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**(54) Device and process for sewing the toe of a sock**

(57) The device (1) for sewing the toe of a sock comprises extraction means of a sock from a knitting machine equipped with locking members of the toe of the sock in a predetermined position and automatic means (2,6,7) for turning the sock (3) inside-out engaging in the toe of the sock and suitable for turning the sock inside out taking it in an inside-out direction and for supplying the sock to a sewing machine (5) for sewing the toe of the sock inside-out.

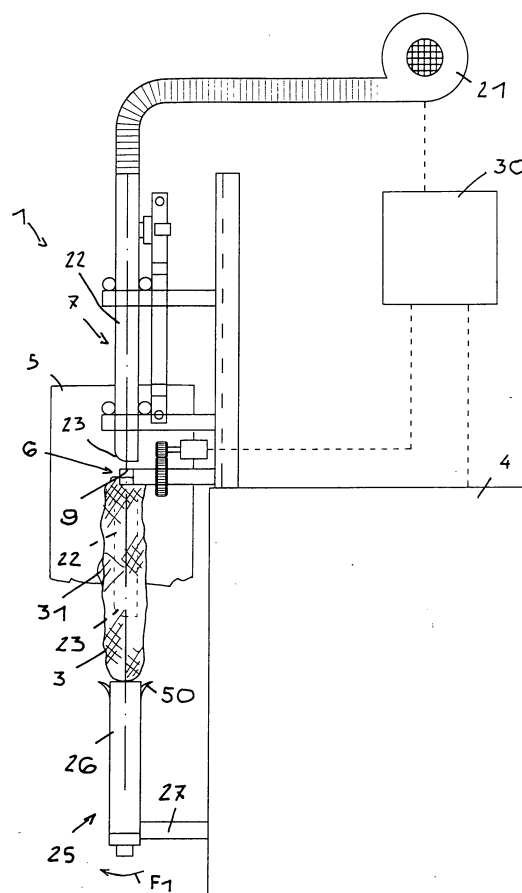


FIG. 1

EP 1 443 134 A1

## Description

**[0001]** The present invention refers to a device and process for sewing the toe of a sock.

**[0002]** Currently, socks are produced by realising, through knitting machines, tubular elements suitably shaped to define the toe and, in some cases, also the calf and the foot.

**[0003]** Then the tubular element is processed with a sewing machine which closes an end of the sock at the toe.

**[0004]** As is known, currently, the sock is taken from the knitting machine from the right side and, after having transported it to the sewing machine, the sock is sewn from the right side obtaining comfort when worn, since the sewing of the toe stays on the outside.

**[0005]** The drawback of this solution is the presence of the most unattractive part of the sewing on the outside which makes it more difficult to commercialise.

**[0006]** The technical task proposed of the present invention is, therefore, that of realising a device and process for sewing the toe of a sock which allows the aforementioned technical drawbacks of the prior art to be eliminated.

**[0007]** In this technical task a purpose of the invention is that of realising a device and process which allow the sock produced on the right side to be taken and arranged to be sewn inside-out (as is normally done manually) so as to eliminate the unattractive drawbacks of the prior art.

**[0008]** Another purpose of the invention is that of realising a device and process which are totally automated and which do not require human intervention to make the finished sock, for example to transport the sock on the sewing machine according to suitable orientations or positions or to turn it inside-out.

**[0009]** The last but not least purpose of the invention is that of realising a device and process which ensure high productivity and low costs.

**[0010]** The technical task, as well as these and other purposes, according to the present invention, are accomplished by realising a device for sewing the toe of a sock, characterised in that it comprises extraction means of a sock from a knitting machine equipped with locking members of the toe of said sock in a predetermined position and automatic means for turning said sock inside-out engaging in said toe of said sock and suitable for turning said sock inside out taking it in an inside-out direction and for supplying said sock to a sewing machine for sewing the toe of said sock inside-out.

**[0011]** The present finding also refers to a process for sewing the toe of a sock, characterised in that it consists of holding said sock by said toe from when it is realised by a knitting machine until it is taken onto a sewing machine for sewing the toe inside-out.

**[0012]** Further characteristics and advantages of the invention are defined, moreover, in the other claims.

**[0013]** Further characteristics and advantages of the

invention shall become clearer from the description of a preferred but not exclusive embodiment of the device and process for sewing the toe of a sock according to the finding, where the device is illustrated for indicating and not illustrating purposes in the attached drawings, wherein:

- figure 1 shows a schematic view of the device according to the finding;
- figure 2 shows a schematic view of a detail of pincers of the device suitable for gripping the edge of the socks to be sewn in an approaching step to the sock;
- figure 3 shows a schematic view of a detail of pincers of the device which have gripped and widened the edge of the socks to be sewn;
- figure 4 shows a schematic view of a detail of the sucker which holds the sock to be sewn sucking it upwards;
- figures 5 and 6 show a detail of the holding means of said sock.

With reference to the quoted figures, a device for sewing the toe of a sock is shown wholly indicated with reference numeral 1.

**[0014]** The device 1 comprises automatic means 2 for turning the sock 3 inside-out, suitable for taking the sock from a knitting machine 4 from the right side, to turn it inside out taking it in a wrong side and to supply it to a sewing machine.

**[0015]** The means 2 for turning inside-out comprise holding means 6 of an end of said sock and pulling means 7 of an opposite end of the sock 3.

**[0016]** In a preferred embodiment of the device 1 according to the present finding, the holding means 6 comprise a body 8 which carries at least two pincers 9 suitable for gripping portions of the edges of the socks 3.

**[0017]** As shown in the attached figures, the pincers 9 are slidably connected to the body 8 and can be actuated into translation through an actuator 11 which, for example, is of the pneumatic or hydraulic type; an analogous actuator 12 commands the opening and closing of the pincers 9.

**[0018]** Moreover, advantageously, the body 8 is rotatably connected to a support 13; for example, the body 8 is connected to a gear 14 connected to a pinion 15 that can be actuated in rotation by a motor 16 for example of the stepper type.

**[0019]** The holding means 6 comprise a housing 18 suitable for guiding the sock 3 during the rotation of the body 8; in the example shown, the housing element 18 consists of a bent rod.

**[0020]** In a suitable manner, the support 13 is slidably connected to a frame 19 of the knitting machine; in this way, after the sock 3 has been turned inside-out, the support 13 translates - aligning it with a guide 20 of the sewing machine 5.

**[0021]** The pulling means 7 comprise a sucker 21 suit-

able for sucking up a portion of the sock 3 and for holding it (continuing to suck). As represented in the attached figures, the sucker 21 comprises a tubular element 22 suitable for being inserted in the sock to suck up a toe portion.

**[0022]** Advantageously, the tubular element 22 has at least one portion of a free toe thereof bevelled at 23; this allows the insertion of the element 22 in the sock to be eased avoiding it getting caught during the downward motion in some portions of the sock 3, such as the calf.

**[0023]** The device 1 also comprises extraction means 25 of the sock 3 from the knitting machine 4, which are suitable for supplying the sock to the holding means 6.

**[0024]** In the present embodiment the extraction means 25 comprise a cylinder 26, equipped with locking members defined by many tabs 50 engaged with the toe of the sock, rotatably connected to the knitting machine 4 through a rod 27 and, moreover, suitable for translating vertically both to collaborate with the knitting machine 4 and gripping the sock 3 in the realisation step, and to collaborate with the holding means 6.

**[0025]** Advantageously, the unit comprises the knitting machine 4, the sewing machine 5 and the device 1 for turning the socks 3 inside-out, also comprises control means 30 suitable for interacting with the knitting machine 4, with the device 1 for turning inside-out and with the sewing machine 5 to command synchronised operation.

**[0026]** In particular, the control means 30 are suitable for commanding the start of each operating step of the knitting machine 4, of the device 1 for turning inside-out and of the sewing machine 5 only when a previous step has ended.

**[0027]** For example, when the knitting machine 4 has realised the sock 3 (in particular one loop before the end of its realisation) an impulse is emitted which informs the control means 30 to start up the device 1 for turning inside out; then the control means 30 command and control the operation of the device 1 and, after the sock has been turned inside out, they command and control the passage to the sewing machine 5 and command the operation of the sewing machine 5 itself.

**[0028]** The operation of the sewing device of the toe of a sock according to the invention is clear from that which has been described and illustrated and, in particular, is substantially the following.

**[0029]** The sock 3 realised by the knitting machine 4 in the form of a tubular element open at the two opposite ends is collected inside the cylinder 26.

**[0030]** This rotates towards the outside of the knitting machine 4 as indicated by the arrow F1 and goes into position aligned with the tubular element 22; then it translates upwards and stops with its upper end (from which the edges project at the toe of the sock 3) between the pincers 9 of the holding means 6 (the knitting means realises the sock so that in this configuration the heel 31 faces outwards, i.e. at the opposite side with respect to the knitting machine 4, figure 1).

**[0031]** The pincers 9 translate towards the sock 3 as indicated by the arrow F2, grip the sock and translate in the opposite direction to the previous one, as indicated by the arrow F3, so as to widen the edge of the sock and to ease the entry of the tubular element 22 inside of it.

**[0032]** The tubular element 22 lowers and enters into the sock until it goes near to the cuff; the end stop for the tubular element 22 is defined by switches which are suitably positioned above the same tubular element 22 in relation to the type of socks being realised.

**[0033]** At this point the sucker 21 sucks in air and sucks up the end at the toe to be sewn of the socks 3 (figure 4); at the same time, the tubular element 22 goes up until the sock is completely inside-out; the point at which the rise of the tubular element 22 is stopped is defined according to the type of socks 3 being processed by another switch positioned above the same tubular element 22.

**[0034]** Then the motor 16 actuates the pinion 15 into rotation and, through the gear 14, makes the body 8 rotate by 180°; at the same time the suction of the sucker 21 is stopped and the sock is guided downwards by the housing element 18; in this way the sock is turned inside-out and stays hung downwards, held by the pincers 9, on the wrong side.

**[0035]** Then the support 13 slides on the frame 19 until the sock 3 is aligned with the guide 20 of the sewing machine 5 which takes the sock 3 and carries it onto the sewing machine where the toe is sewn from the inside of the sock 3 (inside-out).

**[0036]** The present finding also refers to a process for sewing the toe of a sock.

**[0037]** The process according to the present finding consists of taking a sock 3 realised by a knitting machine 4 from the right side and holding the sock by its toe until it is taken on a sewing machine for sewing its toe inside-out.

**[0038]** In practice, it has been seen how the device and process for sewing the toe of a sock according to the invention are particularly advantageous, because they allow socks to be realised which have the sewing at the toe on the inside of the sock, with very high productivity since all of the processes are automated.

**[0039]** The device and process for sewing the toe of a sock thus conceived are susceptible to numerous modifications and variants, all of which are covered by the inventive concept; moreover, all of the details can be replaced by technically equivalent elements.

**[0040]** In practice, the materials used, as well as the sizes, can be whatever according to requirements and the state of the art.

## Claims

1. Device for sewing the toe of a sock, **characterised in that** it comprises extraction means of a sock from

- a knitting machine equipped with locking members of the toe of said sock in a predetermined position and automatic means for turning said sock inside-out engaging in said toe of said sock and suitable for turning said sock inside out taking it in an inside-out direction and for supplying said sock to a sewing machine for sewing the toe of said sock inside-out. 5
2. Sewing device according to claim 1, **characterised in that** said means for turning inside-out comprise holding means of an end of said sock and pulling means of an opposite end of said sock. 10
  3. Sewing device according to one or more of the previous claims, **characterised in that** said holding means comprise a body which carries at least two pincers suitable for gripping portions of said socks. 15
  4. Sewing device according to one or more of the previous claims, **characterised in that** said pincers are slidably connected to said body. 20
  5. Sewing device according to one or more of the previous claims, **characterised in that** said body is slidably connected to a support. 25
  6. Sewing device according to one or more of the previous claims, **characterised in that** said holding means comprise a housing element suitable for guiding said sock during the rotation of said body. 30
  7. Sewing device according to one or more of the previous claims, **characterised in that** said support is slidably connected to a frame of said knitting machine. 35
  8. Sewing device according to one or more of the previous claims, **characterised in that** said pulling means comprise a sucker suitable for sucking up a portion of said sock and holding it. 40
  9. Sewing device according to one or more of the previous claims, **characterised in that** said sucker comprises a tubular element suitable for being inserted into said sock for sucking up a toe portion thereof. 45
  10. Sewing device according to one or more of the previous claims, **characterised in that** said tubular element has at least one portion of a free toe thereof bevelled. 50
  11. Sewing device according to one or more of the previous claims, **characterised in that** said extraction means of said sock from said knitting machine comprise locking members of the toe of said sock and are suitable for supplying said sock to said holding means. 55
  12. Plant for producing socks comprising at least one knitting machine suitable for realising said socks and a sewing machine suitable for sewing at least the toe of said socks, **characterised in that** it comprises a device for turning said socks inside-out, suitable for turning the sock inside-out taking it from the wrong side as it is supplied by said knitting machine to the right side as it is supplied to said sewing machine and, moreover, control means suitable for interacting with said knitting machine, with said device for turning inside-out and with said sewing machine to command its synchronised operation.
  13. Plant according to the previous claim, **characterised in that** said control means are suitable for commanding the start of each operating step of said knitting machine, said device for turning inside-out and said sewing machine only when a previous step has ended.
  14. Process for sewing the toe of a sock, **characterised in that** it consists of holding said sock by said toe from when it is realised by a knitting machine until it is taken onto a sewing machine for sewing the toe inside-out.
  15. Sewing process according to the previous claim, **characterised in that** said sock is turned inside-out by holding an end thereof and pulling the opposite end.
  16. Sewing process according to one or more of claims 14 and thereafter, **characterised in that** the end of said sock which is held is that of the open edge and the end which is pulled is that of the toe.
  17. Sewing process according to one or more of claims 14 and thereafter, **characterised in that** said toe is pulled upwards and, after it has been turned inside-out, the sock is rotated to be taken back into position hanging at the top and free at the bottom.
  18. Device and process for sewing the toe of a sock, all as substantially described, represented in the attached tables of drawings and claimed.

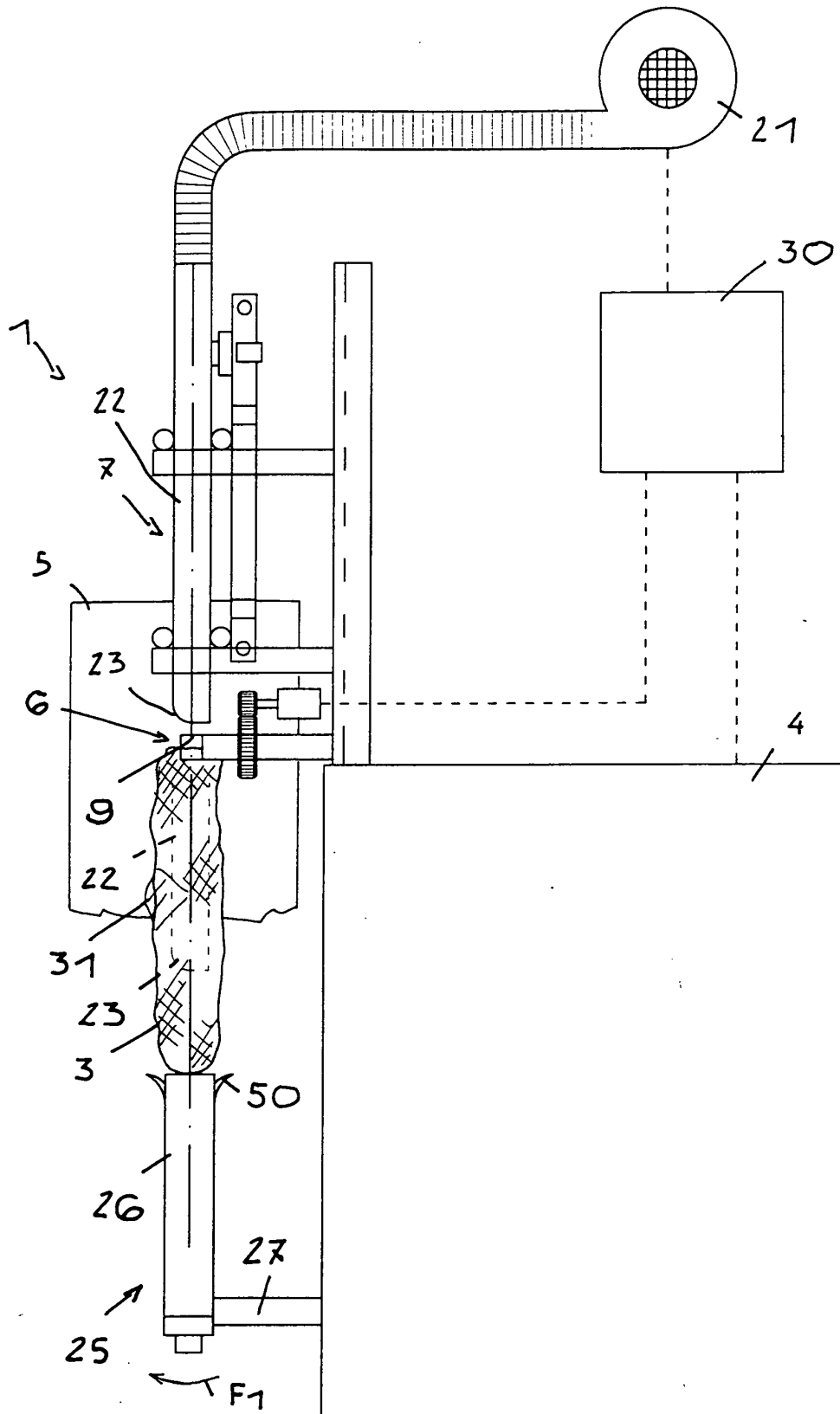
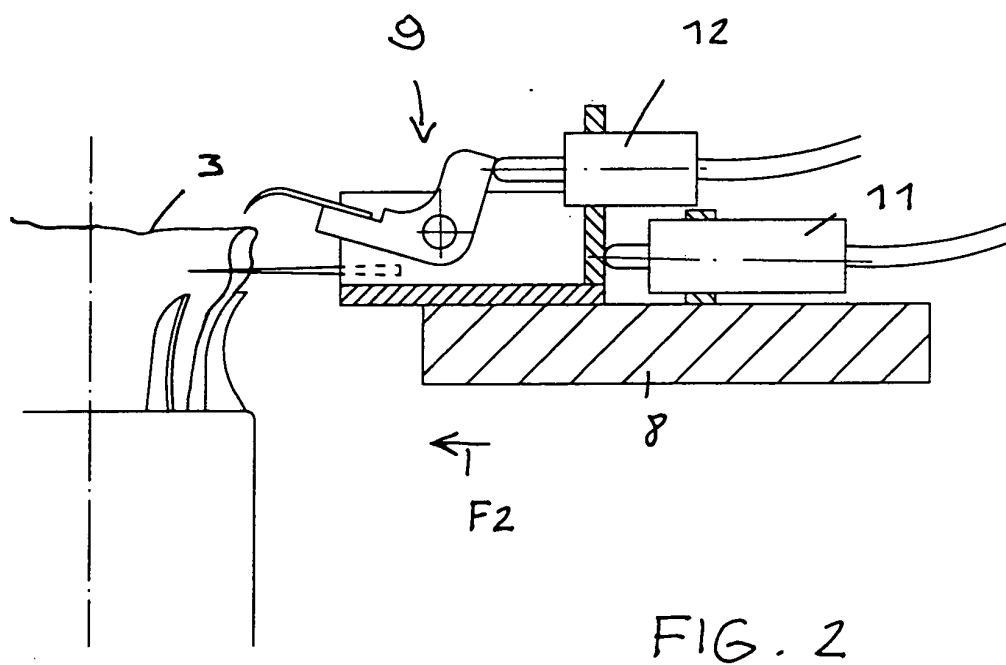
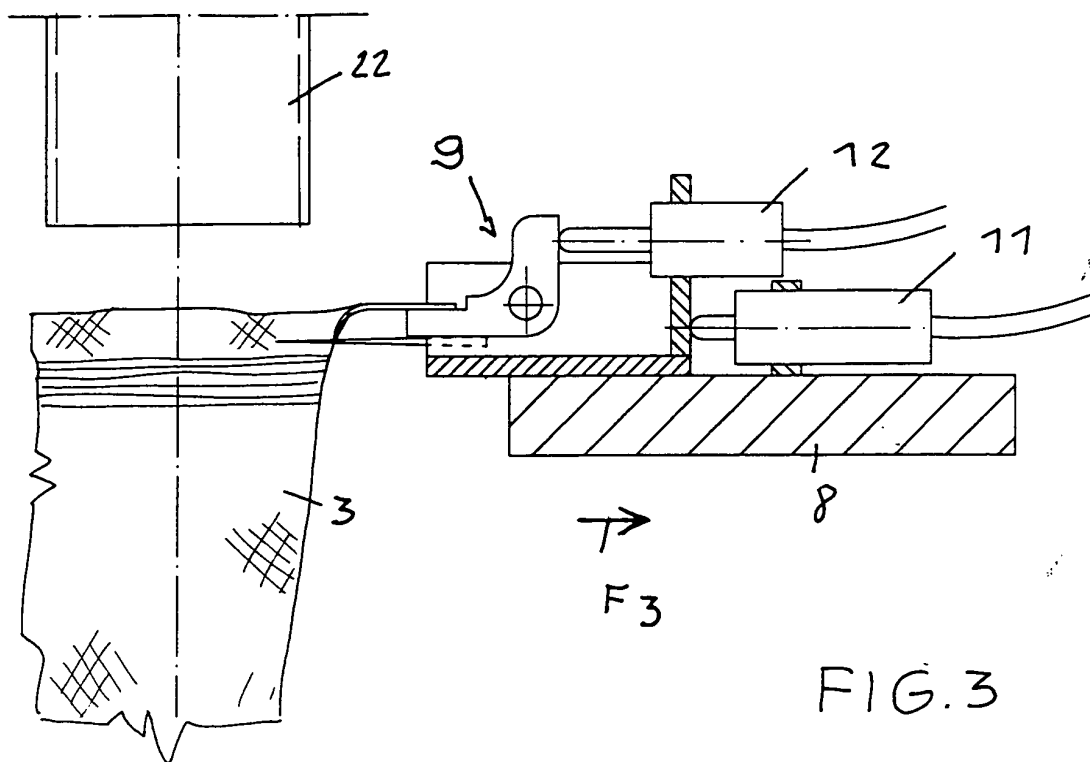


FIG. 1



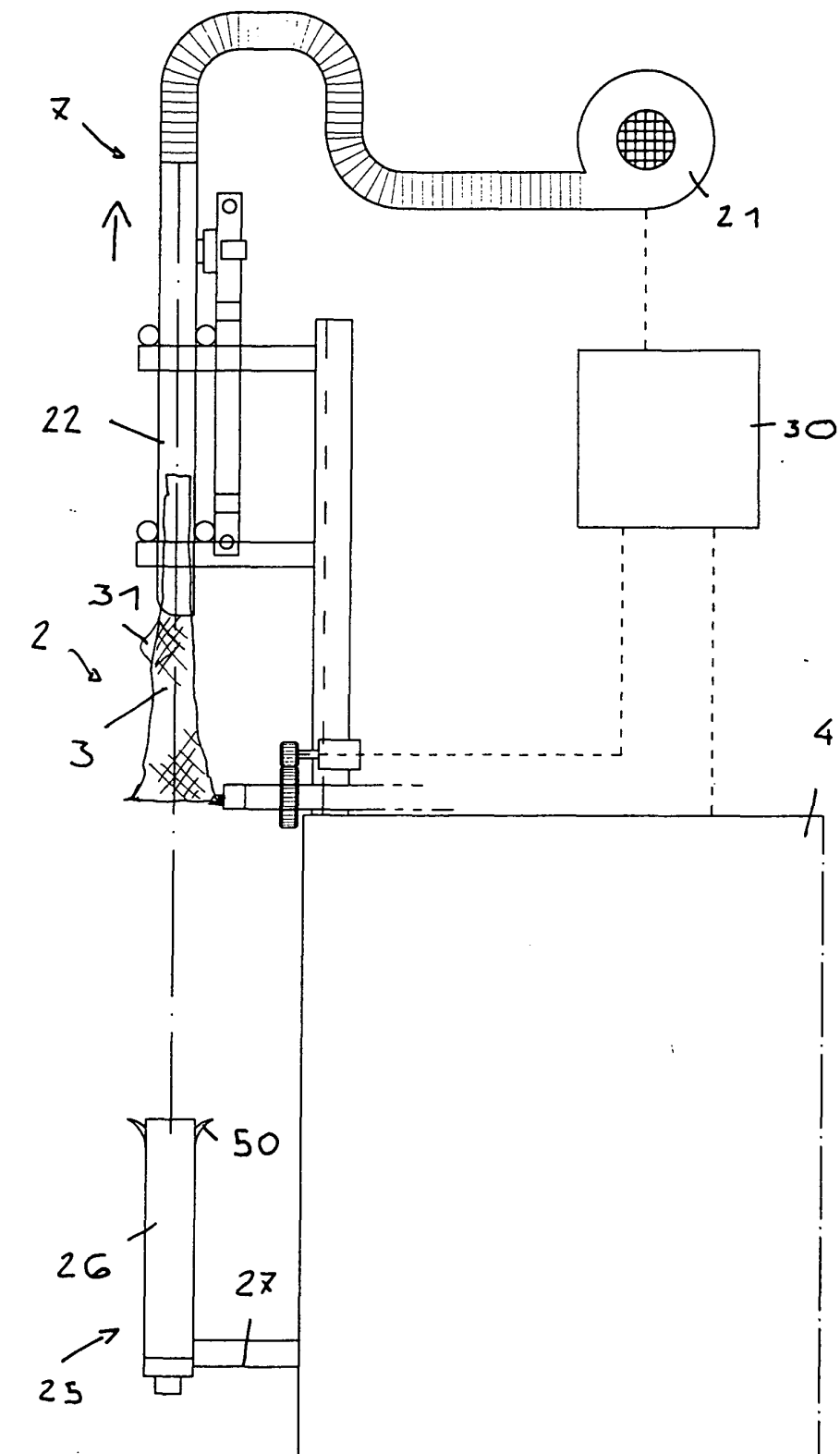
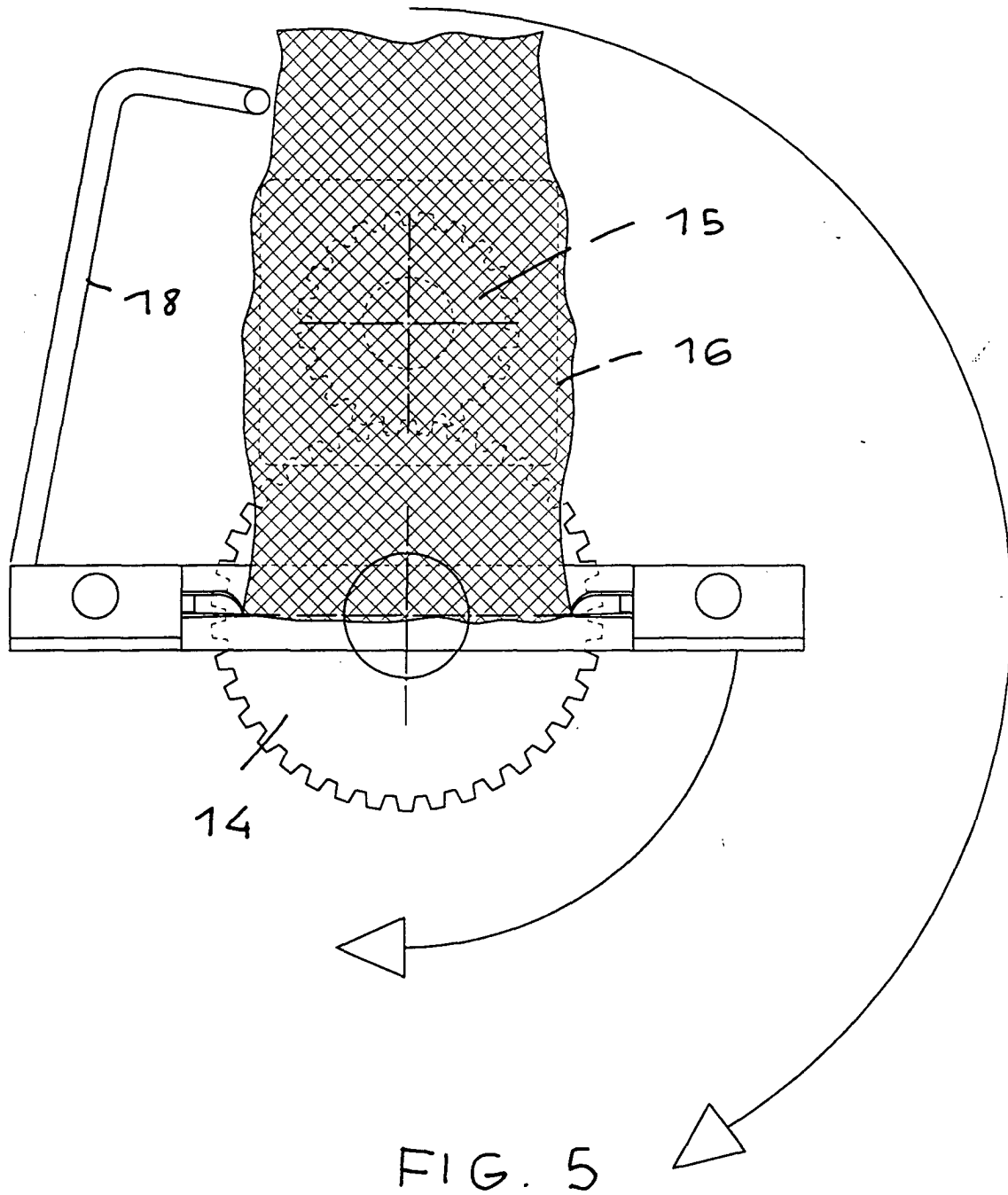
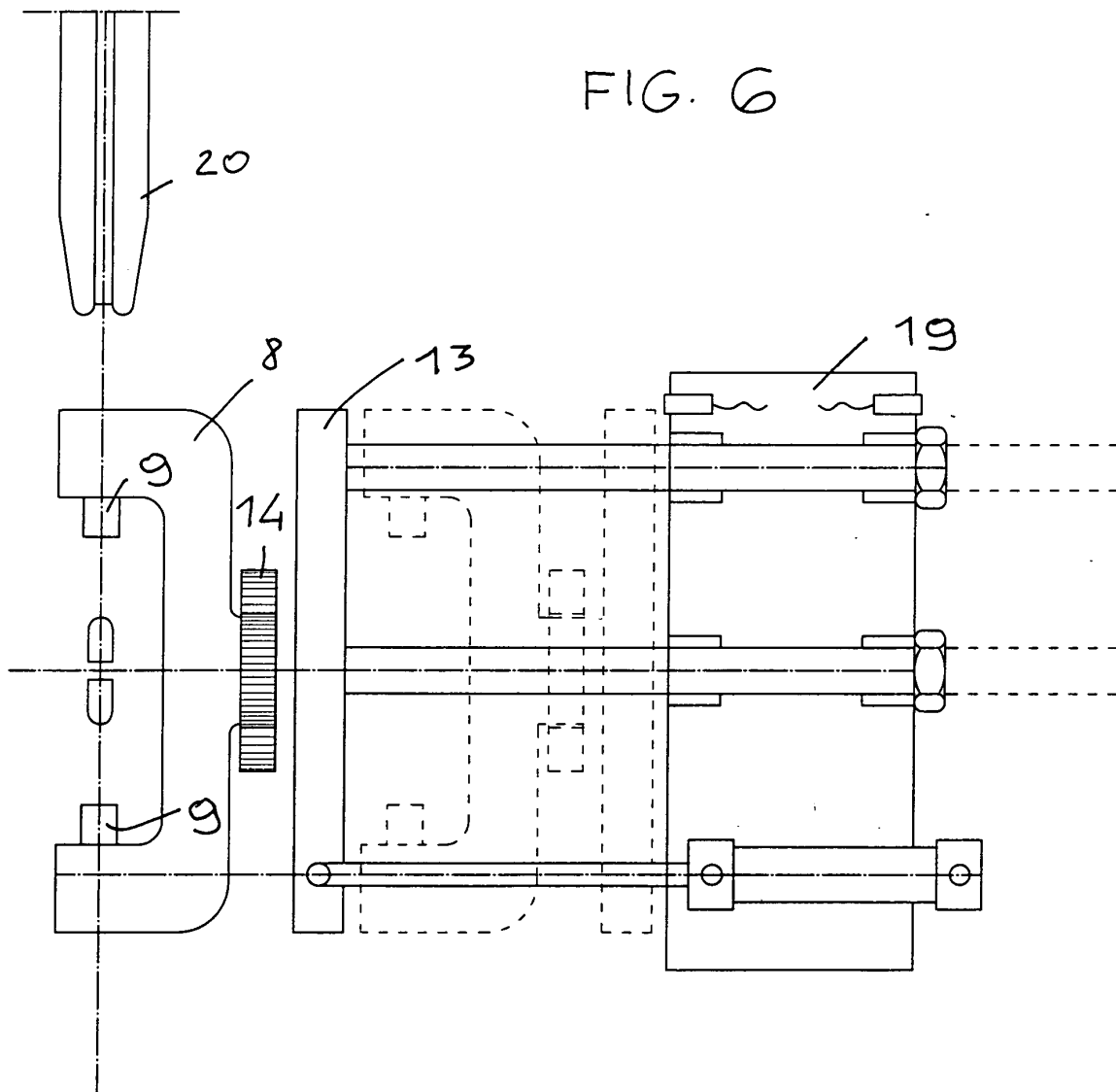


FIG. 4









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# EUROPEAN SEARCH REPORT

Application Number  
EP 04 00 1657

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	US 2001/039816 A1 (UEDA TAKAHIRO ET AL) 15 November 2001 (2001-11-15) * paragraphs [0062]-[0089]; figures 1-31 *	1-15	D04B9/56
X	US 5 551 260 A (FRULLINI ALBERTO ET AL) 3 September 1996 (1996-09-03) * column 4, line 28 - column 5, line 11; figures 1,10-14 *	1,12,14	
X	EP 0 679 746 A (SANGIACOMO SPA) 2 November 1995 (1995-11-02) * claims 1,4,5; figure 1 *	1,12,14	
X,P	WO 03/018903 A (MAGNI ANTONIO ;GOLDEN LADY SPA (IT)) 6 March 2003 (2003-03-06) * page 7, line 19 - page 19, line 12; figures 1-28 *	1,12,14	
A	US 6 158 252 A (CONTI PAOLO) 12 December 2000 (2000-12-12) * the whole document *		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7)  D04B
Place of search <b>MUNICH</b>		Date of completion of the search <b>5 May 2004</b>	Examiner <b>Dreyer, C</b>
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			

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

EP 04 00 1657

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05-05-2004

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2001039816 A1	15-11-2001	CN 1323929 A	28-11-2001
		CZ 20011295 A3	16-01-2002
		ES 2195719 A1	01-12-2003
		FR 2808813 A1	16-11-2001
		GB 2362165 A ,B	14-11-2001
		HK 1040099 A1	07-11-2003
		IT RM20010194 A1	11-10-2002
		JP 2002028386 A	29-01-2002
		TW 538167 B	21-06-2003
US 5551260 A	03-09-1996	IT 1262486 B	28-06-1996
		AT 151125 T	15-04-1997
		BR 9402870 A	11-04-1995
		CA 2128550 A1	30-01-1995
		CN 1103905 A	21-06-1995
		CZ 9401820 A3	15-03-1995
		DE 69402375 D1	07-05-1997
		DE 69402375 T2	23-10-1997
		EP 0636724 A2	01-02-1995
		ES 2102797 T3	01-08-1997
		IL 110293 A	10-03-1998
		JP 2791938 B2	27-08-1998
		JP 7068065 A	14-03-1995
		KR 9610625 B1	06-08-1996
		RU 2093624 C1	20-10-1997
		SK 88594 A3	11-07-1995
		TR 27815 A	29-08-1995
EP 0679746 A	02-11-1995	IT BS940042 A1	26-10-1995
		IT BS940100 A1	11-03-1996
		AT 169353 T	15-08-1998
		CZ 9501033 A3	15-11-1995
		DE 69503827 D1	10-09-1998
		EP 0679746 A2	02-11-1995
		JP 8060502 A	05-03-1996
		US 5606876 A	04-03-1997
WO 03018903 A	06-03-2003	IT FI20010163 A1	28-02-2003
		WO 03018903 A1	06-03-2003
US 6158252 A	12-12-2000	IT FI970033 A1	26-08-1998
		AU 6114698 A	18-09-1998
		CZ 9903018 A3	15-12-1999
		EP 0963471 A1	15-12-1999
		WO 9838367 A1	03-09-1998
		JP 2001513152 T	28-08-2001

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82