April 25, 1967 W. A. SCOVILLE 3,315,593

TYING MACHINE

Filed Dec. 3, 1965

4 Sheets-Sheet 1

FIG_1

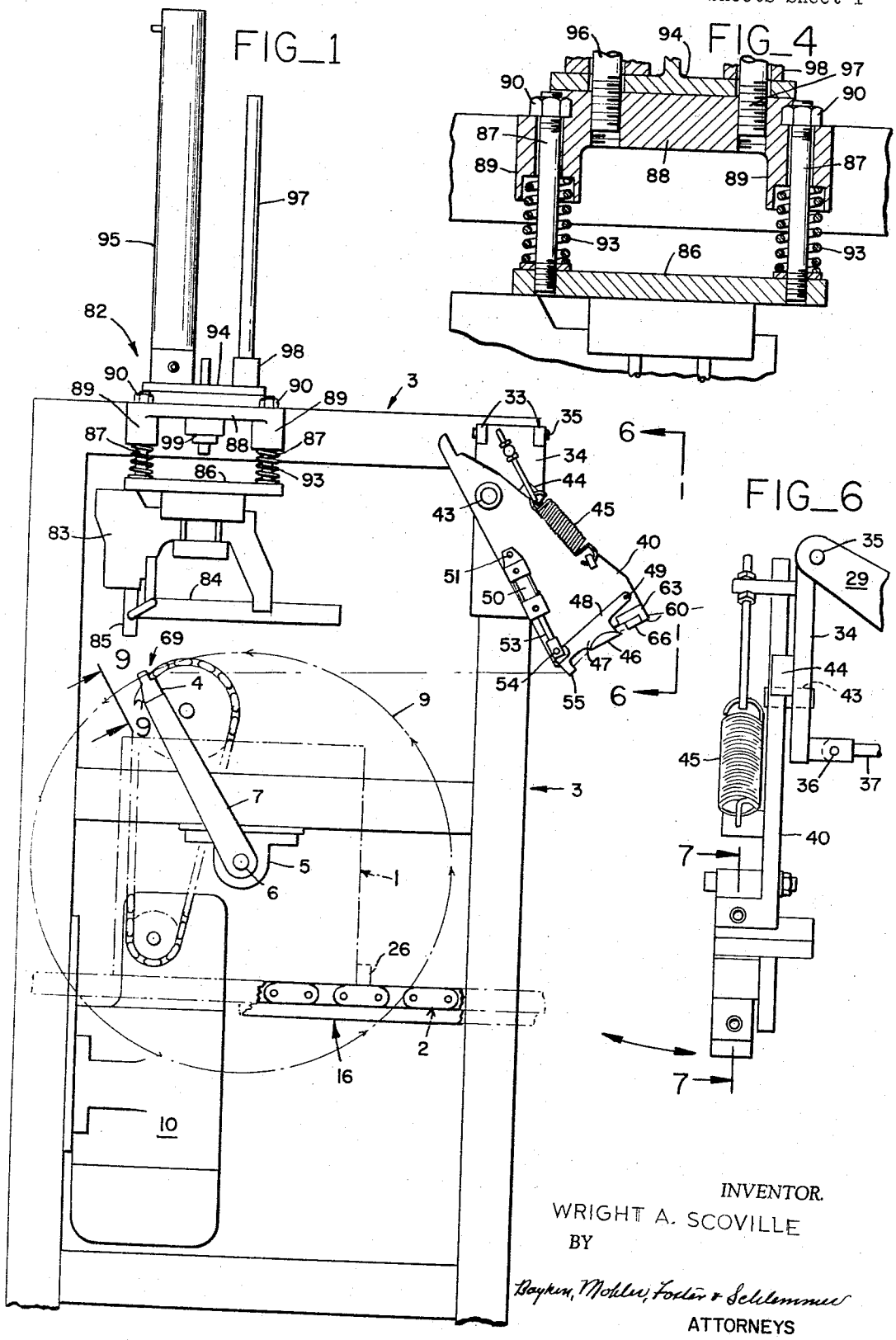


FIG_4




FIG_6




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TYING MACHINE

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FIG_10

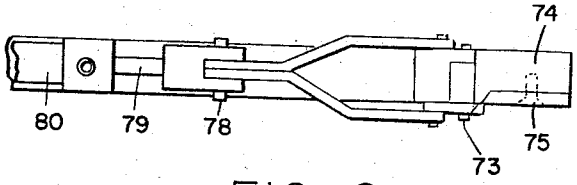
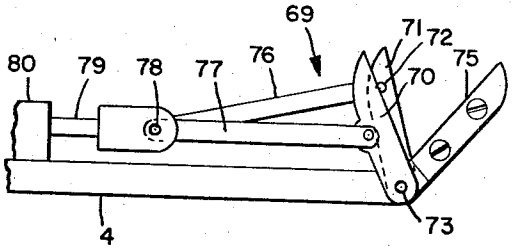



