Oct. 10, 1961 J. H. BROADHEAD ET AL 3,003,297

APPARATUS FOR WRAPPING ARTICLES WITH TAPE

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FIG. 8

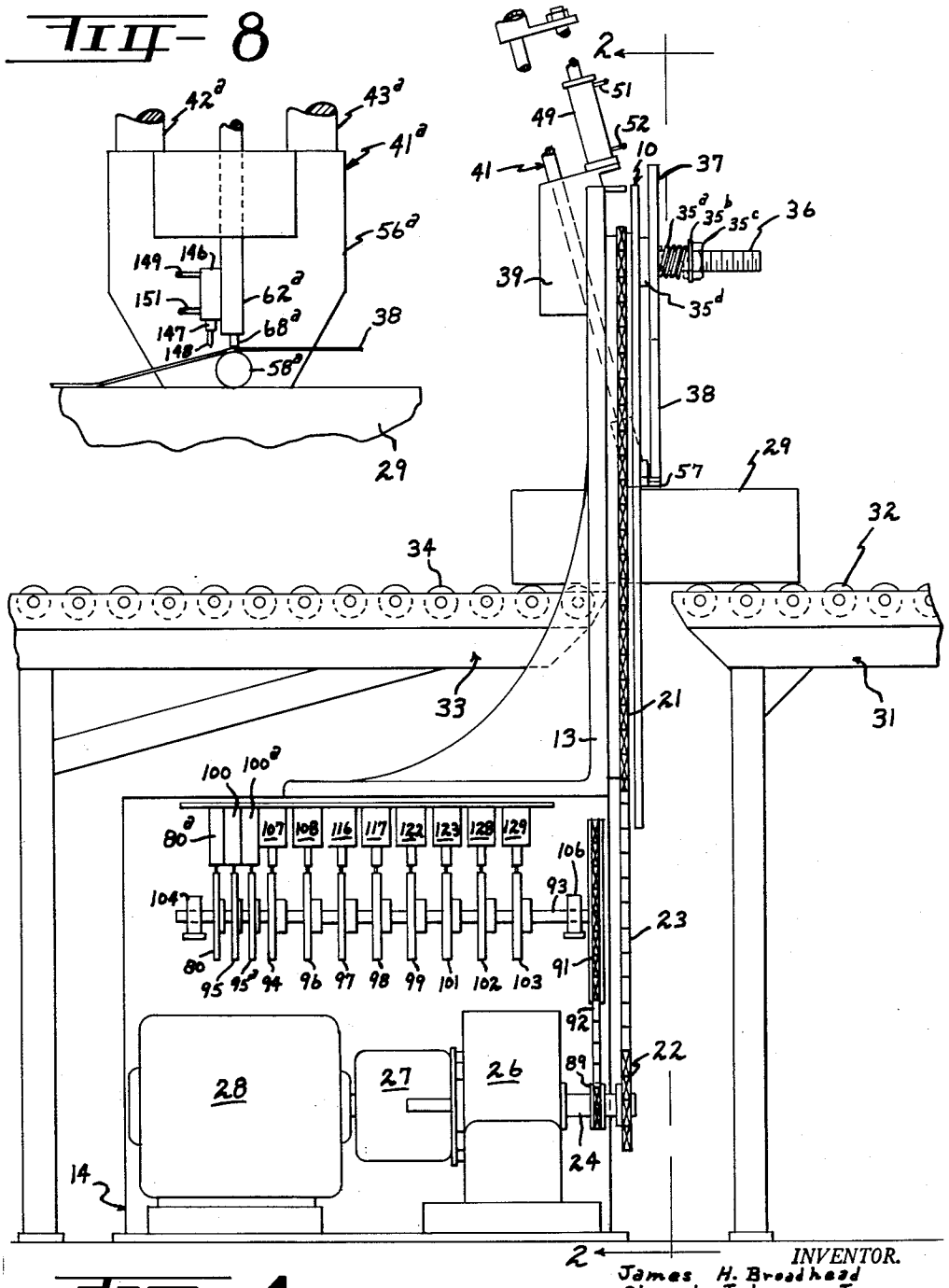


FIG. 1

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Fig. 2

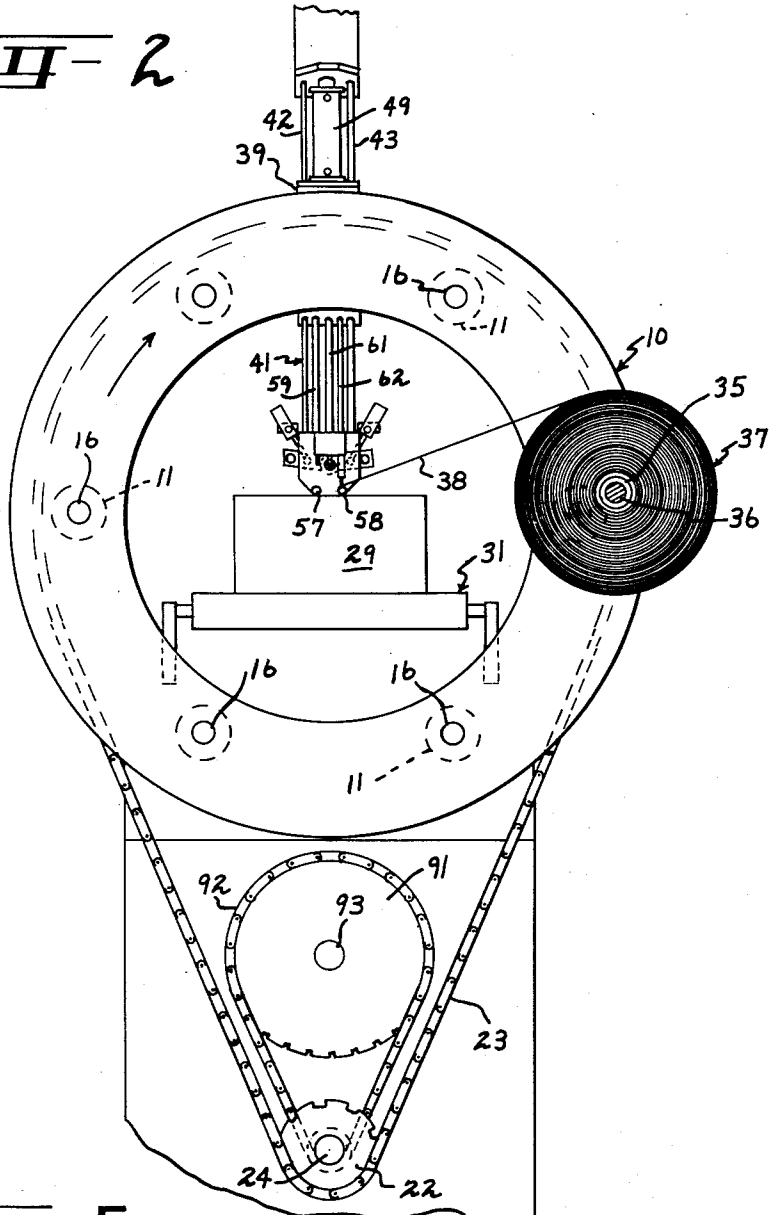
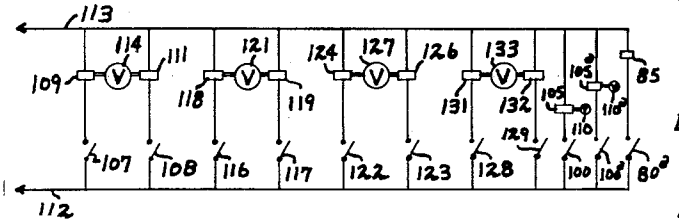



