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(71) Applicant: **T.C.M. Tecno Converting Machinery Srl**
20090 Settala (Milano) (IT)

(72) Inventors:
- **Balasini, Giovanni**
  20097 S. Donato Milanese (IT)
- **Manenti, Carlo**
  23873 Missaglia (LC) (IT)

(74) Representative: **Petruzziello, Aldo**
Racheli & C. S p A
Viale San Michele del Carso, 4
20144 Milano (IT)

(54) Device for stabilising tensions in a film to be printed

(57) A device for stabilising tensions in a film to be printed, disposed between a film unwinding assembly and the printing assemblies of a printing machine, comprising a first set of rollers (3, 5, 7, 9) and a second set of rollers (2, 4, 6, 8, 10) opposed and offset with respect to the rollers of the first set so that the film passes therebetween following a winding course, winding round each roller for at least 180°.

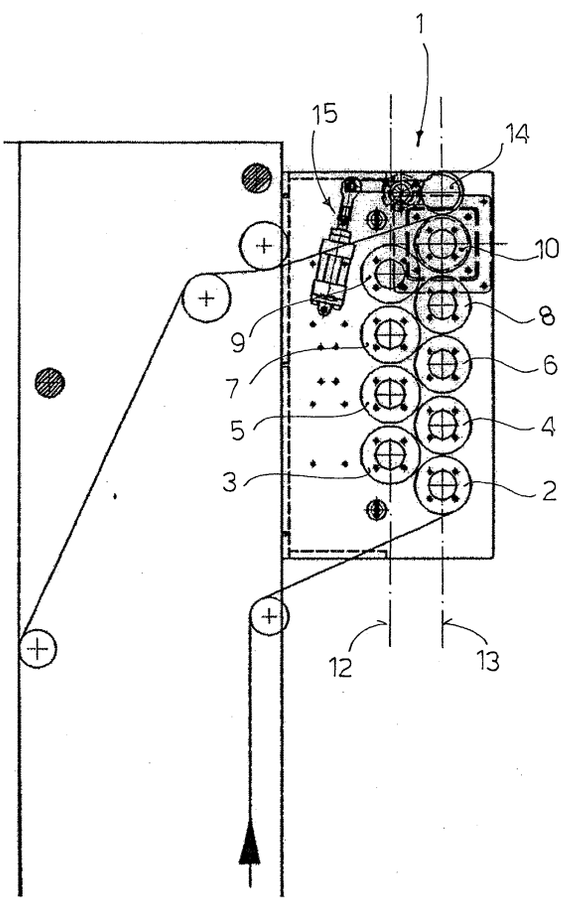


FIG. 1

EP 1 439 059 A1

Description

[0001] The present invention refers to the field of film printing, and in particular to a device able to stabilise or reduce tensions during printing of plastic films.

[0002] In the printing field, and in particular in the printing on plastic film field, the manufacturers' efforts are focused on trying to print on film that is free from tensions. In film printing processes tensions are caused by the quality of the film or are inherent in the process itself, being caused, for example, by incorrect centring of the draw rollers.

[0003] Tensions in film can involve overlapping of the printed parts. In fact, it is possible that, in case of two successive printing operations on the same film, the second printing does not occupy the space intended for it, but is printed on the preceding one, causing an error in the process. Such errors are normally known as register errors.

[0004] Positioning of a tensioning system or calender immediately upstream of the printing machine has been proposed to solve this type of problem.

[0005] The tensioning system comprises a driven roller, a motor that drives the driven roller and a pressing roller opposed to the driven roller. The speed of rotation of the driven roller, which must be synchronous with the speed of the draw rollers situated downstream from the printing units, is decided according to the type of sheet to be printed and to the size thereof. In this manner the same force is given to the sheet downstream and upstream of the printing operation and any tensions or sagging of the sheet is avoided.

[0006] Said tensioning device allows the tensions due to the mechanical devices situated downstream of said device to be stabilised, but it does not allow removal of defects caused upstream of said tensioner or caused by the quality of the material.

