United States Patent [19]

Ishida et al.

[11] **3,884,014**

[45] **May 20, 1975**

[54] **APPARATUS FOR PACKAGING AND PACKING PACKAGES OF YARN**

[76] Inventors: **Kinyu Ishida,** 2750-1 Minamiyoshida-cho; **Eiji Minaka,** 1362 Yogo-cho, both of Matsuyama, Japan

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[21] Appl. No.: **215,619**

[52] **U.S. Cl.** **53/55;** 53/171; 53/187

[51] **Int. Cl.**..... **B65b 57/02;** B65b 57/10

[58] **Field of Search** 53/55, 171, 183, 187

[56] **References Cited**

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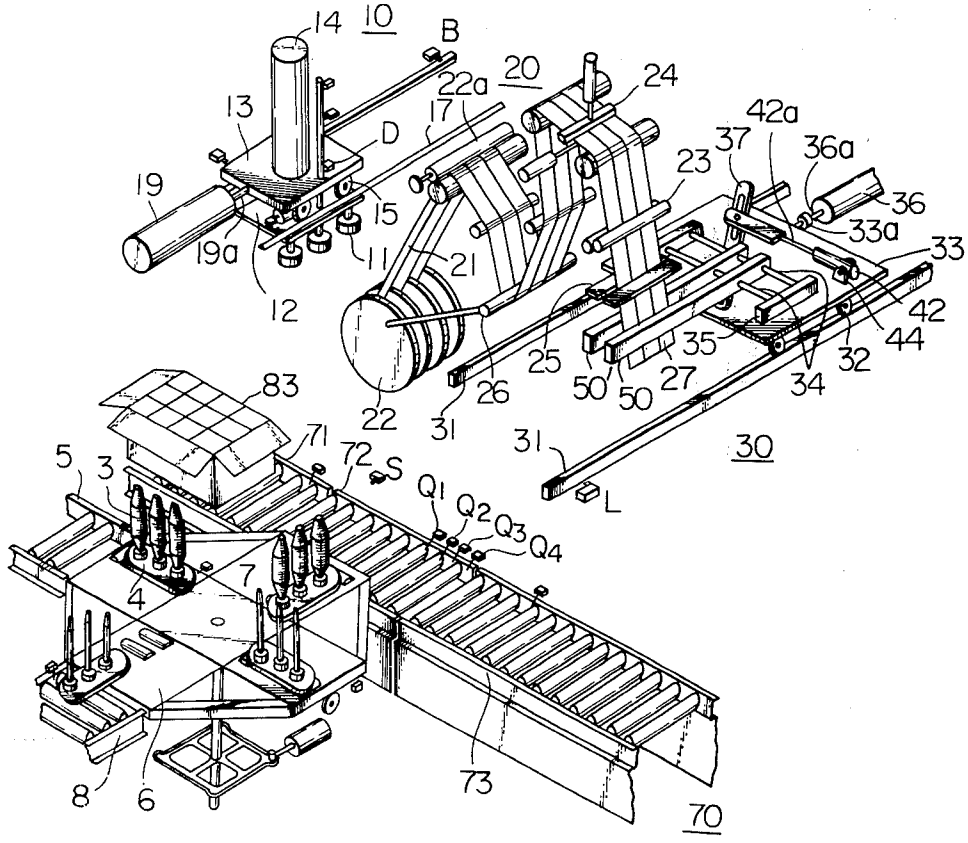
Primary Examiner—Travis S. McGehee

Attorney, Agent, or Firm—Leonard W. Sherman et al.

[57] **ABSTRACT**

This apparatus is to automatically enclose in bags and pack in cases or cartons packages of yarn formed on the supports such as cops, pirns or bobbins by positioning the packages above a position where they are supposed to be enclosed in bags and encased in cases or cartons after they have been picked up from a bobbin pallet with bobbin arrestors, keeping open the bags for enclosing the packages with bag-holding bars provided with vacuum mechanism for opening the bags, positioning the bags under the packages placing the case or carton under the bags whereby the bobbin arrestors are lowered, the carton is raised, the packages are released from the hold of the bobbin arrestors and dropped. Both the enclosing in bags and the packing in cartons of the packages of yarn are automatically conducted at a time.

