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(54) METHOD OF OPERATING A SERVICE ROBOT OF A RING SPINNING MACHINE

VERFAHREN ZUM BETREIBEN EINES BEDIENROBOTERS EINER RINGSPINNMASCHINE

PROCÉDÉ DE FONCTIONNEMENT D'UN ROBOT D'UN MÉTIER À FILER À ANNEAUX

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(73) Proprietor: **Rieter AG**
8406 Winterthur (CH)

(72) Inventors:
- **KAPPELER, Hanspeter**
  9535 Wilen bei Wil (CH)
- **MORAVEC, Milan**
  56201 Ústí nad Orlicí, Hylváty (CZ)

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Description

Field of invention

[0001] The invention concerns a method of operating a service robot of a ring spinning machine and a ring spinning machine according to the independent claims.

Description of related art

[0002] Ring spinning machines comprise a row of spinning stations arranged next to each other, each of which comprises a roving drafting arrangement, from which the processed roving is carried to a twisting device, from which the produced yarn is withdrawn and wound in a winding device to form a package on a tube placed on a rotatable spindle, thereby forming a bobbin, or, in other words, cop, i.e., a tube with a yarn package. If the yarn production is interrupted, e.g., owing to a yarn break, it is necessary to resume yarn production at a given spinning station. During the renewal of the spinning process at the spinning station, where, after the interruption of spinning, roving feed rollers of the drafting arrangement are stopped, or the drafting arrangement is working and the fibers from the roving are sucked into waste, etc., also the motion of a traveller on a flange of a ring is terminated, which is usually recorded by a sensor of the traveller motion. Subsequently, it is necessary to find the yarn end being wound on the package on the bobbin, unwind the yarn from the package, thread it through the traveller, a balloon limiter and a guide eyelet and finally bring the yarn end back between the end rollers of the roving drafting arrangement in such a manner that during the spinning resumption the yarn end is joined to the end of the roving and the spinning station is thereby prepared for the renewal of the yarn production. All these service operations are performed during permanent reversible vertical motion of a ring bench and a balloon limiter carrier, because the other spinning stations continue to produce the yarn. Various handling devices are used for handling a yarn end from the moment of finding the yarn end on a package on a bobbin till the moment of passing it to the means of the spinning station, such as the handling devices according to EP391110 or according to US3,540,200 and others. By their very nature, these are yarn end handling devices performing general motion in space.

[0003] DE10142976 discloses a rotor spinning machine, which has multi-position machines with travelling service units. It is disclosed a transmission of processing parameters between travelling service units on textile machines.

[0004] DE4431810 discloses a rotor spinning machine, in which parameters for optimum yarn splicing are set, on a batch change at a rotor spinning machine. The microcomputer for the splicer gives a basic setting for an optimum splicing action, and displays the splicing parameters before the splicing starts.

[0005] DE4039486 proposes an automatic broken yarn repair at a ring spinner. The broken yarn end is detached from the winding cops by a stream of blown air with an intensity which is controlled according to the deg. of success in loosening the yarn end from the conical wound section of the cop. Preferably the blown air stream control is set by the yarn repair procedure for individual cops. In the event of a failure to detach the loose broken yarn end, the air stream intensity is increased on the second attempt, and then returned to the initial intensity on a third attempt. The success rate of the blowing actions is formed from a number of yarn repair procedures and, if it fails to achieve a nominal success rate, then the air blowing intensity is increased for subsequent yarn repairs.

[0006] Although, DE4039486 might increase the succession rate of a single yarn repair procedure, it does not take into account that the service robot is a complex apparatus, where many other factors influence the succession rate. Furthermore, depending on yarn to be produced and on the spinning machine, the succession rate of the yarn repair procedure might be different. Last but not least, the energy consumption is not taken into account.

[0007] EP394671 discloses a service robot for renewed piecing of broken yarns in a ring spinning machine. First a special spindle braking device is used to stop an individual spindle. Instead of searching the broken yarn-end and detaching it from a winding cop, an auxiliary (external) yarn provided by a storage tube is used for renewed piecing. Therefore, one end of the auxiliary yarn is attached to a winder which is moveable about the spinning cop and subsequently wound around the cop. The auxiliary yarn is then threaded through the ring traveller, an antiballoon ring and the thread guide and into the zone of the output of the drafting arrangement. The spindle and thus also the cop is then driven again and the auxiliary yarn is brought into the path of the drawn roving yarn so that it is twisted with it.

[0008] JP3079833B2 discloses a roving changing machine designed to change roving bobbins and joining roving under different spinning conditions. For this purpose, the roving changing machine appears to comprise stored control pattern data according to which a roving yarn feeding device, roving yarn joining device and the like of the roving changing machine are controlled. A suitable control pattern data set is apparently activated by sending information about spinning conditions of the base machine from a main controller to the roving changing machine. As information on the spinning condition the data number of a control pattern data is used.

Brief summary of the invention

[0009] The purpose of this invention is to provide a method of operating a service robot of a spinning machine and a spinning machine which saves energy, increases the efficiency of the service robot and of the production.

[0010] Another purpose of the invention is to provide a method of operating a service robot of a spinning machine and a spinning machine which configuration management of different service robots of the spinning machine or textile plants can be enhanced.

[0011] This purpose is achieved by a method of operating a service robot of a spinning machine and a spinning machine according to the independent claims. Dependent claims give advantageous embodiments.

[0012] More particularly, it is achieved by a method of operating a service robot of a ring spinning machine, which is displaceable along a row of spinning units of the ring spinning machine, each spinning unit comprising a spindle, wherein the service robot can be stopped at a specific spinning unit in order to perform a service operation at the spinning unit; the method comprising the steps of

- storing in a memory different sets of setting parameters for the service robot, which setting parameters depend on yarn characteristics and characteristics of the ring spinning machine;
- choosing a specific yarn to be produced on the spinning machine; and
- applying one of the sets of setting parameters to the service robot according to the chosen yarn to be produced and the ring spinning machine for use during the service operation.

[0013] Preferably, it comprises the step of entering by an operator at the service robot or the ring spinning machine the yarn to be produced and/or a spinning program defining at least the yarn.

[0014] The method according to the invention further comprises the steps of

- monitoring success rate and energy consumption of the service robot;
- changing at least one setting parameter of the applied set of parameters in dependency of success rate and/or energy consumption.

[0015] Preferably, comprises the step of displaying statistics of success rate and/or energy consumption of the service robot.

[0016] Preferably, it comprises the step of transferring success rate and/or energy consumption of the service robot and the applied set of parameters to an internet server.

[0017] Preferably, it comprises the step of storing different sets of setting parameters for setting one or a plurality of

- negative pressure, belt speed and direction, max search time and/or contact pressure of yarn search device of a yarn search device of the service robot;
- turning speed, turning time and/or turning direction of a tube handling device of the service robot;
- air pressure and/or time for pressured air impulse of a traveller thread device of the service robot;
- time for piecing, moving speed and/or suction pressure of a yarn handling device of the service robot;
- minimum and maximum speed and/or time for moving to a park position of a travelling and position device of the service robot;
- braking force and/or braking time of a spindle brake unit of the service robot;
- general settings of the service robot; and
- settings of a service station of the service robot.

[0018] It turned out that under certain conditions (e.g. depending on yarn characteristics and/or characteristics of the ring spinning machine and/or environmental conditions) the broken yarn end of spindle at an interrupted spinning station cannot be found or not be detached using a yarn search device as described herein. If the yarn-end finding and detaching operation is not successful, a spinning station may be out of production at least until next the doffing takes place. On the other side, if too much time is spent on the search and/or the detachment of a single broken yarn-end, energy consumption and overall efficiency of a service robot decreases significantly and so does the total performance of a ring spinning machine. Therefore, according to a variation of the present invention, which may also be viewed as an independent inventive concept, under certain conditions renewed piecing of broken yarn is performed using auxiliary (external) yarn, alternatively to searching and detaching the broken yarn-end from the winding cop. This allows resuming production of a spinning station even if the broken yarn end cannot be found and/or detached from a winding cop. Consequently, the energy consumption can be further decreased and efficiency of a service robot and a ring spinning machine be further increased.

[0019] Thus, according to a variation of the present invention, the method of operating a service robot of a ring spinning

machine may comprise the step of initiating a renewed piecing operation using auxiliary yarn as described in EP394671 if the search time of a yarn search device of a yarn search robot exceeds a predefined max search time.

[0020] In case the search for the yarn-end is performed using multiple attempts (e.g. the attempts differing in negative suction pressure and/or belt speed and/or belt direction and/or contact pressure of the yarn search device from each other), alternatively or in addition, also a maximum number of search attempts per piecing operation may be set and used alternatively or in addition to the max search time.

[0021] However, renewed piecing by using auxiliary yarn increases the number of yarn-end finding operations in a downstream winding machine, respectively a plurality of down-stream winding machines. Thus processing of a cop that was pieced too many times using auxiliary yarn may critically decrease the overall performance of a winding machine (respectively a plurality of winding machines) due to the required additional yarn-end finding operations. The same holds true for the total number of renewed piecing operations using auxiliary yarn as performed on a whole production batch of a ring spinning machine. Thus, a supercritical application of renewed piecing using auxiliary yarn per cop and/or per production batch of a ring spinning machine may lead to the downstream winding machine(s) becoming a bottleneck of the overall production chain of a spinning mill. The maximum numbers of applications of auxiliary yarn for renewed piecing per cop and per production batch of a ring spinning machine will typically depend on the number, type and topology of the winding machine(s), respectively the yarn-end finding devices associated with the winding machine(s) as well as a plurality of other parameters. Such other parameters include e.g. the type and yarn count of the yarn to be produced, the number of cops per production batch of the spinning machine, the transport capacity of a conveyor line of an interconnected transport system installed between the ring spinning machine and a downstream winding machine or a plurality of downstream winding machines and the buffer storage capacity of an interconnected transport system installed between the ring spinning machine and a downstream winding machine or a plurality of downstream winding machines etc.

[0022] Consequently, the potential decrease of energy consumption and increase in production efficiency of a service robot and ring spinning machine due to the use of auxiliary yarn is conflicting with the potential decrease of the performance of a downstream wining machine arrangement. Hence a trade-off between the conflicting demands is required. Therefore according to variation of the method according to the present invention, the method according to the present invention may also comprise the step of storing different sets of setting parameters for setting one or a plurality of

- maximum number of renewed piecing operations using auxiliary yarn of an auxiliary yarn piecing device of the service robot per cop (respectively spinning station during one production batch of the ring spinning machine);
- maximum number of renewed piecing operations using auxiliary yarn of an auxiliary yarn piecing device of the service robot per production batch of the ring spinning machine.

[0023] **In** accordance with this aspect of the present invention, a further variation of the method according to the present invention comprises the steps of the service robot of a ring spinning machine only initiating a renewed piecing operation using auxiliary yarn if the search time of a yarn search device of a yarn search robot exceeds a predefined maximum search time and/or the number of renewed piecing operations using auxiliary yarn on a specific cop does not exceed a predefined maximum number of renewed piecing operations using auxiliary yarn and/or the total number of renewed piecing operations using auxiliary yarn on all cops of a production batch of the ring spinning machine does not exceed a predefined maximum number of renewed piecing operations using auxiliary yarn per production batch (between two doffing operations) of the ring spinning machine. Thus, a highly efficient and steady production of a spinning machine and downstream winding machine can be obtained.

[0024] Preferably, the method comprises the step of storing different sets of setting parameters which parameters depend on one or a plurality of yarn count, yarn type, S-/Z-Twist as yarn characteristics.

[0025] Preferably, it comprises the step of storing setting parameters depend one or a plurality of characteristics of the ring spinning machine of

- a spindle speed or spindle type;
- a traveller type;
- a ring diameter;
- a traversing;
- a tube length;
- a length of the ring spinning machine;
- a type of the ring spinning machine;
- a side of the ring spinning machine; and
- the existence of a roving stop; and
- the transport capacity of a conveyor line of an interconnected transport system installed between the ring spinning machine and a downstream winding machine or a plurality of downstream winding machines; and
- the buffer storage capacity of an interconnected transport system installed between the ring spinning machine and a

downstream winding machine or a plurality of downstream winding machines;

- the winding capacity of one or the plurality of downstream winding machines;
- the maximum number of yarn-end finding operations of a downstream winding machine or a plurality of downstream winding machines per production batch of cops to be winded;
- the maximum number of yarn-end finding operations of a downstream winding machine or a plurality of downstream winding machines per cop (respectively per spinning station between two doffing cycles).

[0026] Within the context of the present invention, a downstream winding machine is understood to include also arrangements that perform yarn-end searches in such winding machines.

[0027] Due to special circumstances (e.g. failure in a downstream winding machine or e.g. changes in certain environmental conditions) the setting parameters used by the service robot may have to be set or amended by an operator. Therefore a variation of the method according to the present invention comprises the step of entering by an operator at the service robot or the ring spinning machine one or a plurality of:

- the max search time of a yarn search device of the service robot before an auxiliary yarn piecing device of the service robot performs a renewed piecing operation using auxiliary yarn;
- the maximum number of renewed piecing operations using auxiliary yarn of an auxiliary yarn piecing device of the service robot per cop per production batch;
- the maximum number of renewed piecing operations using auxiliary yarn of an auxiliary yarn piecing device of the service robot per production batch of the ring spinning machine.

[0028] These setting parameters may be determined based on information provided by a down-stream winder or a plurality of downstream winders.

[0029] Preferably, the method comprises the step of loading predefined sets of setting parameters to the memory.

[0030] Preferably, it comprises the step of down- or uploading sets of setting parameters from or to a server over the internet to or from the service robot.

[0031] Preferably, it comprises the steps of exchanging the service robot and transferring the applied set of setting parameters to the exchanged service robot.

- transferring the applied set of setting parameters from the service robot to a main controller of the ring spinning machine; and
- synchronizing all service robots connected to the ring spinning machine with the transferred setting parameters.

[0032] Moreover the aim of the present invention is achieved by a ring spinning machine with a service robot, which is displaceable along a row of spinning units of the ring spinning machine, each spinning unit comprising a spindle, wherein the service robot can be stopped at a specific spinning unit in order to perform a service operation at the spinning unit; said ring spinning machine comprises

- a memory for storing different sets of setting parameters for the service robot, which setting parameters depend on yarn characteristics and characteristics of the ring spinning machine;
- a display for choosing a specific yarn to be produced on the ring spinning machine;
- a controller for applying one of the sets of setting parameters to the service robot according to the chosen yarn to be produced and the ring spinning machine for use during the service operation.

[0033] Preferably, an interface is present for down- or uploading sets of setting parameters from or to a server on the internet to or from the service robot.

[0034] According to the present invention, the controller is adapted for monitoring success rate and energy consumption of the service robot and for changing at least one setting parameters of the applied set of parameters in dependency of success rate and/or energy consumption.

[0035] Preferably, setting parameters comprise parameters for setting one or a plurality of

- a yarn search device of the service robot;
- a tube handling device of the service robot;
- a traveller thread device of the service robot;
- a yarn handling device of the service robot;
- a park position of a travelling and position device of the service robot;
- a spindle brake unit of the service robot;
- an auxiliary yarn piecing device of the service robot;

- general settings of the service robot; and/or
- settings of a service station of the service robot.

[0036] In a variation of the present invention, at least some of the setting parameters (e, f, g) also depend on characteristics of a downstream winding machine or a plurality of down-stream winding machines.

[0037] With the present invention, advantageously generally speaking energy can be saved (e.g. by use less negative pressure) and production can be increased.

Brief description of drawings

[0038] The invention will be better understood with the aid of the description of an embodiment given by way of example an illustrated by the figures, in which it is shown schematically by

Fig. 1 a ring spinning machine with a service robot; and

Fig. 2 a service robot according to the invention;

Fig. 3 different sets of these setting parameters; and

Fig. 4 a system for connecting a spinning mil to a network; and

Fig. 5 a further variation of a service robot according to the invention.

[0039] Same feature have same reference numbers in different drawings.

Detailed Description of the invention

[0040] Fig. 1 shows schematically a ring spinning machine 1 according to the present invention, which has a plurality of juxtaposed spinning units 2. The spinning units 2 are located in a longitudinal direction x of the ring spinning machine 1 between a head 31 and a foot 32. Head 3_1 and foot 3_2 of the ring spinning machine 1 may include bearings, drives, control, etc., which are necessary for the operation of the machine. As is further seen, for example, at two spinning units 2 shown schematically in Fig. 1, each spinning unit 2 consists of a roving bobbin 4, which is arranged above a drafting device 5, and on which a roving 6 is wound. The roving 6 runs from the roving bobbin 4 via the drafting device 5, where it is stretched, to then be guided to a yarn forming element via a yarn guide. A circumferential ring winds the finished yarn on a cops 7. The cops 7 is placed on a spindle 8. Along the ring spinning machine 1, a service robot 9 moves, which drives in the event of a yarn breakage to a corresponding spinning station 1 and automatically fixes the yarn breakage. The individual spinning unit 2 can be equipped with spindle monitors or other sensors for monitoring the ring traveller in order to detect a yarn breakage. Alternatively or additionally, the spinning units 2 can be equipped with single spindle drives.

[0041] Fig. 2 shows schematically a service robot 9 according to the invention. The service robot 9 comprises a main controller 10 and a memory 100, which can be part of the main controller 10 or be separated from it. The main controller 10 controls the operation of the service robot 9 for automatically fixing yarn breakage. The service robot 9 comprises

- a yarn search device 11 as disclosed in WO2018/100464; WO2018/100464 relates to a method and device for detecting the yarn end on a bobbin in a textile machine producing or processing yarn, especially after the interruption of winding due to a yarn breakage, when after the breakage the bobbin is approached by a suction nozzle, into which the yarn end is sucked from the rotating bobbin. A bar and a movable means having a carrier surface approach the surface of the package on the bobbin. The movable means is moving in a different direction as the rotating bobbin, whereupon the yarn end is captured and withdrawn from the bobbin by the movement of the movable means and the yarn end is carried to the suction nozzle.
- a tube handling device 12 as disclosed in the unpublished Czech patent application no. PV 2018-47 dated 31.01.2018; the patent application relates to a bobbin handling device for transporting a bobbin from a spindle of a spinning station of a ring spinning machine to yarn end searching position, the device being displaceable between a resting position, a clamping position for clamping the bobbin at the spinning station and the yarn end searching position. The handling device comprises a supporting part, which is coupled to a drive for vertical reversible linear motion, a clamp of the bobbin mounted on the supporting part and coupled to a drive for reversible horizontal linear motion, vertical clamping mandrel mounted on the clamp and coupled to a rotary drive for rotating about the longitudinal axis, and a controlled clamping element, provided at the lower end of the vertical clamping mandrel for insertion into the cavity of the upper end of the tube of the bobbin.

- a traveller thread device 13 as disclosed in the unpublished Czech patent application no. PV 2018-34 dated 24.01.2018; the patent application relates to a device for threading yarn into a traveller on a ring with a flange at a spinning station of a ring spinning machine.
- a yarn handling device 14 as disclosed in the unpublished Czech patent application no. PV 2018-48 dated 31.01.2018; the patent application to a yarn end handling device at a spinning station of a ring spinning machine for detecting a yarn end on a bobbin, which comprises a suction tube with a suction mouth assignable to a spinning station, the suction tube is connected to a vacuum source, whereby the suction tube is mounted on a positioning system for guiding the mouth of the suction tube to a drafting arrangement of the spinning station for the resumption of the spinning process. The positioning system includes a supporting part, which is mounted reversibly linearly slidably on a vertical guide; a horizontal arm, which is mounted reversibly swingingly (swivelly) about the vertical axis on the supporting part, whereby the suction tube is mounted reversibly linearly slidably in the horizontal direction on the horizontal arm.
- a travelling and positioning device 15 as disclosed in the unpublished Czech patent application no. PV 2018-49 dated 31.01.2018 and unpublished Swiss patent application no. 01185/17 dated 28.09.2017.
- a spindle brake unit 16 same or similar to the disclosure of EP394671, wherein the brake shoe 246 can be replaced by a roller.
- a display 17 for displaying and inputting data.

[0042] The main controller 10 controls the operation (indicated by arrows) of the yarn search device 11, the tube handling device 12, the traveller thread device 13, the yarn handling device 14, the travelling and positioning device 15, travelling and positioning device 15 and the spindle brake unit 16 according a predefined schema or program. All these parts of the service robot 9 use specific setting parameters during operation as seen in Tab. 1. According to the present invention, as well shown in Tab. 1 these setting parameters for the service robot depend on specific yarn characteristics and on characteristics of the spinning machine 1.

Tab. 1

Setting for	**Setting Parameters**	**Setting Parameters depend on the yarn characteristics**	**Parameters depend on the characteristics of the ring spinning machine**
Yarn Search Device 11	Negative suction pressure Belt speed Max. Search time Belt direction Contact pressure of yarn search device	Yarn count Yarn type S-/Z-Twist	Spindle speed
Tube handling device 12	Turning speed Turning time Turning direction	Yarn count Yarn type S-/Z-Twist	Tube length Tube diameter
Traveller Thread Device 13	Time for pressured air impulse Air pressure		Traveller type (weight) Ring diameter
Yarn handling device 14	Time for piecing (moving yarn behind top / bottom roller) Moving speed for yarn handling device Suction pressure		Traversing mechanism (changing device)
Travelling & positioning device 15	Low speed Max speed Time for moving to park position Number of Spindles Intermediate drive (IMD) position (last Spi No. before)		Gauge T70/T75mm Tube Length

(continued)

Setting for	Setting Parameters	Setting Parameters depend on the yarn characteristics	Parameters depend on the characteristics of the ring spinning machine
Spindle Brake unit 16	Brake force Brake time		Spindle speed Spindle type
General settings	Numbers of attempts Doff piecing - ON/OF Protective information of empting yarn waste collector	Yarn count Yarn type	machine length (spindle no.) Ring- or Compact MC Roving Stop yes / no Spindle speed
Service station	Service robot left / right Service robot master / slave	Yarn count Yarn type S-/Z-Twist	machine side left / right Mechanical settings like Ring-diameter, tube length, traveller weight, Traversing mechanism (changing device) Gauge T70/T75mm RSM length (No. of Spindles) Ring- or Compact MC Roving Stop yes / no

[0043] According to the present invention as seen in Fig. 3 different sets A, B, C of these setting parameters e, f, g for the service robot 9 are stored in the memory 100. Each set A, B, C of setting parameters e, f, g is used by the service robot 9 for another spinning program and is necessary for the production of a different yarn or to run a different spinning program. In Fig. 3, the number of sets A, B, C and parameters e, f, g is given by way of example only. It will depend on the operation of the service robot 9 and the spinning machine 1.

[0044] As initial configuration (e.g. with delivery of the service robot 9, during a maintenance or when updating the software of the service robot 9 over the internet from server 50), it is possible to load different predefined sets A, B, C of setting parameters e, f, g into the memory 100. Before starting the yarn production, an operator chooses at the display 17 or a display 21 of the spinning machine a specific yarn to be produced (or a specific spinning program defining the yarn). According to the chosen yarn to be produced or the spinning program, one of the different sets A, B, C of setting parameters e, f, g is applied to the service robot 9 for the use during the service operation of the service robot 9.

[0045] Advantageously, during the service operation of the service robot 9, the chosen setting parameters are not fixed, but could be adapted. The service operation continues then with the adapted parameters. Preferred parameters for adapting are the setting parameters of the yarn search device 11, the tube handling device 12 and the traveller thread device 13 as given in Tab. 1. As an example, the controller 10 can be continuously or discontinuously monitor the success rate and the energy consumption of the service robot 9 to form a statistic.

[0046] **If** the controller 10 detects a decreasing success rate of the piecing process of the service robot 9, the controller 10 starts adapting the mentioned parameters. Based on a strategy on the influence of the parameter to increase the success rate the controller 10 will change these parameters in a first priority (e.g. suction pressure of yarn search device). The controller 10 sets these parameters in relation to the attempt of piecing, e.g. the statistic shows that a higher suction pressure of yarn search device increases the success rate for the second or any further attempt.

[0047] **If** the statistic shows a high and constant success rate, the controller 10 could adapt parameters which have an influence on the energy consumption by keeping the same level of success rate. **If** the success rate is decreasing due to adapted parameters having an influence on the energy consumption, the controller 10 could again adapt parameters for having a better success rate. Success rate and/or energy consumption of the service robot 9 or statistics of it can as well be displayed at display 17, display 21 or at a dashboard of the spinning mil (not shown).

[0048] Fig. 4 shows schematically a system for connecting a spinning machine 1 to a server 50 over a network such as the internet 40. Server 50 comprises a database 51 with different sets A, **B,** C of setting parameters e, f, g for the service robot 9 as seen in Fig. 3, which setting parameters e, f, g depend on yarn characteristics and characteristics of a spinning machine as giving in Tab. 1.

[0049] The spinning machine 1 having in this example a plurality of service robots 9, which move along both side of the

ring spinning machine 1. Depending on the length of the spinning machine 1, one side of the spinning machine 1 can as well be served by two or more service robots 9. The spinning machine 1 comprises a main controller 20 and a memory 200, which can be part of the main controller 20 or be separated from it. The main controller 20 controls the overall operation of the spinning machine 1 for production of the yarn as well as the service robots 9 (indicated in Fig. 2 by arrows). An operational control system 30 controls besides the spinning machine 1 other spinning machines of a spinning mil (not shown) and collects operational data from the spinning mil for displaying and analysis.

[0050] In this embodiment, it is possible to transfer settings from one service robot 9 to another service robot 9, e.g. when the service robot 9 is exchanged by another service robot. This can be done by

- a mobile device (e.g. notebook, tablet, smart phone) by cable, Bluetooth, NFC (near field communication);
- direct communication from one service robots 9 to another service robots 9 by WLAN, LAN, Bluetooth, NFC; ZigBee
- communication via the operational control system 30 by LAN, WLAN or ZigBee.

[0051] Furthermore, there are a number of various possibilities to exchange settings between service robots 9 or to save a given configuration of settings of a service robot 9:

- On the spinning machine 1 one service robot 9 can be set as master (e.g. left side of spinning machine 1) and one or a plurality of service robots 9 is/are set as a slave (e.g. right side of spinning machine 1). The settings from the service robot 9 master can be uploaded to spinning machine 1 or operational control system 30, the service robot(s) 9 slave will synchronize the setting with the service robot 9 master;
- Master settings can be uploaded the memory 200 of the spinning machine 1 and all service robots 9 on the spinning machine 1 will be synchronized with these settings;
- Settings of a service robot 9 can be downloaded in a service station;
- Setting configuration of a service robot 9 can be saved in the memory 100, in the memory 200 of the spinning machine 1 or can be uploaded over the internet 40 to the server 50.

[0052] Fig. 5 shows schematically a further variation of a service robot 9 according to the invention. The service robot 9 depicted in Fig. 5 comprises the components of the variation of a service robot according to Fig. 2 and described herein with respect to the variation of a service robot according to Fig. 2. In addition the service robot of Fig. 5 also comprises:

- A store of auxiliary (external) yarn 18 for renewed piecing as described in European patent application EP394671 of 21 March 1990, such as a storage bobbin. EP394671 relates to a method and robot for renewed piecing after yarn breakage using auxiliary yarn. Therefore a predetermined length of yarn may be sucked from e.g. a storage bobbin of the store of auxiliary yarn 18. Therefore, an auxiliary suction gun comprising a storage tube may be used as described in EP394671 and which may be part of the variation of a service robot as shown in Fig. 5. Alternatively, also the tube handling device 12 as disclosed in the unpublished Czech patent application no. PV 2018-47 dated 31.01.2018 and further described herein with respect to Fig. 2 may be applied instead.
- A winder for auxiliary yarn 19 that is movable about the spinning cop where renewed piecing is to be performed as described in EP394671 in order to wind an end portion of the auxiliary yarn around the spinning cop.

[0053] A store of auxiliary yarn 18 and a winder for auxiliary yarn 19 may constitute an auxiliary yarn piecing device. In order to perform a piecing operation using auxiliary yarn, also the tube handling device 12, the traveller thread device 13, the yarn handling device 15 and the spindle brake unit as described above may be applied.

[0054] With the present invention, advantageously generally speaking energy can be saved (e.g. by use less negative pressure) and production can be increased.

Reference numbers

[0055]

1	Ring spinning machine
2	Spinning unit
3_1	Head
3_2	Foot
4	Roving bobbin
5	Drafting device
6	Roving
7	Cops

8	Spindle
9	Service robot
10	Controller of service robot 1
100	Memory
11	Yarn search device
12	Tube handling device
13	Traveller thread device
14	Yarn handling device
15	Travelling and positioning device
16	Spindle brake unit
17	Display
18	Store of auxiliary yarn
19	Winder for auxiliary yarn
20	Main controller of ring spinning machine 1
200	Memory
21	Display
30	Operational control system
40	Internet
50	Server
51	Database
A, B, C	set of setting parameters
e, f, g	setting parameters
x	longitudinal direction of the ring spinning machine 1

Claims

1. A method of operating a service robot (9) of a ring spinning machine (1), which is displaceable along a row of spinning units (2) of the ring spinning machine (1), each spinning unit (2) comprising a spindle (8), wherein the service robot (9) can be stopped at a specific spinning unit (2) in order to perform a service operation at the spinning unit (2); the method comprising the steps of

   • storing in a memory (100, 200) different sets (A, B, C) of setting parameters (e, f, g) for the service robot (9), which setting parameters (e, f, g) depend on yarn characteristics and characteristics of the ring spinning machine (1);

   • choosing a specific yarn to be produced on the spinning machine (1);
   • applying one of the sets (A, B, C) of setting parameters (e, f, g) to the service robot (9) according to the chosen yarn to be produced and the ring spinning machine (1) for use during the service operation; **characterised by** the steps of
   • monitoring success rate and energy consumption of the service robot (9) and
   • changing at least one setting parameter (e, f, g) of the applied set (A, **B,** C) of parameters (e, f, g) in dependency of success rate and/or energy consumption.

2. The method according to claim 1, **characterised in** the step of entering by an operator at the service robot (9) or the ring spinning machine (1) the yarn to be produced and/or a spinning program defining at least the yarn.

3. The method according to any of the preceding claims, **characterised in** the step of displaying statistics of success rate and/or energy consumption of the service robot.

4. The method according to any of the preceding claims, **characterised in** the step of transferring success rate and/or energy consumption of the service robot (9) and the applied set (A, **B,** C) of parameters (e, f, g) to an internet server (50).

5. The method according to any of the preceding claims, **characterised in** the step of storing different sets (A, B, C) of setting parameters (e, f, g) for setting one or a plurality of

   • negative pressure, belt speed and direction, max search time and/or contact pressure of yarn search device of a yarn search device of the service robot (9);
   • turning speed, turning time and/or turning direction of a tube handling device of the service robot (9);

- air pressure and/or time for pressured air impulse of a traveller thread device of the service robot (9);
- time for piecing, moving speed and/or suction pressure of a yarn handling device of the service robot (9);
- minimum and maximum speed and/or time for moving to a park position of a travelling and position device of the service robot (9);
- braking force and/or braking time of a spindle brake unit of the service robot (9);
- general settings of the service robot (9); and
- settings of a service station of the service robot (9); and
- maximum number of renewed piecing operations using auxiliary yarn of an auxiliary yarn piecing device of the service robot (9) per cop;
- maximum number of renewed piecing operations using auxiliary yarn of an auxiliary yarn piecing device of the service robot (9) per production batch of the ring spinning machine (1).

6. The method according to any of the preceding claims, **characterised in** the step of storing different sets (A, B, C) of setting parameters (e, f, g) which parameters (e, f, g) depend on one or a plurality of yarn count, yarn type, S-/Z-twist as yarn characteristics.

7. The method according to any of the preceding claims, **characterised in that** the setting parameters (e, f, g) depend on one or a plurality of characteristics of the ring spinning machine (1):

- a spindle speed or spindle type;
- a traveller type;
- a ring diameter;
- a traversing;
- a tube length;
- a length of the ring spinning machine (1);
- a type of the ring spinning machine (1);
- a side of the ring spinning machine (1); and
- the existence of a roving stop.

8. The method according to any of the preceding claims, **characterised in** the step of entering by an operator at the service robot or the ring spinning machine one or a plurality of

- the max search time of a yarn search device of the service robot (9) before an auxiliary yarn piecing device of the service robot (9) performs a renewed piecing operation using auxiliary yarn;
- the maximum number of renewed piecing operations using auxiliary yarn of an auxiliary yarn piecing device of the service robot (9) per cop per production batch;
- the maximum number of renewed piecing operations using auxiliary yarn of an auxiliary yarn piecing device of the service robot (9) per production batch of the ring spinning machine (1).

9. The method according to any of the preceding claims, **characterised in** the step of loading predefined sets (A, B, C) of setting parameters (e, f, g) to the memory (100, 200).

10. The method according to any of the preceding claims, **characterised in** the step of down- or uploading sets (A, B, C) of setting parameters (e, f, g) from or to a server (50) over the internet (40) to or from the service robot (9).

11. The method according to any of the preceding claims, **characterised in** the step of exchanging the service robot (9) and transferring the applied set (A, B, C) of setting parameters (e, f, g) to the exchanged service robot (9).

12. The method according to any of the preceding claims, **characterised in** the step of

- transferring the applied set (A, B, C) of setting parameters (e, f, g) from the service robot (9) to a main controller (20) of the ring spinning machine (1); and
- synchronizing all service robots (9) connected to the ring spinning machine (1) with the transferred setting parameters (e, f, g).

13. A ring spinning machine (1) for performing one of the method claims 1 to 12 with a service robot (9), which is displaceable along a row of spinning units (2) of the ring spinning machine (1), each spinning unit (2) comprising a spindle (8), wherein the service robot (9) can be stopped at a specific spinning unit (2) in order to perform a service

operation at the spinning unit (2); comprising

• a memory (100, 200) for storing different sets (A, B, C) of setting parameters (e, f, g) for the service robot (9), which setting parameters (e, f, g) depend on yarn characteristics and characteristics of the ring spinning machine (1);
• a display (17, 21) for choosing a specific yarn to be produced on the ring spinning machine (1);
• a controller (10, 20) for applying one of the sets (A, B, C) of setting parameters (e, f, g) to the service robot (9) according to the chosen yarn to be produced and the ring spinning machine (1) for use during the service operation **characterised in that** the controller (10, 20) is adapted for monitoring success rate and energy consumption of the service robot (9) and for changing at least one setting parameters (e, f, g) of the applied set (A, B, C) of parameters (e, f, g) in dependency of success rate and/or energy consumption.

14. The ring spinning machine (1) according to claim 13, **characterised in** an interface for down- or uploading sets (A, B, C) of setting parameters (e, f, g) from or to a server (50) on the internet (40) to or from the service robot (9).

15. The ring spinning machine (1) according to any of the preceding claims 13 to 14, **characterised in that** the setting parameters (e, f, g) comprise parameters (A B, C) for setting one or a plurality of

a yarn search device of the service robot (9);
a tube handling device of the service robot (9);
a traveller thread device of the service robot (9);
a yarn handling device of the service robot (9);
a park position of a travelling and position device of the service robot (9); a spindle brake unit of the service robot (9);
an auxiliary yarn piecing device of the service robot (9);
general settings of the service robot (9); and/or settings of a service station of the service robot (9).

Patentansprüche

1. Verfahren zum Betreiben eines Wartungsroboters (9) einer Ringspinnmaschine (1), der entlang einer Reihe von Spinneinheiten (2) der Ringspinnmaschine (1) verschiebbar ist, jede Spinneinheit (2) umfassend eine Spindel (8), wobei der Wartungsroboter (9) an einer konkreten Spinneinheit (2) gestoppt werden kann, um einen Wartungsbetrieb an der Spinneinheit (2) durchzuführen; das Verfahren umfassend die Schritte

• Speichern von unterschiedlichen Sätzen (A, B, C) von Einstellparametern (e, f, g) für den Wartungsroboter (9) in einem Speicher (100, 200), wobei die Einstellparameter (e, f, g) von Garneigenschaften und Eigenschaften der Ringspinnmaschine (1) abhängen;
• Auswählen eines konkreten Garns, das auf der Spinnmaschine (1) hergestellt werden soll;
• Anwenden eines der Sätze (A, B, C) von Einstellparametern (e, f, g) auf den Wartungsroboter (9) gemäß dem ausgewählten Garn, das hergestellt werden soll, und die Ringspinnmaschine (1) zur Verwendung während des Wartungsbetriebs; **gekennzeichnet durch** die Schritte
• Überwachen einer Erfolgsrate und eines Energieverbrauchs des Wartungsroboters (9) und
• Ändern von mindestens einem Einstellparameter (e, f, g) des angewandten Satzes (A, B, C) von Parametern (e, f, g) in Abhängigkeit von der Erfolgsrate und/oder dem Energieverbrauch.

2. Verfahren nach Anspruch 1, **gekennzeichnet durch** den Schritt eines Eingebens, durch einen Bediener an dem Wartungsroboter (9) oder der Ringspinnmaschine (1), des Garns, das hergestellt werden soll, und/oder eines Spinnprogramms, das mindestens das Garn definiert.

3. Verfahren nach einem der vorstehenden Ansprüche, **gekennzeichnet durch** den Schritt eines Anzeigens von Statistiken zu der Erfolgsrate und/oder zu dem Energieverbrauch des Wartungsroboters.

4. Verfahren nach einem der vorstehenden Ansprüche, **gekennzeichnet durch** den Schritt eines Übertragens der Erfolgsrate und/oder des Energieverbrauchs des Wartungsroboters (9) und des angewandten Satzes (A, B, C) von Parametern (e, f, g) an einen Internetserver (50).

5. Verfahren nach einem der vorstehenden Ansprüche, **gekennzeichnet durch** den Schritt des Speicherns unter-

schiedlicher Sätze (A, B, C) von Einstellparametern (e, f, g) zum Einstellen eines oder einer Vielzahl von

- Unterdruck, Bandgeschwindigkeit und -richtung, maximaler Suchzeit und/oder Anpressdruck der Garnsuchvorrichtung einer Garnsuchvorrichtung des Wartungsroboters (9);
- Drehgeschwindigkeit, Drehzeit und/oder Drehrichtung einer Hülsenhandhabungsvorrichtung des Wartungsroboters (9);
- Luftdruck und/oder Zeit für einen Druckluftimpuls einer Läufer-Fadenvorrichtung des Wartungsroboters (9);
- Zeit zum Anspinnen, Bewegungsgeschwindigkeit und/oder Saugdruck einer Garnhandhabungsvorrichtung des Wartungsroboters (9);
- minimaler und maximaler Geschwindigkeit und/oder Zeit zum Bewegen zu einer Parkposition einer Lauf- und Positionsvorrichtung des Wartungsroboters (9);
- Bremskraft und/oder Bremszeit einer Spindelbremseinheit des Wartungsroboters (9);
- allgemeinen Einstellungen des Wartungsroboters (9); und
- Einstellungen einer Wartungsstation des Wartungsroboters (9); und
- maximaler Anzahl erneuter Ansetzbetriebe unter Verwendung von Hilfsgarn einer Hilfsgarnansetzvorrichtung des Wartungsroboters (9) pro Cops;
- maximaler Anzahl erneuter Ansetzbetriebe unter Verwendung von Hilfsgarn einer Hilfsgarnansetzvorrichtung des Wartungsroboters (9) pro Produktionscharge der Ringspinnmaschine (1).

6. Verfahren nach einem der vorstehenden Ansprüche, **gekennzeichnet durch** den Schritt des Speicherns unterschiedlicher Sätze (A, B, C) von Einstellparametern (e, f, g), wobei die Parameter (e, f, g) von einer oder einer Vielzahl von Garneigenschaften der Garnfeinheit, des Garntyps, der S-/Z-Drehung abhängen.

7. Verfahren nach einem der vorstehenden Ansprüche,
dadurch gekennzeichnet, dass die Einstellparameter (e, f, g) von einer oder einer Vielzahl von Eigenschaften der Ringspinnmaschine (1) abhängen:

- einer Spindelgeschwindigkeit oder einem Spindeltyp;
- einem Läufertyp;
- einem Ringdurchmesser;
- einer Durchquerung;
- einer Hülsenlänge;
- einer Länge der Ringspinnmaschine (1);
- einem Typ der Ringspinnmaschine (1);
- einer Seite der Ringspinnmaschine (1); und
- der Existenz eines Vorgarnstopps.

8. Verfahren nach einem der vorstehenden Ansprüche, **gekennzeichnet durch** den Schritt des Eingebens, durch einen Bediener an dem Wartungsroboter oder der Ringspinnmaschine, einer oder einer Vielzahl von

- der maximalen Suchzeit einer Garnsuchvorrichtung des Wartungsroboters (9), bevor eine Hilfsgarnansetzvorrichtung des Wartungsroboters (9) einen erneuten Ansetzbetrieb unter Verwendung von Hilfsgarn durchführt;
- der maximalen Anzahl erneuter Ansetzbetriebe unter Verwendung von Hilfsgarn einer Hilfsgarnansetzvorrichtung des Wartungsroboters (9) pro Cops pro Produktionscharge;
- der maximalen Anzahl erneuter Ansetzbetriebe unter Verwendung von Hilfsgarn einer Hilfsgarnansetzvorrichtung des Wartungsroboters (9) pro Produktionscharge der Ringspinnmaschine (1).

9. Verfahren nach einem der vorstehenden Ansprüche, **gekennzeichnet durch** den Schritt des Ladens vordefinierter Sätze (A, B, C) von Einstellparametern (e, f, g) in den Speicher (100, 200).

10. Verfahren nach einem der vorstehenden Ansprüche, **gekennzeichnet durch** den Schritt eines Herunter- oder Hochladens von Sätzen (A, B, C) von Einstellparametern (e, f, g) von oder zu einem Server (50) über das Internet (40) zu oder von dem Wartungsroboter (9).

11. Verfahren nach einem der vorstehenden Ansprüche, **gekennzeichnet durch** den Schritt eines Austauschens des Wartungsroboters (9) und des Übertragens des angewandten Satzes (A, B, C) von Einstellparametern (e, f, g) auf den ausgetauschten Wartungsroboter (9).

12. Verfahren nach einem der vorstehenden Ansprüche, **gekennzeichnet durch** den Schritt des

• Übertragens des angewandten Satzes (A, B, C) von Einstellparametern (e, f, g) von dem Wartungsroboter (9) an eine Hauptsteuerung (20) der Ringspinnmaschine (1); und
• Synchronisierens aller Wartungsroboter (9), die mit der Ringspinnmaschine (1) verbunden sind, mit den übertragenen Einstellparametern (e, f, g).

13. Ringspinnmaschine (1) zum Durchführen eines der Verfahrensansprüche 1 bis 12 mit einem Wartungsroboter (9), der entlang einer Reihe von Spinneinheiten (2) der Ringspinnmaschine (1) verschiebbar ist, jede Spinneinheit (2) umfassend eine Spindel (8), wobei der Wartungsroboter (9) an einer konkreten Spinneinheit (2) gestoppt werden kann, um einen Wartungsbetrieb an der Spinneinheit (2) durchzuführen; umfassend

• einen Speicher (100, 200) zum Speichern unterschiedlicher Sätze (A, B, C) von Einstellparametern (e, f, g) für den Wartungsroboter (9), wobei die Einstellparameter (e, f, g) von Garneigenschaften und Eigenschaften der Ringspinnmaschine (1) abhängen;
• eine Anzeige (17, 21) zum Auswählen eines konkreten Garns, das auf der Ringspinnmaschine (1) hergestellt werden soll;
• eine Steuerung (10, 20) zum Anwenden eines der Sätze (A, B, C) von Einstellparametern (e, f, g) auf den Wartungsroboter (9) gemäß dem ausgewählten Garn, das hergestellt werden soll, und die Ringspinnmaschine (1) zur Verwendung während des Wartungsbetriebs,

dadurch gekennzeichnet, dass die Steuerung (10, 20) angepasst ist, um die Erfolgsrate und den Energieverbrauch des Wartungsroboters (9) zu überwachen und mindestens einen Einstellparameter (e, f, g) des angewandten Satzes (A, B, C) von Parametern (e, f, g) in Abhängigkeit von der Erfolgsrate und/oder dem Energieverbrauch zu ändern.

14. Ringspinnmaschine (1) nach Anspruch 13, **gekennzeichnet durch** eine Schnittstelle zum Herunter- oder Hochladen von Sätzen (A, B, C) von Einstellparametern (e, f, g) von oder zu einem Server (50) in dem Internet (40) zu oder von dem Wartungsroboter (9).

15. Ringspinnmaschine (1) nach einem der vorstehenden Ansprüche 13 bis 14, **dadurch gekennzeichnet, dass** die Einstellparameter (e, f, g) Parameter (A, B, C) umfassen zum Einstellen eines oder einer Vielzahl von einer Garnsuchvorrichtung des Wartungsroboters (9);

einer Hülsenhandhabungsvorrichtung des Wartungsroboters (9);
einer Läufer-Faden-vorrichtung des Wartungsroboters (9);
einer Garnhandhabungsvorrichtung des Wartungsroboters (9);
einer Parkposition einer Lauf- und Positionsvorrichtung des Wartungsroboters (9); einer Spindelbremseinheit des Wartungsroboters (9);
einer Hilfsgarnansetzvorrichtung des Wartungsroboters (9);
allgemeinen Einstellungen des Wartungsroboters (9); und/oder Einstellungen einer Wartungsstation des Wartungsroboters (9).

Revendications

1. Procédé de fonctionnement d'un robot de service (9) d'un métier à filer continu à anneaux (1), qui est déplaçable le long d'une rangée d'unités de filage (2) du métier à filer continu à anneaux (1), chaque unité de filage (2) comprenant une broche (8), dans lequel le robot de service (9) peut être arrêté au niveau d'une unité de filage (2) spécifique afin de mettre en œuvre une opération de service au niveau de l'unité de filage (2) ; le procédé comprenant les étapes consistant à

• stocker dans une mémoire (100, 200) différents ensembles (A, B, C) de paramètres de réglage (e, f, g) pour le robot de service (9), ces paramètres de réglage (e, f, g) dépendant de caractéristiques de fil et de caractéristiques du métier à filer continu à anneaux (1) ;
• choisir un fil spécifique à produire sur le métier à filer (1) ;
• appliquer l'un des ensembles (A, B, C) de paramètres de réglage (e, f, g) au robot de service (9) selon le fil choisi à produire et le métier à filer continu à anneaux (1) pour utilisation pendant l'opération de service ; **caractérisé par** les étapes consistant à

• surveiller un taux de réussite et une consommation d'énergie du robot de service (9) et
• changer au moins un paramètre de réglage (e, f, g) de l'ensemble (A, B, C) appliqué de paramètres (e, f, g) en dépendance du taux de réussite et/ou de la consommation d'énergie.

2. Procédé selon la revendication 1, **caractérisé par** l'étape consistant à entrer par un opérateur au niveau du robot de service (9) ou du métier à filer continu à anneaux (1) le fil à produire et/ou un programme de filage définissant au moins le fil.

3. Procédé selon l'une quelconque des revendications précédentes,
caractérisé par l'étape consistant à afficher des statistiques de taux de réussite et/ou de consommation d'énergie du robot de service.

4. Procédé selon l'une quelconque des revendications précédentes, **caractérisé par** l'étape consistant à transférer le taux de réussite et/ou la consommation d'énergie du robot de service (9) et l'ensemble (A, B, C) appliqué de paramètres (e, f, g) à un serveur internet (50).

5. Procédé selon l'une quelconque des revendications précédentes, **caractérisé par** l'étape consistant à stocker différents ensembles (A, B, C) de paramètres de réglage (e, f, g) permettant de régler l'un ou une pluralité parmi

• pression négative, vitesse et direction de courroie, temps de recherche et/ou pression de contact max de dispositif de recherche de fil d'un dispositif de recherche de fil du robot de service (9) ;
• vitesse de rotation, temps de rotation et/ou direction de rotation d'un dispositif de manipulation de tube du robot de service (9) ;
• pression d'air et/ou temps pour une impulsion d'air sous pression d'un dispositif de guidage de fil par curseur mobile du robot de service (9) ;
• temps de raccordement, vitesse de déplacement et/ou pression d'aspiration d'un dispositif de manipulation de fil du robot de service (9) ;
• vitesse minimale et maximale et/ou temps pour se déplacer à une position de parcage d'un dispositif de déplacement et de positionnement du robot de service (9) ;
• force de freinage et/ou temps de freinage d'une unité de freinage de broche du robot de service (9) ;
• réglages généraux du robot de service (9) ; et
• réglages d'un poste de service du robot de service (9) ; et
• nombre maximal d'opérations de raccordement renouvelé à l'aide d'un fil auxiliaire d'un dispositif de raccordement de fil auxiliaire du robot de service (9) par bobine ;
• nombre maximal d'opérations de raccordement renouvelé à l'aide d'un fil auxiliaire d'un dispositif de raccordement de fil auxiliaire du robot de service (9) par lot de production du métier à filer continu à anneaux (1).

6. Procédé selon l'une quelconque des revendications précédentes,
caractérisé par l'étape consistant à stocker différents ensembles (A, B, C) de paramètres de réglage (e, f, g) ces paramètres (e, f, g) dépendant de l'un ou d'une pluralité parmi nombre de fils, type de fil, torsion S/Z, en guise de caractéristiques de fil.

7. Procédé selon l'une quelconque des revendications précédentes,
caractérisé en ce que les paramètres de réglage (e, f, g) dépendent de l'une ou d'une pluralité de caractéristiques du métier à filer continu à anneaux (1) :

• une vitesse de broche ou un type de broche ;
• un type de curseur mobile ;
• un diamètre d'anneau ;
• un va-et-vient ;
• une longueur de tube ;
• une longueur du métier à filer continu à anneaux (1) ;
• un type du métier à filer continu à anneaux (1) ;
• un côté du métier à filer continu à anneaux (1) ; et
• l'existence d'un dispositif d'arrêt de mèche.

8. Procédé selon l'une quelconque des revendications précédentes,
caractérisé par l'étape consistant à entrer par un opérateur au niveau du robot de service ou du métier à filer continu à

anneaux l'un ou une pluralité parmi

- le temps de recherche max d'un dispositif de recherche de fil du robot de service (9) avant qu'un dispositif de raccordement de fil auxiliaire du robot de service (9) ne mette en œuvre une opération de raccordement renouvelé à l'aide d'un fil auxiliaire ;
- le nombre maximal d'opérations de raccordement renouvelé à l'aide d'un fil auxiliaire d'un dispositif de raccordement de fil auxiliaire du robot de service (9) par bobine par lot de production ;
- le nombre maximal d'opérations de raccordement renouvelé à l'aide d'un fil auxiliaire d'un dispositif de raccordement de fil auxiliaire du robot de service (9) par lot de production du métier à filer continu à anneaux (1).

9. Procédé selon l'une quelconque des revendications précédentes, **caractérisé par** l'étape consistant à charger des ensembles (A, B, C) prédéfinis de paramètres de réglage (e, f, g) dans la mémoire (100, 200).

10. Procédé selon l'une quelconque des revendications précédentes, **caractérisé par** l'étape consistant à télécharger ou à téléverser des ensembles (A, B, C) de paramètres de réglage (e, f, g) à partir d'un ou vers un serveur (50) sur internet (40) vers le ou à partir du robot de service (9).

11. Procédé selon l'une quelconque des revendications précédentes, **caractérisé par** l'étape consistant à remplacer le robot de service (9) et à transférer l'ensemble (A, B, C) appliqué de paramètres de réglage (e, f, g) vers le robot de service (9) remplacé.

12. Procédé selon l'une quelconque des revendications précédentes, **caractérisé par** l'étape consistant à

- transférer l'ensemble (A, B, C) appliqué de paramètres de réglage (e, f, g) à partir du robot de service (9) vers un dispositif de commande principal (20) du métier à filer continu à anneaux (1) ; et
- synchroniser tous les robots de service (9) connectés au métier à filer continu à anneaux (1) avec les paramètres de réglage (e, f, g) transférés.

13. Métier à filer continu à anneaux (1) permettant de mettre en œuvre l'une des revendications de procédé 1 à 12 avec un robot de service (9), qui est déplaçable le long d'une rangée d'unités de filage (2) du métier à filer continu à anneaux (1), chaque unité de filage (2) comprenant une broche (8), dans lequel le robot de service (9) peut être arrêté au niveau d'une unité de filage (2) spécifique afin de mettre en œuvre une opération de service au niveau de l'unité de filage (2) ; comprenant

- une mémoire (100, 200) permettant de stocker différents ensembles (A, B, C) de paramètres de réglage (e, f, g) pour le robot de service (9), ces paramètres de réglage (e, f, g) dépendant de caractéristiques de fil et de caractéristiques du métier à filer continu à anneaux (1) ;
- un affichage (17, 21) permettant de choisir un fil spécifique à produire sur le métier à filer continu à anneaux (1) ;
- un dispositif de commande (10, 20) permettant d'appliquer l'un des ensembles (A, B, C) de paramètres de réglage (e, f, g) au robot de service (9) selon le fil choisi à produire et le métier à filer continu à anneaux (1) pour utilisation pendant l'opération de service **caractérisé en ce que** le dispositif de commande (10, 20) est conçu pour surveiller un taux de réussite et une consommation d'énergie du robot de service (9) et pour changer au moins un paramètre de réglage (e, f, g) de l'ensemble (A, B, C) appliqué de paramètres (e, f, g) en dépendance du taux de réussite et/ou de la consommation d'énergie.

14. Métier à filer continu à anneaux (1) selon la revendication 13, **caractérisé par** une interface permettant de télécharger ou de téléverser des ensembles (A, B, C) de paramètres de réglage (e, f, g) à partir d'un ou vers un serveur (50) sur internet (40) vers le ou à partir du robot de service (9).

15. Métier à filer continu à anneaux (1) selon l'une quelconque des revendications 13 à 14 précédentes, **caractérisé en ce que** les paramètres de réglage (e, f, g) comprennent des paramètres (A, B, C) permettant de régler l'un ou une pluralité parmi

un dispositif de recherche de fil du robot de service (9) ;
un dispositif de manipulation de tube du robot de service (9) ;
un dispositif de guidage de fil par curseur mobile du robot de service (9) ;
un dispositif de manipulation de fil du robot de service (9) ;
une position de parcage d'un dispositif de déplacement et de positionnement du robot de service (9) ;

une unité de freinage de broche du robot de service (9) ;
un dispositif de raccordement de fil auxiliaire du robot de service (9) ;
des réglages généraux du robot de service (9) ; et/ou des réglages d'un poste de service du robot de service (9).

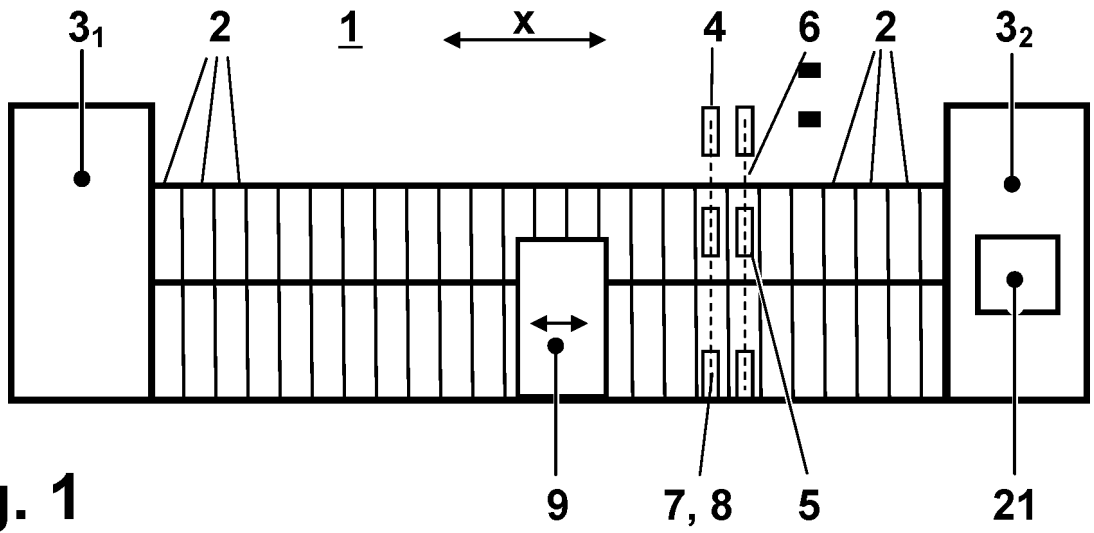

Fig. 1

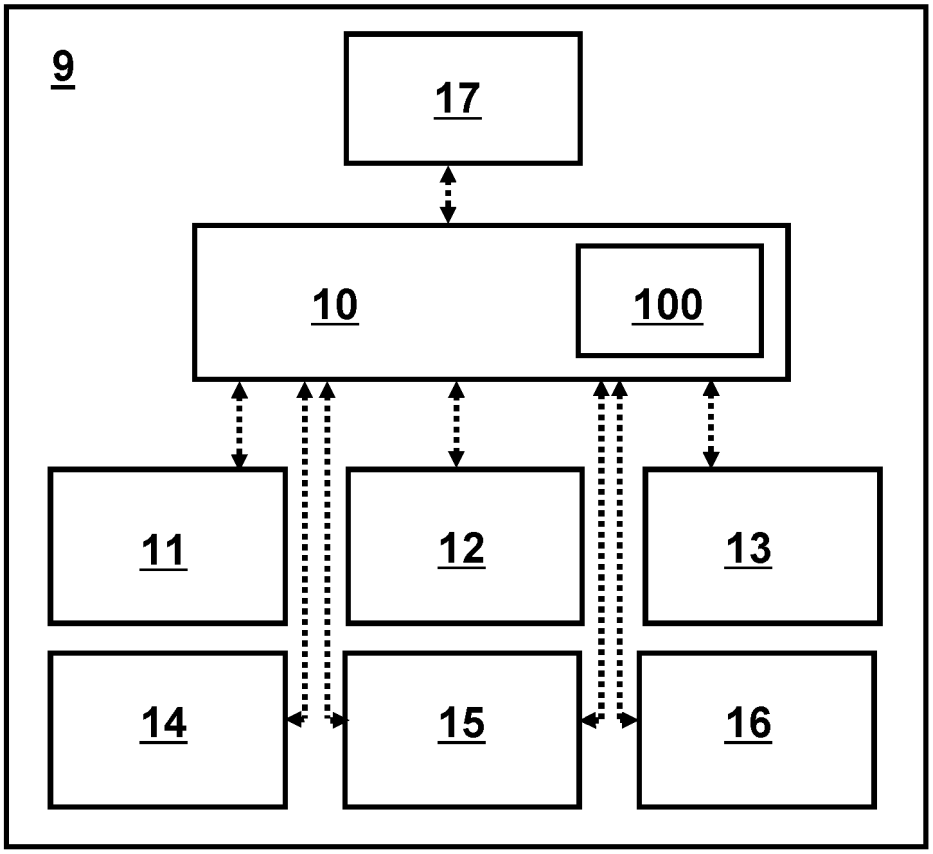

Fig. 2

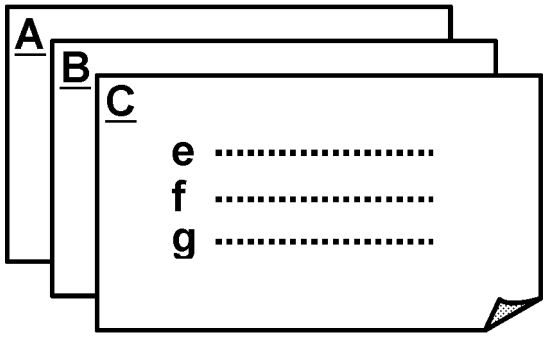

Fig. 3

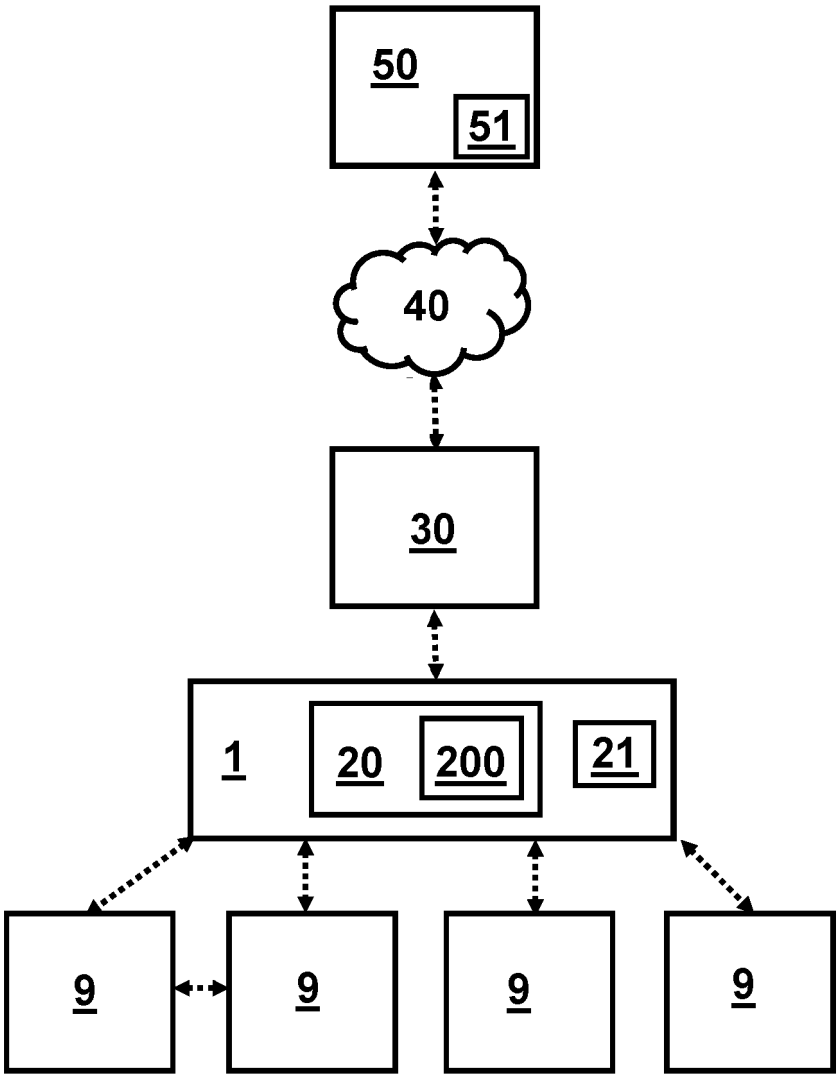

Fig. 4

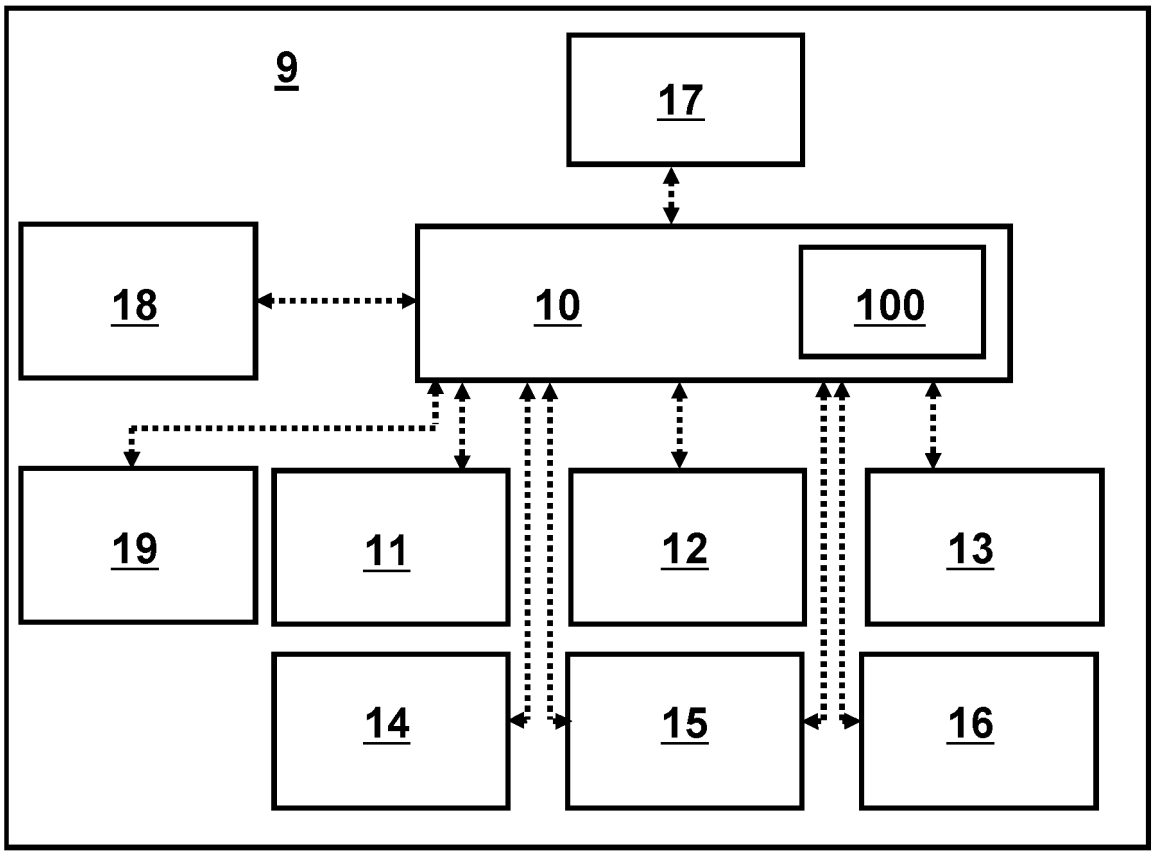

Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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