



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
10.01.2018 Bulletin 2018/02

(51) Int Cl.:
D01H 9/10 (2006.01) D01H 13/00 (2006.01)

(21) Application number: **17180096.4**

(22) Date of filing: **06.07.2017**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(72) Inventors:
• **KUESTERS, Gerard**
I-33170 PORDENONE (IT)
• **COLUSSI, Vittorio**
I-33170 PORDENONE (IT)
• **ANTONIEL, Maurizio**
I-33170 PORDENONE (IT)

(30) Priority: **08.07.2016 IT 201600071598**

(74) Representative: **Mitola, Marco**
Jacobacci & Partners S.p.A.
Via Berchet 9
35131 Padova (IT)

(71) Applicant: **Savio Macchine Tessili S.p.A.**
33170 Pordenone (IT)

(54) **DOFFING METHOD IN AN OPEN-END SPINNING MACHINE**

(57) Doffing method in an open-end spinning machine (4) comprising the steps of:

- preparing an open-end spinning machine (4) comprising a plurality of open-end spinning units (8) and a plurality of winding units into packages (12), each winding unit into a package (12) winding on a tube (16) a package (20) of yarn (22) obtained from an underlying open-end spinning unit (4),

- preparing at least one doffing trolley (24), provided with doffing means adapted to allow the replacement of a package (20) having a predetermined meterage, said doffing means comprising a recovery arm (28) of a yarn end, provided with an uptake mouth (32) fluidically connected to suction means,

- wherein the method comprises the steps of producing yarn (22) continuously without ever interrupting the spinning and, simultaneously, bring at least one doffing trolley (24) in the vicinity of a winding unit in packages (12) in which the package (20) is about to reach a predetermined size,

- removing the package (20), provided with said first yarn end (48), from the winding unit in packages (12),

- winding on a new tube (16) of the winding unit in packages (12), the yarn (22) produced continuously by the spinning unit (8).

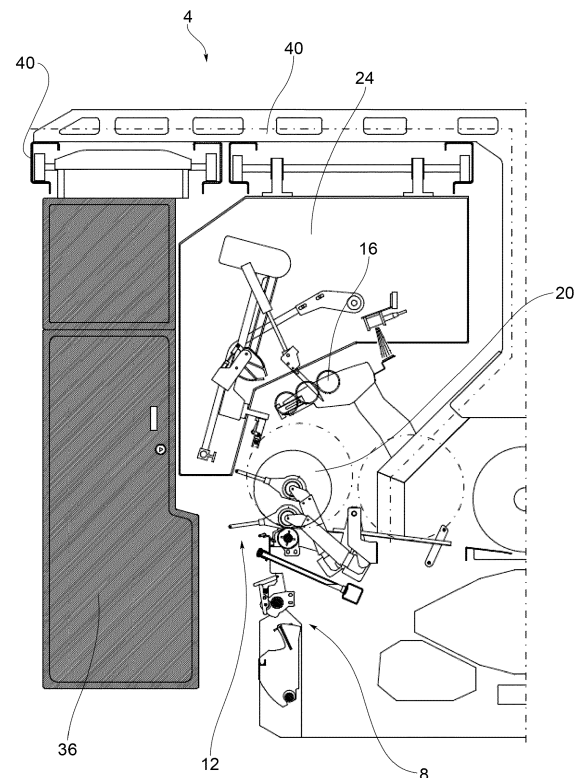


FIG.1

DescriptionSCOPE

[0001] The present invention relates to a doffing method in an open-end spinning machine.

STATE OF THE ART

[0002] As is known, in automatic open-end machines, the current and universally adopted technique involves setting a predefined (generally PC-selectable) meterage, possibly also differentiated in different machine sectors (fronts or sections) and possibly also for single head. Upon reaching the meterage or set diameter, the spinning process is interrupted by stopping the belt feed to the card, and hence the package is lifted so as not to be pulled in rotation by the cylinder and an intervention request signal is sent to the patrol trolley of the spinning machine. This trolley may also be very far from the position requiring intervention, and before arriving there it may have to carry out many other doffing and/or piecing cycles. The trolley, positioning itself on the head that requires intervention, opens the package holder arm, unloads the package onto a special package unloading belt, and places on the arm an empty tube on which the yarn produced by the spinner will be wrapped. Meanwhile, other trolley devices perform a piecing cycle (via an auxiliary yarn) possibly discarding the yarn section containing the splice; moreover, the yarn reserve is made on the right end of the tube and then is restarted with traversing and the formation of the package, having reset the meterage count.

[0003] Semiautomatic open-end machines are also known, for which the current technique provides two possible variants of embodiment, both achieved manually:

A) according to the first known embodiment, the desired meterage or calibration (i.e. the diameter of the package) is set using a process similar to that of the automatic machines; spinning is also stopped in a manner similar to that of automatic machines, but in this case the signal attracts the attention of the operators involved in servicing the machines.

The operator manually performs operations similar to those of the automated equipment: he/she unloads the package from the arm onto the belt, inserts the empty tube, wraps some coils of yarn on the tube by sliding them from the package (this yarn will be used as an auxiliary yarn to start the spinning), and then carries out semiautomatic piecing.

B) In accordance with the second known embodiment, the desired meterage or calibration is set as described above, and when it is reached there is no interruption of the spinning but rather only the activation of the operator's call signal. The operator intervenes quickly and therefore the meterage, even if slightly exceeding the one programmed, will how-

ever be very close to it.

[0004] The cycle takes place in the following way:

- the operator "moves" the yarn from its normal traversing path, up to a special suction duct (economized, i.e. opened manually only during the doffing cycle), positioned on the right side of the package, in line with the reserve which will form on the tube;
- the yarn produced is aspirated by the duct, including the end previously cut (or broken) by the operator, from that which went on the package;
- the operator unloads the package onto the belt;
- the operator inserts the tube in the arm;
- He/she takes the thread temporarily aspirated by the duct in depression and manually, or with the help of a tool, forms the reserve and begins the winding on the tube to form the new package and simultaneously cuts (or breaks) the end of the thread which is aspirated;
- The suction duct is closed;
- The meterage is reset.

PRESENTATION OF THE INVENTION

[0005] The known solutions described above have drawbacks and limitations due essentially to the fact that spinning is interrupted during the doffing phase, with all the problems associated with the subsequent restart phase of open-end spinning. Moreover, the known automatic solutions do not guarantee a fast doffing cycle because the trolley used for such operations must often make a long journey around the spinning machine and is not always ready to do a doffing because it is often engaged in piecing operations on other heads or in other doffings that requested it earlier.

[0006] The known semiautomatic solutions require the interruption of spinning or, if the spinning is not interrupted, require a major manual intervention by the operator which slows down the overall doffing cycle time and in any case, require the intervention of a certain number of operators.

[0007] The need to resolve the drawbacks and limitations cited with reference to the known art is therefore felt.

[0008] This requirement is satisfied by a doffing method of an open-end spinning machine according to claim 1.

DESCRIPTION OF THE FIGURES

[0009] Further features and advantages of the present invention will become more understandable from the following description of its preferred and non-limiting embodiments, wherein:

figure 1 is a sectional side view of an open-end spinning machine suitable for carrying out a doffing method in accordance with the present invention; figures 2, 3a, 4a, 5-8 are sectional side and front

views in sequence of a doffing cycle according to an embodiment of the present invention;
 figures 3b, 4b are perspective views of enlarged details of figures 3a, 4a respectively;
 figure 9 is a further perspective view of an enlarged detail of a spinning machine according to the present invention.

