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(54) METHOD FOR OPERATING A RING SPINNING MACHINE

(57) A method for operating a ring spinning machine (1) having a service carriage (14) is disclosed, wherein the ring spinning machine (1) has a plurality of spinning stations (2), wherein the spinning stations (2) include a drafting system (5) having a discharge cylinder, a thread guide (7), a balloon control ring (8), a spindle (8), a ring traveller (13), and a spindle monitor (15), and wherein the service carriage (14) moves along the spinning stations (2) on one side of the ring spinning machine (1) and eliminates thread breaks at the spinning stations (2) by means of a standard program. When a thread break is detected at a spinning station (2), a status of the spinning station (2) having the thread break is determined in a module (24_1, 24_2), and based on the determined status a decision is made as to whether the thread break can be eliminated by the standard program of the service carriage (14). The invention further relates to a corresponding ring spinning machine (1).

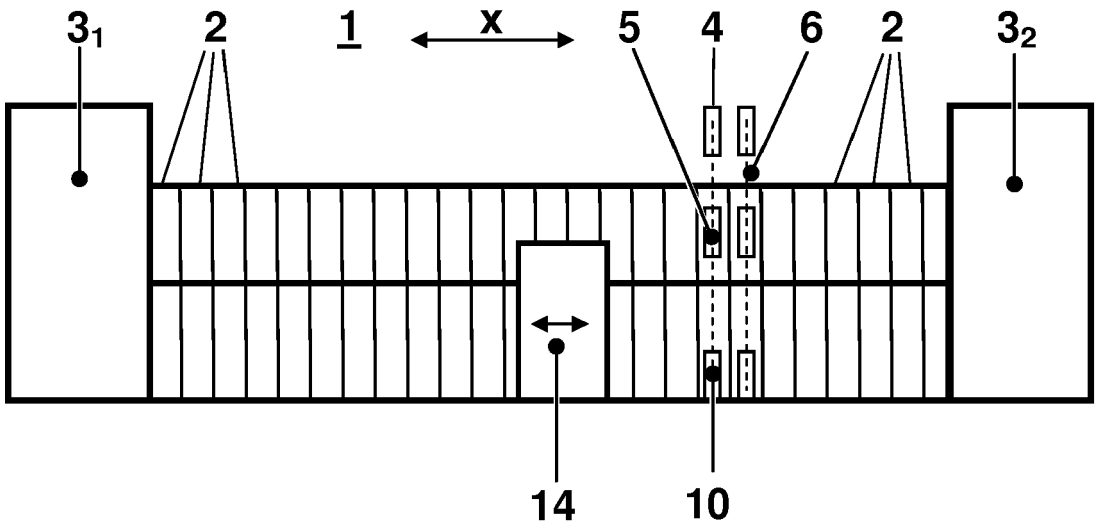

Fig. 1

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Description

Technical Field

[0001] The invention relates to a method for operating a ring spinning machine according to the preamble of the independent claim, and a corresponding ring spinning machine.

Prior Art

[0002] Service robots or service carriages that piece threads on ring spinning machines after a thread break are well known. Mention is made here in particular of the service robot from EP 394671 A2. This service robot moves along a row of spinning stations, detects thread breaks, and then attempts to eliminate the detected thread breaks. The belt driving the spindle is initially lifted from the spindle by means of a special spindle braking device, and the spindle is subsequently stopped. In addition, an auxiliary thread is used. One end of the auxiliary thread is fastened to a winder that is movable around the spinning cop in order to then be wound around the spinning cop. The auxiliary thread is subsequently threaded through the ring traveller and the thread guide and brought into the area of the outlet of the drafting system. The spindle and thus also the spinning cop are driven once again, and the auxiliary thread is brought into the path of the drawn roving so that the auxiliary thread is twisted with the drawn roving.

[0003] DE 3932727 discloses a method for eliminating a thread break on a ring spinning machine. It is provided that an auxiliary thread that is carried along by a service carriage is loosely placed on the cop of a spindle and pieced to a slub that is delivered by a drafting system. It is likewise known from DE 3932727 that during the operation of the service carriage, the spindle actuates a brake by means of an actuating element and/or the drive is interrupted.

[0004] WO 2009/132469 relates to a ring spinning machine having a single-spindle drive. The workstations may contain sensors or other means for determining parameters at the workstations. Thus, for example, the current or power consumption of the spindle drive or the spindle speed may be determined by the spindle drive electronics system, optionally by use of sensors. Information concerning thread breaks or thread tension may be ascertained from these measuring data. In the event of a thread break, the spindle in question or the drive associated with it may be autonomously shut down by the spindle drive electronics unit or the section electronics unit.

