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(54) MACHINE FOR THE CONTINUOUS FORMING OF A LEAD STRIP

(57) Machine for the continuous forming of a lead strip, which comprises a support structure (2) intended to be resting on the ground, at least one molding roller (3) rotatably supported by the support structure (2) around a first rotation axis (X), provided with an outer wall (17) associated with two ring-shaped shoulders (15, 16) that are parallel to each other; a molding chamber (6) remains defined between the outer surface (17) and the ring-shaped shoulders (15, 16), is extended between an inlet section (8) adapted to receive a continuous flow of molten lead and an outlet section (9) adapted to release a continuous lead strip, a steel strip (4) closed in a loop, at least partially wound around the molding roller (3) in abutment against the ring-shaped shoulders (15, 16) to close said molding chamber (6), at least one forming roller (7) rotatably supported by the support structure (2) around a second rotation axis (Y) parallel to the first rotation axis (X) and provided with an arched profile (11), on which the closed loop steel strip (4) is at least partially wound; the arched profile (11) forms a curving (12) on the steel strip (4) provided with a concavity directed towards the interior of the closed loop.

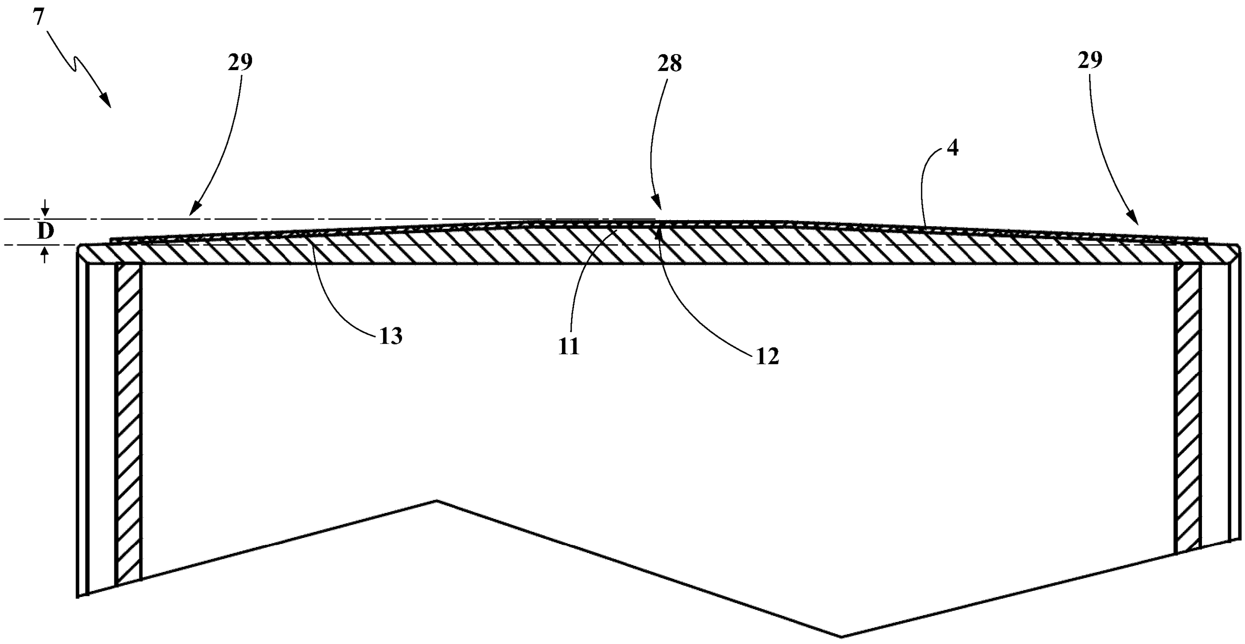

Fig. 3

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Description

Field of application

[0001] The present invention regards a machine for the continuous forming of a lead strip.

[0002] The present machine is intended to be employed in the industrial processes of production of electric storage batteries for making a lead strip with large width, adapted to then be employed in conventional processes of rolling for subsequent steps of molding, incision or expansion for the formation of the grids intended to be employed with positive or negative polarity in the lead electric storage batteries.

