Sept. 13, 1966 F. AUBERY 3,271,925

PACKING MACHINES

Filed March 12, 1964 9 Sheets-Sheet 1

Fig.1

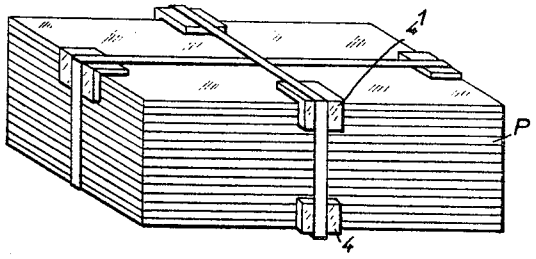
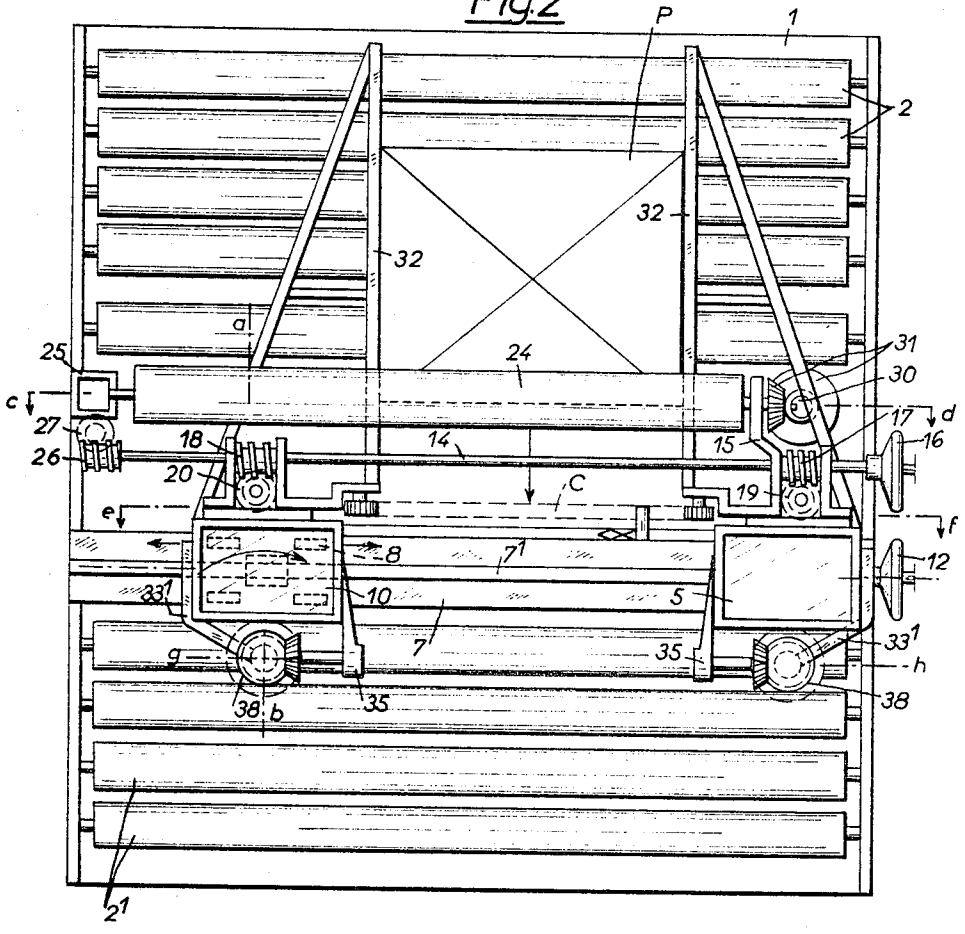


Fig.2



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PACKING MACHINES

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Fig.3

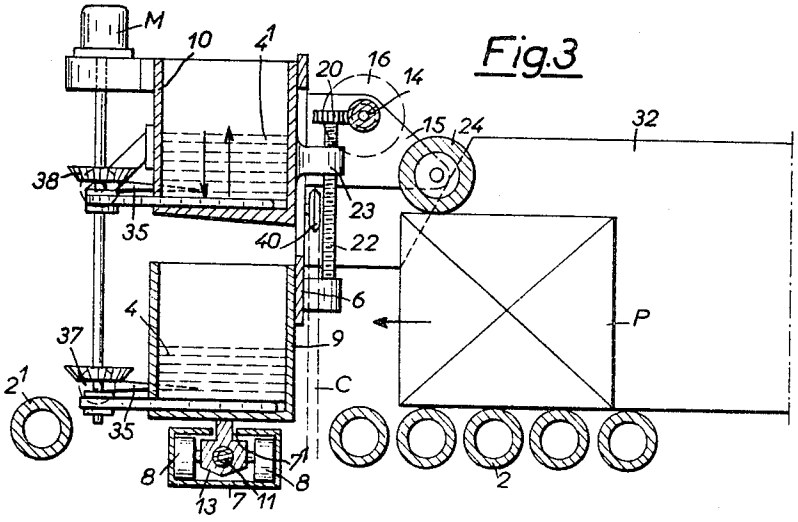


Fig.4

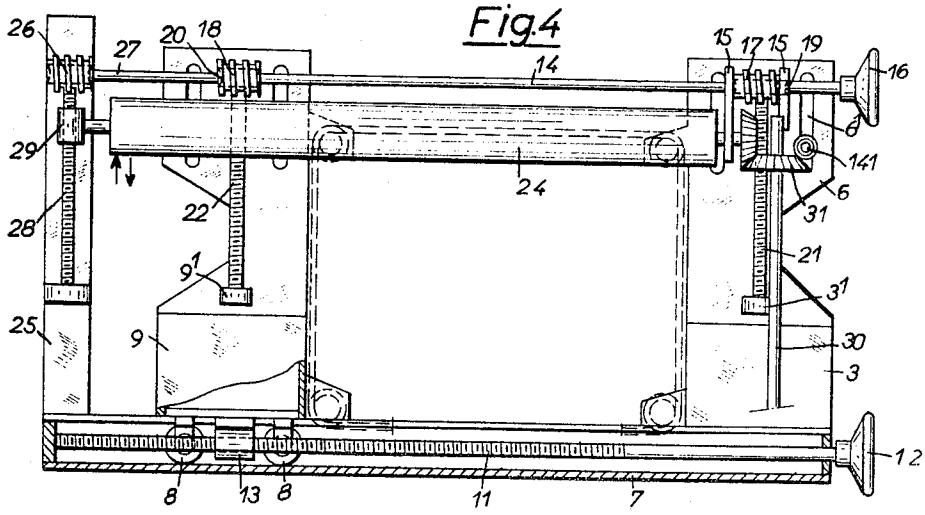
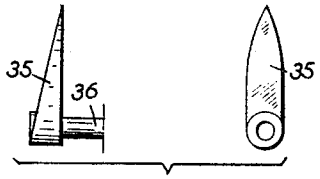


