United States Patent [19]

Falt et al.

[11] **3,916,600**

[45] **Nov. 4, 1975**

[54] **DEVICE FOR LOADING OF PACKAGES INTO TRANSPORT CONTAINERS**

[75] Inventors: **Ingvar K. O. Falt,** Malmo; **Per-Allan Ljungberg,** Lund; **Franz Soukup,** Malmo, all of Sweden

[73] Assignee: **Deering Milliken Research Corporation,** Spartanburg, S.C.

[22] Filed: **Jan. 15, 1975**

[21] Appl. No.: **541,235**

Related U.S. Application Data

[63] Continuation of Ser. No. 331,432, Feb. 12, 1973, abandoned.

[30] **Foreign Application Priority Data**

Feb. 14, 1972 Sweden 1707/72

[52] **U.S. Cl.** **53/142;** 53/26; 53/164; 53/168; 53/247

[51] **Int. Cl.²** **B65B 5/08;** B65B 35/38; B65B 35/56; B65B 25/00

[58] **Field of Search** 53/26, 35, 142, 143, 154, 53/155, 159, 164, 165, 166, 168, 237, 246, 247

[56] **References Cited**

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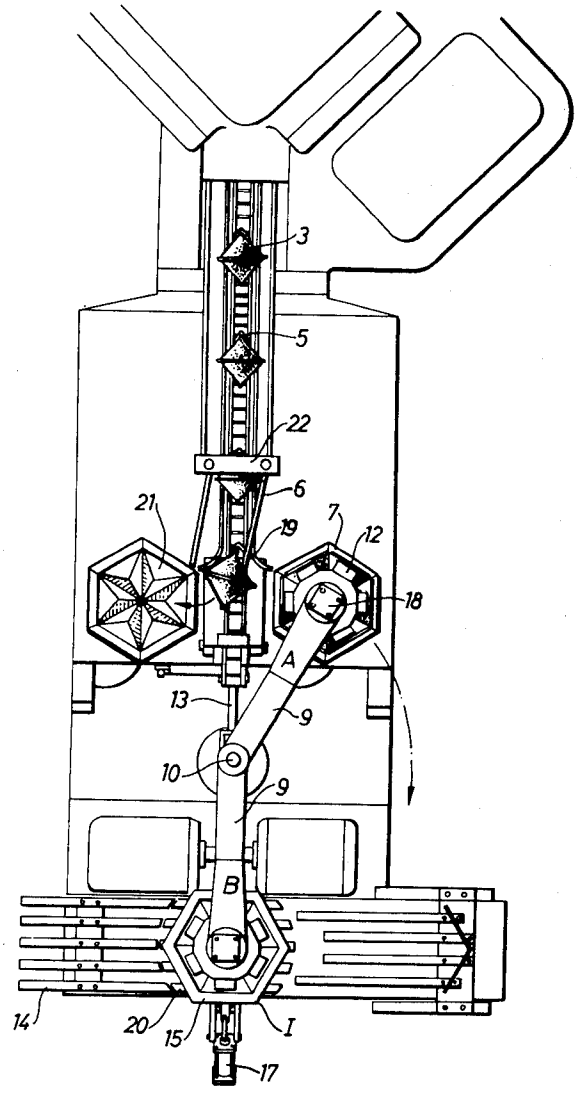
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Primary Examiner—Robert L. Spruill
Attorney, Agent, or Firm—H. William Petry; Earle R. Marden

[57] **ABSTRACT**

A method and apparatus to load a package transport container which includes an intermediate collection station whereat a number of individual packages are collected and oriented prior to transfer to the final transport container.

2 Claims, 11 Drawing Figures



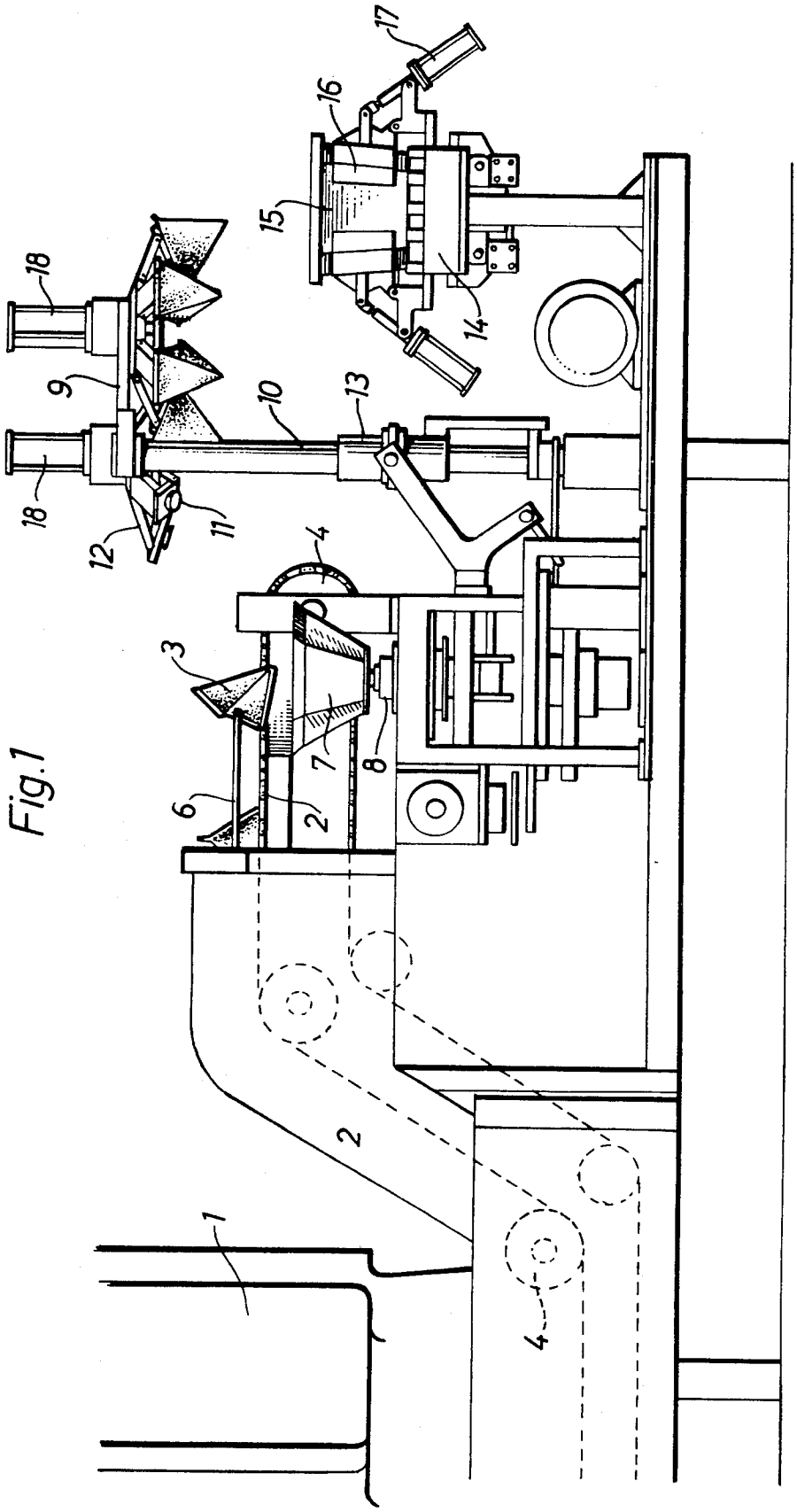


Fig.1

Fig.2

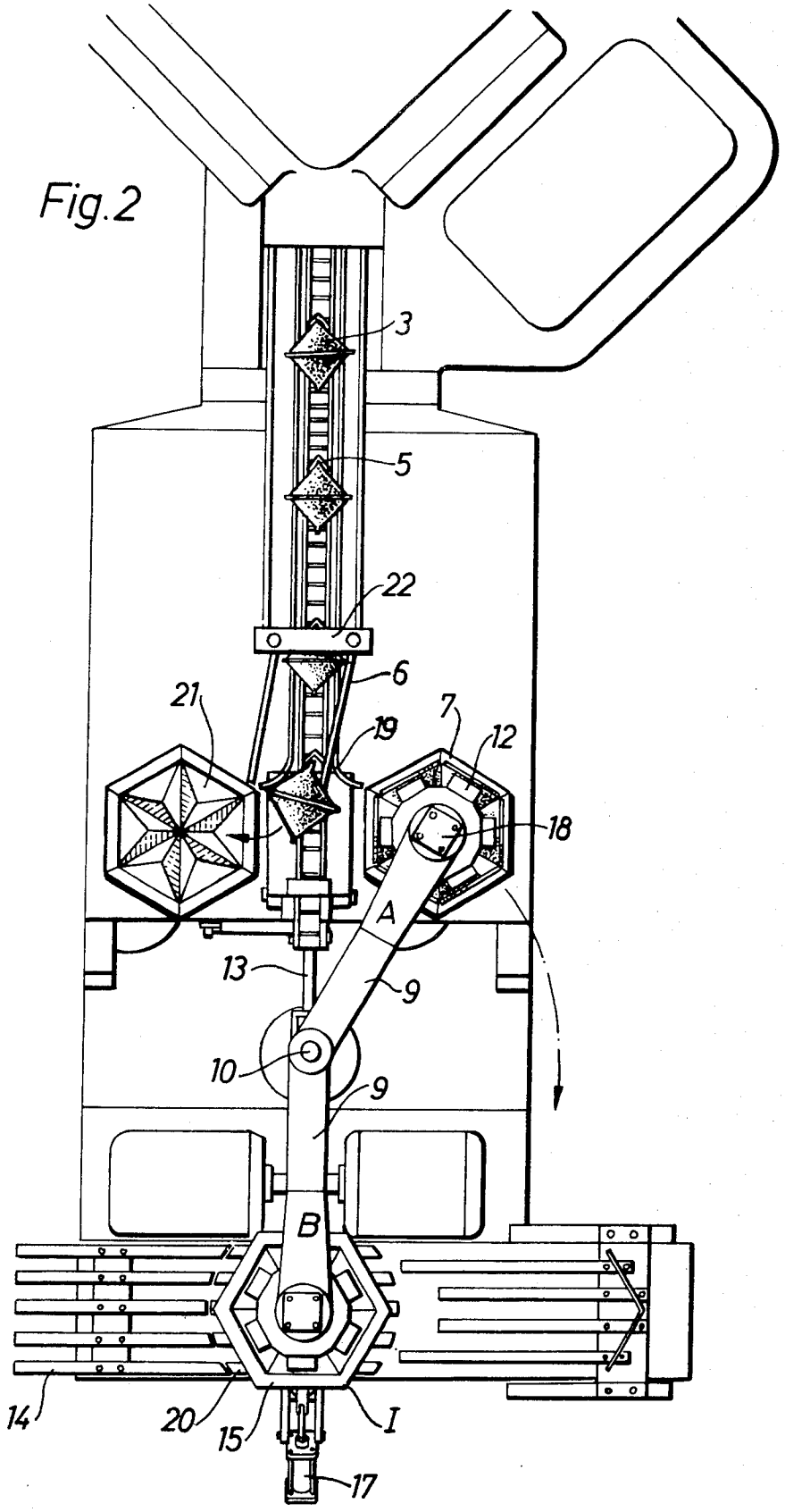


Fig.3

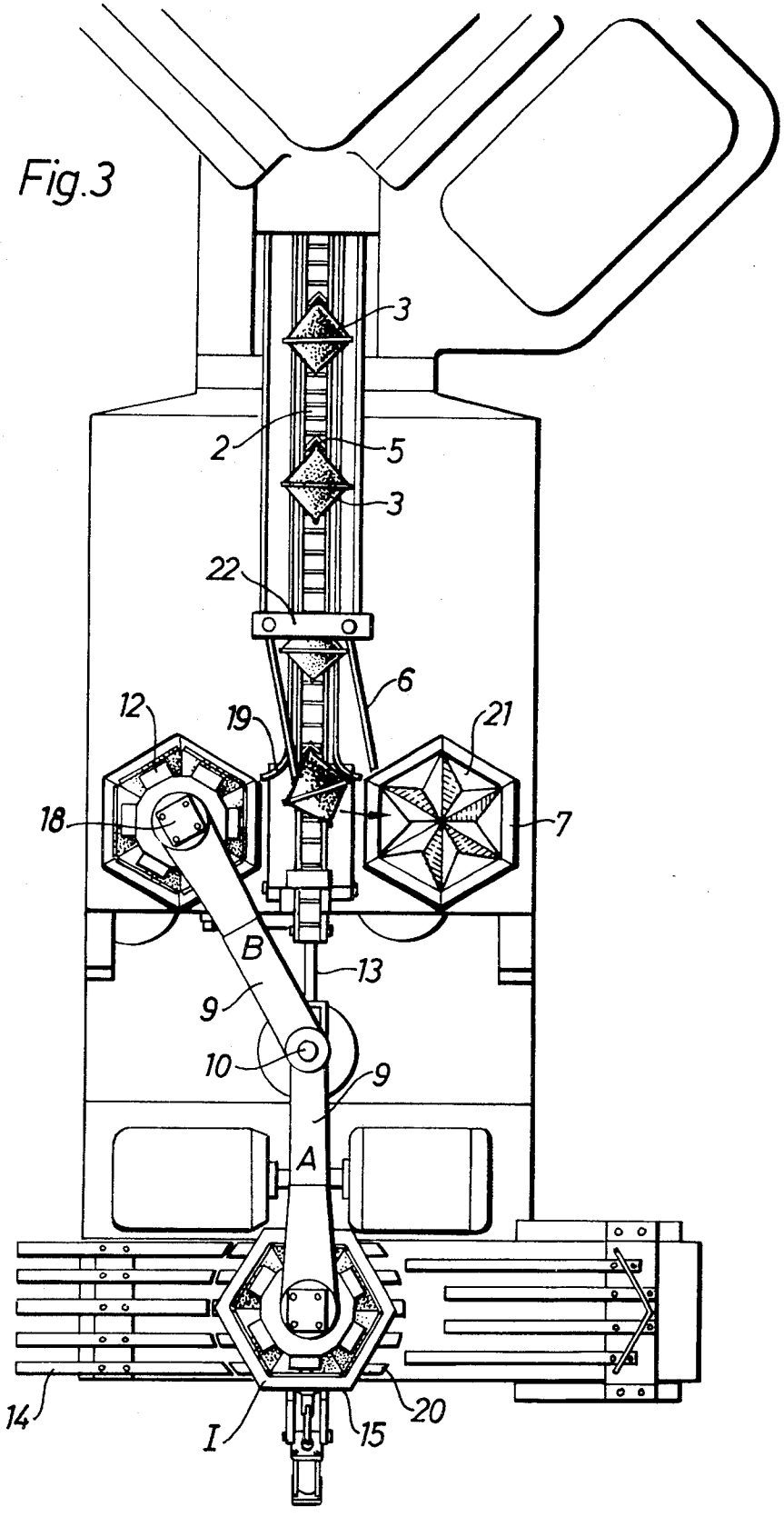


Fig. 4

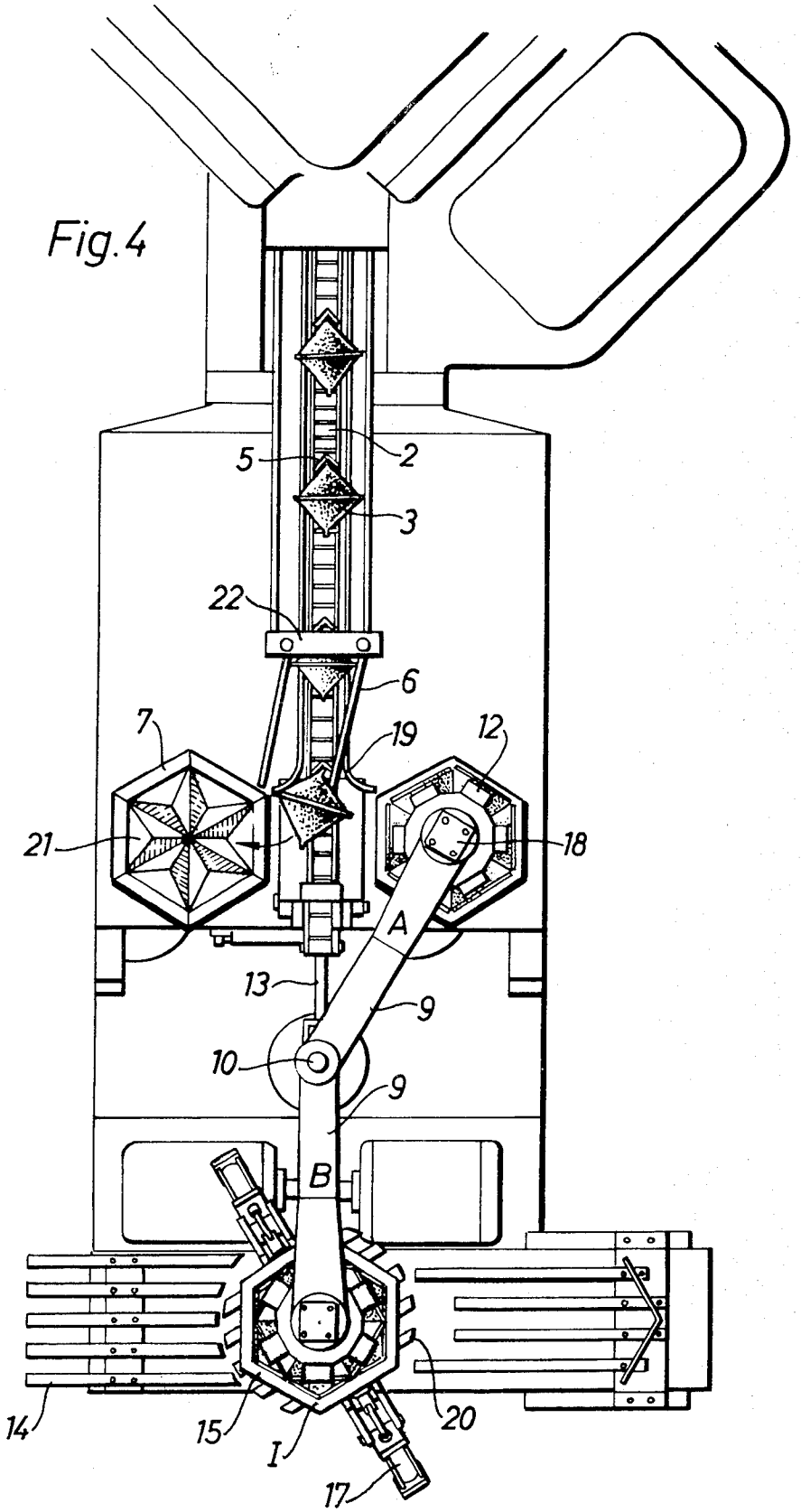


Fig.5

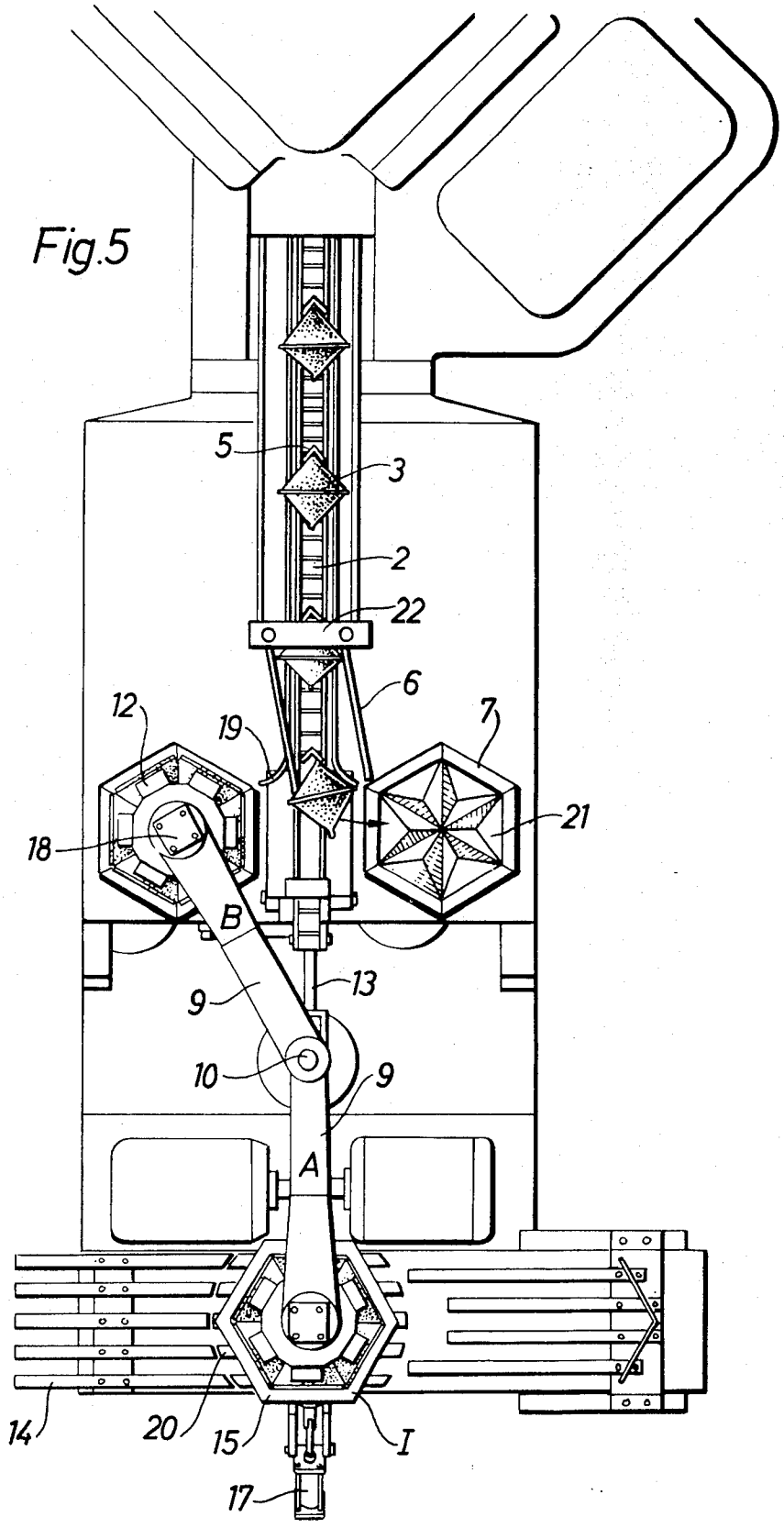


Fig.6

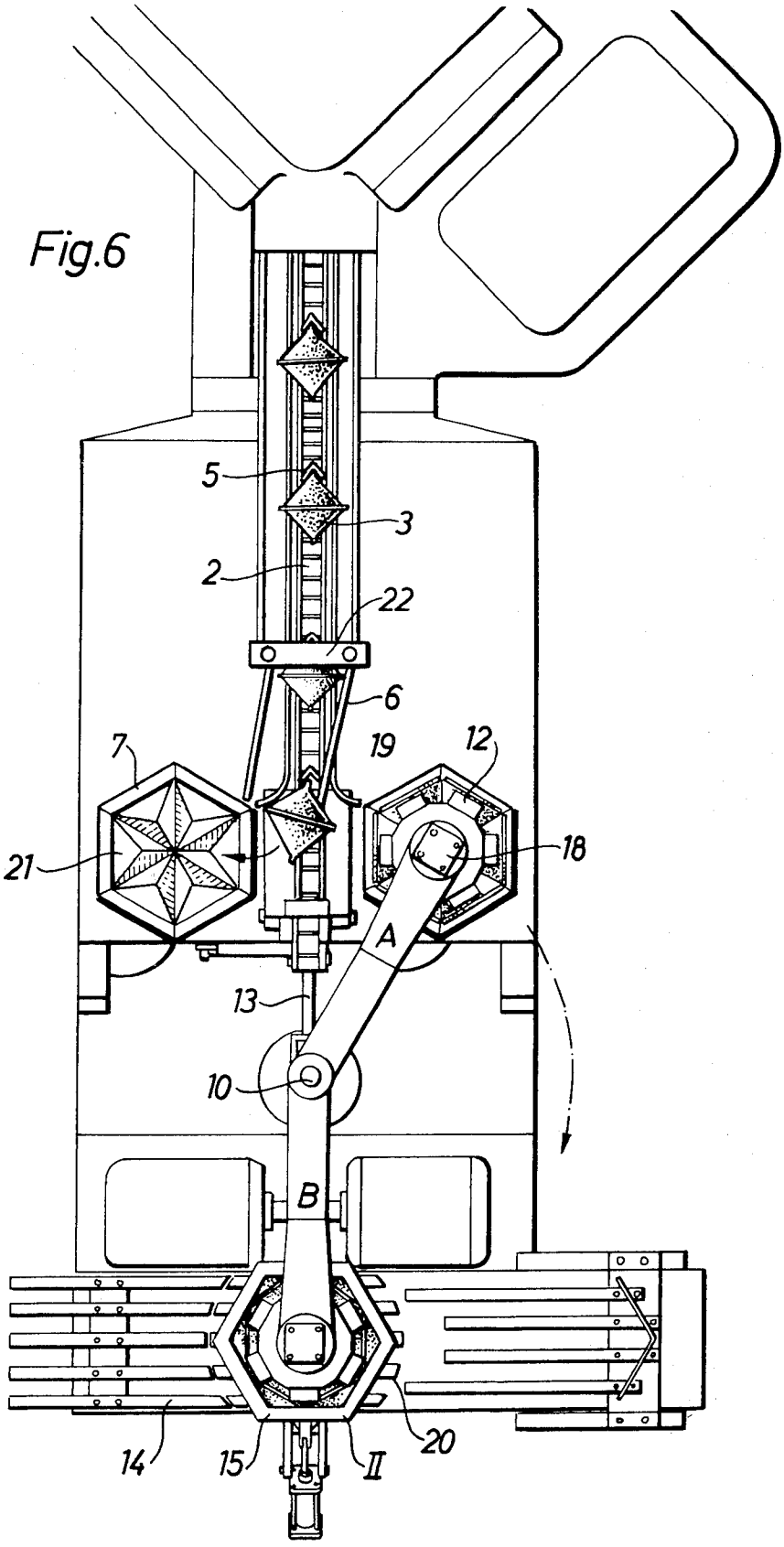


Fig.7

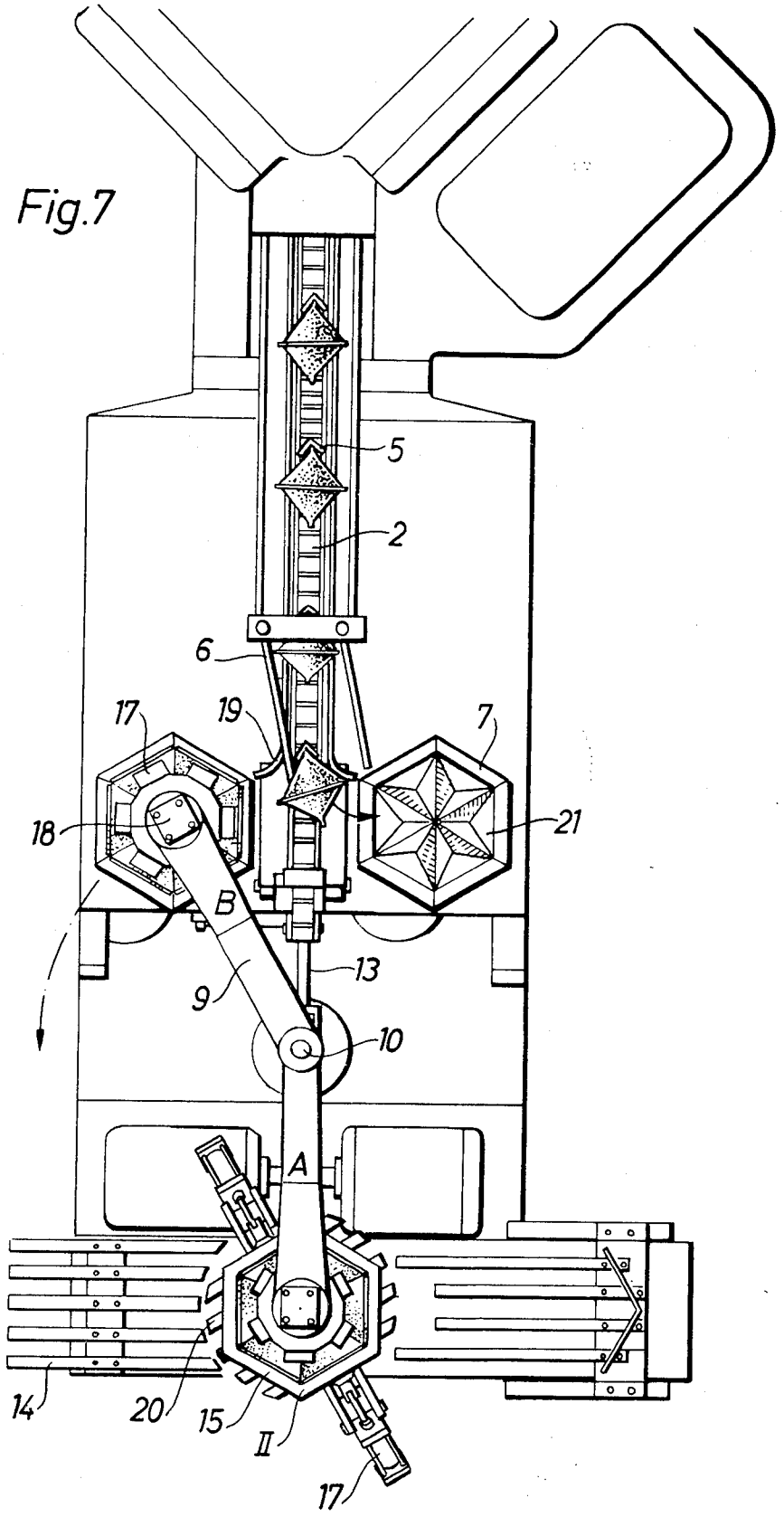


Fig. 8

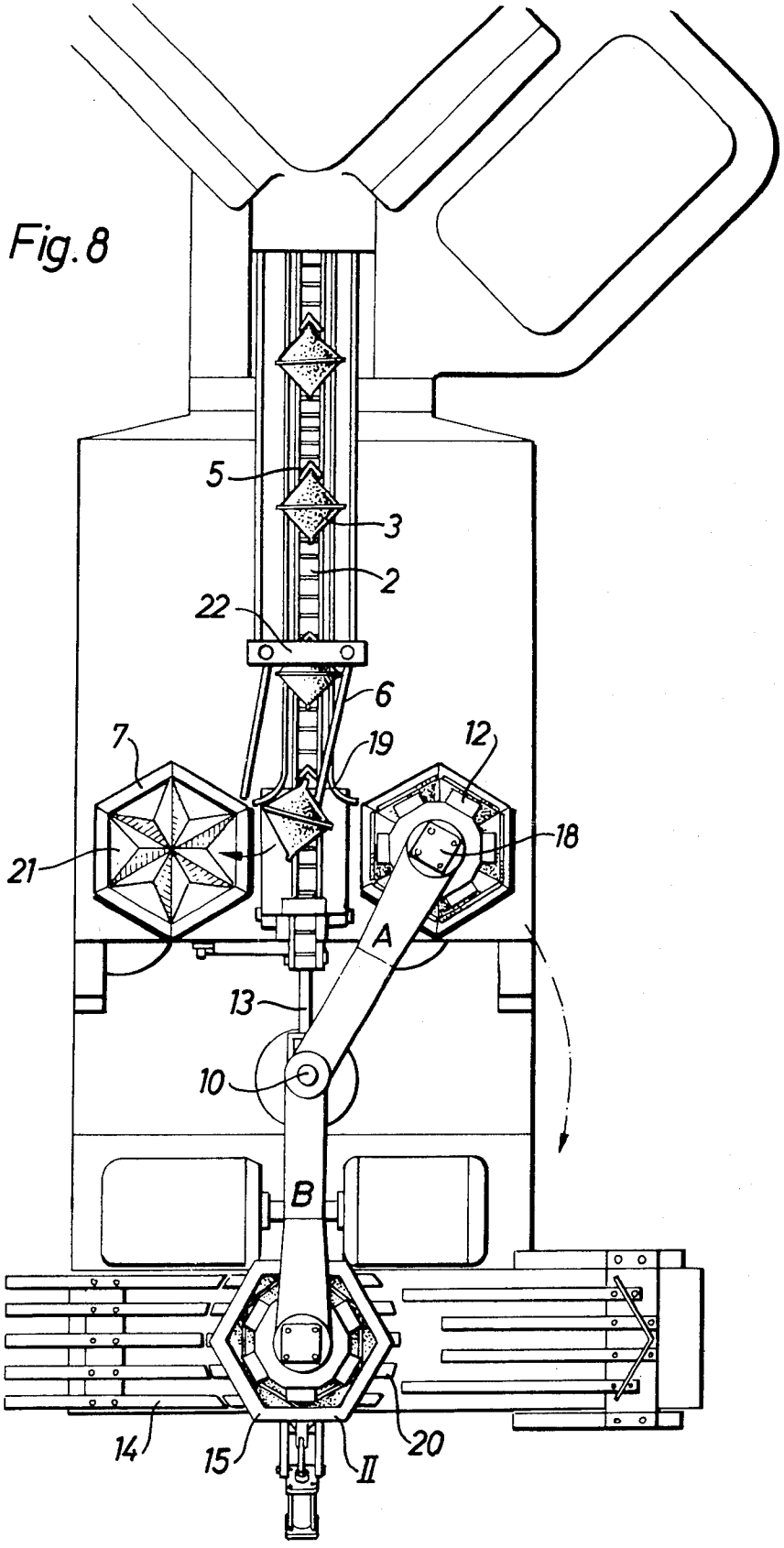


Fig.9

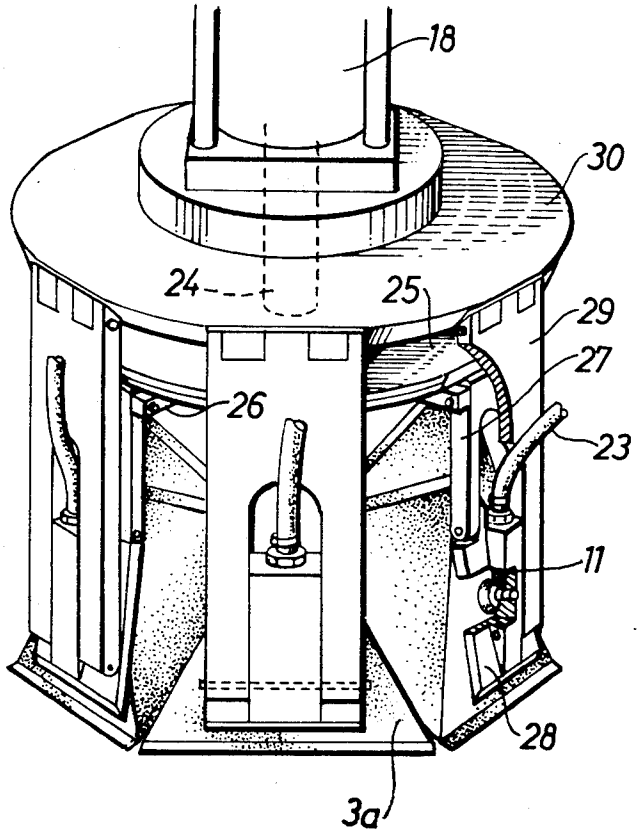


Fig.10

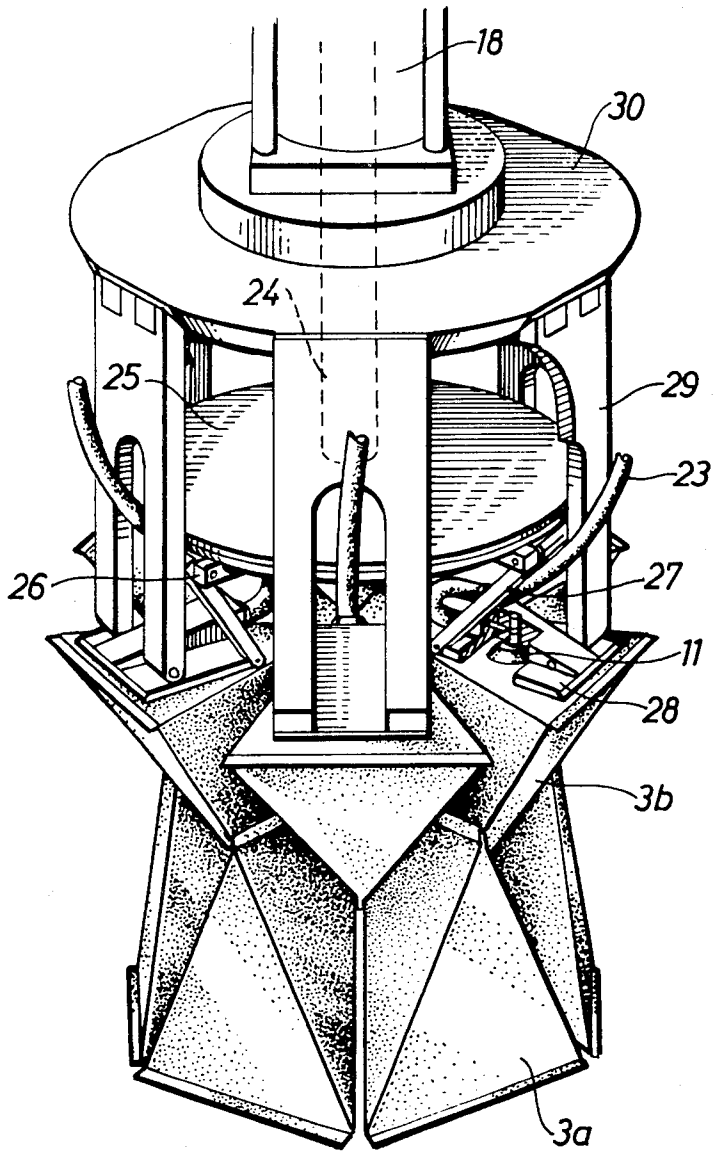
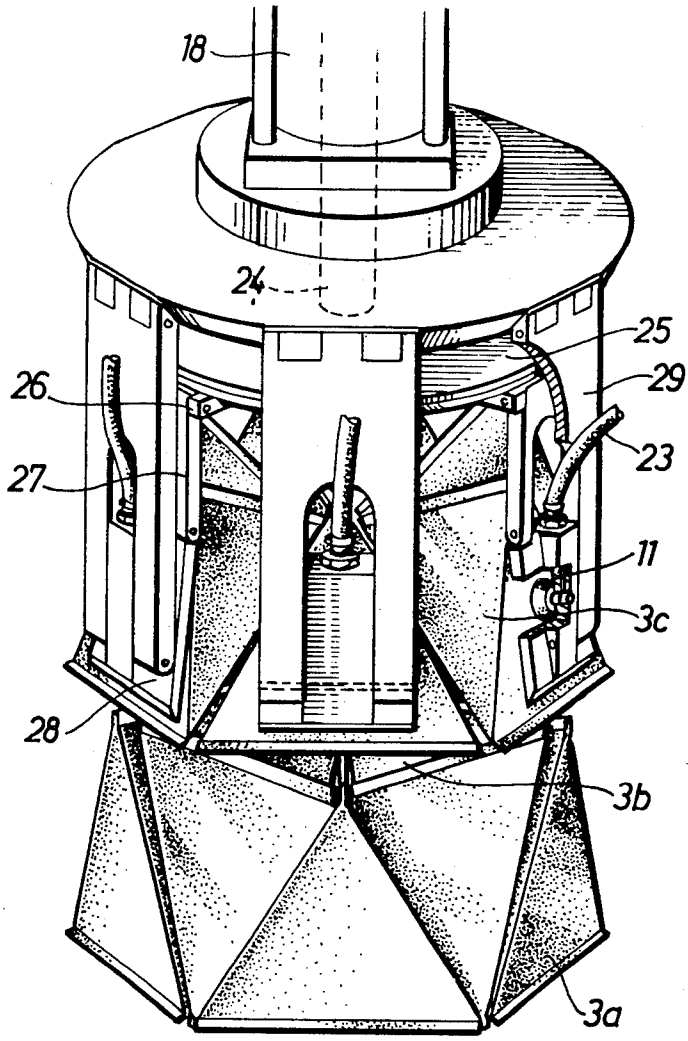


Fig.11



DEVICE FOR LOADING OF PACKAGES INTO TRANSPORT CONTAINERS

This is a continuation of application Ser. No. 331,432, filed Feb. 12, 1973 and now abandoned.

The present invention relates to a device for the loading of packages, and in particular tetrahedron-shaped packages, into transport containers in the form of baskets or cases.

