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(54) **THERMO ROLL FOR A FIBER WEB MACHINE**

(57) The invention relates to a thermo roll. The thermo roll (12) includes a hollow roll body (13) having a plurality of grooves (14) on its outer surface (15). Each groove (14) extends from one end of the roll body (13) to another. In the roll body (13) there are axial bores (16) opening to the grooves (14). The thermo roll (12) also includes an axle stub (17), having conducts (18) extending to said axial bores (16), fixed to both end of the roll body (13) by a plurality of bolts (19). In addition, the thermo roll (12) also includes an outer jacket (21) friction fitted on the roll body (13) and the axle stubs (17) closing the grooves (14) as a plurality of channels (22) for heat transfer medium. Each axial bore (16) has an offset (23) opening to two adjacent grooves (14).

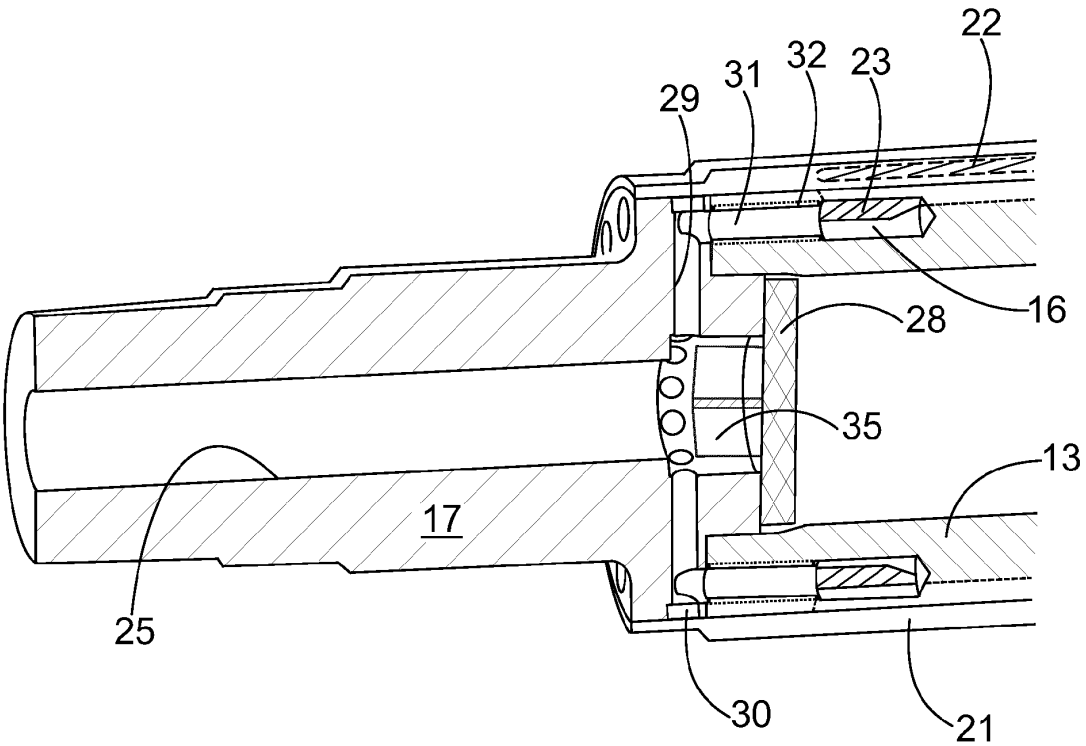


Fig. 2b

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## Description

**[0001]** The present invention relates to a thermo roll for a fiber web machine, which thermo roll includes

- a hollow roll body having a plurality of grooves on its outer surface, each groove extending from one end of the roll body to another, and in the roll body there are axial bores opening to the grooves,
- a axle stub, having conducts extending to the axial bores, fixed to both end of the roll body by a plurality of bolts, and
- an outer jacket friction fitted on the roll body and the axle stubs closing the grooves as a plurality of channels for heat transfer medium.

**[0002]** FI-patent number 122707 discloses a thermo roll of a fiber web machine. The thermo has a roll body with two axle stubs. The axle stubs are bolted to the roll body. In addition, the roll body has grooves and an outer jacket. Thus, channels for heat transfer medium is formed. The axle stubs and the roll body have bores for leading heat transfer medium into and out of the channels. In practice, there is one axial bore for each groove.

**[0003]** The diameter of the known roll body is big as well the thickness of the wall of the roll body itself, because the axial bores and the bolts need space. Also, the bores weaken the axle stub. Thus, also the axle stubs must be massive. These features make the whole thermo roll giant and heavy. This reduces the possibility of utilizing thermo roll in different positions.

**[0004]** The object of the invention is to provide a thermo roll for a fiber web machine, which is more simply and smaller especially in diameter than before. The characteristic features of the thermo roll according to the invention are stated in the accompanying Claims. The thermo roll, especially the roll body and the axle stubs have less bores than before. Thus, even small axle stubs are possible. Simultaneously, the thickness of the wall of roll body can be smaller. Still, by arranging the bores in a new way, the thickness of the wall of the roll body can be minimized.

**[0005]** The invention is described below in detail by referring to the enclosed drawings, which illustrate some of the embodiments of the invention, in which

| | |
|---|---|
| Figure 1 | shows a schematic side view of a part of a fiber web machine equipped with thermo rolls according to the invention, |
| Figure 2a | shows a schematic cross section of the thermo roll according to the invention, |
| Figure 2b | shows a partial cross section of the thermo roll according to the invention, |
| Figure 3 | shows a schematic view of the thermo roll according to the invention seen from the head of the thermo roll, |
| Figure 4 | shows a part of the thermo roll according to the invention without the outer jacket. |

**[0006]** Fig. 1 shows a part of the fiber web machine as a side view. Here is a calender 10 with a stack 11 of rolls. At least part of the rolls are thermo rolls 12. In the calender, the thermo roll is heated by heat transfer medium, which is hot water or oil or other hot fluid. By heating, the properties of the fiber web, as paper for example, can be improved. Also, the guide rolls may be thermo rolls. Usually, the thermo roll is in a nip contact with another roll or thermo roll. The thermo roll according to the invention may be used also elsewhere where needed, for example, in the dryer section of the fiber web machine.

**[0007]** Fig. 2a shows the thermo roll 12 according to the invention in cross section. The thermo roll is intended for a fiber web machine. The thermo roll 12 includes a hollow roll body 13, which has a plurality of grooves 14 on its outer surface 15. The grooves 14 are shown in Fig. 4 in detail. The grooves may run in the axial direction of the thermo roll, but can also run, for example, at an angle or in a spiral, to avoid, among other things, a barring phenomenon. Each groove 14 extends from one end of the roll body 13 to another. Also, in the roll body 13 there are axial bores 16 opening to the grooves 14. The thermo roll further includes an axle stub 17, which has conducts 18 extending to said axial bores 16. One axle stub 17 is fixed to both end of the roll body 13 by a plurality of bolts 19. Two bolts 19 are shown in Fig. 2a and the holes 20 for the bolts in Fig. 3. Further the thermo roll 12 includes an outer jacket 21 friction fitted on the roll body 13 and the axle stubs 17. The friction fitting is also called as interference fitting or press fitting. The outer jacket 21 closes the grooves 14 as a plurality of channels 22 for heat transfer medium. In the shown embodiment in Fig. 2a, the flow of the heat transfer medium is illustrated in solid arrows. In the basic embodiment, the heat transfer medium is fed via the axle stub 17 to the axial bores 16 and thereby into the grooves 14 and finally out of the thermo roll via the other axle stub 17. The cross section of Fig. 2a has two planes showing both the groove 14 with the axial bores 16 (upside) and the bolts 19 (underside).

**[0008]** In the present invention, each axial bore 16 has an offset 23 opening to two adjacent grooves 14. In other words, one axial bore ends to two adjacent grooves. In this way, the number of bores needed is reduced by half. Simultaneously, the thickness of the wall of the roll body may be reduced. In practice, the bore is so big that it as least partially reaches into two grooves 14 (Fig. 4). Here the axial bore 16 is mainly in the neck 24 between two grooves 14. So, with a single drilling, the axial bore reaching two adjacent grooves is simply machined. Alternatively, there might be first one smaller axial drilling and then further two oblique drillings reaching each to one groove.

**[0009]** Also, the bolts are positioned in a new way. Advantageously, between two radial bores 29 there is one bolt 19. In other words, there is a bolt every second neck. More advantageously, the axial bores 16 and the bolts 19 are essentially in the same radius in relation to the

center of the axle stub 17 (Fig. 3). In this way, the thickness of the roll body may be minimized. Even then, there is enough place for the axial bores and the bolts. In Fig. 3 only the holes 20 for the bolts are shown, not the bolts themselves. Here, between the grooves 14 there is a neck 24 to which the axial bore 16 is situated as well are the bolts 19. Also, each bolt 19 is situated at the neck 24 adjacent to the axial bores 16. Thus, it is possible to use bolts long enough to get rigid fixing. More generally, the distance between the bolts and axial bores is essentially the same as the radius drawn through the center of the holes for the bolts and bores intersects the circuit of the adjacent hole.

**[0010]** As mentioned earlier, the axle stub 17 has a conduct 18 extending to axial bore 16. First there is a central bore 25 through the axle stub 17. At the inner end of the central bore 25 there is an enlargement 26 forming a chamber 27 when the central bore 25 is closed with a wall 28. Also, each conduct 18 includes a radial bore 29 situated between two adjacent grooves 14 to which radial bore 29 the corresponding axial bore 16 is arranged to open. In other words, there is one radial bore for each axial bore. When the number of the axial bores is reduced by half so is the number of the radial bores. Then there is enough material between the radial bores, so the axle stub will stand even heavy loads.

**[0011]** After fitting the outer jacket, the radial bores are closed with the outer jacket. However, each radial bore 29 has a plug 30 ensuring the tightness. The plugs also act as heat insulation. For the same purpose, in the axial bore 16 there is an insulation bushing 31 having an air gap 32 between the axial bore 16 and the insulation bushing 31. The insulation bushing 31 ends just before the grooves (Fig. 2b). Then as much heat as possible ends to the grooves. The insulation bushings are replaceable and there may be different sets of bushings with different diameter. So, the flow rate of the heat transfer medium can be adjusted as needed.

**[0012]** By organizing the bores in a new way, there can be more grooves than before. Advantageously, the width of the neck 24 is the same as the width of the groove 14. Then the heat is transferred evenly, and the bolts have enough space to be attached. Also, the temperature of the outer jacket stays even thereby improving the properties of the fiber web.

**[0013]** When the fluid runs only in one direction in the grooves, the depth of the groove diminishes in the flow direction of the heat transfer medium. In this way the stay time of the fluid is equalized. So, the temperature of the thermo roll is even, even if the heat transfer medium is fed only from one end of the thermo roll. If the flow of heat transfer medium is big enough, the temperature of the thermo roll will stay even.

**[0014]** When the axial bores and the bolts are situated according to the invention, the thermo roll may be optimized and thereby minimized. Actually, the thickness of the outer jacket 21 is 20 - 40 mm. In this way, the heat is transferred more efficiently to the fiber web. Simultaneously, the mass of the thermo roll gets smaller than before. At the end, there is still a possibility to grind the outer jacket about ten millimeters.

**[0015]** The biggest weight loss is achieved by hindering the thickness of the wall of the hollow roll body. By this surprising idea, the thickness of the wall of said hollow roll body may be only 60 - 80 mm, even the thermo roll is six meter long. Then, the actual nip pressure is demanding, not the space needed by the bores and the bolts. The size of the thermo roll can by then both minimized and optimized.

**[0016]** In a small, like a thermo roll having the diameter of 600 millimeters, the width of the groove by be about 20 - 30 millimeters. When the neck is about the same size, the temperature of the outer jacket as is even over the whole diameter of the thermo roll.

**[0017]** As well as the axial bores, in the radial bore 29 there is an additional insulation bushing 33 having an air gap 34 between the radial bore 29 and the additional insulation bushing 33. By this way, as much heat as possible ends to the grooves. The air caps may be filled with the fluid, but when the fluid in the air caps stays still, it acts like insulation like air. Thus, no sealant is needed.

**[0018]** As mentioned earlier, there is a central bore 25 in the axle stub 17. Advantageously, the beginning of the radial bore 29 is a flow divider 35 arranged inside the central bore 25. This divider equals the flow of heat transfer medium into the radial bores. Then heat is spread equally even the thermo roll rotates in a high speed.

**[0019]** As shown in Fig. 2a, both axle stubs 17 with their conducts 18 are identical for feeding heat transfer medium from one axle stub 17 via the channels 22 to the other axle stub 17. Thereby, heat transfer medium is fed in from one end of the thermo roll and then led out from the other end of the thermo roll. Alternatively, there might be inside the central bore 25 and the axle stub 17 a central pipe 36 for feeding or returning, like in here, heat transfer medium. Then, the heat transfer medium is fed in and lead out from one end of the thermo roll. This is shown in Fig. 2a with dashed lines. There is also a block 37 closing the central bore 25 and guiding heat transfer medium into the central pipe 36.

## Claims

1. Thermo roll for a fiber web machine, which thermo roll (12) includes

   - a hollow roll body (13) having a plurality of grooves (14) on its outer surface (15), each groove (14) extending from one end of the roll body (13) to another, and in the roll body (13) there are axial bores (16) opening to the grooves (14),
   - an axle stub (17), having conducts (18) extending to said axial bores (16), fixed to both end of the roll body (13) by a plurality of bolts (19), and

- an outer jacket (21) friction fitted on the roll body (13) and the axle stubs (17) closing the grooves (14) as a plurality of channels (22) for heat transfer medium,

**characterized in that** each axial bore (16) has an offset (23) opening to two adjacent grooves (14).

**2.** Thermo roll according to claim 1, **characterized in that** each conduct (18) includes a radial bore (29) situated between two adjacent grooves (14) to which radial bore (29) the corresponding axial bore (16) is arranged to open.

**3.** Thermo roll according to claim 1 or 2, **characterized in that** between two radial bores (29) there is one bolt (19).

**4.** Thermo roll according to any of claims 1 - 3, **characterized in that** the axial bores (16) and the bolts (19) are essentially in the same radius in relation to the center of the axle stub (17).

**5.** Thermo roll according to any of claims 1 - 4, **characterized in that** between the grooves (14) there is a neck (24) to which the axial bore (16) is situated.

**6.** Thermo roll according to claim 5, **characterized in that** each bolt (19) is situated at the neck (24) adjacent to the axial bores (16).

**7.** Thermo roll according to any of claims 1 - 6, **characterized in that** in the axial bore (16) there is an insulation bushing (31) having an air gap (32) between the axial bore (16) and the insulation bushing (31).

**8.** Thermo roll according to any of claims 5 - 7, **characterized in that** width of the neck (24) is the same as the width of the groove (14).

**9.** Thermo roll according to any of claims 1 - 8, **characterized in that** the depth of the groove (14) diminishes in the flow direction of the heat transfer medium.

**10.** Thermo roll according to any of claims 1 - 9, **characterized in that** the thickness of the outer jacket (21) is 20 - 40 mm.

**11.** Thermo roll according to any of claims 1 - 10, **characterized in that** the thickness of the wall of the hollow roll body (13) is 60 - 80 mm.

**12.** Thermo roll according to any of claims 1 - 11, **characterized in that** in the radial bore (29) there is an additional insulation bushing (33) having an air gap (34) between the radial bore (29) and the additional insulation bushing (33) .

**13.** Thermo roll according to any of claims 1 - 12, **characterized in that** there is a central bore (25) in the axle stub (17) and in the beginning of the radial bore (29) is a flow divider (35) arranged inside the central bore (25).

**14.** Thermo roll according to any of claims 1 - 13, **characterized in that** the both axle stubs (17) with their conducts (18) are identical for feeding heat transfer medium from one axle stub (17) via the channels (22) to the other axle stub (17) .

**15.** Thermo roll according to claim 13 or 14, **characterized in that** inside the central bore (25) and the axle stub (17) there is a central pipe (36) for feeding or returning heat transfer medium.

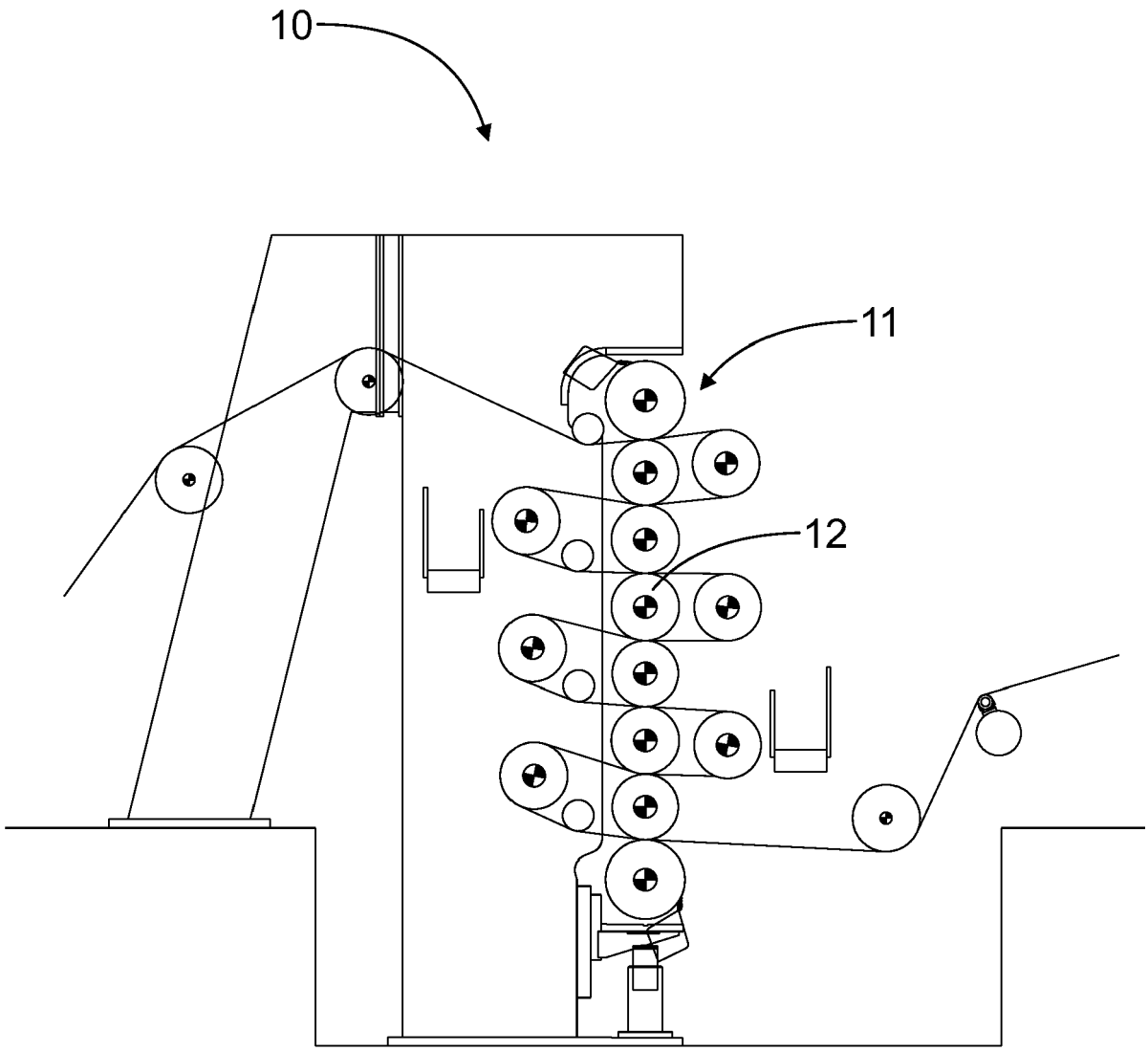


Fig. 1

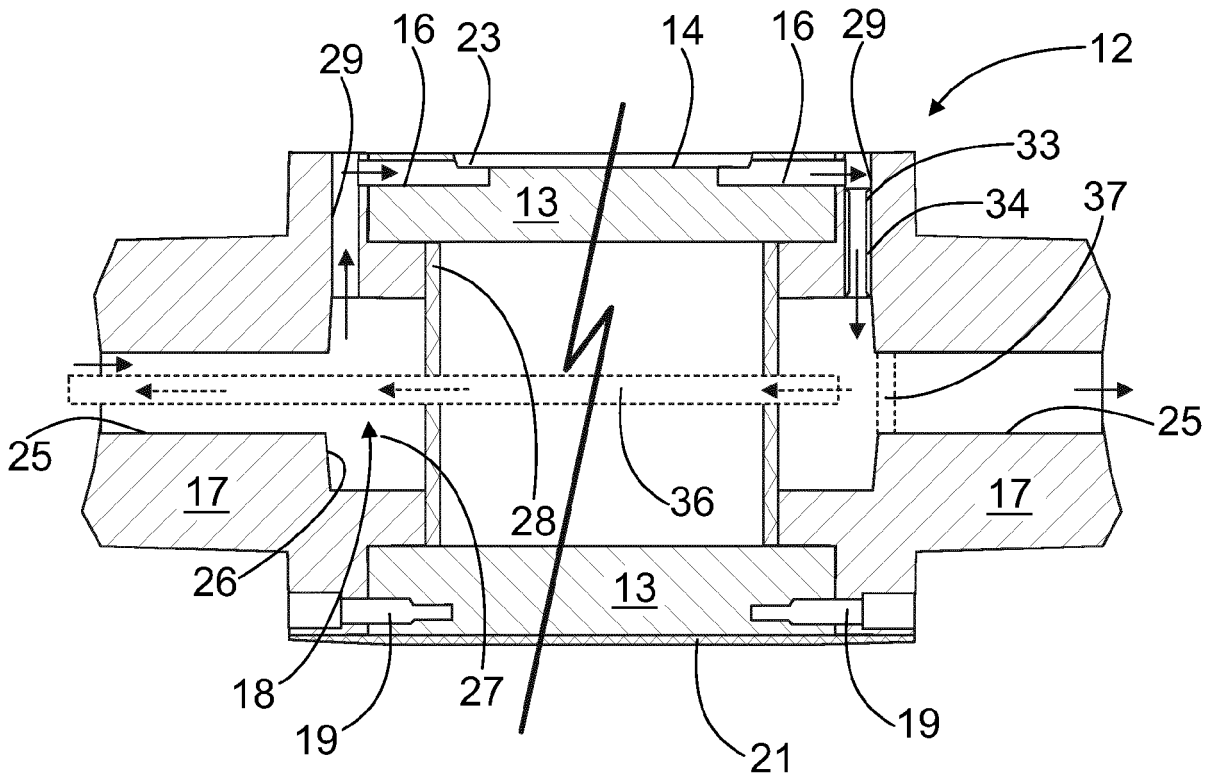
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Fig. 2a

