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(54) **DEVICE AND PROCESS FOR THE
HANDLING AND CONTROL OF THE YARN
IN A CROSWINDING HEAD OF A
CROSWINDING MACHINE IN BOBBIN
DOFFING OPERATIONS**

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(57) **ABSTRACT**

The invention relates to a device and a process for the handling and control of the yarn (1) in a crosswinding head of a crosswinding machine in bobbin (2) doffing operations, said crosswinding machine being equipped with a series of crosswinding heads and at least one service trolley (13), in which the yarn (1) run is moved to a definite position, near the end portion of its course from the pirn to the bobbin (2) and the yarn (1) is subsequently drawn from a handling device (12) of the service trolley (13), cut and, after removal of the bobbin (2), its end coming from the pirn, is arranged on a new winding tube.

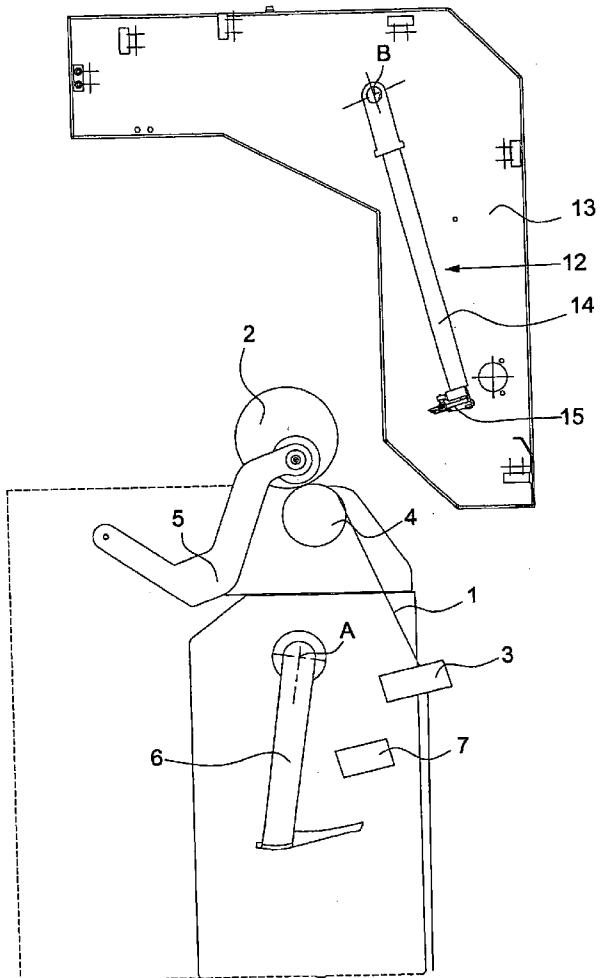


Fig. 1

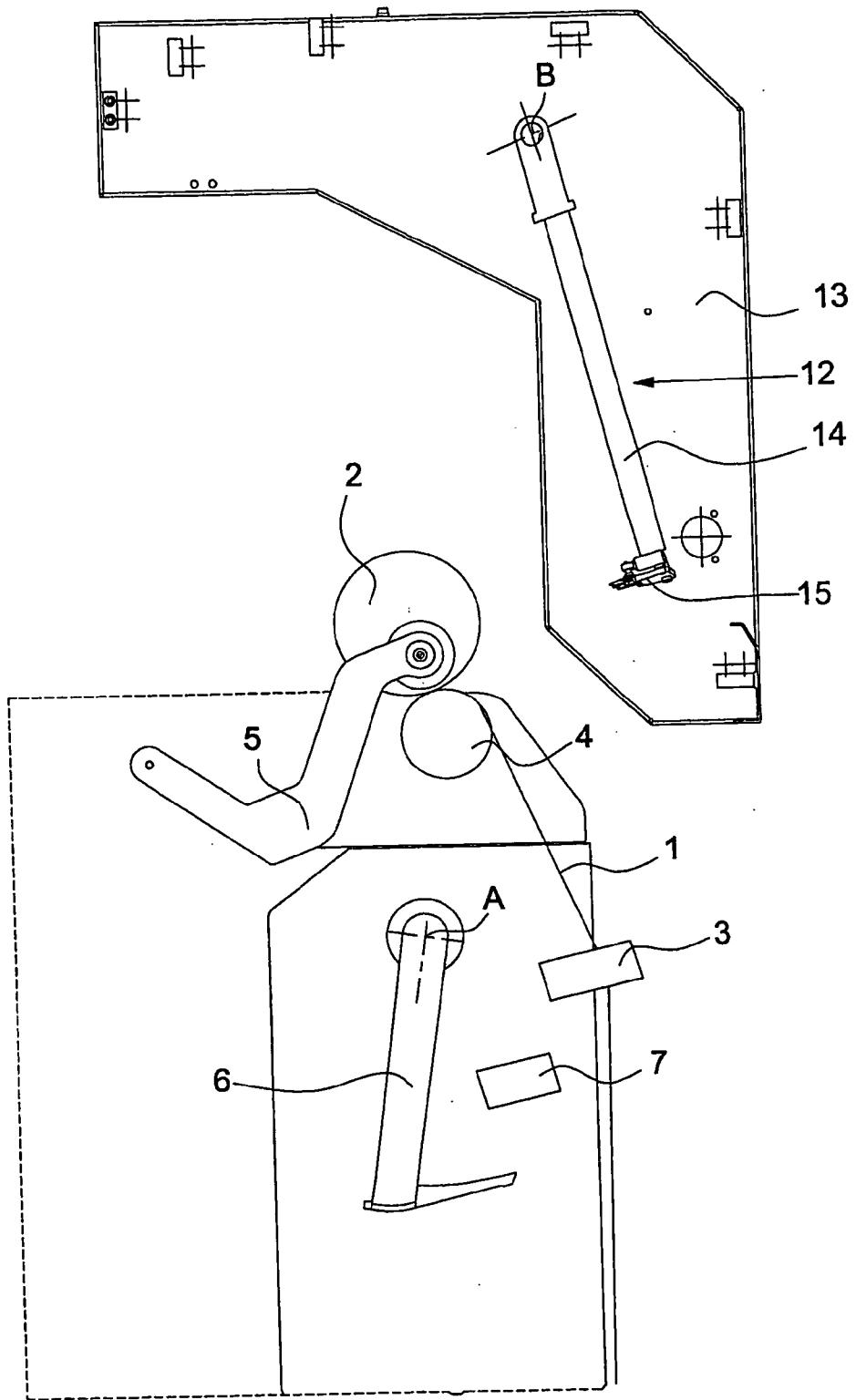


Fig. 2

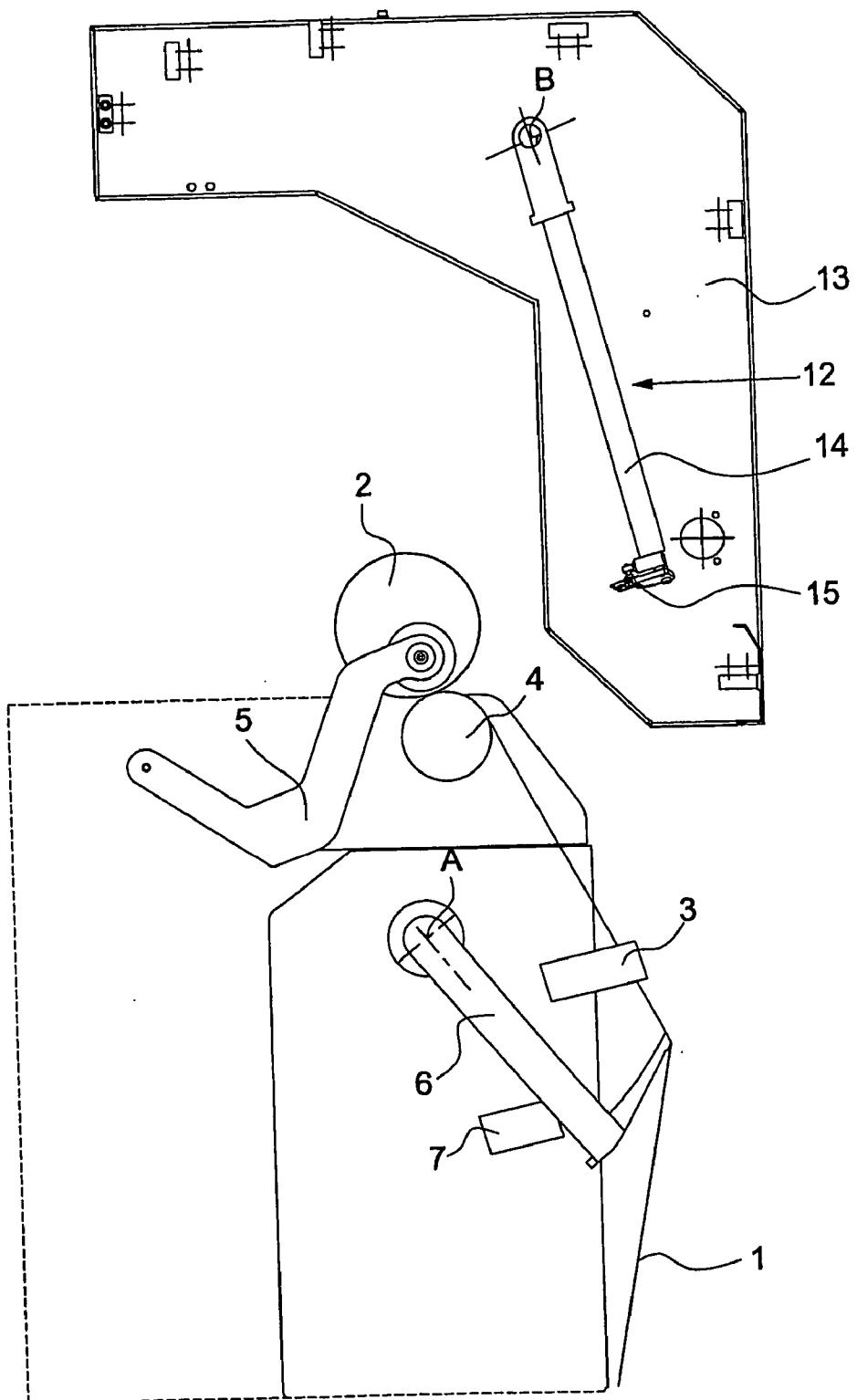


Fig. 3

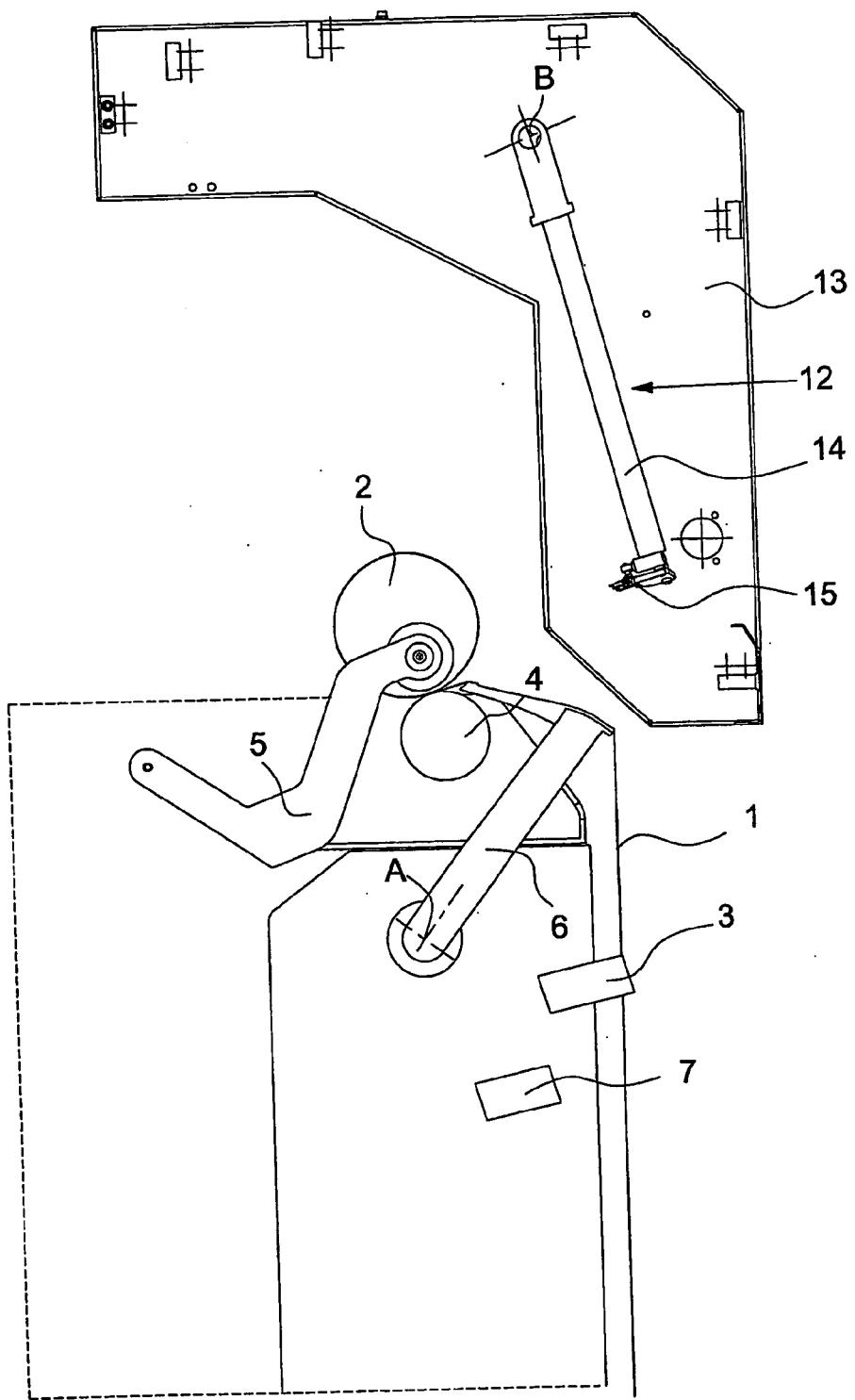


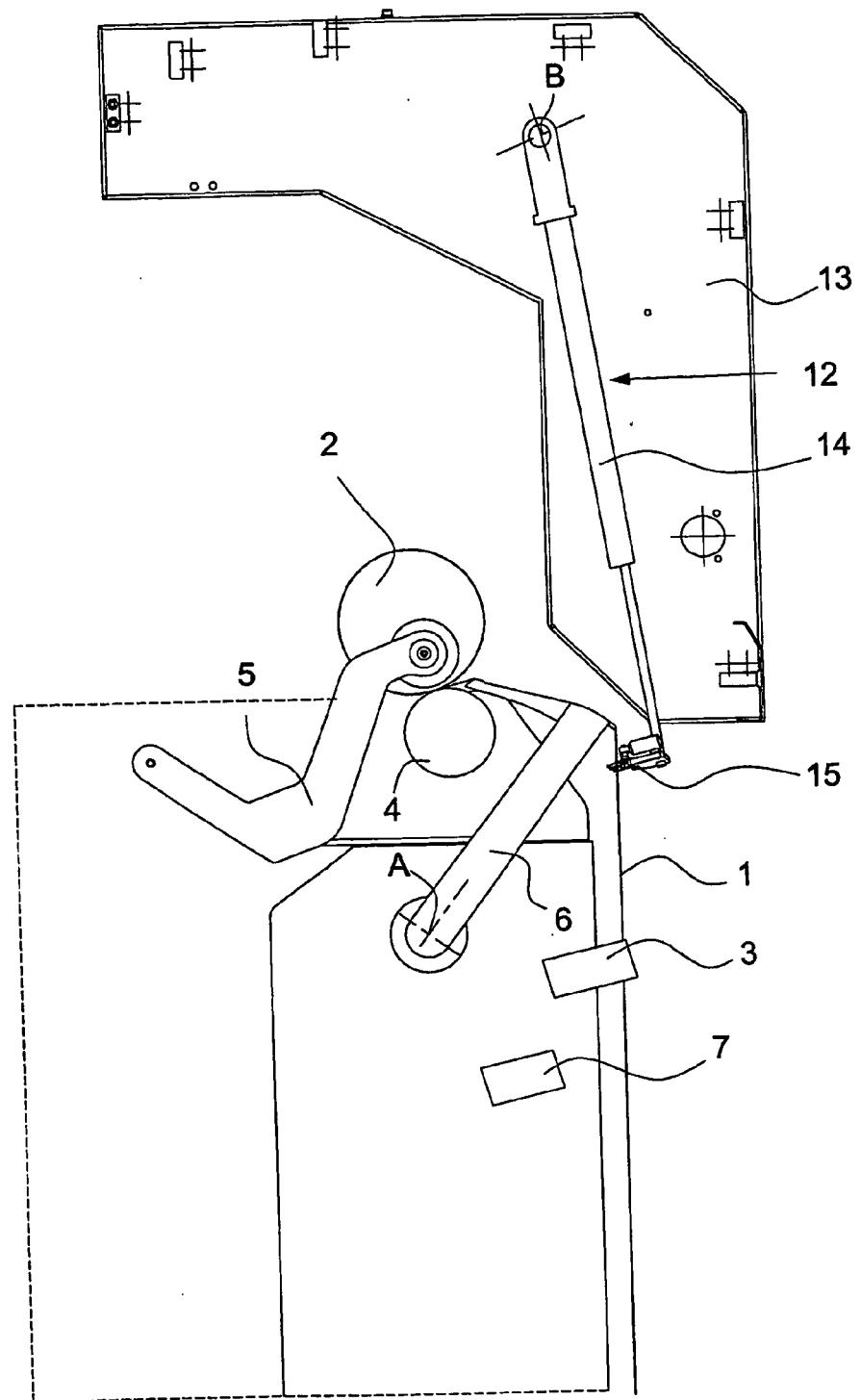
Fig. 4

Fig. 5

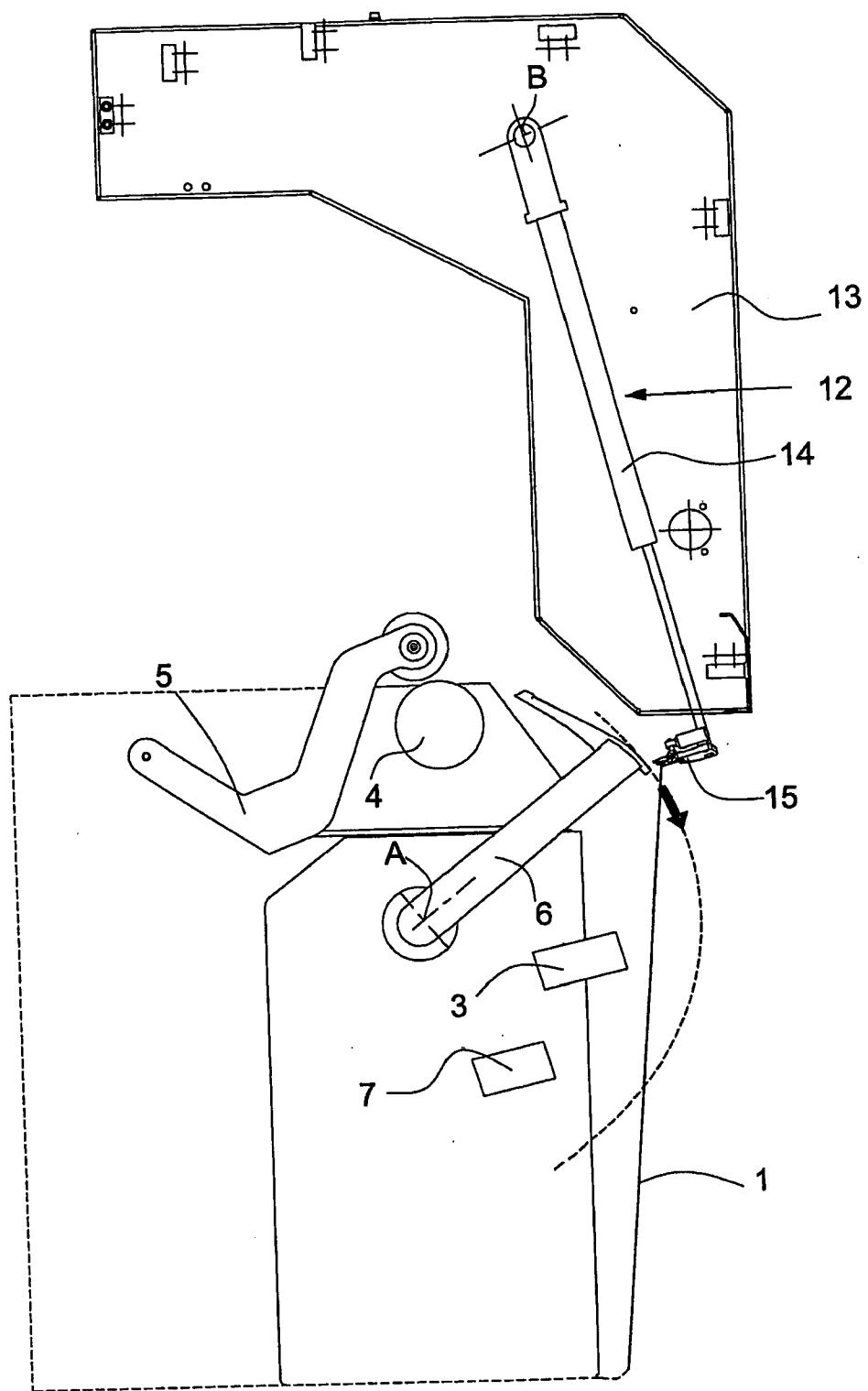
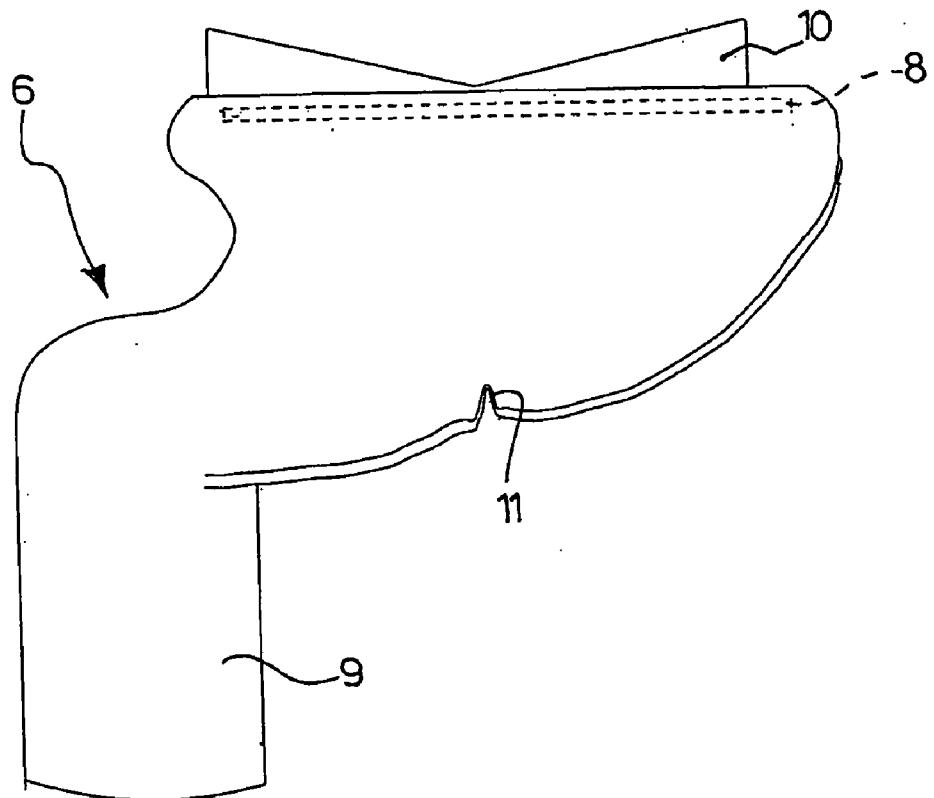


Fig. 6

**DEVICE AND PROCESS FOR THE HANDLING
AND CONTROL OF THE YARN IN A
CROSSWINDING HEAD OF A CROSSWINDING
MACHINE IN BOBBIN DOFFING OPERATIONS**

[0001] The present invention relates to a device and process for the automatic doffing of bobbins in a crosswinding machine, or for the substitution of a bobbin which has reached the pre-established dimensions, with a new tube around which the yarn coming from a feeding pirl is wound to form a new bobbin.

[0002] As is known, the procedure for the formation of a bobbin essentially consists of unwinding operations of the yarn from feeding pirls, cleaning the yarn from possible faults and its crosswinding on tubes, according to forms and dimensions which vary according to the destination of the yarn. If the yarn is destined for feeding high-speed machines, the bobbins are normally cylindrical, or truncated-conical with a low conicity, if, on the contrary, the yarn is destined for feeding low-speed machines, the bobbins are truncated-conical with a higher conicity. The degree of conicity is selected so as to always ensure a correct unwinding of the bobbins during their final use, in the presence of more or less strong centrifugal forces.

[0003] A crosswinding machine allows the contemporaneous formation of a series of bobbins, i.e. it normally comprises a series of so-called crosswinding heads, positioned side by side, and served by at least one common service device, also called trolley, which can run along the whole crosswinding machine, positioning itself in correspondence with each crosswinding head and which effects, in an automated manner, the operations which are cyclically required by each crosswinding head.

[0004] During the formation of the bobbin it may be necessary to intervene to substitute the run-down or faulty pirls, or to substitute the bobbin which has reached the pre-established dimensions, with a new tube.

[0005] In particular, in the case of bobbin doffing, or if it is necessary to substitute a bobbin which has reached the pre-established dimensions, the pirl from which the yarn comes, in turn, not yet being exhausted, the crosswinding head must be stopped in order to be able to discharge the bobbin and substitute it with a new tube. The yarn coming from the pirl is cut and the end is fastened to the new tube to restart the crosswinding.

[0006] Furthermore, according to the known art, each crosswinding head is normally equipped with devices, situated along the run of the yarn from the feeding pirl to the winding bobbin, which eliminate possible defects of the yarn and remedy possible breakages. In the case of yarn defects, in fact, said defects must be located, the yarn must be cut, the faulty part eliminated and the two ends, which have formed on the side of the pirl and bobbin, respectively, must be re-joined. In case of accidental breaking of the yarn, the disruption of the yarn must be detected and the two ends of the yarn, respectively from the one side of the spool/pirl and from the one side of the bobbin, must be once again jointed to each other.

[0007] It is evident that, along the run of the yarn from the unwinding pirl to the winding bobbin, in a crosswinding head, devices for detecting the characteristics of the yarn must be present, together with devices for cutting the yarn,

devices for capturing the ends of the cut (or accidentally broken) yarn and devices for joining the ends of the yarn. In particular, the capturing devices of the cut yarn ends normally consist of two suction mouths, for the collection of the yarn end coming from the pirl and from the bobbin, respectively, situated on arms oscillating between a first position, corresponding to the pirl and the bobbin, respectively, and a second position, in correspondence with the device for joining the yarn ends, also called joiner or knotter.

[0008] The handling and control of the yarn during the bobbin doffing operations, require the intervention of the common service device which, in cooperation with the devices of the crosswinding head situated along the run of the yarn from the feeding pirl to the winding bobbin, recovers the yarn end coming from the pirl, positions the new winding tube and arranges the yarn end on the new winding tube.

[0009] It is therefore important to provide for all the necessary expedients so that all the devices of the different crosswinding heads can cooperate in an optimal way with the common service device, so that the yarn coming from the new pirl is effectively collected by the common service device, which, subsequently, provides for its disposal on the new tube.

[0010] According to the known art, when it is necessary to substitute a bobbin which has reached the pre-established dimensions, the yarn running from the pirl to the bobbin is cut to prevent its continued winding onto the bobbin as a result of the rotation inertia of the same. The yarn ends connected to the pirl and the bobbin are recovered by means of respective suction mouths (in particular, for the end wound onto the bobbin, it is necessary to wait until the bobbin has stopped, the bobbin is then rotated in the opposite direction with respect to the winding direction, until a sufficiently long yarn end is unwound from the bobbin and can be sucked by the suction mouth) and carried by the same to the joining device, which re-establishes the yarn continuity only at this point, as the yarn is not moving, can the service trolley intervene, collecting the yarn by means of a first manipulation device, cutting it, maintaining the end coming from the pirl, then, by means of a second manipulation device, removing the bobbin, which has reached the pre-established dimensions, and positioning a new winding tube, whereas the first manipulation device wedges the yarn coming from the pirl between the tube base and the counterpoint of the bobbin-holder arm. In this way it is possible to restart the yarn winding operations around the tube, to form a new bobbin.

[0011] The above procedure is not very effective as it requires a cutting and subsequent joining of the yarn before the service trolley can intervene and recut the yarn. This procedure however not only solves the problem of the undesired winding of the yarn around the bobbin, due to the rotation inertia of the same, but, above all, it facilitates the withdrawal of the yarn by the manipulation device of the service trolley, which only intervenes when the yarn has stopped. In order to assure a uniform winding of the yarn on the bobbin, in fact, a so-called cross-winding is effected, using means which guide the yarn with a backward-forward movement along the whole length of the bobbin in formation. These means can consist, for example, of a so-called driving or traversing cylinder i.e. which makes the bobbin

rotate and having grooves on its surface which, while the cylinder is rotating and makes the bobbin rotate, direct the yarn according to a backward-forward movement from one end to the other of the bobbin. Under these conditions, the difficulty for the trolley to intervene on the moving yarn, due to the continuous movement of the yarn during its winding onto the bobbin, can be easily understood.

[0012] According to alternative solutions of the known art, it was proposed to cut the yarn when the bobbin has reached the desired dimensions, not to recover however the two ends to re-establish the yarn continuity, but only to recover the end on the pirl side and deliver it to the trolley to be inserted on the winding tube.

[0013] A known procedure for the capturing of the feeding pirl end and its consignment to the service trolley, is described in the patent EP 1127831 in the name of Schlafhorst AG, and envisages that the yarn end be collected by an arm equipped with a nipper which delivers it to a seizure and cutting device situated near the joiner. The yarn is cut by this seizure and cutting device and is collected by a collecting device, from which it is collected by a special supplementary sucking tube which transfers the cut yarn to a seizure and cutting device situated in the upper zone of the crosswinding head, wherein the yarn can be easily reached by the manipulator of the service trolley. This solution requires a series of specific devices, in correspondence with each crosswinding head, which only operate when necessary.

[0014] According to European patent application EP 1236668, in the name of Murata Kikai Kabushiki Kaisha, a procedure is described wherein the yarn end on the pirl side is collected by the suction mouth which is on the side of the pirl and directly delivered by the same to the manipulator of the common service trolley. This solution does not require additional devices on the crosswinding heads, but it is necessary to equip the service trolley manipulator with an extendable arm, capable of reaching and collecting the yarn end in a lowered position with respect to that required for its subsequent arrangement on the tube.

[0015] In European patent application EP 1428783, in the name of Sauer GmbH, a process and a device are described which allow the recovery of the yarn end coming from the pirl, by sucking it with the suction mouth which is situated on the side of the pirl and carrying it to a area crossed by the run of the suction mouth situated on the side of the bobbin. After positioning the suction mouth which is on the side of the bobbin, near the yarn, the suction of the suction mouth situated on the bobbin side is stopped, whereas the suction is activated of the suction mouth which is on the side of the bobbin. In this way, the suction mouth on the side of the bobbin takes delivery of the yarn end. The suction mouth situated on the bobbin side is then rotated to the position near the bobbin, wherein the yarn is collected by the manipulator of the common service trolley. In this way, the intervention of the service trolley is facilitated with respect to the disclosure of the Murata patent, as it is not necessary to excessively extend the arm of the service trolley, but the exchange efficiency of the yarn between the two suction mouths which takes place by deactivating the suction of the suction mouth which is on the side of the pirl and thus allowing the suction mouth situated on the side of the bobbin to suck the yarn end, does not guarantee adequate success, bearing in mind that there can be a considerable yarn length

already engaged by the suction mouth on the pirl side, which can therefore hinder the sucking action on the part of the suction mouth on the side of the bobbin. This possibility of error in the consignment of the yarn is extremely undesirable as it would jeopardize the restarting of the crosswinding head, thus creating a lack of production.

[0016] An objective of the present invention is to facilitate the intervention of the service trolley, in particular its collection of the yarn to be inserted in the new winding tube during the doffing operations of a bobbin which has reached the desired dimensions.

[0017] A further objective of the present invention is to guarantee a higher productivity of the crosswinding machine through a higher operating factor.

[0018] These objectives according to the present invention are achieved by providing a process for the handling and control of the yarn in a crosswinding machine in doffing operations of a bobbin, as specified in claim 1, and a crosswinding machine particularly suitable for the embodiment of this process as claimed in claim 12, as well as a particular suction mouth as described in claim 16.

[0019] Further characteristics of the process, the crosswinding machine and the suction mouth according to the present invention, are described in the respective dependent claims.

[0020] The present invention will be now described, for illustrative but non-limiting purposes, according to one of its preferred embodiments, with particular reference to the figures of the annexed drawings, wherein

[0021] FIG. 1 schematically shows some of the devices of a crosswinding head and a service trolley of a crosswinding machine during crosswinding.

[0022] FIGS. 2-5 schematically show some of the devices of a crosswinding head and a service trolley of a crosswinding machine during a sequence of phases of the process for the handling and control of the yarn in bobbin doffing operations,

[0023] FIG. 6 shows a suction mouth for the recovery of yarn ends on the side of the bobbin, which has positioning means of the yarn on its back, according to an embodiment of the present invention.

[0024] With reference to FIG. 1, various devices are shown of a preferred embodiment of a crosswinding head during crosswinding operations, and in particular a yarn 1, coming from a pirl (not shown), which is wound around the bobbin 2, together with a slit plate 3, a driving and traversing cylinder 4 and a bobbin-holding arm 5. A suction mouth 6 for sucking yarn 1 ends on the side of the bobbin 2 and a joiner 7, are also shown.

[0025] Under normal operating conditions, FIG. 1, the yarn 1 which is unwound from the pirl to the bobbin 2 crosses the slit plate 3, which has the function of detecting defects of the yarn 1, and, possibly, cutting it by means of a cutting device not shown in the figures, but substantially situated in the same position as the same slit plate 3. The driving and traversing cylinder 4 guides the yarn 1, through a backward-forward movement on the whole length of the bobbin 2, so that the yarn 1 is uniformly distributed on the whole length of the bobbin 2. For this purpose, the surface

of the driving and traversing cylinder **4** is crossed by a series of grooves, also called cavities, inside which the yarn **1** is passed, the same driving and traversing cylinder **4** being maintained under rotation.

[0026] The function of the suction mouth **6** and of a corresponding suction mouth on the side of the pirn (not shown) is to take up the ends of the yarn **1**, possibly formed due to the cutting or breakage of the yarn **1** and respectively connected to the pirn and the bobbin **2**, and deliver them to the joining device **7**, which reestablishes the continuity of the yarn **1**.

[0027] With reference to **FIG. 2**, according to the present invention, in correspondence with the detection of the formation of the pre-established dimensions of the bobbin **2**, or, in any case, in correspondence with a command for changing the bobbin **2**, the suction mouth **6** on the side of the bobbin, is moved, by rotating around an axis A, from its rest position to the position near the bobbin **2**, without activating the suction. During its movement, the suction mouth **6** intercepts the run of the yarn **1**, which is forced to pass onto the back of the suction mouth **6**.

[0028] As an alternative, the movement of the suction mouth can be activated, during the rotation of the bobbin **2** or after stopping it. In this second option, the yarn **1** can be cut, the bobbin **2** slowed down and the two yarn ends joined, as in the procedure of the known art described above, before starting the movement of the suction mouth **6** on the side of the bobbin **2**.

[0029] When the rotation of the bobbin **2** is interrupted before the suction mouth **6** has reached the position near the bobbin **2** from its rest position, the necessary amount of yarn due to the engagement of the yarns itself on the back of the suction mouth, will be taken from the pirn. Furthermore, in order to facilitate the exit of the yarn **2** from the grooves of the driving and traversing **4**, it may be necessary to maintain the same driving and traversing cylinder **4** in rotation, after removing the connection through which the cylinder **4** transmitted its movement to the bobbin **2** in formation.

[0030] During the movement phase of the suction mouth **6**, the position of the yarn **1** on its back, can be conveniently constrained through positioning means. With reference to **FIG. 6**, in fact, as the suction inlet **8** of the suction mouth **6** is extremely large (due to the main function of the suction mouth **6**, consisting in recovering the end of a cut yarn from the bobbin **3**, said end being at any point of the bobbin length), the back of the suction mouth **6** becoming narrower from the suction inlet **8** towards the oscillating arm **9**, the yarn **1** can be situated in any point of the back of the suction mouth **6** and, during its rotation around the rotation axis A, in the absence of positioning means, it could also fall to the side.

[0031] The positioning means of the yarn **1** are preferably in the form of at least one draft, situated on the back of the suction mouth **6**, V-shaped so that, once the yarn **1** is collected along the arms of the V-shaped draft, the same tends to converge towards the center of the draft itself. With reference to **FIG. 6**, even more preferably, the positioning means of the yarn comprise two V-shaped drafts, a first draft **10** near the sucking inlet **8** of the suction mouth **6**, substantially having the same width as the inlet **8** of the suction mouth **6**, and a second draft **11**, near the oscillating arm **9**,

with reduced dimensions. During rotation around the axis A, in fact, the suction mouth **6** engages the yarn **1** first with its portion closer to the sucking inlet **8**. Consequently, due to the effect of the first draft **10**, the yarn **1** will have already reached a well-defined position when it engages the whole back of the suction mouth **6**, and consequently the second draft **11**.

[0032] With reference to **FIG. 3**, when the suction mouth **6** has reached the end of its run, or with the suction inlet **8** near the driving and traversing cylinder **4**, the yarn **2** occupies a well-defined position in the space between the back of the suction mouth **6** farthest away from the suction inlet **8** and the slit plate **3**. In correspondence with this position, the yarn **1** can be reached with great precision by the manipulating device **12** of a service trolley **13**. In particular, the manipulating device **12** comprises a telescopic arm **14**, which can rotate around an axis B, at whose end there is a nipping and cutting device **15**.

[0033] From an operative point of view, the call signal of the service trolley **13** on the part of the crosswinding head during a doffing operation of a bobbin, can be sent in correspondence with reaching the pre-established filling degree of the bobbin **2**, but also before this, so that the service trolley **13** is positioned in correspondence with the crosswinding head before the suction mouth **6** reaches the intervention position of the manipulation device **12**. In this way, the devices of the trolley **13** which are involved in the doffing operations of the bobbin and its substitution with a new tube, are ready to intervene the very moment in which the suction mouth **6** has reached the intervention position, but the trolley **13** could be forced to wait.

[0034] As an alternative, the call signal of the service trolley **13** can be sent subsequently, so that the trolley **13** is situated in correspondence with the crosswinding head after the suction mouth **6** has reached the intervention position of the manipulation device **12**. In this way, the time the service trolley **13** dedicates to the specific crosswinding head for the doffing operations of the bobbin **2** and its substitution, is minimized, but the crosswinding head could be forced to remain on standby.

[0035] With reference to **FIG. 4**, once the service trolley **13** and the suction mouth **6** are in the right position, the telescopic arm **14** extends and the nipping and cutting device **15** collects the yarn **1**, in correspondence with the area immediately behind the back of the suction mouth **6**, as defined by the positioning device situated on said back.

[0036] With reference to **FIG. 5**, the nipping and cutting device **15** subsequently cuts the yarn **1** and withholds the end coming from the pirn, whereas the bobbin **2**, freed by the bobbin-holding arm **5**, is moved away.

[0037] Still maintaining the hold of the yarn end **1** coming from the pirn, the manipulating device **12** moves away from the crosswinding head, to facilitate the return of the suction mouth **6** to its rest position.

[0038] The subsequent insertion phase of the yarn **1** on the new winding tube, can be completed, at this point, by the manipulation device **12**, according to any of the known techniques, which have the common aspect of inserting the end of the yarn **1** between the base of the tube and a counterpoint envisaged on the arm of the bobbin-holder **5**.

[0039] The manipulation device **12** of the service trolley **13** subsequently leaves the yarn **1**, and it is possible to start the formation of a new bobbin, whereas the service trolley **13** is free to intervene on other crosswinding heads of the crosswinding machine.

[0040] The present invention is described for illustrative but non-limiting purposes, according to preferred embodiments, but variations and/or modifications can obviously be applied by experts in the field, all included within the relative protection scope, as defined by the enclosed claims.

1. A process for the handling and control of the yarn **(1)** in a crosswinding head of a crosswinding machine in bobbin **(2)** doffing operations, said crosswinding machine being equipped with a series of crosswinding heads and with at least one service trolley **(13)**, each of said crosswinding heads comprising a pirl, from which a yarn **(1)** is unravelled and is wound to form a bobbin **(2)**, around a winding tube, two mouths for the suction of the yarn **(1)** ends possibly formed, by breakage or cutting, on the side of the pirl or on the side of the bobbin **(2)** respectively, and for the delivery of these ends to a joining device **(7)**, situated along the run of the yarn **(1)** from the pirl to the bobbin **(2)**, to re-establish the yarn continuity, said service trolley **(13)** being capable of running along the whole crosswinding machine, in order to position itself in correspondence with each crosswinding head and comprising a manipulation device **(12)** of the yarn **(1)** characterized in that it comprises the following phases:

moving of the yarn **(1)** run in a defined position, near the terminal portion of its course from the pirl to the bobbin **(2)**,

seizure and cutting of the yarn **(1)**, in correspondence with said defined position on the part of a manipulation device **(12)** of the service trolley **(13)**, which withholds the end coming from the pirl,

distancing of the bobbin **(2)**, arrangement on a new winding tube of the yarn **(1)** coming from the pirl and start of the formation of a new bobbin.

2. The process for the handling and control of the yarn **(1)** in a crosswinding head of a crosswinding machine in bobbin **(2)** doffing operations according to claim 1, characterized in that it comprises the following preliminary phase:

interruption of the winding of the yarn **(1)** onto the bobbin **(2)**.

3. The process for the handling and control of the yarn **(1)** in a crosswinding head of a crosswinding machine in bobbin **(2)** doffing operations according to claim 2, characterized in that said interruption phase of the yarn **(1)** winding onto the bobbin **(2)** comprises the following sub-phase:

stoppage of the bobbin **(2)** rotation.

4. The process for the handling and control of the yarn **(1)** in a crosswinding head of a crosswinding machine in bobbin **(2)** doffing operations according to claim 2, characterized in that said interruption phase of the yarn **(1)** winding onto the bobbin **(2)** comprises the following sub-phases:

cutting of the yarn **(1)**,

slowing down of the rotation of the bobbin **(2)**,

rejoining of the two cut yarn **(1)** ends, and

stoppage of the rotation of the bobbin **(2)**.

5. The process for the handling and control of the yarn **(1)** in a crosswinding head of a crosswinding machine in bobbin **(2)** doffing operations according to claim 1, characterized in that said movement phase of the yarn **(1)** run to a definite position, is effected by positioning means present on each crosswinding head.

6. The process for the handling and control of the yarn **(1)** in a crosswinding head of a crosswinding machine in bobbin **(2)** doffing operations according to claim 1, characterized in that said movement phase of the yarn **(1)** run to a definite position, is effected by positioning means present on the service trolley **(13)**.

7. The process for the handling and control of the yarn **(1)** in a crosswinding head of a crosswinding machine in bobbin **(2)** doffing operations according to claim 1, characterized in that said movement phase of the yarn **(1)** run to a definite position, is effected by positioning means situated on the back of the suction mouth **(6)** on the side of the bobbin and comprising the following sub-phase:

movement of the sucking **(6)** mouth on the side of the bobbin from its rest position, in correspondence with the joining device **(7)**, to the intervention position of the manipulating device **(12)**, during the movement of the suction mouth **(6)**, the yarn **(1)** being engaged on its back in correspondence with said positioning means.

8. The process for the handling and control of the yarn **(1)** in a crosswinding head of a crosswinding machine in bobbin **(2)** doffing operations according to claim 7, characterized in that during the movement phase of the suction mouth **(6)**, the yarn **(1)** which is engaged on the back of the suction mouth **(6)** unravels from the pirl.

9. The process for the handling and control of the yarn **(1)** in a crosswinding head of a crosswinding machine in bobbin **(2)** doffing operations according to claim 7, characterized in that it comprises a return phase of the suction mouth **(6)** to its rest position, following the collection and cutting phase of the yarn **(1)** on the part of the manipulating device **(12)**, during which the manipulating device **(12)** moves away from the crosswinding head so as not to obstruct the movement of the suction mouth **(6)**.

10. The process for the handling and control of the yarn **(1)** in a crosswinding head of a crosswinding machine in bobbin **(2)** doffing operations according to claim 1, characterized in that the service trolley **(13)** is positioned in correspondence with the crosswinding head before the suction mouth **(6)** begins moving towards the bobbin **(2)**.

11. The process for the handling and control of the yarn **(1)** in a crosswinding head of a crosswinding machine in bobbin **(2)** doffing operations according to claim 1, characterized in that the service trolley **(13)** is positioned in correspondence with the crosswinding head after the suction mouth **(6)** has reached the intervention position of the manipulating arm **(12)**.

12. A crosswinding machine comprising a series of crosswinding heads and at least one service trolley **(13)**, each of said crosswinding heads comprising a pirl, from which a yarn **(1)** is unravelled and is wound around a bobbin **(2)**, two mouths for the suction of the yarn **(1)** ends possibly formed, by breakage or cutting, on the side of the pirl or on the side of the bobbin **(2)** respectively, and for the delivery of these ends to a joining device **(7)**, situated along the run of the yarn **(1)** from the pirl to the bobbin **(2)**, to re-establish the yarn continuity, said service trolley **(13)** being capable of running along the whole crosswinding machine, in order to

position itself in correspondence with each crosswinding head and comprising a manipulation device (12) of the yarn (1) characterized in that it comprises means for moving the run of the yarn (1) to a definite position, close to the terminal portion of its course from the pirl to the bobbin (2), said means being positioned on each crosswinding head or on the service trolley (13).

13. The crosswinding machine according to claim 12, characterized in that said movement means of the course of the yarn (1) consist of an oscillating arm which engages the yarn (1) on its end, in correspondence with a draft.

14. The crosswinding machine according to claim 12, characterized in that said movement means of the course of the yarn (1) consist of at least one draft, situated on the back of the suction mouth (6).

15. The crosswinding machine according to claim 14, characterized in that said means for the collection and

positioning of the yarn (1) consist of two V-shaped drafts, a first draft (10) near the sucking inlet (8) of the suction mouth (6), substantially having the same width as the inlet (8) of the suction mouth (6), and a second draft (11), near the oscillating arm (9) of the suction mouth (6).

16. A suction mouth (6) of a crosswinding machine, characterized in that it has at least one draft on its back.

17. The suction mouth (6) according to claim 16, characterized in that it has two drafts on its back, a first draft (10) near the sucking inlet (8) of the suction mouth (6), substantially having the same width as the inlet (8) of the suction mouth (6), and a second draft (11), near the oscillating arm (9) of the suction mouth (6).

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