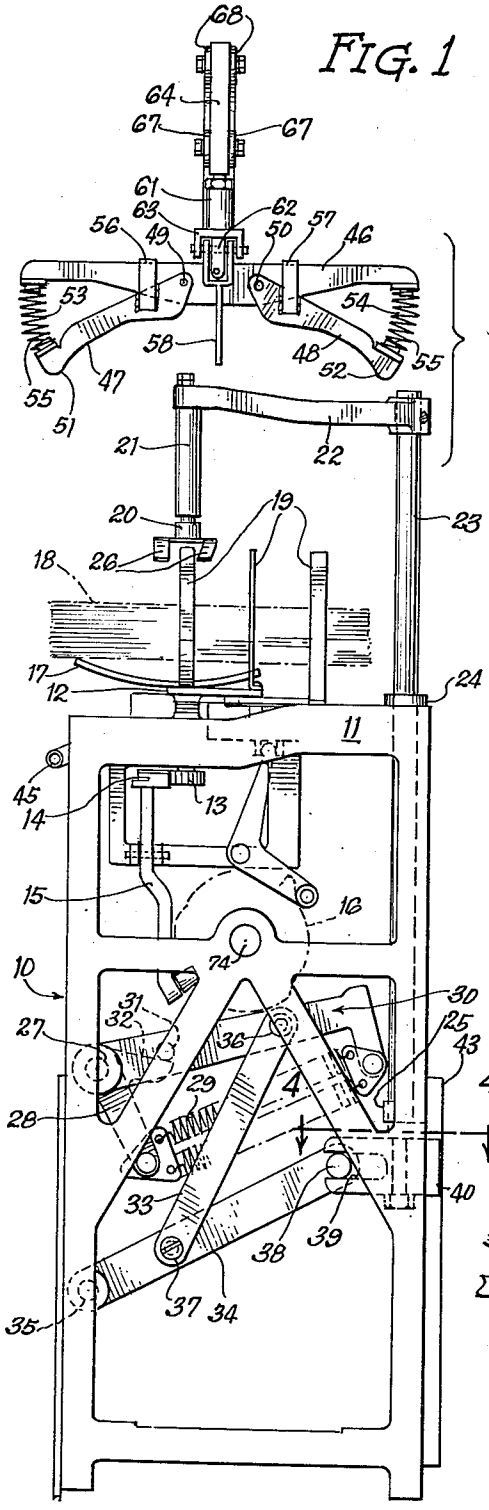


FIG. 2

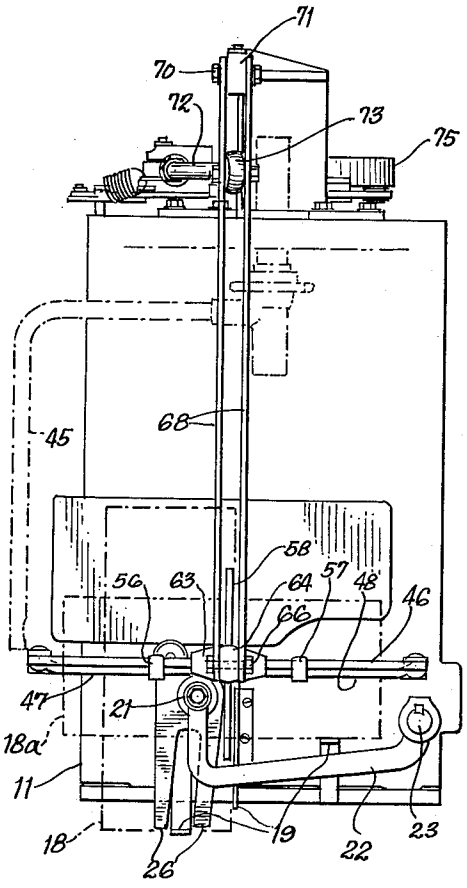
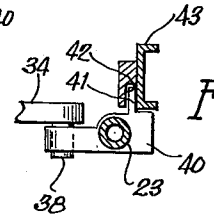


FIG. 4



INVENTORS
Benjamin H. Bunn
BY and Curt E. Nyberg
Horton, Davis,
Brewer & Brugman
Attys