[0007] In the event of the register error being caused by unevenness in pulling of the film, that is to say if the tensions in the film are caused by the unwinding or supporting rollers not being perfectly centred with respect to their own axis of rotation or by rolls for unwinding that are deformed by the weight of the wound material, the register error is repeated cyclically in the printing causing an error that is variable in time and therefore difficult to control.

[0008] Said correction can therefore be done through a dynamic register correcting device which, with the aid of particular sensors designed to detect the position of the prints and various electronic automatisms, controls the adjustment of the print registers.

[0009] However, said devices are very costly and complex and do not guarantee a high degree of reliability.

[0010] The object of the present invention is to solve the problems of the prior art by providing a device that is able to stabilise or reduce film tensions, whether due to the process or to the material.

[0011] Another object of the present invention is to provide a device that allows film tensions to be stabilised also upstream of the printing machine.

[0012] Another object of the present invention is to provide a device that allows film tensions to be stabilised and at the same time is simple and cheap to make.

[0013] These and other objects are achieved by a drawing device that has the characteristics described in appended independent claim 1.

[0014] Further characteristics are described in the dependent claims.

[0015] Essentially, a device for stabilising, according to the present invention, tensions in a film to be printed is disposed between a film unwinding unit and the printing units of a printing machine and is characterised in that it comprises a first set of rollers and a second set of rollers opposed to and offset with respect to the rollers of said first set. All the rollers are driven by motor means and disposed so that the film passes therebetween following a winding course, winding round at least the inside rollers between an input roller and an output roller for at least 180°.

[0016] Such a device allows film tensions to be stabilised or at least substantially reduced. In particular, the device according to the present invention allows obtaining an unrolled film to be printed that is completely flat, i. e. that is free from all tensions typical of the material.

[0017] Thanks to the large friction surface provided, the passage of the film between the various rollers so that, in particular, each of said inside rollers is surrounded by the film for more than 270°, allows to stabilise the tensions caused both by the mechanical devices situated downstream and by those situated upstream of said device.

[0018] According to an advantageous feature of the present invention, all the rollers have the same radius and are positioned on a first and on a second parallel straight line so that the centres of rotation of the rollers lie on the first or on the second straight line and the rollers of the first straight line are offset by a distance equal to at least one radius with respect to the rollers of the second straight line.

[0019] According to a preferential feature of the present invention, the device comprises a number of rollers ranging from 6 to 11.

[0020] Advantageously, the device preferably comprises nine rollers, four of which are positioned on the first straight line, forming the first set of rollers, and five are positioned on the second straight line, forming the second set. In fact, it has been found experimentally that such distribution and number of rollers is optimal for operation of the device according to the present invention.

[0021] According to another aspect of the present invention, one of the rollers is set in rotation by motor means and draws the other rollers into rotation by means of a drive system.

[0022] According to another preferential aspect of the present invention, the device comprises at least one

pressing roller opposed to the last roller and operated by a cylinder-piston assembly.

[0023] According to the present invention, the device advantageously comprises adjustment means able to vary the reciprocal distance between the rollers.

[0024] Further objects and advantages of the present invention will be made clearer by the present description given by way of non-limiting example, with reference to the appended drawings, in which:

- Figure 1 is a schematic side view of a device for reducing or stabilising tensions in a film to be printed according to the present invention;
- Figure 2 is an opposite side view of the device of Figure 1 schematically illustrating the drive system applied to the rollers of the device according to the present invention; and
- Figures 3a, 3b are graphs illustrating, over the time, the distribution of stress in a film on the input, respectively on the output from a device according to the present invention.

[0025] In Figure 1 a device for stabilising or reducing tensions in a film to be printed according to the present invention, indicated as a whole with reference numeral 1, is illustrated.

[0026] The device 1 comprises a first set of rollers 3, 5, 7, 9 and a second set of rollers 4, 6, 8, 10, opposed and offset with respect to the first set. The device 1 is disposed upstream of a printing machine, therefore it is situated between the film unwinding unit (not shown) and the printing units (not shown). According to the preferred embodiment illustrated in Figures 1-3, all the rollers 2-10 of the drawing device 1 have the same radius and are driven at the same speed by a motor and by a drive system described hereunder.

