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Christensen et al.

[11] **3,778,960**

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[54] **AUTOMATIC PACKING DEVICE FOR PALLET STACKS AND THE PROCEDURE PECULIAR HERETO**

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[52] **U.S. Cl.** **53/29,** 53/183, 53/385, 53/386

[51] **Int. Cl.** **B65b 43/30**

[58] **Field of Search** 53/183, 29, 241, 53/385, 386

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[57] **ABSTRACT**

The invention is concerned with an improved method and machine of packing goods items into hoods, whereby each hood is fitted over the goods without being torn by sharp corners of the goods and at high speed.

8 Claims, 7 Drawing Figures

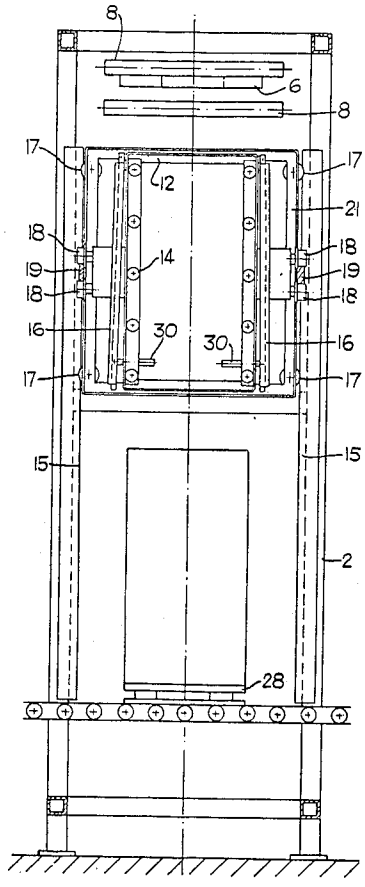

FIG. 1

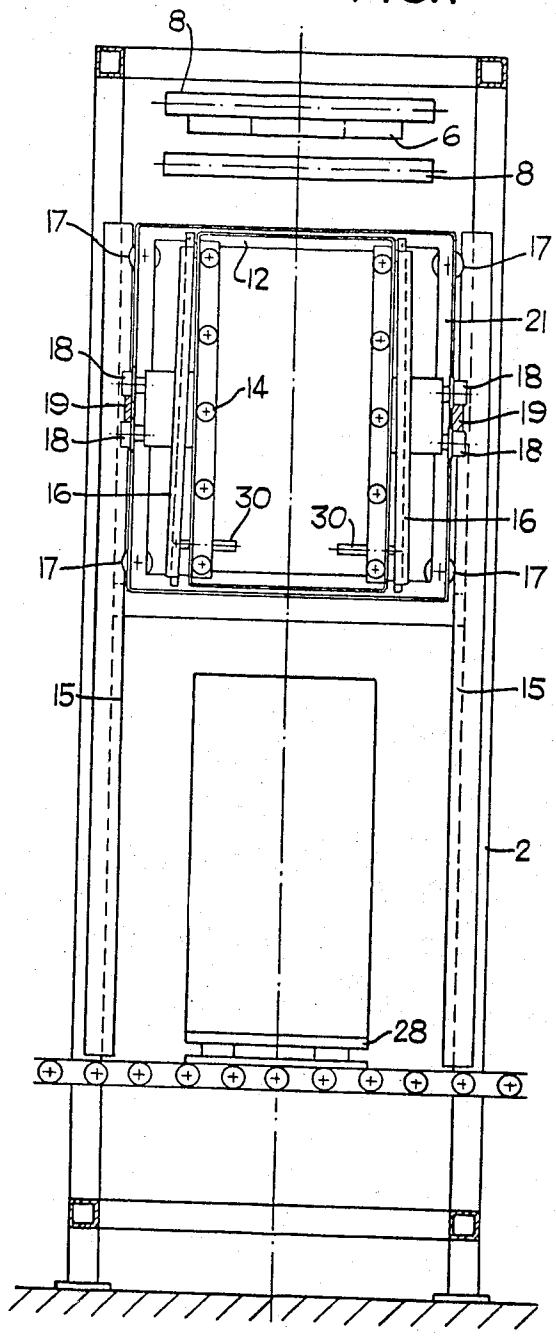

FIG. 2

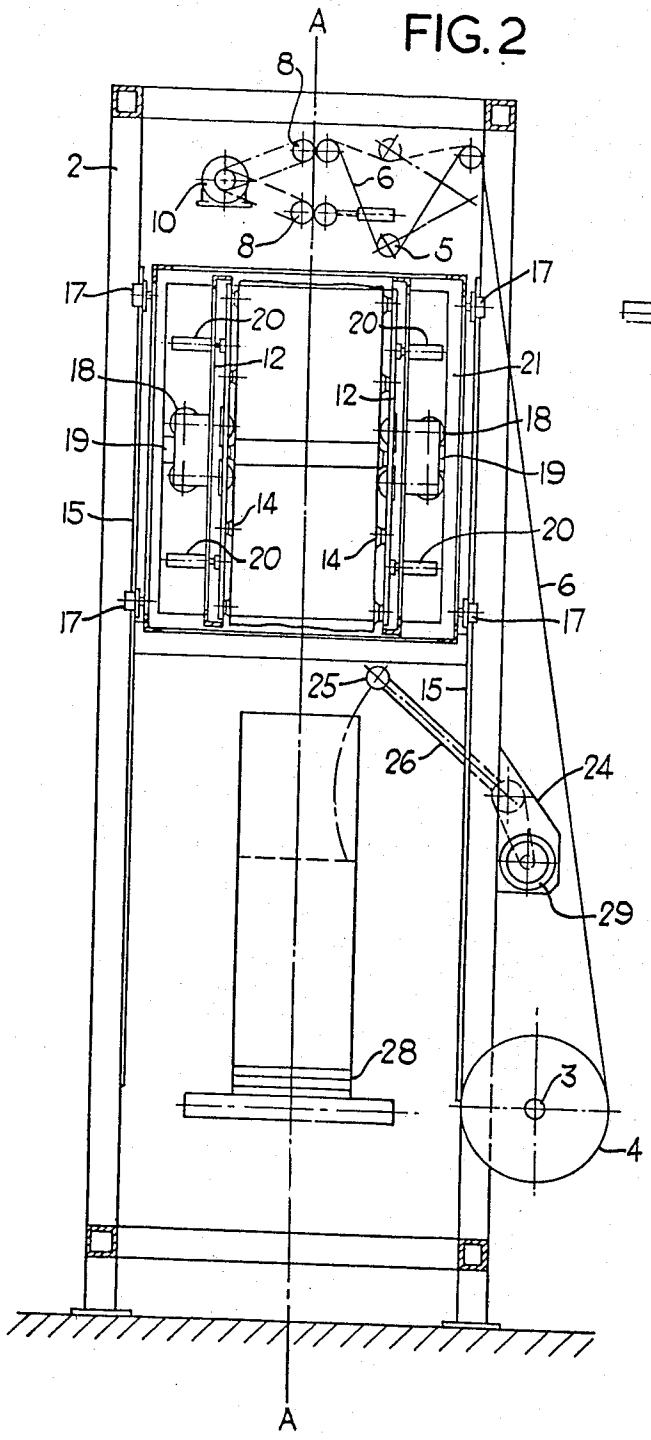
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FIG. 3

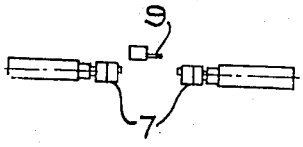
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FIG. 4

