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Bartling et al.

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[45] **Apr. 29, 1975**

[54] **METHOD AND APPARATUS FOR CONTROLLING THE REJOINING OF THREAD IN AN OPEN ENDED SPINNING MACHINE**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.** **D01h 1/12;** D01h 1/28

[58] **Field of Search** ..... 57/34 R, 58.89–58.95, 57/78, 80, 81, 83, 156

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Assistant Examiner—Charles Gorenstein
Attorney, Agent, or Firm—Murray Schaffer

[57] **ABSTRACT**

Method and apparatus for the rejoinder of a broken thread in an open end spinning unit. The thread is formed from fibers fed to a rotating spinning turbine and withdrawn therefrom to a winding device. The continuity of the withdrawn thread is sensed and a signal provided on interruption thereof. A control mechanism responsive to the signal is provided for establishing a predetermined sequence of operation of said spinning unit for rejoining the thread. The turbine is movably mounted, so that the control unit on receipt of a signal first shifts the turbine from a working position into a position where spinning is arrested and to thereafter initiate the rejoinder operation and maintain the operation for a predetermined time interval to complete said sequence. The control mechanism may be provided for individual or a plurality of units. Other sensing means monitoring the operation of the turbine are included.

15 Claims, 10 Drawing Figures

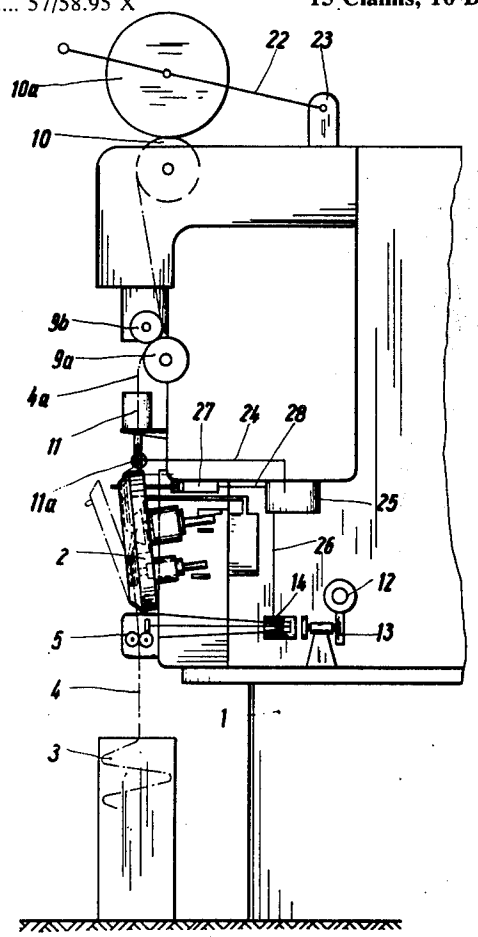

Fig. 1

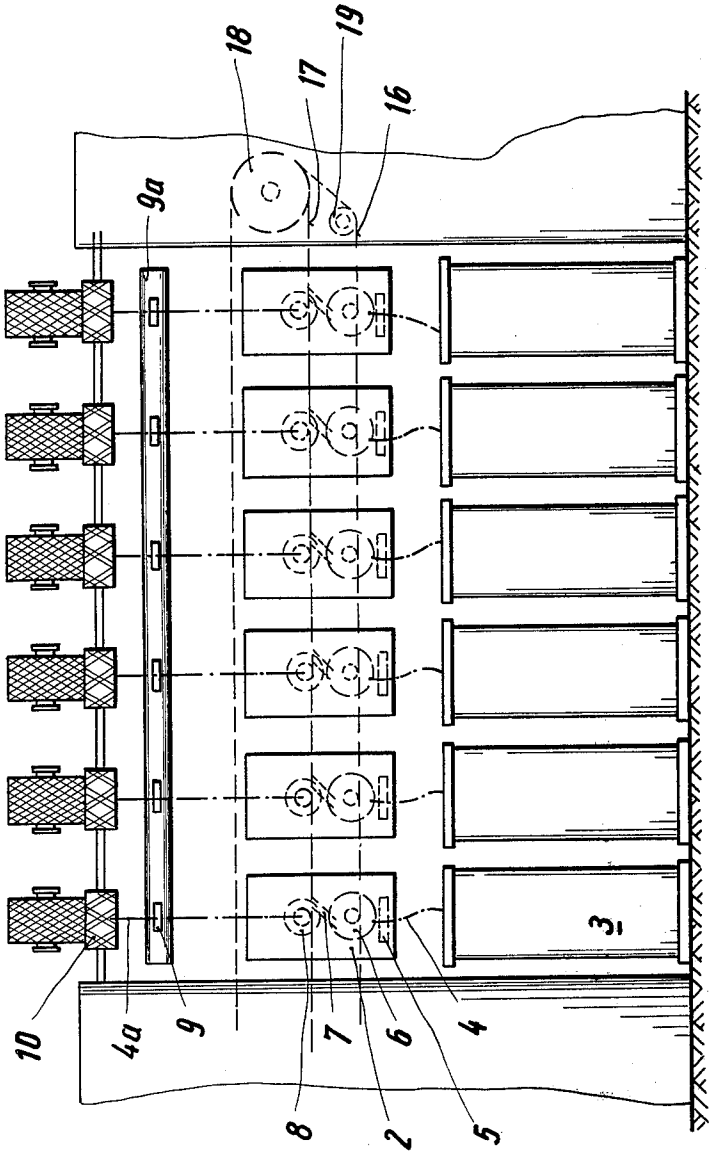

Fig. 2

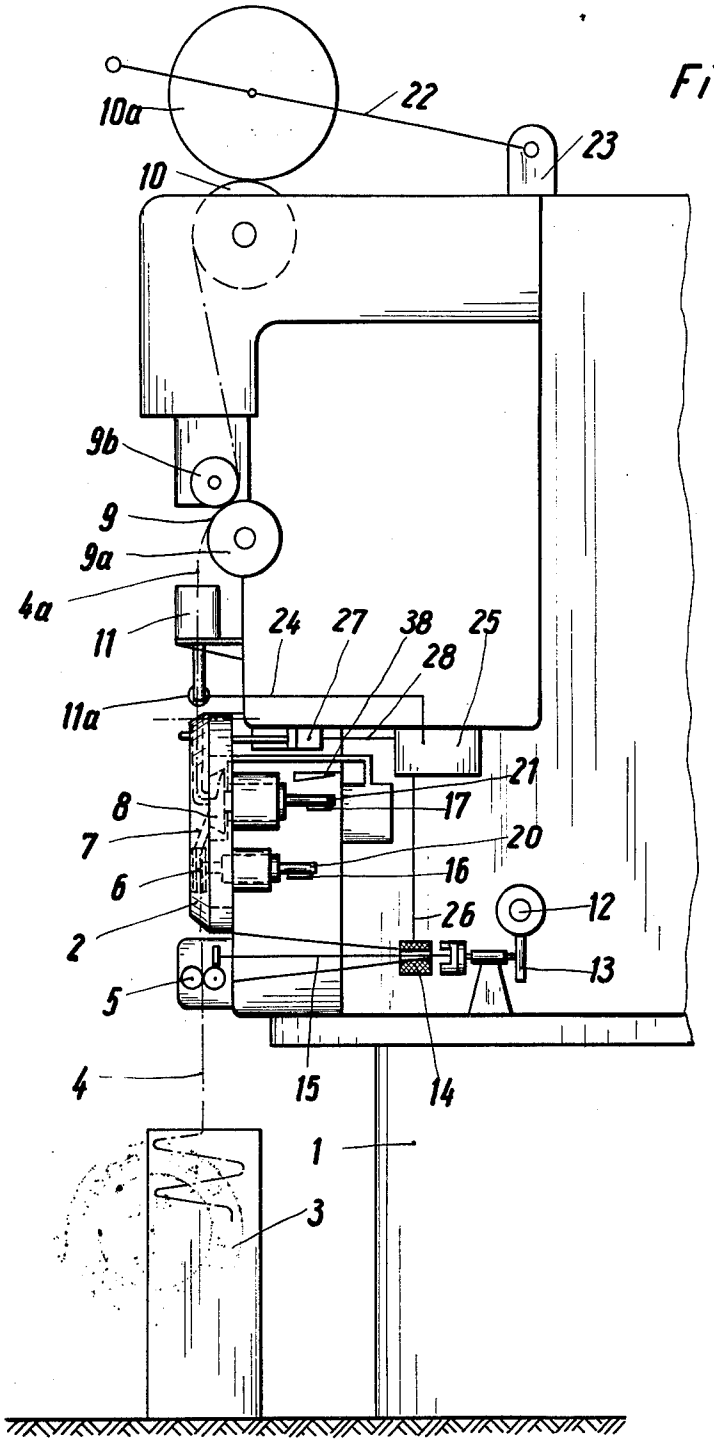
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Fig. 3

