

April 26, 1966

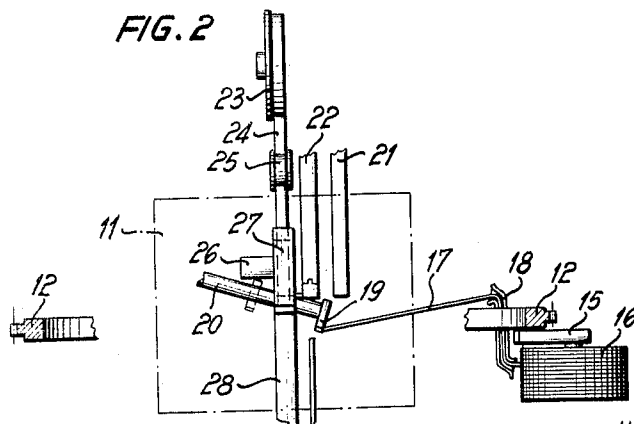
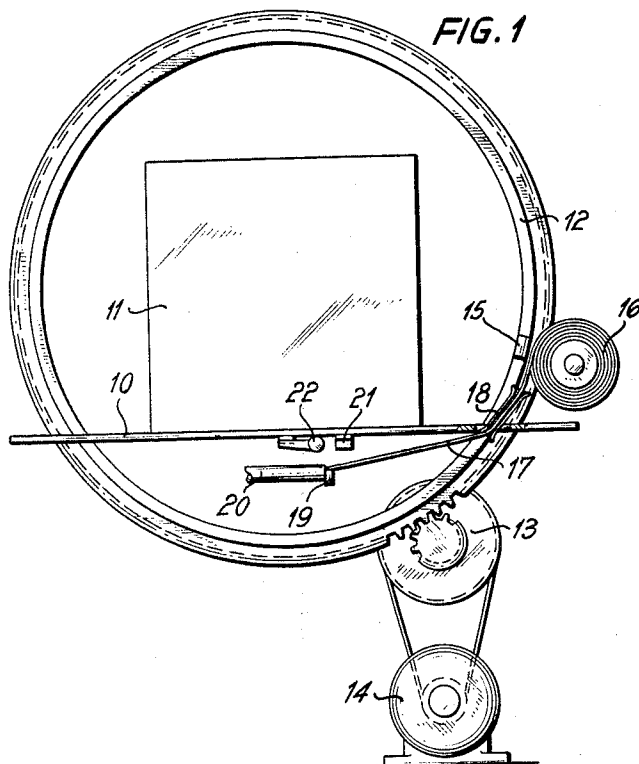
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3,247,781

AUTOMATIC MACHINE FOR TYING OR BALING

Filed May 3, 1965

4 Sheets-Sheet 1



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April 26, 1966

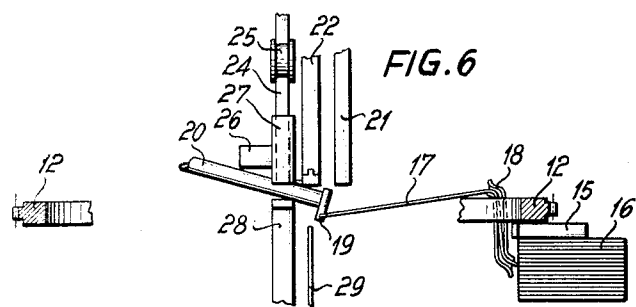
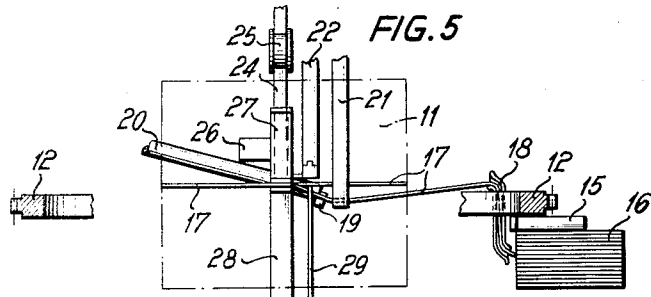
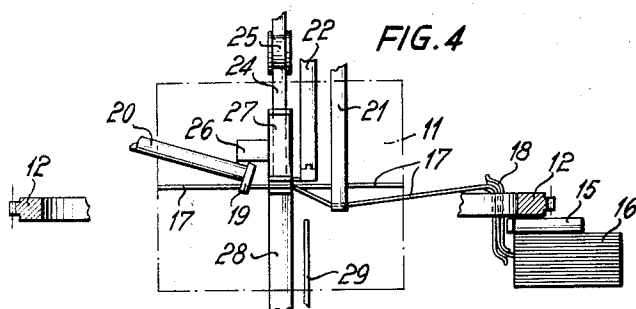
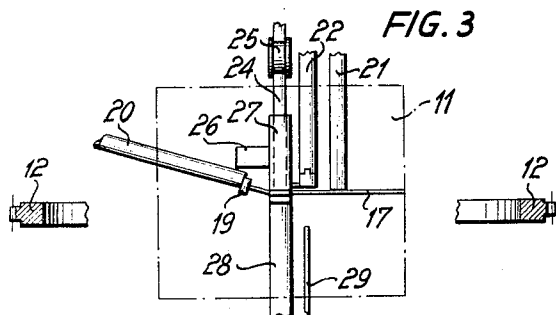
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AUTOMATIC MACHINE FOR TYING OR BALING

Filed May 3, 1965

4 Sheets-Sheet 2



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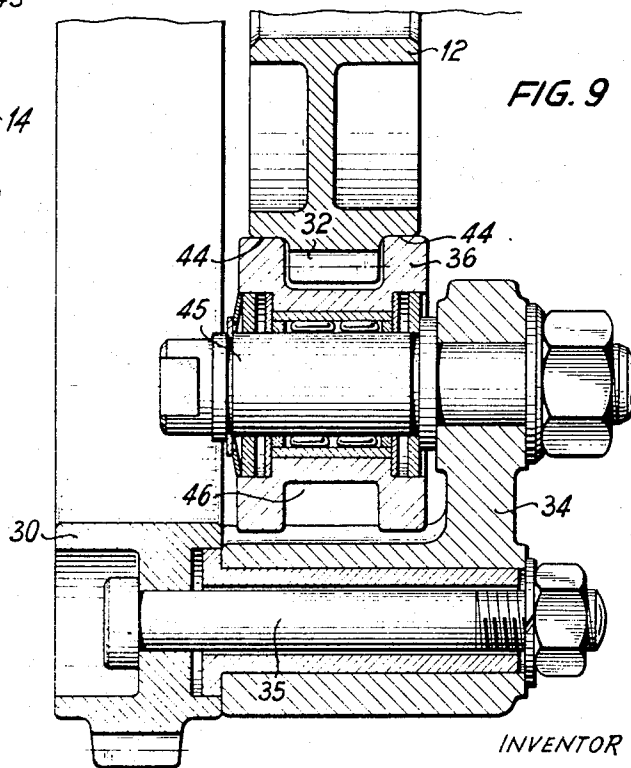
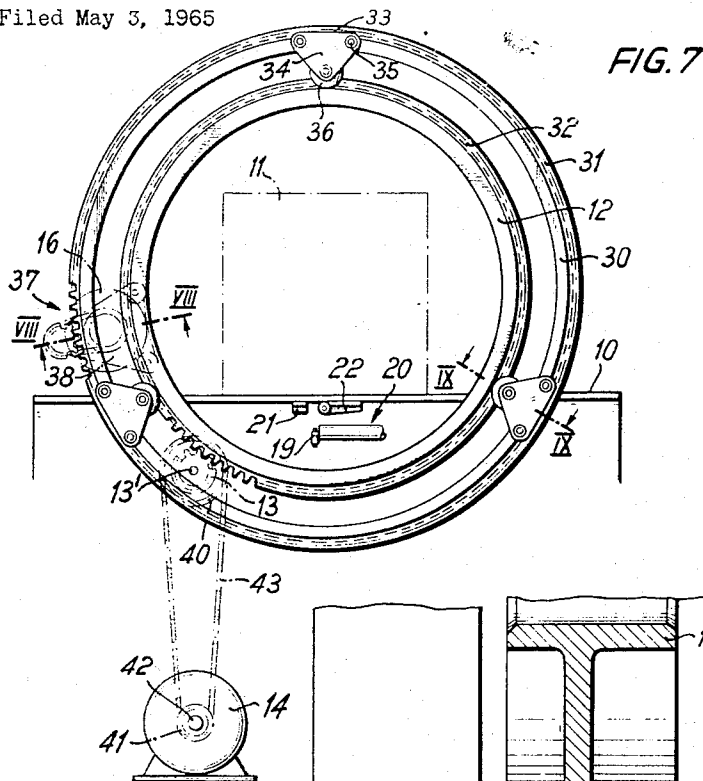
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3,247,781

AUTOMATIC MACHINE FOR TYING OR BALING

Filed May 3, 1965

4 Sheets-Sheet 3



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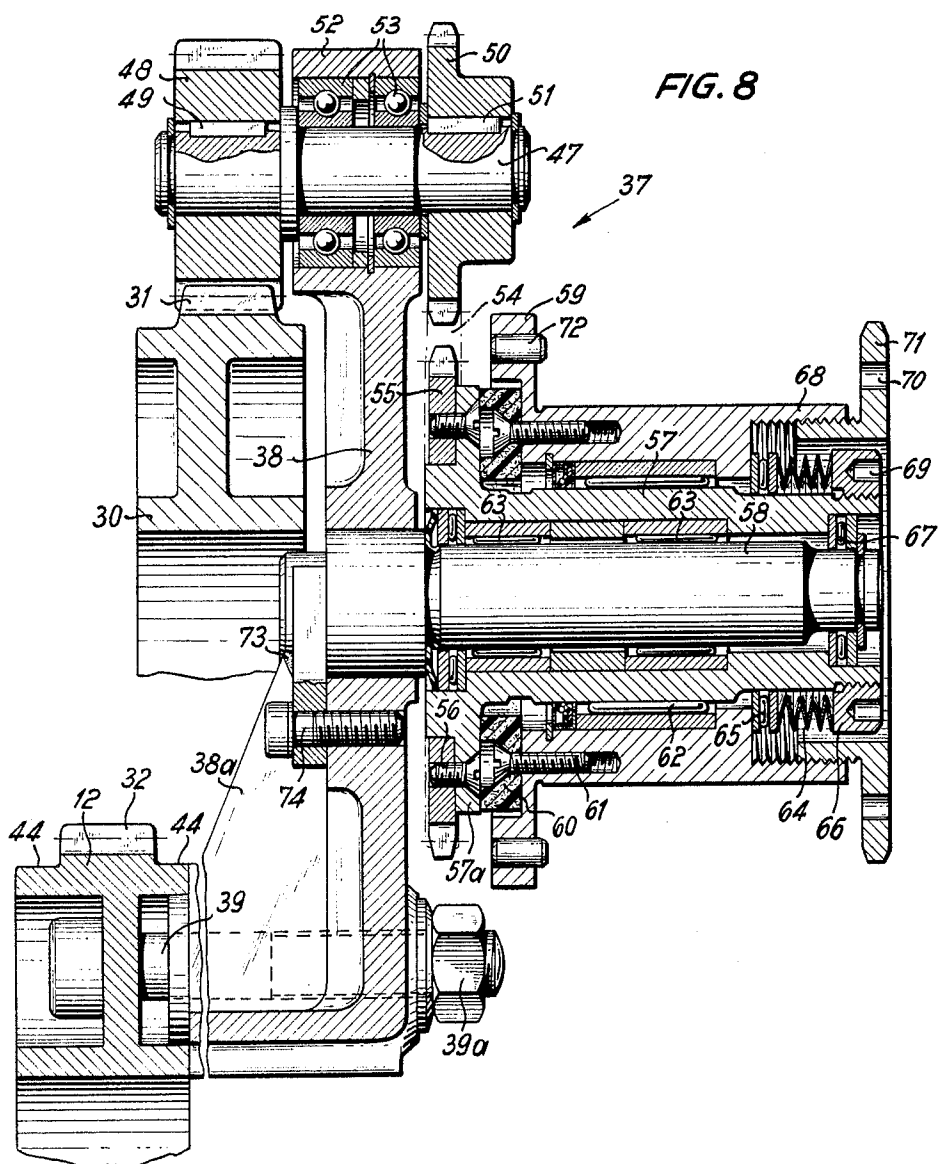
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3,247,781

AUTOMATIC MACHINE FOR TYING OR BALING

Filed May 3, 1965

4 Sheets-Sheet 4



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3,247,781

AUTOMATIC MACHINE FOR TYING OR BALING
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Filed May 3, 1965, Ser. No. 458,808

Claims priority, application Germany, Feb. 6, 1965,
B 80,402

15 Claims. (Cl. 100—27)

The present application is a continuation-in-part applica-
tion of the copending application Serial No. 290,464
filed June 25, 1963 and titled "Automatic Machine for
Tying or Baling."

The present invention relates to an automatic machine
for tying, hooping or baling packages in which the ma-
chine includes a rotary device such as a transporting
ring or chain to place the tying material around the pack-
age.

Machines of this type are known in the art as tunnel
machines. Wires or strips, usually made of iron or steel,
are used as the tying or hooping material. In view of the
high specific gravity of such materials, the supply reels
are usually mounted on a withdrawal device, which is
often accommodated next to the actual tying machine on
the floor of the room where the latter is installed. In
order to place the tying material around the package, the
wire must be led from the supply roll to the apparatus
and in this case a surplus length of wire, several times
the length necessary to encircle the package, must first
be tentatively fed from the supply roll and then again be
retracted until the tying material is taut around the pack-
age. This obviously slows down the tying operation in
an undesirable manner. Another disadvantage of known
tying machines is the so-called loop formation which
occurs when small packages are being tied. Such loop
formation will arrive when a given length of tying mate-
rial has been withdrawn from the supply roll by the
transporting ring but is not used up in tying the package.

It is an object of the present invention to overcome the
above-mentioned disadvantages of tying machines known
in the art.

It is another object of the present invention to provide
for a tying machine which is compact in construction
and in which the supply reel for the tying material is
directly mounted on the transporting means which place
the tying material around the package.

It is an additional object of the present invention to
provide for a tying machine of the aforementioned type
in which loop formation is positively prevented and in
which the tying material is placed in taut condition about
the package to be tied.

Finally, it is also an object of the present invention to
provide for a tying machine of the above-mentioned type
which is constructed of relatively few and simple parts
so that the machine can be manufactured at reasonable
cost and will stand up perfectly under extended use.

With these objects in view, the tying machine according
to the present invention mainly comprises support means
having a supporting surface for supporting a package or
bundle to be tied thereon, moving means encircling a
bundle supported on the supporting surface and adapted
to move about the bundle in one direction, a supply reel
for tying material mounted on the moving means for
moving therewith about the bundle, the supply reel hav-
ing an axis and being mounted on the moving means
turnably about this axis, first gripping means for gripping
one end of the tying material and for holding it adjacent
the bundle while the moving means moves the supply
reel about the bundle so that the tying material is wound
about the bundle while the supply rotates about its axis
in a direction opposite to said one direction, brake means

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cooperating with the supply reel for braking the turning
movement of the reel about its axis so as to apply the
tying material in tensioned condition about the bundle.
The brake means preferably include a friction wheel in
operative engagement with the supply reel and means for
rotating the friction wheel in a direction opposite to the
direction of rotation of the supply reel. The machine
includes further second gripping means located in the
aforementioned direction of rotation of the moving
means beyond the first gripping means for gripping a por-
tion of the tying material unwound from the supply reel
and extending about the bundle beyond the first gripping
means in overlapping relationship to said one end of the
tying material, fastening means adjacent the first and sec-
ond gripping means for fastening the portion of tying
material overlapping the one end of the tying material to
said one end, and cutting means for cutting the tying ma-
terial between the fastened portion and the reel.

The moving means are preferably in the form of a
movable ring located substantially in a plane normal to
the supporting surface of the support means. The mov-
able ring is preferably supported on a plurality of rollers
which in turn are turnably supported on a stationary ring
coaxial with the movable ring. The movable ring is
preferably provided at its outer periphery with a gear
rim and is driven by a motor driving a gear meshing
with the gear rim. The stationary ring is also preferably
provided at its outer periphery with a gear ring and a
gear meshing with the gear rim of the stationary ring is
operatively connected to the supply reel tending to rotate
the latter about its axis in a direction opposite to the
direction of movement imparted to the supply reel dur-
ing movement of the movable ring and withdrawal of ty-
ing material from the supply reel. Means are provided
between the last mentioned gear and supply reel permit-
ting the supply reel to slip relative to the gear and such
means are preferably in the form of a slip clutch. In this
arrangement, the gear meshing with the gear rim of the
stationary ring will tend to rotate the supply reel in a
direction opposite to the direction imparted thereto dur-
ing withdrawal of tying material therefrom, while the
slip clutch will permit the supply reel to slip so that the
tying material will be wound in taut condition about
the bundle. The slip clutch is preferably adjustable so
that the tension at which the tying material is applied
about the bundle may be regulated in a simple manner.

The tying material employed is preferably wire or
strip of elastic plastic material, for example a single
stranded nylon wire, but it is understood that wires or
strips of different materials may also be used in the
machine of the present invention.

The novel features which are considered as character-
istic for the invention are set forth in particular in the
appended claims. The invention itself, however, both
as to its construction and its method of operation, to-
gether with additional objects and advantages thereof,
will be best understood from the following description
of specific embodiments when read in connection with
the accompanying drawings, in which:

FIG. 1 is a side view of an automatic tying machine
according to the present invention and showing the co-
operating components in the starting position;

FIG. 2 is a partially sectioned partial plan view of the
machine shown in FIG. 1;

FIGS. 3-6 are plan views, similar to FIG. 2 and show-
ing the positions of the components of the machine at
various stages of the tying process;

FIG. 7 is a side view of a machine similar to that
shown in FIG. 1;

FIG. 8 is a section taken along the line 8—8 of FIG. 7,

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viewed in the direction of the arrows, and drawn to an enlarged scale; and

FIG. 9 is a section taken along the line 9—9 of FIG. 7, viewed in direction of the arrows and also drawn to an enlarged scale.

With regard to the drawing it is mentioned that only those parts of the machine are shown which are important to a proper understanding of the invention, while certain other parts for moving and controlling the elements illustrated in the drawings are omitted for the sake of simplicity. Moreover, it is immaterial how the packages are brought into the region of the ring, but it is desirable to transport the packages to the ring from one side thereof by conveying means, such as for instance conveyor belts, and, after they have been tied, to remove the same from the opposite side of the ring and to convey them to a storage place.

Referring now to the drawings, and more specifically to FIG. 1 of the same, it will be seen that the tying machine of the present invention comprises support means only partially shown in FIG. 1 as a supporting table 10 having an upper horizontally extending supporting surface for supporting a bundle or package 11 to be tied thereon. Moving means, preferably in the form of a ring 12, encircle the package 11. The ring 12 is mounted in any well known manner, not shown in FIG. 1, for rotation about its axis, and the ring is provided at its outer periphery with a gear rim. A gear 13, supported for rotation in any convenient manner about its axis meshes with the gear rim of the ring 12. The gear 13 is driven by means of a pulley and belt drive, for instance, from a motor 14 so as to rotate the ring 12 in counterclockwise direction. A supply reel 16 is carried turnably about its axis by the ring 12. The tying material 17 is wound onto the supply reel 16 and the tying material is preferably plastics material in either wire or strip form. A braking device 15 schematically shown in FIGS. 1 and 2 cooperates with the supply reel 16 for braking rotation of the latter about its axis. The tying material 17 is guided from the side of the ring 12 carrying the reel 16 to the other opposite side through a sleeve 18 which is mounted in a hole in the ring 12. The sleeve 18 may be formed from a short piece of pipe in which end pieces are inserted to prevent damage to the tying material 17. The free end of the tying material 17 is held by a first gripping means 19 carried by a take-over shaft 20.

Evidently when the ring 12 is rotated in counterclockwise direction, tying material will be unwound from the supply reel 16 and wound about the package or bundle 11 on the table 10, and the brake means 15 braking rotation of the supply reel will assure that the tying material 17 will be wound in taut condition about the package.

The fastening of the overlapping ends of the tying material does not form part of the present invention. Any known fastening means may be used. However, in order to show an advantageous way of forming such fastening with the machine according to the invention, the elements required therefore are also shown and described in further detail hereinafter with reference to FIGS. 2-6.

As shown in these figures, a metallic strip 24 is coiled on a roll 23. The strip 24 can be fed by advancing means 25 to a die 26, a slide plate 27 and a squeeze block 28.

While the free end of the tying material is held by the gripping device 10 on the takeover shaft 20, the advancing means 25 convey the metallic strip 24 from the roll 23 to between the squeeze block 28 and the die 26. The slide plate 27 is then moved to cover in its end position the gap between the squeeze block 28 and the die 26, which movement of the plate 27 is initiated by the advancing means 25. Afterwards, the knife 22 cuts the steel strip 24 at the die 26. The portion of the steel strip cut off is gripped between the squeeze block 28 and the die 26 and the cut off portion of the steel strip is preformed.

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When the components of the machine are in the position as shown in FIG. 3, the takeover shaft 20 has been drawn to the left, as viewed in FIG. 3, to its other end position and has also been swung upwardly. The ring 12 rotates about the package 11 and an auxiliary clamp or second gripping means 21 located in the direction of rotation of the ring 12 beyond the first gripping means 19 is then advanced and closed about a portion of the tying material unwound from the reel and extending about the bundle 11 beyond the first gripping means 19 in overlapping relationship to the end of the tying material held by the gripping means 19. Further rotation of the ring 12 may then be stopped by any means known in the art.

When the components of the machine are positioned as shown in FIG. 4, the squeeze block 28 advances and forms the piece of steel strip gripped between the block 28 and the die 26 into a seal about the overlapping portions of the tying material 17. At the same time the slide plate is pushed back by the block 28 so that as the squeeze block 28 is retracted, and the finished joint can automatically come out of the fastening means.

A knife 29 is then advanced to cut the tying material 17 at the left side, as viewed in FIGS. 4 and 5, of the second gripping means 21. At the same time the first gripping means 19 is opened and the takeover shaft 20 is moved from the position shown in FIG. 4 to that shown in FIG. 5 and moved also upwardly to grip the free end of the tying material at the left side of the second gripping means 21 as shown in FIG. 5, while the second gripping means 21 is opened and retracted to the position shown in FIG. 6 and the knife 29 is also retracted to its starting position.

Finally, the squeeze block 28 returns to its starting position as shown in FIG. 6 and the shaft 20 swings downwardly likewise to its starting position as shown in FIG. 1. This completes one tied loop around the package 11. The package may be tied again in the same way before being finally removed from the machine and taken to a storage room.

As already mentioned the means for fastening the overlapping ends of the tying material are shown in the drawings only in a schematic manner and any other means well known in the art may be used for fastening of the overlapping ends of the tying material in the machine of the present invention.

FIGS. 7-9 illustrate a further embodiment of a tying machine according to the present invention in which the supply reel is mounted on a movable ring of the machine turnable about an axis parallel to the axis of the ring and in which the supply reel is braked by means tending to move about its axis in a direction opposite to the direction of rotation imparted thereto during withdrawal of tying material therefrom while the supply reel is permitted to slip in a controlled manner so that the tying material will be wound about the package in taut condition.

Referring now to FIG. 7, it will be seen that the tying machine illustrated therein includes a support table 10 adapted to support on its upper supporting surface a package or bundle 11 to be tied. Surrounding the package 11 is a movable ring 12 located in a plane normal to the supporting surface of table 10. A stationary ring 30 having an inner diameter greater than the outer diameter of the movable ring 12 is arranged in a plane parallel to that of the movable ring to one side of the latter. The stationary ring 30 is fixed to the support means of the machine in any known manner, not shown in the drawing. The movable ring 12 is supported turnably about its axis on the stationary ring 30 by supporting means which include as shown in FIGS. 7 and 9 three support brackets 34. Brackets 34 are fastened angularly spaced from each other through an angle of 120° by means of screw bolts 35 extending through appropriate openings of the stationary ring 30 to the latter. Each of the sub-

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stantially triangular brackets 34 carries at the apex thereof an axle 45 (FIG. 9) on which a roller 36 is turnably mounted, preferably by means of a needle bearing. A snap ring engaged in a groove of the axle 45 prevents axial shifting of the roller 36. Each roller 36 has a pair of flanges rollingly engaging cylindrical bearing surfaces 44 on the outer periphery of the movable ring and respectively located at opposite sides of a gear rim 32 formed on the outer periphery of the movable ring 12. Each roller 36 is provided with an annular groove 46 through which the gear rim 32 of the movable ring may pass with clearance. This provides for a secure guiding of the movable ring 12 and this will also prevent shifting of the movable ring in axial direction.

The drive means for moving the movable ring 12 about its axis include a gear 13 meshing with the gear rim 32 provided at the periphery of the movable ring 12 and being mounted on the support means for turning movement about the axis 13'. A pulley 40 coaxially fixed to the gear 13 for movement about the axis 13' is driven by a belt 43 from a second pulley 41 fixed to the shaft 42 of a motor 14 mounted in any convenient manner, not further shown in FIG. 7, on the support of the machine. The motor is rotated in a direction to drive the movable ring 12 in clockwise direction as viewed in FIG. 7. Conventional means not shown in the drawing are provided for control of the movement of the movable ring, that is to stop rotation of the same after the same has performed substantially one revolution.

Supply reel means 37 are mounted by means of a bracket 38 and screws 39 on the movable ring 12 and the supply reel means 37 carry a supply spool 16 turnable about an axis parallel to the axis of the movable ring and on which the tying material preferably in the form of a wire or strip of plastic material is wound.

The bracket 38 carrying the supply reel means 37 has a substantially triangular plate portion extending to one side of the stationary ring 30. A portion of the bracket 38 reinforced by rib 38a (FIG. 8) extends through the stationary ring 30, engages the movable ring adjacent the outer periphery thereof and is fastened thereto by a pair of screw bolts 39 extending through appropriate openings of the movable ring 12 and the bracket 38 and being fixed thereto by means of nuts 39a. The end portion of the bracket 38 which extends beyond the outer periphery of the stationary ring 30 is formed into a bearing portion 52 in which a shaft 47 is turnably mounted by means of two roller bearings 53. The shaft 47 projects with opposite ends thereof respectively to opposite sides of the roller bearings 53. A small diameter gear 48 meshing with the gear rim 31 provided on the outer periphery of the stationary ring 30 is fixed to the shaft 47 by means of a key 49 and secured against movement in axial direction of the shaft 47 by a snap ring engaging a groove adjacent the outer end of the shaft 47 so as to hold the gear 48 against a shoulder of the shaft. The other end of the shaft carries fixed thereto by means of a key 51 a sprocket wheel 50 and a snap ring secures the sprocket wheel 50 against axial movement on the shaft 47. The sprocket wheel 50 is connected by means of a sprocket chain 54 to a second sprocket wheel 55 of a diameter larger than that of the sprocket wheel 50 and which is coaxially fixed to a hub 57 turnably mounted, by means of needle bearings 63 on a stud shaft 58 fixedly mounted in a bore formed in the bracket 38 intermediate the ends thereof. The stud shaft 58 is secured against rotation and axial movement relative to the bracket 38 by a flange 73 integral with the free end of the stud shaft 58 or welded thereto and held on the bracket 38 by a screw 74. The hub 57 has on the side thereof facing the bracket 38 a flange portion 57a to which the second sprocket wheel 55 is fastened by means of screws 56. Radial needle bearings respectively engaging opposite shoulder faces on the hub 57 prevent axial displacement of the hub relative to the stationary stud shaft 58. The needle bearings

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67 are secured against axial displacement on the stud shaft 58 in a conventional manner as shown in FIG. 8. A drum having a hub portion 68 surrounds the hub 57 and is turnably mounted thereon by means of a needle bearing 62. The drum has on a side thereof facing the bracket 38 a flange 59 integrally connected to the hub portion of the drum and the flange 59 is formed with a cavity facing the flange portion 57a of the inner hub 57. A friction disk 60 is located in the cavity and fastened to the drum by means of screws 61. The heads of the screw 61 are countersunk in the annular friction disk 60.

Pressure means are provided for pressing the annular friction disk 60 against the flange portion 57a of the inner hub 57. These pressure means comprise a compression spring 64, preferably formed by a plurality of oppositely curved spring washers, located about the right end portion, as viewed in FIG. 4, of the inner hub 57 and being engaged at one end thereof by a ring 66 screwed onto the right end of the inner hub 57 so as to be adjustable in axial direction, while a radial needle bearing 65 is sandwiched between the other end of the compression spring 64 and a shoulder face on the drum 68. The ring 66 is provided with a plurality of angularly spaced bores 69 for engaging with an appropriate wrench so that the ring may be turned about its axis and thereby be axially adjusted with regard to the inner hub 57. In this way the pressure with which the annular friction disk 60 engages the flange portion 57a of the inner hub 57 may be adjusted.

A supply spool 16, as shown in FIG. 7 is mounted on the outer periphery of the hub portion of the drum 68 and a plurality of studs 72 carried by the flange 59 of the drum are adapted to engage into corresponding openings of the supply spool 16 so that the latter is secured to the drum 68 against rotation relative thereto. A second flange 71 having a cylindrical portion provided with an outer screw thread is screwed into a correspondingly threaded portion of the drum to engage a supply spool mounted on the hub portion of the drum on the side thereof opposite the side facing the flange 59. By appropriate adjusting of the axial position of the flange 71 the studs 72 may be securely held in appropriate openings of the supply spool. By unscrewing the cylindrical portion of the flange 71 from the remainder of the drum, an empty supply spool may be removed from the drum and be replaced by a new one. Appropriate openings 70 are formed in the flange 71 for engagement with an appropriate wrench or similar tool to facilitate screwing of the cylindrical portion of the flange 71 into and out from the threaded end of the hub portion of the drum.

The machine illustrated in FIGS. 7-9 includes also first gripping means 19 mounted on a takeover shaft 20, second gripping means 21, cutting means 22, and cooperating with means for fastening the overlapping ends of the tying material, as schematically illustrated in FIG. 1 and as described before in detail in connection with FIGS. 2-6.

The machine as illustrated in FIGS. 7-9 will operate as follows:

A parcel or bundle 11 to be tied is placed on the support table 10 with a portion of the parcel extending through the movable ring 12. The end of the tying material on the supply spool 16 is held by the first gripping means 19 and the electromotor 14 is started whereby rotation of the motor is transmitted through the pulley and belt drive 40, 41, 43 to the gear 13 meshing with the gear rim 32 on the outer periphery of the movable ring 12 so that the latter is rotated in clockwise direction. The supply spool means 37 mounted by the bracket 38 on the movable ring 12 moves together with the movable ring during the rotation thereof, whereby the tying material, for instance a plastic wire is withdrawn from the supply spool so that the drum 68 on which the supply spool is fixedly mounted will be rotated in counterclockwise direction while the movable ring moves in clockwise direction. During movement of the movable ring in clock-

wise direction the small gear 48 on the bracket 38 meshing with the gear rim 31 on the outer periphery of the stationary ring 30 will rotate in clockwise direction, and transmit through the chain drive 50, 54, 55 a rotation in clockwise direction, that is a rotation in the direction opposite to the rotation of the drum 68, to the hub 57 on which the drum is mounted. Since the friction disk 60 fixedly mounted on the drum 68 is in frictional contact with the flange portion 57a of the hub 57, rotation of the hub in the direction opposite to the rotation of the drum will impart to the latter a braking moment so that the tying material will be applied in taut condition about the parcel 11 and undesired unwinding of the tying material from the supply spool for instance at the end of rotation of the movable ring will be positively prevented. The size of the braking force can be easily adjusted by adjusting the pressure of the spring means 64 which presses the friction disk 60 against the flange portion 57a of the hub.

After the movable ring has made about a full revolution, movement of the same is stopped by any well known means not forming part of the present invention, the overlapping ends of the tying material are connected and the tying material cut between the connected ends and the remainder of the tying material on the supply spool in the manner as described above in connection with FIGS. 2-6.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of machines for tying bundles or the like differing from the types described above.

While the invention has been illustrated and described as embodied in a machine for tying bundles and including means for applying the tying material in taut condition about the bundle to be tied, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic and specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In a machine for tying bundles, in combination, support means having a supporting surface for supporting a bundle to be tied thereon; moving means encircling a bundle supported on said supporting surface and adapted to move about the bundle in one direction; a supply reel for tying material mounted on said moving means for moving therewith about the bundle, said supply reel having an axis and being mounted on said moving means turnably about said axis; first gripping means for gripping one end of the tying material and for holding it adjacent the bundle while said moving means moves said supply reel about said bundle so that the tying material is withdrawn from said supply reel and wound about the bundle; brake means cooperating with said supply reel for braking the turning movement of said reel about its axis so as to apply the tying material in tensioned condition about the bundle, said brake means including a friction wheel in operative engagement with said supply reel and means for rotating said friction wheel in a direction opposite to the direction of rotation imparted to said supply reel during withdrawal of tying material therefrom; second gripping means located in said one direction beyond said first gripping means for gripping a portion of the tying material unwound from said supply reel and extending about the bundle beyond the first gripping means in overlapping relationship to said one end of said tying mate-

rial; fastening means adjacent said first and second gripping means for fastening the portion of tying material overlapping said one end of said tying material to said one end; and cutting means for cutting the tying material between the fastened portion and said reel.

2. In a machine for tying bundles, in combination, support means having a horizontal supporting surface for supporting a bundle to be tied thereon; moving means in the form of a ring member arranged in a substantially vertical plane encircling a bundle supported on said supporting surface, said ring member having an outer gear rim; a gear meshing with said gear rim; drive means for rotating said gear to turn said ring member in one direction about the bundle; a supply reel for tying material mounted on said ring member on one side thereof for movement with said ring member about said bundle, said supply reel having an axis parallel to the axis of the ring member and being mounted on said ring member turnably about its axis; guide means mounted on said ring member adjacent said supply reel, said guide means extending from said one side to the other side of said ring member and guiding tying material unwound from said reel to the other side of said ring member; first gripping means for gripping one end of the tying material and for holding it adjacent the bundle while said moving means moves said supply reel about said bundle so that the tying material is wound about the bundle; brake means cooperating with said supply reel for braking the turning movement of said reel about its axis so as to apply the tying material in tensioned condition about the bundle; second gripping means located in said one direction beyond said first gripping means for gripping a portion of the tying material unwound from said supply reel and extending about the bundle beyond the first gripping means in overlapping relationship to said one end of said tying material; fastening means adjacent said first and second gripping means for fastening the portion of tying material overlapping said one end of said tying material to said one end; and cutting means for cutting the tying material between the fastened portion and said reel.

3. In a machine for tying bundles, in combination, support means having a horizontal supporting surface for supporting a bundle to be tied thereon; moving means in the form of a ring member arranged in a substantially vertical plane encircling a bundle supported on said supporting surface, said ring member having an outer gear rim; a gear meshing with said gear rim; drive means for rotating said gear to turn said ring member in one direction about the bundle; a supply reel for tying material mounted on said ring member on one side thereof for movement with said ring member about said bundle, said supply reel having an axis parallel to the axis of the ring member and being mounted on said ring member turnably about its axis; guide means mounted on said ring member adjacent said supply reel, said guide means extending from said one side to the other side of said ring member and guiding tying material unwound from said reel to the other side of said ring member; first gripping means for gripping one end of the tying material and for holding it adjacent the bundle while said moving means moves said supply reel about said bundle so that the tying material is wound about the bundle; brake means cooperating with said supply reel for braking the turning movement of said reel about its axis so as to apply the tying material in tensioned condition about the bundle, said brake means including a friction wheel in operative engagement with said supply reel and means for rotating said friction wheel in a direction opposite to the direction of rotation imparted to the supply reel during withdrawal of tying material therefrom; second gripping means located in said one direction beyond said first gripping means for gripping a portion of the tying material unwound from said supply reel and extending about the bundle beyond the first gripping means in overlapping relationship to said one end of said tying material; fastening means adjacent

said first and second gripping means for fastening the portion of tying material overlapping said one end of said tying material to said one end; and cutting means for cutting the tying material between the fastened portion and said reel.

4. In a machine for tying bundles, in combination, support means having a supporting surface for supporting a bundle to be tied thereon; a stationary ring located substantially in a plane normal to said supporting surface and encircling a bundle supported on said supporting surface; a movable ring coaxial with said stationary ring and located in a plane substantially parallel to said one plane; means supporting said movable ring turnably about its axis on said stationary ring; drive means operatively connected to said movable ring for rotating the latter in one direction about its axis; a supply reel for tying material, said supply reel having an axis and being carried turnably about its axis on said movable ring; first gripping means for gripping one end of the tying material and for holding it adjacent the bundle while said movable ring moves said supply reel about said bundle so that the tying material is withdrawn from said supply reel and wound about the bundle while said supply reel is rotated in a direction opposite said one direction; rotating means cooperating with said stationary ring and operatively connected to said reel tending to rotate said reel in a direction opposite the direction of rotation imparted thereto during withdrawal of tying material therefrom while permitting said reel to slip so as to keep the tying material during winding of the same about the bundle in taut condition; second gripping means located in said one direction beyond said first gripping means for gripping a portion of the tying material unwound from said reel and extending about the bundle beyond the first gripping means in overlapping relationship to said one end of said tying material; fastening means adjacent said first and second gripping means for fastening the portion of tying material overlapping said one end of said tying material to said one end; and cutting means for cutting the tying material between the fastened portion and said reel.

5. In a machine for tying bundles, in combination, support means having a supporting surface for supporting a bundle to be tied thereon; a stationary ring located substantially in a plane normal to said supporting surface and encircling a bundle supported on said supporting surface; a movable ring coaxial with said stationary ring and located in a plane substantially parallel to said one plane; roller means mounted on said stationary ring and engaging said movable ring for supporting the latter turnable about its axis on said stationary ring; drive means operatively connected to said movable ring for rotating the latter in one direction about its axis; a supply reel for tying material, said supply reel having an axis and being carried turnably about its axis on said movable ring; first gripping means for gripping one end of the tying material and for holding it adjacent the bundle while said movable ring moves said supply reel about said bundle so that the tying material is withdrawn from said supply reel and wound about the bundle while said supply wheel is rotated in a direction opposite said one direction; rotating means cooperating with said stationary ring and operatively connected to said reel tending to rotate said reel in a direction opposite to the direction of rotation imparted thereto during withdrawal of tying material therefrom while permitting said reel to slip so as to keep the tying material during winding of the same about the bundle in taut condition; second gripping means located in said one direction beyond said first gripping means for gripping a portion of the tying material unwound from said reel and extending about the bundle beyond the first gripping means in overlapping relationship to said one end of said tying material; fastening means adjacent said first and second gripping means for fastening the portion of tying material overlapping said one end of said tying material to said one end; and cutting means

for cutting the tying material between the fastened portion and said reel.

6. In a machine for tying bundles, in combination, support means having a supporting surface for supporting a bundle to be tied thereon; a stationary ring located substantially in a plane normal to said supporting surface and encircling a bundle supported on said supporting surface; a movable ring having an outer diameter smaller than the inner diameter of said stationary ring and being arranged to one side of and substantially parallel to said stationary ring; a plurality of rollers turnably mounted on said one side of said stationary ring and engaging the outer periphery of said movable ring for supporting the latter turnable about its axis on said stationary ring; drive means operatively connected to said movable ring for rotating the latter in one direction about its axis; a supply reel for tying material, said supply reel having an axis and being carried turnably about its axis on said movable ring; first gripping means for gripping one end of the tying material and for holding it adjacent the bundle while said movable ring moves said supply reel about said bundle so that the tying material is withdrawn from said supply reel and wound about the bundle while said supply wheel is rotated in a direction opposite said one direction; rotating means cooperating with said stationary ring and operatively connected to said reel tending to rotate said reel in a direction opposite to the direction of rotation imparted thereto during withdrawal of tying material therefrom while permitting said reel to slip so as to keep the tying material during winding of the same about the bundle in taut condition; second gripping means located in said one direction beyond said first gripping means for gripping a portion of the tying material unwound from said reel and extending about the bundle beyond the first gripping means in overlapping relationship to said one end of said tying material; fastening means adjacent said first and second gripping means for fastening the portion of tying material overlapping said one end of said tying material to said one end; and cutting means for cutting the tying material between the fastened portion and said reel.

7. In a machine for tying bundles, in combination, support means having a supporting surface for supporting a bundle to be tied thereon; a stationary ring located substantially in a plane normal to said supporting surface and encircling a bundle supported on said supporting surface; a movable ring having an outer diameter smaller than the inner diameter of said stationary ring and being arranged to one side of and substantially parallel to said stationary ring, said movable ring having a gear rim at the outer periphery thereof of a width smaller than the width of said movable ring so as to provide at opposite sides of said gear rim a pair of cylindrical support surfaces; a plurality of rollers turnably mounted on said one side of said stationary ring and engaging the outer periphery of said movable ring for supporting the latter turnable about its axis on said stationary ring, said rollers having each a pair of flanges respectively engaging said cylindrical bearing surfaces and annular groove between said flanges through which said gear rim passes with clearance; a gear turnably mounted on said support means and meshing with said gear rim of said movable ring; drive means operatively connected to said gear for rotating the same about its axis to move thereby said movable ring in one direction about its axis; a supply reel for tying material, said supply reel having an axis and being carried turnably about its axis on said movable ring; first gripping means for gripping one end of the tying material and for holding it adjacent the bundle while said movable ring moves said supply reel about said bundle so that the tying material is withdrawn from said supply reel and wound about the bundle while said supply reel is rotated in a direction opposite said one direction; rotating means cooperating with said stationary ring and operatively connected to said reel tending to rotate said reel in a direc-

tion opposite to the direction of rotation imparted thereto during withdrawal of tying material therefrom while permitting said reel to slip so as to keep the tying material during winding of the same about the bundle in taut condition; second gripping means located in said one direction beyond said first gripping means for gripping a portion of the tying material unwound from said reel and extending about the bundle beyond the first gripping means in overlapping relationship to said one end of said tying material; fastening means adjacent said first and second gripping means for fastening the portion of tying material overlapping said one end of said tying material to said one end; and cutting means for cutting the tying material between the fastened portion and said reel.

8. In a machine for tying bundles, in combination, support means having a supporting surface for supporting a bundle to be tied thereon; a stationary ring located substantially in a plane normal to said supporting surface and encircling a bundle supported on said supporting surface; a movable ring coaxial with said stationary ring and located in a plane substantially parallel to said one plane; means supporting said movable ring turnably about its axis on said stationary ring; drive means operatively connected to said movable ring for rotating the latter in one direction about its axis; a supply reel for tying material, said supply reel having an axis and being carried turnably about its axis on said movable ring; first gripping means for gripping one end of the tying material and for holding it adjacent the bundle while said movable ring moves said supply reel about said bundle so that the tying material is withdrawn from said supply reel and wound about the bundle while said supply reel is rotated in a direction opposite said one direction; rotating means cooperating with said stationary ring and operatively connected to said reel tending to rotate said reel in a direction opposite to the direction of rotation imparted thereto during withdrawal of tying material therefrom while permitting said reel to slip so as to keep the tying material during winding of the same about the bundle in taut condition, said rotating means including a member carried by said movable ring turnably about a turning axis parallel to the axis of said movable ring and engaging said stationary ring to be rotated about said turning axis, during movement of said movable ring in said one direction, in a direction opposite to said one direction, and connecting means connecting said reel to said member for movement therewith in said opposite direction; second gripping means located in said one direction beyond said first gripping means for gripping a portion of the tying material unwound from said reel and extending about the bundle beyond the first gripping means in overlapping relationship to said one end of said tying material; fastening means adjacent said first and second gripping means for fastening the portion of tying material overlapping said one end of said tying material to said one end; and cutting means for cutting the tying material between the fastened portion and said reel.

9. In a machine for tying bundles, in combination, support means having a supporting surface for supporting a bundle to be tied thereon; a stationary ring located substantially in a plane normal to said supporting surface and encircling a bundle supported on said supporting surface; a movable ring coaxial with said stationary ring and located in a plane substantially parallel to said one plane; means supporting said movable ring turnably about its axis on said stationary ring; drive means operatively connected to said movable ring for rotating the latter in one direction about its axis; a supply reel for tying material, said supply reel having an axis and being carried turnably about its axis on said movable ring; first gripping means for gripping one end of the tying material and for holding it adjacent the bundle while said movable ring moves said supply reel about said bundle so that the tying material is withdrawn from said supply reel and wound about the bundle while said sup-

ply reel is rotated in a direction opposite said one direction; rotating means cooperating with said stationary ring and operatively connected to said reel tending to rotate said reel in a direction opposite to the direction of rotation imparted thereto during withdrawal of tying material therefrom while permitting said reel to slip so as to keep the tying material during winding of the same about the bundle in taut condition, said rotating means including a member carried by said movable ring turnably about a turning axis parallel to the axis of said movable ring and engaging said stationary ring to be rotated about said turning axis, during movement of said movable ring in said one direction, in a direction opposite to said one direction, and connecting means connecting said reel to said member for movement therewith in said opposite direction and including a slip clutch permitting said reel to slip relative to said member; second gripping means located in said one direction beyond said first gripping means for gripping a portion of the tying material unwound from said reel and extending about the bundle beyond the first gripping means in overlapping relationship to said one end of said tying material; fastening means adjacent said first and second gripping means for fastening the portion of tying material overlapping said one end of said tying material to said one end; and cutting means for cutting the tying material between the fastened portion and said reel.

10. In a machine for tying bundles, in combination, support means having a supporting surface for supporting a bundle to be tied thereon; a stationary ring located substantially in a plane normal to said supporting surface and encircling a bundle supported on said supporting surface, said stationary ring having a gear rim; a movable ring coaxial with said stationary ring and located in a plane substantially parallel to said one plane; means supporting said movable ring turnably about its axis on said stationary ring; drive means operatively connected to said movable ring for rotating the latter in one direction about its axis; a supply reel for tying material, said supply reel having an axis and being carried turnably about its axis on said movable ring; first gripping means for gripping one end of the tying material and for holding it adjacent the bundle while said movable ring moves said supply reel about said bundle so that the tying material is withdrawn from said supply reel and wound about the bundle while said supply reel is rotated in a direction opposite said one direction; rotating means cooperating with said stationary ring and operatively connected to said reel tending to rotate said reel in a direction opposite to the direction of rotation imparted thereto during withdrawal of tying material therefrom while permitting said reel to slip so as to keep the tying material during winding of the same about the bundle in taut condition, said rotating means including a gear carried by said movable ring turnably about a turning axis parallel to the axis of said movable ring and meshing with said gear rim of said stationary ring to be rotated about said turning axis, during movement of said movable ring in said one direction, in a direction opposite to said one direction, and connecting means connecting said reel to said gear for movement therewith in said opposite direction and including a slip clutch permitting said reel to slip relative to said gear; second gripping means located in said one direction beyond said first gripping means for gripping a portion of the tying material unwound from said reel and extending about the bundle beyond the first gripping means in overlapping relationship to said one end of said tying material; fastening means adjacent said first and second gripping means for fastening the portion of tying material overlapping said one end of said tying material to said one end; and cutting means for cutting the tying material between the fastened portion and said reel.

11. In a machine for tying bundles, in combination,

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support means having a supporting surface for supporting a bundle to be tied thereon; a stationary ring located substantially in a plane normal to said supporting surface and encircling a bundle supported on said supporting surface, said stationary ring having a gear rim; a movable ring having an outer diameter smaller than the inner diameter of said stationary ring and being arranged to one side of and substantially parallel to said stationary ring; a plurality of rollers turnably mounted on said one side of said stationary ring and engaging the outer periphery of said movable ring for supporting the latter turnable about its axis on said stationary ring; drive means operatively connected to said movable ring for rotating the latter in one direction about its axis; a support bracket fixed to said movable ring and extending through said stationary ring to the other side of the latter; supply reel means for tying material, said supply reel means being turnably mounted on said bracket projecting to said other side of said stationary ring; first gripping means for gripping one end of the tying material and for holding it adjacent the bundle while said movable ring moves said supply reel about said bundle so that the tying material is withdrawn from said supply reel and wound about the bundle while said supply reel is rotated in a direction opposite said one direction; a gear turnably mounted on said bracket and meshing with said gear rim of said stationary ring to be rotated, during movement of said movable ring in said one direction, in a direction opposite to the direction of rotation imparted to said supply reel means during withdrawal of tying material therefrom; means connecting said supply reel means with said gear for rotating therewith in said opposite direction while permitting said reel means to slip relative to said gear so as to keep the tying material during winding of the same about the bundle in taut condition; second gripping means located in said one direction beyond said first gripping means for gripping a portion of the tying material unwound from said reel and extending about the bundle beyond the first gripping means in overlapping relationship to said one end of said tying material; fastening means adjacent said first and second gripping means for fastening the portion of tying material overlapping said one end of said tying material to said one end; and cutting means for cutting the tying material between the fastened portion and said reel.

12. In a machine for tying bundles, in combination, support means having a supporting surface for supporting a bundle to be tied thereon; a stationary ring located substantially in a plane normal to said supporting surface and encircling a bundle supported on said supporting surface, said stationary ring having a gear rim; a movable ring having an outer diameter smaller than the inner diameter of said stationary ring and being arranged to one side of and substantially parallel to said stationary ring; a plurality of rollers turnably mounted on said one side of said stationary ring and engaging the outer periphery of said movable ring for supporting the latter turnable about its axis on said stationary ring; drive means operatively connected to said movable ring for rotating the latter in one direction about its axis; a support bracket fixed to said movable ring and extending through said stationary ring to the other side of the latter; supply reel means for tying material, said supply reel means being turnably mounted on said bracket projecting to said other side of said stationary ring and including a hub turnably

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mounted on said bracket, and a drum turnably mounted on said hub and adapted to carry a supply spool fixed thereto for rotation therewith; first gripping means for gripping one end of the tying material and for holding it adjacent the bundle while said movable ring moves said supply reel about said bundle so that the tying material is withdrawn from said supply spool and wound about the bundle while said drum is rotated in a direction opposite said one direction; a gear turnably mounted on said bracket and meshing with said gear rim of said stationary ring to be rotated, during movement of said movable ring in said one direction, in a direction opposite to the direction of rotation imparted to said drum during withdrawal of tying material therefrom; means connecting said hub with said gear for rotating therewith in said opposite direction while permitting said drum to slip relative to said hub so as to keep the tying material during winding of the same about the bundle in taut condition, said connecting means including friction clutch means between said hub and said drum permitting said drum to slip relative to said hub; second gripping means located in said one direction beyond said first gripping means for gripping a portion of the tying material unwound from said reel and extending about the bundle beyond the first gripping means in overlapping relationship to said one end of said tying material; fastening means adjacent said first and second gripping means for fastening the portion of tying material overlapping said one end of said tying material to said one end; and cutting means for cutting the tying material between the fastened portion and said reel.

13. In a machine as set forth in claim 12 wherein said means for connecting said gear with said hub of said reel means further comprise a shaft turnably carried by said bracket, said gear being mounted on one end of said shaft, a first sprocket wheel on the other end of said shaft, a second sprocket wheel fixed to said hub, and a sprocket chain wound about said first and second sprocket wheels.

14. In a machine as set forth in claim 12, wherein said friction clutch means comprises a flange on one end of said hub and having an annular surface facing a corresponding annular surface of said drum, an annular friction disc fixed to one of said annular surfaces and frictionally engaging the other of said annular surfaces, and pressure means cooperating with said hub and said drum for pressing said friction disc against said other annular surface.

15. In a machine as set forth in claim 14, said pressure means comprising compression spring means wound about an end portion of said hub which is opposite said one end thereof, antifriction means between one end of said spring and a face of said drum facing away from said annular surface thereof, and abutting means fixed to said end portion of said hub adjustable in axial direction thereof and engaging the other end of said compression spring.

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