Sept. 4, 1956 D. A. GREGORY 2,761,377

CLAMPING DEVICES

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Fig. 1

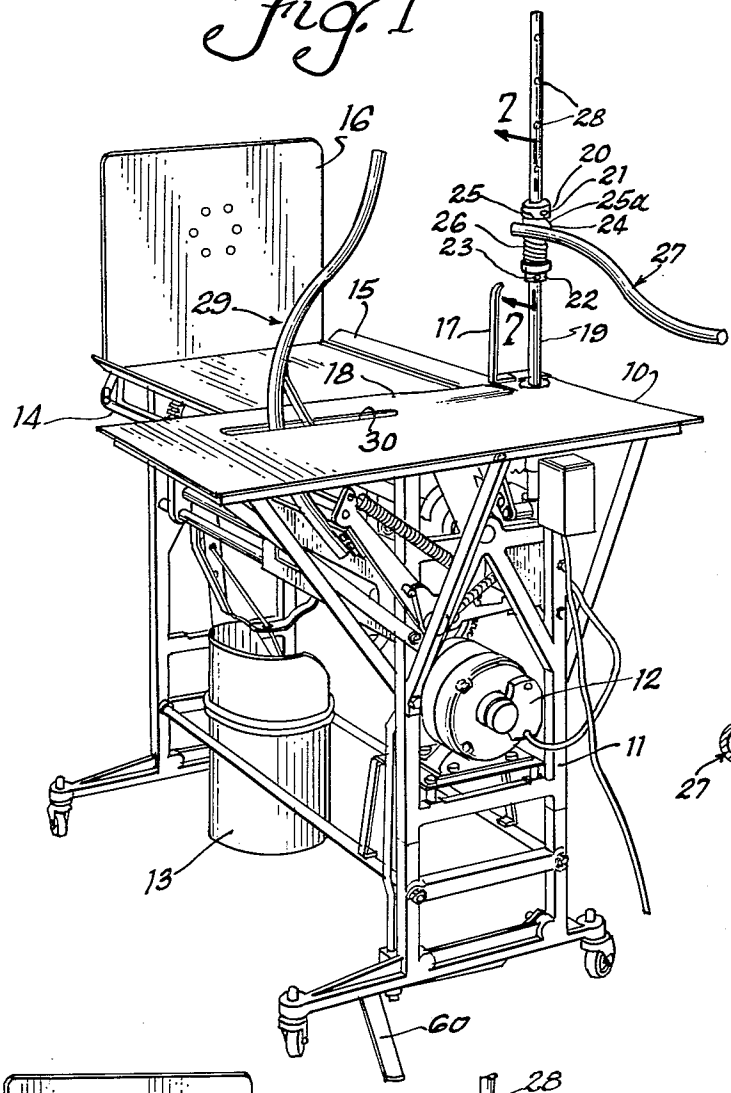
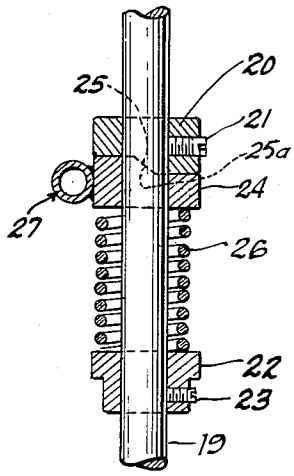