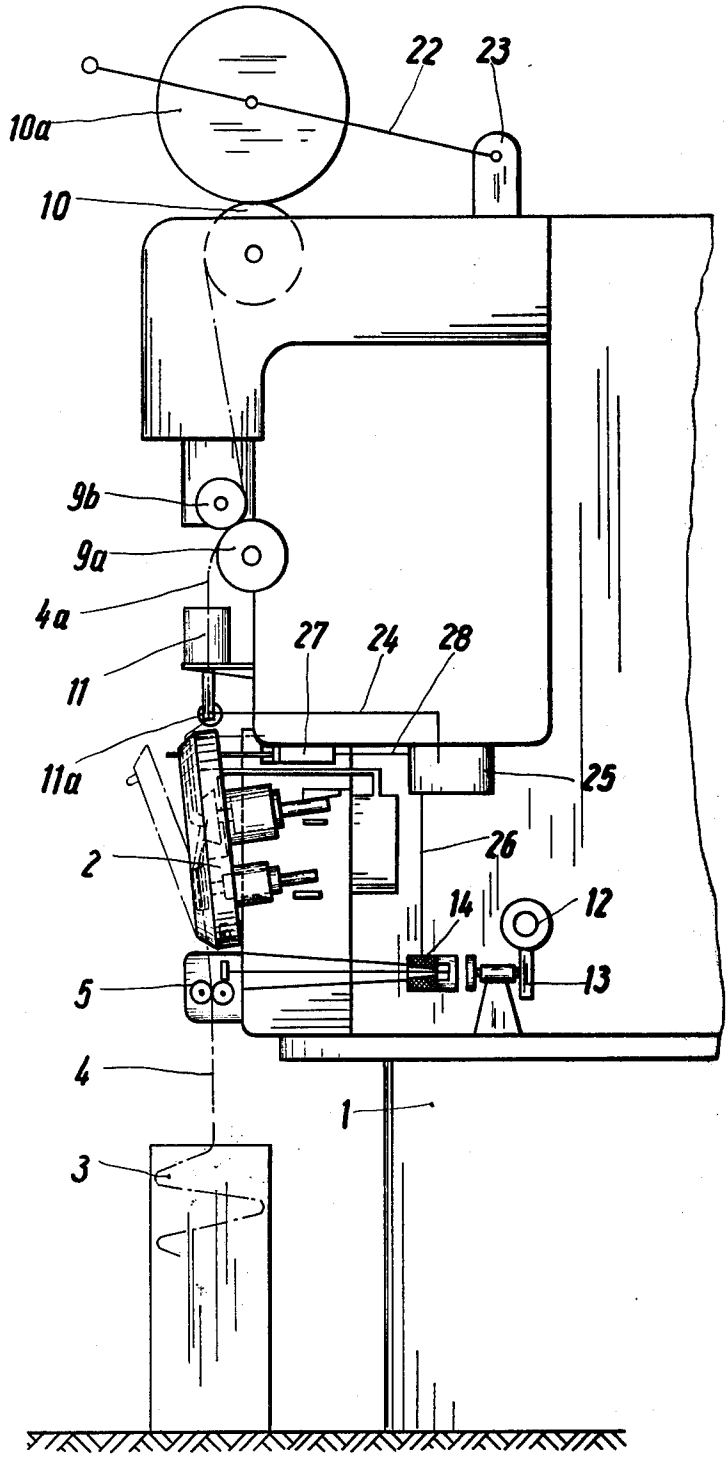

Fig. 4

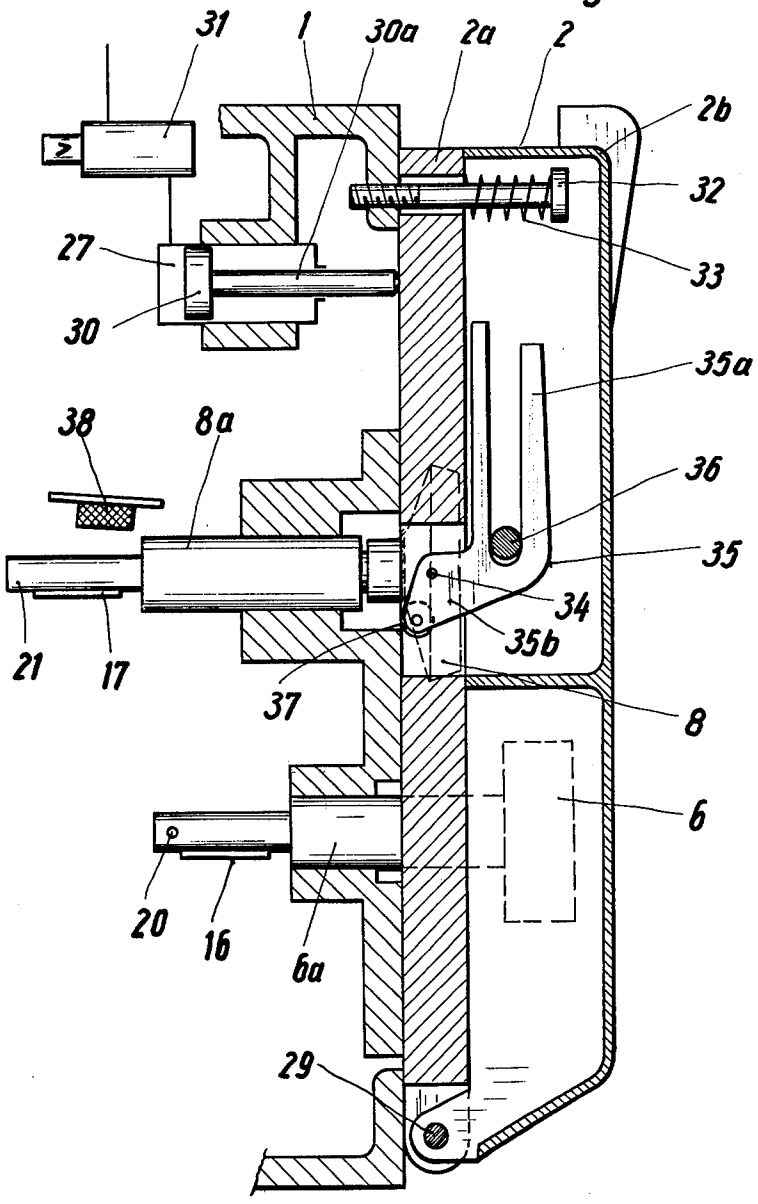
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Fig. 5

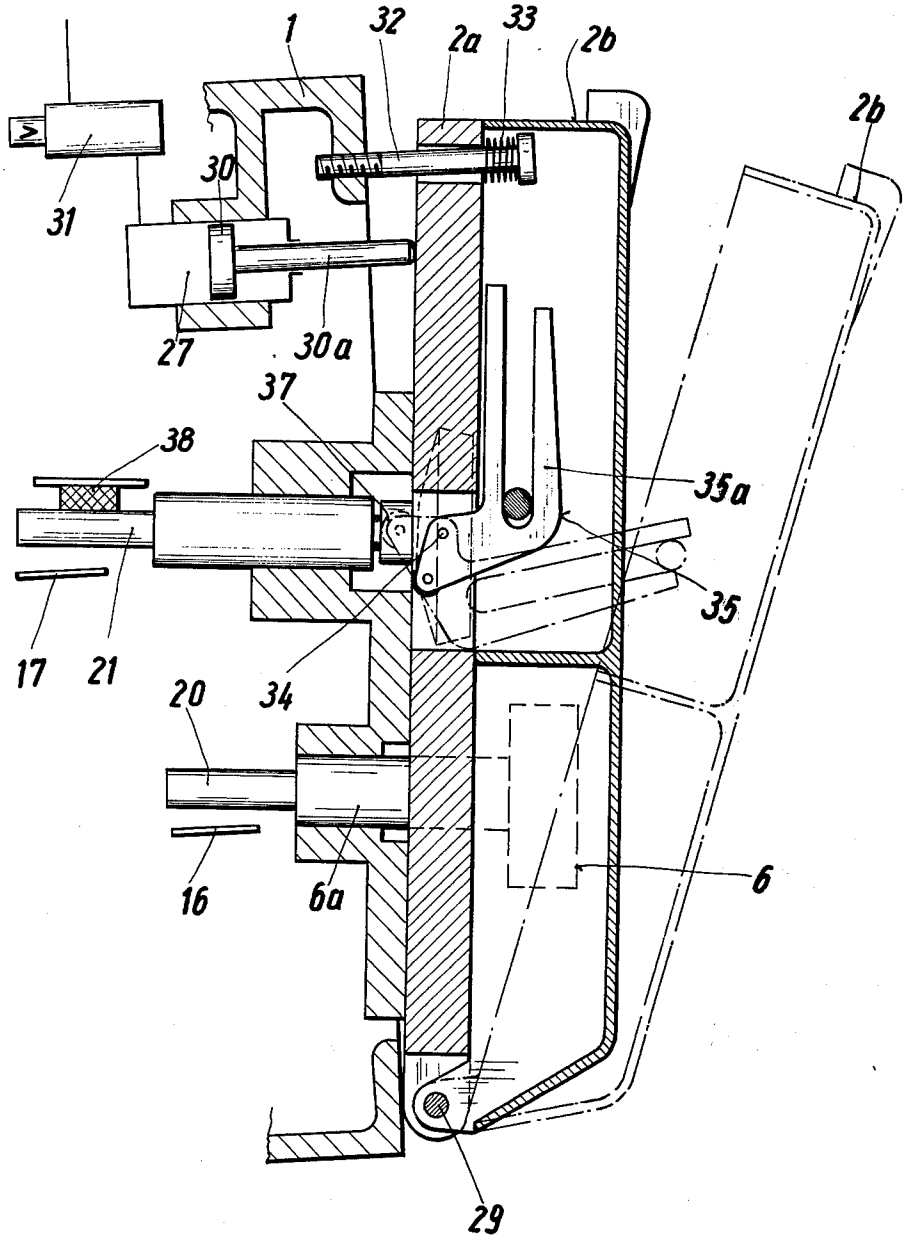


Fig. 7

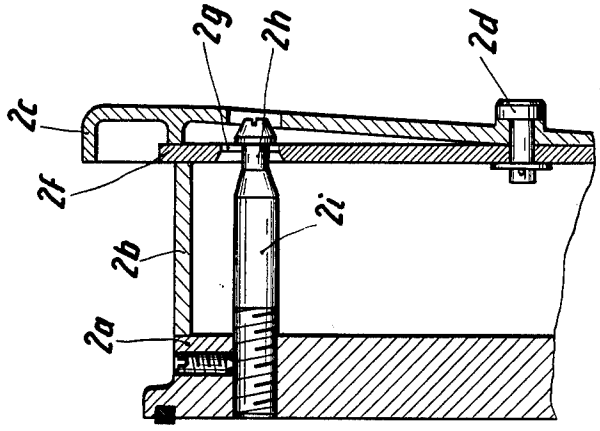


Fig. 6

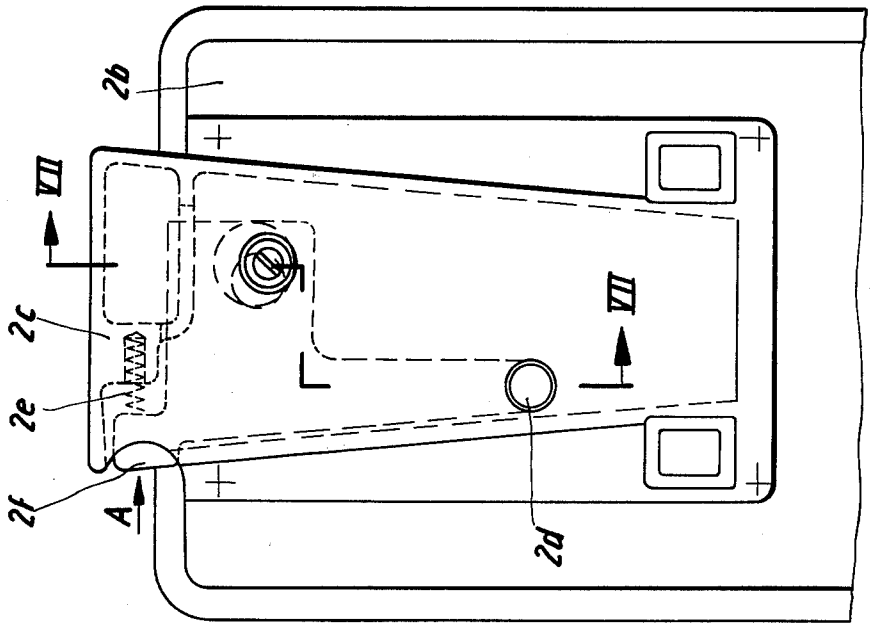
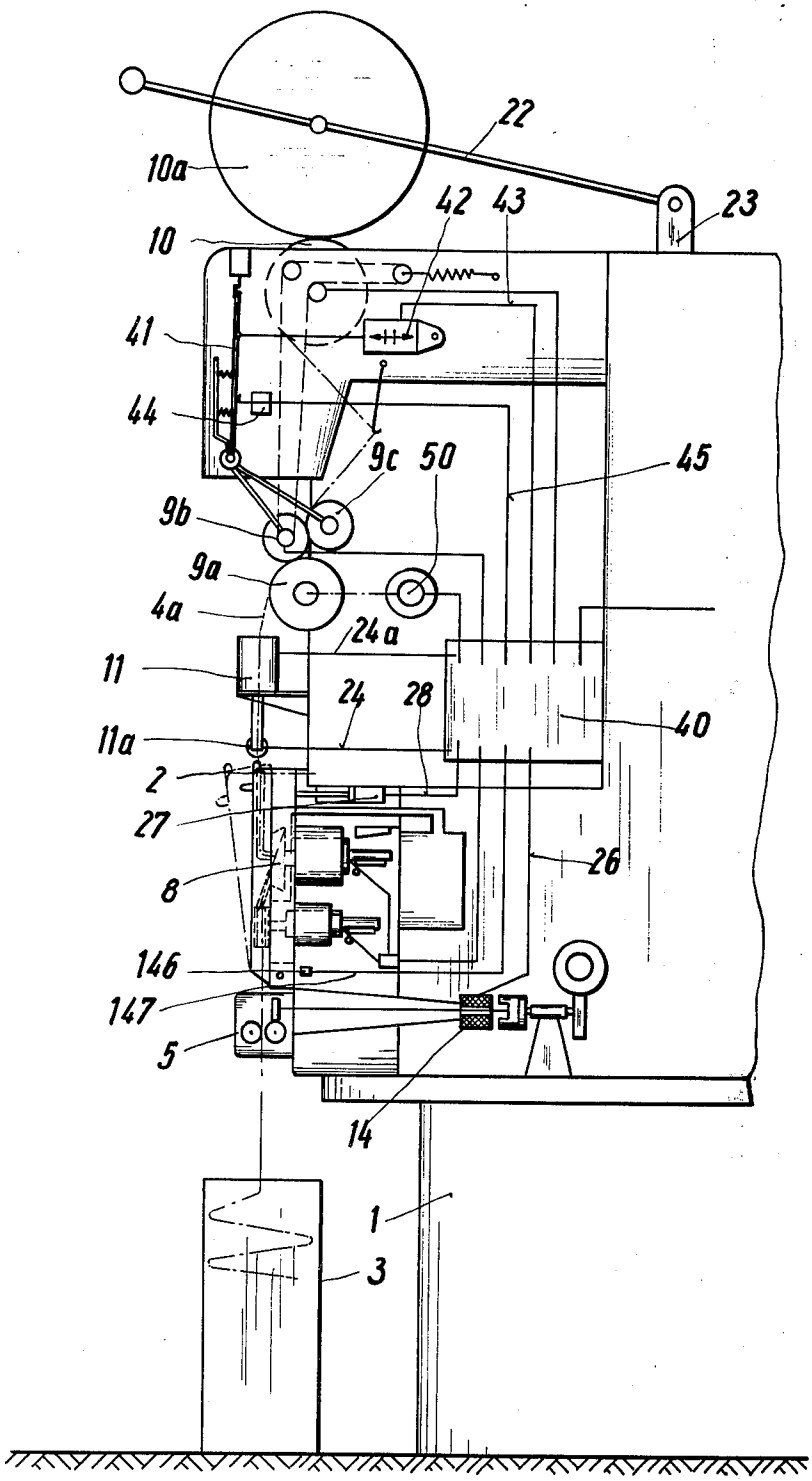


Fig. 8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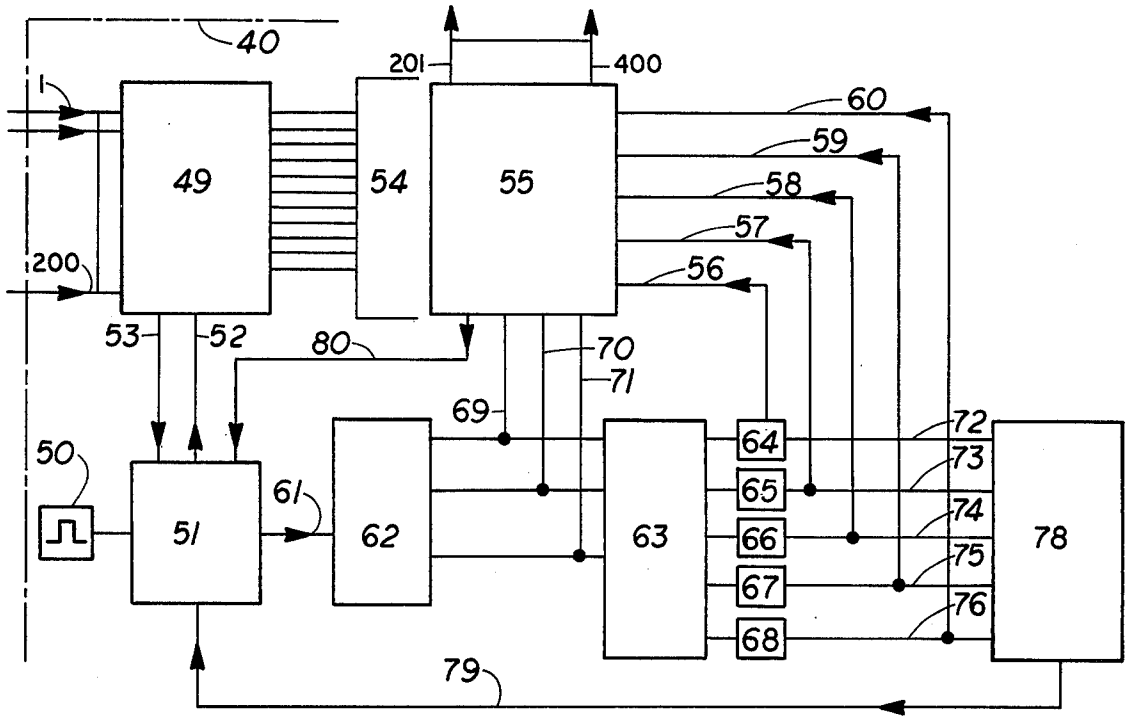
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FIG. 10

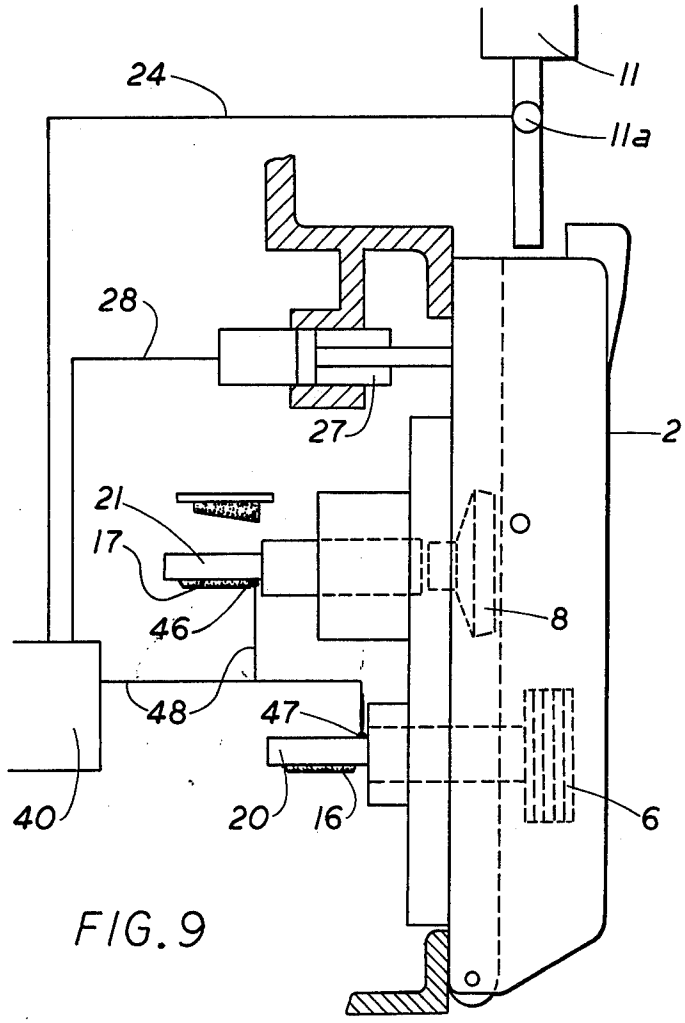
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FIG. 9

METHOD AND APPARATUS FOR CONTROLLING THE REJOINING OF THREAD IN AN OPEN ENDED SPINNING MACHINE

BACKGROUND OF INVENTION

The present invention relates to a method and apparatus for the spindleless spinning of yarn and threads and particularly to a method and apparatus for the operation and control of the steps necessary to rejoin the thread and recommence spinning after a thread breakage.

In spindleless spinning machines, fibers are picked from a roving or sliver by a picker wheel and fed to a spinning turbine where, under centrifugal action, the fibers are spun into the thread. The thread is pulled by a winding device and deposited on a spool or cone. Frequent thread or yarn breakage occurs as the thread is being pulled. A monitoring device employing a sensor is arranged adjacent the moving thread to determine the thread's continuity. The sensing of a break in the thread causes the monitoring device to produce a signal which actuates a control mechanism setting into operation a sequence of steps which stops the fiber feed, spinning, and the other operations to permit the thread to be then rejoined so that operation can be recommenced.

Different processes have become known to define the steps of operation and particularly the steps of rejoining the thread so that it becomes more economical. In the German patent DOS No. 2,008,142, an automatic rejoining device is prescribed functioning for several spinning turbines aligned adjacent to each other in a common bank. In the patent the rejoining device is carried by the frame of the machine so that it is movable from one spinning point to another and is stopped at that point showing a thread breakage. The movement of the mechanism and its performance in rejoining the thread is automatically controlled in response to a coordinated control unit. However, the design of this device is relatively complex and troublesome and liable to frequent breakdown. The mechanism has an added drawback in that thread breakage can only be rectified at a single spinning point on the machine at any one time. In the event thread breakages frequently occur simultaneously, as when materials that are difficult to be spun are employed, or where in the turbine or suction control of the turbine is unsuitable or breaks down the rejoining operation requires a relatively long time since it must include the time of movement of the device from point to point. Thus the economy of open ended spinning machines having such rejoining mechanism is greatly impaired and the goals which are set for such machines are often not met.

In another system shown in the Swiss Pat. No. 481,232 and its corresponding U.S. Pat. No. 3,455,085, the sequence of steps required once a thread breakage is sensed, such as stopping the fiber feed, stopping and cleaning the spinning chamber, restarting the spinning chamber with reinitiated fiber feed, as well as the return of the finished thread to the spinning chamber for rejoinder with the spinning fibers including an appropriate circuit for winding and storing a length of thread until the latter is rewound at production speed, is all commenced and terminated automatically through the use of a coordinated control device. According to this system it is possible to eliminate several thread breakages simultaneously. Nevertheless, such a system requires considerable outlay in switching and control devices at each spinning point so that a considerable expenditure in cost of installation and maintenance occurs.

In addition to the above noted drawbacks, the above mentioned devices have an even greater drawback in that they do not take into account and do not sense the cause of the initial thread breakage. While the devices are capable of rejoining the thread at predetermined points they make no effort whatsoever to determine and eliminate the cause for the actual breakage and the cause for subsequent breakage. In this way damage may occur to various parts of the spinning devices as a whole particularly when multiple spinning devices are arranged in a single bank so that common drive mechanisms are employed for the spinning turbines, picker rollers, etc. for each of the individual units. In general these drive devices are allowed to continue to remain in contact with the spinning chamber and picker rollers, etc. and to be reactivated even though the fault causing the thread break has not been eliminated. A particular problem arises when the spinning turbine is jammed or blocked due to excessive masses of fiber lodging inside the spinning chamber or when the fiber jams the picker roller so that it no longer rotates properly. Even though the thread may be rejoined the rejoining operation is not complete until these faults are eliminated since otherwise the drive means which would drive the spinning turbine and/or picker roller which in most cases takes the form of tangentially guided driving belts, do not properly actuate the turbine or picker rollers. The driving belts are constantly operated so that unless the turbine and picker rollers are actuated the belts create a great deal of friction and generate an inordinate amount of heat. This leads to frequent breakdowns and considerable damage to the parts of the spinning units.

It is the object of the present invention to provide a method and apparatus for controlling the rejoining operation of the thread in an open ended spindleless spinning machine which overcomes the disadvantages and defects of the prior art devices.

It is a further object of the present invention to provide an improved method and apparatus which is simple and provides uncomplicated equipment and is economical in use whereby the rejoining operation of the thread in a spindleless spinning machine may be simply effected.

It is a further object of the present invention to provide an improved method and apparatus for rejoining the thread in a spindleless spinning machine so that the rejoining can be made at any stage of the spinning process.

It is another object of the present invention to provide a method and apparatus for controlling the rejoining operation of several spindleless spinning units arranged along a spindle bank for simultaneous working or operation.

It is an object of the present invention to provide an improved control mechanism and device for the simultaneous control of one or more of the spinning units in a spindleless spinning machine so that for each of the spindle units the thread breakage can be sensed and the rejoinder operation can be commenced, carried on and terminated independently and in whole or in part. Specifically, the control device may initiate the rejoinder operation at any stage of the knitting process so as to

eliminate the repetition of steps which have already been completed and thus effectively simplify the rejoinder operation.

It is another object of the present invention to provide a housing for the spinning turbine of each of the spinning units which housing is capable of being moved so as to engage or disengage the turbine from its drive means on signal from the control mechanism.

It is a further object of the present invention to provide a housing for the turbines of each spinning unit which is provided with a cover member so that the turbine spinning unit may be open for the purposes of cleaning the chamber of the turbine, which cover simultaneous with its opening causes the housing to disengage the spinning turbine from its drive means.

The aforementioned objects, other objects, together with numerous advantages will be seen from the following disclosure of the present invention.

SUMMARY OF INVENTION

In accordance with the present invention a method and apparatus for the control of the rejoining operation of the thread in an automatic spindleless spinning machine is obtained by locating the spinning turbine so that it may be selectively moved into and out of a working position in which the fibers fed to it are spun into a thread and from which the thread is continuously withdrawn. An interruption of the withdrawn thread is sensed and a signal is produced which is fed to a control mechanism which is capable of setting into motion a predetermined sequence by which the spinning turbine is moved out of its working position and the sequence of rejoining the thread is initiated, maintained and terminated by operation in whole or in part of the rejoining cycle.

The method and apparatus of the present invention permits the rejoining of the thread to be actually performed either automatically by suitable mechanisms attached to the spinning unit or manually by the hand operator. Each of the spinning units is provided with means for independently and individually moving its turbine out of engagement with its drive means independently of the operation of the other units in the bank and preferably first stopping the picker roller and the supply of fibers to the turbine and then after a time lag actually stopping and arresting the spinning chamber. Thus, if for instance the spinning unit is set up for rejoinder by hand, the common control mechanism actuates the movement of the spinning turbine out of working position stopping the fiber feed and arresting its rotation. The spinning unit remains in this "shut" down position so that the operator may perform by hand the cleaning of the turbine and the rejoining of the thread with the spun fiber. The spinning unit may then be returned either by the common or central control means or by hand to its working position and the spinning unit be returned to its automatic working.

On the other hand the automatic operation can be effected after the arrival of a signal from the sensing device to the control mechanism. The control mechanism automatically shifts the spinning turbine into its intermediate position where it is disengaged from its drive means and subsequently activates a cleansing mechanism whereby the interior chamber of the spinning turbine is cleansed. After cleansing has been completed the control mechanism may pass a signal to an indicating device which indicates that the spinning device is ready for the subsequent steps of the rejoining operation. The spinning turbine remains in its closed down or open intermediate position making it possible to carry out the actual rejoining operation with the required reverse movement of the thread and the subsequent rewinding by hand with the spun fiber in the spinning turbine. The recommencement of the fiber feed to the spinning chamber and the restarting of the spinning turbine to working speed can be then carried out in the well known manner upon the return shifting of the spinning device into engagement with the drive means.

Finally, the present invention also permits the fully automatic rejoinder of the thread after a break has occurred. In this instance the control mechanism may be advantageously designed so that after the arrival of a fault signal from the sensing device, the movement of the spinning turbine from its working position into its disengaged position, the subsequent cleansing of the spinning chamber, and a single or repeated movement of the spinning turbine from its disengaged position into its working position can be automatically effected simultaneously with the reversing of the already spun thread and the rejoinder of its end to the thread being spun in the chamber of the spinning turbine. These operations can be commenced, carried out and terminated in a predetermined sequence at predetermined intervals either from the beginning of a cycle or from any point within the cycle. In order to avoid damage that may occur through the stopping of the spinning turbine or the picker roller feeding the fibers, it is advisable that the sequence of stages of the rejoining operation, as triggered by the fault signal of the sensing device, be carried out by the controlled mechanism in a predetermined sequence and at predetermined intervals, which may be repeated in a predetermined number until the broken thread is joined. At the expiration of the predetermined or preset number of repetitions of the cycle without the proper rejoining and winding of the thread, the spinning turbine is shifted into its open or intermediate position out of engagement with its drive means and is allowed to remain in this intermediate position, producing a single being passed to an indicating device capable of being seen by the operator. As a result the continuing cause creating the thread breakage and preventing the proper rejoinder of the thread can be determined by the operator and rectified before damage is done to any individual components of the individual components of the spinning unit.

To carry out the method according to the present invention each of the spinning turbines is located in a pivotable housing which housing can be moved into a working position where the spinning turbine engages its drive means and an intermediate position wherein the spinning turbine disengages from the drive means. The individual control element is actuated by a pulse received from the common control mechanism which is coordinated to each of the spinning unit. If necessary, in addition to a control element for each of the spinning units, the open end spinning machine comprising a plurality of spinning units can be provided with a common control element and several monitoring devices which are then connected in a coordinate manner with the control mechanism.

The control element which activates the shifting or movement of the housing locating the spinning turbine is preferably electrically controlled through an impulsive derived from the control mechanism. The control

element may be a mechanical, pneumatic, hydraulic motor such as a piston or cylinder or an electrical component such as a solenoid or the like which would have an arm capable of moving the housing or spinning turbine as a compact unit into its corresponding working and intermediate inactive positions. Preferably the working and inactive positions are defined by limit switches which are connected to the common control mechanism provide coordinated operation of the other elements of the operating cycle.

In order to avoid damage to individual portions of the spinning unit, i.e., spinning turbine, the feed picker roll and the like, when the spinning turbine or the picker roll itself are not free from continual breakdown, it is preferred in accordance with the present invention not only to provide each of the spinning units with a monitoring device sensing the continuity of the finished thread but to a second monitoring device acting independently of it to sense the speed and/or temperature at which the spinning turbine and the picker roller operates. Both sensing devices are connected to the common control mechanism so that by such an arrangement should the sensing device monitoring the travel of the thread break down, or if in the path of the spun thread no fault or defect would be indicated, the monitoring device connected to the spinning turbine or the picker roller sensing its speed and/or temperature would report a corresponding signal to the control mechanism. In response to this signal the spinning turbine would be caused to move out of its working position and to its intermediate position wherein spinning is arrested. In this intermediate position of the spinning turbine and the picker roller are both separated from their driving components so that the fault or defect causing the continual misoperation of the spinning unit can be determined and rectified. If necessary, the sensing device monitoring the path of the thread can be connected via a first priority circuit with the control mechanism so that primarily the signal derived from a broken thread is passed to the common control mechanism without interference from the signal derived from the second sensing device and that the signal derived from the second sensing device would be passed to the common control mechanism in a coordinated manner only after the elapse of a certain interval or a certain number of attempts at automatic rectification of the broken thread.

In order to make the individual spinning units of the entire spinning bank simple and to maintain the total outlay of the machines at as low a cost as possible it is proposed according to the present invention that all the spinning units of the machine should be provided with a common control mechanism. The input of the common control mechanism is derived from the individual sensing devices or control elements monitoring each of the individual spinning units. The control mechanism includes as its components a plurality of timers, switch mechanisms, circuits, and indicating devices with connecting leads so as to bring about an output which is the function of the thread sensing devices, the control elements, and the varying other parameters of the individual spinning units as well as the predetermined sequence of stages and events at any given moment relating to the program for rejoining broken threads, as well as whether such program stages are completed. The common control mechanism can be connected simultaneously with several spinning units so that the time required to obtain the rejoinder of the threads in two or more spinning units can be greatly reduced. The single control mechanism being capable of monitoring several devices simultaneously and receiving signals occurring simultaneously or within a relatively short period from each unit will provide an output command signal to several units simultaneously or within a predetermined period of time less than the time necessary to effect the rejoinder of the thread in any one spinning unit. Thus, the rejoinder of thread in any individual spinning units may be initiated, maintained and terminated from any point in the spinning operation and in sequences which can be commenced simultaneously or with overlapping time intervals or from preset predetermined.

To provide a proper signal to the common control mechanism which is indicative of a break in the thread occurring at any given spinning unit, the control mechanism is provided with an input from a measuring point scanner or stepping circuit. This latter circuit receives signals from each of the sensing, monitoring and control devices of each spinning unit and successively scans the signal lead lines as a function of a timing element. On determination of a fault signal the scanner passes a further signal pulse to a set of logic circuits by which the cyclic onward stepping of the measuring point scanner, in the presence of a fault signal, is interrupted for a given interval. During this interval, the logic circuit simultaneously activates a set of timers and switch mechanisms to set or command into motion the specific steps of the rejoinder operation in the corresponding spinning unit from which the fault signal is derived via a connecting lead from the output side of the control mechanism. Thereupon, the scanner may again be stepped to determine a fault in another spinning unit, and the command signal relative to it may be created. Logic circuits are preferred in order to avoid the unnecessary actuation of the timers and switch mechanisms of the control mechanism and thus the triggering of a subsequent command for initiation of the rejoinder operation during the period in which the initial signal has activated an initial rejoinder sequence. The logic circuits store the fact that a spinning unit is under a rejoinder operation even if the scanner, on a successive sweep, senses the continued presence of a fault. This allows the carrying out of a single rejoinder cycle as a result of only the first and initial report of a thread breakage. On the other hand, the logic circuits, to provide economy and simplicity, have only a finite number of command arrangements or circuits so that in the event a predefined number of spinning units are simultaneously engaged in the rejoinder operation, the further cyclical shift of the measuring point scanner will be interrupted. So long as all sets of the timers and switch mechanisms in the control mechanism are thus activated, the scanner will store the fault signal of the next spinning unit so that interference with the course of the thread rejoinder of the preceding units is avoided. Once a preceding spinning unit is cleared, the scanner will be stepped and shifted to resume the above operation.

As regards the design and choice of the individual switching mechanisms and control elements forming the control mechanisms, these can be selected in accordance with each specific operation and may be capable of many varied modifications within the scope of the present invention. Likewise as regards the design of the control or actuating element moving the spinning de-

vice there need also be no limitation. The mounting of the spinning turbine itself which can be pivoted or shiftable in any well known manner as a self contained enclosed unit from its working position into an intermediate position can also be modified and changed as desired.

Full details of the present invention are given in the enclosed description and are illustrated in the attached drawings.

BRIEF DESCRIPTION OF DRAWINGS

In the drawings:

FIG. 1 is an elevational view of a spinning machine showing a plurality of spinning units in bank,

FIG. 2 is a side elevational view of a single spinning unit of the machine shown in FIG. 1 in working position,

FIG. 3 is a view similar to FIG. 2 showing the spinning unit in intermediate open or disengaged position,

FIG. 4 is an enlarged sectional view of an individual spinning unit in working position,

FIG. 5 is a view similar to FIG. 4 showing the individual spinning unit in its intermediate disengaged position, and with the cover of the unit fully open showing access, therein,

FIG. 6 is a front elevational view of the upper portion of the spinning unit shown in FIGS. 4 and 5,

FIG. 7 is a sectional view taken along lines 7—7 of FIG. 6,

FIG. 8 is a view of a spinning unit similar to that of FIG. 2 showing a modified form of the device,

FIG. 9 is an enlarged view of the spinning unit partially in section showing the modification of FIG. 8,

FIG. 10 is a circuit diagram of the control mechanism for the spinning unit according to FIG. 8.

DESCRIPTION OF THE INVENTION

As seen in FIG. 1 the spinning machine to which the present invention is directed comprises a plurality of spinning devices mounted in uniform spaced relationship on a machine frame 1. Each of the individual spinning devices comprises a spinning unit 2 mounted above a container 3 from which a roving or silver 4 of fibers are withdrawn by a feed device 5. The feed device 5 comprises a picker roll 6 which picks at the end of the silver and dissolves the silver into a plurality of descrete fibers. The picker roller 6 releases the fibers and passes them via a duct 7 into the interior chamber of the spinning turbine 8 where they are then twisted and spun together in the form of a thread 4*a* which is drawn off from the spinning turbine by a device 9 to a winding mechanism 10 to be wound upon a cylindrical or conical core as may be desired. Turning to FIGS. 2 and 3 there is arranged between the winding device 10 and the drawing off device 9 a sensing mechanism 11 which monitors the continuity of the thread 4*a*. Further, the spinning turbine 8 and the feeding device 5 are commonly mounted as a unit and frequently referred to as the spinning unit per se.

Each of the feeding devices 5 comprises a pair of nip rollers which clamp the sliver 4 and pass it at a predetermined speed to the picker roller 6. The drive of the individual feed devices 5 is provided via a shaft 12 common to all of the units in the machine bank which passes lengthwise through the machine. At that point where the shaft 12 passes each of the spinning units there is provided a pair of wormwheels 13 which are connected through an electromagnetically acting coupling or clutch 14 with a driving shaft 15 connected to the pair of nip rollers forming the feed device 5. The picker roller 6 and the spinning turbine 8 are driven via tangentially arranged driving belts 16 and 17 which are driven by a motor (not shown) via pulleys 18 and 19 (see FIG. 1). The belts 16 and 17 are adapted to engage shaft extensions 20 and 21 of the picker roller 6 and the spinning turbine 8 respectively. In this manner all of the spinning units are actuated simultaneously and in unison with each other.

The drawing off of the finished thread 4*a* takes place by means of the drawing off device 9 which comprises a delivery roller 9*a* passing lengthwise through the machine and a pressure roller 9*b* which is adapted to be pressed upon it. The drawing off device 9 is spaced from the spinning unit 2, the thread 4*a* being withdrawn or pulled by the respective rollers 9*a* and 9*b* to the winding device 10. The winding device 10 comprises a driven roller which is provided with means serving to guide the thread in a helical pattern. The thread is wound on a yarn package 10*a* which freely rests on the roller pulling the thread so as to be movable conjointly with it. The yarn package 10*a* is slidably mounted on a lever support 22 which is pivoted in a bearing 23 rigidly fixed on the top of the machine. Thus as the yarn package 10*a* increases in size with the winding of the yarn on it the support 22 allows the adoption of the package to the varying diameter.

Each of the spinning units 2 as seen in FIG. 3 is provided with a sensing device 11 through which the thread 4*a* is drawn. The sensing device 11 comprises a feeler 11*a* or similar sensing device, which is connected by a line 24 with a control mechanism 25 mounted in association with the individual spinning unit 2. The magnetic clutch coupling 14 which controls the operation of the sliver feed rollers 5 is connected via a line 26 to the output of the control mechanism 25. Mounted adjacent the spinning unit 2 is an actuating member 27 which is connected via line 28 to the control mechanism 25. Since each spinning unit 2 is provided with a control mechanism 25 and its associated sensing devices and actuator mechanisms the stopping of the spinning operation of the unit can be relatively quickly obtained in the event of a broken thread. This takes place after the feeler 11*a* senses the discontinuity of the thread 4*a* and produces a signal which passes via the line 24 to the control mechanism 25. The control mechanism in turn passes a signal via lead 28 to the actuating element 27 which on receipt of such a signal pulse shifts the spinning unit 2 out of its working position as seen in FIG. 2 wherein its spinning turbine and picker roller are in engagement with the tangential belts into the intermediate position shown in the dotted lines in FIG. 3 wherein the same spinning turbine and picker rollers are disengaged from the tangential belts. At the same time a signal is passed to the coupling 14 via the lead 26 which disconnects the feed rollers from the drive mechanism comprising the shaft 12. Preferably the impulse to the coupling 14 is timed to be slightly ahead of the impulse to the actuator 27 so that the movement of the sliver 4 is interrupted before the spinning unit 2 is opened. In this position the spinning unit can be cleaned either by hand or by automatically and rejoinder of the thread 4*a* to the fibers in the spinning turbine can also be made either by hand or automatically.

In FIGS. 4 and 5 the design of the spinning unit 2 is shown. The spinning unit comprises a base housing part 2*a* pivotally mounted by a bolt 29 to the frame 1 of the machine. The base housing part 2*a* mounts the bearing housing 8*a* of the spinning turbine as well as the bearing housing 6*a* for the picker roller 6. The details of the bearing housings and the bearings as well as the rollers and of the spinning turbines are omitted for the sake of clarity since they are in fact conventional and common in this art. The actuator 27 is mounted at the upper end of the frame 1 and comprises a conventional pneumatic or hydraulic piston and/or electrically operated solenoid. The actuator includes a piston 30 from which extends a shaft 30*a* adapted to act against the rear surface of the base 2*a*. Interposed in the line 28 from the control mechanism 25 is a switch 31 which may be in the form of a magnetic hydraulic or pneumatic device depending upon the control element 27. In the event a signal is received from the sensing device 11 via the control mechanism 25 the valve switch 31 causes the piston 30 to move the ram 30*a* outwardly against the base 2*a* pivoting the base 2*a* about the pivot pin 29 from the position shown in FIG. 4 to the intermediate position shown in the solid lines of FIG. 5. The upper end of the base 2*a* is provided with a bolt 32 passing freely through the base 2*a* and fits into the machine frame 1. A spring 33 surrounds the bolt 32 and normally biases the base 2*a* into the closed position shown in FIG. 4. The actuation of the actuator element 27 shifting the base 2*a* as seen in FIG. 5 takes place against the normal bias of the spring 33.

In order to clean the chamber of the spinning turbine 8 by hand, the housing of the spinning unit 2 is provided with a cover 2*b* which is also pivoted about the pin 29 fixed to the lower end of the machine frame. This cover 2*b* is swingable with respect to the base 2*a* into the position shown in the dotted lines in FIG. 5 by manually operating a locking device generally depicted by the elements 2*c* through 2*i* which activates a coupling 35 connecting the housing cover 2*b* and the housing base 2*a*. The coupling 35 comprises a two armed lever pivoted to the base 2*a*. The two armed lever has one of its arms 35*a* forked or slotted. The forked arm receives between its shanks a bolt 36 which is attached to the cover 2*b*. The arm opposite the forked arm of the two armed lever 35 is provided at its end with a roller 37 which is adapted to bear against the machine frame. On opening the cover 2*b*, it is first caused to pivot with respect to the base 2*a* causing the pin 36 to swing the forked arms 35*a* of the two armed lever 35 outwardly and downwardly as seen in the dotted lines of FIG. 5 thus opening the interior of the housing and the spinning turbine to view. As the cover 2*b* is swung to its open position the inner end of the two armed lever 35 carrying the roller 37 abuts against the surface of the machine frame 1 and because the two armed lever 35 is pivoted about the pivot pin 34 fixed to the base 2*a* this further swinging causes the base 2*a* to shift or pivot outwardly with respect to the machine frame 1 moving the spinning unit 2 into its intermediate position wherein the spinning turbine and the rollers 6 are disengaged from the drive belts 16 and 17 as seen in FIG. 5. In this way when the cover 2*b* is opened in order to gain access to the spinning turbine and to the picker rollers 6 for their cleansing, the spinning unit is automatically disengaged from its drive means so that formation of the thread can be interrupted and the spinning unit handled without fear of injury to the operator.

As will be seen in FIGS. 4 and 5 the spinning unit 2 is supported and biased by the spring 33 in its working position. The means for locking the cover 2*b* to the housing part 2*a* is shown in FIGS. 6 and 7. The means comprises an extension 2*c* connected to the cover 2*b* which is accessible to the machine operator. Between the extension 2*c* and the cover 2*b* is a bar 2*f* which is pivotally mounted about a bolt 2*d* and is biased by a spring 2*e*. The bolt 2*d* is arranged substantially parallel to the rotating shaft of the spinning turbine 8. The bar 2*f* is provided with a hole 2*g* through which the slotted head 2*h* of a rotatable bolt 2*i* extends. The bolt 2*i* is fixedly attached by a set screw to the base 2*a* of the housing of the spinning unit. The spring 2*e* normally biases the bar 2*f* to the left as seen in FIG. 6 so that the edge of its opening 2*g* fits within the slotted collar 2*h* of the pin 2*i*.

When the cover 2*b* is to be manually moved into the position shown in the dot dash lines of FIG. 5, the bar 2*f* is slewed or shifted in the direction of arrow A as seen in FIG. 6. It is thus possible for the hole 2*g* of the bar 2*f* to move out of the grooved collar 2*h* so that the bar 2*f* can be freely lifted over the top end of the bolt 2*i* by moving the extension 2*c* directly forward as seen in FIG. 6. This swings the cover 2*b* relative to the base 2*a* of the housing and opens the forward end of the spinning unit. At the same time the pin 36 attached to the interior of the cover 2*b* causes the two armed lever 35 to swing outwardly and downwardly. The two armed lever 35 swings about the pin 34 causing the roller 37 to engage the bearing surface of the machine frame 1 thus instigating the shifting and pivoting outwardly of the base member 2*a*. Since the spinning turbine 8 and the picker rollers 6 are mounted in bearings fixed to the base 2*a* these units also swing in a clockwise fashion as seen in FIG. 5 disengaging themselves from the surfaces of the tangential drive belts 16 and 17. The arrangement is of such a nature that an opening of the cover 2*b*, movement of the spinning unit to its intermediate disengaged and inoperative position takes place at all times. A braking member 38 is mounted spaced above the tangential belt 17 so that on swinging movement of the base 2*a* carrying with it the spinning turbine 8, the extension shaft 21 of the spinning turbine is caused to engage the braking member 38. Thus immediately upon opening of the spinning unit and placing the unit in its intermediate position the spinning turbine is braked. The backward shifting of the cover 2*b* and base member 2*a* not only closes the cover 2*b* but also places the spinning units in their operative position.

On pivoting of the spinning unit 2 or its base housing portion 2*a* the sliver feed device 5 is also stopped since the formation of the thread 4*a* is interrupted. The driving shaft 15 is detached from its drive shaft 12 by interruption of the coupling 14 through a signal derived from the control unit 25. The spinning chamber 8 is positively braked by being forced against the brake pad 38 while the picking roller 6 will slowly rotate to a stop since it too is being lifted from the drive belt 16. On pivoting the spinning unit 2 or the base 2*a* back into its working position the shaft 21 of the spinning turbine 8 and the shaft 20 of the picker roller 6 are again forced against the driving belts 16 and 17 and accelerated to the predetermined speed of rotation necessary for the formation of the thread 4*a*. At this time rejoining of the thread 4a to the fibers being spun in the turbine 8 can

be made manually. As the thread 4*a* is pulled downwardly or reversed in its direction toward the spinning chamber of the turbine 8 it again passes the sensor 11. A signal may then be forwarded to the control mechanism 25 to reengage the coupling 14 so as to supply the sliver 4 and the supply of fiber to the picking roller 6 so that sufficient fiber is fed to the spinning turbine to reform the thread. Thus, the driving of the feed device and the rewinding of the thread 4*a* may be easily provided. If it is desired to provide for the automatic rejoining of the thread the apparatus as depicted in FIG. 8 may be provided. In this embodiment the spinning unit has a sensing device 11 which comprises a sensing element 11a which is preferably a photocell rather than the feeler of the previous embodiment and a cutting and clamping device which acts to hold the end of the broken thread and cut its end into square shape so that a proper rejoining splice can be made. Each of these spinning units is provided with a control mechanism 40 which is connected by lines 24 and 24*a* to the sensing head 11*a* and the cutting and splicing device of the sensor. The control mechanism 40 is also connected to the actuating element 27 by the lead line 28. The switch valve shown in the preceding embodiment may be used in this embodiment although it is not shown in FIG. 8. As in the previous embodiment a lead 26 passes from the control mechanism 40 to the magnetic coupling 14 which controls the rotation of the rollers of the feed device 5.

During the operation of the machine, the thread 4*a* is drawn off from the spinning turbine and passes through the sensing device 11. It is withdrawn by the driven roller 9*a* traversing the length of the machine in front of each of the individual spinning units. A pressure roller 9*b* is caused to rest on the driven roller 9*a* with a predetermined pressure so as to pull the thread upwardly for feeding by the driven thread winding roller 10 onto the yarn package 10*a*. In the event of a broken thread the sensor 11*a* of the sensing and monitoring device 11 produces a corresponding signal which is passed via the lead 24 to the control mechanism 40, by which both the deactivation of the coupling 14 and the activation of the control actuator 27 is initiated in the predetermined time sequence necessary to first stop the feeding of the sliver 4 and then opening of the spinning unit 2 by pivoting of the base 2*a* into the position corresponding to that shown in FIG. 5. Simultaneously a signal is developed which controls a carrying arm 41 which carries a pressure roller 9*c* adapted to press the thread 4*a* against the roller 9*b*. The rollers 9*b* and 9*c* have substantially the same diameter. The signal is forwarded to a solenoid type actuator 42 which is connected to the carrying arm 41 via a lead 43 connected to the control mechanism 40. The carrier arm 41 causes the pressure roller 9*c* to move the first pressure roller 9*b* from engagement with a driven roller 9*a* so as to stop the movement of the thread 4*a*. A braking device, not shown in the drawings, may be used at this time to stop the movement of the rollers 9*b* and 9*c*. At the same time that the pair of rollers 9*b* and 9*c* is stopped a position is reached in which neither of the rollers 9*b* or 9*c* rest on the driven rollers 9*a*. The driven roller 9*a* continues to revolve however. At this point the movement of the thread 4*a* has been braked and the spinning unit 2 arrested in its spinning function and opened in the position shown in dotted lines as seen in FIG. 8. The interior of the spinning unit may be cleansed and the cause of the break rectified.

Only when all of the stages of the operation provided by the control device 40 have been initiated or completed, including the cleaning of the spinning chamber 8, is the spinning unit 2 moved by the control unit 40 and the actuating element 27 back into its working position as shown in FIG. 2. This occurs by deactivating the actuating element 27 and allowing the bias of the spring 33 to close the housing of the spinning unit. A limit switch 146 connected by a lead 147 to the control mechanism 40 senses the position of the housing of the spinning unit 2 and produces a signal to the control mechanism 40 when the housing is properly closed. This signals the fact that the return of the thread to the spinning chamber can be made so that rejoining can actually be recommenced. Reversal of the thread to the spinning chamber occurs by moving the pair of rollers 9*b* and 9*c* which is holding the thread 4*a* between them by the lifting or actuating device 42 which is connected by the lead 43 through the control unit for a short time into a position in which the roller 9*c* abuts against the driving roller 9*a*. In this manner the roller 9*c* rotates counterclockwise to that of the first roller 9*b* and thus reverses the direction of the thread 4*a*. The not shown brake is of course released permitting the rotation of the roller 9*c*. The thread 4*a* reverses itself and moves downwardly through the sensor mechanism 11 until it passes the sensing head 11*a*. On passing the sensor 11*a* a corresponding signal is produced to the control unit indicating the presence of a thread capable of being joined by the newly spun fibers. The reversal of the thread 4*a* lags in time behind the closing of the spinning unit 2 and the reactivation of the feed rollers 5, the picker roller 6 and the spinning turbine 8. Thus the spinning of the newly fed fibers precedes by a small interval the return of the thread 4*a* thus permitting the turbine to accumulate a sufficient length of thread which can be spliced to the previously withdrawn and formed thread 4*a*. Immediately upon the resplicing of the thread 4*a* a signal is produced which returns the actuating or lifting means 42 into its working position so that the lever 41 is returned to the position shown in the full or continuous line of FIG. 8. As this occurs the roller 9*b* is again caused to abut against the driven roller 9*a* and caused to rotate so as to pull the thread in the upward direction. It is noted from FIG. 8 that the roller 9*b* and the yarn winding roller 10 are jointly connected by a pulley and belt drive so that they rotate in the same direction. Thus on the movement of the roller 9*b* into its working mode the yarn winding roller 10 is also caused to operate in and revolve in the direction of winding. Positioned next to the carrier arm 41 is a microswitch 44 which is activated upon the roller 9c reaching its full rewinding position. The switch member 44 passes a signal via the line 45 to the control member 40 which then produces a signal to activate the aforementioned steps.

In FIG. 9 an enlarged representation of the spinning unit 2 with the control mechanism 40 referred to in FIG. 8 is shown. In addition to the sensing and monitoring devices 11 and 11*a*, the sensing devices 46 and 47 are provided to monitor the position of the spinning turbine 8 and the picker roller 6. These monitoring devices 46 and 47 operate as a function of the temperature and/or speed of rotation of the picker roller 6 and the turbine 8 and are provided with a common lead 48

to the control mechanism **40**. The circuit of the monitoring devices **46** and **47** are arranged such that it will only respond to a predetermined limiting value of the temperature and/or speed of the elements being sensed when the elements are in their working position or when the sensing device **11** has somehow failed in its own operation. The circuit may contain built in timing delays, cycle counting delays and other techniques so that the indications sensed by the monitoring devices **46** and **47** will not interfere with the normal operation of the device heretofore described.

The employment of monitoring devices **46** and **47** ensures that, independently of the nature of the thread continuity sensing device which indicates the pressence of a thread, that the control mechanism **40** will act to pivot the spinning unit into its intermediate or open position whenever an unnatural occurrence exists preventing the rejoining of the thread. This precludes damage to the elements of the spinning unit by preventing the further fiber feeding into the spinning chamber when the spinning chamber itself is blocked or the picker roller **6** is jammed or blocked for example on account of excessive masses of fiber. Should this occur, one of the monitoring devices **46** and **47** will pass a signal to the control unit **40** via the lead **48** which will initiate the pivoting of the housing of the spinning unit **2** so as to place the spinning unit out of action. Through the use of such monitoring devices safeguard is ensured for every possible fault in the working of the spinning unit and against the damage which may result therefrom. The control mechanism **40** may have switch relays and time relays which may permit the rejoining operation to cycle repetitively for a predetermined number of times, for instance three times, before it will automatically open and disengage the spinning chamber **8** as described above. This permits the device a given number of attempts to be placed back into the working position and into production operation before the signals sensed by the monitoring devices **46** and **47** will finally put the spinning unit out of operation. When, however, this occurs a corresponding fault signal will be produced, visible or audible to the operator which will remain functioning until such time as the machine operator removes the cause creating the corresponding fault signal.

As seen from the embodiment shown in FIGS. **1** through **9** each of the spinning units **2** is provided with its own control mechanism **25** or **40**. However, in order to maintain the costs of construction for an entire bank of a plurality of spinning units as low as possible the machine may be provided with a single common control unit. Whether or not the individual or common control unit is employed such a unit as would function in the embodiment of FIGS. **3** or **8** is diagramatically represented by the dot dash outline **40** in FIG. **10**. As seen in FIG. **10** the control mechanism **40** comprises a circuit having at its input a measuring point scanner **49** or shift register, which is connected across a set of corresponding leads **1** through **200** with the inputs taken from the thread sensing device **11** and the temperature and speed monitoring devices **46** and **47** of each of the individual spinning units **2**. In the present example the circuit **40** is intended to receive signals from **200** individual open end spinning units. Each line **1** through **200** representing the input from a single unit. The scanner **49** scans the connecting leads **1** to **200** cyclically in a repetitive manner for the presence of signals from the corresponding sensing and monitoring devices. It will be obvious that in the present specification what is meant by a signal from the thread sensing and monitoring devices is one which indicates either a thread breakage, or an operational fault such as an inordinate temperature or speed of rotation of the spinning turbine. The repetitive cyclical operation of the scanner **49** is effected through the aid of a timing generator **50** via a first logic circuit **51** and an input line **52** connected to the scanner **49**. If the measuring point scanner **49** which is moved cyclically by the pulses of the timing generator **50** intercepts a signal on one of the connecting leads **100** to **200** which indicates the breaking of the thread or an operational fault, the scanner **49** furnishes a pulse over the lead **53** back to the logic circuit **51**. This pulse blocks the subsequent output of pulses from the pulse generator **50** into the scanning device **49** and the scanning cycle is thus broken and remains in this state wherein the scanner and the input line **1** through **200** which it has intercepted in the position at the time of interception.

The measuring point scanner **49** controls, as may be seen from FIG. **10**, a decoder **54** which has a plurality of inputs **1** through **200** corresponding in number and line to those in the scanner **49**. The decoder **54** is in turn connected with a second logic circuit **55** and passes to this second logic circuit the control border or command to connect one of the **200** connecting leads **201** to **400** leading to the individual spinning devices corresponding to those numbered **1** to **200**. The logic circuit **55** receives outputs **56** through **60**.

The pulse passed via the lead **53** from the measuring point scanners **49** to the first logic circuit **51** moreover results in a signal output from the logic circuit passing over the output lead **61** to a "modulo-5-counter" **62** which as a result of this counting pulse counts an additional step. The counter **62** is connected to a second "**1** out of **5** decoder" **63** which produces a "**1** out of **5** code." In the event of an output signal from the counter **62** the **1** out of **5** decoder controls one of the timing elements **64** through **68**. Each of the timing elements **64** through **68** is connected with one of the leads **56** through **60** which has already been indicated to be the inputs to the logic circuit **55** which circuit has the connecting leads **201** through **400** at its output. Which one of the leads **56** through **60** is to be connected with which of the output leads **201** to **400** is determined by the intersection of the signal furnished by the first decoder **54** as a function of the position of the measuring point scanner **49** and the signal to the second logic circuit **55** from the input leads **69** to **71**. The input leads **69** through **71** branch out from the connecting leads between the modulo-**5**-counter **62** and the second decoder **63**.

The timer elements **64** through **68** are in addition connected via leads **72** through **77** to a third logic circuit **78**, supplies a pulse to an output lead **79**, returning to the first logic circuit **51** as soon as the switching operations described above have been completed provided that not all of the timing elements **64** through **68** have been joined to one of the output connecting leads **201** through **400**. Through the pulse on lead **79** the first logic circuit **51** is again opened for pulses from the timing element **50** so that the measuring point scanner **49** can now shift over to continue its scanning cycle. In the event of the timing elements **64** through **68** have been connected to one of the output leads **210** through **400**

through the second logic circuit **55**, there would be no point in restarting the scanning cycle of the scanner **49** and thus the third logic circuit **78** is not permitted to have an output pulse. The scanner **49** continues its cyclical scanning of each of the monitored signals from each of the 200 spinning units. If the next intersecting lead determined by the scanner **49** on which there is present a signal from one of the sensing or monitoring devices, is not the same as that previously found in the prior cycle (i.e., is from the same spinning unit, the switching operations described above in connection with the first, second and third logic circuits is repeated so that an output command or control signal can be produced on any one of the outputs **201** through **400.** In this second operation the counter **62** moves a step forward and consequently the next one of the timing elements **64** through **68** becomes connected with the corresponding output of the control lead via the second logic circuit **55.**

On the other hand, if the scanner **49** meets with a spinning unit that is still controlled by one of the timing elements **64** through **68** (i.e., the spinning unit is still in the process of its rejoining operation) a signal is supplied by the second logic circuit **55** via a lead **80** back to the first logic circuit **51** preventing this logic circuit from furnishing, via the lead **61** a counting signal to the counter **62.** In this manner reinitiation of the rejoinder operation on an individual spinning unit which has already been activated is prevented and the rejoining operation is permitted to continue to its completion without interruption from any subsequent interfering signal.

In the event all of the timing elements **64** through **68** are connected to spinning units via the connecting leads **201** to **400,** the third logic circuit **78** does not provide a signal to reinstitute the cycle of the scanner **49.** However, as soon as one of the counting elements **64** through **68** become free such a pulse signal is given over lead **79.**

As seen from the above description, the common or central control circuit provides, with only a small number of timing or control elements compared to the number of spinning units, in a very economical manner and by simple and accurate means the possibility of carrying out the control, initiation, maintenance and termination of the rejoinder operation of any one of the individual units of the textile spinning machine, from the moment when the thread snaps or breaks until that time in which the spinning device is again ready for further joining of the thread. It must be understood that the circuit described above is to be only regarded as a practical example and an illustration only. Various modifications, changes and additions can be made by the technician and the specific elements chosen. The control circuits may be suitably constructed of only mechanical relays or of only electrical components or on the other hand with a combination of both relays and electrical components of both mechanical solid state and vacuum tube design. It must be furthermore pointed out that with the use of a common or central control unit, as has been described in detail above the outlay on circuitry is comparatively low. The result of which is that only one open ended spinning unit or a limited number of open ended spinning units can be prepared simultaneously for rejoining since the operation of the scanner **49** is inhibited as soon as a monitoring signal is intercepted. This is not however a drawback from the point of view of the operator since only one operator is engaged in supervising a single textile spinning machine who in any case has to join the open ended spinning devices in turn or when only a single rejoining mechanism, travelling up and down along the machine, is provided. The present circuit provides an integrated repetition circuit which brings about a repeated signal for the rejoinder operation cycle until the rejoining has been effected. In any event, the spinning unit in which a thread is broken is retained out of order while a fault signal is continually furnished, until the fault is removed and the rejoinder operation completed.

Various changes, modifications and additions may be made to the present invention, particularly in the nature of the individual control elements and their switching means, and their arrangement within the spinning machine or the spinning units. Furthermore, as regards the choice of the individual sensing and monitoring elements and their arrangement and wiring these may also take many forms. The tactile or feeler type as well as the photocell type have been disclosed herein. Other types will be available to those skilled in the art. Accordingly, it is intended that the present disclosure be taken as illustrative only and not limiting of the present invention.

What is claimed is:

1. The method for initiating the rejoinder of a broken thread in an open end spinning unit in which the thread is formed from fibers fed by a picker mechanism to a rotating spinning turbine and withdrawn therefrom to a winding device comprising the steps of simultaneously sensing the continuity of the withdrawn thread and the operation of each of said picker mechanism and turbine, said sensing means providing signals on interruption of said thread and on sensing a fault in the operation of said picker mechanism and turbine, providing a control mechanism responsive to each of said signals for establishing a predetermined sequence of operation of said spinning unit, causing said control unit on receipt of a signal to shift the turbine from a working position into a position where spinning is arrested and said thread is broken and to thereafter initiate the rejoinder operation and maintain said operation for a predetermined time interval to complete said sequence.

2. The method of controlling the rejoinder operation of a plurality of spinning units according to claim **1** including the steps of providing said control mechanism with means for receiving said signals from each of said units and means for controlling the operation of each of said units individually, cyclically scanning said receiving means for said signals and initiating and maintaining said sequence of operation for rejoinder.

3. An open end spinning machine comprising frame, a housing pivotally mounted on said frame having means for automatically moving said housing between a closed working position and at least a partially open position, a spinning unit located in said frame comprising a rotatable turbine and a rotatable means for feeding fibers to said turbine to be spun into a continuous thread, a tangential belt drive means mounted on said frame for rotating each of said turbine and feed means, said turbine and said feed means having a drive shaft extending therefrom engageable and disengageable with said belt drive means on closing and at least partially opening of said housing with respect to said frame, means for sensing the continuity of said spun

thread, means for sensing a fault in the operation of each of said turbine and feed means, said sensing means respectively producing a continuity of signals on interruption of said spun thread, and a fault signal on determining a fault in said turbine and on determining a fault in said feed means, control means responsive to each of said signals to actuate said means for moving said housing to disengage the shaft of said turbine and feed means from said tangential belt to interrupt the spinning of said fibers.

4. The machine according to claim **3** wherein said sensing means for said turbine and feed means is responsive to predetermined levels in speed of rotation and the temperature of said turbine and feed means.

5. The machine according to claim **3** including means for withdrawing said spun thread from said spinning unit, said control means being operable after interruption of the spinning of said fibers, to cause said means for withdrawing said thread to reverse the thread, and to actuate said means for moving said housing to close said housing with respect to said frame and thus cause the shafts of said turbine and feed means to engage said tangential belt and effect rejoinder of said thread with the spun thread.

6. The machine according to claim **3** including circuit means for feeding the continuity signal to said control means in priority to the fault signal.

7. The machine according to claim **3** including spring means for normally biasing said housing in closed condition.

8. The machine according to claim **7** including a cover secured to said housing over said turbine and feed means and conjointly movable therewith.

9. The machine according to claim **7** wherein said cover is pivotably hinged with respect to the housing and includes a coupling connecting said housing and cover, said coupling having means causing pivoting of said housing with respect to said frame to engage and disengage said turbine with the tangential belt on corresponding pivoting of said cover.

10. The machine according to claim **3** including switch means actuable on movement of said housing to the open position producing a signal responsive thereto and means for feeding said signal to said control means for terminating operation of said machine.

11. A spindleless spinning machine assembly comprising a plurality of spinning machines according to claim **3,** wherein said control means is common to all said spinning units, said control means having means for receiving said signals from each of said spinning units, including a timing network, switch means and indicating devices associated with each spinning unit which in response to a given signal initially disengage the corresponding turbine from its drive means and initiate, effect and terminate in a predetermined sequence of operation of the corresponding spinning unit to effect rejoinder of said thread on receipt of said signal.

12. The machine according to claim **10** wherein said control mechanism includes a number of set timing networks, switch means, and indicating devices corresponding to the number of spinning units connected simultaneously thereto, and means for integrating each of said sets to selectively control the operation of several units simultaneously.

13. The machine according to claim **11** wherein said control mechanism includes a measuring point scanner, means connecting the output signal of said spinning unit individually to said scanner, said scanner cyclically scanning each of said output signals as a function of a timing pulse and producing a scanned output signal, a timer for producing said timing pulse, logic circuits responsive to the scanned output signal for interrupting the continued scanning of said measuring point scanner and for initiating the operation of series of timing relays and switch devices for performing the rejoinder operation of the correspondingly spinning unit from which said signal is derived.

14. The machine according to claim **12** wherein said logic circuit including means for preventing subsequent output signals from a given spinning unit from being scanned by said measuring point scanner during the rejoinder operation initiated by a previous output signal.

15. The machine according to claim **13** including means for interrupting the scanning of said measuring point scanner in the event a predetermined number of spinning units are subject to a rejoinder operation.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,879,926
DATED : April 29, 1975
INVENTOR(S) : GERHARD BARTLING and MICHAEL VON RONAI-HORVATH

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet [75] the name and address of the inventors should read --

GERHARD BARTLING, Burgstetten; MICHAEL VON RONAI-HORVATH, Ludwigsburg; Germany -- .

Signed and Sealed this

eighteenth Day of May 1976

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks