COMMONWEALTH OF AUSTRALIA

612835

Patents Act 1952

CONVENTION APPLICATION FOR A STANDARD PATENT

We, BOBST SA, a swiss company of CH-1001 Lausanne, Switzerland, hereby apply for the grant of a Standard Patent for an invention entitled

"Device for positioning plate-shaped pieces during their transfer into a processing machine"

which is described in the accompanying complete specification.

Details of basic application:-

Number of basic application:- 01909/88-0

Name of Convention country in which basic application was filed:- Switzerland

Date of basic application:- 19 May 1988

Our address for service is: F.B. RICE & CO.,
28A Montague St,
Balmain N.S.W. 2041

Dated this 9 day of May 1989

BOBST SA

By: _____
Registered Patent Attorney

TO: The Commissioner of Patents,
COMMONWEALTH OF AUSTRALIA

NT OF RECEIPT
7376 10/05/89

Commonwealth of Australia
The Patents Act 1952

DECLARATION IN SUPPORT

In support of the (Convention) Application made by: Bobst SA
CH-1001 Lausanne, Switzerland

for a patent for an invention entitled: Device For Positioning Plate-Shaped Pieces During Their Transfer Into A Processing Machine.

I ~~(We)~~ I, 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~~
~~or~~
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

in Switzerland on 19 May 1988

~~in~~ ~~on~~

~~in~~ ~~on~~

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.~~
~~or~~
b) Georges POLIC,
Rochelle 10,
CH-1008 PRILLY,
Switzerland.
is (~~are~~) the actual inventor(~~s~~) of the invention and the facts upon which
Bobst SA
~~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 18 day of April 19 89

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-34710/89
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 612835

(54) Title
DEVICE FOR POSITIONING PLATE-SHAPED PIECES DURING THEIR TRANSFER INTO A PROCESSING MACHINE

International Patent Classification(s)
(51)[4] B65H 009/20 B65H 009/04

(21) Application No. : 34710/89 (22) Application Date : 10.05.89

(30) Priority Data

(31) Number	(32) Date	(33) Country
1909/88	19.05.88	CH SWITZERLAND

(43) Publication Date : 23.11.89

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(72) Inventor(s)
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(56) Prior Art Documents
US 4680627
US 4677474
GB 2056766

(57) Claim

1. Apparatus for positioning a flat element during its movement on the feed board of a machine which processes it, the element being engageable by feeding means having front guides and side guides prior to its introduction into conveying means said apparatus comprising:

means for viewing a zone of indicia printed on the element and the front edge and one side edge of such element to produce a signal or signals representative of the position of said element,

processing means coupled to said viewing means and arranged to store as a reference data, the position of such a zone relatively to the front edge and one side edge of a reference element, so that in use it can compare the positional data of a zone on following sheets with the stored reference data in order to produce front and side error signals, and

means responsive to said error signals for adjusting the position of one or more of the front and side guides.

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12. A method of using the apparatus according to any preceding claim, characterised in that it comprises:

advancing a flat element to a position in the field of view of the viewing means near the conveying means;

modifying as required the position of the viewing means so that the front edge and one of the side edges of the flat element and a printed portion containing said indicia appears on an image, then locking these settings;

modifying as required correction parameters for brightness and/or contrast and/or numerical enlargement of the processing means, and

moving the flat element slowly over the feed board again so that the processing means can record the reference data.

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COMPLETE SPECIFICATION

(ORIGINAL)

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Application Number :
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Complete Specification Lodged :
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Related Art :

Name of Applicant : BOBST SA

Address of Applicant : CH-1001 Lausanne, Switzerland

Actual Inventor : Georges Polic

Address for Service : F.B. RICE & CO.,
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28A Montague Street,
BALMAIN. 2041.

Complete Specification for the invention entitled:

"Device for positioning plate-shaped pieces during their transfer into a processing machine"

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

This invention relates to means for positioning a flat element, such as a sheet of board or paper, in a machine processing it, more particularly to means for positioning such element on the feed board of the machine where it is engaged with front and side guides by means of feed elements such as resilient strips or rollers before introduced into conveying elements such as grippers mounted on transverse rods or bars rigidly secured to endless chains. A feed board of this kind is usually disposed immediately upstream of the processing station, for example, a cutting and pressing station.

In the case of an unprinted flat element it is necessary and sufficient if the front and side guides used are accurately arranged with respect to the references of the next processing station. The element can then be engaged rapidly with the guides by the feed elements, then taken up by the or each conveying element. The front guides are then retracted and the conveying elements can draw the flat element into the processing station.

However, this kind of positioning becomes unsatisfactory when the flat element has previously been subjected to one or more printing operations and the subsequent processing operations must be aligned very accurately with the previous operations, for despite great care systematic errors or drifts of the position of the processed part relatively to the sheet front and side edges occur fairly frequently, for example, because successive engagements with different parts of an edge are not in a dead straight line or because the engagement occurs systematically at the same places and leaves marks. The cutting of preprinted elements makes accuracy in the positioning of

the elements absolutely essential to obtain the required end product quality.

