607574

COMMONWEALTH OF AUSTRALIA

Patents Act 1952

CONVENTION APPLICATION FOR A STANDARD PATENT

I/WE, BOBST SA, a Swiss company of CH-1001 Lausanne, Switzerland

hereby apply for the grant of a Standard Patent for an invention entitled:

APPARATUS FOR CORRECTING THE LATERAL POSITION OF A SHEET ELEMENT IN A FEED STATION OF A MACHINE PROCESSING SAID SHEET

which is described in the accompanying complete specification.

This application is made under the provision of Part XVI of the Patents Act 1952 and is based on an application for a patent or similar protection made

in Switzerland on 20 January 1988
No. (00191/88-6)

in on
No. (

My/Our address for service is:

F.B. RICE & CO.,
28A Montague St.
Balmain NSW 2041

Dated this 13th day of January 1989

BOBST SA

By: _____
Registered Patent Attorney

SO04783 13/01/89

To: The Commissioner of Patents
COMMONWEALTH OF AUSTRALIA

APPLICATION ACCEPTED AND AMENDMENTS ALLOWED 3-12-90

Commonwealth of Australia
The Patents Act 1952
DECLARATION IN SUPPORT

In support of the (Convention) Application made by:

Bobst SA

for a patent for an invention entitled: DEVICE FOR CORRECTING THE LATERAL POSITION OF A PLATE SHAPED FIECE WITHIN AN INFEED STATION OF A MACHINE USED FOR ITS PROCESSING

I (We) Hans Eggenberger, Executive,

of and care of the applicant company do solemnly and sincerely declare as follows:

---

a) I am (We are) the applicant(s) for the patent

b) I am (We are) authorised by the applicant(s) for the patent to make this declaration on its behalf.

Delete the following if not a Convention Application.

The basic application(s) as defined by section 141 (142) of the Act was (were) made

on 20th January 1988 in Switzerland

by Bobst SA

The basic application(s) referred to in this paragraph is (are) the first application(s) made in a Convention country in respect of the invention the subject of the application.

---

a) I am (We are) the actual inventor(s) of the invention

b) Georges Polic,
Rochelle 10,
CH-1008 Prilly,
Switzerland

is (are) the actual inventor(s) of the invention and the facts upon which the applicant company is (are) entitled to make the application are as follows:

The applicant is a person who would, if a patent were granted upon an application made by the actual inventor, be entitled to have the patent assigned to it.

Declared at Lausanne this 19th day of December 1988

Signed [signature] Status Executive

Declarant's Name Hans EGGENBERGER

F. B. RICE & CO PATENT ATTORNEYS

This form is suitable for any type of Patent Application. No legalisation required.

(12) PATENT ABRIDGMENT (11) Document No. AU-B-28491/89
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 607574

(54) Title
APPARATUS FOR CORRECTING THE LATERAL POSITION OF A SHEET ELEMENT IN A FEED STATION OF A MACHINE PROCESSING SAID SHEET

International Patent Classification(s)
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(56) Prior Art Documents
US 4708759
US 4699370
US 4245830

(57) Claim

1. Apparatus for correcting lateral positioning of a sheet element taken from the top of a stack by a gripper assembly in a feed station of a machine, said gripper assembly comprising a fixed frame in which are disposed means for lifting the sheet element from the stack and conveyor means to move the sheet element in the machine after it has been released by the lifting means, characterised in that it comprises a laterally and generally vertically movable carriage on which are carried said lifting means, a first means for sensing a lateral position of the element, a second means for sensing the lateral position of the carriage, and an assembly for effecting vertical movement of the carriage in a machine

.../2

cycle, and means for moving the carriage laterally according to data from the first means during upward movement of the carriage by the assembly and in accordance with data from the second means on downward movement of the carriage by the same assembly.

