(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 086 754**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **83830024.2**

(22) Date of filing: **04.02.83**

(51) Int. Cl.³: **B 65 B 11/54**

(30) Priority: **16.02.82 IT 1967482**

(43) Date of publication of application: **24.08.83 Bulletin 83/34**

(84) Designated Contracting States: **AT BE CH DE FR GB LI LU NL SE**

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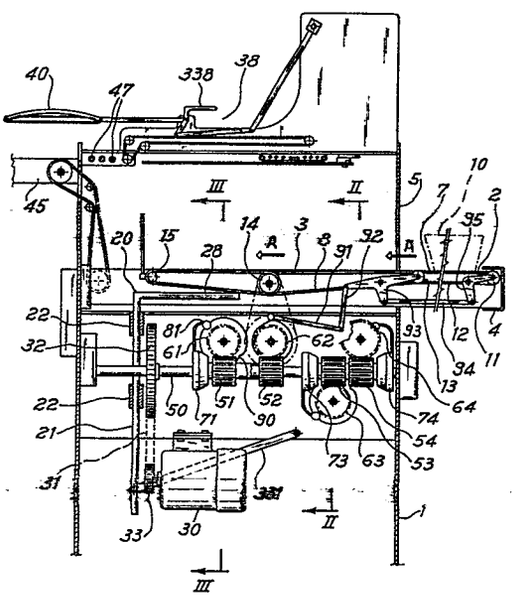
(54) **Packaging machine.**

(57) A packaging machine for articles or products, of the type in which the article, preferably disposed on a tray or container (10), is wrapped with a film of transparent plastic material. The machine comprises microprocessor control, and incorporates a weighing unit and a labelling unit. The mechanical drive actions are distributed selectively by a main shaft (50) which is constantly rotated by worm-gearwheel couplings (51-61, 52-62, 53-63. 54-64) controlled by electromagnetic clutches (71, 73, 74). A peripheral cam contour associated with microswtiches controls the elementary operations of each individual phase, which requires one complete revolution of the corresponding gear wheel. The operating stages can be selected so as to enable the weighing unit, the labelling unit etc. to be used alone. A lifting-plate (20) is formed from a matrix structure of support members (400) able to pass through the horizontal product conveyor, and the resting surfaces of the support members can be swivelled to facilitate folding the plastics sheet, without compromising the support stability.



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"PACKAGING MACHINE"

This invention relates to an automatic machine for packaging and/or weighing and labelling products or articles. The products are preferably contained in trays or similar containers, and are wrapped with a film of plastic material so as to obtain sealed packages which can be handled and are suitable for retail sale.

Various packaging machines are known, both of the type which handles a small number of pieces of limited formats and requiring some intervention by the operator, and of the type arranged for series packaging in which automation is provided at maximum level, and the machines are able to also carry out special operations. The invention relates to an improved packaging machine substantially of the first type.

Packaging machines of this type are normally of rather limited dimensions and rather modest packaging speeds. A further drawback felt particularly with this type of machine is its poor versatility with regard to the dimensions of the trays which can be wrapped, and this results in drawbacks such as wastage of material in packages which are often over-dimensioned or under-dimensioned,

with product deterioration in case of foodstuffs. A further drawback of known machines designed for packaging small batches of products derives from their absence of versatility with regard to the operating cycle. In this respect, ever if they are electronically controlled, these machines have a rigid operating cycle which cannot be modified, so that any alternative or additional operations must be carried out separately with other apparatus, and thus involving costs, space requirements and times which negatively affect the final product. In particular, the weighing and labelling operations for example are not always provided on known machines because the user already possesses equipment for this purpose. However, this requires the introduction of subsequent operating stages, the occupation of further space which is often already extremely reduced, the sometimes manual transfer of the product from one apparatus to another etc.

Further often considerable drawbacks encountered in known machines are a substantially disproportionate overall size and an operating complexity which makes maintenance difficult and setting-up complicated. In particular, and with reference to one of the objects of the present invention, the horizontal conveying path of a packaging machine normally terminates in a separate plate which lifts the package to the wrapping station. This requires a greater machinelength, which is added to the inevitable length of the conveying path, this latter being unable to be reduced without increasing the machine operating speed. A further drawback deriving directly from the non-versability of the operating cycle is the fact that the various operations of this cycle are controlled

in fixed succession, even though, because of the introduction of the electronic logic and more recently the introduction of control microprocessors, the relative controls are theoretically available independently and not in time succession as happened when the control system was electromechanical.

In the light of the aforesaid drawbacks of known packaging machines, the object of the present invention is to provide a packaging machine of small dimensions but of extreme versatility, both with regard to its packaging capability and its operating capacity.

The packaging machine according to the invention is characterised by various and numerous improvements which in terms of performance make it comparable with more sophisticated machines of much higher cost.

In particular, the machine according to the invention is fitted with a plate of new type able to pass through the horizontal conveying path, so reducing the length of this latter and facilitating the wrapping operation with the plastics sheet, while simultaneously ensuring a constant and stable support for the tray.

Again according to the invention, the drive actions are distributed to the various mechanisms of the machine unrelatedly and independently of each other, so as to increase to a maximum the facility for electronic control as provided by a microprocessor. As a secondary effect, this enables each operating stage to be carried out and controlled independently, so as to rapidly identify any faults and simplify the setting-up of the machine.

The packaging machine according to the invention also incorporates weighing and labelling members which are controlled in such a manner as to optimise the required

operations by means of a control panel. In particular, for example the packaging machine can be used merely for labelling an already prepared package, or the weighing and/or labelling can be excluded, and in addition the machine can use trays of variable dimensions by correspondingly adapting the length of the plastics wrapping sheet, and can display written information to allow interactive control by indicating errors, retransmitting operating information etc.

These and further advantages of the machine according to the invention will be apparent from the description given hereinafter of a preferred but non-limiting embodiment illustrated on the accompanying drawings, in which:

FIGURE 1 is a longitudinal diagrammatic section through the packaging machine according to the invention;

FIGURE 2 is a front section through the machine of Fig. 1 on the line II-II;

FIGURE 3 is a partial section on the line III-III of Fig. 1;

FIGURES 4 and 5 are two side views of a support member used in the plate of the machine according to the invention; and

FIGURE 6 shows the pressing blade which facilitates transfer of the packages.

Figs. 1 and 2 show diagrammatically only those parts of the packaging machine which are essential for the purposes of the description. Said machine comprises a main structure or frame 1, on which the various mechanisms are mounted. In the front end of the structure 1 there is provided an aperture 5 through which there passes a tray 10 to be packaged. The tray moves on a conveyor system comprising two conveyors, 2 and 3 respectively,

which are disposed in succession, with the conveyor 2 completely external to the structure 1 and supported by a bracket 4 which also incorporates the weighing members described hereinafter. The conveyors 2 and 3 are each constituted by a plurality of endless elastic cords 7, 8 known as plasticords, which slide on the rollers 11, 13, 14, 15 to transfer the tray 10 from the inlet station to the opposite end of the machine as shown by the arrows A. At the end of the conveyor 3 there is disposed a plate 20 for lifting the tray towards the wrapping station 38, the plate being lifted and lowered by a rod 21 slidable in supports 22 under the control of a hinged lever 331 when the tray reaches a position below the wrapping station.

As shown in Fig. 1, the plate, which is described in greater detail hereinafter with reference to Figs. 4 and 5, is not disposed in succession to the conveyor 3, but lies below it due to the fact that the lifting plate according to the invention is able to pass through the conveyor 3 without interference, and when this latter is at rest is able to take hold of and lift the tray in order to carry out the wrapping operation. In the same manner, before the tray 10 reaches the end of the conveyor lying below the wrapping station, the plate is able to fall again from the raised position to the lowered position shown in the figure, by passing through the moving conveyor.

The wrapping station indicated overall by the reference numeral 38 is not illustrated in detail because it is of conventional type, and comprises suitable known means for spreading a sheet of transparent plastic material over the tray, for lifting the tray above the level

of the plastics sheet, and for completing the wrapping by means of folding members which move below the tray in order to form the side and rear folds of the plastics sheet, slide rollers 47 being finally provided for closing the remaining front edge of the plastics sheet. Reference can be made for such structure to the European patent application published under No.44820 in the name of the same applicant. A self-adhesive label is also applied to the package during this stage.

The tray is then transferred on to the conveyor 45 by the combined effect of the rollers 47 and the pressing blade 40, which keeps the tray adhering to the rollers. The surface of the conveyor 45, which is of belt type, is heated in order to seal the lower flaps of the package, which is then transferred by the same conveyor to the outlet.

The various mechanisms of the machine according to the invention are driven by a main electric motor 30 mounted on the frame 1 and connected to a main shaft 50 by way of a belt 31 and two pulleys 33 and 32 respectively.

During operation, the shaft is thus continuously rotated at constant speed, independently of the operations which the machine carries out.

As will be apparent hereinafter, this enables the drive actions transmitted to the various mechanisms to be made independent of the main motor, they being distributed instead from the main shaft 50 as required. In this respect, on said main shaft there is mounted a plurality of worms, 51, 52, 53, 54 respectively, which can be selectively engaged with helical gear wheels, 61, 62, 63, 64 respectively, in order to transmit move-

ment to the various parts of the machine.

For simplicity, only the coupling of the worm 51 with the helical gear wheel 61 which controls the lifting and lowering of the plate will be described, the other couplings distributed on the shaft being substantially analogous.

The worm 51 is mounted on the shaft 50 with a limited facility for axial movement in proximity to an electromagnetic clutch device 71. During the operating stages in which movement of the lifting plate is not required, suitable resilient return means maintain the worm 51 in a position disengaged from the gear wheel 61. When the plate, which carries out a normal lowering-lifting cycle is required to commence its movement, an electrical control signal generated by the microprocessor activates the clutch 71, which attracts the worm in order to bring it into engagement with the gear wheel 61, thus rotating this latter. The gear wheel 61 is mounted on a shaft 301 supported by the side walls 304 and 305 of the machine as shown in Fig. 3. This transmission engagement determines a complete revolution of the gear wheel 61 which controls the two plate lowering and lifting sub-cycles by virtue of a peripheral cam contour groove formed on the gear wheel, in which the ball of a switch 81 slides. The cam contour associated with the gear wheel 61 comprises two diametrically opposing inwardly directed portions, at which a variation in the movement of the lifting plate occurs. More specifically, at the inwardly directed portion 90 opposite the rest portion shown in Fig. 1, the movement of the plate which has reached its lower position is reversed. When the gear wheel again reaches the position shown in the figure, the microswitch disengages

the clutch, to again release the worm 50 and halt the plate. As shown in Fig. 3, the rotation of the shaft 301 causes the shaft 310 to rotate by way of the connecting rod system 320, 321, 322, and this latter shaft, by way of a further connecting rod system formed from the rods 330 and 331, controls the lifting of the plate 20 guided by the rod 21. In effect, the illustrated structure is able to cause the plate to make a lowering movement followed by a lifting movement by means of a single revolution, and it is therefore sufficient for the microswitch 81 to be configured in such a manner as to halt the plate for an instant in the raised position so as to enable the wrapping folding members to close together. The switch 81 can then cause a temporary disengagement of the clutch determined by the microprocessor at the inwardly directed portion 90, whereas at the opposite inwardly directed portion the disengagement is definitive.

The operation of other worm-gear wheel assemblies is substantially analogous. The assembly 52,62 controls the starting of the conveyor 3, which is also connected by means of the articulated structures 91, 92, 93, 94 and 95 to the conveyor 2. The control signal for engaging the relative clutch is generated by the control microprocessor by means of the weighing unit sensors disposed in the bracket 4, when the tray 10 is rested on the inlet station.

The assembly 53, 63 controls the lifting and lowering on the blade 40 for transferring the package to the outlet station. The blade 40 shown in greater detail in Fig. 6 is constituted by a frame 601 provided with an arm 602 having one end suitably pivoted to the machine. The rectangular frame 601 is fitted with elastic bands

603 of suitable number and arrangement according to the product, these exerting the necessary pressure on the package when it is transferred by the rollers 47 to the conveyor 45.