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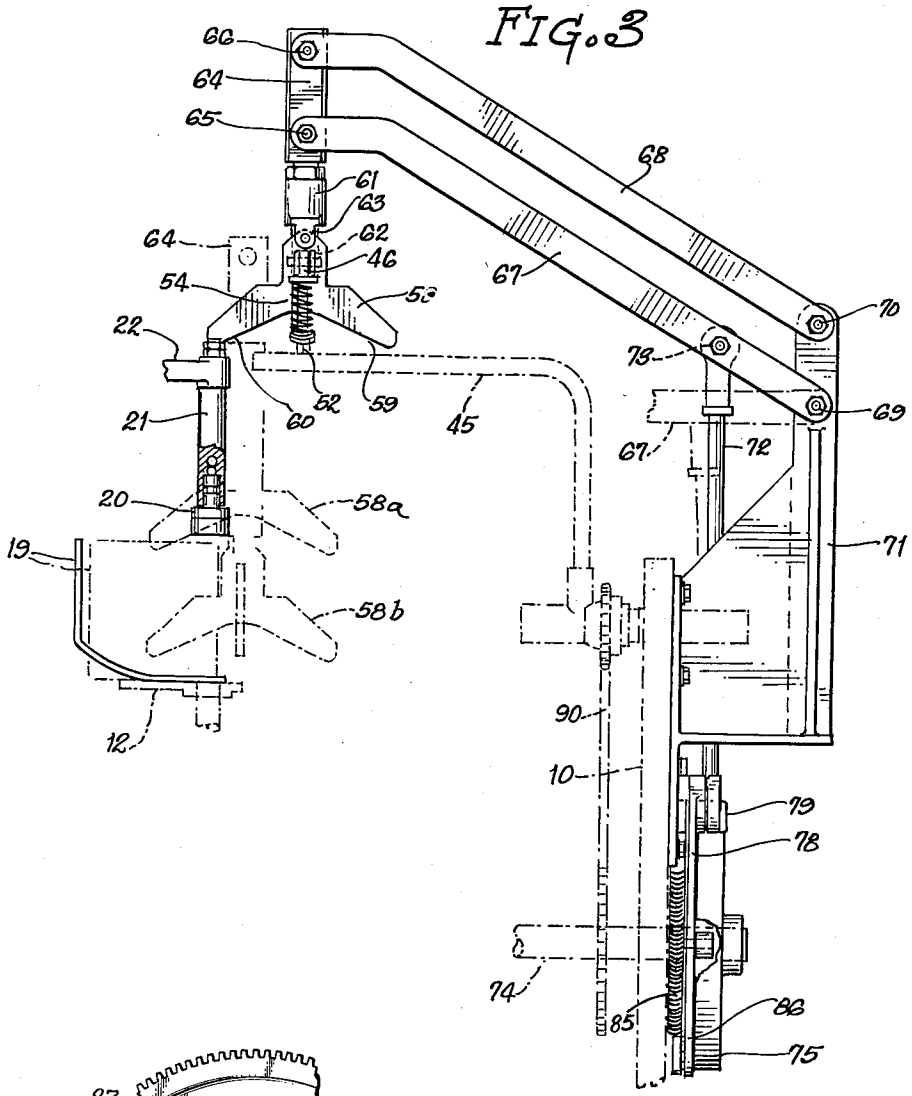
Filed Oct. 11, 1960 3 Sheets-Sheet 2