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Patent Act 1952

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COMPLETE SPECIFICATION

(ORIGINAL)

	Class	Int. Class
Application Number	:	
Lodged	:	
Complete Specification Lodged	:	
Accepted	:	
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Priority	: 20 January 1988	
Related Art	:	

Name of Applicant : BOBST SA

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Actual Inventor/s : Georges Polic

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Complete Specification for the invention entitled:
APPARATUS FOR CORRECTING THE LATERAL POSITION OF A SHEET ELEMENT IN A FEED STATION OF A MACHINE PROCESSING SAID SHEET

The following statement is a full description of this invention including the best method of performing it known to us/~~me~~:-

This invention relates to apparatus for correcting the lateral position of a sheet element, e.g. a sheet of paper or board, taken from a stack before introduction into a machine. Some machines, such as printing or blanking machines, require high accuracy in respect of positioning on introduction of a sheet, whereas the sheets are supplied in stacks which are not always absolutely vertical or not presented exactly in line with the machine axis.

Machines of this kind usually comprise two stations situated upstream of grippers which grip each sheet, i.e. a station comprising a feed table preceded by a feed or inlet station.

On the feed table an individual sheet is jogged forwardly and laterally simultaneously. The lateral jogging is produced by two rollers which clamp the edge of the sheet, pulling it laterally over a maximum distance of 8 mm. This distance of 8 mm therefore represents the maximum permissible error on introduction of the sheet to the feed table by the inlet station.

The inlet station comprises a pallet on which the stack of sheets is formed or on which there is loaded a stack formed previously by means of a movable intermediate pallet. This pallet is suspended at the four corners by chains so that it can be raised as the sheets enter the machine so that the top of the stack remains at a constant level as seen by a photoelectric cell disposed in the required top plane. This inlet station often includes a gripper assembly situated just above the top plane of the stack. This assembly first provides lifting of the top sheet, and only the top sheet, followed by its introduction to the feed table.

To perform these operations, this assembly firstly comprises lifting means disposed along a member parallel to the top front edges of the sheet. Two or more lifting suction cups, particularly, are found there which descend to engage the sheet, gripping it by a vacuum, and then lifting it again. To facilitate lifting of the front edge of the sheet, two nozzles direct air against the rear edge of the sheet. Once the sheet has started to lift, a spike bar actuated by a set of cams engages the rear of the underlying sheet.

The gripper assembly secondly comprises conveying suction cups mounted on a cross-member with respect to the sheet movement and situated approximately at the centre of said sheet. The member is held on the gripper assembly frame by articulated arms. These are actuated by the central machine motor via a mechanical transmission comprising chains, cardan joints and cams so that they advance to push the sheet on to the feed table when necessary in the machine cycle. Prior to this movement the lifting suction cups have released the sheet.

The frame for this gripper assembly is normally mounted in the inlet station so that its position in respect of height and in the direction of movement of the sheet can be adjusted according to the specific requirements of a stack of board or paper of given dimensions.

It will therefore be seen that with this arrangement the accuracy in respect of the position in which the sheets are introduced depends greatly on the initial position of the stack in this inlet station.

Various systems have therefore been developed for correcting the position of the stacks. A system currently fitted by Applicants to their machines comprises, on the one hand, a lever, one end of which provided with a roller follows the successive position of the top sheets of the stack and the other end of which, when necessary,

actuates one of the two switches corresponding to the stack moving too far to the right or left. This system also comprises an electric motor movable along a vertical column close to the side edge of the pallet and whose screwthreaded outlet shaft engages in a tapped aperture in the pallet. Thus the motor moves upwards along the column following the pallet and, depending on which of the said switches is tripped, it rotates the screwthreaded shaft in either direction thus bringing the pallet laterally closer to or farther away from the frame of the inlet station.

According to a second apparatus described in UK patent 4 245 830, the mechanism for logging the top side edge of the stack consists essentially of a shoe provided with a metal flag which acts on two proximity detectors disposed horizontally side by side. Thus depending on the position of the top edge of the stack the flag either has no influence on the detectors or else it acts on one or both simultaneously and the electric motor for adjusting the lateral position of the pallet is actuated accordingly.

These systems for correcting the lateral position of the stack suffer from several disadvantages. Controlling the top edge of the stack by means of a given dimension depends essentially on the repeatability of the triggering of the detector which may in fact be counteracted either at the mechanical switches or by the friction or wedging effect on movement of the sensor. Also, when it is required to increase the rate of production from a large stack which has too great an offset, the motor may be inadequate to overcome the mass inertia of the stack and can no longer correct the position sufficiently quickly. Finally, and particularly, the sensors generally measure the average position of the top five or ten sheets and not a large offset, even if it is exceptional, of one of them, which will subsequently cause complete stoppage of the machine due to a logging fault.

The object of this invention is to obviate the said disadvantages by proposing a means for correcting the lateral position of a sheet taken from the top of a stack so that its introduction into the machine is ensured with an accuracy of the order +/- 2 mm in respect of lateral position irrespective of the rate of production and without requiring high accuracy for setting up the stack in the inlet station.

The present invention comprises apparatus for correcting lateral positioning of a sheet element taken from the top of a stack by a gripper assembly in a feed station of a machine, said gripper assembly comprising a fixed frame in which are disposed means for lifting the sheet element from the stack and conveyor means to move the sheet element in the machine after it has been released by the lifting means, characterised in that it comprises a laterally and generally vertically movable carriage on which are carried said lifting means, a first means for sensing a lateral position of the element, a second means for sensing the lateral position of the carriage, and an assembly for effecting vertical movement of the carriage in a machine cycle, and means for moving the carriage laterally according to data from the first means during upward movement of the carriage by the assembly and in accordance with data from the second means on downward movement of the carriage by the same assembly.

Advantageously, the assembly for vertical displacement of the carriage comprises two horizontal rails on which the carriage slides laterally and which are held in parallel relationship by two struts respectively secured to the bottom end of two shafts each held vertically against the inside surface of the wall of the frame by blocks, each shaft being urged downwards by resilient means acting between the bottom surface of one of the blocks mounted on the frame and a shoulder on the shaft, and being pulled upwardly by one arm of a

lever whose pivot is fixed against the inside wall of the frame and the other arm of which is cyclically pushed by a rotary cam driven by the general machine motor via a set of mechanical transmissions in synchronism with the machine cycle.

Advantgeously, the means for moving the carriage laterally comprise first electronic means generating speed commands in accordance with the data received successively from the first means for logging the position of the element, and from the second means for logging the position of the carriage, second electronic means generating a continuous signal which varies linearly with time in accordance with the speed commands received from the first electronic means, and a speed-control electric motor acting on the lateral position of the carriage in accordance with the ~~speed command~~ continuous signal received from the second electronic means.

Preferably, the electric motor is fixed on the frame above the carriage and acts thereon via a reduction gear coupled to a vertical shaft the bottom part of which is held by a bar connected to the frame and the bottom of which bears a pinion engaging with a rack connected to the carriage and disposed in the direction of movement of said carriage.

According to a first feature, the first means for detecting the lateral position of the element comprises four cells secured to the frame and disposed on a line perpendicular to a reference line for one of the side edges of the element. These cells may be disposed at distances ranging between - 22 and - 2 mm, - 6 and - 1 mm, + 6 and + 1 mm, + 16 and + 22 mm respectively with respect to said reference line. A lifting means is then mounted close to the same side edge on a member connected to the movable carriage.

According to another feature, the second means for logging the lateral position of the carriage comprises a magnetic detector

situated at the centre of the movable carriage, and a metal flag secured to the carriage and influencing the detector.

It will readily be seen that the apparatus according to the invention is particularly advantageous inasmuch as the method of correcting the lateral position of a sheet element taken from the top of a stack by a gripper assembly comprises moving the sheet element laterally in accordance with the data from means logging the lateral position of said sheet element during its lifting by the lifting means before it is engaged by the conveying means.

The invention will be more readily understood from one embodiment given as an example without any limiting force and described in the accompanying drawings wherein:

Fig. 1 is a perspective of the apparatus according to the invention.

Fig. 2 shows the electrical circuit of the apparatus.

Figs. 3a and 3b are diagrams showing the development of the speed command C (broken line) and of the commands VC (unbroken line) against the time t.

