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(54) **SPINNING MACHINE WITH SEMI-AUTOMATIC DOFFING AND A METHOD OF SEMI-AUTOMATIC DOFFING IN A SPINNING MACHINE**

(57) Spinning machine (4) with semi-automatic doffing comprising a spinning unit (8) which produces a yarn (12), said yarn (12) being wound on a tube (16) to form a reel (20), said tube being pivotally supported by a reel-holder arm (24) fitted with a pair of tailstocks (28) between which the tube is pivotally supported, wherein at least one of said tailstocks of the reel-holder arm is an active tailstock (32), so as to be controllable in opening and/or closing, wherein at least one of said tailstocks of the reel-holder arm is a yarn hooking tailstock (34), provided with at least one mechanical means (52) configured to intercept said yarn. The spinning machine is provided with at least one piecing cart (36) having a movable nozzle (40), configured to aspirate the yarn produced by the spinning unit and bring it to an intermediate handover position (44). The piecing cart having a movable yarn-holding unit (48), configured to recuperate the yarn in said intermediate handover position with the movable nozzle, tension it and position it in proximity to said at least one yarn hooking tailstock, so as to allow said at least one yarn hooking tailstock to fix the yarn to the tube.

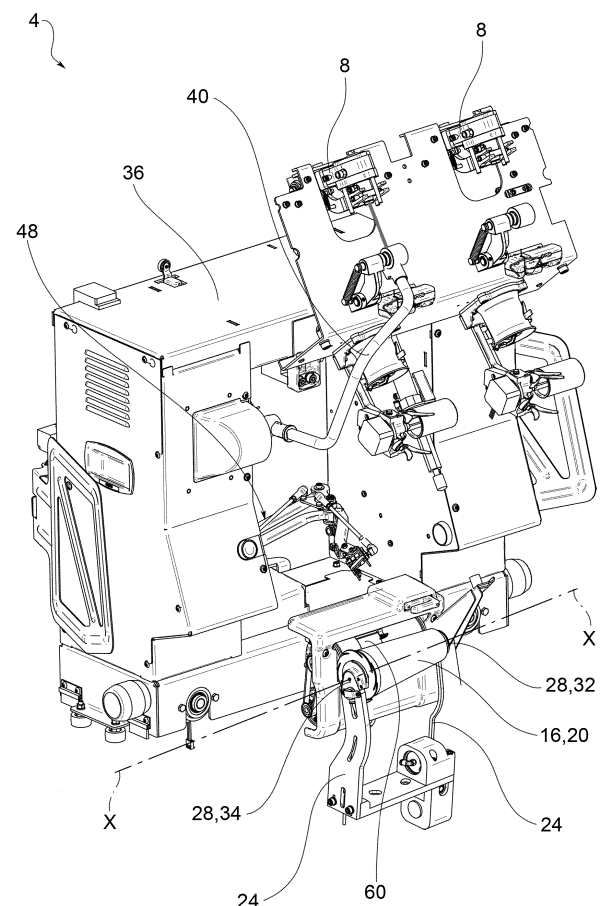


FIG.1

Description

FIELD OF APPLICATION

[0001] The present invention relates to a spinning machine with semi-automatic doffing and a method of semi-automatic doffing in a spinning machine.

STATE OF THE ART

[0002] It should be noted that the term thread or single thread or continuous thread refers to a single filament or continuous filament (for example in the case of silk, artificial or synthetic fibres), while the term yarn refers to a group of fibrils of varying lengths that are paralleled and joined together by twisting. Hereinafter, one or the other term will be used indifferently, it being understood that the applications of the present invention are not limited to one or the other type.

[0003] As is well known, in spinning systems such as open-end and air-jet systems, when the reel reaches the established size, the system stops spinning and the doffing cycle for that specific reel is started.

[0004] The doffing cart, which the spinning system is usually equipped with, reaches the unit concerned by the doffing cycle, removes the reel from the reel-holder arm, inserts an empty tube from a tube magazine (supplied on the cart or the unit), starts spinning and starts winding the yarn produced by the unit onto the tube.