[0027] The rollers 2-10 are disposed with their centres on two parallel straight lines, a first straight line 12, respectively a second straight line 13, in an offset manner, that is so that the centres of rotation of the rollers 3, 5, 7, 9 disposed on the first straight line 12 are offset by a distance little greater than the radius with respect to the rollers 2, 4, 6, 8, 10 disposed on the second straight line 13.

[0028] The rollers are disposed so that the distance between each roller of the first straight line 12 and each roller of the second straight line 13 is such as to allow the passage of the film to be printed in contact with only one of the opposed rollers; obviously said distance can be regulated according to the film to be processed. The distance between rollers of the same straight line, that is to say between the rollers whose centres of rotation lie on the same straight line, is also chosen so as to allow free passage of the film to be processed. In detail, the plastic film coming from the unwinding roller, as shown in Figure 1, winds round the input roller 2 of the device for more than 180°, passing through the gap between said roller 2 and roller 4, and proceeds by winding around roller 3 for about 270°. After having passed through the gap between said roller 3 and roller 5, the film detaches from roller 3 to wind round roller 4. Subsequently, after having wound round roller 4 for about 270° and having passed through the gap between said roller 4 and roller 6, the film leaves roller 4 to wind round roller 5. The path of the film proceeds thus up to exit roller 10 of the device, winding round all the rollers for more than 180°, with a winding course that passes from a roller of the first straight line 12 to a roller of the second straight line 13.

[0029] In practice, the device 1 described behaves like a set of drawing calenders wherein each roller draws the film by friction, eliminating any tensions present on the portions thereof.

[0030] The device 1, acting as a mechanical filter for the tensions, distributes the tensions encountered over the whole length of the film passing there through, making the film leaving the device perfectly flat and substantially free from variations in tension, as shown by the graph illustrated in Figure 3b.

[0031] The graphs illustrated in Figures 3a, 3b in fact show respectively the course over time of the tensions in the film entering and leaving the device 1.

[0032] The arrangement of the rollers and the number thereof is such as to allow a large friction surface between the rollers and the film, which allows a perfect smoothing of the tensions in the latter.

[0033] In the embodiment shown in Figure 1, the device 1 according to the present invention comprises nine rollers, four of which are positioned on the first straight line 12 and five on the second straight line 13. Although said number of opposed rollers is the optimal one, it has, however, been observed that a different number, but in any case no less than six, may be sufficient to realise the device 1 according to the present invention.

[0034] In the embodiment illustrated in the figure a nip roller 14 driven by a cylinder-piston assembly 15 is opposed to the last roller 10, that is to the exit roller 10. The nip roller 14 does not serve, as in the prior art, to turn at the same speed as the draw rollers positioned downstream of the print assemblies to impart a certain tension to the film to be printed, but serves only to ensure that any slipping of the film on the draw rollers does not lead to variations in the speed thereof. The direct consequence of said variations in speed is the formation of tensions inside the film. However, said slipping could occur only exceptionally if the surface of the film and the surface of the rollers fail to guarantee perfect friction through adhesion.

[0035] As mentioned previously, all the rollers 2-10 turn at the same speed in the direction of the arrows F indicated in Figure 2.

[0036] To ensure rotation of the rollers, the roller 10 is keyed on the shaft of a motor of a know type, such as, for example, a brushless motor that can be adjusted according to the speed of the draw rollers situated downstream of the print units. As shown in Figure 2, the other

rollers of the device 1 for reducing tensions are drawn into rotation by a drive system consisting of a belt 17 wound in a winding course and two adjustable tensioning rollers 18. The belt 17 winds around the roller 10 keyed to the motor shaft and the remaining rollers, passing from a roller disposed on the first straight line 12 to a roller disposed on the second straight line 13 and following therefore the course of the plastic film. The two tensioning rollers 18 can be adjusted by appropriate means 19 to allow the tension on the drive belt 17 to be varied.

Claims

1. A device to stabilise tensions on a film to be printed disposed between a film unwinding assembly and the print units of a printing machine, **characterised in that** it comprises a first set of rollers (3, 5, 7, 9) and a second set of rollers (2, 4, 6, 8, 10) opposed and offset with respect to the rollers of said first set, all the rollers (2-10) being driven by motor means and disposed so that the film passes therebetween along a winding course, winding round at least the inside rollers positioned between a film input roller (2) and a film output roller (10) for at least 180°.

2. A device according to claim 1, **characterised in that** the film winds round each of said inside rollers for at least 270° when passing through said rollers (2-10).

3. A device according to claim 1 or 2, **characterised in that** said rollers (2-10) have the same radius and are positioned on a first and on a second parallel straight line so that the centres of rotation of said rollers (2-10) lie on said first (12) or said second (13) straight line and that the rollers of the first straight line (12) are offset by a distance equal to at least one radius with respect to the rollers of the second straight line (13).

4. A device according to any one of the preceding claims, **characterised in that** it comprises a number of rollers ranging between 6 and 11.

5. A device according to claim 4, **characterised in that** it preferably comprises nine rollers, four of which (3, 5, 7, 9), forming said first set, being positioned on said first straight line (12) and five of which (2, 4, 6, 8, 10), forming said second set, being positioned on said second straight line (13).

6. A device according to any one of the preceding claims, **characterised in that** one (10) of said rollers is set in rotation by motor means and draws the other rollers (2-9) into rotation by means of a drive system.

7. A device according to any one of the preceding claims, **characterised in that** it comprises at least one nip roller (14) opposed to said roller (10) and driven by a cylinder-piston assembly (15).

8. A device according to claim 6, **characterised in that** said drive system comprises at least a tensioning roller (18) and at least one belt (17) winding round each roller for more than 180°.

9. A device according to any one of the preceding claims, **characterised in that** it comprises regulating means to vary the reciprocal distance between said rollers (2-10).

10. A printing machine **characterised in that** it comprises a device to stabilise tensions in a film to be printed according to any one of the preceding claims, placed upstream of the print units and downstream of the film unwinding roller.

11. A procedure for stabilising tensions in a film to be printed by using the device claimed in any one of claims 1 to 9, **characterised in that** the film is passed on all the rollers according to a winding course, winding for at least 180° round at least the inside rollers positioned between a film input roller (2) and a film output roller (10).

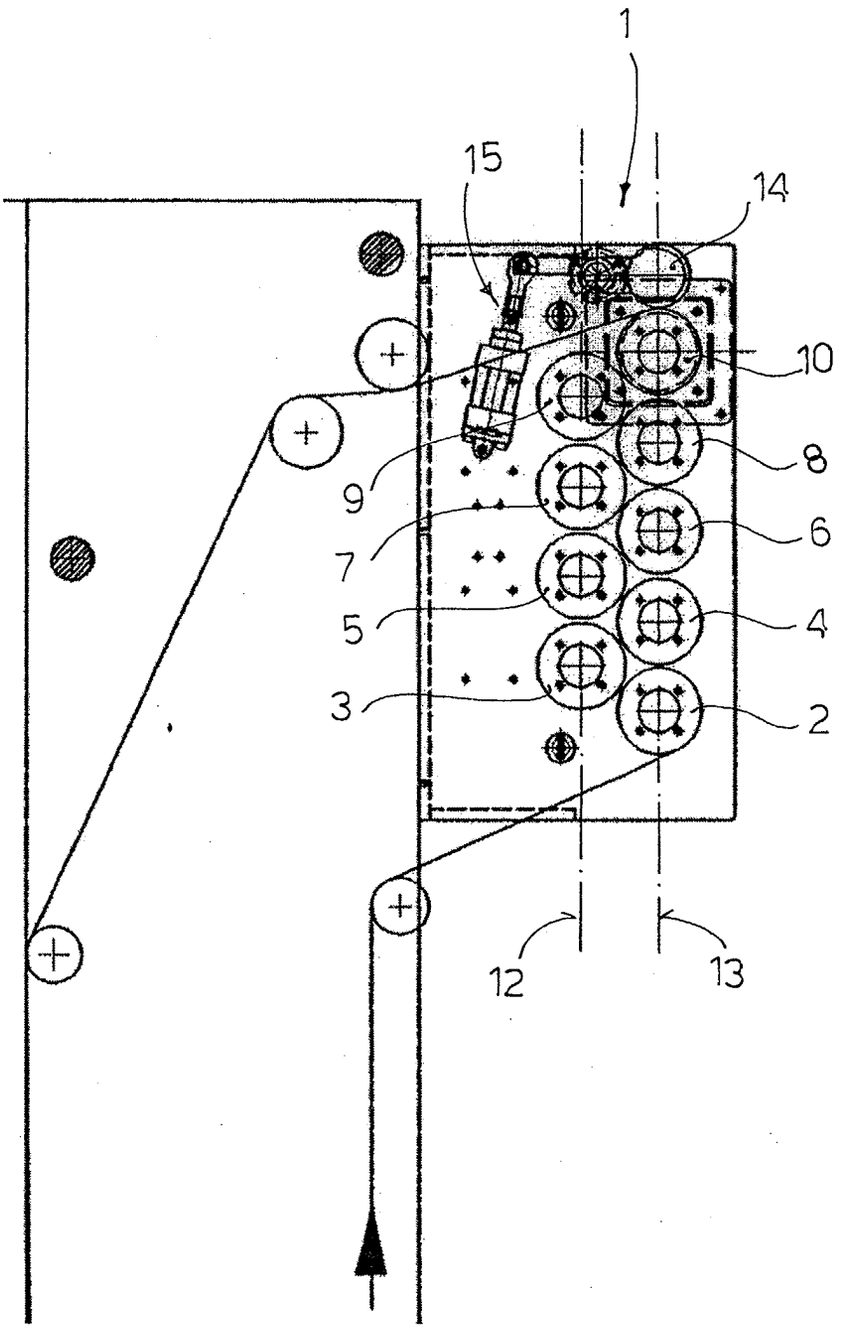


FIG. 1

FIG. 2

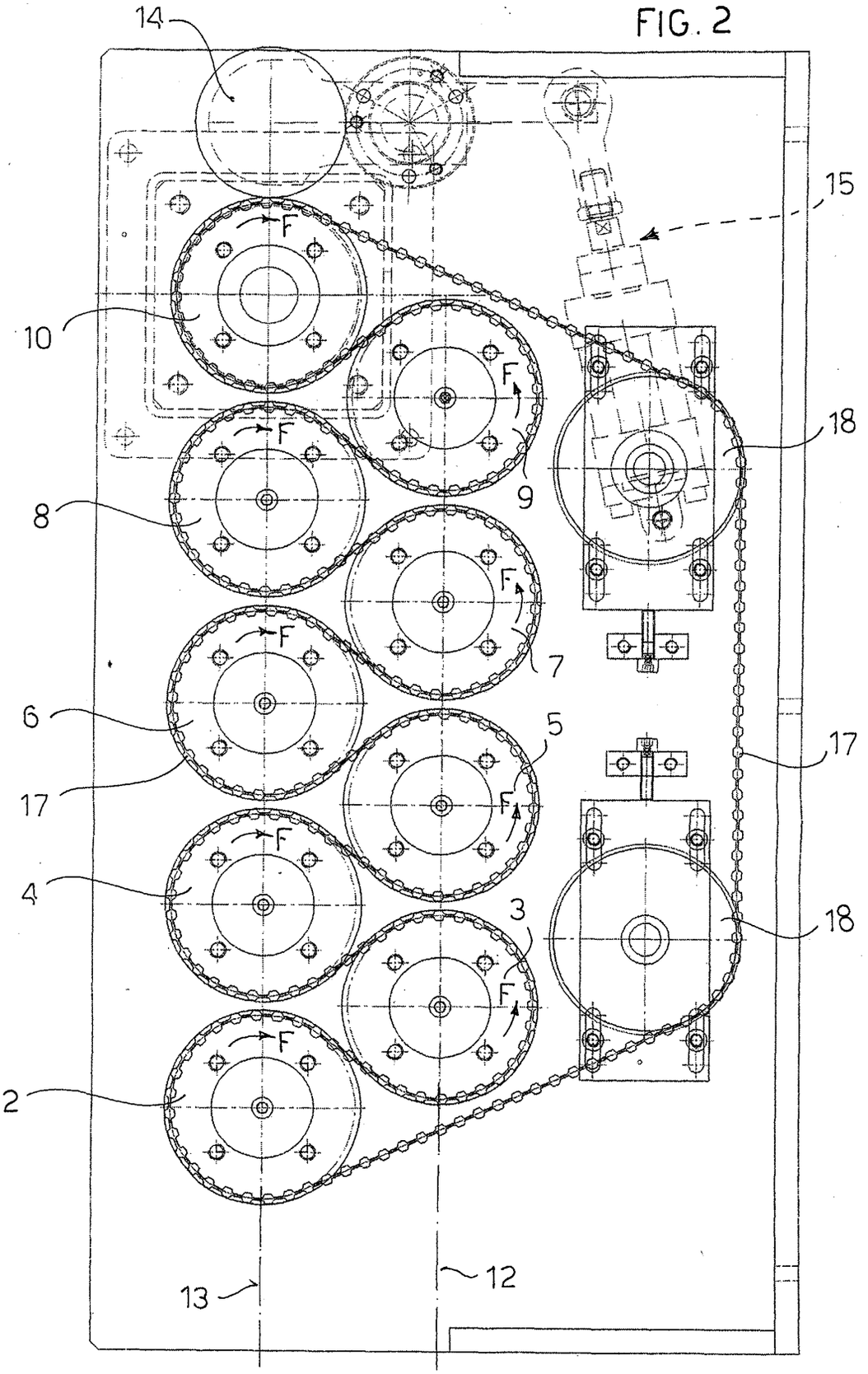


FIG. 3b

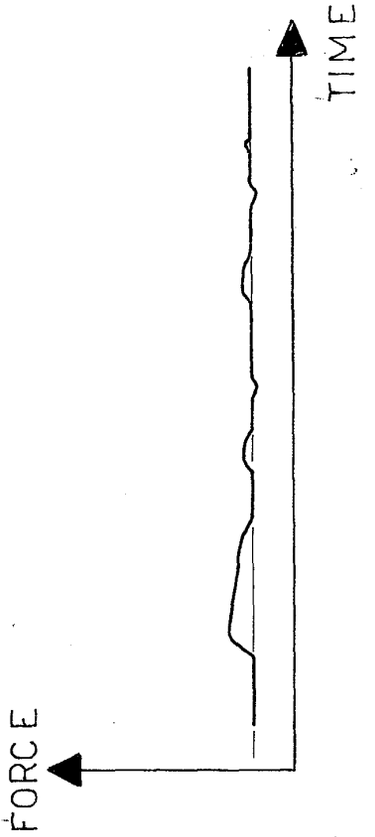
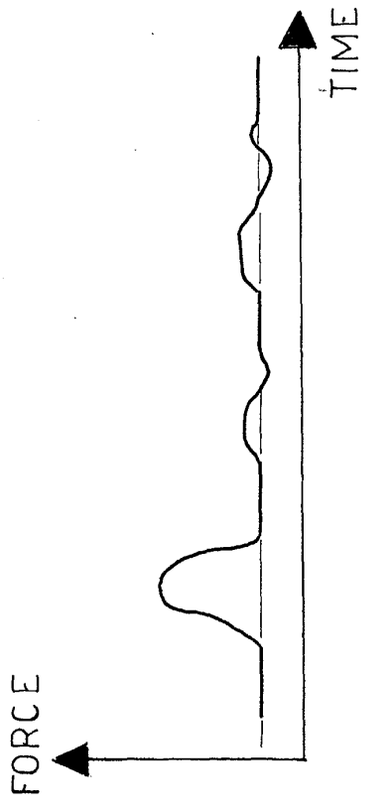


FIG. 3a



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EUROPEAN SEARCH REPORT

Application Number
EP 03 42 5021

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	US 4 778 093 A (RENOLD WALTER) 18 October 1988 (1988-10-18) * column 4, line 55 - column 14, line 46; figures * ---	1-11	B41F13/02 B65H20/24 B65H23/26
A	US 4 569 285 A (FORNO MARIO ET AL) 11 February 1986 (1986-02-11) -----		

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B41F
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	16 June 2003	Louvion, B

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