United States Patent [19]

Marchetti

[11] **3,905,175**

[45] **Sept. 16, 1975**

[54] **DEVICE FOR CLOSING THE REAR FLAP OF A PARALLELEPIPED BOX**

[76] Inventor: **Augusto Marchetti,** Piazza Sicilia, 7, Milan, Italy

[22] Filed: **Apr. 9, 1974**

[21] Appl. No.: **459,278**

[52] **U.S. Cl.** **53/76;** 53/374

[51] **Int. Cl.²** **B65B 57/02;** B65B 7/20

[58] **Field of Search** 53/76, 374, 375, 382

[56] **References Cited**

UNITED STATES PATENTS

3,354,606	11/1967	Miller et al.	53/76
3,775,937	12/1973	Devan et al.	53/374 X

Primary Examiner—Travis S. McGehee

Attorney, Agent, or Firm—Karl W. Flocks

[57] **ABSTRACT**

There is disclosed a device for closing the rear flap of a parallelepiped box. Such device comprises an axially movable and rotatable shaft disposed on one side of the path of advancement of the box and directed transversally thereto, a rod fixed perpendicularly to the shaft, control means operable to cause the axial movement of the shaft from a retracted position to an extended position in which the rod is in the path of advancement of the box, and guide means for transforming at least the last part of the axial movement of the shaft into a helical movement of the shaft and of the rod, which enable the rod to be introduced below the rear flap of the box and to be rotated in engagement with such rear flap to cause closing thereof.

6 Claims, 10 Drawing Figures

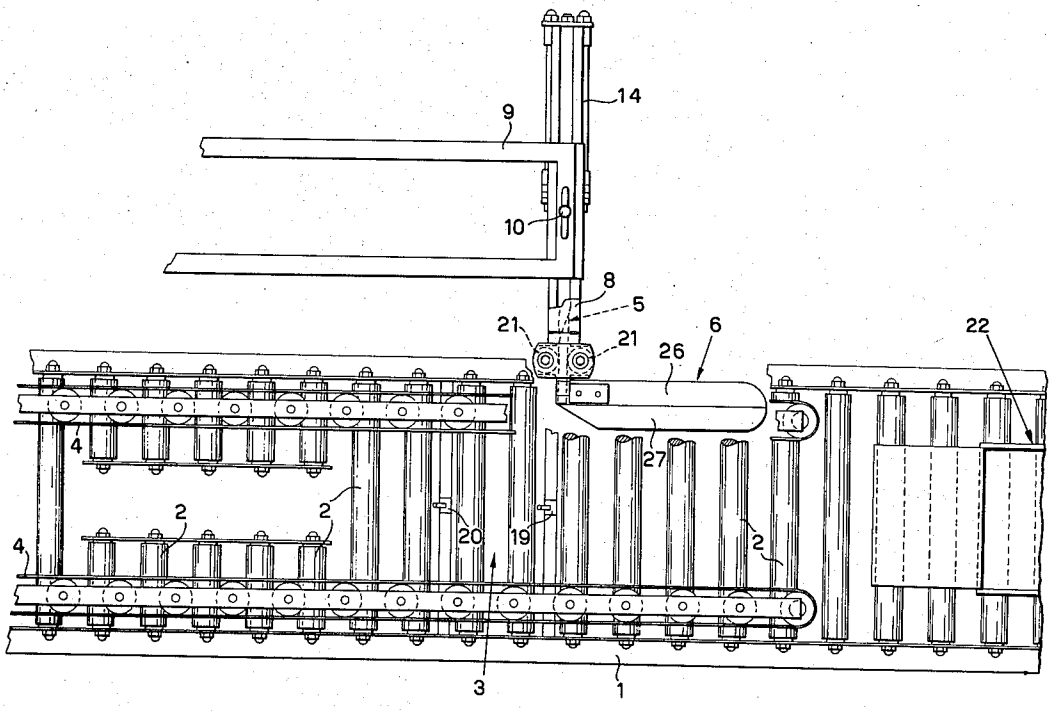


Fig.1

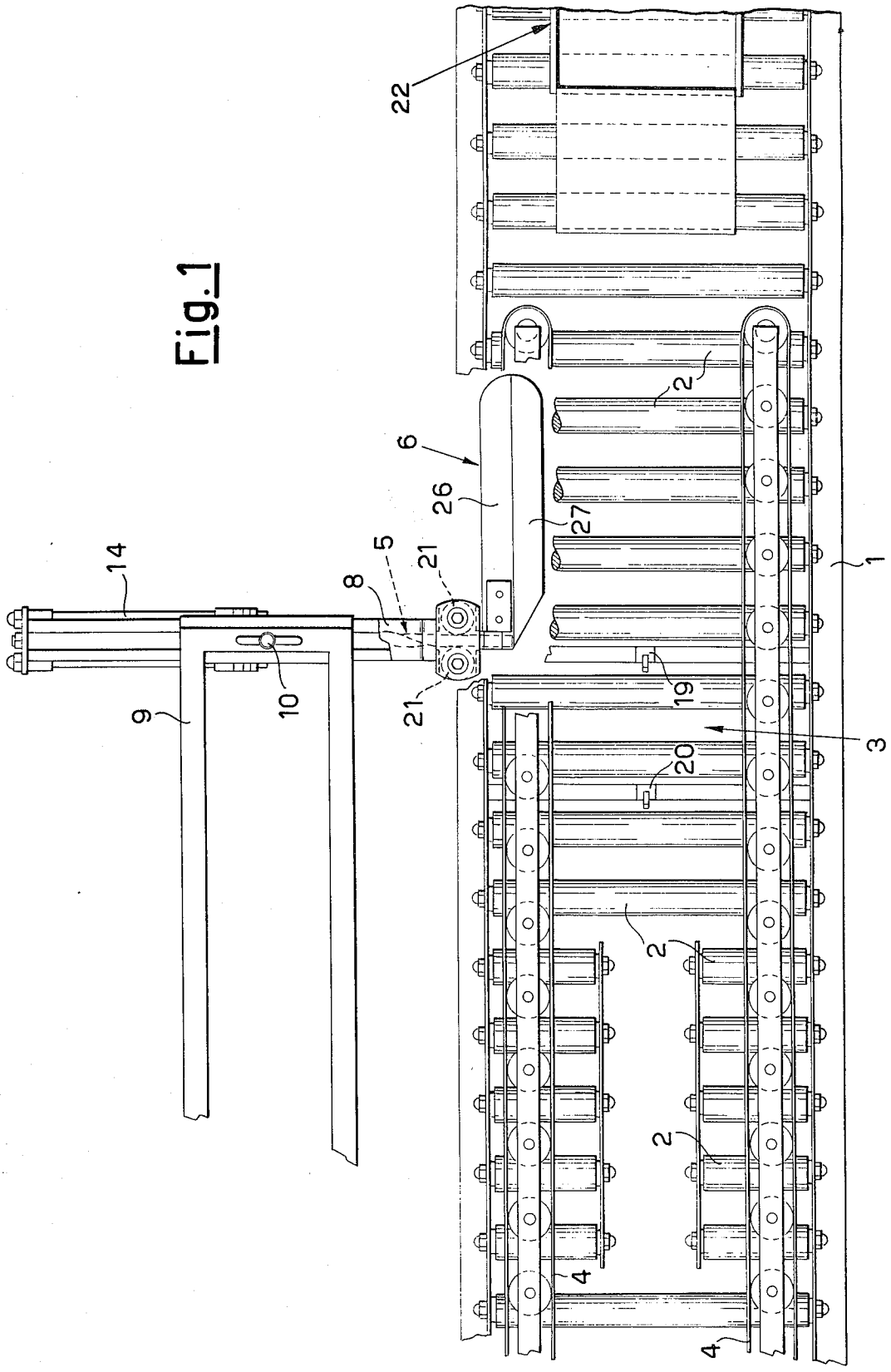


Fig. 2

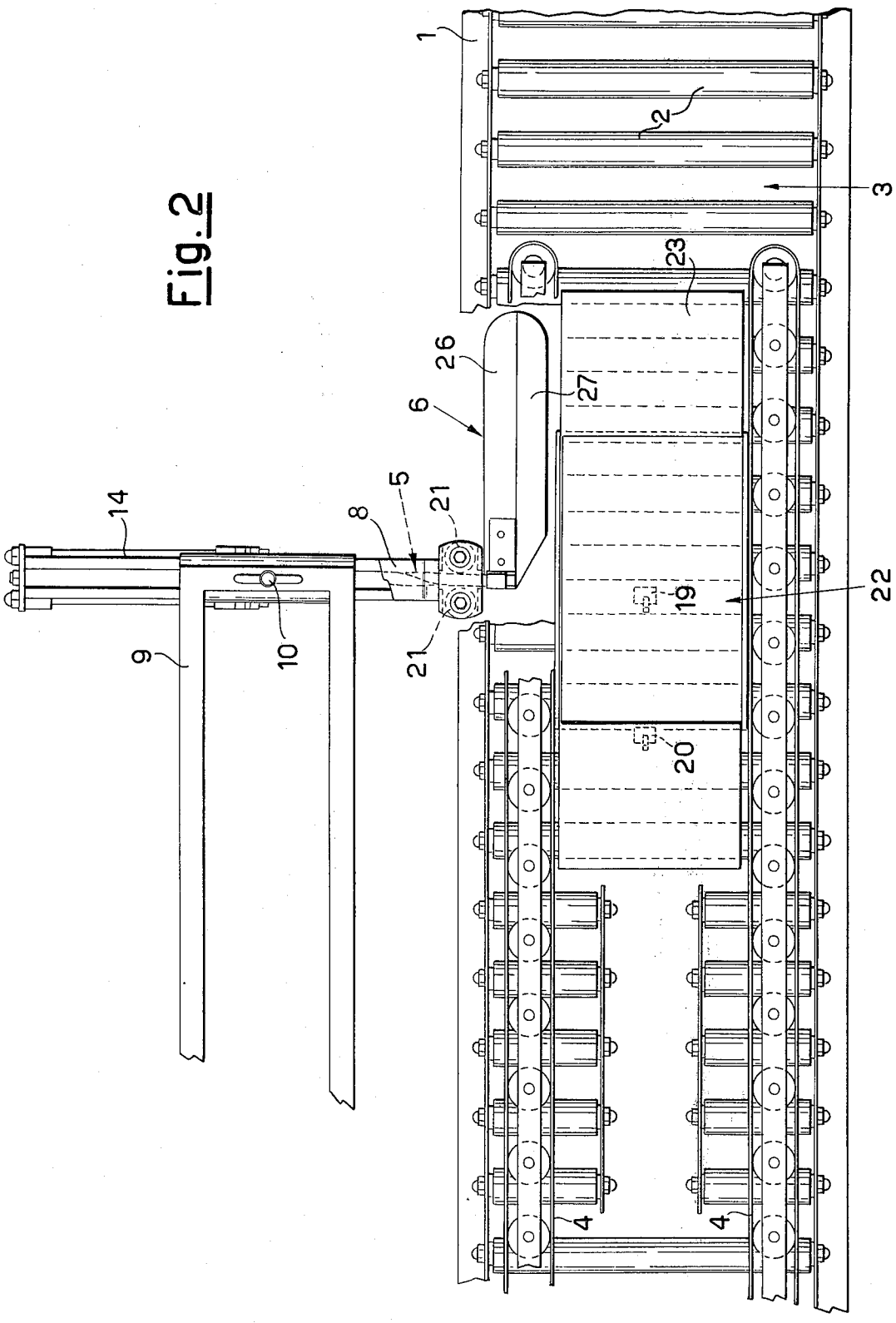


Fig. 3

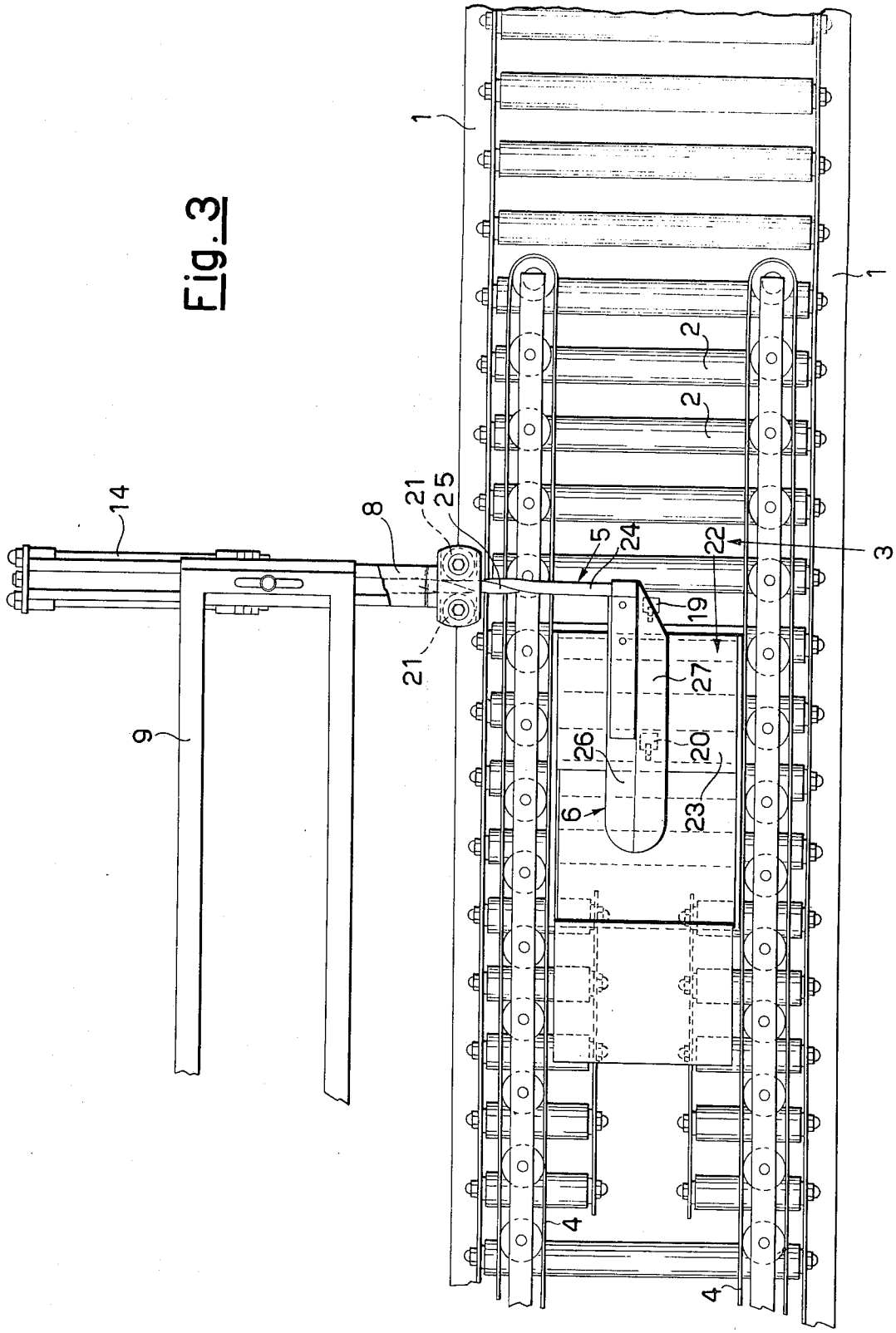


Fig. 4