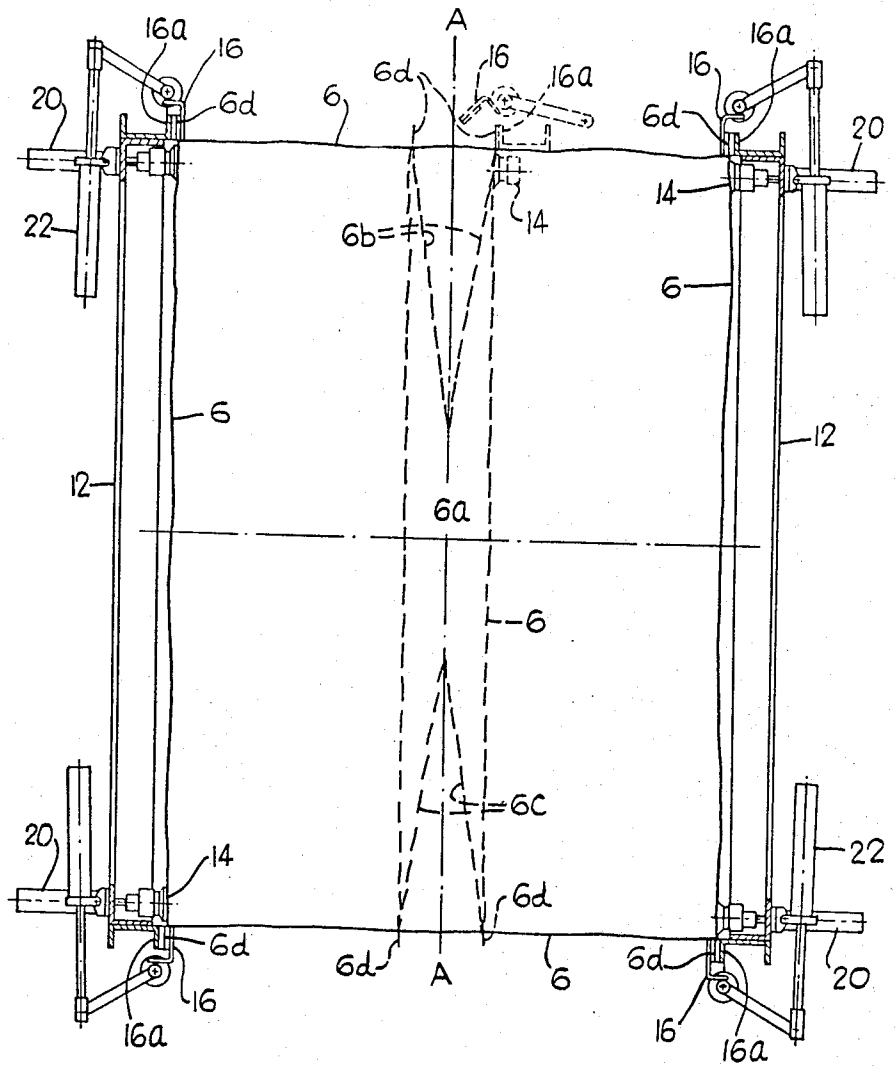


FIG. 5

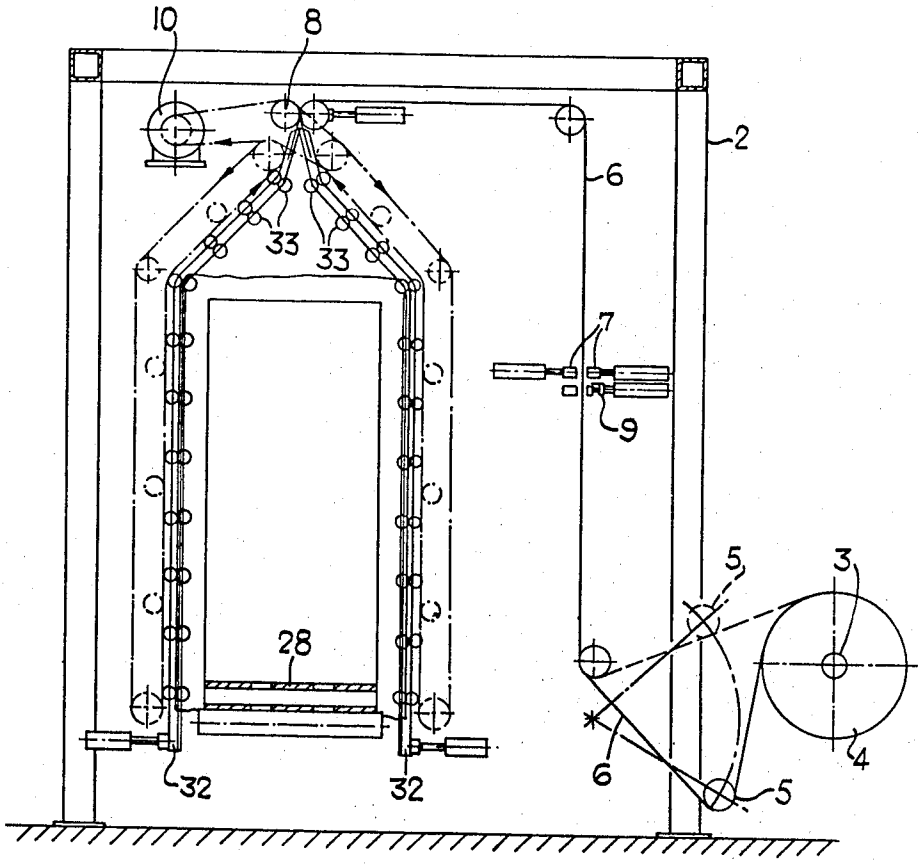


FIG. 6

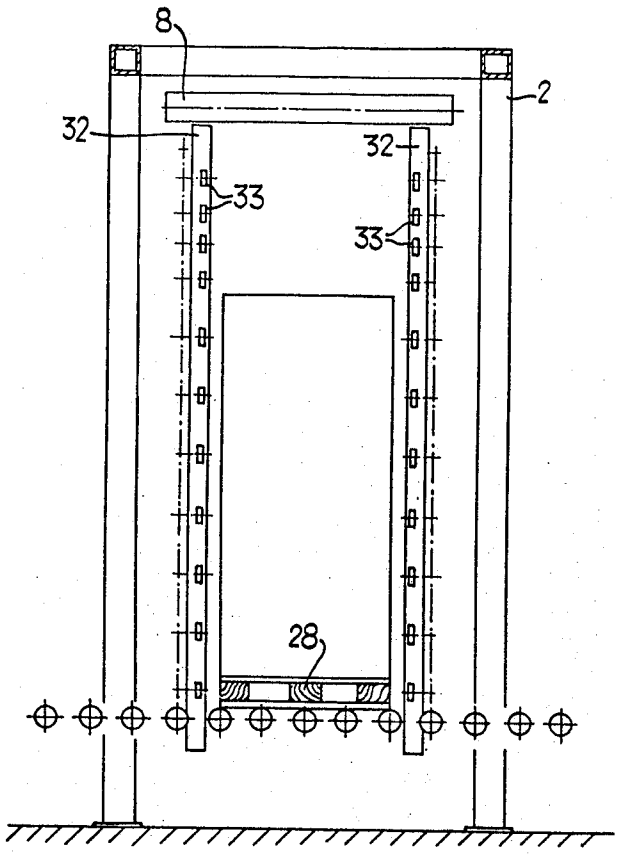
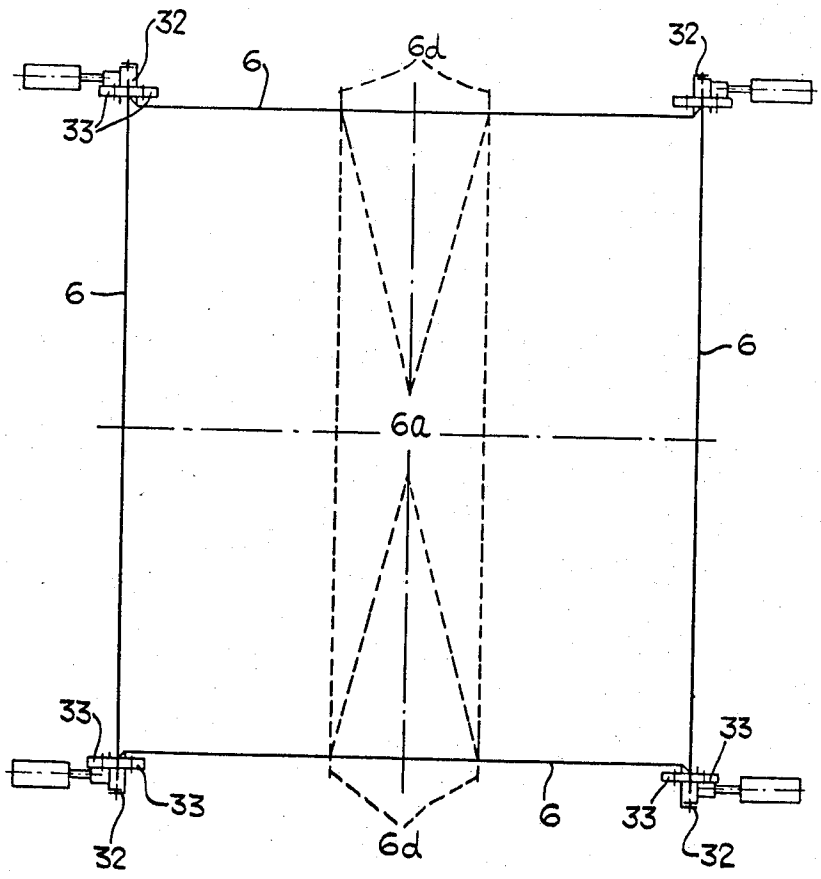


FIG.7



AUTOMATIC PACKING DEVICE FOR PALLET STACKS AND THE PROCEDURE PECULIAR HERETO

The present invention relates to a method of packing goods, employing in particular contractible foil packing means, and to a machine for performing the method.

Particularly in the field employing contractible foil packing means it is known to draw hoods over goods placed on pallets so as to enclose the goods, such hoods being made of contractible foil. In the case of the known methods and machines, the hoods are fitted over the goods without having been previously opened up over a substantial part of their entire length, and this results in the hoods often being torn by the upper sharp corners of the goods and in the hoods having to be fitted very carefully and slowly so as to avoid the risk of tearing.

The invention provides a method of packing goods items, preferably employing contractible foil packing material, comprising fitting a hood of packing material, initially in a closed condition over the item, which is of substantially uniform cross-sectional shape over its entire height and, prior to lowering the hood over the item to be packed, opening up the closed hood over at least one-third of its full length and to a cross-sectional form that is greater in size than and substantially the same as the cross-sectional form of the goods. This substantially reduces the above-mentioned disadvantage in that the hood is partially opened up to its final form before it is drawn over the goods, and while the hood is being drawn over the goods the air in the hood is displaced by the goods to cooperate in the opening up of the hood.

Preferably, the hood is opened up over its entire length and is held in the opened-up position until it has been lowered to a predetermined position to enclose the goods to be packed. This enables the hood to be fitted without the risk of tearing in those cases where the plan contour of the goods is of sharp-cornered form.

Preferably, also the hood is at latest opened up at the same time as the goods are brought to a point where the hood is to be fitted. This step achieves a short packing time in that the hood can be immediately passed down over the goods when the latter are moved to an application position prepared for the purpose.

A further preferred feature is that at least two mutually opposed portions of the side-wall of the hood are supported on the outside during downward movement. The object of this step is to enable the periphery of the hood to be reduced to a given angular cross-sectional form characteristic of the goods, as well as to apply less transverse tension to the supported wall of the hood than to the unsupported part of the wall of the hood, this being of particular importance if the contour of the goods is not circular.

The invention further comprises a machine for performing a method in accordance with the invention and comprising a machine-frame, a supply roller carrying the hood-foil, a station at which the hood is to be fitted and to which the goods to be packed are to be brought, means for welding across the foil to form a closed end of the hood and/or means for transversely cutting the foil, gripping elements which are located above the goods when the goods are positioned at said station which elements are operable to open up each hood over its entire length to a cross-sectional shape substantially similar to the plan form of the goods and to lower the hood over the goods. By the use of such a machine eack packing hood is opened up over its entire length prior to and during its downward passage over the goods.

Preferably, the machine comprises an air-nozzle, fitted on at least one gripping element, which is adapted to emit an upward jet which is slightly inclined relatively to the other gripping element. This enables the hood, already opened a little, to be fully opened up more rapidly since the zone of reduced pressure formed in the interior of the hood while it is being opened is filled more rapidly with air from an air-jet.

Embodiments of the present invention will now be described in more detail, by way of example, with reference to the accompanying drawings, in which:

FIG. **1** shows a vertical side-view of a first embodiment of a machine for performing the method, the goods to be packed being located on a pallet in the machine at the position in which the packing means are applied;

FIG. **2** is a vertical end-view of the machine illustrated in FIG. **1** at the moment when a hood or cap released from a web of hood foil is held in its fully opened condition;

FIG. **3** shows a welding and cutting device for welding the bottom of the hoods made from an endless web of tubular foil, and for cutting off said hoodbottom from the tubular foil;

FIG. **4** shows, on a greater scale, a sectional plan view of a hood foil in the partially and wholly opened-up condition, these conditions being indicated by dotted and solid lines respectively;

FIG. **5** shows a vertical side view similar to FIG. **1**, but of another embodiment of the machine according to the invention;

FIG. **6** is a vertical end-view of the machine shown in FIG. **5**, the web of hood foil being omitted; and

FIG. **7** shows a view similar to FIG. **4**, but of the machine illustrated in FIG. **5** and **6**, broken lines showing in section the hood foil at a level above the uppermost surface of the goods to be packed, and solid lines showing in section the hood foil at a level below the uppermost surface of the goods.

The form of machine shown in FIGS. **1**, **2** and **4** consists of a machine-frame **2** whose longitudinal sides are situated each on one side of a vertical plane A—A (FIG. **2**), which includes the vertical longitudinal central plane of a pallet **28**, when the latter has been introduced in the machine frame for packing the goods supported thereon. Machine frame **2** supports a friction bearing **3** on a shaft which carries a roll of foil **4**, consisting of a wound tubular web **6**. This web of foil **6** is guided from the roll **4** over a guide roller to a tensioning roller **5** which serves to tension the web. The foil web is passed from the tensioning roller through two pairs of feed rollers **8** which cause the web to move downwardly merged in plane A—A. The feed rollers **8** can be provided with rubber surfaces and the lower pair of feed rollers is driven directly from a geared motor **10** provided with braking means. The upper pair of feed rollers is driven independently by a geared motor (not illustrated) having a magnetic clutch and a magnetic brake.

The tubular web **6** is previously wound into the roll **4** by folding two opposite sides of the tubular web inwardly in such a way that the folded sides are situated

between the remaining two unfolded sides permitting the web to be wound in a flat form into the roll **4.** Referring to FIG. **4,** illustrating an example of such a folding, the folded sides **6***b*, **6***c* of the web **6** are shown in broken lines with the remaining unfolded sides of the web shown slightly separated. In folding and flattening the web as described, the flat folded portions of the web along the longitudinal margins of the flat web form four outwardly projecting gripping flanges **6***d*.

Below the two pairs of feed rollers **8,** being arranged at the top of the machine frame **2** the one pair above the other, there are provided two gripping and opening frames **12** being symmetrically situated about plane A—A. Each gripping and opening frame **12** carries firstly two fixed and spaced apart gripping rods **16***a*, both extending upwardly in the machine from the lowermost horizontally extending edge of the matching frame **12,** and each of which being provided with a bearing surface facing plane A—A, and secondly two movable gripping rods **16** each being so devised that it by means of air-cylinders **22** or the like can be removed from and returned to bear against the bearing surface of one of the fixed gripping rods **16**a along the entire length thereof.

According to the invention, the length of the gripping rods **16***a*, **16** is to correspond to at least one-third of the web length required to pack the greatest height of goods which can be treated in the machine, but preferably the gripping rods are provided with a length corresponding to the entire web length required to pack the most frequently occurring height of goods.

Each of the gripping and opening frames **12** further comprises suction cups **14** which are connected to a vacuum pump by way of a flexible tubing (not shown). The suction cups **14** on a frame **12** are arranged in two columns each being practically parallel to and situated inside in the immediate vicinity of a fixed gripping rod **16***a* with the sucking disk of each suction cup facing plane A—A. Each column of suction cups **14** is constructed to be moved by air-cylinders **20** or the like, which are secured to the corresponding frame **12,** relative to the corresponding fixed gripping rod **16***a* between a first extreme position, in which the sucking disks of the suction cups are practically flush with the bearing surface of the fixed gripping rod **16***a*, and a second extreme position, in which the suction cups are pushed forward to inwardly project this bearing surface. The two frames are constructed to be moved horizontally towards and away from each other by control rollers **18** which run on the horizontally disposed control rails **19** by drive mechanisms, not illustrated; the control rollers **19** are fitted in a lifting frame **21** which is adapted to be moved vertically in the machine frame **2** by means of a chain drive and a geared motor, not illustrated, along control rails **15** located in the machine frame and guiding the lifting frame **21** through control rollers **17.**

When a pallet unit **28** is brought into the machine frame by means of a chain conveyor, the pallet **28** upon reaching the position at which the hood is to be fitted simultaneously touches a switch so that its movement is stopped, whereupon the machine starts up. The web **6** is now drawn down into the machine by the feed rollers **8** until a welded seam, extending transversely of the tubular foil, and a following perforation in the foil, running close to the welded seam, have passed the upper set of feed rollers **8** which then stop, whereas the lower set of feed rollers continue to turn, this causing the foil to be torn off at the perforation. As soon as this happens, the lower set of feed rollers **8** also stops and now holds a torn-off flattened hood near its closed end and in a position in which the hood is hanging down between the two gripping and opening frames **12** with the leading open end being situated above the goods located on the pallets and being on a level with the lowermost horizontal edges of frames **12.**

The gripping and opening frames **12** are now moved towards each other, and simultaneously the columns of suction cups are pushed forward to their second extreme positions by the air-cylinders **20,** and as soon as each column with its suction cups bears against the outer surface of a gripping flange **6***d* firmly, whereafter the suction cups, bringing along the flanges **6***d*, are retracted towards the corresponding frames **12** to their first extreme position. The suction cups thus open the closed hood a little, so that air from the atmosphere flows into the interior **6***a* of the hood in the position illustrated in FIG. **4** in dotted lines, and at the same time the suction cups hold the gripping flanges **6***d* of the hood against the fixed gripping rods **16***a* on the frame **12** until the movable gripping rods **16,** associated with the fixed gripping rods, are caused by the air-cylinders **22** to bear against the inner surface of the flanges **6***d*, whereafter the four gripping flanges **6***d* of the hood are each held between a pair of gripping rods.

In order to prevent a vacuum from being created in the interior **6***a* of the hood, when the hood is opened from its flattened state to the state shown in broken lines in FIG. **4,** which vacuum could destroy the hood or cause it to stretch in an undesirable manner, since this vacuum could prevent the unfolded sides of the flattened hood from being separated along the whole width thereof, both the fixed and the movable gripping rods are pivotally mounted at their upper ends to be swung by air-cylinders **30** or the like in such a way that the lowermost edges of the unfolded sides of the hood are tautened, whereby it is ensured that these unfolded edges are completely separated along their entire length, when the gripping flanges **6***d* are slightly separated, resulting in that the open mouth of the hood is opened before the remaining part of the hood to enable air to flow into its interior **6***a* from the atmosphere.

In order to obtain a more effective and a quicker distending of the flattened hood, the lifting frame **21** can at its lower end be provided with one or more air jets (not shown) directly upwardly towards the opened mouth of the hood.

Guided along the rails **19** by the rollers **18** the two gripping and opening frames **12** are then moved away from each other, and simultaneously the lower pair of feed rollers **8** release the closed end of the hood. Hereby the gripping flanges **6***d*, which are held between a pair of gripping rods, are carried along by the frames **12,** and when these frames **12** have reached their outermost position, the hood assumes its fully opened box-shape as illustrated in FIG. **4** in solid lines.

The lifting frame **21** with the fully opened hood is then caused to move down over the goods on the pallet without the hood touching the goods during the downward movement.

When the opened-up hood is placed over the goods in this manner after the downward movement, the gripping frames **12** release the hood, after which the lifting frame **21** is moved into its original position with the

gripping and opening frames **12** in their outermost positions.

In this construction where the packing is effected using a web of tubular foil having ready-made transverse welded seams and perforation lines, the distance between these perforation lines must be suited to the height of the goods located on the pallet if wastage of foil is to be avoided.

The goods, provided with a hood or cap, can now be passed from the machine by means of the chain conveyor into a stove for shrinking the foil, and the machine is then ready for packing the goods located on the next pallet **28.** The time required for removing the packed goods and for introducing the new goods can be utilised to make ready the next hood for lowering over the next pallet loaded with goods, when the latter has been brought into position in the machine.

In another form of construction of the machine in accordance with the invention, the lower pair of feed rollers **8** are replaced by two welding tools **7** as shown in FIG. **3,** which welding tools are horizontally movable relatively to each other and grip and weld up the closed end of the hood, while a high-speed horizontally displaceable blade **9** cuts off the tubular web of foil in the transverse direction. Thus, a web of tubular foil that does not have tear-off perforations can be used in this machine, and the latter can be adapted to pack goods of different heights to which the length of the hood is matched. The welding tools **7** can be designed to carry out thermal or high-frequency welding of the foil if the latter is made of plastics material, and the faces whereby the welding tools make contact with the foil can be prevented from "sticking," for example, by means of a covering strip of polytetrafluorethylene. The high-speed blade **9** can be actuated by means of a specially designed air-cylinder, in which the straight-through piston rod is replaced by a flexible wire which moves round two guide discs and is secured to a holder for the blade **9.**

For the purpose of automatically cutting off a length of foil corresponding to that of the goods to be packed, use can be made of an automatic measuring means **24,** which comprises a probe **25** including, a photo-electric cell being contained in the one, and a light-source in the other, of the two levers **26** which are moved by means of the geared motor **29** provided with a brake. The position of the levers **26** is recorded in an electronic counter which determines the movement of the feed rollers and thus the required length of hood prior to welding and cutting off. When the pallet **28** loaded with the goods is located in position in the machine and when the above mentioned switch is actuated, the geared motor **29** is actuated at the same time to move down the levers **26** with the probe **25** until the light beam is interrupted. This downward movement is recorded or measured by the electronic counter. The rollers **8** for feeding the foil are also started up and continue to pass foil from the roller **4** until another impulse from the electronic counter stops the feed rolls and initiates the welding and cutting-off operation. In FIGS. **5, 6** and **7** a further form of construction, in which the lifting frames **21** and the gripping and opening frames **12** are replaced by sectional rods **32** the number of which corresponds to the number of gripping flanges in the web of foil **6** fed to the machine, so that as shown in FIG. **7** four sectional rods are present in a machine for dealing with a web with four gripping flanges **6*d***. Each sectional rod carries a row of synchronously driven rollers **33** which are arranged in pairs and rotate in mutual contact with each other. From the upper corners of the goods each row of rollers **33** continuously runs along one of the vertical side edges of the goods at a small distance therefrom to the bottom of the goods, and each row of roller-pairs thus form a feed path for one gripping flange **6*d*** of the hood. That part of the rollers in a row that is located below that point in the machine which corresponds to the tallest item of goods to be packed is adapted to move out of paired mutual engagement when a portion of the foil or a welded and torn off hood is passed over the goods to be packed.

Those rollers **33** being situated at a higher level than the uppermost surface of the goods are adapted to move out of paired mutual engagement as soon as a transversal welding seam has passed the feed rollers **8.**

In the embodiment shown in FIG. **5,** the welding and perforating operations are carried out by two welding tools **7** and a perforating device **9,** respectively. The tearing off of a hood from the web **6** is performed by temporarily stopping the feed rollers **8,** when a welding seam has passed, while the rollers **33** draw on the hood. In this embodiment the welding seams are to be arranged in such a way that the gripping flanges **6*d*** of the web are free to be held between the rollers **33.**

The rows of rollers are arranged in pairs and parallel on the sectional rods and are inclined to the sectional rod and therefore to the feed path of the edge of the hood foil in such manner that upon rotation they draw the edge of the foil towards the sectional rod thus preventing the edge of the foil in a row of rollers from disengaging from the rollers, which would be undesirable.

In the forms of construction hitherto described, the web of foil material is fed discontinuously and it is therefore necessary to use the tensioning roller **5** in conjunction with the friction bearings **3** so as to keep the web taut. It has been found that a particularly simple form of friction bearings **3** can consist of cut blocks of plastics material in which the ends of the shaft can rest in such manner as to resist movement by friction in a satisfactory manner. It is however, also possible so to design the machines described with reference to FIGS. **1–4** in such a way that the foil is fed continuously, the means for welding and cutting off the foil web then being mounted on the lifting frame **21.** This however means a greater height for the machine since the cutoff and welded hood has to be opened up before it is moved down over the goods. If the lifting means is moved upwards again after the hood has been placed over the goods, the packed goods are simultaneously removed so that a new pallet carrying goods can be brought to the point at which the hood is fitted, and when the lifting means is right at the top of the machine, it grips the foil, advanced in the meantime, for the cutting off, welding, opening up and lowering operations.

What we claim is:

1. A method of packing an item in a hood of foil material and the like, which comprises the steps of providing a flattened tubular foil hood open at one end and having two opposite sides of the hood folded inwardly on longitudinal fold lines in such a way that said folded sides are enclosed between two exterior sides and the marginal portions of said exterior sides comprise longitudinally extending folds projecting outwardly from the hood, mechanically gripping and holding from outside

the hood each of said longitudinally extending folds at least along one third of the length thereof and from adjacent the open end of the hood, moving the gripped marginal portions of one exterior side away from the marginal portions of the other exterior side thereby separating said exterior sides and unfolding said folded sides of said hood whereby said hood is expanded to a form to receive the item to be packed, and inserting the item to be packed into the open end of the expanded hood while maintaining said hood expanded by pulling and holding said gripped marginal folds in such a way that said hood practically does not touch said item during its insertion.

2. A machine for packing items comprising a frame, means on top of said frame for supplying and supporting a section of an open end flattened tubular packing hood of foil material or the like in which the margins of opposite flattened sides each comprises an outwardly projecting longitudinal fold of the hood material, means to support an item to be packed in the hood and being situated below and in alignment with the open end of the hood when the hood is supported in said supplying and supporting means, gripping elements adapted to grip and hold from outside the hood the longitudinal folds of the hood along at least one third of the lengths thereof from adjacent the open end of the hood, means to cause said gripping elements to move the gripped portions of said folds away from one another in a direction to expand said flattened hood to a form to receive said item by applying oppositely directed pulls to said gripped folds on the margins of said opposite flattened sides of the hood, means to cause relative movement of said expanded hood and said item supporting means for inserting said item into the expanded hood, said gripping elements being adapted to maintain the hood in its expanded form whereby practically the hood does not touch said item during the entire relative movement, and means to actuate said gripping elements to grip, hold and release said folds.

3. A machine as defined in claim **2** wherein each said gripping elements comprises a movable pair of elongated gripping bars adapted to receive a longitudinally extending fold of hood material therebetween, and means for moving one bar of said pairs of bars relative to the other to grip and release a fold between said pair of bars.

4. A machine as defined in claim **3** further characterized by suction means associated with each said pair of elongated gripping bars, said suction means adapted to be engaged by longitudinally extending portions of the flattened hood adjacent said folds, and means to shift said suction means relative to said gripping bars for moving each said hood folds into gripping engagement with one of said pairs of gripping bars.

5. A machine as defined in claim **4** further characterized in that each said pair of gripping bars is pivotably suspended at the upper end thereof, and in that means are provided to swing each pair of gripping bars in such a way that the edges of said open end of the hood are tautened.

6. A machine as defined in claim **3** further characterized by means to move each pair of gripping bars outwardly in said frame above said item to be packed thereby applying said pulls to said gripped folds, and wherein said means to cause said relative movement of said expanded hood and said item consist of means to move each pair of gripping bars downwardly in said frame.

7. A machine as defined in claim **2** wherein said gripping elements consists of four series of pairs of synchronously driven rollers rotatively in engagement with each other, which series each extends in the upper part of said machine frame from said supporting and supplying means for the hood and along paths each leading to the expected position of one of four outermost upper corners of said item to be packed and at a short distance therefrom, each said series of rollers further extending downwardly adjacent to the vertical edges of said item to the bottom level of said item, each series of rollers thus forming a transfer path for one of said longitudinal folds being gripped and held between the rollers in said series, those rollers situated in said upper part of the frame providing for said pulls, and those rollers situated at the sides of said item providing for said relative movement, the rollers in each pair being movable out of mutual engagement when said hood is pulled fully over said item.

8. A machine as defined in claim **7** further characterized in that each pair of rollers rotates about axes being slightly inclined relative to a normal to the transfer path to which the pair belongs in such a way that an escape of said gripped fold from said pair of rollers is counteracted.

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