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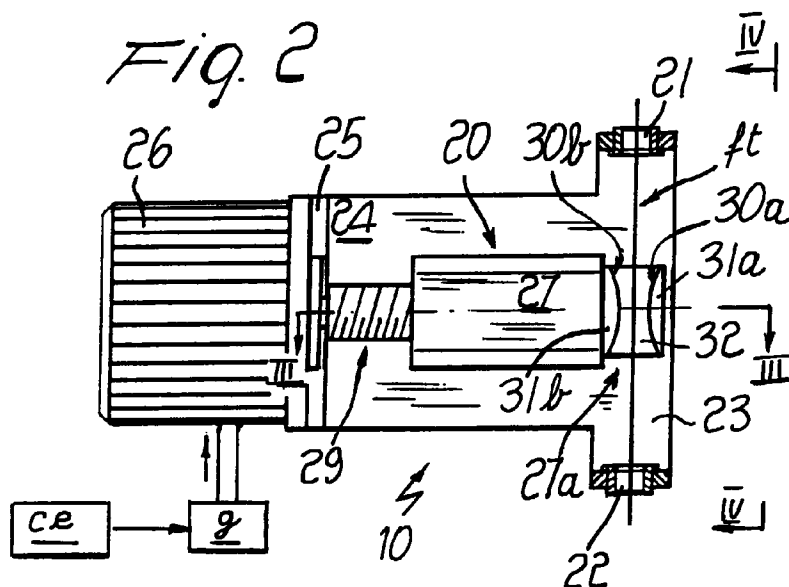
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(54) Weft brake particularly for air-jet looms

(57) A weft brake (10), particularly for air-jet looms, with a diverter (20) for the thread (FT) which moves between two thread guiding bushes (21,22) which are mutually aligned and form a straight path for the thread, wherein the diverter (20) is actuated by a reversible electric motor (26) with the interposition of a bidirectional

transmission (28,29) which is advantageously constituted by a screw (29a) which is associated with the shaft (29) of the reversible motor (26) and cooperates with a female thread (28) associated with the diverter (20).



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Description

The present invention relates to an improved weft brake particularly for air-jet looms, which can be inserted between a weft feeder and a main pneumatic air-jet insertion device arranged on the beater of the reed of the loom.

Weft braking devices are typically used in air-jet looms to reduce the speed of the weft thread shortly before its insertion between the warp threads is completed at each beat of the loom. Since in modern looms and particularly in air-jet looms each individual insertion lasts only a few milliseconds, it is necessary to slow the thread before stopping it to prevent the occurrence of peaks of mechanical tension which can easily break said thread. The weft length required for each insertion is in fact usually measured by the feeder in the form of a preset number of turns which unwind from the fixed drum of the feeder. An optical reader is provided in order to count the unwinding turns and when the preset number of unwound turns is reached a stop element is activated in order to stop the unwinding of said turns.

Typically, the stop element comprises a stop finger which moves radially with respect to the drum of the feeder under the actuation of an electromagnetic means and is suddenly lowered towards and against the drum to interfere with the unwinding of the thread and stop it. This sudden stopping of the thread causes the onset of said peaks in mechanical tension, which easily break the thread; the smaller the count of the thread, the more frequent the breakages.

The weft brake, which is interposed between the feeder and the pneumatic insertion device, has the purpose of slowing the weft thread before stopping it, since the tension peaks caused by stopping increase with the thread advancement speed; for this purpose, it is based on the concept of diverting the thread with respect to the straight path that it performs during insertion.

According to known solutions (EP-A 0 356 380, DE 4 131 652), thread diversion is achieved by means of an element which moves in a linear fashion with fixed thread guides and interposed moving thread guides which are pushed against the thread to divert it during braking. Thread diversion can be partially eliminated after the tension peak has ceased, and there is provided an elastic damping means in order to yield, with a delayed reaction, to the force applied to the thread owing to the diversion.

According to another known solution (EP-A 0 527 510), the thread passes in a straight line through a plurality of fixed thread guides along its insertion path and is diverted, in order to slow it, by two diverting thread guides supported by a rotating support controlled by an electromagnetic actuator which, by moving the support in an angular fashion, pushes the diverting thread guides against the thread.

According to another known solution (EP-A 0 659 919), a transmission means is interposed between the

diverting thread guide and the actuator and allows relative movement between the actuator and the thread guide in order to limit the increase in thread tension caused by braking and also keep the tension at a preset value.

All these conventional weft brakes have the drawback that they produce a limited and non-adjustable diversion of the thread. Accordingly, the speed reduction determined by the diversion angle applied to the thread can be unsuitable for the type of thread being processed. Moreover, the brakes do not allow, or allow only to a limited extent, to take up the thread and retension it as required by the subsequent weaving steps after speed reduction and after damping of the stopping tension peak.

Another drawback of conventional weft brakes is the fact that the intervention speed of the diversion elements cannot be adjusted. Usually, owing to the electromagnetic nature of the actuator, the diverting thread guides are also suddenly moved against the thread and this method of intervention produces an unwanted tension thereon.

The use of elastic damping elements only partially solves this drawback, since in these systems the rigidity of the elastic transmission elements becomes a critical parameter which should be proportional to the speed and count of the thread being processed; accordingly, an intermediate rigidity value is usually chosen which does not adequately meet the requirements of correct operation of the weft brake.

The aim of the present invention is to eliminate these and other drawbacks, and within the scope of this general aim the invention has the important object of providing an improved weft brake with a thread diverter which has a linear motion and in which the breadth and speed of the movement of the diverter can both be adjusted within wide limits and the movement speed can also change, during brake intervention, according to a preset rule of motion.

Another particular object of the present invention is to provide a weft brake with a diverter which has a linear movement and is suitable to assume distinct positions for braking and taking up and retensioning the thread, which correspond to two end positions of the stroke of the diverter, so that transition from one position to the other is very quick and does not require reversal of the motion of the diverter.

Another particular object of the invention is to provide a weft brake with a thread diverter having a linear movement, wherein the transition of the diverter from the braking position to the non-braking or neutral position and to the takeup and retensioning positions or viceversa occur successively owing to a positive actuation which eliminates the use of elastic auxiliary means and allows to graduate both the extent and the speed and/or acceleration of the diverter, adapting the intervention of the brake to the requirements of the process and to the count of the thread being processed.

Another important object of the invention is to provide a weft brake which has a very simple and compact structure, has limited overall dimensions and is highly reliable in operation.

According to the present invention, this aim, these important objects and others are achieved with a weft brake having the specific characteristics stated in the appended claims.

Substantially, according to the invention, there is provided a weft brake with a thread diverter which has a linear movement and travels between two fixed and mutually aligned thread guiding bushes and in which said diverter is actuated by a reversible electric motor with the interposition of a bidirectional transmission, constituted by a screw which is associated with the driving shaft and cooperates with a female thread associated with the diverter (or viceversa). The actuation motor is preferably of the brushless type and can be supplied with a modulated current which is suitable to produce preset rules of motion for said diverter. The diverter comprises mutually opposite active surfaces which are suitable to engage the thread in order to divert it for corresponding mutually opposite operating positions of said diverter with respect to a neutral central position of said diverter.

Further characteristics and advantages of the improved weft brake according to the present invention will become apparent from the following detailed description, given with reference to the accompanying drawings, which are provided only by way of non-limitative example and wherein:

figure 1 is a conventional schematic view of the means for feeding the weft thread to an air-jet loom and of the weft brake according to the invention operatively inserted between the feeder means;
figure 2 is an enlarged-scale top plan view of the weft brake of figure 1;
figure 3 is a partial sectional view, taken along the plane III-III of figure 2;
figure 4 is a front view, taken in the direction of the arrows IV-IV of figure 2;
figures 5, 6 and 7 are views, similar to figure 2, of corresponding operating and neutral positions of the diverter for the weft brake according to the invention.

Figure 1 shows a weft brake 10 inserted in a system for feeding weft thread FT to a loom 11, which comprises a bobbin of thread 12, a weft feeder 13 and a main weft insertion device 14. If the loom 11 is of the air-jet type, the insertion device 14 is constituted by a pneumatic nozzle which is arranged on the slay 15 of the reed of the loom in order to insert, with the aid of auxiliary pneumatic inserters 16, the weft thread FT between the warp threads FO. The length of the weft to be inserted at each beat is measured in a conventional manner by the feeder 13, on which a hollow arm 16

winds, in a windmilling fashion, a plurality of turns of thread which constitute a weft reserve. The weft length is measured in the form of a preset number of turns which unwind from the drum of the feeder 13 when requested by the loom 11.

The unwinding turns are counted by an optical device (not shown), and when the preset number is reached, a stop element 17, by moving into an engagement position towards and against the drum, blocks the unwinding of the thread FT.

In order to overcome the mechanical tension peaks generated on the thread FT by the activation of the element 17, shortly before the thread stops it is slowed by the weft brake 10, which diverts the thread with respect to the straight path that it follows during insertion.

For this purpose, the weft brake 10 comprises a diverter 20 which moves in a straight line between two fixed thread guiding bushes 21 and 22 which are mutually aligned and form the straight path of the thread. The thread guiding bushes 21 and 22 are supported at the corresponding ends of a fixed U-shaped fork 23 which is in turn arranged at the end of a supporting plate 24. The end 25 of the plate which is opposite to the fork 23 is folded at right angles so as to act as a support for a reversible electric motor 26, which is supplied with a current *i* delivered by a power source G. Advantageously, the motor 26 is of the brushless or equivalent type, such as a step motor and the like.

The diverter 20 is constituted by a slider 27 made of a rigid material, possibly a nonmetallic material, which moves along straight paths which are at right angles to the path of the thread FT and moves on the supporting plate 24 in sliding contact with the plate by means of a flat face 27a. In the slider 27 there is provided a blind cylindrical seat 28 which is internally threaded in order to constitute a female thread element. An actuation screw cooperates by thread engagement with the female thread and is constituted by the correspondingly threaded portion 29a of the shaft 29 of the motor 26; the shaft protrudes outside the end of the support 25 and lies parallel to the plate 24 over a suitably long extent which is substantially equal to the depth of the seat 28. The slider 27 has a front part 27a, which lies and moves between the fixed thread guiding bushes 21 and 22 and whereon there are provided mutually opposite active surfaces 30a and 30b which are suitable to engage the thread FT and divert it, so as to slow it, with respect to the straight path defined by the thread guiding bushes 21 and 22. The active surfaces substantially have the profile of a circular segment and are supported by corresponding pawls 31a and 31b which are mutually opposite but are spaced so as to delimit a channel 32 for the free passage of the thread when the thread moves along the straight path and the diverter 20 is inactive.

Figures 5 to 7, show that the diverter, under the actuation of the motor 26, passes from the inactive or neutral position, which is designated by the reference numeral 20 in figure 5 and in which the thread FT

passes freely in the channel 32, to the active position 20x for slowing the thread, shown for example in figure 6, in which the active surface 30a of the pawl 31a is pushed against the thread FT to divert it and slow it with a braking action which is proportional to the diversion angle $[\alpha]$, which in turn depends on the number of turns made by the driving shaft 29 in the braking interval and on the pitch of the thread of the screw 29a. Screw pitch being equal, the rotation rate of the motor 26 and therefore the number of turns performed by the motor in the braking interval can be varied in order to adjust the brake 10 by acting on the power supply current i, for example by means of an electronic control CE which is associated with a power source G.

The same control CE can also be preset to modulate the current i so as to obtain a preset rule of motion of the diverter 20, for example a rule which includes an initial ramp with constant acceleration and a subsequent final stop with constant deceleration.

From the operating position of figure 6, by reversing the direction of rotation of the motor 26, for example by means of a corresponding reversal of the polarity of the voltage applied thereto, which is produced by the control CE, the diverter can be moved in succession into the second operating position 20y shown in figure 7, in which the thread FT is diverted from the active surface 30b of the pawl 31b in the opposite direction in order to take up and retain the thread, as possibly required by the weaving process.

It should be noted that the transition from the active slowing position to the takeup and retensioning position occurs for a single direction of motion, indicated by the arrow in figure 7, of the diverter 20 and can therefore be performed very quickly and with a rule of motion which can be programmed in any fashion. The braking, takeup and retensioning positions can of course be swapped, in that the first one may coincide with the configuration of figure 7 and the second one may coincide with the configuration of figure 6.

The details of execution and the embodiments may also be altered extensively with respect to what has been described and illustrated by way of non-limitative example without thereby abandoning the scope of the invention defined by the appended claims, in which the reference numerals are given merely for the sake of better comprehension.

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.

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pretation of each element identified by way of example by such reference signs.

Claims

1. A weft brake (10), particularly for air-jet looms (11), with a diverter (20) for the thread (FT) which moves between two thread guiding bushes (21,22) which are mutually aligned and form a straight path for the thread, characterized in that the diverter (20) is actuated by a reversible electric motor (26) with the interposition of a bidirectional transmission (28,29).
2. A weft brake according to claim 1, characterized in that the bidirectional transmission is constituted by a screw (29a) which is associated with the shaft (29) of the reversible motor (26) and cooperates with a female thread (28) which is associated with the diverter (20).
3. A weft brake according to claims 1 and 2, characterized in that the diverter (20) comprises mutually opposite active surfaces (30a,30b) which are suitable to engage the thread (FT) for diversion in corresponding mutually opposite operating positions (20x,20y) of said diverter with respect to a neutral central position (20).
4. A weft brake according to the preceding claims, characterized in that the diverter is constituted by a slider (27) in which there is provided a cylindrical seat (28) which is internally threaded so as to constitute a female thread element.
5. A weft brake according to the preceding claims, characterized in that said slider moves between said thread guiding bushes (21,22) along straight paths which are at right angles to the straight path of the thread (RT) and moves in sliding contact engagement with a supporting plate (24).
6. A weft brake according to claims 1 and 5, characterized in that said supporting plate comprises a fork-shaped end (23) for supporting the fixed thread guiding bushes (21,22), the other end (25) being folded at right angles to support the reversible motor (26), and in that the shaft (29) of the motor lies parallel to the supporting plate (24).
7. A weft brake according to claims 1 and 2, characterized in that said screw associated with the shaft (29) of the reversible motor (26) is constituted by a threaded portion (29a) of said shaft.
8. A weft brake according to claims 1, 3, 4 and 5, characterized in that the slider (27) has a front part (27a) which lies and moves between the fixed thread guiding bushes (21,22) and in that the mutu-

ally opposite active surfaces (30a,30b), suitable to engage and divert the thread (FT), are formed on said front part.

9. A weft brake according to claim 8, characterized in that said active surfaces (30a,30b) are supported by corresponding mutually opposite and spaced pawls (31a,31b) which delimit a channel (32) for the free passage of the thread (FT) when the diverter is in the neutral position (20). 5 10
10. A weft brake according to claim 1 and any one of claims 2 to 9, characterized in that said reversible motor (26) is of the brushless or step or similar type. 15
11. A weft brake according to claims 1 and 10, characterized in that said motor is powered by a power source (G) controlled by an electronic control (CE) which is suitable to reverse the polarity of the supply voltage of the motor and to optionally modulate the supply current (i) in order to achieve preset rules of motion for the diverter (20). 20 25 30 35 40 45 50 55

Fig. 1

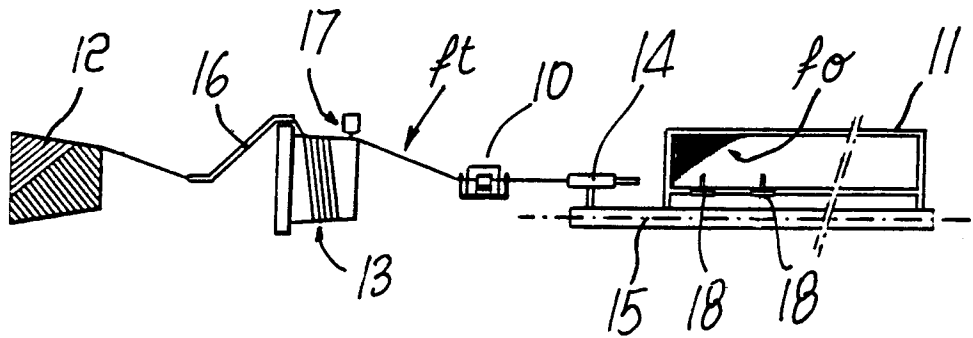


Fig. 2

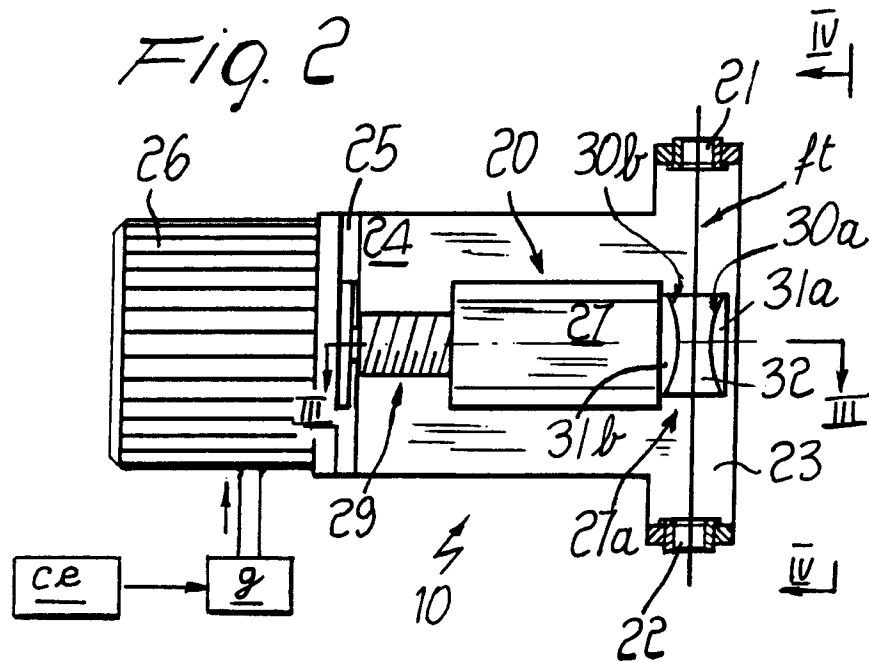


Fig. 3

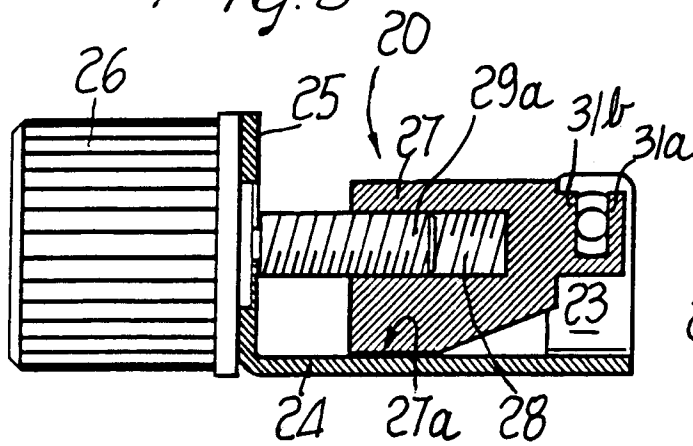


Fig. 4

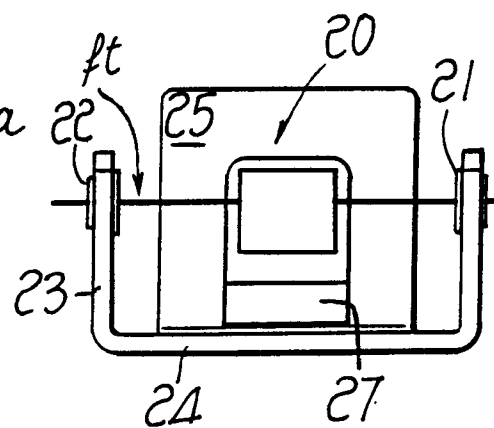


Fig. 6

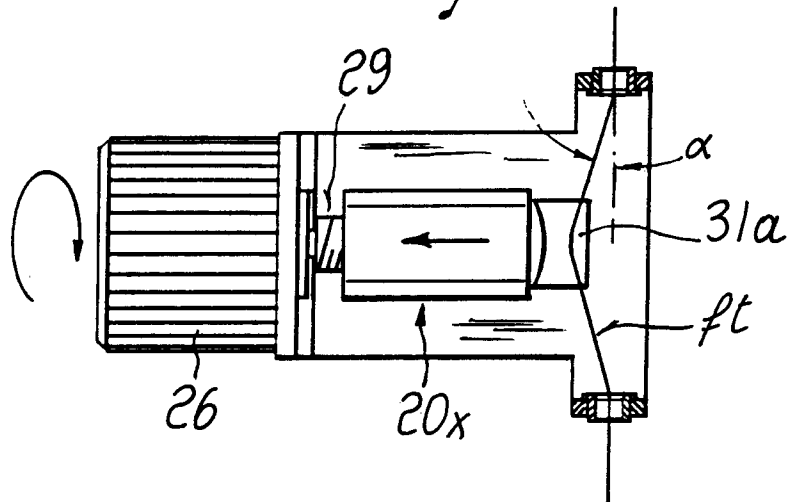


Fig. 5

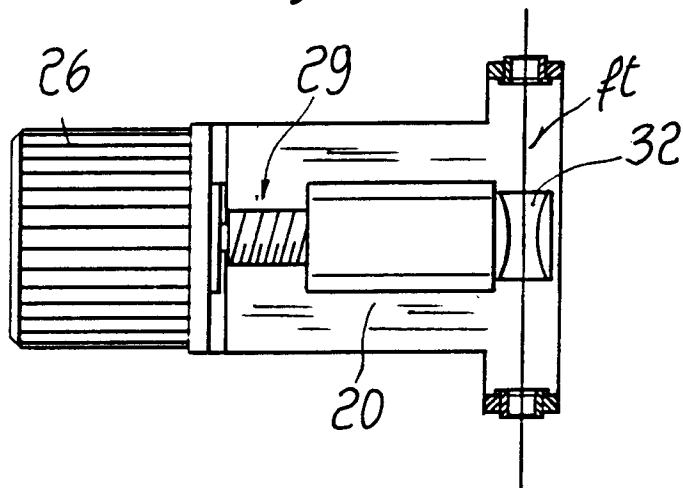
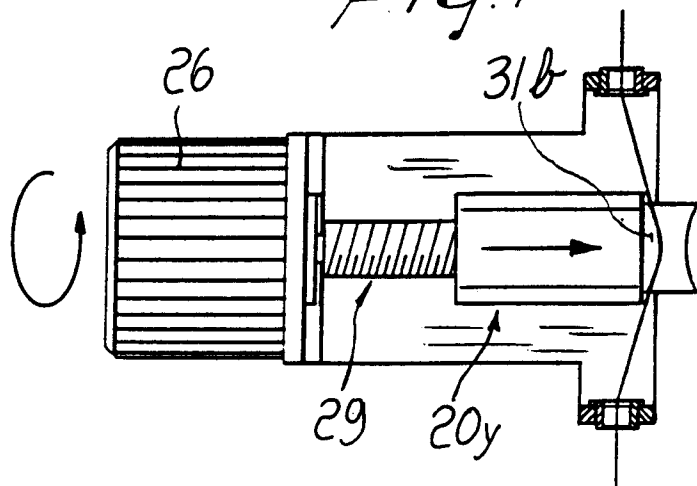


Fig. 7





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EUROPEAN SEARCH REPORT

Application Number
EP 97 11 4831

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 0 467 059 A (VAMATEX) * claims 1,2; figure 1 * ---	1,10,11	D03D47/34 B65H59/34
A	EP 0 239 055 A (ROJ ELECTROTEX) * column 4, line 10 - line 50; figure 2 * ---	1	
A,D	DE 41 31 652 A (IRO) * column 9, line 1 - line 10; figure 5 * ---	1,10	
A,D	EP 0 659 919 A (PICANOL) ---		
A,D	EP 0 527 510 A (PICANOL) ---		
A,D	EP 0 356 380 A (SULZER) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			D03D B65H
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		26 November 1997	Boutelegier, C
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