(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 251 194 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
23.10.2002 Bulletin 2002/43

(51) Int Cl.[7]: **D03C 1/00**, F16D 11/16

(21) Application number: **02006721.1**

(22) Date of filing: **22.03.2002**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **29.03.2001 IT MI010670**

(71) Applicant: **FIMTEXTILE S.p.A.**
24028 Pante Nossa (Bergamo) (IT)

(72) Inventor: **Cremonesi, Gian Luigi**
24028 Ponte Nossa (Bergamo) (IT)

(74) Representative: **Vatti, Paolo, Dr. Ing. et al**
Fumero-Studio Consulenza Brevetti Snc
Pettenkoferstrasse 20-22
80336 München (DE)

(54) Improved programming device for rotary dobbies of weaving machines

(57) Device to carry out the programming of rotary dobbies for the operation of heald frames in weaving machines, particularly looms, of the type in which the control rods (3) for the heald frames are operated by connecting rods (2), and comprising a toggle-joint lever (14) controlled so as to oscillate about a fixed fulcrum (14E) to cause the operation of said device. According to the invention, the controls to cause the oscillation of the toggle-joint lever (14) are obtained, in coordination with the rotation of the main shaft (1) of the loom and against the action of a spring (15), by means of an electric linear stepping motor (16) in which the rectilinear driving member (16A) operates, by means of a link (17), on a rod (18) having one end (19) pivoted close to an end of the toggle-joint lever (14) and the other end (20) guided by a cam profile (21, 22).

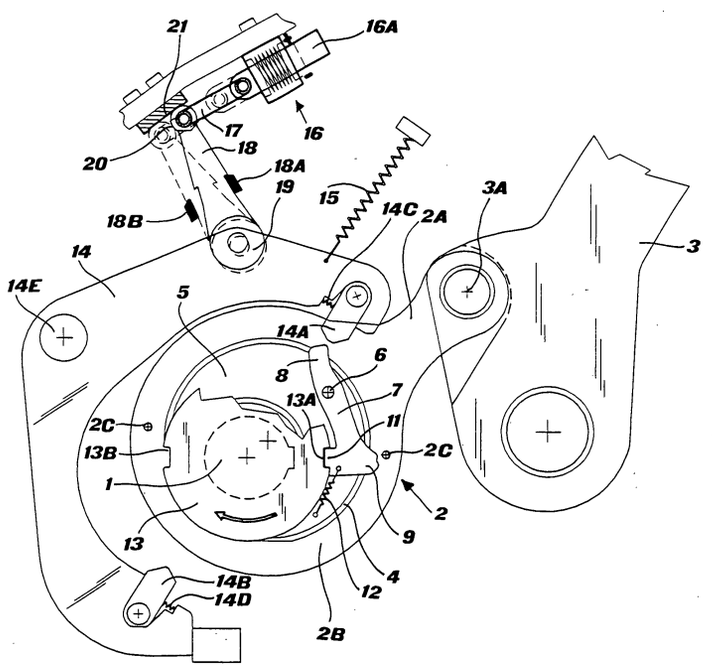

FIG.1

EP 1 251 194 A1

Description

[0001] The present invention concerns a device to carry out the programming of rotary dobbies for the operation of heald frames in weaving machines. It concerns, more particularly, a programming device comprising improved control means operated by electric linear motors.

[0002] As known, the positioning of the heald frames of a weaving machine or loom, which determines the weft pattern of the finished fabric, must be programmed according to a preset sequence indicating the position which each frame should take up at each rotation of the main shaft sending the controls to the oscillating devices operating the heald frames, so as to set them in one of the two requested positions, high or low.

[0003] Since the main shaft of the dobby is operated with an intermittent cycle, having a dead point at each rotation of 180°, the control device must, at each stopping of the main shaft, cause the engagement of the rotation shaft with - or, alternatively, its disengagement from - an eccentric, or similar device, operating the leverages controlling the movements of the heald frames; this would, in one case, change the positioning of such frames and, in the other, keep them in their previous position. The dobbies which control the heald frames in weaving looms must therefore be operated by means of special programming devices apt to determine, through suitable actuators, the change of the respective positions of the control means which, in turn, change the position of the heald frames.

[0004] There are already known to be in technique, since quite some time, a great number of devices to carry out the programming of dobbies; such devices involve however several drawbacks, among which the need to stop the shaft at each rotation of 180°, so as to be able to dispose of the time required to cancel the previous programming and set up a new one for the subsequent rotation. It is evident that programming devices of this type are apt to cause an increase of the dead times of the machine, to the detriment of the useful working time.

[0005] Another drawback of the known-type programming devices - which provide for a single control, the times of action on the control levers being synchronized with the central part of the motion diagram, both for the forward movement and for the reverse movement - lies in the high possibility of errors in selecting the clockwise or anticlockwise moving direction, it being moreover indispensable, with such devices, to carry out sime idle rotations of 180° when having to search for the weft and reset the correct step.

[0006] The technical problem of conceiving a device to carry out the program-ming of dobbies, particularly rotary dobbies for the operation of weaving machines - which device: allows to select the position of the heald frames without stopping the rotation of the main shaft at each half-rotation; allows an independent selection of the frames for the clockwise rotation and for the anticlockwise rotation; and reduces the stress on the warp yarns, keeping reduced stresses and efforts in the dobby members, in order to allow very high working speeds and a low power consumption - had been solved with a device forming the object of EP-B1-0 768 402, in the name of the same Applicant. Said device - meant for rotary dobbies of the type in which the rods to control the heald frames are operated by connecting rods, each mounted onto an eccentric ring rotating in respect of the main shaft of the dobby, which comprises moreover a disk caused to rotate by said shaft and a selection lever pivoted on said eccentric ring and apt to engage said disk with a tooth end thereof, under the action of a spring - comprises a control lever rotating about a fixed fulcrum under the action of thrust means and in opposition to return spring means, so that projecting end profiles of said control lever may alternately position themselves along or outside the trajectory at the end of the selection lever opposite to its toothed end, so as to cause or prevent the engagement of said lever with the rotating disk, the rotation of the control lever taking place during the rotation of the main dobby shaft. In the embodiment according to the cited patent, a mechanical solution was adopted wherein one of the projecting end profiles of said control lever was formed as a tooth pivoted, at the corresponding end of said lever, into a slot having two divergent abutting walls and kept in contact with one of said walls by a spring, so as to oscillate up to contacting the other wall, in order to shift the positive engagement with said selection lever in the condition of reverse movement of the dobby; suitably, the spring acting on the selection lever and the spring acting on the tooth profile of the control lever were dimensioned so that the action of the first spring could not be overcome by the action of the second spring.

[0007] With the subsequent EP-B1-0 799 919, the Applicant again introduced the important improvement to replace the mechanical solution of the previously cited patent with electronically controlled electric drive means, apt to cause the movements of said control lever or to replace said lever in its action of control. The same patent suggested two practical embodiments of the new solution, based on the use of electric linear stepping motors, widely illustrated on its drawings and clearly defined in its secondary claims. Though apt to be realized on a technical level from the constructive point of view, and apt to guarantee a proper working, said embodiments of the aforementioned device supplied no satisfactory solutions to the problems of reducing to a minimum the power and thickness of the electric linear driving motors and of making sure that the control lever is kept in its working positions in a sufficiently reliable manner.

[0008] These problems are instead solved by the present invention which thus most efficiently fulfils all the advantages of the electronic control of the device. The solution according to the present invention is obtained by adopting positively original principles in realizing the

control means - in the form of an electric linear stepping motor - of the device to carry out the programming of dobbies, as explained hereinafter.

[0009] The invention thus concerns a device to carry out the programming of rotary dobbies for the operation of heald frames in weaving machines, particularly looms - of the type in which the control rods for the heald frames are operated by connecting rods, each mounted on an eccentric ring rotating in respect of the main shaft of the dobby, which comprises moreover a disk caused to rotate by said shaft and a selection lever pivoted on said eccentric ring and apt to engage said disk with one of its end teeth, under the action of a spring, said device comprising a toggle-joint lever controlled so as to oscillate about a fixed fulcrum, so that projecting end profiles of said lever may alternately position themselves along or outside the trajectory at the end of the selection lever opposite to the toothed end, so as to cause or prevent the engagement of said lever with the rotating disk - characterized in that the controls to cause the oscillation of the toggle-joint lever are obtained, in coordination with the rotation of the main shaft of the loom and against the action of a spring, by means of an electric linear stepping motor in which the rectilinear driving member operates, by means of a link, on a rod having one end pivoted close to an end of the toggle-joint lever and the other end guided by a cam profile.

[0010] In a first embodiment of the device according to the invention, said cam profile engages said other end of the rod only from the outside.

[0011] In a second embodiment of the device according to the invention, said cam profile and said other end of the rod are shaped so as to obtain a mutual bilateral engagement between them. Preferably, said engagement is obtained by giving to the other end of the rod a substantially cylindrical configuration, and by forming said cam profile as a body with two cylindrical cavities opening towards the rod and being mutually radiused outwardly thereof.

[0012] In a third embodiment of the device according to the invention, the cam profile is replaced by a lever oscillating with one end about a fixed point and having the other end pivoted in the joint between the link and the rod.

[0013] The invention will now be described in further detail with reference to the accompanying drawings, which illustrate by mere way of example some preferred embodiments thereof, and in which:

[0014] Fig. 1 is a diagrammatic part section view of a rotary dobby to which is applied a first embodiment of the device according to the invention;

[0015] Fig. 2 is a section view, similar to that of fig. 1, to which is applied a second embodiment of the device according to the invention; and

[0016] Fig. 3 illustrates, very diagrammatically, a third possible embodiment of the device according to the invention.

[0017] As shown on the drawings, the device according to the present invention forms part of a dobby which comprises a main shaft 1 onto which is keyed a connecting rod 2, shaped so as to have a projection 2A pivoted in 3A to the control rod 3 for the heald frames (not shown) and a substantially circular ring 2B carrying two pins 2C in opposite positions.

[0018] A bearing 4 is inserted at the centre of the connecting rod 2, an eccentric ring 5 being mounted onto the inner ring of said bearing 4 and being apt to rotate in respect of the shaft 1, as seen hereinafter.

[0019] On the eccentric ring 5 there is mounted oscillating, by means of a rivet 6 or like, a rocking or selection lever 7 having shaped ends 8 and 9 and, on its inner side, a tooth 11 opposite to the end 9.

[0020] A spring 12, positioned between the eccentric ring 5 and the end 9 of the lever 7, imparts a returning action on the lever 7 and thus tends to cause its rotation, so as to draw the tooth 11 close to the rotation axis of the shaft 1.

[0021] On said shaft 1 is finally keyed a disk 13, on the periphery of which there are formed two notches 13A and 13B, diametrally opposite in respect of the rotation centre of said disk 13 positioned on the axis of the shaft 1.

[0022] To the disk 13 there is keyed the inner ring of a bearing, on the outer ring of which is keyed the eccentric ring 5, so as to rotate about the shaft 1.

[0023] The disk 13 lies on the same plane as the lever 7, so that the tooth 11 of this latter is apt to engage one of its two notches 13A or 13B, and disengage therefrom.

[0024] The device is completed by a toggle-joint control lever 14, the ends of which have projecting profiles, shaped in the form of pawls 14A, 14B, mounted so as to oscillate against the action of springs 14C, 14D. The control lever 14 is apt to oscillate - being mounted with an intermediate point thereof rotatable about a fulcrum 14E - so as to take up different positions, strictly coordinate with the rotation of the main shaft of the loom on which the dobby is mounted; in such positions, the shaped end profiles 14A and 14B of the lever 14 are apt to engage, or not engage, the end 8 of the selection lever 7 opposite to its toothed end 11.

[0025] According to the invention, the positions of the lever 14 are controlled, against the action of a return spring 15, by an electric linear stepping motor 16, in which the rectilinear driving member 16A operates, by means of a link 17, on a rod 18 having one end 19 pivoted close to an end of the toggle-joint lever, and the other end 20 guided by a cam profile.

[0026] In the embodiment of fig. 1, the cam profile 21 which guides the end 20 of the rod 18, engages said end 20 only from the outside, stops 18A and 18B being apt to limit the lateral movements of said rod 18.

[0027] In the embodiment of fig. 2 - more elaborate - the end 20 of the rod 18 has a substantially cylindrical configuration and said cam profile is formed as a body 22 comprising two radiused cylindrical cavities 23 and 24.

[0028] Finally, in the embodiment of fig. 3, the cam profile is replaced by a lever 25, oscillating with one end 26 about a fixed point 27 and having the other end 28 pivoted in the joint 29 between the link 17 and the rod 18.

[0029] In all the three aforedescribed embodiments of the device according to the invention, the controls to cause the oscillations of the toggle-joint lever 14 about the fixed fulcrum 14E are obtained thanks to the precise rectilinear movements of the driving member 16A of the electric linear stepping motor 16, through the link 17 and the rod 18; this allows the projecting end profiles 14A and 14B of said lever to alternately position themselves - promptly and with great precision - along or outside the trajectory at the end 8 of the selection lever 7 opposite to the toothed end 11, so as to cause or prevent the engagement of said lever with the rotating disk 13, and thereby achieve an optimal working of the dobby in the various operating conditions.

[0030] The solution according to the present invention, illustrated heretofore, allows moreover to limit the effort which the motor 16 has to make in order to cause the oscillation of the toggle-joint lever 14 against the action of the spring 15; said effort is in fact considerably reduced as compared to the solutions of prior art, thanks to the interposition of the leverages - highly advantageous from the mechanical point of view - which characterize the present invention.

[0031] The power required from the motor 16 is thus limited in a mechanical way and this allows to use, in the device according to the invention, electric linear stepping motors 16 of small dimensions and, in particular, of highly reduced thickness (even not exceeding 24 mm). This last characteristic of the motors 16 being used is extremely important in the construction and working of the device according to the invention, wherein - as known - the toggle-joint levers controlling the motion of the connecting rods operating the control rods for the heald frames must be positioned strictly close, just like said frames in the loom. It is hence very important also for the motors operating the toggle-joint levers to be very close (if possible, no less than said levers), so as to avoid the structural complications of the device which would otherwise turn out to be indispensable. The invention fully reaches this object and thus achieves a considerable and unexpected technical progress, allowing to produce far more compact, simple and less costly devices than those produced up to now.

[0032] Such devices have moreover the advantage to guarantee, far more than the known devices, that the toggle-joint levers remain in their working positions, thanks to the cooperation - according to the invention - between the end 20 of the rod 18 of the leverage and the cam profiles 21, 22, or the lever 25. The embodiment of fig. 2 is particularly efficient in this respect, since its cam profile 22 is formed as a body with two cylindrical cavities 23 and 24, opening towards the rod 18 and being mutually radiused outwardly thereof: said cam profile 22 is thus apt to determine, with the end 20 of the rod 18, a mutual bilateral engagement in both working positions.

[0033] It is anyhow understood that there can be other embodiments of the invention, differing from those described and illustrated herefore, without thereby departing from the protection scope thereof.

Claims

1. Device to carry out the programming of rotary dobbies for the operation of heald frames in weaving machines, particularly looms - of the type in which the control rods (3) for the heald frames are operated by connecting rods (2), each mounted on an eccentric ring (5) rotating in respect of the main shaft (1) of the dobby, which dobby comprises moreover a disk (13) caused to rotate by said shaft (1) and a selection lever (7) pivoted on said eccentric ring (5) and apt to engage said disk (13) with one of its end teeth (11) under the action of a spring (12), said device comprising a toggle-joint lever (14) controlled so as to oscillate about a fixed fulcrum (14E), so that projecting end profiles (14A, 14B) of said lever may alternately position themselves along or outside the trajectory at the end (8) of the selection lever (7) opposite to the toothed end (11), so as to cause or prevent the engagement of said lever with the rotating disk (13) - **characterized in that** the controls to cause the oscillation of the toggle-joint lever (14) are obtained, in coordination with the rotation of the main shaft (1) of the loom and against the action of a spring (15), by means of an electric linear stepping motor (16) in which the rectilinear driving member (16A) operates, by means of a link (17), on a rod (18) having one end (19) pivoted close to an end of the toggle-joint lever (14) and the other end (20) guided by a cam profile (21, 22).

2. Device as in claim 1), wherein said cam profile (21) engages said other end (20) of the rod (18) only from the outside.

3. Device as in claim 1), wherein said cam profile (22) and said other end (20) of the rod (18) are shaped so as to obtain a mutual bilateral engagement between them in the two working positions.

4. Device as in claim 3), wherein the other end (20) of the rod (18) has a substantially cylindrical configuration and said cam profile (22) is formed as a body with two cylindrical cavities (23, 24) opening towards the rod (18) and being mutually radiused outwardly thereof.

5. Device as in claim 1), wherein the cam profile is replaced by a lever (25) oscillating with one end (26)

about a fixed point (27) and having the other end (28) pivoted in the joint (29) between the link (17) and the rod (18).

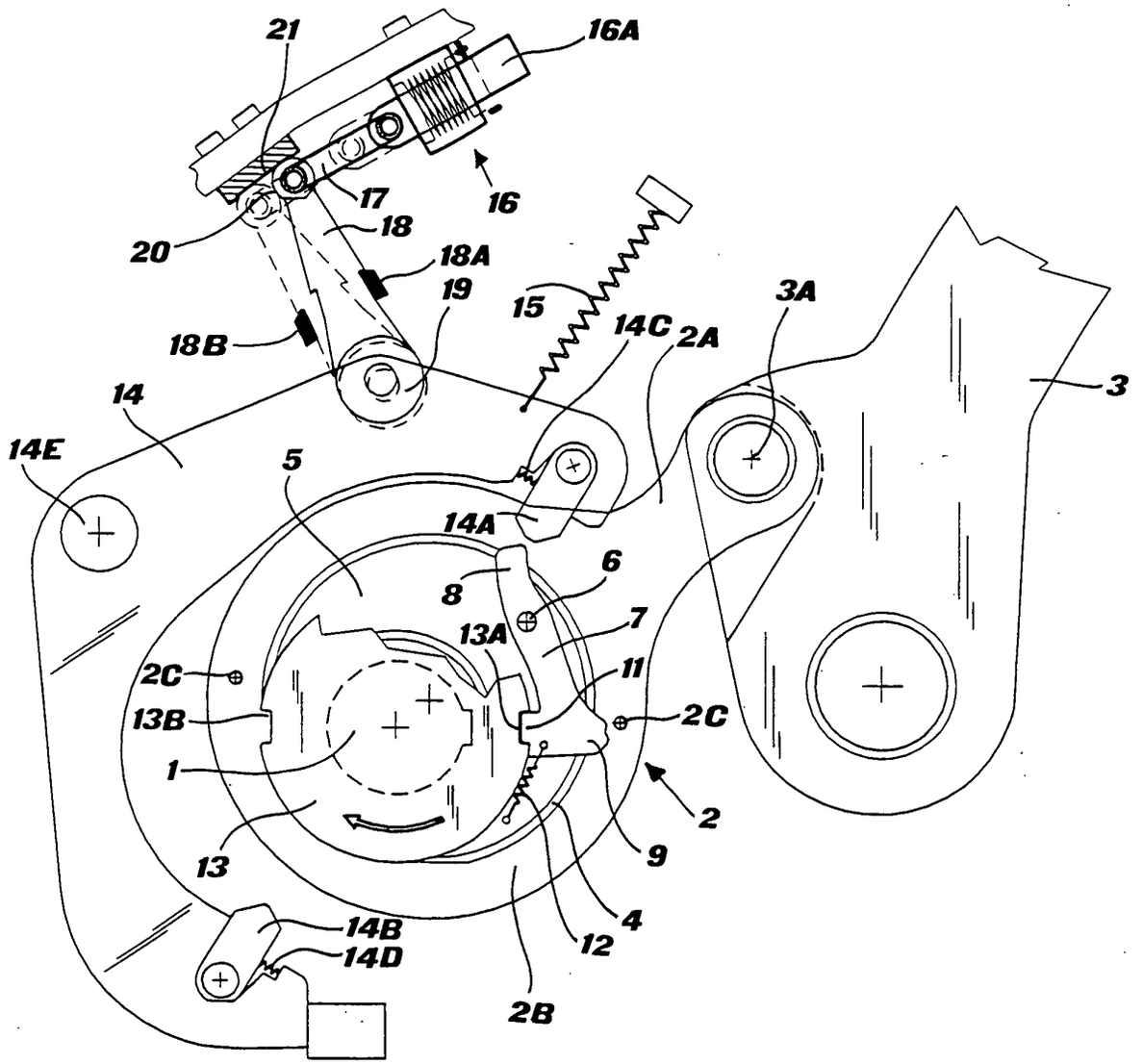
21
16A
17
16
20
18
18A
19
15
3A
18B
14C
2A
3
14
14E
5
14A
6
8
7
13A
11
2C
2C
13B
1
2
9
13
4
14B
14D
12
2B

FIG.1

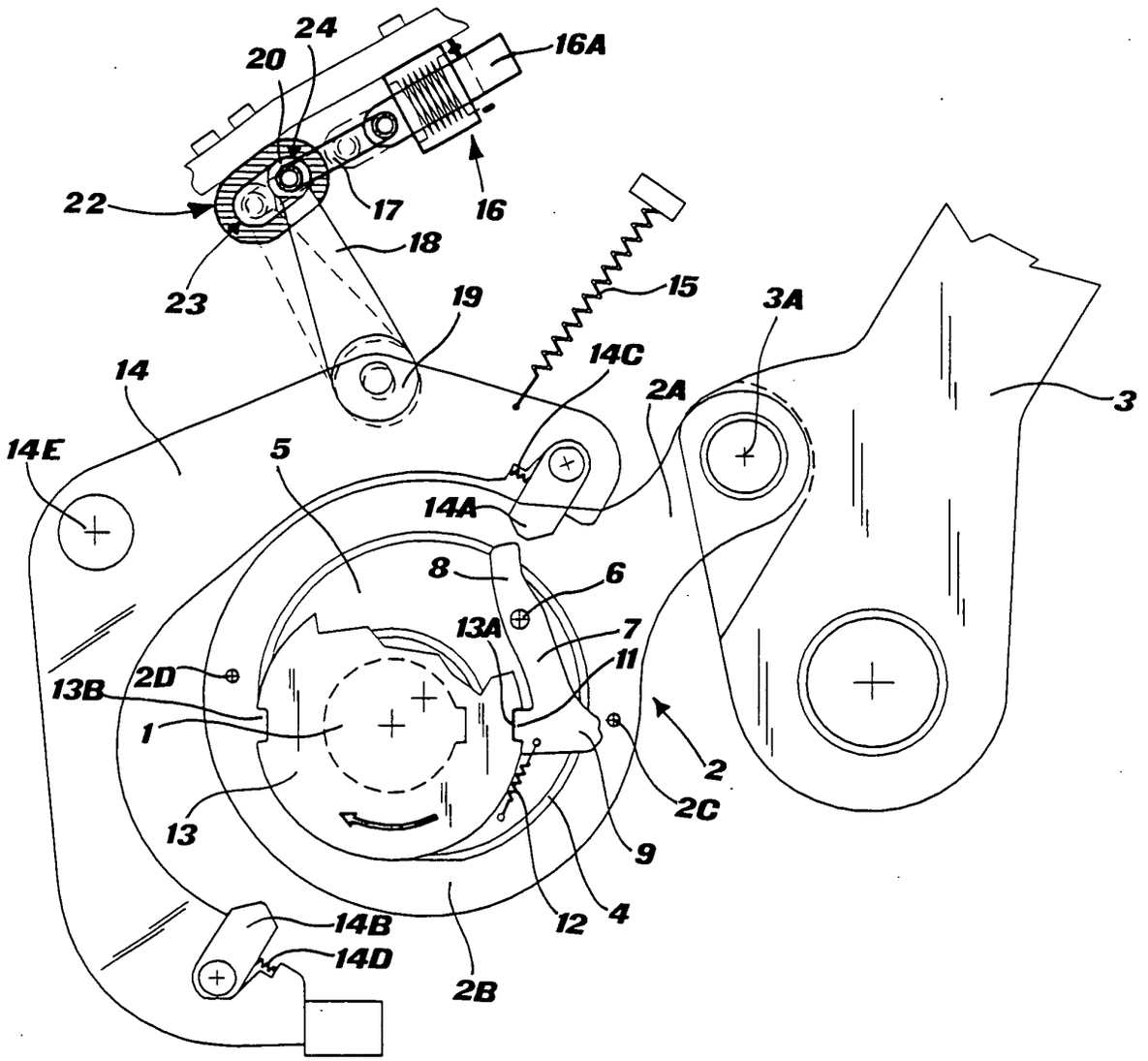
24
20
16A
22
17
16
18
23
19
15
3A
14C
14
2A
3
14E
5
14A
8
6
13A
7
11
13B
2D
1
2
2C
13
9
12
4
14B
14D
2B

FIG.2

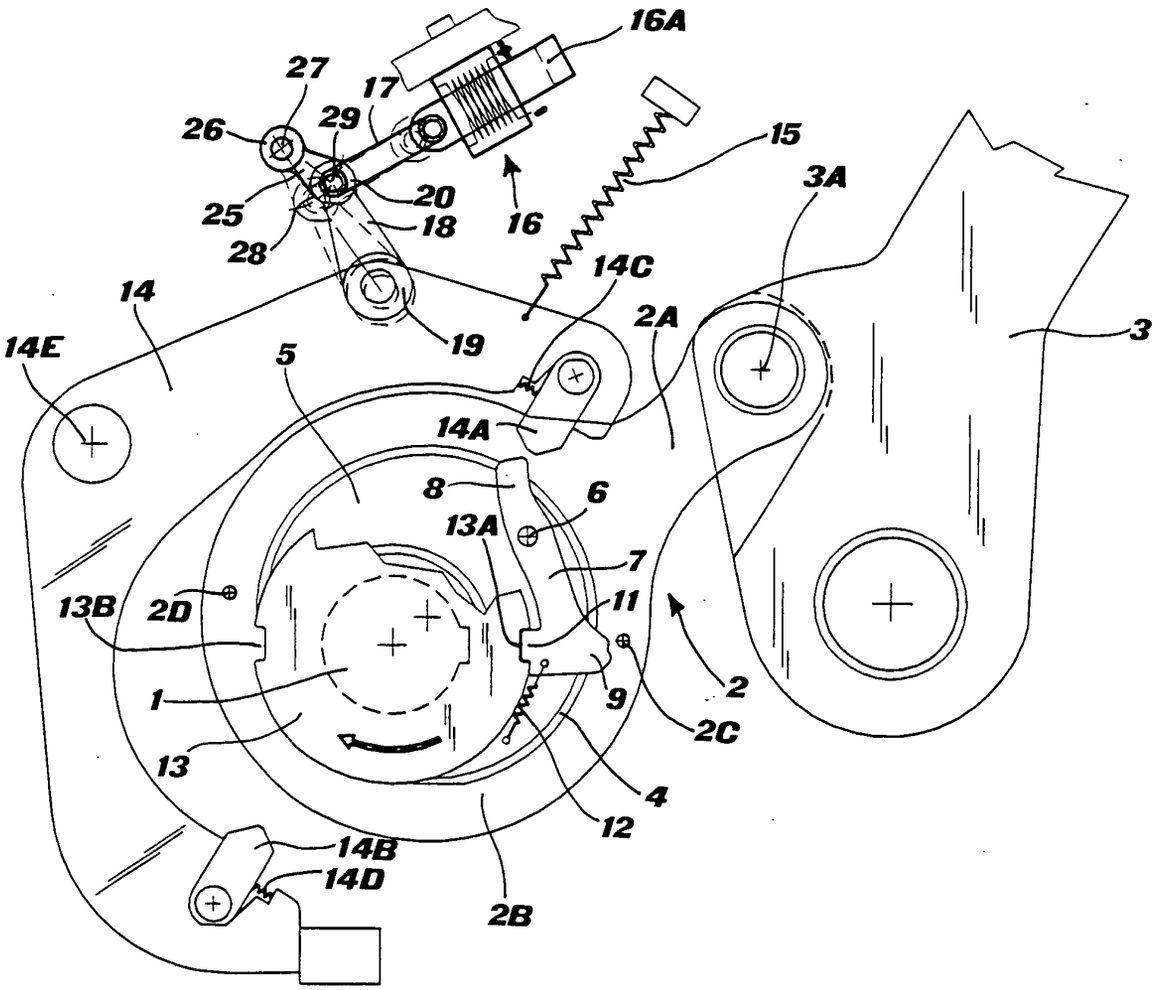
16A
27
17
26
29
15
3A
25
20
16
28
18
14C
14
2A
3
14E
19
5
14A
8
6
13A
7
13B
2D
11
2
9
1
2C
13
4
12
14B
14D
2B

FIG.3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 00 6721

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)
A,D	EP 0 799 919 A (FIMTEXTILE SPA) 8 October 1997 (1997-10-08) * column 3, line 31 - column 4, line 19; figure 1 *	1	D03C1/00 F16D11/16
A	EP 0 485 009 A (GIOBBE SRL) 13 May 1992 (1992-05-13) * column 3, line 56 - column 4, line 51; figures *	1	
A,D	EP 0 768 402 A (FIMTEXTILE SPA) 16 April 1997 (1997-04-16) * column 3, line 19 - column 4, line 6; figures *	1	
A	WO 97 32066 A (KLEINER ERNST ;ROHNER FELIX (CH)) 4 September 1997 (1997-09-04) * page 5, line 27 - page 6, line 3; figure 6 *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 07, 29 September 2000 (2000-09-29) & JP 2000 096379 A (MURATA MACH LTD), 4 April 2000 (2000-04-04) * abstract *		TECHNICAL FIELDS SEARCHED (Int.Cl.7) D03C F16D
A	EP 0 525 862 A (NUOVO PIGNONE SPA) 3 February 1993 (1993-02-03) * figure 1 *		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 August 2002	Rebiere, J-L

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 00 6721

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.

27-08-2002

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0799919 A	08-10-1997	IT MI960657 A1	06-10-1997
		DE 69705982 D1	13-09-2001
		DE 69705982 T2	04-04-2002
		EP 0799919 A1	08-10-1997
		JP 10008343 A	13-01-1998
EP 0485009 A	13-05-1992	IT 1243890 B	28-06-1994
		AT 126841 T	15-09-1995
		DE 69112345 D1	28-09-1995
		DE 69112345 T2	18-04-1996
		EP 0485009 A1	13-05-1992
EP 0768402 A	16-04-1997	IT MI952037 A1	07-04-1997
		DE 69607716 D1	18-05-2000
		DE 69607716 T2	21-09-2000
		EP 0768402 A1	16-04-1997
WO 9732066 A	04-09-1997	AU 1763497 A	16-09-1997
		WO 9732066 A1	04-09-1997
		EP 0883704 A1	16-12-1998
		JP 2000507310 T	13-06-2000
JP 2000096379 A	04-04-2000	NONE	
EP 0525862 A	03-02-1993	IT 1251107 B	04-05-1995
		BR 9202836 A	23-03-1993
		CN 1068864 A ,B	10-02-1993
		CZ 9202327 A3	17-03-1993
		DE 69219414 D1	05-06-1997
		DE 69219414 T2	02-10-1997
		EP 0525862 A1	03-02-1993
		JP 3256813 B2	18-02-2002
		JP 5195362 A	03-08-1993
		RU 2091640 C1	27-09-1997
		US 5259419 A	09-11-1993

EPO FORM P0459

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