Referring to Fig. 1, the general frame 10 of the gripper assembly comprises two side cheeks 100 interconnected by a top plate 110 and a front plate 120 by means of reinforcements 130. The frame 10 is fitted on two parallel longitudinal members 132, 133 by means of guides or brackets 137, 138, the longitudinal members 132, 133 extending in the direction of movement of the sheets. The brackets 137, 138 connected to the frame 10 enable the latter to slide along the longitudinal members in the forward or rearward direction once the handle 135 has been released. At their rear end these longitudinal members are secured to the frame of the machine inlet station by pivots 139 and at the front end they are connected by a

cross-member 134. The latter is in turn supported on the superstructure of the inlet station by a chain and a motor allowing the cross-member 134 to be raised to varying degrees. It will therefore be seen that the position of the frame 10 can be adjusted in respect of height and in the direction of sheet movement in accordance with the specific characteristics of each stack of board or paper.

The frame has a cross-member 460 on which are mounted the means for detaching the top sheet from the stack; the means for correcting the lateral position of the sheets according to the invention; the mechanism (not shown in order to avoid overloading the drawing) of the movable arms holding the cross-member on which the conveying suction cups are mounted, and the mechanism (not shown) for transmitting the mechanical forces from the general motor of the machine to the various members inside the gripper assembly which, inter alia, include a rotary cam 390.

Once the frame 10 has been correctly positioned in the inlet station, the member 460 comes to the level of the top rear edge of the stack. Means which facilitate detachment of the top sheet, such as air ejection nozzles, spring pressers, or sorting brushes, are mounted on said member. An array of four reflecting cells 500 is also mounted at one of the ends, e.g. the left-hand end.

The central component of the system according to the invention is a carriage 220 movable laterally on two rails 230 and vertically by means of two symmetrical assemblies disposed on each inside surface of the walls 100 to lift and lower the two right-hand and left-hand struts 280 which hold the two rails 230 parallel. A bar 260 on which are mounted a plurality of lifting suction cups is fixed on the said carriage transversely to the direction of movement of the sheets.

The following description of the assembly for lifting and lowering the struts 280 is given with reference to the right-hand assembly in Fig. 1 while bearing in mind that a symmetrical left-hand assembly not visible in the drawing is provided on the left-hand inside wall 100.

A bottom block 290 and a top block 340 are fixed against the inside surface of the walls 100. A vertical rod 310 slides in these blocks. The struts 280 are secured to the bottom end of the rod 310. The top end of the rod 310 has a longitudinal slot 350 closed at the top by a roller 360. One of the arms 370 of a lever engages in said slot 350 and holds the roller 360 underneath. The pivot 375 of said lever is connected to the inside surface of the wall 100 and the second arm 371 of said lever supports a roller 380 which bears against a rotary cam 390.

A spring 330 engaging around the rod 310 acts between the bottom surface of the block 340 and a shoulder 320 on the rod 310. Spring 330 tends to lower the rod.

Conversely, lever 370 tends to lift the rod 310 by acting on the roller 360, through the agency of the thrust of the cam 390 on the roller 380. The periphery of the cam 390 is generally circular except for a rectilinear portion 400. It will thus be obvious that when the section 400 of the periphery of the roller 390 is in register with the roller 380, the arm of the lever 370 tends to drop in response to the spring 330 which lowers the rod 310 and hence the strut 280. Similarly, when, as a result of the continuing rotation of the cam 390 by means not shown, a circular section of said cam bears on the roller 380, the lever rotates and the arm 370 lifts the rod 310 against the effect of the spring 330 and also lifts the strut 280.

An electric motor 150 coupled to a reduction gear 160 is mounted perpendicularly to the carriage 220 on the top surface 110 of the frame. The output shaft 170 of the reduction gear 160 is coupled at 180 to a shaft 190 the bottom part of which is held in a block 200 connected to the cross-member 140. Cross-member 140 is held stationary with respect to the frame by being connected, through connecting members 300, to the bottom blocks 290, on the left and right respectively. This shaft 190 is therefore held simultaneously at the top by the reduction gear 160 and the connection 180 and at the bottom by the block 200.

The bottom end of the shaft 190 bears a pinion 210 meshing with a rack 240 secured to the carriage 220 in the direction of lateral movement thereof. The connection between the carriage and the rack is produced by a front connecting plate 250 secured by screws 253 to the carriage 220 while rack 240 is held against the plate 250 by screws 252.

