United States Patent

Fabbri

[15] **3,662,513**

[45] **May 16, 1972**

[54] **METHOD AND APPARATUS FOR WRAPPING ARTICLES IN STRETCHABLE SHEET MATERIAL**

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[52] **U.S. Cl.**.....**53/33,** 53/34, 53/222, 53/226, 53/389

[51] **Int. Cl.**.....**B65b 11/54,** B65b 41/12, B65b 49/08

[58] **Field of Search**.....53/33, 34, 220–228, 53/230

[56] **References Cited**

UNITED STATES PATENTS

2,130,680	9/1938	Ferenci	53/231 X
2,627,709	2/1953	Schlicksupp	53/226 X
3,332,324	7/1967	Lehmacher et al.	53/28 X
2,553,871	5/1951	Sandberg	53/220

FOREIGN PATENTS OR APPLICATIONS

955,764	7/1949	France	53/220

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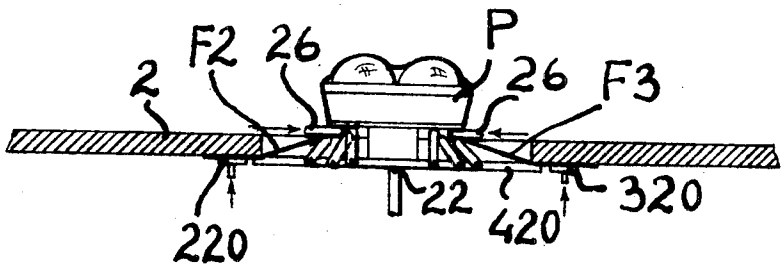
Assistant Examiner—Neil Abrams
Attorney—Richard Wiener

[57] **ABSTRACT**

A packaging machine for packaging items in stretchable foils of soft plastic material comprises a horizontal plate having an opening through which the items may pass, a mechanism for severing required lengths from a continuous foil web and placing a foil length below the said opening, a gripping device for holding opposed edges of the foil in a final position, a lifting table for pushing an item to be packaged upwards through the opening, a folding mechanism above the plate for folding the foil sheet edges under the item and a conveying device above the plate for pushing the packaged item off the plate.

22 Claims, 36 Drawing Figures



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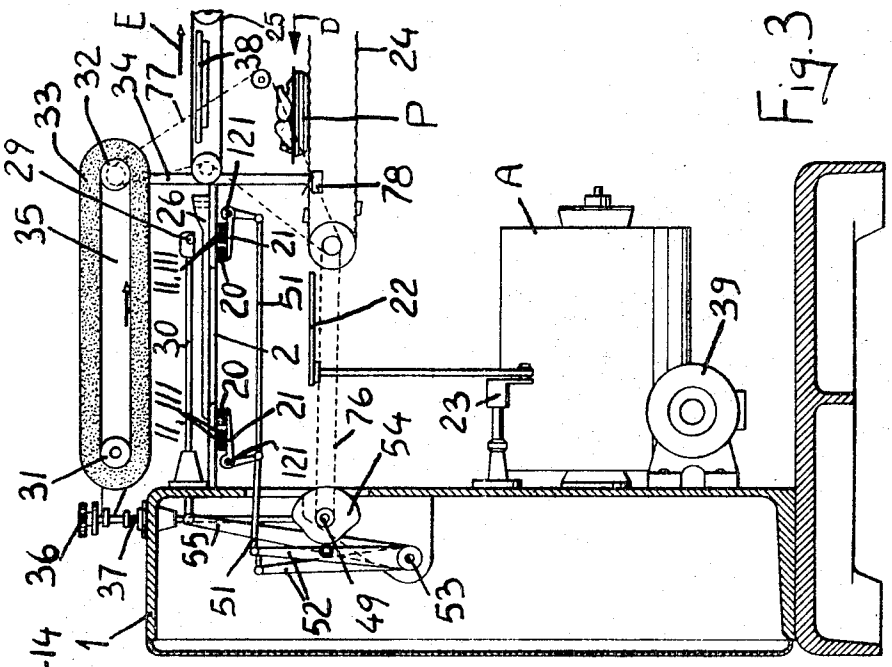

Fig. 3

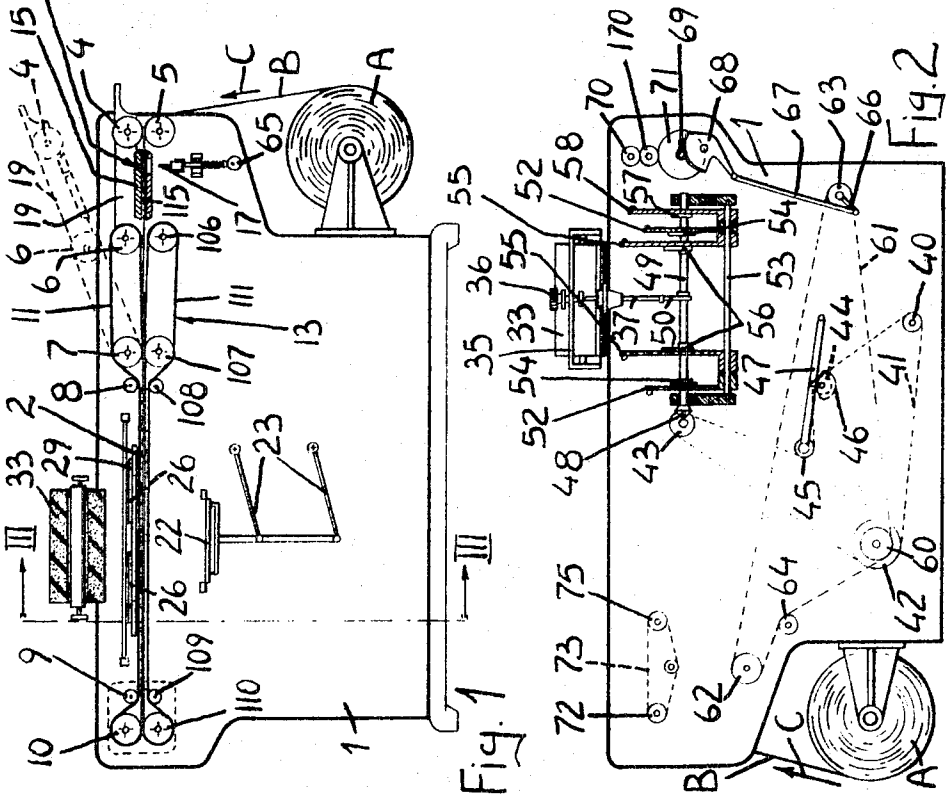

Fig. 2

Fig. 1

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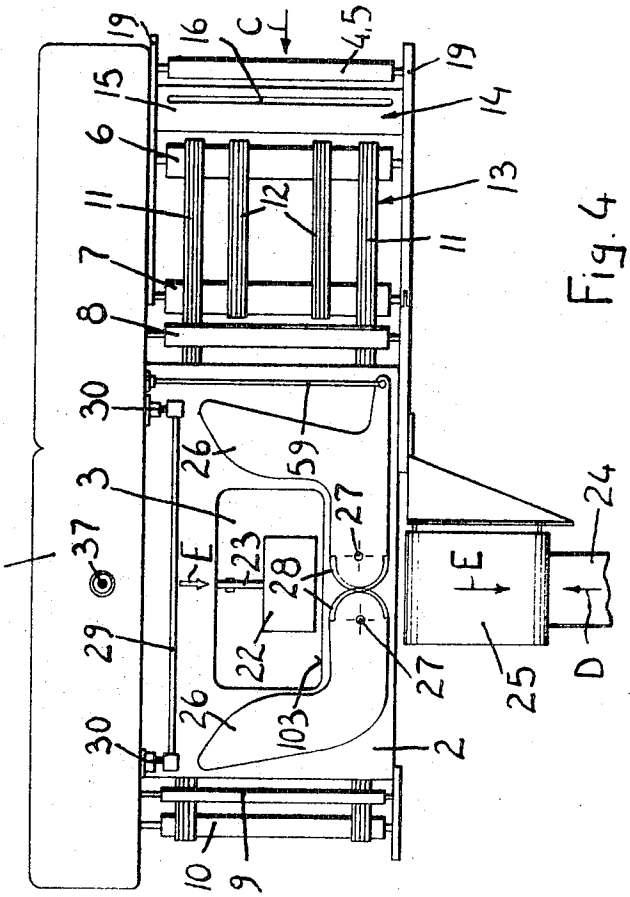