[0005] The spindle drive electronics system unit or section electronics system unit in question may be designed, for example, for autonomously carrying out one or more of the following functions: thread break detection, slub stopping, single-spindle drive control, thermal monitoring of the single-spindle drives, slubbing switchover, spindle speed measurement, thread tension measurement, communication with an associated automatic traveller, operator guidance of spinning stations, malfunction displays, hand switches, and/or other sensor functions. A thread break and/or increased thread tension are/is preferably determinable by the particular spindle drive electronics system unit via the current or power consumption of the electric motor drive associated with the particular workstation. The machine control unit itself carries out, for example, the start-up and/or process control, which may be effective, for example, for normal shut-off as well as for an emergency shut-off in the event of a power failure.

[0006] However, regardless of a mechanical spindle brake or a single spindle having an electronics system, it is disadvantageous that the service carriage has only limited usability, since in certain configurations no piecing by the service carriage is possible, as described in EP 415290, for example, as irreparable thread breaks.

Description of the Invention

[0007] The object of the invention is to provide a method for operating a service carriage with which the reliability and possible applications of the service carriage may be increased.

[0008] According to the invention, the object is achieved by a method for operating a ring spinning machine having a service carriage according to the preamble of the independent method claim, in that a status of the spinning station having the thread break is determined in a module, and based on the determined status a decision is made as to whether the thread break can be eliminated by the standard program of the service carriage.

[0009] If it is ascertained that the determined status of the spinning station does not allow elimination of the thread break by the standard program, the service carriage advantageously does not approach the spinning station. Hence, this keeps the service carriage available for spinning stations that have thread breaks which can be eliminated by the standard program. Consequently, downtimes of spinning positions that can be restarted by the service carriage using the standard program can be reduced, as the service carriage does not work unsuccessfully at spinning stations which actually require special programs. This allows a significant reduction of total downtimes and thus an increase in production capacity as well as decrease in energy consumption. At the same time, it enables a higher number of spinning positions to be handled by one robot.

[0010] Alternatively, the service carriage may approach the spinning station and determine the status of the spinning station. In this way, unnecessary attempts to eliminate a thread break are avoided. For some types of spinning machines or types of yarns to be produced, the service carriage may also approach the spinning station and determine the status of the spinning station after

a first pre-assessment of the status has already been performed by a special module as described herein. For example, only a rough preliminary analysis may be carried out by a sensor (as subsequently described in more details) installed at a certain spinning position in order to detect certain types of defects that cannot be treated with the standard program. If treatment by the standard program cannot be ruled out by this preliminary analysis, the service wagon may approach the spinning position and perform a second more sophisticated analysis using one or more additional types of sensors (as described herein) in order to determine whether the thread break can be eliminated by the standard program of the service carriage. This can further reduce the time required for unsuccessful runs of the standard program for elimination of thread breaks. At the same time it allows to combine relatively simple and cost-efficient sensors arranged at the spinning stations with a more sophisticated sensor system arranged at the service carriage. This allows to decrease spindle downtimes and at the same time a highly reliable determination of thread breaks that can be eliminated by the standard program with relatively low costs for sensors.

[0011] The ring spinning machine may advantageously be informed of the determined status of the spinning station, this status may be shown on a display, and/or an operator may be called to place the spinning station back in operation. As such, an operator may e.g. be called to place a spinning station back to operation if it was determined that this can not be done by the standard program. Alternatively or in addition, an operator may e.g. be called to place a spinning station back to operation if a high number of yarn breaks has occurred.

[0012] The spinning station may advantageously be monitored by a camera, a microphone, a capacitive sensor, the spindle monitor, and/or a thread and slub monitor, the result be transmitted to the module, and the status is determined in the module. Alternative means for the same purpose are likewise conceivable. According to one variation of the invention, one or multiple of these means are arranged at each spinning stations. Alternatively or in addition, one or multiple of these means may be used to monitor multiple spinning stations. As such, e.g. a camera may be used in order to monitor multiple spinning stations.

[0013] The spinning station may advantageously be recorded by at least one camera, and the status of the spinning station determined by image analysis. It is possible for the spinning station to be recorded in sections by different cameras, the result transmitted to the module, and the status determined in the module. It is advantageous when the recorded status images are stored and used in the image analysis of the status of the spinning station. Thus a particualry reliable determination of yarn break that can be eliminated by the standard program becomes possible.

[0014] The accuracy of the status analysis during operation may be improved by presenting and demonstrating actual examples of statuses to the service carriage in a type of training. This is particularly advantageous when a ring spinning machine is converted or modified, and the conditions at the spinning stations have changed. This training may advantageously improve the quality or speed of the status analysis. The module may also contain self-learning functions so that the status analysis may be adjusted for altered environmental conditions such as production speed (delivery, rotational speed), yarn color, lighting, etc.

[0015] Good results may be obtained if the service carriage is presented with examples of statuses before or during operation in order to improve the quality or speed of the status analysis.

[0016] At least one of the following statuses is advantageously determined in which the thread break cannot be eliminated by the standard program of the service carriage:

- the roving bobbin is empty or the roving feed is interrupted;
- a winder is situated at the discharge cylinder;
- a stationary thread is situated between the discharge cylinder and the thread guide;
- a soiled thread guide;
- no tube is present;
- no spindle is present;
- a soiled or missing ring traveller; or
- unknown interfering objects.

[0017] The service carriage or a cleaning carriage may advantageously carry out at least one of the following actions before eliminating the thread break:

- cleaning a ring traveller or inserting a new ring traveller;
- removing a stationary thread;
- removing a winder; or
- triggering slub stopping.

[0018] The service carriage and/or the ring spinning machine may advantageously be retrofitted with the module for determining the status. Hence, retrofitting of existing machines with such a system becomes possible.

[0019] According to the invention, the object is further achieved by a ring spinning machine having a service carriage according to the preamble of the independent device claim, in that a module is present for determining the status of the spinning station, and based on the determined status ascertains whether the thread break can be eliminated by the standard program of the service carriage.

[0020] The module may advantageously be designed to inform the ring spinning machine of the status of the spinning station, to show the status on a display, and/or to call an operator. Hence, a particularly economical operation of the ring spinning machine becomes possible and the amount of manual surveillance by the operator

can be reduced.

[0021] At least one camera, at least one microphone, at least one capacitive sensor, the spindle monitor, and/or at least one thread and slub monitor may advantageously be present which are/is connected to the module in order to determine the status of the spinning station. These means may be interconnected with the module directly or indirectly. Hence e.g. information acquired by a camera may be processed by an image registration sytem that may be part of the module or may be separated from the module but provide information to the module.

[0022] A memory may advantageously be present for storing status images and comparison images that are recorded with a camera, and for using same in an image analysis of the status of the spinning station.

[0023] To determine the status of the spinning station, the module may advantageously determine at least one of the following statuses:

- the roving bobbin is empty or the roving feed is interrupted;
- a winder is situated on the discharge cylinder;
- a stationary thread is situated between the discharge cylinder and the thread guide;
- a soiled thread guide;
- no tube is present;
- no spindle is present;
- a soiled ring traveller; or
- unknown interfering objects.

[0024] The service carriage and/or the ring spinning machine may advantageously be retrofitted with the module for status detection.

[0025] As a result of the present invention, configurations are excluded in which piecing by the service carriage is not possible. The reliability and possible applications of the service carriage may thus be advantageously increased.

Brief Description of the Figures

[0026] Further advantages of the invention are described in the following exemplary embodiments, wherein

Figure 1 shows a ring spinning machine having a service carriage;

Figure 2 shows a detailed drawing with a service carriage upstream from a spinning station; and

Figure 3 shows a flow chart of the method according to the invention.

[0027] Identical features are provided with the same reference numerals in the various figures.

Approaches for Carrying Out the Invention

[0028] The foregoing summary, as well as the following detailed description of the preferred embodiments, is better understood when read in conjunction with the appended drawings. For the purposes of illustrating the invention, an embodiment that is presently preferred, in which like numerals represent similar parts throughout the several views of the drawings, it being understood, however, that the invention is not limited to the specific methods and instrumentalities disclosed.

[0029] Figure 1 schematically shows a ring spinning machine 1 according to the invention which has a plurality of adjacently situated spinning stations 2. The spinning stations 2 are situated in a longitudinal direction x of the ring spinning machine 1, between a head 3_1 and a foot 3_2. The head 3_1 and the foot 3_2 of the ring spinning machine 1 may contain bearings, drives, controllers, etc., necessary for operating the machine. As is further apparent, for example, at two spinning stations 2 schematically illustrated in Figures 1 and 2, each spinning station 2 is made up of at least one roving bobbin 4 that is situated above a drafting system 5, and onto which a roving 6 is wound. The roving 6 runs from the roving bobbin 4 through the drafting system 5, where it is drawn, and from there is led over a thread guide 7 and a balloon control ring 8 to a yarn forming element. Situated on a ring rail 11 is a ring with a mounting 12 that bears a ring traveller 13. The revolving ring traveller 13 winds the finished yarn onto a tube 10. The tube 10 is mounted on a spindle 9. A service carriage 14, which in the event of a thread break travels to an appropriate spinning station 1 and automatically eliminates the thread break, moves along the ring spinning machine 1. The individual spinning stations 2 may be equipped with spindle monitors 15 or other sensors for monitoring the ring traveller 13 and/or the run of the thread in order to detect a thread break. Alternatively or additionally, the spinning stations 2 may be equipped with single-spindle drives.

[0030] Figure 2 schematically shows a spinning station with a service carriage 14 situated in front of the spinning station. The service carriage 14 includes a controller 16 and a memory 160, which may be part of the controller 16 or may be separate from same. The main controller 16 via a standard program controls the operation of the service carriage 14 for automatically eliminating a thread break. The service carriage 14 includes several, all, or at least one of the following function modules:

- a yarn search device 17 as disclosed in WO 2018/100464; WO 2018/100464 relates to a method and a device for detecting the thread end on a cop in a ring spinning machine that produces yarn, after an interruption due to a thread break, wherein after the thread break the cop is approached by a suction nozzle, into which the thread end is suctioned from the rotating cop. A bar and a movable strap having a carrier surface approach the surface of the cop. The movable device moves in a different direction than the rotating cop, and the yarn end is captured by the movement of the movable device and is with-

drawn from the cop, and the yarn end is conveyed to the suction nozzle;

- a cop lifting device 18 as described in unpublished Czech Patent Application No. PV 2018-47 dated January 31, 2018; the patent application relates to a cop lifting device for transporting a cop from the spindle of a spinning station of a ring spinning machine to a thread end search position;

- a traveler threading device 19 as described in unpublished Czech Patent Application No. PV 2018-34 dated January 24, 2018; the patent application relates to a device for threading yarn into a traveller on a ring having a flange on a spinning station of a ring spinning machine;

- a yarn handling device 20 as described in unpublished Czech Patent Application No. PV 2018-48 dated January 31, 2018; the patent application discloses a yarn handling device on a spinning station of a ring spinning machine for detecting a thread end on a cop. The device has a suction tube with a suction opening that may be associated with a spinning station, wherein the suction tube is connected to a vacuum source, wherein the suction tube is mounted on a positioning system for guiding the opening of the suction tube to a drafting system of the spinning station in order to resume the spinning operation;

- a positioning device 21 as described in unpublished Czech Patent Application No. PV 2018-49 dated January 31, 2018, and unpublished Swiss Patent Application No. 01185/17 dated September 28, 2017; the positioning device 21 is used for positioning the service carriage 14 in front of the spindle 9.

- a spindle brake unit 22 that is identical or similar to the disclosure in EP 394671, wherein the brake shoe 246 may be replaced by a roller;

- a display 23 for displaying and entering data;

- a module 24_1 for determining the status of a spinning station 2.

[0031] All of the mentioned disclosures in the patent applications for portions of the service carriage 14 are integral parts of the present description. The communication within the service carriage 14 is illustrated by dotted lines. The service carriage may integrate all parts or only individual subfunctions. Figure 3 shows in parallel a flow chart of the method according to the invention.

[0032] If a thread break is detected (Figure 3, step 100), the standard program provides for piecing, so that the service carriage 14 searches for the thread end on the cop and guides it through the balloon control ring 8 and the thread guide 7 to the drafting system 5, where it is pieced.

[0033] If a thread break is now detected at a spinning station 2 (Figure 3, step 100), according to the invention the module 24_1 and/or a corresponding module 24_2 situated on the ring spinning machine 1 determine(s) the status of the spinning station 2 (Figure 3, step 200) in order to ascertain whether the thread break can be eliminated by the service carriage 14, using the stated automated program.

[0034] The module 24_1 and/or the module 24_2 could determine the following as possible statuses in which automatic elimination of a thread break via the above-mentioned components is difficult or impossible:

- the roving bobbin 4 is empty or the roving feed is interrupted;
- a winder is situated on the discharge cylinder of the drafting system 5;
- a stationary thread is situated between the discharge cylinder and the thread guide 7;
- a soiled thread guide 7;
- no tube is present on the spindle 9;
- no spindle 9 is present;
- a soiled or missing traveller 13; or
- unknown interfering objects.

[0035] The status of the spinning station 2 could be determined by a camera 25, a microphone 26, a capacitive sensor 27, the spindle monitor 15, and/or a thread and slub monitor, or some other equivalent sensor.

[0036] In a first variant, the service carriage 14 or the ring spinning machine 1 includes one or more cameras 25 that record one or more images of the spinning station. It is also conceivable, as illustrated in Figure 2, to use multiple cameras, for example a camera at the top that records the roving bobbin 4 and the drafting system 5, a camera situated in the middle for the thread guide 7 and the balloon control ring 8, and a camera at the bottom for the spindle 9, cop 10, ring 12, and ring traveller 13. The recorded images are processed in the module 24_1 and/or module 24_2 for the status detection. Using appropriate pattern recognition algorithms and example or comparison images, various operating states at the spinning station are then recognized. A spinning station that is running without problems during piecing, or images with corresponding statuses that are to be determined, could be used as a comparison image. Many of the statuses mentioned above may be determined by image recognition.

[0037] In a second variant, the status, for example of a winder on the discharge cylinder, is determined by a capacitive sensor 26. The ring spinning machine 1 is equipped with a controller 50 and a memory 500, which may be part of the controller 50 or may be separate from same. In the present example, in addition to the service carriage the ring spinning machine 1 includes the module 24_2 for status detection. The sensor 26 is read out by the module 24_2, and the sensor 26 transmits the correspond-

ing measuring data. The module 24_2 then recognizes, for example, that a winder is present on the discharge cylinder of the drafting system 5.

[0038] In a third variant the status is determined by a microphone 27. Changes in one of the customary sounds during the spinning operation may indicate one of the above-mentioned statuses. The microphone 27 is read out by the module 24_2 and transmits the corresponding measuring data. The module 24_2 then recognizes one of the statuses mentioned above.

[0039] In a fourth variant the status is determined by a spindle monitor 15. It could be recognized in particular whether a ring traveller 13 is present, and whether it is soiled.

[0040] In a fifth variant the status is determined by a thread and slub monitor, which could possibly recognize a stationary thread, for example.

[0041] It is understood that the stated variants may be used and evaluated in parallel and in combination. It possible for the module 24_2 of the ring spinning machine 1 to determine (Figure 3, decision in step 300) that a thread break cannot be eliminated by the standard program of the service carriage 14 (Figure 3, step 400, left path from step 300). In this case, the service carriage 14 may omit the spinning station 2 in question, and need not approach it. If no such status of an irreparable thread break is determined, the thread break is eliminated in the specified manner (Figure 3, step 500, right path from step 300).

[0042] It is also possible for the service carriage 14 to approach the spinning station 2, and for the module 24_1 to check whether an appropriate status is present. This is possible, for example, when no such module 24_2 is present on the ring spinning machine 1. If the module 24_1 makes no finding that the thread break cannot be eliminated, the thread break is automatically eliminated by the above-mentioned components of the service carriage 14, using the stated standard program.

[0043] If a status is determined and recognized that at the spinning station 2 it is not possible to eliminate the thread break using the above-mentioned program of the service carriage 2, the service carriage 2 does not attempt to eliminate the thread break. The spinning station could be displayed on the spindle monitor 15 by an LED, etc. The service carriage 14 could then inform the ring spinning machine 1 about the spinning station 2 and the type and scope of the determined status. The communication between the service carriage 14 and the controller of the ring spinning machine 1 is illustrated by a dashed arrow. The ring spinning machine 1 updates this information in a central data information system of the spinning facility, and could possibly show it on a display 51. The information may advantageously indicate which service person, or which operator/technician with specific capabilities, is needed to place the spinning station 2 back in operation. Such an operator could be called via a mobile device 15 (smart watch, smart phone, tablet, etc.). The mobile device 15 could be linked to the ring spinning machine 1 or the higher-order central data information system of the spinning facility via a mobile radio communications network or a local connection (NFC, WLAN, ZigBee, etc.).

[0044] The accuracy of the status analysis during operation may be improved by presenting and demonstrating actual examples of statuses to the service carriage. This is particularly advantageous when a ring spinning machine is converted or modified, and the conditions at the spinning stations have changed. This training may advantageously improve the quality or speed of the status analysis. The module 24_1, 24_2 may contain self-learning functions so that the status analysis may be adjusted for altered environmental conditions such as production speed (delivery, rotational speed), yarn color, lighting, etc.

[0045] In another exemplary embodiment, if a status is determined that it is not possible to eliminate the thread break with the standard program, the service carriage could carry out at least one of the following actions before eliminating the thread break:

- cleaning a ring traveller or inserting a new ring traveller;
- removing a stationary thread;
- removing a winder; or
- triggering slub stopping and resetting a triggered slub stop.

[0046] This assumes that the service carriage 14 is capable of such an activity. A suction device and/or a gripper and/or brushes could remove a winder or a stationary thread.

[0047] In another exemplary embodiment, a second service or cleaning carriage could take over the above-mentioned activities for eliminating the undesirable statuses. As soon as the ring spinning machine 1 or the service carriage 14 determines one of the statuses mentioned above, the second service carriage (cleaning carriage) actuates the spinning station and corrects the status and prepares the spinning station for piecing by the service carriage 14. The second service or cleaning carriage could also take over the entire function of status determination by the module 24_1, so that the service carriage 14 always approaches spinning stations that can be pieced.

[0048] The service carriage 14 and/or the ring spinning machine 1 could be retrofitted with the sensors (camera, microphone, capacitive sensor, thread and slub monitor, etc.) and an additional module for determining the status, or retrofitted with the cleaning carriage.

[0049] Configurations are advantageously excluded in which piecing by the service carriage is not possible. The reliability and possible applications of the service carriage may thus be advantageously increased.

List of reference numerals

[0050]

1	ring spinning machine
2	spinning stations
3_1	head of the ring spinning machine 1
3_2	foot of the ring spinning machine 1
4	roving bobbin
5	drafting system
6	roving
7	thread guide
8	balloon control ring
9	spindle
10	tube
11	ring rail
12	ring mounting
13	ring traveller
14	service carriage
15	spindle monitor
16	controller
160	memory
17	yarn search device
18	cop lifting device
19	traveler threading device
20	yarn handling device
21	positioning device
22	spindle brake unit
23	display
24_1	module for status determination (service carriage 14)
24_2	module for status determination (ring spinning machine 1)
25	camera
26	capacitive sensor
27	microphone
50	controller of the ring spinning machine 1
500	controller
51	display of the ring spinning machine 1
52	mobile device
100	detection of a thread break
200	status analysis
300	decision as to whether elimination of the thread break is possible
400	elimination of the thread break is not possible
500	start of the thread piecing

Claims

1. A method for operating a ring spinning machine (1) having a service carriage (14),
wherein the ring spinning machine (1) has a plurality of spinning stations (2),
wherein the spinning stations (2) include a drafting system (5) having a discharge cylinder, a thread guide (7), a balloon control ring (8), a spindle (9), a ring traveller (13), and a spindle monitor (15), and
wherein the service carriage (14) moves along the spinning stations (2) on one side of the ring spinning machine (1) and eliminates thread breaks at the spinning stations (2) by means of a standard program, comprising the method step that a thread break at a spinning station (2) is determined,
characterized in that
a status of the spinning station (2) having the thread break is determined in a module (24_1, 24_2), and based on the determined status a decision is made as to whether the thread break can be eliminated by the standard program of the service carriage (14).

2. The method for operating a ring spinning machine (1) according to Claim 1, **characterized in that** if it is ascertained that the determined status of the spinning station (2) does not allow elimination of the thread break by the standard program, the service carriage (14) does not approach the spinning station (2).

3. The method for operating a ring spinning machine (1) according to Claim 1, **characterized in that** the service carriage (14) approaches the spinning station (2), and the status of the spinning station (2) is determined.

4. The method for operating a ring spinning machine (1) according to one of the preceding claims, **characterized in that** the ring spinning machine (1) is informed of the determined status of the spinning station (2), this status is shown on a display (23, 51), and/or an operator is called to place the spinning station (2) back in operation.

5. The method for operating a ring spinning machine (1) according to the preceding claim, **characterized in that** the spinning station (2) is monitored by a camera (25), a microphone (27), a capacitive sensor (26), the spindle monitor (15), and/or a thread and slub monitor, the result is transmitted to the module (24_1, 24_2), and the status is determined in the module (24_1, 24_2).

6. The method for operating a ring spinning machine (1) according to one of the preceding claims, **characterized in that** the spinning station (2) is recorded by at least one camera (25), and the status of the spinning station (2) is determined by image analysis.

7. The method for operating a ring spinning machine (1) according to the preceding claim, **characterized in that** the spinning station (2) is recorded in sections by different cameras (25), the result is transmitted to the module (24_1, 24_2), and the status is determined in the module (24_1, 24_2).

8. The method for operating a ring spinning machine (1) according to preceding Claim 6 or 7, **characterized in that** recorded status images are stored and used in the image analysis of the status of the spin-

ning station (2).

9. The method for operating a ring spinning machine (1) according to one of the preceding claims, **characterized in that** at least one of the following statuses is determined in which the thread break cannot be eliminated by the standard program of the service carriage (14):

- the roving bobbin (4) is empty or the roving feed is interrupted;
- a winder is situated on the discharge cylinder;
- a stationary thread is situated between the discharge cylinder and the thread guide (7);
- a soiled thread guide (7);
- no tube (10) is present;
- no spindle (9) is present;
- a soiled or missing ring traveller (13); or
- unknown interfering objects.

10. The method for operating a ring spinning machine (1) according to one of the preceding claims, **characterized in that** the service carriage (14) or a cleaning carriage carries out at least one of the following actions before eliminating the thread break:

- cleaning a ring traveller (13) or inserting a new ring traveller (13);
- removing a stationary thread;
- removing a winder; or
- triggering slub stopping.

11. The method for operating a ring spinning machine (1) according to one of the preceding claims, **characterized in that** the service carriage (14) and/or the ring spinning machine (1) are/is retrofitted with the module (24_1, 24_2) for determining the status.

12. A ring spinning machine (1) having a service carriage (14),
wherein the ring spinning machine (1) has a plurality of spinning stations (2),
wherein the spinning stations (2) include a drafting system (5) having a discharge cylinder, a thread guide, a balloon control ring (8), a spindle (9), a ring traveller (13), and a spindle monitor (15),
wherein the service carriage (14) is situated so as to be movable along the spinning stations (2) on one side of the ring spinning machine (1), and thread breaks at the spinning stations (2) may be eliminated by means of a standard program,
characterized in that
a module (24_1, 24_2) is present for determining the status of the spinning station (2), and based on the determined status ascertains whether the thread break can be eliminated by the standard program of the service carriage (2).

13. The ring spinning machine (1) according to the preceding claim, **characterized in that** the module (24_1, 24_2) is designed to inform the ring spinning machine (1) of the status of the spinning station (2), to show the status on a display (23, 51), and/or to call an operator.

14. The ring spinning machine (1) according to one of preceding Claims 12 or 13, **characterized in that** at least one camera (25), at least one microphone (27), at least one capacitive sensor (26), the spindle monitor (15), and/or at least one thread and slub monitor are/is present and are/is connected to the module (24_1, 24_2) in order to determine the status of the spinning station (2).

15. The ring spinning machine (1) according to one of preceding Claims 12 to 14, **characterized in that** to determine the status of the spinning station (2) at least one of the following statuses is ascertainable by the module (24_1, 24_2);

- the roving bobbin (4) is empty or the roving feed is interrupted;
- a winder is situated on the discharge cylinder;
- a stationary thread is situated between the discharge cylinder and the thread guide (7);
- a soiled thread guide (7);
- no tube (10) is present;
- no spindle (9) is present;
- a soiled or missing traveller (13); or
- unknown interfering objects.

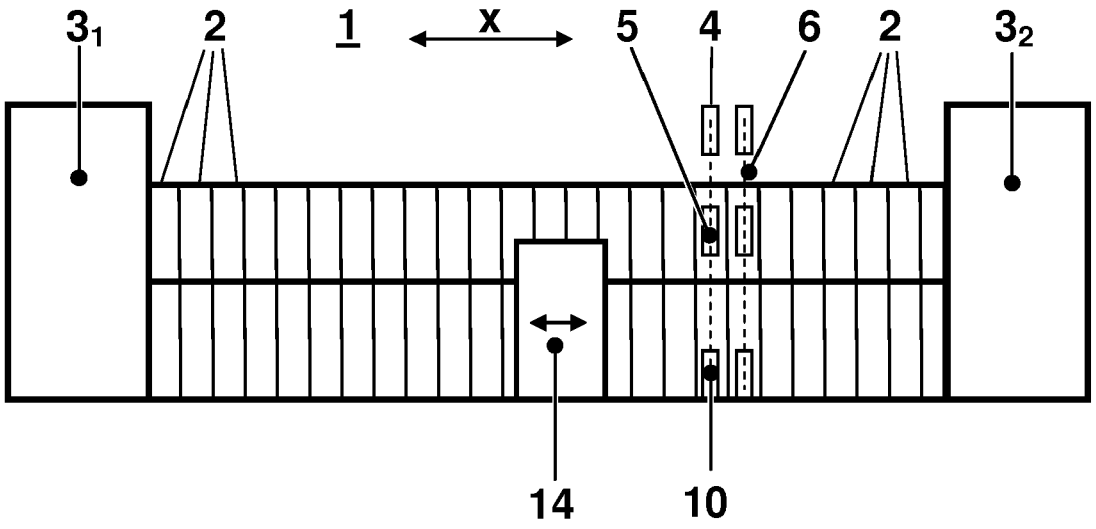

Fig. 1

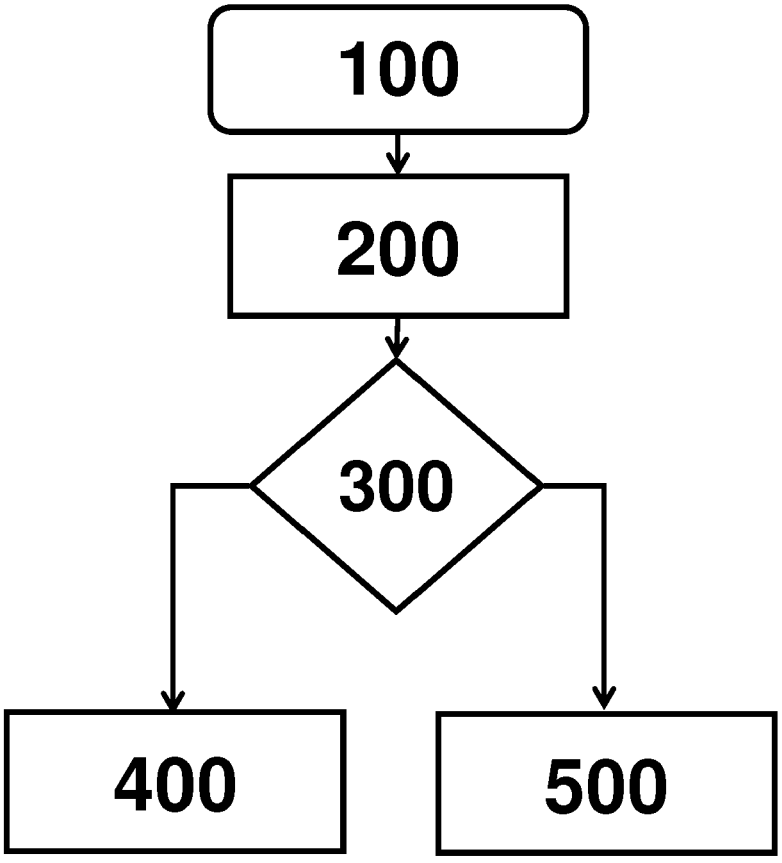

Fig. 3

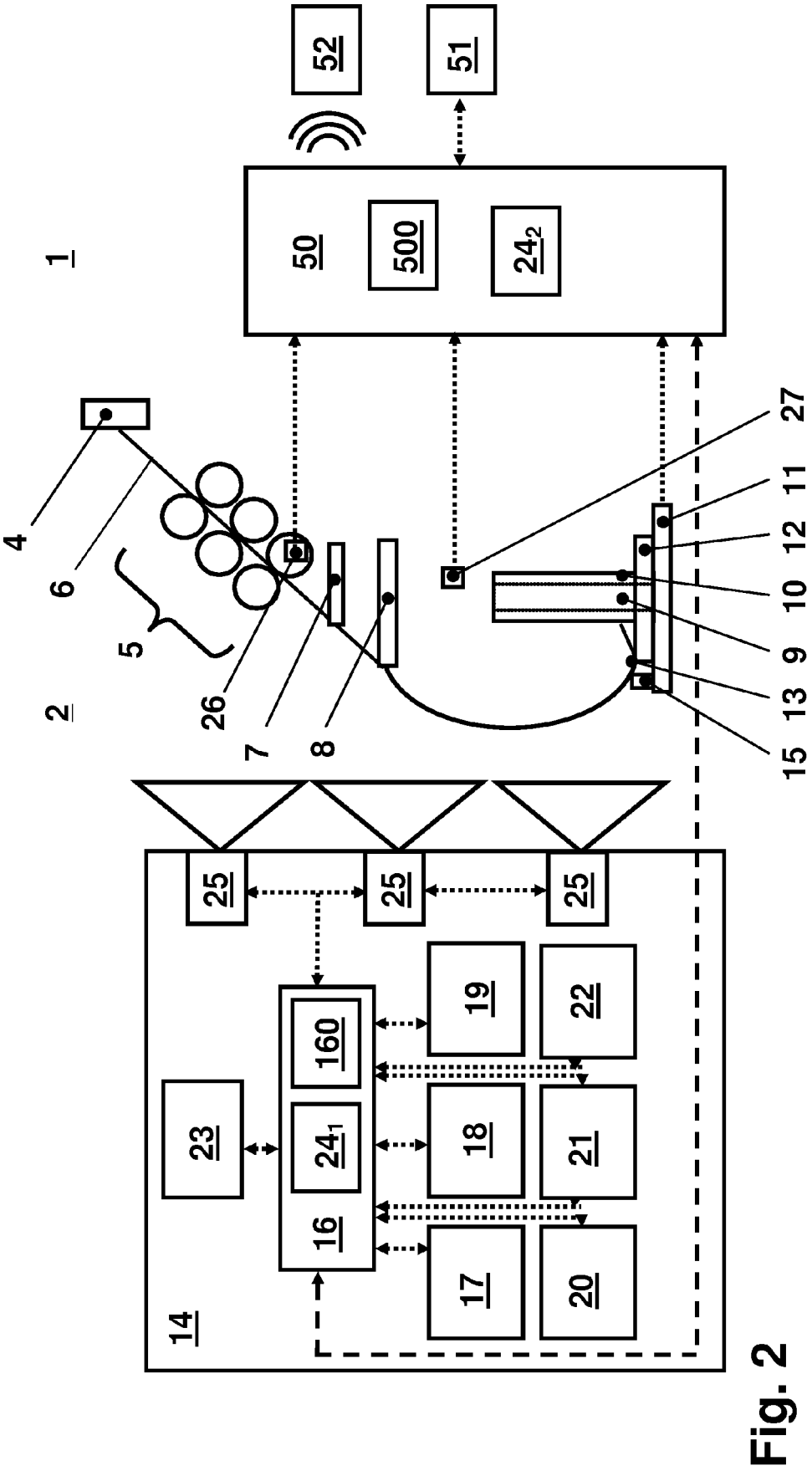
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Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 19 19 9256

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 February 2020	Todarello, Giovanni

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