April 4, 1961 D. ALLFREE 2,977,872

STRAPPING MACHINE

Filed March 3, 1960 2 Sheets-Sheet 1

Fig. 1

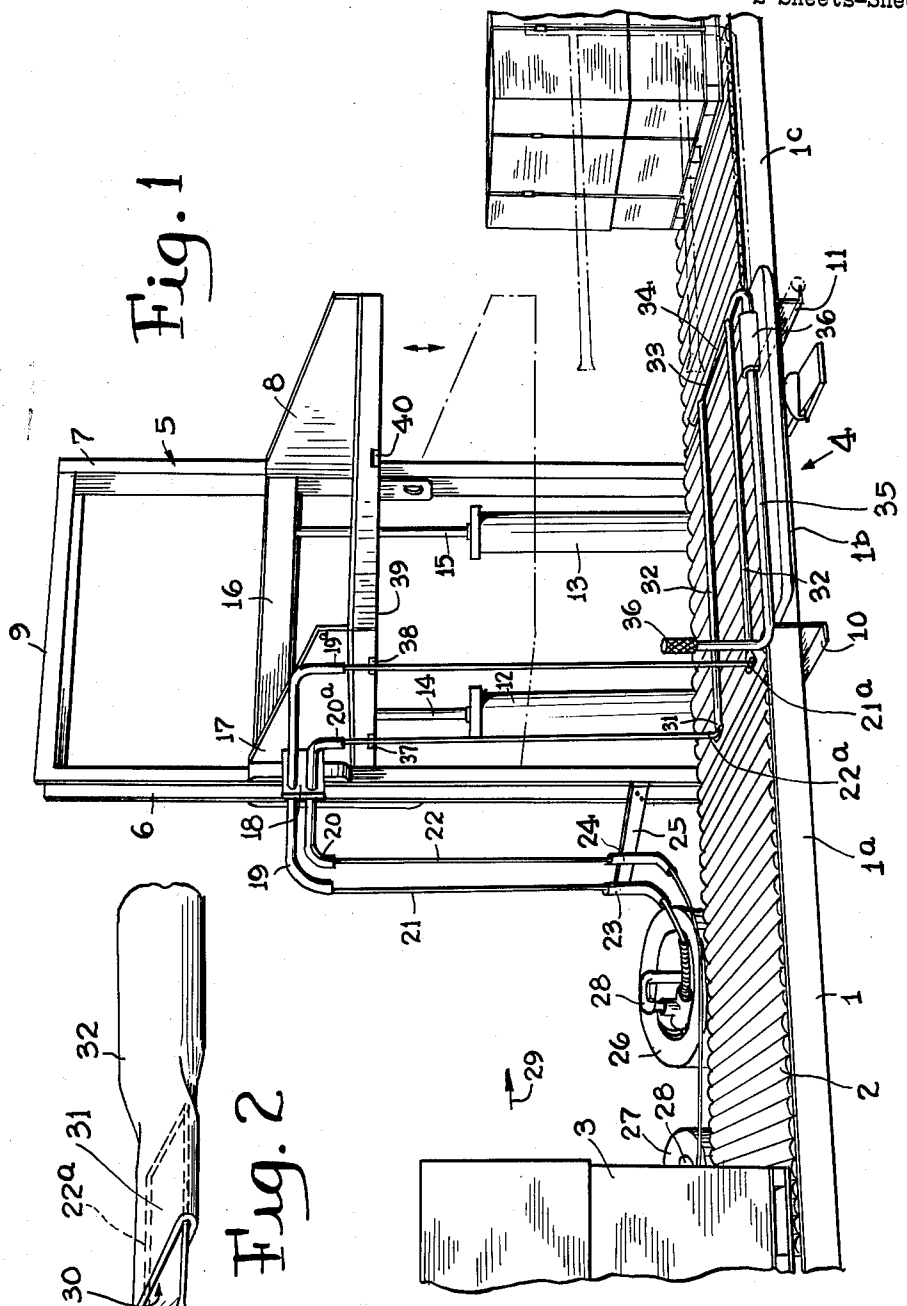

Fig. 2

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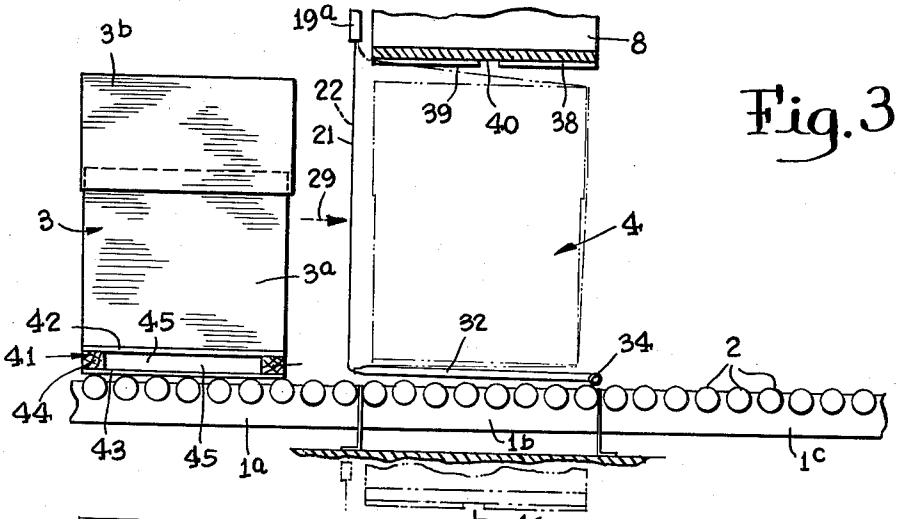

Fig. 3

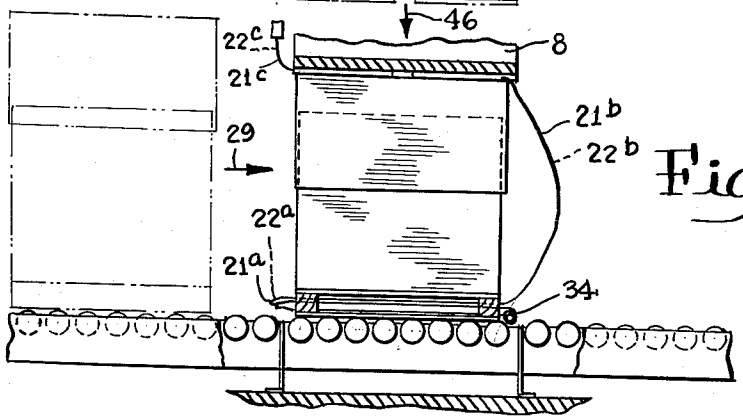

Fig. 4

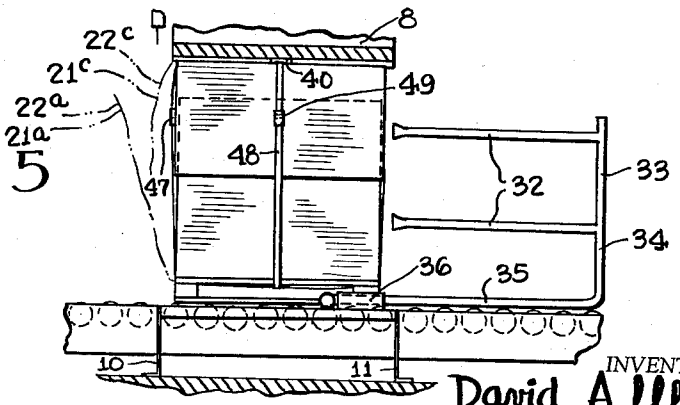

Fig. 5

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STRAPPING MACHINE

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11 Claims. (Cl. 100—17)

This invention relates to the art of strapping and particularly to an improved means for applying straps about palletized loads.