Fig. 7



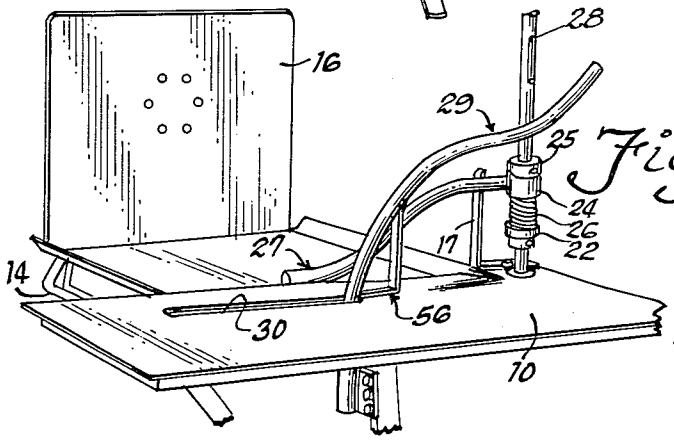


Fig. 2

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Fig. 3

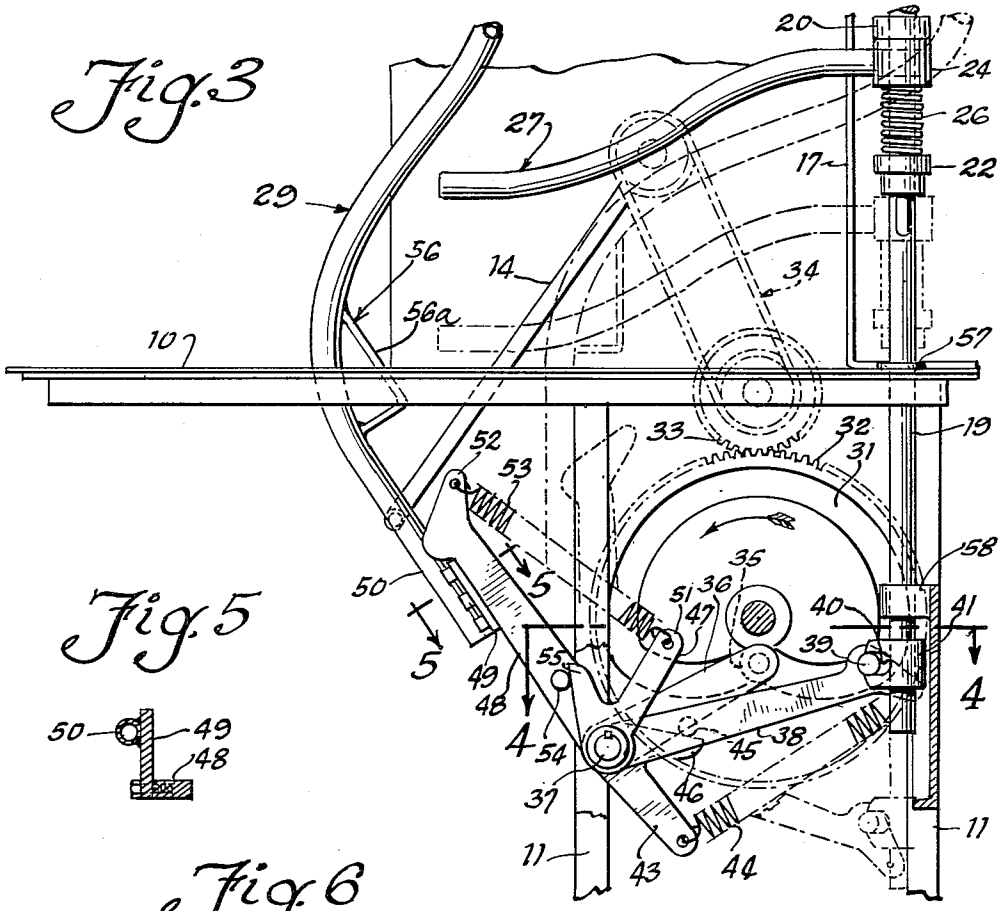


Fig. 5

Fig. 6

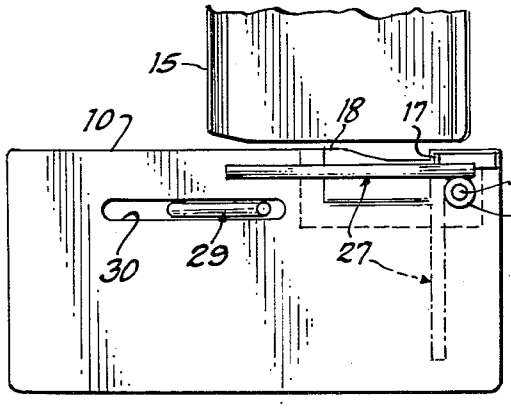
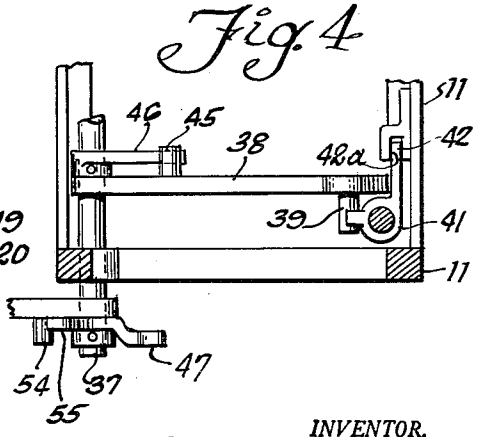


Fig. 4



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CLAMPING DEVICES

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Application July 17, 1953, Serial No. 368,602

3 Claims. (Cl. 100—232)

This invention relates to clamping devices, and more particularly to such devices which are adapted to use in conjunction with tying machines for compressing and holding a portion of an object being tied.

It is frequently desirable to tie loose material or objects, such as shrubbery, thorny bushes and the like with twine and with or without other wrapping to facilitate shipment of such objects or material from place to place, or to facilitate the handling and storage thereof. Although machines of the type illustrated can be used for tying such objects or material without the aid of a clamping device, it has been found that the applied ties are rather loose due to the natural resilience of some material or objects, such as shrubbery, unless that material or object is manually compressed and compacted during the tying operation. It is, of course, quite apparent that such manual compression and holding of a bushy object is not only awkward and time consuming, but is an unpleasant task when thorny bushes are being tied. Although the tying of tighter bundles might be accomplished by increasing the tension on the twine, this approach to the solution of the problem, for many reasons, is not desirable. For example, the resultant slippage of the twine might cut or cause damage to the material or object, and in some instances it might even be necessary to change the design of certain tensioning apparatus and certain apparatus for holding one end of the twine while a reach of the twine is being wound, because the required twine tension would impose loads on portions of the machine for which those portions are not ordinarily designed.

One of the principal objects of this invention is to provide a clamping mechanism for use on a tying machine to adapt such machine to the tying of loose resilient material, such as shrubbery or the like, and whereby the material is firmly compacted prior to the completion of the tying cycle.