Fig.5



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PACKING MACHINES

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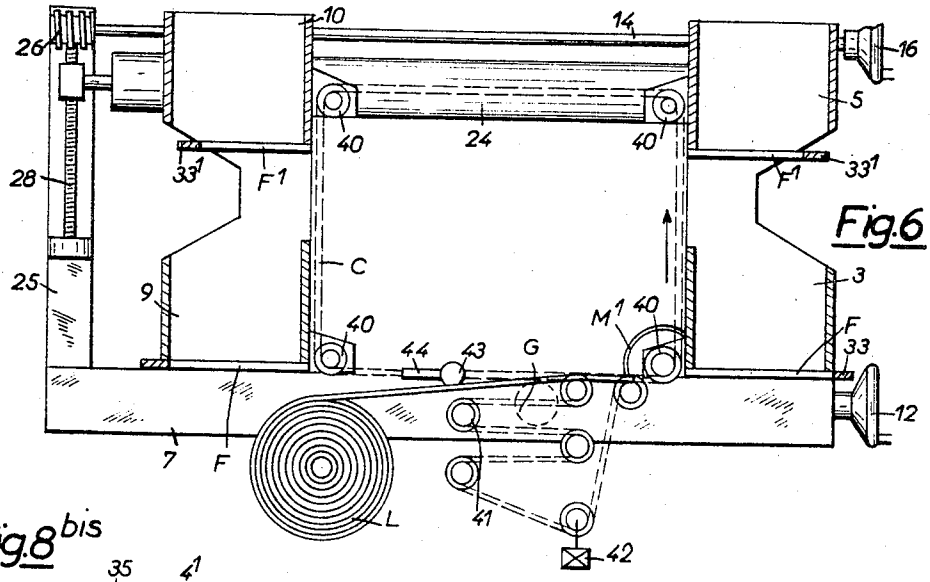
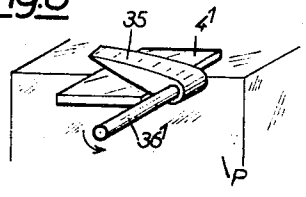


Fig.6

Fig.8 bis



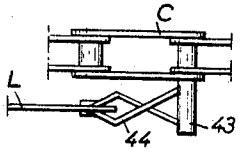


Fig.7

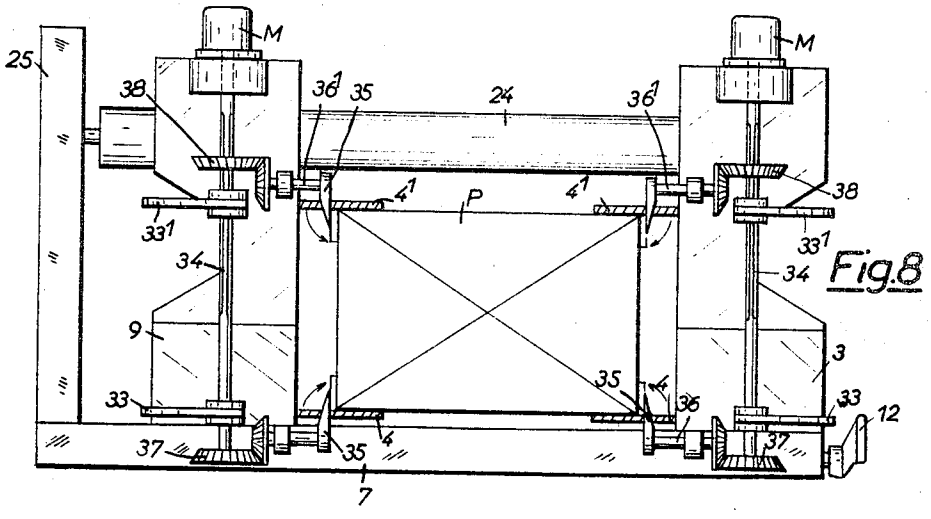


Fig.8

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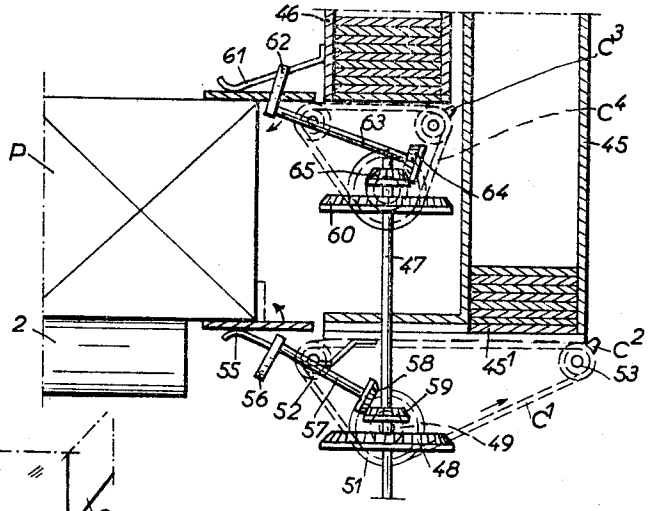

Fig.9

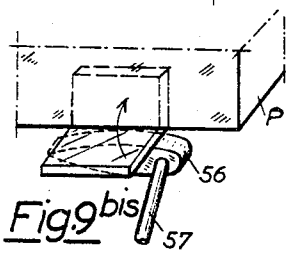

Fig.9bis

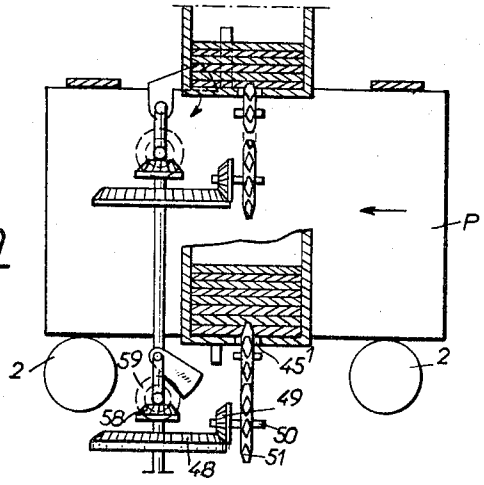

Fig.10

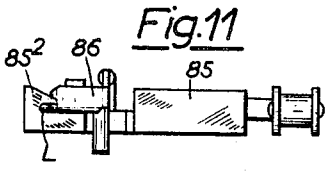

Fig.11

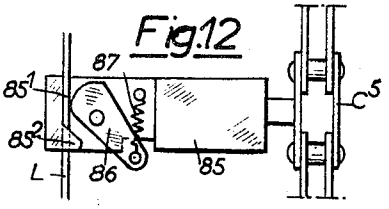

Fig.12

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PACKING MACHINES

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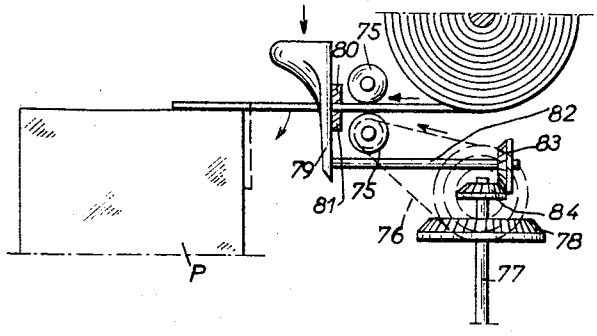