One solution of the problem is suggested by FR-PS 1 470 054 and is to print on the flat element an additional mark in the form of a transverse black line of a defined thickness, such line being disposed in the middle of a white zone of sufficient length. During the transfer of the flat elements the mark moves into a zone specially illuminated by a floodlight and is read in such zone by five photelectric cells disposed transversely in a row. An electronic logic facility connected to the photocells confirms the passage of such a mark by checking for the simultaneous presence of a number of conditions and thus triggers a control signal directly related to the longitudinal position of the printing. However, this facility has many disadvantages. First, it deals only with the front position and even this is inaccurate because of the width of the reading beam of the cells. Above all it requires the printing of an additional mark in the middle of an adequate space between the processed zones and this cannot always be ensured when optimum use of the surface of the flat elements requires staggered arrangements.

In one broad form the present invention provides a means for positioning a flat element during its passage on the feed board of a

machine, the element being engaged through the agency of feeding means with front guides and side guides, the means comprising: a stationary camera covering a zone of printed indicia and the front edge and one side edge of the flat element; electronic and data-processing means connected to the camera and storing as reference a position of the characteristic place relatively to the front edge and one side edge of the same zone on the following sheets with a reference in order to produce front and side error signals; and electronic means converting such error signals into electrical instructions applied to electromechanical systems which adjust the final position of one or more of the front and side guides respectively.

Advantageously, the electronic and data-processing means comprise: a processor of signals received by the camera for correcting the brightness and/or contrast, then digitising the signals, then modifying the enlargement, as required; and a calculating unit which determines the error relatively to the reference - which was either stored during the passage of the first sheet or read into storage by means of a keyboard - of the position of the image printed on the sheet.

Preferably, the electromechanical system adjusting the position of a guide comprises: a support disposed on a cross-member below the feed board; an adjusting screw rotatable in the support by means of a ball bearing which engages a bearing surface of such screw, the ball bearing being retained laterally in the support by two stop rings, the adjusting screw being retained laterally in the ball bearing by means of a collar and a stop ring; an electric motor secured to the support by a stirrup and connected by a coupling to that end of the adjusting screw which is near the bearing surface; and a support for a guide, a nut in the support engaging the screwthreaded end of the adjusting screw, the latter support being

slidable, when the adjusting screw rotated by the motor acts on the nut, along a guide rod rigidly secured to the support. In this case the guide support can be formed with a bore before, as considered lengthwise, the adjusting screw and the bore can receive a spring operative between the bore base and a washer which extends around the adjusting screw and engages the support disposed on the cross-member.

In preferred embodiments, the electric motor can be a d.c. motor and the electrical instructions imparted to it are in voltage or pulse form or a position-controlled servo motor receiving its electrical instructions in voltage form or a stepping motor receiving its electrical instructions in pulse form.

Conveniently, the camera support has provision for initial adjustment before locking of the lateral and longitudinal positions and height and angular position (inclination) of the camera relatively to the feed board.

Advantageously, the method of using the means according to the invention can reside in advancing a flat element as far as below the field of view of the camera near the elements for conveying the flat element, modifying as required camera position or lens enlargement so that the front edge and one of the side edges of the flat element and a zone of indicia printed appear on the image, locking these settings, modifying as required the correction parameters for brightness and/or contrast and/or numerical enlargement of the signal processor, then moving the flat element slowly over the feed board again so that the electronic and data-processing means can record the reference values.

The invention and its advantages will be more clearly understood from a study of the following description of a preferred embodiment of the invention with reference to the accompanying drawings wherein:

Fig. 1 is a basic diagram of the means according to the invention;

Fig. 2 is a diagrammatic representation of the arrangement of parts of the means at the downstream end of the press feed board - i.e., at the entry to the press;

Fig. 3 is a diagrammatic representation of a variant of assembly of the camera on a cross-member;

Fig. 4 is a side view in partial section of the movable front guide, and

Fig. 5 is a side view in partial section of the movable side guide.

Fig. 1 is a partial plan view of the downstream corner, on the side remote from the machine operator, of a feed board of a machine tool treating flat elements (paper or board sheets). The left front corner of such a sheet 15 comprises a printed motif 20 and is shown during the phase in which a roller 25 is feeding it towards a front guide 35.

When the sheet 15 has reached the front guide 35 it is drawn laterally by a roller pair, namely a bottom roller and a top roller 30, towards a side guide 40. When this double engagement of the sheet with the guides is complete the two downstream corners of the sheet are disposed somewhere between the bottom and top fingers of two side conveying grippers, only the gripper 45 of which is shown. The grippers 45 are rigidly secured to a gripper bar 44 secured to a partially shown endless chain 50. On completion of engagement of the

sheet 15 with the front and side guides, the fingers of the grippers 45 close as the result of movement of an actuating spindle 46, whereafter the chain 50 starts to move so that the grippers 45 draw the sheet into the platen (not shown).