In modern, high-capacity packaging machines a need exists for the automatic handling of the packages put out by the packaging machine and placing the same in a transport container. Special difficulties arise from the fact that the said packages are not of parallelepipedic shape, but are e.g. tetrahedral, as is the case with certain packages marketed under the trade mark TETRA PAK. These tetrahedral packages are transported mainly in a special transport container consisting of a hexagonal container with a pyramid-shaped base insert, into which containers the tetrahedron-shaped packages are loaded, usually in three layers with six package units in each layer. The stacking of the tetrahedron-shaped containers in the said transport containers can be done automatically with special loading machines, which in principle comprise a revolving table upon which are placed a number of transport containers on a rotatable base, whereupon package units are fed to the transport containers with stepwise advance of the revolving table and stepwise rotation, which package units are delivered by the packaging machine and made to fall into the transport containers, which with the help of the revolving table and the rotatable base are advanced into such positions that the dropping package units are made to fall on the intended place in the stacking pattern.

These automatic loading devices worked satisfactorily in themselves, but it has been found that with an increased rate of production of the packaging machines the number of faulty loadings increased to a disproportionately great extent so that the speed of production of the packaging machines could not be put to full advantage.

A clear need exists therefore for an automatic loading device, and it has been found that an appreciably safer loading function even at much higher loading speeds can be achieved with a device in accordance with the invention. The device according to the invention is based on the principle that the packaging units are introduced first into an intermediate collecting space, the so-called matrices, in which they are arranged in the desired configuration and from which they are transferred by means of gripping members provided with suction heads to the transport container in which the packages are put down. The invention is characterized for one thing by the device for the movement of the packages along a conveyor track, for another by the intermediate collecting space, the so-called matrices, in which a certain number of packages are arranged so that they can be collected in a desired configuration, for another by the device for the transfer of the packages from the said conveyor track to the said matrices and for another by devices for the transfer of the packages collected in the said matrices to the said transport container and the loading of the packages into the transport container.

The invention will in the following be described with reference to the enclosed schematic drawing, in which:

FIG. 1 shows a side view of the device in accordance with the invention;

FIGS. 2–8 show the device seen from the top during various sequences of the loading process; and

FIGS. 9–11 show a gripping device during the loading of the three layers into the transport container.

In the side view of the device shown in FIG. 1 a packaging machine, indicated only schematically is marked 1. A conveyor track for the packages is marked 2 and the packages which are moved along the track 2 and which are produced by means of the packaging machine are marked 3. The conveyor track 2 is conducted over a number of driving or pulley wheels 4 and it is provided with carrier devices 5 which are arranged at equal distance from one another along the conveyor track 2. The device comprises furthermore movable guide rail elements 6, by means of which the packages 3 can be transferred from the track 2 to specially arranged matrices 7, which function as intermediate collecting place for the packages 3. The matrices 7 are rotatable step-by-step by means of an indexing gear box 8 and the indexing of the matrices 7 takes place synchronously with the advance of the packages 3.