State of the art

[0003] In the industrial field of production of electric storage batteries, there is the particular need to obtain, with low-cost processes, continuous high-quality lead strips with which the lead grids with positive or negative polarity are then made, by means of conventional processes of molding or forming via incision or expansion.

[0004] The aforesaid properties are well-known to be attained by means of rolling of a strip obtained via continuous casting of molten lead, with thickness typically of about 1 - 3 mm.

[0005] The present invention therefore refers to the industrial field of production of lead strips of large width, with such term a width being intended that is advantageously greater than 200 mm, intended to be subsequently processed in order to obtain the aforesaid grids or plates for electric storage batteries.

[0006] Known from patent EP 1078703 is a machine for the continuous production of a steel strip, which is provided with two counter-rotating rollers delimiting on the upper part, together with two lateral sides, a tank for containing the molten steel. The rollers are spaced from each other by a slit which is arranged at the bottom of the tank, and which is traversed by a flow of steel that is cooled in contact with the surface of the rollers so as to exit from the rollers in the form of a continuous strip.

[0007] In the passage through the slit, the metal is partially drawn so as to exit in the form of a continuous strip with the desired thickness.

[0008] The machine with counter-rotating rollers for the continuous production of a steel strip, described briefly above, is nevertheless not adapted for the production of a very wide strip with high quality standards.

[0009] Known in the field of production of lead strips is a machine "wheel-and-belt" in the technical jargon of the field. Such machine provided with at least three counter-rotating rollers, including a molding roller interposed between two centering rollers, and a steel strip wound as a ring on such rollers.

[0010] The molding roller is provided with two ring-shaped shoulders which define, with the steel strip, a molding chamber. The latter is intended to receive a flow of molten lead at an inlet section and to release the formed strip in the form of a solidified continuous strip at an outlet section thereof.

[0011] More clearly, the molding chamber defines, with its elongated rectangular cross section, the shape of the strip to be formed.

[0012] The molding roller and the two centering rollers are mechanically associated with each other, one on top of the other, and are rotated around three corresponding substantially horizontal and parallel axes.

[0013] The molding roller is provided with an electric motor for its driving in rotation while the two centering rollers are idle and driven in rotation through the steel strip. The latter is closed and wound as a ring on the aforesaid three rollers as well as on a further tensioning roller flanking the other three superimposed rollers.

[0014] The steel strip is placed in abutment against the two ring-shaped shoulders of the molding roller, and faces the external cylindrical surface of the same molding roller for a circular section of the latter in which it delimits the aforesaid molding chamber.

[0015] In operation, the molten lead is introduced tangentially to the molding roller into the inlet section of the aforesaid molding chamber and is then accompanied within the latter along the circular sector up to the outlet section, where it exits tangentially in solidified form.

[0016] The steel strip is driven in rotation along its closed path by the molding roller, and rests on the ring-shaped shoulders of the latter at the lateral edges thereof. Therefore, the central band of the steel strip does not rest on the molding roller and is suspended in front of the cylindrical surface of the molding roller.

[0017] In the case of forming of a continuous lead strip provided with large width, in particular greater than 200 mm, the steel strip tends to be deformed by thermal expansion due to the heat that is transmitted thereto by the molten lead. Consequently, the steel strip tends to slightly collapse towards the interior of the molding chamber containing the molten lead.

[0018] Such collapse of the steel strip causes a decrease of the thickness of the molten lead at the central band thereof, thus with the formation of a continuous strip with altered cross section due to the aforesaid collapse of the steel strip. The lead strip therefore requires a further step of flattening, up to obtaining a cross section with uniform thickness.

[0019] In order to overcome this drawback, and allow the formation of lead strips with large width, a machine of "wheel-and-belt" type is known from the European patent EP 798060, of the type described up to now and provided with lifting magnets arranged as an arch around the molding roller at the molding chamber, in order to attract and lift the central band of the steel strip and avoid its collapse towards the interior of the molding chamber.

[0020] The machine for the continuous forming of a lead strip of the document EP 798060, described briefly up to now, has in practice shown that it does not lack drawbacks.

[0021] A first drawback lies in the fact that the magnets arranged around the molding roller attract the steel strip, which tends to be lifted from the ring-shaped shoulders, allowing a lower lateral seal with the risk of an undesired exit of the molten lead from the molding chamber.

