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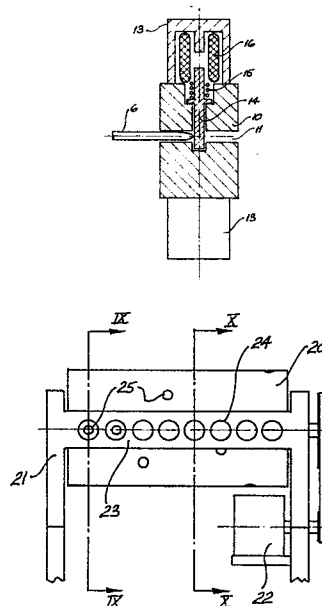
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⑤4 A Jacquard type system.

57) The present invention discloses a replacement mechanism for conventional Jacquard tapes. One form of the mechanism is a block (10) having a plurality of orifices (11) extending through the block (10) and through which the pins (16) of a conventional Jacquard mechanism can pass. Each orifice (11) is able to be individually opened or closed by the armature (14) of a corresponding solenoid (13). Alternatively, a rotatable drum (20) is provided with holes (25) through which the Jacquard pins (6) can pass, rotation of the drum aligning or mis-aligning pins (6) and holes (25) to respectively allow or prevent relative movement between drum (20) and pins (6). A Jacquard tape punching mechanism (40, 41) incorporating the abovedescribed drum arrangement is also disclosed.



"A JACQUARD TYPE SYSTEM"

The present invention relates to a Jacquard type system and in particular to a controller for use with a Jacquard mechanism for embroidery, carpet or weaving machines, and a punching device which permits Jacquard cards or tapes to be quickly produced.

The Jacquard mechanism has been in existence for almost 200 years and provides a plurality of pins, or fingers, which are able to penetrate, or not penetrate, a card or tape having a plurality of rows of encoding apertures.

The tape is moved relative to the pins so that those pins which correspond to holes in the tape remain in their initial position whilst those pins which do not correspond to holes are moved from their initial, or rest, position and thereby actuate the embroidery, carpet or weaving mechanism in accordance with the predetermined plan embodied in the encoded apertures. It will be appreciated, that the movement between the pins and the tape is relative and therefore the pins may be moved towards the tape, if desired.

After each stitch, or movement, has been read, the Jacquard tape is moved longitudinally by a small increment to bring the next row of holes to be decoded into alignment with the pins. A roll of Jacquard tape can be many meters in length, the length depending upon the number of movements required to be executed by the machine. For example, in an embroidery machine, the length of the Jacquard tape is dependent upon the number of stitches.

Furthermore, the Jacquard tape must have a length of blank tape at the start so that it can be fed through the mechanism to allow progress through the machine. Also, at the end of the Jacquard tape, there must be another length of unpunched tape in order to allow the tape to exit properly from the machine.

Because of the Jacquard tape's physical size, storage costs, the cost of blank card or tape prior to punching, the time consumed in loading and unloading the tape (which must be done for every complete cycle of the machine), the use of Jacquard tapes is an expensive and time

consuming procedure, notwithstanding their many advantages.

In addition, any holes which may, in error, not have been punched in the tape, or which may have been blocked by dirt or some other obstruction, can cause errors in the intended operation of the machine. Furthermore, the life of a Jacquard tape is to some extent limited because it is being subjected to the pins detecting whether or not a hole is present in the tape, so the tape deteriorates after a number of cycles.

The object of the present invention is to improve the Jacquard system and provide a controller which enables existing Jacquard mechanisms to operate without the need for any tape and preferably with electronic control. In addition, a punching device for reproducing or preparing Jacquard tapes is also provided in order to substantially reduce the cost of production of such tapes.

According to one aspect of the present invention there is disclosed a controller for a Jacquard mechanism having a plurality of longitudinally actuatable pins, said controller comprising a like plurality of aperture means each located opposite to, and aligned with, the corresponding pin, each of said aperture means being reciprocable relative to said pins to pass said pins through said aperture means, and selector means to render open or closed each of said aperture means whereby only those ones of said pins passing through open ones of said aperture means remain unactuated. The selector means can take the form of a solenoid device having an armature which opens or closes the aperture. Alternatively, the selector means can take the form of a rotatable drum having a plurality of holes therein.

According to another aspect of the present invention there is disclosed a punching device for punching apertures in Jacquard cards or tapes, said device comprising a rotatable drum having a plurality of openings therein, a plurality of punch fingers, and means to reciprocate said fingers relative to said drum whilst passing an unpunched Jacquard tape past said fingers, those fingers passing through correspondingly positioned openings in said drum not

punching an aperture in said tape. Preferably the punching device is equipped with a printing device to print on the tape a command or instruction corresponding to the punched apertures. Additionally, or alternatively, a read device
5 can read the apertures punched in order to verify same.

