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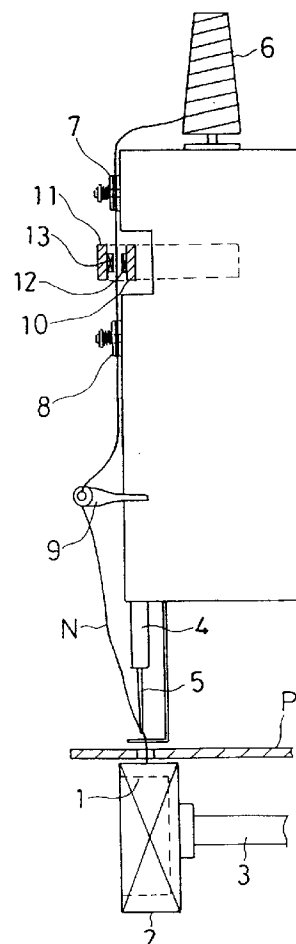
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(54) **Thread breakage detecting system for sewing machine.**

(57) The present invention aims to detect thread breakage in industrial sewing machines, especially multi-shaft sewing machines or multi-head sewing machines, by providing a pair of sensors (12,13) facing each other with the needle thread (N) between them. The sensors are disposed in the neighbourhood of the sending out position of the needle thread conducted by the needle shaft placed at the sewing position and detect the stop of sending out movement of the needle thread produced as a result of breakage. The invention also provides a mobile case (K) housing the bobbin (26) of the needle thread (N) movably on the machine head, a swing arm (24) which swings with a drive system on the side of the machine body, the tip of the swing arm being arranged in the shape of a fork (25) with a pair of sensors (22,23) disposed at the fork.

Fig.1



The present invention relates to a thread breakage detecting system which detects breakage of needle thread or bobbin thread in industrial sewing machines especially multi-shaft sewing machines or multi-head sewing machines with certainty by using a pair of sensors.

In embroidery sewing machines and industrial sewing machines especially multi-shaft sewing machines or multi-head sewing machines, thread breakage has a great influence on the sewing efficiency of the machine. For that reason, a sewing machine is provided with a device for informing the operator of any thread breakage immediately after occurrence of a breakage and for indicating at which needle shaft or machine head such breakage is produced. Such thread breakage detecting systems are disclosed in JP-A-57-1387, JP-A-57-1388 and JP-U-60-63180. The known systems are designed to be provided with a piezoelectric element in projection through the intermediary of a bracket at the position where the bobbin thread is conducted on the bottom face of the needle plate, put this bobbin thread sent out against this piezoelectric element and detect the pressing force of the bobbin thread to detect presence or not of any thread breakage.

However, in any of such known examples, the structure of the bottom face of the needle plate becomes complicated and, if the needle plate is not set accurately, the pressing force of the bobbin thread sent out changes, making any accurate detection difficult. Moreover, they also have the shortcoming of being liable to produce a detecting error of thread breakage due to adhesion of oil, dust, etc. to the piezoelectric element because they are provided with a piezoelectric element on the bottom face of the needle plate.

Furthermore, there is also proposed a system designed to wind the needle thread around a runner with sensor and turn this runner with sensor with the sending out of the needle thread so as to detect any thread breakage with the rotation and stop of this runner with sensor. However, this thread breakage detecting system has such problems that it can detect only a breakage of needle thread and that it requires a large number of sensors, becomes complicated in construction and is costly because a runner with sensor must be installed for each of the needle threads placed in parallel.

SUMMARY OF THE INVENTION

The present invention aims at making it possible to detect any thread breakage with certainty by detecting stop of sending out movement of needle thread produced as a result of breakage of either needle thread or bobbin thread in industrial sewing machine especially multi-shaft sewing machine or multi-head sewing machine by means of a pair of sensors

arranged in a way to pinch the needle thread.

To achieve the above-mentioned purpose, the gist of the present first invention consists in disposing a pair of sensors facing each other with the needle thread between them in the neighborhood of the sending out position of the needle thread conducted by the needle shaft placed at the sewing position and detecting the stop of sending out movement of the needle thread produced as a result of breakage of either the needle thread or the bobbin thread by means of said sensors to detect any thread breakage.

Moreover, the gist of the present second invention consists in providing movably a mobile case housing the bobbin of the needle thread on the machine head, providing a swing arm which swings with a drive system on the side of the machine body, arranging the tip of said swing arm in the shape of a fork in a way to pinch the needle thread stretched between thread stretchers provided on a lateral face of the mobile case, disposing a pair of sensors at said fork and detecting the stop of sending out movement of needle thread produced as a result of breakage of either needle thread or bobbin thread by means of said sensors to detect any thread breakage.

In the case of the first invention, a pair of sensors facing each other with the needle thread between them are disposed in the neighborhood of the sending out position of the needle thread conducted by the needle shaft placed at the sewing position.

In the case of the first invention, a mobile case housing the bobbin of the needle thread is provided movably on the machine head, a swing arm which swings with a drive system is provided on the side of the machine body, the tip of said swing arm is arranged in a way to pinch the needle thread stretched between thread stretchers provided on the lateral face of the mobile case in the shape of a fork, a pair of sensors is disposed at said fork and a pair of sensors are provided at said fork

The feed of thread is detected as normal by the sensors if the needle thread is sent out smoothly but the sending out of needle thread stops if a breakage is produced with either the needle thread or the bobbin thread. This state of feed of thread is detected with a pair of sensors to inform occurrence of a thread breakage. For that reason, only a pair of sensors are enough to detect with certainty any breakage of all needle threads and bobbin threads even in a multi-shaft sewing machine. Moreover, being disposed in the neighborhood of the sending out position of needle thread, the sensors are little subject to adhesion of oil, dust, etc., provide excellent detecting accuracy and are also capable of detecting any breakage of bobbin thread at the same time.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an explanatory drawing of the first exam-

ple of the thread breakage detecting system for sewing machine of the present invention.

Fig. 2 is a perspective view showing the appearance of the first example of the thread breakage detecting system for sewing machine of the present invention.

Fig. 3 is an explanatory drawing of the second example of the thread breakage detecting system for sewing machine of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention will be explained hereafter based on the examples indicated in the drawings.

Fig. 1 and Fig. 2 indicate the first example of the present invention in which a bobbin case (inner hook) 1 supporting by fitting a bobbin with a bobbin thread of required length wound around it is fit in a rotating outer hook 2 and this outer hook is fixed by bolting to the tip of the main shaft and rotates together with a hook shaft 3. This rotation is represented by either one turn of hook shaft and outer hook against a stitch (1-turn hook) or two turns of hook shaft and outer hook against a stitch (2-turn hook) depending on the type of sewing machine. Moreover, the tip of a hook retaining lever provided in projection on the machine body so as to always maintain the bobbin case (inner hook) 1 in the stopped state is bound to a part of the inner hook.

And as the needle shaft 4 makes up-down movements i. e. stitching movements in synchronization with the rotation of the hook shaft 3, the bobbin thread and the needle thread perform sewing or embroidery in regular succession. Namely, with the rotation of this hook shaft 3, the outer hook 2 fixed to the hook shaft 3 also rotates and the bobbin thread is sent out from the bobbin housed in the inner hook 1 while the needle thread N is entwined with the bobbin thread to be sewn in the cloth and sent out in succession.

In a multi-shaft sewing machine, a plural number of needle shafts 4 are provided on the machine body, and a mobile frame H supporting those needle shafts 4 is made to turn in order to selectively connect the desired needle shaft 4 only to a drive system disposed inside the machine body for making up-down movements. And needles 5 are fixed to the lower end of the respective needle shafts 4.

The needle thread N is stretched on the thread stretchers 7, 8 provided in projection on the front face of the mobile frame H to be sent out under the required tension. The needle thread which passed through the thread stretcher 8 is put on a balance 9 and then conducted to the needle 5. The needle thread N is provided in the number equal to that of the needle shafts 4 and the respective needle threads N are passed into the respective balances 9. And only the needle shaft 4 and the balance 9 found in the

sewing position are driven while other needle shafts 4 and balances 9 are kept in the stopped state. The explanation of the detailed mechanism for sending out the needle thread N will be omitted because this mechanism is similar to that of conventional multi-shaft sewing machines.

Fixed frames 10, 11 will be fixed to the machine body so that they may not move even with the rotation of the mobile frame H and facing each other in a way to pinch from inside and outside the needle thread N sent out. And a pair of sensors 12, 13 are disposed on the frames 10, 11 in the neighborhood of the sending out position of the needle thread N conducted by the needle shaft 4 and the balance 9 found in the sewing position, between the upper and lower thread stretchers, for example. The sensors 12, 13 are intended to discriminate movement and stop of the thread and constructed to be able to detect any movement of extremely slow speed. To be concrete, sensors of optical type, sound wave type, electromagnetic wave type, etc. are adopted. The sensors 12, 13 detect presence or not of a movement of needle thread N with or without contact with the thread.

Moreover, the sensors 12, 13 are connected to an electric circuit constituting means of discrimination, actuation, etc. (not indicated in the drawing) so as to either light an alarm lamp provided on the sewing machine or ring an alarm buzzer and stop the machine when they detected a state of stop of sending out of needle thread N produced as a result of breakage of either needle thread or bobbin thread.

The first example indicated in Fig. 1 and Fig. 2 is an apparatus of a system which changes the needle thread by turning the mobile frame H of a multi-shaft sewing machine, but the present invention can also be applied to an apparatus of a system which changes the needle thread by horizontally moving a plural number of needle shafts provided in a straight line in their entirety. In that case, thread stretchers 7, 8 and a balance 9 will be provided side by side on the front face of a flat mobile frame H and fixed frames 10, 11 on which to mount the sensors 12, 13 will also be provided on a straight line in the same way. The sensors 12, 13 will be disposed in the neighborhood of the sending out position of the needle thread N conducted by the needle shaft 4 and the balance 9 found in the sewing position, between the upper and lower thread stretchers, for example.

The example 1 explained above is realized in a way to provide the machine body with a plural number of bobbins 6 fixed to a mobile frame H and selectively use the needle thread N from those bobbins 6. Next, explanation will be given about an apparatus of a system housing the bobbin 26 of the needle thread used in a mobile case K, moving this mobile case K on the machine head and selecting a needle thread as desired from a plural number of needle threads, which is the second example of the present invention indi-

cated in Fig. 3. In this apparatus, a pair (upper & lower) of thread stretchers 27, 28 for pinching the needle thread sent out from a bobbin 26 will be provided on a lateral face of the mobile case K housing the bobbin 26. And a swing arm 24 which swings in the direction perpendicular to the direction of movement of the mobile frame K and in the longitudinal direction against the machine body will be provided at the top of the machine body. The swing arm 24 will be realized in the shape of a fork 25 at the tip and a pair of sensors 22, 23 will be provided at this forked part.

The base end side of the swing arm 24 will be constructed in a way to swing with a drive system 29 such as solenoid, etc. so that the needle thread N stretched between the thread stretchers 27, 28 may be pinched by the forked part 25 when the swing arm 24 swings to the case side and that the sending out of the needle thread may be detected with the sensors 22, 23.

Moreover, a change of needle thread is performed as the forked part 25 swings the swing arm 24 with a drive system 29 in a way to be separated from the front face of the case and moves the mobile case K housing the bobbin 26 in either the transversal or the longitudinal direction in the state where the forked part 25 is separated from the needle thread stretched between the thread stretchers 27, 28.

The thread breakage detecting system of the present invention is provided with a pair of sensors in the neighborhood of the sending out position of the needle thread conducted by the needle shaft placed at the sewing position and detects (judges) (the thread feed) as normal if the needle thread used is sent out smoothly. On the other hand, because the sending out of needle thread stops in case of occurrence of any breakage with either the needle thread or the bobbin thread, the pair of sensors facing each other detect this stop and inform occurrence of a thread breakage. For that reason, only a pair of sensors are enough to detect with certainty any breakage of all needle threads and bobbin threads even in a multi-shaft sewing machine. Moreover, being disposed in the neighborhood of the sending out position of needle thread, the sensors are little subject to adhesion of oil, dust, etc., provide excellent detecting accuracy and are also capable of detecting any breakage of bobbin thread at the same time.

Claims

1 A thread breakage detecting system for sewing machine characterized in that it is provided with a pair of sensors facing each other with the needle thread between them in the neighborhood of the sending out position of the needle thread conducted by the needle shaft placed at the sewing position and detects the stop of sending out movement of the needle

thread produced as a result of breakage of either the needle thread or the bobbin thread by means of said sensors to detect any thread breakage.

2 A thread breakage detecting system for sewing machine characterized in that it is provided with a mobile case housing the bobbin of the needle thread movably on the machine head, a swing arm which swings with a drive system disposed on the side of the machine body, the tip of said swing arm being arranged in the shape of a fork in a way to pinch the needle thread stretched between thread stretchers provided on a lateral face of the mobile case, a pair of sensors disposed at said fork, and detects the stop of sending out movement of needle thread produced as a result of breakage of either needle thread or bobbin thread by means of said sensors to detect any thread breakage.

Fig.1

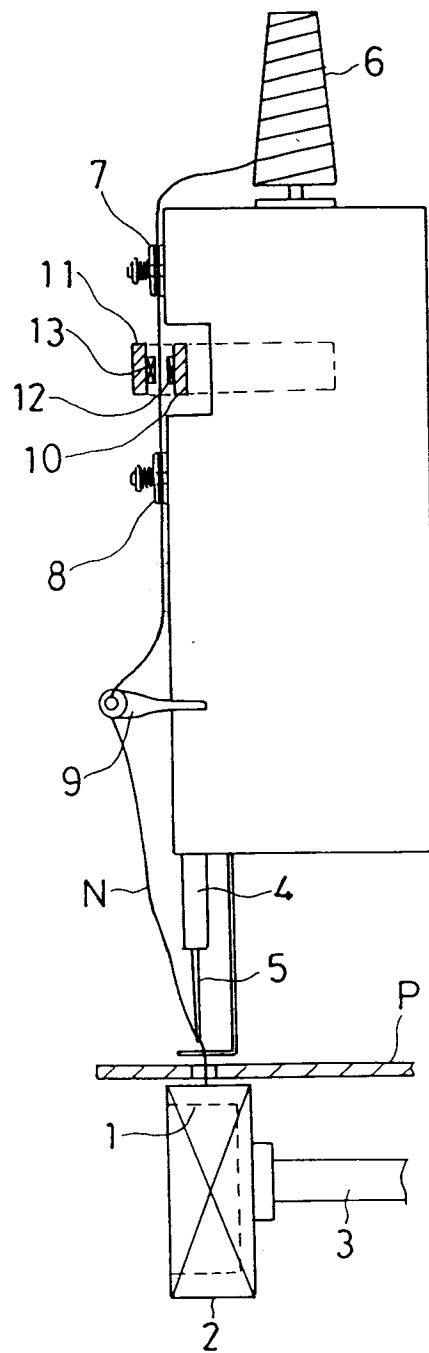


Fig.2

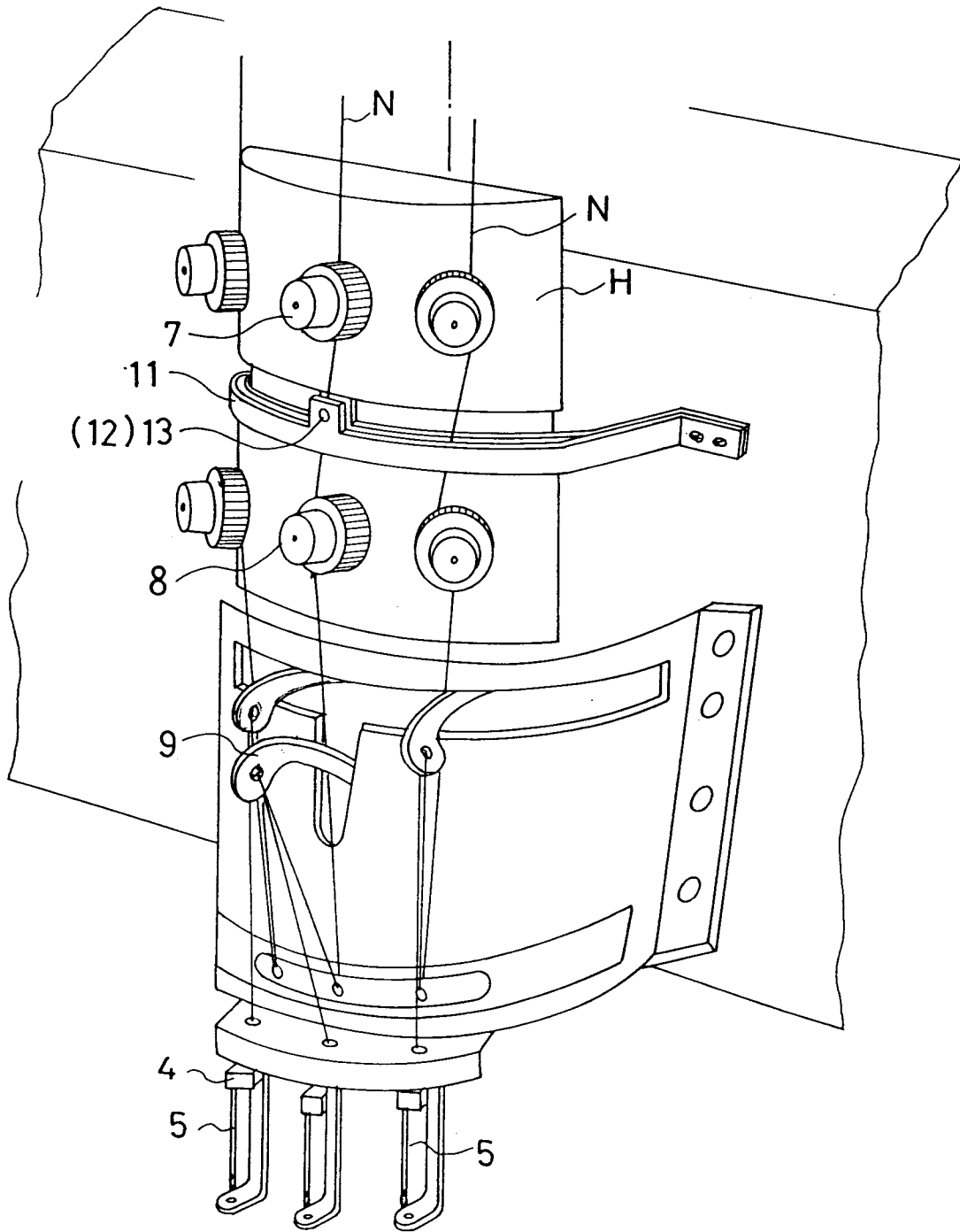
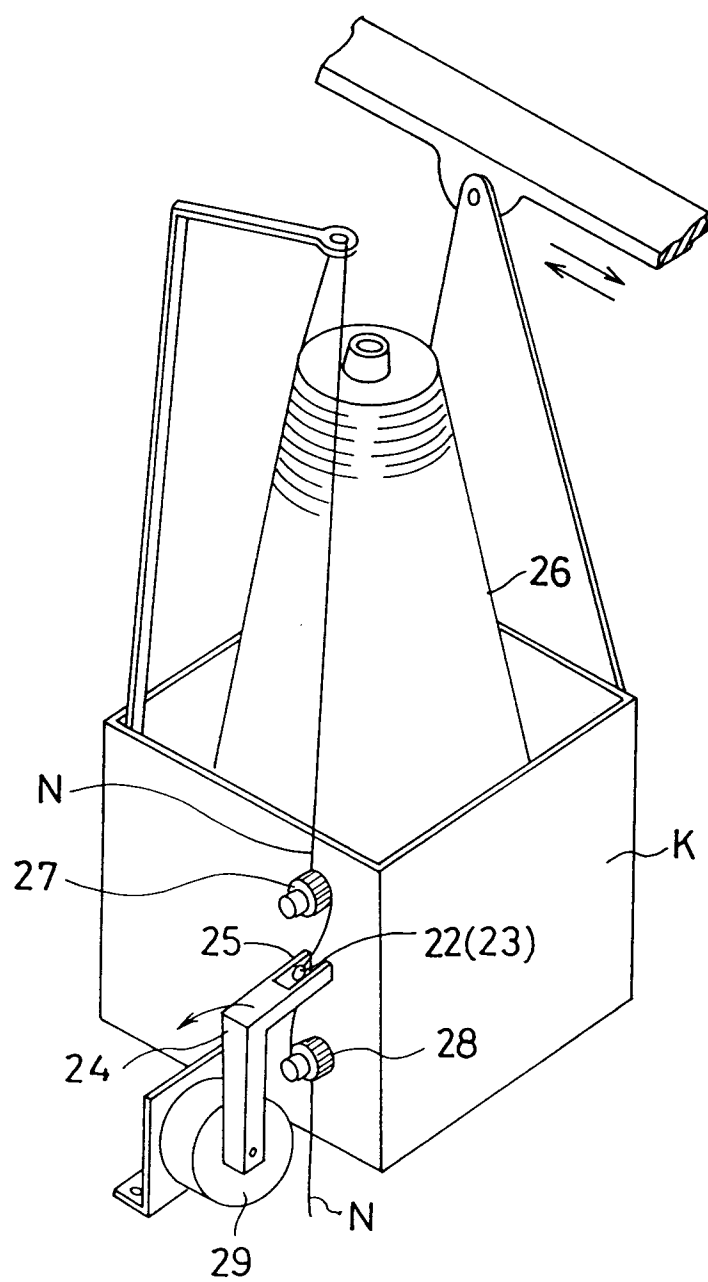


Fig.3





European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 92 30 8445

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	DE-A-4 013 648 (S.A.O. RYDBORN) * claims; figures *	1	D05C11/14
A	DE-A-3 120 355 (CSEPEL MÜVEK JARMÜ-ES KONFEKCIOIPARI GEPGYARA) * claims 1,2,4; figure 1 *	1	
A	US-A-4 075 958 (A.D. SACCHETTI)		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			D05C D05B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 14 DECEMBER 1992	Examiner COURRIER G.L.A.
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			

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