



Publication number: **0 581 745 A1**

EUROPEAN PATENT APPLICATION

Application number: **93830309.6**

Int. Cl.⁵: **D03D 47/36, B65H 51/22**

Date of filing: **20.07.93**

Priority: **27.07.92 IT TO920643**

Date of publication of application:
02.02.94 Bulletin 94/05

Designated Contracting States:
BE CH DE IT LI SE

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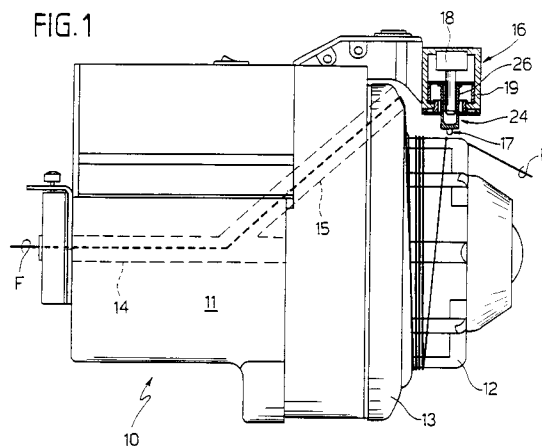
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Improvement of weft feeders for pneumatic looms.

A weft feeder (10) for pneumatic looms, comprising a fixed drum (12), a rotating disk (13) for winding on the drum a reserve of thread to be fed to the loom, and an electromagnetic stop element (16) for blocking the unwinding of the thread from the drum after the counting, performed by means of a photoelectric cell, of a preset number (n) of turns of thread. The electromagnetic stop element (16) comprises a permanent magnet (18) which cooperates with a fixed magnetic core (19) provided with an annular gap in which a hollow moving element passes (24); a winding is associated with the moving element, and an energization current flows through it. The moving element (24) supports, at its end, a thread stopping finger (17), and is fitted without contact engagement on a cylindrical extension of the fixed magnetic core (19); said moving element (24) is supported so that it can move axially with respect to the cylindrical extension.

FIG.1



The present invention relates to an improvement of weft feeders for textile pneumatic looms with high insertion speed.

As is known, weft feeders are devices suitable to accumulate a reserve of thread in the form of turns wound on a fixed drum and to feed the loom by unwinding the accumulated turns in an amount equal to the length L of thread required by the loom at each beating; said length being equal to the transverse dimension, or width, of the fabric being formed.

In the specific case of pneumatic looms, the pre-feeder also has the task of pre-measuring said length L, and this task is performed by counting the unwound turns of thread by means of a photoelectric cell. The following equation holds:

$$L = n\pi D \quad (1)$$

where n is the number of unwound turns and D is the diameter of the drum of the feeder. The unwinding of the thread is controlled by an electromagnetic stop element which, by means of a movable finger, blocks said thread when the n-th turn is reached.

More precisely, when the one before last turn n-1 is counted, the photocell provides for the supply of power to the stop element, the intervention of which is completed when the subsequent last turn (n) is reached.

It is easily understood that the intervention time "t" available to the electromagnetic stop element is extremely limited and is generally comprised between 10 and 20 ms (milliseconds). In fact, considering for example a modern pneumatic loom capable of inserting approximately 1500 meters of weft per minute, with a fabric width equal to 3000 mm, a drum speed equal to 500 rpm, a feeder drum diameter D equal to (approximately) 136 mm, the above equation (1) yields a value of 7 for n. Since the energization of the electromagnetic stop element occurs 500 times per minute, equal to 8.3 times per second, and since the unwinding of the turns consequently occurs in 120 ms, considering that the intervention of the electromagnetic stop element must occur within the time separating the unwinding of turn n from turn n-1, in the exemplified case one obtains:

$$t = 120/7 = 17.14 \text{ ms}$$

These onerous working conditions pose considerable problems in the design of the electromagnetic stop element, which on one hand must have moving elements with a very low inertia but at the same time must have an intense magnetomotive force, and on the other hand must have an acceptable working life, for example equal to four or five years of operation, and thus the ability to perform approximately 10^9 cycles without being

damaged.