[0022] A further drawback lies in the fact that the magnets attract the steel strip, which tends to adhere to the latter, slowing its advancement and negatively affecting machine operation.

[0023] A further drawback lies in the fact that the magnets are very energy-consuming, if they are made by means of electromagnets provided with a reel of electrically conductive material traversed by an electric current.

[0024] In any case, one such system for lifting the steel strip by means of magnets is structurally more complex and costly to achieve.

[0025] Known from patent JP H0323040 is an apparatus for molding metal strips, which comprises two opposite advancing strips, between which the molten metal is injected. Behind each advancing strip, a cooling block is arranged, provided with a central cavity for absorbing the thermal expansion of the advancing strip during the operating processes.

[0026] Also known from patent US 4,498,519 is an apparatus for the production of lead strips provided with counter-rotating rollers adapted to receive the molten metal coming from a crucible in order to make a strip with width of 400 mm and thickness of 1 mm.

[0027] The latter two apparatuses of known type, however, do not allow resolving the abovementioned problems of the prior art.

Presentation of the invention

[0028] In this situation, the problem underlying the present invention is therefore that of overcoming the drawbacks manifested by the machines of known type, by providing machine for the continuous forming of a lead strip which allows producing lead strips with large width and with high quality standard.

[0029] A further object of the present invention is to make a machine which is very simple structurally and inexpensive to make.

[0030] A further object of the present finding is to make a machine that is entirely reliable in operation and which requires little maintenance.

[0031] A further object of the present invention is to make a machine that allows making an optimal seal of the chamber containing the molten lead.

Brief description of the drawings

[0032] The technical characteristics of the finding, according to the aforesaid objects, can be clearly seen in the contents of the below-reported claims and the advantages thereof will be more evident in the following detailed description, made with reference to the enclosed drawings, which represent several merely exemplifying and non-limiting embodiments of the invention in which:

- **FIG. 1** shows a side view of the machine for the continuous forming of a lead strip, object of the present invention;
- **FIG. 2** shows a schematic side view of the machine illustrated in figure 1, with some parts removed in order to better illustrate other parts;
- **FIG. 3** shows a top sectional view of the machine illustrated in figure 1 according to the trace III-III of figure 2 itself;
- **FIG. 4** shows a front sectional view of the machine illustrated in figure 1 according to the trace IV-IV of figure 2 itself;
- **FIG. 5** shows a side view of a detail of the machine of figure 1 relative to a molding roller and to a first and a second centering roller, with some parts removed in order to better illustrate other parts.

Detailed description of a preferred embodiment

[0033] With reference to the enclosed drawings, reference number 1 overall indicates a machine for the continuous forming of a lead strip, object of the present invention.

[0034] The lead strip produced by this machine is advantageously intended to be employed in conventional processes for the formation of lead grids and/or plates to be employed with positive or negative polarity in electric storage batteries.

[0035] The strip formed with the machine, object of the present invention, generically indicated as made with lead, should nevertheless be intended as obtained with any one lead alloy susceptible of being employed for the production of the grids and/or plates for electric storage batteries.

[0036] With particular reference to the enclosed figures, the machine 1 is provided with a support structure 2 intended to be resting on the ground, at least one molding roller 3 rotatably supported by the support structure 2 around a first rotation axis X, provided with an outer surface 17 with substantially cylindrical form associated with two ring-shaped shoulders 15, 16 that are substantially parallel to each other. Such ring-shaped shoulders 15, 16 are preferably positioned and fixed at two circumferential edges which delimit the outer surface 17 of the molding roller 3.

[0037] In accordance with the preferred embodiment of the machine 1 illustrated in the enclosed figures, the ring-shaped shoulders 15, 16 are raised in a single body from the outer surface 17 of the molding roller 3.

[0038] Otherwise, in accordance with a further embodiment of the machine 1, not illustrated in the enclosed figures, the ring-shaped shoulders 15, 16 are mechanically fixed to the molding roller 3, e.g. by means of welding or by means of coupling via hot deformation.

