United States Patent [19]

Maassen

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[54] **AUTOMATIC WINDING MACHINE AND METHOD OF OPERATION THEREOF**

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May 29, 1971 Germany 2126983

[52] **U.S. Cl.** ..... **252/35.6 R,** 242/35.5 R

[51] **Int. Cl.** **B65h 54/22**

[58] **Field of Search** ..... 242/35.6 R, 35.5 R, 35.5 A

[56] **References Cited**

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3,033,478	5/1962	Furst	242/35.6 R
3,092,340	6/1963	Furst	252/35.5 R
3,160,358	12/1964	Furst	252/35.5 R
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[57] **ABSTRACT**

An automatic winding machine for winding cross-wound spools has an automatic exchange device for automatically exchanging the supply and take-up spools. The winding machine comprises a thread sensing device for sensing the presence of an uninterrupted thread from the supply spool to the take-up spool prior to an exchange of take-up spools. A thread tying device is controlled in operation by the thread sensing device in a manner whereby if the thread sensing device senses an interrupted thread, the thread tying device ties the thread and the thread sensing device initiates the operation of the exchange device.

3 Claims, 2 Drawing Figures

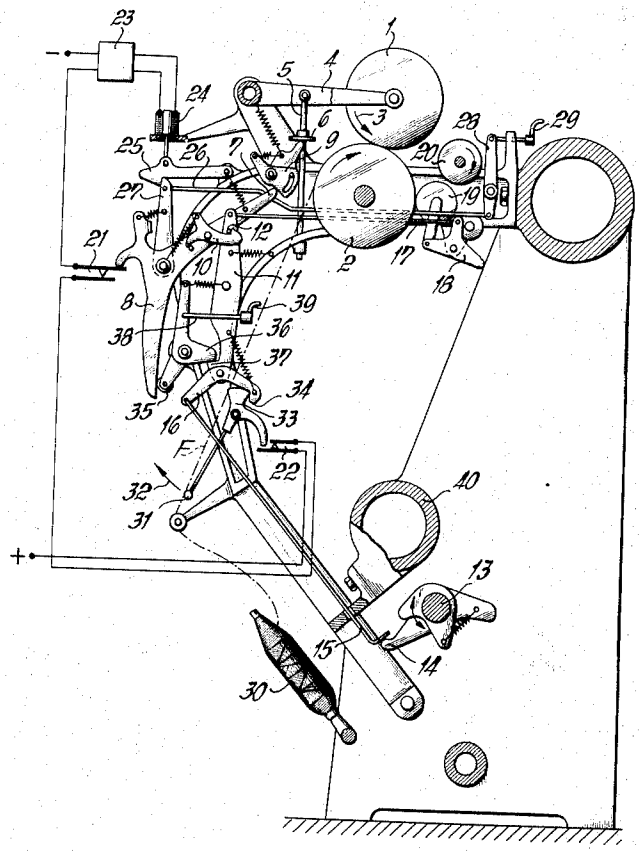

FIG. 1

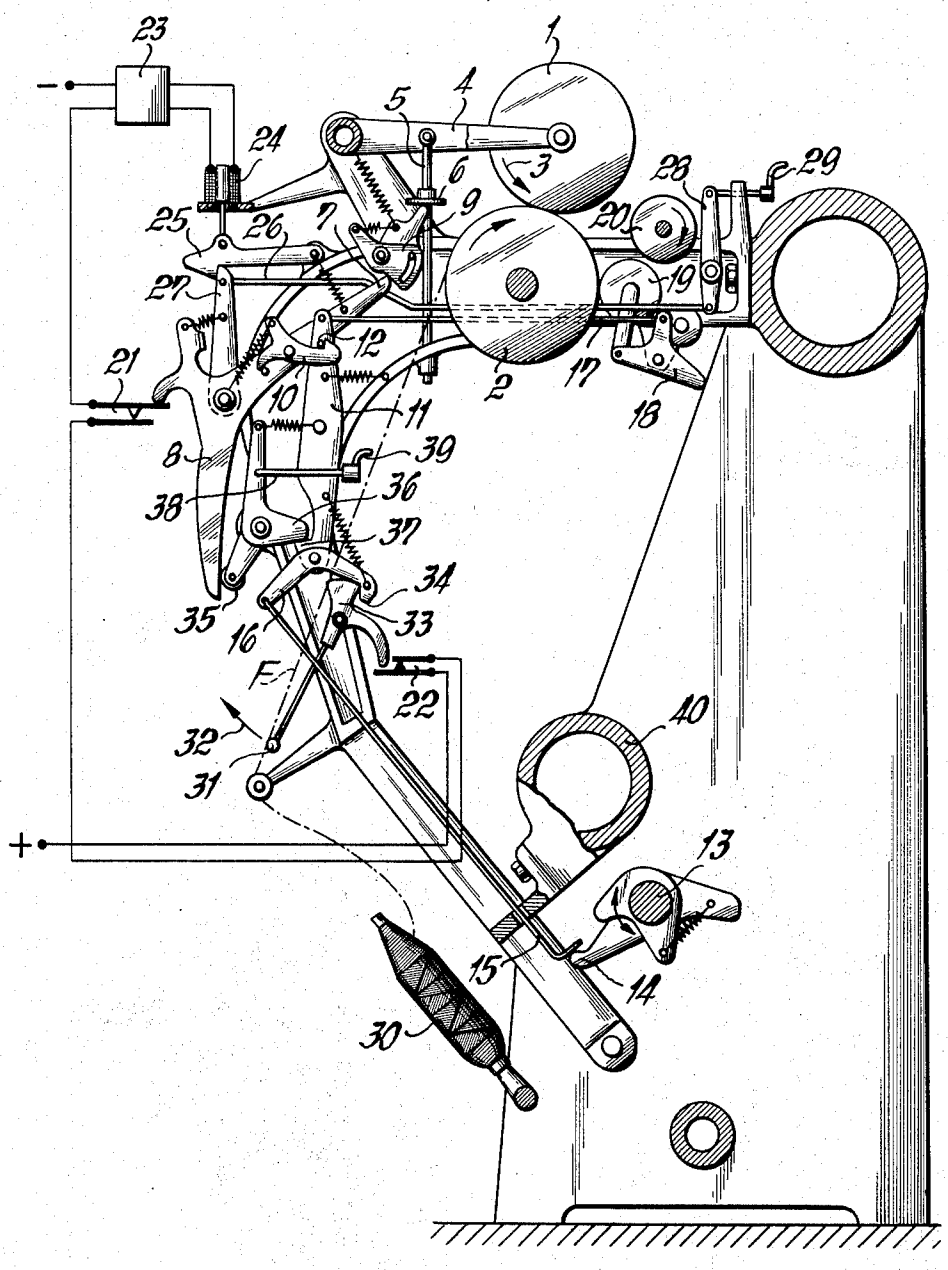
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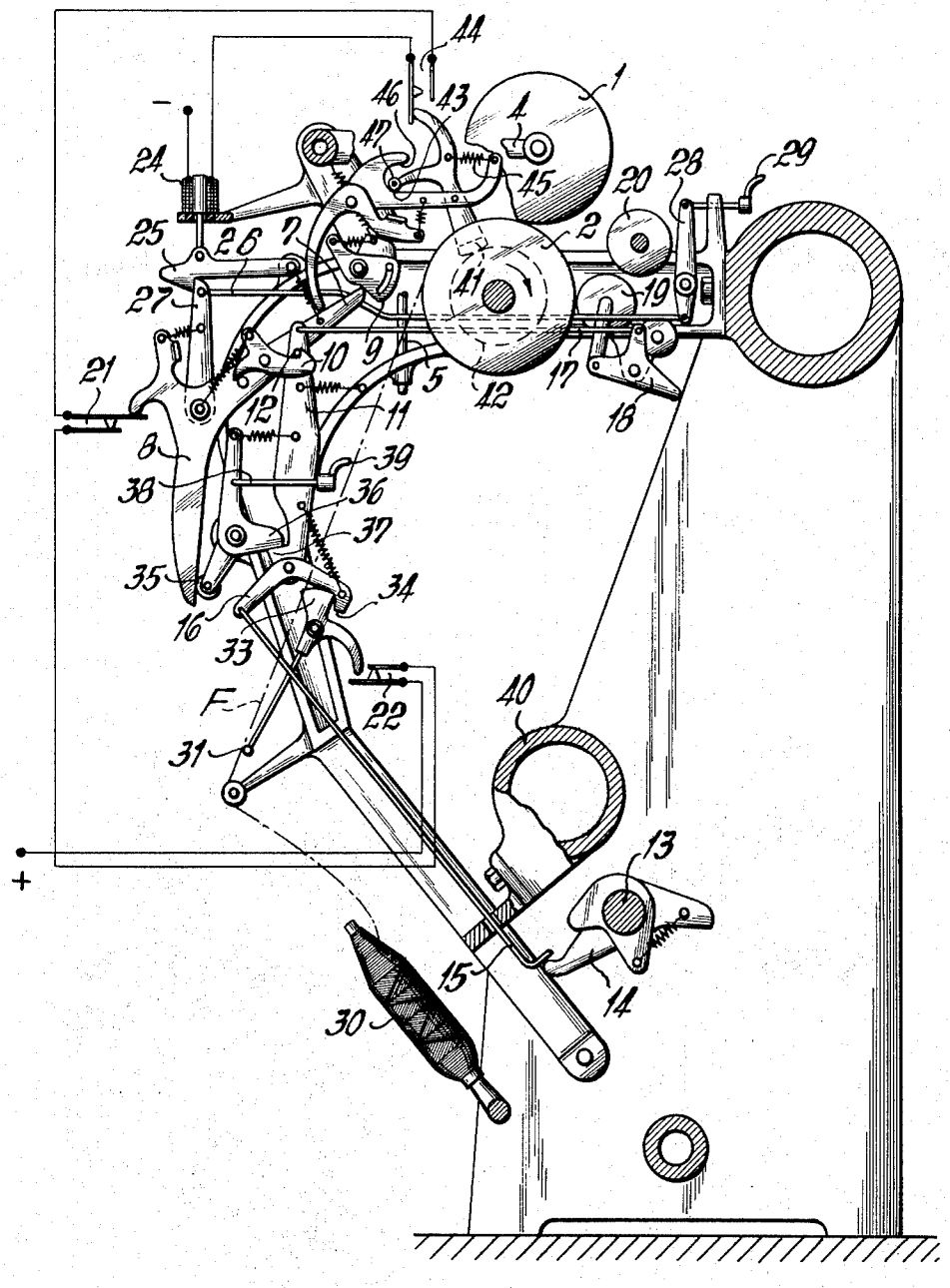
FIG. 2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AUTOMATIC WINDING MACHINE AND METHOD OF OPERATION THEREOF

SPECIFICATION:

The invention relates to an automatic winding machine and the method of operation of the automatic winding machine.

The automatic winding machine includes machinery for an automatic change of the supply and take-up spools, and for winding cross-wound coils or cheeses at a plurality of winding stations.

In winding machines of the type of the invention, automation has progressed so far that all operations of the winding process such as, for example, the preparation of supply spools, the elimination of thread breaks, the exchange of full take-up spools for new empty bobbins, and the winding start of the empty bobbins proceed completely automatically. In the phase of changing the take-up spools, the flow of operation may, however, be critically disturbed if, during the deceleration of the full spool, there is an interruption of the thread to be wound. Any supply spool which runs out at just that time, a thread break occurring in the thread cleaner or elsewhere, or an interruption of the thread on the supply spool, may cause an interruption of the thread connection between the supply spool and the takeup spool. In all the aforedescribed cases, the take-up spool exchange device is no longer in a position to automatically start up a new empty spool.

Heretofore, such interruptions in the course of the operation have been tolerated as so-called "rare occurrences" and have been left to the operator to correct. However, it has been found that at high thread velocities and with frequent change of take-up spools and a large number of winding stations, the efficiency of an automatic winding machine is substantially reduced by such interruptions.

It is an object of the invention to provide an automatic winding machine which avoids manual intervention and outages related thereto during the changing of the take-up spools.

In accordance with the invention, the aforedescribed problem is solved by a machine and a method of operating the machine according to which prior to the exchange of take-up spools, the presense of an uninterrupted thread from the supply spool to the take-up spool is ascertained, the thread connection is restored in case the thread is missing and the change of take-up coils is subsequently initiated.

A preferred embodiment of the machine of the invention includes a switching member which activates the take-up spool changing device upon reaching a predetermined diameter of the take-up spool. The switching member is connected to the take-up spool changing device via a sensing element which ascertains the presence of an uninterrupted thread and controls the take-up spool changing device.

Although in automatic winding machines having an automatic exchange of supply and take-up spools which heretofore have become known, each winding station is provided with a thread monitor which is positioned in the path of the thread and senses the thread, the thread tension decreases steadily when the takeup spool runs out. Thus, each tension or velocity dependent thread monitor signals, despite the presence of the thread, an actually non-existent thread break and can therefore initiate an unnecessary knotting operation,

which may create additional possibilities for trouble. Heretofore, in order to prevent this, the thread monitor has been blocked immediately when the winding station was stopped in order to exchange take-up spools. In contrast to this, in accordance with the invention, prior to the exchange of take-up spools the presence of an uninterrupted thread from the supply spool to the take-up spool is ascertained. That is, either the existing or an additional sensing element remains connected during the entire running-out time of the full take-up spool, or is temporarily connected after the running-out process is completed, but before the take-up spool changing operation is initiated.

If there is still a thread connection between the supply spool and the take-up spool when the take-up spool is at a standstill, the exchange of take-up spools is initiated and undertaken. If the sensing element, however, detects an interruption in the thread, the take-up spool changing procedure is blocked and the thread connection between the supply spool and the take-up spool is first re-establised by a thread tying device. To accomplish this, the start of the thread of a new and ready supply spool can be tied to the end of the thread of the take-up spool, or a broken thread end still in the thread tensioner may be found and reknotted. After the thread connection is re-established, the exchanging or changing of the spools may be initiated. At this point, it may be advantageous to briefly start up the take-up spool again prior to the exchange.

The automatic winding machine of the invention and the method of the invention therefore eliminate the need for intervention by the operator during the exchange of the take-up spools.

In order that the invention may be readily carried into effect, it will now be described with reference to the accompanying drawings, wherein:

FIG. 1 is a schematic diagram, partly in section, of a winding station of an embodiment of the automatic winding machine of the invention; and

FIG. 2 is a schematic diagram, partly in section, of a modification of the embodiment of FIG. 1.

In the FIGS., the same components are identified by the same reference numerals.

In FIG. 1, a take-up spool 1 is driven by a thread guiding drum 2 in the direction of an arrow 3 for the winding of a thread F on said take-up spool. The take-up spool 1 is rotatably supported in a spool frame 4. A rod 5 is movably linked to the spool frame 4. The rod 5 has a stop 6 against which a segment-shaped lever 9 rests. The rod 5 adjusts the diameter of the take-up spool 1.

As soon as the predetermined diameter of the take-up spool 1 is reached, the end 7 of a lever 8 drops off the lever 9 into the position shown. During the winding of the take-up spool 1, a lever 11 executes a swinging motion. A latch 10 permits the interruption of the movement of the lever 11. The lever 11 may be arrested by a pin 12. The swinging motion of the lever 11 is imparted to said lever from a rocking shaft 13 via a lever 14, a rod 15 and a support lever 16, and is transmitted to an angular lever 18 via another rod 17.

A friction roller 19 is linked to the angular lever 18 and produces an intermittent drive between the thread guiding drum 2 and a drive roller 20. By the arresting of the lever 11, the friction roller 19 is also kept away from the drive roller 20 and the drive for the thread guiding drum 2 and for the take-up spool 1 is thereby

interrupted. After a specific running-out time, the take-up spool **1** comes to a standstill. A contact **21** is actuated simultaneously with the rocking of the lever **8**, and a circuit including another contact **22** and a delay relay **23** is closed.

The delay relay **23** is adjustable corresponding to the running-out time for a take-up spool, and after the take-up spool **1** has come to a standstill, said delay relay switches on or actuates a pull magnet **24**, causing a latch **25** to release a lever **27**. A switching element **29** may then be pushed into the track of a take-up spool changing device via a tie rod **26** and a double lever **28**. The take-up spool changing device is known per se and travels along the winding stations, but is not shown in the FIGS. The take-up spool changing device may then be brought to a stop and the take-up spools are exchanged. An example of a take-up spool changing device is disclosed, for example, in U. S. Pat. No. 3,160,358 issued Dec. 8, 1964 and entitled "Automatic Yarn-Coil Winding Machine" and in U. S. Pat. No. 3,184,174 issued May 18, 1965 and entitled "Yarn-Spool Winding Machine With Automatic Spool-Exchanging Device." Examples of these devices and take-up spool exchange devices and thread tying devices are also disclosed in U. S. Pat. No. 3,033,478 issued May 8, 1962 and entitled "Automatic Yarn-Package Winding Machine" and U. S. Pat. No. 3,092,340 issued June 4, 1963 and entitled "Yarn-Package Winding Machine."

However, if a thread break occurs during the running-out time of the take-up spool **1**, or if, for example, a supply spool **30** is empty, a sensing element **31** is deflected in the direction of an arrow **32** and a segment-shaped lever **33** is moved under a support projection **34** of the continuously oscillating support lever **16**. The lever **11** may therefore be pivotted, rotated or swung into a position in which a latch lever **36** slides off a seat **37** of the lever **11**. A switching element **39** is pushed via a rod **38** into the path of a known thread tying device which continuously travels back and forth on a support tube **40**. The thread tying device is not shown in the drawing, in order to maintain the clarity of illustration. The thread tying device either reestablishes only the thread connection between the supply spool **30** and the take-up spool **1**, or first puts a new supply spool in place and then makes a thread connection to the take-up spool in the known manner. Simultaneously with the sliding off of the latch lever **36**, the lever **8** is returned to its initial position via a roller **35** and the contact **21** is opened in the process. Since the sensing element **31** returns behind the passing thread F, the contact **22** is also opened. The circuit of the delay relay **23** is thereby interrupted again. The relay **23** is switched to zero or deenergized.

The mechanical thread sensing element **31** may be replaced by electronic monitoring elements, which deliver a suitable switching pulse. The switching pulse may be used to bring the thread tying device into operation. An existing thead may, however, also be checked by a device and the presence of the thread may be ascertained after the running-out process of the take-up spool **1** is terminated.

Another switching pulse may be used to bring the take-up spool changing device into operation and to initiate the spool changing operation. The running out or stopping of the take-up spool **1** and the thread guiding drum **2** may be monitered directly, by a tachometer generator, for example, instead by the delay relay **23**, which must be adjusted to the running-out time of the take-up spool **1** and the thread guiding drum **2**.

In the modification of FIG. **2**, when the end **7** of the lever **8** drops off from the segment lever **9**, a braking sensor **41** is applied to a braking disc **42** of the thread guiding drum **2**. The braking sensor **41** and a roller **47** mounted thereon is brought to a stop **43** by a rotary motion produced in this manner. A contact **44** is thereby opened before the contact **21** is closed.

As soon as the thread guiding drum **2** has come to a standstill, a tension spring **45** returns the braking sensor **41** to a stop **46**. The contact **44** is thereby closed. The pulling magnet **24** is energized and pulls up the latch **25** and releases the lever **27**, so that the take-up spool changing device is brought into operation, as in the embodiment of FIG. **1**, and may go into operation. If the thread connection is interrupted, the aforedescribed control steps are followed as described with reference to FIG. **1**.

While the invention has been described by means of specific examples and in specific embodiments, it should not be limited thereto, for obvious modifications will occur to those skilled in the art without departing from the spirit and scope of the invention.

I claim:

1. An automatic winding machine having supply and take-up spools and automatic exchange means for automatically exchanging the take-up spools, the winding machine comprising means for rotating said take-up spool to wind thread thereon, take-up spool diameter sensing means for stopping rotation of said take-up spool and initiating operation of said exchange means upon said take-up spool attaining a predetermined diameter, thread sensing means for indicating the presence or absence of a thread between the supply spool and take-up spool, actuating means responsive to said thread sensing means indicating an absence of a thread after said diameter sensing means has stopped rotation of said take-up spool for preventing operation of the exchange means prior to exchange of said take-up spool, thread tying means for tying thread ends extending from said supply spool and said take-up spool, and operable means controlled by said sensing means to initiate operation of said tying means to tie the thread ends when the thread sensing means senses an absence of thread, whereby the exchange means is operated only when a thread is present between said supply spool and take-up spool.

2. An automatic winding machine as claimed in claim **1**, wherein said diameter sensing means including a switching element for actuating the exchange means when a specific diameter of the take-up spool is reached and sensed by the diameter sensing means.

3. A method of operating an automatic winding machine having supply and take-up spools and automatic exchange means for automatically exchanging the take-up spool, the method comprising the steps of rotating said take-up spool to wind thread thereon, sensing the diameter of the thread, stopping rotation of said take-up spool and initiating operation of the exchange means upon said take-up spool attaining a predetermined diameter, sensing the presence or absence of a thread between the supply spool and take-up spool, preventing operation of the exchange means prior to exchange of the take-up spool and after stopping rotation of said take-up spool in the event of an absence of

thread between said supply spool and take-up spool, tying the thread ends extending from said supply spool and take-up spool if an absence of thread is sensed, and then initiating operation of said exchange means after tying the thread ends, whereby exchange of the take-up spool is preformed only when a thread is present between the supply spool and take-up spool.

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