

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 630 277 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

01.03.2006 Bulletin 2006/09

(51) Int Cl.:

D05B 23/00 (2006.01)

(21) Application number: **05005355.2**

(22) Date of filing: **11.03.2005**

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR**
Designated Extension States:
AL BA HR LV MK YU

(72) Inventor: **Inli, Mustafa**

**Cifte Hafuzlar Cad.
Istanbul (TR)**

(74) Representative: **Modiano, Micaela Nadia et al
Dr. Modiano & Associati S.p.A.**

**Via Meravigli 16
20123 Milano (IT)**

(30) Priority: **26.07.2004 TR 200401840**

(71) Applicant: **Conti Complet S.p.A.
20156 Milano (IT)**

(54) Apparatus and method for closing toe parts of socks

(57) Apparatus for closing the toe part of a sock, comprising a frame (14), at least one sewing head (11, 12) mounted on the frame (14) for sewing the toe part of a

sock and a conveyor (13) for conveying the sock to said at least one sewing head (11, 12). The sewing head (12) can move with respect to the frame (14) so as to sew the toe part according to a substantially curved line.

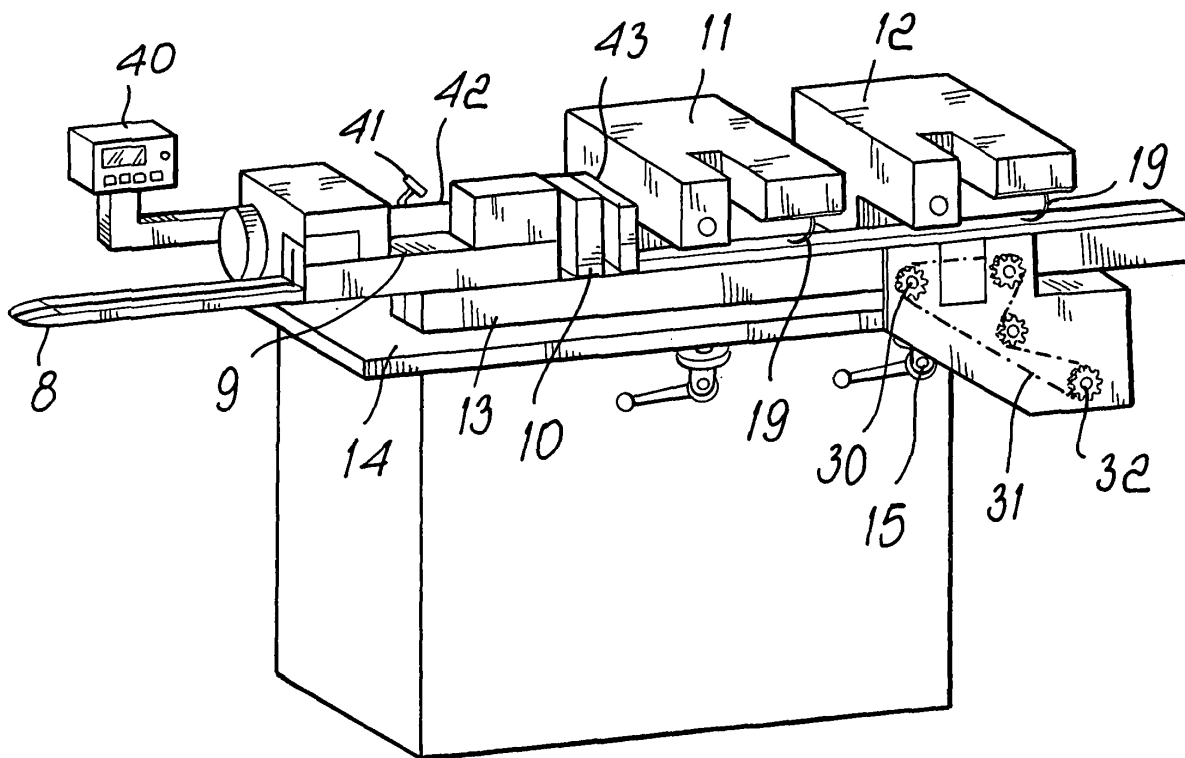


Fig. 8

EP 1 630 277 A1

Description

[0001] The present invention relates to an apparatus and a method for closing toe parts of socks. Particularly, the invention relates to an assembly equipped with a microprocessor controlled assembly that enables a shifting movement of the sewing heads, thereby enabling fine seaming of the toe part of the sock.

[0002] Sock weaving machines weave the sock in seven parts, namely welt 1, heel 3, sole 4, toe 5, toe seam allowance 6, scrap 7 and leg portion 2. Once the sock is woven, the toe part of the sock coming from the knitting machine is seamless, i.e. open (see Figure 1).

[0003] Seaming of this open hosiery toe part is effected by another apparatus. A conventional hosiery toe closing apparatus consists of following components: a clip 8 on which the sock is fitted, a chain 9 that inserts the sock fitted to the clip 8 into a conveyor 13, a knife assembly 10 that cuts and separates the scrap part 7 of the sock, a first head 11 sewing the hosiery toe, a second head 12 sewing the hosiery toe, a conveyor 13 passing the sock through the seam frame 14, an arm 15 for securing the heads 11 and 12 to the frame, an upper revolving body 16, a lower stationary body 17 and a base 18 (Figure 2).

[0004] The stages of a sock toe sewing apparatus, depending on the components of this apparatus, conventionally comprise the following steps: during production the sock toe seam allowance 6 is made of fine yarn and is clipped to the clip from this sock seam. The guide chain 9 catches the sock from its scrap part 7 and inserts the sock appropriately on the conveyor (Figure 3). The scrap part 7 of the sock advancing on the conveyor is cut when passing through the knife assembly 10 and this scrap part is sucked by a suction mechanism and sent into a separate vessel (Figure 4).

[0005] After this step, the hosiery toe of the sock is ready for sewing. When the sock passes under the first head 11, it is sewn by the needle on this head.

[0006] The first head is firmly attached to the frame of the apparatus and, therefore, the sock transported in the linearly moving conveyor enables the stationary head 11 to perform a linear sewing (Figure 5).

[0007] In a similar way, when the sock passes through the second head 12 it is subjected to another sewing procedure. The purpose of this second sewing is usually to sew the sock at two different distances and thus to increase the sewing stability. Since the second head is attached to the frame similarly to the first head, the sock transported in the linearly moving conveyor again enables a linear sewing procedure (Figure 6).

[0008] However, the fact that the sewing heads are attached to the frame, causes the seams to be linear and the curved form of the hosiery toe part of the sock makes the continuity of the seam impossible to achieve (Figures 7a and 7b). A top view of the hosiery toe seam form resulting from the foregoing assembly is shown in Figures 7a and 7b.

[0009] According to Figure 7a, the sock toe is com-

posed of three components. The component indicated by 21 represents the seam line, the component indicated by 20 represents the region within the seam and the elements indicated by 22 represent the side regions. In Figure 7a, the region within the seam is relatively thick and it is not possible that side regions are wasted (cracked) with such a thick seam. Therefore a solid sewing configuration is obtained by this arrangement. However, this kind of thick seam socks may irritate the toe region of the user because of a frictional effect of the shoe against the sock and thus makes the sock uncomfortable to wear.

[0010] In Figure 7b, the region 20 within the seam is made of fine seam. However, in this configuration with fine seam the side regions 22 cannot be sewn and, as a consequence thereof, the toe part of the sock may be cracked.

[0011] The technical problems presented above result from the fact that since the sewing heads are attached to the frame the sewing is made in a linear way.

[0012] The aim of the present invention is to sew the hosiery toe parts in an efficient way on the one hand with a fine seam and on the other hand without cracking the side parts of the hosiery toe region.

[0013] This aim and these and other objects which will become better apparent hereinafter are achieved by the apparatus for closing the toe part of a sock according to claim 1 and the method for closing the toe part of a sock according to claim 16.

[0014] The apparatus preferably comprises a clip for fitting the sock the toe of which is to be sewn, a guide chain for inserting the sock on the clip to the conveyor, a knife assembly for cutting and separating the scrap part from the sock, at least one sewing head for sewing the sock hosiery toe, a conveyor for conveying the sock to the sewing heads and a frame connected to this at least one sewing head, which is movable with respect to the frame. In particular, the sewing head is movable in a substantially vertical direction with respect to the sock conveying direction or to the plane of the conveyor.

[0015] In the preferred embodiments of the invention, two sewing heads are provided, namely a first head and a second head. Movement of these heads is driven by an automatic assembly that preferably comprises a sensor for identifying the sock advancing on the conveyor, a counter for detecting the position of the sock as well as its width and its distance from the sewing head, a microprocessor in which the data taken from these components are fed and a motor component controlled by this microprocessor.

[0016] With the structure according to the present invention, the toe regions of socks can be sewn on the one hand in a fine way and on the other hand without wasting (cracking) the side parts of the toe regions.

[0017] Further characteristics and advantages of the invention will become better apparent from the detailed description of particular but not exclusive embodiments, illustrated by way of non-limiting examples in the accom-

panying drawings, wherein:

Figure 1 is an illustration of a representative embodiment showing the parts of a sock coming from a weaving apparatus according to the state of the art; Figure 2 is an illustration of a representative embodiment showing the hosiery toe apparatus according to the state of the art;

Figure 3 is an illustration of a representative embodiment showing the arrangement of the sock in the clip assembly according to the state of the art;

Figure 4 is an illustration of a representative embodiment showing the cutting of the sock scrap part according to the state of the art;

Figure 5 is an illustration of a representative embodiment showing the sewing phase of the sock hosiery toe in the first head according to the state of the art; Figure 6 is an illustration of a representative embodiment showing the sewing phase of the sock hosiery toe in the second head according to the state of the art;

Figure 7a is an illustration of a representative embodiment showing the thick seam location of the sock hosiery toe according to the state of the art;

Figure 7b is an illustration of a representative embodiment showing the fine seam location of the sock hosiery toe according to the state of the art;

Figure 8 is an illustration of a representative embodiment showing the hosiery toe design apparatus according to the present invention;

Figure 9 is a flow diagram of the method for driving the head assembly of the hosiery toe apparatus according to the present invention;

Figure 10 is an illustration of a first embodiment showing an optical eye structure for identifying passage of the sock;

Figure 11 is an illustration of a first embodiment showing the assembly driving the sewing heads according to a first embodiment of the present invention;

Figure 12 shows a detailed illustration of the assembly driving the sewing heads according to the first embodiment the present invention;

Figure 13 is an illustration of the first embodiment showing the side view of the assembly driving the sewing heads according to the present invention;

Figure 14 shows an illustration of a sock toe sewn by means of the assembly of the present invention;

Figure 15 is a perspective view of the sewing head and its drive mechanism according to a second embodiment of the invention;

Figure 16 is a top view of the assembly of Figure 15;

Figure 17 is a cross sectional broken away view of the assembly of Figure 16, taken along line A-A;

Figure 18 is a cross sectional view of the assembly of Figure 16 taken along line B-B.

gard conventional arrangements which have been discussed above.

[0019] Figure 8 is an illustration of a first embodiment of the hosiery toe apparatus. According to this figure, a sock coming from a weaving apparatus and still not having a seam in its toe part is fitted to the apparatus by means of a clip assembly 8 of the known kind. The clip assembly 8 is connected to a guide chain 9 and the insertion of the sock to a linearly moving conveyor 13 is made through this guide chain 9.

[0020] The hosiery toe apparatus comprises a screw 41 and a proximity counter 42 sensible to this screw. Screw 41 is preferably attached to the main shaft of the sock apparatus and counter 42 is attached to the frame. At each rotation of the main shaft, the screw 41 comes face to face with the counter 42, the counter detects the face to face position and produces a signal that is fed to a microprocessor μP .

[0021] By the combined action of the screw 41 and the counter 42 sensible to this screw, the information about the position of the sock transported by the conveyor 13 in the apparatus at a given time, the width size of the sock and its distance to the sewing head are obtained.

[0022] Other sensing devices, e.g. of the optical kind, may be alternatively used for detecting the sock parameters.

[0023] As anticipated above, the scrap part of the sock shown in Figure 1 is removed from the sock by the knife assembly 10 and taken away from the apparatus, preferably via a suction unit (not shown).

[0024] An optical eye 43 sensor is provided for identifying the sock, before the toe part of the sock transported by the conveyor 13 is sewn. The signal received from the optical eye 43 is fed to the microprocessor. The optical eye 43 is designed to comprise a light source preferably provided in a signal transmitting cable 23 (Figure 10) and a light receptor provided in a signal receiving cable 24. An opening 25 is provided between these cables 23,24.

[0025] When the sock passes through this opening 25, since the connection between the light source and its associated receiver is interrupted, a signal is produced and this signal is sent to the microprocessor.

[0026] Sewing of the sock toe is preferably accomplished by means of two heads, namely a first head 11 and a second head 12. However, a structure made of only one head can optionally perform the sewing procedure, too. While the first head 11 preferably makes a weak seam in the form of basting, the second head 12 is the head in which the main seam is performed.

[0027] The components of the hosiery toe apparatus stated above are provided on a frame 14.

[0028] The sewing heads 11,12 or, in case of assemblies provided with one head only, the sewing head or anyone of these heads can move with respect to the frame 14 and, preferably, this movement is made in a vertical plane along an upward/downward directions. However, if desired, the movable head or heads can also be moved along a direction that is sloped with respect to

[0018] With reference to the figures, Figures 1 to 7 re-

the vertical or horizontal planes.

[0029] The movable sewing heads are pivotally mounted on the frame 14 so that they can rotate about an axis 38 together with the sewing mechanisms that are mounted into the sewing head. The axis 38 is laterally spaced with respect to the needle 19.

[0030] In order to drive the movable sewing head 12 or heads 11, 12 a motor is provided which receives the signals needed for the rotational drive from the microprocessor and which is connected to the moving head 12. In a preferred embodiment of the invention, this motor is a step motor. However, other types of motor that are known to the person skilled in the art can be provided in the alternative.

[0031] An arrangement for driving the head 12 is schematically shown in the flow-chart of Figure 9. The signals taken from the optical eye 43 and the counter 42 are fed to the microprocessor μ P and the motor 45 controlled by the microprocessor, depending on the coming drive, makes a rotational movement and drives the head 12.

[0032] The assembly shown in Figs. 11-13 provides for the movement transmission from the motor to the head according to a first embodiment of the invention. The movement transmission assembly comprises bearings 27 connected to the frame 14, a shaft 28 mounted between these bearings 27 and eccentric component 29 integrated to this shaft.

[0033] Shaft 28 is equipped at one end with a driving gear 30. A chain 31 connects this driving gear 30 to a gear 32 that is attached at one end of the motor.

[0034] In the first embodiment shown in Figure 8 and in Figure 11, two shafts 28, two eccentric components 29 mounted on them and two bearings 27 are provided and this combination allows movement of the second head 12. However, if desired, the first head 11 can also be driven with the same assembly.

[0035] An embodiment comprising only one movable head (without using another head) may be provided, too. As an alternative, a separate motor component for each sewing head can be provided.

[0036] Again, as an alternative, the following can be used instead of a power transmission over a chain 31: a rim attached to a motor, another rim attached to the shaft 28 and a rim mechanism comprising a strap transmitting the movement between these rims. Otherwise, the following arrangement may be provided: a gear connected to the motor, a gear wheel mechanism comprising another gear directly connected to this gear and attached with its axis to the shaft 28 or revolving components that can be driven with magnetic force and having various geometric forms.

[0037] By means of the assembly of Figures 8 and 11, when the motor is rotated the eccentric component 29 also rotates. The eccentric component 29, as can be seen in Figure 12, is connected to a movement transmission component 33 and enables this component 33 to be shifted. The eccentric component 29 contacts a roller bearing 35 formed on one end of this movement transmission

component 33. This roller bearing 35 is attached by means of a pin 36 to the movement transmission component 33. The movement transmission component 33 is secured to the head 12 through a hole 34 opened on it, as can be seen in Figure 12.

[0038] In Figure 13, the assembly driving the head 12 and the head 12 are shown together. The head 12 is attached to the frame 14 via a revolving bearing so as to be rotatable about an axis 38.

[0039] When the motor controlled by the microprocessor is rotated, the movement transmission assembly 30, 31, 32 and the eccentric component 29 rotate. As a consequence thereof, the roller bearing 35 connected to the eccentric component 29 is shifted in an upward/downward direction and the whole sewing head 12 connected thereto also moves in an upward/downward direction, indicated by the arrows in Figure 13. By this way the movement of the needles 19 in an upward or downward direction is provided.

[0040] A spring assembly is also provided which is able to dump to the frame vibrations that may occur in the movable head 12. In particular, a spring connection part 37 comprised in the movement transmission component 33 is connected to an arm of this component 33 provided with a spring 39 along its axis. When the head 12 makes a shift, the spring 39 is stretched and tends to pull the head 12 towards the frame, thus allowing the vibration movement of the head 12 to be dumped.

[0041] An arrangement for the movable sewing head according to a second preferred embodiment of the invention is shown in Figures 15-18, in which the same reference numbers of the preceding figures are used for similar elements.

[0042] As in the embodiment shown in Figure 13, the sewing head of Figures 15-18 is rotatable about an axis 38 so as to move the sewing mechanisms associated thereto, such as the needle 19, in an upward/downward direction, thus approaching or departing from the conveyor 13.

[0043] The rotation of the sewing head 12 about axis 38 in the second preferred embodiment is driven by an operating screw assembly 44, in which a threaded rotating shaft 46 of a motor 45 meshes with the internal thread of a saddle or carriage 47 so as to move the saddle in a vertical direction. Vertical movement of the saddle 47 is guided by means of vertical guides 49 connecting upper and lower portions of a case 48 which houses the saddle 47 and the rotating shaft 46 of the motor 45.

[0044] The saddle 47 comprises a longitudinal recess 54 extending substantially perpendicularly with respect to the guides 49 and a pin 53 which can slide in the recess 54 by means of roller bearings 55.

[0045] A lever arm 52 is rigidly coupled to the movable sewing head 12 and is connected to the saddle 47 by means of the pin 53. Accordingly, vertical movement of the saddle 47 results in a rotation of the sewing head 12 about its axis 38, i.e. in a movement of the head along an upward/downward direction.

[0046] The motor 45 is preferably a step motor and is operated by means of command signals from the microprocessor.

[0047] Within the scope of the present invention, the hosiery toe sewing apparatus also comprises a monitor terminal 40, which is connected to the electronic and optical components of the apparatus and serves to set up the operational parameters.

[0048] In the preferred embodiments of the invention, the distance between the optical eye 43 and the sewing heads 11,12 is predetermined (e.g. about 188 steps) and the generation of commands is provided by sending signals to the microprocessor.

[0049] When the sock toe passes under the head 12, the head goes slowly up and, about 16 steps after, the head sews the middle part of the sock keeping its position at a certain height. Finally, before sewing arrives at the second end of the sock, the head 12 gradually lowers for about 16 steps, thereby sewing the region closer to the other end part of the toe region of the sock.

[0050] When sewing is completed, the head 12 waits for the next sock of which the toe part is to be sewn. Since sock parameters such as height or width vary from sock to sock, this data may be fed to the microprocessor through the monitor terminal 40, i.e. the microprocessor is programmable.

[0051] The control system comprising the microprocessor may also be fed with signals from fibre optical sensors of the known type, which sense the above sock parameters upstream of the sewing heads 11, 12.

[0052] An illustrative view of a sock toe sewn with a hosiery toe closing apparatus according to the present invention is shown in Figure 14. As can be seen from this figure, the apparatus and method according to the invention allow hosiery toe sewing to be made in a curved fashion.

[0053] The disclosures in Turkish Patent Application No. 95130 from which this application claims priority are incorporated herein by reference.

[0054] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. Apparatus for closing the toe part of a sock, comprising a frame (14), at least one sewing head (11, 12) mounted on said frame (14) for sewing the toe part of a sock, and a conveyor (13) for conveying the sock to said at least one sewing head (11, 12), **characterized in that** said at least one sewing head (11,12) is movable with respect to said frame (14) so as to sew said toe part according to a substantially

curved line.

2. The apparatus of claim 1, **characterized in that** said at least one sewing head (11, 12) is pivotally mounted on said frame (14) so as to be movable in upward and downward directions with respect to said conveyor (13).
3. The apparatus of claims 1 or 2, **characterized in that** it comprises a microprocessor for driving said at least one sewing head (11, 12) according to sock parameters, said sock parameters being selected in a group comprising height of the sock, width of the sock and distance of the sock with respect to the at least one sewing head (11,12).
4. The apparatus of claim 3, **characterized in that** said sock parameters are stored in a monitor terminal (40).
5. The apparatus of claim 3, **characterized in that** it comprises sensors for measuring said sock parameters and sending signals to said microprocessor, which is programmed so as to drive said sewing head in response to said signals.
6. The apparatus of any one of the preceding claims, **characterized in that** it comprises a motor (45) for moving said at least one sewing head (12) and comprises a power transmission assembly (30,31,32, 44) for providing connection between said motor and said at least one sewing head (11,12).
7. The apparatus of claim 6, **characterized in that** it comprises a shaft (28) connected to said power transmission assembly (30,31,32) and an eccentric component (29) placed on this shaft (28).
8. The apparatus of claims 6 or 7, **characterized in that** said power transmission assembly comprises a gear (32) connected to said motor, another gear (30) connected to said shaft (28) and a chain (31) for transmitting the movement between said gears.
9. The apparatus of claim 6 or 7, **characterized in that** said power transmission assembly comprises a rim connected to said motor, another rim connected to said shaft (28) and a strap transmitting the movement between said rims.
10. The apparatus of claims 6, **characterized in that** said power transmission assembly comprises a gear connected to said motor, another gear directly connected to this gear and is axially connected to said shaft (28).
11. The apparatus of any one of claims 6 to 10, **characterized in that** it comprises a movement transmis-

sion component (33) attached to said at least one head (11,12) and comprises a roller bearing (35) for coupling to said eccentric component (29).

12. The apparatus of claim 11, **characterized in that** said at least one head (11,12) comprises an arm (15) equipped with a spring (39) and connected to a spring connection part (37) formed in said movement transmission component (33) in order to dump vibrations. 5
10
13. The apparatus of claim 6, **characterized in that** said motor is comprised in an operating screw assembly (44), in which a threaded rotating shaft (46) of said motor (45) meshes with an internal thread of a saddle (47) so as to move the saddle in a vertical direction, said saddle being connected to said at least one sewing head (11,12) so as to move it with respect to said frame (14). 15
20
14. The apparatus of claim 13, **characterized in that** said saddle (47) is guided by means of vertical guides (49) connecting an upper portion (48) and a lower portion (51) of a case which houses the saddle (47) and the rotating shaft (46) of the motor (45). 25
15. The apparatus of claim 14, **characterized in that** the saddle (47) comprises a longitudinal recess (54) extending substantially perpendicularly with respect to the guides (49) and a pin (53) which can slide in the recess (54) by means of roller bearings (55), a lever arm (52) being rigidly coupled to said at least one sewing head (11,12) and being connected to the saddle (47) by means of the pin (53). 30
35
16. A method for closing with a curved sewing the toe parts of a sock comprising the steps of conveying the sock to at least one sewing head (11,12) mounted on a frame (14) and moving the at least one sewing head (11,12) with respect to the frame (14) during sewing of the toe part so as to sew said toe part according to a substantially curved line. 40
45
50
55

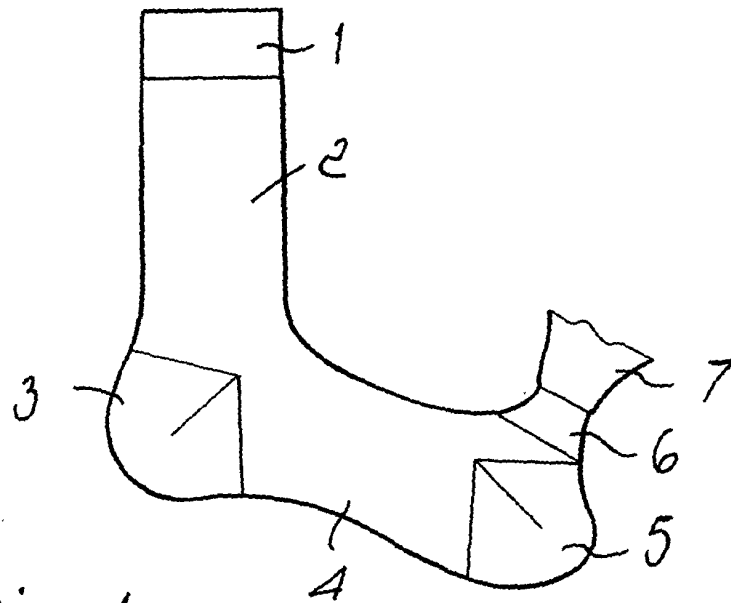


Fig. 1

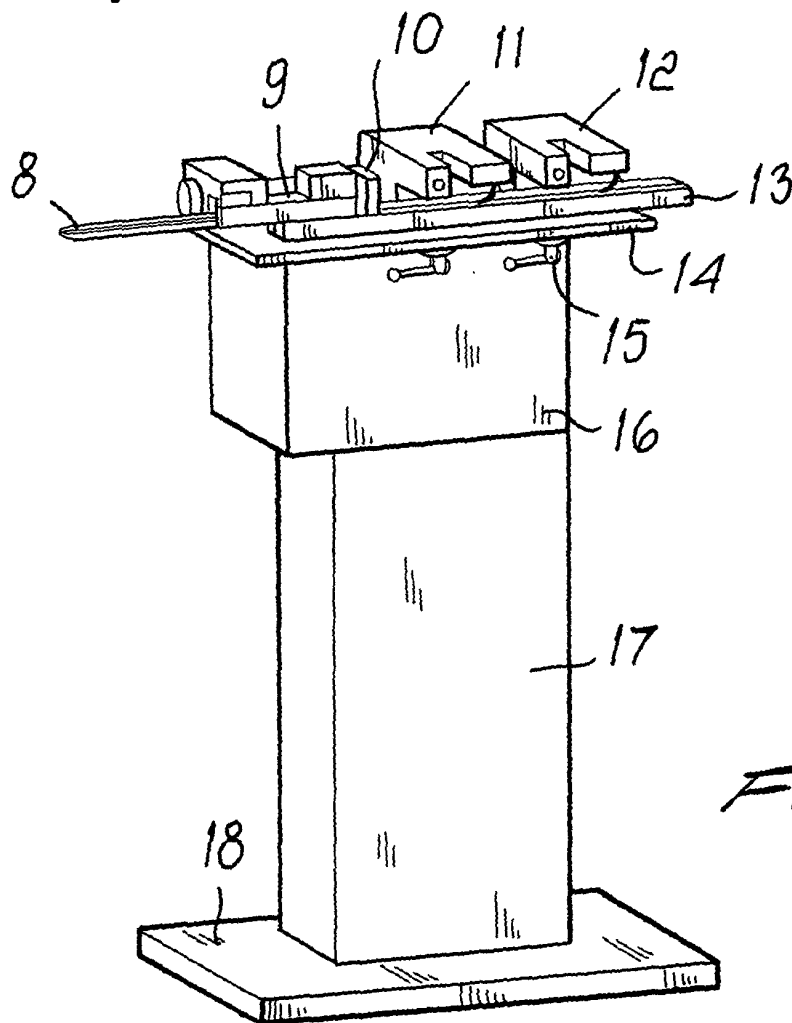


Fig. 2

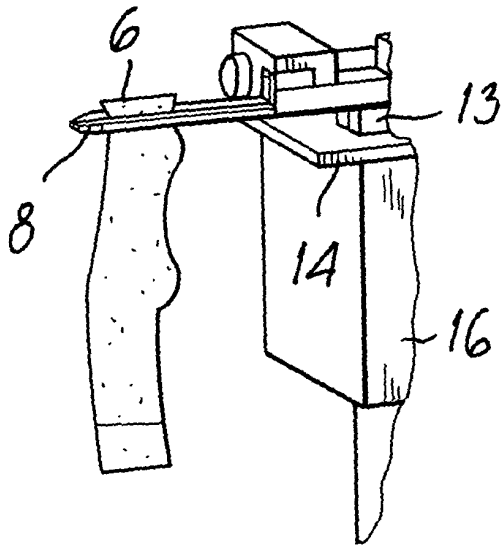


Fig. 3

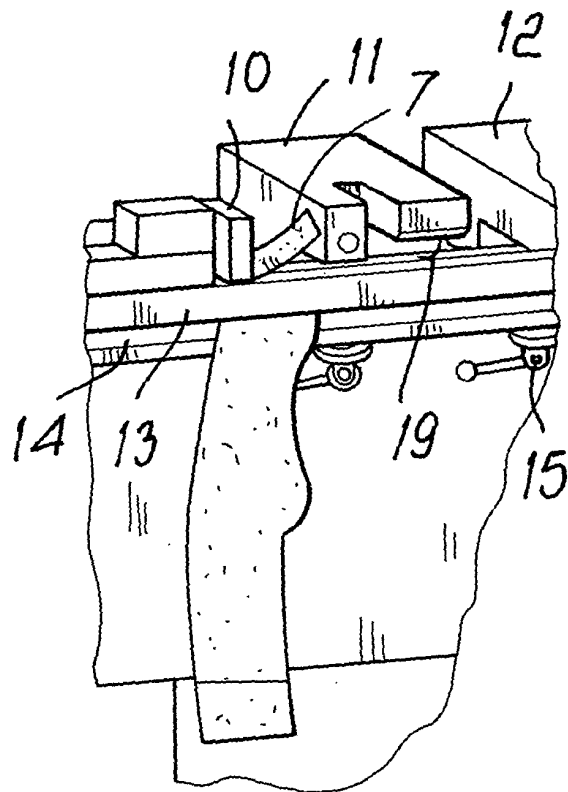


Fig. 4

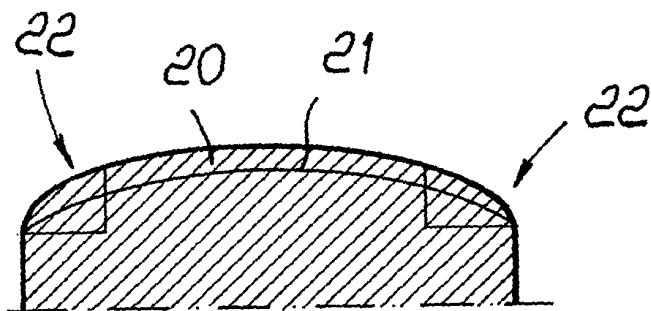


Fig. 14

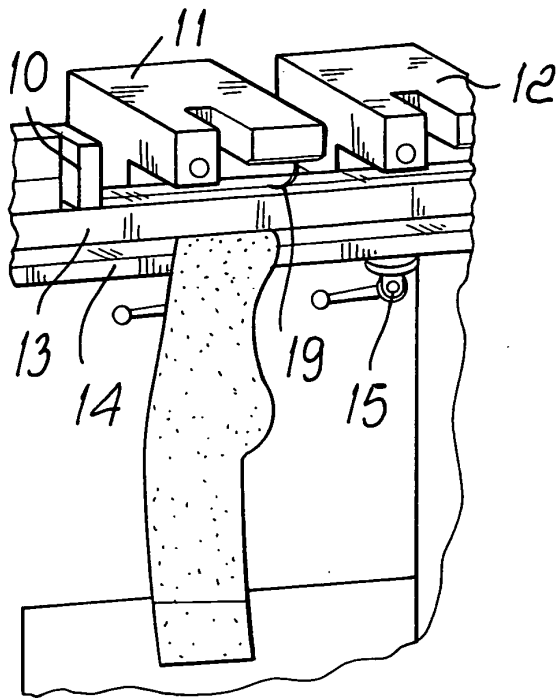


Fig. 5

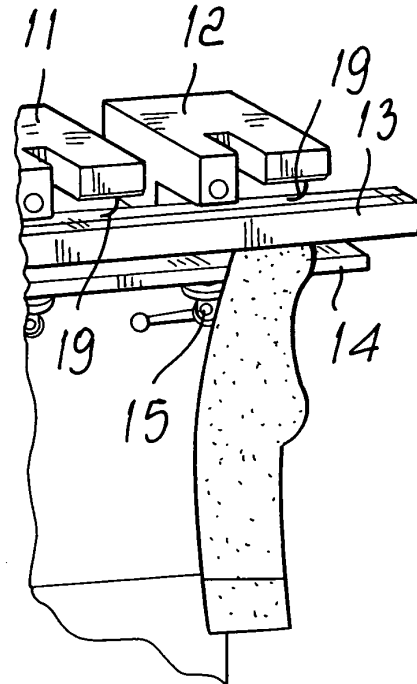


Fig. 6

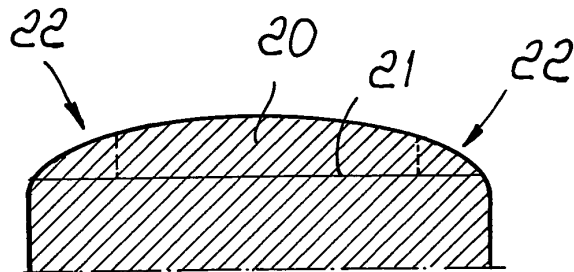


Fig. 7a

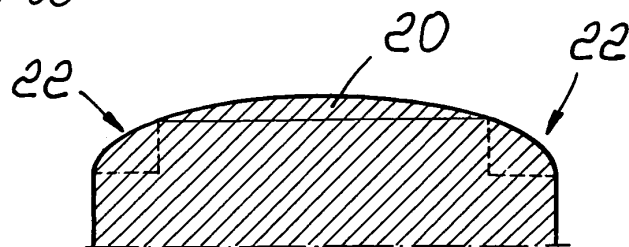


Fig. 7b

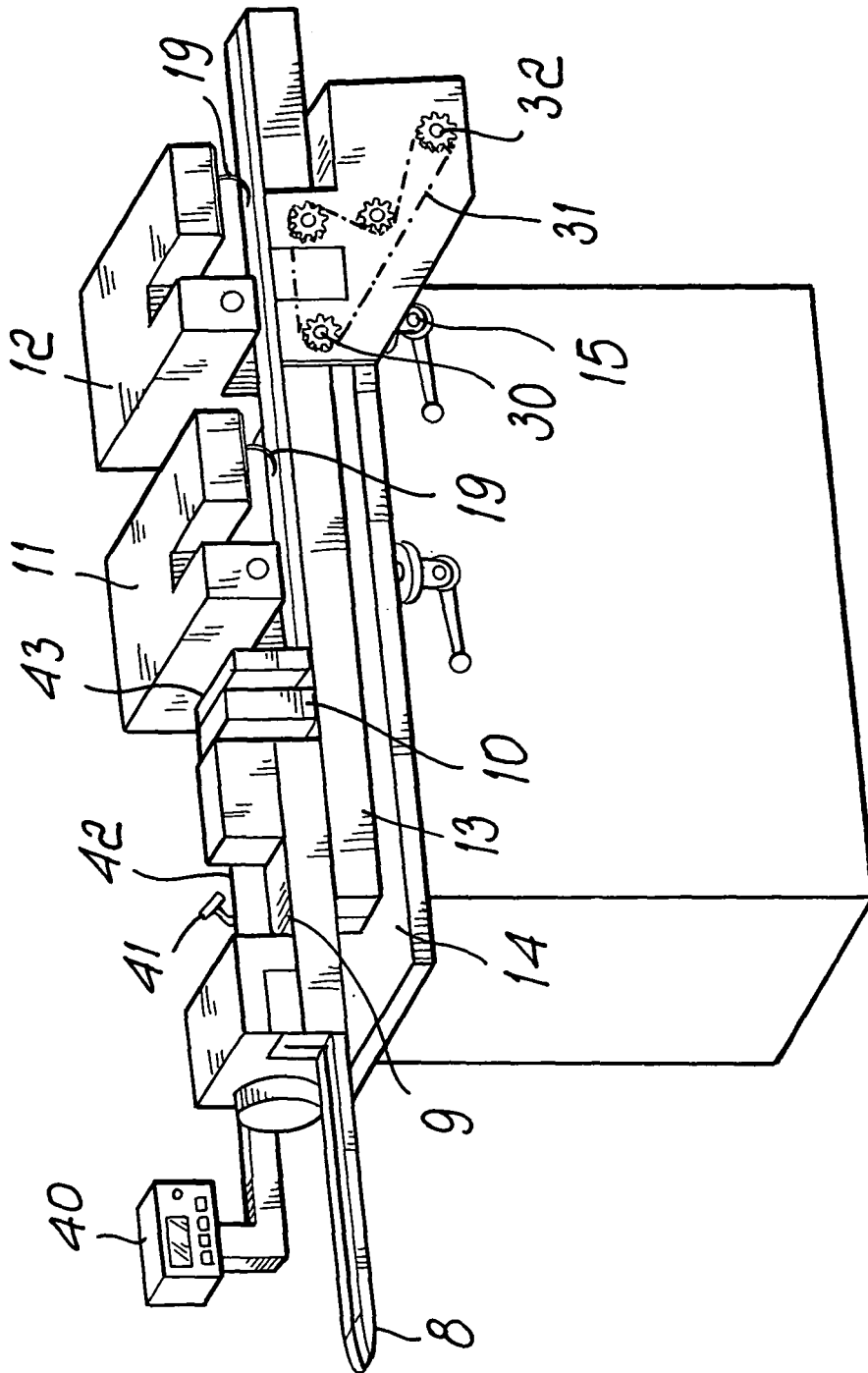


Fig. 8

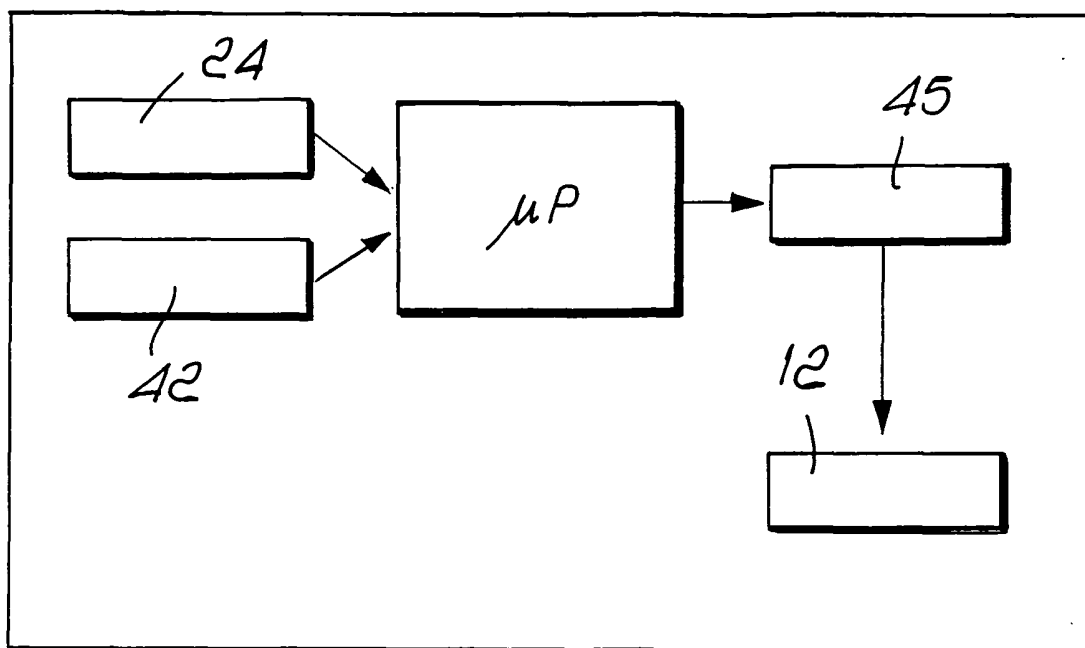


Fig. 9

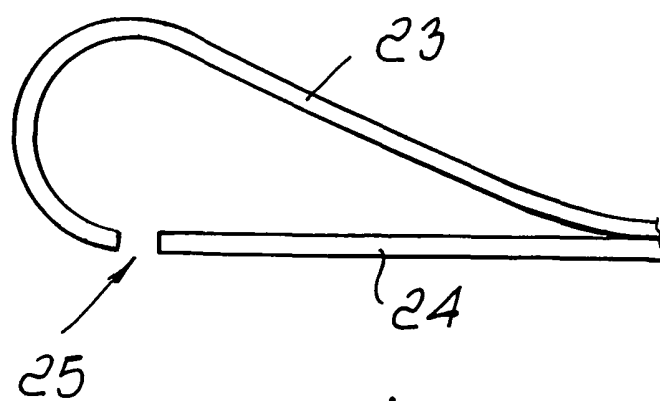
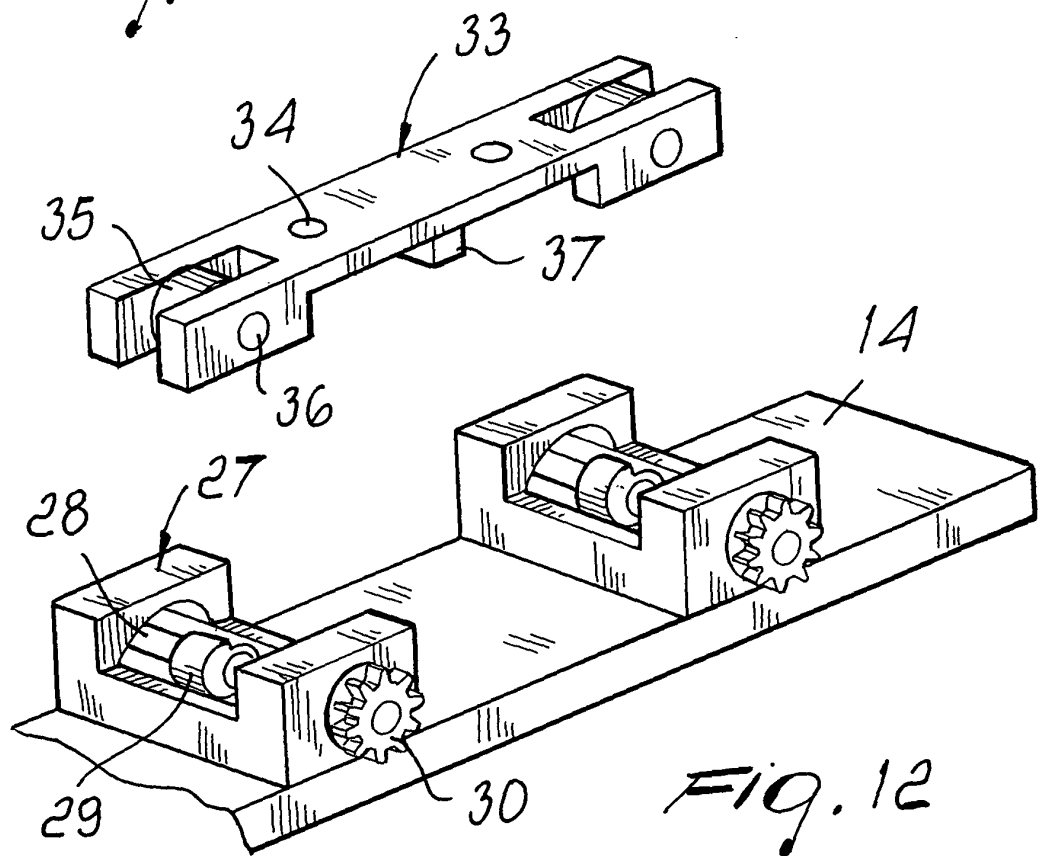
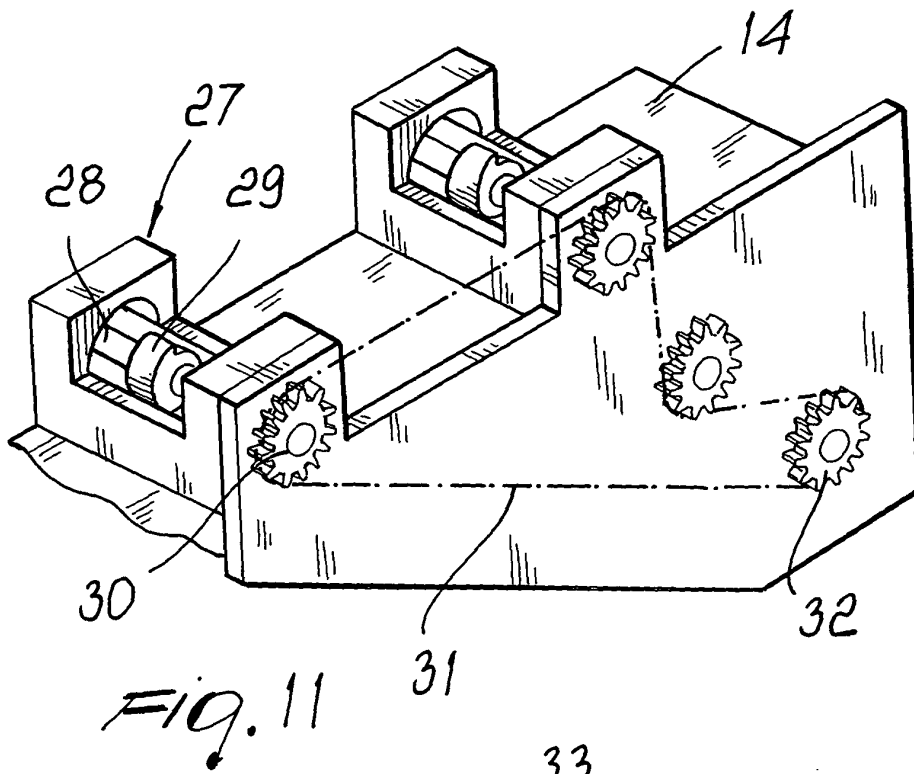


Fig. 10



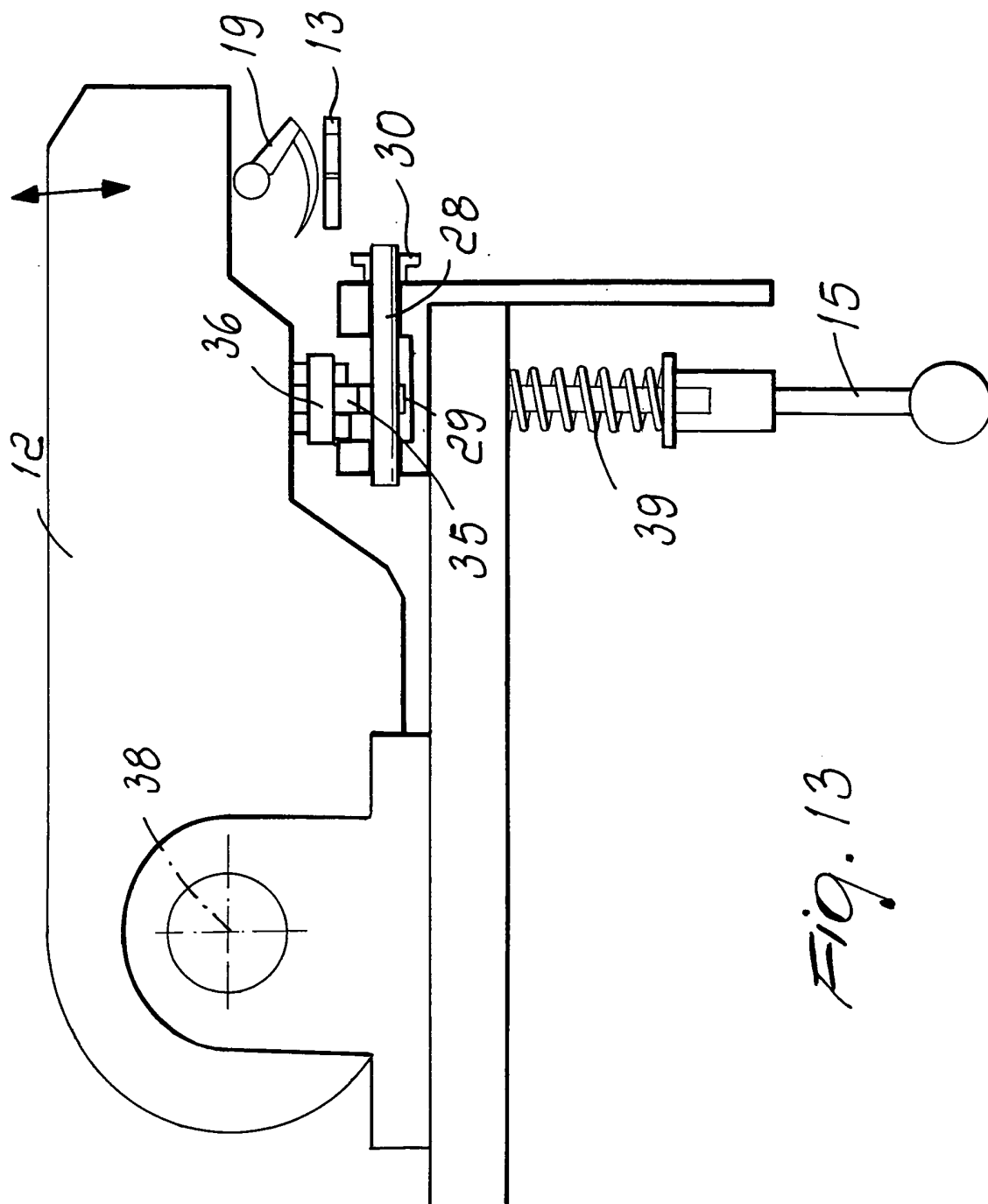


Fig. 13

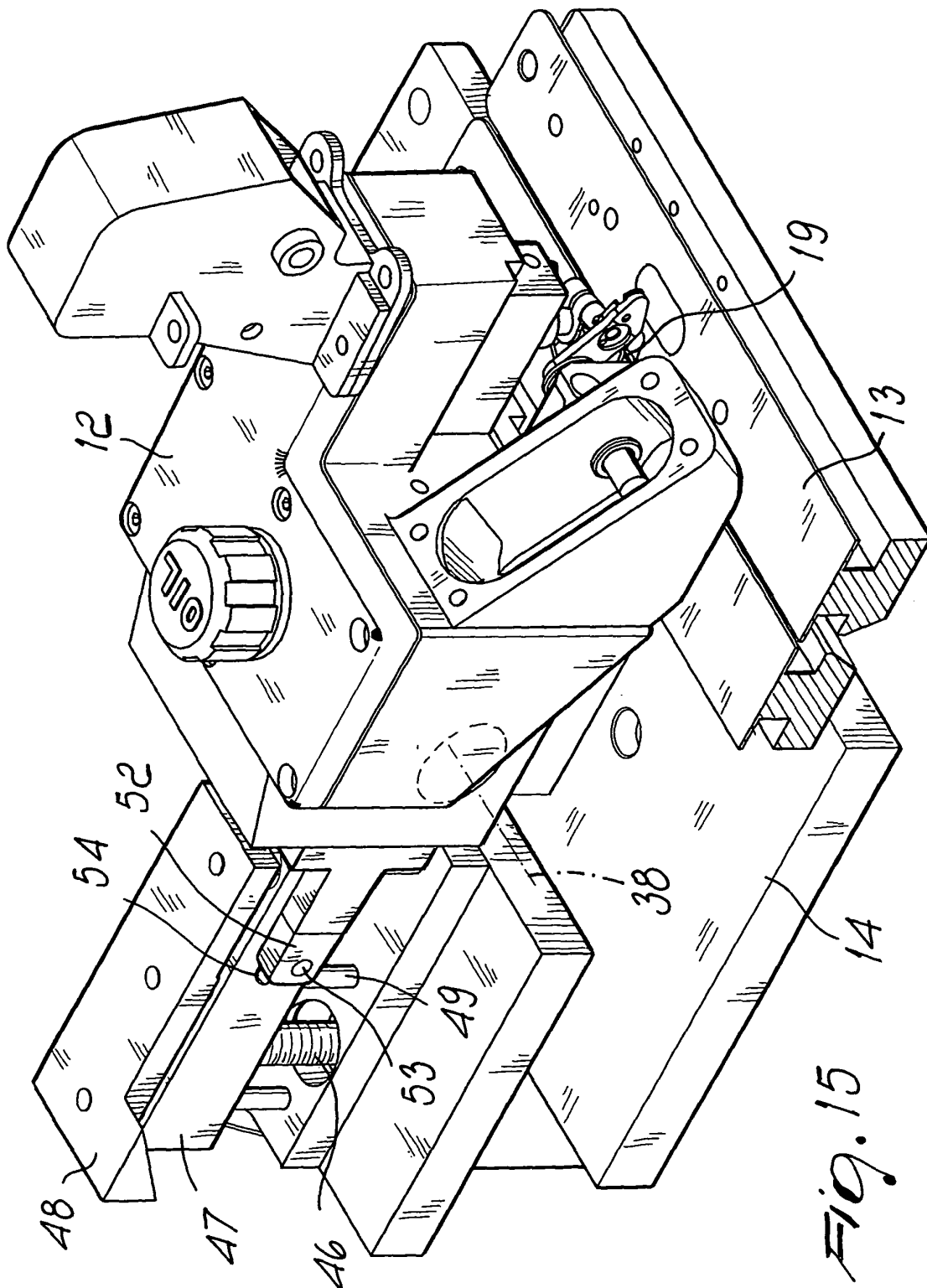


Fig. 15

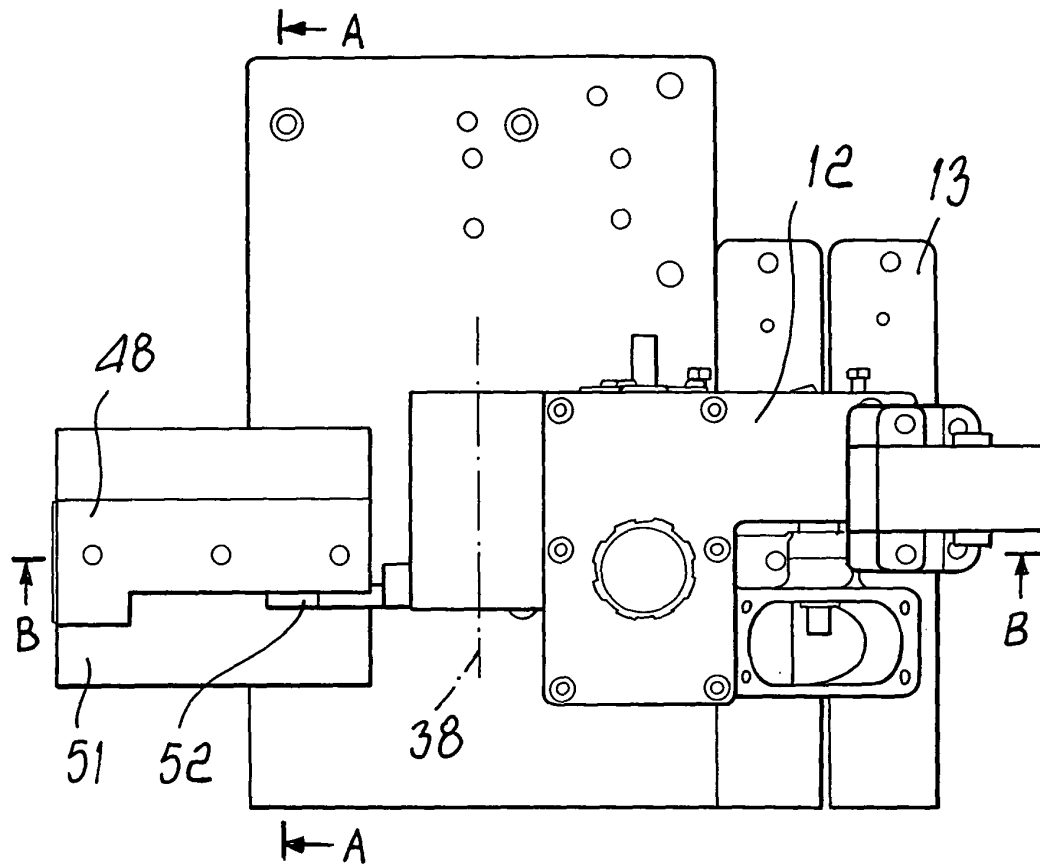


Fig. 16

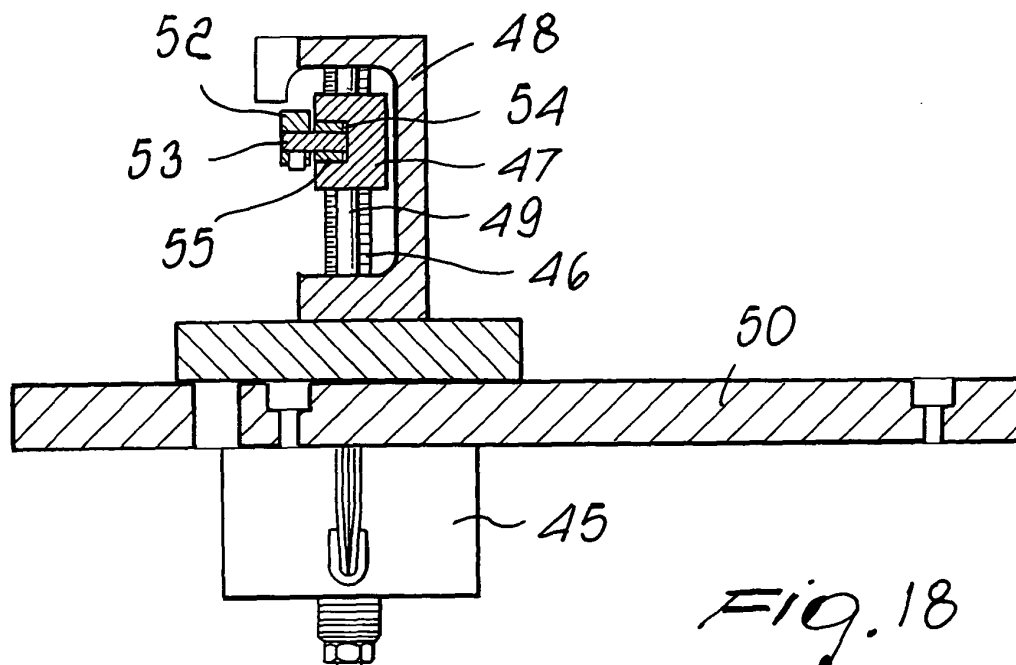
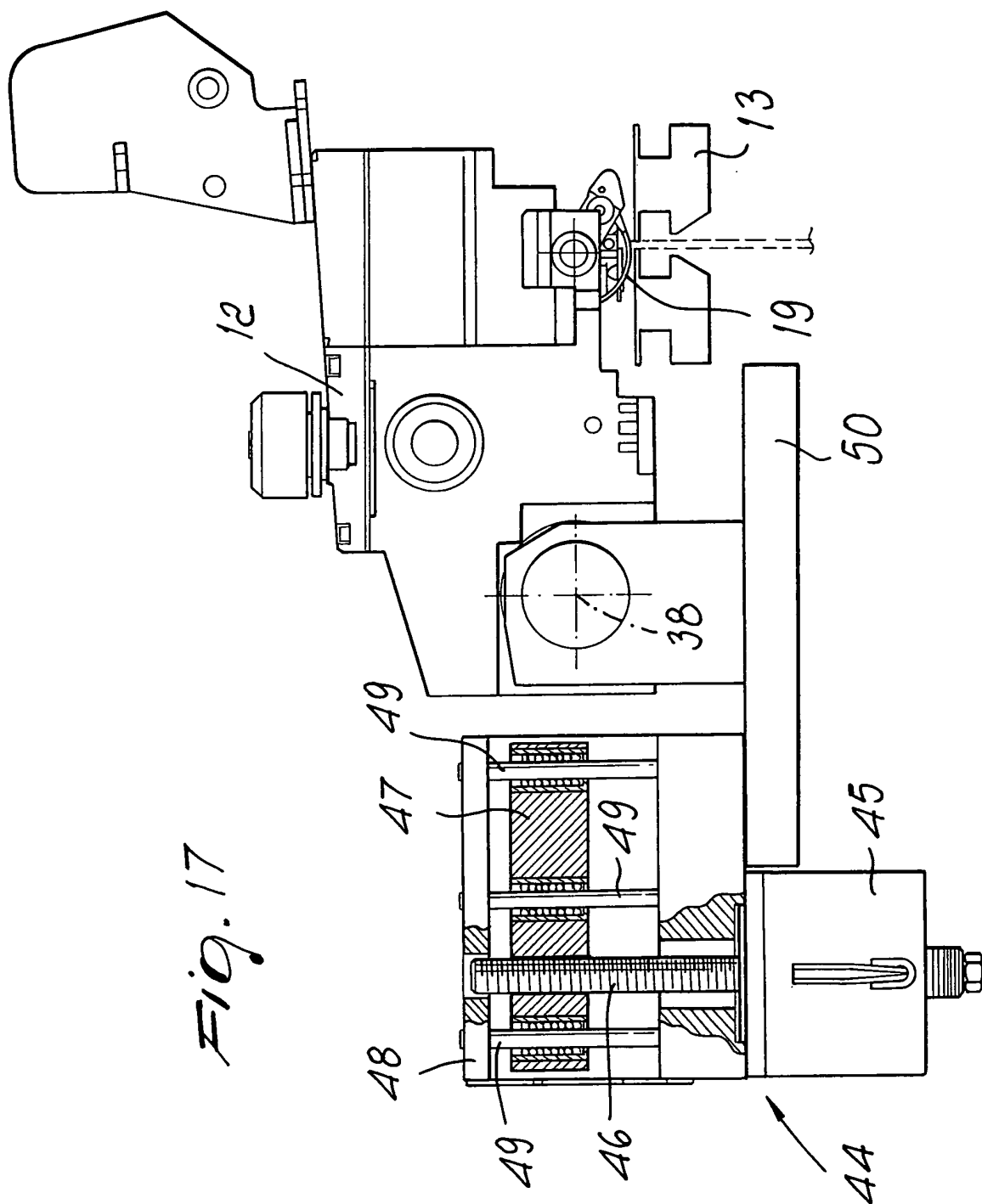


Fig. 18





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 00 5355

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.7)
X	GB 1 071 461 A (BALLITO HOSIERY MILLS LIMITED) 7 June 1967 (1967-06-07) * page 2, lines 41-52 * * page 3, line 27 - page 4, line 87; claims 1,14,16; figures 6-10 *	1,16	D05B23/00
A	EP 0 075 477 A (DETEXOMAT MACHINERY LIMITED) 30 March 1983 (1983-03-30) * the whole document *	1-16	
A	US 4 132 183 A (KIENEL ET AL) 2 January 1979 (1979-01-02) * the whole document *	1-16	
A	US 4 120 251 A (TAKATORI ET AL) 17 October 1978 (1978-10-17) * the whole document * * column 1, lines 56-62 *	1-16	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			D05B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 October 2005	Examiner Bichi, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 05 00 5355

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

28-10-2005

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
GB 1071461	A	07-06-1967	NONE	
EP 0075477	A	30-03-1983	NONE	
US 4132183	A	02-01-1979	NONE	
US 4120251	A	17-10-1978	AU 503169 B2	23-08-1979
			AU 1713276 A	02-03-1978
			CA 1044531 A1	19-12-1978
			DE 2638779 A1	15-12-1977
			ES 451127 A1	01-12-1977
			FR 2354408 A1	06-01-1978
			GB 1541124 A	21-02-1979
			IT 1071664 B	10-04-1985
			JP 1031890 C	29-01-1981
			JP 52152360 A	17-12-1977
			JP 55020713 B	04-06-1980
			NL 7609601 A	13-12-1977
			SU 821580 A1	15-04-1981