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APPARATUS FOR ASSOCIATING OBJECTS AND WRAPPING MATERIAL

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Fig. 1

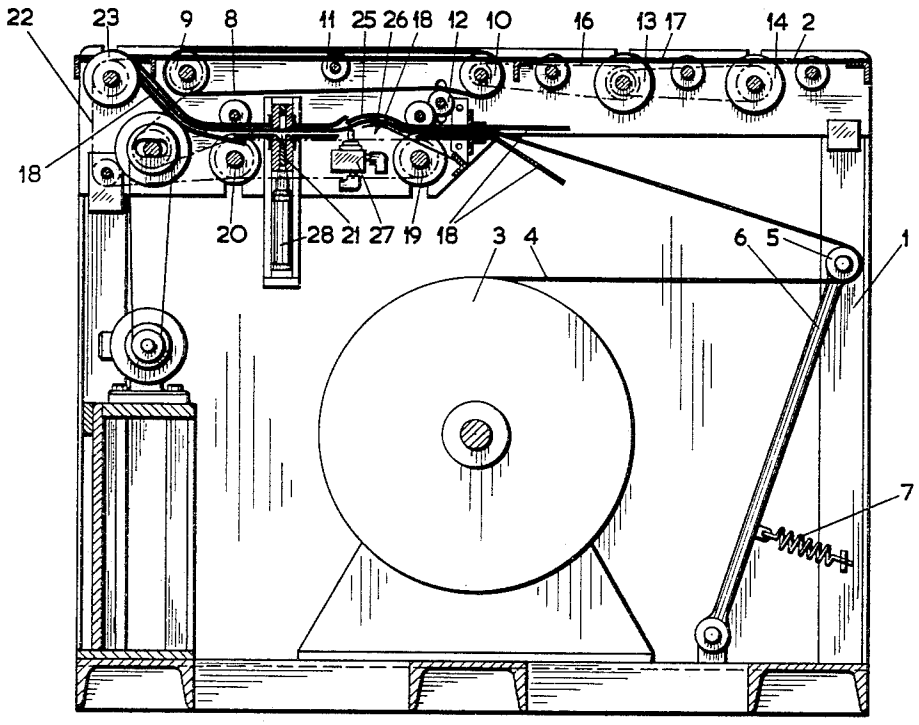

Fig. 2

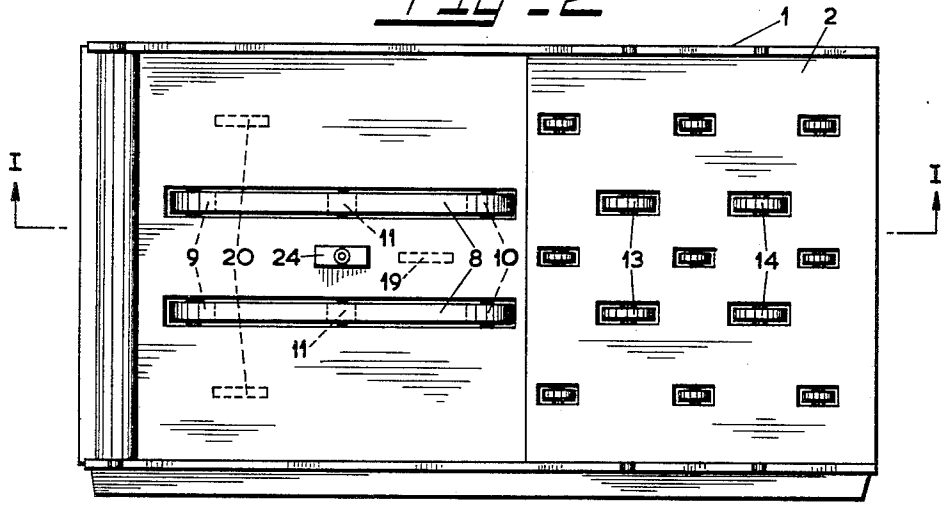

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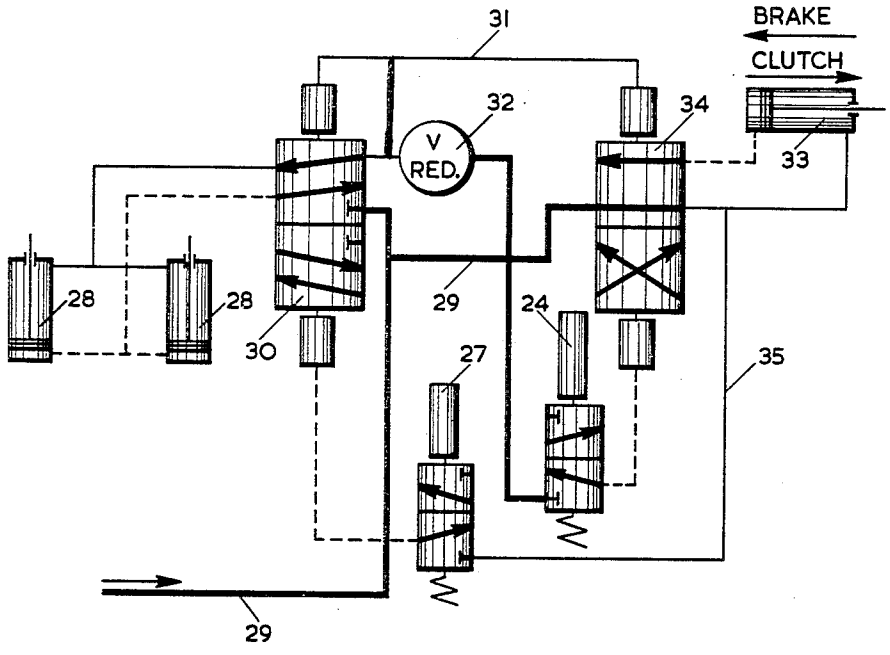
FIG. 3



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APPARATUS FOR ASSOCIATING OBJECTS AND WRAPPING MATERIAL

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U.S. Cl. 53—66 8 Claims

ABSTRACT OF THE DISCLOSURE

Sheets of wrapping material and objects to be wrapped in the sheets are fed together by apparatus that cuts the sheets to the right length depending on the length of the object to be wrapped. Feed rolls are positioned upstream and downstream from the cutting blade, and the advancing object actuates a brake for the upstream feed rolls. When the upstream feed rolls are braked, the tension in the strip increases, and this actuates the cutter. The tensioned strip springs free from the blade. The feed rolls are staggered for centering the strip. If the object to be wrapped is originally stacked, then relatively low-speed feed rolls feed one by one from the bottom of the stack to a relatively high-speed conveyor belt to space the articles apart.

The present invention relates to apparatus for associating an object to be wrapped and an appropriate length of wrapping material with each other, so that the wrapping material can be disposed about the object to be wrapped. The object to be wrapped may be a stack of individual objects, a package, or any other object. The wrapping material can be in the form of a sheet which covers or encloses the object to be wrapped, about which a wire or tape or rope can be subsequently passed or not, or it can be a length of wrapping material which is itself to be disposed about another packaging material that encloses the object.

The apparatus of the present invention is characterized by means for advancing an indeterminate length of wrapping material and for severing the wrapping material into separate lengths, at the same time that the object to be wrapped is also advanced, and the severing of the associated length of wrapping material is controlled by the advance of the object to be wrapped.

Various devices of this type have already been proposed. In U.S. Patent 3,001,352, there is disclosed an apparatus for feeding a sheet to the bottom of a stack, in which feeding rollers under the control of a switch pull the sheet off a supply roll and feed it to a worktable where the sheet is drawn along by the front edge of the stack under the impetus of belt conveyors. The sheet is cut from the supply by means of a cutting mechanism that operates a certain time after the switch is tripped. However, apparatus such as this has the drawback that sheets of only a single length can be supplied, and that these sheets are drawn from the supply by the object itself.

In U.S. Patent 2,803,930, there is disclosed an apparatus in which the length of the sheet is determined by a measuring roll that feeds the sheet. After a given number of revolutions of this roll, the cutting mechanism is actuated to separate the sheet from the supply. Again, however, only one length of sheet can be supplied.

These known devices also suffer from the disadvantage that the edges of the cut material tend to stick to the blade, so that the further feed of the web is impeded.

These known devices have the further disadvantage that sheets can be fed only to the bottom of the object to be packaged, it not being possible with these devices to feed sheets to the top where such a protective sheet may be equally necessary. For the feed of a sheet to the top, there is however apparatus that operates on different principles, as in U.S. Patent 3,026,659. In the device of this latter patent, the uppermost sheet from a stack of previously cut sheets is fed by means of suction devices, conveyor members, and hold-down members to the top of the object to be wrapped.

Accordingly, it is an object of the present invention to provide apparatus as described above, which can feed any desired length of material, dependent upon the physical characteristics of the object to be wrapped.

It is also an object of the present invention to provide such apparatus, which can feed lengths of wrapping material either to the top or to the bottom of the object to be wrapped.

Finally, it is an object of the present invention to provide apparatus as described above, which will be relatively simple and inexpensive to manufacture and install, easy to operate, maintain and repair, and rugged and durable in use.

Other objects and advantages of the present invention will become apparent from the following disclosure.

Briefly, the objects of the present invention are achieved in that between a worktable and a cutting blade for the packaging material there is provided, in addition to the upstream set of feeding rollers, a second set of feeding rollers, downstream of the cutter. When the apparatus has been started, these second feeding rollers rotate continuously with the same speed as that with which the first rollers are driven. Between these two sets of feeding rollers, in addition to the cutting device, is a device which responds to tension in the sheet and which, when a given value is exceeded, operates a switch that actuates the cutting device.

The first set of feeding rollers is driven intermittently according to the advance of an object to be wrapped, and this intermittent drive pulls a length off a supply roll and starts it toward the worktable. However, the second set of rollers rotates continuously. So when the first rollers stop, then the tension in the sheet rises and the switch that actuates the cutting device is operated and the sheet is cut through. After that, the rollers of the second set continue to rotate and feed the sheet positively to the worktable. At the same time, because of this tension in the sheet at at the time of cutting, the edges of the sheet are positively pulled off both sides of the blade and the tension is relieved by the cutting of the sheet. As a result of this positive feed by means of the second set of feeding rollers, the apparatus can also be used to feed sheets to the top of the object to be wrapped, because the entrainment of the sheet by the object no longer depends upon the friction which the object exerts on the sheet. If the article-advancing means is a belt conveyor, then it is preferable that the belt conveyor be driven at the same linear speed as the peripheral speed of the second set of feeding rollers, in order that the cut-off wrapping material and the object to be wrapped may meet at the same speed.

The means responsive to tension in the stretch of wrapping material between the first and second roller means may consist of a bent guideway between the two sets of roller means, the guideway extending in such a way that the sheet traverses, between the two sets of roller means, a path which is longer than the shortest path between the sets of roller means. At the same time, at least the side of the guideway that faces toward that shortest path is yieldably mounted and is adapted to cooperate with a switch that actuates the cutting device. Of course, as soon as the cutting device has cut the sheet through, then the tension is relieved and this part of the guideway springs

back and the leading edge of the supply material, from which a length has just been cut off, is drawn back to a point some distance from the cutting device or blade, so that no difficulties arise upon subsequent feed actuation. As the switch is no longer operated, the cutting device or blade returns automatically to its rest position.

The switch for controlling the cutting device can operate the cutting device only when the first set of feeding rollers is stopped. Thus it is ensured that the blade is not moved by other conditions that might cause tension, such as the inertia of the supply roll. If the cutting device is pneumatically operated, as in the illustrated embodiment, then the switch for controlling the cutting device may be an air valve which controls the position of a control valve in the supply of compressed air to cylinders which move the cutting device such as a blade. Such an air valve is incorporated in a pneumatic circuit in such a way that pressure medium can be supplied by this valve only when the first set of feeding rollers is stopped, the compressed air circuit to the cutting device or blade being pressureless when the first set of feeding rollers is driven.

Of course, the pneumatic controls of the present invention can be replaced by electric controls or by combined fluid-electric controls.

It is a further feature of the invention that the first set of feeding rollers for the packaging material consists of two wheels which contact the middle of the material, and the second set consists of two pairs of wheels which contact it near its edges. During feeding by means of rollers or sets of wheels, it is extremely difficult to ensure that the web follows a perfectly straight path, as infinitesimal aberrations in the circumference of the rollers or the positions of the roller shafts in relation to each other result in continuously increasing deviations of the web. But with the feeding rolls arranged as above, in substantially three-point gripping arrangement with the web, any deviation is automatically corrected after the cutting operation. In fact, the material from the supply roll during the first part of the renewed feed is pulled only by a set of rollers contacting its middle, as a result of which the necessary corrections are easily effected.

In the apparatus of the present invention, the length of the sheet can be predetermined by varying the length of time during which the first set of feeding rollers operates. This can be done by providing in the worktable a switch which is actuated by the object to be wrapped, for example by providing that the forward edge of the object actuates the first set of feeding rollers and the rear edge actuates a brake for these rollers. By means of a control blade carried by the switch, it can be assured that the feeding rollers supply a length of material which is greater than is the length of the bottom of the object to be wrapped.

According to another feature of the invention, ahead of the belt conveyor in the working plane of the table, that is, upstream of the conveyor with regard to the direction of travel of the upper or working run of the conveyor that advances the object to be wrapped, there are provided at least two driven rollers, spaced apart in the direction of belt travel, these rollers being power driven and the roller farthest from the belt having a nonslip surface while the roller between the nonslip roller and the belt has a smooth surface. The peripheral speed of the nonslip roller is substantially lower than the linear speed of the upper run of the conveyor belt, while the speed of the smooth roller lies between those upper and lower speeds. By this means, the separation of consecutive objects is achieved, even if these objects are fed from a stack or other closely contiguous supply, because the roller with the nonslip surface slowly feeds the objects to the smooth roller and the conveyor belt pulls them off the smooth roller at a substantially greater speed. In other words, the objects speed up when on the smooth roller, which is why the smooth roller must be smooth and the nonslip roller must be nonslip.

The invention will be more clearly understood in connection with the accompanying drawings, in which:

FIGURE 1 is a side cross-sectional view showing apparatus according to the invention;

FIGURE 2 is a top plan view of apparatus according to the invention; and

FIGURE 3 is a fluid circuit diagram of the invention.

Referring now to the drawings in greater detail, there is shown particularly in FIG. 1 apparatus according to the present invention, comprising a frame **1** that carries a worktable **2** with a horizontal working surface. A supply roll **3** comprises in the illustrated embodiment a rolled-up web of paper **4** of indeterminate length. Web **4** extends about a roller **5** which is carried by the end of a lever **6** which is continuously yieldably urged into bight-forming relationship by a tension spring **7**.

A pair of conveyor belts **8** are disposed with their upper or working runs in the plane of worktable **2**. These conveyor belts are mounted on pulleys **9** and **10**, support wheels **11**, and idlers **12**.

To the right of conveyor belts **8** as seen in FIGS. 1 and 2 are conveyor rollers **13** and **14** which are driven by chains **16** and **17** from pulleys **10** so that rollers **13** rotate with a peripheral speed that is lower than the linear speed of belts **8**, while rollers **14** rotate with a lower peripheral speed then the rollers **13**. Rollers **14** have a nonslip surface and rollers **13** have a smooth surface. Because of this difference in speed, a separation of immediately consecutive objects to be wrapped takes place. In operation, the conveyor members **8**, **13** and **14** are continuously driven.

Disposed beneath the conveyor members in the frame **1** is apparatus for feeding and cutting off sheets of paper from the web **4**. This apparatus comprises a guideway **18**, a first set of driven feeding rollers or wheels **19**, and a second set of feeding rollers **20**, as well as a pneumatically actuated reciprocating cutter blade **21** or other severing device. The rollers **20** are driven by means of a chain **22** from the shaft of pulleys **9**, this same chain driving a conveyor roller **23** which is disposed at the end of the apparatus immediately downstream of the mouth of guideway **18**. The conveyor belts **8** and the roller **23** and the feeding rollers **20**, and the feeding rollers **19** when they are actuated, are therefore all driven at the same peripheral or linear velocity, so that a severed sheet emerging from guideway **18** leaves the guideway at the speed of the object which is to be wrapped therein.

Between conveyor belts **8** is disposed a control strip **24** in the form of a feeler mechanically moved by the advancing object. Control strip **24** controls the operation of the feeding rollers **19**. These feeding rollers operate as long as the advancing object is in contact with the strip **24**. It will be seen that a length of the web **4** which is thus fed by the rollers **19** will be equal to the length of the object to be wrapped plus the length of the strip **24** that contacts the object. By selection of an appropriate length for strip **24**, an appropriately long excess of wrapping material, over and above the length of the object, can be obtained. Moreover, objects of different length can be successively fed and the length of wrapping material will be automatically appropriately varied.

These feed rollers **19** pull the web gripped between them through the guideway **18**, the lever **6** pivoting to the left during the first part of this movement until the supply roll **3** has lost its rest inertia.

Guideway **18** has a downwardly opening concave portion **25**. The lower wall of this portion of the guideway has a resilient lip **26** adapted to engage and operate a switch **27**. The web then passes the cutting mechanism and is gripped by the rollers **20**.

In operation, the conveyor members on worktable **2** move objects to be wrapped, such as stacks of paper or the like, from the right to the left as shown in the drawing. The feed of these objects is accelerated from rollers **14** to rollers **13** to belts **8**, so that the objects are

separated from each other. Upon passing and actuating the strip **24**, the feed rollers **19** are actuated, which guide an uncut portion of web **4** through guideway **18** through feeding rollers **20**.

When the fed object passes from the strip **24**, the feeding rollers **19** stop while the feeding rollers **20** continue to rotate. The tension of the web thus increases between the rollers **19** and **20** and the resilient lip **26** is drawn downwardly and operates the switch **27**. Switch **27** then causes the feed of fluid under pressure to cylinders **28** which actuate blade **21**, which rises and cuts through the paper web **4**. The cut-off sheet is then moved farther by the rollers **20** and ultimately the roller **23**. The resilient lip **26** springs back and draws the forward end of the remainder of the web back from the blade, so that when the web is next advanced by the rollers **19**, the leading edge can pass without difficulty through the guideway near the cutting mechanism. The rollers **19** are chain driven from rollers **20** through a pneumatically operated clutch while a pneumatically controlled brake provides for stopping the rollers **19** when the clutch is disengaged.

The fluid pressure circuit for the apparatus of the present invention is shown diagrammatically in FIG. 3. Fluid under pressure, which in the illustrated embodiment is air but could be a liquid, is fed through the pipe **29** from a source of pressure fluid (not shown) and through a pressure-reducing valve **32**, and thence to a pneumatically operated spool valve **30**. In the illustrated position of valve **30**, air under reduced pressure through a branch conduit **31** maintains valve **30** in a position in which the air is fed to cylinders **28** of blade **21** in a direction to maintain the blade lowered or retracted from the path of the web.

A pneumatic cylinder **33** operates the brake and clutch in alternate positions thereby to stop or drive rollers **19**, respectively. A spool valve **34** controls the feed of compressed air to cylinder **33** and, in the position shown in the drawing, the cylinder **33** is in the position in which the rollers **19** are braked. Valve **34** in this position also feeds compressed air through conduit **35** to the valve operated by switch **27** which, in the drawing, is in the inactive position. Valve **34** is also acted upon by the relatively low pressure in the conduit **31**.

When an object to be wrapped passes the strip **24**, the associated valve is actuated from the position shown in FIG. 3 to a lower position. Compressed air from conduit **29** is then fed to spool valve **34** so as to move it from the position shown in FIG. 3 to the other position, because the pressure in conduit **29** is higher than the reduced pressure in conduit **31**. Cylinder **33** is thus actuated to engage the clutch to drive rollers **19**.

The upward movement of valve **34** also vents conduit **35**, so that movement of the switch **27** during this condition of the parts will have no effect at all. Therefore, if for example the supply roll resists turning and the tension rises in the advancing web between the rollers **19** and **20**, the corresponding operation of the switch **27** will have no effect and the blade **21** will remain at rest. It is only when the advancing object has released the strip **24** and the latter returns to the position shown in FIG. 3, as does the valve **34** and the cylinder **33**, that the conduit **35** is again supplied with compressed air, and actuation of of switch **27** under the influence of the increased tension resulting from the uncoupling and braking of the rollers **19** will shift the spool valve **30** to the upper position of FIG. 3, in which the blade **21** is raised to sever a sheet. After the sheet is severed, the tension in the web immediately disappears, so that switch **27** returns to its original or raised position, as does also the valve **30**, so that the blade **21** is immediately returned to its lower position.

From a consideration of the foregoing disclosure, therefore, it will be evident that all of the initially recited objects of the present invention have been achieved.

Although the present invention has been described and illustrated in connection with a preferred embodiment, it is to be understood that modifications and variations may be resorted to without departing from the spirit of the invention, as those skilled in this art will readily understand. Such modifications and variations are considered to be within the purview and scope of the present invention as defined by the appended claims.

Having described my invention, I claim:

1. Apparatus for associating an object to be wrapped and an appropriate length of wrapping material, comprising conveyor means for advancing an object to be wrapped, means for advancing an indeterminate length of wrapping material, means for severing the wrapping material into separate lengths, said wrapping material advancing means comprising first feed roll means upstream of the severing means and second feed roll means downstream of the severing means with regard to the direction of travel of the wrapping material for feeding the wrapping material past the severing means, means responsive to the position of a portion of the advancing object to stop the rotation of the first feed roll means with the first feed roll means in contact with the wrapping material while the second feed roll means continue to rotate in contact with the wrapping material thereby to increase the tension in the wrapping material between the first and second feed roll means, means deflecting the path of said wrapping material between said first and second roll means from the shortest path between said first and second roll means, and means responsive to movement of said wrapping material toward said shortest path to actuate said severing means.

2. Apparatus as claimed in claim **1**, said deflecting means comprising a bent guideway between said first and second roll means and along which said wrapping material traverses a path longer than the shortest path between said first and second roll means, and means movably supporting at least the side of the guideway that faces said shortest path, said actuating means comprising switch means responsive to movement of said guideway side.

3. Apparatus as claimed in claim **2**, said severing means comprising a blade, fluid pressure means for moving the blade, said means comprising a valve to control the supply of pressure fluid to said blade-moving means.

4. Apparatus as claimed in claim **1**, and means permitting actuation of said severing means only when said rotation-stopping means has been actuated.

5. Apparatus as claimed in claim **1**, said conveyor means including a conveyor belt, and means for driving said conveyor belt at the same linear speed as the peripheral speed of said second feed roll means.

6. Apparatus for associating an object to be wrapped and an appropriate length of wrapping material, comprising conveyor means for advancing an object to be wrapped, means for advancing an indeterminate length of wrapping material, means for severing the wrapping material into separate lengths, said wrapping material advancing means comprising first feed roll means upstream of the severing means and second feed roll means downstream of the severing means with regard to the direction of travel of the wrapping material for feeding the wrapping material past the severing means, means responsive to the position of a portion of the advancing object to stop the rotation of the first feed roll means with the first feed roll means in contact with the wrapping material while the second feed roll means continue to rotate in contact with the wrapping material thereby to increase the tension in the wrapping material between the first and second feed roll means, and means responsive to said increase in tension to actuate said severing means, said conveyor means including a conveyor belt, and means for driving said conveyor belt at the same linear speed as the peripheral speed of said second feed roll means, said conveyor belt having an object-supporting upper run, and driven conveyor rolls upstream and in the plane of said active run and spaced apart in the direction of movement of the object along the conveyor belt, the driven rolls nearest the conveyor belt having a smooth surface and the driven rolls

farthest from the conveyor belt having a nonslip surface, and means for driving the nonslip rolls at a substantially lower peripheral speed than the linear speed of the conveyor belt and for driving the smooth surfaced rolls at a peripheral speed intermediate the latter two speeds.

7. Apparatus for associating an object to be wrapped and an appropriate length of wrapping material, comprising conveyor means for advancing an object to be wrapped, means for advancing an indeterminate length of wrapping material, means for severing the wrapping material into separate lengths, said wrapping material advancing means comprising first feed roll means upstream of the severing means and second feed roll means downstream of the severing means with regard to the direction of travel of the wrapping material for feeding the wrapping material past the severing means, means responsive to the position of a portion of the advancing object to stop the rotation of the first feed roll means with the first feed roll means in contact with the wrapping material while the second feed roll means continue to rotate in contact with the wrapping material thereby to increase the tension in the wrapping material between the first and second feed roll means, and means responsive to said increase in tension to actuate said severing means, said first feed roll means comprising a single pair of opposed rolls that contact the middle of the wrapping material, said second feed roll means comprising two pairs of opposed rolls that contact the wrapping material adjacent the edges of the wrapping material.

8. Apparatus as claimed in claim 1, and means mounting said deflecting means for movement responsive to an increase in tension in the wrapping material, said means responsive to movement of said wrapping material toward said shortest path comprising means responsive to said movement of said deflecting means to actuate said severing means.

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U.S. Cl. X.R.

53—74