[0039] The machine 1, object of the present invention, also comprises a molding chamber 6, which remains defined between the outer surface 17 of the molding roller 3 and the ring-shaped shoulders 15, 16 and is extended between an inlet section 8 adapted to receive a continuous flow of molten lead and an outlet section 9 adapted to release a continuous lead strip.

[0040] Advantageously, the molding chamber 6 has substantially rectangular cross section and is extended over a path with arc of circumference from the inlet section 8 to the outlet section 9 along the outer surface 17 of the molding roller 3. The chamber thus defined rotates from the inlet section to the outlet section. Such sections are defined between the molding roller and two centering rollers indicated hereinbelow.

[0041] In order to facilitate the movement of the molten lead by gravity, the inlet section 8 is placed at a greater height than the outlet section 9.

[0042] The machine 1 also comprises a steel strip 4 closed in a loop, at least partially wound around the molding roller 3 in abutment against the ring-shaped shoulders 15, 16 to close the molding chamber 6.

[0043] Preferably, the steel strip 4 is made of stainless steel, thermally resistant and is provided with a thickness comprised between 1 and 4 mm and in particular comprised between 1.5 mm and 2.5 mm, and is provided with a transverse width comprised between 250 mm and 550 mm and in particular comprised between 350 mm and 500 mm.

[0044] Advantageously, the machine 1 also comprises feeding means 10 positioned at the inlet section 8 of the molding chamber 6, adapted to introduce at its interior the continuous flow of molten lead to be formed.

[0045] More in detail, the feeding means 10 comprise an introduction head 20 provided with a perforated lip 21 facing the inlet section 8, from which the continuous flow of molten lead is intended to exit, a delivery duct 23 which hydraulically connects the introduction head 20 with a crucible of molten lead (not illustrated in the enclosed figures and *per se* well-known to the man skilled in the art) and at least one valve 22 placed to intercept the delivery duct 23, actuatable for varying in a controlled manner the flow rate of the molten lead flow exiting from the perforated lip 21 and intended to be introduced in the inlet section 8 of the molding chamber 6, tangentially with respect to the outer surface 17 of the molding roller 3.

[0046] Preferably, the outer surface 17 of the molding roller 3 is knurled with transverse striation in order to facilitate a friction engagement with the continuous flow of molten lead that enters into the chamber 6, in order to force it to travel through the molding chamber 6 itself from the inlet section 8 to the outlet section 9.

[0047] According to the idea underlying the present invention, the machine 1 for the continuous forming of a lead strip also comprises at least one forming roller 7 rotatably supported by the support structure 2 around a second rotation axis Y substantially parallel to the first rotation axis X and provided with an arched profile 11 on which the closed-loop steel strip 4 is at least partially wound. The arched profile 11 forms a curving 12 on the steel strip 4 provided with a concavity directed towards the interior of the closed loop.

[0048] Preferably, the curving 12 of the steel strip 4 confers, at a median section 28 thereof, a height that is higher than its edges 29, intended to abut against the lateral shoulders 15, 16 of the molding roller 3.

[0049] The deformation produced by the arched profile 11 of the forming roller is of plastic type. The concavity associated with the aforesaid curving 12, at the molding chamber 6, is directed towards the interior of the same chamber 6 in order to compensate for the collapse that is verified at the median section 28 of the steel strip along the arch of the molding roller 3 at the chamber 6 itself.

[0050] Therefore, the curving 12 confers to the steel strip 4 a greater resistance to deformation by thermal expansion at the molding chamber 6, preventing the steel strip 4 from collapsing towards the flow of molten lead and thus preventing a deformation of the lead strip exiting from the chamber 6, which is therefore provided with a substantially constant cross section along the entire width thereof.

[0051] In accordance with the preferred embodiment illustrated in the enclosed figures, the machine 1 comprises a first centering roller 18 and a second centering roller 19 rotatably supported by the support structure 2 respectively around a third rotation axis W and a fourth rotation axis Z substantially parallel to each other and to the first rotation axis X of the molding roller 3. Such molding roller 3 is interposed between the first centering roller 18 and the second centering roller 19.

[0052] More in detail, the first and the second centering roller 18, 19 are supported by the support structure 2 substantially superimposed on each other, with the molding roller 3 interposed between them and with which the inlet 8 and outlet 9 sections of the molding chamber 6 are defined.

[0053] The steel strip 4 closed in a loop is wound around the forming roller 7, the first centering roller 18, the molding roller 3 and the second centering roller 19.

[0054] The molding roller 3, the forming roller 7, the first and the second centering roller 18, 19 are provided with corresponding shafts rotatably constrained to the support structure 2 and driven to rotate around the respective rotation axes X, Y, W, and Z by motorization means (not illustrated in the enclosed figures).

[0055] More in detail, such motorization means comprise an electric motor, connected by means of a transmission belt to a gear motor operatively connected to the shaft of the molding roller 3. Therefore, the electric motor rotates the molding roller 3, which moves the steel strip 4 along a closed path, around the rollers 3, 7, 18, 19 of the machine 1.

[0056] In this manner, when the motorization means are actuated and rotate the molding roller 3, the first and the second centering roller 18, 19 are driven by the steel strip 4 and are counter-rotating with respect to the molding roller 3 itself.

[0057] In accordance with the embodiment illustrated in the enclosed figure 2, the steel strip 4 engages the first and the second centering roller 18, 19 in a position diametrically opposite with respect to the position in which it engages the molding roller 3, therefore imparting a rotation in opposite sense to the first and to the second centering roller 18, 19 (in particular in clockwise sense, with reference to the embodiment illustrated in the enclosed figures) with respect to the sense (counter-clockwise, with particular reference to the enclosed figures) of the rotation imparted to the molding roller 3 itself.

[0058] Advantageously, the first and the second centering roller 18, 19 are each provided with two ring-like centering edges, adapted to contain therebetween the steel strip 4 in the desired position during its movement along the closed path, in order to precisely direct the steel strip 4 itself to close the molding chamber 6.

[0059] Between the first centering roller 18, the molding roller 3 and the second centering roller 19, the steel strip 4 delineates a double S path provided with a first inflection point 36 at the inlet section 8 and a second inflection point 37 at the outlet section 9 of the molding chamber 6. The steel strip 4, when it travels along the first and second inflection point 36, 37, modifies the orientation of the concavity of the curving 12 thereof.

[0060] More clearly, the concavity of the curving 12 of the steel strip 4 that exits from the forming roller 7 directed towards the interior of the closed loop is, after the first inflection point 36, at the inlet section 8 of the molding chamber 6, directed towards the outside of the closed loop or towards the interior of the same molding chamber 6. Subsequently, the steel strip 4, after having left the outlet section 9 at the second inflection point 37, once again changes the orientation of the concavity of the curving 12 thereof, bringing it back directed towards the interior of the closed loop.

[0061] At the first and second inflection point 36, 37, the orientation of the concavity of the curving 12 is changed since the median section 28 of the steel strip 4 with greater height follows a longer path than the lateral edges 29 with lower height and therefore is provided with a greater tangential velocity than that of the lateral edges 29.

[0062] In this situation, when the steel strip 4 is moved along the first inflection point 36 at the inlet section 8 of the molding chamber 6, the median section 28 is forced to snap between the lateral edges 29, moving away from the molding chamber 6, so as to maintain the concavity of the curving 12 directed towards the first rotation axis X of the molding roller 3 so to be able to continue to follow a longer path than the lateral edges 29. In the same manner, when the steel strip 4 is moved along the second inflection point 37 at the outlet section 9 of the molding chamber 6, the median section 28 is once again forced to snap between the lateral edges 29 in order to continue to follow the aforesaid longer path at greater velocity than the lateral edges 29. In other words, the curving 12 is once again overturned, in order to return into the position at which it was formed by the forming roller 7.

[0063] More in detail, the steel strip 4 in abutment against the ring-shaped shoulders 15, 16 associated with the molding roller 3 is susceptible of being deformed by thermal expansion, due to the heat transmitted by the flow of molten lead that travels through the molding chamber 6 on the outer surface 17 of the molding roller 3.

[0064] At the molding chamber 6, the curving 12 of the steel strip 4 imparted by the forming roller 7 has a concavity always directed towards the interior of the molding chamber 6 itself, and in particular directed towards the flow of molten lead, in order to not compress it and not deform the lead strip exiting from the outlet section 9.