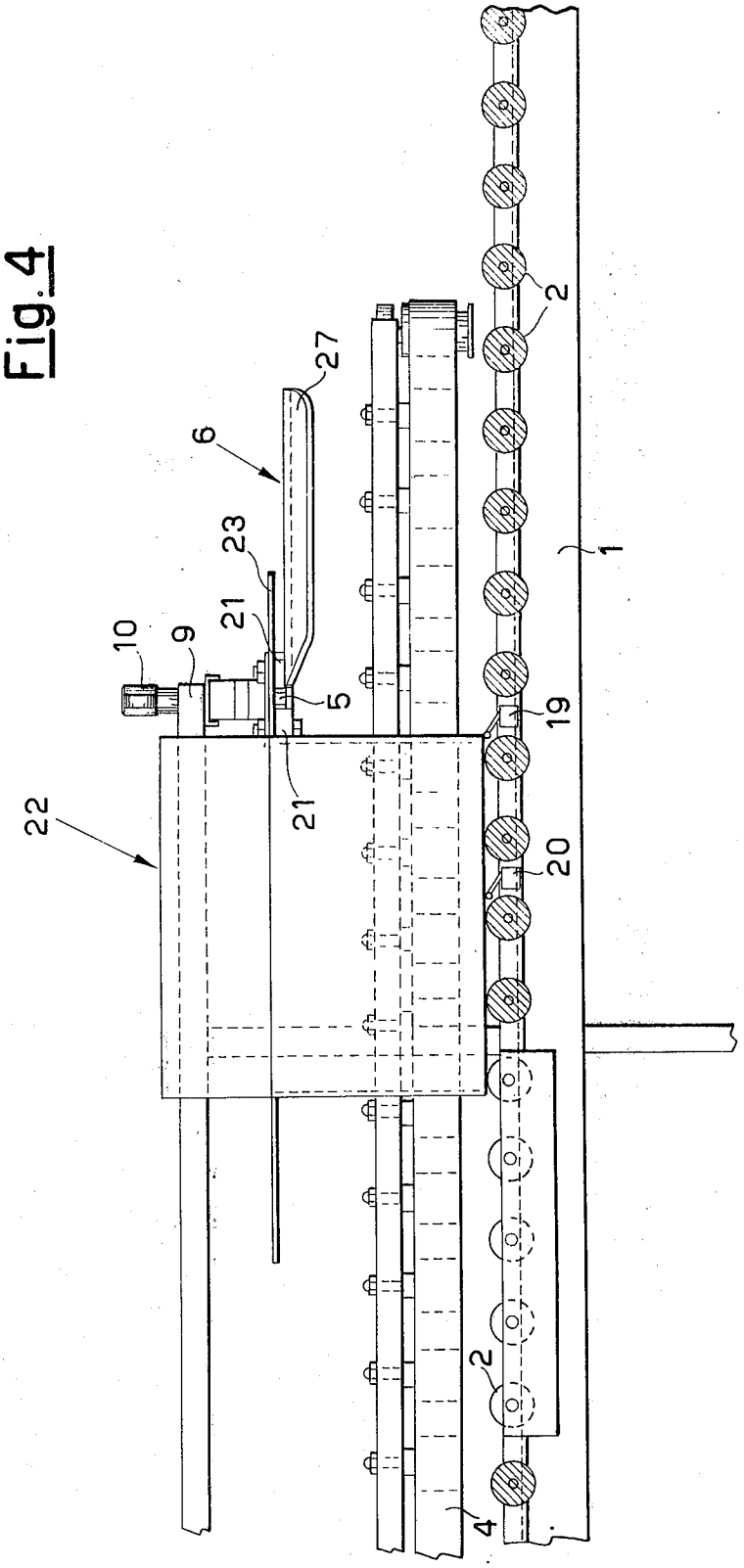


Fig. 5

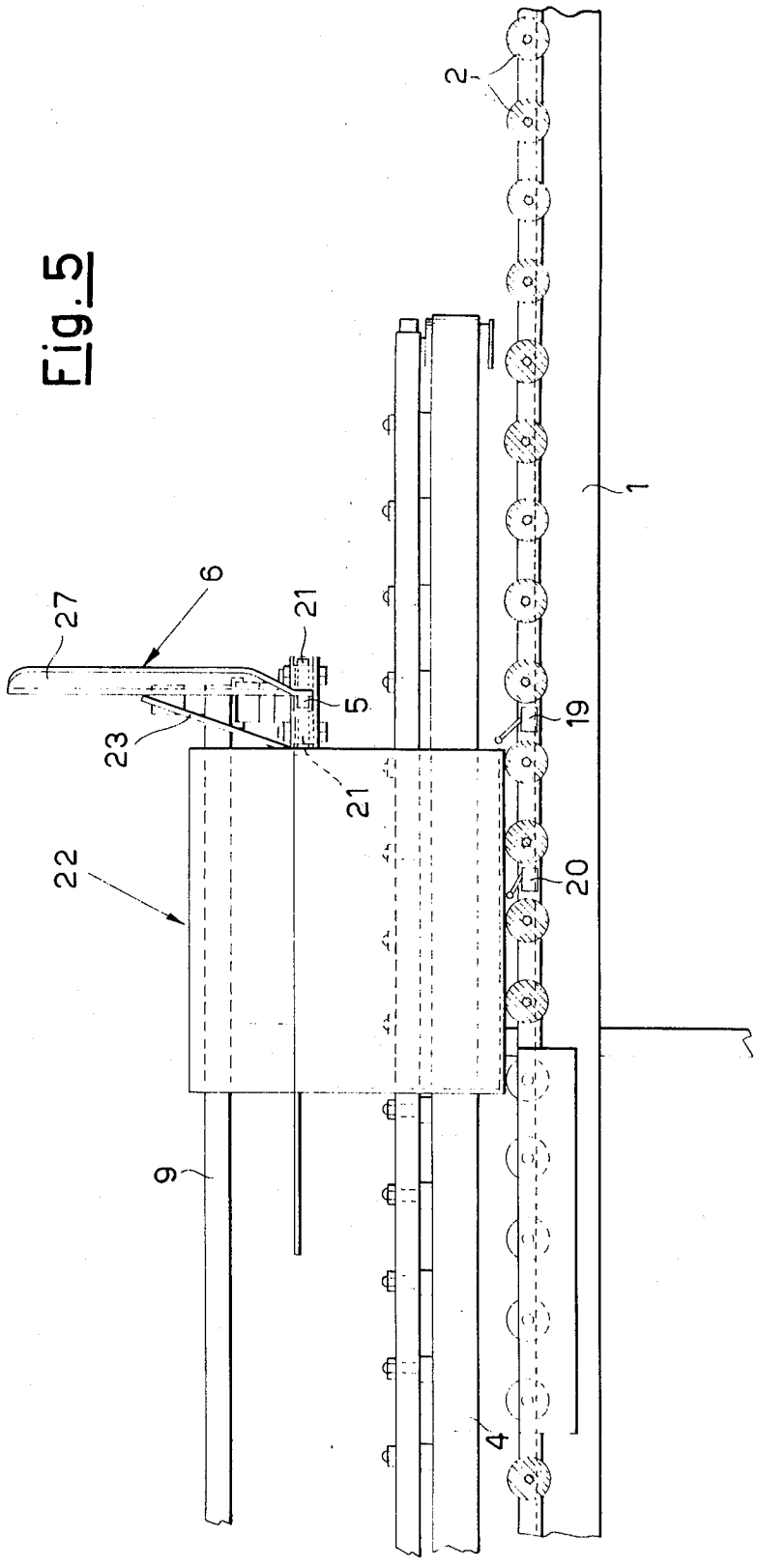


Fig.6

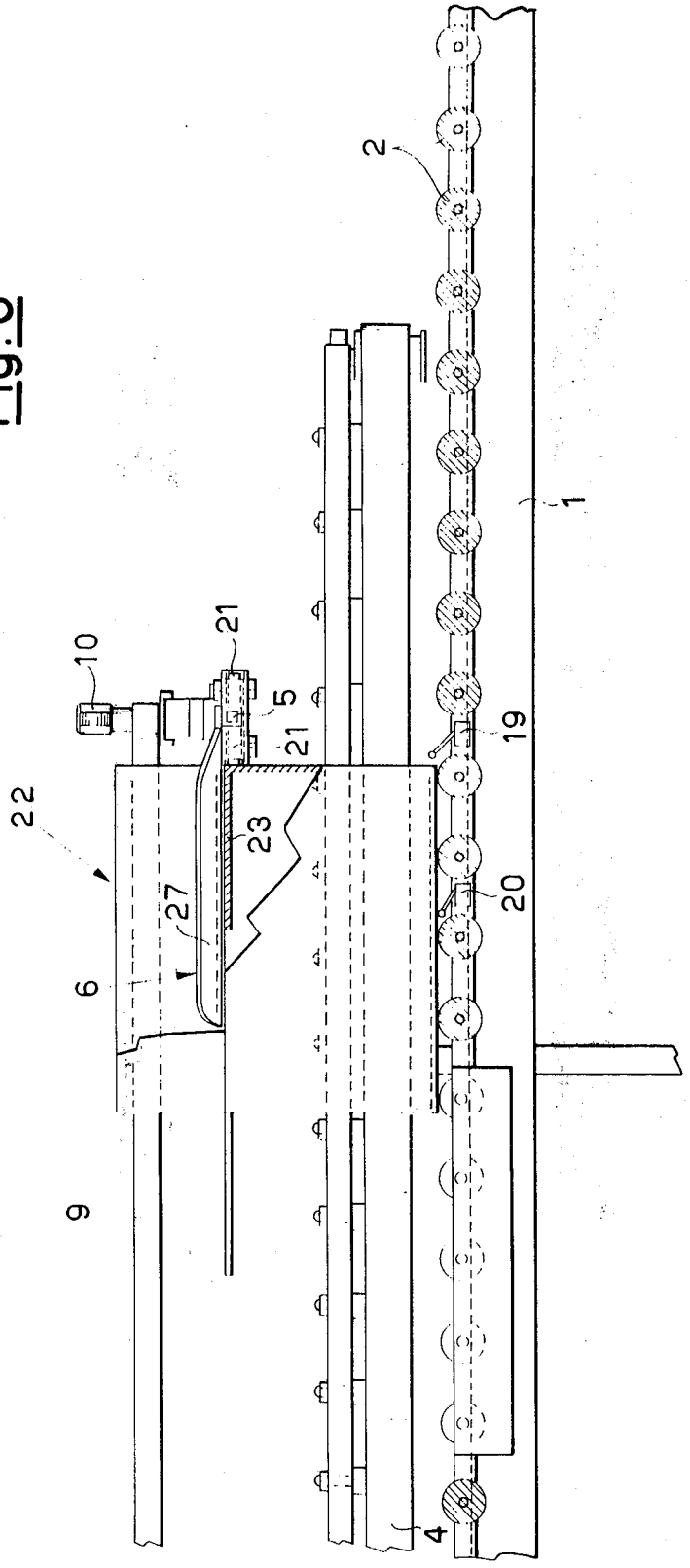


Fig. 7

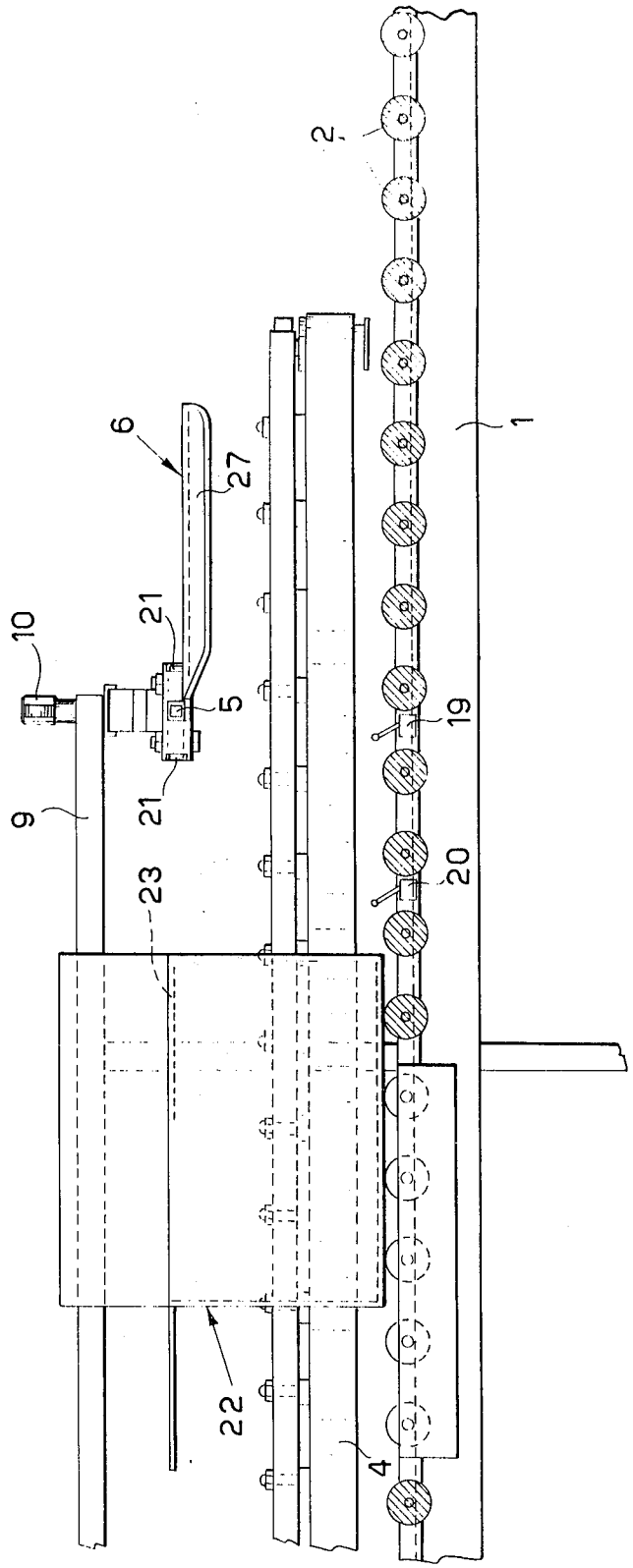
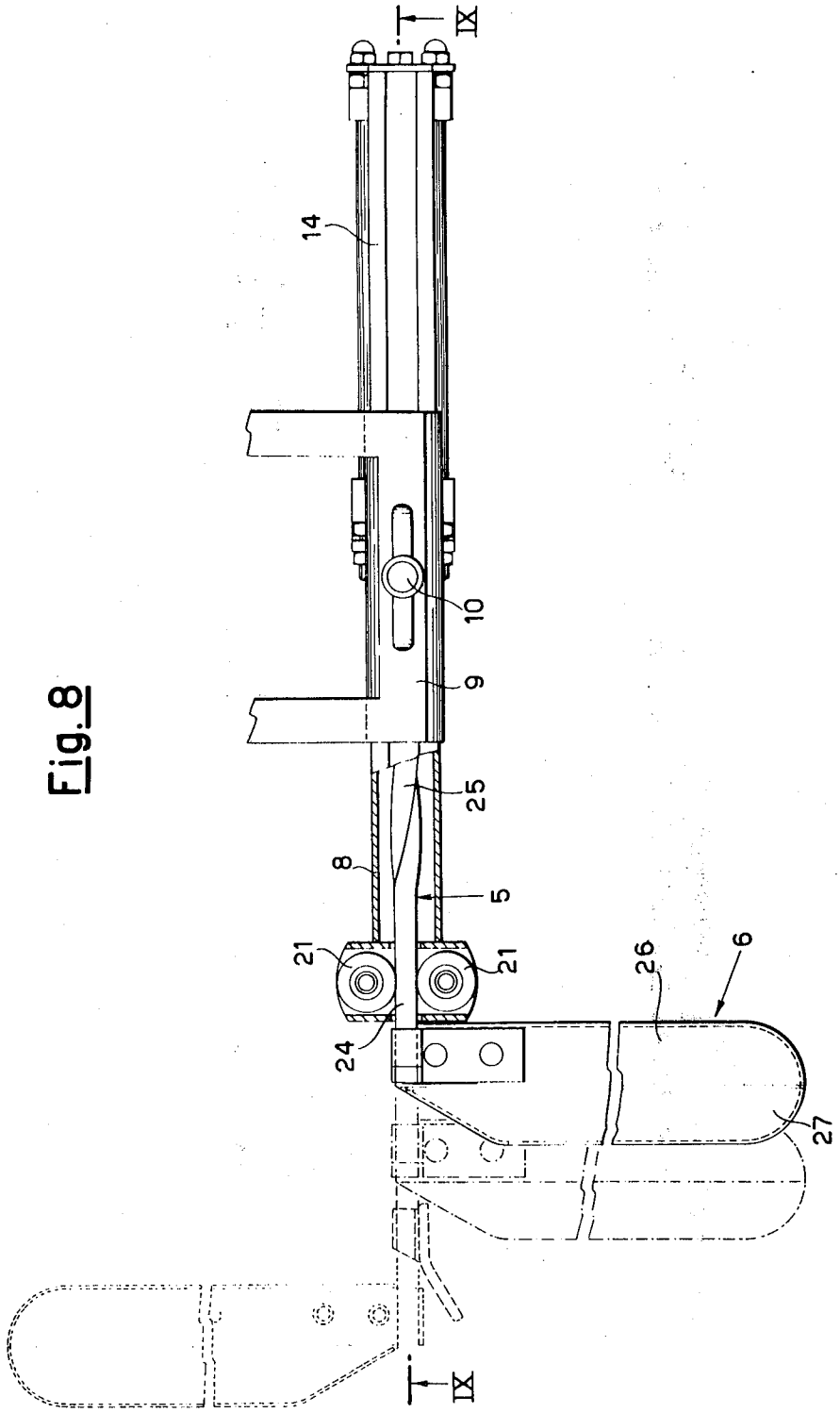


Fig. 8



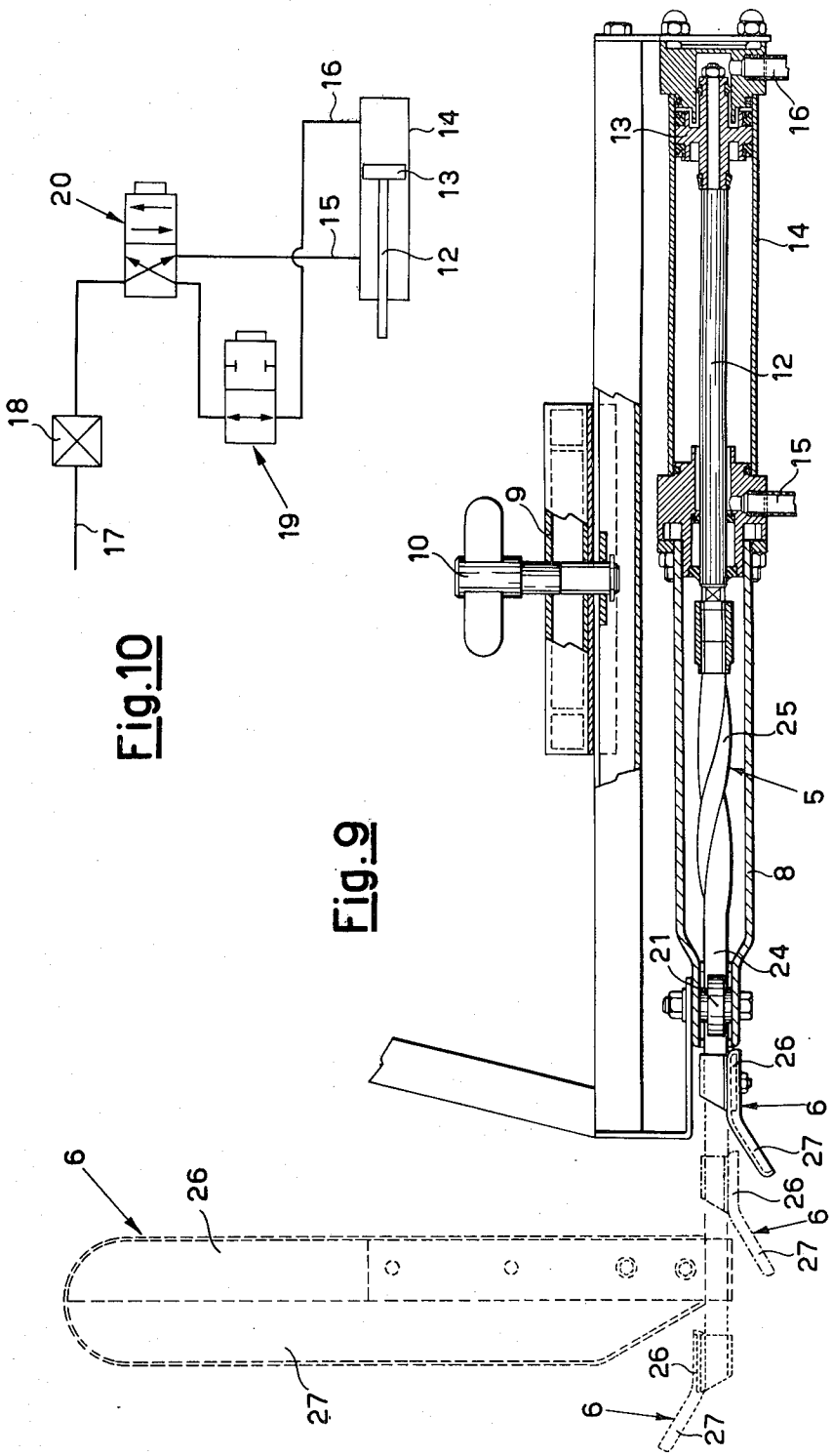

16
14
13
12
15
20
18
17
19
10
9
13
16
14
12
15
25
5
8
21
24
26
6
27
26
6
27
26
27
6
27

Fig.10

Fig.9

DEVICE FOR CLOSING THE REAR FLAP OF A PARALLELEPIPED BOX

This invention relates to a device for closing the rear flap of a parallelepiped box.

Numerous machines for closing parallelepiped boxes are known, which first bend over the end flap and then the side flap, using suitable devices distributed along the path of advancement of the box.

Perhaps the greatest problem encountered in constructing machines of this type is represented by the construction of the closing device for the rear flap, which must be able to satisfy the double condition of firstly not hindering the movement of advancement of the box and then, when the box has passed, of applying a thrust to the rear flap in the same direction as its direction of motion, capable of bending it over.

This problem has been resolved up to the present time by mainly using devices based on the presence of rotating arms of horizontal axis of rotation situated above the box, or on the presence of oblique toothed belts driven so as to engage with the free end of the rear flap, and, on advancing, bend it over into the closure position. An example of this latter type of device is described and illustrated in Italian Pat. No. **953,635** of **8/4/1972** in the name of the present applicant.

However the aforementioned devices give rise to the difficulty of being completely ineffective where the box presents itself with the rear flap very open, in particular at **90°** to the wall of the box to which it is fixed. In this case neither the rotating arms nor the toothed belts are able to efficiently engage with the flap, which consequently remains open.

The object of the present invention is consequently to provide a device which besides satisfying the previously mentioned double condition is also able to bend over the rear flap of a parallelepiped box into the closure position when the inclination of the open flap is very accentuated, for example **90°** or more.

According to the invention this object is attained by a device comprising a support surface along which the box is made to advance, an axially translatable and rotatable shaft disposed on one side of said support surface and directed transverse to the path of advancement of the box, a rod fixed perpendicularly to that end of the shaft nearer said support surface, control means operable after the box has advanced beyond the shaft in order to cause the axial movement of said shaft from a retracted position in which said rod is outside the path of advancement of the box to an extended position in which said rod is inserted into the path of advancement of the box, and guide means for transforming at least the last part of said axial movement of the shaft into a helical movement which enables said rod to rotate simultaneously about the axis of the shaft from a first position in which it is directed towards the inlet end of the support surface to a second position in which it is directed towards the exit end of the support surface, passing through a succession of intermediate positions in which said rod engages from below with the rear flap of the box and bends it over into the closure position.

It is evident that the device according to the invention, which is very simple and of extremely reduced cost, is perfectly able to satisfy with complete reliability of operation the double condition of firstly not hindering the advancement of the box and then, when the box has passed, of applying to the rear flap of the box that thrust necessary for its closure. In fact the shaft and rod fixed to it normally remain outside the path of advancement of the box, and only when the box has passed is that axial movement given to the shaft which enables the rod in its turn to advance so that it becomes introduced into the path of the box and at the same time rotate so as to give the rear flap of the box the thrust necessary for bending it over into closure.

It should also be noted (and this is the most important characteristic of the device according to the invention) that by suitably setting the height between the shaft and support surface according to the height of the box to be closed, it is possible to make the rod introduce itself below the rear flap (so as to then bend it over into the closure position) even if the flap is very open, for example at **90°** or more to the wall to which it is fixed. This characteristic, which is further improved and made more reliable by making the initial part of the movement of the rod a movement only of translation, evidently enables the stated disadvantage common to all known devices to be overcome and thus makes the device according to the invention perfectly able to close the rear flap of a box in whatever position the flap may effectively present itself (in fact the device according to the invention is ineffective if the flap presents itself at **180°**, but this condition is notably one which in practice cannot occur). In conclusion a device is thus provided which has a performance considerably superior to that of known devices.

The operation of the control means for the axial movement of the shaft could possibly be entrusted to an operator, but it is clearly preferable to make this depend on suitable means sensitive to the position of the box, which by causing operation of the control means as soon as the box reaches a predetermined position completely automates the operation of the device.

This latter case is that of the preferred embodiment of the device according to the invention, which is shown by way of example in the accompanying drawings in which:

FIGS. **1, 2** and **3** are plan views showing a device according to the invention in different stages of its operation;

FIGS. **4, 5, 6** and **7** are longitudinal sectional views showing said device in different stages of its operation;

FIG. **8** is an enlarged detailed plan view of the assembly consisting of the shaft, rod, control means and guide means;

FIG. **9** is a sectional view on the line IX—IX of FIG. **8**;

FIG. **10** is a diagrammatic representation of the means for providing the automatic intervention of the control means for the shaft.

The device shown in the drawings comprises a base frame **1**, which rotatably supports a plurality of idle rollers **2** which overall define a support surface **3** for the boxes to be closed.

Close to the sides of the support surface thus defined are disposed two belts **4** the purpose of which is to engage with the sides of the boxes so as to move them along said support surface.

On one side of the support surface **3**, but outside the path of advancement of the boxes, a shaft **5** with its outer surface partly flat (**24**) and partly helical (**25**) is disposed horizontally and transversely to the development of the surface **3**, and is housed in an axially slid-

able and rotatable manner in a cylinder **8** (FIGS. **8** and **9**), which in its turn is removably connected in an axially adjustable manner to a fixed support **9** provided with a locking clamp **10**. The shaft **5** carries at one end a rod **6** perpendicular to it (divided into two portions **26** and **27** disposed at an angle) and is connected at its other end to the rod **12** of a piston **13** slidable in a pneumatic cylinder **14**. This latter is fixed to the cylinder **8** and is provided with two feed and discharge ducts **15** and **16** which connect it to a source of compressed air **17** or to discharge (FIG. **10**) by way of a main switch **18** and two pneumatic valves **19** and **20** inserted in the path of advancement of the boxes (FIGS. **1–7**).

The free end of the cylinder **8** carries two idle rollers **21** which are engaged with the partly flat and partly helical surface of the shaft **5** so as to transform the axial movements given to the shaft **5** by the piston **13** into partly translational movements and partly helical movements. Because of this transformation of movement, when the piston **13** moves the shaft **5** from the retracted position of FIGS. **1** and **2** to the extended position of FIG. **3**, the rod **6** firstly translates along the axis of the shaft **5** and then, in addition to translating, rotates about it in the anti-clockwise direction (observing FIGS. **4–7**), so that it moves finally from the rest position of FIGS. **1, 2** and **4** (where it is situated outside the path of advancement of the boxes and is directed towards the inlet end of the support surface **3**) to the end of working position of FIGS. **3** and **6** (where it is situated within the path of advancement of the boxes and is directed towards the exit end of the support surface **3**), passing through a plurality of intermediate positions, one of which is shown in FIG. **5**. An exactly contrary movement obviously occurs when the piston **13** returns the shaft **5** from the extended position of FIG. **3** to the retracted position of FIGS. **1** and **2**.

The device shown on the drawings, relative to the described structure, operates in the following manner. When a box **22** provided with an open rear flap **23** begins its movement of advancement along the support surface **3** (firstly under the thrust of the operator and then by being dragged by the engagement of the belts **4** with the sides of the box), the two pneumatic valves **19** and **20** are in the rest position shown in FIG. **10**, because of which (obviously considering the main switch **18** closed) the duct **15** of the pneumatic cylinder **14** is connected to the supply **17** and the duct **16** of the cylinder **14** is connected to discharge. Consequently the piston **13** maintains the shaft **5** and hence the rod **6** in the rest position shown in FIG. **1** (and also in FIGS. **8** and **9**, in full line).

When the box **22** arrives in such a position that it pushes the operating pushbutton for the pneumatic valve **19** (FIG. **2**), this latter changes over with respect to the position of FIG. **10**, but this changeover has no effect on the piston **13** and therefore neither on the shaft **5** nor on the rod **6**, which consequently remain in the previously defined rest position. Likewise, the subsequent engagement of the box **22** with the pneumatic valve **20** (FIG. **4**) is also limited to changing over this latter with respect to the rest position of FIG. **10**, but in practice has no effect on the piston **13**, on the shaft **5** or on the rod **6** because of the position previously assumed by the valve **19**.

However when the valve **19** returns to the rest position of FIG. **10** because of its disengagement from the box **22** (FIGS. **5, 6** and **3**), the duct **15** finds itself connected to discharge, while the duct **16** is now connected to the supply **17**, because of which the piston **13** moves towards the left (observing FIGS. **9** and **10**) and consequently causes an analogous axial movement of the shaft **5**. Because of the engagement existing between the rollers **21** and the surface of the shaft **5**, this axial movement is initially maintained as such so as to enable the rod **6** to become introduced under the rear flap **23** (in this it is aided by the oblique disposition of its portion **27**), and is then transformed into a helical movement which obliges the rod **6** to effect a double simultaneous movement of translation and rotation (FIGS. **8** and **9**). The result of all this is that the rod **6**, besides advancing so as to become introduced into the path of advancement of the box **22** (but behind it and below the flap **23**), also rotates in the anti-clockwise direction and thus engages with the rear flap **23** of the box from below (FIG. **5**) and bends it over into the closure position (FIGS. **3** and **6**) even if, as in the case shown on the drawings, the flap is at **90°** to the wall of the box to which it is fixed.

When the box **22** leaves the valve **20** (FIG. **7**), this latter then returning to the rest position of FIG. **10**, the duct **15** becomes again connected to the supply **17** and the duct **16** becomes again connected to discharge, because of which the piston **13** makes an opposite movement, to which corresponds firstly a helical movement and then a translational movement of the shaft **5** and rod **6**. This latter thus returns to its rest position.

What I claim is:

1. Device for closing the rear flap of a parallelepiped box, comprising a support surface along which the box is made to advance, an axially translatable and rotatable shaft disposed on one side of said support surface and directed transverse to the path of advancement of the box, a rod fixed perpendicularly to that end of the shaft nearer said support surface, control means operable after the box has advanced beyond the shaft in order to cause the axial movement of said shaft from a retracted position in which said rod is outside the path of advancement of the box to an extended position in which said rod is inserted into the path of advancement of the box, and guide means for transforming at least the last part of said axial movement of the shaft into a helical movement which enables said rod to rotate simultaneously about the axis of the shaft from a first position in which it is directed towards the inlet end of the support surface to a second position in which it is directed towards the exit end of the support surface, passing through a succession of intermediate positions in which said rod engages from below with the rear flap of the box and bends it over into the closure position.

2. Device as claimed in claim **1**, comprising first means sensitive to the position of the box, which are operationally connected to said control means in such a manner as to cause these latter to operate for moving the shaft axially from said retracted position to said extended position when the box reaches a first advanced position beyond said shaft, and second means sensitive to the position of the box, which are operationally connected to said control means in such a manner as to cause these latter to operate for axially moving the shaft from said extended position to said retracted position when the box reaches a second position further advanced than the first.

3. Device as claimed in claim **2**, in which said sensitive means consist of pneumatic valves and said control

means consist of a pneumatic cylinder-piston unit, the cylinder of which is fed through said valves and the piston comprises a rod connected to the aforementioned horizontal shaft.

4. Device as claimed in claims **1,** in which the outer surface of said horizontal shaft is provided with at least one helical groove and said guide means comprise a fixed guide cylinder which surrounds said horizontal shaft and at least one element projecting radially from said cylinder which is slidably engaged in said helical groove.

5. Device as claimed in claim **4,** in which said outer surface of the horizontal shaft is provided with a flat portion situated between that end of the shaft to which said rod is fixed and the beginning of said helical groove.

6. Device as claimed in claim **1,** in which said rod is divided into two mutually inclined portions which follow each other in the direction of advancement of the horizontal shaft from said retracted position to said extended position, the rear portion being coplanar with said horizontal shaft and the front portion being inclined so as to aid insertion of the rod below the rear flap of the box.

* * * * *