Fig. 4

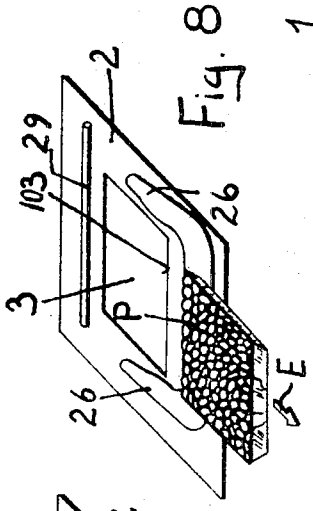

Fig. 8

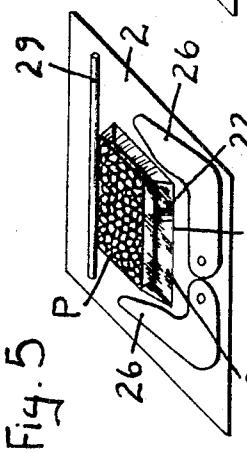

Fig. 5

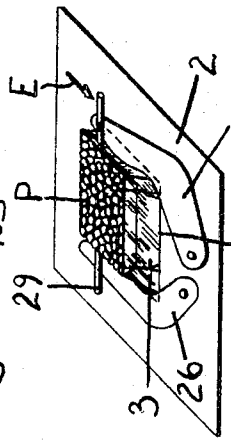

Fig. 6

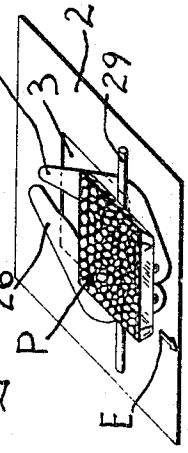

Fig. 7

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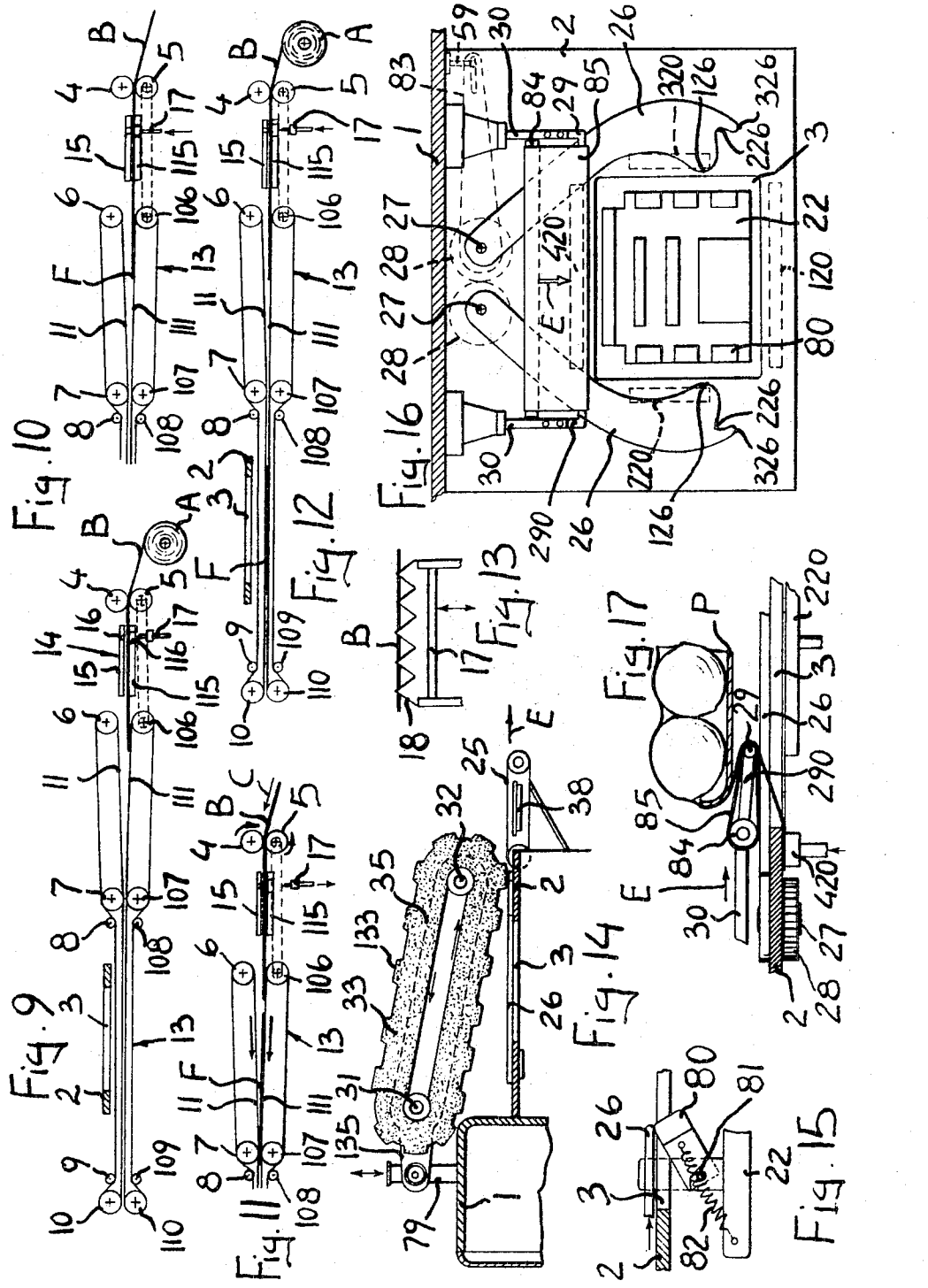

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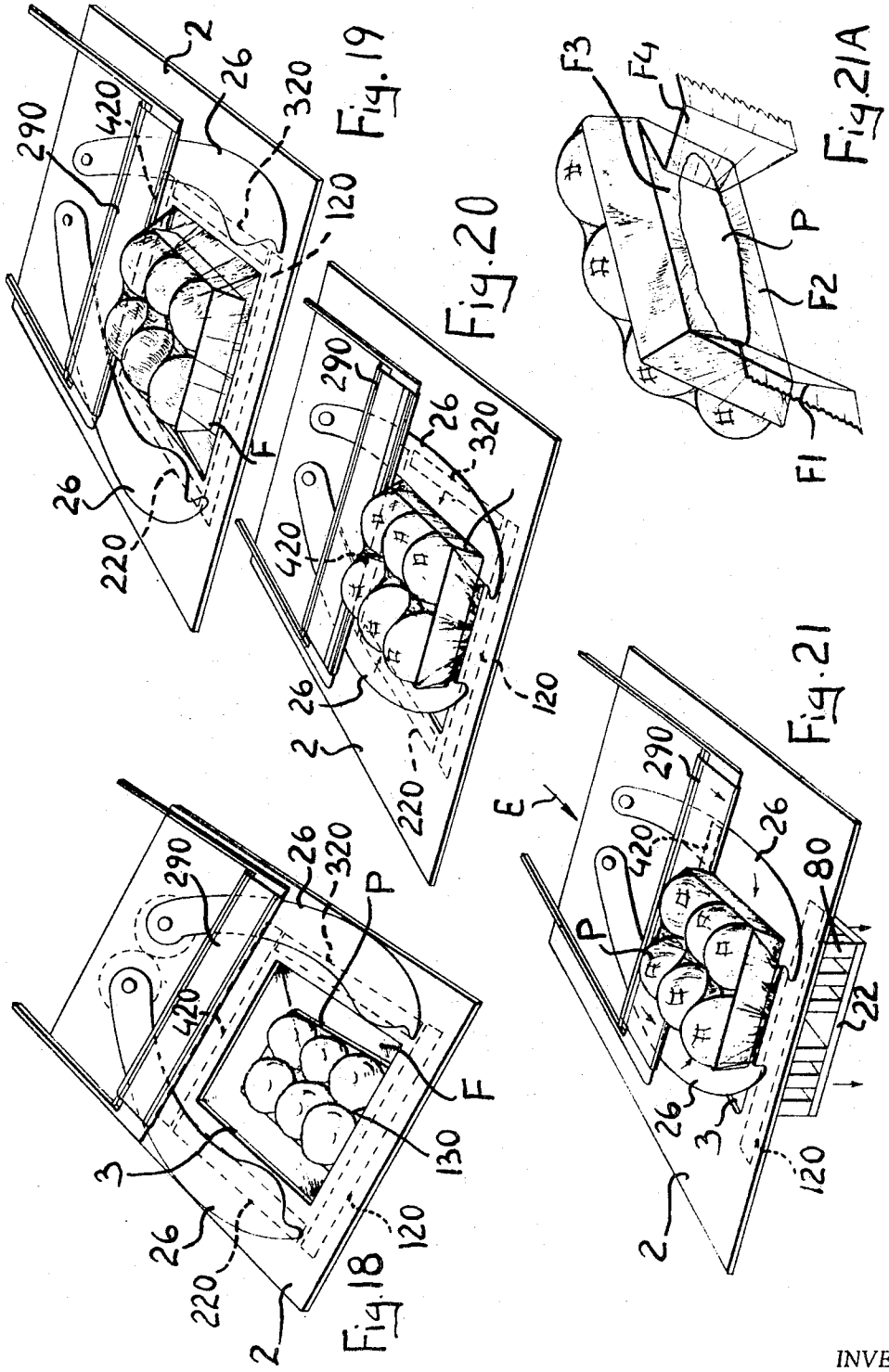

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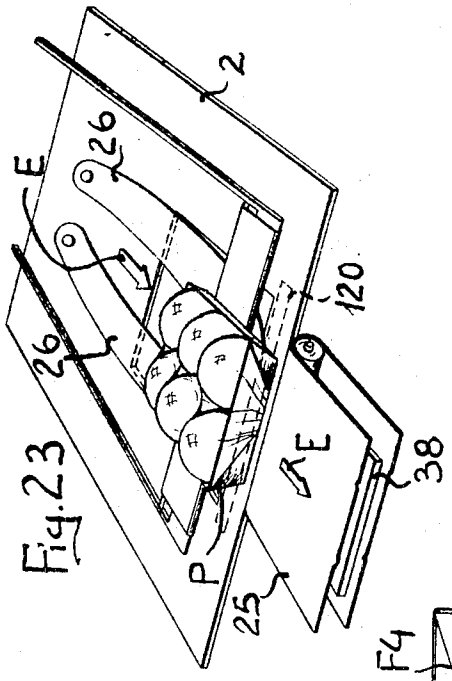


Fig. 23

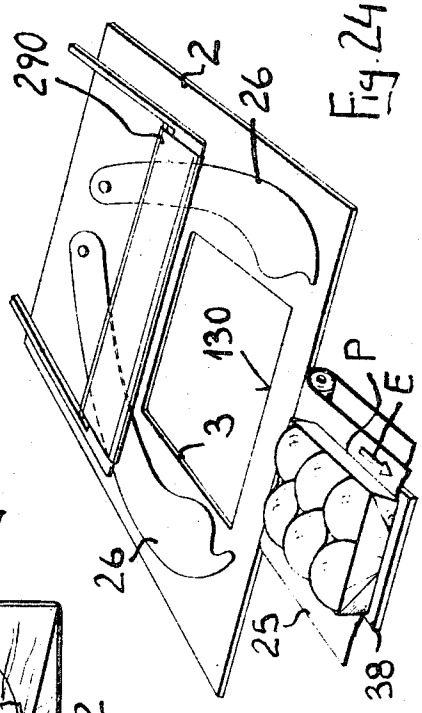
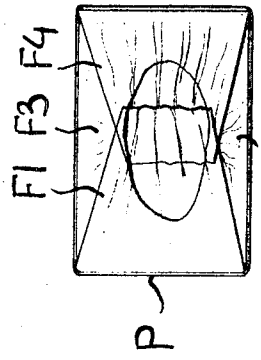