[0065] Therefore, the curving 12 confers, to the steel strip 4, an arched bridge-like structure, laterally in abutment against the ring-shaped shoulders 15, 16, which is structurally solid and prevents the steel strip 4 from collapsing towards the interior of the molding chamber 6 due to the heat transmitted by the molten lead, therefore preventing the steel strip 4 from crushing the flow of molten lead and deforming the lead strip exiting from the outlet section 9 of the molding chamber 6.

[0066] Advantageously, the arched profile 11 of the forming roller 7 is raised with respect to a cylindrical generatrix 13 centered on the rotation axis Y and which is extended starting from the lateral sides of the outer surface of the forming roller 7, with a maximum height D comprised between 0.5 - 5 mm at the median section 28 of the steel strip 4, and progressively laterally decreases along the lateral edges 29 of the strip 4 itself, which are intended to abut against the ring-shaped shoulders 15, 16 associated with the molding roller 3.

[0067] In accordance with the preferred embodiment illustrated in the enclosed figures, the machine 1 comprises a plurality of flattening rollers 5 rotatably supported by the support structure 2 and placed outside the molding chamber 6 in proximity to the inlet section 8 in contact with the steel strip 4, in order to maintain the latter to close the molding chamber 6 against the ring-shaped shoulders.

[0068] In order to limit the possible deformations (in particular a convexity) of the lead strip due to the curving 12 of the steel strip 4, which would lead to having a thicker lead strip at a central band thereof, the flattening rollers 5 limit the aforesaid curving 12 to a maximum deflection comprised between 0.2 and 1 mm.

[0069] In operation, the flattening rollers 5 press the steel strip 4 and elastically deform the curving 12. In this manner, the flow of molten lead is forced to assume a substantially plate-like shape with substantially rectangular and constant cross section, considerably decreasing the risk that a convexity could form at the median section 28 of the steel strip 4, due to the curving 12.

[0070] Advantageously, the support structure 2 comprises a curved frame 24 arranged externally around the molding chamber 6 and facing the steel strip 4. Such curved frame 24 rotatably supports the aforesaid flattening rollers 5, maintaining them in abutment against the steel strip 4, in order to push such strip in abutment against the ring-shaped shoulders 15, 16, ensuring the sealed closure of the molding chamber 6 and decreasing the height D of the curving 12 generated by the forming roller.

[0071] The machine 1, object of the present invention, also comprises cooling means 25 operatively associated with the molding roller 3, to cool the continuous flow of molten lead into the molding chamber 6, introduced by the feeding means 10, and allow a quick forming of the desired lead strip.

[0072] More in detail, the cooling means 25 comprise a plurality of external nozzles 26 mechanically supported by the curved frame 24 of the support structure 2, directed towards the steel strip 4, placed to close the molding chamber 6, and in flow connection with pumping means adapted to feed such external nozzles 26 with a flow rate of cooling water. In operation, the external nozzles 26 of the cooling means 25 spray water on the steel strip 4 in order to cool it during the forming of the lead strip and prevent its deformation by thermal expansion.

[0073] In accordance with the preferred embodiment illustrated in the enclosed figures, the molding roller 3 is internally hollow and delimits a cylindrical volume. The cooling means 25 comprise a plurality of internal nozzles 27 radially arranged within the cylindrical volume delimited by the molding roller 3, directed from the interior towards the outer surface 17 of the molding roller 3 and in flow connection with the aforesaid pumping means adapted to feed the internal nozzles 27 with a flow rate of cooling water. In operation, the internal nozzles 27 of the cooling means 25 spray water on the outer surface 17 in order to cool it during the forming of the lead strip.

[0074] The machine 1, object of the invention, also comprises detachment means 30 positioned at the outlet section 9 of the molding chamber 6 to detach the lead strip from the steel strip 4, on which it is set during the forming inside the molding chamber 6.

[0075] More in detail, the detachment means 30 comprise a blade 31 positioned at the outlet section 9, tangentially with respect to the second centering roller 19, adapted to detach the lead strip from the steel strip 4 and to act as a slide for the lead strip in order to direct it towards the outside of the machine 1. The detachment means 30 also comprise at least one accompanying roller 32 rotatably supported in an idle manner by a bracket 33 of the support structure 2, adapted to accompany the movement of the lead strip once detached from the steel strip 4 of the machine 1 by means of the interception of the blade 31.