A camera 55 is arranged somewhere vertically above the feed board so as to be able to read simultaneously before the start of engagement of the sheet with the guides the front edge of the sheet 15, the side edge thereof remote from the machine operator and a part of the printed motif 20. In other words, by virtue of its position the camera can read, while the sheet 15 is being advanced by the roller 15, the distance A between the side edge of the motif 20 and the side edge of the sheet 15 and the distance B between the front edge of the motif 20 and the front edge of the same sheet 15.

The camera transmits in the form of electrical signals one or more consecutive images to a signals processor 60 for pre-processing and digitization. The new signals are transmitted to a calculating unit 65 and to electronic interfaces 66 where specific instructions for each of electric motors 75, 78 are generated in dependence upon a program and parameters pre-recorded in a memory 70. The motor 75 is mechanically coupled at a place 77 to the side guide 40 so as to move the same forwards or backwards in dependence upon the direction of motor rotation. Similar considerations apply to the motor 80 which, by way of a mechanical coupling 85, moves the front guide 35 forwards or backwards in dependence upon the direction of motor rotation.

Fig. 2 is a view in side elevation showing the passage of a sheet 215 from a feed board 210 to a platen 252. After engagement with the front guide 240 the sheet 215 is taken up by the fingers of the gripper 245 in dependence upon actuation of the shaft 246. The electromechanical system actuating the front guide 240 and comprising

the motor 275, stationary support 281 and mobile guide support 27 is disposed on a pivoted cross-member 279. A board 212 which supports the front part of the sheet 215 during the alignment step is secured to the top face of the support 281. This electromechanical system is retracted downwardly by rotation of the cross-member 279 towards position 280 shortly before the gripper 245 moves the sheet 215 away above the platen 252.

A camera 255 is disposed vertically above the front edge of the board 212 by means of an arm 275 whose other end is secured to a cross-member 259 by means of two strips 261 - a top strip and a bottom strip - retained by screws 262. With this form of securing, the end of the arm 275 can be slid along the cross-member 259 as required after the screws 262 have been loosened.

Fig. 3 shows another form of assembly of the camera which provides greater freedom for accurate positional adjustment to suit requirements. As previously, the system can slide along a cross-member 359 by means of a bar 376 which can be loosened from the frame 375. The same supports a vertical pivot around which a support 372 rotates. An extending bar 373 can be retracted into or extended from the support 372. The bar or rod 373 is connected by an articulation 370 to an arm 369 at whose end the camera 368 is locked vertically by a nut 367. Camera height y can therefore be adjusted by action either on position y1 of the support 372 along the pivot 371 or on camera position y2 relatively to the arm 369. The longitudinal position X relatively to the machine can be adjusted either by rotation of the system around the pivot 371 and/or by varying the extent to which the bar 373 projects from the support 372.

The electromechanical system actuating the front guide is shown in greater detail in Fig. 4. As in Fig. 2, a support 410 is rigidly

secured to a pivoted cross-member 479 by way of a screw 411. The board 412 is secured to the top surface of the support 479. Also, the same is formed with a horizontal cylindrical aperture receiving a ball bearing 15 retained by two side rings 418. The bearing 415 supports an adjusting screw 416 by way of a bearing surface 422 thereof. The screw 416 is retained laterally in relation to the ball bearing 415 by means of a collar 420 on one side and a stop ring on the other.

An electric motor 475 is secured to the support 410 by means of a stirrup 423 and is connected to the adjusting screw 416 by a coupling 417. The motor 475 is effective to rotate the screw 416 by an accurate amount corresponding to instructions received from the electronic means 65 mentioned with reference to Fig. 1. To this end the motor 475 can be a voltage-operated or pulse-operated d.c. motor or a position-controlled servo motor whose counter-reaction is voltage-controlled or a stepping motor controlled by a predetermined number of pulses.

A moving support 430 of guide 440 is formed with a first horizontal transverse aperture which widens out near the stationary support 410 into a bore 432. The unwidened part of the aperture receives a nut 435 whose screwthreading engages with the screwthreading of the adjusting screw 416. To ensure that the support 430 is not rotated around the screw 416 by the electric motor, a second bore is present through which a guide rod 412 extends, the same being rigidly secured to the support 410 either by welding or by being screwed into a tapped aperture in the support 410 or, and as shown in Fig. 4, retained by a disc 413 and a backscrew 414. In other words, when the motor 475 rotates the screw 416 the support 430 moves forwards or backwards sliding around the guide rod 412, thus varying the distance between the front guide 440 and the feed board 412 in accordance with the instructions of the calculator 65 of Fig. 1.

A spring 434 is received in the bore 424 and is effective between the end of the bore 424 and a disc 437 which extends around the screw 416 and which the spring 434 engages with the front face of the support 410. The spring 434 obviates any mechanical clearance between the screwthreading of the screw 416 and the internal screwthreading of the nut 435 by forcing the same - i.e., its screwthreads - forwards into engagement with the corresponding surfaces of the screwthreading of the screw 416.

Fig. 5 shows the electromechanical system adjusting the lateral position of the guide 535 in accordance with instructions from the electronic means 65. The system is identical to the one described with reference to Fig. 5 except that the cross-member 579 is stationary and the support 510 is below the feed board 512. As previously mentioned with reference to Fig. 1, a top pressing roller 525 and a bottom drawing roller 520 enable the sheet 515 to be drawn laterally on to the side guide 535.

The means according to the invention as hereinbefore described operate as follows:

The machine minder first decides if he wants to use as automatic guides those on the minder's side or those on the side remote from the minder.

He then checks that the feed cycle of the grippers 55 moved by the or each chain 50 and the feeding by the rollers 25 of the sheets 15 required to be positioned agree correctly with one another. Having made this check he feeds a sheet as far as below the field of view of the camera and checks on a display screen that the shape of the signal is correct - i.e., sufficient contrast appears between the black zones coming from the feed board, the white zones corresponding to the edges of the unprinted sheet and the printing at an

intermediate grey level. If the signal shape is wrong the minder alters the camera position or the focal length of the lens or the direction of the floodlighting or the correction parameters made in the signal processor. He then makes this first sheet, used as reference, move from the feed board to the platen, with marking of the sheet.

The minder recovers this first sheet at reception and checks the position of the processing relatively to the printing. Depending on the result he corrects the initial position of the front or back guides by manual transmission of pulses to the motor 475.

He then makes the reference sheet repeat the movement, the data-processing means 65 storing the values A and B characteristic of the position of the printing relatively to the sheet edges, and he checks the correctness of platen operation.

The machine is then ready for production - i.e., positioning of the subsequent sheets is based not on their front and side edges but on the printing itself. The means operate rapidly first because of the rapid operation of the microprocessor of the calculating unit and second as a result of adequate dimensioning of the electric motor for the moving masses. Since the resolution of the camera reading and data-processing by the means hereinbefore referred to is less than 50 microns and mechanical clearances are completely obviated in the electromechanical system, register error of a corrected sheet depends more upon mechanical adjustment of the complete machine. Many improvements can be made to these means within the scope of the invention.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. Apparatus for positioning a flat element during its movement on the feed board of a machine which processes it, the element being engageable by feeding means having front guides and side guides prior to its introduction into conveying means said apparatus comprising:

means for viewing a zone of indicia printed on the element and the front edge and one side edge of such element to produce a signal or signals representative of the position of said element,

processing means coupled to said viewing means and arranged to store as a reference data, the position of such a zone relatively to the front edge and one side edge of a reference element, so that in use it can compare the positional data of a zone on following sheets with the stored reference data in order to produce front and side error signals, and

means responsive to said error signals for adjusting the position of one or more of the front and side guides.

2. Apparatus according to claim 1, wherein said reference data is obtained during passage of a reference element through said apparatus.

3. Apparatus according to claim 1, wherein said reference data is entered into said processing means by operation of a keyboard.

4. Apparatus according to any preceding claim, wherein said viewing means comprises a stationary camera disposed generally above said zone,

said processing means comprises an electronic and data processing means, and said

responsive means comprise:

electrical means for convering said error signals into electrical instructions which are fed to electromechanical means which adjust the final position of one or more of the front and side guides respectively.

5. Apparatus according to claim 4, characterised in that the electronic and data-processing means comprise:

a processor for processing signals received from the camera and which can correct the brightness and/or contrast, then digitise the signals, and then modify their enlargement, as required, and

a calculating unit which can determine the error relative to the reference data of the position of a first characteristic place on a sheet.

6. Apparatus according to claim 4, characterised in that the electromechanical means for adjusting the position of a guide comprises:

a support disposed on a cross-member below the feed board;

an adjusting screw rotatable in the support by means of a ball bearing which engages a bearing surface of such screw, the ball bearing being retained laterally in the support by two stop rings, the adjusting screw being retained laterally in the ball bearing by means of a collar and one of the stop rings;

an electric motor secured to the support by a stirrup and connected by a coupling to that end of the adjusting screw which is near the bearing surface, and

a support for a guide, a nut in the guide

support engaging the screwthreaded end of the adjusting screw, the latter support being slidable, when the adjusting screw rotated by the motor acts on the nut, along a guide rod rigidly secured to the guide support.

7. Apparatus according to claim 6, characterised in that the guide support is formed with a bore before, as considered lengthwise, the adjusting screw, such bore receiving a spring operative between the bore base and a washer which extends around the adjusting screw and engages the support disposed on the cross-member.

8. Apparatus according to claim 6, characterised in that the electric motor is a d.c. motor and electrical instructions imparted to it are in voltage or pulse form.

9. Apparatus according to claim 4, characterised in that the camera is mounted on a camera support which has provision for initial adjustment prior to fixing the lateral position of the camera relative to the feed board.

10. Apparatus according to claim 4, or claim 9, characterised in that the camera is mounted on a camera support which has provision for initial adjustment prior to fixing of the longitudinal position of the camera relative to the feed board.

11. Apparatus according to claim 4 or claim 10, characterised in that the camera is mounted on a camera support which has provision for initial

adjustment prior to fixing of camera inclination relative to the feed board.

12. A method of using the apparatus according to any preceding claim, characterised in that it comprises:

advancing a flat element to a position in the field of view of the viewing means near the conveying means;

modifying as required the position of the viewing means so that the front edge and one of the side edges of the flat element and a printed portion containing said indicia appears on an image, then locking these settings;

modifying as required correction parameters for brightness and/or contrast and/or numerical enlargement of the processing means, and

moving the flat element slowly over the feed board again so that the processing means can record the reference data.

13. Apparatus for positioning a flat element substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

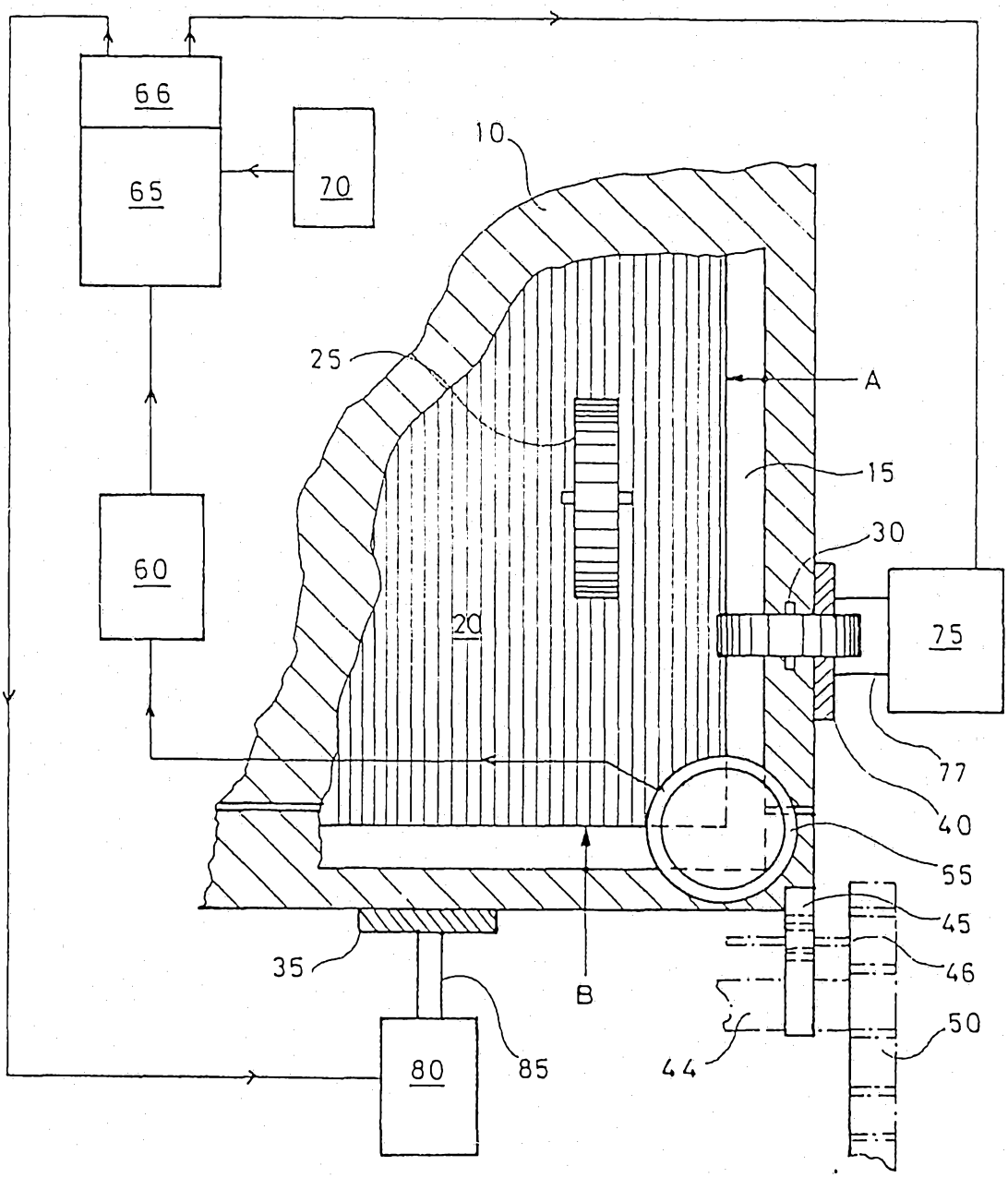
14. A method of positioning flat elements substantially as hereinbefore described.

Dated this 27 day of March 1991

BOBST SA

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

FIG. 1



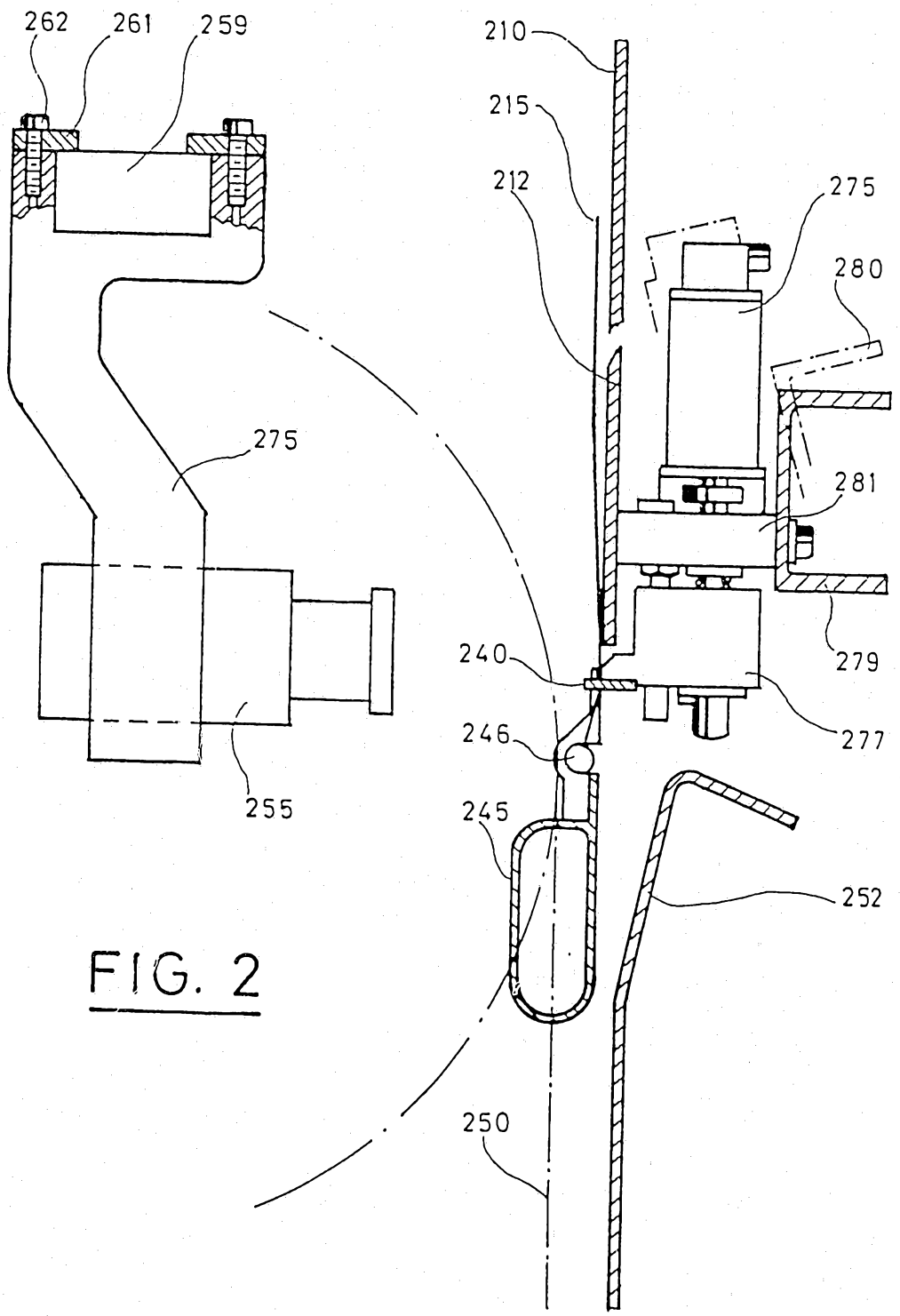

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FIG. 2

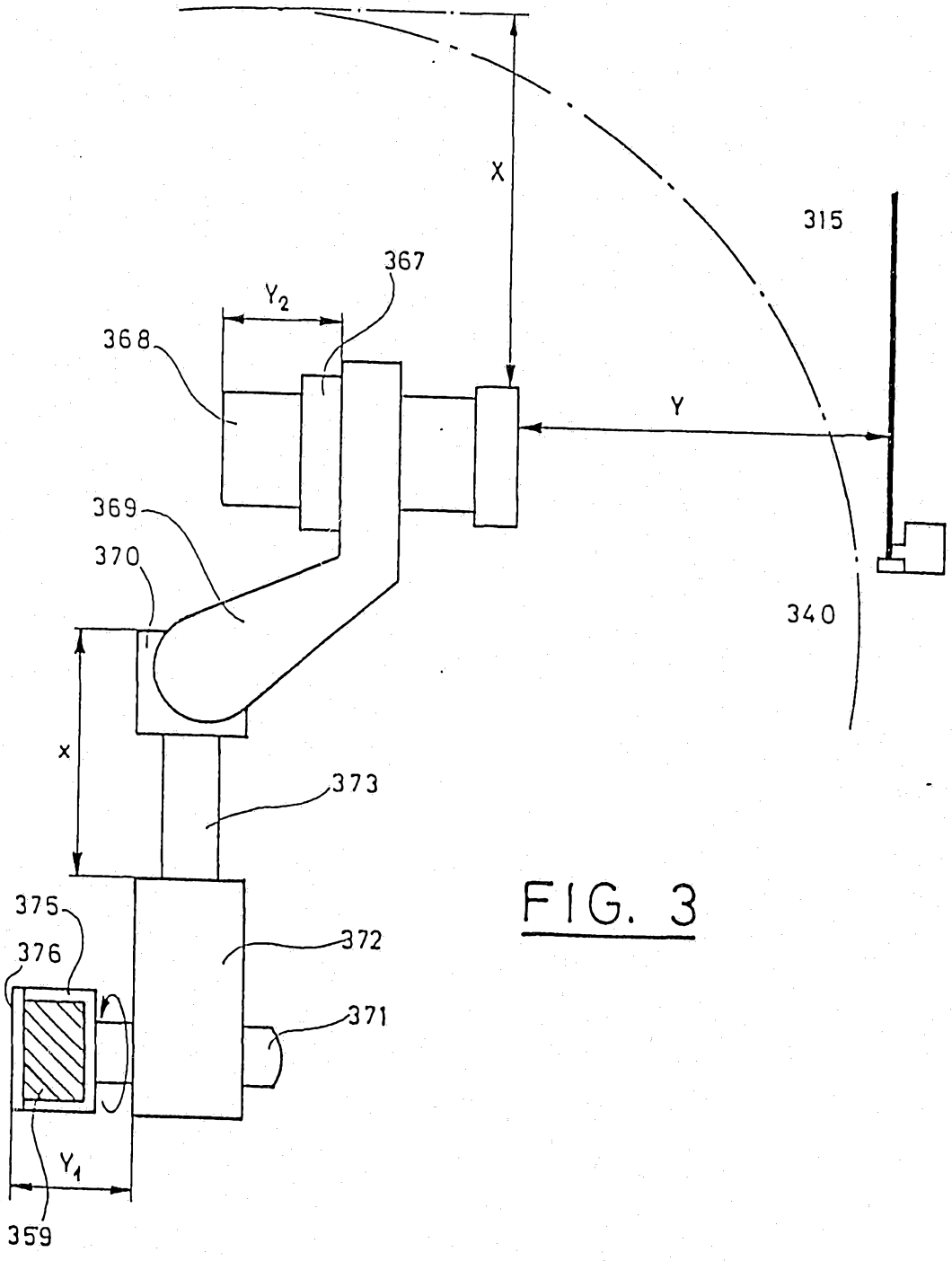

FIG. 3

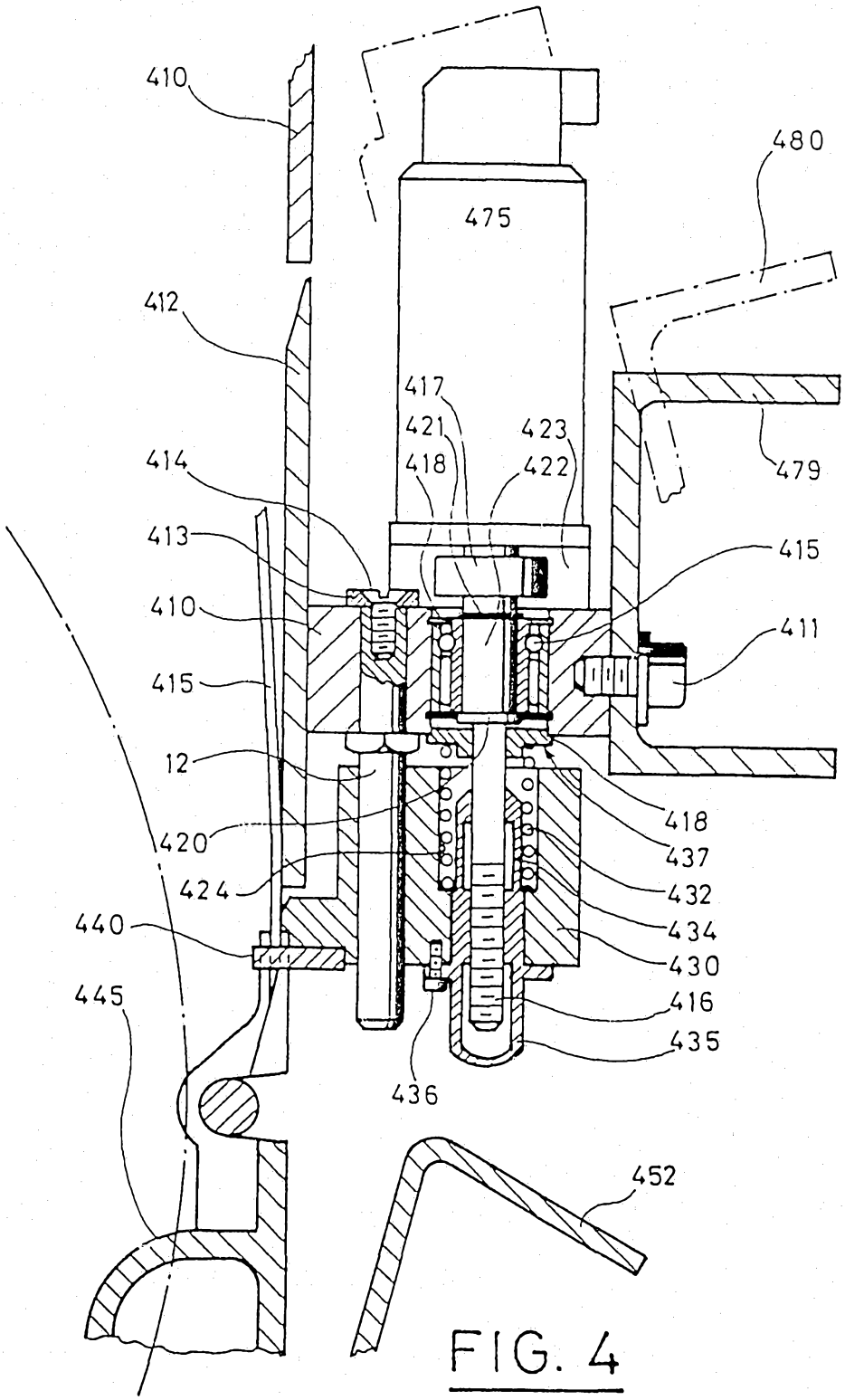
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FIG. 4

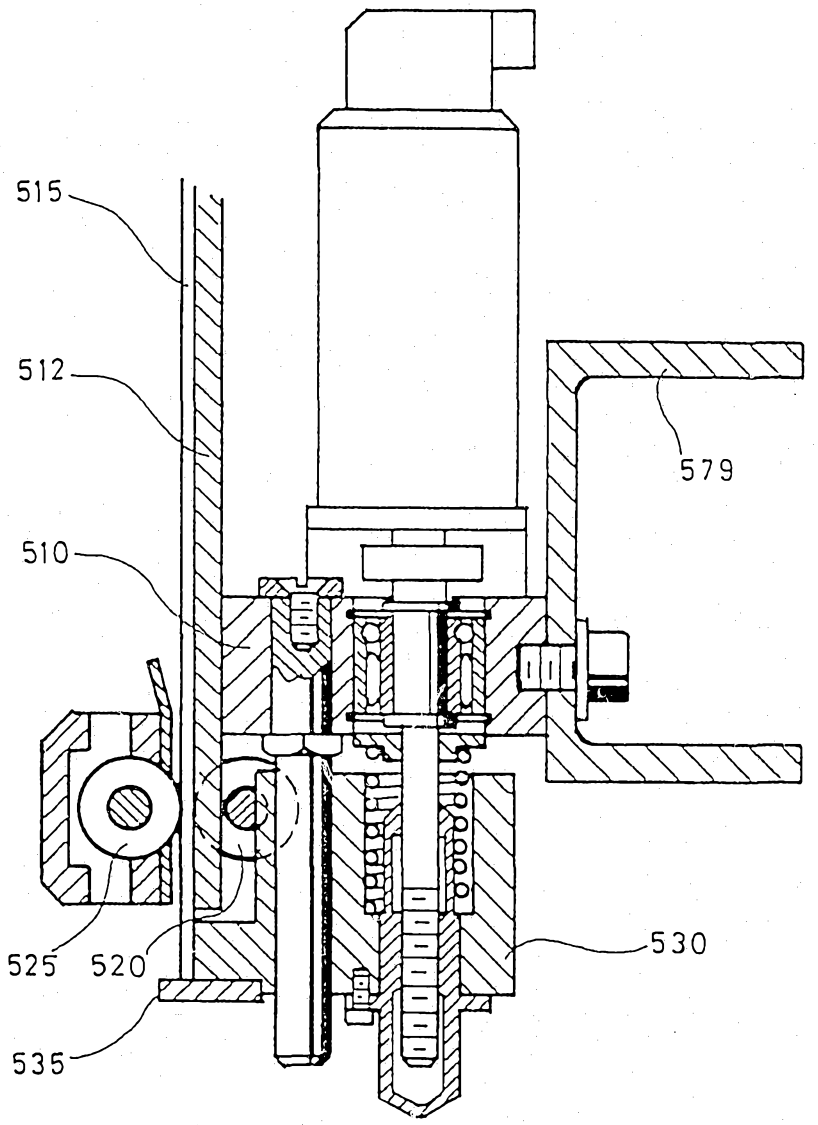

FIG. 5