[0010] The elements or parts of elements in common between the embodiments described hereinafter will be indicated at the same numerical references.

DETAILED DESCRIPTION

[0011] With reference to the aforementioned figures, a total schematic view of an open-end spinning machine according to the present invention is collectively indicated at 4.

[0012] In particular, the open-end spinning machine comprises a plurality of open-end spinning units 8 and a plurality of winding units in packages 12, wherein each winding unit 12 winds on a tube 16 a package 20 of yarn 22 obtained from an underlying spinning unit 8. In other words, the spinning unit 8 produces yarn 22 which is then wound by a corresponding winding unit 12 on a tube 16 to form a package 20 having a predetermined meterage or yarn length.

[0013] The spinning machine 4 furthermore comprises at least one doffing trolley 24, provided with doffing means adapted to allow the replacement of a package having a predetermined meterage, said doffing means comprising a recovery arm 28 of a yarn end, provided with an uptake mouth 32 fluidically connected to suction means (not shown).

[0014] The suction means may be specific to each spinning unit 8 and/or winding unit 12, i.e., mounted locally on each unit, or preferably are common to a plurality of units or to the entire spinning machine, that is, they are arranged remotely.

[0015] According to one embodiment, the spinning machine 4 further comprises at least one piecing trolley 36, provided with means for preparing the piecing of free, separated ends of said yarn.

[0016] Preferably, said doffing and piecing trolleys 24, 36 are mechanically separated and may move independently from one another along at least one actuation path in the vicinity of said spinning and winding units 8, 12.

[0017] Said actuation path may be defined, for example, perimetrically by suitable pairs of tracks (one for each trolley) or upper guides 40 to which the doffing trolleys 24 and/or piecing trolleys 36 may be coupled.

[0018] The doffing method according to the present invention comprises the steps necessary to produce yarn continuously without ever interrupting spinning.

[0019] Specifically, at the same time as the yarn production, which is never interrupted, the doffing phase begins by sending an alarm signal when the system detects that a package 20 is about to reach a predetermined me-

terage, i.e. the length of the yarn wound on the related tube (figure 2).

[0020] Following this alarm signal, the spinning machine 4 sends a doffing trolley 24 in the vicinity of the winding unit 12 which generated the signal, i.e. wherein the package is about to reach a predetermined meterage.

[0021] The doffing trolley 24 locates the unit that made the call, for example, via a bar code reader, in a known manner.

[0022] The doffing trolley 24 stabilizes itself (figure 3a) by engaging, for example, the parking brakes (not shown).

[0023] Once the package 20 has reached the preset meterage, the actual doffing cycle starts.

[0024] The next step includes the stages of:

- positioning the uptake mouth 32 in the vicinity of the yarn 22 leaving the spinning unit 8 (figure 4a), and positioning a first cutting device 44 of the recovery arm 28 in the vicinity of the yarn 22 (figure 3b),
- cutting the yarn 22 in output from the spinning unit 8, with a first cutting device 44 (figure 4b), obtaining a first yarn end 48 connected to the package 20 of the corresponding winding unit 12 and, a second yarn end 52 connected to the yarn 22 in output from the spinning unit 8.

[0025] Preferably, the first cutting device 44 is arranged in the vicinity of the uptake mouth 32 and is actuated after actuation in suction of the uptake mouth 32, so as to catch and aspirate the second yarn end 52 formed as a result of cutting the yarn 22.

[0026] One proceeds to the step of aspirating the second yarn end 52 by means of the uptake mouth 32, within the recovery arm 28, without interrupting the operation of the spinning unit 8, so as to suck the yarn continuously from the spinning unit 8.

[0027] In this way, the yarn does not accumulate or twist or suffer damage and continues to go up into the recovery arm 28.

[0028] Therefore, as seen, advantageously, during doffing, the stage of continuously aspirating and conveying the yarn produced by the spinning unit 8 into the recovery arm 28 is provided through the continuous suction of the uptake mouth 32, so as to avoid the accumulation of yarn produced in the vicinity of the spinning unit 8.

[0029] Hence the package 20 is unloaded, provided with said first yarn end 48 from the winding unit 12.

[0030] For example, this step is carried out by means of an arm opening and package raising assembly 56 which raises the package 20 by contact with a corresponding drive cylinder 60 to stop it in rotation (figures 4a-5).

[0031] The lifting of the package 20 is sketched by the arrow 62 in figure 4a.

[0032] One then proceeds to the step of winding, on a new tube of the winding unit 12, the yarn 22 produced continuously from the spinning unit 8, as better described

hereinafter.

[0033] Specifically (figure 5), the arm opening and package raising assembly 56 opens the tailstocks that grip the package so that a package unload assembly 64 may accompany the package to prevent its incorrect positioning.

[0034] The package 20 may, for example, be positioned on a package unloading belt, in a known manner.

[0035] A tube loading assembly 72 takes an empty tube from a tube carrying basket 74 and places it in axis between the tailstocks.

[0036] Then (figure 6), the arm opening and package raising assembly 56 closes the tailstocks to secure the new tube.

[0037] The arm opening and package raising assembly 56 lowers an empty tube, which is intended to become a package, and connects it to the drive cylinder 60: in this way, the tailstocks and the tube are placed in rotation by means of the pressure against the drive cylinder 60 produced by a special counterweight system.

[0038] Following the suction of the second yarn end 52 through the uptake mouth 32 is the step of moving the recovery arm 28, provided with the relevant yarn 22, so as to hook a portion of said yarn 22 on a tailstock 76 of the winding unit 12, said tailstock 76 being associable with a new tube on which to wind the yarn to form a new package.

[0039] The step of hooking the yarn 22 on the tailstock 76 occurs, for example, by positioning the yarn 22 in the vicinity of the teeth 80, provided on the tailstock 76, suitable to grip the yarn without damaging it or breaking it.

[0040] In particular, the tailstock 76 is rotatable, and during the rotation, the teeth 80 are able to effectively hook the yarn 22.

[0041] One then proceeds with the steps of (figure 7):

- cutting the yarn 22 aspirated by the uptake mouth 32 in the vicinity of a cutting point 84 external to the recovery arm 28, by means of a second cutting device 88 positioned on the recovery arm 28 so as to obtain a waste yarn end, associated with a section of waste yarn aspirated into the recovery arm 28, and a winding yarn end 92, associated with the section of yarn already hooked to the tailstock 76 of the winding unit 12.

[0042] One proceeds with the step of catching, with a yarn guide device 96 of the winding unit 12, the section of yarn 22 hooked to the tailstock 76 and beginning its winding on the new tube for the formation of a new package.

[0043] Upon completion of the doffing cycle (figure 8) the doffing trolley 24 disengages the parking brakes and may start to patrol the various spinning 8 and winding 12 units of the spinning machine 4, ready for a new positioning request. The winding of a new package is restored.

[0044] According to one embodiment, said doffing and

piecing trolleys 24,36 are shaped and/or modelled so as not to interfere with each other when moving along the actuation path.