Fig. 24

Fig. 24A



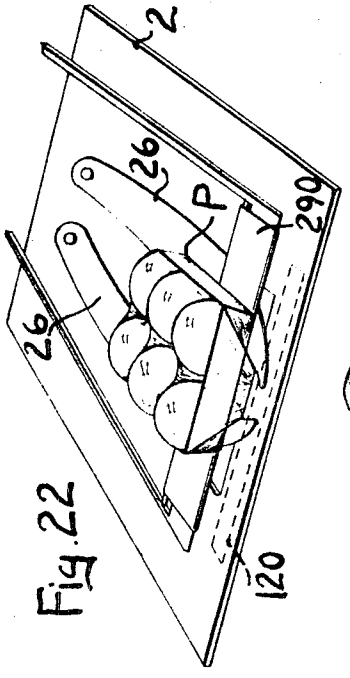


Fig. 22

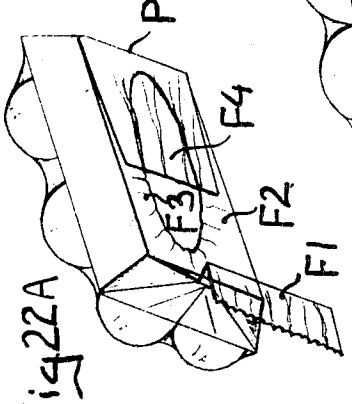


Fig. 22A

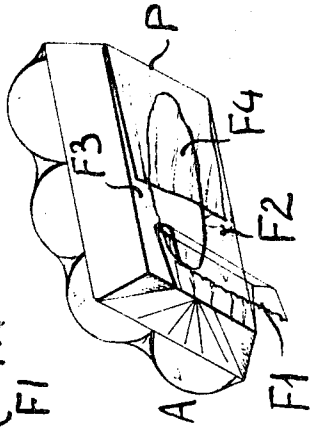


Fig. 23A

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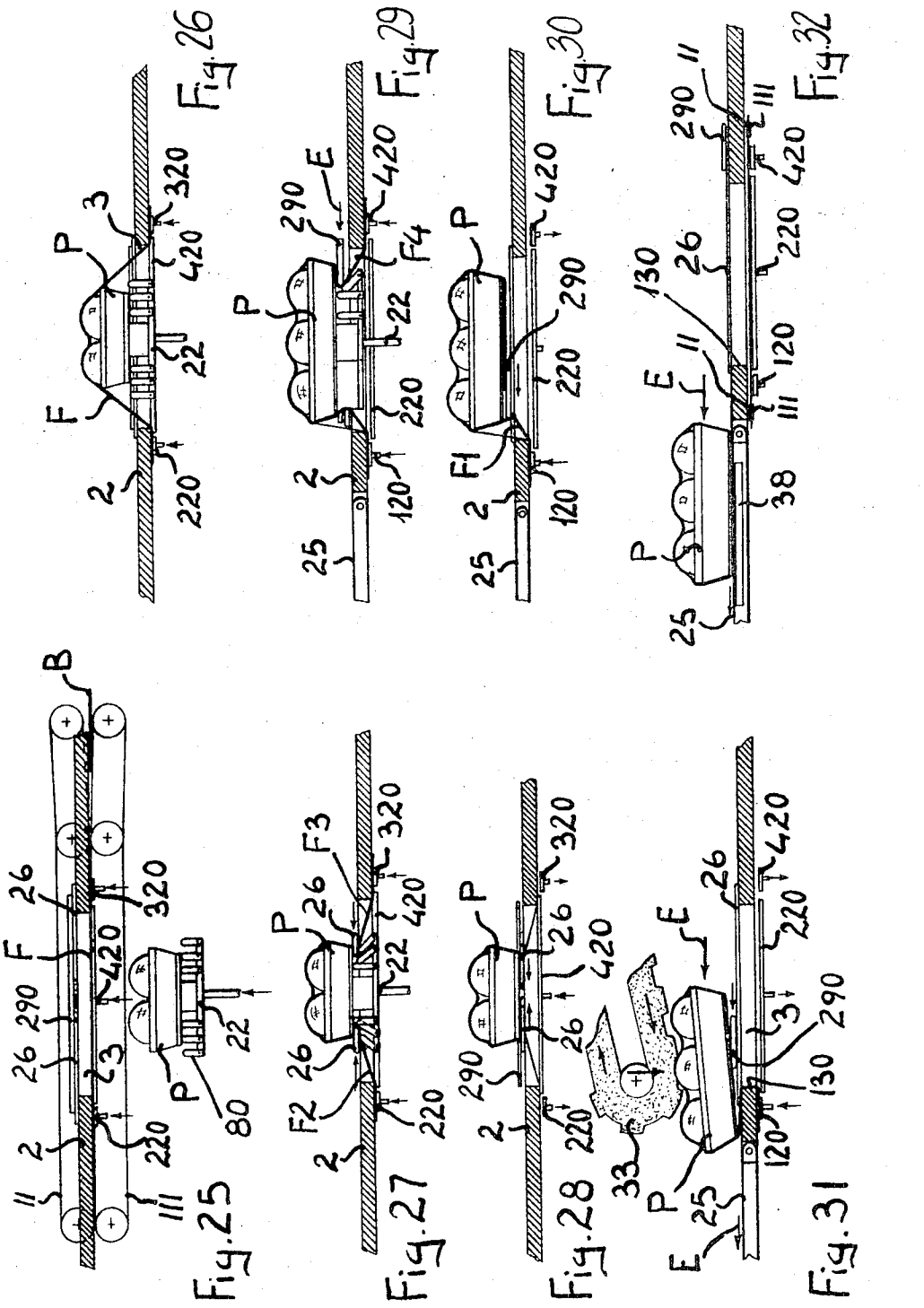

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METHOD AND APPARATUS FOR WRAPPING ARTICLES IN STRETCHABLE SHEET MATERIAL

BACKGROUND OF THE INVENTION

The invention relates to a process and a machine for the packaging of packaged goods in stretchable foils of soft plastic material.

The foils of stretchable plastic material known as "stretch films" are highly appropriate as packaging materials due to their high extensibility (up to more than 300 percent) and to their greater or lesser adhesivity, as well as to their deformability and their satisfactory adaptability to irregular shapes of the packaged items.

On the other hand, these foils have the disadvantage that, because of the said properties, i.e. owing to their softness, ductility, deformability, adhesivity and tendency to form folds, they are very difficult to handle and to process. The packaging of objects in conventional plastic foils raises major difficulties and the use of said foils of stretchable soft plastic raises even further difficulties. The wrapping of the packaged items in such stretchable foils of soft plastic is consequently mainly performed manually with consequent expense on time, labor and costs.

The object of the invention is to provide a process and a machine which render it possible for packaged items of the most varied and also irregular shape deviating considerably from the specified shape or size and laid on a carrying tray or the like, to be packaged mechanically or automatically in stretchable foils of soft plastic (stretch films) without any manual labor and also to secure a foil envelope which is tightly stretched over the packaged item, fits tightly, is free of folds, and is stretched as uniformly as possible. At the same time, the foil should be treated in the most careful manner, without incurring the risk of tearing or the like.

SUMMARY

According to the invention, this problem is resolved by virtue of the fact that a foil sheet intended to form the packaging envelope and severed from a continuous foil web is set up in stretched condition under a folding matrix plate comprising a passage opening corresponding to the item to be packaged, and that the item to be packaged is then pushed vertically upwards from below through the passage opening of the folding matrix plate while at least two opposed foil sheet edges are held firm so that the foil sheet is stretched thereby and forms an approximately bag-like envelope and is drawn over the item to be packaged. The foil sheet edges are then folded under the item to be packaged and pressed against its external base surface, after which the packaged item is pushed off the folding matrix plate parallel to its surface. In the case of packaged goods of approximately rectangular form in plan view, it is preferred that when the item to be packaged is held fast above the folding matrix plate, the lateral edges extending approximately parallel to the direction of ejection of the packaged item and the transverse edge of the foil sheet which is the trailing edge in this direction of ejection, are folded under first, after which the transverse edge of the foil sheet which is the leading edge in the direction of ejection of the packaged item is folded under by the folding matrix plate by means of the front edge of the passage opening acting as a folding edge.

A particularly careful treatment of the stretchable foil of soft plastic may be accomplished in further development of the process, by virtue of the fact that the foil sheet is initially severed by perforation from the continuous foil web unreeled from a storage roll and is then torn off the foil web along the perforation by forcibly moving it forwards relative to the foil web.

The packaging machine according to the invention for the application of the process is characterized by a horizontal folding matrix plate comprising a passage opening of a shape corresponding to the plan view of the item to be packaged, a severing and conveying mechanism for the severing of a foil sheet from a continuous foil web unreeled from a storage roll and for positioning this foil sheet under the folding matrix plate in the area of the passage opening of the same, a gripping mechanism for retention of at least two opposed edges of the foil sheet, a lifting platform or stage situated below the folding matrix plate for reception of the item to be packaged and for pushing the latter in vertical direction upwards from below through the passage opening of the folding matrix plate, a folding mechanism arranged above the folding matrix plate for the folding of the foil sheet edges under the packaged item lifted by the lifting stage through the passage opening of the folding matrix plate, and a conveying device situated at a distance above the folding matrix plate for pushing the packaged item off the folding matrix plate parallel to the surface of the same.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a packaging machine according to the invention in vertical longitudinal section;

FIG. 2 shows a view of the rear side of the packaging machine according to FIG. 1, partially in section;

FIG. 3 shows a cross-section along the line III—III of FIG. 1, to enlarged scale;

FIG. 4 shows a plan view of the folding matrix plate of the packaging machine according to FIGS. 1 to 3, with the co-ordinated conveying and folding mechanisms for the foil sheet;

FIGS. 5 to 8 show several consecutive operating stages of the foil folding mechanism in simplified graphic illustration;

FIGS. 9 to 12 show several consecutive operating stages of the severing and conveying device for the foil sheet, in vertical and partially incomplete longitudinal section;

FIG. 13 shows the foil perforation tool in elevation;

FIG. 14 shows a modified form of embodiment of the conveying device arranged above the folding matrix plate and intended to push off the packaged item, in elevation and partly in section;

FIG. 15 shows a modified form of embodiment of the lifting stage for the packaged item, in partially broken off elevation;

FIG. 16 shows a plan view of the folding matrix plate of a modified form of embodiment of the packaging machine;

FIG. 17 shows a vertical cross-section through the displaceable folding bar of the form of embodiment according to FIG. 16;

FIGS. 18 to 24 show several consecutive operating stages of the packaging machine according to FIGS. 16 and 17 in simplified graphic illustration;

FIGS. 21A to 24A show the packed conditions of the packaged item corresponding to the operating stages according to FIGS. 21 to 24;

FIGS. 25 to 28 show several consecutive operating stages of the folding mechanism in vertical section extending transversely to the direction of ejection of the packaged item;

FIGS. 29 to 32 show several consecutive operating stages of the folding mechanism in vertical section extending along the direction of ejection of the packaged item.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The machine illustrated in FIGS. 1 to 13 is intended to pack items P to be packaged, of the most varied nature and size, in particular packaged items consisting of a carrying tray and one or more objects placed therein, e.g. fruit or the like, in foils of stretchable soft plastic. The packaging machine consists of a hollow pedestal frame 1 on which is fastened a bracket-like projecting and horizontal folding matrix plate 2. The folding matrix plate 2 has a passage opening 3 which is shaped in accordance with the plan view of the packaged item P and is so dimensioned that the packaged item P can pass through without fouling. In the example of embodiment illustrated, the packaged item P has a rectangular carrying tray so that the passage opening 3 of the folding matrix plate 2 is also rectangular.

The foil sheet F in which the packaged item P is to be wrapped, is severed from a continuous foil web B of stretchable soft plastic. The foil web B is reeled off a storage roll A by means of an intermittently drivable pair of drawing rollers **4, 5**. Following the pair of drawing rollers **4, 5** is a horizontal conveying path **13** which extends close under the folding matrix plate **2** and consists of an upper pair of endless belts **11** carried by deflecting and guiding rollers **6, 7, 8, 10** and by a co-operating pair of endless belts **111** carried by deflecting and guiding rollers **106, 107, 108, 110**. Another endless upper pair of belts **12** and a lower co-operating pair of endless belts which is not apparent in the Figures, are laid around the two corresponding deflecting and guiding rollers **6, 7** and **106, 107** at the intake end of the conveying path **13**. The deflecting rollers **6, 106** at the intake end of the conveying path **13** are arranged at a greater distance from each other than the following guiding rollers **7, 107** so that the pairs of belts **11, 111** situated one above the other diverge in V-shape in the direction towards the intake end of the conveying path **13**. The actual point of action of the conveying path **13**, i.e. the point at which a foil running into the conveying path **13** is grasped by the pairs of belts **11, 111**, is situated approximately in the area of the guiding rollers **7, 107**. The pairs of belts **11, 111** arranged one above the other thereafter remain in engagement with each other under light contact pressure up to the other pair **10, 110** of deflecting rollers and in doing so run past as close as possible to the underside of the folding matrix plate **2**.

Between the pair of drawing rollers **4, 5** and the conveying path **13** is situated a perforating device **14** for the foil web B. This device consists of two contact thrust plates **15, 115** arranged one above the other and displaceable towards and away from each other, the foil web B running through between these. The contact thrust plates **15, 115** each have a slot extending transversely to the foil web B or a corresponding row of drillings **16** and **116**, as apparent in particular from FIGS. **4** and **9**. A perforating tool **17** displaceable in a vertical direction towards and away from the foil web B, preferably consists of an electric incandescent wire **18** bent to undulant or zigzag shape. The wire **18** extends transversely to the foil web B, as shown in FIG. **13** and can pass through these slots or rows of drillings **16, 116**. The upper drawing roller **4** and the upper contact thrust plate **15** of the perforating device **14** as well as the upper deflecting roller **6** at the intake end of the conveying path **13**, are fitted on a carrying frame **19** which is upwardly pivotable around the axis of rotation of the upper guiding roller **7**, to provide access to the lower elements **5, 115, 106** as illustrated in FIG. **1** in particular.

The distance between the perforating tool **17** and the point of action of the pairs of belts **11, 111**, i.e. the pair of guiding rollers **7, 107**, is greater than the length of a foil sheet F to be severed from the foil web B and intended to wrap a packaged item P. Moreover, the belts **11, 111** of the conveying path **13** are driven at higher running speed than the pair of drawing rollers **4, 5**, that is in such manner that the following operation is the result, as illustrated in FIGS. **9** to **12** in particular.

At the beginning of each operation of the packaging machine, the foil web B passes through between the drawing rollers **4, 5** and the separated contact thrust plates **15, 115** of the perforating device **14** and is pulled off the storage roll A to a limited extent so that its leading extremity does not reach the point of action **7, 107** of the pairs of belts **11, 111** of the conveying path **13**, as illustrated in FIG. **9** in particular. The leading portion of the foil web B extending rearwards up to the perforating tool **17** corresponds to the foil sheet F to be severed from the foil web, which is to be employed as a packaging wrapper for the packaged item P. In this position, the contact thrust plates **15, 115** are thrust against each other and the perforating tool **17** is lifted so far that the upwardly projecting tips of the electric incandescent wire **18** pass through the transverse slot **116** of the lower contact thrust plate **115** and partially also into the transverse slot **16** of the upper contact thrust plate **15** and correspondingly perforate the foil web B, as illustrated in FIGS. **10** and **13**. The contact thrust plates **15, 115** are then opened again and the perforating tool **17** is lowered, whereas the pair of drawing rollers **4, 5** and the pairs of belts **11, 111** are placed in motion in the direction of operation shown in FIG. **11**. The foil web B is consequently pulled off the storage roll A in the direction of the arrow C and runs on into the conveying path **13**, in which it initially lies free on the lower pair of belts **111** and does not as yet come into contact with the upper pair **11** of belts. Since the conveying path **13** is driven at higher speed than the pair of drawing rollers, the lower pair **111** of belts runs ahead of the foil web B and gently and carefully pulls the same in the lightly stretched and smoothly spread state into the conveying path **13**. When the leading extremity of the foil web B reaches the point of action **7, 107** of the two pairs of belts **11, 111** arranged one above the other, it is grasped by these and drawn forward at higher speed than the running speed of the pair of drawing rollers **4, 5**. As a result, the leading portion of the foil web B is torn off along the perforation, as illustrated in FIG. **11**. The separated foil sheet F is carried between and by the pairs **11, 111** of belts to below the folding matrix plate **2** and removed from the leading extremity of the foil web B. At the same time, the foil web B lying loose on the lower pair of belts is inserted further into the conveying path **13** by the pair of drawing rollers **4, 5**. When the foil sheet F is positioned precisely under the passage opening **3** of the folding matrix plate **2**, the foil web B has been run into the conveying path **13** so far that its leading portion extending rearwards up to the perforating tool **17** again corresponds to a foil sheet F intended to form a wrapper for a packaged item P. In this position illustrated in FIG. **12**, the pairs of belts **11, 111** and the pair of drawing rollers **4, 5** are switched off and the actual wrapping operation of the packaged item in the severed foil sheet F is initiated.

Under the folding matrix plate are situated two contact thrust bars **20** which extend along the intake direction of the foil sheet F and are situated on the corresponding opposed sides of the passage opening **3**. Each contact thrust bar **20** is fastened on an angled rocking lever **21** which is pivotally arranged around a pivot spindle **121** on the machine frame. Under the folding matrix plate **2** is moreover situated a lifting table or stage **22** which by means of parallel links **23** pivotally arranged on the machine pedestal **1** may be moved up and down through the passage opening **3** of the folding matrix plate **2**. In its lowered initial position illustrated in FIGS. **1** and **3**, the lifting stage **22** extends flush with a pair of conveyor chains **24** which runs transversely to the intake direction C of the foil sheet F and serves the purpose of intermittently feeding in the packaged items P. By contrast, in its raised position, the lifting stage **22** extends approximately flush with a conveyor belt **25** extending transversely to the intake direction C of the foil sheet F, which is situated above the pair of conveyor chains **24** and is intended to remove the ready wrapped packaged item P. The packaged items P which are to be wrapped are thus fed to the lowered lifting stage **22** in the direction of the arrow D by the pair of conveyor chains **24**, whereas the ready wrapped packaged items are pushed off on to the conveyor belt **25** in the direction of the arrow E and are removed in the same direction E.

Above the folding matrix plate **2** is situated a folding mechanism which comprises two flat angular folding levers **26** which are arranged to be swivelled on and parallel to the folding matrix plate **2** around vertical pivot pins **27**. The pivot pins **27** of these folding levers **26** are situated in the middle area of the leading transverse edge **103** of the passage opening **3** of the folding matrix plate **2**, meaning the leading edge in the direction of ejection E of the packaged item P. The folding levers **26** are coupled with each other at their extremities which face each other, e.g. by means of toothed sectors or gearwheels **28** that they are swung inwards i.e. closed at the same time in pincerlike manner above the passage opening **3** from an initial position situated outside the passage opening **3** of the folding matrix plate **2** and illustrated in FIGS. **4, 5** and **8**, and are then swung back to their initial position, i.e. opened.

Each folding lever **26** in the swung-out initial position has a branch extending approximately parallel to the leading edge **103** of the passage opening **3** of the folding matrix plate **2** and a following rearwardly angled branch extending approximately parallel to the lateral edge of the passage opening **3**, as illustrated in particular in FIG. **4**. Moreover, the folding mechanism has a folding bar **29** extending transversely to the direction of ejection E of the packaged item P and displaceable back and forth over the folding levers **26** and parallel to the folding matrix plate **2**. The bar **29** is formed as a round rod and is fastened on two holding rods **30** displaceably arranged on the machine pedestal **1**. The folding bar **29** may be displaced forward from an initial rear position set back outside the passage opening **3**, over the passage opening **3** and the folding levers **26** in forward direction (that is in the direction of ejection E of the packaged item P) up to the front edge **103** of the passage opening **3**, and back again.

At a distance above the folding mechanism **26**, **29** is arranged a conveyor belt **33**, which is continuous, tensioned on rollers **31**, **32** and extending in the direction of ejection E of the package item P and equipped with a thick padded coating of soft and elastically yielding material, being expanded rubber or the like. The carrying frame **35** of this conveyor **33** is pivotably arranged around the pivot spindle of the roller **32**, which is the leading roller in the direction of ejection E of the packaged item, on an auxiliary stand **34** of the machine frame. The opposite end of the frame **35** bears through a set screw **36** on a pushrod **37** which is displaceable up and down in the machine pedestal **1**. The conveyor belt **33** is drivable in the direction of ejection E of the packaged item P and serves the purpose of pushing the packaged items off the folding matrix plate **2** on to the output conveyor belt **25**.

The foil sheet F severed from the foil web B is conveyed beneath the passage opening **3** of the folding matrix plate **2** when the contact thrust bars **20** are lowered. When movement of the foil sheet F along the conveying path **13** is stopped, the contact thrust bars **20** are raised and press the two opposed edges of the foil sheet F firmly against the underside of the folding matrix plate **2** as illustrated in particular in FIG. **3**. During the severing and infeed of the foil sheet F, an item P to be packaged is pushed on to the lowered lifting stage **22** by the pair of conveyor chains **24**. The lifting stage **22** is then raised and pushes the item P which lies on it, upwards in vertical direction, through the passage opening **3** of the folding matrix plate **2**. The foil sheet F stretched below the passage opening **3** and still held fast at its edges by the contact thrust bars **20** is thereby stretched and pulled tightly over the item P to be packaged, as illustrated in FIG. **5**. When the lifting stage **22** reaches its final position raised above the folding matrix plate **2**, the upper conveyor belt **33** which is temporarily not driven and had been raised until then, is lowered so that it comes into contact with the item P to be packaged and exerts a gentle pressure on the same. The folding levers **26** which had been swung out in the initial open position until then, are then swung inwards in opposite directions over the passage opening **3**, i.e. closed. At approximately the same time, or preferably with a short delay after the beginning of the closing movement of the folding levers **26**, the contact thrust bars **20** are lowered and the corresponding edges of the foil sheet F are released. These edges of the foil sheet F are consequently folded under the packaged item P by the folding levers **26** and are simultaneously pressed against the underside of the packaged item P owing to the drawing action of these folding levers **26** to the pressure exerted by the padded upper conveyor belt **33**. The lifting stage **22** is lowered as soon as the folding levers **26** partly extend under the item P at the start of their closing movement and the levers **26** take over the support of the item P, as shown in FIG. **6**. During the further closing displacement of the folding levers **26**, the lifting stage does not therefore cause an obstruction to the folding of the edges of the foil sheet. To this end, the carrying surface of the lifting stage **22** may be smaller than the base area of the packaged item P, so that the latter projects beyond the edges of the lifting stage at least at the sides adjacent to the folding levers **26**, as is apparent from FIG. **4**. After the complete inward displacement of the folding levers **26**, the folding bar **29** which had until then been retracted to the initial position, is thrust forward in the direction of ejection E of the packaged item P, up to the front edge **103** of the passage opening **3** of the folding matrix plate **2**, as illustrated in FIG. **7**. This folds the corresponding trailing edge of the foil sheet F under the packaged item P and presses it against the underside of the latter. The padded upper conveyor belt **33** is then placed in motion, which pushes the packaged item P in the direction of the arrow E off the folding matrix plate **2** on to the output conveyor belt **25**, as shown in FIG. **8**. The leading edge of the foil sheet F is simultaneously folded under the packaged item P by the corresponding front edge **103** of the passage opening **3** of the folding matrix plate **2**, which edge acts as a folding edge. The folding levers **26**, the folding bar **29** and the padded upper conveyor belt **33** then return to their initial positions and the packaging machine is ready for the next operation.

It is also possible to delay the lowering and placing into contact with the packaged item P of the padded upper conveyor belt **33** until after the inward displacement of the folding levers **26** and the advance of the folding bar **29**. In this case, the folding of the lateral edges and of the rear edge of the foil sheet occurs without complementary contact pressure on the packaged item P, whereas the upper conveyor belt **33** merely serves the purpose of pushing off the packaged item P and of simultaneously folding the front foil sheet edge.

In the case of stretchable soft plastic foils which possess a higher degree of adhesivity, the folded edges of the foil sheet F stick to each other firmly enough as well as to the underside of the packaged item P, so that the pack needs no further processing. In the case of soft plastic foils having a lower degree of adhesivity when the simple bonding action appears to be inadequate for the stresses to be expected for the package, the portions of the foil sheet edges which overlap each other on the underside of the packaged item P may be welded to each other. To this end, a heating device **38** may be arranged, e.g. below the upper run of the output conveyor belt **25**, which briefly heats the underside of the packaged items P which slide past, and thereby weld the folded edges of the foil wrapper.

The specified displacements of the individual parts of the packaging machine may be obtained by means of suitable drive systems and control means, e.g. by means of an electric program control device, and adjusted to the required sequence and duration. In the example according to FIGS. **1** to **3**, the packaging machine has an electric motor **39** which drives a chain sprocket **40** through a reduction gear which is not illustrated. The chain sprocket **40** is in engagement with a driving chain **41** which runs over chain sprockets **42**, **43**, **44** as well as over a deflecting chain sprocket **44** arranged to run idle freely. The chain sprocket **44** is coupled with a cam plate **46** which by means of a rocking lever or the like **47** acting on the link **23** causes the reciprocating vertical displacement of the lifting stage **22**. The chain sprocket **43** is coupled to a cam shaft **49** through a pair of bevel gears **48**. On this shaft **49** is fastened a cam **50** which displaces the pushrod **37** for the upward and downward displacement of the padded upper conveyor belt **33**. The carrying levers **21** of the contact thrust bars **20** are each connected through an actuating rod **51** to a rocking lever **52** which is arranged in freely pivotable manner on a fixed spindle **53** and is actuated by means of a co-ordinated cam plate **54** fastened on the cam shaft **49**. The displaceable holding rods **30** of the folding bar **29** are articulated on the co-ordinated rocking levers **55**, which are equally arranged in freely pivotable manner on the spindle **49** and are actuated by means of appropriate cam plates **56** of the cam shaft **49**. Another rocking lever **58**, arranged on the spindle **53** and actuated by means of a co-ordinated cam plate **57** of the cam shaft **49**, is connected to one of the folding levers **26** through a pushrod **59** (FIG. **4**) and causes the swivelling displacement of the folding levers **26** which are coupled to each other by means of the gears or toothed sectors **28**.

The chain sprocket **42** may be coupled to a co-axial chain sprocket **60** by means of an electromagnetic clutch which is not illustrated. This chain sprocket **60** is in engagement with a driving chain **61** which runs over two other chain sprockets **62, 63** and a freely rotatable chain tensioner sprocket **64**. The chain sprocket **62** is connected to a cam plate **65** (FIG. **1**) which displaces the perforating tool **17**. The chain sprocket **63** drives a crank **66** however, which operates a rocking lever **68** formed as a toothed sector, by means of a connecting rod **67**. The two deflecting rollers **10, 110** of the pairs of belts **11, 111** at the exit end of the conveying path **13** are coupled to each other by means of gears **70, 170**. The one gear **170** is in engagement with a driving gear **71** which is coupled to a co-axial pinion **69** by means of a free-wheel coupling which is not illustrated. The pinion **69** is in engagement with the rocking toothed sector **68**.