The height of the rack 240 is equivalent to the height of the pinion 210 plus the distance of vertical movement of the carriage according to the above-described assembly. The length of the shaft 190 plus the length of the pinion 210 is such that when the carriage 220 is in the top position the pinion 210 is flush with the top surface of the carriage at maximum. In this way, when the carriage is in the bottom position as shown in Fig. 1, the pinion is still completely in engagement with the rack 230.

A metal flag 225 is secured to the middle of the rear surface of the carriage 220. A magnetic proximity detector 226 is secured to the frame equidistant from the two walls and close to the rails 230 in such manner that they are influenced by the metal flag 225.

Four reflecting cells 501 - 504 are mounted at the end of the member 460 connected to the frame 10, the said cells being disposed around

the axis YO which is the reference axis for the position required for the side edge of the sheet. Preferably, the cells 501 and 502 are disposed inwardly with respect to the axis YO and at distances ranging between +1 and +6 mm, e.g. 2 mm in the case of 502; between +16 and +22 mm, for example 18 mm, in the case of 501 The cells 503 and 504 are mounted symmetrically in relation to the cells 501 and 502 with respect to the axis YO and their distances with respect to this axis YO are marked negatively.

Fig. 2 is a diagram of the electrical circuit of the system showing the carriage 220 supporting a member on which four lifting suction cups 270 holding a sheet 250 are mounted. The left-hand edge of this sheet 250 as shown in Fig. 2 moves past the four reflecting cells 501 - 504. These cells are connected to electronic means 100 which generate a command C. The magnetic proximity detector 226 is also situated near the carriage 220 and is in turn connected to the electronic means 100.

The command signal C is applied to second electronic means which generate a signal VC which varies linearly with time and which represents the speed required for the carriage 220. Signal VC is applied to the command input point of an electric servomotor 210 actuating the carriage 220 via the reduction gear 160. The servomotor in known manner comprises a speed control 300 connected to a servoamplifier 400 controlling the actual electric motor 150. The speed of the electric motor is measured by a tachometer 152 generating a feedback signal fed to the comparator 250 which, together with the command signal VC, generates a control signal E.

As described above, the system operates as follows:

Referring to Figs. 1, 2 and 3, the carriage is lowered by the spring 330 when the rectilinear surface of the cam 390 is in register with the roller 380. A vacuum is produced in the lifting suction cups

270 which then grip the sheet. As the sheet starts to rise, the electronic means 100 are connected to the reflecting cells 501 - 504. if the sheet 250 is present completely on the left, as shown in Fig. 2, so that its left-hand edge is beyond the cell 504, the means 100 generate a command C = 1800 rpm approximately. If the edge of the sheet 250 is somewhere between the cell 504 and 503, the means 100 generate a command C = 600 rpm. If the edge of the sheet 250 250 is situated somewhere between the cell 503 and 502, the position of the sheet is considered to be correct and the means 100 generate a zero control signal. A command C = - 600 rpm is symmetrically generated if the edge of this sheet is situated somewhere between the cell 502 and 501, or a command C = - 1800 rpm if the edge is beyond to the right of the reflecting cell 501. Of course the position of the sheet being corrected during its lifting movement the command C develops as the lifting continues. In the examples illustrated in Figs. 3, the sheet starts from a position too far to the left and moves successively past the cells 504 and 503. The electronic means 100 thus generate a stepped command signal C: a first phase at 1800 rpm, a second phase at 600 rpm and a last phase at zero speed.

These commands C are converted by second electronic means 200 which limit the acceleration and deceleration of the system to fixed values. By way of example, the acceleration value is equivalent to passing from 0 rpm to 1800 rpm in 38 ms and the deceleration value is equivalent to passing from 1800 rpm to 0 rpm in about 48 ms. Thus, as illustrated in Fig. 3a, the speed command VC = 1800 rpm progresses linearly from a zero value to the value VC = 1800 rpm, and it retains this value until the side edge of the sheet 250 moves past the reflecting cell 504. Once the new command C = 600 rpm has been requested, the ramp generator linearly reduces the signal VC until this new speed value is reached, this value being retained until the edge moves past the cell 503. At that instant the generator 200 decreases the value VC linearly to a zero value. If the edge of

the sheet is initially slightly beyond the cell 504, the speed command VC has not yet reached the first value corresponding to 1800 rpm when the deceleration already starts as shown in Fig. 3b.

