

12

EUROPEAN PATENT APPLICATION

21 Application number: **85830159.1**

51 Int. Cl.⁴: **D 05 B 51/00**

22 Date of filing: **25.06.85**

30 Priority: **19.10.84 IT 2324084**

43 Date of publication of application:
30.04.86 Bulletin 86/18

84 Designated Contracting States:
CH DE FR GB LI

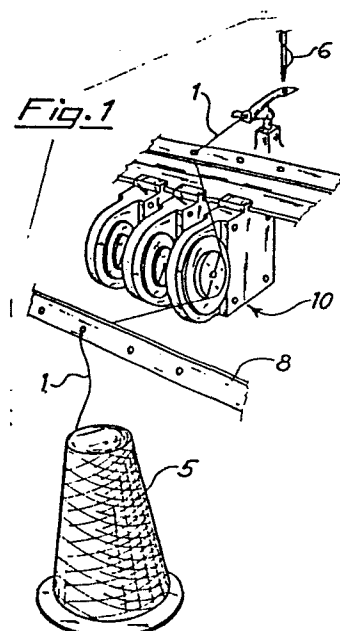
71 Applicant: **MECA S.a.s. di CAGNONI, LANDONI & C.**
Strada Prov. le Busto Arsizio
Cassano Magnago(IT)

72 Inventor: **Landoni, Giannino**
Via Dante
Fagnano Olona(IT)

74 Representative: **Caregaro, Silvio et al,**
c/o Società Italiana Brevetti S.p.A. Via Carducci 8
I-20123 Milano(IT)

54 **Device for the control and stopping of automatic sewing machines, in particular multi-needle embroidering machines.**

57 Device for the control and stopping of a sewing machine, comprising at least one pulley (15) driven into rotation by one of the sewing threads (controlled thread) and a disc (20) connected to said pulley. A plurality of reference elements (21) on the disc and an external sensor (24) make possible accurate measurement of the pulley's rotating speed, which is proportional to the consumption of the thread under control. Said speed is compared by an electronic circuit (26) with two extreme selectable preset values to stop operation of the machine when the speed deviates from preset limits. In this way, a total control is obtained over all the sewing anomalies such as: breakage of the top needle thread, breakage of the crochet or shuttle bottom thread, skipping of stitches, anomalous tension of the threads.



DEVICE FOR THE CONTROL AND STOPPING OF AUTOMATIC SEWING
MACHINES, IN PARTICULAR MULTI-NEEDLE EMBROIDERING
MACHINES

The present invention relates to a device for the control and stopping of automatic sewing machines, preferably but not exclusively of automatic multi-needle
5 embroidering machines.

In sewing machines in general, especially multi-needle embroidering machines, different known systems (mainly electro-mechanical) are adopted to control the top sewing
10 thread; these systems control stopping of the machine when the thread breaks. Especially in embroidering machines, which will be dealt with hereinafter, said known systems presented many drawbacks and limitations.

In fact, by relating the stopping of the machine exclusively to the breakage of the thread of the needles, it
15 is not possible to control other important anomalies such as breakage of the bottom crochet or shuttle thread, inadequate thread tension, etc. These drawbacks are made even more serious by the present tendency to render fully
20 automatic (hence not supervised) the operation of the machines, because production is scarcerly reliable in the absence of an operator to supervise operation and intervene whenever drawbacks of the type above described occur which do not directly involve the integrity of the top thread.
25 Moreover, with the introduction of electronically controlled embroidering machines, affording the possibility to perform embroidered type quiltings, manual chacking of the

design in case of defects due to thread breakage becomes almost impossible. With the control device according to this invention, on the other hand, the zone to be repaired becomes altogether insignificant or inexistent.

5 The purpose of this invention is to provide a device for the control and stopping of sewing machines, in particular automatic embroidering machines and apt to command stopping of the machines not only as a result of breakage of the needles thread, but also in case of
10 breakage or depletion of the lower crochet or shuttle thread, skipping of stitches or irregular tension applied on the yarn.

 The invention consists of a device for the control and stopping of automatic sewing machines, characterized
15 in that it comprises:

- at least one element rotating around a fixed axis and drawn into rotation by one of the sewing threads;
- means to measure the speed of rotation of said element; and
- 20 - means to compare said measured rotating speed value with two preset values, said means being apt to control stopping of the machine when the measured value of the rotating speed deviates from the range defined by the two preset values.

25 The invention will now be described in one of its preferred embodiments as applied to an embroidering machine, with reference to the attached drawings, in which:

FIGURES 1 and 1a are schematic views of the device
30 applied to a multi-needle embroidering machine with double chain stitch and an embroidering machine with knotted

stitch;

FIGURE 2 is an exploded view of the device;

FIGURE 3 is a view in cross-section of the device.

