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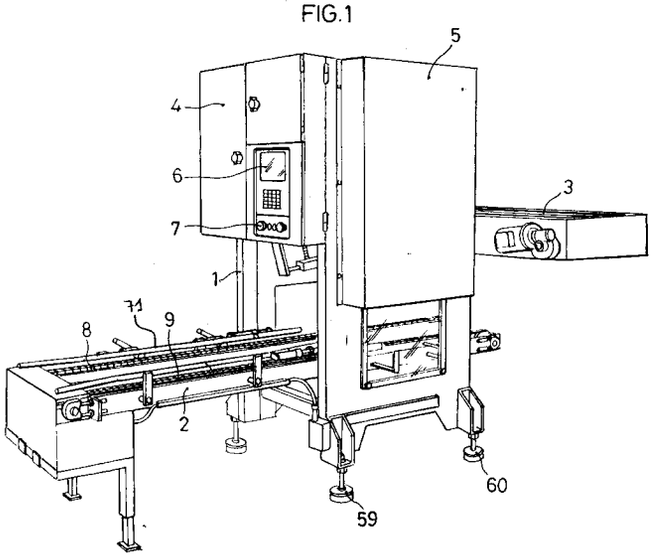
(54) **A machine for the automatic filling of fruit boxes.**

(57) This machine for the automatic filling of boxes with industrial products but preferably fruit, is characterized by comprising a central body (1) in conjunction with a transfer unit (2) for propelling the boxes in a rectilinear direction being guided to the filling table which is variable in position, retention by stops and subsequent withdrawal of the filled boxes, the central body including the fruit feeder unit (3) forming alignments of the individual fruit pieces so that the fruit will be always introduced in the boxes in form of full rows, as well as the unit for controlling the operations of the pneumatic suction devices for picking up the fruit and effecting their transfer as well as the control and programming elements for the cycle of operations accesible from the front of the machine.

FIG.1



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This patent relates to a machine for carrying out the automatic filling of boxes for industrial products and fruit of various types particularly oranges, mandarins and other similar species as defined in the introduction to claim 1.

The machine which is the object of the claims in this patent is designed to carry out the entire automatic cycle, commencing with the presentation of the fruit from the bulk supply and proceeding to the alignment of the pieces in successive rows and layers inside the fruit boxes or trays completing the filling both quickly and efficiently.

It is possible with this machine to vary the numb-of pieces in each row in the box and a multiplicity of electronic and mechanical means are provided to adapt the cycle programming to suit the type of fruit, the size of the fruit and the precise form of the box itself.

Essentially the machine as disclosed in this patent comprises a main body section incorporating a unit for preparing the fruit, a unit for conveying the fruit to the boxes, a table which can alter in height and inclination to receive the pieces of fruit and the control and programming mechanisms for the full operating cycle of the process, the same main body of the machine also comprising the box feed assembly conveying them to the table and the unit providing the supply feed system of the fruit into the machine itself.

The fruit preparation section consists of a transfer unit comprising a system of adjacent conveyor belts moving in one plane feeding a vibratory belt which sends the fruit to an endless conveyor from where the lines of fruit pass on to a variable position arrangement of stops, the fruit so aligned then being picked up by pneumatic suction heads each on its own tubular member having a suction element picking up the individual fruits.

The fruit conveying unit is provided with the means required to cause the pneumatic suction head to rise or fall and to move in a circular arc so as to transfer the successive lines of fruit from the delivery end of the endless conveyor to the fruit box, while also being able to have the distance between the pneumatic suction heads adjustable to adapt the machine to various sizes of fruit. The machine, in addition, has the means to lessen the length of the line of fruit when, as occurs frequently, the entry to the fruit box is restricted by lateral slats or battens and then to restore the normal length of the line once the fruit has been placed inside the box.

The lateral movement of the pneumatic suction heads is provided by means of an overhanging cantilever arm carrying the drives for moving the suction heads and guiding them by means of a system of endless belts driven by motorized stepped drives with each drive actuating a a pair of suction heads in symmetry in relation to the central plane of the cantilever arm such that the said suction heads can be mutually parted or drawn together with their respective pieces of fruit as may be required. The fruit held by the central suction head can be moved vertically independent of the rise, transfer on its curved trajectory and fall of the other suction heads so that the complete fruit line may be restored to its original length once the other fruits are in position in the box.

The table carrying unit incorporates provision for a vertical movement which is required for successive layers of the box to be filled and for a change in the inclination of the table so as to facilitate the positioning of the individual fruits lines successively as they make up the full contents of each layer or level in the box.

Incorporated in the machine are the control systems for the sequence of operations and a data memory system for both permanent and variable functions for programming the variables as may be required in operation of the machine as well as a display screen or VDU for displaying the variable instructions fed into the unit, preferably by keyboard indicating also the program sequence or cycle of operations being carried out.

As has been stated previously the machine provides the mechanism for the boxes to proceed to a a table having rectiliniar guides for the transfer of the boxes with a roller chain or similar conveying system taking the boxes from the entry position on to the table which is variable in its position.

The fruit entry unit consists essentially in two conveyor belts of which the upper strands are adjacent one to the other and moving in the contrary direction and having angled deflectors allowing a varying number of fruit pieces to be held in store from the number supplied to the fruit preparation unit for their alignment stage.

In view of the foregoing, it follows that the machine, object of this patent, which belongs to the general category of machines with a movable and inclinable table for receiving the successive lines of fruit carried to it by an assembly of pneumatic suction devices having an ascending, transfer and descending motion, is characterized in that it comprises a central body with which is associated a unit for the transfer of the boxes, effected by a rectilineal propulsion, guiding them and arresting the movement against a stop once on to the variable position table, withdrawing the fruit boxes after filling, and in this central body of the machine a unit for feeding the fruit pieces into an alignment and another unit for controlling the movement of the pneumatic pick-up suction head devices transfering the fruit and having also the control and programming systems for establishing the cycle of operations of the machine accessible from the front

panel.

The box feed unit comprises for preference a set of parallel roller chain conveyors horizontally placed for drawing the fruit boxes with lateral guide bars taking the boxes to a variable position table fitted with pivoting stop plates located on the front and rear edges of the table and which are actuated by means of a piston and cylinder for the purpose of retaining the boxes in position during the process of filling.

The variable position table holding the boxes is characterized by being mounted on a block guided vertically through a vertical movement caused by an independent stepped motorized driven screw. It is also subject to mutually perpendicular movements from other independently individual motor driven screws traversing the block guided by parallel straight bars in pairs thus providing simultaneous movement of the block carrying the table on two coordinate axes horizontally and one axis perpendicular to those two.

Preferably the table holding the box during the filling operation is hinged on a transverse axis adjacent to one of its edges perpendicular to the direction of travel of the boxes, operated by means of piston and cylinder causing the table to swing on the said axis.

In the preferred embodiment of the machine the fruit feeder unit supplying the alignment stage comprises a conveyor system of adjacent flat belts transfering the fruit to an inclined vibrating tray having longitudinal dividers separating the fruit pieces into a number of channels and then by an endless conveyor to line up against buffers which are variable in position and which determine the location of the alignment prior to the pick-up operation by the pneumatic suction heads for the transfer of the fruit to the boxes and their placement in the box itself.

The preferred embodiment has the suspension of the vibrating tray for feeding the fruit on flexible members fixed to the framework of the machine with the actuation by means of a motorized viratory mechanism located in the lower part of the machine housing.

The tubular arms of the suction devices for picking up and transferring the fruit into their alignment are assembled on an overhanging cantilever arm along which they can travel with the arm being integral with a block which can travel on two coordinate axes in a plane perpendicular to that of the cantilever.

The said block fixed to the cantilever arm and capable of movement along axial coordinates in one plane is assembled such that it can move along two guide bars parallel to the suction tube members, the extremities of the guides being attached to sleeves each of which can move along a transverse guide bar thus enabling the block to travel along two coordinate axes in a plane perpendicular to that of the cantilever arm.

The tubular arms of the suction devices, in the preferred embodiment, are assembled into the overhanging cantilever arm such that they can slide along a guide bar longitudinal in relation to the said cantilever and thus being capable of movement along the said bar either inwards or outwards in relation to the central plane of the pneumatic suction head assembly.

This patent provides that the inward and outward motion of the suction heads is actuated by an assembly of endless belts built into the cantilever arm each being driven by a motorized stepped drive and with the upper and lower strands of each belt actuating respectively the movement of one suction head tubular arm of a pair symmetrically in relation to the central plane.

Also, in the preferred version of the machine the central suction head can move vertically, independently of the other heads under the action of a piston and cylinder.

Finally, the machine as disclosed in the claims in this patent includes in its central body a hinged front control panel carrying the instrumentation and the controls for the manual operations and the programming of the machine cycle with a keyboard and the corresponding display screen.

To assist in the explanation the accompanying drawings show one embodiment as an example of a machine in accordance with this patent.

Figure 1 is a perspective of the whole assembly as disclosed in this patent.

Figure 2 is a plan view of the machine showing the layout of the feeder and withdrawal arrangement for the boxes.

Figure 3 is a schematic transverse view in partial section of the positioning mechanism for the box carrying table.

Figure 4 shows a detail of the box carrying table actuation system while filming.

Figure 5 is a schematic view in lateral elevation of the fruit feed unit.

Figure 6 is a lateral schematic view showing the upward, downward and transfer motions of the pneumatic pick-up tubular members.

Figure 7 is a front elevation in partial cross-section and in schematic layout of the pneumatic pick-up assembly.

Figures 8,9, 10 and 11 are details, partly in section of the action of the pneumatic suction heads for taking hold of the pieces of fruit by suction and transfering them.

As may be seen in the drawings herewith the machine, object of this patent comprises a main body -1-to which is attached the unit -2- for feeding in the boxes and the unit -3- for the entry of the

fruit pieces. The main body -1- has a hinged upper front panel -4- for the manual controls -7- and the visual display unit -6-displaying the cycle instructions and the keyboard entered program. The side panel -5- encloses the internal organs of the machine and encloses the machine laterally.

The main body is supported at ground level by the adjustable feet such as shown at -59- and -60-.

Unit -2- for feeding the boxes or trays through the machine from the entry point to the exit comprises roller conveyor chains with strands -8- and -9- and guide bars -71- and -62- guiding the boxes to the table -10-which can move upwards, downwards and to an inclined position as well as being mobile on two coordinate axes in a horizontal plane. These movements enable the table to adopt a variety of positions to correspond to the different levels of fruit being placed with its variation in height, the different alignments of fruit on each level or layer, with its movement on the coordinate axes on a horizontal plane and with the variable inclination to facilitate the placing of the lines of fruit pieces by utilizing the gravity to ensure a correct positioning within she box.

Actuation on the coordinate axes in one plane is provided by means of the stepped motorized drive -11-and the parallel screwed rods -12- passing through the block -13- in respect of one of axes in the horizontal plane, there also being another motorized stepped drive -14- with a V belt and pulley transmission actuating a transverse screw which displaces the carrier block -13-along the transverse guide rods -24- and -25-.

The vertical movement of the table is caused by the operation of a vertical screwed rod -15- carrying a threaded bush -16- actuated by a driving pulley -17-. Rotation of the screwed rod -15- is translated into the upward or downward movement of the assembly carrying the block -13- and hence also the table -10- in its movement on a vertical axis.

Vertical movement is guided by the columns -18-and -19- sliding in fixed sleeves -20- and -21-. The block -13- which carries the table -10- is guided as has been indicated above, by the rods -24- and -25- corresponding to the transverse screwed drive rod operating on the block -13- and the rods -22- and -23- corresponding to the other screwed rod -12- operating at right angles to the previous one.

Table -10- hinges on an articulated axis -63- actuated by a hydraulic or pneumatic cylinder, not shown, and has plate type extremity stops -64- and -65- actuated by a hydraulic or pneumatic cylinder -66- thus securing the box laterally once it is in its position on the table -10- and preventing it accidentally falling off.

The arrangement of functional components as described above enables the empty boxes to be fed to the main body of the machine -1-, supported on the carrier table which can adopt the most suitable position in respect of its upward, downward or horizontal movement, the latter on any of its horizontal mutually perpendicular axes as well as its angular position, the requisite actuating mechanisms having been previously programmed for the required cycle and introduced or modified by operation of the keyboard -67-.

The fruit preparation unit of the machine as disclosed in this patent is shown schematically in figure 5 and includes an endless conveyor comprising covered rollers -26-receiving the fruit pieces from a vibratory tray -28- operated by a motor and vibration device -29- acting on the tray frame -28- which is suspended by flexibles -30- and -31-.

Two feeder belts -32-, side by side but moving in contrary directions provide the progressive feeding to the various tracks of the tray -28- which are separated by longitudinal dividers -68- as well as allowing some amount of storage of the fruit as required.

Variable position buffers -27- are situated at the lower end of the roller conveyor -26-, the latter being on a slight incline so that the fruit by force of gravity can take its position against the buffers or stops -27- and form lines which will then be picked up by the pneumatic suction tubes for transfer to the interior of the boxes.

As previously described the machine includes a unit for carrying the lines of fruit from the entry point to within the boxes successively located on the variable position table. The mechanism for this operation consists of a system of pneumatic suction heads consisting of tubular arms as shown in figure 7, there being in this case seven such heads arranged symmetrically either side of the central plane and numbered -33-, -34-, -35-, -36-, -61-, -37-, and -38-. The central suction head is numbered -36- with two sets of heads symmetrical on either side, -33-, -34-, -35-, to one side and -61-, -37-, and -38- to the other side. The number of such suction heads is variable and will depend on the size of fruit pieces to be packed in the boxes.

The pneumatic suction heads are capable of movement upwards, crosswise and downwards such that starting from-the line of fruit resting against the stops -27-, the fruit itself not being shown here for clarity, the pieces can be seized by suction, raised, transferred and deposited into the boxes. The pneumatic suction heads are held in the overhanging cantilever arm -39-, moving vertically in relation to that arm and longitudinally along the bar -69-. The cantilever arm -39- assembly can travel on the arc of a circle traced out by the chain wheel -49- which engages with the chain -51- en-

gaging in turn with the free wheel -50- the said chain -51- being the drive means for the cantilever arm -39- on its travel on the arc determined by the wheel -49-. The drive for this movement is by a motorized stepped drive through the gear box -33-.

The cantilever arm -39- is mounted on the block -44- which rises or lowers on the guides -47- and -48-which in turn can move by means of the bushes -70- and -71-along the transverse guide bars -45- and -46-. This layout permits the suction heads to descend and ascend and also to cross travel as determined by the circular arc traced by the chain wheel -49- and then to descend to position the lines of fruit within the boxes during the filling part of the machine cycle.

As has been explained, in the arrangement of movements, the pneumatic suction heads move in pairs in relation to the central plane of symmetry of the cantilever arm the said pneumatic devices being usually although not necessarily grouped in pairs symmetrical to the central plane, there being a system of endless belts actuating each pair so as to cause the devices to approach or withdraw from the said central plane simultaneously. The example as shown in the drawings shows three belts -40-, -41- and -70- each actuated by its corresponding stteped drive, this number not being limitative the motors -42- and -43- in figure 7 pertaining to the belts -40- and -41-. Figures 7 and 8 show these belts running on the rollers -56- and -58- with the roller -57- carrying the belt -70-. Each belt is connected integrally by its upper and lower strand respectively to one or other of the pneumatic suction devices in one symmetric pair.

This arrangement allows the suction heads pick-up and depositing the fruit to approach and withdraw from each other in a joint movement which is necessary when filling boxes that have a restricted opening, as is often the case, due to a slat or batten on the side of the box. In such cases in order to insert the fruit into the box the pairs of suction tube devices are drawn together in symmetry in relation to the central suction device tubular arm -36- which will have been positioned above the box by action of the pneumatic cylinder -55- so that the fruit held by the suction heads -54- in alignment may enter easily into the box. Once in the box having overcome the restrictive side batten the symmetrical pairs of suction heads are then able to withdraw to their normal remote positions, shown in this example as numbered -33-, -34-, -35-, -61-, -37- and -38-, with the head -36-then descending to place the central piece of fruit in its position, thus completing the full line in the box.

The disclosures of the component parts of the machine, object of this patent, show arrangements £or the simple and effective operation of filling fruit boxes from a bulk supply with the fruit alignment transfered smoothly and rapidly to the box with the necessary means to adjust the operation to suit various sizes of fruit and to programme the full work cycle of the machine.

The above description relates to one particular preferred embodiment of the machine as an example but it is understood that this can be varied in accordance with the modifications that could be introduced by technicians in the matter while remaining within the scope of the following claims, without excluding such variations from the scope of the claims.

Claims

1. A machine for the automatic filling of fruit boxes, of the type having a movable and inclinable table placed so as to receive successive alignments of individual fruits transfered to it by sets of pneumatic suction heads which move upwards, in traverse and downwards, characterized by comprising a central body associated with a box feeder unit providing the forward impulsion, guiding and retaining in position by stops of the boxes to be filled on the variable position table and the subsequent withdrawal of the said full boxes, there being also in the central body of the machine a fruit feeder unit forming an alignment of the pieces of fruit with a unit for controlling the operations of the sets of the pneumatic tubular suction devices for picking up the fruit and transfering it with also the instrumentation for controlling and programming the operating cycle of the machine accessible from the front panel.

2. A machine for the automatic filling of fruit boxes, as in claim 1, characterized by the unit for con - veying the boxes to be filled comprising a set of parallel, horizontal roller chains carrying the boxes, laterally disposed parallel guide bars directing the boxes to the movable table which is fitted with axially hinged stops on its front and rear edge operated by a cylinder and piston for the purpose of retaining the box on the table during the filling operation.

3. A machine for the automatic filling of fruit boxes, as in claims 1 and 2, characterized in that the variable position table receiving the boxes is attached to a block which is guided vertically and can move vertically under the action of a screwed rod driven by a stepped motorized drive independently and also can move independently under the action of one or other of mutually perpendicular screwed rods passing through the said block, driven respec-

tively by individual stepped motorized drives, the said screwed rods being accompanied in each case by pairs of guide rods parallel thereto permitting the block to move simultaneously along two coordinate horizontal axes and one axis vertical to those two.

4. A machine for the automatic filling of fruit boxes as in claims 1 and 2 characterized in that the table receiving the boxes to be filled is hinged on a transverse axis adjacent to one of its transverse edges at right angles to the direction of travel of the boxes and the hinged movement of the table being actuated by means of a cylinder and piston mechanism.

5. A machine for the automatic filling of fruit boxes, as in claim 1, characterized by including therein a fruit feeder unit which comprises a conveyor of adjacent flat belts transporting the fruit pieces to an inclined vibrating tray having longitudinal dividers to form separate channels through which the individual fruit pieces go on to an endless conveyor leading to a system of stops which cause the fruit to be aligned prior to being picked up by the suction heads of a pneumatic device for transfer to the corresponding box and placing therein.

6. A machine for the automatic filling of fruit boxes, as in claim 5, characterized in that the vibratory tray is suspended from the fixed framework of the machine by means of flexibles and the vibration is caused by means of a motorized vibrator located in the lower part of the machine casing.

7. A machine for the automatic filling of fruit boxes, as in claim 1, characterized in that the tubular elements of the suction devices are connected to a cantilevered arm such that they are able to move in the longitudinal direction of the arm, the arm being mounted as a fixture on a block which can move on two coordinate axes in a plane perpendicular to that of the overhead arm.

8. A machine for the automatic filling of fruit boxes, as in claim 7, characterized in that the block, which can move on two coordinate axes in one plane is assembled such that it can slide along two guides parallel to the tubular elements of the pneumatic suction devices, the guides being fitted in turn, at their extremities in bushes each of which is capable of movement along a transverse guide bar thus enabling the block to move on two axes in a plane perpendicular to that of the cantilevered arm.

9. A machine for the automatic filling of fruit boxes, as in claim 7, characterized in that the tubular members of the pneumatic pick-up suction devices are fitt-to the cantilever arm with the capability of sliding along a longitudinal guide bar of the arm so that they can move inwards or outwards with respect to the central plane of the pneumatic pick-up device assembly.

10. A machine for the automatic filling of fruit boxes, as in claim 9 characterized in that the action of inward and outward movement of the pneumatic devices is caused by a system of endless belts within the cantilever arm each driven by a stepped motor drive independently, the upper and lower strands respectively actuating the tubular sections of a pair of the said pneumatic devices symmetrically to the central plane.

11. A machine for the automatic filling of fruit boxes, as in claim 7, characterized in that, within the assembly of pneumatic suction devices the central device is caused to rise vertically independently of the other suction devices by means of a piston and cylinder mechanism.

12. A machine for the automatic filling of fruit boxes, as in claim 1, characterized in that it incorporates within the central body of the machine a hinged panel housing the manual controls and controls for the programming of the machine operations with the corresponding keyboard and visual display unit.

FIG.1

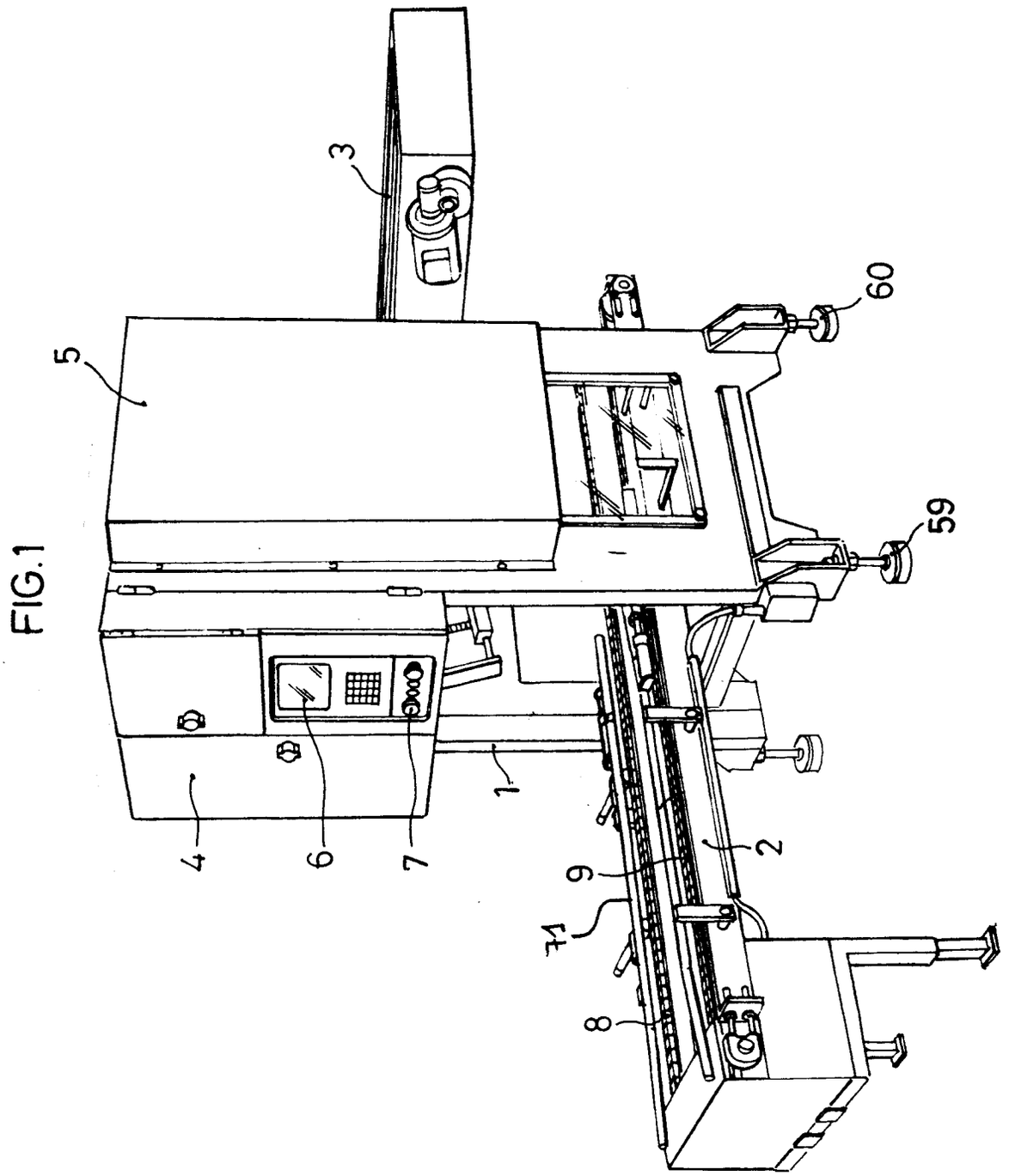
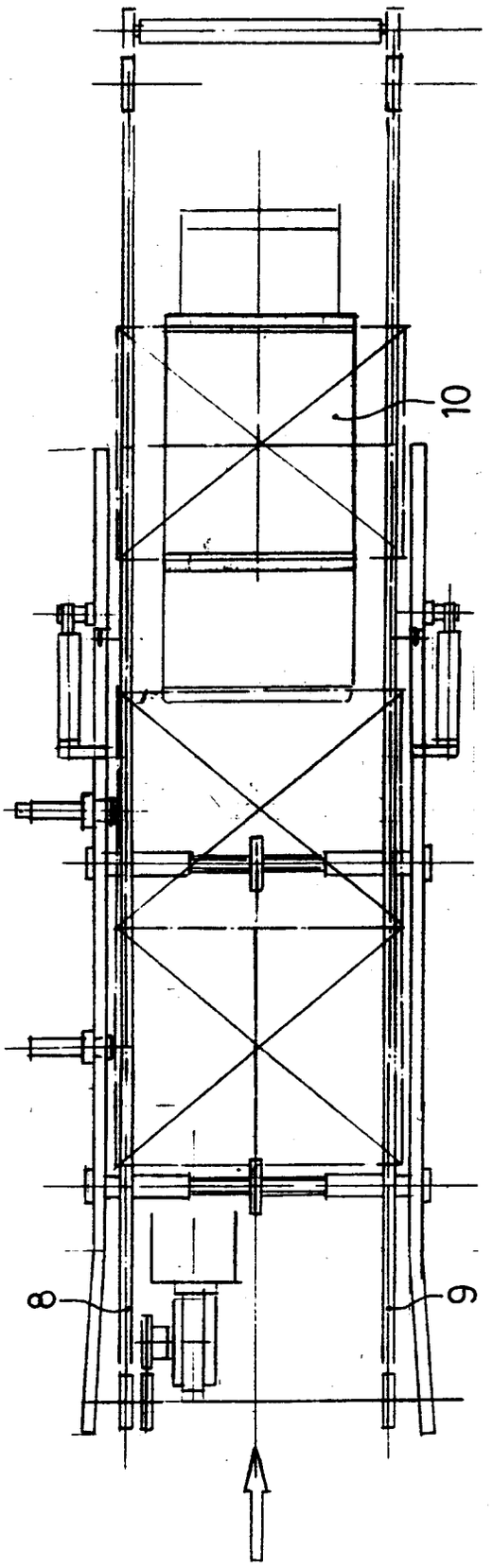


FIG. 2



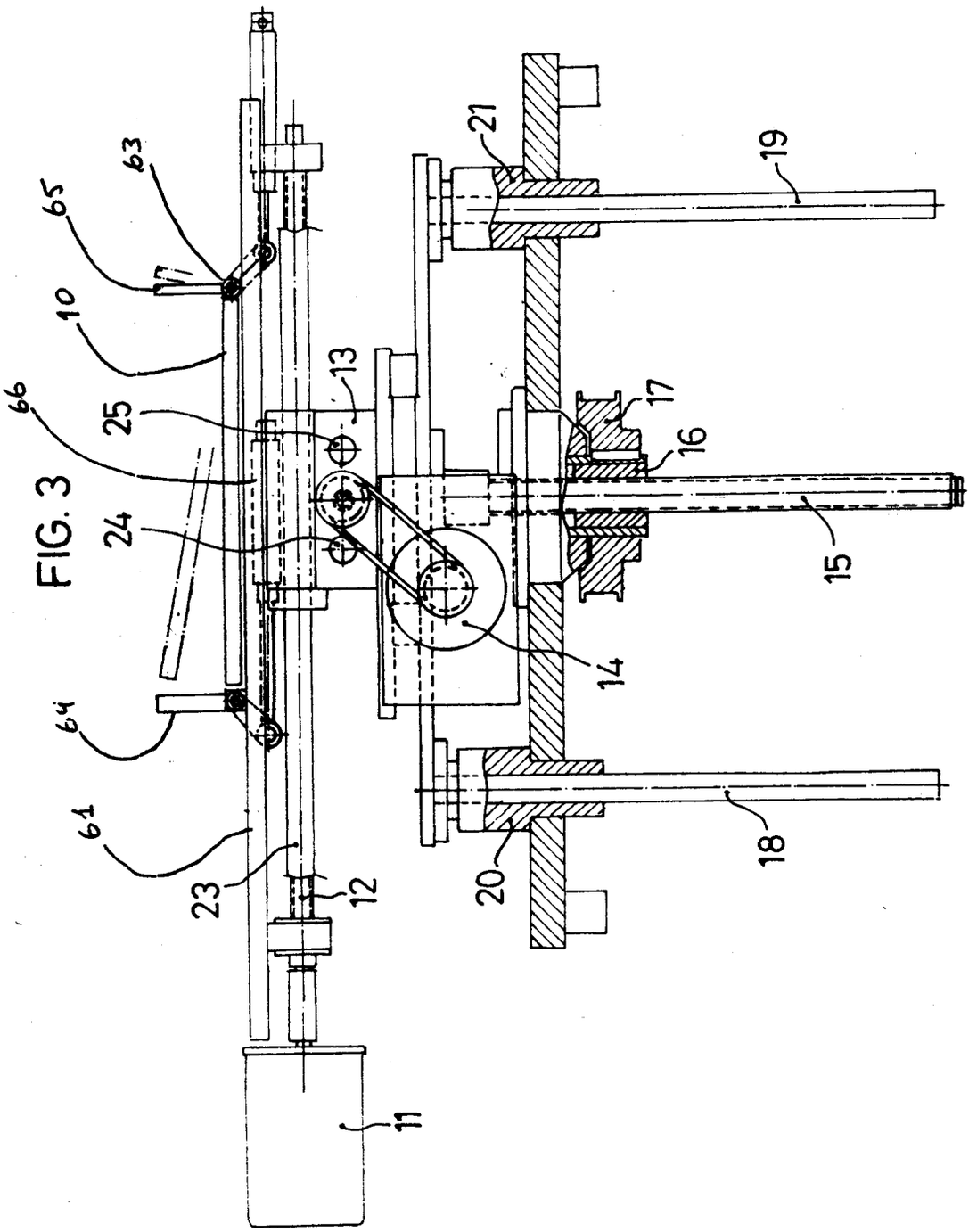
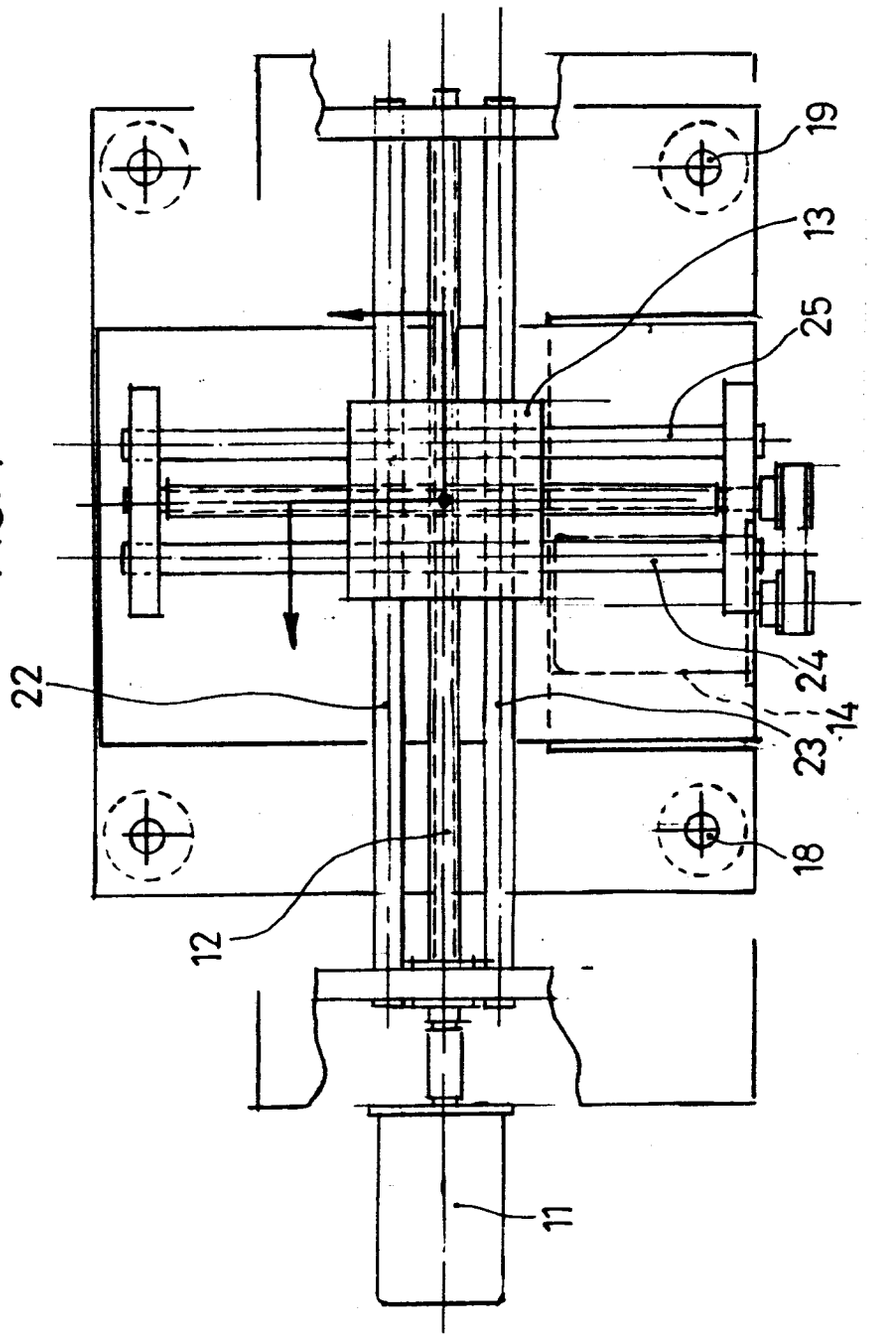


FIG. 3

FIG.4



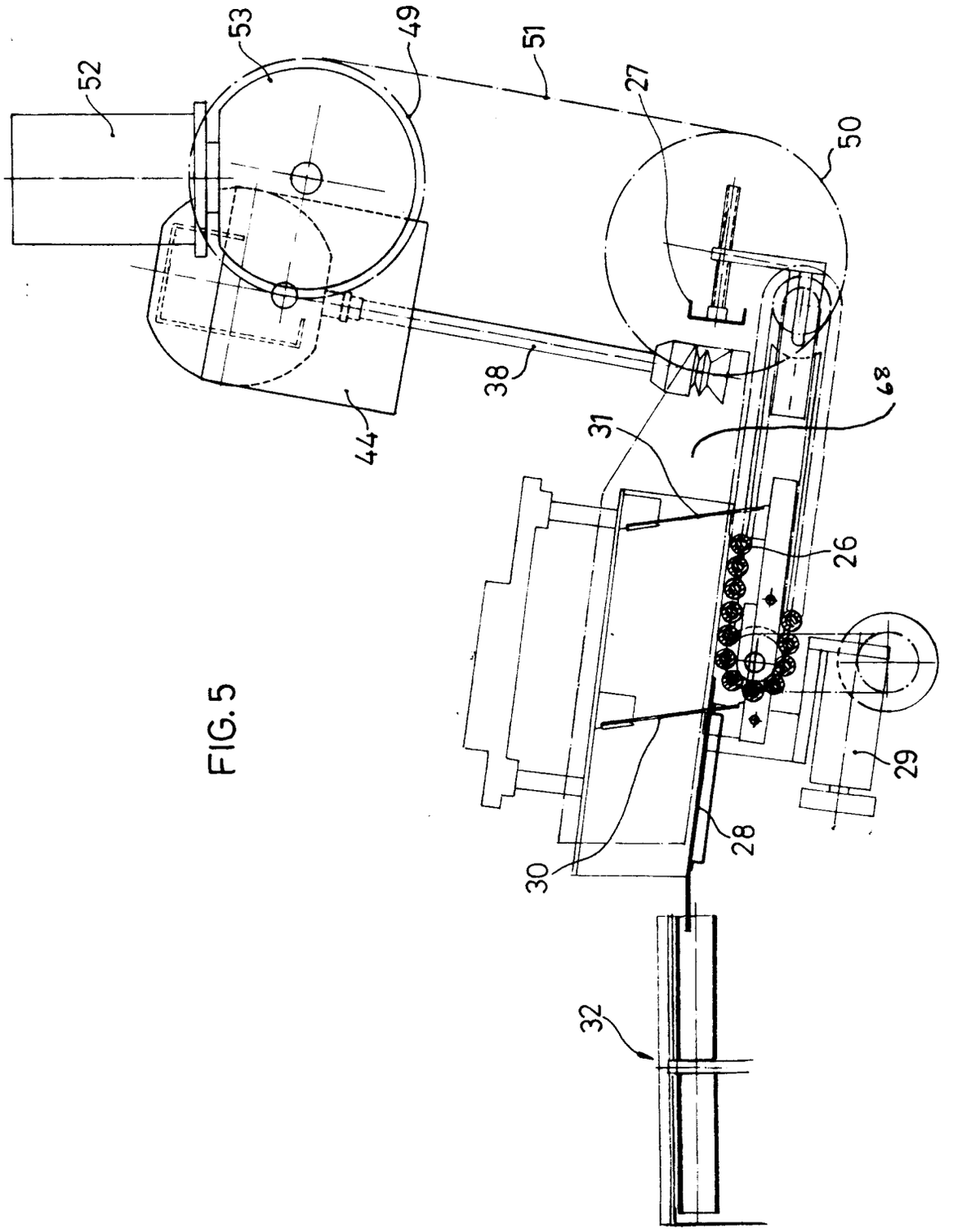
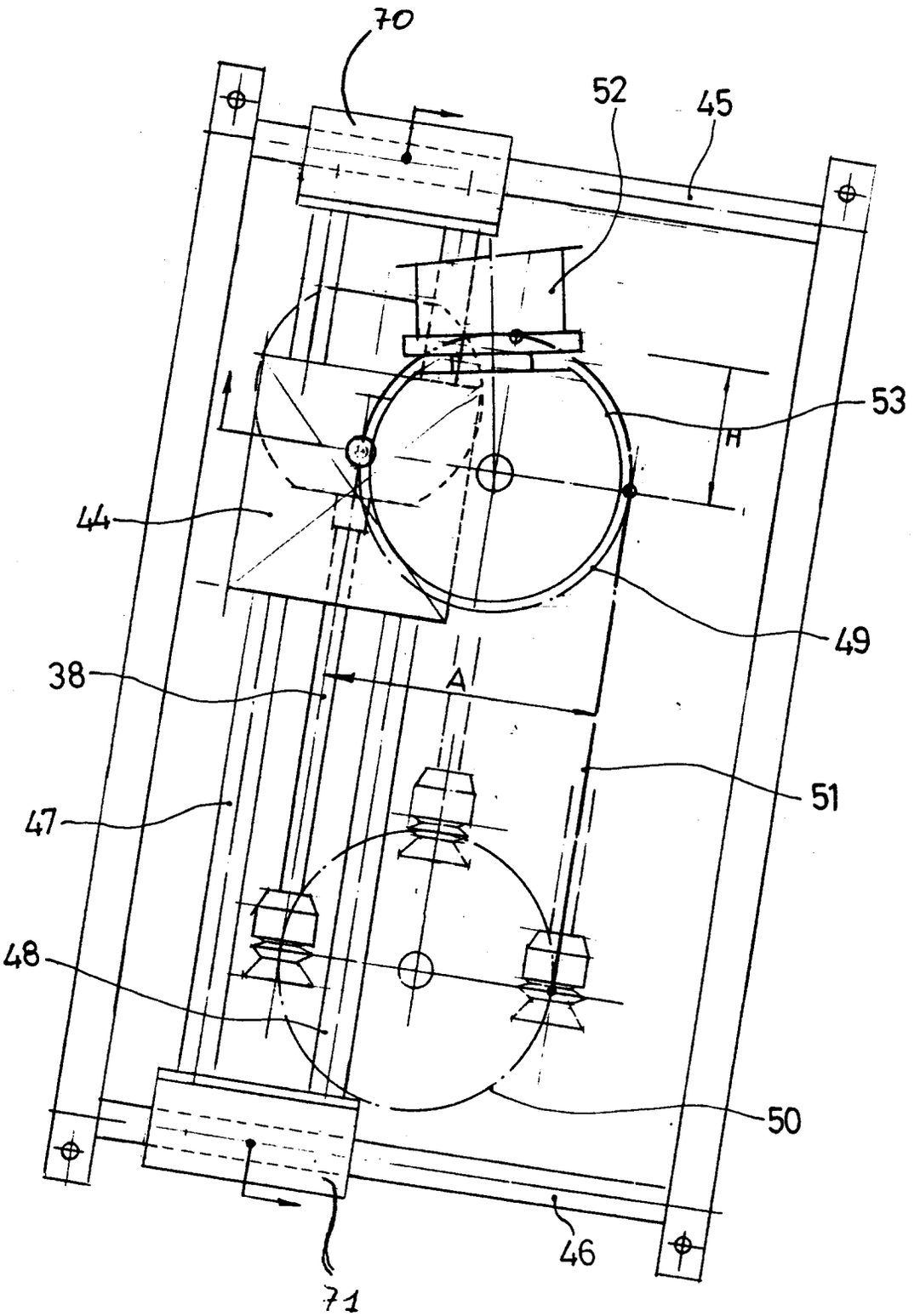


FIG. 5

FIG. 6



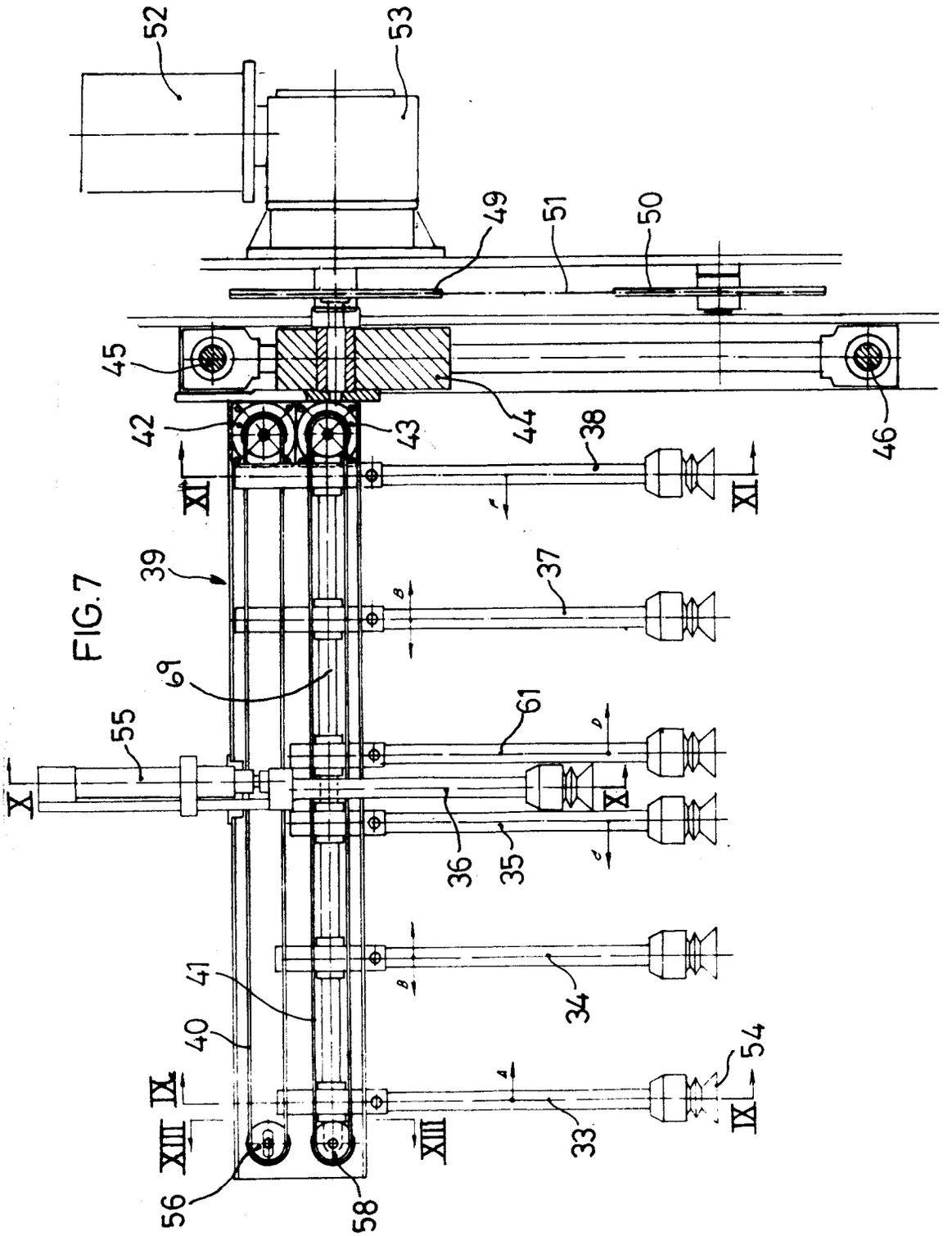

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FIG.7

FIG. 8

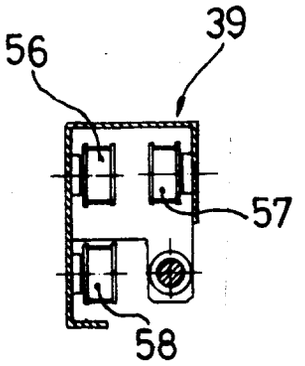


FIG. 10

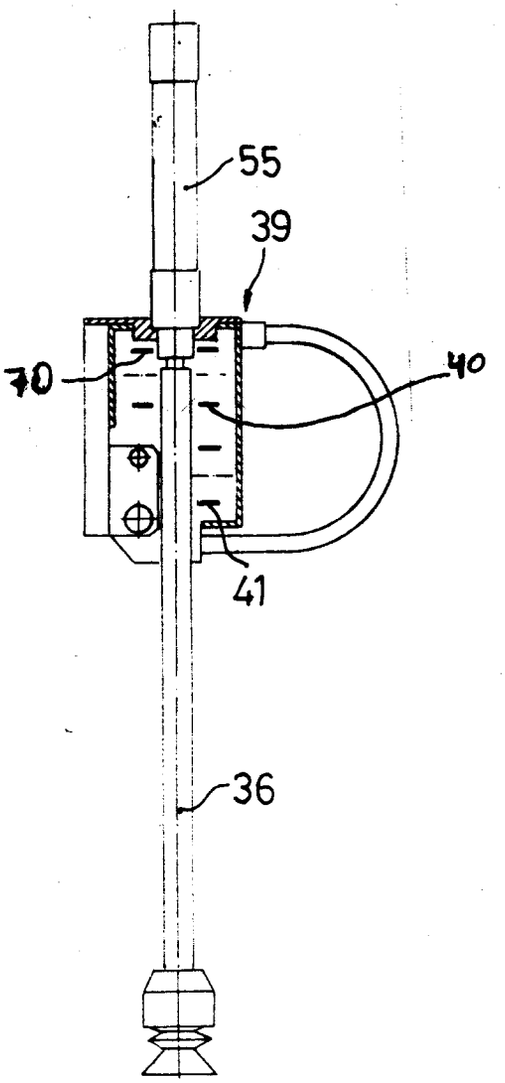


FIG. 9

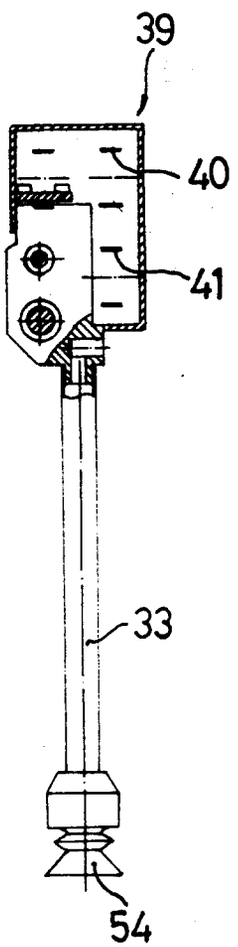
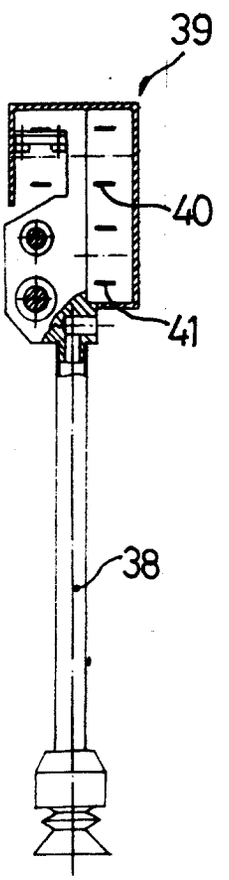


FIG. 11



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EUROPEAN SEARCH REPORT

Application Number

EP 92 50 0110

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-4 905 456 (OLAECHEA) * the whole document * ---	1	B65B25/04 B65B35/38 B65B43/54
A	FR-A-2 267 935 (SUNKIST GROWERS) * page 5, line 4; figures 1,2 * * page 14, line 18 - page 15, line 16 * ---	1	
A	US-A-3 633 732 (RUSSELL) * column 6, line 33 - line 64; figure 3 * -----	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29 APRIL 1993	CLAEYS H.C.M.

CATEGORY OF CITED DOCUMENTS

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Y : particularly relevant if combined with another document of the same category
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EPO FORM 1503 03.82 (P0401)