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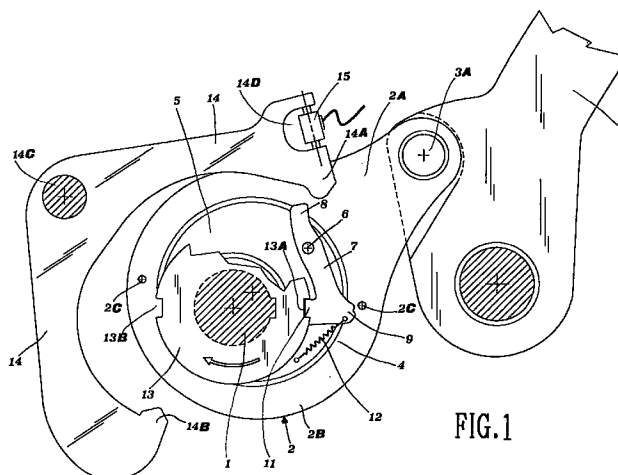
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(54) **Device for carrying out the programming of rotary dobbies in weaving machines**

(57) Device for carrying out the programming of rotary dobbies for the operation of heald frames in weaving machines, of the type in which the heald frame operating levers (3) are actuated by connecting rods (2) each mounted on an eccentric ring (5) rotating with respect to the main shaft (1) of the dobby, which has moreover a disc (13) made to rotate by said shaft (1) and a selection lever (7) pivotably hinged on said eccentric ring (5) and designed to engage with said disc (13) via one of its end teeth (11), through the action of a spring (12). The device comprises operating means which are arranged alternately along or outside the trajectory at the end (8) opposite to the toothed end (11) of the selection lever (7) so as to cause or avoid the engagement thereof with the rotating disc (13). The action of said operating means is co-ordinated with the rotation of the main shaft. Said operating means comprise at least one electric linear stepper motor (15, 18, 19).



EP 0 799 919 A1

## Description

The present invention relates to an improved device for carrying out the programming of rotary dobbies for the operation of heald frames in weaving machines.

It is known that the positioning of the head frames of a weaving machine or loom, from which the configuration of the weft of the finished fabric is obtained, must be programmed in a predetermined sequence which defines the position which each frame must assume upon each rotation of the main shaft, this generating the controls for the oscillating devices which operate the frames themselves, so as to obtain for them one of the two - high or low - positions required.

Since the main shaft of the dobby is operated in accordance with an intermittent cycle, with the dead centre at each half-rotation through 180°, the operating and control device, for each stoppage of the main shaft, must be able to make the rotating shaft integral or not with an eccentric cam or similar device actuating the frame moving levers, resulting, in one case, in the change of position thereof and, in the other case, in the previous position being maintained. The dobbies which operate the heald frames in weaving looms must therefore be controlled by means of special devices for carrying out the programming, which are designed to produce, by means of special actuators, the variation in the relative positions of the operating means which, in turn, vary the position of the frames.

It is already known in the art of devices for carrying out the programming of the dobbies, which, however, have numerous drawbacks, including the need to stop the shaft at each half-turn, so as to have the time necessary for clearing the previous programming operation and entering a new one for the next half-turn. It is obvious how the programming devices of this type cause an increase in the idle time of the machine, to the detriment of the useful working time.

Another type of drawback which may be encountered in the devices of the known type involving a single control with times for pressing of the operating levers synchronised with the middle of the movement diagram, both for forwards movement and for reverse movement, consists in the high probability of errors during selection of the movement in a clockwise or anti-clockwise direction, it being indispensable, moreover, with said devices, to perform a few half-turns under zero load when it is required to locate the weft and re-establish the shed for recording purposes.

The technical problem of providing a device for carrying out the programming of dobbies, in particular rotary dobbies for controlling weaving machines, which allows: selection of the position of the heald frames to be performed without stopping rotation of the main shaft at each half-turn; independent selection of the frames for rotation in the clockwise direction and for rotation in the anti-clockwise direction; and reduced stressing of the warp yarns, ensuring reduced stresses and forces in the dobby components, so as to allow very high working

speeds and a low power consumption, has been solved with the device forming the subject of Italian Patent No. (Application No. MI95A 002037) in the name of the same Applicant. This device intended for rotary dobbies of the type in which the heald frame operating rods are actuated by connecting rods each mounted on an eccentric ring rotating with respect to the main shaft of the dobby, which has moreover a disc made to rotate by said shaft and a selection lever pivotably hinged on said eccentric ring and designed to engage with said lever via one of its end teeth, through the action of a spring, comprises an operating lever rotating about a fixed fulcrum owing to the action of thrusting means and in opposition to spring-type recall means, so that the projecting end profiles of the same operating lever are arranged alternately along or outside the trajectory at the end opposite to the toothed end of the selection lever so as to cause or avoid engagement thereof with the rotating disc, the rotation of the operating lever being performed during rotation of the main shaft. In the embodiment according to the aforementioned patent a mechanical solution is adopted, whereby one of the projecting end profiles of said operating lever is formed as a tooth pivotably hinged on the corresponding end of said lever, inside a recess having two diverging abutment walls, and kept in contact with one of them by a spring, so as to be able to oscillate until it makes contact with the other one so as to phase-displace the active engagement with said selection lever, in the condition of backwards movement of the dobby, and, correspondingly, the spring acting on the selection lever and the one acting on the toothed profile of the operating lever are dimensioned so that the action of the former cannot be exceeded by the action of the latter.

It has now been discovered that, in a somewhat simpler manner, the problem of carrying out the programming of rotary dobbies of the type defined immediately above may be dealt with and solved with the use of electric operating means which are controlled electronically and capable of producing the movements of said operating lever or replacing it during its control action.

More precisely the present invention therefore relates to a device for carrying out the programming of rotary dobbies for the operation of the heald frames in weaving machines, of the type in which the heald frame operating levers are actuated by connecting rods each mounted on an eccentric ring rotating with respect to the main shaft of the dobby, which has moreover a disc made to rotate by said shaft and a selection lever pivotably hinged on said eccentric ring and designed to engage with said disc via one of its end teeth, through the action of a spring, said device comprising operating means which are arranged alternately along or outside the trajectory at the end opposite to the toothed end of the selection lever for causing or avoiding the engagement thereof with the rotating disc, the action of said operating means being coordinated with the rotation of the main shaft, characterized in that said operating means comprise at least one electric linear stepper

motor.

In a first embodiment said operating means comprise a toggle lever rotating with its middle point about a fixed fulcrum so that projecting end profiles of the said lever are arranged alternately along or outside the trajectory at the end opposite to the toothed end of the selection lever so as to cause or avoid the engagement thereof with the rotating disc and an electric linear stepper motor which controls rotation of said lever in both directions.

In a second embodiment said operating means comprise two projections which are designed to engage with the end of the selection lever opposite to the toothed end and are arranged angularly spaced, and two electric stepper motors which control the engagement of said projections with said selection levers so as to cause or avoid engagement of the toothed end of the latter with the rotating disc.

The invention will now be described in greater detail, with reference to two currently preferred embodiments thereof, illustrated purely by way of example by the accompanying drawings, in which:

Fig. 1 shows a partial schematic cross-section of a rotary dobby to which the device according to a first embodiment of the invention is applied, in the initial position of a half-turn; and

Fig. 2 is a schematic illustration, similar to that of Fig. 1, of a second embodiment of the invention.

As illustrated in the drawings, the device according to the invention forms part of a dobby which comprises a rotating shaft 1 which has keyed onto it a connecting-rod element 2 shaped so as to have a projection 2A pivotally hinged at 3A with the operating rod 3 of head frames 2B (not shown) and a substantially circular ring 2B which has two rollers 2C in opposite positions.

The centre of the connecting rod 2 has inserted inside it a bearing 4, the inner ring of which has mounted on it an eccentric cam 5 which is able to rotate, as can be seen further below, with respect to the shaft 1.

The eccentric cam 5 has mounted on it in an oscillating manner, by means of a rivet 6 or the like, a rocker lever 7, or selection lever, which has shaped ends 8 and 9 and, on its inner side, a tooth 11 opposite to the end 9.

A spring 12 arranged between the eccentric cam 5 and the end 9 of the lever 7 exerts a recall action on the lever 7 itself and thus tends to cause it to rotate so as to move the tooth 11 towards the axis of rotation of the shaft 1.

Finally, said shaft 1 has keyed onto it a disc 13, at the periphery of which there are formed two grooves 13A and 13B arranged diametrically opposite with respect to the centre of rotation of the disc 13 itself and which is located on the axis of the shaft 1.

The disc 13 has keyed onto it the inner ring of a bearing, the outer ring of which has keyed onto it the eccentric cam 5 for thus rotating about the shaft 1.

The disc 13 lies in the same position as the lever 7, such that the tooth of the latter is able to engage with one of two notches 13A or 13B and be disengaged therefrom.

In the embodiment shown in Fig. 1, the dobby is completed by an elbow-shaped operating lever 14, the ends of which have shaped projecting profiles 14A and 14B formed as one piece. The operating lever 14 is able to oscillate, being mounted with its middle point about a fulcrum 14C, so as to assume different positions in which its shaped end profiles 14A and 14B are able to engage with or not engage with the end (8) of the selection levers (7) opposite to the toothed end (11).

According to the invention, the positions of the lever 14 are controlled by an electric stepper motor 15 shown acting in the vicinity of the end 14A of the lever 14, inside a suitable seating 14D thereof, so as to cause oscillations thereof positively controlled in both directions of rotation.

In the embodiment shown in Fig. 2, the dobby no longer has the operating lever 14, but a pair of projections 16 and 17 arranged, at a considerable angular distance from one another, so as to be able to engage directly with the end 8 of the selection lever 7 opposite to the toothed end 11 under the control of two electric linear stepper motors, 18 and 19 respectively.

Operation of the dobby with reference to its embodiment shown in Fig. 1 is now described: at the start of the half-turn of the shaft 1 (Fig. 1A) and assuming forwards movement and that programmed has been performed with a view to varying the position of the frame, the motor 15 keeps the lever 14, with its end 14A outside the trajectory of the end 8 of the lever 7, thus leaving the rocker selection lever 7 subject to the recall action of the spring 12, with the tooth 11 engaged in the recess 13A.

In this situation the eccentric cam 5 is integral with the rotating disc 13 which, rotating with the shaft 1 during the next half-turn, causes rotation with it of the eccentric cam 5 itself and hence the connecting rod 2 which, rotating, drives the frame operating rod 3, causing it to change position.

Before the half-turn has been completed, the motor 15 carries out the control for the next half-turn, i.e. in the example in question so as to keep the frame in the previous position. It therefore exerts a pressure against the end 14A of the lever 14 so as to cause anti-clockwise rotation of the same lever 14, which brings the profile 14B thereof into contact with the rear surface of the end 8 of the lever 7, which lever in the meantime has moved into a position opposite the end 14B of the lever 14. The said lever 7 is thus obliged, continuing the rotation of the disc 13, to rotate about its own pin 6, causing the gradual emergence of the tooth 11 provided at the end faced by the recess 13A of the disc 13.

Once the dead centre of the half-turn has been reached (Fig. 2A), the selection lever 7 is totally rotated outwards and engaged with the roller 2C, while the tooth 11 is totally extracted from the recess 13A.

The eccentric cam 5 thus remains idle with respect to the disc 13, this causing the previous position of the heald frame controlled by the lever 3 to be maintained during the next half-turn, as desired.

Operation of the dobby in the case of the embodiment according to Fig. 2 is similar: in an even simpler manner than in the previous case, engagement of the projections 16 and 17 with the end 8 of the selection lever 7 occurs by means of direct controls of the motors 18 and 19 carried out at suitable moments.

The corresponding operating phases of the device according to the invention in the condition of reverse movement does not require any particular illustration for the person skilled in the art, following the explanation provided for the condition of forwards movement.

With the arrangement described and illustrated the present invention ensures in a fairly convenient manner precise and reliable selection of the position of the heald frames, without it being necessary to stop rotation of the shaft at each half-turn, thus avoiding any possible jamming during this stage and allowing independent selection of the frames both during forwards movement and during reverse movement, at even very high dobby speeds, with important advantages in terms of the productivity of the weaving machine with which it is associated.

