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54 **Apparatus for the automatic feeding and withdrawal of a sewing machine workholder.**

57 An apparatus for automatically feeding to and withdrawing from an automated sewing machine (2) a workholder (A, B), containing a material to be sewn, comprises a working plane (6) on which two workholders (A, B) may independently and simultaneously move in the x direction, towards or away

from a sewing head (2), or in the y direction, at least two displacement means movable in the x direction, at least one displacement means movable in the y direction, and control means for controlling the movement of the displacement means.

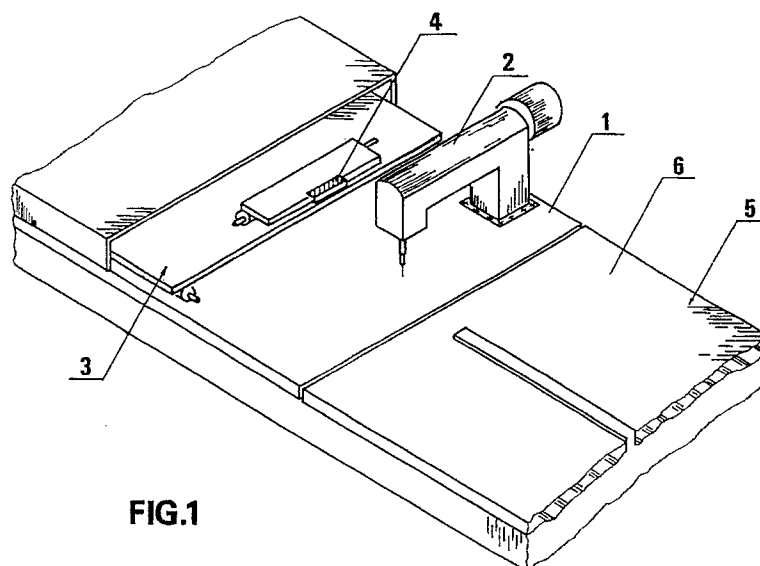


FIG.1

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APPARATUS FOR THE AUTOMATIC FEEDING AND WITHDRAWAL OF A SEWING MACHINE WORKHOLDER

Field of the invention

The present invention relates to an apparatus for the automatic feeding to and withdrawal from an automated sewing machine of a workholder containing a material to be sewn.

Background of the invention

During the operation of automated sewing machines, which are normally controlled by microprocessors - normally a microcomputer -and in which the sewing pattern is predetermined, an operator must normally take care to charge and discharge the workholder from the working plane of the sewing machine, and to replace sewn material with material to be sewn, within the workholder. Normally, however, one operator will be in charge of more than one sewing machine. In conventional sewing machines, the operator receives the workholder with the sewn material, removes it therefrom and positions within the workholder new material to be sewn in the next step. Because this operation takes time, the sewing head meanwhile is inoperative. Furthermore, if two sewing machines are operated by the same operator, very often both sewing heads will stop, the operator will load one workholder to one sewing machine and only then will be free to remove sewn material from the workholder of the second sewing machine and recharge it. This, as will be appreciated, results in a considerable down-time of the machines. It is thus clear that it will be desirable to be able to provide more than one workholder ready for sewing, so that it can be fed to the sewing head when sewing of the former workholder is completed, thereby reducing the down-time.

The prior art

The art has recognized the importance of providing such means, but has failed, so far, to find convenient and simple apparatus which can be used for this purpose. The existing apparatus is complicated and inadequate. For instance, Israeli Patent Nos. 65759, 76063 and 76065 relate to apparatus for automatically handling workpieces in an automatic sewing machine system, and relate to an apparatus in which a plurality of workholders can be prepared and automatically fed into the sewing head. The apparatus described therein involves the dropping of the workholder from a height onto the plane in which actual sewing oc-

curs, and then elevation of the workholder to a higher level. This movement of workholders to and from different heights severely complicates the apparatus and renders it costly and cumbersome.

SUMMARY OF THE INVENTION

It is an object of the present invention to obviate the aforesaid disadvantages and to provide a simple apparatus which can be used to handle two different workpieces at a time.

It is another object of the invention to provide an apparatus in which all operations take place on a single plane, which is both simple and inexpensive in construction.

The apparatus according to the invention comprises:

- a working plane on which two workholders may independently and simultaneously move in the x direction towards or away from a sewing head, or in the y direction;
- at least two displacement means movable in the x direction;
- at least one displacement means movable in the y direction; and
- control means for controlling the movement of the displacement means.

According to a preferred embodiment of the invention, each displacement means comprises a moving body and coupling means for the coupling of the moving body with the workholder. The coupling means may comprise, e.g., a clamp or two or more pins.

The moving body may be displaced in the x or y direction by any means known to a person skilled in the art. According to one embodiment of the invention, the moving body is slidably movable along a rail or the like slide base.

The displacement of the moving body can be done utilizing different techniques well known to the skilled engineer. For instance, the moving body may be actuated by an electric motor, or by compressed air. Furthermore, a tension cable and winding means can be provided, to move the moving body forward and backward by the tension of the cable winding around the winding means. In one embodiment of the invention, one x displacement means is connected to the second displacement means via a cable, and only one motor or the like is provided, which actuates both moving bodies.

All movements and couplings of the apparatus need controlling. Controlling may be easily achieved by control means known in the art, such as control means which comprise a microprocessor

or the like, such as a personal computer or a minicomputer.

A workholder that can be used in conjunction with the apparatus of the invention also forms part of this invention. Such a workholder comprises a frame within which a piece of material to be sewn is fastened, a clampable end for the x-y clamping device, positioned on one side of the workholder frame, and at least two receiving means for the coupling means of the displacement means, positioned on two other adjacent sides. According to one embodiment of the invention, the receiving means comprise two or more holes. According to this embodiment of the invention, of course, the coupling means will comprise a corresponding number of pins. These pins will move upwards and downwards, as dictated by the controlling means, and engage or disengage the workholder, accordingly. As will be easily appreciated by a person skilled in the art, the workholder may be engaged by clamps provided on the moving bodies, if so desired, which clamps will be opened and closed by the same controlling means hereinbefore discussed with reference to the movement of the pins.

An apparatus for the automated sewing of a piece of material is also encompassed by the invention. This apparatus comprises:

- a sewing head;
- automatic feeding and withdrawal apparatus of the invention;
- an x-y system, to move the workholder to the sewing position and during sewing operations; and
- at least one microprocessor to control the operation of the sewing head, of the automatic feeding and withdrawal apparatus and of the x-y system.

The above and other characteristics and advantages of the invention will be better understood through the following description of illustrative and non-limitative preferred embodiments of the invention, with reference to the appended drawings, wherein:

Brief description of the drawings

- Fig. 1 schematically shows a sewing apparatus according to the invention;
- Figs. 2 through 4 illustrate the movement of two workholders on the working plane;
- Fig. 5 schematically shows the displacement means and the general construction of an apparatus according to one embodiment of the invention;
- Fig. 6 illustrates an apparatus according to another particular embodiment of the invention;
- Fig. 7 is a particular view of the displacement means of the apparatus of Fig. 6; and
- Fig. 8 is a schematic detailed view of engage-

ment means according to one embodiment of the invention.

Detailed description of preferred embodiments

With reference now to Fig. 1, an automatic sewing apparatus comprising an apparatus for the automatic feeding according to the invention, comprises a working plane, 1, a sewing head, 2, x-y apparatus 3, clamping means of the x-y apparatus, 4, and apparatus for the automatic feeding, 5. The automatic feeding apparatus 5, which is shown in a slightly detached position in Fig. 1, is positioned close to the working plane 1, so that its own working plane 6 is on the same level as working plane 1, and in fact constitutes a continuation of the same plane.

The operation of the automatic feeding and withdrawal apparatus can be appreciated through the schematic representation of its operation, as seen in Figs. 2 through 4. In Fig. 2, a workholder B is positioned in the sewing position, below the sewing head 2 which is actually working. The workholder B is attached to the x-y system, indicated by X in the figure, through the clamping means 4. A second workholder, indicated by A, is waiting and is charged with the material to be sewn. In the next stage, when sewing of the material in workholder B is completed, clamping means 4 will open up and the workholder B will move in the direction of the arrow B', by means of the displacement means (not shown in the figure). At the same time, or subsequently, the workholder A will move towards the sewing apparatus, in the direction of the arrow A', and the x-y system will move towards it, in the direction of the arrow X'.

When these movements have been completed, the situation is as shown in Fig. 3. The x-y system (designated by X' in this position) has engaged the workholder A (designated by A' in this position). The workholder B is now in the position designated B'. Next, the x-y system will move in the direction of the arrow X'' and will bring with it the workholder A' in the direction of the arrow A'', viz., this workholder will now move towards a position below the sewing head, and sewing operations will begin. At the same time, or independently shortly before or shortly thereafter, the workholder B' will move in the direction indicated by the arrow B''. The situation will now be as shown in Fig. 4. It can be seen that this is the same situation existing in Fig. 2, but the workholders A and B have been interchanged. The workholder B, designated B'' in Fig. 4, will now be discharged of the already-sewn material, and will be recharged with material to be sewn. While this charging operation is effected, workholder A'' is being processed below the sewing head. When this charging operation is completed, the operator may

take care of another sewing machine, and when sewing of the material in workholder A'' is completed, the cycle of operations hereinbefore described with reference to Figs. 2 through 4 will repeat itself. The operator will need to discharge and recharge a workholder only when this cycle has been completed.

Referring now to Fig. 5, an apparatus for the automatic feeding and withdrawal is shown. The apparatus 5 comprises a slot 7 provided in its middle. This slot houses displacement means 8, which can move in the x direction along the slot, as shown by the dotted lines. These displacement means are used to displace the workholder, the sewing of which has been completed, away from the sewing head. Additional similar displacement means 8' are provided at the lower side of the working plane. These displacement means are used to move the newly charged workholder towards the x-y system. Furthermore, displacement means 8'', movable in the y direction, are provided, to move the already-sewn workholder from the upper position to the lower position, in which it can be discharged by the operator, and then recharged anew. It should be emphasized that the words "upper" and "lower" are used with reference to Fig. 5, only for illustrative purposes, to illustrate the movement of the workholder on the plane as it appears in the figure, it being understood that the real apparatus rests on one horizontal plane, so that there is no "upper" or "lower" position, these positions being designated so only for reasons of convenience and only with respect to this figure.

The displacement means 8-8'' comprise coupling means which engage the workholder, so that it moves along with the displacement means, when they move. These coupling means, therefore, may be in the "engaged" position, in which they are coupled with the workholder, or in the "disengaged" position, in which the displacement means run freely, without causing a movement of the workholder. Thus, if we wish to analyze the operation of the displacement means in the cycle of Figs. 2 through 4, their operation will be as follows. With reference to Fig. 2, displacement means 8 will be in the 8b position, and disengaged. Displacement means 8' will be in the 8'b position, and either engaged or disengaged, but they must engage workholder A, before the next step, if disengaged. Displacement means 8'' can be either in the 8''a position, or in the 8''b position and disengaged, but they must move to the 8''a position before the next step. When the movement shown by the arrows (Fig. 2) is effected, then displacement means 8' must be engaged in the 8'b position, before movement of workholder A begins, and displacement means 8 must engage workholder B in the 8b position, before movement thereof be-

gins.

Referring now to Fig. 3, before the movement shown in the arrows begins, displacement means 8' must disengage workholder A', and either return to the 8'b position, or be ready to return thereto. Displacement means 8 must be in the 8a position and disengaged, and 8'' in the 8''a position, and engaged.

In Fig. 4, again, displacement means 8 must be disengaged, and may be either in the 8b or 8a position, displacement means 8' must be in the 8'b position, either engaged or disengaged, and 8'' must be in the 8''a position, or in the 8''b position and ready to move to the 8''a position.

While providing the displacement means 8 in the slot 7 is convenient, because they utilize the same receiving means provided in the workholder for the coupling means as are utilized by displacement means 8', it will be clear to a person skilled in the art that the displacement means 8 may be positioned at the upper side of the working plane, symmetrically with displacement means 8', and the slot 7 can be dispensed with. The only addition in this case will be to provide receiving means also in the upper portion of the workholder, for the coupling means of displacement means 8.

It will also be easily understood by a person skilled in the art that the movement of the workholders A and B, as have been described, constitute only one possible cycle. Other cycles can be easily devised by the skilled engineer. For instance, movement can be either clockwise or counterclockwise, it can be synchronized differently, the workholder B can remain in the upper position during part of the time in which the material in the workholder A is being sewn, and may move downwards while sewing is being effected, or different and additional movements or intermediate positions can be provided, depending on the size of the working plane.

Referring now to Fig. 6, an apparatus according to one preferred embodiment of the invention is shown. This apparatus utilizes pins as the coupling means of the displacement means. Therefore, the receiving means for the coupling means are holes drilled in the frame of the workholder. The pins which constitute the displacement means 8 of Fig. 5 are indicated by 9 and 9' in the figure, and engage holes 10 and 10' respectively. Additional holes 11 and 11' are provided in workholder A, as shown in the figure. These will be engaged by pins 12 and 12' which constitute the displacement means 8'' of Fig. 5. The displacement means 8' of Fig. 5 are, in the embodiment of Fig. 6, the two pins 13 and 13' which engage holes 14 and 14' of workholder B. Additional holes 15 and 15' will be engaged by pins 12 and 12', to provide for the displacement of the workholder in the y direction. A

clampable end 16 is also shown on workholder B, which can be engaged by the clamping means 4 of the x-y system X. According to one preferred embodiment of the invention, safety means 17 are provided, which stop the operation of the system when the hands of the operator are extended towards the workplane, so that when the operator discharges and charges workholder B, the system cannot be operated by mistake. The safety means 17 can be any means known in the art, such as light detecting or body-heat detecting apparatus.

As will be easily appreciated by a person skilled in the art, the displacement means can be built in many different ways. One such way is schematically shown in Fig. 7, which shows one possible embodiment of the invention, which provides the apparatus of Fig. 6. According to this embodiment, each displacement means is positioned on a rail. For instance, displacement means 8 of Fig. 5 is positioned on a rail 18, displacement means 8' on a rail 18', and 8'' on a rail 18''. The pins are also shown in Fig. 7, and indicated by the same numerals as in Fig. 6. In this figure, there is schematically seen that a cable 19 attached to an attachment 20 of the displacement means 8 causes the body of the displacement means 8 to move along the rail 18, when the cable 19 is caused to move by the action of, e.g., a piston-and-cable arrangement 21. The same apparatus can be provided for all other displacement means. These, of course, can also be actuated by other power means, such as an electric motor. In this embodiment of the invention, the piston-and-cable assembly 21 is utilized to move both displacement means 8 and 8' together, by the action of common cable 19 which is kept in tension by and slides on appropriate rollers 22. This, although economically advantageous, clearly has the disadvantage that both displacement means must move synchronically. If it is devised to permit an independent motion of these displacement means, separate power or actuating means must be provided. Similar apparatus is provided for displacement means 8' (not shown in the figure).

Displacement means 8 are located, with respect to Fig. 6, in the central slot 7. The working plane will therefore extend beyond the rail 18, as shown in broken lines in Fig. 7. The pins 10, 10' of displacement means 8, and the corresponding pins of the displacement means 8' and 8'', can be moved upwards and downwards by any suitable means, such as electrical and/or mechanical means which can push them upwards, or the displacement means can be coupled to a compressed air outlet at the engagement and disengagement position, so that compressed air can be used to push the pins upwards or to release them at will, at predetermined engagement/disengagement positions.

Fig. 8 is a schematic detailed view of the engagement and disengagement means, according to one embodiment of the invention. In Fig. 8(a) the workholder 23, resting on the working plane 6, is disengaged. Two pins 24 are positioned outside the working plane and below its level. The pins 24 are connected through a bar 25 to a piston (not shown), located within the housing 26 which is positioned, e.g., on the displacement means 8' of Fig. 7 (not shown). The housing 26 is connected to a supply of compressed air or other fluid, through hose 27. (Alternatively, housing 26 may contain electromagnets and 27 may be an electric wire.)

When it is desired to engage workholder 23, compressed air is applied to housing 26 through hose 27, and pin 24 rises to engage holes 28 drilled in the frame of workholder 23, as seen in cross-section in this figure. The resulting situation is shown in Fig. 8(b), in which the pins are activated and the workholder is engaged.

The pin may have a tapered top, to permit engagement if a minor mismatch in the relative positioning of the pins and holes occurs, and these are thus misaligned. The pin head, furthermore, may be made of soft material, such as rubber. The pin can, of course, be withdrawn to disengage the workholder and to return to the position of Fig. 8(a), by means known to the skilled technician and which depend on the particular actuation system employed.

As will be apparent to the skilled engineer, it may be convenient and advantageous to provide position detectors for the various coupling and displacement means, to provide positive and safe control of the position of the various moving parts. These position detectors may be, e.g., micro-switches, optical detectors, etc., and are of course well within the scope of a person skilled in the art.

As will be appreciated, the above are only preferred embodiments of the invention, and should not be considered to limit its scope. Many changes can be made in the apparatus of the invention. For instance, different displacement means, which are differently movable, can be provided; different means of engaging the workholder, as well as different shapes and sizes of working plane and workholders can be provided, all without exceeding the scope of the invention.

Claims

1. Apparatus for the automatic feeding to and withdrawal from an automated sewing machine of a workholder containing a material to be sewn, comprising:
 - a working plane on which two workholders may independently and simultaneously move in the x

- direction, towards or away from a sewing head, or in the y direction;
- at least two displacement means movable in the x direction;
 - at least one displacement means movable in the y direction; and
 - control means for controlling the movement of the displacement means.
2. Apparatus according to claim 1, wherein each displacement means comprises a moving body and coupling means for the coupling of the moving body with the workholder. 5
3. Apparatus according to claim 2, wherein the coupling means comprise a clamp. 10
4. Apparatus according to claim 2, wherein the coupling means comprise two or more pins. 15
5. Apparatus according to claim 3 or 4, wherein the moving body is slidably movable along a rail or the like. 20
6. Apparatus according to claim 5, wherein the moving body is actuated by an electric motor. 25
7. Apparatus according to claim 6, comprising a tension cable and winding and unwinding means actuated by the electric motor.
8. Apparatus according to claim 5, wherein the moving body is actuated by compressed air or hydraulic fluid. 30
9. Apparatus according to any one of the preceding claims, wherein the control means comprise a microprocessor. 35
10. Apparatus according to any one of the preceding claims, wherein the control means comprise a microcomputer, such as a personal computer. 40
11. A workholder to be used in an apparatus for the automatic feeding and withdrawal of the same to and from an automated sewing machine, comprising a frame within which one or more pieces of material to be sewn are fastened, a clampable end for the x-y clamping device, positioned on one side of the workholder frame, and at least two receiving means for the coupling means of the displacement means, positioned on two other adjacent sides. 45
12. A workholder according to claim 11, wherein the receiving means comprise two or more holes provided on the sides of the frame. 50
13. Apparatus for the automated sewing of a piece of material comprising:
- a sewing head;
 - automatic feeding and withdrawal apparatus as claimed in claim 1;
 - an x-y system to move the workholder to the sewing position and during sewing operations; and
 - at least one microprocessor to control the operation of the sewing head, of the automatic feeding and withdrawal apparatus, and of the x-y system. 55

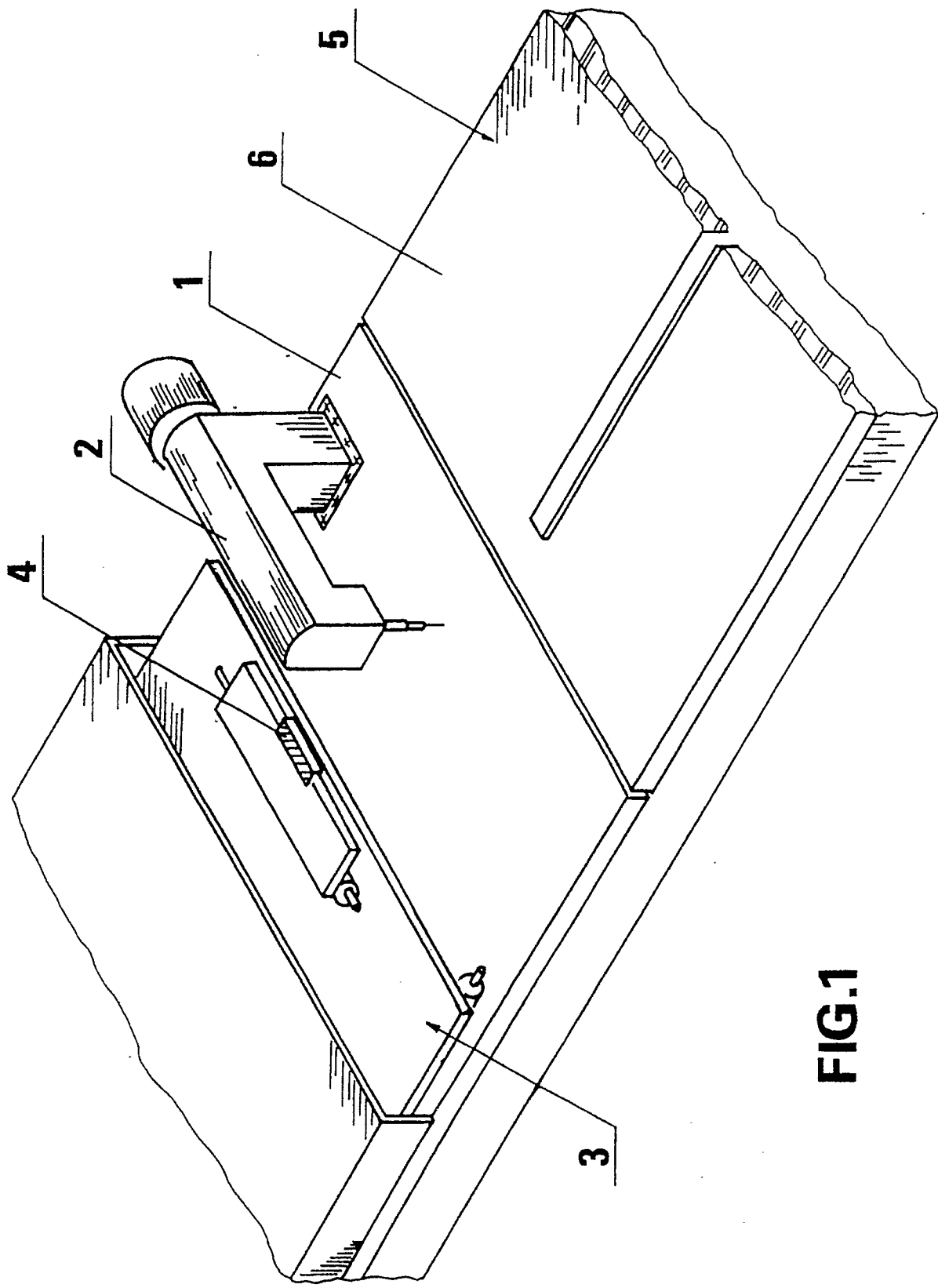


FIG.1

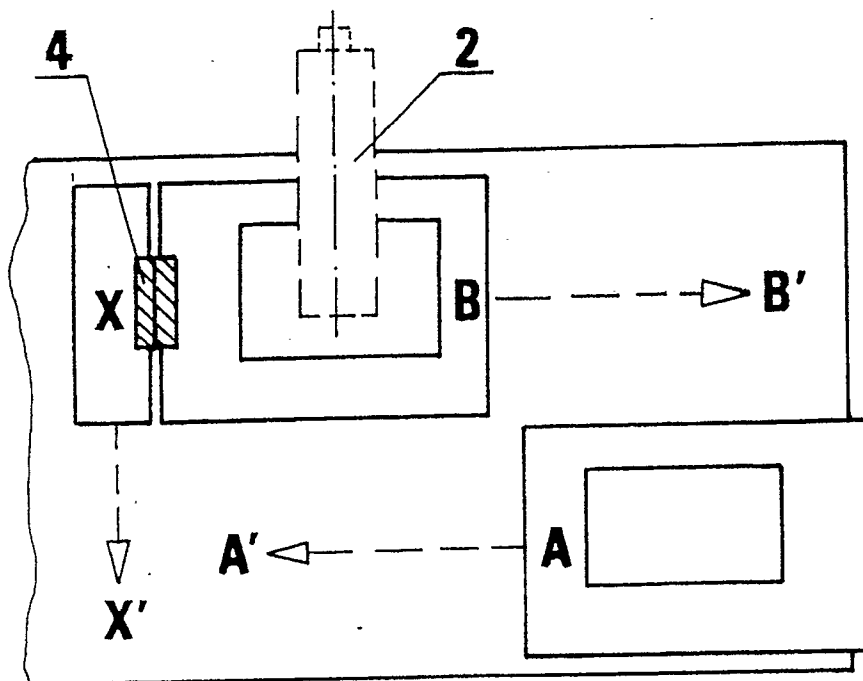


FIG. 2

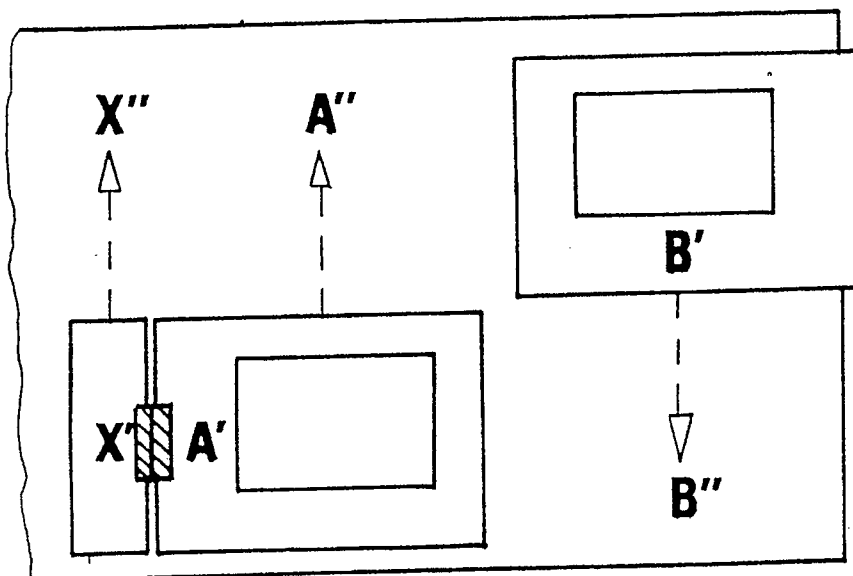


FIG. 3

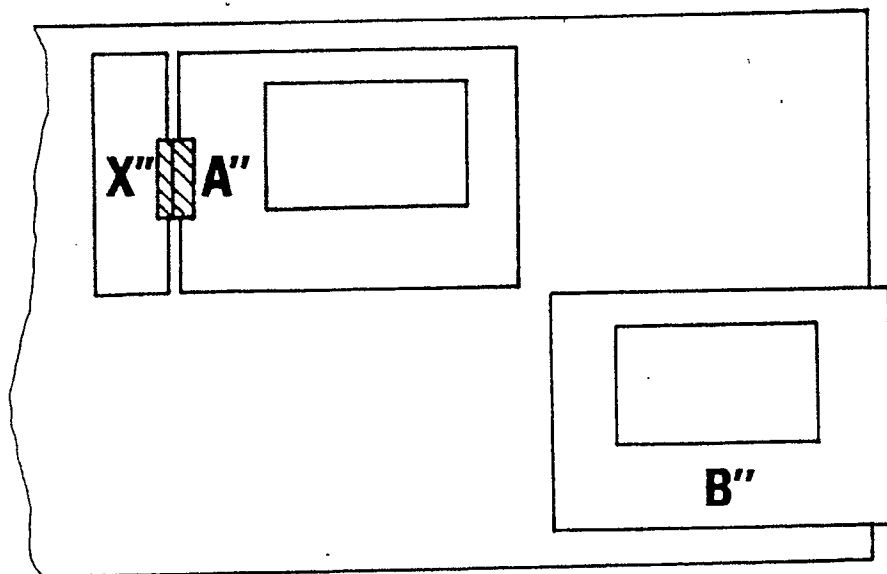


FIG. 4

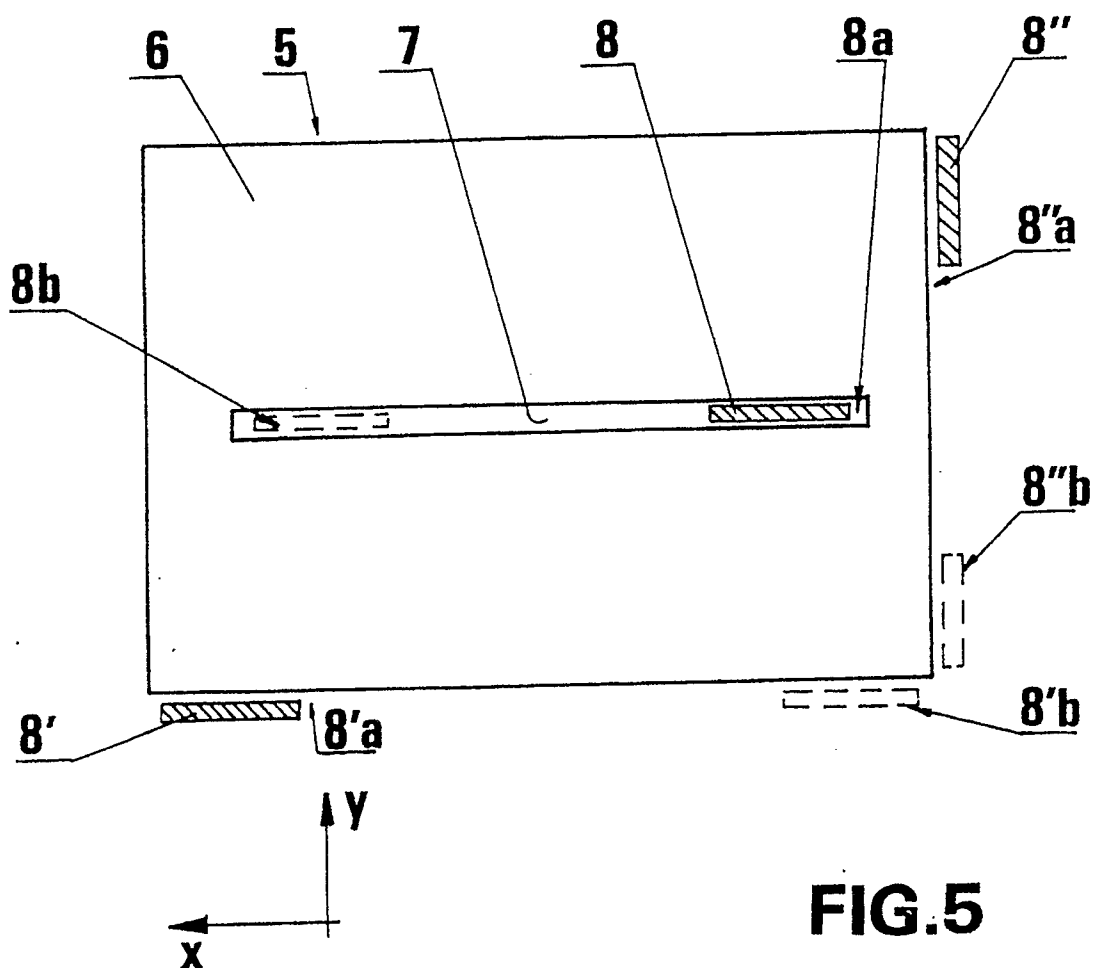


FIG. 5

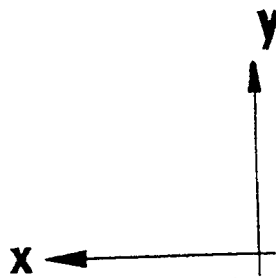
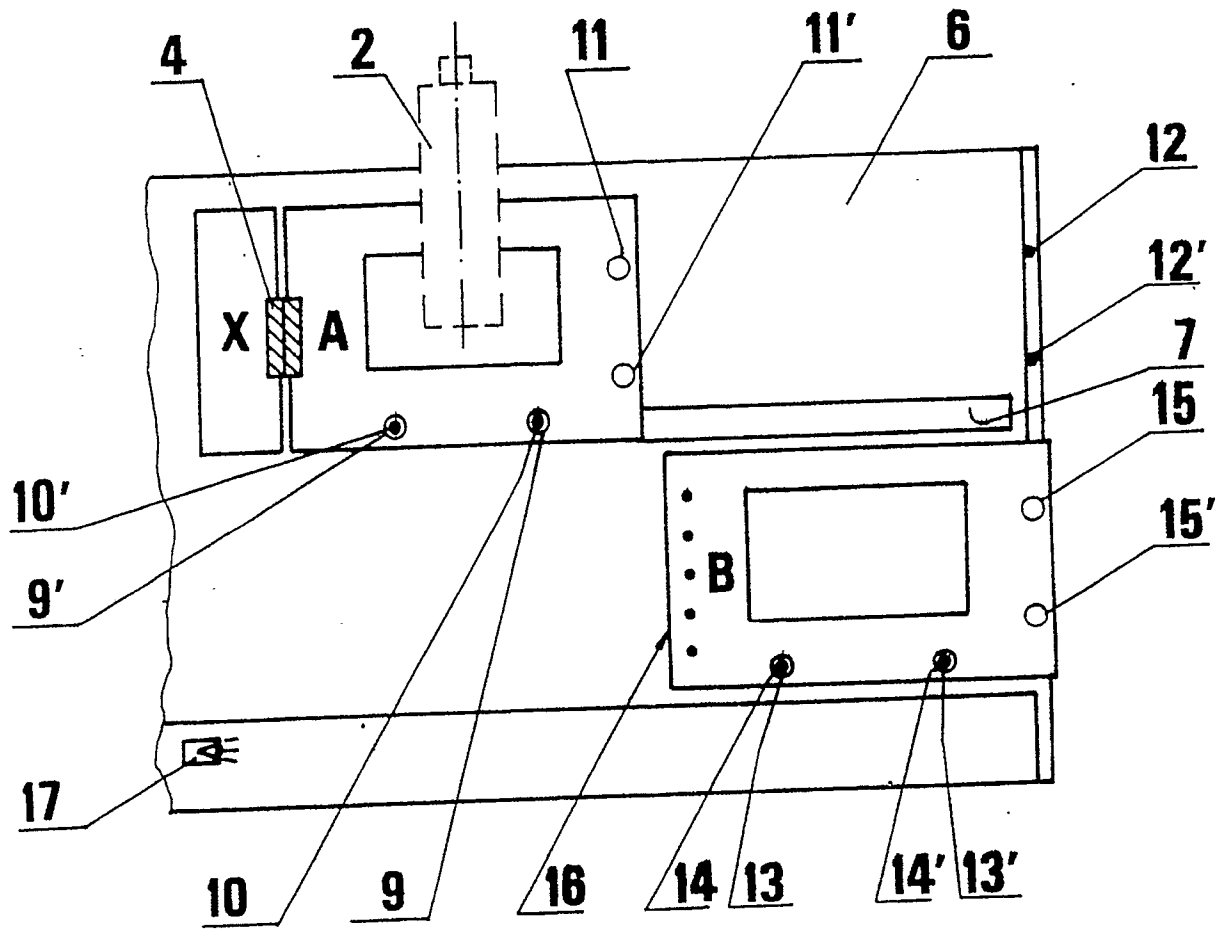


FIG. 6

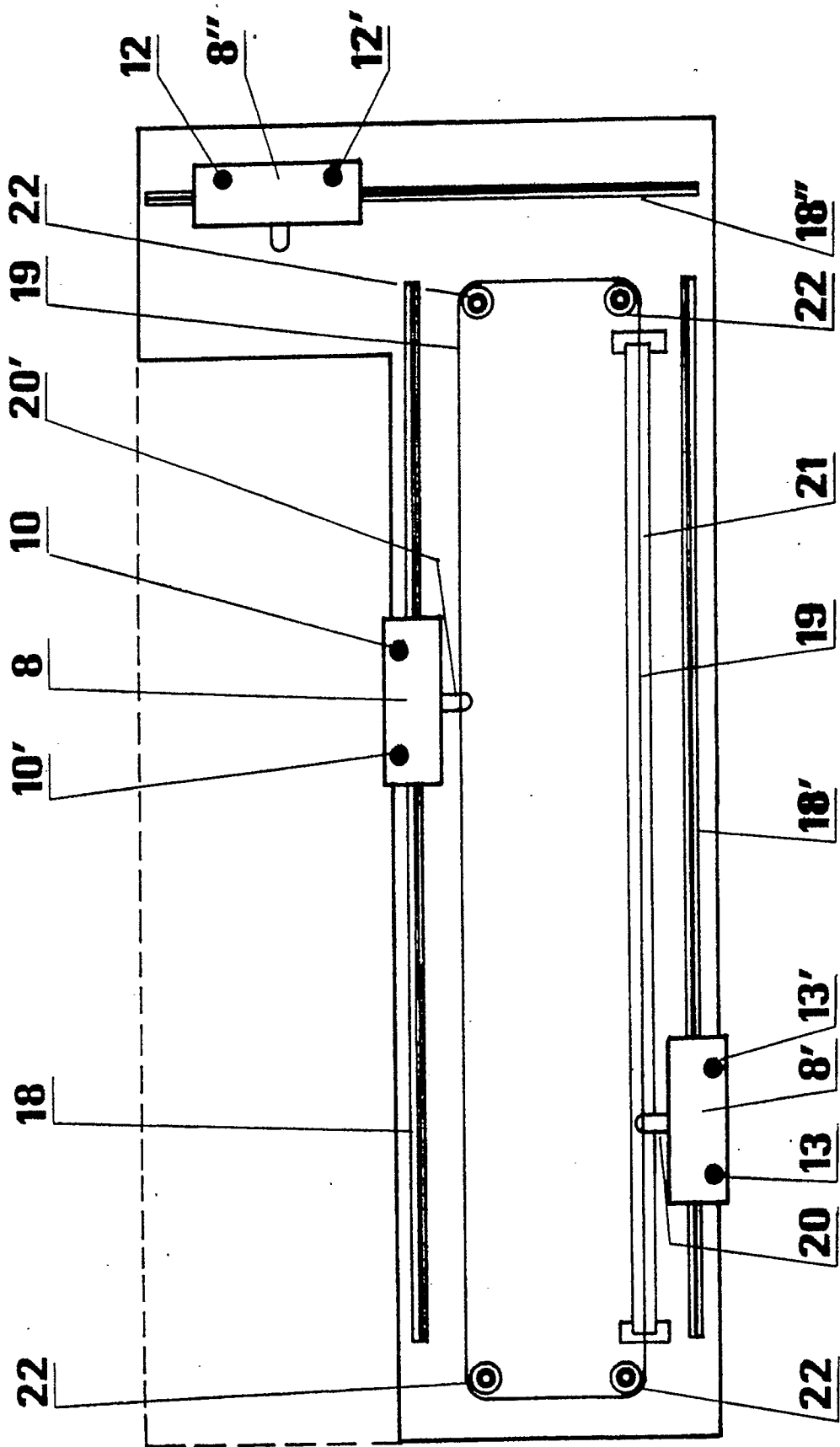
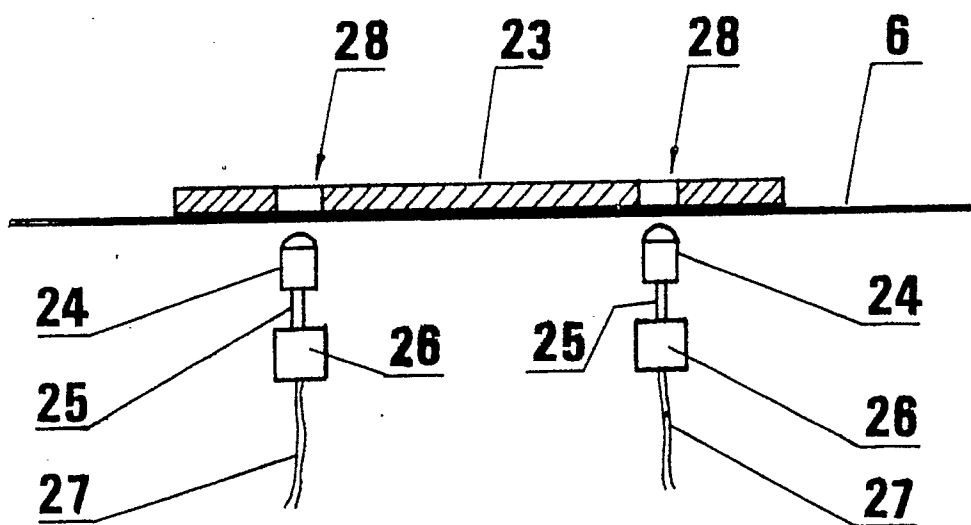
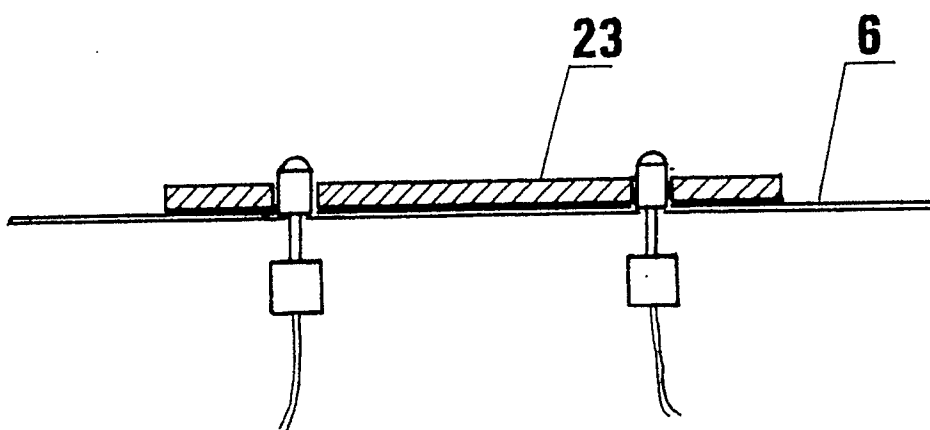


FIG. 7



(a)



(b)

FIG. 8



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**EUROPEAN SEARCH
REPORT**

Application Number

EP 90 11 7258

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-3 669 046 (D.W. FOWLER) * claim 1; figure 2 * - - -	1,2,5-7, 13	D 05 B 33/00
A	US-A-3 769 924 (W.H. ROGERS) * column 2, line 6 - column 3, line 19; figure 1 * - - - - -	1-3,5, 8-11,13	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			D 05 B A 41 H
The present search report has been drawn up for all claims			
Place of search		Date of completion of search	Examiner
The Hague		02 January 91	COURRIER,G.L.A.
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