A more specific object of the invention is to provide clamping means for loose resilient material to be tied, said clamping means being so designed that it will exert pressure in transverse directions upon the material and will maintain such pressure during the tying cycle.

As another object, this invention has within its purview the provision of a clamping means for resilient material wherein said clamping means comprehends two curved arms, one arm being adapted to exert pressure on the material in a direction toward a support and the other arm being particularly designed to exert pressure on the material in a direction lateral to that of the first mentioned arm, there being provided a suitable abutment against which the pressure is exerted in the latter mentioned direction.

This invention has for another object the provision of a clamping mechanism for a tying machine wherein said clamping mechanism includes two arms, one of which is movable in a vertical direction and the other is movable in a horizontal direction, both arms being

subject to mechanical actuation in timed relationship to the operation of the tying machine by a single cam.

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

Fig. 1 is a perspective view taken from in front and somewhat to one side of a complete tying machine incorporating the clamping means of this invention;

Fig. 2 is an enlarged perspective view of the table and clamping means of the machine depicted in Fig. 1, with the clamping means in a different operating position than that shown in Fig. 1;

Fig. 3 is an enlarged fragmentary front elevation view of the clamping means of this invention, including means for mechanically effecting the operation thereof;

Fig. 4 is a fragmentary sectional view, with the section taken substantially along a line 4—4 of Fig. 3 and in the direction of the arrows;

Fig. 5 is a sectional view through a portion of the clamping means, taken substantially along a line 5—5 of Fig. 3;

Fig. 6 is a fragmentary top plan view of the table and clamping means of the machine of Fig. 1; and

Fig. 7 is an enlarged fragmentary sectional view through another portion of the clamping means, and wherein the section is taken substantially along a line 7—7 of Fig. 1.

Referring now to the drawings for a detailed description of the invention, and particularly to Fig. 1, there is shown a tying machine which, in its essential parts, is substantially like the tying machine shown in B. H. Bunn Patent No. 1,606,290, dated November 9, 1926. Description of the parts common to the machines disclosed in Fig. 1 and in the aforementioned patent will be limited in detail herein to that necessary for an understanding of this invention, but reference is made to the description contained in the aforementioned patent as a source of information regarding details of the machine which are beyond the disclosure required for an understanding of the structural details and operation of the mechanism of this invention. The machine, in general, comprises a table **10** for the support of an article to be tied and which is mounted on a supporting frame **11**. The frame **11** also carries a drive motor **12** which serves as the prime mover for the machine, a container **13** for holding a ball of twine, and suitable other mechanism for wrapping a length of twine about an article and tying a knot in the twine after the wrapping operation is completed. The wrapping operation is effected by means including an arm **14**, which arm carries the twine and winds it around the article or material to be tied.

Adjacent and substantially on a level with the table **10** is a platform **15** upon which one end portion of the material to be tied may be placed, the table and platform being spaced apart at a position aligned with the end of the arm **14**, so that twine extending from the arm **14** for wrapping and tying purposes passes through the space between the table and platform. Said platform **15** may be provided with a back plate **16** which functions as a support for the platform and prevents the material being tied from being pushed into operating parts of the machine.

Table **10** has secured to the top surface thereof a substantially vertical abutment **17** which is located next to an edge **18** of the table **10** which is adjacent the platform **15**, as well as to the right hand side of said table **10**, as viewed in Fig. 1. Abutment **17** serves as a lateral guide for the placement of material upon the table **10** to be tied. Adjacent abutment **17** is an upwardly extending rod **19** which passes through an opening in the table **10** to a clamp driving mechanism located below said table.

A collar 20 is normally held in an adjusted position on rod 19 by a set screw 21 (Fig. 7). A second collar 22 is likewise adjustably mounted on rod 19 and normally held in position thereon by a set screw 23, and a third collar 24 is slidably and rotatably mounted on the rod between collars 20 and 22. Adjacent end surfaces of the collars 20 and 24 are formed as cams having abruptly sloped surfaces 25 and 25*a* which coact so that when collars 20 and 24 are angularly disposed in a manner to cause the corresponding sloped surfaces 25 and 25*a* to abut one another, rotation of collar 24 relative to collar 20 is impossible without an axial movement of one collar relative to the other. A spring 26 is compressed between collars 22 and 24 to cause collar 24 to bear continuously against collar 20 and thereby offer substantial resistance to an axial movement of collar 24 relative to collar 20.

A curved clamp arm 27 is secured to collar 24 in a manner such that clamp rod 27 and collar 24 move together relative to rod 19. Sloping surfaces 25 and 25*a* are so disposed angularly of rod 19 that they will abut one another when clamp arm 27 is disposed crosswise of the machine in a plane parallel to the edge 18, substantially as shown in Fig. 2, and spring 26 will tend to hold clamp arm 27 in this angular clamping position throughout the tying cycle. The resistance of spring 26 is not sufficient, however, to prevent clamp arm 27 from being manually rotated out of its aforementioned clamping position and to the position shown in Fig. 1, wherein said clamp rod will not interfere with the placement of a bundle or article to be tied upon the table of the machine.

It is contemplated that rod 19 will be reciprocated in a direction toward and from the table 10 to compact the material to be tied against that table. In order to accommodate material of various thicknesses, that is to say, bundles or articles of various thicknesses, collars 20 and 22 may be set at various positions along rod 19. To this end rod 19 in the disclosed structure is provided with indentations 28 which provide seats for set screws 21 and 23 and assist in locating collars 20 and 22 on said rod, thereby firmly to hold the collars at predetermined positions along the rod 19 without overstressing or damaging the set screws or mutilating the surface of the rod.