Fig. 5

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APPARATUS FOR WRAPPING ARTICLES WITH TAPE

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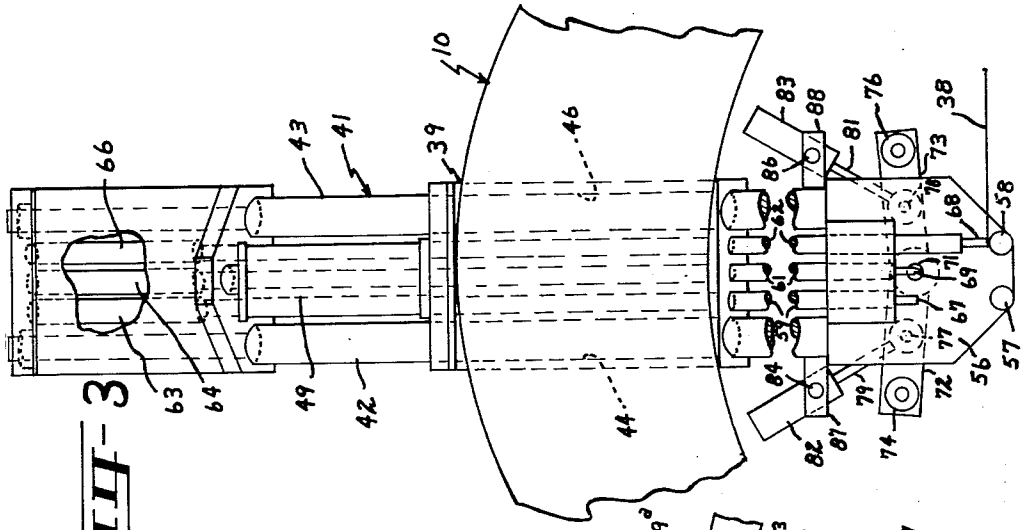

FIG. 3

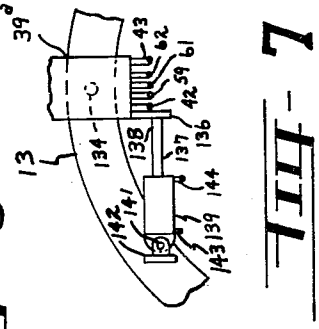

FIG. 7

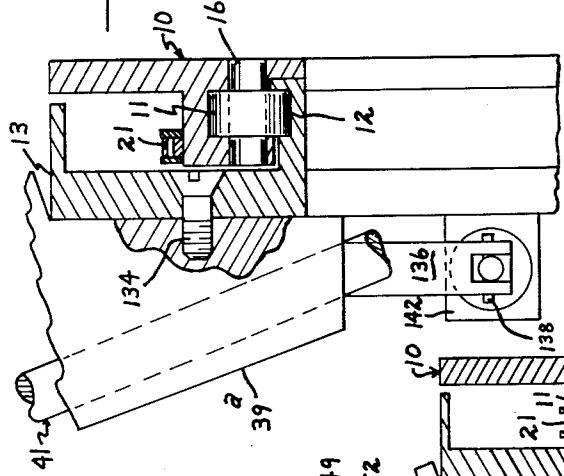

FIG. 6

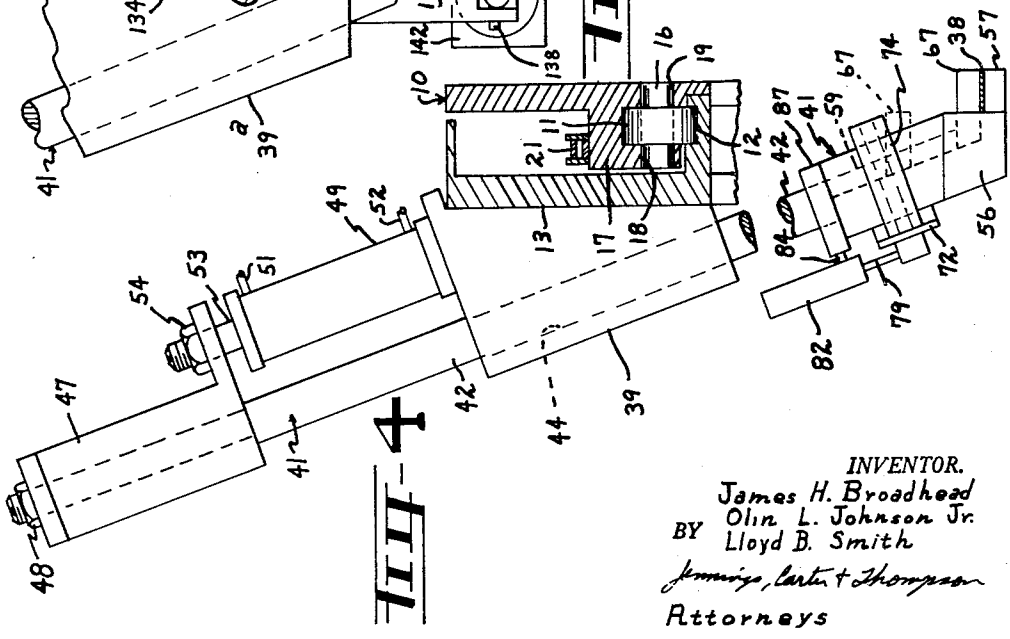

FIG. 4

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APPARATUS FOR WRAPPING ARTICLES WITH TAPE

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Fig. 9

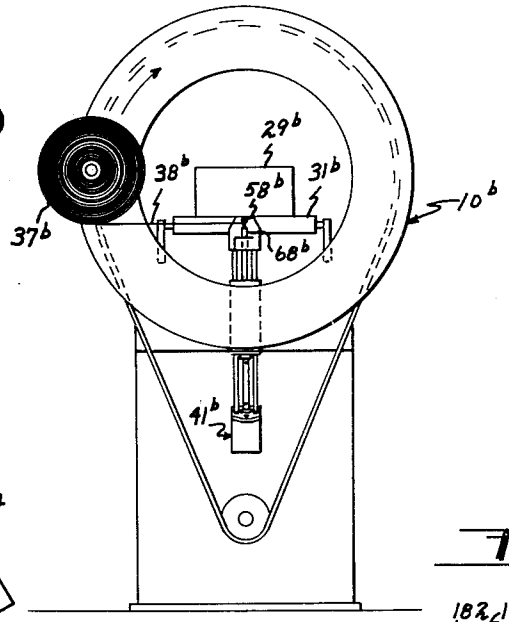
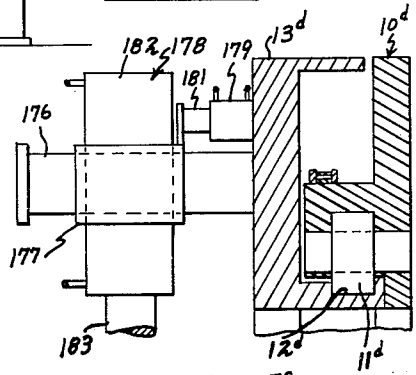