8 Claims, 19 Drawing Figures



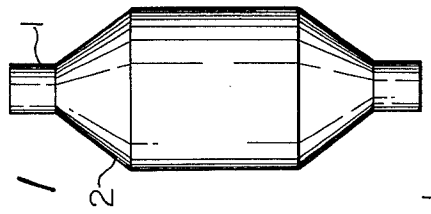


Fig. 1

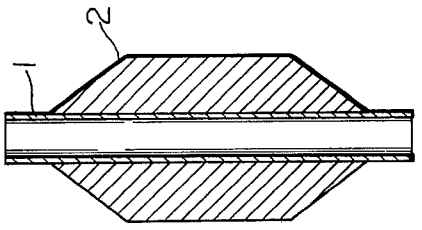


Fig. 2

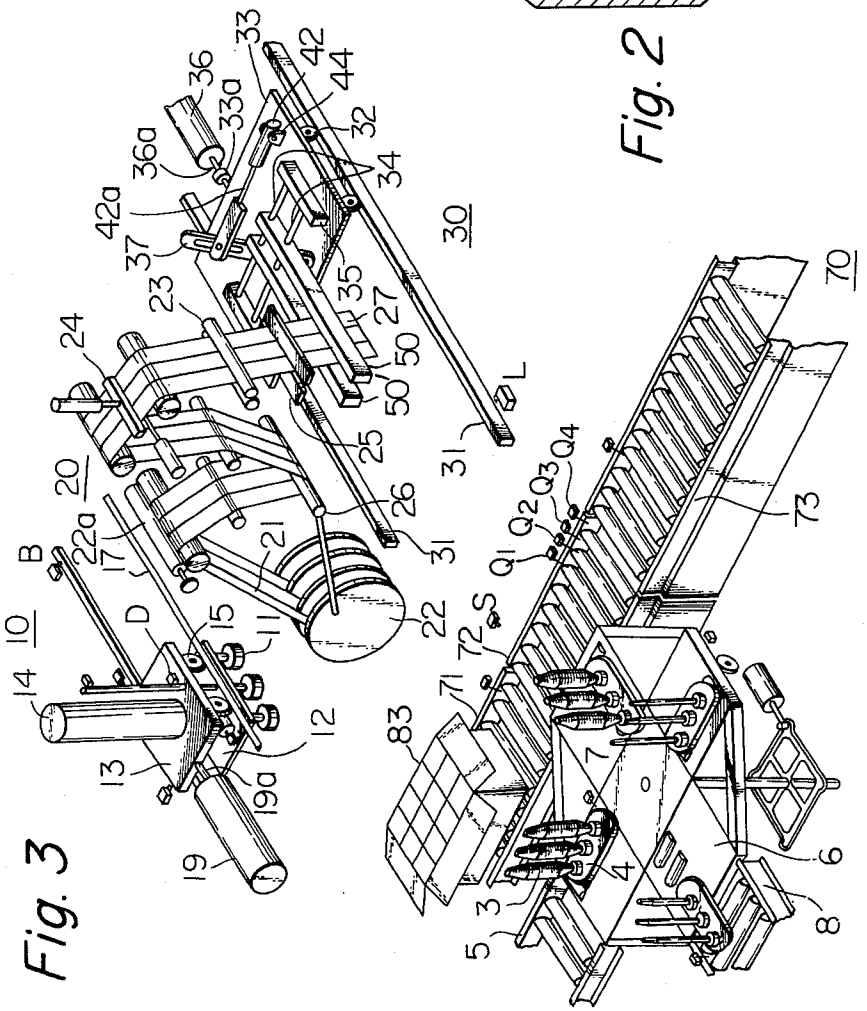


Fig. 3

Fig. 4

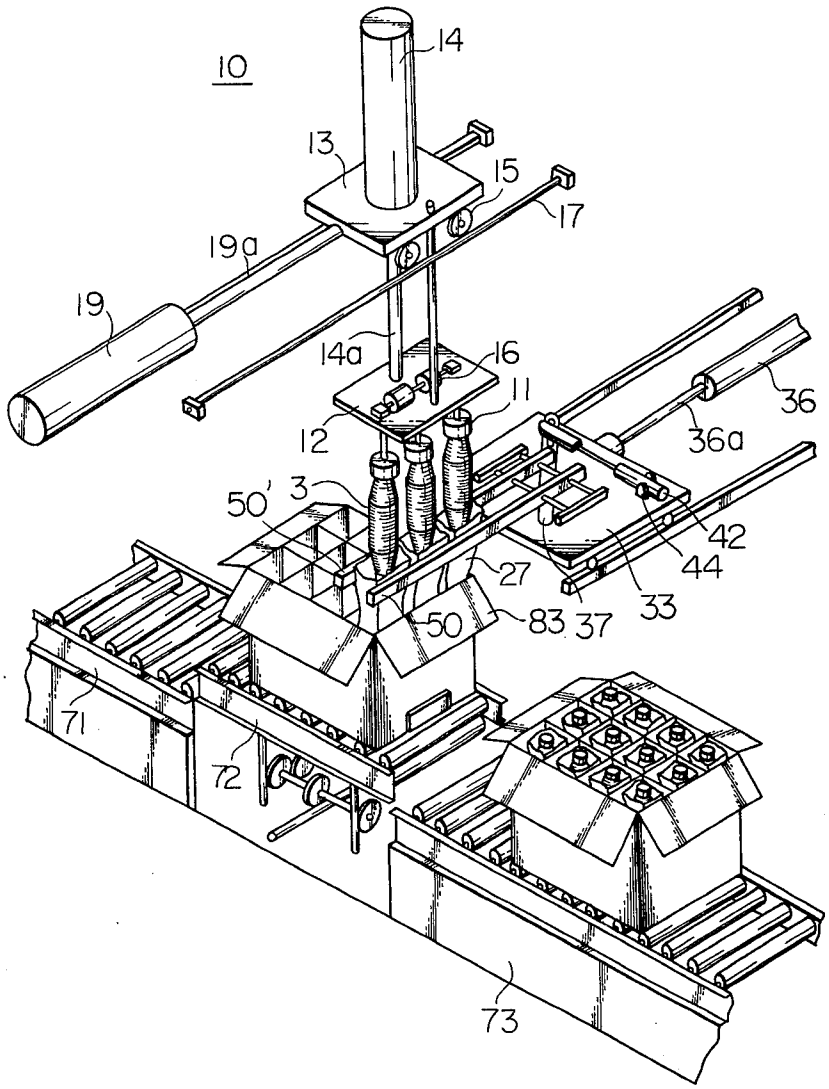

10
14
13
15
17
19a
19
14a
16
11
12
36
36a
50'
3
42
44
27
33
50
83
37
71
72
73

Fig. 5

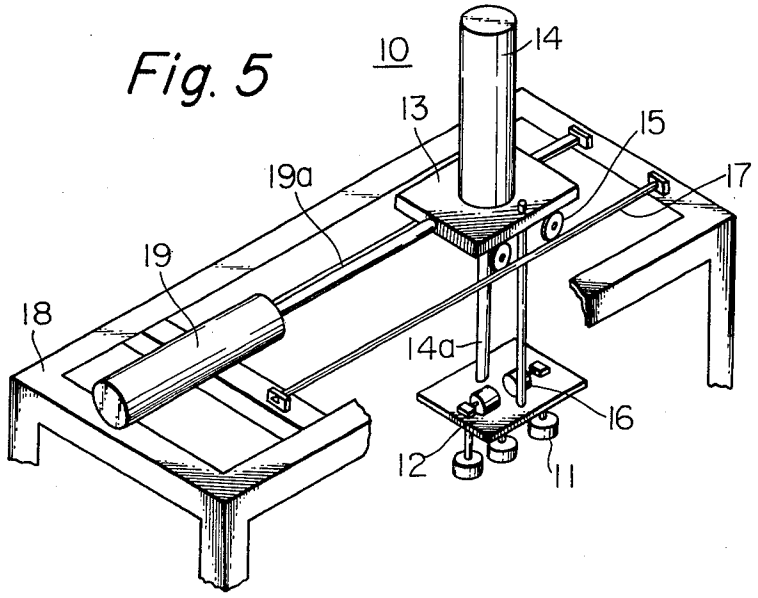

10
14
13
15
17
19a
19
18
14a
16
12
11

Fig. 6

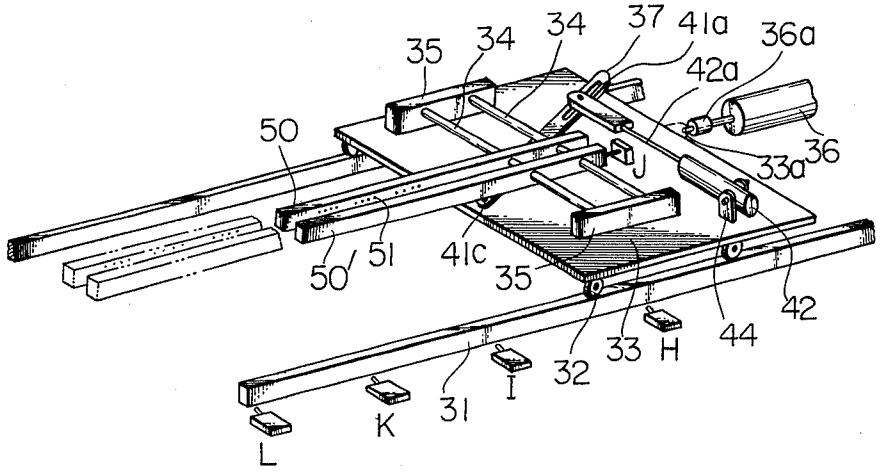

35
34
34
37
41a
36a
42a
50
36
33a
J
50
51
41c
35
42
44
33
H
32
31
I
K
L

Fig. 7

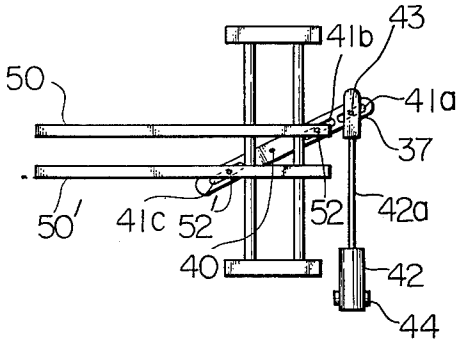

43
41b
50
41a
37
50'
41c
52
52
42a
40
42
44

Fig. 8

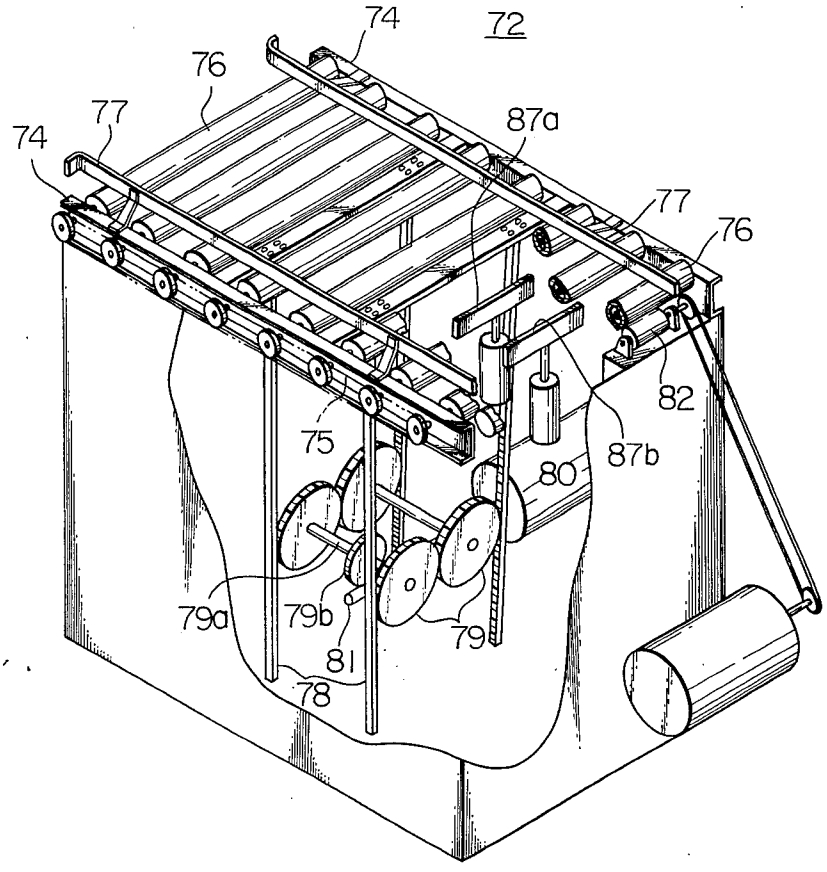

74
72
76
77
74
87a
77
76
82
75
87b
80
79a
79b
79
81
78

Fig. 9

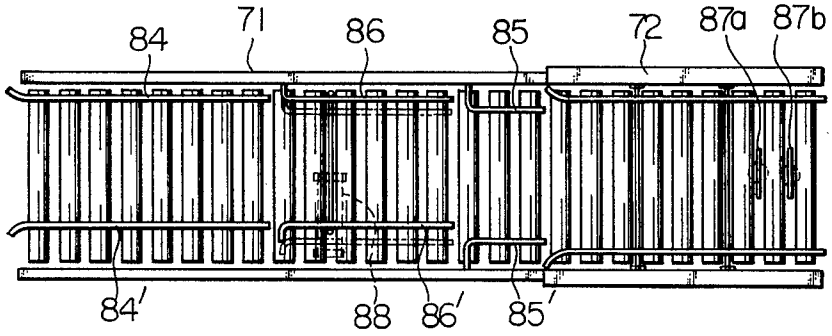

84
71
86
85
72
87a
87b
84'
88
86'
85'

Fig. 18

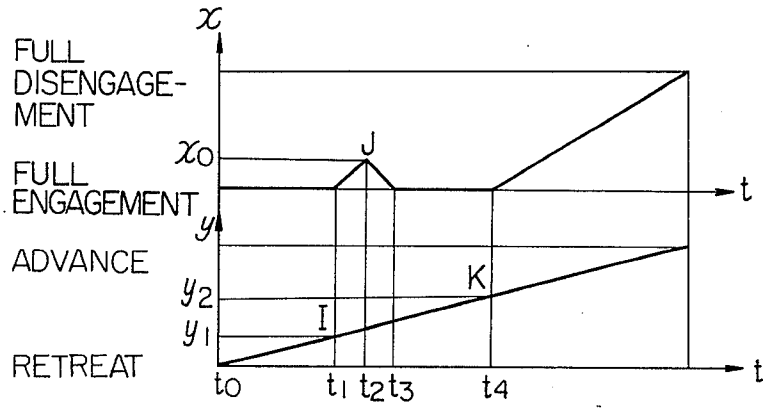

x
FULL DISENGAGE-MENT
x0
J
FULL ENGAGEMENT
t
y
ADVANCE
K
y2
I
y1
RETREAT
t
t0
t1
t2
t3
t4

Fig. 10

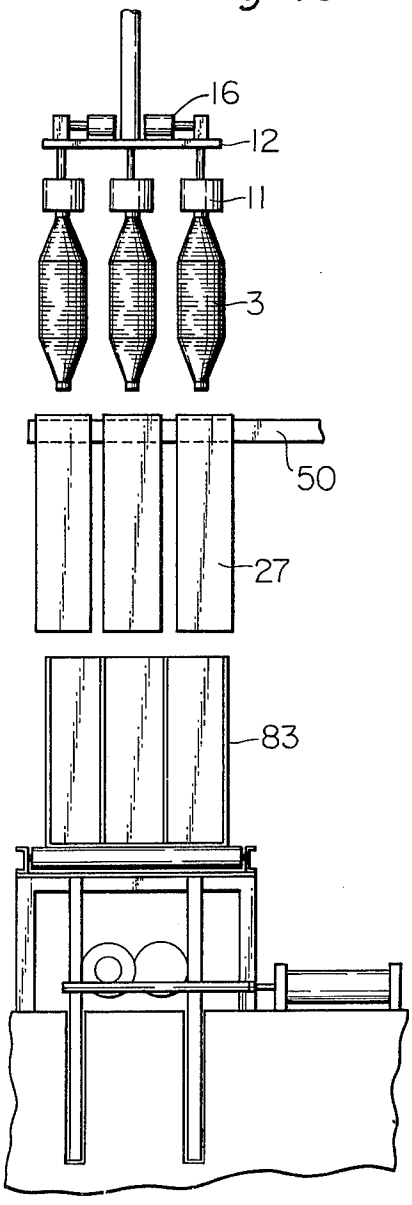


Fig. 11

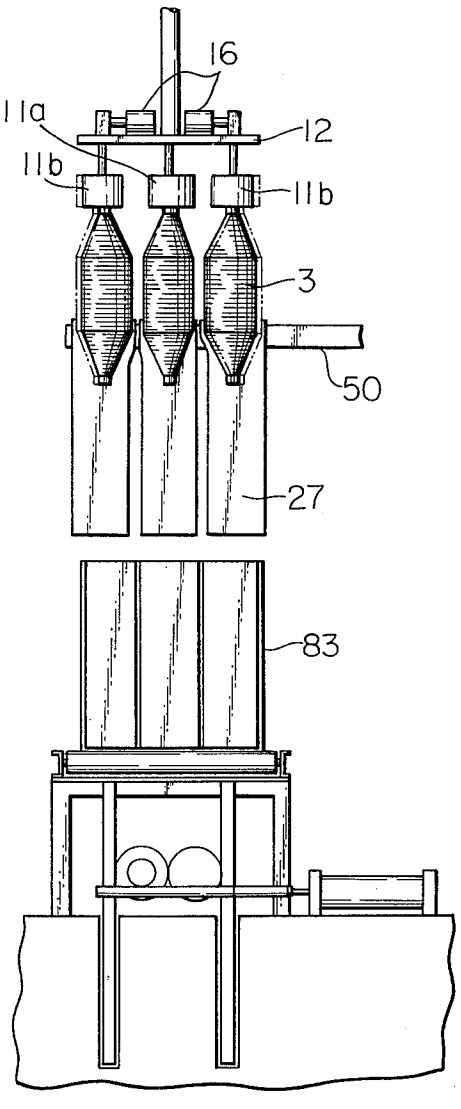


Fig. 12

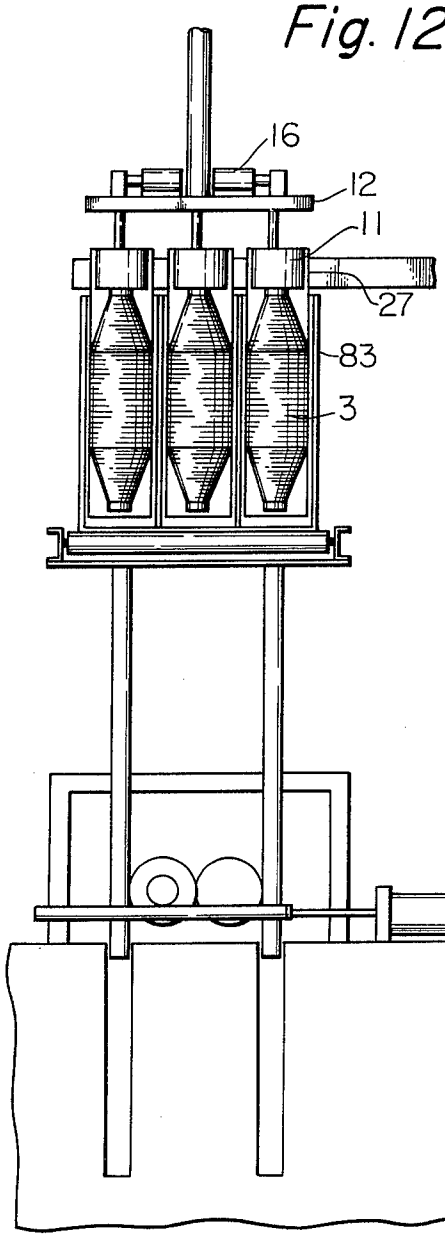


Fig. 15

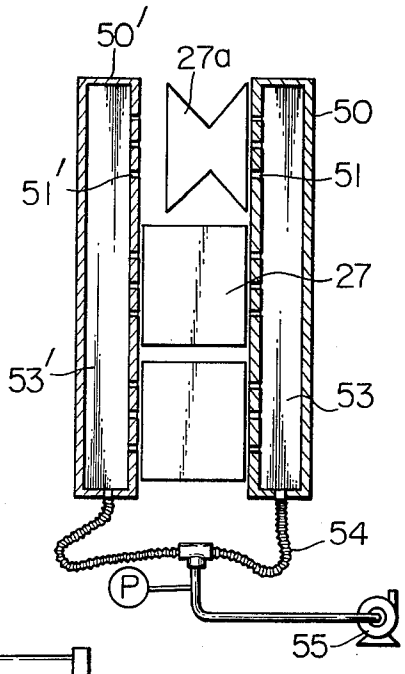


Fig. 13-(A)

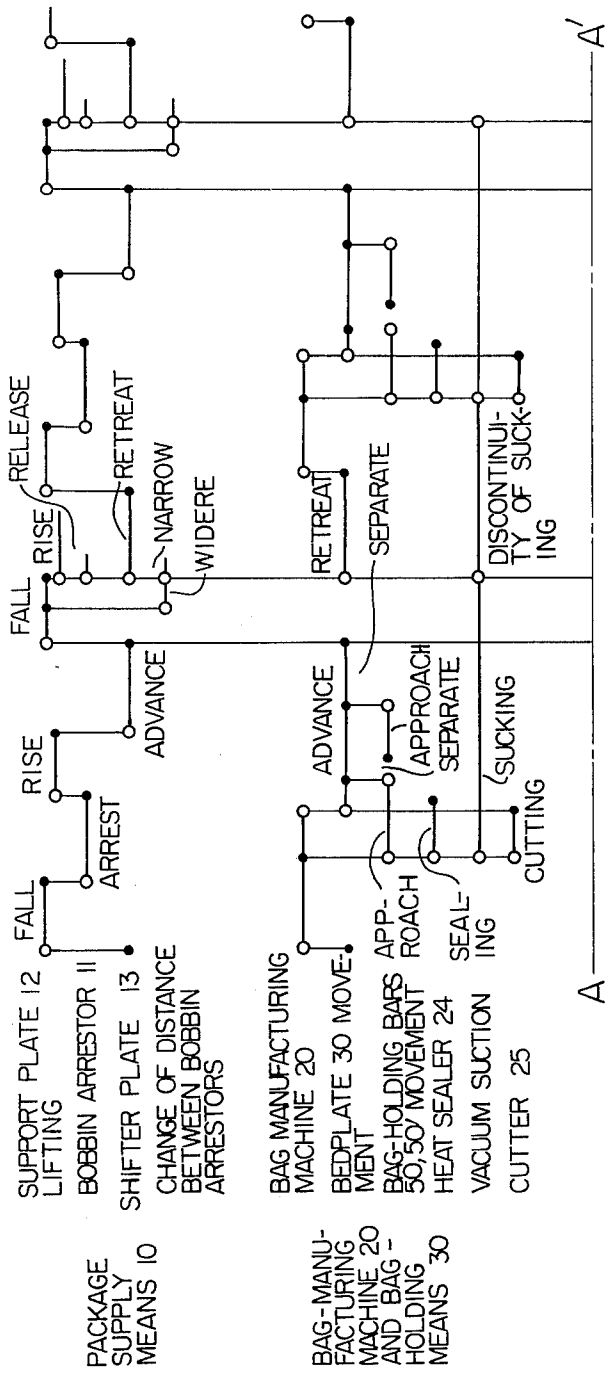


Fig. 13-(A)
Fig. 13-(B)

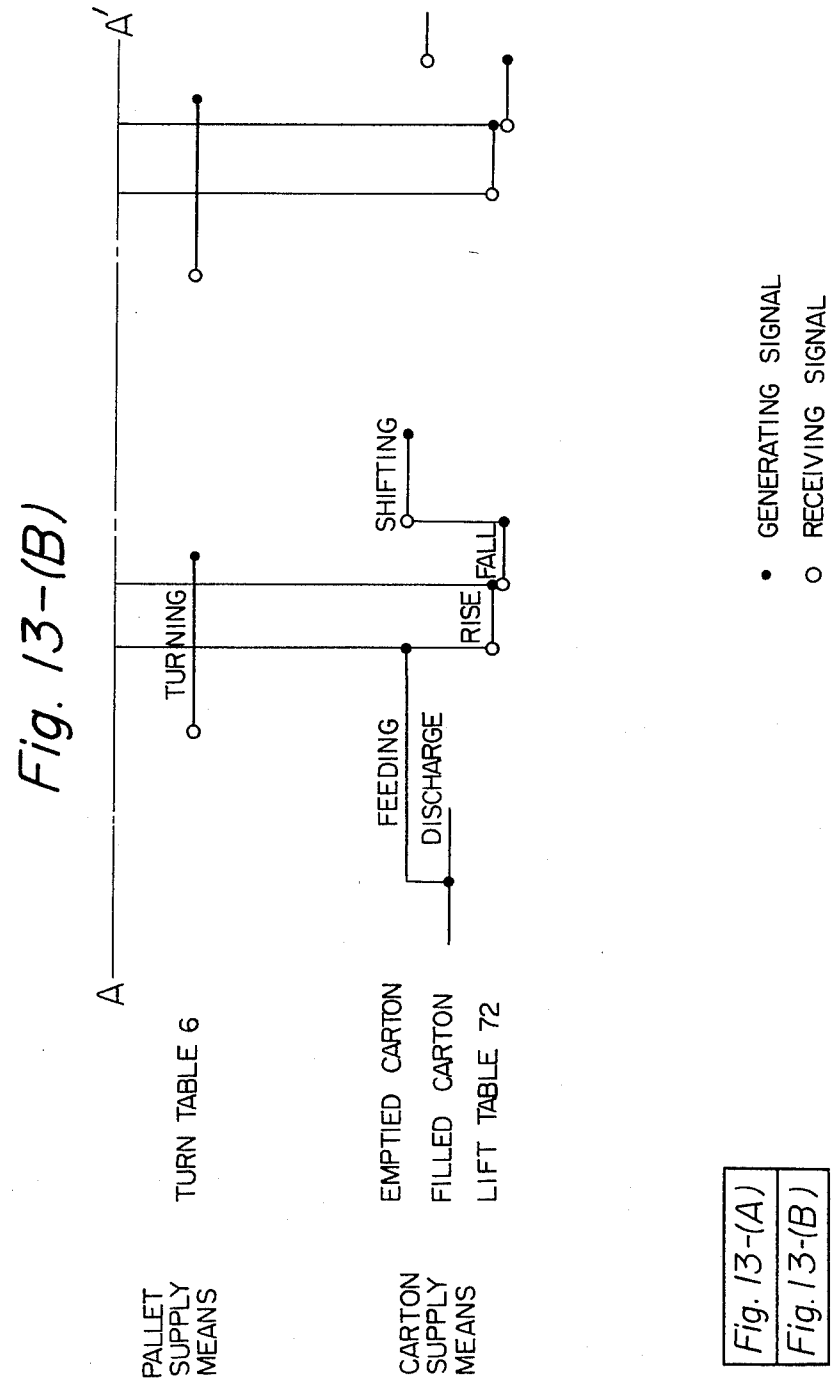


Fig. 13-(B)

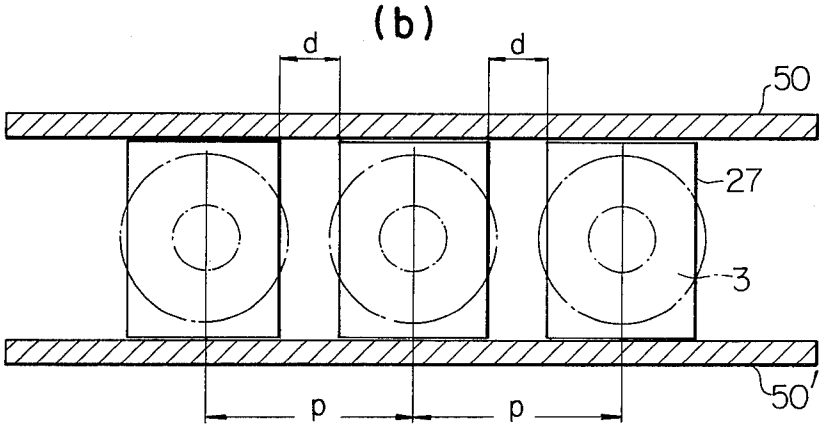
Fig. 13-(A)
Fig. 13-(B)

Fig. 14

(a)



(b)



(c)

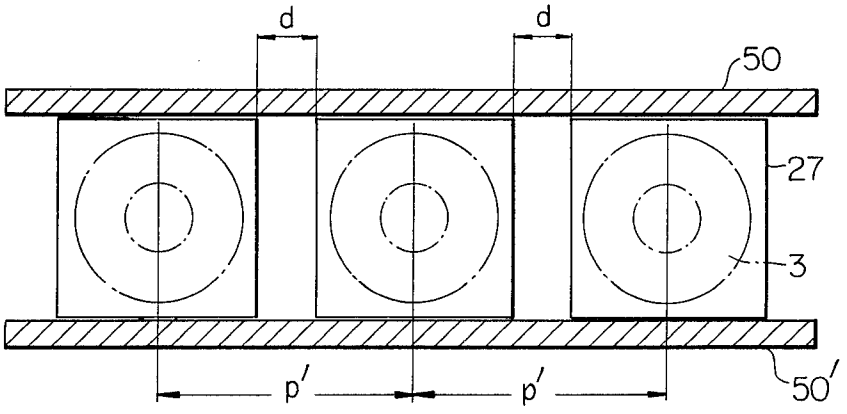


Fig. 16

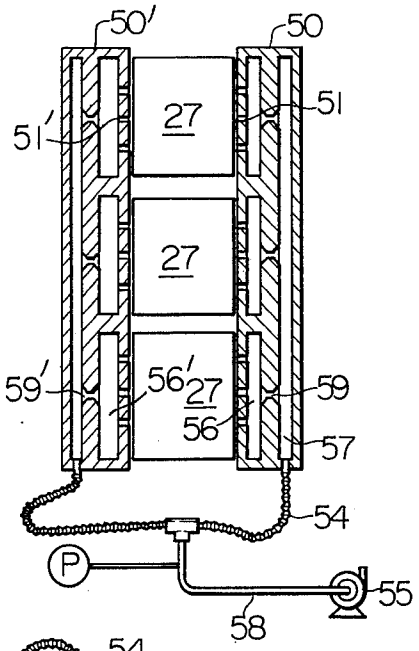
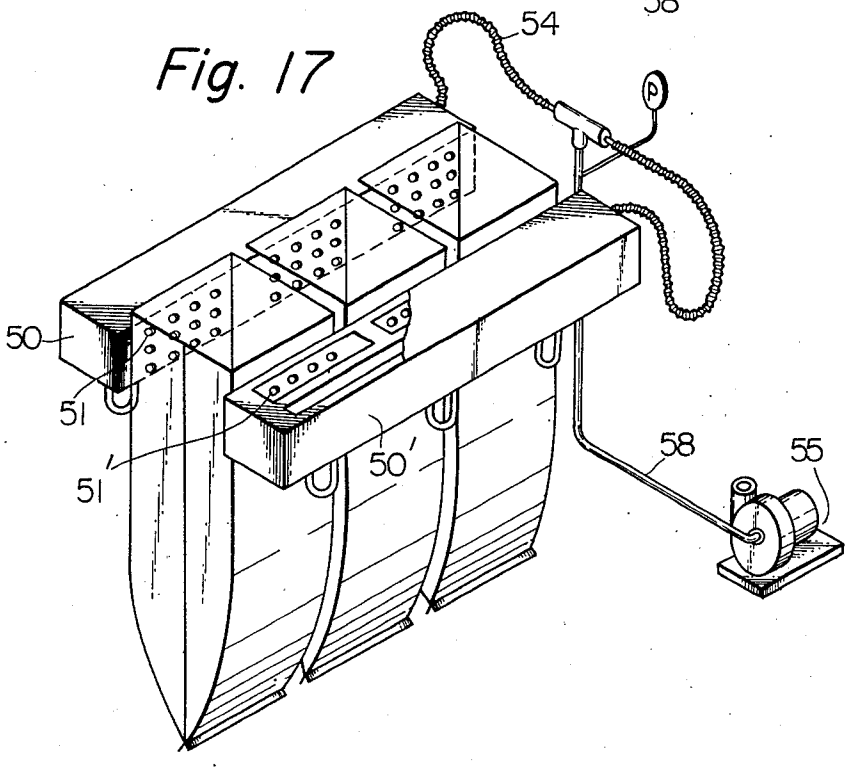


Fig. 17



APPARATUS FOR PACKAGING AND PACKING PACKAGES OF YARN

The present invention relates to the packing of synthetic yarn packages formed on supports such as bobbins or pirns.

The enclosing in bags (hereinafter called packaging) and packing in cases or cartons packages of synthetic yarn have hitherto been carried out manually. That is, packages of yarn wound on bobbins with drawtwisters are each put into plastic bags with one end sealed after they have been subjected to visual inspection and encased in a paperboard carton having predetermined partitions to receive each package. U.S. Pat. Nos. 3,321,073, 3,306,439, 3,335,858 and 3,381,817 disclose cop packaging and a carton for storing packages.

Drawing speeds for synthetic yarn, however, have recently been increased to produce large packages of great dimensions and weight and it has become difficult and inefficient to package and pack such large packages manually.

Hence automation of the packaging and packing of packages has been desired, but was not completed until recently on account of the following difficulties: Synthetic yarn tends to easily slough and fuzz with a slight touch or rubbing on the surface of the package and becomes impossible to rewind and unserviceable. The accuracy of handling of packages sufficient enough to eliminate the above trouble was not obtained by the conventional mechanical operations.

The object of the present invention is to provide an apparatus with high reliability for packaging and packing the packages of synthetic yarn.

Another object of the present invention is to provide an apparatus for packaging and packing numerous packages at a time.

Still another object of the present invention is to provide an apparatus which is capable of avoiding injuring or staining packages of yarn during the packaging and packing operations.

A further object is the provision of a compact, inexpensive automatic packaging and packing apparatus for packages of yarn.

Other objects of the present invention will in part be obvious and will in part be apparent hereinafter.

The present invention relates to an apparatus for automatically and simultaneously packaging and encasing the packages of yarn. That is, the apparatus of the present invention comprises package supply means movable horizontally and vertically, bag-holding means movable horizontally, means for shifting cartons horizontally and vertically, a control mechanism for the package supply means, the bagholding means and the means for shifting cartons, which is capable of detecting that the package supply means, the bag-holding means and the carton each have been positioned in place, lowering the package supply means for a predetermined distance, raising the carton for a predetermined distance with the means for shifting the carton and releasing the packages from the package supply means.

The package supply means comprises a shifter plate with bobbin arrestors mounted thereon and an air cylinder or a motor for moving horizontally the shifter plate and vertically the bobbin arresters.

The bag-holding means consists of a pair of bag-holding bars provided with a vacuum mechanism, a device for engaging or disengaging one bag-holding bar with or from the other bag-holding bar and an air cylinder or a motor to move horizontally the bag-holding bars.

The means for shifting the carton is composed of a conveyor, preferably a roller type of conveyor, and a lift table.

The control mechanism has numerous limit switches or photoelectric tubes for detecting the horizontal and vertical positions of the bobbin arresters, the bag-holding bars and the carton and sends signals to each means according to a predetermined sequence. When the package supply means is positioned above the position where packaging and packing are conducted, the bag-holding means is positioned under the package supply means while the bars are kept open, and an empty carton is positioned under the bag-holding means, the bobbin arresters descend for a predetermined distance, the empty carton ascends for predetermined distance by means of the lift table and the packages are freed from the hold of the bobbin arrestors during which time the degree of vacuum of the bag-holding bars becomes zero to drop the packages while enclosed in the bags to the bottom of the carton. Thus packaging and encasing of the packages are conducted at the same time.

One embodiment of the apparatus for automatically packaging and encasing yarn packages of the present invention will be described below with reference to the accompanying drawings.

FIG. 1 is a front view of a package of yarn wound on a bobbin.

FIG. 2 is a vertical sectional view of the package.

FIG. 3 is a perspective view of the apparatus of the present invention just prior to operation.

FIG. 4 is a perspective view of the apparatus of the present invention during the packaging and encasing operations.

FIG. 5 is a perspective view of package supply means.

FIGS. 6 and 7 are a perspective view and a plan view of bag-holding means.

FIG. 8 shows a lift table.

FIG. 9 is a plan view illustrating a mechanism for feeding cartons one by one to the lift table.

FIGS. 10, 11 and 12 are diagrams illustrating packaging and encasing of yarn packages by the process.

FIG. 13 is a diagram illustrating a sequence of packaging and encasing operations.

FIG. 14 is a view showing the positioning of packages clamped with bobbin arrestors relative to the bags.

FIGS. 15, 16 and 17 are views illustrating one embodiment of bag-holding bars.

FIG. 18 is a diagram showing the movements of the bag holding bars.

In FIGS. 1 and 2, numeral 1 is a bobbin comprising a hollow metal (as aluminum) tube and yarn is wound on it to form yarn layers 2. The wound arrangement of yarn 2 such as found on the bobbin 1 is referred to as a package. Both ends of the bobbin 1 protrude an appropriate length (about 20 to 44 mm) from the yarn layers 2. As described below, the bobbin arrester clamps this portion of a bobbin.

FIGS. 3 and 4 are perspective views illustrating one embodiment of the packaging and encasing apparatus according to the present invention. Some packages 3 are placed on a pallet 4 (three packages in the drawings) and delivered to a turn table 6 from the prior process with a roller conveyor 5. In the drawings, the pallets 4 are being placed one by one on the turn table

6 but two or more pallets may be placed simultaneously. In this case bobbin arrestors 11 should be arranged in two or more rows.

The turn table 6 rotates intermittently through 90 degrees per each turn and the packages are arrested with the bobbin arresters 11 in a position 7. The emptied pallet is discharged to a roller conveyor 8.

Package supply means is shown in FIGS. 3, 4 and 5. In the drawings, the bobbin arresters 11 are secured on a support plate 12 and three bobbin arresters are arranged in a row. But six bobbin arresters in two rows may be arranged. The support plate 12 is linked to a piston rod 14*a* of an air cylinder 14 mounted on the shifter plate 13 and vertically moved with the air cylinder 14. The shifter plate 13 is provided with wheels 15, which roll on rails 17. The shifter plate 13 is linked to a piston rod 19a of an air cylinder 19 and runs horizontally along the rails 17.

A bag manufacturing machine 20 is shown in FIG. 3. Tubular film 21 folded and wound on a drum 22 is discharged from film supply rollers at a constant speed. High-speed rollers 23 intermittently driven synchronously with the movement of the bag-holding bar 50 feed film 21 having a given length with one end open and the other end sealed between the bag-holding bars 50, 50'. A heat sealer 24 is positioned such that it seals the film 21 just above the location where it will be cut with a cutter 25. While the rollers 23 stand still, the film 21 is maintained under tension with a dancer roller 26.

Bag-holding means 30 is illustrated in FIGS. 3, 6 and 7. A bedplate 33 is placed on rails 31 by means of wheels 32. Two shafts 34 are supported with brackets 35 secured on the bedplate 33 and slidably pass through the bag-holding bars 50, 50'. The bag-holding bars 50, 50' have inlet ports 51, 51' on their inner sides. The insides of the bars 50, 50' are linked to a vacuum mechanism shown in FIG. 16 through a vacuum hose. The inside structure of the bag-holding bars 50, 50' will be discussed later. The bedplate 33 is linked to a rod 36*a* of a stationary air cylinder 36 at one edge 33*a* of the bedplate 33.

In FIGS. 6 and 7 is shown one example of a driving mechanism for bag-holding bar 50. A lever 37 is journaled rotatably in a level surface on a pin 40 (FIG. 7) secured to the bedplate and positioned halfway between the bars 50, 50'. The lever 37 is provided with slits 41*a*, 41*b* and 41*c*, which are respectively engaged with a pin 43 mounted at the tip of a piston rod 42*a* of an air cylinder 42 and pins 52' and 52 mounted on the bottom of the bag-holding bars 50, 50'. The air cylinder 42 is secured on the bed-plate 33 by means of a bracket 44. With such a mechanism, the lever 37 rotates at the pin 40 according to the movement of piston rod 42*a* of the air cylinder 42 to cause the bag-holding bars 50, 50' to engage or disengage with or from each other.

As shown in FIG. 3, the film 21 sealed at the lower end, hanging between the bag-holding bars 50, 50' is held between the engaged bag-holding bars 50, 50' with the inlet ports 51, 51' (FIG. 6) and cut just above the point of the holding with the cutter 25. By the disengagement of the bag-holding bars 50, 50' is opened a film bag 27.

Means 70 for shifting a carton is shown in FIGS. 3, 8 and 9. The means 70 for shifting a carton comprises a roller conveyor 71 on the supply side, a lift table 72 and a roller conveyor 73 on the discharge side. In FIG. 8 is illustrated the mechanism of the lift table 72. Rollers 76 connected so as to interlock each other with a chain 75 and guide rails 77 are mounted on a frame 74. The frame 74 is supported with racks 78 such that it moves up and down, the teeth of the racks 78 gearing with those of two pairs of pinions 79 engaging each other.

A piston rod 81 of an air cylinder 80 serves as a rack as well. The teeth of the rack gear with the teeth of the pinion 79b attached to the pinion shaft 79a to rotate the pinion 79*b* and four pinions 79 and thereby move vertically the racks 78 and the frame 74.

When the lift table 72 is located in the lowest position, one of the rollers 76 is engaged with a driving roller 82 at its lower face and caused to rotate by the rotation of the roller 82. Since the roller 82 is arranged separately from the frame 74, the rollers 76 are detached from the roller 82 when the frame ascends. Thus the rollers 76 will not rotate. The lift table 72 is provided with stoppers 87*a*, 87*b*, 87*c* and 87*d* which are projected from between the rollers 76 and spaced apart from each other the same interval as one partition of the carton. However for simplicity in FIG. 8 only two stoppers 87*a*, 87*b* are disclosed.

One embodiment of a mechanism for feeding cartons one by one onto a lift table is shown in FIG. 9. On supply roller conveyor 71 are mounted stationary guards 84, 84' and 85, 85' positioned in stagger to each other and guards 86, 86' rendered transversely movable by means of an air cylinder 88. The length of the movable guards 86, 86' is almost the same as that of the carton. When a carton is present on the lift table 72, the guards 86, 86' are positioned as shown by the solid line and the carton stands still debarred with the stationary guards 85, 85'. When the lift table is emptied, the movable guards 86, 86' move to a position as shown by a dotted line to push only one carton to a position which is free from the stationary guards 85, 85'. As a result, the moving carton is conveyed onto the lift table and stops when it hits the stopper 87*a* movable up and down between the rollers.

With reference to FIGS. 3, 4, and 10 to 12, the operations of packaging and encasing the packages of yarn with the invention apparatus will be described below (FIG. 13 illustrates the timing of movement of each element of the apparatus.).

In FIG. 3, a pallet 4 loaded with packages of yarn 3 is sent to position 7 where the packages are picked up by a turn table 6 during which time bobbin arresters 11 descend by the action of air cylinder 14 to arrest the packages 3 and ascend. Then shifter plate 13 advances (to the right in FIG. 3) by means of air cylinder 19, and when it comes just above lift table 72, strikes a limit switch B and stops.

In FIGS. 3 and 6, bag-holding bars 50, 50' hold bags 27 between them and open them by means of air cylinder 42, and the bedplate 33 is caused to advance to left (in the drawing) by means of air cylinder 36. When the bedplate 33 comes under the bobbin arresters 11 and just above the lift table, it strikes the limit switch L and stops.

A carton 83, as described above with reference to FIG. 9, is fed to the lift table 72 and strikes a limit switch Q_1. When limit switches B, L and Q_1 all generate signals, the following actions are started as shown in FIGS. 4 and 10 to 12. The bobbin arresters 11 start to descend together with the support plate 12 by means of air cylinder 14, and at the same time the lift table 72 starts to ascend. During this time the bag-holding bars

50, 50' stand still and hold the bags 27 opened. When the packages descend for a predetermined distance, slightly above the bottom of the bags, the limit switch D generates a signal and the bobbin arresters discontinue to fall. When the lift table 72 ascends for a predetermined distance such that the bottom of the carton 83 is slightly spaced from the bottom of the bags 27, the limit switch S generates a signal to stop the ascending of the lift table 72.

When the limit switches D and S generate signals, the bobbin arresters 11 release the packages 3 and start to ascend, and the shifter plate 13 starts to retreat. At the same time, the degree of vacuum inside the bag-holding bars 50, 50' becomes zero, and the bedplate 33 begins to retreat. The packages 3 fall to the bottom of the carton together with the bags 27 by gravity to consummate packaging and encasing simultaneously. By the signals of the limit switches D and S, the lift table 72 starts to descend.

When the lift table 72 returns to the lowest position, the rollers 76 come into contact with the driving roller 82 and start to rotate. Then the first stopper 87*a* falls ignore the carton advances. The positioning of the carton is determined with the stopper 87*b* to cause a limit switch Q_2 (FIG. 3) to generate a signal. In this way the carton is shifted by the amount of one partition to receive the packages into the next partition. In the carton as shown in FIG. 4, positions of the carton are changed four times to receive packages in turn. (However for simplicity in FIG. 8, only two stoppers are disclosed.) And if the support plate 12 of the package supply means 10 is provided with bobbin arresters in two rows, one shifting of the position of the carton will suffice. In this case, the two rows of the bobbin arresters are preferably arranged so as to have the distance twice the width of two times one partition of the carton lest the adjacent packages rub each other.

Instead of shifting the carton, it is possible to provide a mechanism for moving the package supply means 10 and the bag-holding means 30. After all the partitions are filled with the packages, the carton 83 is sent to the roller conveyor 73.

