Aug. 23, 1966 YO SATO ETAL 3,267,837

PACKAGE BINDER

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Fig. 1.

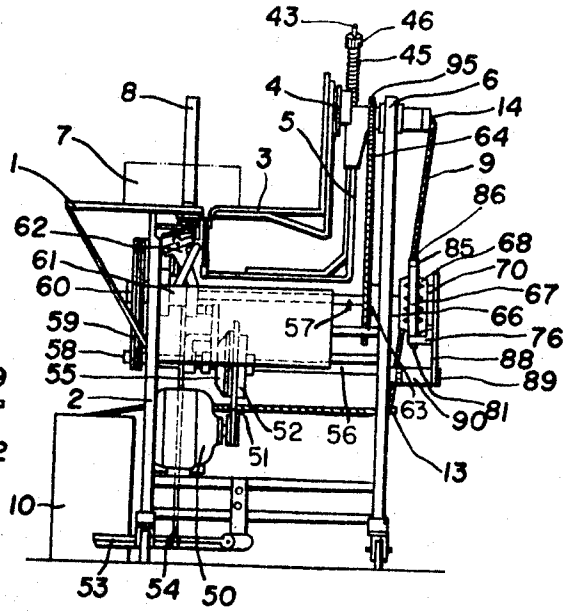
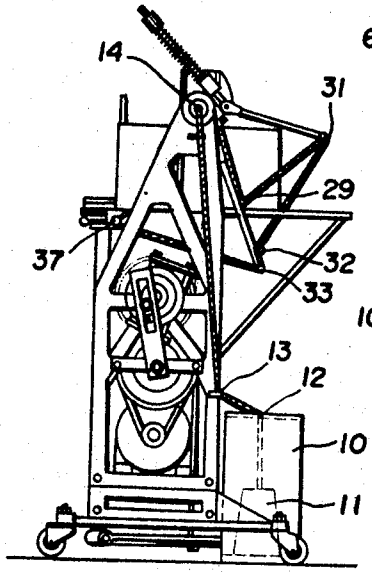


Fig. 3.



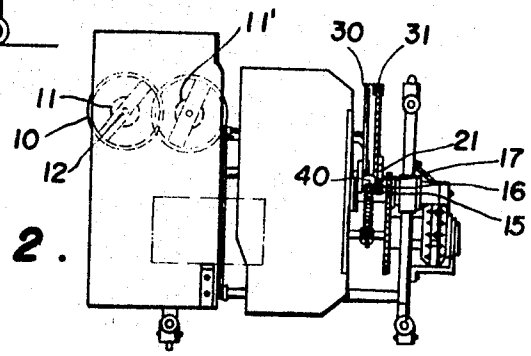


Fig. 2.

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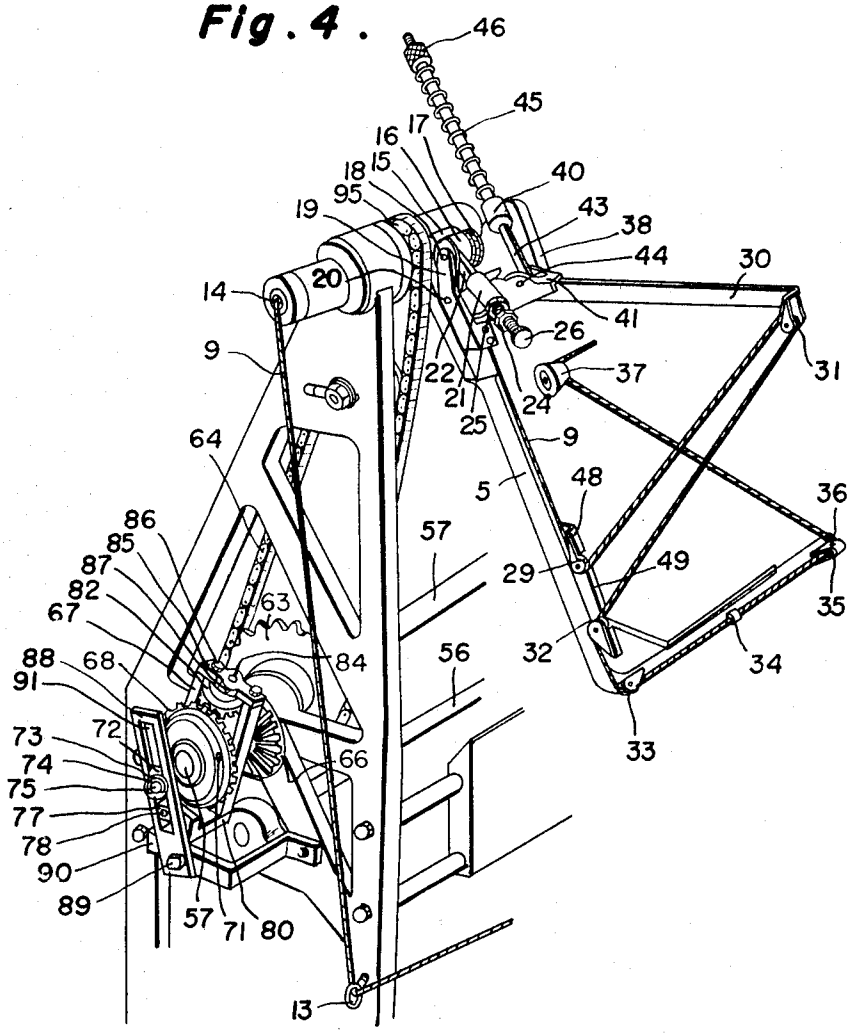
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PACKAGE BINDER

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Fig. 4.



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Fig. 16.

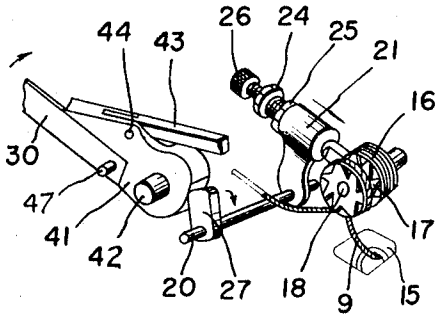


Fig. 17.

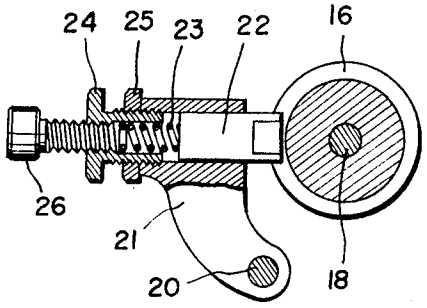


Fig. 5.

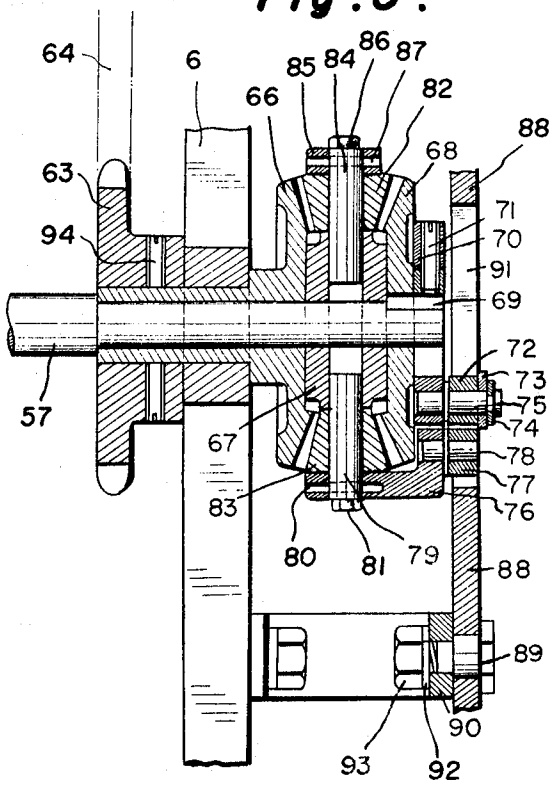
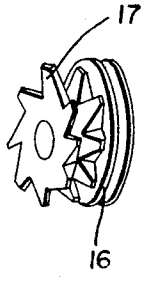


Fig. 18.



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Fig. 6. Fig. 7. Fig. 8.

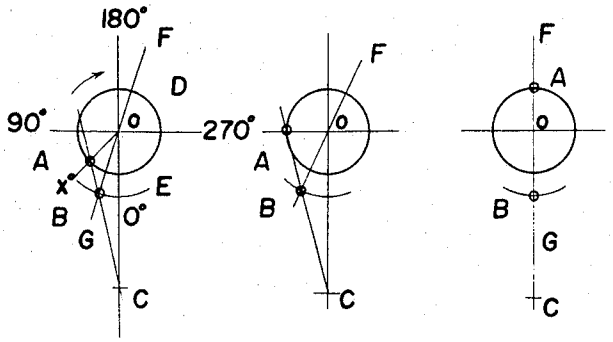


Fig. 9. Fig. 10.

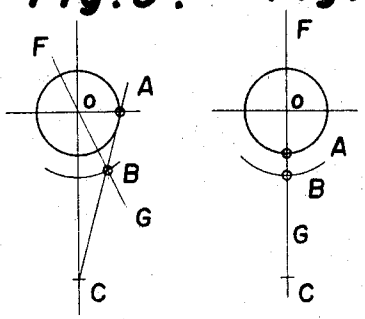
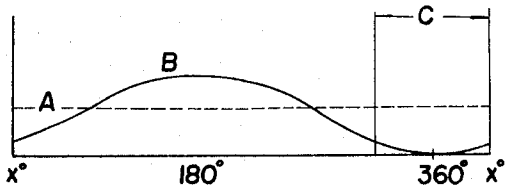


Fig. 11.



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Fig. 12.

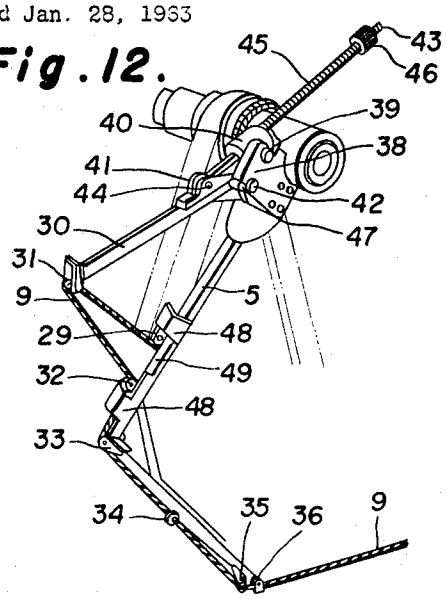


Fig. 13.

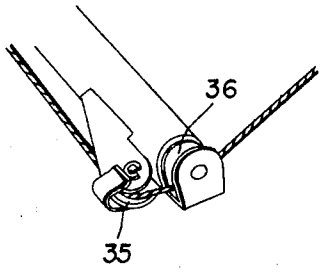


Fig. 14.

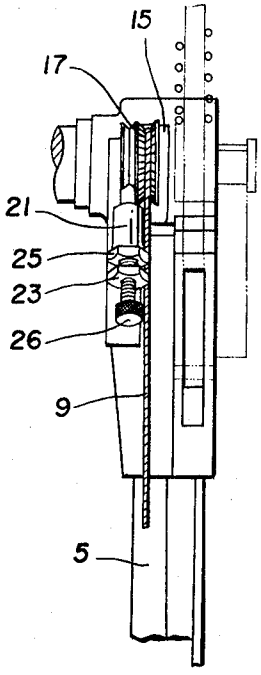
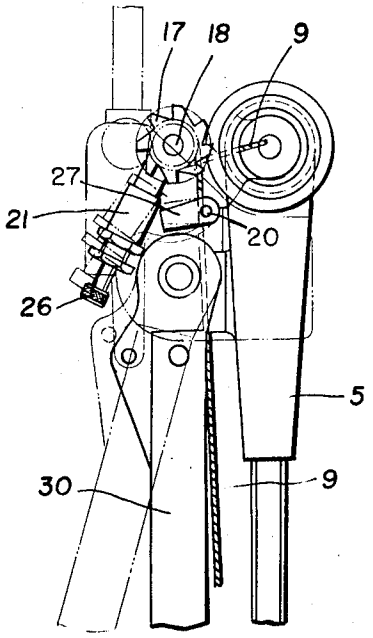


Fig. 15.



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United States Patent Office 3,267,837
Patented August 23, 1966

3,267,837

PACKAGE BINDER

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Filed Jan. 28, 1963, Ser. No. 254,108
Claims priority, application Japan, Jan. 30, 1962, 37/2,580 (utility model) 37/3,105; July 5, 1962 (utility model) 37/27,638; Mar. 7, 1962 (utility model), 37/11,028
5 Claims. (Cl. 100—27)

The present invention relates to a package binder and it is one object of the present invention to provide a package binder, wherein a string carrying arm is subjected to rotation to bind material to be packaged.

With this and other objects in view, which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawings, in which:

FIGURE 1 is a side elevation of the package binder;

FIG. 2 is a top plan view thereof;

FIG. 3 is a rear elevation of the package binder;

FIG. 4 is a fragmentary perspective view of the change differential gear device and a rear view of the string carrying rotating arm;

FIG. 5 is an axial section of the change differential gear device;

FIGS. 6 to 10 are schematic views indicating the relative location of each part of the change differential gear device at different positions;

FIG. 11 is a diagram depicting the angular velocity of the main driving bevel gear in relation to the rotating angle;

FIG. 12 is a perspective front view of the string carrying arm;

FIG. 13 is a fragmentary perspective view of the free edge of the string carrying arm;

FIG. 14 is a side elevation of the string paying-out and damping mechanism;

FIG. 15 is a front elevation of the mechanism disclosed in FIG. 14;

FIG. 16 is a perspective view thereof;

FIG. 17 is an axial section of the holding device; and

FIG. 18 is a perspective view of the grooved wheels.

Referring now to the drawings, and in particular to FIGS. 1 to 4, the package binder comprises a string carrying arm **5** (FIG. 1) which binds package material **7**, and a motive power transmission to a bend forming member **37** and includes a string stretching device which is fitted to the string carrying arm **5**, and a roller string paying-out and damping device.

Concerning the condition of the package bound by the package binder heretofore used, the bound condition varies according to the various shapes of package materials, or of the nature of the material and the thickness of the used string.

The package binder avoids the drawbacks of the known devices and comprises a fixed table **1**, which is secured to a front post **2** of the frame structure, the lower part of which is equipped with casters. A traveling table **3** is provided, which is fixed to a bearing case having a bearing **4** located in the upper part thereof. The string carrying arm **5**, to which the traveling table **3** is mounted for free rotation and also one end of the string carrying arm **5** is suspended upon the rear frame **6**, so as to freely rotate relative to the frame **6**. The fixed table **1** and the traveling table **3** are spaced apart from each other and maintain a horizontal position, so that package material **7** can be received on the surface of the tables **1** and **3**. A stationary member **8**, disposed on the fixed table **1**, serves the purpose of guiding the package material on the table **1**, and simultaneously, operates as an abutting member which supports the package material while the package material is in the process of package binding by means of a string **9**. The latter is to be wound about the package material **7** and is drawn upwardly from a cone **11** (FIG. 3) which is kept in a container **10** disposed adjacent to the package binder and several spare cones **11'** are disposed in the rear of the cone **11**, so that a continuous supply of the string **9** is available. The string **9** taken from the cone **11** is fed through a guide **12** fitted in the container **10** and a second guide **13** fitted to the rear frame **6**, in order to pass through the center bore **14** of a rotating shaft of the string carrying arm **5**. An opening **15** is provided in the string sustaining arm **5** and a grooved pulley **17** (FIG. 4) is provided on one side of the opening **15**. Guide rollers **29** and **31** are provided at the end of a tension receiver **30** and guide rollers **32** and **33** and a guide link **34** feed the string **9** into the string retainer of a knot forming structure **37** (FIG. 4). Guide rollers **35** and **36** (FIGS. 4, 12 and 13) are provided on the free end of the string sustaining arm **5**, where the string **9** is connected with the other end of the wound string **9**, and thereupon a knot may be formed.

