

①② **EUROPEAN PATENT APPLICATION**

②① Application number: 84201925.9

⑤① Int. Cl.⁴: **B 07 C 5/36, B 07 C 5/24**

②② Date of filing: 21.12.84

③① Priority: 27.01.84 NL 8400261

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④③ Date of publication of application: 07.08.85
Bulletin 85/32

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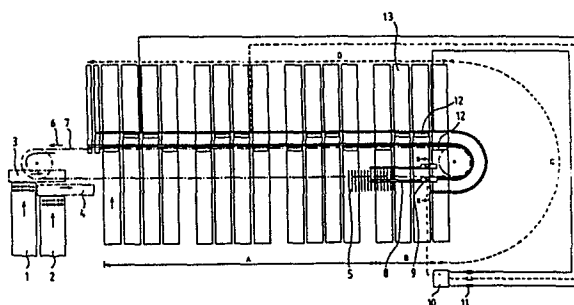
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⑧④ Designated Contracting States: **DE FR GB IT NL**

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⑤④ **Device and method for subjecting objects to a treatment in treatment stations allocated to them.**

⑤⑦ The invention relates to a device for controlling stations located along a line conveyor supporting a row of objects, such that to each object a station is allocated. Actuation of the station happens by an allocation signal delayed by a time delay corresponding to the time the objects need to attain the station. The invention provides a detector at the station side which detects the presence of the object at an exactly determined location, which detection together with the allocation signal actuates the related station.



Device and method for subjecting objects to a treatment
in treatment stations allocated to them.

The invention relates to a device for subjecting objects to a treatment, which objects move one behind the other in a track along which treatment stations are positioned, said device being provided with an allocation instrument for
5 determining in which treatment station or stations each of said objects has to be submitted to a treatment, said allocation instrument being provided with means for generating signals, characteristics for activating the allocated station or stations, a delay means being present to delay
10 said signals over a time period corresponding to the time the objects need to travel from the allocation instrument to an allocated station, each station being provided with an actuation mechanism and means being provided to correct the delay of the said delay means for deviations in the
15 time the objects needs for travelling from the allocation instrument to an allocated station.

A device of this type has been depicted in the European Patent EP-A-0 028 527 (FMC CORP.).

20 In this known device the step period is divided in a large number of for instance 500 equal sub steps. The step period is the period the objects need to travel over the distance occupied by an object or the center-to-center distance of
25 two adjacent objects. Further a marker means travels with the objects and at the location of each station a check signal is generated which in a computer is used to determine the exact sub step in which the object is in cooperative relation with the station. If, for instance by reason of
30 elongation of a conveyor to which the objects are attached, the center to center distance of two adjacent objects, to be called the step distance, has changed, the computer is adjusted to let the station respond again in the right moment.

35 This known device has the disadvantage, that it is only possible to correct the sub step value once in the time the conveyor needs to travel along its entire track. This means,

that when starting the device in the first run no exact adjustment of the sub step value has occurred, which is rather serious, because any conveyor elongation may be due to temperature deviations and consequently may change during
5 a machine stop, which may be the night (or weekend) over. A second disadvantage is, that a corrected sub step value has to be available for each treatment station for calculating the corrected moment for actuation of the related station. This means that a considerable computer capacity has to be
10 used for this purpose.

Further a drive chain encoder is necessary, which should be able to give said large number of pulses for each step period, which necessitates an accurate mechanical device
15 coupled to the machine.

Finally changes in the location of the station in the time between the passing of the said marker will not be corrected.

20 The invention aims to overcome these difficulties and to provide a device which is more reliable, needs a smaller computer capacity, avoids difficulties with starting or restarting the device and allows for at least limited adjustments of the location of the stations, even with
25 running machine.

A further aim of the invention is to obtain the above indicated results with only little additional apparatus.

30 It is remarked, that the above indicated know device shows also some advantages over older devices of this type having no means to correct the delay of said delay means for deviations. Such devices, are for instance shown in the copending European Application 83201479.9 in the mean time
35 published as EP-A-0 108 439. These advantages are mainly that velocity changes cannot hamper the correct working of the device, for instance with starting or stopping and that it is possible to locate the stations at arbitrary locations along the track.

Therefor it is a further aim of the invention to overcome the above disadvantages without sacrificing the advantages of the known device.

- 5 According the invention the above aims are attained by providing that the delay means are adapted to cause a delay that is smaller than the time the objects need to reach the allocated station and in that at at least some stations a detector is present for detecting the presence of an object
- 10 generating a further signal AND circuit means being provided to combine the said signal and the said further signal to generate a control signal for the actuation mechanism of the allocated station.
- 15 According to a preferred embodiment of the invention it is provided that the delay devices are adapted to issue an output signal having a duration equalling the time period the objects need to travel over the step distance of the objects in the track.
- 20 Herewith it is attained that the complete step period is available for actuating the related treatment station and that practically no limitations exist as to the location of the treatment stations, which would be the case if the
- 25 signal procured by the allocation device would emit pulses of a duration shorter than the step period.
- According to a further feature of the invention it may be provided that the actuation mechanisms have an actuation
- 30 member which can take two positions, namely an inactive and an active position, the actuation members being adapted to be moved by the actuation mechanism on receipt of a control signal and to remain in said active position when the same station is also allocated to the object immediately following
- 35 the object which caused the actuation member to take its active position. Herewith is attained that the actuation mechanism needs not to be reset if the next object has to be treated in the same station. This allows not only for a smoother working of the device but also gives a better use
- 40 of the time available for setting and resetting, which time

now can be extended, because the resetting can be carried out in the next step period.

According to still a further elaboration of the invention
5 it can be provided that the treatment stations are combined to form sets, one of the treatment stations belonging to a set being controlled by an actuation mechanism and the other stations of the set being controlled by said one station. This embodiment of the invention is specially useful when
10 the distance between corresponding points of juxtapositioned treatment stations, to be called the station width, is larger than the step distance. In that instance it is difficult to control the stations unambiguously without subdividing the step period in a rather high extent. Nevertheless the
15 important advantages are attained which result from having the station width smaller than the step distance, which advantages are among other a shorter machine length and consequently a smaller travelling speed of the objects with the same capacity of the machine.

20 In case the locations of the treatment stations have mutual distances equalling or being an exact multiple of the step distance, it is possible to procure only one detector for a number of consecutive stations. In fact the variations of
25 the length of a conveyor supporting the objects are very small, if only a short length of the conveyor is considered.

Accordingly a further improvement of the invention provides that the treatment stations or sets of treatment stations
30 are combined to groups, one of the stations or sets of stations of a group being provided with a detector and that this detector supplies the further control signal for the other stations or sets of stations of the group.

35 A constructively simple embodiment of the invention provides that the delay devices are shift registers and that a pulse shaper is present feeding a small integer number of shift pulses to the shift registers in each step period of the device.

In order to restrict the number of cells of the shift registers it is desirable that the number of steps corresponding to a step distance is as small as possible. If for instance the distance between treatment stations (the
5 station width) is $2/3$ of the step distance three pulses per step period suffice, in which case a following station is reached after two pulses.

In many cases, however, it is possible to make this number
10 unity, especially if the embodiment is used in which a number of successive stations is combined to a set or group, so that only the first stations of the sets or groups have to comply with the exigence of a mutual distance equalling an integer number of step distances.

15 In practice a preferred embodiment exists in that the delay devices and/or the actuation mechanisms and/or the AND circuits are part of a computer device such as a computer or a microprocessor.

20 Though the invention is applicable to any treatment, a preferred embodiment exists in that the objects are containers and the treatment consists in discharging the containers. A container is to be defined as any member able to contain,
25 support, grip or in any other way bear anything, for instance an egg gripper or a fruit scale. Further the invention can also be applied to devices having a number of parallel tracks along which the objects travel, as has been shown in European Patent EP-A-0 028 527 or in EP-A-0 108 439.

30 Further the invention encompasses a method for controlling treatment stations for treating objects selected out of a row of objects moving one behind the other along a fixed track, in which at a first location along said track is
35 indicated which objects have to be treated in which stations, signals being transmitted from said location to said stations, said signals being delayed with a time period mainly corresponding to the time period an object needs to travel from the said first location to the station allocated to it,
40 which method is characterized in that in the near neighbour-

hood of the allocated treatment station the presence of the objects is detected, which detection determines the moment for executing the treatment.

- 5 The invention in the following is elucidated on hand of the drawing in which:-

Figure 1 schematically shows a plan view of a machine in which the invention can be used,

- 10 Figure 2 shows schematically the application of the invention at one of the treatment stations,

Figure 3 shows a time diagram of the control signals,

Figure 4 shows a variant of the electronical part of the device of figure 2,

- 15 Figure 5 shows a diagram elucidating a further aspect of the invention,

Figure 6 shows a variant of figure 4, and

Figure 7 shows a number of signal graphs.

- 20 In the drawing fig. 1 shows a plan view of a grading machine in which by means of feeding webs 1 and 2 objects are fed to transfer conveyors 3 and 4, which cooperate with bearing members 5, which are schematically indicated at 5 and which are moved in the direction of arrow 6 by an endless chain 7.

- 25 These bearing members each bear two balances, each provided with an egg gripper. After a stabilisation by means of guides 8 the position of these balances can be read by an allocation device 9, which consists of two members which each cooperate with one of the balances of each bearing

- 30 member 5 or with the other of them.

The data of the allocation device 9 are fed to an electronical processor 10 which determines to which of the discharge stations 12 the object in the related balance has to be sent.

- 35 Communication lines run from processor 10 to the different discharge stations 12 and are provided with shift registers 11. For clarity's sake in the drawing only the 2nd, 10th and 15th of these lines have been shown.

- 40 It is remarked that the discharge stations in the shown

embodiment have been mounted in groups of four, namely firstly one for the balances at the innerside of the conveyor 7, then two successive ones for the balances located at the outerside of the said conveyor and again one for the balances
5 at the inner side, the four discharge stations normally being organized such, that the first two of them are allotted to a first weight class and the next two to another weight class. The objects discharged by the discharge stations 12 come on transport webs 13 which may be provided with packages
10 for the objects.

When the objects from the webs 1 and 2 via the transfer conveyors 3 and 4 have been put in the balances, the latter can damp out over the distance A. If desired a division in
15 unambiguous weight regions is realized by means of guides 8 in a way known per se in the distance B, at the end of which the position taken by the balances is read by the allocation device 9 and fed to the processor 10 which determines which of the lines starting from 10 has to be energized. The time
20 the balances need to cover the track portion C and the part of track portion D to the allocated discharge station corresponds to the delay of the shift registers 11, which receive a shift pulse when the chain 7 travels over the step distance.

25 The invention is applied to this known device. A schematical embodiment hereof has been shown in fig. 2, in which the entrance of a discharge station 12 has been depicted. The balances have guide rolls 14 cooperating with fixed guides 15. A switch plate 16 is normally in the position indicated with
30 interrupted lines and can pivot about pivot 17. A link 18 connects the switch plate 16 with the armature 19 of an electro-magnet 20. The balance which is connected to roll 14 also bears a marker 21, which may consist of any detectable part of a balance or bearing member and which can cooperate
35 with a detector 22. The marker 21 can be a permanent magnet in which instance detector 22 can be a Reed contact, but it is also possible that marker 21 contains an electrically conducting portion and detector 22 an oscillator the tuning or damping of which is influenced by the vicinity of 21.
40 Of course each other detector system such as a photo sensitive

one can be used also. The output of 22 is connected to one input of an AND gate 23. The other input of this gate is connected to the output 24 of the concerned shift register 11. The output of the AND gate 23 energizes the electro-
5 magnet 20.

After receipt of a control pulse on 24 indicating that the next roll 14 has to be conducted to the branch guide 25, the marker 21 will cooperate with detector 22. This happens
10 at a moment at which roll 14 is in^{an} accurately determined position with respect to the switch plate 16, which is elected such, that sufficient time is available for switching the switch plate 16. This eliminates all difficulties with
15 late. In the shown embodiment switch plate 16 is reset by means of its tail portion 26, actuated by roller 14 when running on guide 27.

In fig. 3 graph 11 shows the output of a shift register 11
20 which firstly during one step period 29 is high, then two step periods low and then two successive step periods 30 high.

Line 22 shows the output of detector 22. The pulses 28
25 shown in solid lines all show the same timing with respect to shift register pulses such as 29 or 30. If, however, for some reason they should deviate from this timing, as has been indicated with pulse 28', shown in interrupted lines, electromagnet 20 will be energized in exactly the same way.
30 Because, however, the location of detector 21 is related to that of switch plate 16 the latter still will be actuated when roll 14 is at the desired location with respect to the switch plate. The pulses 28 may occur in the whole time period corresponding to 29.

35 In the right hand part of fig. 3 the case has been shown that two successive pulses of the type of 29 occur. If the shift registers show the rather common feature to give an output pulse covering the complete step period of the
40 register, one single long pulse 30 will occur having twice

the length of pulse 29. When pulse 28a occurs a switch plate corresponding to 16 but without mechanical reset 26 can be set.

- 5 At the moment 28b occurs pulse 30 still exists, so that a pulse for setting the switch plate passes the related AND gate 23, but this has no influence, because the switch plate still is set.
- 10 Fig. 4 shows an example of a circuit with electrical reset. The electromagnetic relay 20' is of the polarized or bistabile type, which means that it takes a position after energizing a first circuit and only takes its second position after energizing a second circuit. In fig. 4 these circuits have
15 been indicated with 31 and 32. A differentiating circuit 33 reacts on the trailing edge of the shift register output 24 and is adapted to energize the reset circuit 32.

In fig. 5 a diagram has been shown in which the long bars
20 $34_1, 34_2 \dots 34_8$ indicate the edges of the pulse regions of the type of 29. If the distance between the objects is the same the bars $34_1 \dots 34_8$ correspond to locations in the machine where an object is located at the end of the preceding and the start of the next pulse corresponding to
25 29. The location where detectors 22 should be placed in case each discharge station is provided with its own detector and the distance between adjacent discharge stations is smaller than the step distance, are indicated at $35_1 \dots 35_{11}$.

30 In this case a detector 22 and switch plate 16 is only present for each set of six discharge stations. The stations $35_1, 35_2 \dots 35_6$ of the first set cover the region indicated with arrow 36. The follow stations $35_2 \dots 35_6$ are mecha-
35 nically controlled for successively discharging all containers sent to them by the related switch plate. Such sets of discharge stations are known, for instance the United States Patent Specification no. 3,749,260.

40 The invention has the advantage, that the location of the

switch point 35₁ can be freely selected between two bars 34₁ 34₈ and that nevertheless the possibility is created to use discharge stations having a width that is considerably smaller than the step distance. In case the discharge station
5 sets have to be spaced from each other, for instance to allow for space between two output webs, it is only necessary to locate the next detector clearly between two bars 34, f.i. 34₆ and 34₇.

Fig. 6 shows a practical embodiment of the invention. In this
10 figure the references 11, 14, 15, 16, 17, 21, 22 and 24 have the same meaning as in fig. 2, it being remarked that a spring 18a biases switch plate 16 in the inactive or reset position, which is indicated with interrupted lines. Members 14 and 21 pertain to a first container and 14a and 21a to a second one.

15

Reference 42 is a so called data flip flop. This flip flop has the feature to give an energizing output on its Q terminal, by line 38 connected to electromagnet 20, if simultaneously a high signal is received on its D and C inputs, connected
20 to the shift register output 24 and via line 37 to detector 22 respectively.

In fig. 7 graph 39 shows the clock pulse for the shift registers, a step only being made at the downward edges
25 of 40, 40b and so on. Graph 24 shows the shift register output, the leading and trailing edges of which correspond to the downward edges 40 of graph 39.

Graph 37 shows the pulses 41 generated by detector 22, when
30 the markers 21 pass.

Finally graph 38 shows the energizing pulses of the electromagnet 20. Only if a pulse 41 coincides with part of a pulse of graph 24 an energizing pulse of a duration that is determined by the data flip flop 42 is sent to 20. This duration
35 equals the duration between two successive downward edges of clock graph 39. By reason hereof it is easily possible to maintain power on electromagnet 20 in more than one successive step periods.

As is shown in fig. 6 detector 22 is located somewhat ahead of the left end of switch plate 16, so that sufficient time is available to set this plate. On the other hand as roll 14 already moved so far on that at the moment marker 21a cooperates with detector 22 roll 14 does not hamper switch plate 16 to move from the set position into the inactive position or vice versa.

In fig. 7 at the occurrence of downward edge 40 shift register output 24 becomes high, which at the occurrence of pulse 41 causes magnet 20 to be energized until pulse 41a occurs. Then at downward edge 40b shift register output 24 becomes high for two successive clock periods until edge 40d. Pulse 41b causes 38 to become energized and pulse 41c prolongs the activation duration of data flip flop 42. Finally pulse 41d again has no influence, because then shift register output 24 is low.

It is remarked, that it is possible to feed the output of detector 22 to a number of consecutive data flip flops 42, provided the switch plates served by these flip flops are not so far away from each other, that elongation of the conveyor 7 supporting the containers bearing the markers 21 could show to much length variation between these switch plates and that the distance between the switch plates is an exact multiple of the step distance.

Claims:

1. Device for subjecting objects to a treatment, which objects move one behind the other in a track (A,B,C,D) along which treatment stations (13) are positioned, said device being provided with an allocation instrument (9,10)
5 for determining in which treatment station or stations each of said objects has to be submitted to a treatment, said allocation instrument being provided with means for generating signals, characteristic for activating the allocated station or stations, a delay means (11) being
10 present to delay said signals over a time period corresponding to the time the objects need to travel from the allocation instrument to an allocated station, each station being provided with an actuation mechanism and means being provided to correct the delay of the said delay means for
15 deviations in the time the objects need for travelling from the allocation instrument to an allocated station, characterized in that the delay means are adapted to cause a delay that is smaller than the time the objects need to reach the allocated station and in that at least some
20 stations a detector (22) is present for detecting the presence of an object generating a further signal AND circuit means (23) being provided to combine the said signal and the said further signal to generate a control signal for the actuation mechanism (20) of the allocated
25 station.
2. Device according to claim 1, characterized in that the delay devices are adapted to issue an output signal having a duration equalling the time period the objects need to
30 travel over the step distance of the objects in the track.
3. Device according to claim 1 or 2, characterized in that the actuation mechanisms have an actuation member (16) which can take two positions, namely an inactive and an
35 active position, the actuation members being adapted to be moved by the actuation mechanism on receipt of a control signal and to remain in said active position when the same station is also allocated to the object immediately following

the object which caused the actuation member to take its active position.

4. Device according to any of the claims 1-3, characterized
5 in that the treatment stations are combined to form sets (36),
one of the treatment stations belonging to a set being
controlled by an actuation mechanism and the other stations
of the set being controlled by said one station.
- 10 5. Device according to any of the preceding claims 1-4,
characterized in that the treatment stations or sets of
treatment stations are combined to groups, one of the
stations or sets of stations of a group being provided with
a detector and that this detector supplies the further control
15 signal for the other stations or sets of stations of the
group.
6. Device according to one or more of the preceding claims,
characterized in that the delay devices are shift registers
20 (11) and in that a pulse shaper is present feeding a small
integer number of shift pulses to the shift registers in
each step period of the device.
7. Device according to one or more of the preceding claims,
25 characterized in that the objects are containers and the
treatment is the discharge of the containers.
8. Device according to one or more of the preceding claims,
characterized in that the delay devices and/or the actuation
30 mechanisms and/or the AND circuits are part of a computer
device such as a computer or a microprocessor.
9. Method for controlling treatment stations for treating
objects selected out of a row of objects moving one behind
35 the other along a fixed track, in which at a first location
along said track is indicated which objects have to be
treated in which stations, signals being transmitted from
said location to said stations, said signals being delayed
with a time period mainly corresponding to the time period
40 an object needs to travel from the said first location to

the station allocated to it, characterized in that in the near neighbourhood of the allocated treatment station the presence of the object is detected, which detection determines the moment for executing the treatment.

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Fig. 1

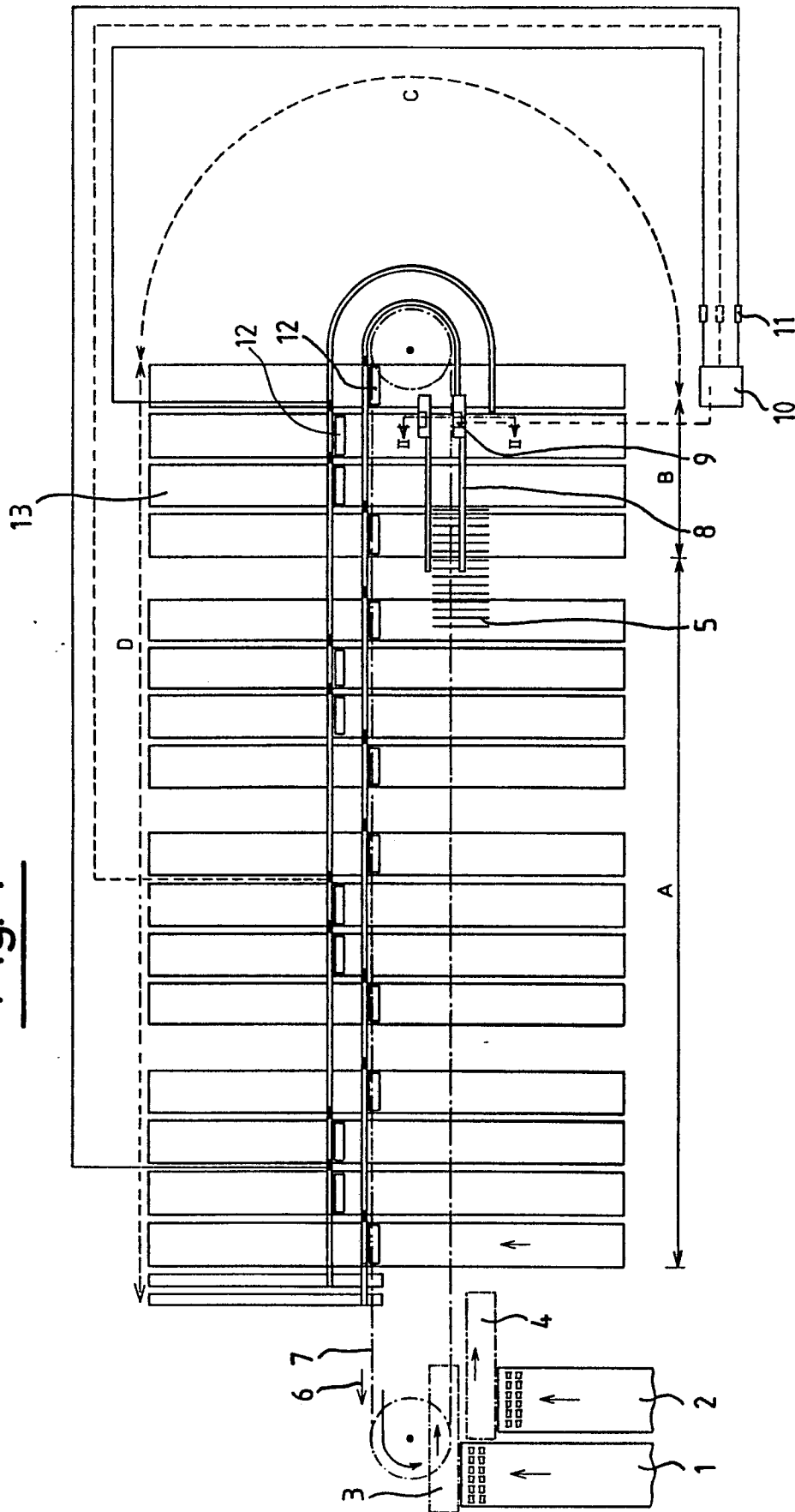


Fig. 2

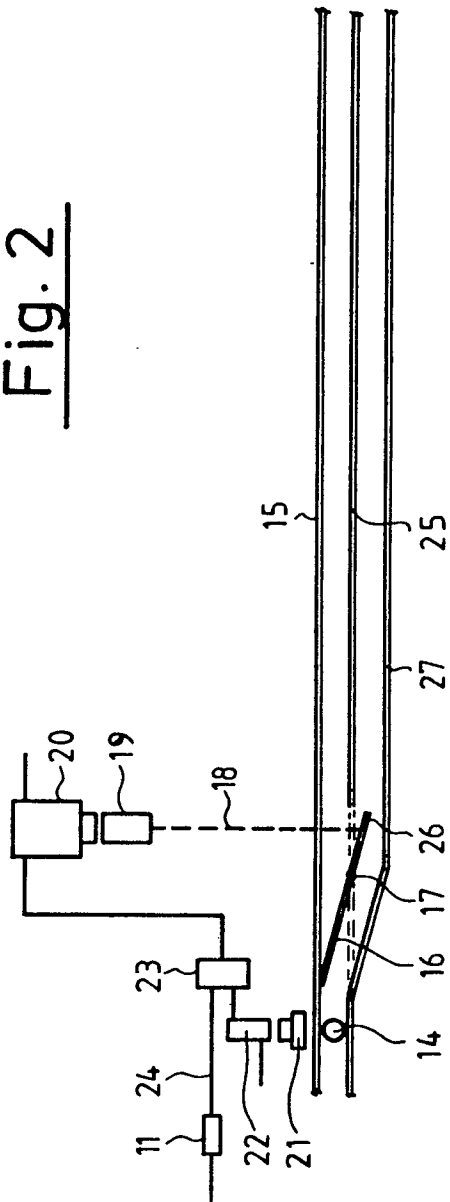
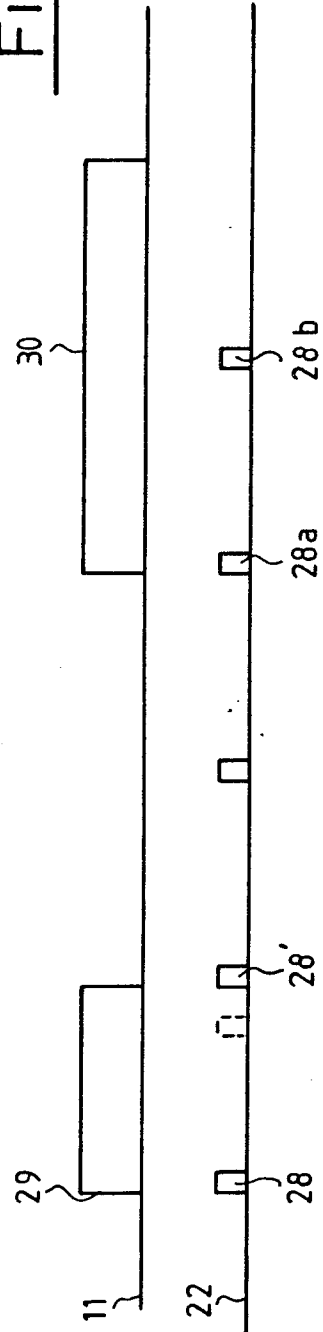


Fig. 3



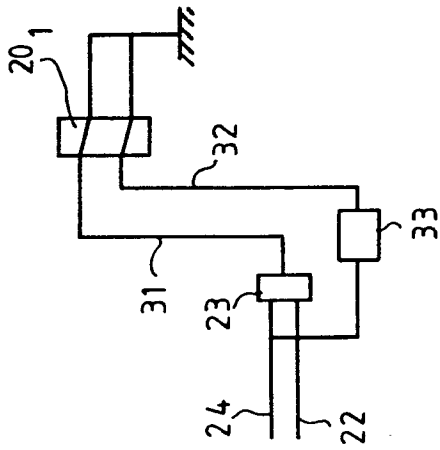


Fig. 4

Fig. 5

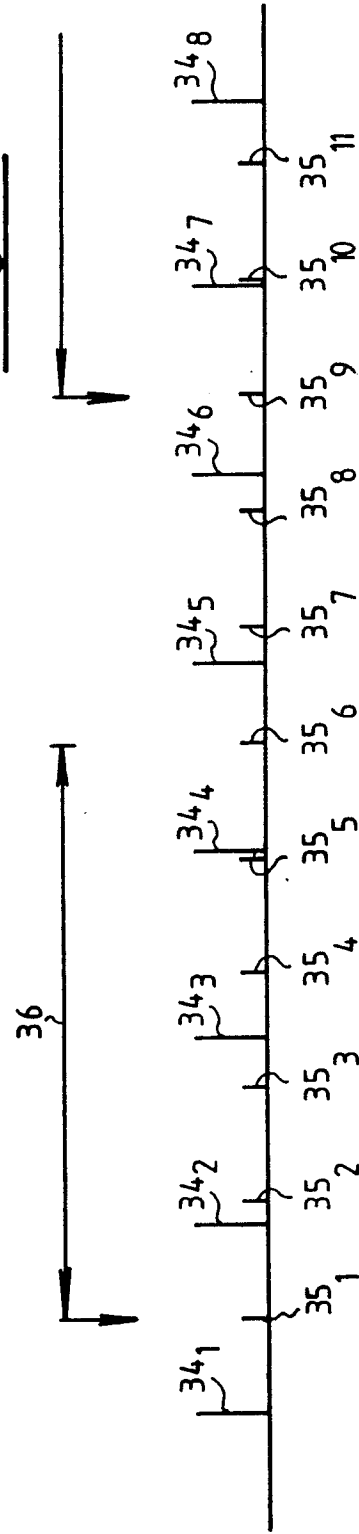


FIG. 6

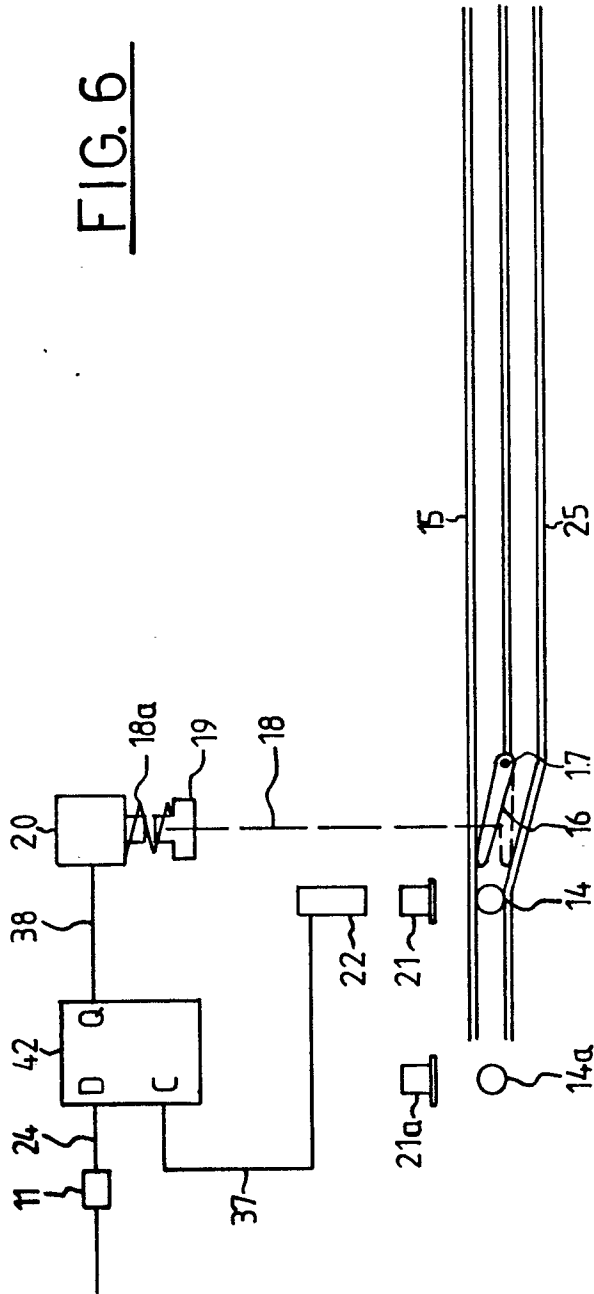


FIG. 7