Fig. 12



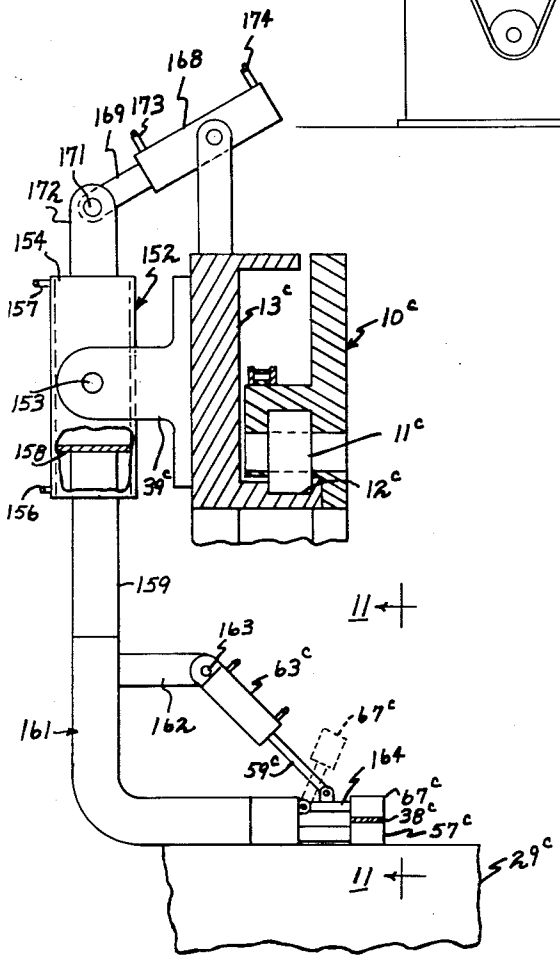




Fig. 10

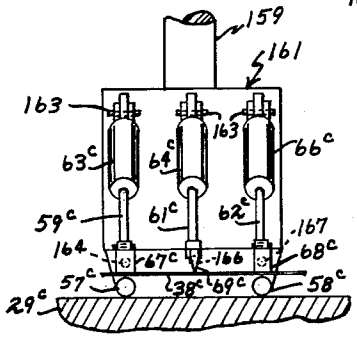



Fig. 11

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3,003,297

# APPARATUS FOR WRAPPING ARTICLES WITH TAPE

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19 Claims. (Cl. 53—198)

This invention relates to apparatus for wrapping articles with tape and more particularly to such apparatus which shall apply the tape to the article or articles in a minimum of time and with a minimum of labor.

An object of our invention is to provide apparatus for wrapping an article or articles with tape in which the apparatus does not have to be pre-set in order to accommodate various size articles, bundles or the like.

Another object of our invention is to provide apparatus of the character designated which not only is adapted to wrap box-like objects but is particularly adapted for wrapping bundles which comprise individual pieces or articles such as individual pieces of wood molding and the like.

A more specific object of our invention is to provide apparatus of the character designated which shall embody a rotatable member having an axial opening therethrough for receiving the article to be wrapped and a tape supply means mounted on the rotatable member and adapted for rotation therewith, together with an actuating member mounted for movement inwardly and outwardly of the rotatable member and having means adjacent the inner end thereof for holding an end of the tape whereby the tape is wrapped about the article as the rotatable member rotates.

A further object of our invention is to provide apparatus of the character designated in which improved means is provided for clamping the tape and cutting the same at predetermined intervals of rotation of the rotatable member whereby any desired amount of tape may be applied to the article being wrapped.

A still further object of our invention is to provide apparatus of the character designated which will be simple of construction, economical of manufacture and one which is adapted to wrap articles as they are passed intermittently through the rotary member.

Apparatus embodying features of our invention is illustrated in the accompanying drawings, forming a part of this application, in which:

FIG. 1 is a side elevational view, partly broken away and in section;

FIG. 2 is a front elevational view, partly broken away, taken generally along the line 2—2 of FIG. 1;

FIG. 3 is an enlarged, fragmental view;

FIG. 4 is a side elevational view of the apparatus shown in FIG. 3, partly broken away and in section;

FIG. 5 is a diagrammatic view showing a wiring diagram which may be employed with our improved apparatus;

FIG. 6 is a fragmental view, partly broken away and in section, showing a modified form of our invention;

FIG. 7 is a fragmental, rear elevational view of the apparatus shown in FIG. 6, drawn to a smaller scale;

FIG. 8 is a fragmental view showing another modified form of our invention;

FIG. 9 is a front elevational view showing another modified form of our invention;

FIG. 10 is a side elevational view, partly broken away and in section, showing a further modified form of our invention;

FIG. 11 is a view taken generally along the line 11—11 of FIG. 10; and,

FIG. 12 is a fragmental view, partly broken away and in section, showing a still further modified form of our invention.



Referring now to the drawings for a better understanding of our invention, we show a rotary ring 10 having a plurality of angularly spaced roller bearing members 11 which ride in an annular guideway 12 whereby the rotary ring 10 is supported for rotation. The annular guide member 12 is carried by a stationary member 13 which in turn is supported by a suitable frame indicated generally at 14. The roller bearing members 11 are supported on suitable shafts 16 carried by the rotatable member 10. As clearly shown in FIG. 4, an outwardly and downwardly extending flange member 17 is carried by the rotatable member 10 and is provided with a plurality of angularly spaced openings 18 therein for receiving the adjacent ends of the shaft 16. The other ends of the shafts 16 project through suitable openings 19 provided in the annular member 10.

The rotatable member 10 is driven by a sprocket 21 which is secured to the flange member 17, as shown in FIG. 4. Passing around the sprocket 21 and a lower sprocket 22 is a sprocket chain 23. The lower sprocket 22 is secured to a shaft 24 which is operatively connected to a gear reducer 26. A clutch and brake unit 27 operatively connects the gear reducer 26 to a suitable prime mover, such as a motor 28.

The article or articles to be wrapped, indicated generally at 29, are fed into the rotary ring 10 by a suitable conveyor 31 which may have suitable power driven feed rollers 32. The article or articles 29 are removed from the rotary ring 10 by a second conveyor unit 33 which may have driven rollers 34. It will be noted that the conveyor units 31 and 33 are spaced from each other whereby the tape may be wrapped around the article 29 in a manner to be described hereinafter without contacting the conveyor units.