A fitting plate **38** (FIGS. 4 and 12) is fixed to one side of the string carrying arm **5** and the plate **38** has a U-shaped slot receiving the rod carrier **40** for free rotation thereof. A tension receiver **30** has the guide roller **31** fitted to its end and its other end is fixed to a cage **41**. On one end of a pin **42**, fixed to the fitting plate **38**, the cage **41** is set so that it can rotate freely, while one end of a rod **43** is suspended on a pin **44**, so as to rotate. The rod carrier **40** has a bore receiving the rod **43** for reciprocation, while a spring **45** is disposed on the rod **43** and an adjusting screw **46** is screwed onto the threaded part of the rod **43**. A control pin **47** (FIGS. 12, 16) is fastened to the cage **41** and the tension receiver **30**, and it controls the tension receiver **30** not to be raised higher than required. A sustaining board **48** (FIGS. 4, 12) fixed to the string carrying arm **5** supports the guide rollers **29** and **32**, and an ear-member **49** serves the control of the tension receiver **30** not to be lowered more than required. When the tension receiver **30** is lowered on the fulcrum of the pin **42**, one end of the rod **43** is joined in the direction of rotation, which causes the spring **45** to be compressed.

A retainer **19** (FIG. 4) is fastened to the lower part of the opening **15**, and to one side of the retainer **19** is secured a small shaft **18** having a body of grooved pulleys **16**, **17** to permit rotation thereof. The grooved pulley **17** is equipped with ratchet-teeth, as shown on the drawing (FIG. 18) for the purpose of prevention of slipping of the string **9** and an interlocking shaft **20** (FIGS. 4, 16) has both of its ends set in the fitting plate **38** and the retainer **19**, permitting rotation and further, to one side of the interlocking shaft **20** an inverted cam **27** (FIG. 16) is secured, while to the other side of it a control retainer **21** (FIGS. 16, 17) is secured, forming an appropriate state of the cam **27** on one side of the cage **41** which is made to come into engagement with the inverted cam **27**. Also to one side of the control retainer **21** a damper **22** (FIG. 17) is set, so as to freely move from side to side, which contacts the groove of the grooved pulley **16** and on the other side of the regulative retainer **21** (FIGS. 14, 16, 17) an adjusting screw cylinder **24** with a nut **25** and an adjusting screw **26** is received, where a spring **23** (FIG. 17) is housed, so that the spring pressure may be adjusted easily.

The operating condition of this device with reference to FIGS. 16 and 17 will now be explained. The string carrying arm **5** is placed such, that it can be introduced into the guide roller **29** only after it has been coiled about the resistance grooved pulley **17** for the purpose of providing resistance to the string **9**. As the tension lever **30** rises on the fulcrum of the pin **42**, the cam on one side of

When the pedal 53 (FIG. 1) is operated, the rotating shaft 57 performs one revolution. The pin 75 rotates together with the bevel gear 68 fixed to one side of the rotating shaft 57, while the member 72 reciprocates in the longitudinal slot 91, and causes oscillation of the oscillating rod 88 about the shaft 89 as the fulcrum. By means of the bevel gears 82 and 83, the bevel gear 66 and the sprocket 63 rotate in reverse direction to the direction of rotation of the bevel gear 68. In this case, in connection with the oscillation of the oscillator 88 to both sides, the core of the pin 78 and the member 77 reciprocates in the longitudinal slot 91 along an arc centering about the core of the shaft 57 as its locus, so that the position of the gear shafts 84, 79 varies at all times, which changes the velocity of the bevel gear 66, while the velocity of the bevel gear 68 is fixed and non-changeable.

Characteristics and effects

The present device has the following characteristics as a package binder:

The rotating shaft 57 which transmits the rotation of the string carrying arm 5 of the package binder and motive power for the knot forming member is decelerated automatically by the change differential bell gear device (FIG. 5) until it comes to a complete stop. The device, not forcing the string carrying arm 5 to rotate vigorously, eliminates the difficulties in the operation and thus the package material can be bound with a higher efficiency than it was possible with the known devices.

By this device the equalized binding condition can be maintained, not influenced by the shape of the package material, by elongation of the string, or by others, so that the package material can be bound far more firmly by this device than with the known devices.

In binding package materials, no difficulties occur in paying-out of the string irrespective of the strength of the tightening power of the string, and the operator is not required to approach to the rear frame, as it was required before, for adjustment of the tightening power of the string for the package material, rather not only is he able to do the work of adjustment easily without leaving his present working location, but also he can find out with ease whether the cone 11 is secured or not, or he can exchange cones and reserve cones 11′ are ready and serviceable for his work, which in a small workshop, enables the operator to carry out his work without wasting time nor causing any difficulties.

The spare cone 11′ is placed next to the cone 11 such, they may be linked with each other, so as soon as the string 9 is unwound, the spare cone 11′ is shifted to the place of the cone 11 and a continuous binding operation is obtained, though heretofore the end of the string of the unwinding cone 11 and the start of the new cone had to be connected.

While we have disclosed one embodiment of the present invention, it is to be understood that this embodiment is given by example only and not in a limiting sense, the scope of the present invention being determined by the objects and the claims.

We claim:

1. A package binder comprising
- a frame,
- a fixed table secured to said frame,
- a traveling table disposed adjacent to but spaced apart from said fixed table and movably secured to said frame,
- a string carrying arm operatively connected with said traveling table and pivotally secured to said frame in order to permit rotation relative to said frame,
- a knot forming device operatively connected with said string carrying arm,
- a main shaft and a second shaft operatively connected with said main shaft,
- means for operation of said string carrying arm from said main shaft,
- said means for operation including a change differential gear device operatively connected with and driven by said main shaft in order to control the rotation of said string carrying arm from a slow start to a maximum speed and to terminate with a slow speed,
- said change differential gear device comprising a first bevel gear mounted for relative rotation on said second shaft and adapted to drive said string carrying arm and a second bevel gear keyed to said second shaft,
- a pin carrier including third and fourth bevel gears pivotally mounted thereon the latter gears meshing with said first and second bevel gears, said pin carrier being supported for rotation on said second shaft, and
- an oscillating rod having a longitudinal slot pivoted about a fitting frame and being adapted to receive two members independently oscillating therein, one of said members being connected for rotation with said second bevel gear, while the other of said members being operatively connected with said fourth bevel gear to oscillate it about the second shaft.

2. The package binder, as set forth in claim 1, which includes
- a tension lever pivotally connected with one end of said string carrying arm, and
- means for oscillating said tension lever relative to said string carrying arm,

3. The package binder, as set forth in claim 1, which includes
- a string paying-out member and
- means for damping the movement of said string paying-out member.

4. The package binder, as set forth in claim 1, which includes
- a tension rod secured to one end of said string carrying arm.

5. The package binder, as set forth in claim 1, which includes
- a container receiving a plurality of string carrying cones and secured to said frame, and
- said container having an opening for feeding the string from one of said cones to said string carrying arm.

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