[0045] According to one embodiment, the doffing method of the present invention comprises the steps of said doffing and piecing trolleys 24,36 passing over each other to reach separate spinning units and winding units 8,12.

[0046] As may be appreciated from the foregoing, the doffing method of an open-end spinning machine according to the invention allows the drawbacks presented in the prior art to be overcome.

[0047] In particular, with respect to fully automatic open-end machines, the present invention:

- allows a very short doffing cycle;
- allows one to work on the machine even by carrying out manual doffings when needed;
- allows one to operate on the machine even by carrying out manual piecings if necessary;
- allows one to have machines with a different number of piecing and doffing trolleys depending on the working conditions of the spinning mill, e.g. a doffing trolley and two piecing trolleys for the front of each machine, in the event of a high number of spinning breakages that are usually accompanied by few doffings (in the case of fine counts), or one piecing trolley and two doffing trolleys for the front of each machine when there are few breaks that are usually accompanied by frequent doffings (in case of coarse counts).

[0048] Furthermore, the present invention involves a labor requirement comparable to that of fully automatic machines, but at a very low cost with respect to the latter, therefore with a total reduction in the cost of processing the raw material.

[0049] Moreover, the present invention permits a very high machine efficiency to be obtained, as there are no dead times waiting for the intervention of automated equipment, which in automatic machines may also be very frequent in the case of frequent doffings (coarse counts).

[0050] In addition, the present invention, with respect to semi-automatic machines, allows one to obtain:

- a drastic reduction in labor, which is employed the most in the doffing cycle;
- a geometry (height) of the spinning machine that also allows manual doffing and/or piecing when needed;
- a total cost for the spinning machine slightly greater than for the semiautomatic machines of the known art;
- greater precision in the meterage of the packages.

[0051] Moreover, the solution of the present invention allows for a very light trolley (compared to that of full-auto machines) since it has only a few units on board, being

there are few operations required of the automated equipment to doff the completed package and start the winding of the next one, without having also to piece the yarn, for which a special and independent piecing trolley may be provided.

[0052] Consequently, the machine's cycle according to the present invention will be much shorter (reduced by 50%) than that of the full-auto machines and its travel speed will be much higher (approximately double) than that of the full auto machines.

[0053] The separation of the piecing trolley and the doffing trolley of the prior art into two separate trolleys, which perform respectively and exclusively the task of doffing and the task of piecing is one of the advantages of the present invention.

[0054] In fact, as seen, the two trolleys may work independently and autonomously of each other.

[0055] The trolley which takes care of doffing will use shorter cycles than the ones currently used.

[0056] The doffing trolley is what most characterizes the invention, reproducing in automatic mode what is already performed manually by an operator in non-automatic machines. Shortening cycles and accelerating travel speeds saves time and reaches individual spinning units before their packages have reached the set dimensions. This will result in accurate doffings and very precise package dimensions.

[0057] The separation of the piecing and doffing trolleys described above serves both to streamline the original trolley (by lightening it) and to optimize the running times of the functions that each trolley performs.

[0058] The separation of the carriage functions ensures that the two trolleys may work independently and autonomously without having to wait for each other: this is particularly useful because, depending on the yarn to be processed, one of the two trolleys could be requested more frequently while the other is requested much less frequently.

[0059] The gauge adopted for the two trolleys and the trajectory of the individual devices ensures that the two trolleys may operate simultaneously: they may meet in any area of the machine and cross the same section without disturbing each other (even if one of the two is performing operations on a spinning unit).

[0060] The combination of these factors greatly increases the number of doffing cycles possible for the trolley in a unit of time (by approximately four times), so under normal operating conditions, for most of its time, the trolley will be inactive, because the time actually required for the doffing cycles is much lower than what is available.

[0061] This allows the machine's PC to know the meterage of the individual packages in formation, to call and position the trolley on the head that is about to reach the meterage beforehand and to be ready to immediately carry out the doffing cycle, thus avoiding extra-meterage, i.e. surpassing the predetermined meterage for the individual package.

[0062] Only in a few cases of simultaneous doffing will there be packages with limited extra-meterage, but in very small numbers and much reduced compared to the case of semiautomatic machines and approaching the situation of fully automatic machines.

[0063] A person skilled in the art, in the object of satisfying contingent and specific requirements, may make numerous modifications and variations to the doffing methods of an open-end spinning machine described above, all of which are within the scope of the invention as defined by the following claims.

Claims

1. Doffing method in an open-end spinning machine (4) comprising the steps of:

- preparing an open-end spinning machine (4) comprising a plurality of open-end spinning units (8) and a plurality of winding units into packages (12), each winding unit into a package (12) winding on a tube (16) a package (20) of yarn (22) obtained from an underlying open-end spinning unit (4),
- preparing at least one doffing trolley (24), provided with doffing means adapted to allow the replacement of a package (20) having a predetermined meterage, said doffing means comprising a recovery arm (28) of a yarn end, provided with an uptake mouth (32) fluidically connected to suction means,
- wherein the method comprises the steps of producing yarn (22) continuously without ever interrupting the spinning and, simultaneously, bring at least one doffing trolley (24) in the vicinity of a winding unit in packages (12) in which the package (20) is about to reach a predetermined size,
- removing the package (20), provided with said first yarn end (48), from the winding unit in packages (12),
- winding on a new tube (16) of the winding unit in packages (12), the yarn (22) produced continuously by the spinning unit (8).

2. Doffing method in an open-end spinning machine (4) according to claim 1, comprising the steps of:

- positioning the uptake mouth (32) in the vicinity of the yarn in output from the spinning unit (8),
- cutting the yarn in output from the spinning unit (8), with a first cutting device (44), obtaining a first yarn end (48) connected to the package (20) of the corresponding winding unit (12) and, a second yarn end (52) connected to the yarn (22) in output from the spinning unit (8),
- aspirating the second yarn end (52) by means

- of the uptake mouth (32), within the recovery arm (28), without interrupting the spinning unit (8), so as to aspirate the yarn continuously from the spinning unit (8),
- removing the package (20), provided with said first yarn end (48), from the winding unit (12),
 - winding, on a new tube (16) of the winding unit (12), the yarn (22) produced continuously by the spinning unit (8).
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3. Doffing method in an open-end spinning machine (4) according to claim 1 or 2, wherein the first cutting device (44) is arranged in the vicinity of the uptake mouth (32) and is actuated after actuation in suction of the uptake mouth (32), so as to catch and aspirate the second yarn end (52) formed as a result of the cut.
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4. Doffing method in an open-end spinning machine (4) according to claim 1, 2 or 3, wherein during doffing, it provides for the step of aspirating and conveying continuously, in the recovery arm (28), the yarn produced by the spinning unit (8), through the continuous suction of the uptake mouth (32), so as to avoid the accumulation of yarn produced, in the vicinity of the spinning unit (8).
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5. Doffing method in an open-end spinning machine (4) according to any one of the preceding claims dependent on claim 2, in which, as a result of suction of the second yarn end (52) through the uptake mouth (32), the step of moving the recovery arm (28) with the relative yarn is provided for so as to engage a portion of said yarn on a tailstock (76) of the winding unit (12), said tailstock (76) being associable to a new tube on which to wind the yarn to form a new package.
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6. Doffing method in an open-end spinning machine (4) according to claim 5, providing for the steps of:
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- cutting the yarn (22) aspirated by the uptake mouth (32) in the vicinity of a cutting point (84) external to the recovery arm (28), by means of a second cutting device (88) positioned on the recovery arm (28), so as to obtain a waste yarn end, associated to a section of waste yarn aspirated into the recovery arm (28) and a winding yarn end (92), associated to the section of yarn already hooked to the tailstock (76) of the spinning unit (8),
 - intercepting, with a yarn guide device (96) of the winding unit (12), the section of yarn hooked to the tailstock (76) and beginning its winding on the new tube (16) for the formation of a new package (20).
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7. Doffing method in an open-end spinning machine (4) according to any of the preceding claims, comprising

the steps of:

- providing at least a piecing trolley (36), provided with means for preparing the piecing of free, separated ends of said yarn (22).
8. Doffing method in an open-end spinning machine (4) according to claim 7, wherein said doffing trolley (24) and piecing trolley (36) are mechanically separate and can be moved independently of each other along at least an actuation path in the vicinity of said open-end spinning unit (4) and winding into packages (12).
9. Doffing method in an open-end spinning machine (4) according to claim 7 or 8, wherein said doffing trolley (24) and piecing trolley (36) are shaped and/or modelled so as not to interfere with each other when moving along the actuation path, the method comprising the steps of mutual bypassing of said doffing (24) and piecing trolleys (36) to reach the same or different spinning units (8) and the winding units (12), even while one of said two trolleys (24,36) is performing its cycle.

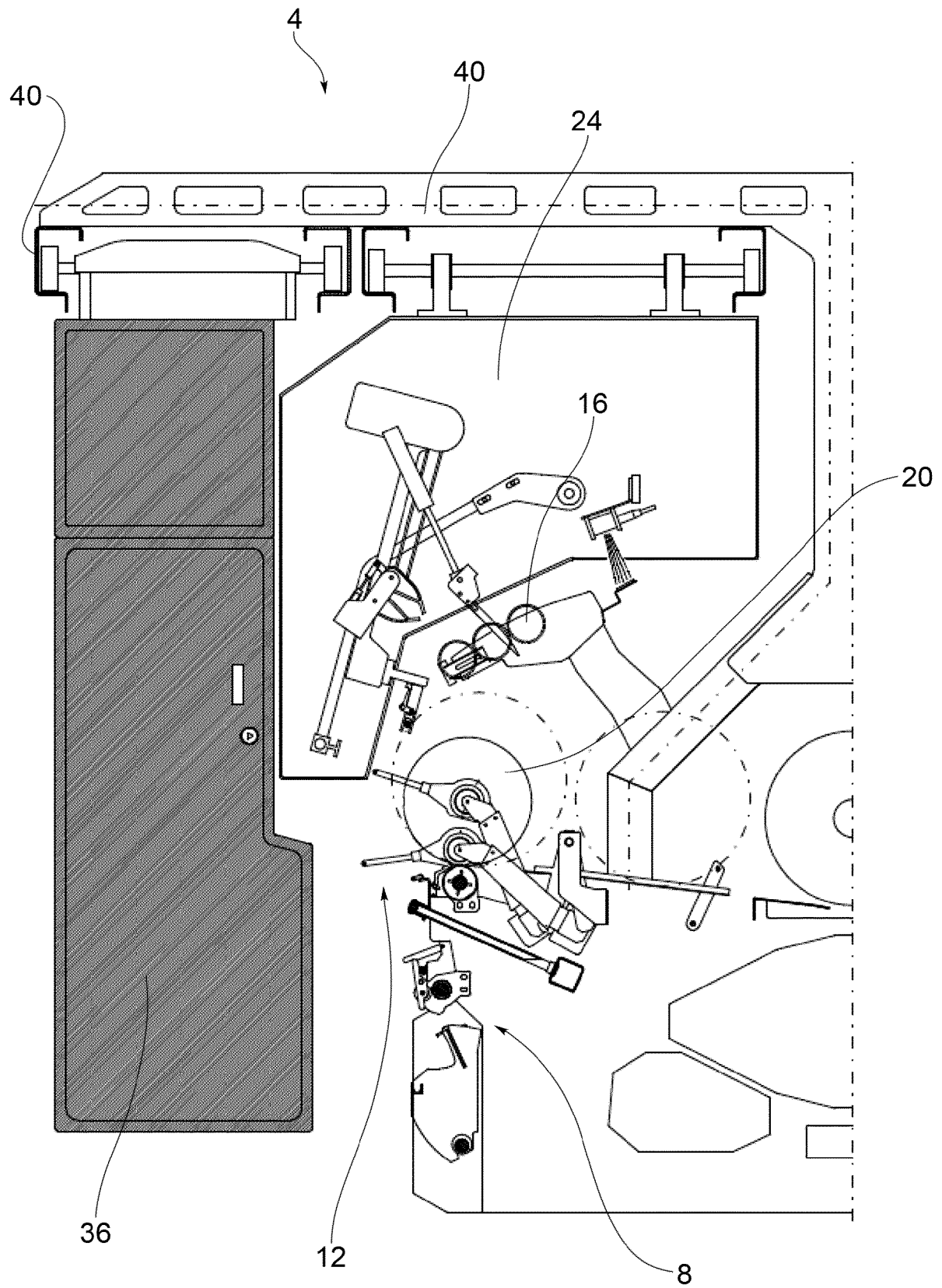


FIG.1

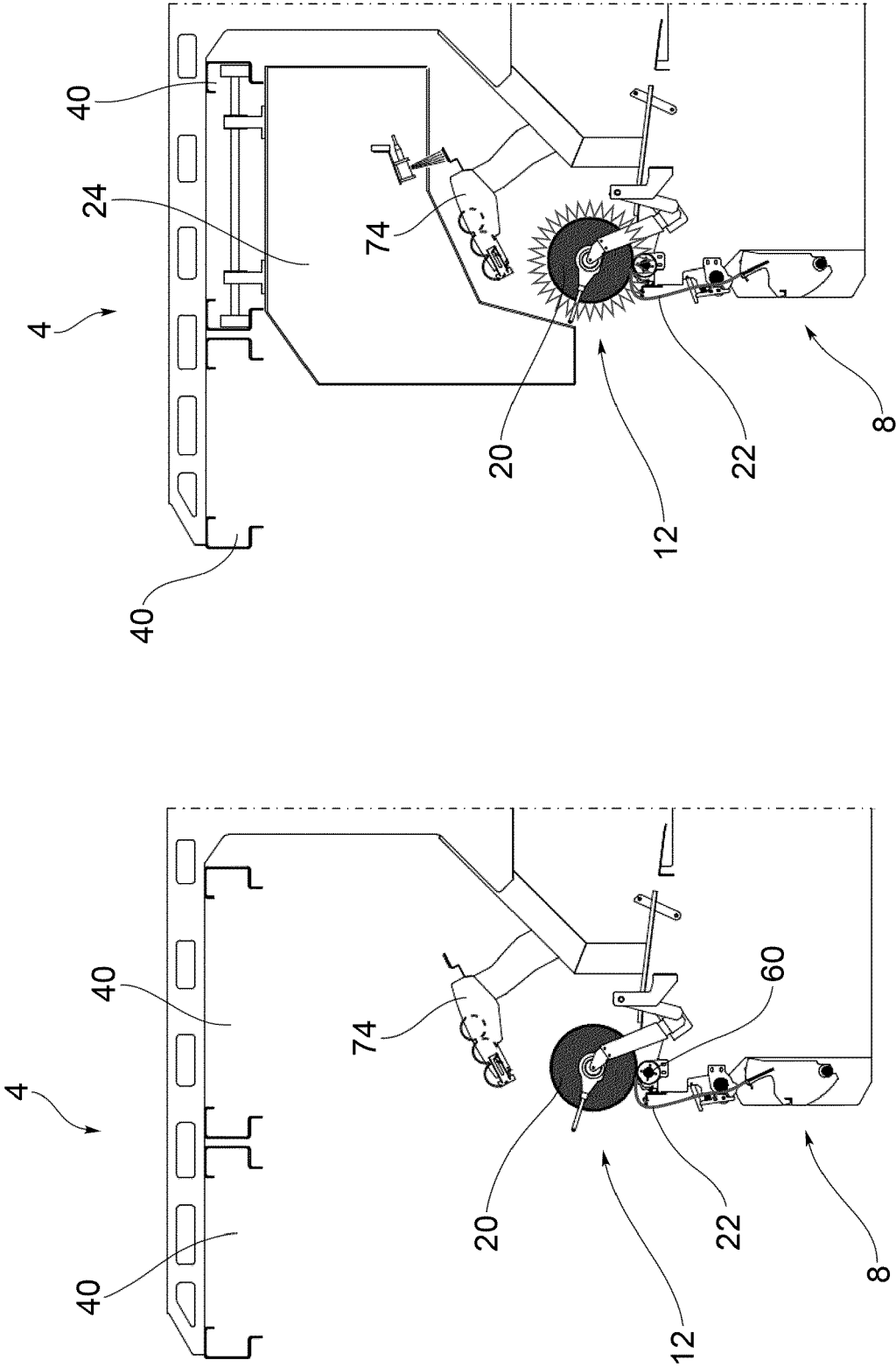


FIG.3a

FIG.2

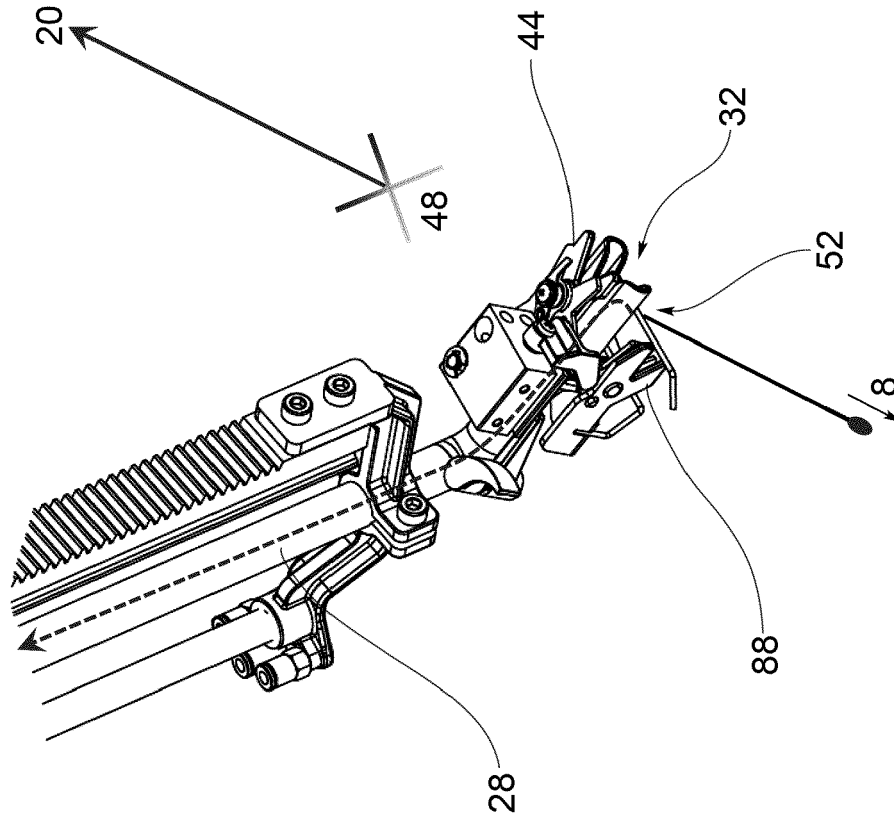


FIG. 4b

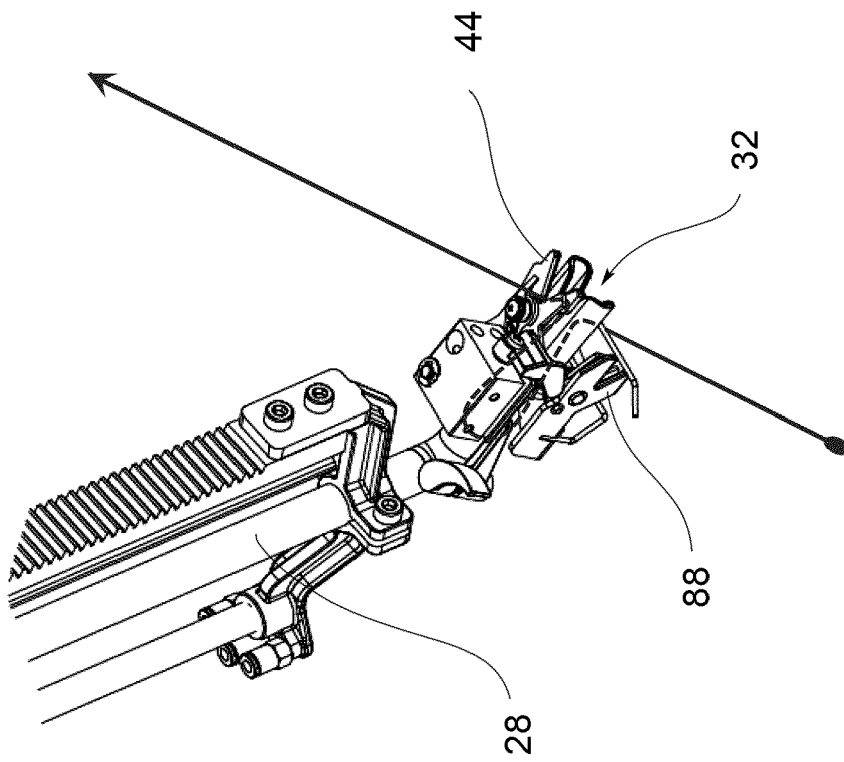


FIG. 3b

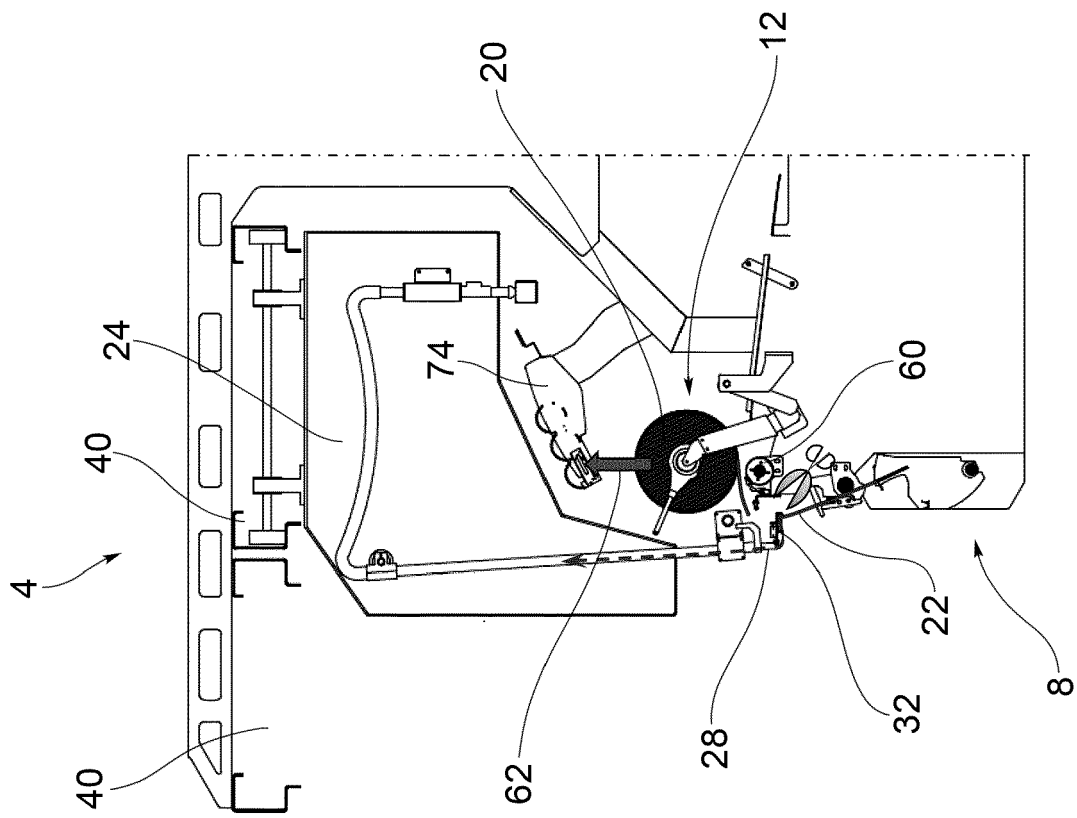


FIG. 4a

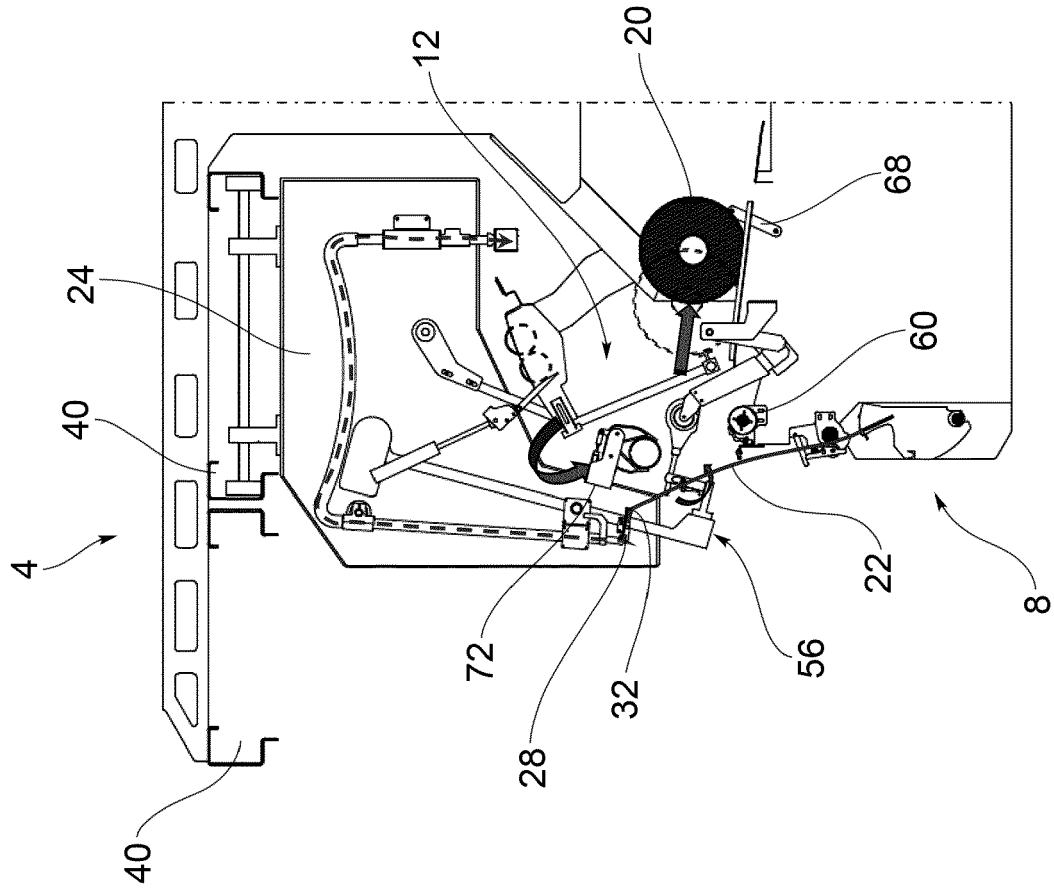


FIG. 5

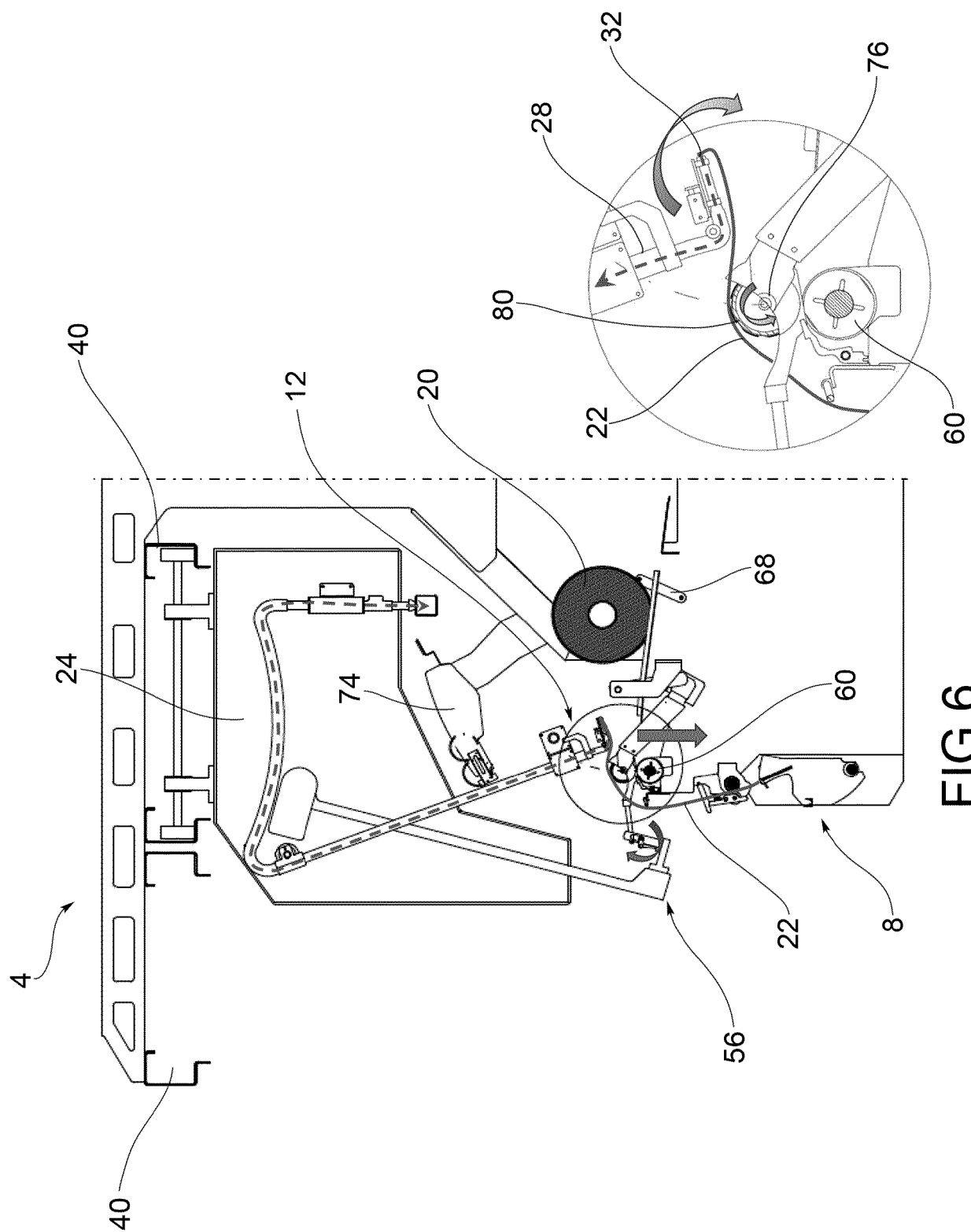


FIG. 6

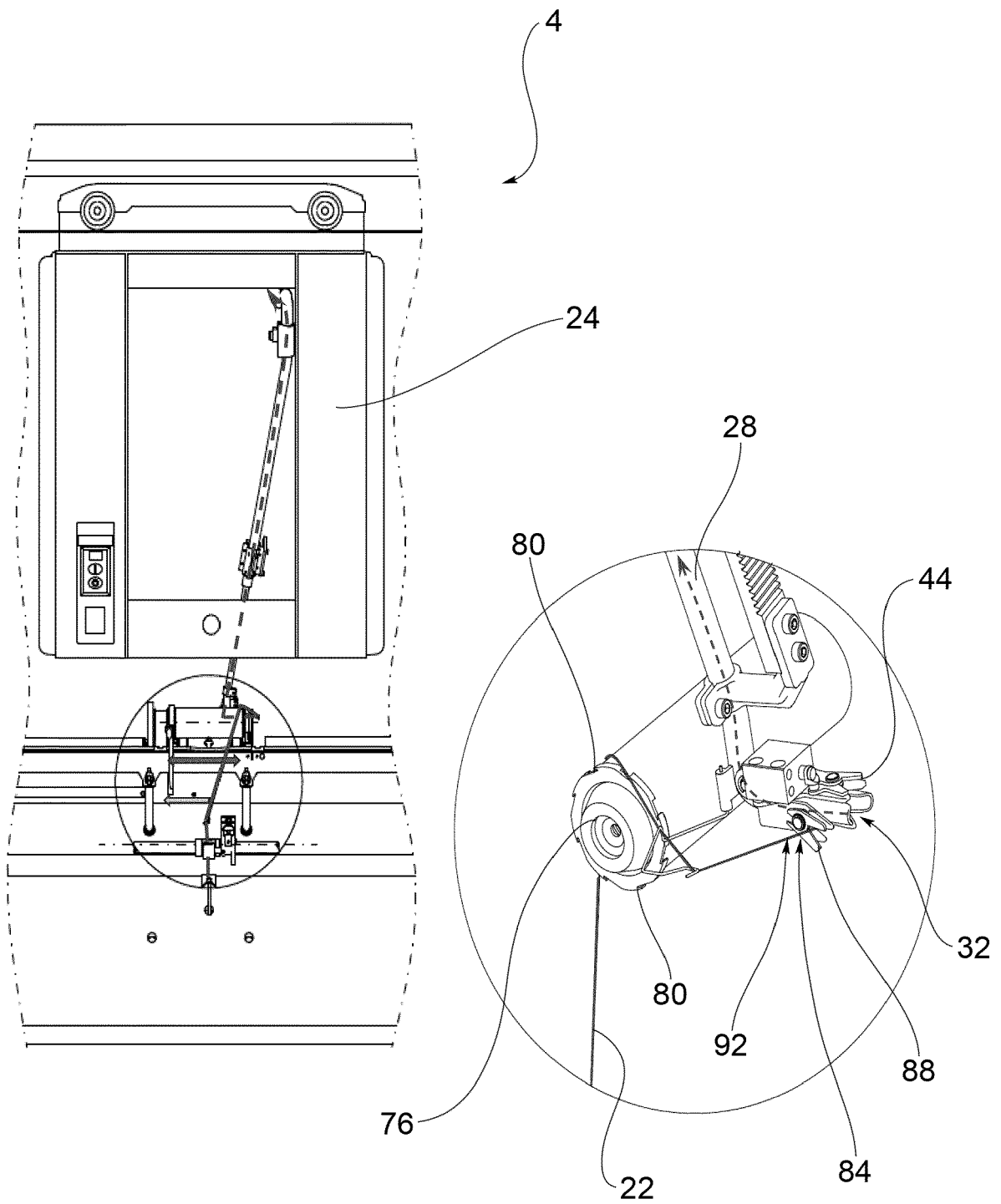


FIG.7

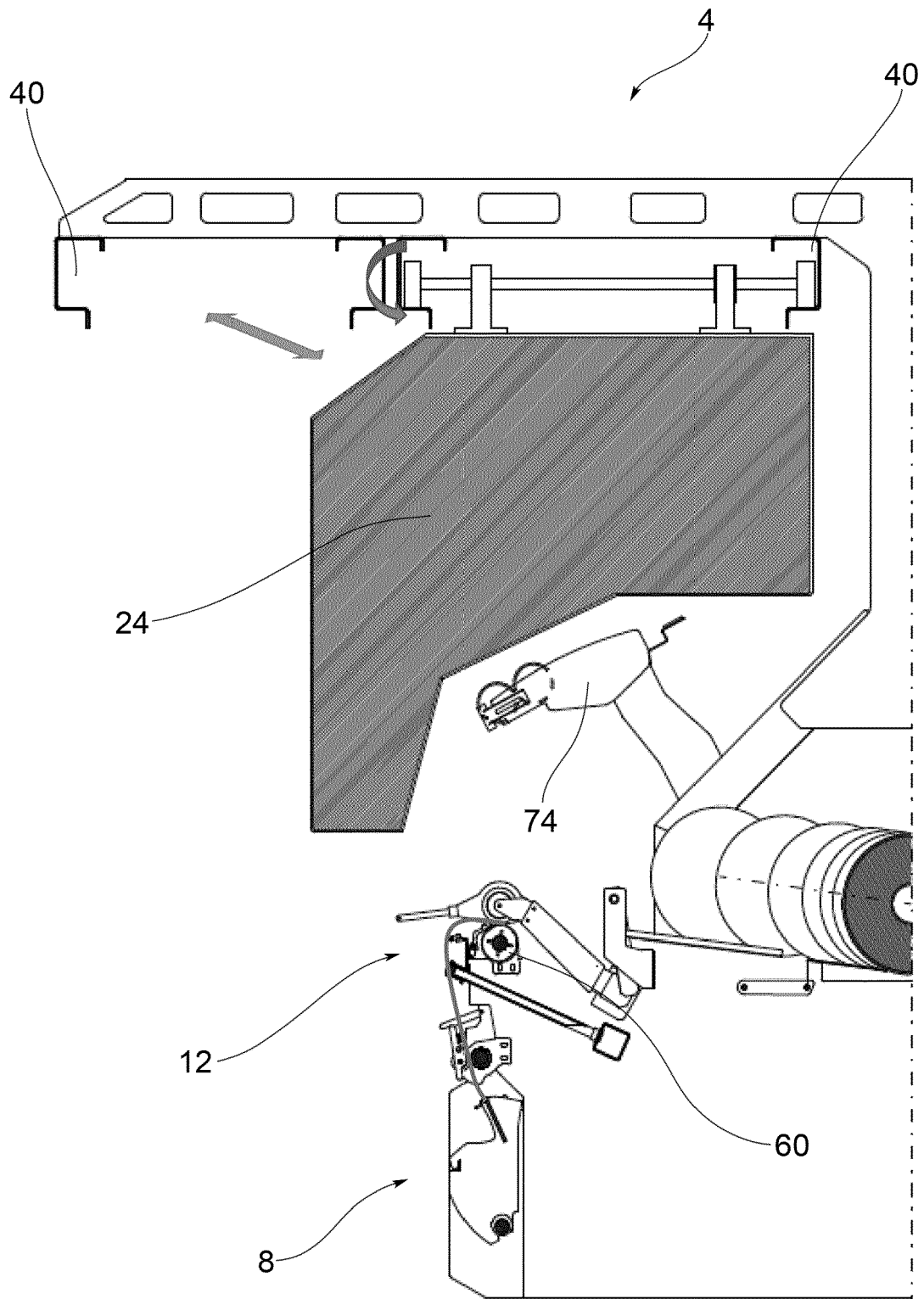


FIG.8

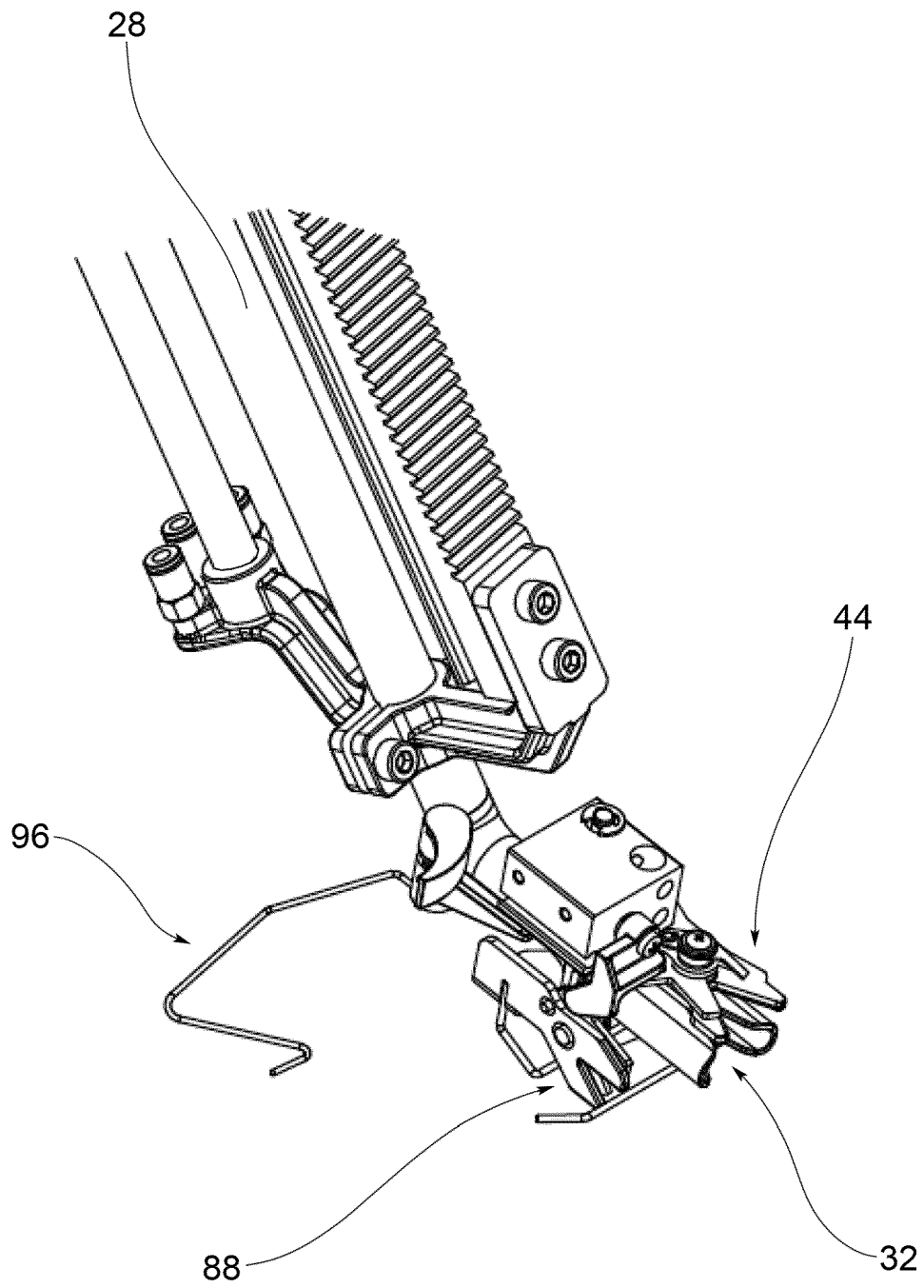


FIG.9



EUROPEAN SEARCH REPORT

Application Number
EP 17 18 0096

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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 4 116 395 A (COURVOISIER GUY) 26 September 1978 (1978-09-26)	1-5	INV. D01H9/10 D01H13/00
Y	* column 1, lines 12-21, 41-63; figures 1-5 * * column 2, lines 17-34 * * column 3, line 49 - column 4, line 59 *	7-9	
X	EP 0 017 631 A1 (SAVIO SPA [IT]) 15 October 1980 (1980-10-15)	1-6	
Y	* page 2, lines 5-7; figures 1-7 * * page 6, lines 12-20 * * page 6, line 26 - page 7, line 18 * * page 8, lines 1-7 * * page 8, lines 20-27 * * page 9, lines 3-17 *	7-9	TECHNICAL FIELDS SEARCHED (IPC) D01H B65H
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 23 November 2017	Examiner Wendl, Helen
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	

EPO FORM 1503 03.82 (P04C01)

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