With the increase in labor costs and the resulting trend toward mechanization and assembly line techniques, the tendency has been to provide strapping mechanisms adapted to the swiftness and other advantages of the mechanized assembly line. A common manner of packaging is to stack an object or objects on pallet supports and secure straps around each stack and its pallet support to provide a unitized pallet supported load. To make use of the assembly line technique with the palletized stacks moving along conveyor means to a strapping station, an arrangement is provided whereby the leading end lengths of the binder straps are suspended vertically downward from guide tubes with their leading ends held in temporary gripping devices. As a palletized stack is moved forward on the conveyor means toward the strapping station, it contacts the suspended straps and deflects them into loops with wrapping contact around the bottom of the pallet and the forward and upper surfaces of the stack, thereby providing a wrap of the strap around three sides of the stack. At that time, the leading ends of the straps are withdrawn from the temporary gripping devices and brought into overlapping engagement with the supply ends of the strap along the rear or fourth surface of the stack where ordinary strapping tools are used to tension the strap loops onto the stack and unite the overlapping strap ends.

This loop type wrapping of the palletized stack or load has the advantage of allowing the straps to be applied to the package longitudinally of the direction of the conveyor which is otherwise difficult to achieve on a conveyor system. One way this difficulty has been met is by applying the transverse straps first and then rotating the package through ninety degrees and applying the longitudinal straps as transverse straps. This has the objection that, when the package is one which is being held in a compression device such as a baler, the compression must be released before the package can be rotated. Experience has shown that, unless all of the straps are applied during the same compression stroke, it is almost impossible to obtain uniform tension of the applied straps and this often results in straps which can be loose enough to fall off the package during shipment and handling.

This assembly line technique has proven to be well adapted to palletized stacks requiring that the straps pass beneath the pallets when applied to the stacks. But, heretofore, no apparatus has been known which allows this assembly line technique, as described, to be applied to the use of double faced pallets where the straps are passed between the faces of the pallet during the strap application. Therefore, it is the principal object of this invention to provide improved apparatus which adapts a strapping station in a conveyor system to the application of straps to a palletized stack by said assembly line

technique wherein the straps are fed between the two faces of a double faced support pallet.

In order to accomplish this object, it is still another object to provide a device on a conveyor having separate tines for holding the leading ends of the vertically supported straps, the tines being aligned to project between the two faces of a double faced pallet as the pallet is moved on the conveyor toward the device. This movement causes each strap to be forwardly bulged into wrapping contact against the forward and upper surfaces of the load supported by the pallet and also against the lower surface of the upper face above the lower face of the two face pallet. In this way, by the use of the tined device, the straps are inserted between the layers or faces of the pallet.

In order to allow the palletized load to be transported forward on the conveyor after the strap wrapping is accomplished, it is still another object of the invention to have the tined device movably supported so that its tines or forks can be retracted from between the pallet faces and clear of the pallet load. This retraction of the tines also allows straps to be applied in a direction transverse of the direction of the tines without interference from the tines so that all straps, both longitudinal and transverse, can be applied during the same compression stroke of the baler if one is used.

Other objects and advantages of the invention should become apparent by referring to the accompanying drawings in which—

Figure 1 shows a perspective view of apparatus including a bale press and a conveyor at a strapping station embodying the improvements of this invention.

Fig. 2 shows a perspective view of an end portion of a tine of the fork device embodying the invention and particularly shows how it engages the leading end of a binder strap and

Figs. 3, 4 and 5 schematically show a front elevation of the apparatus of Fig. 1 and the sequence of applying binder straps to a palletized load in a direction longitudinally of the conveyor at the strapping station by the use of the improved apparatus of the invention.

As particularly shown in Fig. 1, the apparatus in which the invention is shown embodied consists of a roller type conveyor **1** in which are journalled a plurality of rollers **2** on which a palletized load **3** can be easily transported longitudinally in the direction of the conveyor. The conveyor **1** is divided into an entrance length **1***a*, a strapping station length **1***b* and an exit length **1***c*. The load **3** is normally transported from the entrance length **1***a* to the strapping station **1***b* where binder straps are applied to it and then on to the exit length **1***c* from where it is taken for shipment or other subsequent handling.

The strapping station length **1***b* is positioned at the strapping station, generally designated at **4**. At this strapping station **4** is positioned a bale press type machine **5** which is provided with two vertical supports **6** and **7** for supporting a pressure platen **8** which is guided for vertical movement along the two vertical support members **6** and **7**. The vertical support members **7** are secured apart from each other by a horizontal member **9** secured at their upper ends. The lower ends of these vertical members **6** and **7** are secured to two members **10** and **11** which extend transversely below the conveyor length **1***b* and act as supports for the conveyor. Two cylinders **12** and **13** are mounted between the vertical supports **6** and **7** with their lower ends fixed relative to the base members **10** and **11**. The upper ends of these cylinders **12** and **13** are provided with piston rods **14** and **15** extending therefrom and which are connected to a header **16** which is an integral part of the pressure platen **8**. The cylinders **12** and **13** are of a

type which can be actuated either by air or fluid to cause the piston rods 14 and 15 to simultaneously extend or retract in order to raise or lower platen 8 vertically along the vertical supports 6 and 7.

On one sidewall 17 of the pressure platen 8 is secured a plate 18 extending outwardly therefrom. This plate is provided with two openings in which two guide tubes 19 and 20 are secured. These guide tubes 19 and 20 are generally U-shaped and guide binder straps 21 and 22 in a path leading from other guide tubes 23 and 24, which are supported on an arm 25 secured to the vertical upright 6. These guide tubes 23 and 24 in turn guide the straps 21 and 22 from supply coils 26 and 27 of binder strap mounted on coil holders 28. These coil holders 28 are of a conventional type which allow the strap to be drawn off of the coils 26 and 27 by merely pulling on the leading ends of the straps.

The leading ends of the straps 21 and 22 emerge from the forward ends 19*a* and 20*a* of the guide tubes 19 and 20 where they extend vertically downward to the region of the upper level of the conveyor rollers 2 in the path of a palletized load 3 which would be transported in the direction of the arrow 29 on the conveyor 1. The extreme ends 21*a* and 22*a* of the straps 21 and 22 are ordinarily projected into an opening 30 of a flattened end 31 of a tube 32 which is one of the tines or forks of the improved device or apparatus of the invention. In order for the strap ends 21*a* or 22*a*, as shown in Fig. 2, to be inserted into the openings 30, the strap ends must be bent at approximate right angles and the springiness of the straps themselves provides a frictional bind in the openings 30 which temporarily holds the strap ends 21*a* and 22*a* in position in the openings 30.

The inner ends of these forks 32 are secured to an L-shaped frame 33 having a transverse arm 34 and a longitudinal arm 35. The longitudinal arm 35 passes through a guide sleeve 36 which guides it longitudinally and allows it to be rotated on its axis. This longitudinal arm 35 is also provided with a lever 36 which an operator can grasp to manipulate the entire frame 33 and the forks 32 attached to it. By manipulation of the lever 36, the longitudinal arm 35 can be moved longitudinally through the sleeve 36 to move the forks 32 clear of the strapping station 4 and it can also be used to rotate the longitudinal arm 35 on its axis to raise the transverse arm 34 and its attached forks 32 to a vertical position out of the path of an oncoming palletized load 3 so that the load can pass by the strapping station 4 without interference from the formed frame 33.

The pressure platen 8 is provided with grooves 37 and 38 at its lower face 39 and these grooves 37 and 38 extend for the entire width of the platen and provide clearance for the straps 21 and 22 when the platen 8 is lowered against a load 3. The platen 8 is also provided with a groove 40 in its lower face 39 and this groove extends for the entire width of the platen in a direction normal to the direction of the grooves 37 and 38. This groove 40 provides clearance between the platent and the package to permit positioning of the transverse straps on the load. Although only three grooves 37, 38 and 40 are shown, obviously any number of grooves can be provided depending upon the number of straps to be applied to the load.

In operation, a load 3 is positioned on the conveyor 1 at its entrance length 1*a* in preparation for being strapped and all parts of the apparatus are positioned as shown in Fig. 1. At this time, the straps 21 and 22 are guided through the guides 23 and 24, up through the guides 19 and 20 and out through their exit ends 19*a* and 20*a* in vertically suspended positions with their extreme ends 21*a* and 22*a* temporarily frictionally gripped in the ends 31 of the tines or forks 32. The forks 32 are, at this time, positioned down closely parallel to the rollers 2 at the strapping station 4. They are deliberately positioned above the level of the rollers 2 by an amount sufficient to allow for the lower face of a pallet to be positioned freely beneath them. Their height is controlled by having their inner ends secured to the arm 34 of the frame 33 at a proper level. Also, at this time, the entire frame 33 including the forks 32 and the arm 35 is retracted relative to the sleeve 36 substantially as far to the left, as viewed in Fig. 1, as possible. Also, the platen 8 of the baling press 5 is in its elevated position caused by having extended the piston rods 14 and 15 of the cylinders 12 and 13 by proper control of fluid or air in the cylinders by conventional control means.

The sequence of operation of the apparatus can be better understood upon reference to Figs. 3, 4 and 5. In Fig. 3, the parts shown schematically are in the same relative positions as are shown in Fig. 1. The load 3 consists of a compressible package having a lower container 3*a* provided with a cover 3*b* telescoped over it. The load 3 is supported on a pallet 41 which consists of two faces 42 and 43 positioned parallel to and vertically apart from each other by means of corner posts 44 so that a space 45 exists between the two faces 42 and 43.

When it is desired to begin the strapping cycle, the load 3 is moved with its pallet 41 in the direction of the arrow 29 to a position at the strapping station 4 as shown in Fig. 4. When moved to this position the forward face of the load 3 presses against the straps 21 and 22 and forms them into a loop of reverse C-shape. As the load 3 is moved, the forks or tines 32 are directed between the layers 42 and 43 of the pallet 41 so that the strap is directed into the space 45 beneath the face 42 of the pallet. This results in the straps 21 and 22 being in contact with the lower surface of the upper face 42 of the pallet and also in contact with the forward and upper faces of the load. When the load 3 is in this position the pressure platen 8 is lowered by actuation of the piston rods 14 and 15 of the cylinders 12 and 13. It is lowered until its lower face 39 contacts the upper surface of the load 3. The platen 8 continues downwardly by an amount sufficient to compress the cover 3*b* in telescoping fashion further down onto the container portion 3*a* of the load 3 to compress the contents of the container 3*a*. This movement is indicated by the arrow 46 in Fig. 4 where it is apparent that the straps 21 and 22 are provided with free movement in the grooves 37 and 38 even though the platen 8 is pressed against the load 3. As the load 3 is compressed, the straps 21 and 22 also bulge as shown at 21*b* and 22*b*. This is not significant, but it occurs because the guide tubes 19 and 20 are lowered along with the pressure platen 8 because they are attached to it.

After the conditions of Fig. 4 are reached, the operator grasps the strap ends 21*a*, 22*a*, 21*c* and 22*c* after severing the ends 21*c* and 22*c* from the supply portion connected to the coils 26 and 27 and draws them around to positions as indicated in dotted lines in Fig. 5 where they are overlapped, tensioned and joined together by conventional strapping tools which form interlocking joints 47 between the strap ends. After the joints 47 are formed, the straps are then in the form of closed strap loops encircled longitudinally about the load.

Up until the time that the strap ends 21*a* and 22*a* are removed from the forks 32, they are frictionally held therein. However, after the straps are applied in a longitudinal direction, a need for the frame member 33 and its associated forks 32 is no longer required. Also, it is necessary to remove the forks 32 from the space 45 between the pallet faces 42 and 43 so that the strapped load can be passed on the conveyor beyond the strapping station 4 to the exit length 1*c* of the conveyor where it can be removed for subsequent handling or shipment. In addition, it is desirable to remove the forks 32 so that the transverse straps or strap can be secured around the load without interference from the forks 32. As viewed in

Fig. 5, a transverse strap 48 is shown applied around the load 3. This strap extends above the load through the groove 40 in the lower face of the platen 8, around the rear of the load and beneath the upper face 42 of the pallet. The two overlapping ends of the strap loop terminate at a sealed joint 49 on the forward face of the load. The application of this transverse strap loop 48 can be made entirely by hand by directing the strap from one side of the load to the other to form the loop around it, or else a separate strap guide can be inserted in the apparatus for applying this strap. Whether auxiliary apparatus is used or application of the strap is entirely by hand, is immaterial to this invention. The important aspect is that this transverse strap 48, or as many others as are required, can be applied while the pressure platen 8 remains in its compressed stroke during which the longitudinal strap loops from the straps 21 and 22 have been previously applied.

In order to remove the forks 32 from the space 45 between the faces 42 and 43 of the pallet, the handle 36 of the frame 34 is slid in the sleeve 36 toward the right until the ends 31 of the forks 32 are clear of the forward edge of the pallet 41. At that time, the handle 36 is used to pivot the arm 35 of the frame on its longitudinal axes in the sleeve 36 as a pivot. This angularly elevates the forks 32 to a position as shown in Fig. 5 where the entire frame and its fork members 32 are clear of the path of the strapped load. When this position of the frame is reached, the platen 8 is again raised to the position as shown in Figs. 1 and 3 and the strap load is transported forward to the exit length 1c of the conveyor. Two new lengths of the straps 21 and 22 are drawn off from the coils 26 and 27 and suspended vertically from the strap guides 19 and 20 with their new ends 21a and 22a inserted in the openings 30 of the forks 32 where they are temporarily held for the next strapping cycle. The entire strapping cycle is then repeated for the next palletized load and repeated thereafter in the same manner for all subsequent loads.

Although only a single embodiment of the invention has been shown and described, it should be understood that the invention can be made in many different ways without departing from the true scope of the appended claims.

I claim:

1. Strapping apparatus for encircling a flexible strap around a load supported on a pallet of a type having two parallel faces provided with a space therebetween comprising, support means for supporting said pallet at a strapping station, strap guide means for directing a strap downwardly in a suspended substantially vertical position at the strapping station in the path of said pallet, a tine being positioned above the level of the support means and approximately parallel to it, the end of said tine being provided with gripping means for temporarily gripping the leading end of a strap suspended from the strap guide means so that movement of the pallet toward the suspended strap causes the tine and the strap end it grips to be inserted into the space between the two parallel faces of the pallet and causes the strap to bulge in the direction of movement of the pallet and be wrapped along the bottom of the upper face of the pallet and the forward and upper surfaces of the load supported on the pallet.

2. Strapping apparatus as defined by claim 1 characterized by, said tine being mounted at said strapping station for retraction from the space between the two faces of the pallet.

3. Strapping apparatus as defined by claim 1 characterized by, said tine being mounted at said strapping station for retraction from the space between the two faces of the pallet and clear of the path of movement of the pallet.

4. Strapping apparatus for encircling flexible straps around a load supported on a pallet of a type having two parallel faces provided with a space therebetween comprising, support means for supporting said pallet at a strapping station, strap guide means for directing a plurality of straps downwardly in suspended substantially vertical positions at the strapping station in the path of said pallet, a plurality of tines being positioned above the level of the support means and substantially parallel to it, the ends of the tines each being provided with gripping means for temporarily gripping the leading end of one of the straps suspended from the strap guide means so that movement of the pallet toward the suspended straps causes the tines and the strap ends gripped thereby to be inserted into the space between the two parallel faces of the pallet and cause the straps to bulge in the direction of movement of the pallet and be wrapped along the bottom of the upper face of the pallet and the forward and upper surfaces of the load supported by the pallet.

5. Strapping apparatus as defined by claim 4 characterized by, said tine being mounted at said strapping station for retraction from the space between the two faces of the pallet.

6. Strapping apparatus as defined by claim 4 characterized by, said tine being mounted at said strapping station for retraction from the space between the two faces of the pallet and clear of the path of movement of the pallet.

7. Strapping apparatus for encircling a flexible strap around a load supported on a pallet of a type having two faces with a space therebetween comprising, support means for supporting said pallet at a strapping station, strap guide means for directing a strap downwardly in a suspended substantially vertical position adjacent the strapping station and in the path of said pallet, a tine being positioned above the level of the support means and approximately parallel to it with its free end extending in a reverse direction to the ordinary path of travel of said pallet toward said strapping station, the free end of said tine being provided with gripping means for releasably gripping the leading end of a strap suspended from the strap guide means so that movement of the pallet toward the suspended strap causes the tine and the strap end it grips to be inserted into the space between the two faces of the pallet and the strap to be bulged in the direction of movement of the pallet and wrapped along the bottom of the upper face of the pallet and the forward and upper surfaces of the load supported on the pallet, said tine being supported on the end opposite its free end by a frame slidably mounted at said strapping station for movement which retracts the tine from the space between the faces of the pallet.

8. Strapping apparatus as defined by claim 7 characterized by, said frame also being pivotally mounted at said strapping station in such a manner that pivotal movement of said frame causes said tine to be moved out of the ordinary path of movement of said pallet away from said strapping station.

9. Strapping apparatus for encircling flexible straps around a load supported on a pallet of a type having two faces with a space therebetween comprising, support means for supporting said pallet at a strapping station, strap means for positioning a plurality of straps in vertical positions adjacent the strapping station and in the path of said pallet, a fork provided with a plurality of tines connected to it, said fork being mounted on a frame which supports the tines above the level of the support means and substantially parallel to it, the ends of the tines each having gripping means for releasably gripping the leading end of one of the straps positioned vertically by the strap means, the relative positions of the tines to the pallet adjacent the strapping station being such that movement of the pallet toward the positioned straps causes the tines and the strap ends gripped thereby to be inserted into the space between the two faces of the pallet and cause the straps to be bulged into wrapping contact with the lower surface of the upper face of the pallet and outside surfaces of the load supported by the pallet.

10. Strapping apparatus for encircling flexible straps around a load supported on a pallet of a type having two faces with a space therebetween comprising, support

means for supporting said pallet at a strapping station, strap means for positioning a plurality of straps in vertical positions adjacent the strapping station and in the path of said pallet, a fork provided with a plurality of tines connected to it, said fork being mounted on a frame which supports the tines above the level of the support means and substantially parallel to it, the ends of the tines each having an opening into which the leading end of one of the straps positioned vertically by the strap means can be inserted for releasably gripping the strap end, the relative positions of the tines to the pallet adjacent the strapping station being such that movement of the pallet toward the positioned straps causes the tines and the strap ends gripped thereby to be inserted into the space between the two faces of the pallet and cause the straps to be bulged into wrapping contact with the lower surface of the upper face of the pallet and outside surfaces of the load supported by the pallet.

11. Strapping apparatus for encircling a flexible strap around a load supported on a pallet of a type having two parallel faces provided with a space therebetween comprising, support means for supporting said pallet at a strapping station, strap guide means for directing a strap downwardly in a suspended substantially vertical position at the strapping station in the path of said pallet, a tine being positioned above the level of the support means and approximately parallel to it, the end of said tine being provided with an opening into which the leading end of a strap suspended from the strap guide means can be inserted for releasably gripping the strap end so that movement of the pallet toward the suspended strap causes the tine and the strap end it grips to be inserted into the space between the two parallel faces of the pallet and causes the strap to bulge in the direction of movement of the pallet and be wrapped along the bottom of the upper face of the pallet and the forward and upper surfaces of the load supported on the pallet.

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