[0005] Typically, the first coils are wound by clamping the yarn between the tube and the tailstock on the bottom side of the reel and rotating the tube. Restart can be facilitated by the cart by placing the tube in rotation by its own means before releasing it or alternatively can be "brutal" by releasing the tube against the cylinder rotating at full speed.

[0006] All these operations are very delicate, precise and must be carried out in extremely short times and in a perfectly synchronised manner: the doffing cart is therefore a highly complex and costly robot.

[0007] In short, the traditional doffing cycle involves the following operations:

- 1) opening the reel-holder arm to detach the reel from the drive cylinder;
- 2) opening the tube tailstock and simultaneously unloading the reel onto a special belt for reel transport;
- 3) taking an empty tube from the tube magazine and positioning it between the tailstocks;
- 4) starting spinning and suction of the yarn produced;
- 5) positioning of the yarn between the tube and tailstock on the bottom side of the reel and simultaneous closure of the tailstock;
- 6) possible yarn reserve on the tube;
- 7) positioning of the arm in the working position and simultaneous acceleration of the tube up to almost full spinning speed;
- 8) end of cycle.

[0008] In order to be able to carry out all these steps, the doffing cart (or rather, the automatic doffing function) requires the presence of a store of tubes at the head, a mechanism for loading 3 or 4 tubes onto the cart and a system for unloading the yarn waste aspirated during the doffing cycle. The doffing cart must also return to the tube magazine to unload the yarn waste and replenish its stock of tubes. This leads to inefficiency if several reels are being spun at the same time, which is often the case in spinning systems comprising multiple spinning heads.

[0009] If the spinning machine is not equipped with a doffing cart and is therefore not able to carry out doffing in an automated manner, the traditional semi-automatic solution is typically used, which involves manual unloading of the finished reel and manual positioning of the new tube by the operator. This conventional solution, which is the prior art provides, however, that a few metres of yarn are pre-wound onto the tube and that the restart of spinning is in fact configured as a simple piecing cycle carried out by the piecing cart.

[0010] This solution has several disadvantages, such as the fact that yarn has to be manually pre-wound onto the tube, that this yarn is of the same type as the one in production and that an additional join is inevitably produced in the reel and that it is not possible to carry out the yarn reserve.

PRESENTATION OF THE INVENTION

[0011] The need is therefore felt to resolve the drawbacks and limitations mentioned with reference to the prior art.

[0012] Such need is met by a spinning machine with semi-automatic doffing according to claim 1 and a doffing method according to claim 9.

DESCRIPTION OF THE DRAWINGS

[0013] Further characteristics and advantages of the present invention will be more clearly comprehensible from the description given below of its preferred and non-limiting embodiments, wherein:

[0014] figures 1-4 shows partial perspective views of sequential operating steps of a spinning machine according to a further embodiment of the present invention.

[0015] The elements or parts of elements common to the embodiments described below will be indicated using the same reference numerals.

DETAILED DESCRIPTION

[0016] With reference to the aforementioned figures, reference numeral 4 globally denotes a spinning machine with semi-automatic doffing.

[0017] In particular, the spinning machine (4) with semi-automatic doffing comprises a spinning unit 8 which produces a yarn 12, said yarn 12 being wound onto a tube 16 to form a reel 20.

[0018] The tube 16 is pivotally supported by a reel-holder arm 24 fitted with a pair of tailstocks 28 between which the tube 16 is pivotally supported.

[0019] Typically, the tube 16 is arranged along a transverse direction X-X perpendicular to said tailstocks 28. Said transverse direction X-X defines the rotation axis of the tube 16.

[0020] At least one of said tailstocks 28 of the reel-holder arm is an active tailstock 32, so as to be controllable in opening and/or closing, to allow loading/unloading of the tube 16 and/or the reel 20.

[0021] For example, said at least one active tailstock 32 is provided with an electrical, mechanical, or pneumatic opening and closing drive.

[0022] Advantageously, the spinning machine 4 is provided with at least one piecing cart 36 having a movable nozzle 40, configured to aspirate the yarn 12 produced by the spinning unit 8 (figure 1) and bring it to an intermediate handover position 44 (figure 2).

[0023] Preferably, at least one of said tailstocks 28 is a yarn hooking tailstock 34, provided with at least one mechanical yarn catching means 52.