FIG. 3



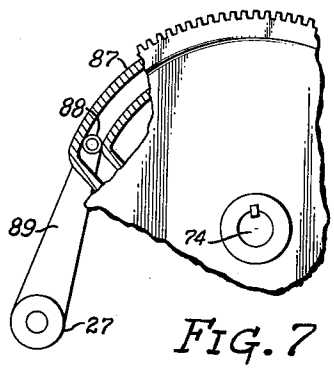


FIG. 7

INVENTORS
Benjamin H. Bunn
BY and Curt E. Nyberg

Horton, Davis, Brewer & Brugman
Att'ys

Oct. 22, 1963 B. H. BUNN ETAL 3,107,603

HOLD-DOWN AND FORMING MECHANISM FOR TYING MACHINE

Filed Oct. 11, 1960 3 Sheets-Sheet 3

FIG. 5

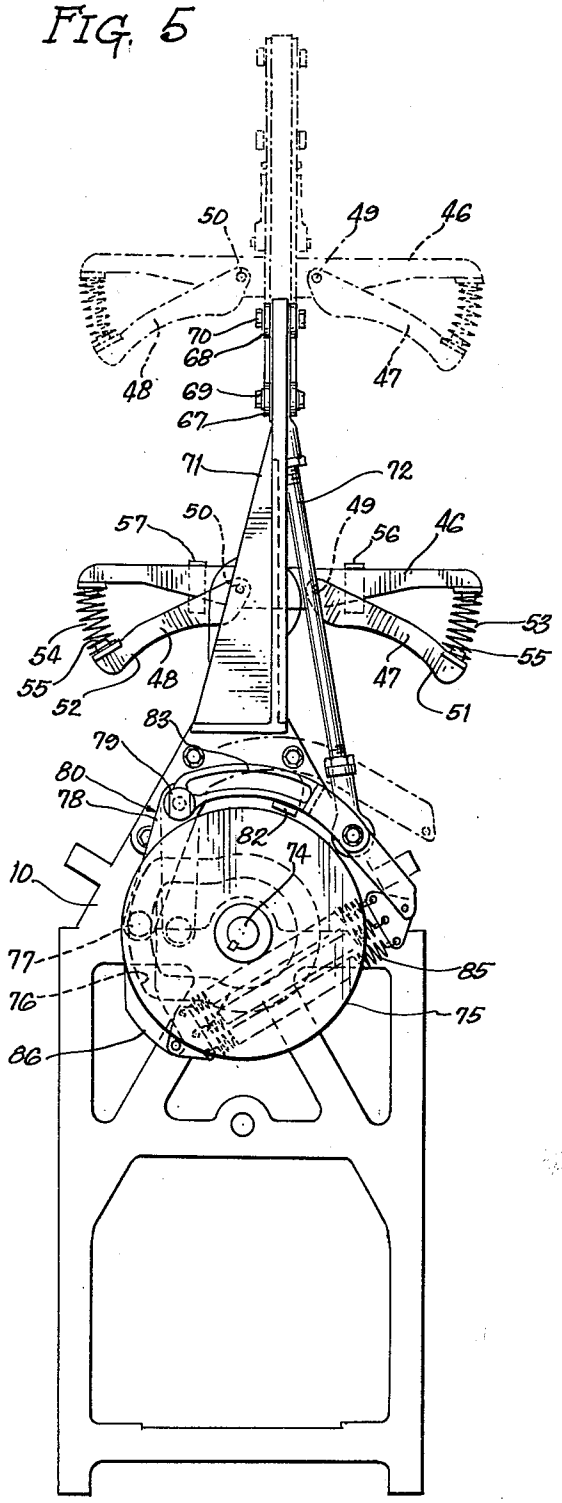
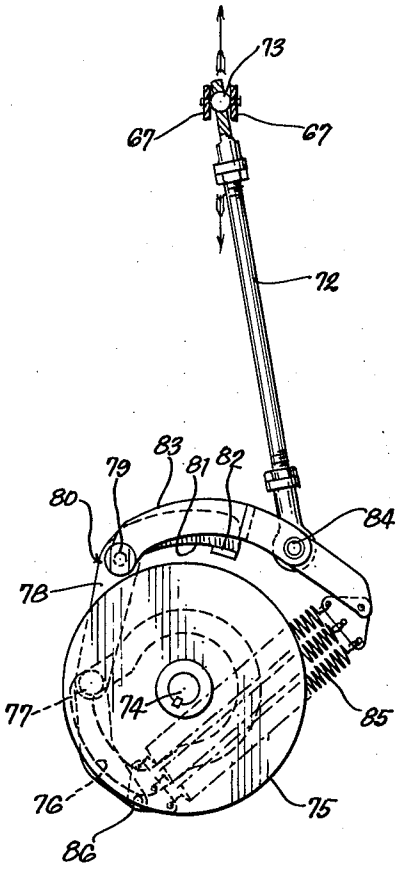


FIG. 6



INVENTORS
Benjamin H. Bunn
BY and Curt E. Nyberg
Horton, Davis,
Brewer & Brugman
Attys

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HOLD-DOWN AND FORMING MECHANISM FOR TYING MACHINE

Benjamin H. Bunn, Chicago, and Curt E. Nyberg, Skokie, Ill., assignors to B. H. Bunn Company, Chicago, Ill., a corporation of Illinois

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4 Claims. (Cl. 100—14)

This invention relates to tying machines and particularly to means for holding and shaping a bundle while it is being tied.

For purposes of illustration this invention will be described with reference to its application to a tying machine of the type disclosed in B. H. and R. N. Bunn Patent No. 1,201,688 granted October 17, 1916, for Tying Machine. The machine disclosed in said Bunn et al. patent is provided with a turntable on which a bundle to be tied may be placed, and with means for turning the bundle through ninety degrees after it has been tied in one direction so that it may automatically be tied in a direction transverse to the first tie without any manual effor on the part of the operator. To insure a tight wrap on the bundle, a mechanism is provided which descends upon the bundle and holds it firmly against the table during the entire tying operation. Additional mechanism is provided for appropriately compressing the ends of long bundles of mail or the like while the long dimension of the bundle is being tied.

The general object of this invention is to simplify the construction of the hold-down and bundle forming mechanism of a tying machine, to reduce the cost and facilitate the repair thereof.

As a more specific object, this invention seeks to provide a hold-down mechanism for a turntable type of tying machine wherein the actuator for the hold-down mechanism is disposed in the base of the machine, thereby reducing the obstructions to the manipulation of a bundle to be tied and to some extent reducing the hazards to the operator.

Another specific object of this invention is the provision of a simplified forming mechanism, the operative parts of which are disposed on the exterior of the base of the machine for ready accessibility and permitting the use of less bulky mechanism above the turntable.

These and other objects and features of this invention will become apparent from the following detailed description when taken together with the accompanying drawings in which:

FIGURE 1 is a front elevational view of a tying machine incorporating the novel hold-down and bundle-forming mechanisms of this invention;

FIGURE 2 is a plan view of the machine of FIG. 1;

FIGURE 3 is a side elevational view of the bundle-forming mechanism of the machine of FIG. 1.

FIGURE 4 is a fragmentary plan view in section of the reciprocating mechanism for operating the hold-down mechanism of FIG. 1, said view being taken along lines 4—4 of FIG. 1 and in the direction of the arrows at the ends thereof;

FIG. 5 is a rear elevational view of the bundle-forming mechanism of FIG. 1;

FIGURE 6 is a rear elevational view of the bundle-forming mechanism of FIG. 5 showing only the drive mechanism therefor and showing said drive mechanism in a different stage of operation from that of FIG. 5; and

FIGURE 7 is a fragmentary elevational view of the drive for one of the shafts of FIGURE 1.

Inasmuch as the driving mechanism for the twine arm, knotter and turntable is not a part of this invention, the details of such mechanism will not be described herein, such details being fully explained in the aforementioned

Bunn et al. Patent No. 1,201,688 and in a prior patent to B. H. Bunn, No. 1,606,290, granted November 9, 1926, for Tying Machine.

Referring now to FIG. 1 for a detailed description of the invention, there is disclosed a tying machine having a frame **10** including a generally horizontally disposed top member **11** upon which is mounted a turntable **12** for oscillation about a vertical axis. The driving mechanism for said turntable is disposed below top member **11** and may comprise a gear **13**, a rack **14**, and a pivoted lever **15** connected to rack **14** at one end and adapted to be driven by a cam shown in dotted outline at **16**. The lever and cam and the drive mechanism for the cam are similar to those disclosed in the aforesaid Bunn et al. Patent No. 1,201,688.

Turntable **12** has an upwardly curved resilient forming element **17** upon which a bundle of letters or the like **18** to be tied may be placed. Various stop elements **19** extending vertically from turntable **12** serve to locate the bundle on the turntable in the optimum position for the operation of the tying mechanism.

It is contemplated that the machine will tie a bundle of mail or the like together along its short dimension first and then will turn the bundle through ninety degrees to enable the tying mechanism to tie the bundle across its long dimension. To avoid a loose bundle, it is desirable to exert downward pressure upon the bundle during both the short and long ties. To this end a hold-down mechanism is provided which is brought down upon the bundle at a point offset from its center so as to avoid interfering with the twine during both the short and long ties.