To the left of table 10 from the rod 19 and abutment 17, as viewed in Fig. 1, is a second clamping arm 29 which protrudes from beneath table 10 through an elongated opening 30 in said table. The arm 29 is mounted for oscillatory swinging movement in opening 30, and thereby to move toward or away from abutment 17. It is contemplated that arm 29 will provide horizontal clamping force required to hold and compact the material to be tied against abutment 17. It may be noted that clamping arm 27 is curved at its free end, as viewed in Fig. 1, so that as it advances toward table 10 the material will be urged not only against table 10, but lateral components of force will be developed which tend to effect the gathering of projecting material, branches or the like which are to be tied and urge such material to the right, as viewed in Fig. 1, against abutment 17. Thus arm 27 tends to supplement the action of clamping arm 29.

The driving mechanism for the vertical and horizontal clamping arms is shown in detail in Fig. 3. The tying machine as heretofore constructed and as described in the aforesaid patent, includes a face cam 31 on the side of a driven gear 32, which gear meshes with a second gear 33, to transmit driving force through a chain-and-sprocket drive indicated generally at 34 to rotate the twine arm 14. The follower for face cam 31 is a roller 35 mounted on the end of an arm 36 secured to a shaft 37 extending from the general vicinity of cam 31 to the forward part of the machine and in proximity to the clamping means of this invention.

It may be observed that inasmuch as roller 35 follows a fixed cam path, the oscillations imparted by roller 35 to arm 36 and to the associated shaft 37 must necessarily follow a rigid and invariable pattern having determined amplitudes. The material to be tied, however, may vary in diameter and in its ability to be compressed, with the result that the movement of clamp arms 27 and 29 may not always produce the same compactness of different material by a selected range of movements. It is necessary, therefore, to provide a form of lost motion connection between shaft 37 and the means used to operate clamp arms 27 and 29 to compensate for the variations in compressibility of materials.

Referring again to Fig. 3, the lost motion connection of the disclosed mechanism takes the form of a pair of arms loosely mounted on shaft 37 and connected to clamp arms 27 and 29, and corresponding arms rigidly secured to shaft 37 so as to oscillate therewith in a fixed path, with resilient means for transmitting the motion of the shaft from the rigidly connected arms to the loosely mounted arms, so that should clamp arms 27 or 29 be sufficiently resisted in their movements to stop before the oscillation of shaft 37 ceases, the difference in motion may be taken up by the resilient connections. To this end, an arm 38 is loosely mounted on shaft 37, so as to be rotatable relative thereto, said arm having a pin 39 on the end thereof which is retained in a slot 40 in a casting 41 secured to the lower end of the vertical rod 19. As depicted in Fig. 4, the casting 41 is also provided with a guide finger 42 which rides in a guide slot 42*a* in a portion of the frame 11 of the machine. Guide finger 42 prevents rotation of rod 19, whereby a predetermined angular relationship between the sloping surfaces 25 and 25*a* on collars 20 and 24 and edge 18 of table 10 may be maintained at all times to make certain that clamp arm 27 extends across the material while the latter is being tied.

Adjacent arm 38 on shaft 37 is another arm 43 which is pinned or otherwise keyed to shaft 37 so as to constrain it to move with said shaft 37. The free end of arm 43 is connected to the free end of arm 38 by a tension spring 44, but relative rotational movement of arms 38 and 43 in the direction urged by spring 44 is limited by a stop 45 extending laterally from arm 38 and into the path of movement of a portion 46 of arm 43. In the form chosen to illustrate this invention, portion 46 is in the form of a shorter arm extending angularly from arm 43, but obviously arm 43 may take any form or shape found convenient or desirable and may, in fact, be a sector of a circle which includes arm 46, or arm 46 may be a lateral extension of arm 43 formed on the side of arm 43 adjacent stop 45. It is understood, therefore, that the form of the arm 43 shown in the drawings is merely illustrative of the many forms this arm may take and is not in any sense a limitation upon the scope of this invention.

It may be observed from the description thus far given that tension spring 44 will transmit the motion of shaft 37 from arm 43 to arm 38 when shaft 37 is rotated in a clockwise direction and that when the rotation of shaft 37 is counterclockwise, as viewed in Fig. 3, arm 38 will be positively moved in a counterclockwise direction by the contact of pin 45 with portion 46 of arm 43. The clockwise movement of shaft 37 effects the clamping movement of the arm 27, and the counterclockwise movement effects the release of that arm. Thus, should the article to be tied present greater resistance to movement of the arm 27 than spring 44 can overcome, said spring 44 will be extended to take up the remainder of the movement of shaft 37 and its associated arm 43, while clamp arm 27 remains substantially stationary; it being understood, of course, that in the disclosed mechanism the movements of arm 27 are produced by axial movements of rod 19 through a bearing 57 in the table 10 and a bearing 58 secured to the machine frame 11 below the table.

A similar combination of parts is provided for effecting the movement of the second and angularly movable clamping arm 29. Thus, an arm 47 is secured to shaft 37 to be movable therewith and an arm 48, adjacent arm 47, is mounted loosely on shaft 37 so as to be rotatable relative thereto. Said arm 48 has secured to the end region thereof a plate 49 to which is welded an end portion 50 of clamping arm 29 to constrain said clamping arm 29 to move with arm 48. The free ends 51 and 52 of arms 47 and 48, respectively, are connected together by a tension spring 53. Movement of said arms toward one another is limited by a stop 54 mounted on arm 48 and interposed in the path of movement of a portion 55 of arm 47.

As in the case of the arms for transmitting movement to the vertical clamp arm 27, movements of arms 47 and 48 in a clockwise direction, as viewed in Fig. 3, are imparted to clamp arm 29 through spring 53 to produce gripping action of the arm 29, and the structure and arrangement is such that if arm 29 be stopped by the compactness of the article to be tied before shaft 37 reaches the limit of its oscillation, the further movement of said shaft is made possible by the extension of spring 53. In the opposite direction, however, portion 55 of arm 47 strikes stop 54 and positively rotates arm 29 to its released position.

It may be noted that arm 29 has a generally curved longitudinal contour as viewed from the front of the machine. To impart a more symmetrical section to the article to be tied, as confined by the arms and to effect more uniform compression of portions of the article, arm 29 is provided with an angularly shaped strip 56 which is welded or otherwise secured to arm 29 over that portion of said arm which is immediately adjacent the top of table 10 when arm 29 is in its operative or clamping position. Said angularly shaped strip 56, as shown to better advantage in Fig. 2, provides a substantially vertical abutment 56*a* which is generally parallel and opposed to abutment 17, so that any material compacted between arms 27 and 29 will assume a generally rectangular section with the possible exception of the side defined by arm 27.

In the operation of the clamping device, the operator starts with the machine and clamping device in the condition shown in Fig. 1. In this condition arm 29 is in its raised position and arm 27 has been manually swung forward to leave a clear space between abutment 17 and arm 29 for the insertion of the material to be tied. The material is then placed on table 10 with as much of it extending beyond edge 18 as the operator deems desirable, because it is along and adjacent edge 18 that the tie will be made. Clamp arm 27 is then swung through substantially 90° to a position parallel to the edge 18. This precise position will be readily and automatically located when the sloping surfaces 25 and 25*a* of collars 24 and 20 abut one another. The tying operation is then commenced by the operation of a suitable trip mechanism, as, for example, by actuating foot pedal 60, and gear 32 is then immediately set in motion so that face cam 31 is rotated and follower 35 is moved from the normal position of rest shown in Fig. 3 to the dwell portion of the cam which is near the peripheral region of gear 32. The movement of follower 35 in face cam 31 between the starting and dwell portions of the cam causes arm 36 to rotate shaft 37 in a clockwise direction. This clockwise rotation of shaft 37 is transmitted through arms 43 and 37 and springs 44 and 53 respectively, to arms 38 and 48, respectively. The rotation of arm 38 causes the associated rod 19 to move downward toward table 10, thereby compressing the material against the table top. The rotation of arm 48 in a clockwise direction is transmitted directly to arm 29, thereby moving said arm toward abutment 17 and compacting the material against that abutment. If the resistance of the material to such compacting is greater than the tension in springs 44 and 53, said springs 44 and 53 will then be distended so as to leave

arms 27 and 29 in contact with the material and arms 43 and 47 will then continue moving to the end of the oscillation of shaft 37. Continued rotation of face cam 31 during the dwell period of the cam allows time for the tying operation to be completed by the tying machine, as described in the aforementioned Patent No. 1,606,290, whereupon follower 35 moves off the dwell portion toward the center of the cam, that is, toward its initial or normal position, and arms 38 and 48 are moved in counterclockwise directions through their respective pins 45 and 54 in contact with arm portions 46 and 55 to their released positions, as shown in solid lines in Fig. 3. Arm 27 is then manually swung forward to the position shown in Fig. 1 and the tied material is removed from the machine, or alternatively, advanced farther along the table 10 to tie the material again at a position spaced from the first location of the tied twine.

It may be observed that the clamping device described above is readily adaptable to standard machines and does not require the addition of any cams and followers which might otherwise complicate the construction of the machine and necessarily make such construction special. It may also be observed that the clamp means herein described is adjustable to render it adaptable to bundles of material of various sizes. The machine is protected from damage by unusually thick or unyielding bundles by the resilient connections between the positively driven elements of the machine and the clamping arms themselves.

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

I claim:

1. A clamp mechanism for use with a tying machine having a table on which an article to be tied is placed and an abutment projecting upwardly from the table, and comprising a first clamp movable toward and from the table for clamping the article against the table, a second clamp movable laterally of the table surface toward and from said abutment for clamping the article against the abutment, and unitary mechanical means for actuating both clamps, said first clamp comprising a rod projecting upwardly in angular relationship to the surface of the table, an arm extending from the rod, a collar secured to the rod, a second collar secured to the rod and spaced from the first-mentioned collar, a third collar mounted for sliding and rotational movements on said rod, said arm being secured to said third collar, a cam surface on the first collar and adapted to coact with the third collar to provide an abutment for resisting rotation between said first and third collars, and resilient means, compressed between said second and third collars and serving to hold the first and third collars in contact with one another to resist rotation of the arm about said rod.

2. A clamp mechanism for use with a tying machine having a cam, a pivoted follower mechanism, a table upon which an article to be tied is placed and an abutment disposed in angular relationship to the surface of the table and comprising a clamp mounted for movement toward and from said table in a first plane lateral to the table surface and which clamp is operated by the said follower mechanism for clamping the article against the table, and a second clamp movable toward and from said abutment in a second plane substantially parallel to and spaced from said first plane and operated by said follower mechanism for clamping the article against the abutment, said first and second clamps having overlapping portions when in their article clamping positions, and the first mentioned clamp being manually swingable from the first plane and in a general plane substantially parallel to the table for providing a space between the clamps to facilitate the placement of articles on the table.

3. Article clamping mechanism for article tying ma-

chines or the like, said mechanism comprising a substantially horizontal table for the article, a clamp disposed over the table and mounted for linear movement toward and from said table, a vertical abutment in proximity to the table, a second movable clamp disposed at one side of said table and mounted for swinging movement laterally of the table to clamp the article against the vertical abutment, said clamps being relatively disposed so as to cross one another during their movements, and means for operating said clamps, said operating means comprising an oscillatable shaft, a first lever loosely mounted on said shaft, means connecting said first lever to the linearly movable clamp, a second lever loosely mounted on said shaft, means connecting the second lever to the second clamp, an arm secured to the shaft for rotation therewith, said arm being disposed adjacent to the first lever, spring means connecting the arm with the said first lever to cause the first lever to rotate with the arm in one direction of rotation, an abutment on said arm limiting the movement of the said first lever toward the arm under the action of the spring and causing a positive return of the said first lever by said arm, a second arm secured to the shaft for rotation therewith, said arm being disposed adjacent the second lever, spring means connecting the second arm to the second lever to cause the second lever to rotate with the second arm in one direction of rotation, and an abutment on said second arm limiting the movement of the said second lever toward the arm under the action of the spring and causing a positive return of the said second lever by said second arm.

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