As a result of its speed feedback, the servomotor 210 can follow the applied commands VC and moves the carriage 220 by means of the reduction gear 160 accordingly.

After the sheet has been centred and then released just after having been engaged by the conveying suction cups, the carriage 220 may be in an offset position to varying degrees from its central position in the frame 10. This offset is a direct function of the initial offset of the last sheet lifted. The electronic means 100 are then connected to the magnetic proximity pick-up 226. Depending upon the direction of offset, to the right or left, the electronic means 100 generate a command equal to +/- 1800 rpm which is passed to the ramp generator 200 to create a linearly increasing signal VC. The carriage is then returned to its initial central position and the cycle re-starts for the next sheet.

Numerous improvements can be made to the system within the scope of the invention. For example, a system of this kind can be duplicated: one in the front and one at the rear in the direction of movement of the sheets enables both the offset of the sheet edge from a given reference and the parallelism of said edge with respect to the reference axis to be corrected.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. Apparatus for correcting lateral positioning of a sheet element taken from the top of a stack by a gripper assembly in a feed station of a machine, said gripper assembly comprising a fixed frame in which are disposed means for lifting the sheet element from the stack and conveyor means to move the sheet element in the machine after it has been released by the lifting means, characterised in that it comprises a laterally and generally vertically movable carriage on which are carried said lifting means, a first means for sensing a lateral position of the element, a second means for sensing the lateral position of the carriage, and an assembly for effecting vertical movement of the carriage in a machine cycle, and means for moving the carriage laterally according to data from the first means during upward movement of the carriage by the assembly and in accordance with data from the second means on downward movement of the carriage by the same assembly.

2. Apparatus according to claim 1, characterised in that the assembly for vertical displacement of the carriage comprises two horizontal rails arranged in parallel spaced relationship and on which the carriage can slide laterally, said rails being supported at the bottom end of two shafts secured to the inside surface of the wall of the frame, each shaft being urged downwards by resilient means acting between the bottom surface of a block mounted on the frame and a shoulder on the shaft, and being urged

upwardly by an arm of a lever whose pivot is fixed against the wall and another arm of which is cyclically pushed by a rotary cam driven by a general machine motor via a mechanical transmission in synchronism with the machine cycle.

3. Apparatus according to claim 1 or claim 2 characterised in that the means for moving the carriage laterally comprise first electronic means for generating speed commands in accordance with data received successively from the first means for sensing the position of the element, and from the second means for sensing the position of the carriage, second electronic means for generating a continuous signal which varies linearly with time in accordance with the

speed commands received from the first electronic means, and a speed-control electric motor acting on the lateral position of the carriage in accordance with the ~~speed command~~ continuous signal received from the second electronic means.

4. Apparatus according to either claim 2 or claim 3, characterised in that the electric motor is secured to the frame above the carriage and acts thereon via a reduction gear coupled to a generally vertical shaft the lower part of which is held by a bar connected to the frame and the bottom of which carries a pinion engaging with a rack connected to the carriage and disposed in the direction of movement of said carriage.

5. Apparatus according to any preceding claim, characterised in that the first means for detecting the lateral position of the element comprises four reflecting cells (501, 502, 503, 504) secured to the frame and disposed on a line generally perpendicular to a reference line (YO) for one of the side edges of the element, at distances ranging between - 22 and -2 mm, - 6 and - 1 mm, + 6 and + 1 mm, + 16 and +22 mm respectively with respect to said reference line (YO);

and lifting means located close to the same side edge and mounted on a member connected to the movable carriage.

6. Apparatus according to any preceding claim, characterised in that the second means for sensing the lateral position of the carriage comprises a magnetic detector located centrally of the frame near the rails on which the movable carriage moves, and a metal flag secured to the carriage and arranged to influence the magnetic detector.

7. Apparatus for correcting the lateral position of a sheet element substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

Dated this 13th day of January 1989

BOBST SA
Patent Attorneys for the Applicant
F.B. RICE & CO.

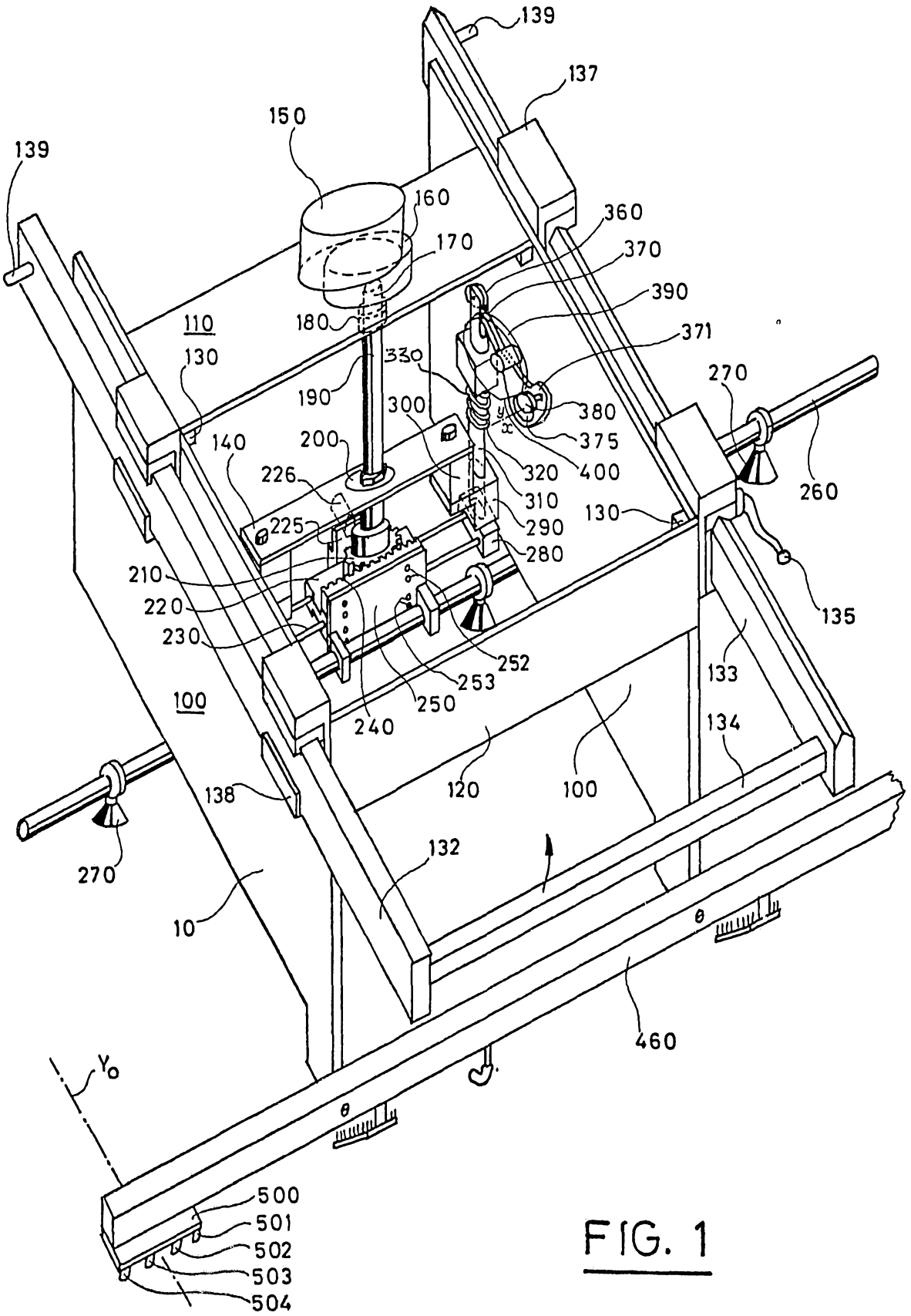
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FIG. 1

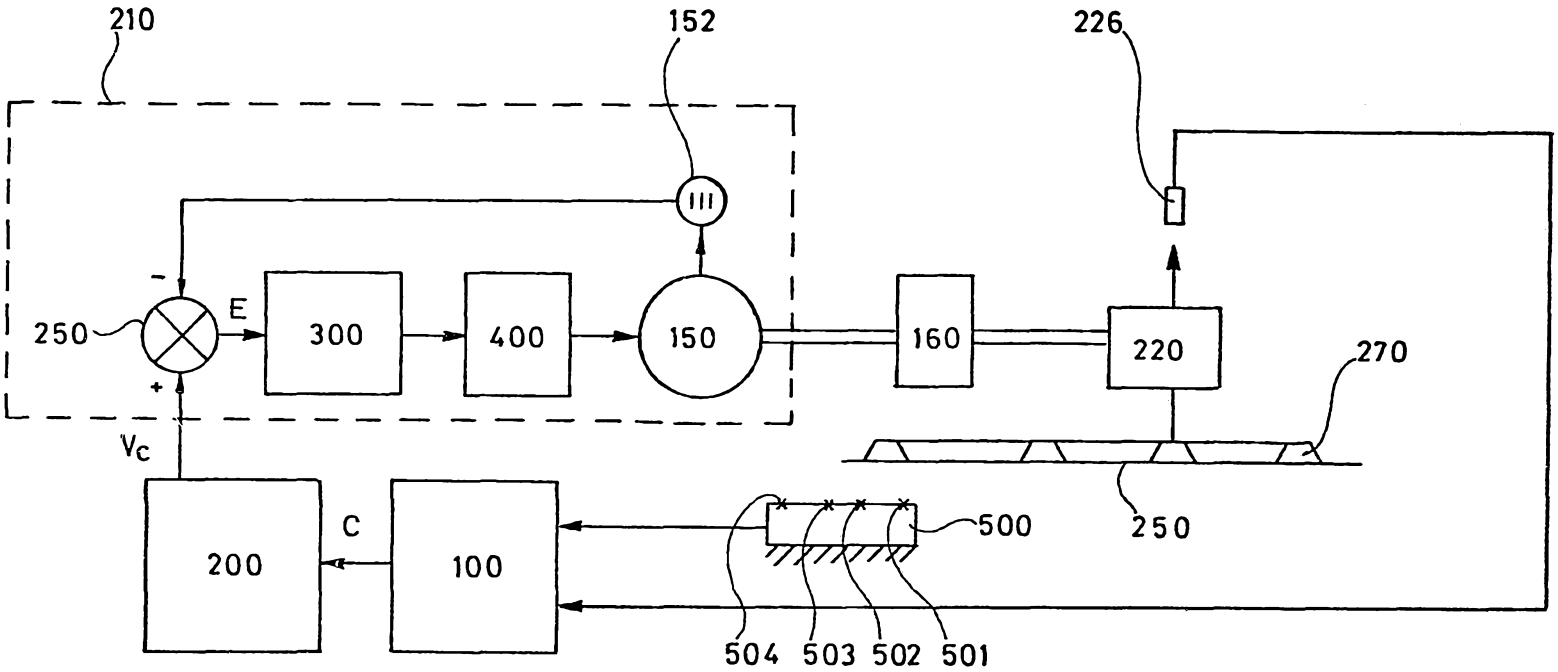

FIG. 2

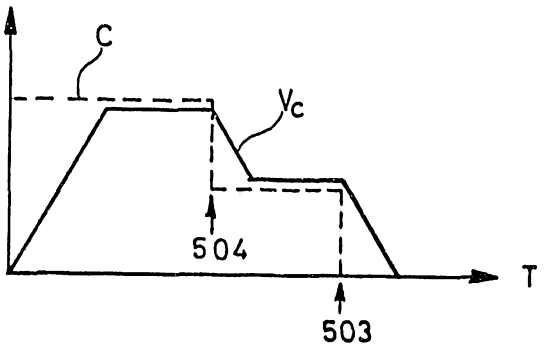

FIG. 3a

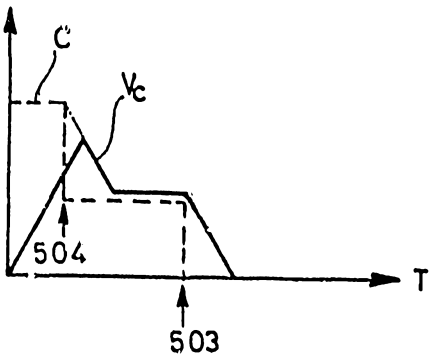

FIG. 3b