FIG_9



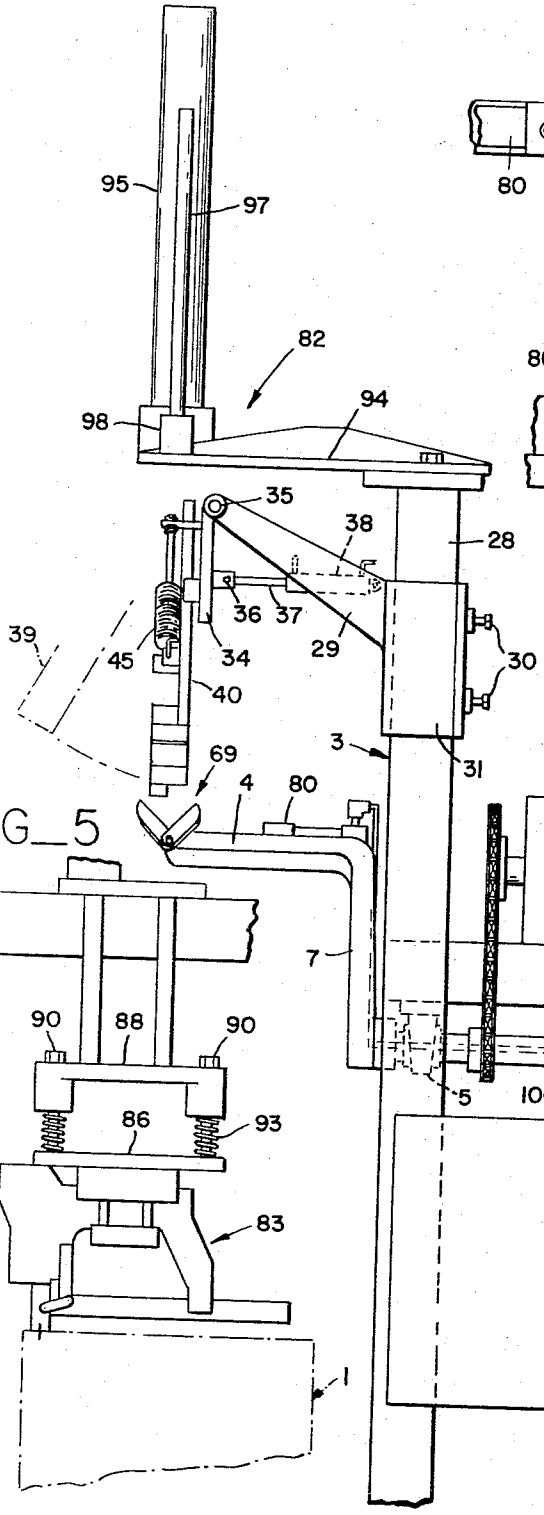




FIG_2

FIG_5




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FIG_3

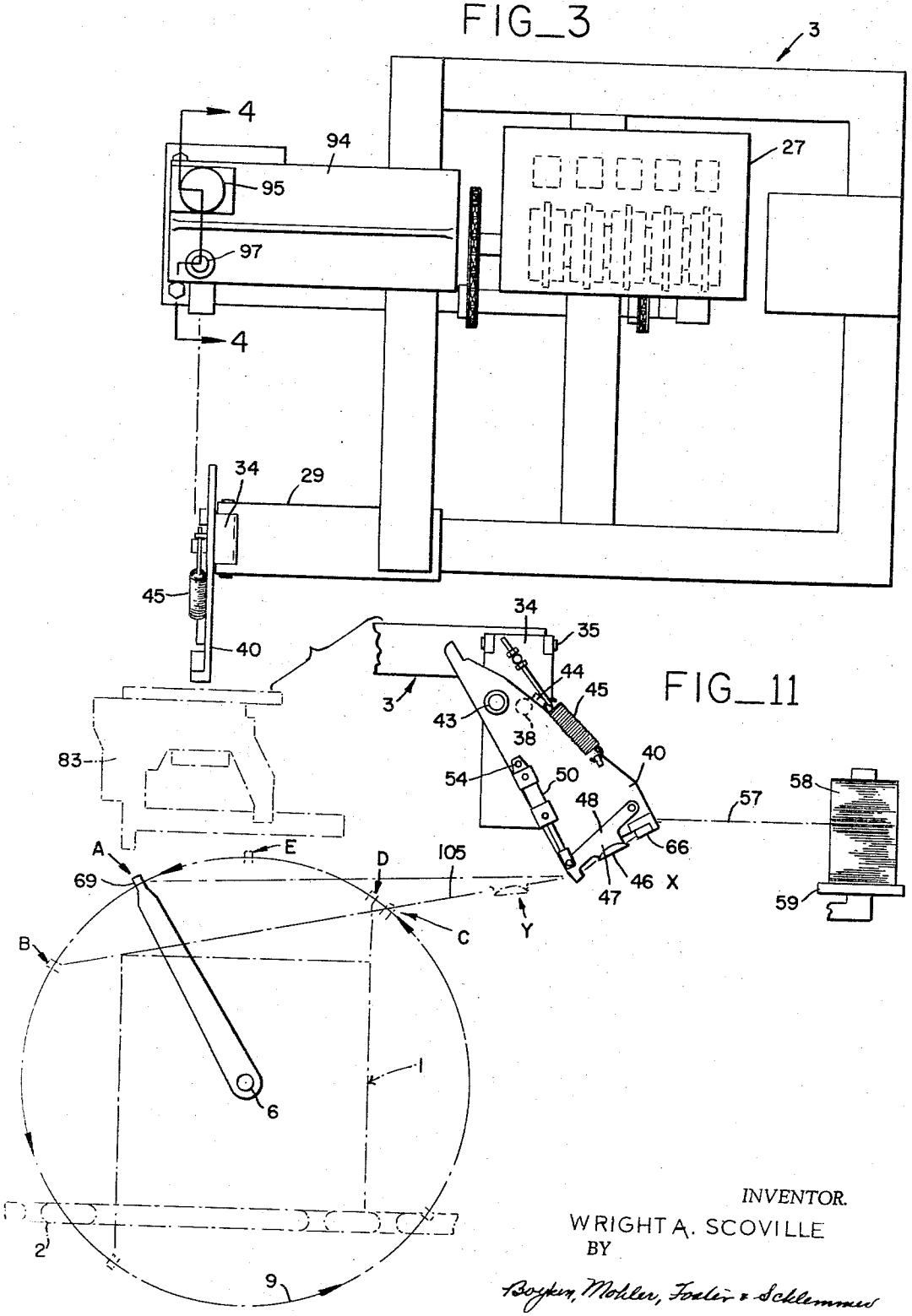


FIG_11




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TYING MACHINE

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FIG_7

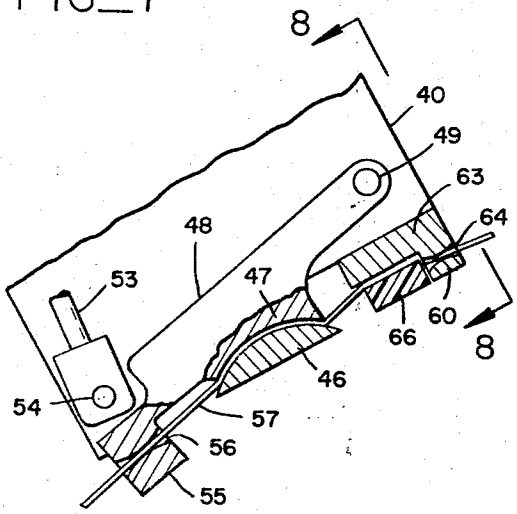



FIG_8

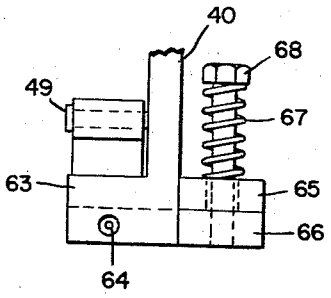
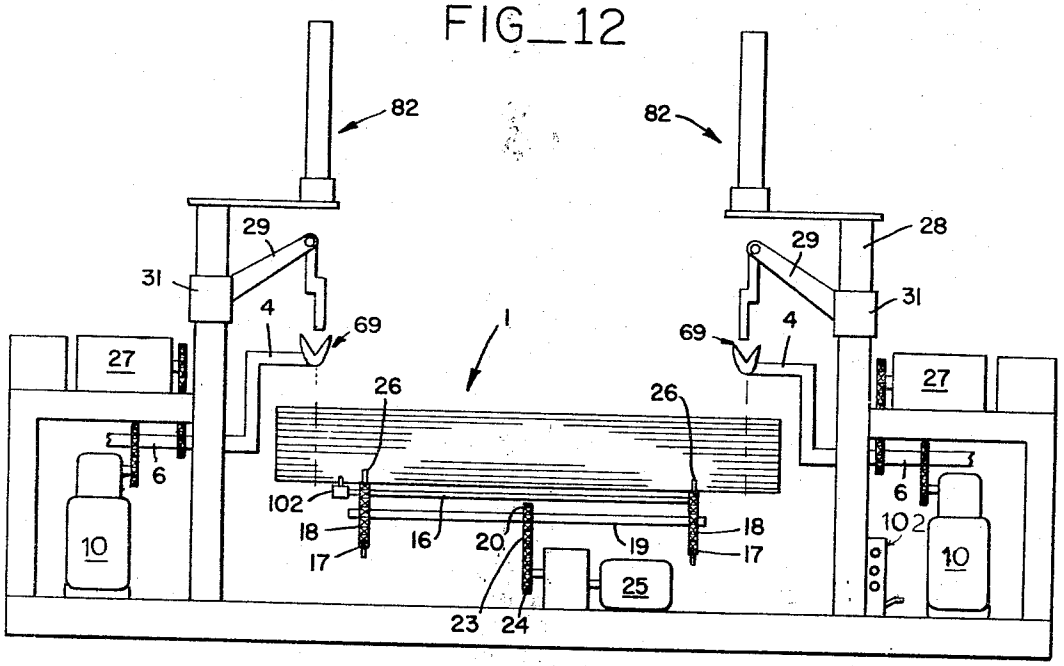



FIG_12

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Patented Apr. 25, 1967



3,315,593

# TYING MACHINE

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7 Claims. (Cl. 100—27)

This invention relates to apparatus for securing an article or articles by wrapping a cord, tape or the like thereabout and securing the same in encircling relation about such article or articles.

The word "tying" is used in the broad sense inasmuch as a cord or the like is not knotted or formed with a knot. In the embodiment illustrated herein, the ends of the encircling cord are secured by staples, and while the word "cord" will be used to identify the tying medium, it is to be understood that any similar tying medium such as tape, etc., may be used.

One of the objects of the invention is the provision of apparatus for securing a cord tightly about a package, bundle of articles, or the like.

Another object of the invention is the provision of apparatus for securing a cord or the like tightly about a package or bundle of articles by stapling the ends of a leading section of a continuous cord about the package or articles after the apparatus has tightly drawn such section about the package or articles and then severing such leading section from the remainder and cutting it from the latter, and then setting the machine for subsequent tying operations.

Another object of the invention is the provision of improved apparatus for securing succeeding sections of a pair of continuous cords about the opposite end portions of horizontally elongated bundles of similarly elongated elements, by encircling each of successively presented bundles with said sections, under tension, and securing the ends of each such sections to each other and to the ends of the bundles, and thereafter automatically severing the sections so secured from the remainders of the continuous cords, and then repeating the cycle including the presentation of the bundles.

Other objects and advantages will appear in the description and in the drawings.

In the drawings,

FIG. 1 is a front elevational view of a tying machine.

FIG. 2 is a side elevational view of the machine of FIG. 1 as seen from the right hand side of FIG. 1, certain parts shown in FIG. 2 being omitted for clarity.

FIG. 3 is a top plan view of the machine of FIG. 2.

FIG. 4 is an enlarged fragmentary, cross sectional view at line 4—4 of FIG. 3 showing part of the stapler.

FIG. 5 is a fragmentary front elevational view of the stapler shown in FIG. 1 in stapling position, the outline of the bundle or article being shown in dot-dash line.

FIG. 6 is an enlarged, fragmentary, elevational view of part of the machine as shown from line 6—6 of FIG. 1.

FIG. 7 is an enlarged part section, part elevational view, generally at line 7—7 of FIG. 6.

FIG. 8 is an end elevational view of the part shown in FIG. 6 as seen from line 8—8 of FIG. 7.

FIG. 9 is an enlarged, fragmentary elevational view of the cord clamping and cutting portion of the machine as viewed from line 9—9 of FIG. 1.

FIG. 10 is a top plan view of the portion shown in FIG. 9.



FIG. 11 is a semischematic view showing the steps in a cycle of tying or stapling.

FIG. 12 is a simplified view showing an installation for tying or securing together the ends of bundles of elongated articles, such as flooring.

Referring to FIG. 1, an article to be tied, which may be a container, package or a bundle of elements, is indicated in dot-dash line and is generally designated **1**. This article is supported on the upper run of an endless conveyor, generally designated **2**, or any other suitable support. The conveyor, or support, is in a position spaced from one side of the frame **3** of the tying machine, and it is adapted to support the article **1** thereon in a position projecting from said support in a direction toward said frame a sufficient distance to enable a horizontally disposed arm **4** on the tying machine to complete 360 degree revolutions, and more, around the portion of the article that projects from said support.

Suitable bearings **5** on frame **3** (FIG. 2) rotatably support a horizontal shaft **6**, in a position extending at a right angle to the length of conveyor **2** with one end projecting from a side of frame **5** adjacent to said conveyor. Said projecting end of shaft **6** has a radially outwardly projecting arm **7** projecting therefrom; and the aforesaid arm **4**, which may be called a tying arm, is rigid with and projects horizontally from the outer end of arm **7** in a direction away from frame **3**.

From the foregoing, it is seen that the arm **4** will revolve in an annular path **9** (FIGS. 1, 11) upon rotation of shaft **6**, and the latter is connected, through suitable reducing gears, with a motor **10** (FIG. 2) through sprocket wheels **13**, **14** that, in turn, are connected by a sprocket chain **15**.

The upper run of conveyor **2** is supported on a rigid support **16** (FIG. 1) at the point adjacent to frame **3** where the article **1** is supported for tying, and said conveyor supports article **1** in a position in which the arm **4** will revolve completely about the projecting end of said article (FIGS. 1, 11).

FIG. 12 shows the article **1** as comprising a bundle of flooring of uniform length with the flooring arranged to provide a square cross sectional container (FIG. 1). The conveyor in FIG. 12 comprises a pair of endless chains **17** in horizontally spaced side by side relation extending at their opposite ends over sprocket wheels **18** that are on parallel shafts **19**. A sprocket wheel **20** secured on one of the shafts **19** is connected by a sprocket chain **23** with a sprocket wheel **24** that, in turn, is driven through reducing gears by a motor-brake **25**. Chains **17** are provided with lugs **26** (FIG. 1) that project upwardly from the upper runs of the conveyors for spacing the bundles along the chain, and the circuit for motor **25** includes a control box **27** (FIG. 3) in which the conveyors are timed for intermittent movement with the movements of the tying machine.

The bundles **1** positioned horizontally extending across the conveyor chains by lugs **26**, have their ends projecting oppositely outwardly from the opposite sides of the pair of chains and a pair of the tying machines, each corresponding to the machine of FIG. 1 except the left-hand tying machine is complementary to the right-hand machine in operation, are at opposite sides of the conveyor with their forward sides facing each other so that the arms **4**, when actuated, will similarly revolve about the projecting ends of the bundles **1** upon each bundle being

positioned between the machines. The height of the support for the bundles at the tying station is such that the horizontal axes of the shafts **6** about which the arms revolve will be approximately the central longitudinal axis of the bundle or article **1**. The positioning of the article to be wrapped is preferably the same irrespective of whether a conveyor is used or whether the bundles are held manually on a stationary support.

In the case of the conveyor, it is timed to automatically stop at the tying station, to enable tying each bundle upon revolution of the arm **4**.

As viewed in FIG. 2, the frame **3** includes a vertically extending post **28**. Adjustably secured on said post for vertical movement to different levels is a bracket **29** extending angularly upwardly and forwardly relative to post **28**, the forward side of the frame is the side at which bundle **1** is positioned.

Set screws **30** secure a sleeve **31** on the lower end of bracket arm **29** at the desired level on post **28** for supporting the elements carried by the bracket at the desired level.

The bracket arm **29** is relatively wide and has a pair of ears **33** (FIG. 1) at the upper end between which is suspended a plate **34** from a horizontal pin or pivot **35** that extends between said ears. Connected to the rear side of plate **34** by a pivot **36** (FIG. 6) is a piston rod **37** that projects from an air cylinder **38** (FIG. 2) which cylinder, in turn, is pivotally connected at its end opposite to said piston rod with the bracket **29**. By this arrangement, one actuation of the air cylinder may swing the plate **34** and any elements supported thereon forwardly to dot-dash line position **39** (FIG. 2) and an opposite actuation will return the plate to vertically suspended full line position.

A vertically elongated plate-like arm **40** is pivotally suspended at its upper end portion to plate **34** at the forward side of the latter by a pivot **43** (FIG. 1) for swinging in approximately the same vertical plane as the plane in which path **9** of arm **4** and conveyor **2** are disposed, and which plane is normal to the direction in which plate **34** is adapted to swing about pin **35**.

Plate **34** is formed with a forwardly projecting stop in the form of a lug **44** along the edge thereof that faces away from arm **4**. A spring **45** is connected at its opposite ends to arm **40** and plate **34** for yieldably holding arm **40** against a lug **44** (FIG. 1) on plate **34**, while the lower end of said arm is adapted to swing clockwise, as viewed in FIG 1, against the resistance of said spring.

The lower edge of arm **40** is relatively wide in the plane in which the lower end is adapted to swing about pivot **43**, and spaced between the ends of said edge and integral with arm **40**, is a forwardly projecting generally horizontally elongated stationary lug **46** (FIG. 7) that has an upwardly facing convexly curved upper surface, which lug extends longitudinally of said lower edge. Above said lug is a movable clamping jaw **47** that has a lower generally horizontally elongated surface that is concave and complementarily curved with respect to the upper surface of lug **46**.

Jaw **47** is on a generally horizontally extending arm **48** at a point intermediate the ends of the latter, a pivot **49** connects one end of the arm with plate **40** for upward swinging of the end nearest to the tying arm **4** from a position in which the complementarily formed surfaces of lug **46** and jaw **47** are together, to a position in which jaw **47** is spaced above said lug **46**.

An air cylinder **50** (FIG. 1) is generally vertically disposed above the end of arm **48** that is opposite to pivot **49**, and the upper end of this cylinder is pivotally connected to arm **40** at **51**. The piston rod **53** projects from the lower end of cylinder **50** and is pivotally connected at **54** (FIG. 7) with the end of said arm **48** that is opposite to pivot **49** (FIG. 7).

Upon one actuation of cylinder **50**, the clamping jaw will be elevated away from the lug **46**, while an opposite actuation of the cylinder will result in the clamping jaw **47** being in clamping engagement with lug **46**.



The end of arm **48** that is opposite to pivot **49** is formed with a downward projection **55** (FIG. 7) that is formed with a through aperture **56**, the walls of which are preferably outwardly flared at its ends for passage of a tying cord **57** therethrough and which cord may be drawn from any continuous source thereof, such as a roll **58** (FIG. 11) carried by a support **59** that, in turn, may be secured to frame **3** and which roll may include any suitable conventional brake means (not shown) to prevent over-running when cord is drawn therefrom.

At the lower edge of the plate **40** opposite to projection **55**, said plate is formed with a generally inverted L-shaped portion (FIG. 7) that projects forwardly of the plate with the leg **60** of said portion projecting downwardly, and with the arm **63** of said portion extending toward the clamping jaw **47**. The depending leg **60** is formed with an aperture **64** that is approximately in alignment with aperture **56**, and is of the same shape.

The portion **63** may continue transversely across the lower edge of plate **40** to project at **65** (FIG. 8) to the rear side of plate **40**, and a nylon brake-plate **66** extends transversely of plate **40** across the under surface of portions **63** and **65**, said undersurface being at about the level of aperture **64**. A spring **67** (FIG. 8) above portion **65** and around an upstanding bolt **68**, that is threaded into plate **66** and that freely extends through an opening in portion **65**, reacts between the head of the bolt at its upper end above portion **65**, and portion **65** yieldably holding the brake plate **66** against the undersurface of projection **63** when no cord is in place.

Cord **57** from spool or roll **58** extends through aperture **64** and between the brake plate **66** before passing over lug **46** and through aperture **56**. When the cylinder **50** is actuated to release clamping jaw **47**, the cord **57** from the spool **58** may be pulled through apertures **64**, **56** from right to left as seen in FIGS. 1, 7, but the frictional resistance of block **66** will remain at all times, and thus resistance may be increased or decreased by tightening or loosening bolt **68**.

The outer end of arm **4** carries a cord clamping and cutting mechanism generally designated **69** in the form of a cutting blade **70** and a clamping element **71** (FIGS. 9, 10) that are pivotally supported on arm **4** at one of their ends by a single pivot **73**.

The outer end of arm **4** beyond pivot **73** extends upwardly and outwardly to provide a stationary clamping jaw **74** toward which the element **71** is adapted to swing to engage a cord clamping relation between element **71** and jaw **74**. Blade **70** is adjacent to the jaw **74** and the latter has a stationary cutting blade **75** (FIG. 10) screwed thereto in shearing relation to blade **70**, scissors fashion, when the latter is swung about pivot **73** alongside blade **75**.

A link **76** is pivotally connected at one end by pivot **72** to the movable clamping element **71** adjacent to the outer end of the latter, while a similar but shorter line **77** is pivotally connected at one end to the movable cutting blade **70** at a point closer to pivot **73** than pivot **72**. The opposite ends of said links are pivotally connected by a common pivot **78** to the outer end of the piston rod **79** of a cylinder **80**.

Upon one actuation of cylinder **80** to move piston rod **79** outwardly thereof, the clamping jaw **71** will clamp a cord extending between the jaws before the cutting blade cuts the cord and thereafter the cord will be tightly clamped between the jaws **71**, **74** until a reverse actuation of rod **79**. The clamping and cutting are almost simultaneous.

Supported on frame **3** substantially above the circular path **9** of the outer end of arm **4** is a stapler assembly generally designated **82** (FIG. 1). The stapler **83** of the stapler assembly is conventional, and it includes a magazine **84** that automatically feeds the staples to the stapler head **85**, which head is vertically reciprocable to cock

and release the hammer for driving the staples upon each downward movement of the head **85** into engagement with the material **1** to receive the staples, and to cock the stapler head upon each upward movement of the head.

The stapler **83** is secured to and below a horizontal plate **86** that, in turn, has a pair of spaced vertical bolts **87** (FIG. 4) secured thereto and projecting upwardly therefrom.

Spaced above plate **86** is an upper plate **88** that, in turn, is formed with downwardly projecting bosses **89** that have vertical open ended bores therethrough through which the upper ends of bolts **87** project. Nuts **90** on the upper ends of said bolts function as stops for upward movement of the plate **88**. Helical springs **93**, through which bolts **87** extend, react between plate **86** and bosses **89** to yieldably hold them spaced apart.

Above the plate **88** is an overhead arm **94** that is rigidly secured at one end to the upper end of frame **3**, and this arm projects outwardly of frame **3** so that the outer end portion of arm **94** is over path **9**. A vertical air cylinder **95** is secured at its lower end to said arm with its piston rod **96** (FIG. 4) freely extending through an opening in arm **94** and the downwardly projecting end of said rod **96** is secured to plate **88**.

A vertical guide rod **97** (FIG. 1) spaced from rod **96** is secured at its lower end to plate **88** (FIG. 4) and also extends through an opening in arm **94** and is reciprocable through a vertically extending boss **98** (FIG. 1) rigid with arm **94**.

Upon downward movement of piston rod **96** under the influence of compressed air in cylinder **95**, the stapler will be moved down to effect a stapling operation, and the provision of springs **93** compensates for variation in the vertical thickness of bundles and insures a firm contact of the stapler with the material **1**. Also the springs have a cushioning effect, and enable the relative movement between the plates **86**, **88** for actuation of the microswitch **99** (FIG. 1) on plate **88**, which actuates the solenoid valve in the air line to cylinder **95** for returning the air cylinder and stapler to its original elevated position.

From the foregoing description, it is seen that there are several air cylinders, namely; and in the order in which they are mentioned, the cylinder **38** that is connected with the plate **34** for swinging plate **34** and arm **40** between the full line and dot-dash line position **39** (FIG. 2); the air cylinder **50** that actuates the clamp **47**, that in turn, is on arm **40**; the air cylinder **80** on arm **4** that actuates the cord clamping and cord cutting means on said arm, and the air cylinder **95** for the stapler.

These are all double acting air cylinders, except the cylinder **80**, and each has conventional air pressure lines connecting each with conventional solenoid valves that, in turn, are controlled in the desired sequence by conventional adjustable rotating cam limit switches in a control box **27**. The air cylinder **80** is single acting and is controlled by a cam-actuated limit switch in box **27**, but the air line leading to the air cylinder **80** comprises a duct **100** (FIG. 2) extending from the source of compressed air to cylinder **80** and the piston rod in this instance is spring returned after actuation for cutting and clamping the cord. Said source is indicated at **101**.

The motor for actuating arm **4** and the conveyor **2** are of the conventional type, each having an automatically actuated brake to prevent over-running when the circuit thereto is broken, and in FIG. 12 a stationary microswitch **102** in a circuit to the control box **27** may be actuated by engagement with load **1** to stop the conveyor at the tying station and upon the tying cycle being concluded, the current to the motor **25** will be re-established for moving the next bundle to the tying station.

A brief explanation of a cycle of operation is as follows, referring to FIG. 11.



The cord clamping and cutting mechanism **69** on the outer end of arm **4** is shown at A in a position approximately at 11 o'clock, viewing the apparatus toward the forward side, as seen in FIG. 1, and the cylinder **80** may be actuated by a manually actuatable switch in the electrical current to grip the cord when the latter is in position A. This is merely to start the operation, since subsequent operations and cycles are automatic. The circuit for the cycling operation is then closed, and the bundle **1** being in a position substantially coaxial with the axis of shaft **6**, the arm **4** will be revolved counterclockwise through positions B, C, D, E. At position C, it will be seen that the cord clamping mechanism **69** would engage the dot-dash line position **105** of the cord **57**, were it not moved to a position to one side of the dot-dash position, and just before the mechanism **69** reaches the cord, the air cylinder **38** that is connected with plate **34** will swing the latter to position **39** (FIG. 2) to permit the clamping mechanism **69** to pass the cord at position **105**, and then the plate **34** and the clamps **46**, **47** will be returned to their normal position D (FIG. 11).

While the clamping mechanism **69** is moving counterclockwise from position A to D in the wrapping step, the clamp **48** on plate **40** is inoperative, and the plate **40** will be held in the full line position under the tension of spring **45**. The friction of the friction block **6** is not sufficient to overcome the tension of spring **45**, but it does hold the cord straight.

When the cord clamping mechanism **69** reaches approximately the position E, which is approximately a 12 o'clock position, the air cylinder **50** on plate **40** is actuated to cause clamp **47** to firmly grip the cord, and thereafter during movement of the clamping mechanism **69** through position A to position B will place a substantial tension on the cord to tighten it about the bundle **1** since the plate **40** will be swung clockwise to move the clamping elements **46**, **47** (now in cord clamping position X to position Y [FIG. 11]), and the plate **40** will swing against the resistance of spring **45**.

When the cord clamping mechanism **69** reaches position B, the air cylinder **95** of the stapler is actuated to staple the lapping side-by-side end portions of the section of the cord that is tightly wrapped about the top of the bundle and to each other, after which the cord at the mechanism **69** is released through release of air pressure in cylinder **80**.

The clamping and cutting mechanism, in open position, then moves again to and through position C but without the cord. This time the air cylinder **38** is not actuated to swing plate **40**, hence the cord will be engaged by the clamping mechanism and the latter will be actuated through actuation of cylinder **80** to both sever the portion of the cord between the cutting mechanism and the staple, and to grip the end of the cord that extends to the clamp, of the tensioning device that includes plate **40**, the clamping action taking place before the cutting of the cord.

The clamp **47** on plate **40** may be released after the cord is cut at position B to release the plate **40** and then the conveyor may be actuated to bring the next bundle to the desired position for tying while the clamping mechanism **69** moves to position A and through the cycle as described.

The invention is not to be considered as being restricted to the details in the foregoing description, since it is obvious that changes and modifications may be made without departing from the spirit of the invention and within the scope of the appended claims.

I claim:

**1.** A tying machine comprising:

(a) a stationary frame;

(b) a gripping member adapted to releasably grip one end portion of a cord to be wrapped around an article to be tied;

(c) means supporting said gripping member on said frame for movement through a distance greater than 360° in a generally circular path for wrapping a section of said cord about an article positioned within the space enclosed by said path and for positioning the ends of said section in side by side lapping relation;

(d) cord securing means on said frame operable for movement from a position spaced from said path to a position against a side of said article and against said lapping ends of a section of said cord for stapling said lapping ends together and to said article;

(e) means for so moving said cord securing means against said lapping ends for stapling them to said article;

(f) a pivotally mounted cord tensioning means mounted on said frame and being normally positioned in the same plane as the path in which the gripper member travels;

(g) and means operably connected to said tensioning means for moving the latter axially of said path during the period in its movement when said gripping member has approximately moved a distance of 360° in said path to avoid interference of said gripping member with said section at said distance.

**2.** In a tying machine as defined in claim **1**:

(h) said last mentioned means comprising an element supported on said frame for lateral movement relative to the length of a cord gripped by said gripping member, and

(i) guide means on said element through which such cord is adapted to extend to said gripping member, and

(j) means connected with said element for so moving it laterally to so move said cord.

**3.** In a tying machine as defined in claim **2**:

(k) friction means on said element for frictionally engaging such cord for maintaining the length of the latter between said gripping member and said friction means taut during movement of said gripping member in said path and while said gripping member is in gripping relation to said cord.

**4.** In combination with a bundle support adapted to support a horizontally elongated bundle thereon at a wrapping station with one end portion of said bundle projecting laterally from said support:

(a) a tying machine mounted on a frame at said wrapping station in a position generally in axial alignment with the longitudinal axis of such bundle when the latter is on said support, and facing the projecting end of said bundle;

(b) an arm on said machine projecting generally toward said support and adapted to extend to a spaced lapping relation relative to the said projecting end of a bundle on said support;

(c) cord gripping means on the projecting outer end of said arm being adapted to grip one end of a cord to be wrapped around the projecting end of a bundle on said support;

(d) means connected with said cord gripping means for moving it in a substantially annular path around said projecting end of a bundle on such support for wrapping said cord around said bundle;

(e) means for securing said cord to said bundle after the latter completely encircles the latter;

(f) a pivotally mounted cord tensioning means mounted on said frame and being normally positioned in the same plane as the path in which the gripper member travels;

(g) and means operably connected to said tensioning means for moving the latter axially of said path during the period in its movement when said gripping member has approximately moved a distance of 360° in said path to avoid interference of said gripping member with said section at said distance.



**5.** In combination with a support adapted to support a horizontally elongated bundle of articles at a wrapping station with one end portion of said bundle projecting laterally outwardly thereof:

(a) a tying machine adjacent to said support in a position generally in axial alignment with the longitudinal axis of said bundle when the latter is on said support, and facing the projecting end of such bundle;

(b) an arm on said machine having an outer end generally projecting toward said support in a position spaced laterally from and in lapping relation to said projecting end of a bundle on said support;

(c) a cord gripping member on the projecting outer end of said arm operable to releasably grip one end of a cord continuously extending from said member to a supply thereof;

(d) said machine adapted to have a supply of said cord having one end thereof releasably gripped by said cord gripping member;

(e) said cord extending away from said cord gripping member in a direction generally normal to said axis when said bundle is on said support;

(f) means supporting said arm and said cord gripping member when in gripping relation to said one end of said cord for movement in a generally circular path around said axis through a distance greater than 360° for wrapping said cord around said projecting end of a bundle on said support;

(g) stapling means operable for stapling said cord to said bundle after said cord has been wrapped around said projecting end of said bundle by said movement of said arm and said cord gripping member;

(h) cord tensioning means pivotally mounted on said machine so that it may be moved into and out of a plane which contains said circular path;

(i) and means to move the tensioning means axially of said path.

**6.** In the combination as defined in claim **5**:

(j) cord tensioning means is spaced from said cord wherein said cord gripping member in nonstopping but releasable engagement with said cord movable with said cord during the latter part of the movement of said cord gripping member in said circular path and during actuation of said stapling means for stapling said cord to said bundle for holding the cord taut around said projecting end of said bundle;

(k) means connected with said cord gripping member operable for releasing the latter from gripping relation to the end of said cord after said cord has been staple to said bundle by said stapling means and while said tensioning means hold the portion of said cord between the point of stapling thereof and said tensioning means taut;

(l) said tensioning means being in a position holding said portion of said cord in the circular path of said cord gripping member for engagement thereof by said member upon continued movement of said cord gripping member following said release thereof from said cord;

(m) said cord gripping member being operable for gripping said cord upon said last mentioned engagement between said cord gripping member and said portion of said cord; and

(n) means with and adjacent to said cord gripping member operable for severing said portion of said cord between said cord gripping member and said bundle substantially simultaneously with the actuation of said cord gripping member for gripping said portion of said cord, whereby movement of said cord gripping member in said path after said severance of said portion will wrap said cord about another bundle on said support.

**7.** In the combination as defined in claim **5**:

(o) means adjacent to said arm and said cord gripping member and between the latter and said source of

cord movable laterally relative to the portion of said cord between said cord gripping member and said source and into engagement with said portion of said cord for moving said portion axially to one side of said circular path during movement of said gripping member in said path to enable said cord to complete a greater than 360° movement free from interference with said portion.



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