[0076] Advantageously, the machine 1, object of the present invention, comprises tightening means 35 susceptible of being activated in order to move the forming roller 7. For such purpose, the latter is mechanically associated with a movable section 34 susceptible of sliding on the support structure 2, between a work position, illustrated in the enclosed figures 1 and 2, in which it maintains the steel strip 4 taut and allows a normal operation of the machine 1, and a rest position in which the forming roller 7 releases the steel strip 4, which can be removed in order to allow a cleaning or a maintenance of the machine 1, object of the invention.

[0077] The finding thus conceived therefore attains the pre-established objects.

[0078] The machine 1 for the continuous forming of a lead strip, object of the present invention, allows producing lead strips with large width, in particular with width comprised between 250 and 550 mm, with high quality standard and low cost.

[0079] In addition, the machine 1, object of the present invention, is inexpensive to make, requires little maintenance and allows forming lead strips without deformations due to the collapse of the steel strip, caused by thermal expansion.

Claims

1. Machine for the continuous forming of a lead strip, which comprises:

    - a support structure (2) intended to be resting on the ground;
    - at least one molding roller (3) rotatably supported by said support structure (2) around a first rotation axis (X), provided with an outer surface (17) with which two parallel ring-shaped shoulders are associated (15, 16);

    a molding chamber (6) remaining defined between said outer surface (17) and said ring-shaped shoulders (15, 16), extending between an inlet section (8) adapted to receive a continuous flow of molten lead and an outlet section (9) adapted to release a continuous lead strip;
    - a steel strip (4) closed in a loop, at least partially wound around said molding roller (3) in abutment against said ring-shaped shoulders (15, 16) to close said molding chamber (6);
    - at least one forming roller (7) rotatably supported by said support structure (2) around a second rotation axis (Y) parallel to the first rotation axis (X);

    characterized in that said least one forming roller (7) is provided with an arched profile (11) around which said closed loop steel strip (4) is at least partially wound;
    said arched profile (11) forming a curving (12) on said steel strip (4) provided with a concavity facing the inside of the closed loop.

2. Machine for the continuous forming of a lead strip according to claim 1, **characterized in that** between said inlet section (8) and said outlet section (9) of said molding chamber (6), said curving (12) of said steel strip (4) is provided with the concavity facing the outside of the closed loop and the inside of said

molding chamber (6).

3. Machine for the continuous forming of a lead strip according to claim 1, **characterized in that** said arched profile (11) of said forming roller (7) raises from a cylindrical generatrix (13) thereof of height (D) comprised between 0.5-5 mm.

4. Machine for the continuous forming of a lead strip according to claim 1, **characterized in that** it comprises a first centering roller (18) and a second centering roller (19) rotatably supported by said support structure (2) respectively around a third rotation axis (W) and a fourth rotation axis (Z) parallel to each other and to the first rotation axis (X) of said molding roller (3);
said molding roller (3) being interposed between said first centering roller (18) and said second centering roller (19).

5. Machine for the continuous forming of a lead strip according to claim 4, **characterized in that** said closed loop steel strip (4) is wound around said forming roller (7), said first centering roller (18), said molding roller (3) and said second centering roller (19), forming a double S closed path provided with a first inflection point (36) at said inlet section (8) of said molding chamber (6) and a second inflection point (37) at said outlet section (9) of said molding chamber (6).

6. Machine for the continuous forming of a lead strip according to any one of the preceding claims, **characterized in that** it comprises a plurality of flattening rollers (5) rotatably supported by said support structure (2) and placed externally to said molding chamber (6) in proximity to said inlet section (8) in contact with said steel strip (4), so as to maintain said steel strip (4) to close said molding chamber (6).

7. Machine for the continuous forming of a lead strip according to claim 6, **characterized in that** said flattening rollers (5) delimit the aforesaid curving (12) of said steel strip (4) with a maximum deflection comprised between 0.2 and 1 mm.

8. Machine for the continuous forming of a lead strip according to claim 1, **characterized in that** it comprises cooling means (25) operatively associated with said molding roller (3), to cool the continuous flow of molten lead in the molding chamber (6).