The device comprises furthermore elements for the transfer of the packages 3 from the said conveyor track 2 to the matrices 7, and these devices consist of laterally displaceable guide rails 6 which are operated with the help of an operating member 22. The movable guide rails 6 can cooperate with fixed guide rails 19, which are arranged on either side of the conveyor track 2 and which terminate in parts directed toward the matrices 7.

For the transfer of the packages 3 collected in the matrices 7 to the transport container an arrangement is present which consists of a column 10 which can be vertically raised and lowered and which carries two arms 9A and 9B which are rigidly connected to one another. At the outer ends of the said arms 9 gripping devices 12 are arranged which are adapted so that they can pivot in the vertical plane. The said gripping devices 12 carry suction heads 11 which can be connected to a vacuum source (not shown). The column 10 can be raised and lowered and can moreover be rotated by means of a guiding member 13 which is adapted so as to work synchronously with the rotatory movement of the matrices 7 in a manner which will be described later. The gripping device 12 is adapted so that it can at least partly be operated by means of air cylinders 18.

The transport containers intended for filling are marked 15 and they are moved along the track 14. The transport containers 15 are fixed in position by a member 16 which is controlled by means of air cylinder 17.

For the sake of greater clarity the same reference numbers as in FIG. 1 are also used in the other figures. In FIGS. 2–8 which show a plan view of the device shown in FIG. 1, some of the details are illustrated which cannot be seen in FIG. 1. Thus the guide rails arranged along the track 2 are marked 19 and a turn table in connection with the conveyor track 14 is marked 20. The spaces for the collection of the tetrahedral packages in the matrices 7 are marked 21 and the operating device for the guide rail elements 6 is marked 22.

Finally in FIGS. 9–11 the operating rod of the air cylinder 18 is marked 24, a movable plate connected to the operating rod is marked 25. A base plate on which the air cylinder 18 is arranged and which is joined to

the arms 9 is marked 30 and the vertical fastening device for the suction head device connected to the plate 30 is marked 29. Numerals 26 and 27 refer to hinged members which can be acted upon by the plate 25, and 28 refers to the fixing plate for the suction heads 11.

DESCRIPTION OF THE OPERATION OF THE DEVICE

Tetrahedron-shaped packages are manufactured in a manner known in itself in that a packaging material web of plastic-lined paper by means of the packaging machine 1 is folded round to a tube, the longitudinal edges of which are joined together in a seam, whereupon the tube is filled with the filling material concerned, pressed flat and sealed along sealing regions situated at a distance from each other and arranged perpendicular to one another. After the sealing the individual package units 3 are separated by cutting in the said sealing regions and are made to drop onto a transport track 2 which consits of an endless chain passing over driven pulley wheels 4. The tetrahedral packages 3, which from the packaging machine 1 drop down onto the transport track 2 are collected by carriers 5 and are transported along the transport track 2 with the packages 3 being supported by guide rails 19. The tetrahedral packages 3 transported along the conveyor track can be deflected from the conveyor track 2 by means of movably arranged guide rail devices 6, in that the said guide rail devices which appropriately may consist of two straight bars parallel to one another, can be switched from the one side to the other side by means of the operating member 22.

The aforementioned fixed guide rails 19 terminate in a bent portion, which at each guide rail is directed toward the matrices 7 representing the intermediate collecting space. By switching the movable guide rail device 6 for example toward the right, the package units 3 moved along on the conveyor track are forced against the right-hand side of the fixed guide rails 19 and are deflected from the track, while the package receives guidance by the said bent portion of one of the fixed guide rails 19. The fixed guide rails 19, the movable guide rail devices 6 and the matrices 7 representing the intermediate collecting space are so placed in relation to one another, that the deflected tetrahedral packages 3 are made to fall into a free space 21 in that matrix 7 toward which the package 3 is being deflected.

In the embodiment of the device shown here each matrix 7 has six spaces 21 which are so formed that each of them can receive one tetrahedral package 3, so that the upturned side-wall of the same is located mainly in the horizontal plane. In order that the feed of the tetrahedral packages 3 to the matrix 7 may take place in the desired manner the movement of the matrix 7 and the movement of the movable guide rail device 6 must of course be synchronized with the movement of the conveyor track 2 in such a manner, that the matrix 7 is advanced in the same rhythm as new packages 3 are deflected from the conveyor track 2. It is also necessary that after (in the example described here) six packages have been fed into the matrix 7 and thus all the spaces 21 have been taken up by packages, the movable guide rail member 6 is switched so that the next passage is deflected to the other matrix 7, which is empty and ready to receive new package units 3.

The package units 3 temporarily stored in the matrices 7 are transferred from the matrices to a transport container 15 by means of transfer devices which comprise arms 9 rigidly connected to one another and rotatable about a column 10, at the outer end of which arms gripping devices 12 are arranged. The said gripping devices are shown in greater detail in FIGS. 9–11 and they each consist of a base plate 30 which is connected to the arms 9 and an air cylinder 18 arranged on the base plate 30 with an operating rod 24 by means of which a plate 25 can be raised and lowered between vertically arranged fixing members 29. The fixing members 29 are six in number in the example shown and are distributed evenly around the base plate 30 and each of the fixing members 29 has in its lower part pivotable plates 28 which each carry a suction head 11 which can be connected by means of a hose 23 to a vacuum source. The plates 28, moreover, are pivotably connected by means of a hinged member to a link 27 which in turn is pivotably connected to the movable plate 25 along a hinged link 26.

If we start from the position shown in FIG. 2 the right-hand matrix 7 is filled with tetrahedral packages 3, while the left-hand matrix is empty. The movable guide rail device 6 has just switched from right to left and therefore deflects the package units 3 moved along the conveyor track 2 to the left-hand matrix 7, while the latter performs a step-by-step revolving movement, so that a new space 21 is advanced for each new package unit 3 which is deflected to the matrix 7 in question. The right-hand matrix 7 is filled with tetrahedral packages 3 and the arms 9 are brought into such a position as a result of rotation around the column 10, that the gripping device 12 fitted to arm A is located directly above the right-hand, filled matrix 7. The gripping device 12 connected to the arm B carries no tetrahedral packages, since the condition shown in FIG. 2 is meant to illustrate the starting-up of the device. Directly underneath the gripping device 12 connected to the arm B, however, a transport container 15 is present of the type which consists of six walls and a pyramid-shaped base, the walls forming a hexagonal prism and the angles of the edges between the prism walls and the pyramid-shaped base plane corresponding largely to the angles of the edges of the tetrahedrons which are meant to be placed into the transport container. The transport container 15 has also been given the designation I to indicate that it is the first transport container to be presented for packing. The transport container 15 is moved along the track 14 until it reaches the correct position when the position-fixing member 16 shown in FIG. 1 with the help of the air cylinders 17 fixes the container in correct position in relation to the gripping device 12.

When the arms 9 are swivelled to the position shown in FIG. 2 the arms 9 are lowered, and with them also the gripping device 12, down toward the matrix 7 or the transport container 15, and the suction heads 11 of the gripping device 12 are brought into contact with the upturned sides of the tetrahedral packages 3, whereupon the suction heads 11 are connected to a vacuum source so that the packages are sucked fast to the suction heads. The arms 9 are then raised, whereupon they are swivelled so that the arm A is brought into a position directly above the transport container 15, while the arm B is swivelled toward the now filled, left-hand matrix 7.