The hold-down mechanism is thus comprised of a head **20** which is pivotally mounted in a vertically disposed rod **21** rigidly secured to a horizontal arm **22**, the latter in turn being rigidly secured to a vertically reciprocable rod **23** mounted in spaced bearings **24** and **25** in frame **10**. Said head **20** has secured thereto horizontally disposed flexible fingers **26** which serve to distribute the pressure of the head upon the bundle.

Vertical reciprocation of rod **23** is derived in part by shaft **27** horizontally mounted on frame **10**. The drive for shaft **27** is shown in FIGURE 7 and comprises a plate cam **87** mounted on and keyed to a shaft **74** driven by a suitable motor (not shown). A follower **88** mounted on the end of an arm **89** is driven by said plate cam **87**, said arm in turn being mounted on and keyed to shaft **27**. The shape of plate cam **87** is such as to oscillate arm **89** and shaft **27** as shaft **74** is rotated. Said shaft **74** drives a twine arm **45** (FIGURE 3) through a sprocket and chain drive shown at **90** so that shaft **27** is periodically oscillated in synchronism with the movement of the twine arm to the end that the bundle will be tightly tied across both its short and long dimensions.

The oscillating movement of shaft **27** is imparted to a lever **28** appropriately secured thereto and is transmitted thence from the lever through a double spring **29** to a long lever **30** mounted for free rotation about shaft **27**. Springs **29** are normally in tension, the minimum length of the spring being controlled by a stop mechanism comprising a pin **31** on lever **30** and a finger **32** contacted by pin **31** and rigidly secured to, or forming an integral part of, lever **28**. The oscillatory movement of lever **30** is transferred through a link **33** to a second lever **34** pivotally mounted on frame **10** at **35**.

It may be noted that the pivot point **36** of link **33** on lever **30** is at a greater radius with reference to the axis about which lever **30** oscillates than is the pivot point **37** from the axis about which lever **34** oscillates. Levers **30** and **34** and link **33** therefore constitute a compound lever system in which the movement of lever **30** is amplified angularly. Since the effective lengths of levers **30** and **34** are approximately equal, this means that the linear

movement of the free end of lever 34 is similarly amplified with respect to the linear movement of the end of lever 30.

A transverse pin 38 is mounted on the free end of lever 34 and extends into a slot 39 formed in a slide 40 secured to the lower end of vertically reciprocable rod 23. Said slide 40, as seen more clearly in FIG. 4, has a tongue 41 formed integrally therewith and extending laterally therefrom into a groove 42 formed by the back of a channel-shaped guide 43 and one leg of an L-shaped strip secured to the back of said channel-shaped guide 43. Tongue 41 riding vertically in the groove 42 serves to prevent rod 23 from turning in its spaced bearings 24 and 25. This in turn assures a predetermined location of head 20 on a bundle and makes certain that the head will not be so placed as to interfere with the tying operation.

It may be apparent from the description thus far given that oscillation of shaft 27 will impart an oscillatory movement to lever 34 through spring 29 from lever 30 and link 33 and that such oscillatory movement will be translated into a reciprocating movement of rod 23 through the pin-and-slot connection 38, 39 with slide 40 secured to the lower end of said rod. Such reciprocating movement of rod 23 will in turn be transmitted through horizontal arm 22 to rod 21 and head 20, thereby alternately bringing head 20 down upon a bundle, and after certain cyclic operations have been performed, removing the head therefrom. Variations in height in the bundle are accommodated by the resilience in springs 29, said springs being extended when movement of rod 23 is arrested by a bundle.

It may be noted that the axis of rod 21 is aligned with the axis of rotation of turntable 12 to permit free rotation of the bundle under the head without damage to the uppermost parts of the bundle in contact with the head. This is an equally important reason why the angular disposition of rod 23 must remain fixed during the reciprocation of the rod.

The twine arm of the machine is shown in dotted outline at 45 in FIG. 2 and it is rotated about an axis which is substantially horizontal. The position of the bundle on the machine when the short dimension is being tied is shown at 18 and the position of the bundle when the long dimension thereof is being tied is shown at 18*a*, both in dot-dash outline. After the short dimension is tied, the remaining untied edges tend to separate from one another to produce a bundle which is thinner in the central tied region than it is at the outer untied regions. In this condition it would be difficult to tie the bundle across its long dimension without compacting the loose end regions before the twine is drawn up tight and knotted. The mechanism for compressing such loose ends will now be described.

Referring now to FIGURE 5, the compacting mechanism is comprised of a horizontally disposed bar 46 of a length greater than the longest bundle to be tied. Arms 47, 48 are pivotally secured to bar 46 at 49 and 50, respectively, in such manner that said arms extend downwardly from bar 46. The bottom edges 51 and 52 of arms 47 and 48, respectively, are curved downwardly when levers 47 and 48 are in operative position so that when said bottom edges compact a bundle, they will depress the edge regions toward turntable 12 a greater amount than the central regions of the bundle, thereby not only counteracting the tendency of the loose edges to flare outwardly away from one another, but compressing the generally empty end regions of envelopes of which the bundle may be comprised.

Damage to the bundle by the arms 47 and 48 is avoided by the use of springs 53 and 54 which may be ordinary helically wound springs centered on buttons such as 55 secured to the opposed ends of the arms 47, 48 and bar 46. Downward movement of the arms under the action of the springs is limited by stops 56 and 57 respectively secured to arms 47 and 48 and extending over the top edge of bar 46.

The head 20 is designed primarily to exert pressure upon a bundle at the central region thereof and the head is present upon the bundle while the twine is being wrapped around the bundle in both the short and the long directions thereof. Consequently it is also possible that the long edge regions of the bundle will not be sufficiently compacted to make to tight bundle. To alleviate this situation, the forming clamp shown in FIG. 3, for example, at 58 is used. This clamp has downwardly sloping ends 59 and 60 which serve to compress the long edges of a bundle together at the same time that the short edges are being compacted by the arms 47 and 48.

It is desirable that the bundle forming mechanism be presented to the bundle in precisely the same manner regardless of the thickness of the bundle, that is, regardless of the height of the bundle above turntable 12. To insure this operation, a parallel arm arrangement is used, said parallel arm arrangement being shown in FIGS. 1 and 3. As there shown, bar 46 is secured to a rod 61 through a yoke 62 formed in the lower region thereof, and clamp 58 is similarly secured to rod 61 through a yoke mechanism 63 also formed in the lower regions thereof. Rod 61 is fastened to a vertical member 64 of the parallel arm mechanisms, said vertical member in turn being pivotally secured at 65 and 66 to the ends of parallel arms 67 and 68, the opposite ends of said arms being in turn pivotally secured at 69 and 70 respectively to a bracket 71 secured to frame 10. Oscillatory movement of the arms 67 and 68 about their pivots 69 and 70 is effected by a rod 72 connected by a ball joint 73 (FIG. 6) to the lower arm 67. For greater strength and also to avoid producing eccentric forces in the pivots, double arms are used, one on each side of the vertical member 64 and bracket 71. The double arms are shown clearly in FIG. 2. The necessary reciprocating movement of the rod 72 is produced by a cam and lever mechanism shown in FIGS. 5 and 6. Thus, the tying machine has as an element thereof a shaft 74. The drive means for shaft 74 is not essential to this invention and hence will not be detailed herein.

Keyed to said shaft 74 is a plate cam 75 in one face of which there is a cam groove 76 shown in dotted outline in FIGS. 5 and 6. A follower 77 riding in groove 76 is rotatably mounted on the end of an arm 78 (see also FIG. 3) pivoted to machine frame 10 at 79 and constituting one of the arms of a bell crank 80. The other arm 81 of bell crank 80 has a horizontally extending stop 82 formed in the end thereof which is adapted to contact the bottom edge of a lever 83 also pivoted to frame 10 at 79. The lower end of rod 72 is pivotally connected at 84 to lever 83 such that when said lever is rotated about its pivot 79 in a counterclockwise direction as viewed in FIGS. 5 and 6, the rod 72 will be pushed upwardly, thereby raising arm 67 and its associated forming mechanisms relative to the turntable 12 and to any bundle which may be located thereon. Rotation of lever 83 in the opposite sense will result in a lowering of the forming mechanism upon a bundle. Counterclockwise movement is imparted to lever 83 by the stop 82 on the other arm of bell crank 80. Downward movement, that is, clockwise movement of arm 83 about its pivot 79, as viewed in FIGS. 5 and 6, is effected through a plurality of springs 85 connected at one end through appropriate swinging means to an extension 86 of bell crank arm 78 and at their opposite ends to the end of lever 83. Thus, downward pressure upon the bundle is transmitted to rod 72 through springs 85 so that variations in the thickness of the bundle will have no effect upon the operation of the lowering means for the compacting mechanism.