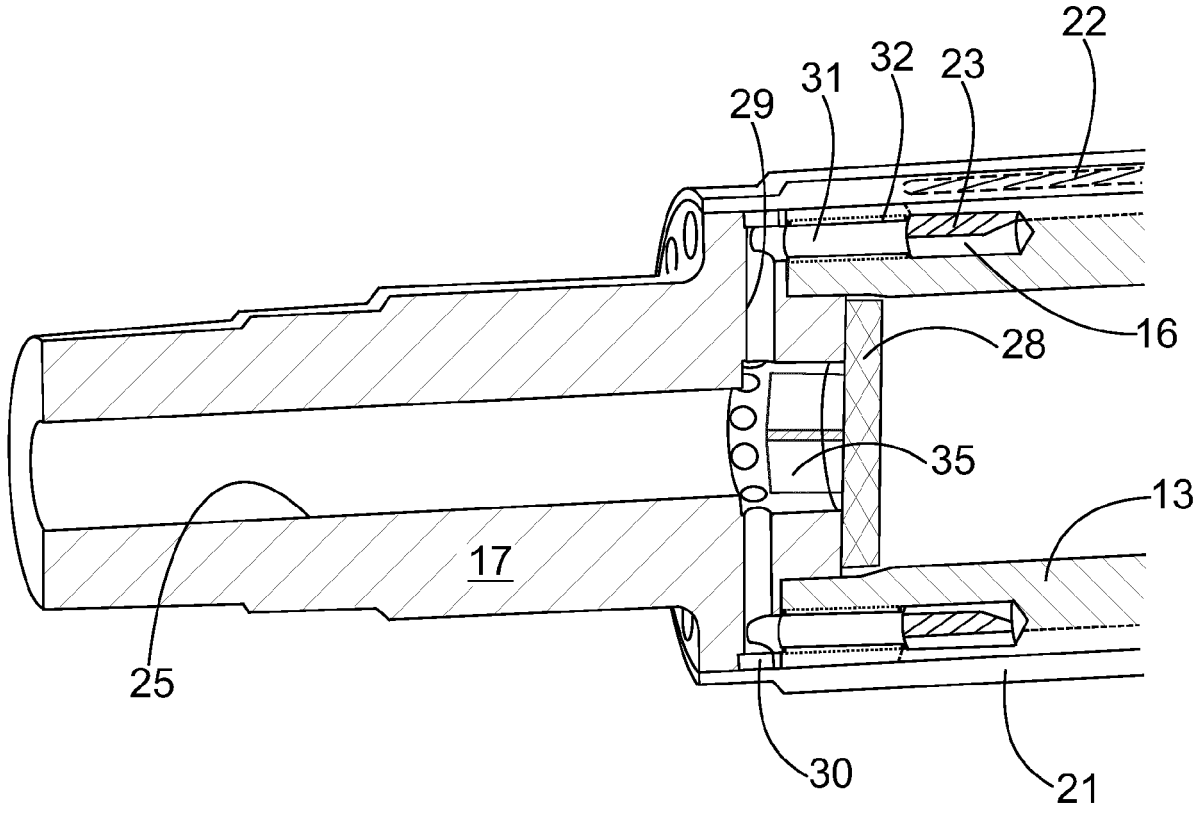
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Fig. 2b

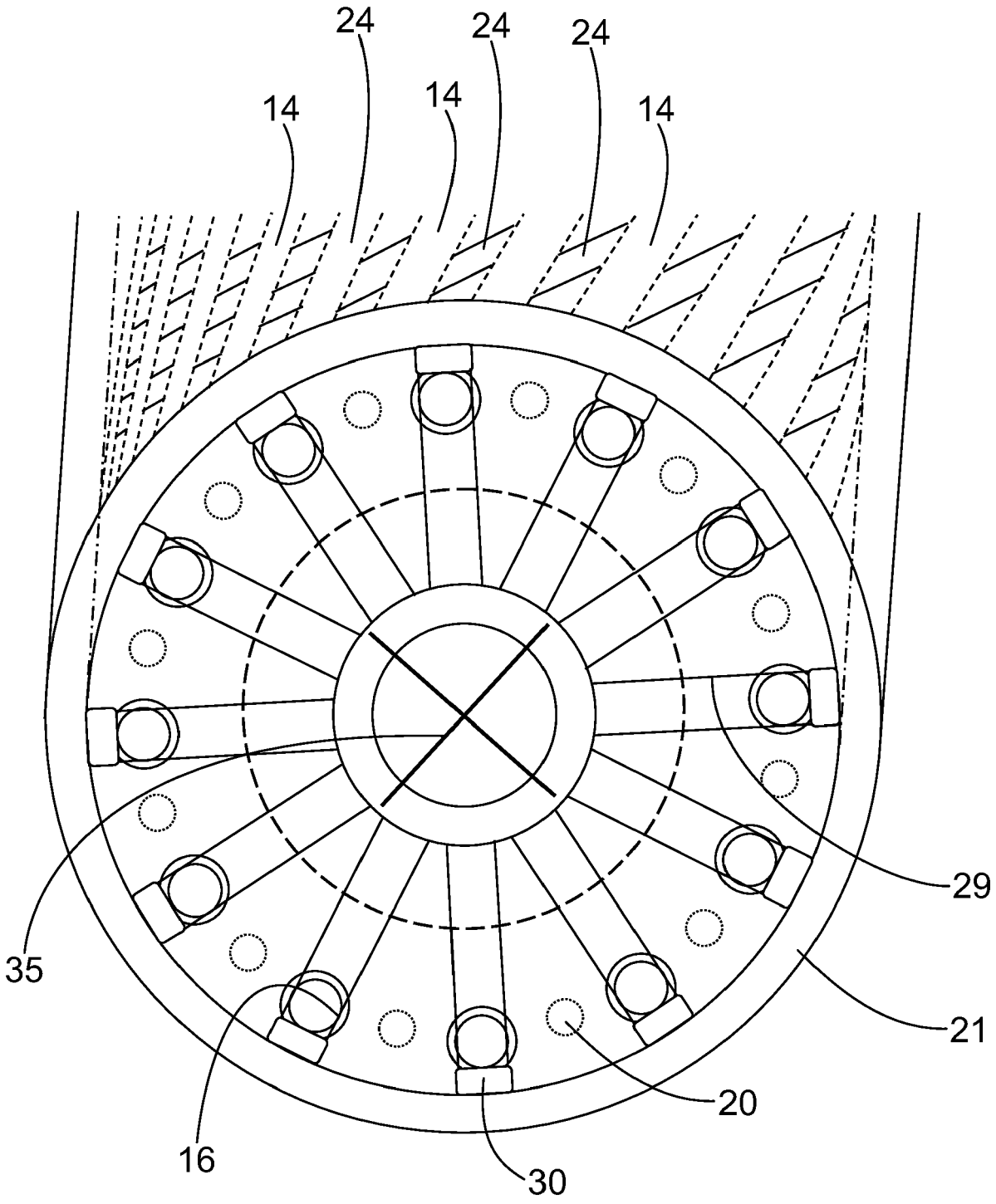


Fig. 3

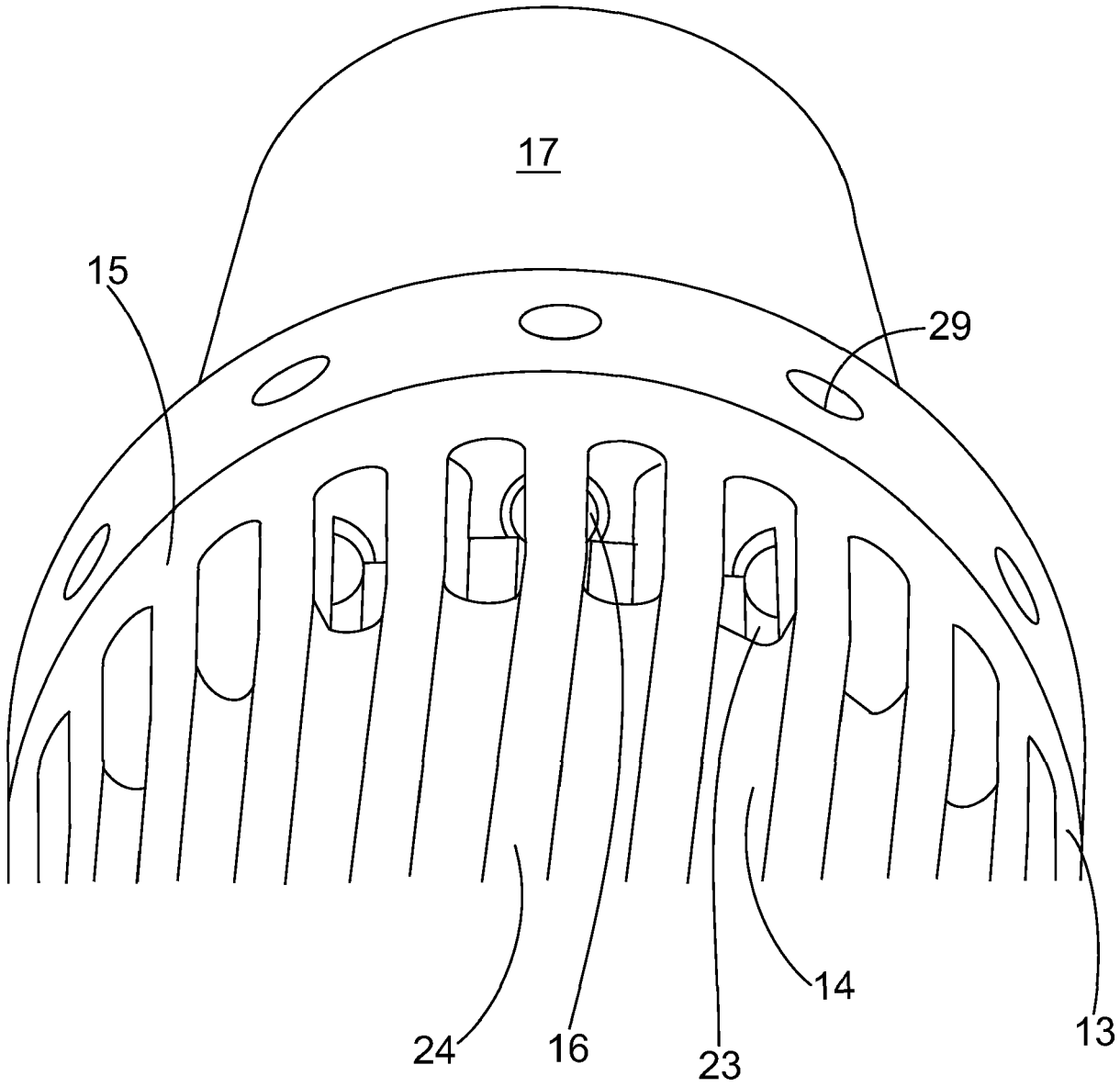


Fig. 4

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# EUROPEAN SEARCH REPORT

Application Number
EP 20 18 1925

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| A | DE 10 2010 001850 A1 (METSO PAPER INC [FI]) 23 September 2010 (2010-09-23)<br>* paragraphs [0042] - [0078]; figures * | 1-15 | INV.<br>D21G1/02<br>D21F5/02 |

TECHNICAL FIELDS SEARCHED (IPC)

D21G
D21F

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 31 July 2020 | Maisonnier, Claire |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 18 1925

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31-07-2020

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| | | FI 20095284 A | 20-09-2010 |



For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

## REFERENCES CITED IN THE DESCRIPTION

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