During their swivelling movement from the right-hand matrix 7 to the position which is shown in FIG. 3

the plates 28 provided with suction heads 11 are swivelled inward-upward to the position which is shown in FIG. 9. The swivelling up of the plate 28 takes place with the help of the link arms 27, which in their turn are fixed to the plate 25 which through the action of the operating rod 24 of the air cylinder 18 can be brought into the position shown. Since the tetrahedral packages 3 are gripped by the suction heads 11 on the upturned sides, which are largely horizontal when the packages 3 are in the matrix 7, the packages 3*a*, as can be seen in FIG. 9 will also be swivelled inward-upward to the position shown. When the arms 9 have attained the position shown in FIG. 3 they are lowered anew along the column 10, the gripping device 12 arranged on the arm B with its suction heads seizing hold of the tetrahedral packages collected in the left-hand matrix 7 while the tetrahedral packages 3*a*, which are held fast by the suction heads in the gripping device 12 connected to the arm A are released from the suction heads 11 in that the connection of the suction heads to the vacuum source via the hoses 23 is interrupted. When the tetrahedral packages 3*a* are at the same time released from the suction heads 11 they fall down toward the pyramid-shaped base of the transport container 15 and place themselves in the position which is shown in FIG. 9 with their down-turned sides resting against the sides of the pyramid-shaped base. So that the height of drop should not be too great at the loading of the first layer 3*a* it may be suitable that during the loading of this layer the transport containers 15 should be raised one height of package, that is to say generally 10–15 cm.

When the first layer of tetrahedral packages 3*a* has been loaded into the transport container 15 the arms are swivelled anew so that the arm A with its gripping device 12 comes to be located above the right-hand matrix 7, which is now filled with tetrahedral packages 3, while the gripping device of the arm B is located above the transport container 15. Before the arms 9 are lowered to seize hold and lift up the tetrahedral packages 3 collected in the right-hand matrix 7, and respectively release the tetrahedral packages held fast by the gripping device connected to the arm B down into the transport container 15, a part 20 of the track 14 is rotated by 30° so that the tetrahedral packages in the manner as shown in FIG. 10 are released down in between the tetrahedral packages placed in the bottom layer 3*a*. As can be seen from FIG. 10 the plates 28 with the corresponding suction heads 11 are not pivoted up during the insertion of the second layer of tetrahedral packages 3*b* in the manner described earlier, but the tetrahedral packages 3*b* are retained in the position as they are lifted out of the matrix when they are released from the suction heads by virtue of the interruption of the vacuum connection to the suction heads 11 and are made to drop down between the tetrahedral packages placed in the bottom layer 3*a* as shown in FIG. 10.

The third and last layer of tetrahedral packages 3*c* is loaded in accordance with FIG. 5 in the same manner as the first layer by means of the arms 9 being swivelled and the tetrahedral packages 3 collected from the right-hand matrix 7, after they have been pivoted up with the help of suction heads 11 in the manner as shown in FIG. 11, being put down in the transport container 15, which has now been rotated back to its original position, while at the same time the gripping device 12 connected to the arm B seizes hold of the tetrahedral packages 3 collected in the left-hand matrix 7.

After loading of the two first layers of tetrahedral packages 3*a* and 3*b* the packages 3 already loaded form a conical or pyramidal recess in the transport container 15, and the packages 3*c* placed into the third layer, on being released from the suction heads, can fall down with their parts turned toward each other into the said recess, so that they form with their upper sides a relatively plane or somewhat convex total surface in the transport container 15. After loading of the said third layer 3*c* in the transport container 15 the arms 9 swivel in the manner as shown in FIG. 6 and the full transport container 15, also marked by 1, is replaced by a new empty transport container 15 which is marked by II. The tetrahedral packages 3 collected from the matrix 7 are loaded as described earlier as a first layer in the new transport container II at the same time as the tetrahedral packages 3 collected in the right-hand matrix 7 are picked up by the gripping device 12 arranged on the arm A.

The middle layer 3*b* is loaded into the transport container II in the manner as described earlier, while the part 20 of the transport track 14 is rotated 30° and the suction head plates are maintained in the same position which they had during the picking up of the tetrahedral packages from the matrix 7 in accordance with what is shown in FIG. 7. In FIG. 8 finally is shown how the third layer 3*c* of tetrahedral packages is inserted into the transport container II, which has now been rotated back to its original position. When the transport container II has been filled with packages the working cycle is complete and a new transport container can be advanced into the loading position while the loading procedure in accorance with FIG. 3 is repeated.

As is apparent from the descriptions given all the movements must be synchronized accurately with one another so that the arms 9 work accurately in tact with the loading of the tetrahedral packages 3 in the matrices 7. The arms 9 will thus be swivelled at every sixth indexing of the matrices 7 and the suction heads 11 will be connected to their vacuum source during the period of time which it takes to seize hold of the tetrahedral packages stored in the matrix 7 and swivel them over to the transport container 15. After the suction operation the suction head plates 28 in the gripping devices 12 will be pivoted inward-upward at the loading of the first and the third layer in each transport container, but a corresponding pivoting up will not take place at the loading of the middle layer of tetrahedral packages 3*b*. For this purpose the transport container 15 will be rotated about 30° at the loading of this layer 3*b* with the help of the movable section 20 of the transport track 14.

The above-mentioned movements can advantageously be controlled with the help of cam plates and gear devices of different kinds, and it has been found that with devices in accordance with the invention a very safe loading function can be achieved even at very great loading speeds.

In the embodiment of the invention dealt with here only the loading of tetrahedral packages into hexagonal containers is described in which the tetraheders are loaded in three layers in a space-saving manner, known in itself. It is also possible, however, to carry out loading operations for packages other than tetrahedral ones with the device in accordance with the invention. The

invention should advantageously be applicable to packages of conical, cylindrical, primatic, parallelepipedic or other form. It should further be observed that the invention is not limited to the loading of packages into hexagonal transport containers, even though such containers are particularly suitable for the space-saving stacking of tetrahedral packages, but it is of course fully possible to use transport containers of different shape, e.g., an ordinary rectangular container, but the design of the intermediate collecting spaces and matrices must naturally be adapted to the appearance of the transport container and the appearance of the packages for best results to be achieved.

Although we have described in detail the preferred embodiment of the invention, we contemplate that many changes may be made without departing from the scope or spirit of the invention and desire to be limited only by the claims.

That which is claimed is:

1. Apparatus for the loading of tetrahedron shaped packages into transport containers comprising: means to move a plurality of tetrahedron shaped packages along a conveyor track to a collection station, means mounting a first container on one side of said conveyor track, means mounting a second container on the other side of said conveyor track, said containers being adapted to support an oriented arrangement of said tetrahedron shaped packages, means to rotate each said container in a step-by-step manner in synchronization with the advance of the packages along the conveyor track, means to selectively place tetrahedron shaped packages in an oriented position in said first container or said second container, swivellable arm means to transport the oriented arrangement of tetrahedron shaped packages in one of said containers to a transport container and means to load said pre-oriented packages into said transport container.

2. The apparatus of claim **1** wherein said means to selectively place tetrahedron shaped packages in one or the other of said containers includes a pivotally mounted guide rail to deflect packages into one container or the other.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,916,600 Dated November 4, 1975

Inventor(s) Ingvar K. O. Falt, Per-Allan Ljungberg and Franz Soukup

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

Assignee should be Tetra Pak International AB, Lund, Sweden as recorded August 25, 1975, Reel 3223, Frame 765, not Deering Milliken Research Corporation, Spartanburg, South Carolina as shown on patent.

Column 6, line 14, number "1" should be Roman numeral --I--.

Signed and Sealed this

thirteenth Day of *April 1976*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks