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(54) **A CHILL ROLL FOR A PRINTING MACHINE**

KÜHLWALZE FÜR EINE DRUCKMASCHINE

ROULEAU REFROIDISSEUR POUR MACHINE D'IMPRESSION

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Intellectual Property

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Description

[0001] The present invention refers to a chill roll with recirculation of water or other suitable fluid used in printing machines, such as in particular rotogravure printing machines.

[0002] As known, in printing machines of the above mentioned type a plurality of printing units or printing stages follow one another. Once a first printing stage is over, before entering the subsequent one the printing support undergoes a drying treatment, pursuant to which the support is directed, via a set of deviation rolls, to the subsequent printing stage. One or more of these deviation rolls is an idle one and is water-cooled.

[0003] This cooled roll, known as chill roll, is presently the source of some unsolved problems.

[0004] In particular, being it idle, it is important that the roller opposes a minimum resistance to the printing support, otherwise the differences in speed between the printing support and the roller may result in the support being warped, being it not perfectly adherent to the roller.

[0005] However, minimizing the friction is a serious problem with the presently known chill rolls.

[0006] The rolls that are currently subject to a widespread use in the field are of two different types. A first type of known chill roll comprises a hollow sleeve into which a water jet is injected. The water, being poured over the inner surface of the sleeve, carries out the cooling of the outer surface contacting the printing support, by way of thermal conduction. The water jet falls then out of the sleeve due to simple gravity. This type of chill roll presents specific drawbacks. In particular, making it use of an open circuit, i.e. with an open water discharge, the water becomes oxygenated and this causes significant corrosion effects over the metal wall forming the sleeve. Moreover, the oxygen fosters the proliferation of microorganisms such as algae and fungi. This implies therefore that the maintenance of this type of chill roll and the relative water circulation system is demanding and troublesome. Another problem that occurs in this type of roll is that, by effect of the centrifugal force caused by the rotation of the roller, the water injected inside the sleeve gains a certain speed that hinders the idle rotation of the same roller, due to the dynamic friction between the water and the sleeve. This clearly contributes to an increased resistance between the printing support and the roller, and thus to cause the above mentioned defects (incorrect adhesion between the support and the roll, warping of the support).

[0007] A second type of known chill roll provides for, instead of an open water discharge as the one described above, a forced discharge. Therefore, the hydraulic circuit arranged within the roller is of a closed type. This implies that the oxygenation of the water is reduced, thus solving, with this roller, the above explained problems in connection with the corrosion and the formation of algae and other microorganisms. However, the forced discharge, carried out through a pressurized mechanical

seal, causes a remarkable increase of the friction force opposing the rotation. This known roll is thus particularly unsatisfactory as far as the occurrence of friction is concerned, and then the correct interaction between the same roller and the printing support. The document JP H09 109367 A discloses a chill roll according to the preamble of claim 1. It is therefore an object of the present invention to solve the above mentioned problems.

[0008] A particular object of the present invention is to provide a water-cooled chill roll that solves the problem of friction and that does not need a frequent and demanding maintenance.

[0009] These objects are achieved by the chill roll defined in claim 1. Further preferred embodiments of the present invention are presented in the dependent claims.

[0010] The characteristics and advantages of the chill roll according to the invention will become apparent from the following description of an embodiment thereof, provided by way of example and not limitative, with reference to the attached drawings wherein:

- figure 1 is a perspective view of a water recirculation chill roll according to the invention;
- figure 2 is a longitudinal section of the roll of figure 1, i.e. carried out by a sectional plane passing through the rotation axis of the same roll;
- figure 3 is an enlarged view of an end portion of the roll, as marked in figure 2; and
- figure 4 is a broken view of the roll end portion of figure 3, taken according to sectional planes including longitudinal planes such as those of figure 2 and a cross-wise plane perpendicular to the longitudinal plane.

[0011] With reference to the above figures, a chill roll adapted to be mounted in a printing machine such as in particular a rotogravure printing machine, comprises a cylindrical body 1, elongated according to a longitudinal axis X. Two shaft pieces 2 project axially from respective end sections of the body; through the shafts the cylindrical body can be pivotally supported around the axis X by a fixed frame (not shown) of the printing machine.

[0012] Within the roll a cooling circuit 3 evolves, for the circulation of a cooling fluid, such as for instance, but this is not limitative, water; the circulation of the fluid in the cooling circuit causes a cooling of the roll, and in particular of an outer surface 10 thereof, which is adapted, when the roll is mounted in the printing machine, to be contacted by a printing support. The cooling circuit develops not only in the cylindrical body 1, but also in a first piece 20 of the two shaft pieces 2. An inlet 30 to the cooling circuit is arranged on the first shaft piece 20, as clarified hereafter.

[0013] This inlet 30 opens in a first chamber 40, defined by a hydraulic seal element 4 that rotatably engages, in the fashion of a cap, on the first shaft piece 20. An access 41 for the inlet of the cooling fluid from the outside the chamber 40 also opens in the chamber 40.

[0014] The seal element 4 further comprises a second chamber 42, hydraulically separated from the first chamber 40. This second chamber 42 is communicated with a drain passage 420 for draining outside the cooling fluid coming from the circuit.

[0015] Close to its end the first shaft piece 20 supports auxiliary rotation drive means 5 arranged so as to be housed in the first chamber 40 and to be hit by the flow of cooling fluid entering the chamber to be supplied to the cooling circuit; as a result, the auxiliary drive means 5 impart a rotational drive around the longitudinal axis X to the relevant shaft piece and consequently to the cylindrical body.

[0016] More in detail, the auxiliary drive means 5 comprise a turbine, and namely a polar array of fixed blades 50 around the end of the first shaft piece 20. The inlet access 41 is arranged tangentially, taking as a reference the outer circumference defined by the outmost portions of the blades, so that the entering flow hits the effective surface of the blades, propelling the rotation of the turbine, and as a consequence of the shaft, around the X axis.

[0017] Furthermore the first shaft piece 20 comprises two sleeves coaxially arranged one inside the other (with a fixed relationship, i.e. with no relative motion), and namely an outer sleeve 200 and an inner sleeve 201.

[0018] The inner sleeve 201 axially projects with an end portion 201a from the outer sleeve, and it is on this end portion 201a that the auxiliary rotation drive means 5 are arranged.

[0019] The hydraulic seal element 4 is coupled in the fashion of a cap around the end 201a and engages over the outer periphery of the outer sleeve 200. The hydraulic seal element is mounted in a fixed relationship with the frame of the printing machine, that is to say with no relative motion with respect to it. The outer sleeve 200 and the inside of the seal element 4 are mutually connected in a pivotal arrangement around the X axis, via a bearing arrangement. Therefore, the outer sleeve and thus the shaft piece (and consequently the cylindrical body) are free to rotate with respect to the hydraulic seal element 4.

[0020] The two sleeves include part of the cooling circuit, in that they define intake and discharge segments of the same circuit. In particular, the inner sleeve 201 forms an inner duct 210, extending along the X axis, which represents a first intake segment 3a of the circuit 3.

[0021] The spout of the intake segment 3a at the end 201a of the first shaft, i.e. the end where the drive means 5 are mounted, is the inlet 30 to the cooling circuit.

[0022] An annulus gap 201 between the inner sleeve 201 and the outer sleeve 200 extends in turn along the X axis and defines a final, discharge segment 3b of the cooling circuit. The open end 211a of the annulus gap 211 is the outlet of the cooling circuit and opens in the second chamber 42, so that the flow coming from the circuit is collected in the second chamber 42 and discharged from it through the drain passage 420.

[0023] The cylindrical body 1, in the preferred embod-

iment shown in the figures, comprises a tubular drum 11 the ends of which are shut by end plugs 12, to which the shaft pieces are fixed. The cooling circuit develops throughout both the end plugs and the thickness of the tubular drum 11. In particular, within the thickness of the tubular drum a plurality of channels 110 are formed, extending along the X axis and consecutively arranged throughout the circumference of the drum, as visible in figure 4. In an alternate fashion following the circumference of the drum, among the channels one can distinguish flow supply channels 110' and flow return channels 110" that communicate respectively with the first intake segment 3a and the final discharge segment 3b, thereby the cooling fluid flows along the drum in a direction or the other (depending on the direction having a consequently different temperature) in an orderly alternate arrangement. Indeed, the temperature of the fluid in the supply direction is lower than that in the return direction, considering the progressive thermal exchange which it undergoes with the outer wall portion of the drum. Therefore, by alternating supply channels and return channels, and concurrently providing the inlet 41 and the drain/outlet 420 of the circuit in correspondence with the same end of the drum, the overall average temperature over the drum, and in particular over its outer surface remains substantially constant, or at least prevents the rise of excessive thermal gradients.

[0024] Once installed in the printing machine, the chill roll according to the invention operates as follows. As mentioned, the seal element 4 is fixed to the frame of the machine. On the contrary, the cylindrical body rotates with respect to the fixed frame. As a result of the tangential engagement by the printing support and its advancement, the idle cylindrical body is set into rotation. The water flow injected into the first chamber 40 hits the turbine 5 imparting a rotation thereto, around the X axis; as a result, an auxiliary torque is supplied to the same body, opposing the frictional resistance due e.g. and in particular to the contact between the outer face of the roll and the printing support. This assists to achieve a desirable consistency between the rotation speed of the roll and the speed of the printing support, with no mutual resistances that can be responsible for defects like warps or tensions in the printing support.

[0025] The cooling fluid flows then from the first chamber 40 to the first intake segment 3a and from it to the drum through the flow supply channels 110'. After running along the drum for all its elongation, the fluid enters the return channels 110" and then the final discharge segment 3b, to be discharged thorough the second chamber 42 and eventually the drain passage 420. As mentioned, this internal construction accomplishes an optimum distribution of the cooling action over the whole width of the printing support.

[0026] The amount of fluid fed to the roll, and the pressure thereof, are such as to generate a torque that is sufficient to win the friction almost totally, so that the roll is rotated by the drawing power of the printing support

with a negligible opposing force.

[0027] As mentioned, the fluid can be water; being the circuit inside the roll actually a close one, the water does not become oxygenated, thus avoiding corrosion phenomena and formations of algae or other microorganisms.

[0028] The present invention has been described with reference to a preferred embodiment thereof. It should be understood that there can be other embodiments that belong to the same inventive concept, inasmuch as they fall within the scope of protection of the following claims.

Claims

1. A chill roll for a printing machine, the chill roll comprising a cylindrical body (1) elongated according to a longitudinal axis (X) and shafts (2) projecting from respective opposite ends of the cylindrical body (1), the cylindrical body (1) containing a cooling circuit (3) for the circulation of a cooling fluid, said chill roll further comprising a first chamber (40), an inlet (30) to said cooling circuit being open inside said first chamber (40), said first chamber (40) further comprising an access (41) for the inlet of said cooling fluid in said first chamber (40), **characterised in that** a first one (20) of said shafts (2) provides auxiliary rotation drive means (5) housed inside said first chamber (40), said auxiliary rotation drive means (5) being adapted, under the pushing action of said cooling fluid supplied through said access (41), to transmit a rotational movement around said longitudinal axis (X) to said cylindrical body (1).
2. The chill roll according to claim 1, wherein said inlet (30) to said cooling circuit (3) is formed in said first shaft (20) in correspondence of a free end thereof.
3. The chill roll according to claim 2, wherein said first chamber (40) is formed inside a sealing body (4) pivotally engaged over said free end of said first shaft (20) in the fashion of a cap.
4. The chill roll according to claim 3, wherein said sealing body (4) defines a second chamber (42) hydraulically separated by said first chamber (40), a drain passage (420) of said cooling fluid opening inside said second chamber (42).
5. The chill roll according to any of the claims from 2 to 4, wherein said auxiliary rotation drive means (5) comprise a plurality of blades (50) integrally connected to said first shaft (20) and projecting in a polar array around said longitudinal axis (X) from an outer surface of said first shaft (20) in correspondence of said free end.
6. The chill roll according to claim 5, wherein said access (41) is in a tangential arrangement with respect to an outer circumference defined by the outer periphery of said plurality of blades (50), so that said cooling fluid supplied through said access (41) strikes on to a surface of said blades (50).
7. The chill roll according to any of the claims from 4 to 6, wherein said first shaft (20) comprises two tubular sleeves coaxially arranged with respect to said longitudinal axis (X), one inside the other, an inner sleeve (201) of said two sleeves projecting with a free end (201a) from an outer sleeve (200) of said two sleeves, said free end (201a) of the inner sleeve (201) supporting said auxiliary rotation drive means (5).
8. The chill roll according to claim 7, wherein said inner sleeve (201) defines a first intake segment (3a) of said cooling circuit (3), an entry of said first intake segment (3a) being arranged in correspondence of said free end (201a) of said inner sleeve (201) and defining said inlet (30) to the cooling circuit (3).
9. The chill roll according to claim 8, wherein a tubular gap (211) is defined between said inner sleeve (201) and said outer sleeve (200), said tubular gap (211) defining a final discharge segment (3b) of said cooling circuit (3).
10. The chill roll according to claim 9, wherein an end (211a) of said tubular gap (211) defines an outlet of said cooling circuit (3) and is opened inside said second chamber (42).
11. The chill roll according to any of the claims from 8 to 10, wherein said cylindrical body (1) comprises a tubular drum (11) closed at opposite ends by end caps (12) to which said shafts (2) are integrally connected.
12. The chill roll according to claim 11, wherein a plurality of channels (110) are formed in the thickness of said tubular drum (11), said channels (110) being consecutively arranged throughout the circumference of the tubular drum (11) around said longitudinal axis (X) and extending substantially along the whole elongation of the tubular drum (11).
13. The chill roll according to claim 12, wherein said channels (110) alternatively comprise, following the circumference of the tubular drum (11), flow supply channels (110') and flow return channels (110'') of said cooling circuit (3), said intake channels (110') being hydraulically connected with said first intake segment (3a), said discharge channels (110'') being hydraulically connected with said final discharge segment (3b).
14. A printing machine comprising a chill roll according

to any of the previous claims.

Patentansprüche

1. Kühlwalze für eine Druckmaschine, die Kühlwalze umfassend einen zylindrischen Körper (1), der in einer Längsachse (X) länglich ist, und Wellen (2), die von entsprechenden gegenüberliegenden Enden des zylindrischen Körpers (1) vorstehen, wobei der zylindrische Körper (1) einen Kühlkreislauf (3) für die Zirkulation eines Kühlfluids enthält, wobei die Kühlwalze weiter eine erste Kammer (40) umfasst, wobei ein Einlass (30) zu dem Kühlkreislauf im Inneren der ersten Kammer (40) offen ist, die erste Kammer (40) weiter einen Zugang (41) für den Einlass des Kühlfluids in der ersten Kammer (40) umfasst, **dadurch gekennzeichnet, dass** eine erste (20) der Wellen (2) ein Hilfsdrehantriebsmittel (5) bereitstellt, das im Inneren der ersten Kammer (40) aufgenommen ist, wobei das Hilfsdrehantriebsmittel (5) ausgebildet ist, unter der Schubwirkung des Kühlfluids, das durch den Zugang (41) zugeleitet wird, eine Drehbewegung um die Längsachse (X) auf den einen zylindrischen Körper (1) zu übertragen.
2. Kühlwalze nach Anspruch 1, wobei der Einlass (30) des Kühlkreislaufs (3) in der ersten Welle (20) entsprechend ihrem freien Ende gebildet ist.
3. Kühlwalze nach Anspruch 2, wobei die erste Kammer (40) im Inneren eines Dichtungskörpers (4) gebildet ist, der schwenkbar über dem freien Ende der ersten Welle (20) in der Form einer Kappe in Eingriff steht.
4. Kühlwalze nach Anspruch 3, wobei der Dichtungskörper (4) eine zweite Kammer (42) definiert, die hydraulisch durch die erste Kammer (40) getrennt ist, wobei sich ein Ableitungsdurchlass (420) des Kühlfluids im Inneren der zweiten Kammer (42) öffnet.
5. Kühlwalze nach einem der Ansprüche 2 bis 4, wobei das Hilfsdrehantriebsmittel (5) eine Vielzahl von Schaufeln (50) umfasst, die einstückig mit der ersten Welle (20) verbunden sind und in einer polaren Anordnung um die Längsachse (X) von einer Außenfläche der ersten Welle (20) entsprechend dem freien Ende vorstehen.
6. Kühlwalze nach Anspruch 5, wobei der Zugang (41) eine tangentiale Anordnung in Bezug auf einen Außenumfang ist, der durch die äußere Peripherie der Vielzahl von Schaufeln (50) definiert ist, sodass das Kühlfluid, das durch den Zugang (41) zugeleitet wird, auf die Oberfläche der Schaufeln (50) trifft.
7. Kühlwalze nach einem der Ansprüche 4 bis 6, wobei
8. Kühlwalze nach Anspruch 7, wobei die Innenhülse (201) ein erstes Zulaufsegment (3a) des Kühlkreislaufes (3) definiert, wobei ein Eintritt des ersten Zulaufsegments (3a) entsprechend dem freien Ende (201a) der Innenhülse (201) angeordnet ist und den Einlass (30) zu dem Kühlkreislauf (3) definiert.
9. Kühlwalze nach Anspruch 8, wobei ein rohrförmiger Spalt (211) zwischen der Innenhülse (201) und der Außenhülse (200) definiert ist, wobei der rohrförmige Spalt (211) ein Endausgabesegment (3b) des Kühlkreislaufes (3) definiert.
10. Kühlwalze nach Anspruch 9, wobei ein Ende (211a) des rohrförmigen Spalts (211) einen Auslass des Kühlkreislaufes (3) definiert und im Inneren der zweiten Kammer (42) geöffnet ist.
11. Kühlwalze nach einem der Ansprüche 8 bis 10, wobei der zylindrische Körper (1) eine rohrförmige Trommel (11) umfasst, die an gegenüberliegenden Enden durch Endkappen (12) verschlossen ist, mit welchen die Wellen (2) einstückig verbunden sind.
12. Kühlwalze nach Anspruch 11, wobei eine Vielzahl von Kanälen (110) in der Dicke der rohrförmigen Trommel (11) gebildet ist, wobei die Kanäle (110) der Reihe nach um den gesamten Umfang der rohrförmigen Trommel (11) um die Längsachse (X) angeordnet sind und sich im Wesentlichen entlang der gesamten Ausdehnung der rohrförmigen Trommel (11) erstrecken.
13. Kühlwalze nach Anspruch 12, wobei die Kanäle (110) abwechselnd, entlang des Umfangs der rohrförmigen Trommel (11), Strömungszuleitungskanäle (110') und Strömungsrückleitungskanäle (110'') des Kühlkreislaufs (3) umfassen, wobei die Zulaufkanäle (110') hydraulisch mit dem ersten Zulaufsegment (3a) verbunden sind, die Abgabekanäle (110'') hydraulisch mit dem Endabgabesegment (3b) verbunden sind.
14. Druckmaschine, umfassend eine Kühlwalze nach einem der vorstehenden Ansprüche.

Revendications

1. Rouleau refroidisseur pour une machine d'impression, le rouleau refroidisseur comprenant un corps cylindrique (1) allongé selon un axe longitudinal (X) et des arbres (2) faisant saillie à partir d'extrémités opposées respectives du corps cylindrique (1), le corps cylindrique (1) contenant un circuit de refroidissement (3) pour la circulation d'un fluide de refroidissement, le rouleau refroidisseur comprenant en outre une première chambre (40), une entrée (30) vers ledit circuit de refroidissement étant ouverte à l'intérieur de ladite première chambre (40), ladite première chambre (40) comprenant en outre un accès (41) pour l'entrée dudit fluide de refroidissement dans ladite première chambre (40),
caractérisé en ce qu'un premier (20) desdits arbres (2) fournit des moyens d'entraînement en rotation auxiliaires (5) logé à l'intérieur de ladite première chambre (40), lesdits moyens d'entraînement en rotation auxiliaires (5) étant adaptés, sous l'action de poussée dudit fluide de refroidissement fourni à travers ledit accès (41), pour transmettre un mouvement de rotation autour dudit axe longitudinal (X) audit corps cylindrique (1).
2. Rouleau refroidisseur selon la revendication 1, dans lequel ladite entrée (30) vers ledit circuit de refroidissement (3) est formée dans ledit premier arbre (20) en correspondance avec une extrémité libre de celui-ci.
3. Rouleau refroidisseur selon la revendication 2, dans lequel ladite première chambre (40) est formée à l'intérieur d'un corps d'étanchéité (4) mis en prise de manière pivotante au-dessus de ladite extrémité libre dudit premier arbre (20) à la manière d'un capuchon.
4. Rouleau refroidisseur selon la revendication 3, dans lequel ledit corps d'étanchéité (4) définit une seconde chambre (42) séparée hydrauliquement de ladite première chambre (40), un passage de drainage (420) dudit fluide de refroidissement s'ouvrant à l'intérieur de ladite seconde chambre (42).
5. Rouleau refroidisseur selon l'une quelconque des revendications 2 à 4, dans lequel lesdits moyens d'entraînement en rotation auxiliaires (5) comprennent une pluralité d'ailettes (50) reliées d'un seul tenant audit premier arbre (20) et faisant saillie en un réseau polaire autour dudit axe longitudinal (X) à partir d'une surface externe dudit premier arbre (20) en correspondance avec ladite extrémité libre.
6. Rouleau refroidisseur selon la revendication 5, dans lequel ledit accès (41) est selon un agencement tangentiel par rapport à une circonférence externe définie par la périphérie externe de ladite pluralité d'ailettes (50), de sorte que ledit fluide de refroidissement fourni à travers ledit accès (41) vient frapper une surface desdites ailettes (50).
7. Rouleau refroidisseur selon l'une quelconque des revendications 4 à 6, dans lequel ledit premier arbre (20) comprend deux manchons tubulaires agencés de manière coaxiale par rapport audit axe longitudinal (X), l'un à l'intérieur de l'autre, un manchon interne (201) desdits deux manchons faisant saillie avec une extrémité libre (201a) à partir d'un manchon externe (200) desdits deux manchons, ladite extrémité libre (201a) du manchon interne (201) supportant lesdits moyens d'entraînement en rotation auxiliaires (5).
8. Rouleau refroidisseur selon la revendication 7, dans lequel ledit manchon interne (201) définit un premier segment d'admission (3a) dudit circuit de refroidissement (3), une entrée dudit premier segment d'admission (3a) étant agencée en correspondance avec ladite extrémité libre (201a) dudit manchon interne (201) et définissant ladite entrée (30) vers le circuit de refroidissement (3).
9. Rouleau refroidisseur selon la revendication 8, dans lequel un espace tubulaire (211) est défini entre ledit manchon interne (201) et ledit manchon externe (200), ledit espace tubulaire (211) définissant un segment de décharge final (3b) dudit circuit de refroidissement (3).
10. Rouleau refroidisseur selon la revendication 9, dans lequel une extrémité (211a) dudit espace tubulaire (211) définit une sortie dudit circuit de refroidissement (3), et est ouverte à l'intérieur de ladite seconde chambre (42).
11. Rouleau refroidisseur selon l'une quelconque des revendications 8 à 10, dans lequel ledit corps cylindrique (1) comprend un tambour tubulaire (11) fermé aux extrémités opposées par des capuchons d'extrémité (12) auxquels lesdits arbres (2) sont reliés d'un seul tenant.
12. Rouleau refroidisseur selon la revendication 11, dans lequel une pluralité de canaux (110) sont formés dans l'épaisseur dudit tambour tubulaire (11), lesdits canaux (110) étant agencés consécutivement sur toute la circonférence du tambour tubulaire (11) autour dudit axe longitudinal (X) et s'étendant sensiblement sur la totalité de la longueur du tambour tubulaire (11).
13. Rouleau refroidisseur selon la revendication 12, dans lequel lesdits canaux (110) comprennent en

alternance, suivant la circonférence du tambour tubulaire (11), des canaux d'amenée d'écoulement (110') et des canaux de retour d'écoulement (110'') dudit circuit de refroidissement (3), lesdits canaux d'admission (110') étant reliés hydrauliquement audit premier segment d'admission (3a), lesdits canaux de décharge (110'') étant reliés hydrauliquement audit segment de décharge final (3b).

14. Machine d'impression comprenant un rouleau refroidisseur selon l'une quelconque des revendications précédentes.

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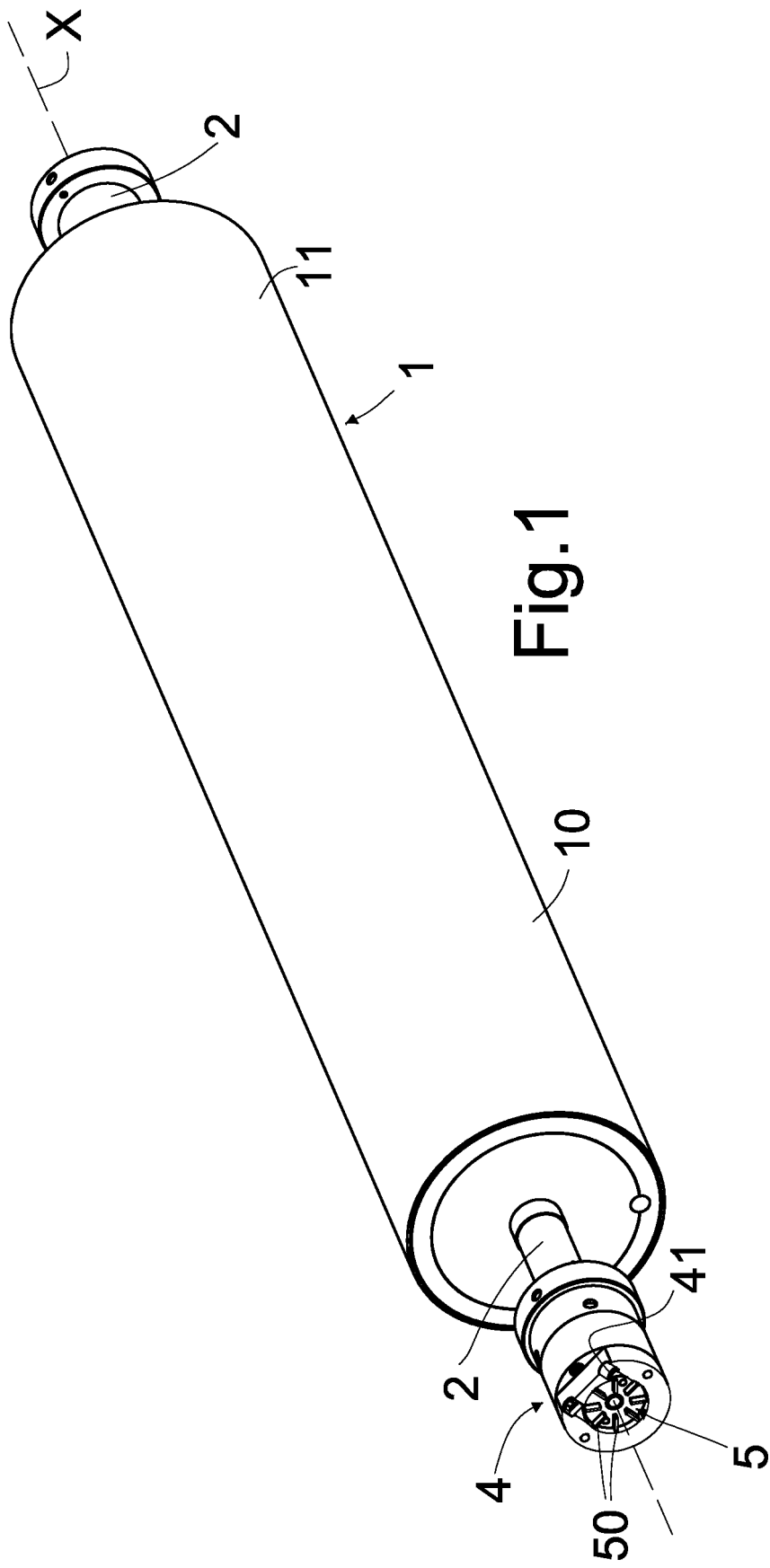
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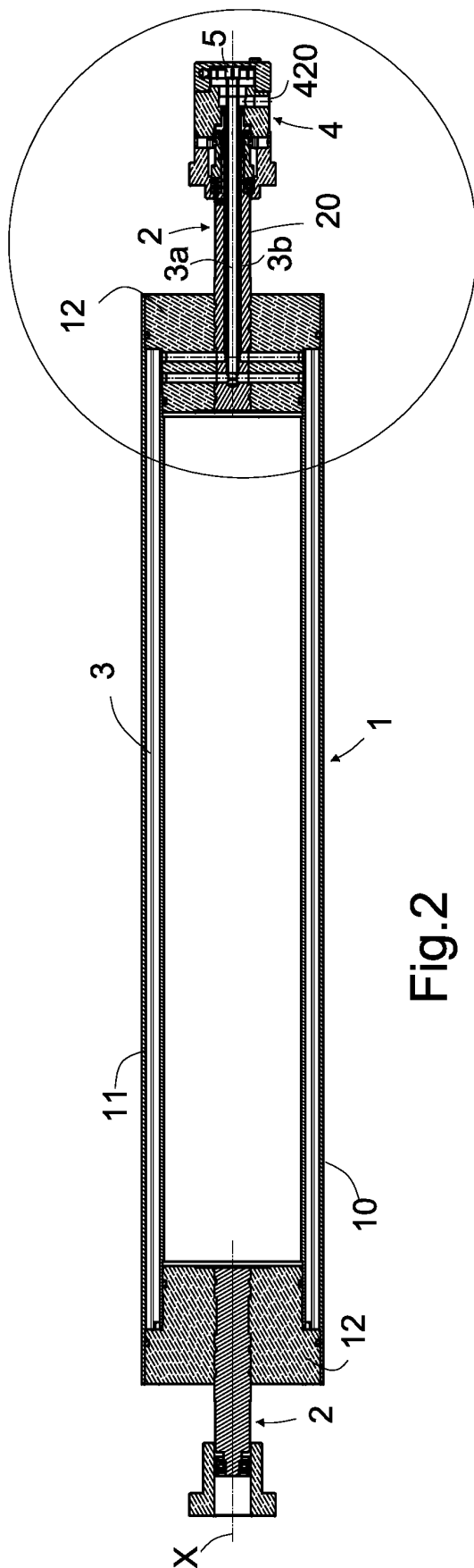
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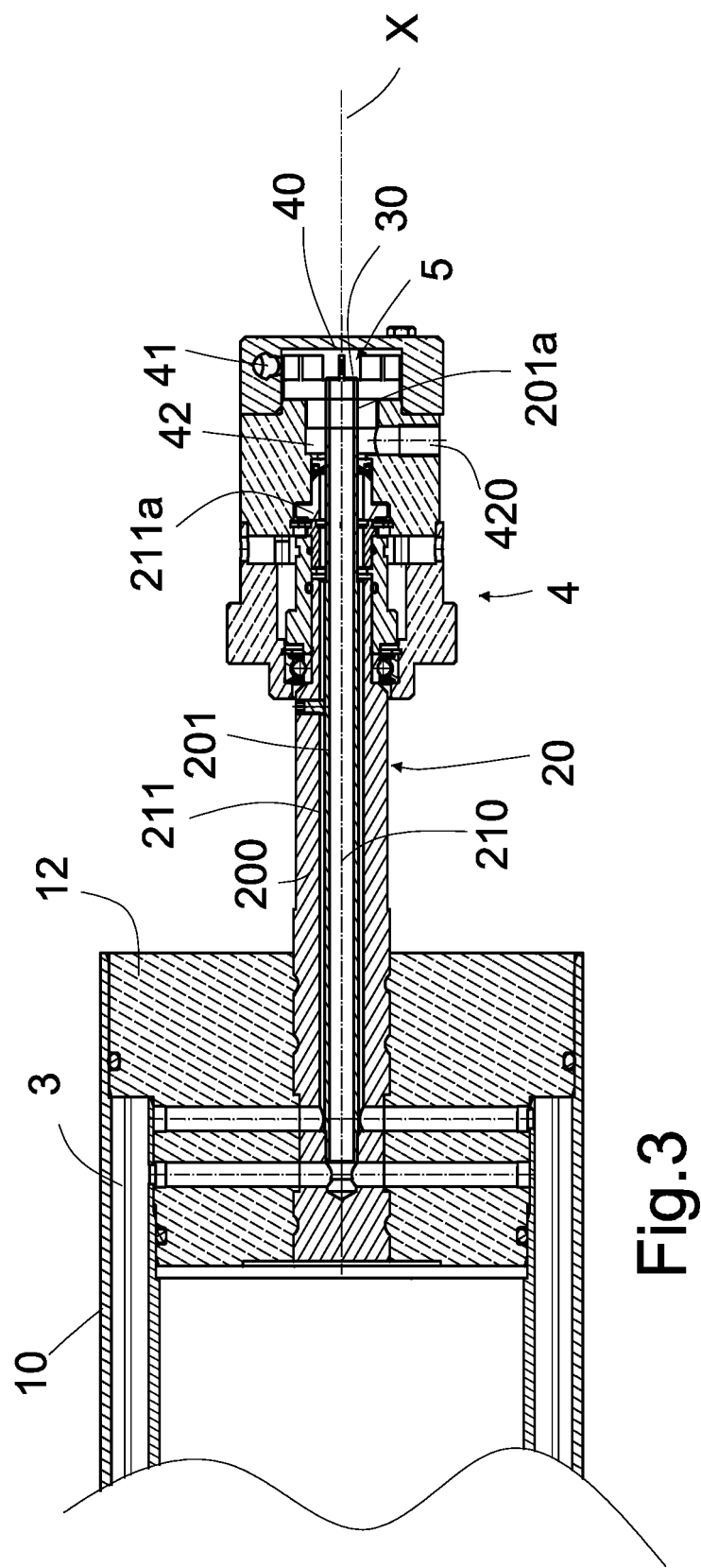
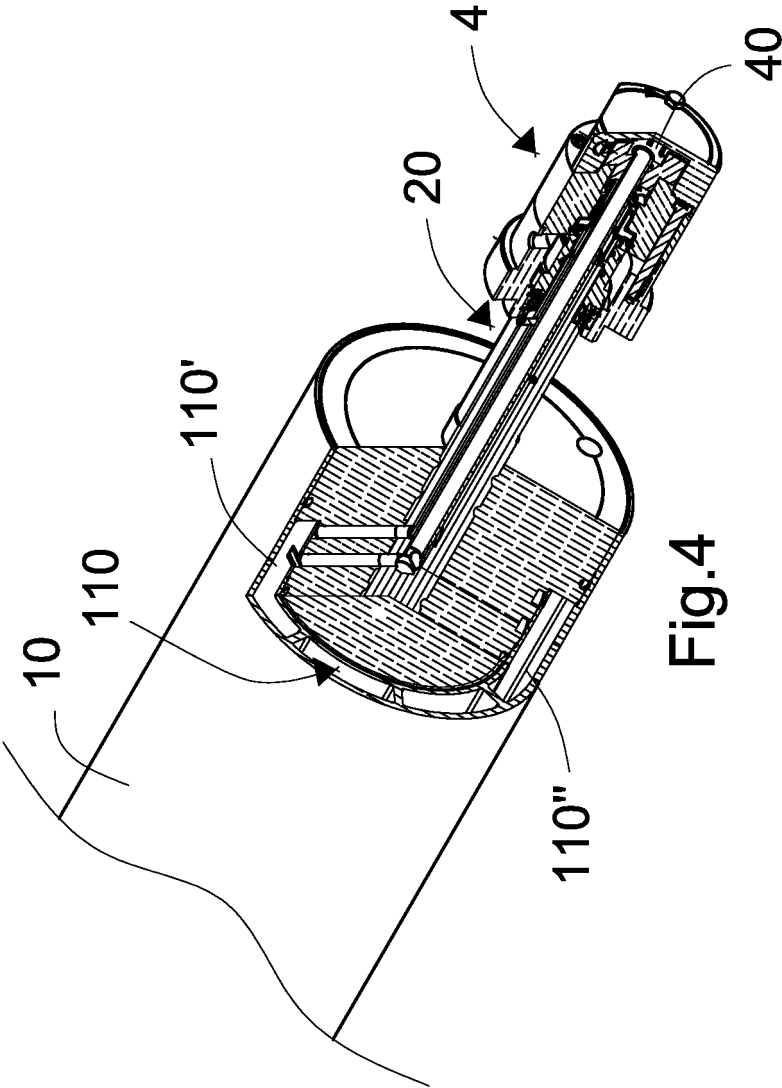


Fig.3



REFERENCES CITED IN THE DESCRIPTION

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