The assembly 54,64 controls the members for folding the film below the product. As will be seen hereinafter, the product expulsion member is also constituted by a support 338 able to convey a label. By using a programme already stored in the control system, it is thus possible to cause the support 338 to make only the movement towards the inlet station. With the machine according to the invention, it is therefore possible to weigh and label an already made-up package. In such a case, the stages involving the conveying, lifting, wrapping with film etc. are excluded, and only the stages involving the weighing, label printing and transferring of the label to the inlet station are activated. The adhesive label is thus presented to the operator adhering to the support 338, without the tray having to pass through the machine as happens in known apparatus, in which it is possible to exclude the wrapping operation but not the transfer of the entire package, because the labelling takes place in a predetermined and non-changeable position in the packaging path.

Fig. 2 is a front view of the machine, also showing at the same time some rear devices for unwinding the film of plastic material. As shown in the figure, the wrapping unit according to the invention comprises two devices 218, 228 for unwinding the film, these being disposed to the sides of the machine. The two rolls of film, 210 and 220 respectively, can be of different widths so as to adapt to the different measurements

required by the package. Alternatively these can be identical, in which case a higher operating speed is attained. This is because when one roll is exhausted, it is possible to replace it while the machine continues operation using the other roll. Likewise, if the film develops a fault or tears, or other trouble arises in one of the unwinding systems, the operation need not be interrupted, and can continue with the other unwinding system. Unwinding is carried out in known manner using transmission rollers and idle rollers operated at choice by one of the two belts 225 or 235 for the right hand system and left hand system respectively. In proximity to the main shaft 50, the transmission belts wind about pulleys 226 and 236, each of which can be engaged selectively with the main shaft 50 by means of suitable gears. The selection is set automatically on the machine control panel 115, and is made by means of friction clutch devices of the type illustrated.

A support member 400 of the type used for forming the plate according to the invention is described hereinafter with reference to Figs. 4 and 5. Said member is preferably constructed of moulded plastic material, for example nylon, and comprises a main body 403 elongated lowerly and provided with a reinforcement 401 in which a hexagonal through bore 402 is formed, and further comprises a head 410 pivoted to the body. The head 410 is internally hollow and traversed by a pin 430 housed in a block 432. The block is mounted in its turn on the body 403 by a pin 435 orthogonal to the preceding, and one of the lower ends of the head is connected by a helicoidal spring 440 to the lower end of the body 403. The spring is partially housed in a seat or groove 442 pro-

vided in the reinforcement projection 401, so as to exert a return action in two mutually orthogonal directions, and in addition a stop pin 451 projects from the body 403 to abut against the lower surface of the bock 432.

The head 410 for the support member according to the invention can thus swivel through about 90° in two orthogonal directions as shown by the arrows R and S in Figs. 4 and 5, the spring 440 exerting a return action in both cases. The plate of the machine according to the invention is formed from a regular arrangement of a number of support members of the type illustrated, these being mounted on side-by-side but spaced apart hexagonal bars 28, to thus form a rectangular or square support structure of array type. In this manner, with reference also to Fig. 1, the plate is able to pass through the elastic cords, because the hexagonal bars 28 are aligned with them and are able to pass through them. When the plate supporting the tray has been raised to the wrapping station, the folding members, which are in the form of curved strips, are able to penetrate under the tray because the heads of the support members are able to incline without hindering the folding members, and rise again immediately after they have passed by. This ensures constant support for the tray during the folding of the sheet, in that the exclusion of the support members is only temporary and takes place progressively starting from the most outer support members.

As already stated, the machine according to the invention also comprises a weighing surface formed from longitudinal rods disposed in comb formation on the base of the inlet station and lying between the plasticords. These rods, which slightly project beyond the plasticords

when in the rest position, are connected to sensors which determines the weight of the package. The conveyor belts 2 then rise to take hold of the weighted package, and simultaneously start the machine.

The packaging machine control unit is based on a programmable microprocessor which can be housed in a container 115 mounted on one side of the machine front. On the other side is mounted the weighing unit control panel 118 for setting the weight, cost and other values. The machine control unit 115 provides for various previously programmed operations selectable by means of a keyboard, with simultaneous display of the chosen programme. As stated, the versatility of the programmable electronic control system is utilised to its full extent in the machine according to the present invention, because its main mechanisms, corresponding to the main scheduled operating stages, can be controlled completely independently, also from the mechanical aspect.

As already stated, one method of using the machine according to the invention is as a weighing/labelling unit without any conveying of the package. In this case, only the weighing, label printing and label transfer cycles are activated from the control panel. As already stated, in this case the transfer operation takes place in the opposite direction, and the label support moves towards the front of the machine to offer to the operator the self-ashesive label adhering to the support. A further possibility is obviously to exclude the weighing and labelling unit, and merely package the product. A further programme comprises the simple transfer of the package from the inlet station to the outlet station without applying either the sheet of plastic material or the

label. In this case, the weighing unit can remain activated in order to display the package weight.

The other possibilities offered by the machine include wrapping by selecting either one of the two rolls of film, with adjustrent of the length of the unwound plastic sheet, with control of the temperature of the heated belt for thermowelding etc. By using a more sophisticated display for the control unit 115, it is possible to maintain a dialogue with the operator, in which this latter imposes the various characteristics of the required operations, and the machine displays the set data in the form of alphanumerical characters, indicating errors, exhaustion of supplies, etc.

The preferred embodiment of the packaging machine according to the invention has been shown fitted with a main distribution shaft, with movement transmission by means of worms and helical gear wheels comprising associated cam contours and variable dimensions. However the invention is not limited to this particular embodiment and extends to other packaging machines with microprocessor control and distributed mechanical drive actions. For example, the movement distribution can take place by transmission using belts and pulleys which are selectively driven by a main pulley, or by a plurality of gear wheels disposed about a main distribution gear wheel etc.

In the same manner the form of the plate is also not intended to be limiting, and it can be constructed with a plurality of discrete elements, which can either swivel or not, and which are able to pass through the horizontal conveying device of the packaging machine. These obvious modifications and others which will be easily attained

by an expert of the art are included within the scope of the invention.

C L A I M S

1. A machine for packaging products or articles contained in trays or the like with a film of plastic material, of the type in which the articles are conveyed from an inlet station to an outlet station for the packaged product by means of endless elastic cords, said machine being controlled by a programmable microprocessor, characterised by comprising a plate (20) for lifting the tray (10) towards a wrapping station (38) and formed from a plurality of support members (400) disposed in a number of rows, between which said elastic cords pass so as to enable the plate to pass through the conveying path in order to take hold of and lift the article to the wrapping station, and in that the upper ends (410) of said support members are hinged to bodies (403) which are rigid with each other, and is further characterised by comprising a main distribution member (50) kept in constant movement, to which the devices which carry out the various operations are selectively connected mechanically, so as to make the operating stages actuable independently of each other.

2. A packaging machine as claimed in claim 1, characterised by comprising a weighing device and a labelling unit associated with the machine and controlled by the microprocessor of this latter.

3. A packaging machine as claimed in claim 1 or 2, characterised in that the main distribution member is constituted by a longitudinal shaft (50) constantly rotated by the main machine motor (30), on said shaft (50) there being mounted a plurality of worms (51, 52, 53, 54) engageable with corresponding helical gear wheels

(61, 62, 63, 64), each of said worms (51, 52, 53, 54) being axially mobile under the control of an electromagnetic friction clutch device (71, 73, 74) in order to engage the corresponding helical wheel (61, 62, 63, 64).

4. A packaging machine as claimed in claim 3, characterised in that with each of the helical wheels (61, 62, 63, 64) there is associated a cam contour in which the feeler (81) of a control switch slides in order to automatically disengage the friction clutch on completion of each revolution of the helical wheel.

5. A packaging machine as claimed in claim 4, characterised by comprising a friction clutch-worm-gear assembly for each of the following stages of the packaging operations: lowering and lifting the plate; starting the tray conveyors; moving the folding members; moving a pressing blade; expulsion; lowering and raising the conveyor belts; translatory movement of the film.

6. A machine as claimed in claim 5, characterised by comprising a pressing blade (40) constituted by a rectangular swivel-mounted frame (601), on which elastic bands (603) are fitted to engage the upper surface of the wrapped package by friction.

7. A packaging machine as claimed in claim 1 or 2, characterised in that the support members (400) which constitute the plate are formed from a body (403) lowerly provided with a hexagonal bore (402) for its mounting on side-by-side but spaced apart hexagonal bars (28), and a head (410) pivoted to the body such that it can rotate through 90° in two mutually orthogonal directions, a return spring (440) being provided in order to return the head to a position aligned with the body.

8. A packaging machine as claimed in claim 7, characte

rised in that said support member is of nylon construction, the body being of elongated shape with a lower reinforcement protuberance comprising a hexagonal bore (402) and an external groove (442), the head being internally hollow and fixed to the body by two orthogonal pins (430, 435), and a helicoidal spring (440) which rests in the groove and engages by means of one of its ends with the lower end of the support member body.

9. A packaging machine as claimed in any one of the preceding claims, characterised by comprising two independent systems for feeding the plastic wrapping sheet, they being disposed to the side of the longitudinal axis of the machine and selectively operable under the control of the microprocessor.

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Fig. 1

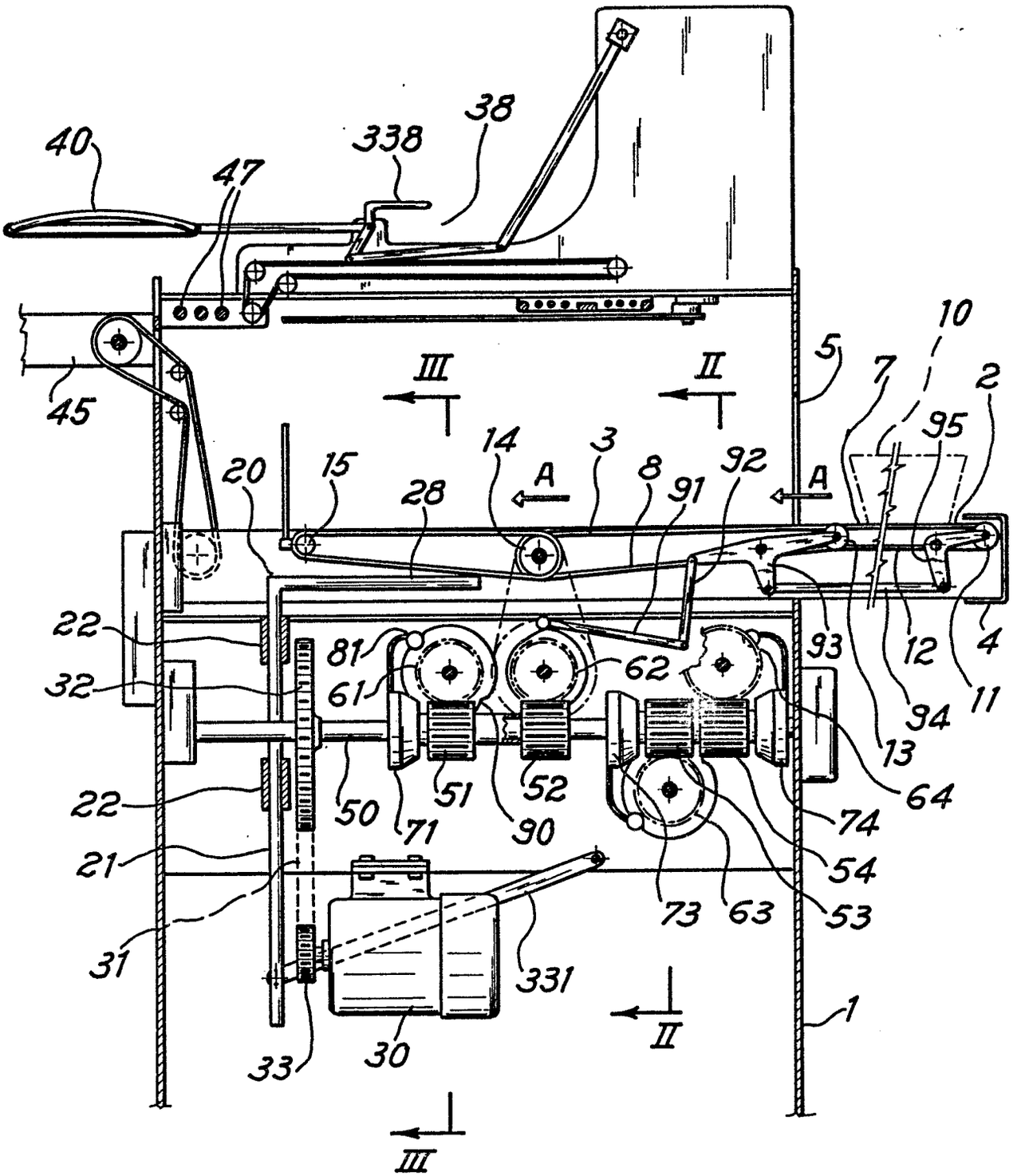

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Fig. 2

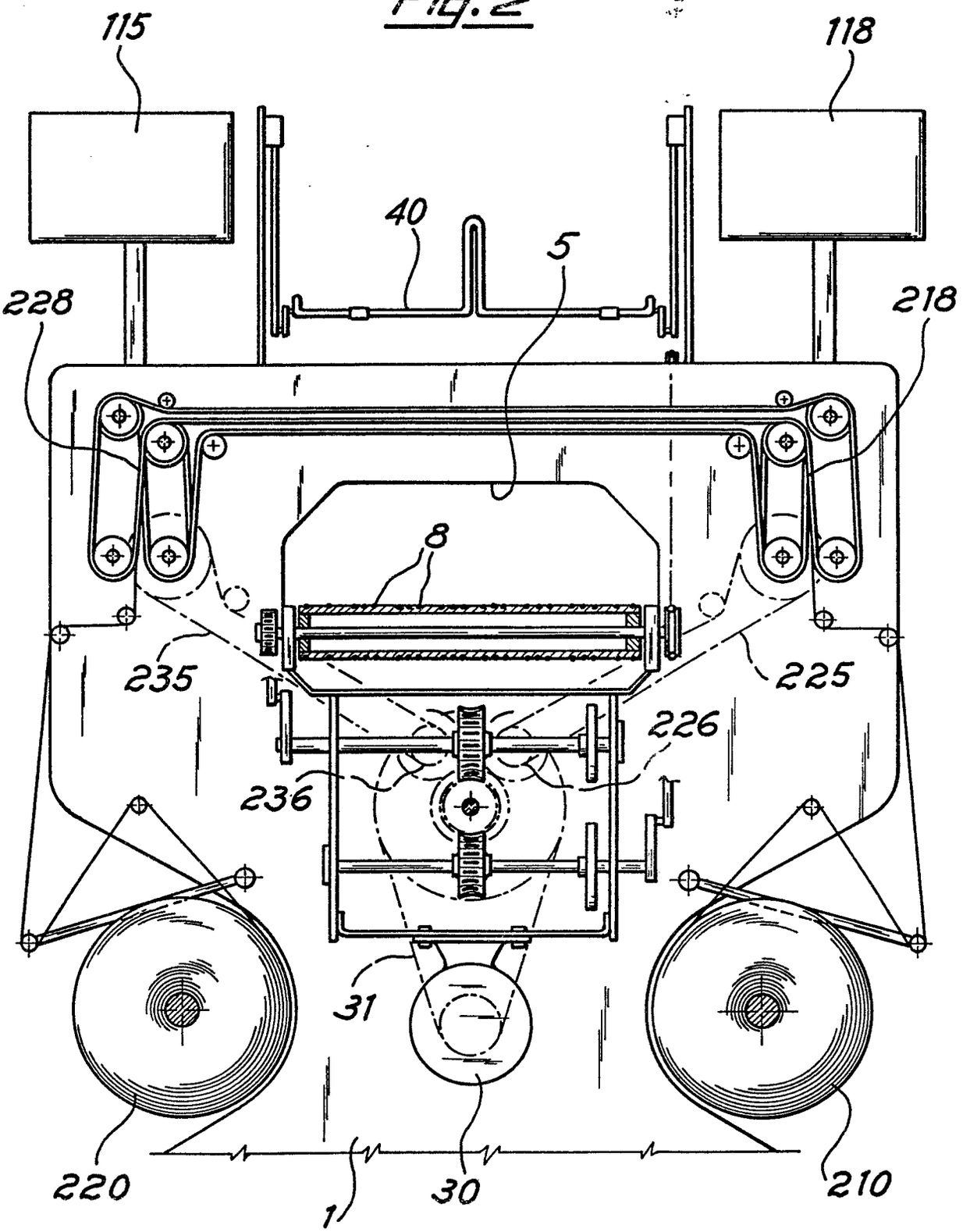

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Fig. 3

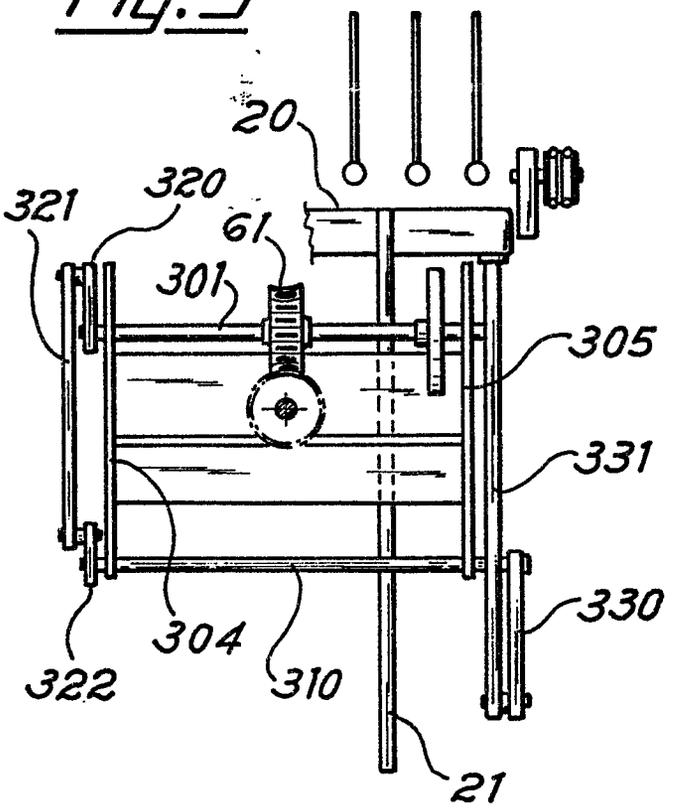

Fig. 4

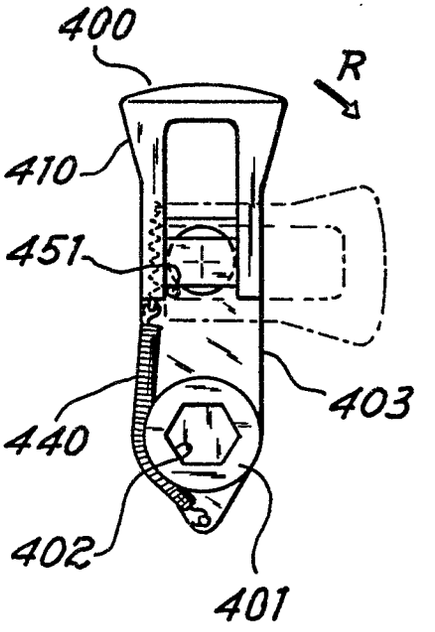

Fig. 5

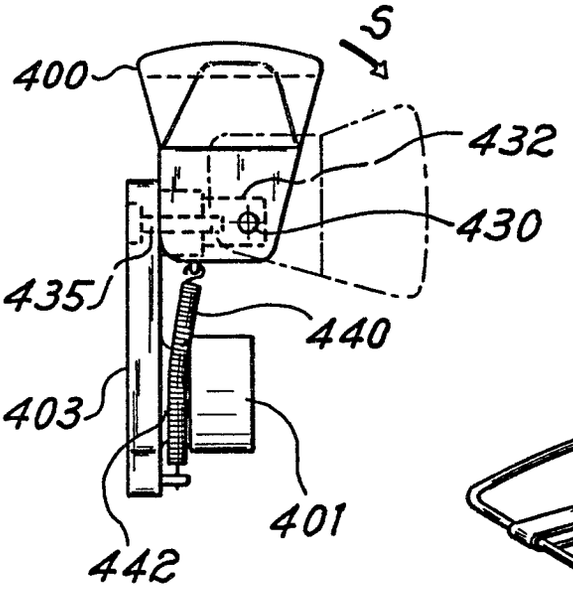

Fig. 6