The aim of the present invention is to achieve these important purposes, and for this reason it relates to a weft feeder for pneumatic looms, with an electromagnetic stop element suitable to block the unwinding of the thread from the drum of the feeder after the counting, performed by means of a photoelectric cell, of a preset number of turns, characterized in that said electromagnetic stop element comprises a permanent magnet which cooperates with a fixed magnetic core provided with an annular gap through which a hollow moving element passes, said moving element supporting a winding through which an energization current flows. The moving element, which also supports the thread stopping finger at its end, is fitted without contact engagement on a cylindrical extension of the fixed magnetic core and is supported so that it can move axially with respect to said cylindrical extension.

According to a preferred embodiment, the moving element is elastically supported, so that it can move axially with respect to the cylindrical extension of the core, by a pair of flat springs which also act as elements for retaining and centering said moving element with respect to said cylindrical extension.

According to this preferred embodiment, the moving element, which is of a substantially phonic type and is made of a low specific weight material, has a very small inertial mass and is thus capable of responding without appreciable delays to the electrodynamic actuations to which it is subjected. Furthermore, the presence of the plates for centering and retaining said moving element, which eliminate the sliding friction between said moving element and the fixed core, on one hand helps to improve said response of the moving element to electrodynamic actuations and on the other hand avoids wear, achieving the further object of significantly increasing the duration of the electromagnetic stop element.

The invention will become apparent from the following detailed description and with reference to the accompanying drawings, given by way of non-limitative example, wherein:

figure 1 is a partially sectional view of a feeder for a pneumatic loom, with the improved stop device according to the present invention;

figure 2 is an axial longitudinal sectional view of the stop device in inactive conditions;

figure 3 is a partially sectional view, similar to figure 2, of the stop device in operating conditions;

figures 4 and 5 are sectional views, similar to figure 2, illustrating a further embodiment of the invention.

In the drawings, the reference numeral 10 generally designates a weft feeder for pneumatic looms comprising, in a per se known manner, a fixed body 11, a fixed drum 12 and a rotating disk 13, arranged at the base of the drum and actuated by a hollow drive shaft 14. A hollow rotatable arm 15 is rigidly coupled to the disk 13 and is connected to the shaft 14; the thread F runs in the cavities of the shaft and of the arm and is wound by the disk 13 on the drum so as to form a reserve of thread to be fed to the loom. At every beating of the loom, a number of thread turns n, equal to the length L of the weft inserted by the loom with said beating, are unwound from the drum 12.

The number of turns which unwind is counted by a photocell cooperating with a counter (both not shown) which, when the one before last turn (n-1) is reached, causes the energization of an electromagnetic stop device 16. Said stop device engages the thread against the drum with a stopping finger 17, blocking its unwinding when the last turn (n) is reached.

According to the present invention, the electromagnetic stop device 16 comprises a permanent magnet 18 contained in a cylindrical skirt 19 which constitutes a fixed magnetic core. The magnet 18, arranged within the skirt 19 at the rear wall 20 of said skirt, extends with an axial extension 21, termed pin for the sake of brevity, which ends at a circular opening formed on the face 22 of the skirt opposite to the rear wall 20 so as to form an annular gap 23 of adequate size, for example equal to, or smaller than, the radius of the axial pin 21. A moving element 24 is slideably fitted on said axial pin; said moving element is constituted by a hollow cylindrical case 26, made of material having low relative density, for example cardboard or textile material impregnated with resin, or polymeric material, provided with a winding 27. The stopping finger 17 is provided at the free end of the case and is preferably applied and made of ceramic material or the like.

The winding 27 is arranged outside the case 26 at the annular gap 23, and is thus crossed by the lines of the magnetic field produced by the permanent magnet 18. The internal diameter of the case 26 is chosen so that it is significantly greater than the outer diameter of the pin 21, so that there is no contact between said case and said pin. The moving element 24, as a whole, is elastically suspended, so that it can move axially with respect to the pin 21, by a pair of annular flat springs 28 and 29 rigidly coupled to the case 26 and to the skirt 19 and also acting as elements for retaining and centering said moving element with respect to said pin 21.