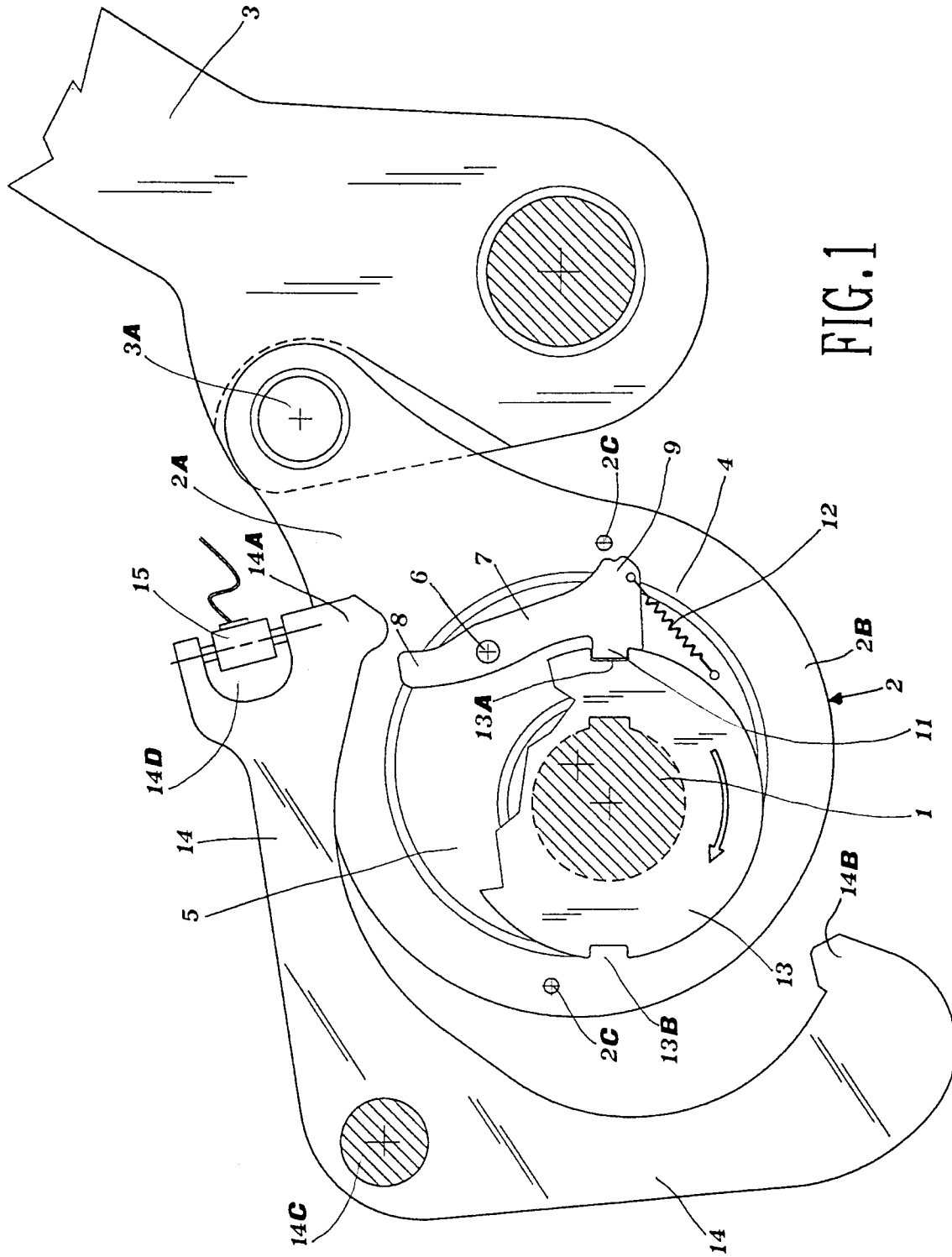
It is understood that other practical embodiments of the invention, different from the one described, are possible, said embodiments legitimately falling within the protective scope of the present invention, as will be obvious to persons skilled in the art.

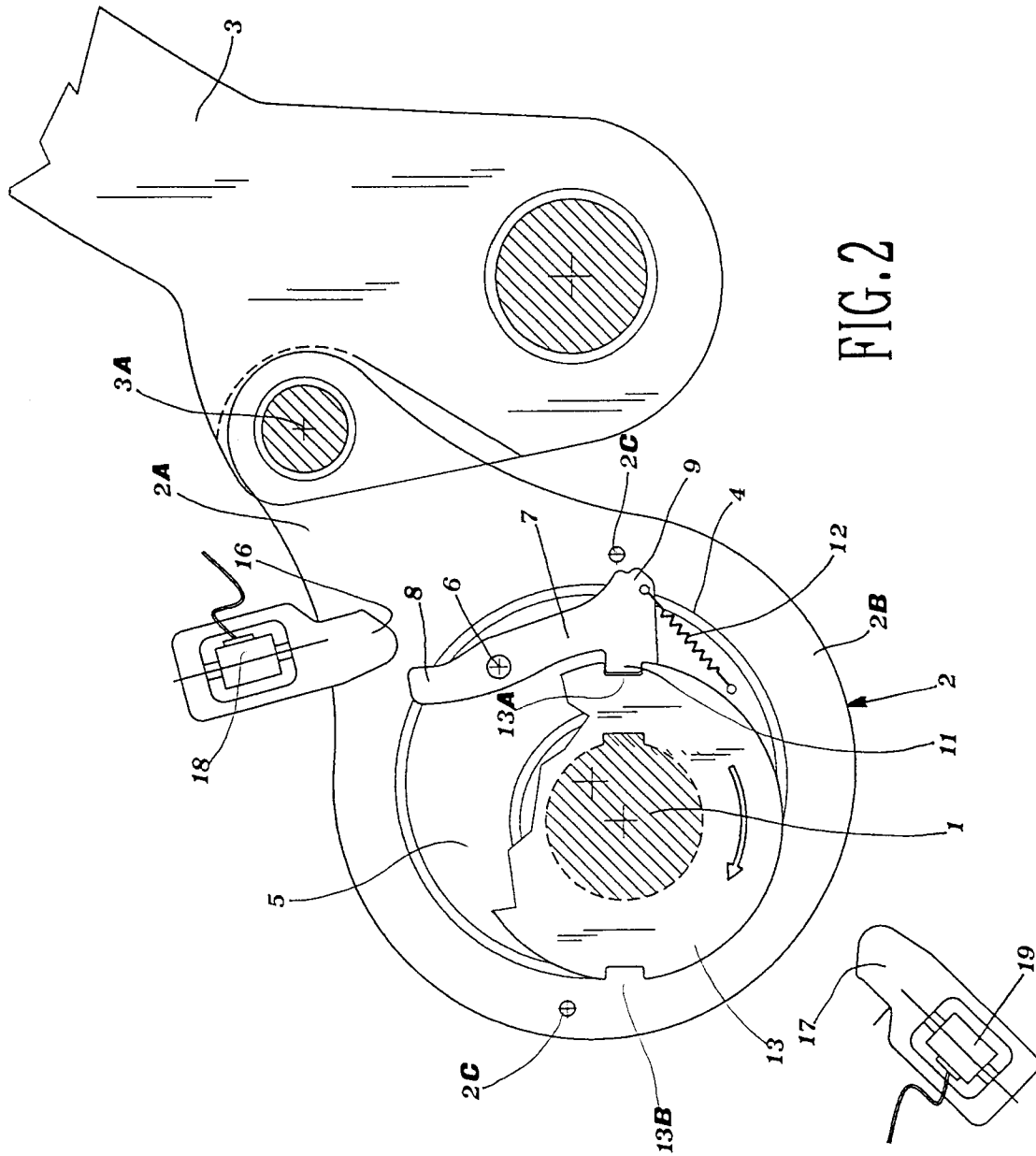
## Claims

1. Device for carrying out the programming of rotary dobbies for the operation of the head frames in weaving machines, of the type in which the heald frame operating levers (3) are actuated by connecting rods (2) each mounted on an eccentric ring (5) rotating with respect to the main shaft (1) of the dobby, which has having moreover a disc (13) made to rotate by said shaft (1) and a selection lever (7) pivotably hinged on said eccentric ring (5) and designed to engage with said disc (13) via one of its end teeth (11), through the action of a spring (12), said device comprising operating means which are arranged alternately along or outside the trajectory at the end (8) opposite to the toothed end (11) of the selection lever (7) for causing or avoiding the engagement thereof with the rotating disc (13), the action of said operating means being co-ordinated with the rotation of the main shaft, characterized in that said operating means comprise at least one electric linear stepper motor (15, 18, 19).
2. Device according to Claim 1, characterized in that said operating means comprise a toggle lever (14) rotating with its middle point about a fixed fulcrum (14C) so that projecting end profiles (14A, 14B) of

the same lever (14) are arranged alternately along or outside the trajectory at the end (8) opposite to the toothed end (11) of the selection lever (7) so as to cause or avoid the engagement thereof with the rotating disc (13) and an electric linear stepper motor (15) which controls the rotation in both directions of said lever (14).

3. Device according to Claim 1, characterized in that said operating means comprise two projections (16, 17) which are designed to engage with the end (8) of the selection lever (7) opposite to the toothed end (11) and are arranged angularly spaced, and two electric stepper motors (18, 19) which control the engagement of said projections with said selection levers (7) in order to cause or avoid engagement of the toothed end (11) of the latter with the rotating disc (13).







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# EUROPEAN SEARCH REPORT

Application Number  
EP 97 10 5168

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.6)
A	EP 0 607 632 A (BURIGANA) * the whole document *	1,3	D03C1/00
A	EP 0 485 009 A (GIOBBE) * the whole document *	1,2	
A	EP 0 525 862 A (NUOVUIGNONE)		
The present search report has been drawn up for all claims			<b>TECHNICAL FIELDS SEARCHED (Int.Cl.6)</b> D03C
Place of search THE HAGUE		Date of completion of the search 26 June 1997	Examiner Boutelegier, C
<b>CATEGORY OF CITED DOCUMENTS</b> 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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