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(71) Applicant: **COMECO Cooperativa Meccanica Conselice Società Cooperativa a responsabilità Limitata**
Via Amendola
I-48017 Conselice (Ravenna)(IT)

(72) Inventor: **Vassura, Gabriele**
Corso Garibaldi, 50
I-48018 Faenza (Ravenna)(IT)

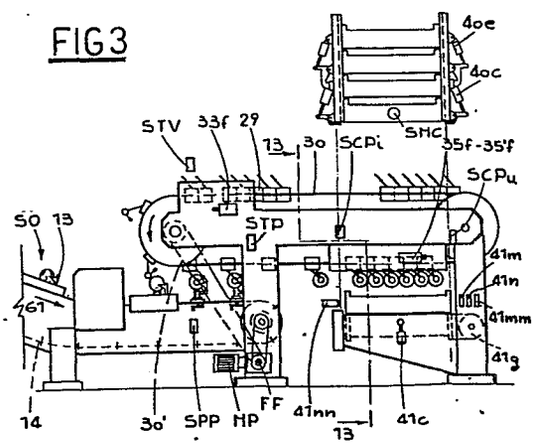
(74) Representative: **Lanzoni, Luciano**
c/o BUGNION S.p.A. Via Farini, 37
I-40124 Bologna(IT)

(54) Apparatus for automatically packaging fruit.

(57) In an apparatus that is able to pack fruit, such as peaches, automatically inside special containers 2, with uniform orientation, taking them downstream of a station SO where the fruit is identically orientated, there are a plurality of carriages 29 movable, under the action of a drive chain 30, along an endless guide 36 in a continuous fashion; each of the carriages being provided with means 29f for the traction thereof by the said chain and with elements 29g for bilaterally taking hold of each individual item of fruit being supplied; the said elements being rotatable around a horizontal axis that passes through the centre of the fruit at an angle corresponding to a right angle.

The said carriages, with the fruit, are then supplied to and are accumulated in the region of a depositing station B where, once the number reaches a predetermined quantity, the fruit is placed in rows, inside an underneath container that comes from a container magazine.

FIG3



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Apparatus for taking hold of and automatically packing fruit, particularly peaches, supplied in succession and coming from a station where the fruit is identically orientated

In the fruit packing field, particular importance is given to the packing of peaches which, after having been selected by size, are placed (especially for certain foreign markets) in special containers constituted by a support, generally made of a plastic material, that is provided with a number of pockets and is placed in the inside of a tray.

The fruit can be arranged, inside each pocket, in two different ways to meet the requirements, namely:

- like a plant that is flowering; that is to say, each item of fruit has to be placed in the pocket in such a way as to have the peduncular cavity pointing towards the base of the tray, and thus with the opposite polar area visible, while the line of suture thereof has to be orientated in a predetermined direction, or;
- lying on one side; in other words, each item of fruit has to be so placed that the line of suture thereof be on a plane parallel to the base of the tray, with the peduncular cavity pointing in a given direction, and with the fruit displaying at the top the part of the surface that has, from a commercial point of view, the most interesting colouring, this being constituted in general by the reddest part.

At the present time, the packing of peaches in one or the other of the two above mentioned forms is done manually with the fruit placed in bulk once the peaches have been graded by size. The said containers have a number of pockets according to their dimensions, the size of the fruit and the form of the support; generally the pockets are placed in parallel rows in the direction of the longest side of the

tray. It is customary for the pockets in adjacent rows to vary in number and to be staggered, so that the best possible use may be made of the space available.

On even date, the same Applicant as herein has deposited an application for a patent in respect of an apparatus that is able to automatically orientate the fruit, peaches in particular, in a way whereby they be individually distributed on orientating means, of which there is a constant plurality connected to an endless driven chain. When the fruit leaves the said apparatus, it is all identically orientated, that is to say, with the peduncular cavity pointing downwards and the line of suture lying in the vertical plane of the infeed motion, in the case of the "plant flowering" configuration, or again with the peduncular cavity pointing downwards but with the line of suture lying in a vertical plane perpendicular to the infeed direction, in such a way as to have the most coloured part thereof pointing in the said motion direction, in the case of fruit "lying on one side".

The essential object of the invention is, therefore, to make available an apparatus that is able to attend to the automatic packing inside the containers, without pockets being left empty, of fruit coming in a continuous succession from a station where it has been identically orientated and given a final configuration either of the "plant flowering" or of the "lying on one side" type.

A further object of the invention is to make available an apparatus that is able to attend to the said automatic packing operation whilst the trays containing the supports, which can be either of staggered or non-staggered parallel row conformation, are automatically infed continuously.

These and other objects too are all attained by the appar-

atus forming the subject of the invention, placed downstream of a fruit orientation station, and designed to deposit each item of fruit on corresponding means for the support and orientation thereof, connected, in a constant succession, to a first endless chain given continuous infeed motion, all the said fruit being orientated in the same direction with the peduncular cavity pointing downwards, resting on the said support and orientation means, the said apparatus being characterized by the fact that it comprises : a plurality of carriages movable, under the action of a second, also endless drive chain that is provided with continuous motion in time with the infeed motion of the said first chain, along a path constituted by an endless guide, each carriage being provided with means for the traction thereof by the said chain and with an element for bilaterally taking hold of each individual item of fruit being supplied; a first releasing station for the said carriages, placed downstream of the area where the fruit is deposited in the containers and the carriages are in an empty configuration, comprising first means for halting the latter, one at the side of the other, in the accumulation configuration; a device for opening the said grippers, placed along the path of the said guide, at least downstream of the said first station; a device for closing the said gripper elements placed, in the region of where the said carriages pass, in time with and above the corresponding fruit support means, downstream with respect to the former gripper elements; first means for detecting the passing of the said fruit support means, designed to actuate for each carriage, the timed release thereof, one at a time, from the said first station; a second halting station, placed downstream of the preceding stations, in the region of the area where the fruit is deposited, with the carriages in the filled configuration, comprising second means for the halting thereof one in line with the other in the accumulation configuration, spaced at

a distance equal to one pitch between two successive pockets for the containment of the fruit in one and the same row of the said container; means for counting the number of carriages transiting upstream of the said second station, designed to bring about, once the predetermined number has been reached, the actuation of a second device for contemporaneously opening the gripper elements of all the carriages present at the said second station, in the halted position and in a number equal to the number of pockets in the underneath row to be packed; and a third station for infeeding the containers underneath the said second station, movable in a horizontal direction perpendicular to the advancement direction of the said carriages, designed to intermittently infeed the said containers in a quantity corresponding to the pitch between two successive rows of pockets.

Further characteristics and advantages of the apparatus forming the subject of the invention will become more apparent from the detailed description that follows of one preferred form of embodiment, illustrated as an unlimited example on the accompanying drawings, in which:

- Figures 1 and 2 are lateral diagrammatic views of the fruit packed in the "plant flowering" and the "lying on one side" configuration, respectively;
- Figure 3 is a lateral diagrammatic view of the apparatus forming the subject of the invention;
- Figure 4 is a diagrammatic functional view of the depositing module of the apparatus depicted in Figure 3;
- Figure 5 is a front view of the device for infeeding the trays from the magazine thereof;
- Figure 6 is a lateral view of one of the carriages of the apparatus in question, in an enlarged scale;
- Figure 7 is a view, along a section 7-7, of the carriage

depicted in Figure 6;

- Figure 8 is a diagrammatic view from above of the carriage depicted in Figure 6;
- Figure 9 is a diagrammatic view of the means for opening and closing the gripper elements of the carriages;
- Figures 10 and 11 are diagrammatic plan views of the first and second means for halting the carriages at the carriage releasing station and at the carriage halting station, respectively;
- Figure 12 is a lateral diagrammatic view of the stages which, in succession, lead to the rotation of the fruit;
- Figure 13 is a view, along a section 13-13 of Figure 3, of the tray infeed station;
- Figure 14 is a plan view of the unit for the infeeding of the trays in the fruit depositing area;
- Figure 15 is a view of the diagram of the connection and safety halting devices of the apparatus in question;
- Figures 16 and 17 are perspective diagrammatic views of the main actuator and sensor devices of the apparatus, and of the general wiring diagram, respectively;
- Figure 18 is a general diagram of the assembly for the infeeding of the trays.

With reference to Figure 3, it can be seen that the apparatus in question is placed downstream of a fruit orientating station, shown globally at SO, virtually constituted by a first endless chain 14 that is provided with continuous infeed motion in the direction of the arrow 61 and is equipped with a plurality of orientating means 13, each supporting one item of fruit, the orientation of all the fruit being in the same direction, that is to say, with the peduncular cavity pointing downwards and with the line of suture 4 thereof (see Figures 1 and 2) lying in a vertical plane perpendicular to the plane in Figure 3, with the most coloured part thereof pointing forwards.

The said succession and orientation can be achieved manually or through an automatic apparatus designed for this purpose.

The apparatus forming the subject of the invention is placed downstream, above the aforementioned station SO, and virtually consists of a plurality of carriages 29 drawn along an appropriate path constituted by an endless guide 36 with horizontal bifurcations, that lies in the plane of Figure 3, by an endless chain 30 provided with uniform motion in time with that of the preceding fruit infeed chain 14, through a concatenation shown in the figure at 30'. To be more precise, the main drive MP is directly connected to the packing apparatus in question but operates the orientation station, that is to say, the chain 14, through a brake-clutch unit FF which is normally connected up, thereby keeping the two systems in phase, though it can be disconnected, as will be seen, in the case of infeed discontinuity.

The chain 30 thus moves continuously, while the carriages 29 can be stopped, under the action of suitable halting means, in any position to form rows, one behind the other. In this way, with reference to Figure 4, it is possible to halt a certain number of carriages 29 in the waiting area shown at A.