In order to ensure the correct retention of the moving element 26, the flat springs 28 and 29 are

mutually spaced by an extent "d" which is equal to approximately half of the axial extension of the pin 21. Preferably, said flat springs are made of steel plate with a thickness comprised between 2 and 6 tenths of a millimeter. However, they may also be made of textile fiber or cardboard, impregnated with polymeric resin, or of woven or felted glass fiber, also impregnated with polymeric resin. The rigid connection between the case 26 and the springs 28 and 29 is preferably obtained by glueing with polymeric adhesive.

An energization current I having an intensity comprised for example between 1 and 2 amperes is made to circulate in the winding 27 and is supplied in a known manner by a generator (not shown) under the control of the counter associated with the photoelectric cell which counts the number of turns. This energization current is directed so as to generate, by interaction with the magnetic field produced by the magnet 18, a magnetomotive force suitable to move the moving element 24, in contrast with the elastic action of the flat springs 28 and 29, in the direction of the arrow F of figure 3, so that in the presence of the current I the finger 17 blocks the thread against the drum 12, preventing its unwinding.

In the further embodiment of figures 4 and 5, the permanent magnet 180 is cylindrical and is supported by a cylindrical extension 191 of the skirt 190 at the annular gap 230 in which the moving element 240 passes; said moving element 240 supports the winding 270, and is formed by a cylindrical sleeve 271 preferably made of textile material impregnated with resin and provided with a rigid bottom 272.

The cylindrical sleeve 271 is fitted on the magnet 180 without sliding contact and is guided in its axial movement by a pin 273 which is supported by the bottom 272 and which slideably passes in a guiding and retention bush 192 formed on the fixed magnetic core 190. The stopping finger 17 is provided on the end of the pin 273 opposite to the bottom 272. A helical spring 274 is interposed between the bottom 272 and the magnet 180, actuates the moving element 240 into the thread engagement position shown in figure 4 and provides an elastic thread stopping force which acts on the stopping finger 17.

According to this constructive embodiment, during the unwinding of the thread from the drum 12, an energization current I' is supplied in the winding 270 of the moving element 240 and, by reacting with the magnetic field of the magnet 180, keeps the moving element 240 in the raised position of figure 5, in contrast with the action of the spring 274. Under the control of said turn counter, the current I' is interrupted when the last turn is reached, and the spring 274 pushes the moving

element and the finger 17 into the thread stopping position.

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

Claims

1. Weft feeder (10) for pneumatic looms, comprising a fixed drum (12), a rotating disk (13) for winding on said drum a reserve of thread (F) to be fed to the loom, and an electromagnetic stop element (16) for blocking the unwinding of the thread from the drum after the counting, performed by means of a photoelectric cell, of a preset number (n) of turns, characterized in that said electromagnetic stop element (16) comprises a permanent magnet (18) which cooperates with a fixed magnetic core (19) provided with an annular gap (23) in which a hollow moving element (24) passes, said moving element supporting a winding (27) through which an energization current (I') flows, and in that the moving element (24) supports a thread stopping finger (17) at its end, and is fitted without contact engagement on a cylindrical extension (21) of the fixed magnetic core, said moving element (24) being supported so that it can move axially with respect to said cylindrical extension. 15 20 25 30 35
2. Weft feeder according to claim 1, characterized in that the moving element (24) of the electromagnetic stop element (16) is fitted on a pin (21) which constitutes an extension of the permanent magnet (18) and is elastically suspended, so that it can move freely along the axis of said pin (21), by a pair of flat springs (28,29) also acting as elements for retaining and centering the moving element (24) with respect to the pin (21). 40 45
3. Weft feeder according to claims 1 and 2, characterized in that said fixed magnetic core is constituted by a cylindrical skirt (19), said permanent magnet (18) being arranged inside said cylindrical skirt and at its rear wall (20), and said pin (21) of the magnet (18) extending axially, passing through a circular opening of the wall of the skirt (19) opposite to the rear wall (20) in order to delimit the annular gap (23). 50 55
4. Weft feeder according to claims 1, 2 and 3, characterized in that the width of the annular gap (23) is substantially equal or smaller than the radius of the pin (21) of the magnet (18).
5. Weft feeder according to claims 1 to 4, characterized in that the moving element (24) is constituted by a hollow cylindrical case (26) made of a material having low specific weight, and in that the internal diameter of the case (26) is substantially greater than the external diameter of the pin (21) of the magnet (18).
6. Weft feeder according to claim 5, characterized in that said hollow case (26) is made of polymeric material.
7. Weft feeder according to claim 5, characterized in that said hollow case (26) is made of cardboard.
8. Weft feeder according to claim 7, characterized in that said hollow case (26) is impregnated with polymeric resin.
9. Weft feeder according to claims 1 to 6, characterized in that the winding (27) of the moving element (24) is arranged outside the case (26) at the annular gap (23).
10. Weft feeder according to claims 1 and 2, characterized in that said flat springs (28,29) are annular and are rigidly coupled to the skirt of the fixed magnetic core (19) and to the hollow case (26) of the moving element (24).
11. Weft feeder according to claims 1 and 10, characterized in that said flat springs (28,29) are made of steel plates.
12. Weft feeder according to claims 1 and 10, characterized in that said flat springs (28,29) are made of a non-metallic material selected from a group consisting of textile fiber, cardboard, glass fiber.
13. Weft feeder according to claim 12, characterized in that said non-metallic material is impregnated with polymeric resin.
14. Weft feeder according to claims 1, 10, 11 or 12, characterized in that said flat springs (28,29) are mutually spaced by an extent which is equal to approximately half the axial extension of the pin (21) of the magnet (18).
15. Weft feeder according to claim 1, characterized in that the moving element (240) com-

prises a cylindrical sleeve (271) with an energization winding (270), in that said sleeve is closed by a bottom (272) provided with a pin (273) ending with the stopping finger (17), said permanent magnet (180) being supported by a cylindrical extension (191) of the magnetic core (190) at the annular gap (230) and receives the cylindrical sleeve (271) of the moving element, which is slideably fitted on said magnet and on said cylindrical extension, and said bottom (272) of the moving element (240) being subjected to the action of a spring (274) which actuates the moving element (240) and the stopping finger (17) into the position for engaging the thread and provides an elastic force for stopping said thread.

16. Weft feeder according to claim 15, characterized in that the energization winding (270) of the moving element (240) is supplied with an energization current (I') which reacts with the field of the permanent magnet (180) to move the moving element (240) in contrast with the action of said spring (274) and to release the thread from the stopping action produced by the stopping finger (17).

17. Weft feeder according to claims 15 and 16, characterized in that the pin (273), rigidly coupled to the bottom (272) of the moving element, can slide in a bush (192) formed on the fixed magnetic core (190) and in that the pin (273) and the bush (192) cooperate in order to guide the moving element (240), allowing it to move without contact engagement, with respect to the magnet (180) and to the cylindrical extension (191).

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FIG. 1

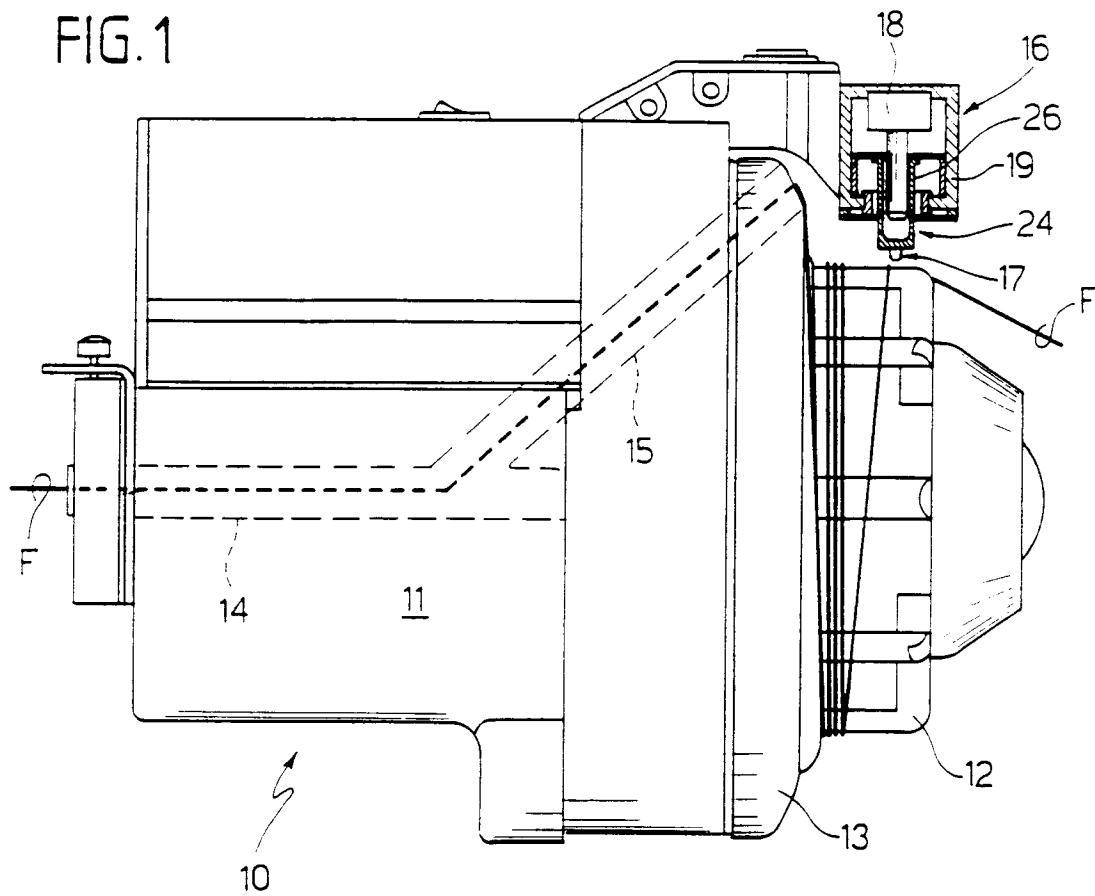


FIG. 2

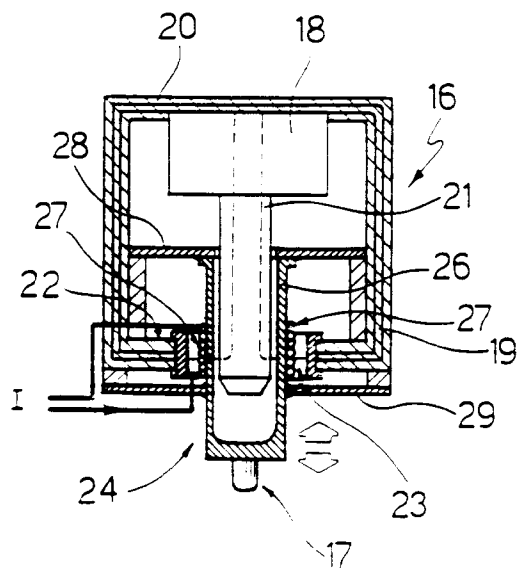
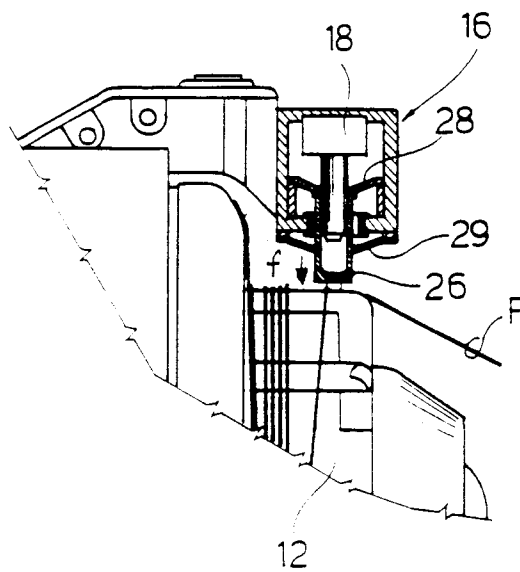


FIG. 3





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 83 0309

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.5)
A	EP-A-0 363 938 (ROJ ELECTROTEX) ---		D03D47/36 B65H51/22
A	EP-A-0 436 197 (ROJ ELECTROTEX) ---		
A	EP-A-0 253 760 (SULZER) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			D03D B65H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 October 1993	Examiner BOULEGIER, C
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