The drive to the pair of drawing rollers **5, 4** is derived from the conveying path **13**. To this end, the shaft of the lower drawing roller **5** has fastened on it a chain sprocket **72** which is connected through a driving chain **73** to a chain sprocket **74** fastened on the shaft of the lower deflecting roller **106** of the pairs of belts **111** at the entry side of the conveying path **13**. The upper drawing roller **4** is coupled to the lower drawing roller **5** in manner which is not illustrated, e.g. by means of gear wheels. The pair of conveyor chains **24** for feeding the items P to be packaged is driven by the cam shaft **49** through a chain drive **76**. The drive to the padded upper conveyor belt **33** and of the conveyor belt **25** for removal of the packaged items is derived through a chain drive **77** from the lower pair of feed chains **24** by means of electromagnetic clutches which are not illustrated. Each operation of the packaging machine is initiated by means of an electric switch **78** which is actuated by the items P which are fed in.

In the modified form of embodiment illustrated in FIG. **14**, the carrying frame **35** of the padded upper output conveyor belt **33** has its rear extremity **135**, which is the rear extremity in the direction E of ejection of the packaged item, arranged to be freely pivotable and displaceable in vertical direction on an upper post **79** of the machine pedestal **1**. Consequently, in the idle position, the output conveyor belt **33** rests with its leading end on the folding matrix plate **2** below as illustrated in FIG. **14**. Upon raising the lifting stage **22**, the output conveyor belt **33** which is not driven as yet, is pressed upwards by the item to be packaged which has been pushed through the passage opening **3** of the folding matrix plate **2** and its weight bears during the folding operation on the packaged item. After the folding of the lateral edges and of the rear edge of the foil wrapper, the conveyor belt **3** is placed in motion and pushes the packaged item off the folding matrix plate **2** in the direction of the arrow E on to the subsequent output conveyor belt **25**. This arrangement has the advantage that the padded upper ejecting conveyor belt **33** has its position adapted automatically to the different heights of the items P to be packaged and need not be adjusted especially. Moreover, the foam rubber padding of the ejecting conveyor belt **33** is equipped with projecting entraining cogs **133** which assure a safe and simultaneously careful ejection of the packaged items.

In the embodiment according to FIG. **15**, the lifting stage **22** is equipped on its upper side with upwardly projecting supporting webs or supporting fingers **80** for the item to be packaged, which may be deflected around a lower tilting pin **81** against the erecting action of a co-ordinated spring **82**. In this embodiment, only the supporting webs **80** with the item to be packaged resting on the same, which webs project upwards in the idle position, pass through the passage opening **3** of the folding matrix plate **2**, whereas the actual lifting stage **22** remains under the folding matrix plate **2** in the raised position, as shown by partially dotted lines in FIG. **15**. During the folding operation, i.e. during inward pivoting of the folding levers **26** and advance of the folding bars **29**, the supporting webs **80** are resiliently tipped over by the folding levers **26** and the folding bar **29** in the direction of movement i.e. in the folding direction of the corresponding edges of the foil sheet, as illustrated in solid lines in FIG. **15**. This arrangement ensures trouble free insertion of the folding levers **26** and of the folding bar **29** and of the corresponding edges of the foil sheet to be folded under the packaged item P. Moreover, it is possible to employ the same lifting stage **22** for items P which have a base or support area differing in size. The mode of operation of the tiltable supporting fingers **80** is apparent from FIGS. **25** to **29**.

In the example of FIGS. **16** to **32**, the pivot pins **27** of the two pincer-like folding levers **26** are arranged in the middle area of the edge of the passage opening **3** of the folding matrix plate **2**, which edge is the trailing edge in the direction of ejection E of the packaged item P. The folding levers **26** which are coupled to each other by the gear wheels **28**, extend forward in approximate V-shape in the direction of ejection E of the packaged item P, as illustrated in FIG. **16**, when in their outwardly pivoted initial position. Each folding lever **26**, on its front free-standing extremity, has a folding cam **126** which is preferably rounded off and projects towards the passage opening **3** of the folding matrix plate **2**, as well as a folding finger **326** projecting towards the front and separated from this cam by an indentation **226**. The actuation of the folding levers **26** is performed by the previously described pushrod **59** through a rocking lever **83** connected to a gear wheel **28** for rotation therewith.

The displaceable folding bar marked **290** consists, in this case, of a front transverse rod **29** having a round profile and fastened on the securing rods **30**, and of a deflecting roller **84** which is parallel to the rod **29** but arranged further back on the securing rods **30** in freely rotatable manner, as illustrated in FIG. **17**. An endless tensioned Teflon belt **85** runs freely around the front transverse rod **29** and the rear deflecting roller **84**. The deflecting roller **84** has a greater diameter than the front transverse rod **29**, so that the Teflon belt **85** assumes a wedge-like profile in cross-section. This embodiment has the advantage that no friction intervenes between the foil and the folding bar during advance of the folding bar **290** and during the folding of the corresponding rear edge of the foil wrapper, since the Teflon belt revolves according to the feed motion of the folding bar **290** and rolls along the foil.

In the example of embodiment according to FIGS. **16** to **32**, four contact thrust bars **120, 220, 320, 420**, each co-ordinated with one edge of the rectangular passage opening **3** of the folding matrix plate **2** and extending approximately parallel to the corresponding edges of the passage opening, are arranged moreover on the underside of the folding matrix plate **2**. These contact thrust bars **120, 220, 320, 420** are independent of each other in their vertically reciprocating displacements performed for example by means of separate cam plate driving systems of the kind described with reference to FIGS. **2** and **3**. Their displacements are matched to each other, and to the actuation of the folding levers **26**, of the folding bar **290** and of the ejection conveyor belt **33**, in such manner as to result in the following operation illustrated in FIGS. **18** to **32**.

After the foil sheet F severed from the foil web B is placed under the folding matrix **2** in the area of its passage opening **3**, all four thrust bars **120, 220, 320, 420** are raised at the same time and immobilize the corresponding edges F1, F2, F3, F4 of the foil sheet F on the underside of the folding matrix plate **2** (FIGS. **18** and **25**). The item P to be packaged is then pushed upwards vertically from below through the passage opening **3** of the folding matrix plate **2**, the foil sheet F still held fast by its four edges F1, F2, F3, F4 being stretched accordingly and forming a foil wrapper resembling a bag and drawn tightly over the packed item P (FIGS. **19** and **26**). The inward folding or closing displacement of the folding levers **26** is then initiated, the corresponding lateral edges F2, F3 of the foil sheet initially continuing to be held fast by the thrust bars **220, 320**. As a result, the foil sheet F is drawn and stretched over the packaged item P by means of the folding levers **26** in the closing direction of the latter (FIGS. **20** and **27**). It is only after this partial closing displacement of the folding levers **26** that the lateral thrust bars **220, 320** are lowered and the folding levers are swung inwards through another step. This completely folds the corresponding and now released lateral

edges F2, F3 of the foil sheet F and as a result of the tucking action the edges are pressed against the lower external side of the packaged item P (FIG. 28). The folding levers **26** are preferably not closed completely, but are swung in only up to a semi-open position, as illustrated in FIG. 21. In this position, the feed displacement of the folding bar **290** is initiated in the direction E of ejection of the packaged item P. To this end, the corresponding rear edge F4 of the foil sheet initially continues to be held fast by the thrust bar **420**, so that the foil sheet F is stretched over the packaged item P owing to the advancing displacement of the folding bar **290** (FIGS. 21, 21A and 29). After a partial feed displacement of the folding bar **290**, the rear contact thrust bar **420** is lowered and releases the corresponding rear edge F4 of the foil sheet F which is folded completely under the packaged item P by the continuing feed displacement of the folding bar **290** and is pressed against the external base surface of the same (FIGS. 22, 22A and 30). At the same time, the folding levers **26** are also closed completely, whilst the lifting stage **22** is being lowered. The padded upper conveyor belt **33** then comes into operation and pushes the packaged item P from the folding matrix plate **2** in the direction of the arrow E on to the adjacent output conveyor belt **25**. The front contact thrust bar **120** temporarily still remains in its raised contact position and holds the corresponding front edge F1 of the foil sheet F fast on the folding matrix plate 2 (FIGS. 23, 23A, 31). As a result, the foil sheet F is drawn and stretched over the packaged item P by the front edge **130** of the passage opening **30** of the folding matrix plate **2**, which edge acts as a folding edge. It is only after a partial displacement of the packaged item P in the direction E of ejection under the action of the ejecting conveyor belt **33** that the front thrust bar **120** is also lowered and releases the corresponding front edge F1 of the foil sheet F. The packaged item P is then pushed right off the folding matrix plate **2** and on to the output conveyor belt **25**, the front edge **130** of the passage opening **30** rearwardly folds the front edge F1 of the foil sheet F under the packaged item P and presses it against the base surface of the same (FIGS. 24, 24A and 32).

The invention is not limited to the details of the examples illustrated.

I claim:

1. Process for the packaging of items in stretchable foils of soft plastic material, comprising the steps of

a. severing a foil sheet from a continuous foil web;
b. placing the severed foil sheet under tension below a folding matrix plate having a passage opening therethrough corresponding to the item to be packaged;
c. elevating the item to be packaged vertically through the passage opening of the folding matrix plate while simultaneously holding fast at least two opposed edges of the foil sheet, the foil sheet thereby being stretched and drawn over the item to be packaged while forming a bag-like wrapper;
d. folding the edges of the foil sheet under the item to be packaged;
e. pressing said edges against the external base of said item; and
f. pushing the packaged item off the folding matrix plate parallel to the surface of the latter.

2. Process according to claim **1**, including the further steps of initially marking off the foil sheet intended to form the packaging wrapper by perforating the continuous foil web unreeled from a storage roll, and tearing off the foil sheet from the foil web along the perforation by forced movement relative to the web.

3. Process according to claim **23**, in particular for the packaging of items to be packaged which have an approximately rectangular shape in plan view, in which the edges of the foil sheet are held fast at opposite pairs of sides of the item to be packaged extending approximately parallel to the direction of ejection of the packaged item and approximately transversely to this direction, and are initially folded under the item at the sides parallel to the direction of ejection of the packaged item, then at the rear side and finally along the front side.

4. Process according to claim **1**, in which the immobilized edges of the foil sheet are not released until after partial folding under the item and stretching of the foil sheet over the item to be packaged.

5. Process according to claim **1**, in which the item to be packaged is pressed from above against the foil sheet edges at least during the ejection of the item from the folding matrix plate.

6. Machine for packaging of items in stretchable foils of plastic material, comprising

a. a horizontal folding matrix plate having a passage opening corresponding in shape to the plan view of the item to be packaged;
b. a severing mechanism for the severing of a foil sheet from a continuous foil web unreeled from a storage roll;
c. a conveying mechanism for placing this foil sheet below the folding matrix plate in the area of its passage opening;
d. a gripping device for immobilizing at least two opposed edges of the foil sheet;
e. a lifting table situated under the folding matrix plate for reception of the item to be packaged and for pushing the latter vertically upwards through the passage opening of the folding matrix plate;
f. a folding mechanism arranged above the folding matrix plate for folding the foil sheet edges under the item to be packaged; and
g. a conveying device arranged at a distance above the folding matrix plate for pushing the packaged item off the folding matrix plate parallel to the surface of the same.

7. A packaging machine according to claim **6**, in which the severing and conveying device for the foil sheet comprises a pair of drawing rollers followed by a conveying path consisting of two sets of endless belts arranged one above the other and travelling at higher running speed than the pair of drawing rollers, as well as a perforating device arranged between the conveying path and the pair of drawing rollers, the distance between a perforating tool of the perforating device and the point of action of the two sets of endless belts being greater than the length of the foil sheet to be severed from the foil web, and the lower of the two endless belt conveyors supporting the foil sheet and being driven at the same running speed as the movement of the conveying path.

8. A packaging machine according to claim **6**, in which the gripping device is arranged to hold fast at least two opposed edges of the foil sheet and comprises a contact thrust device for pressing the foil sheet edges against the underside of the folding matrix plate.

9. A packaging machine according to claim **8**, in which the contact thrust device comprises at least two contact thrust bars which are arranged at opposed sides of the passage opening of the folding matrix plate and are arranged to be displaceable towards and away from this opening.

10. A packaging machine according to claim **8**, in particular for items intended to be packaged which have an approximately rectangular shape in plan view, in which the contact thrust device comprises two contact thrust bars arranged at two opposed sides of the passage opening of the folding matrix plate and extending approximately parallel to the direction of ejection of the packaged item, and two further contact thrust bars arranged at two opposed sides of the passage opening of the folding matrix plate and extending transversely to the direction of ejection of the packaged item, at least the front and rear contact thrust bars being arranged to be displaceable singly and independently of the two lateral contact thrust bars, away from and towards the underside of the folding matrix plate.

11. A packaging machine according to claim **6**, in which the folding mechanism for the folding of the edges of the foil sheet under the item to be packaged has two flat angular or arcuate folding levers which are arranged to be pivotable parallel to the folding matrix plate around vertical spindles and to be

swung in and out in pincer-like manner above the passage opening of the folding matrix plate.

12. A packaging machine according to claim 11, in which the folding levers are pivotally arranged on and in the middle area of the transverse edge of the passage opening of the folding matrix plate which edge is the leading edge in the direction of ejection of the packaged item, and in the swung-out idle position each have a branch extending approximately parallel to the front edge of the passage opening and an adjacent rearwardly angled branch extending approximately parallel to the co-ordinated lateral edge of the passage opening.

13. A packaging machine according to claim 11, in which the folding levers are pivotally arranged on and in the middle area of the transverse edge of the passage opening of the folding matrix plate which edge is the trailing edge in the direction of ejection of the packaged item and in the swung-out idle position extend in approximately V-shape towards the front in the direction of ejection of the packaged item.

14. A packaging machine according to claim 13, in which each folding lever has a folding cam projecting from its free front extremity towards the passage opening of the folding matrix plate and a forwardly projecting folding finger separated from the former by an indentation.

15. A packaging machine according to claim 11, in which the folding mechanism for the folding of the edges of the foil sheet has a folding bar extending transversely to the direction of ejection of the packaged item and displaceable back and forth parallel to the folding matrix plate in this direction of ejection.

16. A packaging machine according to claim 15, in which the folding bar comprises a rod of circular cross section.

17. A packaging machine according to claim 15, in which the folding mechanism includes an endless belt laid in freely travelling manner around two deflecting members which extend transversely to the direction of ejection of the packaged item and are displaceable back and forth conjointly in this direction of ejection.

18. A packaging machine according to claim 6, in which the lifting stage for receiving the item to be packaged and to push the same upwards from below through the passage opening of the folding matrix plate, is equipped on its upper side with upwardly projecting supporting webs or fingers for the item to be packaged which may be resiliently tipped over in the folding direction of the foil element edges.

19. A packaging machine according to claim 6, in which a conveying device is situated at the height of the lowered lifting stage for intermittent feed of the items to be packaged, and a further conveying device is situated at the height of the raised lifting stage for removal of the packaged items pushed off the folding matrix plate.

20. A packaging machine according to claim 6, in which the conveying device for ejection of the packaged items from the folding matrix plate comprises an endless conveyor belt displaceable in a vertical direction and pivotably arranged, the conveying device being equipped with a padding of soft resiliently yielding expanded material.

21. A packaging machine according to claim 19, including a heating device for heating and welding of the overlappingly folded edges of the foil sheet the said heating device being arranged in the area of the conveying device intended for removal of the packaged items when pushed off the folding matrix plate.

22. A packaging machine according to claim 7, in which the perforating device consists of an electric incandescent wire which is bent to approximately zigzagging shape, and extends transversely to the foil web and is displaceable towards and away from the latter.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,662,513 Dated May 16, 1972

Inventor(s) Ermanno Fabbri

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 9, line 68, "claim 23" should read -- claim 1 --.

Signed and sealed this 1st day of May 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

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