[0024] For example, said mechanical means 52 comprises at least one hook 56.

[0025] According to a possible embodiment, said at least one yarn hooking tailstock 34 comprises a wheel having a plurality of hooks and lying on a plane perpendicular to the axis of rotation of the tube 16.

[0026] In addition, the piecing cart 36 is fitted with a movable yarn-holding unit 48, configured to recuperate the yarn 12 in said intermediate handover position 44 with the movable nozzle 40, tension it and position it in proximity to said at least one yarn hooking tailstock 34 so as to allow said at least one yarn hooking tailstock 34 to intercept the yarn 12 and fix it to the tube 16 (figures 3 -4).

[0027] According to a possible embodiment, the spinning machine 4 is provided with a yarn cleaner (not illustrated); preferably, said intermediate handover position 44 is positioned in proximity to said yarn cleaner.

[0028] Preferably, the spinning machine 4 is provided with a processing and control unit programmed so that said yarn-holding unit 48 manages both the hooking of the yarn 12 onto said at least one yarn hooking tailstock 34, and the amount and position of the yarn 12 rewound at the beginning of the tube 16.

[0029] Advantageously, the spinning machine 4 is equipped with an independent single yarn guide 60, configured to autonomously manage the restarting of the individual spinning units and thus improve reel formation.

[0030] The operation of the spinning machine with semi-automatic doffing according to the present invention will now be described.

[0031] The movable nozzle 40 on the piecing cart 36 aspirates the yarn 12 produced by starting the spinning and brings it downwards, centralizing its position in correspondence with the yarn cleaner, if provided.

[0032] At this point, the special yarn-holding unit 48

positions the yarn 12 under tension near the yarn hooking tailstock 34, the drive cylinder is rotated and the yarn 12 is fixed to the tube by the mechanical hooking means 52, such as the hooked tailstocks 56.

[0033] At the same time, the single yarn guide 60 intercepts the yarn end and, being electronic and single, is able to manage in an accurate and customizable manner the winding of the yarn 12 on the tube 16, creating well-made and easily configurable reels.

[0034] As may be appreciated from the description, the spinning machine described above makes it possible to overcome the drawbacks of the prior art.

[0035] In fact, the present invention illustrates an innovative semi-automatic doffing solution, which leaves to the operator solely the steps of reel unloading and positioning of the empty tube on the tailstocks, and at the same time assigns the functions of yarn winding on the tube and spinning restart to the yarn holding unit of the piecing cart and to the electronic yarn guide system. In this way it is possible to start winding a reel after doffing even without a doffing cart.

[0036] Furthermore, it is no longer necessary for the empty tube to be pre-wound with yarn by hand, let alone with the same yarn as the one being processed.

[0037] Furthermore, the present invention allows a reduction of the number of additional joins during the formation of the reel, with a consequent improvement in the performance of the same in the subsequent phases of the textile cycle (warping, loom, knitting).

[0038] In addition, the method illustrated provides a semi-automatic doffing solution capable of performing yarn reserve on the tube.

[0039] The present invention also appreciably simplifies the architecture of the spinning machine.

[0040] In fact, according to the present invention, the piecing cart is already provided with a yarn waste suction nozzle and the corresponding centralized discharge.

[0041] Moreover, the piecing carts of spinning machines, being typically more than one (normally from 3 to 6), can advantageously replace the doffing carts, i.e. perform the same operations as the doffing carts of the prior solutions. This reduces doffing time by a factor of 3-6 compared to prior solutions, which usually require one or at most two doffing carts.

[0042] Furthermore, in the present invention, if present, the doffing cart becomes a simple cone magazine (up to 15-20) with functionality for unloading/accompanying the reel onto the conveyor belt.

[0043] Moreover, thanks to the tailstock provided with yarn hooking means, it is possible to fix the yarn onto the tube without the need to interpose it between the tailstock and the tube. Using the "hooked" tailstock, it is possible to bring the yarn close to a suitable position and, by slowly starting the drive cylinder, the yarn is blocked and wraps on the tube without getting damaged.

[0044] Lastly, as may be clearly seen, it is possible advantageously to have an automatic and a semi-automatic machine without too many differences.

[0045] A person skilled in the art may make numerous modifications and variations to the solutions described above so as to satisfy contingent and specific requirements.

[0046] The scope of protection of the present invention is defined by the following claims.

Claims

1. Spinning machine (4) with semi-automatic doffing comprising:

- a spinning unit (8) which produces a yarn (12), said yarn (12) being wound on a tube (16) to form a reel (20),
- said tube (16) being pivotally supported by a reel-holder arm (24) fitted with a pair of tailstocks (28) between which the tube (16) is pivotally supported,
- wherein at least one of said tailstocks (28) of the reel-holder arm (24) is an active tailstock (32), so as to be controllable in opening and/or closing,
- wherein the spinning machine (4) is provided with at least one piecing cart (36) having a movable nozzle (40), configured to aspirate the yarn (12) produced by the spinning unit (8) and bring it to an intermediate handover position (44),
- wherein at least one of said tailstocks (28) of the reel-holder arm (24) is a yarn hooking tailstock (34),
- the piecing cart (36) having a movable yarn-holding unit (48), configured to recuperate the yarn (12) in said intermediate handover position (44) with the movable nozzle (40), tension it and position it in proximity to said at least one yarn hooking tailstock (34), so as to allow said at least one yarn hooking tailstock (34) to fix the yarn (12) to the tube (16).

2. The spinning machine (4) with semi-automatic doffing according to claim 1, wherein said at least one active tailstock (32) is provided with an electrical, mechanical or pneumatic opening and closing drive.

3. The spinning machine (4) with semi-automatic doffing according to any of the claims from 1 to 2, wherein said at least one yarn hooking tailstock (34) is provided with at least one mechanical means (52) configured to intercept said yarn (12) and fix it to the tube (16).

4. The spinning machine (4) with semi-automatic doffing according to claim 3, wherein said mechanical means (52) comprises at least one hook.

5. The spinning machine (4) with semi-automatic doff-

ing according to claim 4, wherein said mechanical means (52) comprise a plurality of hooks (56) arranged on a plane perpendicular to the axis of the tube (16).

6. The spinning machine (4) with semi-automatic doffing according to any of the claims from 1 to 5, wherein the spinning machine (4) is fitted with a yarn cleaner and wherein said intermediate handover position (44) is arranged in proximity to said yarn cleaner.

7. The spinning machine (4) with semi-automatic doffing according to any of the claims from 1 to 6, wherein the spinning machine (4) is provided with a processing and control unit programmed so that said yarn-holding unit (48) manages both the hooking of the yarn (12) onto said at least one yarn hooking tailstock (34), and the amount and position of the yarn (12) rewound at the beginning of the tube (16).

8. The spinning machine (4) with semi-automatic doffing according to any of the claims from 1 to 7, wherein the spinning machine (4) is provided with an independent single yarn guide (60) configured to manage the reel formation (20) on restart in an accurate and customizable manner.

9. Semi-automatic doffing method comprising the steps of:

- providing a spinning unit (8) producing a yarn (12), said yarn (12) being wound on a tube (16) to form a reel (20), said tube (16) being pivotally supported by a reel-holder arm (24) fitted with a pair of tailstocks (28) between which the tube (16) is pivotally supported, wherein at least one of said tailstocks (28) of the reel-holder arm (24) is an active tailstock (32), so as to be controllable in opening and/or closing, and at least one of said tailstocks (28) of the reel-holder arm (24) is a yarn hooking tailstock (34),
- providing at least one piecing cart (36) having a movable nozzle (40), so as to aspirate the yarn (12) produced by the spinning unit (8) and bring it to an intermediate handover position (44),
- providing a yarn-holding unit (48) on said piecing cart (36),
- controlling the yarn-holding unit (48) so as to recuperate the yarn (12) in said intermediate handover position (44) with the movable nozzle (40), tension it and position it in proximity of said at least one yarn hooking tailstock (34), so as to allow said yarn hooking tailstock (34) to fix the yarn (12) to the tube (16).

10. The semi-automatic doffing method according to claim 9, comprising the step of actuating the yarn-holding unit (48) to allow the yarn (12) to be engaged

on said at least one yarn hooking tailstock (34) and creating a yarn reserve (34) on the tube (16) during the initial winding step.

11. The semi-automatic doffing method comprising the step of providing a spinning machine (4) according to any of the claims from 1 to 8.

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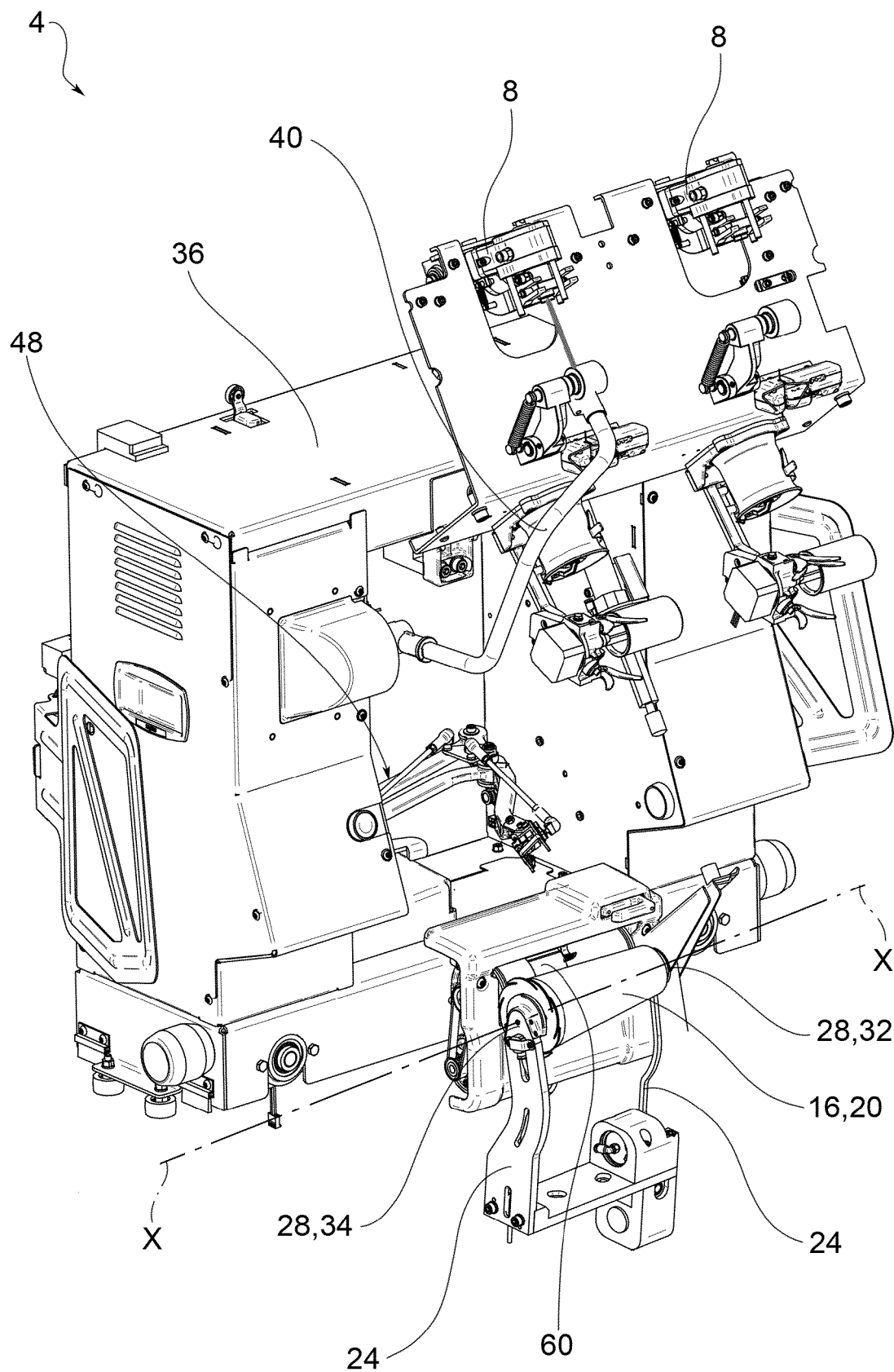


FIG.1

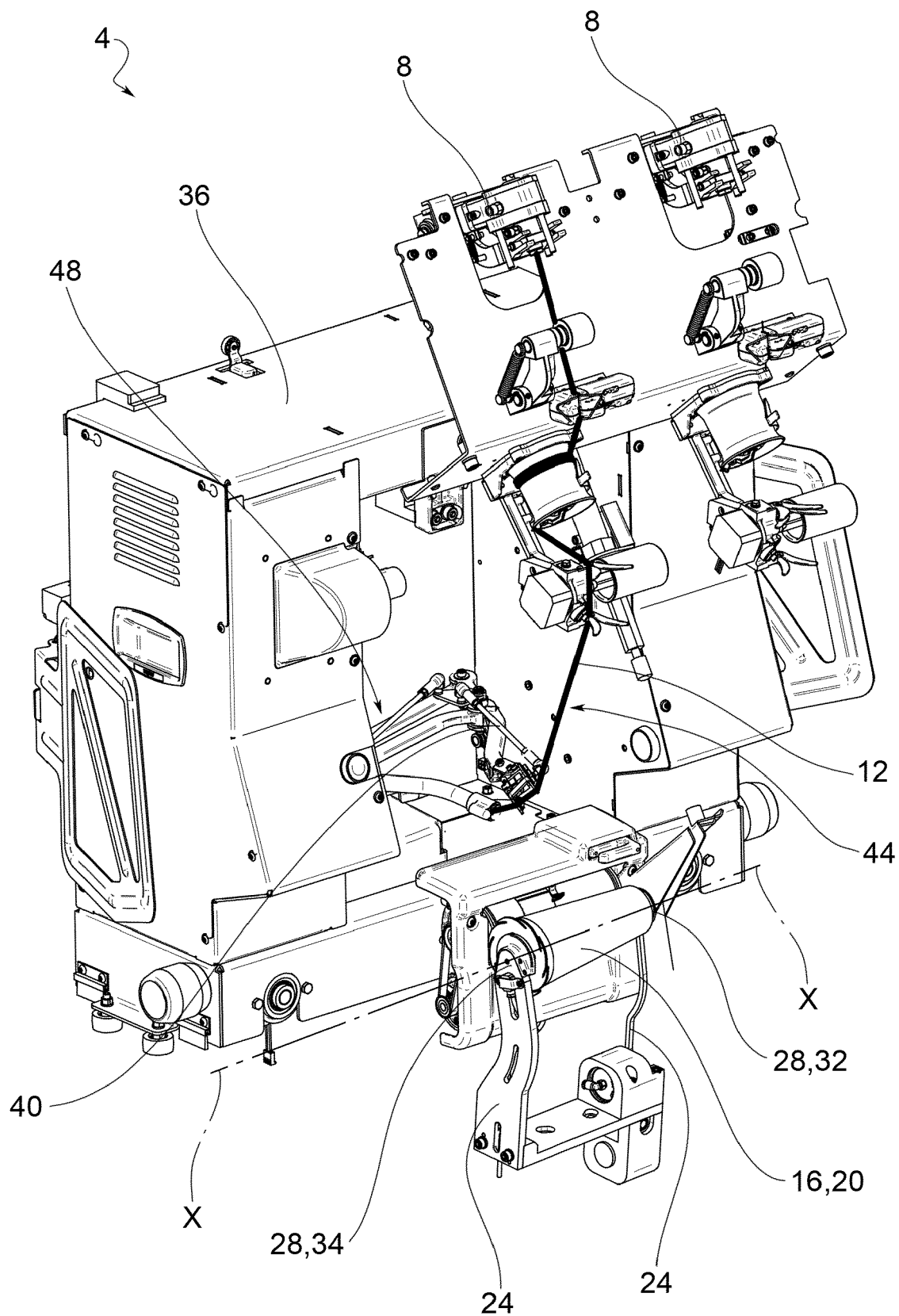


FIG.2

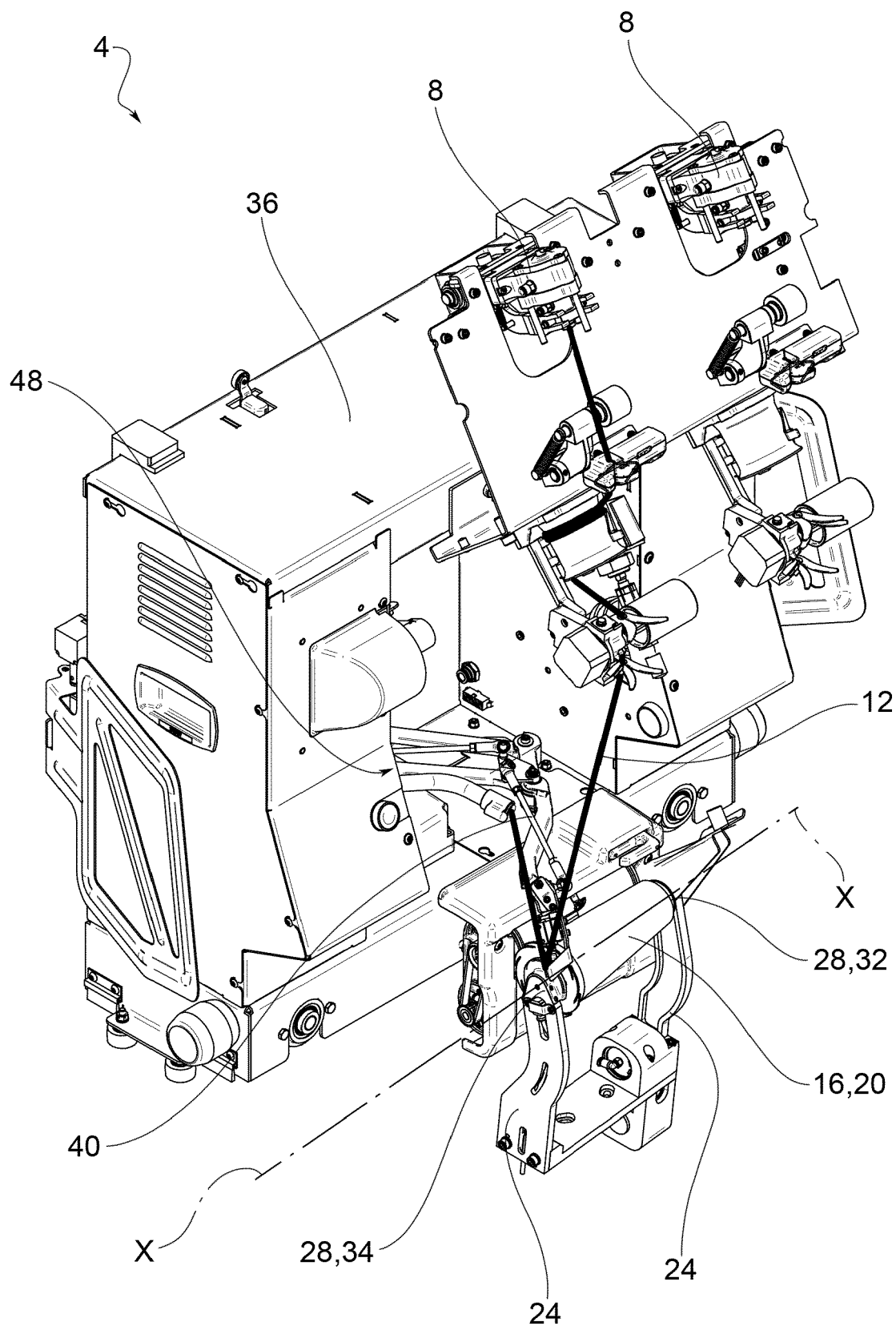


FIG.3

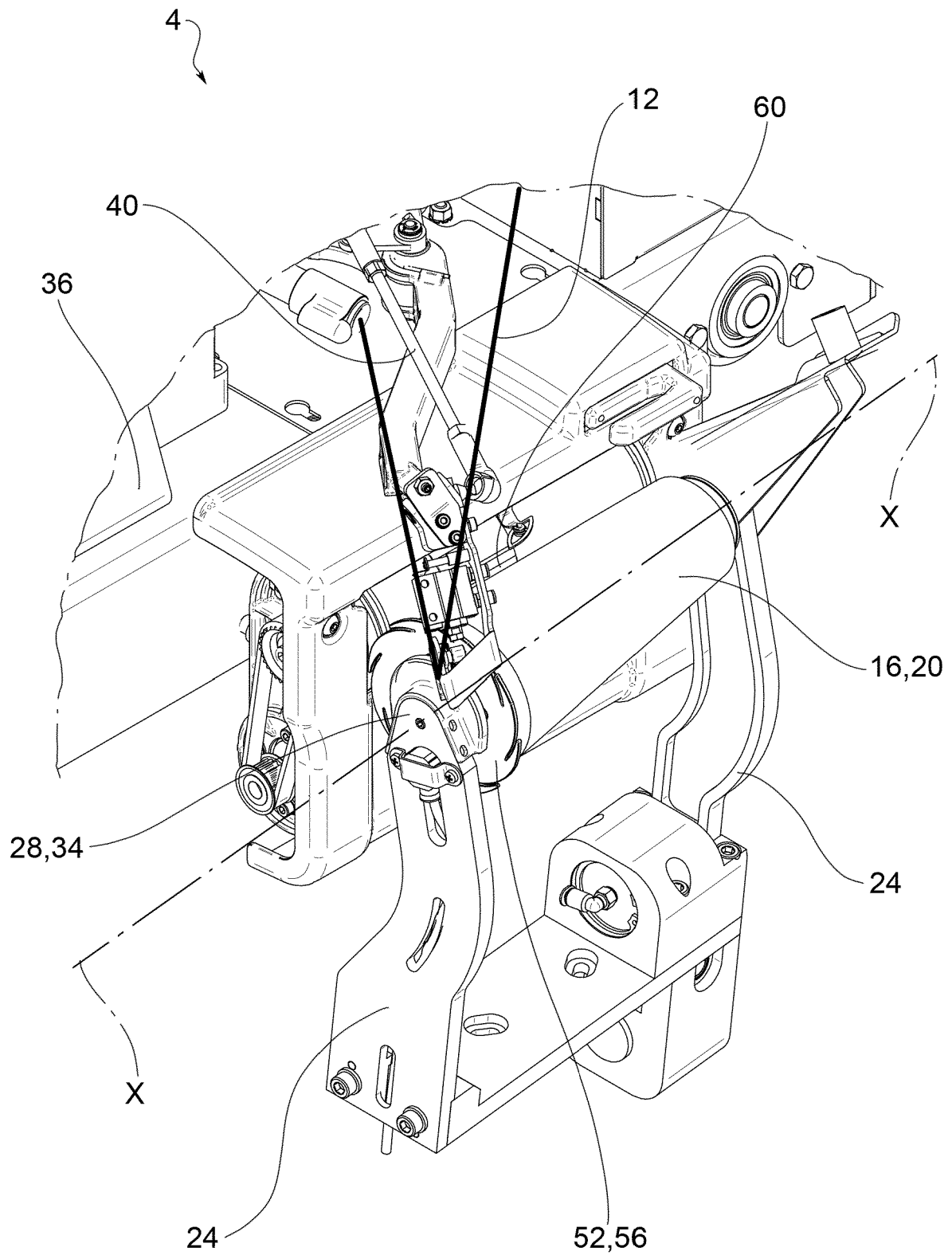


FIG.4



EUROPEAN SEARCH REPORT

Application Number

EP 22 17 1561

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 5 676 322 A (STAHLECKER FRITZ [DE]) 14 October 1997 (1997-10-14) * column 4, line 6 - column 9, line 3; figures 1-3 *	1-11	INV. D01H9/08 D01H15/013
A	EP 3 358 051 A1 (SAVIO MACCH TESSILI SPA [IT]) 8 August 2018 (2018-08-08) * paragraph [0013] - paragraph [0025]; figures 1a, 1b, 6 *	1-5, 9-11	
			TECHNICAL FIELDS SEARCHED (IPC)
			D01H B65H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 May 2022	Examiner Pollet, Didier
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 17 1561

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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18-05-2022

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