Embodiments of the present invention will now be described with reference to the drawings in which:

Fig. 1 is a schematic side elevation of a conventional Jacquard mechanism,

10 Fig. 2 is a schematic plan view of the conventional mechanism of Fig. 1,

Fig. 3 is a schematic side elevation of a controller of the first embodiment,

15 Fig. 4 is a side elevational view taken along the line IV-IV of Fig. 3,

Fig. 5 is a cross-sectional view taken along the line V-V of Fig. 4,

Fig. 6 is a cross-sectional view identical to Fig. 5 but showing the solenoid energised,

20 Fig. 7 is a schematic end elevation of a controller of a second embodiment,

Fig. 8 is a front elevation taken along the line VIII-VIII of Fig. 7,

25 Fig. 9 is a cross-sectional view taken along the line IX-IX of Fig. 8,

Fig. 10 is a cross-sectional view taken along the line X-X of Fig. 8,

Fig. 11 is a schematic end elevational view of a punching device of a preferred embodiment,

30 Fig. 12 is a side elevation taken along the line XII-XII of Fig. 11,

Fig. 13 is a cross-sectional view taken along the line XIII-XIII of Fig. 12,

35 Fig. 14 is a view similar to Fig. 13 but illustrating the tape being punched,

Fig. 15 is a side elevation of a combination punch and printer,

Fig. 16 is a plan view of the apparatus of Fig. 15,

Fig. 17 illustrates the output of the apparatus of

Fig. 16 and 17, and

Fig. 18 is a schematic side elevational view of a multi-stage tape preparation device of a preferred embodiment.

5 Turning now to Figs. 1 and 2, the conventional Jacquard mechanism comprises a length of tape 1 which extends between two rolls 2,3. The tape 1 is moved longitudinally by a sprocket wheel 4, or other conventional tape transport device.

10 The tape 1 passes through a feed device 5 which is reciprocally movable towards a plurality of feed fingers, or pins, 6 which, when actuated, operate the actual embroidery machine, carpet making machine, weaving machine, or the like.

15 As the tape is moved towards the pins 6, those pins 6 which are to remain unactuated, pass through holes in the tape 1 and therefore remain in their rest position. However, those pins 6 which are not aligned with a corresponding hole in the tape 1, are actuated by tape 1 and moved from their rest position.

20 Thus the coding determined by the presence or absence of holes in each row of holes extending across the tape 1 determines which pins 6 are to be actuated and the sequence of rows determines the sequence of operations of the pins 6.

25 Referring now to Figs 3 to 6 inclusive, in accordance with the preferred embodiment of the present invention, the Jacquard tape is replaced by a guide block 10 having a plurality of orifices 11 which comprise bores passing directly through the guide block 10. Each of the
30 orifices 11 corresponds with a matching one of the pins 6 which remain unchanged. The guide block 10 is mounted on a bracket 12 so as to be reciprocated relative to the pins 6 by the conventional operating mechanism of the machine.

35 Mounted above and below the guide block 10 are a plurality of solenoids 13 each of which has an armature 14 biased by a spring 15 so as to close the orifice 11 when the solenoid coil 16 is unenergized.

 In Fig. 5 the solenoid coil 16 is unenergized and therefore the armature 14 blocks or closes the orifice 11

thereby actuating the pin 6 as the guide block 10 is moved towards the pins 6. However, as illustrated in Fig. 6, where the solenoid coil 16 is energized, the armature 14 is drawn towards the solenoid 13 against the action of spring 15 thereby clearing or opening the orifice 11 and permitting the pin 6 to pass through the orifice 11 and therefore remain in its rest position as guide block 10 is moved towards the pin 6. As seen in Fig. 4, it will be apparent that locating solenoids 13 both above and below the guide block 10 permits the spacing between adjacent solenoids 13 to be twice the spacing between adjacent pins 6 and their corresponding orifices 11.

A second embodiment of the controller of the present invention is illustrated in Figs. 7 to 10 inclusive. A hollow drum 20 is mounted in a frame 21 and is rotatable about its longitudinal axis by means of a stepping motor 22. A guide bar 23 having a plurality of openings 24 each corresponding to a pin 6, is provided intermediate the pins 6 and drum 20. The frame 21 permits the entire arrangement to be reciprocated towards and away from the pins 6 so that the pins 6 penetrate the openings 24 in the guide bar 23.

As seen in Figs. 9 and 10, depending upon the position of the drum 20, the pins 6 either penetrate the drum 20 and therefore are not displaced from their rest position, or do not penetrate the drum 20 in which case the pins 6 are displaced from their rest position.

Which, if any, of the pins 6 are displaced from their rest position is determined by the position of a plurality of holes 25 in the drum 20 and also by the position of the drum 20 at the particular instance. It will be apparent that the desired "program" or sequence of operations to be executed by the fingers 6 will be a function of both the location of the holes 25 in the drum 20 and also the position of the drum 20 as determined by stepping motor 22.

It will be also apparent to those skilled in the art that the solenoid armature 14 of Figs. 3 to 6 and the drum 20 of Figs. 7 to 10 are both strong and durable items which possess a low moment of inertia. Thus fast operation of the

controller can be achieved and there is no wear as is the case with conventional paper, Jacquard cards or tapes. Furthermore, the solenoids 13 or stepping motor 22 can be operated electronically and therefore the desired program of instructions can be stored on magnetic tape, or like electronic storage media.

The drum 20 of Figs. 7 to 10 can also be used to create conventional Jacquard tapes by means of the punching device illustrated in Figs. 11 to 14. The drum 20 is mounted in a frame 30 and rotatable by stepping motor 22 as before. The Jacquard tape 1 passes through a punch head and card feed block 31 which is able to be vertically reciprocated towards and away from the drum 20, the tape 1 rising and falling with the block 31. Contained within the block 31 are a plurality of punch fingers 32 which correspond to the pins 6 of Figs. 1 to 10. The punching fingers 32 are biased by means of springs 33 away from the tape 1.

As seen in Figs. 13 and 14, depending upon the position of drum 20, as the block 31 moves towards the drum 20 the punching fingers 32 either enter the drum 20 (in which case no hole is punched in the tape 1) or are forced downwardly by the drum 20 to compress the spring 33 and punch a hole in the tape 1 as illustrated in Fig. 14.

It will be apparent to those skilled in the art, that the apparatus of Figs. 11 to 14 permits a program stored on a magnetic tape, for example, to be used to control the stepping motor 22 and thereby create the same program as a pattern of holes in the Jacquard tape 1. Furthermore, the holes may be punched at high speed relative to conventional, entirely mechanical, tape duplicating and punching arrangements. In addition, the punching fingers 32 permit relatively tough and durable material such as MYLAR (Registered Trade Mark) plastics film to be used instead of paper or cardboard.

As seen in Fig. 12, the drum 20 can be provided as a plurality of co-axially aligned drums or cylinders 20A, 20B and 20C as indicated by dashed lines. This is particularly advantageous where the length of each drum 20A, 20B and 20C

corresponds to a number of holes 25 representing a unit of data such as a character or individual stitch. Thus the drums 20A, 20B and 20C can be rotated independently of each other to provide a greater variety of combinations of holes 25. Naturally each drum 20A, 20B and 20C requires a corresponding stepping motor 22. an equivalent arrangement is equally applicable in respect of the controller of Figs. 7 to 10.

Turning now to Figs. 15 to 17, it requires many years practice and a high degree of skill to be able to "read" Jacquard tapes so as to decipher the encoded holes contained in each row. Therefore, in accordance with a further embodiment of the present invention, a tape printer and puncher are combined together and operated in synchronism so that blank tape is both punched with the desired coded holes and simultaneously, or substantially simultaneously, printed with comments or instructions which indicate the various stages of the embroidery process, for example, to be carried out.

Thus, as seen in Figs. 15 and 16, a punch 40 and printer 41 are positioned side-by-side so as to produce from a blank tape 42 a punched and printed tape 43. Fig. 17 illustrates both the blank tape 42, the final punched and printed tape 43 and the intermediate, punched only, tape 44. It will be apparent to those skilled in the art that by reversing the direction of movement of the tape, or transposing the punch 40 and printer 41, it is possible to first print the tape and then punch it.

Furthermore, turning now to Fig. 18, it is highly desirable that Jacquard tapes be provided with a means of ensuring that the tape has been correctly punched. In this way, minor errors which are not immediately apparent to the eye when the article, for example, is embroidered but which result in stitches coming undone prematurely, can be detected.

Such an arrangement is illustrated in Fig. 18. The apparatus comprises a first stage 50, an intermediate stage 51, and a final stage 52. The first stage 50 can be either a punching mechanism, or a printer; the intermediate stage

51 can be either a reader, a punching mechanism, or a
printer; and the final stage 52 can be either a reader or a
printer. Clearly it is necessary that each stage be
different and that a read, printer and punching mechanism
5 all be provided with the reader "downstream" from the
punching mechanism. In this way, the tape 1 can be punched,
printed and verified in a single "pass" through the
apparatus. It will be apparent to those skilled in the art
that the reader can be either an optical, or a mechanical,
10 reader. The optical reader is easily realised by means of
LED's which direct light through the holes in the tape 1 to
be detected by photo-transistors.

The foregoing describes only some embodiments of the
present invention and modifications, obvious to those
15 skilled in the art, can be made thereto without departing
from the scope of the present invention.

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CLAIMS

1. A controller for a Jacquard mechanism having a plurality of longitudinally actuatable pins, said controller comprising a like plurality of aperture means each located
5 opposite to, and aligned with, the corresponding pin, each of said aperture means being reciprocable relative to said pins to pass said pins through said aperture means, and selector means to render open or closed each of said aperture means whereby only those ones of said pins passing
10 through open ones of said aperture means remain unactuated.

2. A controller as defined in claim 1, wherein said selector means and said aperture means are combined in a drum having a plurality of holes therein and rotatable about its longitudinal axis.

15 3. A controller as claimed in claim 2, wherein said drum comprises a plurality of coaxially aligned adjacent cylinders each having a plurality of said holes, each of said cylinders being individually rotatable of its longitudinal axis.

20 4. A controller as defined in claim 2 or 3, wherein said drum is rotatable by stepping motor means.

5. A controller as defined in claim 1, wherein said selector means comprises a plurality of solenoid devices each having an armature which opens or closes said
25 aperture means.

6. A controller as claimed in claim 5 wherein said solenoid devices are mounted on a guide block, said aperture means comprises a plurality of parallel orifices extending through said guide block, each orifice
30 corresponding to one of said solenoids, each solenoid armature passes transversely across the corresponding orifice, and said guide block is longitudinally reciprocal in the direction of said orifices relative to said pins.

7. A controller as claimed in claim 6 wherein
35 each solenoid armature is resiliently biased to extend across the corresponding orifice when the corresponding solenoid is unenergised, energisation of said corresponding solenoid withdrawing said armature from the corresponding orifice.

8. A punching device for punching apertures in Jacquard cards or tapes, said device comprising a rotatable drum having a plurality of openings therein, a plurality of punch fingers, and means to reciprocate said fingers
5 relative to said drum whilst passing an unpunched Jacquard tape past said fingers, those fingers passing through correspondingly positioned openings in said drum not punching an aperture in said tape.

9. A punching device as claimed in claim 8,
10 wherein said drum comprises a plurality of coaxially aligned adjacent cylinders each having a plurality of said holes, each of said cylinders being individually rotatable of its longitudinal axis.

10. A punching device as defined in claim 8 or 9,
15 wherein said punching device is equipped with a printing device to print on the tape a command or instruction corresponding to the punched apertures.

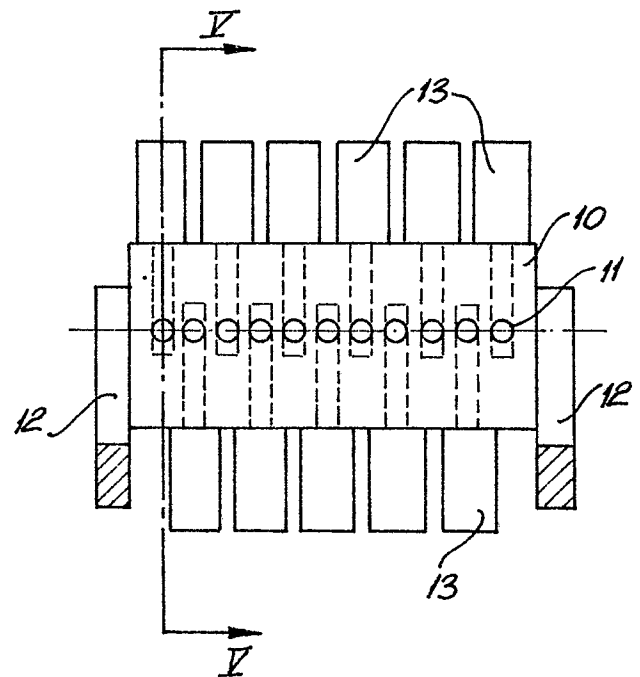
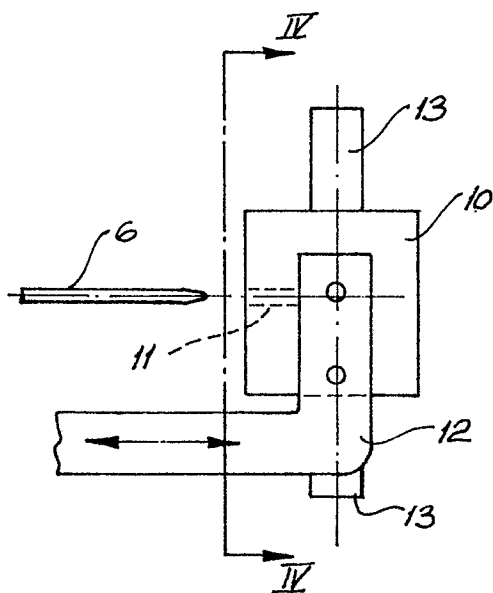
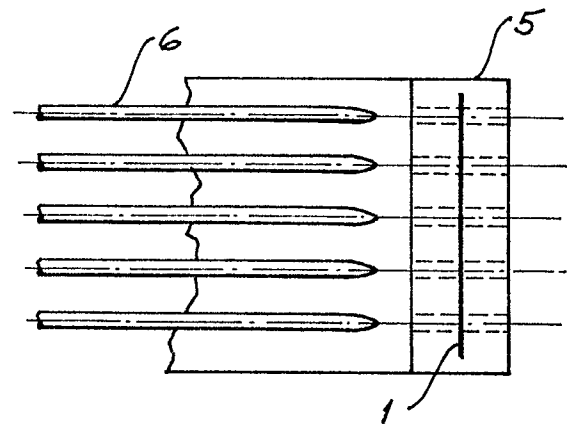
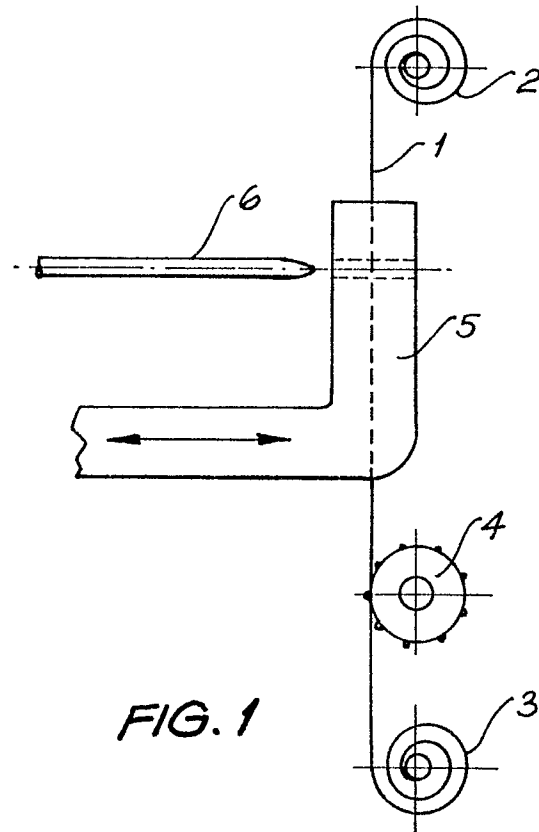
11. A punching device as defined in any one of claims 8 to 10, wherein said punching device is equipped
20 with a read device to read the apertures punched in order to verify same.

~~12. A controller substantially as herein before described with reference to Figs. 3 to 6 or Figs. 7 to 10 of the drawings.~~

25 ~~13. A punching device substantially as described with reference to Figs. 11 to 14, or Figs. 15 to 17 or Fig. 18 of the drawings.~~

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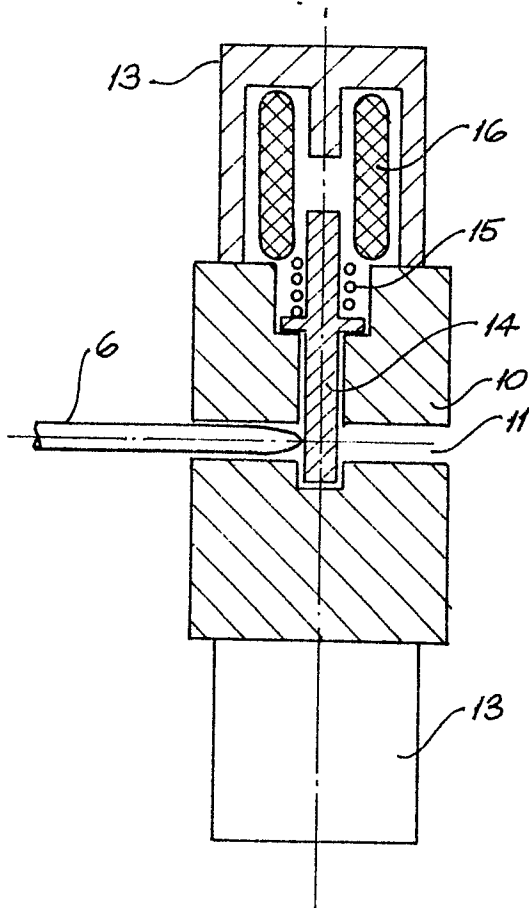


FIG. 5

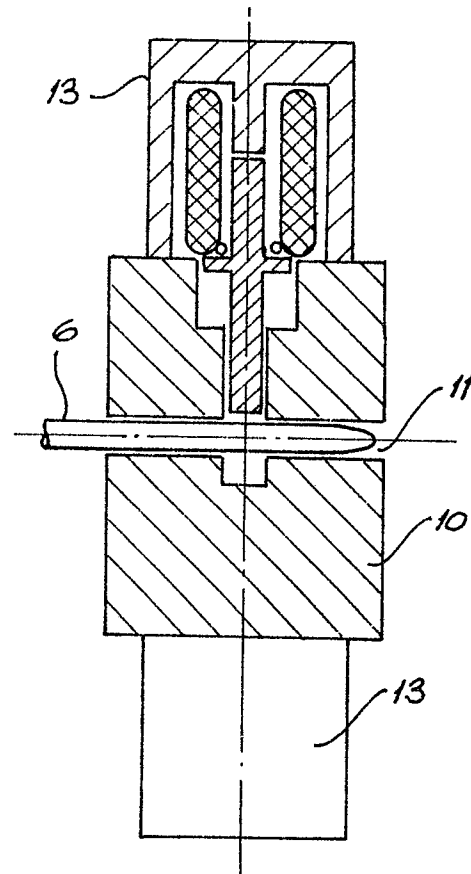


FIG. 6

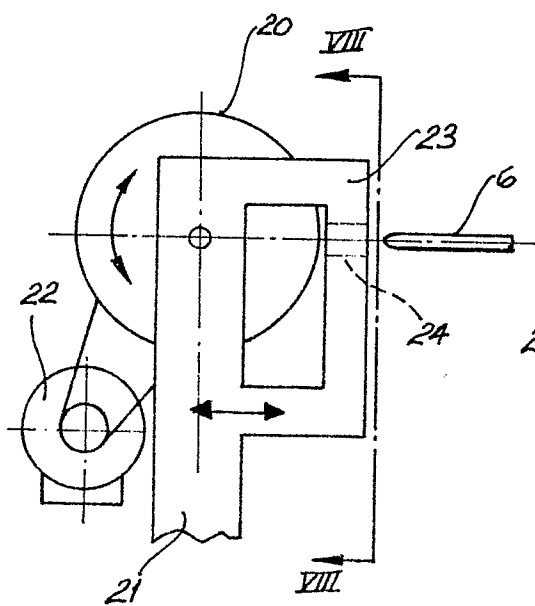


FIG. 7

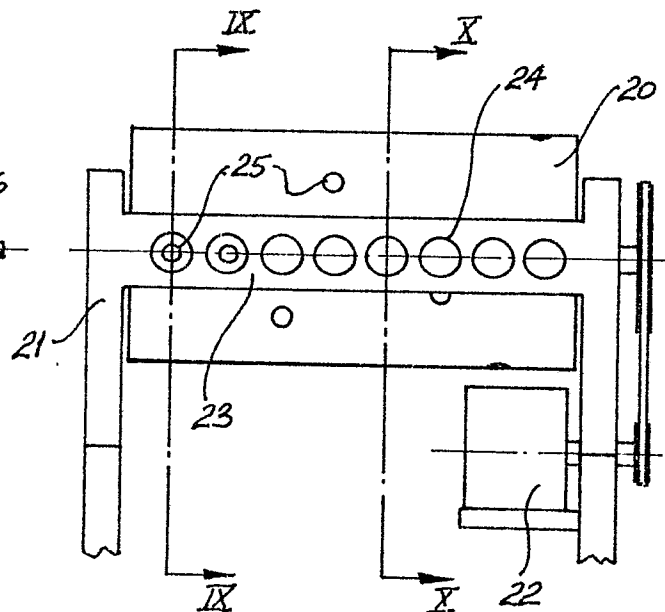


FIG. 8

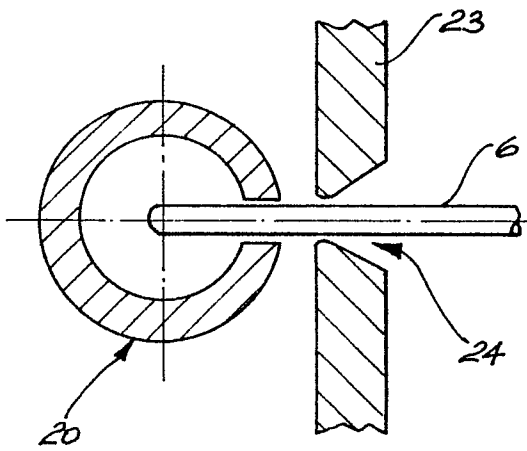


FIG. 9

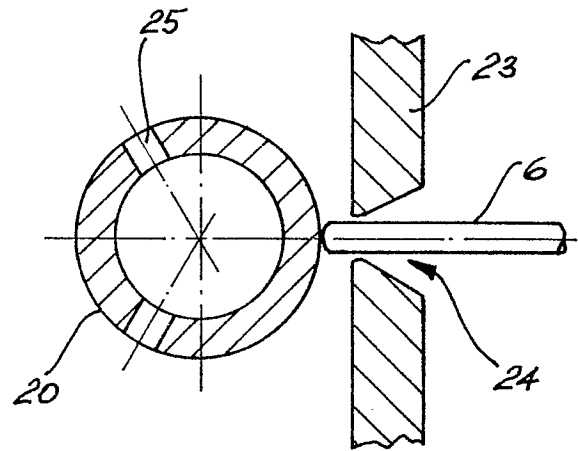


FIG. 10

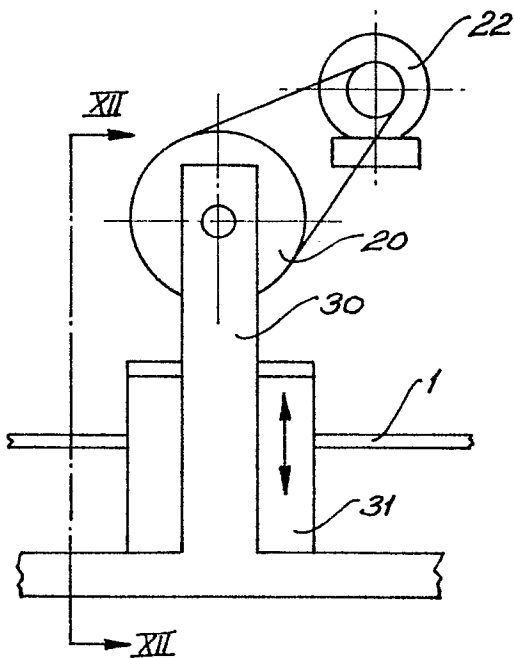


FIG. 11

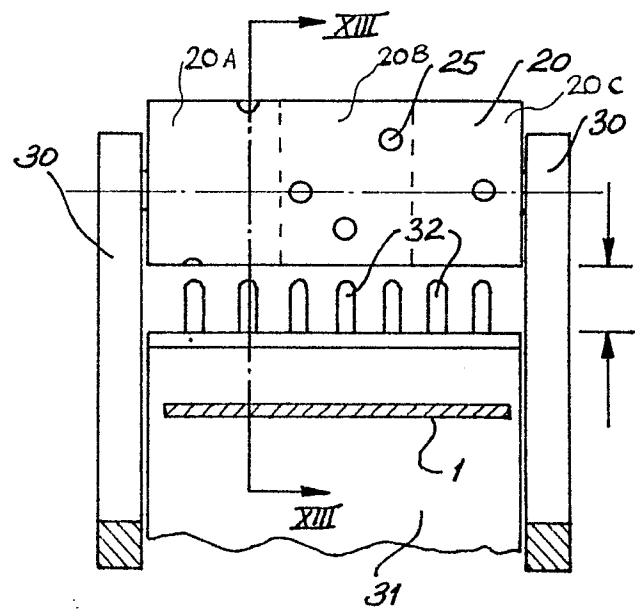


FIG. 12

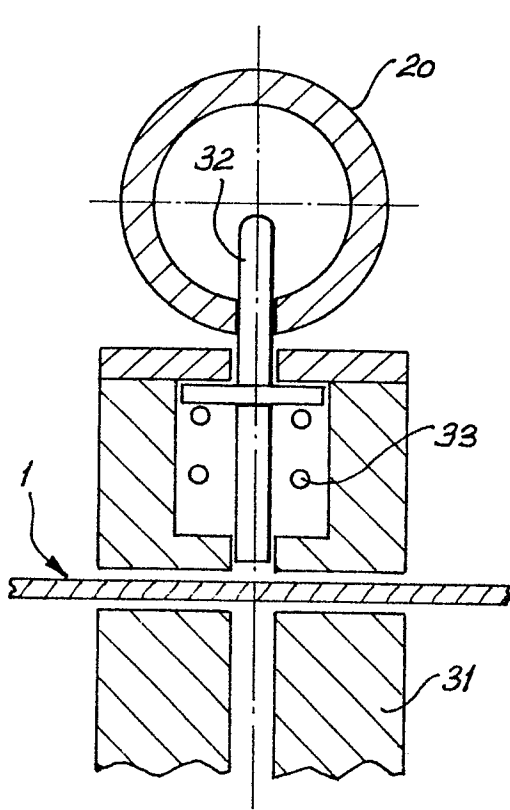


FIG. 13

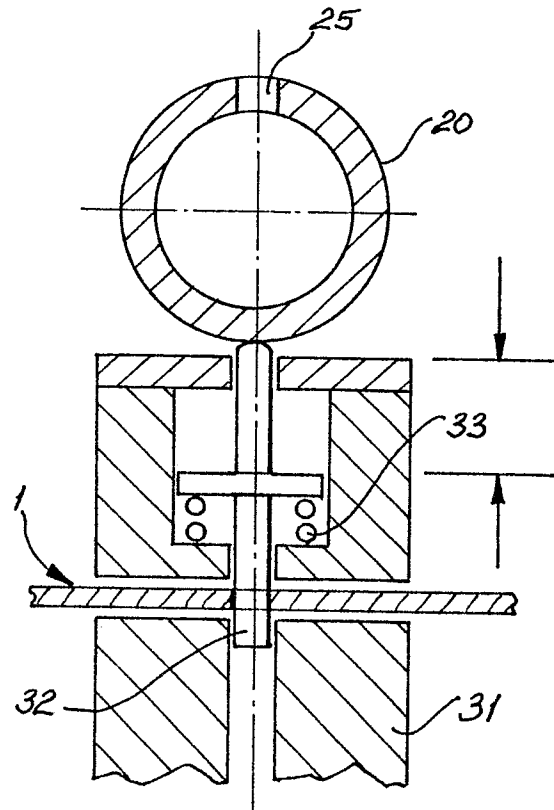


FIG. 14

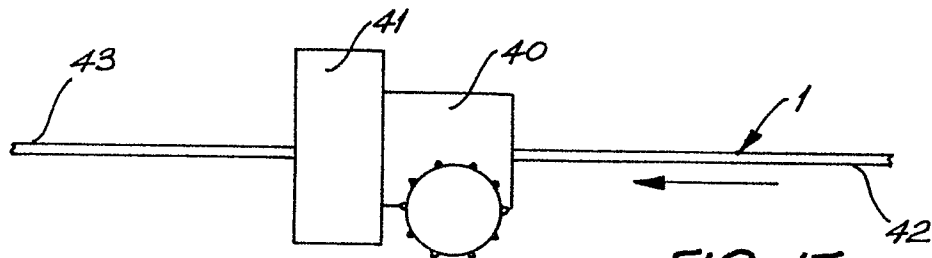


FIG. 15

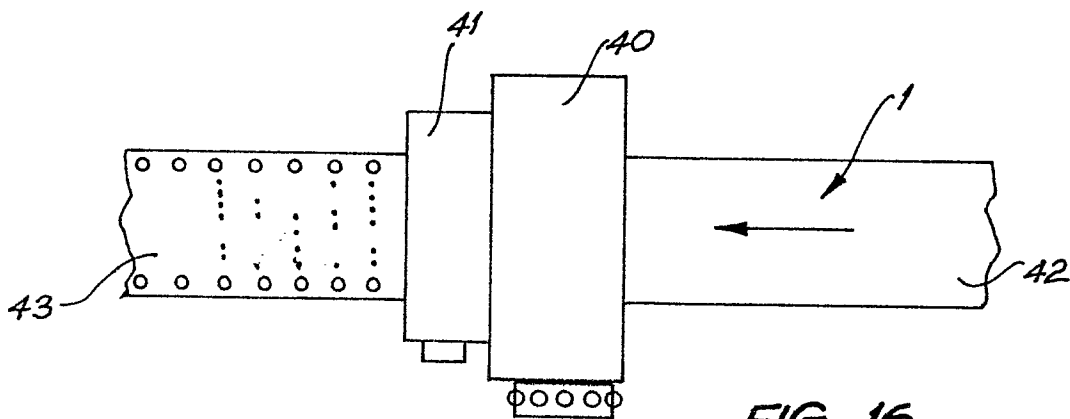


FIG. 16

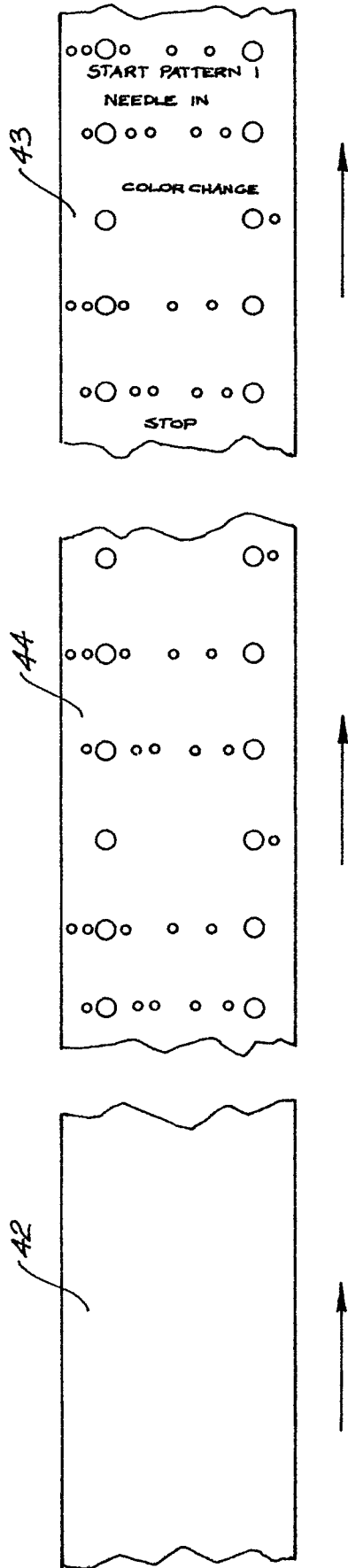


FIG. 17

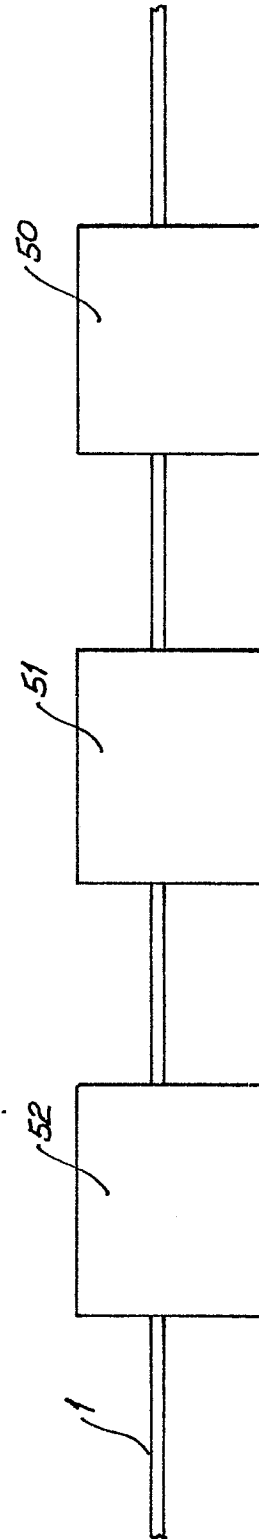


FIG. 18