Mounted on the rotary member 10 and projecting outwardly therefrom in a direction substantially parallel to the axial center line of the rotary member 10 is an elongated support member 36 which may be in the form of a shaft or the like. Mounted for rotation and axial sliding movement along the elongated member 36 is a tape supply roll 37 having an end 38 thereof extending inwardly of the rotary ring 10, as shown in FIG. 2. An annular core member 35 is inserted within the usual opening in the supply roll 37 whereby the roll is mounted for rotation on the shaft 36. Also a suitable spring $35^a$ is mounted on the shaft between the core member 35 and a washer $35^b$ whereby tension is applied to the supply roll to restrain rotation thereof. The outer end of the shaft 36 is threaded for receiving a retaining nut $35^c$ whereby the tension applied by the spring $35^a$ may be varied and the axial position of the supply roll 37 along the shaft 36 may be varied by positioning suitable spacer members $35^d$ between the supply roll 37 and the adjacent surface of the rotary member 10.

Mounted on the stationary member 13 adjacent the rotary ring 10 is a bracket 39 which carries a reciprocable actuating member 41. As shown in FIGS. 1–4, the reciprocable member 41 comprises a pair of laterally spaced guide members 42 and 43 which are adapted for sliding movement through suitable openings 44 and 46, respectively, provided in the stationary bracket 39. The outer ends of the guide members 42 and 43 are rigidly secured to a housing 47 by suitable lock nuts 48, whereby the housing 47 moves with the guide members 42 and 43. Mounted on the stationary bracket 39 is a fluid pressure operated cylinder 49 which extends in a direction generally parallel to the guide members 42 and 43. Fluid under pressure, such as air, is supplied to opposite ends of the cylinder 49 by suitable conduits 51 and 52. The cylinder 49 is provided with a piston rod 53 which is

connected to the housing 47 by suitable lock nuts 54 whereby the housing 47 is reciprocated by the fluid pressure operated cylinder 49.

Mounted at the lower ends of the guide members 42 and 43 is a bracket 56 which carries a pair of laterally spaced tape engaging members 57 and 58, which preferably are in the form of rollers. As clearly shown in FIGS. 1 and 4 of the drawings, the reciprocable member 41 extends inwardly of the rotary ring 10 at an inclination relative to the axis of rotation of the rotatable ring. Accordingly, the tape engaging members 57 and 58 are in alignment with the inwardly extending end 38 of the tape when the reciprocable member 41 is in an inner position an is out of alignment with the inwardly extending end 38 of the tape when the reciprocable member 41 is in an outer position. The reciprocable member 41 is shown in the inner position in FIGS. 1 and 2 of the drawings whereby the tape engaging members 57 and 58 are disposed adjacent the article 29 being wrapped.

By providing axial movement of the roll of tape 37 along the shaft 36, the tape engaging members 57 and 58 can move inwardly to accommodate articles 29 of various sizes. That is, when a smaller article 29 is wrapped with tape the members 57 and 58 would move further inwardly and away from the rotary ring 10 due to the fact that the reciprocable member 41 extended at an inclination relative to the axial center line of the rotary ring. Accordingly, the roll of tape 37 would have to move outwardly along the shaft 36 in order to be in alignment with the tape engaging members 57 and 58.

Mounted for reciprocatory movement in suitable openings provided in the stationary bracket 39 are laterally spaced actuating rods 59, 61 and 62 having their outer ends operatively connected to fluid pressure operated cylinders 63, 64 and 66, respectively. The actuating rods 59, 61 and 62 extend in a plane generally parallel to the guide members 42 and 43 whereby they also move inwardly of the rotatable ring at an inclination relative to the axis of rotation of the rotatable ring 10. Fluid under pressure for actuating the cylinders 63, 64 and 66 is supplied in a manner well understood in the art by suitable means, not shown.

Mounted at the inner ends of the actuating rods 59 and 62 are clamp members 67 and 68, respectively, which are in alignment with the tape engaging members 57 and 58, as clearly shown in FIGS. 2 and 3. That is, the clamp member 67 is adapted to move toward the tape engaging member 57 while the clamp member 68 is adapted to move toward the tape engaging member 58. Mounted at the lower end of the actuating rod 61 is a cutter 69 which is adapted to move into cutting relation with the tape between the tape engaging members 57 and 58.

Pivotally connected to the bracket 56 by a suitable pivot pin 71 are a pair of laterally projecting arms 72 and 73 having forwardly projecting wiper members 74 and 76, respectively, which may be in the form of rollers. As shown in FIG. 3, the rollers 74 and 76 are adapted to move into engagement with the ends of the tape applied to the article being wrapped. That is, the wipers press the free ends of the tape downwardly into sealing relation with the subjacent surface. Pivotally connected to the arms 72 and 73 intermediate their ends by suitable pins 77 and 78 are the ends of piston rods 79 and 81 of fluid pressure operated cylinders 82 and 83, respectively. The cylinders 82 and 83 are pivotally supported by suitable pins 84 and 86 which project outwardly from support brackets 87 and 88, respectively. The brackets 87 and 88 are rigidly mounted adjacent the lower end of the reciprocable member 41 by a suitable means, such as by welding.

Mounted non-rotatably on the shaft 24 is a sprocket 89 which is operatively connected to a sprocket 91 by a sprocket chain 92. The sprocket 91 is mounted non-rotatably on a shaft 93 having cams 94, 96, 97, 98, 99, 101, 102 and 103 mounted thereon and adapted for rotation therewith. The shaft 93 is mounted for rotation in suitable bearings 104 and 106, as shown. The cam members 94 and 96 actuate switch elements 107 and 108 which are in circuit with solenoids 109 and 111, respectively. Current is supplied to the switch elements 107 and 108 and the solenoids 109 and 111 by suitable power lines 112 and 113. The solenoids 109 and 111 are operatively connected to a valve 114 which supplies fluid under pressure to opposite ends of the fluid pressure operated cylinder 49. That is, when the solenoid 109 is energized, the valve 114 is moved to a position to introduce fluid into the cylinder 49 through conduit 51 whereby the reciprocable member 41 is lowered. On the other hand, when the solenoid 111 is energized, the valve 114 is moved to a position to introduce fluid into cylinder 49 through conduit 52 to thereby raise the reciprocable member 41.

The cam members 97 and 98 actuate switch elements 116 and 117 which are in circuit with the power line 112 and one side of electrical solenoids 118 and 119, respectively. The other sides of the solenoids 118 and 119 are connected to the power line 113. The solenoids 118 and 119 are operatively connected to a control valve 121 whereby fluid under pressure in introduced adjacent opposite ends of the fluid pressure operated cylinder 63. That is, when the solenoid 118 is energized the actuating rod 59 is lowered. On the other hand, when the solenoid 119 is energized, the rod 59 is raised.

The cam members 99 and 101 actuate switch elements 122 and 123 which are in circuit with the power line 112 and one side of solenoids 124 and 126, respectively. The other sides of the solenoids 124 and 126 are connected to the power line 113. The solenoids 124 and 126 are operatively connected to a valve 127 whereby fluid under pressure is introduced selectively at opposite ends of the fluid pressure operated cylinder 64. When the solenoid 124 is energized, the actuating rod 61 carrying the cutter 69 is lowered. On the other hand when the solenoid 126 is energized, fluid under pressure is introduced into the cylinder 64 whereby the actuating rod 61 and the cutter 69 are raised.

The cam members 102 and 103 actuate switch elements 128 and 129 which are in circuit with the power line 112 and one side of electrical solenoids 131 and 132. The other sides of the solenoids 131 and 132 are connected to the power line 113. The solenoids 131 and 132 are operatively connected to a control valve 133 whereby fluid under pressure is introduced selectively at opposite ends of the fluid pressure operated cylinder 66. That is, when the solenoid 131 is energized, the fluid under pressure is introduced into the cylinder 66 whereby the actuating rod 62 is lowered. On the other hand, when the solenoid 132 is energized the valve 133 is moved to a position to introduce fluid into the cylinder 66 whereby the actuating rod 62 is raised.

While we show each valve 114, 121, 127 and 133 as being actuated by a pair of solenoids, it will be apparent that each valve may be operated by a single solenoid having a spring return, which is operated in a manner well understood in the art, thereby reducing the number of switches, cams and solenoids required.

The cam members 94 through 103 inclusive rotate with the shaft 93 whereby they actuate their associated switch elements in timed relation to the rotation of the rotary ring 10 in a manner well understood in the art. The brake and clutch member 27 is provided with suitable control means whereby upon rotation of the rotary ring 10 a predetermined angular distance, the drive connection between the motor 28 and the gear reducer 26 is interrupted. That is, the clutch is deenergized after the rotary ring 10 has rotated a predetermined angular distance. Also, immediately upon deenergizing the clutch, the brake is applied whereby rotation of the rotary ring 10 is stopped, thus completing one cycle of operation. The

clutch and brake unit 27 may be energized and deenergized by a cam 80 mounted on the shaft 93 in position to actuate a switch element 80a which in turn energizes and deenergizes a solenoid 85. The clutch and brake unit is operatively connected to the solenoid 85 whereby the drive connection between the motor 28 and the gear reducer is interrupted upon rotation of the rotary member 10 a predetermined angular distance. No detail description of the gear reducer 26 and the clutch and brake unit 27 is given herein due to the fact that such apparatus is well known in the art.

Also mounted on the shaft 93 are cams 95 and 95a which actuate switch elements 100 and 100a as shown in FIG. 5, the switch elements 100 and 100a are in circuit with solenoids 105 and 105a and the power line 112. The other sides of the solenoids 105 and 105a are connected to the power line 113. The solenoids 105 and 105a actuate valves 110 and 110a, respectively, which in turn operate the cylinders 82 and 83, respectively, whereby the wiper 76 moves into engagement with the end of the tape initially applied to the article 29 and the wiper 74 moves into engagement with the end of the tape last applied to the article. The cylinders 82 and 83 may be of the single action type whereby the wipers are returned to inoperative position immediately after operation of the cylinders 82 and 83.

From the foregoing description, the operation of our improved apparatus shown in FIGS. 1–5 will be readily understood. The article or bundle 29 to be wrapped with tape is conveyed into the rotary ring 10, as shown in FIG. 1 whereby the end 38 of the tape is in position to be wrapped around the article 29. In the starting position, the reciprocable member 41 is in the raised position. Also, the actuating rods 59 and 61 are in the raised position relative to the reciprocable member 41. The actuating rod 62 is in the lowered position relative to the reciprocable member 41 whereby the end 38 of the tape is clamped between the clamp member 68 and the subjacent tape engaging member 58, as shown in FIG. 3. Also, to add a new supply of tape to the apparatus, the elements of the reciprocable member 41 are in the position just described. With the end 38 of the tape clamped between the tape engaging member 58 and the clamp member 68, the cam member 94 actuates the switch element 107 whereby the solenoid 109 moves the valve 114 in a direction to lower the reciprocable member 41. The tape engaging member 58 having the end of the tape attached thereto thus moves into contact with the article 29 being wrapped. The clutch of the clutch and brake element 27 is then energized whereby the rotary ring 10 is rotated in a clockwise direction, as viewed in FIG. 2, thus wrapping the tape around the article 29. It will be apparent, however, that the rotary member 10 may rotate in a counter-clockwise direction by timing the sequence of operation of the associated apparatus for operation in that direction. After rotation of the rotary ring 10 has commenced, the cam member 103 actuates the switch element 129 whereby the solenoid 132 moves the valve 133 in a position to raise the actuating rods 62 and the clamp 68 carried thereby to thus release the end of the tape clamped between the clamp member 68 and the tape engaging member 58. Cam member 96 then closes switch 108 whereby the solenoid 111 is energized to thus move the control valve 114 to a position to raise the reciprocable member 41, thereby removing the end of the tape from the tape engaging member 58. By providing a tape engaging member in the form of a roller, the tape is easily removed from the member 58 as the reciprocable member 41 is raised due to the fact that the roller rotates as the member 41 is raised. Just prior to raising the reciprocable member 41, cam member 95 actuates switch 100 whereby solenoid 105 operates valve 110 to move wiper member 76 into engagement with the end of the tape which was initially applied to the article. The free end of the tape is thus forced into firm engagement with the article 29.

The tape may be wrapped about the article any number of times. If two passes of the tape around the article 29 are desired, the cam member 96 is so constructed that it actuates the switch 108 to energize the solenoid 111 before the second revolution of the rotary ring 10 is commenced. That is, the reciprocable member 41 is in the raised position at this time whereby both tape engaging members 57 and 58 are out of alignment with the end 38 of the tape, thus permitting the tape to be wound on itself around the article 29. After the second revolution is commenced, the cam 94 actuates switch 107 to energize the solenoid 109 whereby the valve 114 introduces fluid into the cylinder 49 to lower the reciprocable member 41. The tape engaging members 57 and 58 thus move into engagement with the outer surface of the tape thus applied with both clamp members 67 and 68 and the cutter 69 in raised position. As the second revolution of the tape about the article 29 is completed, the tape passes over the tape engaging members 57 and 58 or between the tape engaging members and the superjacent clamp members 67 and 68.

Immediately after completion of the second revolution, cam members 97 and 102 close switch elements 116 and 128 to energize solenoids 118 and 131, thereby lowering the clamp members 67 and 68 to thus clamp the tape between the clamp members and the subjacent tape engaging members. Cam member 99 then closes switch element 122 to energize solenoid 124 whereby the cutter element 69 is lowered to thereby cut the tape as it extends between the tape engaging members 57 and 58 and their associated clamp members.

Immediately after the tape has been cut by the cutter element 69, the cam members 98 and 101 close switch elements 117 and 123 to energize solenoids 119 and 126 to thereby raise the clamp member 67 and the cutter element 69. The clamp member 68 remains in the lowered position whereby the end 38 of the tape is clamped between the clamp member 68 and the tape engaging member 58. The cam 95a then actuates switch 100a to energize solenoid 105a whereby valve 110a is actuated. Valve 110a operates cylinder 82 whereby wiper 74 moves into engagement with the end of the tape last applied to the article 29. The cam member 96 then closes the switch element 108 whereby the solenoid 111 is energized to raise the entire reciprocable member 41 whereby the apparatus is in position for another cycle of operation.

By applying tension on the tape supply means, the articles being wrapped may be forced into a compact bundle during the wrapping operation. That is, by restraining rotation of the roll of tape relative to the shaft 36 the tape draws the articles closer together.

In FIGS. 6 and 7 of the drawings, we show a modified form of our invention which is particularly adapted for applying a single revolution of tape about the article 29 being wrapped. The apparatus shown in FIGS. 6 and 7 is substantially identical to the apparatus shown in FIGS. 1–5, the principal difference being that the bracket 39a carrying the reciprocable member 41 is pivotally mounted on the stationary member 13 by a suitable pivot pin 134. Extending downwardly from the bracket 39a is a depending member 136 having one end of a piston rod 137 pivotally connected thereto by a pivot pin 138. The piston rod 137 is carried by a fluid pressure operated cylinder 139 which is pivotally connected to the stationary member 13 by a pivot pin 141 and a suitable bracket 142. Fluid is supplied under pressure to opposite ends of the cylinder 139 by suitable conduits 143 and 144 whereby the bracket 39a is pivoted relative to the stationary ring 13, thereby positioning the cutter at selected angular positions. Accordingly, by moving the cutter element in the direction of rotation of the rotary ring after the tape has been initially applied to the bundle, the cutter element is in a position to cut the tape after the tape has over-

lapped the initial end applied to the bundle or article 29. That is, the cutter moves in a position to cut the tape at a different position from the original position of the cutter whereby the tape overlaps the initial end applied to the article 29 prior to being cut.

In FIG. 8 we show a further modified form of our invention in which a single actuating rod $62^a$ is carried by the reciprocable member $41^a$. The reciprocable member $41^a$ extends inwardly of the rotary ring 10 at an inclination relative to the axial center line of the rotary ring in the same manner as the apparatus described hereinabove. Also, the reciprocable member $41^a$ is provided with guide members $42^a$ and $43^a$ and a lower bracket $56^a$ which carries a single tape engaging member $58^a$. The actuating member $62^a$ carries a clamp member $68^a$ adjacent the inner end thereof in position to clamp the end 38 of the tape between the clamp $68^a$ and the tape engaging member $58^a$. Mounted on the actuating member $62^a$ is a fluid pressure operated cylinder 146 which carries a depending piston rod 147 having a cutter element 148 mounted on the free end thereof. Fluid under pressure is introduced into opposite ends of the cylinder 146 by suitable conduits 149 and 151 whereby the cutter element 148 is selectively raised and lowered into engagement with the tape.

The apparatus shown in FIG. 8 is operated in a manner similar to the apparatus described hereinabove. Instead of having to lower the actuating rods 59 and 61 carrying the clamp members 67 and the cutter 69, the cutter 148 is carried by the actuating rod $62^a$. Accordingly, after the tape has made the desired number of rounds around the article 29 being wrapped, the tape is clamped between the clamp member $68^a$ and the tape engaging member $58^a$. Fluid under pressure is then introduced through the conduits 149 whereby the cutter element 148 is moved into engagement with the tape to thereby cut the same adjacent the tape engaging member $58^a$. It will be noted that the cutter 148 is positioned quite close to the clamp member $68^a$ whereby it is adapted to move into close proximity to the subjacent tape engaging member $58^a$ as it is lowered. Accordingly, the tape is supported a sufficient distance above the article being wrapped for the cutter to sever the tape.

The position of the reciprocable member 41 relative to the article 29 being wrapped may be varied by adjusting the elevation of the conveyors for the article or by adjusting the elevation of the entire rotary assembly relative to the conveyors. Also, the length of stroke of the piston rod 53 may be varied whereby the reciprocable member 41 would move to selected elevations to accommodate various size articles.

In FIG. 9 of the drawings, we show the actuating member indicated generally at $41^b$ as being mounted adjacent the lower portion of the rotatable member indicated at $10^b$ whereby the tape engaging member $58^b$ is adapted to move into engagement with the under surface of the article being wrapped indicated generally at $29^b$. A tape supply roll $37^b$ is mounted on the rotatable member $10^b$ and is adapted for rotation therewith as described hereinabove with reference to the apparatus disclosed in FIGS. 1–8. The inner end $38^b$ of the tape is adapted to be engaged between the tape engaging member $58^b$ and a clamp member $68^b$ in the manner described hereinabove with reference to tape engaging members 58 and clamp 68. Also, the article $29^b$ to be wrapped is conveyed into the axial opening of the rotatable member $10^b$ by a suitable conveyor indicated generally at $31^b$.

The rotatable member $10^b$ is mounted for rotation on a suitable supporting frame in the same manner as the rotatable member 10 described hereinabove. Also, the operation of the apparatus shown in FIG. 9 is substantially identical to the operation of the apparatus described hereinabove, the only difference being the position of the actuating member $41^b$ relative to the article being wrapped. That is, by causing the actuating member $41^b$ to move upwardly of the rotatable member $10^b$ whereby it engages the under surface of the article $29^b$ to be wrapped, the point of contact between the article and the actuating member is always at the same point. Accordingly, with the apparatus shown in FIG. 9, it is not necessary to adjust the elevation of the conveyors relative to the rotatable member $10^b$, or vice versa, in order to accommodate articles of various sizes. That is to say, regardless of the size of the article being wrapped, the bottom of the article will always lie in the same horizontal plane in position to be engaged by the actuating member $41^b$ as it moves upwardly thereagainst.

Referring now to FIGS. 10 and 11 of the drawings, we show a further modified form of our invention in which the rotatable member $10^c$ is mounted for rotation on a stationary member $13^c$ having an annular guideway $12^c$ therein. The rotatable member $10^c$ is supported by rollers $11^c$.

Mounted on the stationary member $13^c$ is a support bracket $39^c$ which pivotally supports an actuating member 152 by a pivot pin 153. The actuating member 152 comprises a fluid pressure operated cylinder 154 having fluid connections 156 and 157 for introducing fluid at opposite sides of a piston 158. A piston rod 159 is connected to the piston 158 whereby upon movement of the piston 158, the piston rod 159 is raised and lowered. Mounted adjacent the lower end of the piston rod 159 is a generally L-shaped plate-like member 161. Projecting outwardly from the lower end of the plate-like member 161 are tape engaging members $57^c$ and $58^c$. Preferably, the tape engaging members are in the form of rollers mounted at the outer ends of suitable support members.

A bracket 162 is mounted on the plate-like member 161 in position to support the upper ends of fluid pressure operated cylinders $63^c$, $64^c$ and $66^c$. Suitable pivot pins 163 connect the upper ends of the fluid-pressure operated cylinders $63^c$, $64^c$ and $66^c$ to the plate-like member, as shown. An actuating rod $59^c$ is actuated by the cylinder $63^c$ while actuating rods $61^c$ and $62^c$ are actuated by the fluid pressure operated cylinders $64^c$ and $66^c$. The lower ends of the actuating rods $59^c$, $61^c$ and $62^c$ are pivotally connected to outwardly projecting arms 164, 166 and 167, respectively, which in turn are pivotally supported by the plate-like member 161, as shown. Clamp members $67^c$ and $68^c$ are carried adjacent the free ends of the arms 164 and 167, respectively, in position to engage the end of the tape indicated at $38^c$.

A cutter element $69^c$ is mounted adjacent the free end of the arm 166 in position to engage the tape $38^c$ while it is clamped between the clamps $67^c$ and $68^c$ and their associated tape engaging members $57^c$ and $58^c$, as clearly shown in FIG. 11.

The actuating member 152 is moved about its pivot pin 153 by a fluid pressure operated cylinder 168 having a piston rod 169. A pivot pin 171 connects the end of the piston rod 169 to an upstanding bracket 172 carried by the fluid pressure operated cylinder 154. The fluid pressure operated cylinder 168 is provided with suitable supply conduits 173 and 174 whereby fluid may be introduced into and exhausted from opposite ends of the cylinder.

The operation of the apparatus shown in FIGS. 10 and 11 is similar to that of the apparatus described hereinabove, the principal difference being that the actuating member 152 is first pivoted inwardly in position for the tape engaging members to be in alignment with the tape $38^c$ prior to being moved radially toward the article $29^c$ being wrapped. That is, the actuating member 152 is pivoted into the tape line by actuating the fluid pressure operated cylinder 168 and is then moved radially toward the article being wrapped by the fluid pressure operated cylinder 154. The cylinders $63^c$, $64^c$ and $66^c$ actuate the rods $59^c$, $61^c$ and $62^c$ in the same manner as the cylinders 63, 64 and 66 actuate the rods 59, 61 and 62. Instead of having the actuating member 152 reciprocate at an in-

clination relative to the axis of rotation of the rotatable member **10c**, the actuating member is moved axially of the opening through the rotatable member **10c** and is then moved radially inwardly toward the article being wrapped.

In FIG. 12 of the drawings, we show a still further modified form of our invention in which the rotatable member indicated at **10d** is mounted for rotation on suitable rollers **11d** which in turn are supported by an annular guideway **12d** carried by a stationary member **13d**. Mounted on the stationary member **13d** is an outwardly projecting support and guide member **176** which supports a sleeve-like member **177** carried by an actuating member **178**. That is, the sleeve-like member **177** slidably receives the elongated guide member **176** whereby the sleeve member is adapted for sliding movement along the guide member **176**. A suitable fluid pressure operated cylinder **179** having a piston rod **181** moves the sleeve member **177** to selected positions along the guide member **176**.

Secured to the sleeve member **177** is a fluid pressure operated cylinder **182** having a piston rod **183** which is adapted to support a plate-like member **161** adjacent the lower end thereof in the same manner as the piston rod **159** supports the plate-like member **161**.

The operation of the apparatus shown in FIG. 12 is similar to that of the apparatus described hereinabove. The actuating member **178** is first moved axially by actuating the fluid pressure operated cylinder **179** to move the tape engaging members **57c** and **58c** into and out of the tape line in the manner described hereinabove. The plate-like member **161** is then moved radially relative to the article being wrapped by actuating the fluid pressure operating cylinder **182** in the manner described hereinabove.

It will thus be seen that the apparatus shown in FIGS. 10, 11 and 12 is adapted for axial and radial movement relative to the article being wrapped whereby the tape engaging members and the clamp members **67c** and **68c**, together with the cutter element **69c**, all move in a generally radial path when actuated by their associated cylinders. By providing such radial movement, the tape engaging members, the clamp members and cutter all move vertically toward the article being wrapped whereby it is not necessary to provide for movement of the tape roll relative to the support member therefor. Also, it will be apparent that the apparatus shown in FIGS. 10, 11 and 12 may be mounted beneath the rotatable member **10c** and **10d** in the same manner as the actuating member is mounted beneath the rotatable member **10b** in FIG. 9 of the drawings.

While we have shown apparatus for moving the entire plate-like member **161** toward and away from the tape **38c**, it will be apparent that suitable mechanism might be employed with the plate-like member for moving the tape engaging members **57c** and **58c** toward and away from the tape line. Also, it will be apparent that other apparatus might be employed for moving the plate-like member **161** toward and away from the tape.

From the foregoing, it will be seen that we have devised improved apparatus for wrapping tape around articles. By providing an actuating member which is adapted to move tape engaging members, clamp members and a cutter element into and out of alignment with the tape, the tape may be readily applied to the article and then cut after the desired number of rounds of tape have been applied to the article. Also, by providing means for holding the free end of the tape in position for another cycle of operation after the tape has been cut, the next article is wrapped without having to introduce the free end of the tape. By applying tension on the tape supply means, the bundle or articles being wrapped may be forced into a compact bundle during the wrapping operation.

While we have shown only one reciprocable member **41** as being mounted for movement inwardly of the rotary member **10**, it will be apparent that several such reciprocable members may be associated with the rotary member **10**, whereby various sizes of tape may be employed on a single machine or various size articles may be wrapped without having to adjust the position of the conveyor relative to a single reciprocable member.

While we have shown our invention in several forms, it will be obvious to those skilled in the art that it is not so limited but is susceptible of various other changes and modifications without departing from the spirit thereof, and we desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What we claim is:

1. Apparatus for wrapping an article with tape comprising a rotatable member having an axial opening therethrough for receiving the article being wrapped, tape supply means carried by said rotatable member with an end of said tape extending inwardly of said rotatable member, an actuating member adapted for movement at an angle to the plane of rotation of said rotatable member toward and away from the article being wrapped, means carried by said actuating member disposed to engage the inwardly extending end of said tape when said actuating member is moved toward said article at an angle to the plane of rotation of said rotatable member whereby upon rotation of said rotatable member the tape is wrapped about said article, and means to move said actuating member away from said article at an angle to the plane of rotation of said rotatable member after rotation of said rotatable member has commenced whereby said actuating member is moved out of contact and alignment with said inwardly extending end of the tape as the tape passes adjacent said actuating member to overlap the tape first applied to the article.

2. Apparatus for wrapping an article with tape as defined in claim 1 in which the actuating member is mounted in position to move toward the under surface of the article being wrapped.

3. Apparatus for wrapping an article with tape as defined in claim 1 in which the tape supply means is in the form of a roll of tape mounted for rotation on a shaft-like member carried by said rotatable member, and means is provided to restrain rotation of said roll of tape relative to said rotatable member.

4. Apparatus for wrapping an article with tape comprising a rotatable member having an axial opening therethrough for receiving the article being wrapped, tape supply means mounted on said rotatable member and adapted for rotation therewith with an end of said tape extending inwardly, an actuating member mounted for movement at an angle to the plane of rotation of said rotatable member toward and away from the article being wrapped, a tape engaging member adjacent the inner end of said actuating member disposed to be in alignment with the inwardly extending end of said tape when the actuating member is in an inner position and disposed to be out of alignment with said inwardly extending end when the actuating member is in an outer position, means to detachably connect said inwardly extending end of the tape to said tape engaging member while said actuating member is in an inward position, means to rotate said rotatable member with said end of tape connected to said tape engaging member whereby the tape is wrapped about said article, means to release said inwardly extending end of the tape from said tape engaging member and means to move said actuating member outwardly away from said article after rotation of said rotary member has commenced whereby said end of the tape is removed from said tape engaging member as the tape overlaps the tape first applied to said article, means to move said actuating member inwardly toward said article after said tape has overlapped the tape first applied to said article, means to detachably connect said tape to said tape engaging member again after the tape has overlapped the tape first

applied to said article, and means carried by said actutaing member to cut said tape.

5. Apparatus for wrapping an article with tape as defined in claim 4 in which the tape supply means comprises an elongated member secured to said rotatable member and extending generally parallel to the axial center line of said rotary member, the tape being in a roll adapted for axial adjustment along said elongated member.

6. Apparatus for wrapping an article with tape as defined in claim 4 in which the actuating member is mounted for pivotal movement on a stationary member whereby said tape engaging member is adapted for lateral movement relative to the article being wrapped, and means is provided to pivot said actuating member selectively from one side to the other to position the cutting means at the time the tape is cut in an advanced position in the direction of rotation of the rotatable member relative to the initial position of the tape engaging member whereby the cut end of the tape overlaps the end of the tape which is initially applied to said article.

7. Apparatus for wrapping an article with tape as defined in claim 4 in which means is provided to move the actuating member inwardly after said end of the tape is removed from said tape engaging member and the tape has made at least two revolutions around said article and means is provided to detachably connect said tape to said tape engaging member after the tape has made said revolutions around said article.

8. Apparatus for wrapping an article with tape as defined in claim 4 in which a first conveyor unit is mounted adjacent one side of the rotatable member in position to convey the article into said rotatable member and a second conveyor unit is mounted adjacent the other side of said rotatable member in spaced relation to the first conveyor unit and in position to remove said article from the rotatable member, whereby the tape is free to encircle the article.

9. Apparatus for wrapping an article with tape as defined in claim 4 in which the tape engaging member is a roller mounted for rotation adjacent the inner end of said actuating member.

10. Apparatus for wrapping an article with tape as defined in claim 4 in which at least one wiper member is pivotally mounted on said actuating member in position to swing inwardly of said tape engaging member whereby the adjacent end portion of the tape is forced into engagement with the article, and means is provided to move said wiper member into engagement with the tape.

11. Apparatus for wrapping an article with tape as defined in claim 10 in which wiper members are pivotally mounted at opposite sides of the tape engaging member in position for one wiper member to press one end of the tape into engagement with the article and in position for the other wiper member to press the other end of the tape into engagement with the article.

12. Apparatus for wrapping an article with tape comprising a rotatable member having an axial opening therethrough for receiving the article being wrapped, tape supply means mounted on said rotatable member and adapted for rotation therewith with an end of said tape extending inwardly, an actuating member mounted for movement at an angle to the plane of rotation of said rotatable member toward and away from the article being wrapped, a tape engaging member adjacent the inner end of said actuating member disposed to be in alignment with the inwardly extending end of said tape when the actuating member is in an inner position and disposed to be out of alignment with said inwardly extending end when the actuating member is in an outer position, a clamp carried by said actuating member, means to move said clamp selectively toward and away from said tape engaging member whereby the inwardly extending end of said tape is clamped between said clamp and said tape engaging member when the clamp moves toward said tape engaging member with the tape therebetween, means to rotate said rotatable member with said end of the tape clamped between said clamp and said tape engaging member whereby the tape is wrapped about said article, means to move said clamp away from said tape engaging member and said actuating member outwardly away from said article after rotation of said rotary member has commenced whereby said end of the tape is unclamped and removed from said tape engaging member as the tape overlaps the tape first applied to the article, means to move said actuating member inwardly toward said article after the tape has overlapped the tape first applied to the article, means to move said clamp inwardly after said actuating member moves inwardly toward said article and the tape passes over said tape engaging member whereby the tape is again clamped between said clamp and said tape engaging member, and a cutter carried by said actuating member and disposed to cut said tape.

13. Apparatus for wrapping an article with tape comprising a rotatable member having an axial opening therethrough for receiving the article being wrapped, tape supply means mounted on said rotatable member and adapted for rotation therewith with an end of said tape extending inwardly, an actuating member mounted for movement at an angle to the plane of rotation of said rotatable member toward and away from the article being wrapped, a pair of laterally spaced tape engaging members adjacent the inner end of said actuating member disposed to be in alignment with the inwardly extending end of said tape when the actuating member is in an inner position and disposed to be out of alignment with said inwardly extending end when the actuating member is in an outer position, a first and a second independently movable clamp carried by said actuating member, each of the clamps being in alignment with and disposed to engage a tape engaging member, means to move said first clamp selectively toward and away from its tape engaging member whereby the inwardly extending end of said tape is clamped between said first clamp and its tape engaging member when said first clamp moves toward its tape engaging member with the tape therebetween, means to rotate said rotatable member with said end of the tape clamped between said first clamp and its tape engaging member whereby the tape is wrapped about said article, means to move said first clamp away from its tape engaging member and said actuating member outwardly away from said article after rotation of said rotary member has commenced whereby said end of the tape is unclamped and removed from said first tape engaging member as the tape overlaps the first tape applied to the article, means to move said actuating member inwardly toward said article after the tape has overlapped the first tape applied to the article, means to move said first and second clamps inwardly toward said article after said actuating member has moved inwardly and the tape passes over said tape engaging members whereby the tape is clamped between said first and second clamps and the tape engaging members, and a cutter mounted on said actuating member between said first and second clamps and disposed to cut said tape after the tape is clamped by said first and second clamps.

14. Apparatus as defined in claim 13 in which the actuating member is reciprocable member mounted for reciprocatory movement inwardly of said rotatable member at an inclination relative to the axis of rotation of said rotatable member.

15. Apparatus for wrapping an article with tape as defined in claim 14 in which the clamps are carried by the inner ends of actuating rods, and means is provided to actuate said rods in timed relation to rotation of the rotatable member.

16. Apparatus for wrapping an article with tape as defined in claim 15 in which the cutter is carried by an actuating rod mounted for reciprocatory movement be-

tween the actuating rods for the clamps whereby the cutter is in position to cut the tape between the clamps.

17. Apparatus for wrapping an article with tape comprising a rotatable member having an axial opening therethrough for receiving the article being wrapped, tape supply means carried by said rotatable member with an end of said tape extending inwardly of said rotatable member, an actuating member adapted for movement axially and radially of said rotatable member, means carried by said actuating member disposed to engage the inwardly extending end of said tape when said actuating member is moved axially and inwardly of said rotatable member whereby upon rotation of said rotatable member the tape is wrapped about said article, and means to move said actuating member axially and outwardly of said rotatable member after rotation of said rotatable member has commenced whereby said actuating member is out of contact and alignment with said inwardly extending end of the tape as the tape passes adjacent said actuating member to overlap the tape first applied to the article.

18. Apparatus for wrapping an article with tape as defined in claim 17 in which the actuating member comprises an elongated member mounted for pivotal movement adjacent said rotatable member, means to move said actuating member about its pivot point whereby a portion of said actuating member moves generally axially of said rotatable member, and means to move said elongated member generally radially of said rotatable member.



19. Apparatus for wrapping an article with tape as defined in claim 17 in which the actuating member comprises a reciprocable member mounted adjacent said rotatable member for movement in a generally vertical plane, means to reciprocate said reciprocable member, and a generally horizontal guide member mounted adjacent said rotatable member and adapted to support said reciprocable member for horizontal adjustment relative to said rotatable member, and means to move said reciprocable member along said guide member to selected positions.

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