The control system for the package supply means, the bag-holding means and the means for shifting cartons can be implemented with conventional electric circuits and can easily be arrived at by one skilled in the art; and, thus, the present invention should not be understood as including the novelty of the control mechanisms for the system.

In automatic packaging and packing with the use of bags of conventional size for the manual operations, there have frequently occurred troubles in that the bags are disengaged from the bag-holding bars 50, 50' before the packages are fully enclosed in the bags. The reason is that a conventional bag slightly greater in circumference than the package makes a rectangle the shorter sides of which become smaller than the diameter of the package as illustrated in FIG. 14(b). Hence in automatic packaging and packing apparatus, bags of greater size as shown in FIG. 14 (*c*) should be used. In this case the interval "*d*" between the bags depends upon the bag manufacturing machine 20 and cannot be very small lest they over lap each other over the bag-holding bar 50. In short, the gauge P' of the packages becomes greater, and, in turn a carton must disadvantageously have a greater size than conventional cartons used for manual operation.

For this reason a device has been proposed for increasing high reliability in the packaging operation with the use of bags of greater size and cartons of the same size as in the manual operation. That is, in FIG. 11, the middle one 11*a* of the three bobbin arrestors 11 is secured on the support plate 12 and the other two 11*b* are engaged with small air cylinders 16, secured on the support plate 12, which are capable of moving the bobbin arrestors 11*b* horizontally and thereby altering the interval between the bobbin arresters 11*a* and 11*b*. At the start of the packaging operation, the initial interval between the bobbin arrestors 11*a* and 11*b* is *p'* as shown in FIG. 14 (*c*) and the dotted lines in FIG. 11. After by fall of the bobbin arresters 11, such that the lower ends of the packages 3 have been enclosed in the bags held with the bag-holding bars 50, 50', the air cylinders 16 work to move the bobbin arresters 11*b* at both ends into the center and reduce the interval between the bobbin arresters 11*a* and 11*b*, that is, the interval between the packages 3 (positioned as shown by the solid lines). Thus the packages 3 can be stored in a carton of conventional size.

The mechanism of the bag-holding means 30 is described referring to FIGS. 15, 16 and 17. In conventional bag-holding means, the interiors of the bag-holding bars 50, 50' form single hollow vacuum chambers 53, 53' as shown in FIG. 15. The vacuum chambers 53, 53' are connected with a vacuum pump 55 through a flexible tube 54. However with such a bag-holding means, the bags have defectively been opened because some bags are found difficult to open under the influence of their material, manufacturing conditions, ambient temperatures or humidity. That is, such a defective bag 27*a* is not sufficiently sucked to the bag-holding bar 50', and a small gap occurs between an inlet port 51' and the bag 27*a*. Thus air flows in from the inlet port 51'. Though the flow rate is very low, the pressure in the vacuum chamber 53' gradually rises and approaches atmospheric pressure unless the gap disappears in a short time to cause other bags to be disengaged from the bag-holding bar 50'.

In promoting operational efficiency, it will suffice, therefore, to provide an inlet port corresponding to each bag and to prevent one defective opening from affecting other bags. But each chamber would, therefore, require a vacuum hose, resulting in the provision of bulky bag-holding means and complicated operation of the means. On the other hand increasing the capacity of the vacuum pump represents another manner of solving this problem but is undesirable in view of installation cost and space.

In FIGS. 16 and 17, numerals 56, 56' indicate secondary vacuum chambers independent of each other. The secondary vacuum chambers each have inlet ports 51, 51' in an appropriate number. Numerals 57, 57' are primary vacuum chambers connecting with the secondary vacuum chambers. One end of each primary vacuum chamber is connected with a vacuum pump 55 by means of flexible tube 54 and a hose 58. Numerals 59, 59' are restrictions to retard the flowing of air and may take the form of small copper tubes, orifices or any other appropriate design to control air flow.

In this device the fact that any bag is disengaged from the inlet ports and the inlet ports become open will not affect other secondary vacuum chambers due to the restrictions 59, 59'. Further the vacuum capacity of the whole bag-holding means is increased with the provision of the primary vacuum chambers 57, 57'.

Therefore the degree of vacuum is maintained satisfactorily to attract instantly a bag disengaged from inlet ports and to widely increase efficiency of the bag opening.

A pressure gauge P for detecting pressure in the vacuum chambers may be provided. The pressure gauge P generates a signal to discontinue the packaging operation when the pressure in the vacuum chambers exceeds a predetermined amount of pressure.

Further in order that the bag opening operation may be more accurate, it is effective to move the bag-holding bars **50, 50'** stepwise, not at a stretch, that is, to narrow the interval between the bars after they have been extended to a certain extent and then increase it.

The above steps will be described with reference to FIGS. **6** and **18.**

FIG. **18** is a diagram is which the interval X between the bag-holding bars **50, 50'** and the advancing distance *y* of the bedplate **33** are plotted as ordinate and time as abscissa. Under the conditions where the bag-holding bars are engaged with each other holding bags, the bedplate **33** starts to advance. When the bedplate **33** advances for a distance *y*, a limit switch I generates a signal I and starts to extend the interval between the bars **50, 50'** by means of air cylinder **42.** When the interval between the bag-holding bars reaches a predetermined valueX_o, a limit switch J generates a signal J and causes the bars **50, 50'** to start to be engaged with each other. Then when the bedplate **33** advances for a distance Y_2, a limit switch K generates a signal K to start disengaging one bar from the other. The signal K is arranged in such a way to cancel the signal J of the limit switch J and to cause the bars to be fully disengaged from each other. A timer may be used instead of the limit switches.

We claim:

1. Apparatus for automatically enclosing in bags and encasing packages of yarn comprising package supply means horizontally and vertically movable; bag-holding means horizontally movable; means for shifting a carton horizontally and vertically; and means for controlling the package supply means, the bag-holding means and the means for shifting a carton, said controlling means detecting when the package supply means, the bag-holding means and the carton are each in a predetermined position to operate the package supply means to descend a predetermined distance, to operate the carton shifting means to raise the carton a predetermined distance, and to disengage the packages from the package supply means to drop the packages into bags held by the bag-holding means and into the carton.

2. The apparatus as set forth in claim **1** in which the package supply means has a plurality of bobbin-arresters and means for altering the spacing between the bobbin arresters.

3. The apparatus as set forth in claim **1** in which the package supply means has a plurality of bobbin arresters arranged in at least two rows and the distance between the rows is two times the width of one partition of the carton.

4. The apparatus as set forth in claim **1** in which the bag-holding means has at least a pair of bag-holding bars.

5. The apparatus as set forth in claim **4** in which each of the bag-holding bars has a primary vacuum chamber, a plurality of secondary vacuum chambers and restriction means communicating with the primary vacuum chamber and the secondary vacuum chambers.

6. The apparatus as set forth in claim **5** in which the bag-holding means has a device for moving one bag-holding bar toward and away from the other bag-holding bar.

7. The apparatus as set forth in claim **6** in which in opening the bags, the device for moving the one bag-holding bar toward and away from the other bag-holding bar narrows the interval between the bag-holding bars once the bag-holding bars are extended and subsequently widens the interval between the bag-holding bars.

8. The apparatus as set forth in claim **1** in which the means for shifting the carton includes a lift table having at least two stoppers spaced from each other by an interval equal to the interval of one partition of the carton.

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