It may be apparent from the description thus far given of the compacting mechanism and its driving mechanism that the compacting mechanism will be lowered upon a bundle and compressed thereagainst in such manner that the compacting mechanism is always presented in the same relation to the bundle. This is shown in dotted outline in FIG. 3 at 58*a* and 58*b*.

The sequence of operation of the hold-down and compacting or forming mechanisms described above in relation to the operation of the twine arm, turntable rotating mechanism and the knotter is substantially the same as that of the corresponding elements in the aforesaid Bunn et al. Patent No. 1,201,688. The hold-down and compacting mechanisms of this invention differ from the corresponding prior mechanisms in the elimination of bulky superstructure rotatable with the bundle during the hold-down operation, and in the simplification and placement of the mechanism for operating the compacting mechanism. The compacting head itself has been improved in that individual springs are used for each side, enabling the head to adjust to differences in the composition of the bundle at its ends, whereas in the prior unitary spring design, the pressure on both ends was equalized, whether or not the composition of the bundle required it.

It is understood that the foregoing description is merely illustrative of a preferred embodiment of this invention and that the scope of this invention therefore is not to be limited thereto, but is to be determined by the appended claims.

We claim:

1. In a tying machine having a turntable support for a bundle to be tied, a rotatable twine arm for wrapping twine around a bundle on said turntable, and means for driving the twine arm and turntable in predetermined sequence, a head assembly for compressing and holding the bundle against the turntable, a rod spaced from said head assembly, means connecting the rod to the head assembly, a slide connected to the rod, a fixed guide cooperating with the slide and limiting said slide to rectilinear movement, an oscillatable power shaft, and resilient means and compound lever means serially connecting the oscillatable power shaft to the slide to impart reciprocating movement to the slide, said reciprocating movement of the slide being transmitted to the rod, to the means connecting the rod to the head assembly, and to the head assembly, to move the head assembly toward and away from the turntable, said resilient means and compound lever means comprising a crank arm on the oscillatable power shaft, a lever loosely rotatable on said shaft, a second lever, a fixed support, a pivot for the second lever on said fixed support, a pin on said second lever, said slide having a slot to receive said pin, a link connecting the first-mentioned lever with the second lever, the connection of the link to the first-mentioned lever being at a greater distance from the said shaft than the connection of the link to the second lever is from the pivot for said second lever, and said resilient means comprising tension spring means connecting the crank arm to the first-mentioned lever.

2. In a tying machine having a frame, a turntable on the frame adapted to support a bundle to be tied, a rotatable twine arm for wrapping twine around a bundle on said turntable, and means for driving the twine arm and turntable in predetermined sequence; means for compacting and shaping said bundle, and means for raising and lowering said compacting means relative to said turntable, said last-mentioned means comprising a rotatable shaft for driving said twine arm, said shaft being supported on said frame and having a portion extending outwardly of said frame, an oscillatable shaft supported within said frame, cam means rotatable with the rotatable shaft, a follower cooperating with said cam, a lever oscillated by said follower, means reciprocated by said oscillating lever, said compacting and shaping means comprising a first bundle compacting means reciprocated by said reciprocated means; a reciprocable slide on the frame, means connecting the oscillatable shaft with the slide and converting oscillating movement of the shaft into reciprocating movement of the slide, said compacting and shaping means comprising further a second bundle compacting means connected to and driven by said slide, and means synchronizing the movements of both said bundle compacting means.

3. A tying machine as described in claim 2, said cam means comprising a plate cam spaced from the frame and having a cam groove therein facing the frame, and said lever and follower being disposed in the space between the cam and frame.

4. A tying machine as described in claim 2, said means for converting the movement of the lever oscillated by the follower to reciprocating movement comprising a lever loosely pivoted on the same center as the oscillated lever, means on the oscillated lever contacting the loosely pivoted lever in one direction of oscillation, resilient means connecting the oscillated lever to the loosely pivoted lever in the opposite direction of oscillation, and motion amplifying means connecting the loosely pivoted lever to the said first bundle compacting means.

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