Fig.13

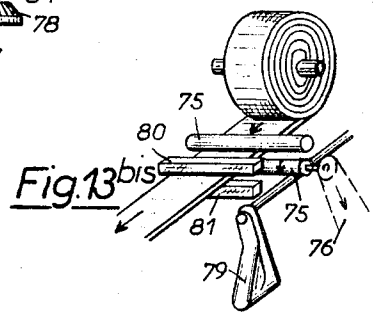
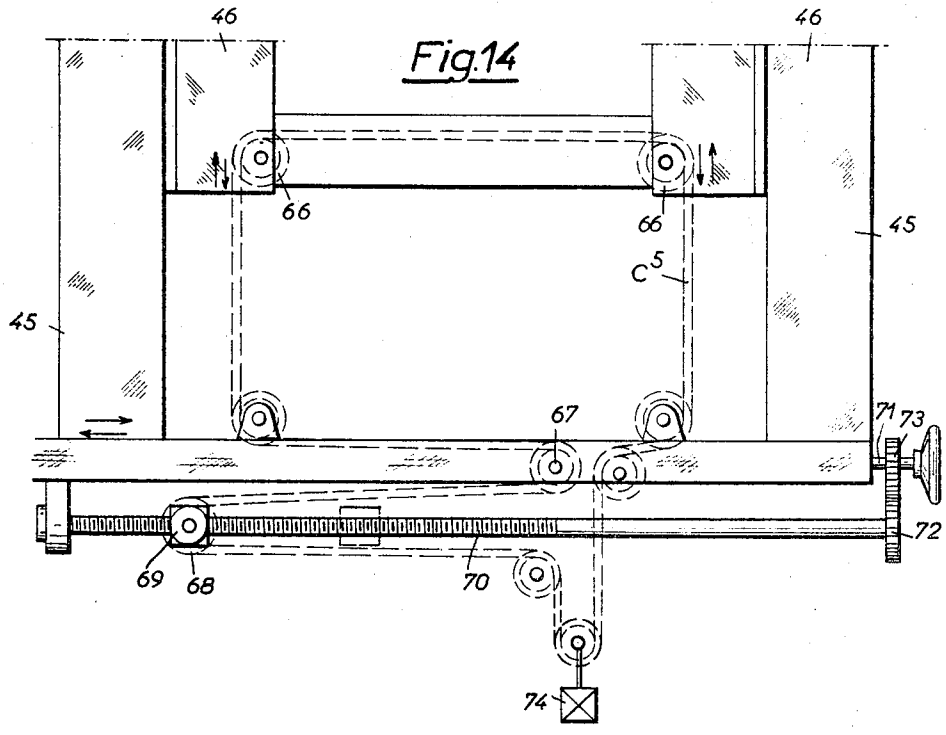


Fig.13bis

Fig.14



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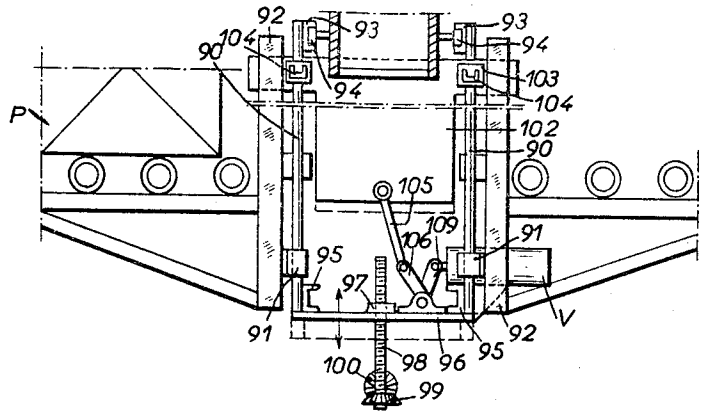

Fig.15

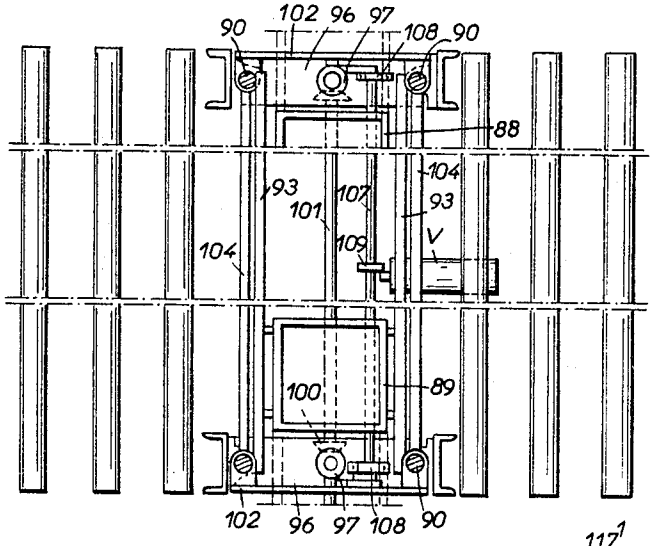

Fig.16

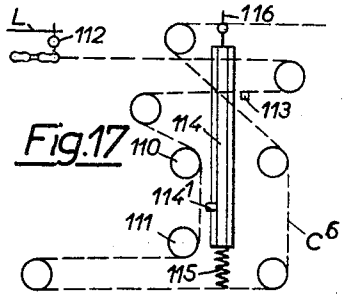

Fig.17

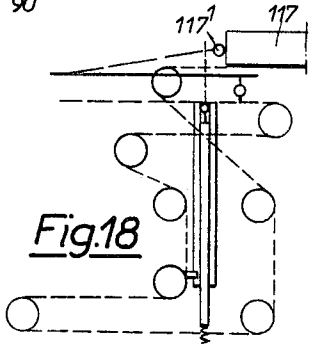

Fig.18

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PACKING MACHINES

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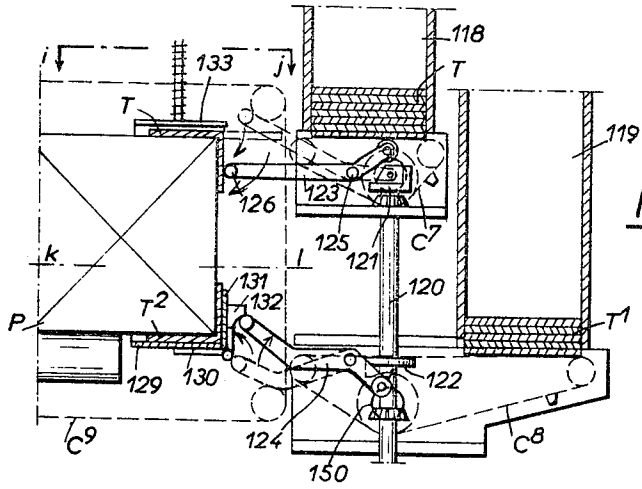

Fig.19

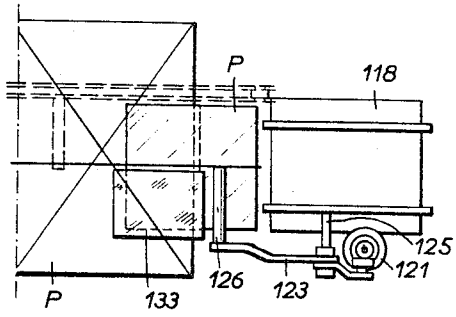

Fig.20

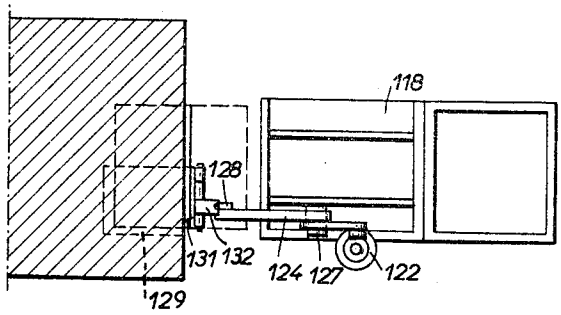

Fig.21

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Fig. 22

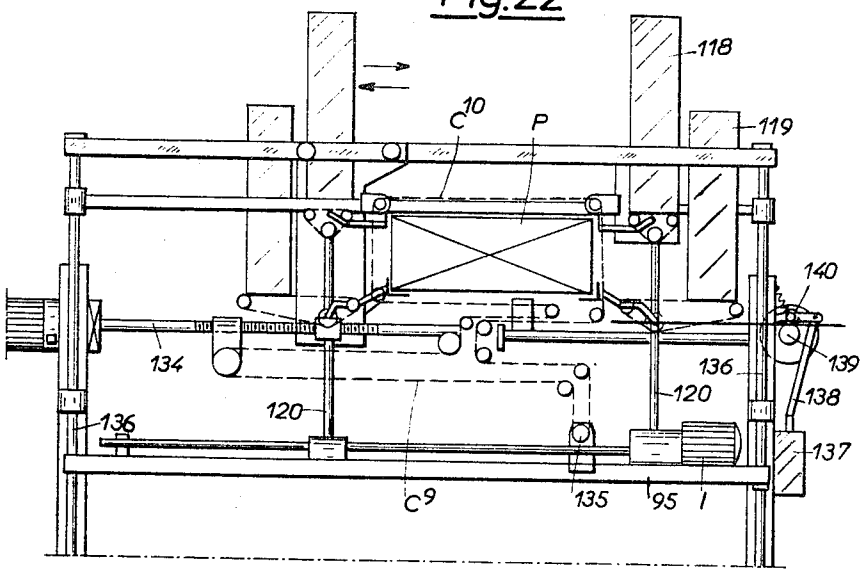

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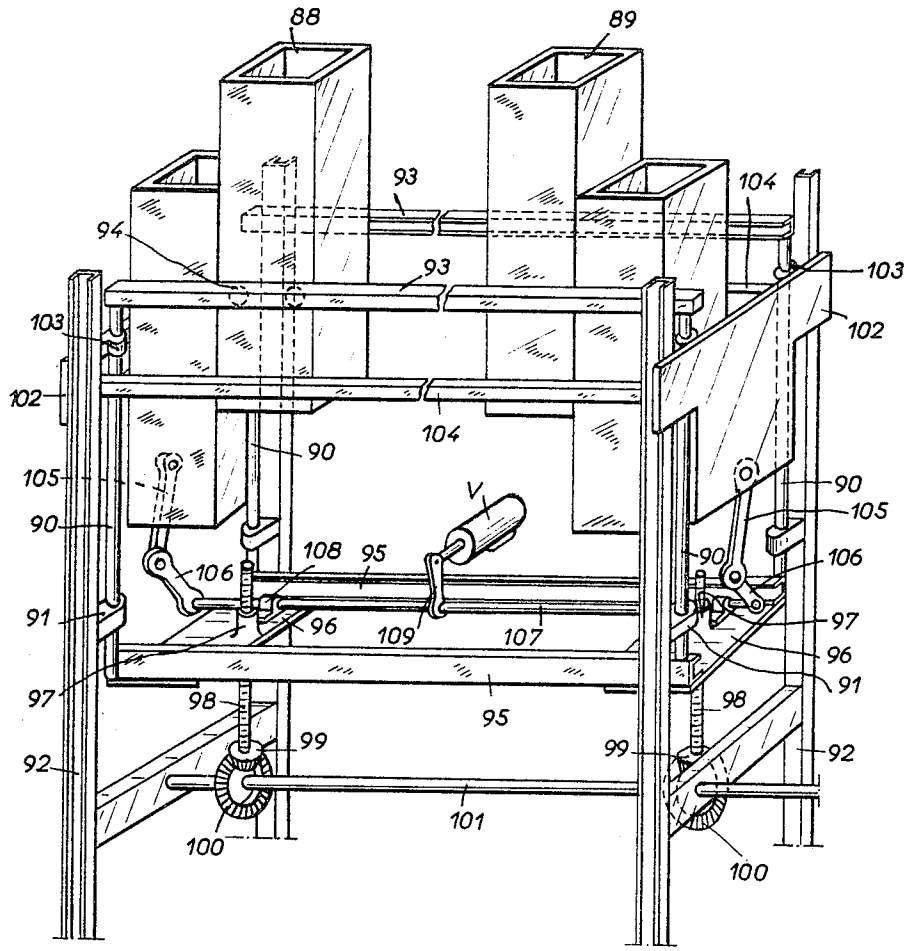
Fig.23



United States Patent Office 3,271,925
Patented Sept. 13, 1966

3,271,925

PACKING MACHINES

Francois Aubery, 18 Rue Colbert, Valence, Drome, France

Filed Mar. 12, 1964, Ser. No. 351,453
Claims priority, application France, Mar. 20, 1963, 8,647, Patent 1,351,883; June 26, 1963, 8,720; July 10, 1963, 8,733; Dec. 12, 1963, 8,822
16 Claims. (Cl. 53—128)

This invention relates to semi-automatic packing machines.

It is the primary object of this invention to provide a semi-automatic packing machine in which a substantially rectangular block composed, for example, of a stack of flat rectangular plates, is surrounded and tied by a strapping element, the machine placing reinforcing elements at the four edges of the pack about which the strapping element is to pass and folding these elements to a right angled shape before encircling the pack and said reinforcing elements with the strapping element.

It is a further object of the invention to provide a packing machine which owing to its adjustable parts permits packs of a wide range of sizes to be handled.

These and other objects of the invention will become apparent during the detailed description which follows and which is given with reference to the accompanying drawings, in which,

FIGURE 1 is a perspective view of a reinforced and tied pack produced by a semi-automatic packing machine according to the present invention,

FIGURE 2 is a diagrammatic plan view of a packing machine according to the present invention,

FIGURE 3 is, on a larger scale, a section on the line *a–b* of FIGURE 2,

FIGURE 4 is a section on the line *c–d* of FIGURE 2,

FIGURE 5 shows two views of a cam for folding flat reinforcing elements,

FIGURE 6 is a section on the line *e–f* of FIGURE 2,

FIGURE 7 is a plan view, on a larger scale, of an endless chain of the packing machine and also shows a gripper carried by the chain for entraining the strapping elements,

FIGURE 8 is a section taken on the line *g–h* of FIGURE 2,

FIGURE 8bis is a perspective view illustrating the manner in which the reinforcing elements are folded,

FIGURE 9 is a section, on a smaller scale, of the part of the machine which positions and folds flat reinforcing elements,

FIGURE 9bis is a perspective view illustrating the manner in which the reinforcing elements are folded in FIGURE 9,

FIGURE 10 is a further section of the part of the machine illustrated in FIGURE 9, the sections of FIGURES 9 and 10 being at right angles to one another,

FIGURE 11 is a front view of a gripper for entraining a strapping element,

FIGURE 12 is a plan view of the gripper of FIGURE 11,

FIGURE 13 is a diagrammatic side view of a modified form of the part of the packing machine which folds the reinforcing elements,

FIGURE 13bis is a perspective view illustrating the manner in which the reinforcing elements are severed and folded in the arrangement of FIGURE 13,

FIGURE 14 is a side view illustrating a modified disposition for the endless chain of the machine,

FIGURE 15 illustrates a modified form of the part of the machine illustrated in FIGURE 3,

FIGURE 16 is a plan view of the machine part of FIGURE 15,

FIGURE 17 is a diagrammatic view, on a smaller scale, illustrating a further modified disposition of the endless chain of the machine,

FIGURE 18 shows the chain of FIGURE 17 in a different operative position,

FIGURE 19 is a cross section, on a smaller scale, of a further modified form of the part of the machine which positions and folds the flat reinforcing elements,

FIGURE 20 is a plan view on the line *i–j* of FIGURE 19,

FIGURE 21 is a plan view on the line *k–l* of FIGURE 19,

FIGURE 22 is a diagrammatic view, on a smaller scale, showing a further modified disposition and construction for the endless chain, and

FIGURE 23 is a perspective view of the embodiment of FIGURES 15 and 16 and illustrates the manner in which the casings are adjustable.

The semi-automatic packing machine illustrated has a frame which includes a table **1** on which are mounted horizontal supporting rollers **2** which rotate freely to facilitate the advance through the machine of a pack P which is being formed.

A fixed casing **3** arranged at one edge of the table **1** and about halfway along the table forms a box within which a stack of flat reinforcing elements **4**, which are made for example of corrugated cardboard, are disposed.

The casing **3** has thereabove an upper casing **5** (FIGURE 6) supported by and vetrically displaceable on a plate **6** (FIGURE 4) mounted on the casing **3** and extending upwardly therefrom. Studs **141** fast with the casing **5** extend through slots **6^1** of the plate **6** to permit vertical sliding movement of the casing **5** which can be fixed in position by means of nuts. The upper casing **5** contains flat reinforcing elements **4^1** which are intended to be provided on the upper edges of the pack P. The disposition of the elements **4** and **4^1** on the pack P is illustrated in FIGURE 1.

Beneath the superposed casings **3** and **5**, there is fixed a guideway **7** having a longitudinal slot **7^1** at the top thereof. This guideway **7**, because of its hollow cross-section, permits the guiding of rotatable wheels **8** (FIGURE 3) fixed to the base of a lower casing **9** which is intended to receive further flat reinforcing elements **4**, and which is displaceable transversely of the table **1** towards and away from the casing **3**. A further plate **6** secured to the lower casing **9** carries a vertically displaceable upper casing **10**.

From the above description it will be appreciated that the casings **9** and **10** slide transversely on the guideway **7** to move towards or away from the casings **3** and **5** to adapt to the width of the pack P. Furthermore, as described, the upper casings **5** and **10** of the two assemblies are displaceable together vertically in order to correspond to the height of the pack P.

The transverse displacement control of the casings **9** and **10** is effected by a screw **11** (FIGURES 3 and 4) mounted in the guideway **7**. This screw is controlled by a hand wheel **12** and co-operates with a nut **13** fixed to the base of the lower casing **9**. It will be appreciated that rotation of the screw **11** effects the transverse displacement, in both directions, of the assembly of the casings **9** and **10** which are guided by the wheels **8**.

A transverse shaft **14** (FIGURES 3 and 4) is rotatably mounted in supports **15** which are carried by the upper casings **5** and **10**. The shaft **14** can be rotated by means of a hand wheel **16** and has fixed thereto worms **17** and **18** which mesh with worm wheels **19** and **20**. Vertical screws **21** and **22** rotatably mounted in supports **3^1**

and 9^1 fast with the lower casings 3 and 9 are rotated by the wheels 19 and 20 and co-operate with nuts 23 fixed to the upper casings 5 and 10. It will be understood that rotational motion of the transverse shaft 14 causes the vertical displacement of the casings 5 and 10 upwardly or downwardly. Of course, after adjustment of the positions of the casings 5 and 10, locking in position is effected by the nuts co-operating with the guiding studs in the slots 6^1.

In front of the casings 3, 5, 9 and 10 there is positioned a roller 24 which is adjustable vertically with the casings 5 and 10. The roller extends the entire width of the table 1 to bear on the upper face of the pack P. This roller 24 is mounted at one of its ends on a prolongation of the support 15 of the upper casing 5 while being guided at its other end by a vertical support 25 fixed to the table 1.

The displacement of the roller 24 vertically is effected at one side by the upper casing 5 and at the other side by the shaft 14 which carries a worm 26 at the end thereof. This worm 26 meshes with a worm wheel 27 fixed on a vertical screw 28 bearing on the vertical support 25. A nut 29 on the screw 28 supports the shaft of the roller 24 and thus permits its vertical displacement in combination with the displacement of the upper casings 5 and 10.

The roller 24 thus arranged is effective as a driving means for driving a pack through the machine and the roller 24 receives its drive from a motor (not shown) arranged below the table 1 via a vertical shaft 30 and bevel gearwheels 31.

It will be understood that the roller 24 can be made of rigid material or elastic material to permit flexible and progressive bearing contact against the pack P.

The assembly of casings 3, 5, 9 and 10 is supplemented by angle members 32 (FIGURES 2 and 3) fixed to the lower casings 3 and 9 so as to form a guide passage for the packs P.

The lower and upper casings have transverse slots F and F^1 therein (FIG. 6) respectively in order to permit the ejection of the lowest reinforcing element of each stack. This ejection is effected by blades 33 and 33^1 (FIGS. 2 and 8) which enter the slots F and F^1 and are pivotably mounted on vertical shafts 34, there being one shaft 34 for each pair of casings.

At their bases the shafts 34 (which may be coupled together or driven separately by motors M and any suitable transmission) are rotatably mounted on the lower casings 3 and 9 and are fast with the lower blades 33 which co-operate with the lower slots F to eject the lowest flat reinforcing elements 4 to a position beneath the lower face of the pack P (see FIG. 8). The upper blades 33^1 corresponding to the slots F^1 are splined to and slide on the shafts 34 to act in the same way as blades 33 to eject the upper flat reinforcing elements 4^1 to a position above the upper face of the pack P. Thus, the upper blades 33^1 are driven in rotation by shaft 34 to permit ejection of the upper reinforcing elements 4^1, but the blades 33^1 slide vertically on the shafts because blades are fixed with the upper casings 5 and 10 corresponding to the slots F^1 so that the blades are driven by the latter when vertically displaced.

After the flat reinforcing elements 4 and 4^1 are ejected from the stacks to the positions shown in FIGURE 8, they are bent at right angles so as to be carefully applied to the edges of the pack P. This operation, illustrated by the broken lines in FIGURE 8, is effected by means of cams 35 fixed to the ends of transverse shafts 36 and 36^1 which are rotatably mounted on the rear faces of the lower casings 3 and 9. These shafts 36 and 36^1 are rotated by the vertical shafts 34 via bevel gearwheel assemblies 37 and 38. One cam 35 is illustrated in FIGURE 5.

The upper casings 5 and 10, and also the lower casings 3 and 9 carry toothed wheels 40 for guiding an endless chain C (FIG. 6) along a rectangular path of travel corresponding to the periphery of the pack P. Below the lower casings 3 and 9 guide pulleys 41 co-operate with a weight 42 to form a means for compensating the useful length and the tension of the chain C to take into account the vertical and transverse adjustments of the casings 3, 5, 9 and 10. This arrangement enables the chain C to encircle the pack P whatever the size of the pack. The chain C is driven by a motor M^1 through any suitable clutch system.

The chain C has secured thereto a support 43 with a gripper 44 intended to grip the end of a wire L and to draw it along the path of travel of the chain C and consequently around the outside of the pack P. For this purpose, the metal wire L, or any other appropriate strapping element, is brought at the beginning of the strapping operation in accordance with the engagement point of the gripper 44 through the agency of independent-control driving wheels G.

The moving chain C engages by means of its gripper 44 the wire L which is thus carried along and encircles the pack P, resting on the flat reinforcing elements 4 and 4^1. When one end of the wire L arrives opposite the other end and the pack is encircled, the driving wheels G are stopped in any suitable manner well known in the art, e.g., mechanically or automatically while the chain C continues its travel so as to apply tension to the wire L and consequently tighten it around the pack P. The detail construction of the means for controlling the driving wheels G forms no part of the invention and is well understood by those skilled in the art. After tightening, the overlapping ends of the wire L are secured in a maner known per se as by welding, twisting, knotting or by any other means and the wire is thereafter cut.

The pack P is then displaced by the driving roller 24 onto the supporting rollers 2^1.

There is thus produced a pack having corner reinforcing elements on two sides of the pack and an encircling wire. The pack can then, if desired, be turned through 90° and refed through the machine to provide corner elements on four sides with two perpendicular reinforcing wires, as is shown in FIG. 1. In FIGURES 9 and 10 there is shown a modified device for ejecting and folding the reinforcing elements. The casings 45 and 46 which contain the reinforcing elements and which are arranged at one and the same side of the machine are offset transversely and the means for effecting transverse displacement of a pair of casings, and vertical displacement of the upper casing, are constructed as hereinbefore described.

In front of the casings 45 and 46, and at each side of the machine, a vertical shaft 47 is arranged which drives a bevel gearwheel 48 which co-operates with the wheel 49 arranged vertically and fixed to a shaft 50. This shaft has a toothed wheel 51 for driving an endless chain C arranged below the lower casing 45 and so guided by two wheels 52 and 53 as to provide a triangular path of travel with a rectilinear, horizontal run. The chain C^1 is also provided, at its outer side, with a projecting finger C^2 which engages in a corresponding slot 45^1 in the bottom of the casing 45 and acts on the lowest reinforcing element in the casing 45. This element is entrained by the chain and driven along the path between the wheels 52 and 53 while being guided at its outlet from the casing 45 by means of a profiled passage 54. The flat reinforcing element is displaced by the finger C^2 until over half of its extent is below the pack P and it is retained in this position by means of a flat spring 55 fixed to the casing 45.

The projecting portion of the flat reinforcing element is folded over by an offset finger 56 mounted at the end of a transverse shaft 57. The shaft 57 carries (and is driven via) a bevel gearwheel 58 which meshes with a gearwheel 59 fixed on the vertical shaft 47.

It will be understood that the ratio of the speeds of the gearwheels, combined with the circular motion of the finger **56**, is such that the advancing and positioning of the flat reinforcing element is carried out while the finger **56** performs its rotational movement below the flat reinforcing element, and such that the folding operation is carried out by the finger **56** during the return motion of the finger C^2 of the chain C^1.

The same construction is used for the upper casing **46** the lowest flat reinforcing element of which is ejected by a finger C^3 of a chain C^4 driven via a bevel gearwheel **60** mounted on the vertical shaft **47**.

A flat spring **61** fixed to the casing **46** ensures that the flat reinforcing element is held in position on the upper face of the pack P. The finger **62** is driven by a shaft **63** which itself is driven via a bevel gearwheel **64** co-operating with a gearwheel **65** fixed on the shaft **47**.

In FIGURE 14 there is illustrated a compensating device for the transverse endless chain. The endless chain C^5 is so guided by toothed wheels **68** fixed on the corresponding casings **45** and **46** as to follow a rectangular path of travel.

The upper run of the chain passes around guide pulleys **66** while the lower run of the chain C^5 passes around a guide pulley **67** and a return pulley **68** rotatably mounted on a nut **69**. The latter co-operates with the screwthread of a transverse screw **70** arranged below the guide screw **71** (previously referred to as screw **11**) and intended for the transverse displacement of two of the casings.

At one end thereof, the transverse screw **70** carries a gearwheel **72** which meshes with a wheel **73** fixed to the guide screw **71**. It will be understood that the rotation of the guide screw **71** results in rotation of the transverse screw **70** in the opposite direction. As a result, movement of one pair of casings towards the other to adapt to the width of the pack P causes the nut **69** to be displaced carrying with it the return pulley **68** so as to form a compensating means for the useful length of the chain C^5. Alternatively, an increase in the separation of the casings results in returning the mobile nut **69** in the opposite direction.

A regulatable counterweight **74** is mounted on the chain C^5 by means of a pulley in order to permit variations in height due to the vertical displacements of the upper casing **46**.

In the device of FIGURE 13, the reinforcing elements are not flat, stacked elements but are drawn from a reel and cut to size. Thus the casings for the flat reinforcing elements are replaced by corrugated cardboard reels or reels of any other suitable material. The spindles of these reels are, of course, capable of vertical displacement and transverse displacement in the same manner as the casing they replace. Thus, for example, the spindles of the reels can be secured to the nuts **23** of the embodiment shown in FIGS. 2–8 to undergo vertical displacement while the spindle of the reel associated with casing **9** is connected to plate **6** for transverse displacement.

The strip unwound from each reel passes between two wheels **75**, one of which is driven by means of a transmission chain **76** which itself is driven via a vertical shaft **77** and bevel gearwheels **78**. A cutting bar **79** is situated opposite fixed counter-blades **80** and **81** arranged at each side of the strip at the outlet side of the wheels **75** and is driven in rotational movement by means of a transverse shaft **82** carrying a bevel gearwheel **83** co-operating with a gearwheel **84** fixed to the vertical shaft **77**. The cutting bar, **79**, is mounted at the end of the shaft **82** so as to be driven by the latter such as to move in a circle facing the fixed counterblades **80** and **81**. The cutting bar **79** is shaped as regards its thickness to permit, after the cutting of the desired length of strip material, the folding of the flat reinforcing element to a right-angled form.

Turning now to FIGURES 11 and 12, the form of gripper illustrated for clamping and carrying along the strapping wire is in the form of a flat member **85** having a recess in which a clamping lever **86** is pivotably mounted and subjected to the restoring force of a coil spring **87**. This lever **86** forms a cam at its eccentric end to ensure the clamping of the wire L maintained by the bearing face 85^1 of the member. A nose 85^2 formed at one of the ends of the bearing face 85^1 ensures the guiding of the wire L while preventing its disengagement whatever the position of the gripper.

The supporting rollers **2** for the pack P can be utilized as driving rollers with any timing device permitting controlled and precise advancing movements of the said pack P. Moreover, the various mechanisms of the machine can be controlled by any compressed-air or hydraulic device.

In FIGURES 15 and 16 there is illustrated a modified form of construction for guiding and vertically adjusting the upper casings of the machine of FIGURE 2. The upper casings **88** and **89** are supported vertically by columns **90** arranged in pairs at the sides of the machine. These columns **90** slide in bearings **91** secured in uprights **92** which are fixed to the frame of the machine. At their upper ends, the columns **90** are connected transversely by straps **93** constituting guideways for wheels **94** carried by the transversely displaceable upper casing (see FIG. 23).

At their lower ends, the columns **90** are connected by members **95** to constitute a parallelepipedic assembly adapted for vertical sliding movement.

Along their lateral sides, the members **95** carry support plates **96** having at their central portions nuts **97** for co-operating with vertical screws **98**. Bevel gearwheels **99** mounted at the lower ends of the screws **98** co-operate with wheels **100** fixed to a transverse shaft **101**. This shaft is driven either manually or mechanically.

It will be understood that the driving of the transverse shaft **101** causes the simultaneous rotational movement of the vertical screws **98** and consequently the vertical displacement of the support plates **96**. The columns **90** are thus displaced and the upper casings **88** and **89** are thus adjusted to the height of the pack.

The columns **90** freely guide lateral plates **102** through bearings **103** of which the columns **90** pass. The plates **102** are connected transversely by straps **104** which are adapted to bear on the pack P in order to keep it in position. The plates **102** are coupled to links **105** which are pivotably connected to pivoting levers **106**. These latter are fixed to a control shaft **107** rotatably mounted in bearings **108** fixed on the support plates **96**. The control shaft **107** has a lever **109** fast therewith which lever is driven by a hydraulic, pneumatic or other form of jack V.

It will be understood that the vertical displacement of the support plates **96** during the displacement of the upper casings **88** and **89** also causes the lateral plates **102**, and consequently the straps **104**, to be displaced to permit the passage of the pack P.

After positioning of the assembly, the jack V is actuated so that the straps **104** are displaced on the columns **90** to subject the pack P to pressure. Any of the previously described devices for folding the reinforcing elements on the packs can be employed in the arrangement shown in FIGS. 15 and 16.

Referring now to FIGURES 17 and 18, the endless chain C^6 shown therein is adapted to carry the strapping wire L about the pack P and thus has the same function as the chain C of FIGURE 6. The chain C^6 is guided at its lower portion by a set of pulleys to permit, inter alia, by means of successive changes of direction a vertical path comprised between two pulleys **110** and **111**.

The chain C^6 carries a gripper **112** for the entrainment of the wire L, and a finger **113** which co-operates with a dog 114^1 fast with a vertical slide **114** arranged adjacent the pulleys **110** and **111**. This slide **114** is

subject to the action of a coil spring **115** which urges the slide upwardly and the slide receives at its upper portion a gripper **116** which comes into the circuit of the wire L when the wire is entrained by the chain C^6. A wire twisting unit **117** (FIG. 18) is also arranged above the slide **114**.

In use, the gripper **112** entrains the wire L and carries the wire from a supply around a pack P. After encircling the pack the gripper **112** reaches the position shown in FIGURE 17. Subsequently, the projecting finger **113** co-operates with the dog 114^1 and causes the slide **114** to be urged downwardly to the position illustrated in FIGURE 18.

This lowering of the slide **114** causes the withdrawal of its gripper **116** so as to permit the passage past the gripper **116** of the gripper **112**.

As the wire L passes the griper **116** it is engaged by the gripper **116** and, after disengagement of the finger **113** from the dog 114^1, the vertical slide **114** is urged upwardly by the coil spring **115** to position the part of the wire L held by the gripper **116** adjacent gripper 117^1 of the twisting unit **117**. The wire supply is so arranged that the other end of the loop of wire which encircles the pack is already adjacent the unit **117**.

The wire L, which is immobilized and held by the gripper **116**, is then twisted. During this operation, the chain C^6 continues its travel and eventually the gripper **112** entrains the wire L once more and carries the wire about the pack P.

In FIGURES 19 to 21 there is illustrated a further modified form of automatic device for ejecting and folding flat reinforcing elements.

The casings **118** and **119** have at their front portion a vertical shaft **120** driven by an independent motor or by any other suitable means. This shaft **120** by means of toothed wheels **150** drives endless chains C^7 and C^8 which serve to eject flat reinforcing elements T and T^1 from the casings **118** and **119** respectively and position them along the corners of the pack P. Circular cams **121** and **122** are fixed to the shaft **120** and rollers carried by a pair of two-armed levers **123** and **124** bear on these cams.

The upper lever **123** is pivotally mounted on a pin **125** and carries at one end a transverse finger **126** which, before the folding of the element T, is disposed above the element T as indicated by broken lines.

It will be understood that the folding of the flat reinforcing element T is effected by the transverse finger **126** as the upper lever **123** is pivoted about the pin **125** by the cam **121**. The fold is applied exactly to the edge of the pack P, forming a neat angle along the entire length of the said flat reinforcing element T.

The lower lever **124** is pivotably mounted on a pin **127** and carries a roller **128** at one end.

A member **129** arranged below the pack P and fast with a plate **130** of the machine supports the flat reinforcing element T^2 after it has been positioned below the pack P. The member **129** is in two parts which are pivotally connected together, one part **131** constituting a flap which carries a shaped projection **132** for co-operating with the roller **128**.

It will be understood that swinging movement of the lower lever **124** causes, by means of shaped projection **132**, the upward displacement of the flap **131** and consequently the folding of the lower flat reinforcing element T^2.

The upper flat reinforcing element T is held against the pack P, during folding, by means of a bearing element **133** fast with the straps **104**.

A further form of device for compensating for the variations in the length of chain required to encircle the pack is illustrated in FIGURE 22. The automatic taking-up of the length of the chain C^9 which encircles the pack P in accordance with the changes in thickness of the pack P is effected automatically on the one hand by means of a transverse guide screw **134** driven synchronously with the screw controlling the transversely displaceable casings, as described hereinbefore, and on the other hand, in the vertical sense, by a guide pulley **135** fixed on the section members **95** connecting movable columns **136** supporting the casings **118** and **119**. According to this arrangement, the adjustment of the distance between the lower and upper runs of the chain to correspond with the thickness of the pack P is obtained directly by vertical displacement of the columns **136** together with the casings **118, 119** so as to make the member **95** move therewith and cause guide pulley **135** to be displaced and take up or pay out the chain such that the upper run C^{10} of the chain straddles the upper face of the pack P. The latter is firmly supported on the rollers of the machine.

It is proposed to provide the casings **118** and **119** with any mechanical means ensuring that they can be interchanged for replacement purposes.

It will be apparent that the various transmission chains can be replaced by belts.

Finally, it should also be noted that FIGURE 22 provides a tensioning device acting on the wire L after it is held by the gripper 117^1 of the twisting unit **117**. This device includes an electromagnet **137** acting by means of links **138** on a roller **139** which co-operates with a further roller **140** having an opposite direction of rotation with respect to the normal travel of the wire L when being wound about the pack P.

I claim:

1. A packing machine comprising:
   (a) a frame,
   (b) a first lower casing fixed to said frame and adapted for containing reinforcing elements,
   (c) a second lower casing adapted for containing reinforcing elements,
   (d) first and second upper casings adapted for containing reinforcing elements, the first and second upper casings being above the first and second lower casings respectively,
   (e) screw means for displacing the second lower casing together with the second upper casing towards and away from the first upper and lower casings,
   (f) means for synchronously displacing the upper casings vertically towards and away from the lower casings,
   (g) horizontal rollers for supporting a pack of material, the rollers being rotatably mounted on said frame,
   (h) a drive roller for contacting and displacing a pack of material across said horizontal rollers and between the first and second casings, the drive roller being rotatably carried by said upper casings and being vertically displaceable therewith,
   (i) means for ejecting reinforcing elements from the upper and lower casings towards a pack between the casings,
   (j) means for folding each ejected reinforcing element to a right angled form about an edge of the pack,
   (k) guide wheels carried by said casings,
   (l) an endless chain entrained around said guide wheels and having runs defining a loop the size of which varies with the relative positions of the casings and through which loop a succession of packs are propelled by said drive roller, the chain having runs in addition to the runs defining the loop, said chain being payed out from and taken up by the additional runs to compensate for variations in the length of the perimeter of the loop as a consequence of variations in the size of the loop,
   (m) means for driving said chain, and
   (n) means carried by the chain for engaging an elongated strapping element and for drawing the strapping element around said pack to form a tie around

the pack with said reinforcing elements between the strapping element and the pack.

2. A packing machine according to claim 1 comprising means defining a transverse guideway supported on the frame beneath the casings, said screw means including a screw mounted in said transverse guideway and having a handwheel thereon, and a nut secured to said second lower casing and engaging said screw, and wheels on said second lower casing running on said guideway.

3. A packing machine according to claim 1, wherein said means for displacing the upper casings comprises a transverse shaft including worms and a handwheel rigid therewith, vertical shafts including worm wheels meshing with said worms, bearings for said vertical shafts carried by the lower casings, and nuts fixed to the upper casings and through which nuts the vertical shafts pass.

4. A packing machine according to claim 1, wherein each casing has a slot at the bottom thereof, the means for ejecting reinforcing elements from the casings including rotatable shafts and blades mounted on said shafts for rotation therewith, said blades passing through said slots to engage and eject elements from the casings, the means for folding reinforcing elements including transverse shafts rotatably mounted on the lower casings and bevel gearing on the shafts which carry the blades for driving the transverse shaft, and cams on the transverse shafts which contact and fold the reinforcing elements about the edges of the pack.

5. A packing machine according to claim 1, wherein the means carried by the chain for entraining an elongated strapping element comprises a base member having a bearing surface, a lever pivotably mounted on the base member and having a bearing surface, the pivotal mounting of the lever being about an eccentric point of the lever, spring means acting on said lever to urge the bearing surface of the lever towards the bearing surface of said member to grip the strapping element therebetween, and a projecting nose at one end of the bearing surface of the member for guiding and holding the strapping element.

6. A packing machine according to claim 1, and further comprising means guiding said chain to form a vertical run, a slide arranged adjacent said vertical run, a restoring spring acting on said slide, said gripper at one end of said slide for gripping the strapping element, and a finger carried by said chain for periodically displacing said slide against the action of said spring.

7. A packing machine according to claim 1, wherein the means for ejecting reinforcing elements comprises vertical shafts, toothed wheels driven by said shafts, endless chains driven by said wheels and each having a horizontal run beneath the associated casing, and a finger carried by each chain for engaging and ejecting a reinforcing element, the means for folding the ejected elements comprising pivotably mounted two-armed levers, cams driven by the vertical shafts and co-operating with one arm of each two-armed lever to pivot each lever, and the other arm of each lever including a folding element for folding said reinforcing elements about the pack.

8. A packing machine according to claim 1, wherein the means for folding the reinforcing elements comprises upper and lower two-armed levers each including a folding element, said folding element of the lower lever including a roller, and a moveable flap partially defining a channel and wherein the said roller acts on said flap which supports the lower reinforcing element after ejection from its casing to bring the flap to a position substantially at right angles to the remainder of the channel and produce the folded reinforcing element.

9. A packing machine comprising:

(a) a frame,

(b) means for propelling packs through the machine,

(c) reels forming a supply of reinforcing element material,

(d) vertical shafts,

(e) wheels driven from said vertical shafts for gripping and unwinding reinforcing element material from said reels,

(f) cutting and folding bars driven by said vertical shafts for cutting unwound reinforcing material into lengths and folding the same about the edge of a pack,

(g) guide wheels,

(h) an endless chain entrained around the guide wheels and having runs defining a loop of variable size through which loop a succession of packs are propelled, the chain having runs in addition to those defining the loop and chain being payed out and taken up from these additional runs to compensate for variations in the length of the perimeter of the loop consequent on variations in the size of the loop,

(i) means for driving the chain, and

(j) means carried by the chain for entraining an elongated strapping element and for drawing the strapping element around said pack to form a tie around the pack with said reinforcing elements between the strapping element and the pack.

10. A packing machine comprising,

(a) a frame,

(b) means for containing a first lower supply of reinforcing material,

(c) means for containing a second lower supply of reinforcing material,

(d) means for containing first and second upper supplies of reinforcing material, the means for containing the first and second upper supplies being above the means for containing the first and second lower supplies respectively,

(e) means for displacing the means containing the second lower supply together with the means containing the second upper supply towards and away from the means containing the first upper and lower supplies,

(f) means for simultaneously displacing the means containing the upper supplies up and down with respect respect to the means containing the lower supplies,

(g) means for propelling a series of packs between the means containing the first supplies and the means containing the second supplies,

(i) means for feeding reinforcing material from the means containing the supplies towards a pack between the means containing the first and second supplies,

(j) means for folding reinforcing material about the edges of the pack,

(k) an endless chain having runs defining a loop of variable size through which loop a succession of packs are propelled by the propelling means,

(l) means for driving the chain, and

(m) means carried by the chain for entraining an elongated strapping element and for drawing the strapping element around said pack to form a tie around the pack with the reinforcing material between the strapping element and the pack.

11. A packing machine according to claim 1, comprising a loaded pulley around which said chain passes for applying tension to the chain, and wherein the means for engaging and drawing an elongated strapping element comprises gripping means on the chain for engaging the strapping element, and guide wheels guiding the strapping element to the location at which it is engaged by said gripper.

12. A packing machine according to claim 1, wherein the means for ejecting the reinforcing elements from the casings comprises vertical drive shafts, gear wheel assemblies on said shafts, endless chains engaging the latter gear wheel assemblies for being driven thereby, each chain having a rectilinear run beneath the associated casing and including a finger for engaging a reinforcing element and ejecting the same from the casing, the means for folding the reinforcing elements comprising shafts driven by

said vertical shafts, and fingers mounted on the latter driven shafts for engaging and folding the reinforcing elements, and leaf springs holding said reinforcing elements which are ejected from the upper casings against the upper part of the casing.

13. A packing machine according to claim **1**, comprising a guide pulley, said endless chain being passed around said guide pulley, a nut on which is mounted said guide pulley, a screw passing through said nut and coupled to the screw means which serves to displace the second casings.

14. A packing machine according to claim **1**, wherein the means for folding the reinforcing elements comprises upper and lower two-armed levers each including a folding element and wherein the folding element of the upper lever includes a transverse finger.

15. A packing machine according to claim **1**, comprising a guide pulley, said endless chain being passed around said guide pulley, a nut on which is mounted said guide pulley, a screw passing through said nut and coupled to the screw means which serves to displace the second casings, and a further guide pulley which is vertically displaced with the upper casings, the endless chain being also passed around said further guide pulley.

16. A packing machine comprising a frame, a first lower casing fixed to said frame and adapted for containing reinforcing elements, a second lower casing adapted for containing reinforcing elements, first and second upper casings adapted for containing reinforcing elements, the first and second upper casings being above the first and second lower casings respectively, screw means for displacing the second lower casing together with the second upper casing towards and away from the first upper and lower casings, means for synchronously displacing the upper casings vertically towards and away from the lower casings, horizontal rollers for supporting a pack of material, the rollers being rotatably mounted on said frame, means for ejecting reinforcing elements from the upper and lower casings towards a pack between the casings, means for folding each ejected reinforcing element to a

right angled form about an edge of the pack, guide wheels carried by said casings, an endless chain entrained around said guide wheels and having runs defining a loop the size of which varies with the relative positions of the casings and through which loop a succession of packs are propelled, the chain having runs in addition to the runs defining the loop, said chain being payed out from and taken up by the additional runs to compensate for variations in the length of the perimeter of the loop as a consequence of variations in the size of the loop, means for driving said chain, and means carried by the chain for engaging an elongated strapping element and for drawing the strapping element around said pack to form a tie around the pack with said reinforcing elements between the strapping element and the pack, said machine further comprising vertical columns between which the pack is driven, cross members connecting the upper ends of the columns and forming guides for the second upper casing, support plates connecting the bottoms of the columns, a nut fixed to each support plate, a screw passing through each nut, means for rotating said screws to displace said support plates and the columns vertically, lateral plates freely slidable on said columns, a rotatable shaft mounted on said support plates, links secured with the shaft and connecting the shaft to said lateral plates, a jack connected to said shaft for rotating the shaft and drawing said links and the lateral plates downwardly, and struts connecting the lateral plates and bearing on a pack when the lateral plates are drawn downwardly.

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