With reference to the drawings and to Fig. 1 in particular, the thread under control, identified as 1 is unwound from a reel 5 and, after having crossed guide bar 8 and device 10 according to the invention, is led to the sewing zone where it engages, in the fabric, with the other thread 6. For the sake of simplicity, the arrangement of only one thread is shown, but as it can be seen from Fig. 1, the machine is provided with a plurality of devices 10, each associated with the corresponding thread which unwinds from the different reels.

The device of the invention, illustrated in more detail in Figs. 2 and 3, comprises a housing formed by two halves 11 and 12. A shaft 18 crosses the two halves and is free to rotate, if necessary, under the control of friction means. Shaft 18 is provided with a pulley 15 located outside the housing and with a disc 20, located inside the housing. Half 12 is moreover provided with a sensor 24, connected to an electronic processing circuit 26. Disc 20 is provided, peripherally, with a plurality of reference elements 21, the passage of which, through the angular position (corresponding to that of the sensor) can be detected by the sensor. In the example illustrated, the reference elements consist of equally spaced notches or slots and the sensor is an optic coupler apt to generate an electric pulse each time a slot is passing.

It is obvious that other types of embodiments are

possible, for example, a set of magnets in conjunction with a hall type detector may be used, provided the combination is apt to generate a succession of pulses representing the rotating speed of the disc.

5 During operation of the machine, thread 1 is wound on the pulley, forming one or two complete turns around it, before going on toward the sewing zone. In regular operating conditions the rotating speed of the pulley (hence of the disc) is proportional to the consumption of the thread. Said value, in addition to being
10 dependent on the type of stitch applied, is also variable in a given interval which defines two acceptable operating limit conditions. An electronic control circuit, generally identified by reference number 26, processes the pulse
15 signals issued by sensor 24 and compares them with preset limits. More specifically, the pulses can be memorized periodically in a counter and successively converted to a direct voltage of proportional value by means of a digital-analogue converter. In alternative, the pulses
20 can be integrated in a preset time interval or processed in other known ways to obtain a voltage (or a current) proportional to the rotating speed of the disc. This voltage is then compared by applying it to the reference inputs polarized with voltages proportional to the
25 preset limit values. A digital type logic will then determine if the value of the detected voltage is comprised within the limits or not. If not, a signal is generated which, suitably amplified, controls stopping of the machine.

30 Control circuit 26 is shown schematically in Fig. 2 as a wired circuit with discrete components and, in

this case, the setting of the limit values is effected by adjusting two components (for example, two potentiometers) on two graduated scales. Preferably, however, the control circuit comprises a programmable microprocessor 27, serving all the control devices 10, the operation of which is much more flexible, as any modification of the limit values can be entered directly from a keyboard or by the same program governing operation of the entire machine.

10 In the example illustrated, disc 20 is keyed directly on shaft 18 of the pulley and reference elements 21 are set at equal distances from each other so that a linear proportionality exists between the speed (or consumption rate) of the thread and the electric signal to
15 be compared. This ratio of proportionality can however be varied by providing step-up gears between the pulley and the disc and/or providing a different distribution of the reference elements so as to obtain an improved sensitivity of the device in the regular operating zone. Another
20 alternative is to operate a non linear digital-analogue conversion, again for the purpose of expanding the interval of the values measured during a regular operation. It is understood that these and other changes and modifications, which are within the reach of the average technician
25 of the sector, are included in the protective scope of this invention.

By associating univocally the condition of regular operation to the consumption of the top or bottom thread and setting an interval of values for said consumption,
30 it is possible to control stopping of the machine in all of the following irregular operating conditions.

1) Breaking of the thread, either top or bottom.

In the first case, in fact, the pulley, no longer being drawn, will quickly reduce its speed to a value below the lower limit setting. In the second case, the absence
5 of the lower thread, will cause a further reduction of the speed of the pulley to a value below lower limit setting, thereby causing the machine to stop even if the directly controlled thread is still intact.

2) Skipping of stitches. Even in this situation, consum-
10 ption of the controlled thread will deviate from the limits allowed (increasing or decreasing, depending on whether the controlled thread is the top or bottom one) and will cause the machine to stop running.

3) Exhaustion of the thread from the bottom spools
15 or crochet. This occurs in the same manner described for breakage of the bottom thread.

4) Anomalous tension applied to the thread. This condi-
tion in fact determines a higher or lower rotating speed of the pulley with respect to the preset speed. If the
20 operator intervening after the stopping of the machine does not find any of the anomalies referred to under points 1-3, the operating irregularity is traceable to an incorrect tension of the thread.

From the above description, the advantages afforded
25 by the device according to this invention, as compared to the devices heretofore known (which were apt to stop the machine only in case of breakage of the thread directly controlled) are quite evident.

Although the description of the invention is referred
30 only to one of its preferred embodiments, it is obvious that the invention is not limited to said embodiment, but

also extends to other embodiments contemplating control of thread consumption (controlled thread) to verify the operating regularity of a sewing machine and to control stopping of same when thread consumption deviates from
5 a preset and selectable interval.

CLAIMS

1. Device for the control and stopping of automatic sewing machines, characterized in that it comprises:

- at least one element rotatable on a fixed axis and drawn into rotation by one of the sewing threads;

5 - means to measure the rotating speed of said element; and

- means to compare said measured rotating speed with two pre-set values, said means of comparison being apt to control stopping of the machine when the measured
10 rotating speed value is external to the interval of said two preset values.

2. Device according to claim 1, characterized in that the sewing machine is a multi-needle embroidering machine.

3. Device according to claims 1 or 2, characterized
15 in that said rotating element comprises a pulley rotatable around a fixed axis, located along the thread feeding pathway, and on which at least one complete turn of the thread is wound.

4. Device according to claim 3, characterized in
20 that said measuring means consist of a disc revolving around said fixed axis together with said pulley, said disc being provided with a plurality of reference elements, a fixed sensor apt to detect the passage of each reference element by generating an electric pulse, said sensor
25 being disposed at a point close to the periphery of the disc.

5. Device according to claim 4, characterized in that said reference elements are notches or slots, equally spaced from each other on the periphery of the disc,

and in that the sensor is of the optical type.

6. Device according to claims 4 or 5, characterized
in that said means of comparison comprise a voltage
generator controlled by the number of pulses detected
5 in a preset time interval, and two comparators, having
first inputs connected to the output of said voltage
generator and second inputs connected respectively
to two preset and selectable reference voltages.

7. Device according to claim 4 or 5, characterized
10 in that said means of comparison comprise a microprocessor
in which the number of pulses received in a preset time
interval is compared with two preset and selectable
values.

8. Embroidering machine equipped with a control and
15 stopping device according to any one of the above preced-
ing claims.

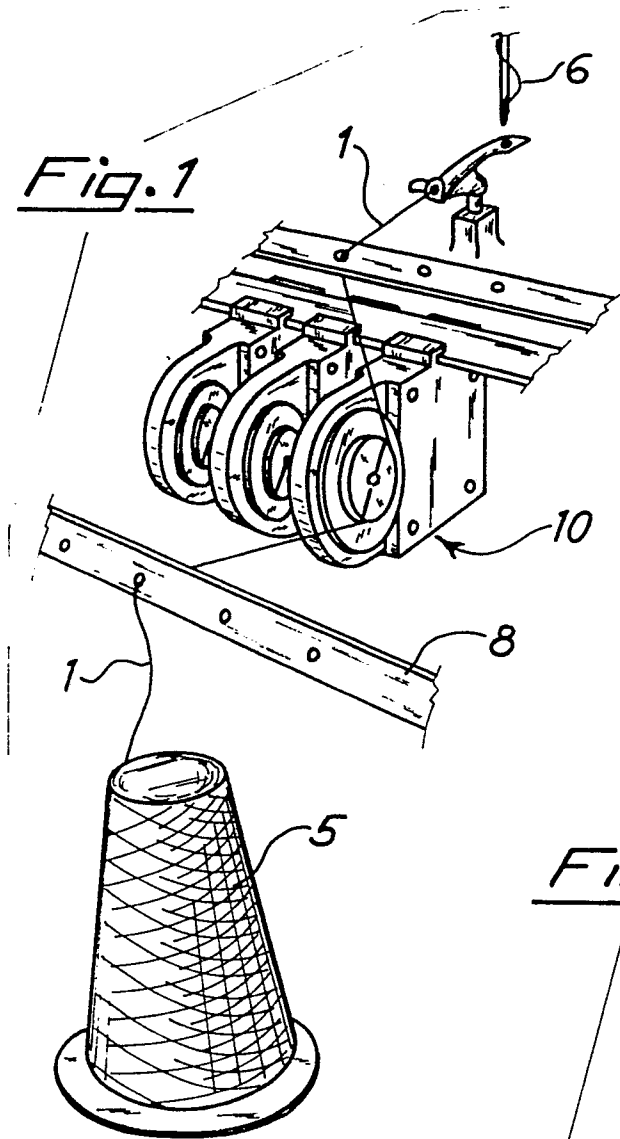
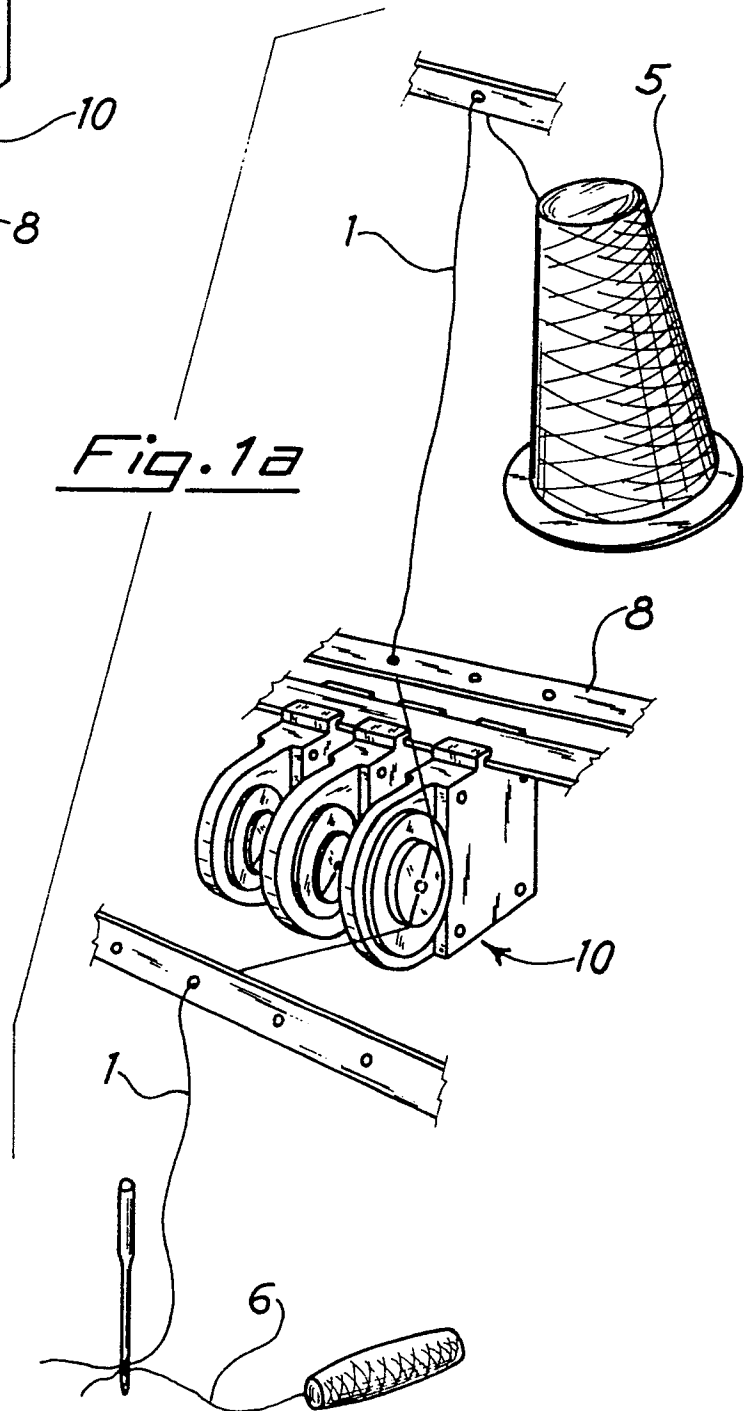
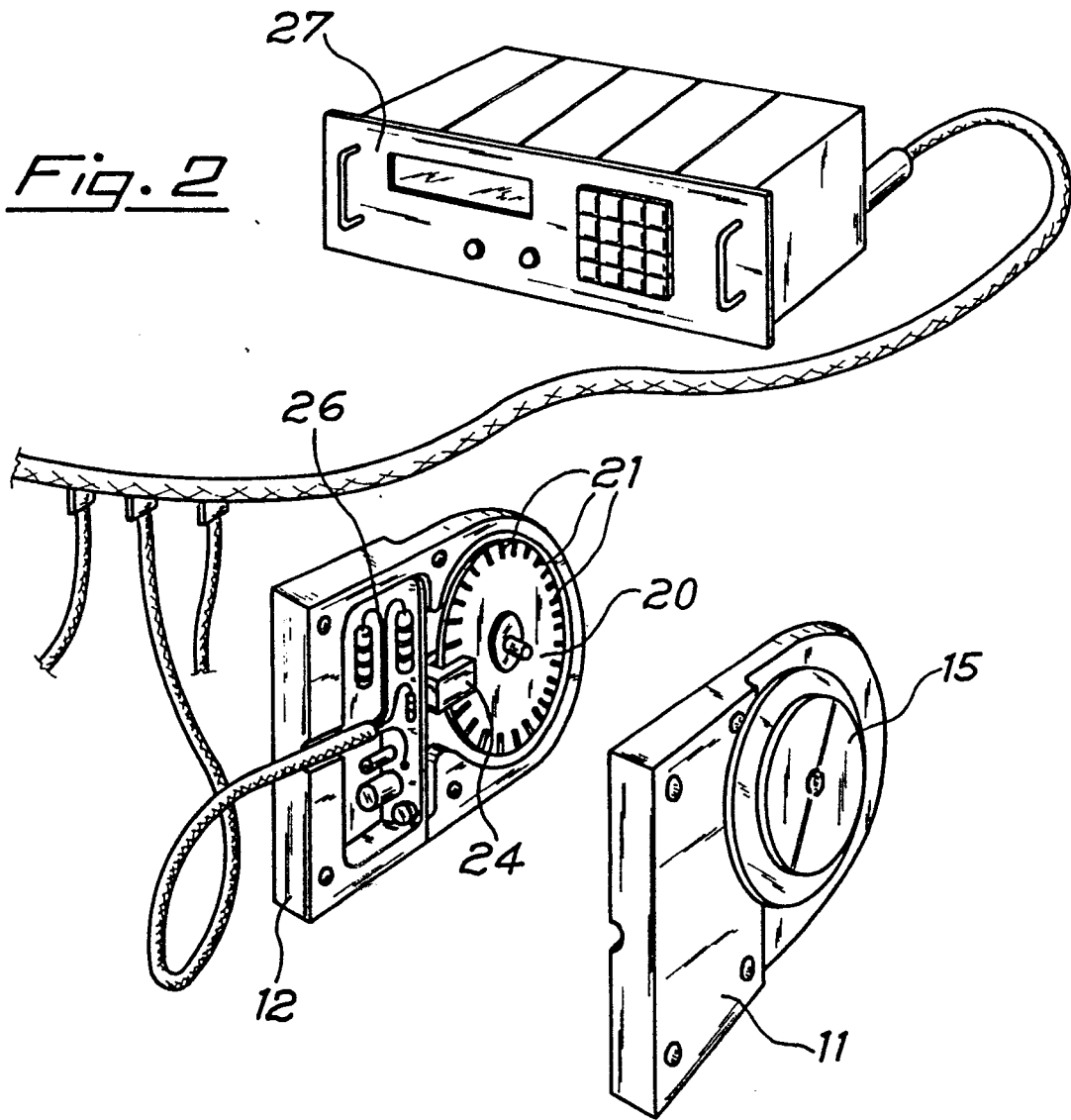
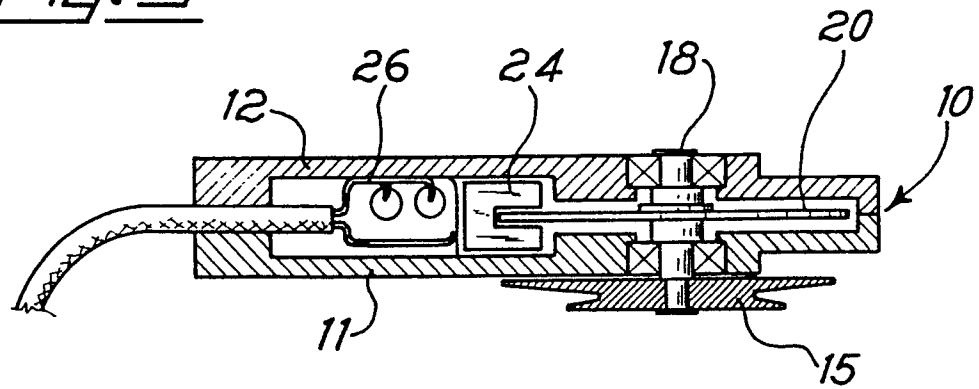
Fig. 1Fig. 1a

Fig. 2Fig. 3



European Patent
Office

EUROPEAN SEARCH REPORT

0179742
Application number

EP 85 83 0159

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. 4)
X	US-A-3 843 883 (DE VITA) * Whole document *	1-8	D 05 B 51/00
X	FR-A-2 041 627 (VEB) * Page 2, paragraph 1 *	1, 3, 4, 5, 8	
X	US-A-4 196 685 (TAMURA) * Whole document *	1, 3, 4, 6-8	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
			D 05 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 28-01-1986	Examiner VUILLEMIN L.F.
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	