Synchronized with the arrival of one item of fruit on the corresponding orientation means 13, the first carriage is released from the area A and goes and takes the peach present, this being done under the action of a first releasing station shown at 33, while the opening and closing on to the peach of the gripper elements of the carriage is effected by corresponding devices shown globally at 34.

In the region of the area B, a second halting station 35 or 35' stops the arriving carriages 29, which thus go tightly

one up against the other and form a row of growing length.

The halting point of the first carriage and the pitch P of the compact row are such as to cause the position of the peaches to coincide with the underneath pockets of the suitably positioned tray 2.

Just as soon as a number of peaches corresponding to the pockets in the row has been halted, all the gripper elements of the carriages 29 open simultaneously and the peaches drop into their respective pockets. Once the said operation has ended, the station 35 releases the whole row of empty carriages which move off together in order to reach the waiting area A, where they queue with the others.

Meanwhile, the station 35', staggered by half a pitch P with respect to the station 35 and placed on the opposite side thereto, attends to the halting of a second row of filled carriages.

When the new row has been completed, a fresh release will take place, and so on and so forth until the container, which each time is displaced in a crosswise direction by an amount D in between the rows, has been completely filled.

With reference to Figures 6, 7 and 8, each carriage 29 is constituted by a body 29a provided transversely with a through pin 29e that has at the extremities thereof a pair of wheels/bearings 29c, at the back of which (with respect to the motion direction shown again at 61) there are two expansion members 29b, both the said wheels and the said expansion members being so placed as to create stable guide elements for the carriage 29 inside the two lateral guides 36 that follow the same path as the triple chain 30 from whose axis they maintain spacing that is constant.

In the centre of the said body and idly mounted on the pin 29e there is a sprocket 29d, meshed constantly with the central link in the chain 30. The sprocket 29d is held tightly in between the said clutch drive elements constituted by two permanent magnets 29f, in such a way as to always be braked.

The effect of this is that if the carriage 29 is free to move (that is to say, the resistant force is not greater than the braking force), the carriage moves along with the chain 30 just as though it were rigidly connected thereto. If, instead, a resistant force greater than the braking force were to be applied, the sprocket 29d commences to rotate and rubs against the electromagnets 29f, while the carriage is held in position; just as soon as the resistant force is removed, the carriage is again set in motion along with the chain.

The lower part of the body 29a houses what is really the gripping element or device, constituted by two arms 29g, fixed to bushes 29h, in turn movable inside a horizontal transverse tubular element 291, drawn one towards the other through the action of a spring 29m. The two arms, which engage in a longitudinal slot machined bilaterally in the element 291, are provided, at the upper extremity thereof, with two needle rollers 29i that slide, following the action of the carriages, on a cam 34' (see Figure 9) which constitutes the said opening and closing device 34.

The two arms 29g are bent forward with respect to the motion direction of the carriage 29, and the lower part of each is provided with a rubber pad 29n, connected to the arm 29g by a small ball bearing 29o, for bilaterally grasping the peach which is thus able to rotate around the horizontal centre of gravity axis v-v so that it may be given a definite "lying on one side" configuration.

The simultaneous rotation of the peach and of the two rubber pads is applied through the action applied to a rod 29r that is integral with a transverse tubular element 29q and connects, in a sliding fashion, two small arms 29p integral with the aforementioned rubber pads 29n.

In this way, it is possible to achieve the simultaneous rotation of the peach around the axis v-v contemporaneously with the opening and closing displacement, along the said axis, of the arms 29g.

The latter are normally positioned forward in the open condition (as shown in dashes in Figure 6) through the abutment of a pin 29s on the said arms 29g, while the final closure position (shown in Figure 6 with a solid line), rotated anticlockwise by 90° with respect to the former, is achieved through the action on the rod 29r of a locator member 37 (see also Figure 4), more about which will be said hereinafter, placed along the path followed by the said carriages; upstream of the said second halting station 35 or 35', with the rod 29r flush up against the said arm 29g.

As has already been stated, at 33, 35 and 35' there is the carriage releasing station and the stations for the halting thereof in the depositing area. The need exists for two stations, 35 and 35', so as to operate different halts for the carriages 29, with respect to the underneath container, to suit the depositing of a "long row" or of a "short row" which, as outlined in the premise hereto form the composition of the container in the tray 2, the said two stations being staggered by half a pitch P, one with respect to the other.

The said stations can be seen in Figures 10 and 11, and since they are constructionally identical, the details of

one only, 33, will be described.

The system for controlling the motion or the halting of the peach carrying carriages is constituted by a cross 33c, placed horizontally at the side of the path followed by the carriages and free to rotate around a pin 33b, in turn integral with the support 33a that joins the station to the frame of the apparatus.

At the extremity of each arm of the cross 33c is mounted an idle roller 33d, of a suitable diameter, the pin 33b being so placed that the cross, during the rotatory motion thereof, hits the trajectory of the lateral tail pieces 29b of each carriage.

If the cross is free to rotate, each arriving carriage causes a quarter rotation of the cross 33c, without this in any way affecting the motion of the said carriage. Vice versa, if it is wished to halt the motion of the carriages, it is sufficient to impede the motion of the cross 33c through the interposition of a latch 33e that is held in the blocking position under the action of a spring 33g.

The thrust of the carriage (or of the row of carriages) on the cross is directly absorbed by the pin 33h of the said latch, placed perpendicularly to the tangent of contact between the roller 33d and the latch 33e.

The blocking of the carriage occurs through the interposition of the latch 33e under the action of an electromagnet 33f, or some other similar actuating means . If the magnet stays de-energized, that is to say, the cross 33c continues to be free to rotate, it is possible to cause whatever number wished of carriages (this applies to the stations 35 and 35') to transit freely. Should, instead, the electromagnet

be excited by one single impulse and then be immediately released, only one carriage is able to transit; behind this is automatically repositioned a stop roller which, with the latch 33e having returned to the operative position, serves to block the following carriage and all the others there behind (this applies to the releasing station 33).

As regards the assemblies 35 and 35', it can be said that they are identical to 33 and that they are placed (Figure 11) on opposite sides to the carriage motion guide 36, for reasons of space. The position of one with respect to the other in the direction in which the carriages move forwards, is adjustable in such a way as to allow the inter-row staggering to be varied. Additionally, the position of the complete assembly can, in turn, be varied to suit the depositing necessities and the shape of the container.

The assemblies 35 and 35' are operated alternately, as already described, in a sequence of operations that will be described in the ensuing text.

The devices for opening and closing the elements that take hold of the peaches have, as previously stated, been shown at 34. More precisely, with reference to Figures 7 and 9, the said devices are constituted by a fixed cam 34', integral with the frame, that extends along the path of the guides 36 from the station 33 where the opening of the arms 29g takes place under the action of the rollers 29i (the major area of the cam 34 seen diagrammatically in Figure 9), right along the area where the carriages move downwards, the profile of the cam continuing to be constant and the gripping elements in a continuously open configuration, until the region where possession is taken of the peach (shown at K in Figure 4) is reached, the profile decreasing there in a brusque fashion in order to allow the pads 29n, under the

action of the spring 29m, to grasp the underneath peach.

Each filled carriage then passes over the lower bifurcation of the guides 36 until it arrives in the region of the aforementioned locator member 37, with the arms 29g displaced forwards in the configuration depicted in Figure 12a. Subsequently, through the lateral tail piece 29r integral with the pad 29n, it is possible to cause the pad to be displaced in the reverse direction to the motion, namely anti clockwise, with the consequent rotation of the peach around the centre of gravity axis v-v thereof and the definite "lying on one side" configuration (Figures 12b and 12c) of the peach, the stable positioning of this being created by the constant abutment of the tail piece 29r on the arm 29g.

The flexure rigidity of the locator member 37, to which is coupled a spring 37', is such as to allow the inflection thereof only when the tail piece 29r is able to offer a certain resistance, that is to say, after rotation when the tail piece is resting on the arm 29g.

For the "plant flowering" configuration, the device 37 is dismantled and the peach is deposited in the configuration depicted in Figure 12a.

In view of the value, that cannot be disregarded, of the mass of the assembly constituted by 29n, 29p, 29q and 29r, the return from the depositing position (Figure 12c) to the gripping position (Figure 12a), once the peach has been deposited, occurs spontaneously by the force of gravity during the subsequent travel and the overturning of the carriage along the return bifurcation of the guides 36, this position being maintained by the pin 29s.

The extreme positions of the complete system are stable

since, to change from one to the other, it is necessary to augment the centre of gravity thereof.

The carriages 29 filled with peaches, whether in the "plant flowering" or the "lying on one side" arrangement, transit in the region of counting means 69 which detect the number of carriages accumulated in the region of the subsequent halting station 35 or 35'. When the number of carriages accumulated corresponds to the number of underneath pockets in the container of the tray 2 (that is to say, the row is complete), the peaches have to be deposited and to this attends a second device for opening the gripping elements, shown globally at 39, placed along the path of the guides 36, in the region of the depositing area. This (see Figure 13) comprises a pair of "L" shaped bars 39a, the conformation of which is such that the arriving carriage 29 can move freely or halt in an open or closed position. For this purpose, the vertical edge 39c of each bar lies in between the side of the carriage and the innermost position adopted by the roller 29i.

Each of the said bars is connected to two members 39b and 39c which, jointly with the frame T of the apparatus, constitute an articulated parallelogram whose operation is achieved through a pair of double acting pneumatic cylinders 39d that exert an effect on the extension to the member 39c and are pivoted to the frame T.

The length of the bar 39a is such as to be able to exert, contemporaneously, an effect on all the carriages present in a depositing area, corresponding to the length of each container.

To achieve the depositing of the fruit, the two bars 39a are returned outwards, this moving the rollers 29i of each

carriage (arrow 39m in Figure 13), thereby causing the arms 29g to open and, in consequence, the fruit to drop into the underneath container.

With the said form of embodiment it is possible to house the actuating devices above the chain 30 and thus to limit the transverse volume of the apparatus. The complete operating stages include the opening and closing travel, since it is necessary to reset the path for the departure of the empty carriages.

An examination will now be made of the complete system or third station for infeeding and positioning the trays.

The said station is composed of two parts, namely a magazine-cum-feeder 40 that is able to insert, each time it is required, a tray into the filling area (see Figures 13 and 5), and a drive group 41 (see Figures 13 and 14) capable of supplying the said tray, coming from the preceding magazine, to the depositing area.

The magazine-cum-feeder 40, placed vertically and supported at the sides by the frame T of the complete apparatus, serves to house the trays 2 that are manually stacked within the guides 40a thereof. The locking and releasing of each individual tray occurs through a system of control whereby the whole stack drops down by gravity.

Under manual charging conditions, a first locking element 40b, constituted by a catch pivoted to the guides 40a, by exerting an effect on the underneath of the tray under the action of the pneumatic cylinders 40c, prevents the trays placed in the magazine from freely dropping down, while a second locking element 40d, placed higher up allows, since it is open, the trays to arrive at the lower position.

At the beginning of the working cycle, with a "commence the operations" signal, the element 40d is actuated and, through the elastic pads 40f, it applies a hold on the side of the penultimate tray, thereby blocking all those above. Through the element 40b (see the configuration shown in dashes in Figure 5), it is possible to free only the last tray, which drops by gravity on to the underneath drive group 41.

Following the dropping down of the last tray, the element 40b is repositioned (the configuration shown in Figure 5 with a solid line) and then the upper element 40d is opened so as to allow the whole stack to move downwards and rest on the closed element 40b.

In the absence of trays, an emergency signal from the device SMC takes the apparatus out of operation once the last container has been filled.

The group for driving the said trays, or containers, is constituted (see also Figure 14) by a roller support platform 41a on which the tray, dropping out of the feeder 40, rests.

The said platform is connected to the framework of the complete drive group 41, through an articulated parallelogram system 41b operated by a pneumatic cylinder 41c, that causes the entire roller platform 41a to be raised or lowered. The latter is then placed beneath and inside the area occupied by the pair of drive chains 41e, parallel and endless, that connect such a number of idle pusher rollers 41d as to define, between one pusher and the next, a number of spaces in which a tray can be deposited. Via the sprockets 41f, the said chains 41e are moved by a self-braking geared motor that always rotates in the same direction (anti-clockwise in Figure 13), corresponding to the direction needed to carry the trays into the depositing area.

The said trays are made to drop out of the magazine at the very moment when a pusher 41d is timed to be positioned suitably, as will be seen, underneath the magazine.

The movement of the chains, and thus of the trays, is intermittent so that the individual tray may move each time the filling of one row has been brought to an end, with a displacement perpendicular thereto, in such a way that there be, each time, an empty row under the depositing area. After each displacement, the tray pauses for the time required to deposit another row, and then moves off again once the filling has been completed.

It should be noted that the tray has to be arranged in a way whereby the rows of aligned pockets be perpendicular to the movement direction, the extent of this being dependent upon the shape of the tray, the number of rows, the position in which the tray lies with respect to the borders, and the distance in between two adjacent trays, etcetera.

The system adopted to control these displacements, seen in Figure 14, is constituted by two cogged pulleys 41h, integral with the rivets of the chains 41e, which cause an endless cogged belt 41L to move, the outside of the latter having mounted thereon, either by gluing or some other method, a number of, suitably spaced, reflector plates (three sets, in the case under consideration).

A first optical sensor 41m detects the presence of the first set T_1 of the said datum marks and, for each of them, operates in the region thereof the halting of the motor 41g and thus of the tray, the said datum marks being spaced apart at a distance identical to that in between two successive rows in one and the same tray or in two adjacent trays.

In this way, it is possible to "memorize" on the back of the belt the succession of movements required for a given number of rows, in such a way that the extent of each successive movement may be programmed without control circuit complications. A change of trays or a different number of rows will always render necessary the replacing of the said memory with another prior set-up belt.

The belt 41L can also be utilized to memorize other data too : for example, regarding the nature of the row, namely whether it has to have one item of fruit less than the others and, consequently, it may be necessary to override the operation of the halting station 35 or 35', etcetera; data of this nature can be detected by a second sensor 41n on the second set of plates T_2. In pratice, the traction system is identical to a step-by-step system : upon completion of one operation (the depositing operation, for example), the motor 41g is set in operation until the subsequent T_1 datum mark makes itself seen and causes the halting thereof. This, in turn, causes a fresh depositing operation, upon completion of which the system starts up again, and so on and so forth.

When each moving operation has ended, the tray is raised, in a standstill position, in such a way as to partially engage the peach in the pocket in the container thereof, this being to prevent any tendency to overturn during the releasing stage, which would jeopardize the final result. Similarly, the tray has to be back in the down position at the commencement of the subsequent displacement, in order not to hit the trajectory of the gripping elements 29g when the motion is resumed and, above all, in the changeover from a filled tray to the subsequent empty tray.

Each movement of the chains 41e is followed by the raising

of the roller platform 41a, then by the depositing of the row of fruit, then by the subsequent lowering of the tray and, lastly, by the positioning displacement of this. Filled trays are cleared from the apparatus via a chute 41p.

The operation of the apparatus in question will now be briefly examined with the aid of a diagrammatic representation of the connections that exist between the actuator and the sensor devices, that is to say, of the control system for the realization of a logical sequence.

In this case it is possible to distinguish a number of parts that are functionally independent but are interconnected by phase or consent signals, and with reference again to Figure 3, the following groups can be distinguished :

C_1 = main drive for the chains 30 and 14e and for the brake-clutch unit FF.

C_3 = system for moving and raising the trays (group 41), means for counting and halting the carriages (35 and 35'), device for opening the arms (39).

C_4 = system for the infeeding of the trays (group 40).

As regards the group C_1 (see Figure 15), the main motor MP is directly connected to the chain 30 (via the connection 30'), while it operates the orientation station SO, that is to say, the chain 14, via the unit FF. The clutch is normally engaged and thus the START-STOP control operates both chains of the apparatus.

In this circuit, furthermore, the following occurs :

- the clutch FF is disengaged, thereby halting the chain 14, when a sensor STV detects the absence of carriages in the releasing station 33, and thus the flow of incoming peaches is interrupted;

- the clutch FF is also disengaged when a sensor STP signals an excessive build-up of carriages in and upstream of the depositing area, and thus the station SO is again halted whilst the stations 35 and 35' clear the excess that is waiting;
- the complete apparatus is halted when the sensor SMC detects an absence of trays in the magazine 40.

Shown at SPP in Figure 3 there is a peach presence sensor which, with the apparatus kept timed, operates the electromagnet 33f that releases a carriage from the station 33.

In Figures 16 and 17 is illustrated the group C_3 which can be subdivided into three sub-groups $C_{3/1}$, $C_{3/2}$ and $C_{3/3}$. The first of these comprises the tray advancement motor 41g which is set in motion either through a manual starter AM or the contemporaneous presence of the two signals ⌒RIL and ⌒DEP, mention of which will also be made hereinafter. The blocks marked with the letter Q are "AND" elements, whilst those marked with the letter R are "OR" elements.

There are four optical sensors, namely 41m, 41n, 41nn and 41mm. Mention has already been made of the first two. The sensor 41mm detects the datum marks on a third set T_3 provided on the belt 41L, which are spaced one away from the other at a distance equal to the width of one tray. The said signals cause the chain 41e to come to a halt in a way in which the pushers 41d are in the precise position to receive a tray dropping out of the magazine 40.

The sensor 41nn checks the presence of the tray in the depositing area and, should there not be one, invalidates the signals of the other two sensors 41m and 41n but not that of the sensor 41mm; in fact, in this instance the motor 41g only halts the chain in the region of a T_3 datum mark

up until the time when a tray is present in the depositing area (actuation of the sensor 41nn); just as soon as a tray does drop down, the sensor 41nn reinstates the signal of the sensor 41m, which halts the chain in the region of each of the datum marks T_1 of the first row that determine the correct positioning for the release of the peaches.

When everything starts up again after each pause (always when there is a tray present), the sensor 41n is informed by the datum mark T_2, eventually present in the second row, whether the next row of peaches is to be a long or short one: this information is transferred to the counting and releasing sub-group $C_{3/2}$.

The latter is constituted by two optical sensors SCPu and SCPi, the first of which counts the carriages leaving the depositing area after the depositing operation has taken place, and the second of which counts the filled carriages entering the said area, that have to be blocked for the subsequent depositing of one complete row; by two pairs of counting means $\sum'$ K, $\sum'$ J, and $\sum$ K, $\sum$ J having preselected value possibilities, the consent to each pair being given by SCPu and SCPi, respectively; and by the two electromagnets 35f and 35'f that belong to the stations 35 and 35', respectively (see Figure 17).

Each of the said sensors detects the passing of the transiting carriages, the number of which is totalled by both the counting means (preselected at different values for the pockets in two consecutive rows) but only one of them is taken into consideration each time, this depending on whether or not, during the positioning of the tray 2, the datum mark T_2 was present (the short row detected by the sensor 41n), this latter being a SET signal from the flip-flop Z controlled by the signal detected by the sensor 41n.

If, in fact, SET > 0, that is to say, 41n has detected the next short row datum mark T_2, then through the AND element Q'1, $\Sigma'J$ is gated and counts the number of peaches in the preceding outgoing long row that has just been deposited; furthermore, it operates the electromagnet 35'f in order to prepare for the next short row.

Vice versa in the case of SET = 0; through the AND Q'_2(the "0" indicating a negated signal), $\Sigma'K$ is gated and counts a short outgoing row, and then once the value has been attained, the electromagnet 35f is energized and prepares for the blocking of the carriages for the next long row.

Just as the sensor SCPu is utilized for the blocking of the stations 35 and 35', so is the sensor SCPi for the device that opens the gripping elements once the predetermined value has been reached.

If, in fact, SET = 1 > 0, the next row to be deposited is short and, through the AND element Q_1 the counting means ΣK are set to count the number therein; once the preselection value has been attained, through the OR element R_1 and the concatenation derived from the other AND elements Q_3 and Q_4, consent is given to the successive group $C_{3/3}$, through an input signal α DEP, to proceed with the depositing of the peaches.

Vice versa, with SET = 0 consent is given to the counting means ΣJ and these operate α DEP once the value corresponding to the long row has been reached.

The group $C_{3/3}$ is constituted by a pneumatic cylinder 41c that raises the tray in order to bring it close to the peaches, and by the pair of cylinders 39d for opening the arms 29g. The said cylinders are connected to a logic

pneumatic circuit $CP_{3/3}$ that is independent and attends to the following sequence of operations, namely : the raising of the platform, the opening and closing of the arms, and the lowering of the platform.

The consent signal α DEP is given when the following has occurred: the chain has placed the tray in position (41m-41nn); the counting means Σ J or Σ K have signalled the presence of the row of peaches and the corresponding station 35 or 35' has blocked them in position.

Once $CP_{3/3}$ has concluded the depositing operations, it emits a consent signal $\curvearrowright_{DEP}$ which causes the following actions: the motor 41g sets the chain 41e back in motion for fresh positioning (group $C_{3/1}$); the counting means are zeroed since $\curvearrowright_{DEP}$ = RESET; and the column of empty carriages is set back in motion and deblocks both the station 35 and 35'.

As soon as the motor 41g resumes operation, the signal from the sensor 41n prepares the counting means for the formation of a fresh row.

To conclude, the group C_4 (see Figure 18) which has as actuator devices the two pneumatic cylinders 40c and 40e, the operational sequence of which has been previously described, is controlled by a logic-pneumatic circuit CP_4 activated by the presence of the consent signal α RIL generated by the following condition having occurred : the chain 41e at a standstill in the correct tray release position (signal from the sensor 41mm, see group $C_{3/1}$) this necessitating there being trays in the magazine 40 (sensor SMC).

When the said cycle has ended, that is to say, with a fresh tray being released, the circuit CP_4 generates a consent sig-

nal α RIL for the actuation of the groups and of the subsequent operations.

In the practical form of embodiment thereof, the invention can also adopt forms that differ from what has been described above and, in particular, numerous modifications of a practical nature may be made without this, in any way, deviating from the framework of protection afforded thereto.

Claims:

1. Apparatus for taking hold of and automatically packing fruit, particularly peaches, supplied in succession and coming from a station SO where the fruit is identically orientated, the said station being designed to deposit each item of fruit on corresponding means 13 for the support and orientation thereof, connected in a constant succession, to a first endless chain 14 given continuous infeed motion, all the said fruit being orientated in the same direction with the peduncular cavity 3 pointing downwards, resting on the said support and orientation means, the said apparatus being characterized by the fact that it comprises : a plurality of carriages 29 movable, under the action of a second, also endless, drive chain 30 that is provided with continuous motion in time with the infeed motion of the said first chain, along a path constituted by an endless guide 36, each carriage being provided with means 29f for the traction thereof by the said chain and with an element 29g for bilaterally taking hold of each individual item of fruit being supplied; a first releasing station 33 for the said carriages, placed downstream of the area B where the fruit is deposited in the containers and the carriages are in an empty configuration, comprising first means 33d for halting the latter, one at the side of the other, in the accumulation configuration; a device 34 for opening the said grippers, placed along the path of the said guide , at least downstream of the said first station; a device 34 for closing the said gipper elements placed, in the region of where the said carriages pass, in time with and above the corresponding fruit support means 13, downstream with respect to the former gripper elements; first means SPP for detecting the passing of the said fruit support means, designed to actuate for each carriage, the timed release thereof, one at a time, from the said first station 33; a second halting station 35, placed downstream

of the preceding stations, in the region of the area where the fruit is deposited, with the carriages in the filled configuration, comprising second means 35d for the halting thereof, one in line with the other, in the accumulation configuration, spaced at a distance equal to one pitch P between two successive pockets for the containment of the fruit in one and the same row in the said container 2; means 69 for counting the number of carriages transiting upstream of the said second station 35, designed to bring about, once the predetermined number has been reached, the actuation of a second device 39 for contemporaneously opening the gripper elements of all the carriages present at the said second station, in the halted position and in a number equal to the number of pockets in the underneath row to be packed; and a third station 40-41 for infeeding the containers underneath the said second station, movable in a horizontal direction perpendicular to the advancement direction of the said carriages, designed to intermittently infeed the said containers in a quantity D corresponding to the pitch between two successive rows of pockets.

2. Apparatus according to the preceding claim, for automatically packing fruit inside containers wherein the successive rows are staggered one with respect to the other, characterized by the fact that the said second halting station is constituted by two groups, 35 and 35', one independent of the other, placed along the path of the said carriages 29 and staggered one with respect to the other, it being possible to adjust the said groups in the direction in which the said carriages slide, by a value equal to the said staggering value between two consecutive rows.

3. Apparatus according to Claim 1, for packing the fruit in the "lying on one side" configuration, with the fruit placed on the corresponding orientation means 13 and orientat-

ed with the most coloured part pointing forwards with respect to the movement direction, characterized by the fact that it comprises locator means 37 that exert an effect on the said gripper elements 29g, designed to cause a rotation of these around a horizontal axis, crosswise to the direction in which the carriages move, that is to say, a 90° rotation of the fruit.

4. Apparatus according to Claim 1, wherein each of the said carriages is constituted by a body 29a, provided transversely with a pin 29e that has at the extremities thereof, a pair of bearings 29c and, also, with a pair of expansion members 29b, both the said bearings and the said expansion members being so placed that they can slide in the inside of the said bilateral guide 36, the path of which is the same as that of the said drive chain 30, the said body 29a being provided with a sprocket 29d that rotates idly around the said pin 29e, meshes with the said chain, and on which the said drive element 29f exerts an effect.

5. Apparatus according to Claims 1 and 4, wherein the said drive elements 29f are constituted by two permanent magnets that exert a bilateral effect on the said sprocket 29d.

6. Apparatus according to Claim 1, wherein the said gripper elements are constituted by two vertical arms 29g, placed bilaterally to the said body 29a, integral with corresponding bushes 29h that are movable inside a horizontal transverse tubular element 29l and are connected at the front to the opposite extremities of a spring 29m housed in the inside of the said tubular element 29l, each of the said arms being provided at the top with a needle roller 29i on which the said opening and closing device 34 exerts an effect and, at the bottom, with a fruit gripping pad 29n.

7. Apparatus according to the preceding claim, wherein the said arms 29g are bent forward with respect to the motion direction of the carriages 29.

8. Apparatus according to Claims 3 and 6, wherein the said pads 29n are connected, idly rotatable around a horizontal transverse axis v-v, to the said arms 29g and are provided with two small arms 29p, integral there with, in the form of an "L" upside down, transversely connected in a way that permits one to slide with respect to the other by a tubular element 29q provided with a rod 29r on which the said locator means 37 exert an effect.

9. Apparatus according to the preceding claim, wherein the said small arms are turned upwards and each of the said pads is provided with a pin 29o designed to intercept, following the rotation of the said pad, the relevant arm 29g, each of the small arms beihg movable between two extreme stable positions, namely a front position in which the fruit is gripped and the said pin 29o abuts with the corresponding arm 29g, and a rear position, rotated by 90° with respect to the former, with the said rod 29r flush with the corresponding arm.

10. Apparatus according to Claims 3 and 8, wherein the said locator means 37 are constituted by a bar 37 connected to a spring 37' integral with the frame of the apparatus.

11. Apparatus according to Claims 1 and 6, wherein the said devices for opening and closing the gripper elements downstream of the first releasing station 33 are constituted by a double cam 34', fixed to the frame of the apparatus and extending along the full path of the said carriages from the said station 33 to the area K where possession is taken of the peaches, from the relevant support means, the said

cam exerting an effect on the said rollers 29i.

12. Apparatus according to Claims 1 and 2, wherein the said first station 33 and the said second station 35-35' are each constituted by a horizontal cross 33c-35c-35'c, placed at the side of the path of the carriages, and free to rotate around a vertical pin integral with the frame, each arm of the said cross being interposed along the trajectory of the lateral tail pieces 29b of each carriage, with means being provided to block, when the order is given, the rotation of the said cross.

13. Apparatus according to the preceding claim, wherein the said blocking means are constituted by a latch 33e-35e-35'e, pivoted to the frame, placed along the path of the arms of the cross and subjected to the action of a control element 33f-35f-35'f.

14. Apparatus according to Claim 1, wherein the said carriages are of a length, measured in the movement direction, equal to the pitch P between two successive peaches belonging to one and the same row.

15. Apparatus according to Claim 1, wherein the said second opening device 39 comprises a pair of bars 39a placed bilaterally to the said carriages in the region of the said fruit depositing area B and internally with respect to the said rollers 29i, that is to say, in the space existing between these and the body 29a, the said bars being of a length corresponding to the maximum length of the row in each container and, furthermore, being movable in the two directions, horizontally and transversely to the motion direction of the said carriages.

16. Apparatus according to the preceding claim, wherein each

of the said "L" shaped bars is pivoted, in the form of an articulated parallelogram, to two members 39b-39c which, in turn, are pivoted to the frame T of the apparatus, and operating means 39d, connected to one of the said members, are provided for the aforementioned movement of the said bars.

17. Apparatus according to Claim 1, wherein the chain 14 of the said orientation station SO is connected to the chain 30 of the apparatus in question, via a brake-clutch unit FF.

18. Apparatus according to Claim 1, wherein the said third station comprises a magazine-cum-feeder 40, placed at the side of the said guides 36, containing a plurality of containers 2 stacked one on top of the other, and a drive group 41 that extends perpendicularly to the carriage infeed direction, designed to supply the containers coming, one at a time, from the aforementioned magazine 40, into the region of the depositing area and to position them there.

19. Apparatus according to the preceding claim, wherein the said drive group 41 is constituted by a roller platform 41a for supporting the container, that extends horizontally from the said magazine 40 to the said second halting station 35-35', placed beneath and inside a pair of parallel endless chains 41e that connect a number of idle pusher members 41d that define a plurality of spaces in which a container can be deposited, the said chains being intermittently operated through an independent motor 41g actuated by a corresponding control group.

20. Apparatus according to the preceding claim, wherein the said roller platform 41a is movable vertically between two extreme positions, namely a lower position moving away from the said carriages, in the region of the passage of these in the depositing area, and an upper position in which the poc-

kets are made to approach the fruit, in the region of where the fruit is released by the gripper elements 29g concerned.

21. Apparatus according to the preceding claim, wherein the said control group comprises an endless belt 41L mounted around a pair of pulleys 41h keyed to the rivets of the said chains 41e, the said belt being provided, on the outside surface thereof, with a first set of datum marks T_1, spaced suitably one from the other at a distance equal to the distance D between two successive rows, sensor means 41m being provided for the detection thereof and to give the consequent halting instruction to the said motor 41g.

22. Apparatus according to the preceding claim, wherein the said belt is provided with a second set of datum marks T_2, spaced at a distance equal to the distance in between two rows having the same number of pockets, sensor means 41n being provided for the detection thereof and to give the consequent blocking instruction to the corresponding elements 35f or 35'f.

23. Apparatus according to Claim 21, wherein the said belt is provided with a third set of datum marks T_3, spaced at a distance equal to the distance in between two successive pusher members 41d, sensor means 41mm being provided for the detection thereof and to give the consent for the release of a container from the magazine 40 plus the consequent halting instruction to the motor 41g.

24. Apparatus according to Claim 1, wherein the said counting means 69 are constituted by two sensors SCPu and SCPi, the first of which placed in the outgoing region of the said carriages from the depositing area, and the other in the incoming region of the said carriages into the depositing area B, provided to activate, as a function of the outgoing sig-

nal from the said sensor 41n, a pair of counting means $\Sigma'J$, $\Sigma'K$, and ΣJ, ΣK that operate, once the preselected value has been reached, the elements 35f-35'f and the said second opening device 39.

25. Apparatus according to Claim 18, wherein the said drive group includes sensor means 41nn, placed in the region of the depositing area, for detecting the presence of a container and activating the sensors 41n-41.

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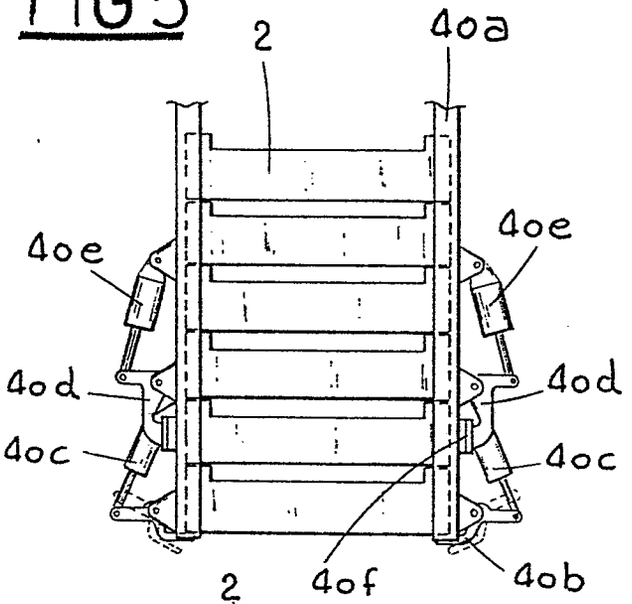
FIG5



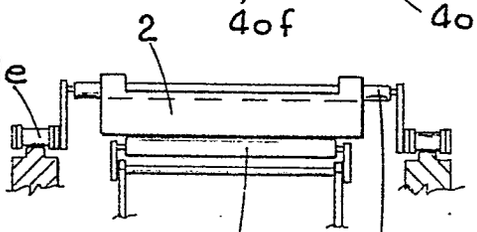


FIG14

FIG1

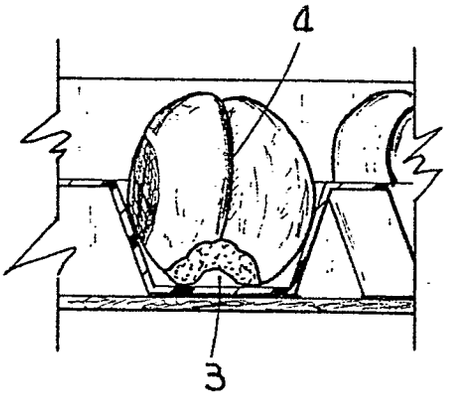
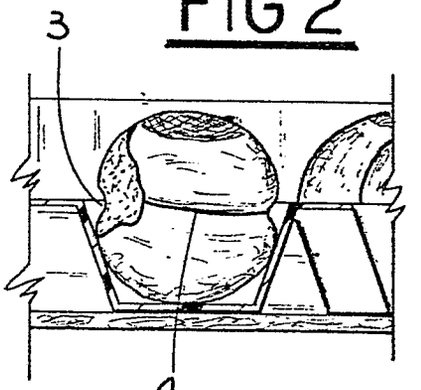


FIG2



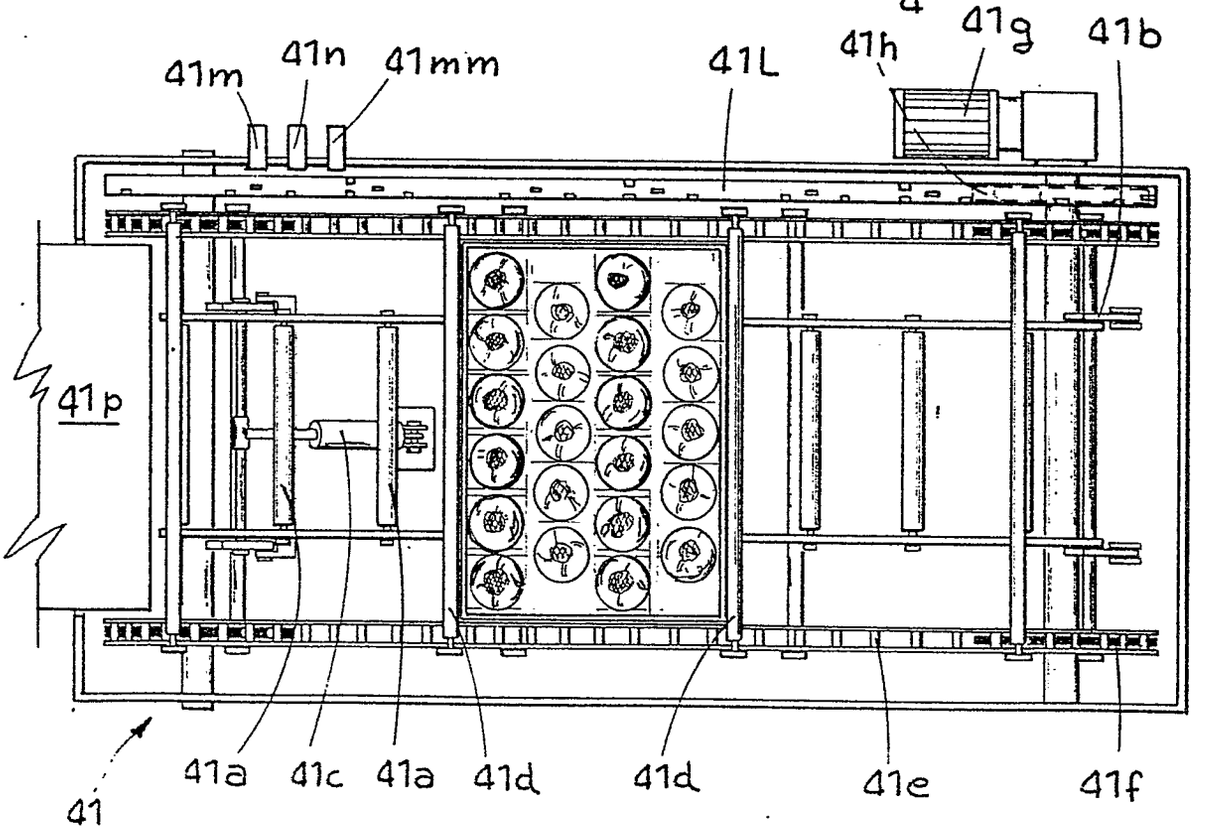


FIG3

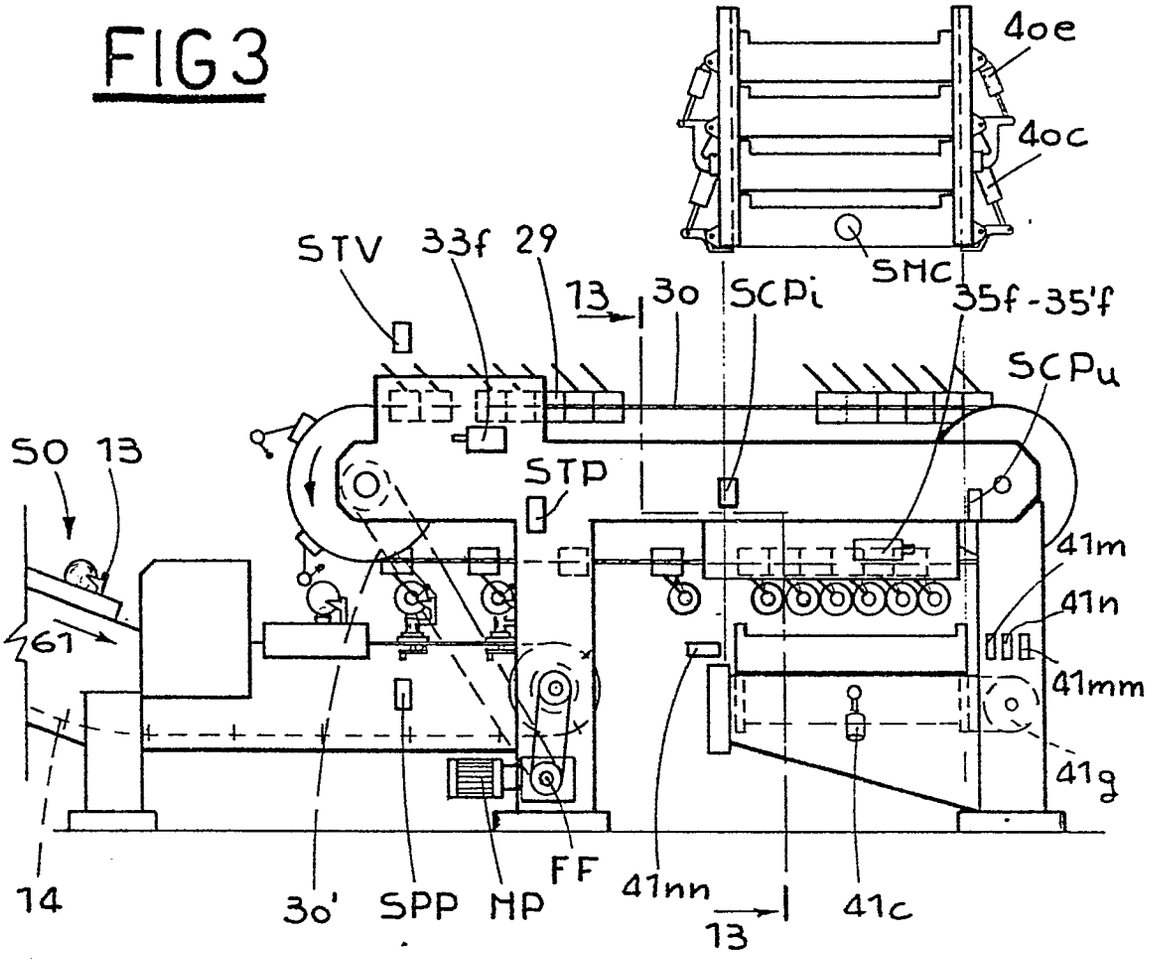

40e
40c
SMC
STV
33f
29
13
30
SCPi
35f-35'f
SCPu
50
13
STP
41m
41n
41mm
41g
61
14
30'
SPP
MP
FF
41nn
13
41c

FIG4

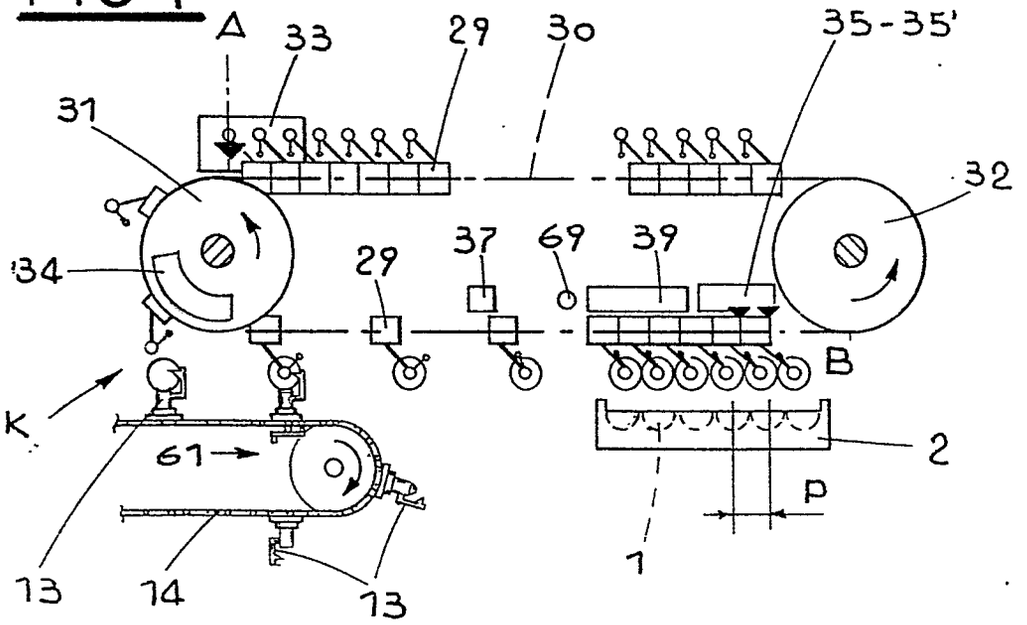

A
33
29
30
35-35'
31
32
34
29
37
69
39
B
K
61
2
P
1
13
14
13

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FIG7

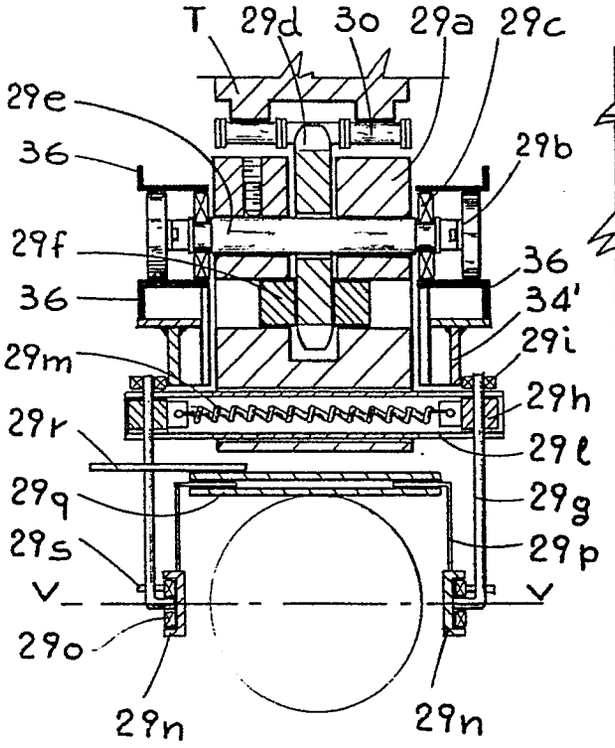

FIG6

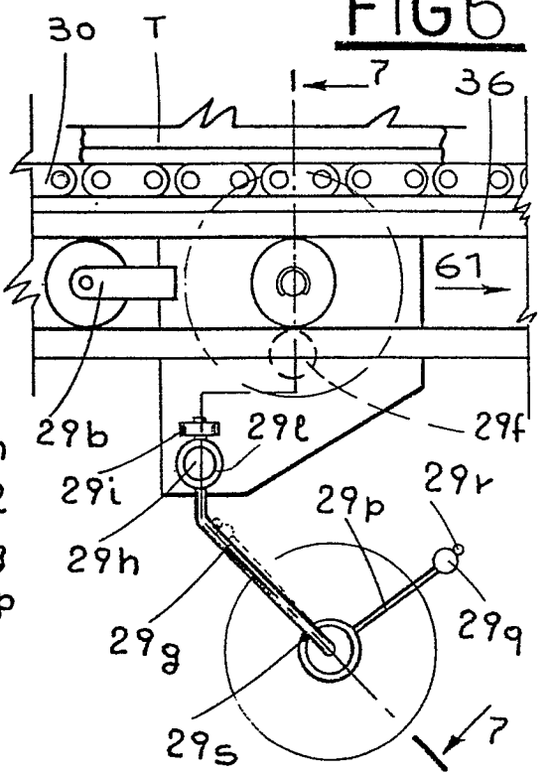

FIG8

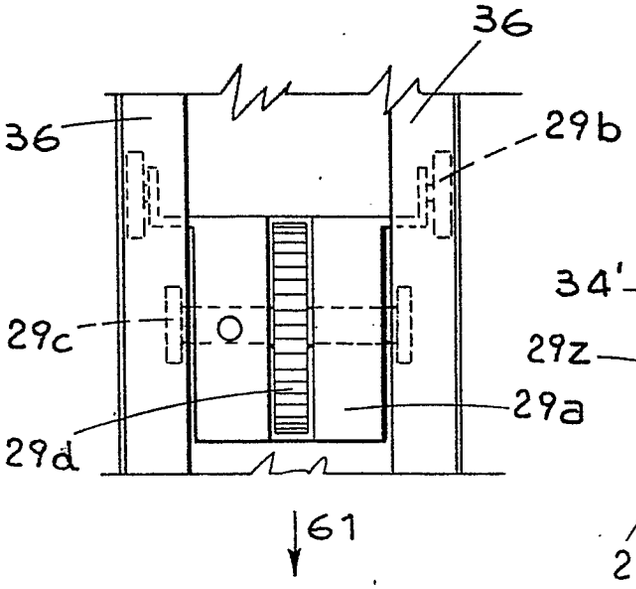

FIG9

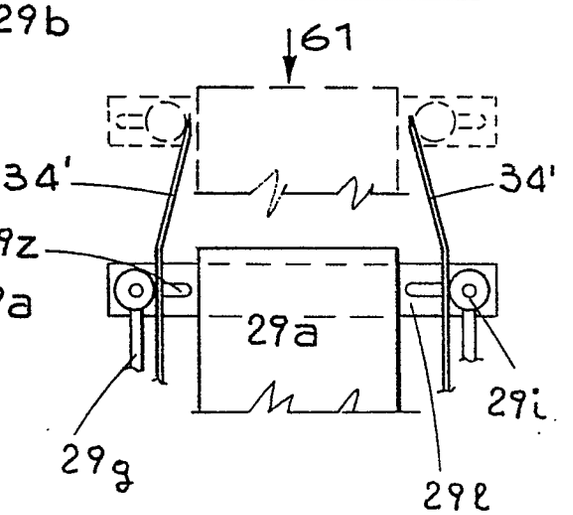

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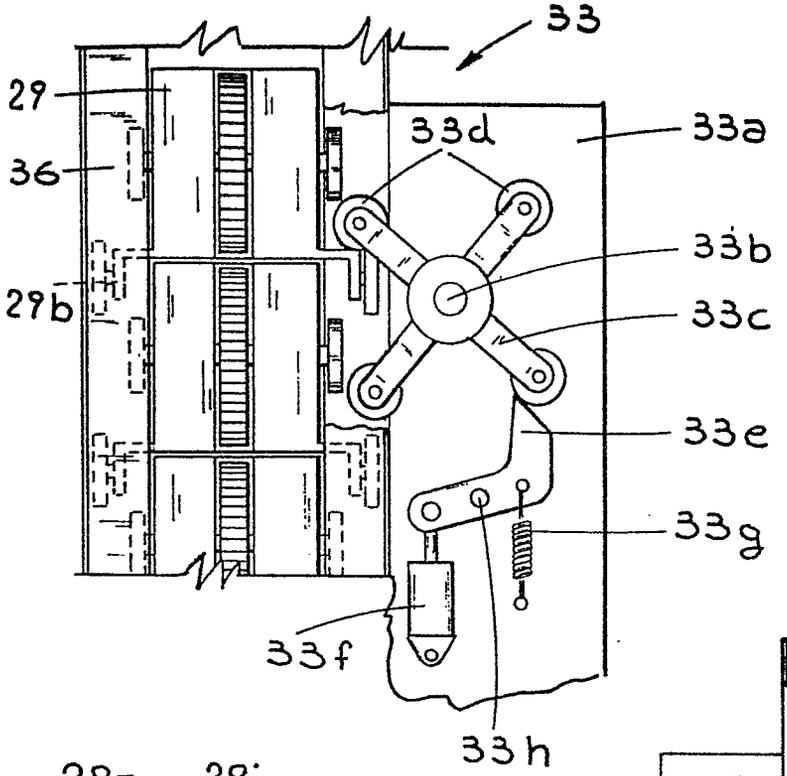
FIG10



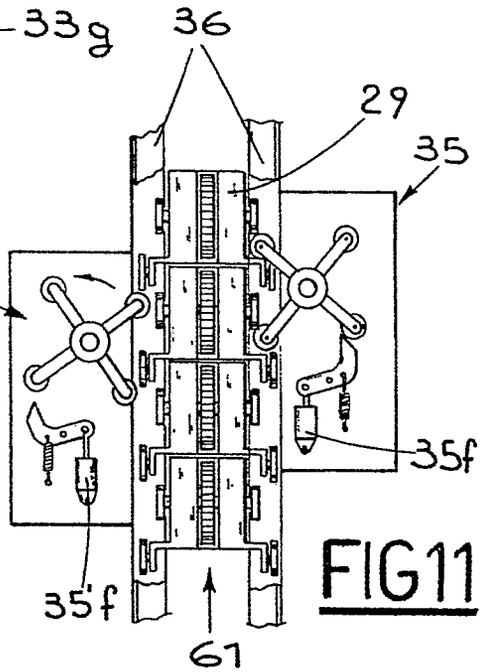


FIG11

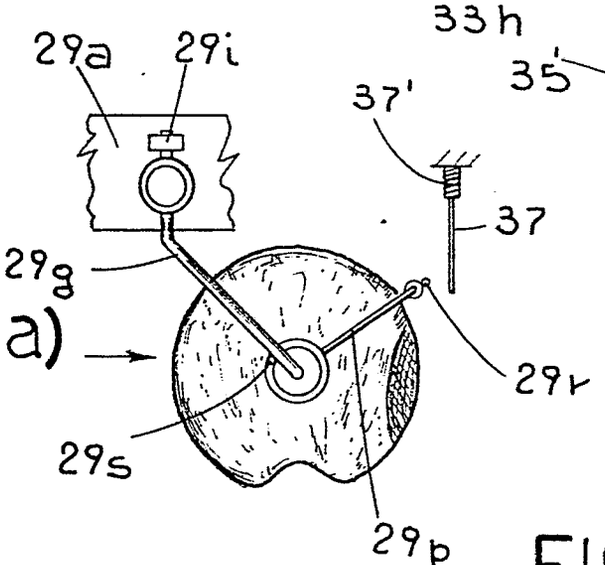
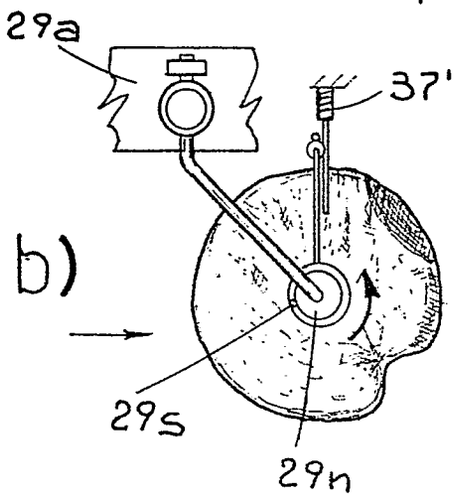
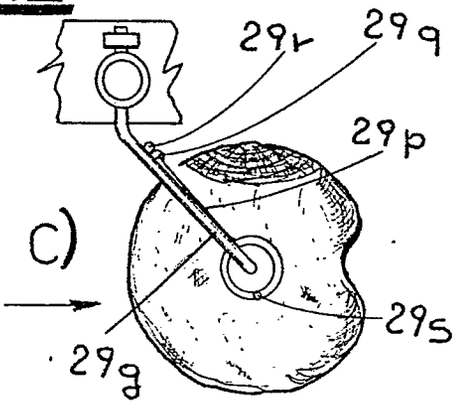


FIG12





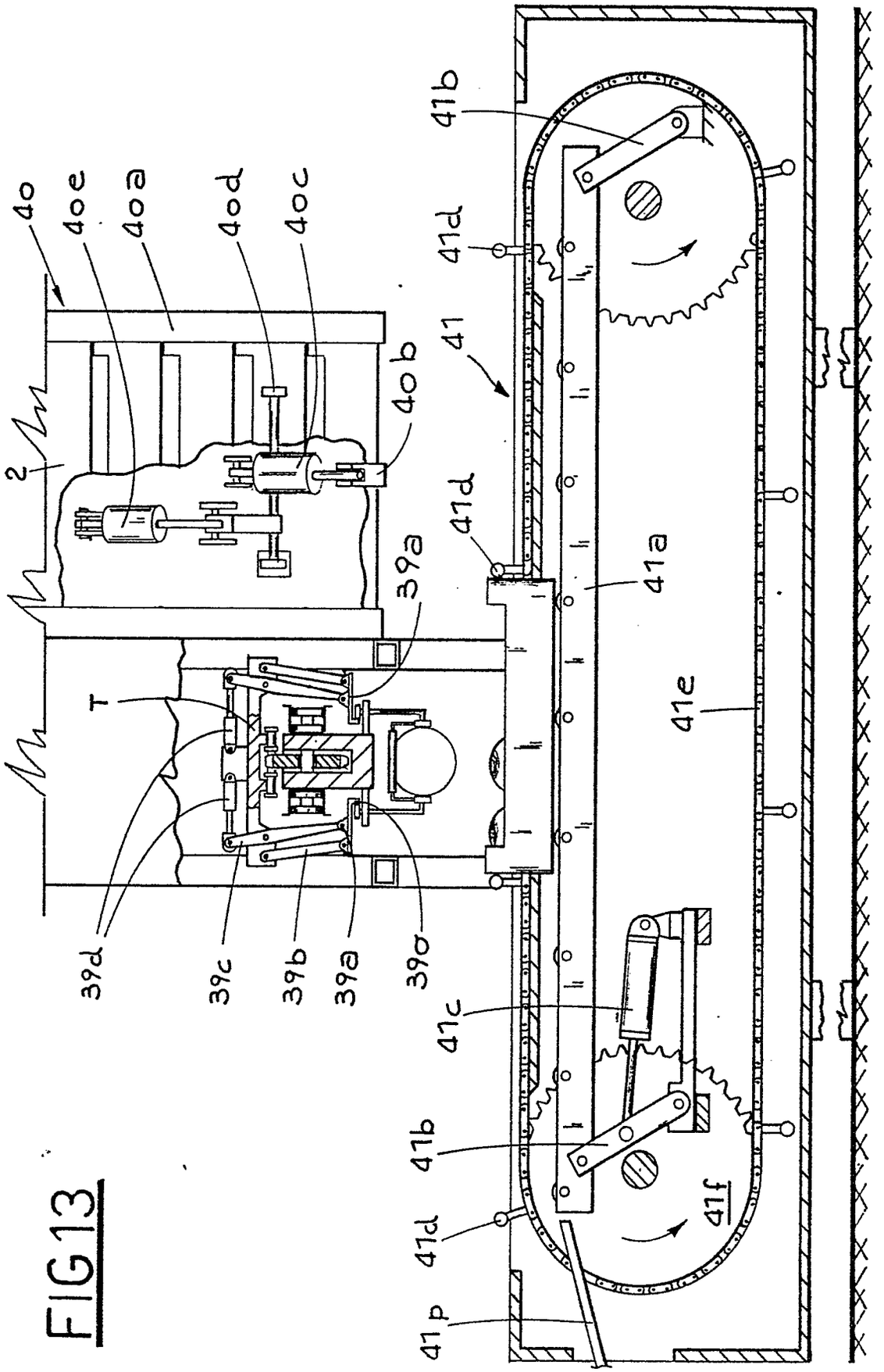

40
40e
40a
40d
40c
40b
2
T
39d
39c
39b
39a
39a
39a
41
41b
41d
41a
41e
41c
41b
41d
41f
41p

FIG13

FIG16

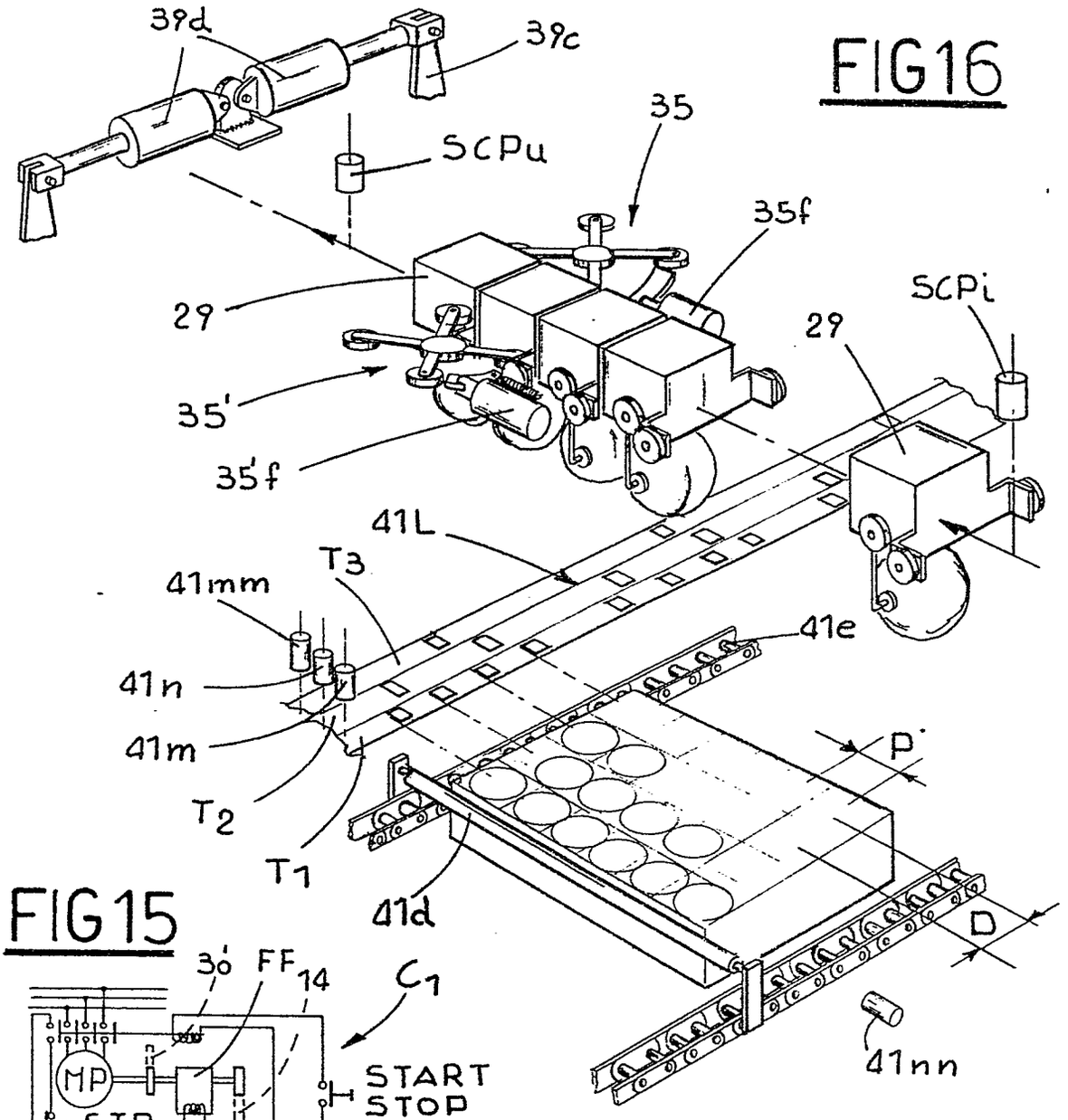
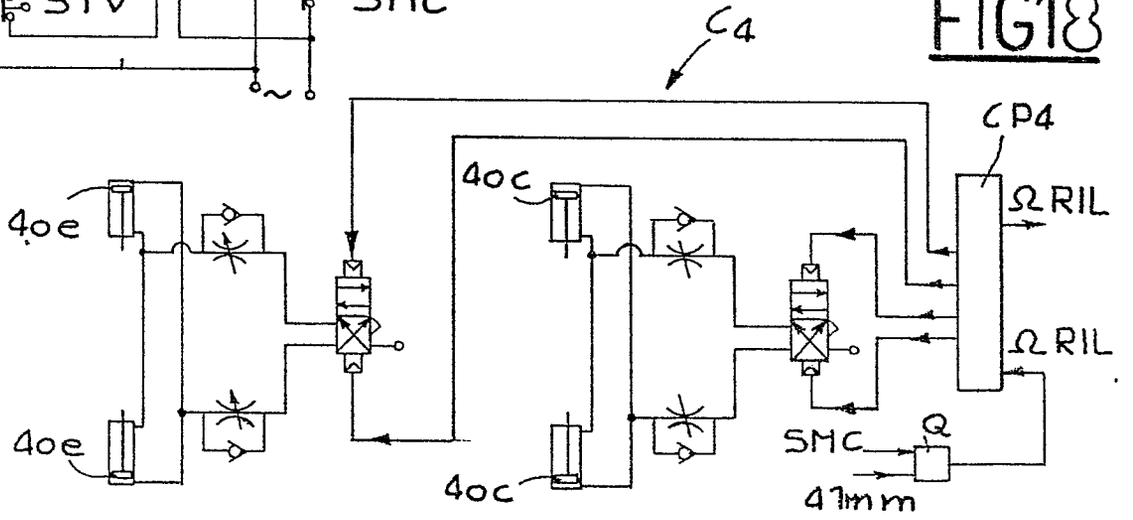


FIG15

FIG18



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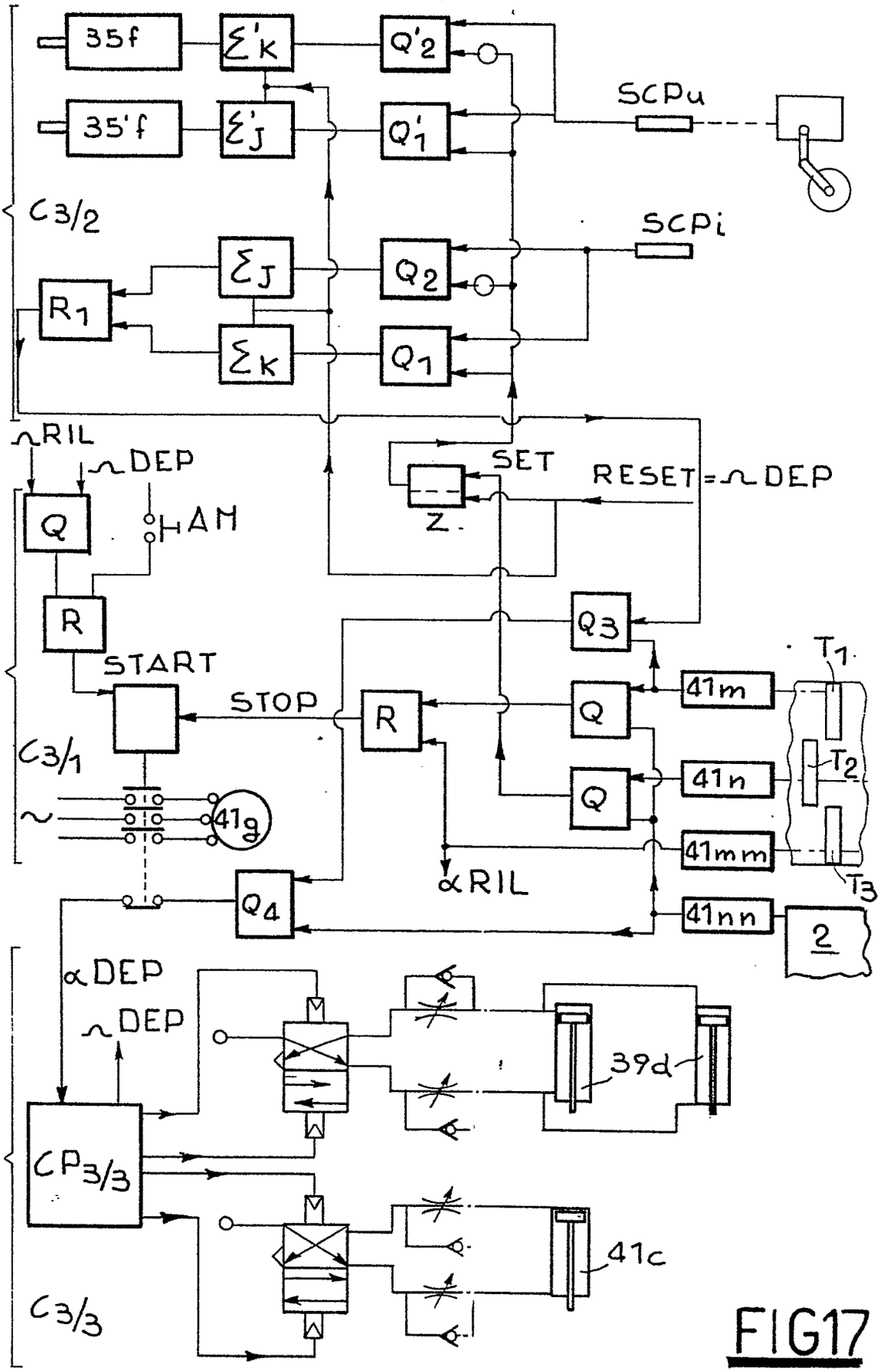

FIG17