July 24, 1962 W. G. VANDER WAAL 3,045,939

FLEXIBLE MATERIAL WINDER

Filed May 6, 1960 4 Sheets-Sheet 1

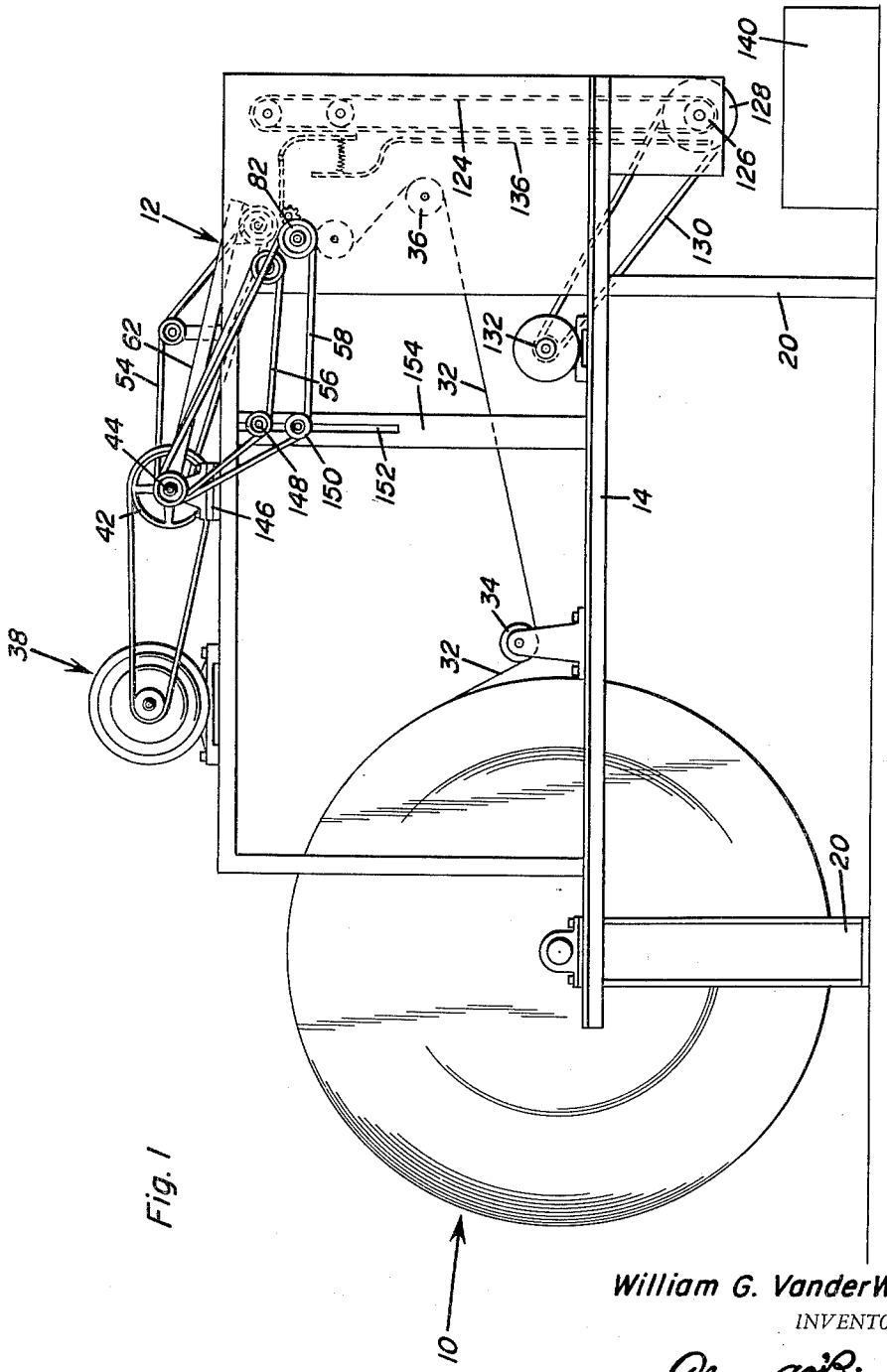

Fig. 1

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Filed May 6, 1960 4 Sheets-Sheet 2

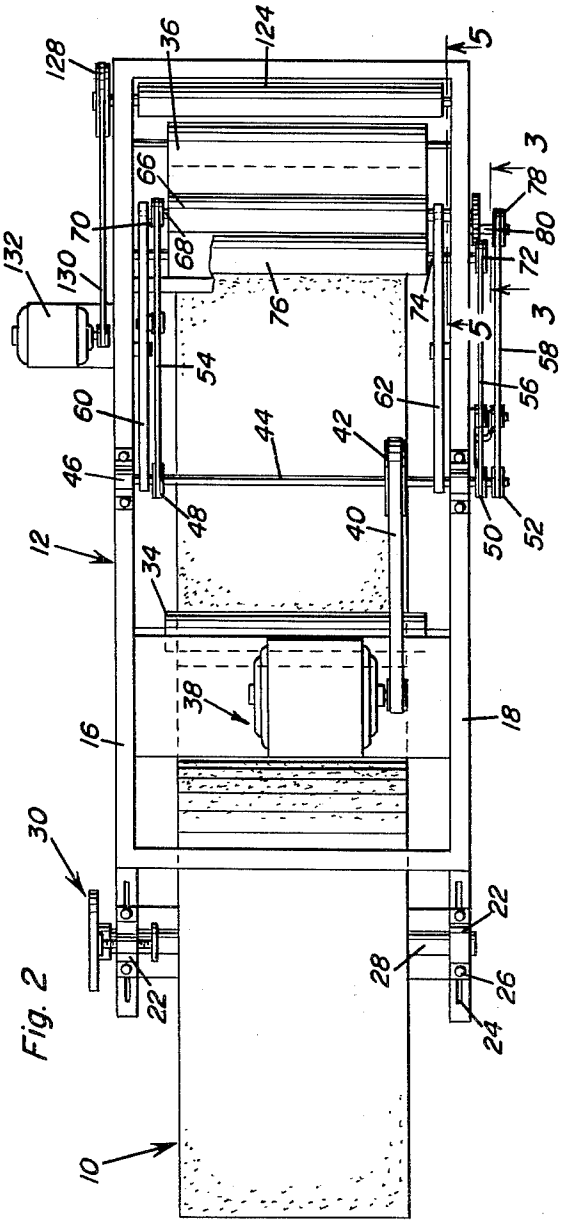

Fig. 2

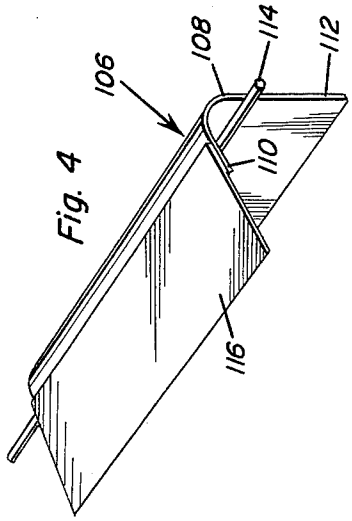

Fig. 4

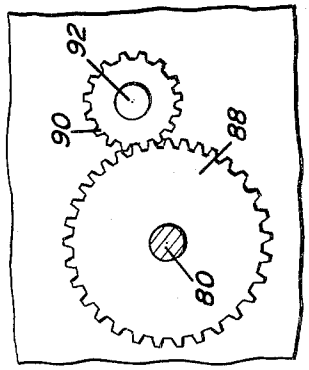

Fig. 3

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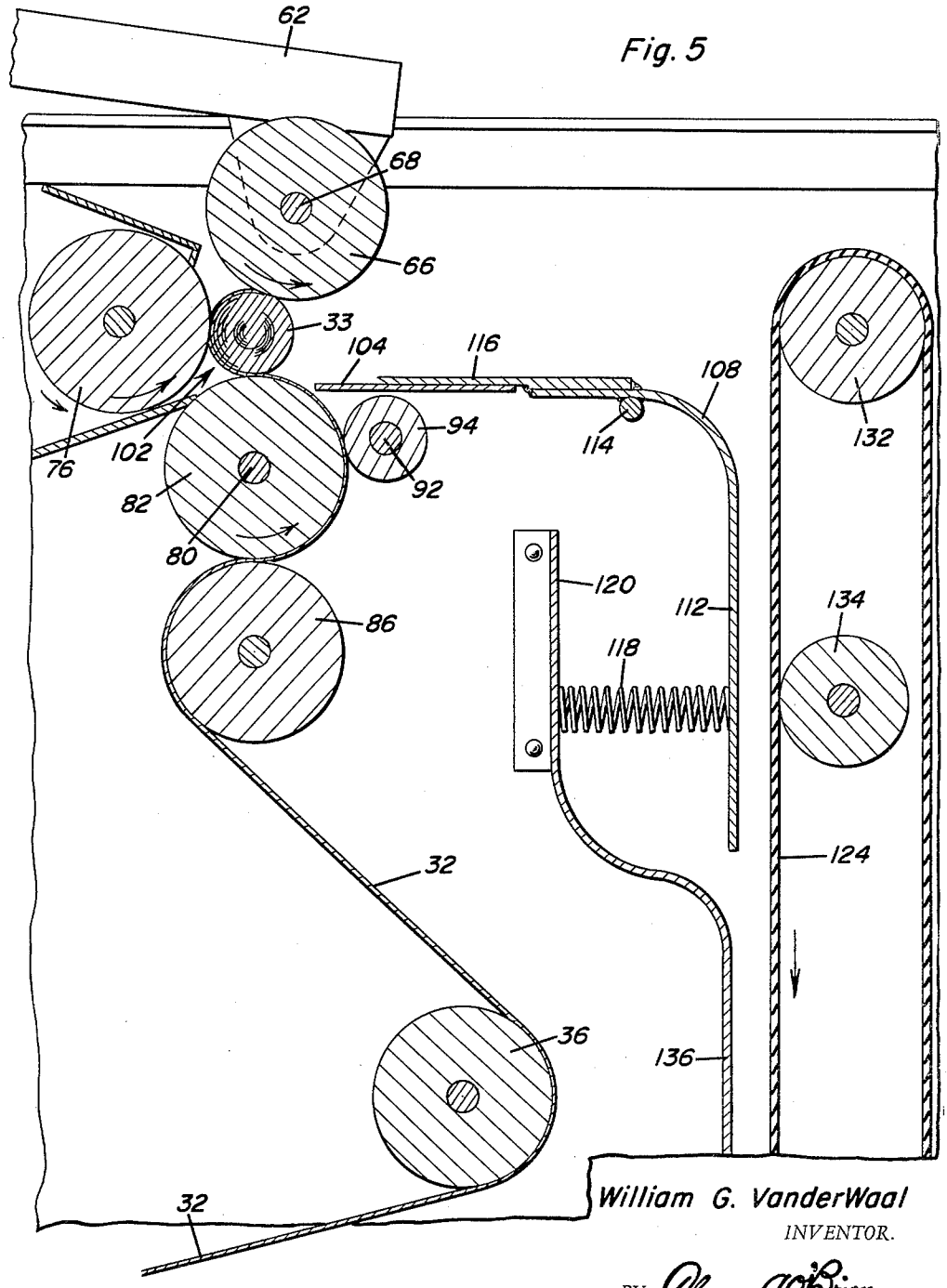
FLEXIBLE MATERIAL WINDER

Filed May 6, 1960 4 Sheets-Sheet 3

Fig. 5



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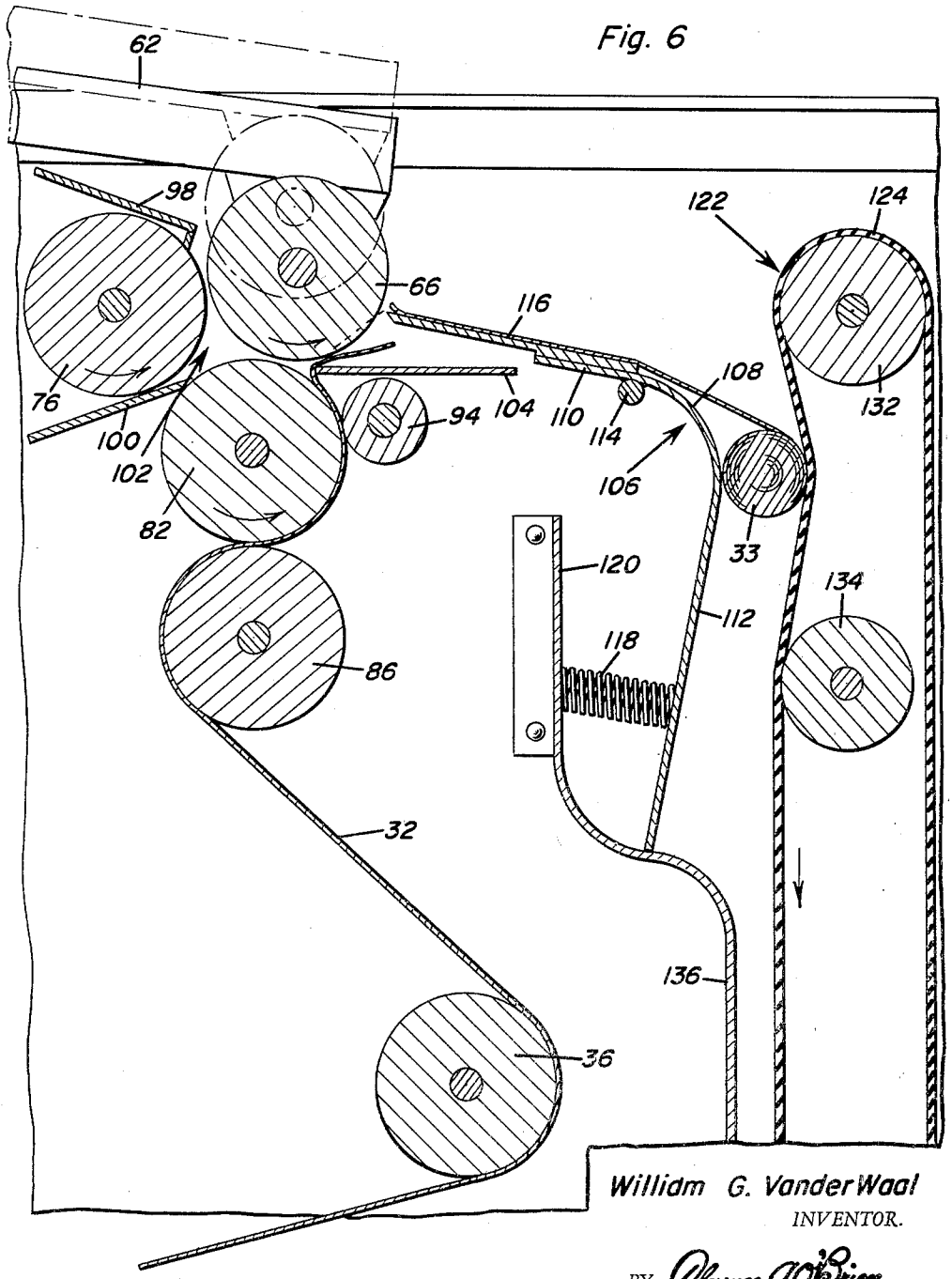
Filed May 6, 1960 4 Sheets-Sheet 4

Fig. 6



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FLEXIBLE MATERIAL WINDER

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This invention relates generally to apparatus for spirally winding flexible material and more particularly to apparatus particularly designed for winding small coreless rolls of flexible material and severing the roll so formed from the parent material roll.

Many rolling and winding devices are illustrated by the prior art for rolling flexible material as rugs, cotton, paper, etc. Several of these devices suggest the formation of flexible material coreless rolls. Although the prior art apparatus has been adequate for the purposes utilized, they each possess certain significant deficiencies. All the devices known require the manual or automatic stopping of the apparatus movement in order to sever a formed roll from the feed material. Whether the actuation is automatic or manual, it requires the momentary discontinuing of the parent roll movement and accordingly the apparatus, in a sense, only works intermittently. In order to make it economically feasible to wind small diameter paper rolls for household use, it is desirable to provide apparatus for continuously winding small material rolls from a continuously moving parent roll which does not stop to eject finished materials or to start new material rolls. The provision of apparatus for automatically, rapidly, continuously and repeatedly forming material rolls is desirable.

It is accordingly the principal object of this invention to provide novel flexible material winding apparatus for automatically and continuously forming coreless rolls.

It is more particularly an object of this invention to provide novel winding apparatus which forms rolls of flexible material and automatically severs the formed roll from the material after the formation of a particular size material roll. The apparatus includes three powered rolls including a drive roll, a winding roll, and an ejection roll which define a pocket therebetween. The rolls engage material in the pocket for spiralling the material. The rolls are so positioned that when the formed roll reaches a predetermined size, it is ejected from the pocket. Further means are then provided for actuating a cutter blade for severing the formed roll from the material.

It is a still further object of this invention to provide a novel and improved apparatus for winding flexible material into coreless rolls which is relatively simple in construction and operation and accordingly inexpensive to manufacture, utilize, and maintain.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is an elevational side view of the winding apparatus;

FIGURE 2 is a top plan view of the winding apparatus;

FIGURE 3 is an enlarged fragmentary sectional view taken substantially along the plane 3—3 of FIGURE 2;

FIGURE 4 is an enlarged perspective view of the triggering mechanism and cutting blade for severing the material rolls from the material after the roll is formed to a desired size;

FIGURE 5 is an enlarged fragmentary sectional view taken substantially along the plane 5—5 of FIGURE 2 and illustrating a material roll being formed; and

FIGURE 6 is a view similar to FIGURE 5 illustrating the ejected material roll engaging the triggering mechanism for engaging the cutting blade with the material for severing the material roll.

It is often necessary to provide apparatus for winding flexible material into small rolls, as for instance for household use. For example only, industry must provide means for rolling paper towels from a parent roll into small rolls appropriate for distribution to the consumer. It of course is desirable to provide apparatus which can form the rolls as rapidly as possible with a minimum of expense. By forming coreless rolls, the cylindrical rigid insert generally used is eliminated and accordingly, a substantial economic saving is realized. The invention herein concerns apparatus for automatically and continuously forming small rolls of flexible material, as paper, from material carried by a parent roll 10. The apparatus generally designated as 12 includes a frame 14 having a pair of opposed side rails 16 and 18. Legs 20 support the frame 14. Bearings 22 are adjustably carried by the sides 16 and 18 of the frame 14. Slots 24 receiving bolts 26 allow the bearings 22 to be selectively positioned on the frame 14. The parent roll 10 is provided with a spindle 28 rotatably journalled between the bearings 22. A conventional brake assembly 30 is provided for use with the spindle 28. Flexible material, as paper 32 is carried by the parent roll 10 and extends about rotatably mounted hitch rollers 34 and 36.

A first drive motor 38 is carried by the frame 14 between the sides 16 and 18. The motor 38 drives a belt 40 which is engaged with pulley 42 secured to shaft 44 rotatably journalled between bearings 46 carried by the sides 16 and 18. Pulleys 48, 50 and 52 are respectively secured to the shaft 44 and drive the V-belts 54, 56 and 58 respectively. Spaced arms 60 and 62 terminate in bearing assemblies through which shaft 44 extends. Terminally carried between the arms 60 and 62 is an ejection roller 66 secured to shaft 68 upon which pulley 70 is mounted. Belt 54 is drivingly engaged with pulley 70. Belt 56 is drivingly engaged with pulley 72 secured to shaft 74 which has mounted thereon winding roll 76. Belt 58 drives pulley 78 which is secured to shaft 80 which carries thereon drive roll 82. A base carrier roll 86 is rotatably mounted immediately adjacent the roll 82 whereby the material 32 may be passed around hitch roll 36 and driven by the powered drive roll 82 between the drive roll 82 and the base carrier roll 86. It will of course be appreciated that each of the rolls is provided with a frictional surface for allowing frictional engagement with the material 32. Also secured to the shaft 80 is a gear 88 engaged with gear 90 mounted on shaft 92. Shaft 92 carries a small diameter guide roll 94 engaged with drive roll 82 for pinching material 32 therebetween.

Attention is now called to FIGURE 6 wherein, in full line position, the relationships between the various rolls are illustrated. It is to be noted that the winding roll 76 is vertically positioned between the ejection roll 66 and drive roll 82 adjacent to each. The drive roll 82 is horizontally positioned between the winding roll 76 and ejection roll 66. An upper and lower doctor 98 and 100 respectively are disposed above and below winding roll 76. The powered rolls 82, 76 and 66, form a winding pocket 102 therebetween. The material 32 engaged with the drive roll 82 is carried past the hitch roll 36 and between the rolls 82 and 86 and 94 by the drive roll 82 into the pocket 102.

Attention is called to the arrows on each of the powered rollers which indicates the direction of driven rotation thereof. It will be noted that the drive roller 82 carries the material 32 into the pocket designated by 102. Within the pocket 102, the drive roller 82 carries the material 32 into engagement with the winding roll 76. Inasmuch as the surfaces of the drive roll 82 and the winding roll 76 are travelling in opposite directions within the

pocket 102, the material 32 is caused to begin to spiral. The material 32 engages the roll 66 subsequent to the roll 76 and it wil be noted that the surface of the roll 66 travels opposite to the surface of the roll 76 within the pocket 102. Accordingly, the powered rolls 66, 76 and 82 cause the material 32 to roll spirally within the pocket 102 as illustrated in FIGURE 5. The material roll is designated by the numeral 33. As the material 32 continues to roll spirally, the material roll 33 increases in size and the engagement between the roll 33 and the ejection roll 66 causes the arms 60 and 62 to pivot upwardly about the shaft 44. It is to be appreciated that at the beginning of the formation of the material roll 33, the roll 66 defines an axis which is spaced horizontally towards roll 76 from the axis of the drive roll 82 mounted below. Accordingly, when the material roll 33 is small, the ejection roll 66 engages the material roll 33 so as to cause a force thereon which is substantially in a direction between the rolls 76 and 82. As the size of the material roll 33 increases, the arms 60 and 62 are pivoted upwardly about the shaft 44, and the shaft 68 or rotational axis of the ejection roll 66 moves upwardly and away from the shaft 80 or rotational axis of the roll 82. As the material roll 33 continues to increase in size, the point of engagement between the material roll 33 and ejection roll 66 moves toward a straight line drawn between axes of the shafts 68 and 80. Accordingly, the radial force imparted by ejection roll 66 on material roll 33 gradually changes from a substantially vertical force to a substantially horizontal or transverse force tending to push the roll 33 to the right as viewed in FIGURE 5. In other words, once the roll 33 moves to an over center position with respect to rolls 66 and 82, the curved surface of roll 66 acts as a cam, and cams roll 33 out of space 102. Also, as the diameter of the roll 33 increases, its axis and center of gravity move away from roll 76 so as to eventually cause the roll 33 to be urged by gravity down the right upper surface of roll 82 as viewed in FIGURE 5. When these forces are sufficient, the material roll 33 is ejected from the pocket 102. Of course, the ejection of the material roll 33 from the pocket 102 causes the ejection roll 66 to drop back to the full line position illustraed in FIGURE 6.

An ejector table 104 is positioned immediately adjacent the pocket 102 above the roll 94. The material roll 33 is ejected onto the table 104. A trigger mechanism 106 including a member 108 having a first leg 110 and a second leg 112 is pivotally mounted about shaft 114. A cutter blade 116 is secured to leg 110. A coil spring 118 is mounted between a portion of the frame 120 and the leg 112. A packager 122 includes a conveyor belt 124 driven by pulley 126 in turn driven through pulley 128 having belt 130 driven by motor 132 connected thereto. A pair of idler rolls 132 and 134 engage the belt 124 remote from the pulley 126. A guide 136 is mounted adjacent the belt 124. The motor 132 drives the belt 124 in the direction indicated by the arrows in FIGURES 5 and 6. As the material roll 33 is ejected by the ejection roll 66 from the pocket 102, it rolls over the ejection table 104 and blade 116 and engages the belt 124 which carries it in the direction of the belt movement shown by the arrow in FIGURES 5 and 6. The material roll 33 of course engages the leg 112 of member 108. The member is caused to pivot about 114 as illustrated in FIGURE 6 so as to engage the cutting blade 116 with the material 32 for severing the material roll 33 from the material 32. The material roll 33 pivots the member 108 about shaft 114 against the force exerted by spring 118. The belt 124 carries the material roll 33 downward past the leg 112 and continues to engage the material roll 33 with the guide 136. The portion of the material which follows the material roll 33 is spiralled onto the roll 33 by the belt 124. The drive roll 82 carries the material 32 back into the pocket 102 wherein

the rolls 76 and 66 initiate the winding of another material roll. As shown in FIGURE 6, the roll 66 rotates in a direction which tends to move the free end of the tape 32 to the right. However, since the tape is in driving contact with about one-half of the roll 82, and barely touches roll 66, if at all, it is apparent that roll 82 will move the upper end of the tape into space 102. Table 104 maintains the tape in driving contact with roll 82.

The material roll 33 is carried by the belt 124 past the guide 136 and may be taped if desired by conventional means and then deposited in container 140. It will therefore be appreciated that the apparatus has provided for the continuous and automatic formation of small rolls of flexible material without necessitating the cessation of movement of parent roll 10.

Inasmuch as it is necessary to properly position the ejection roll 66, the drive shaft 44 must be vertically adjustable. Means are provided therefore for allowing the insertion of blocks 146 between the frame and the shaft 44 to establish the elevation desired. In order to therefore allow for the proper tensioning of belts 56 and 58, idler pulleys 148 and 150 are vertically adjustably positioned in slot 152 defined in standard 154.

It is to be appreciated that conventional slitters and spreader assemblies of various designs may be mounted to obtain the width of roll desired. The particular dimensions provided for the various powered rolls determine the size of material roll formed. It has been found that apparatus constructed in accordance with the teachings herein may be utilized to form material rolls from one through nine inch diameters. The scale size of the particular machine of course determines the diameter of the material rolls to be run. The respective rotational speeds of the powered rollers determine whether the material is wound into a loose or a tight roll. Actually, the surface speeds of the powered rolls in feet per minute are the significant factor to be considered rather than merely the revolutions per minute of the rolls. Faster comparative speeds of the rolls wind harder or tighter rolls while slower speeds make softer or looser rolls. The drive roll 82 of course pulls the material from the parent roll 10 and therefore determines the base speed of the apparatus. Although the apparatus may be utilized to form rolls of a wide range of sizes, the particular apparatus has a limited range of adjustment which is effected by varying the spacing between the powered rolls.

Although the preferred embodiment of the invention has been disclosed, certain modifications should be understood as falling within the inventive concepts pointed out. For example only, when found more convenient in a particular location, the packaging attachment may be operated in a horizontal or any angular position. That is, the belt 124 may move in a horizontal or angularly disposed plane instead of the vertical plane shown. A horizontal position is particularly desirable when a conveyor belt receives the rolls instead of the container 140.

Further, by utilizing proper counter-balance means or such, the spring 118 may be eliminated. Also, in lieu of the tape mentioned, a paste sponge may be provided for sealing the wound rolls.

It should therefore be appreciated that the apparatus herein disclosed provides for the automatic, continuous, and repeated formation of small diameter coreless rolls of flexible material which are convenient for, for instance, household use. The simplicity of the apparatus makes the formation of the rolls extremely economical and accordingly significantly advances the state of the art.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents

may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. Apparatus for winding flexible material into coreless rolls comprising in combination with a rotatably mounted parent roll carrying said material, a powered drive roll engaged with said material unwinding said material from said parent roll, a powered winding roll, a powered ejection roll, said rolls defining parallel axes, said drive, winding, and ejection rolls defining a winding pocket therebetween, said winding roll vertically positioned between said drive roll and said ejection roll and adjacent to each, said drive roll normally horizontally positioned below said winding roll and said ejection roll, said ejection roll surface adjacent said pocket moving from said winding roll, said drive roll surface adjacent said pocket moving toward said winding roll, said drive, winding, and ejection rolls engaged with said material in said pocket whereby said material is caused to roll spirally, said spiral rotation of said material and said engagement of said material roll with said ejection roll causing said arm to pivot and said ejection roll to move vertically away from said drive roll whereby said material roll will be ejected from said pocket, a cutter blade, a mechanism operatively connected to said cutter blade, and means causing engagement between said material roll and said mechanism after the material roll is ejected from said pocket, said engagement causing said mechanism to move and force said blade into engagement with said flexible material whereby the material is severed.

2. Apparatus for winding flexible material into coreless rolls comprising in combination with a rotatably mounted parent roll carrying said material, a powered drive roll engaged with said material unwinding said material from said parent roll, a powered winding roll, a powered ejection roll, said rolls defining parallel axes, said drive, winding, and ejection rolls defining a winding pocket therebetween, said winding roll vertically postioned between said drive roll and said ejection roll and adjacent to each, said drive roll normally horizontally positioned below said winding roll and said ejection roll, said ejection roll surface adjacent said pocket moving from said winding roll, said drive roll surface adjacent said pocket moving toward said winding roll, said drive, winding, and ejection rolls engaged with said material in said pocket whereby said material is caused to roll spirally, said spiral rotation of said material and said engagement of said material roll with said ejection roll causing said arm to pivot and said ejection roll to move vertically away from said drive roll whereby said material roll will be ejected from said pocket, a cutter blade, a mechanism operatively connected to said cutter blade, and means causing engagment between said ejected material roll and said mechanism after the material roll is ejected from said pocket, said engagement causing said mechanism to move and force said blade into engagement with said flexible material whereby the material is severed, said mechanism including a member having a pair of angularly related legs, said member mounted for pivotal movement about a vertex formed by said legs, said cutting blade secured to a first of said legs whereby engagement of said material roll with a second of said legs causes said cutting blade to pivot into engagement with said material.

3. Apparatus for continuously winding flexible material into a coreless material roll comprising in combination with a rotatably mounted parent roll carrying said material, a powered drive roll engaged with said material unwinding said material from said parent roll, a second powered roll, a third powered roll movably mounted with respect to the drive roll, means mounting said drive, second and third rolls to form a pocket therebetween, each of said powered rolls engaged with said material in said pocket, and means rotating said rolls causing said material to roll spirally to form a material roll, said rolls being arranged whereby said material roll will be automatically ejected after it reaches a predetermined diameter, and means for severing the ejected roll from the parent roll comprising a cutter blade, a mechanism operatively connected to said cutter blade, and means causing engagement between said ejected material roll and said mechanism for engaging said blade with said material and severing said material between the ejected roll and parent roll.

4. Apparatus for continuously winding flexible material into coreless material rolls comprising in combination with a rotatably mounted parent roll carrying said material, a powered drive roll engaged with said material unwinding said material from said parent roll, a second powered roll, a third powered roll, means mounting said rolls to form a pocket therebetween, each of said powered rolls engaged with said material in said pocket, and means rotating said rolls causing said material to roll spirally to form a material roll, and said rolls automatically ejecting one of said material rolls from said pocket after a predetermined amount of spiralling, and severing means comprising a cutter blade, a mechanism operatively connected to said cutter blade, and means causing engagement between said ejected material roll and said mechanism for engaging said blade with said material and severing said material between the ejected roll and the parent roll.

5. Apparatus for continuously winding flexible material into coreless material rolls comprising in combination with a rotatably mounted parent roll carrying said material, a powered drive roll engaged with said material unwinding said material from said parent roll, a second powered roll, a third powered roll, means mounting said rolls to form a pocket therebetween, each of said powered rolls engaged with said material in said pocket, and means rotating said rolls causing said material to roll spirally to form a material roll, and said rolls automatically ejecting one of said material rolls from said pocket after a predetermined amount of spiralling, and means automatically severing said ejected roll from said material comprising a cutter blade, a mechanism operatively connected to said cutter blade, means causing engagement between said ejected material roll and said mechanism for engaging said blade with said material, said mechanism including a member having a pair of angularly related legs, said member mounted for pivotal movement about the vertex formed by said legs, said cutting blade secured to a first of said legs whereby engagement of said material roll with a second of said legs causes said cutting blade to pivot into engagement with and sever said material.

6. A device as defined in claim 5 wherein said means causing engagement between said ejected material roll and said mechanism comprises a driven flexible belt spaced from and generally parallel to said second of said legs.

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