9. Machine for the continuous forming of a lead strip according to any one of the preceding claims, **characterized in that** it comprises detachment means (30) placed at the outlet section (9) of the molding chamber (6) to detach the lead strip from the steel strip (4).

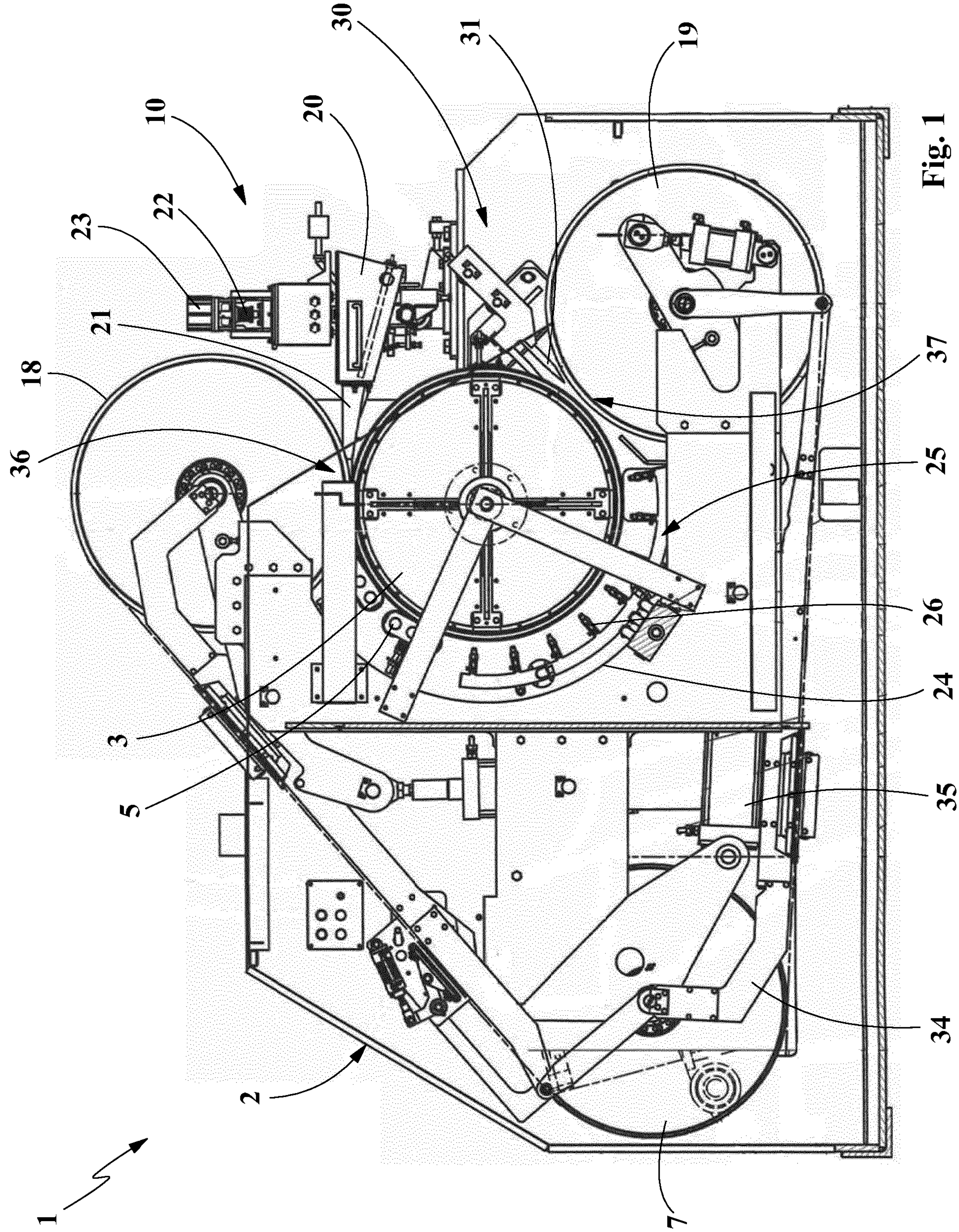

Fig. 1

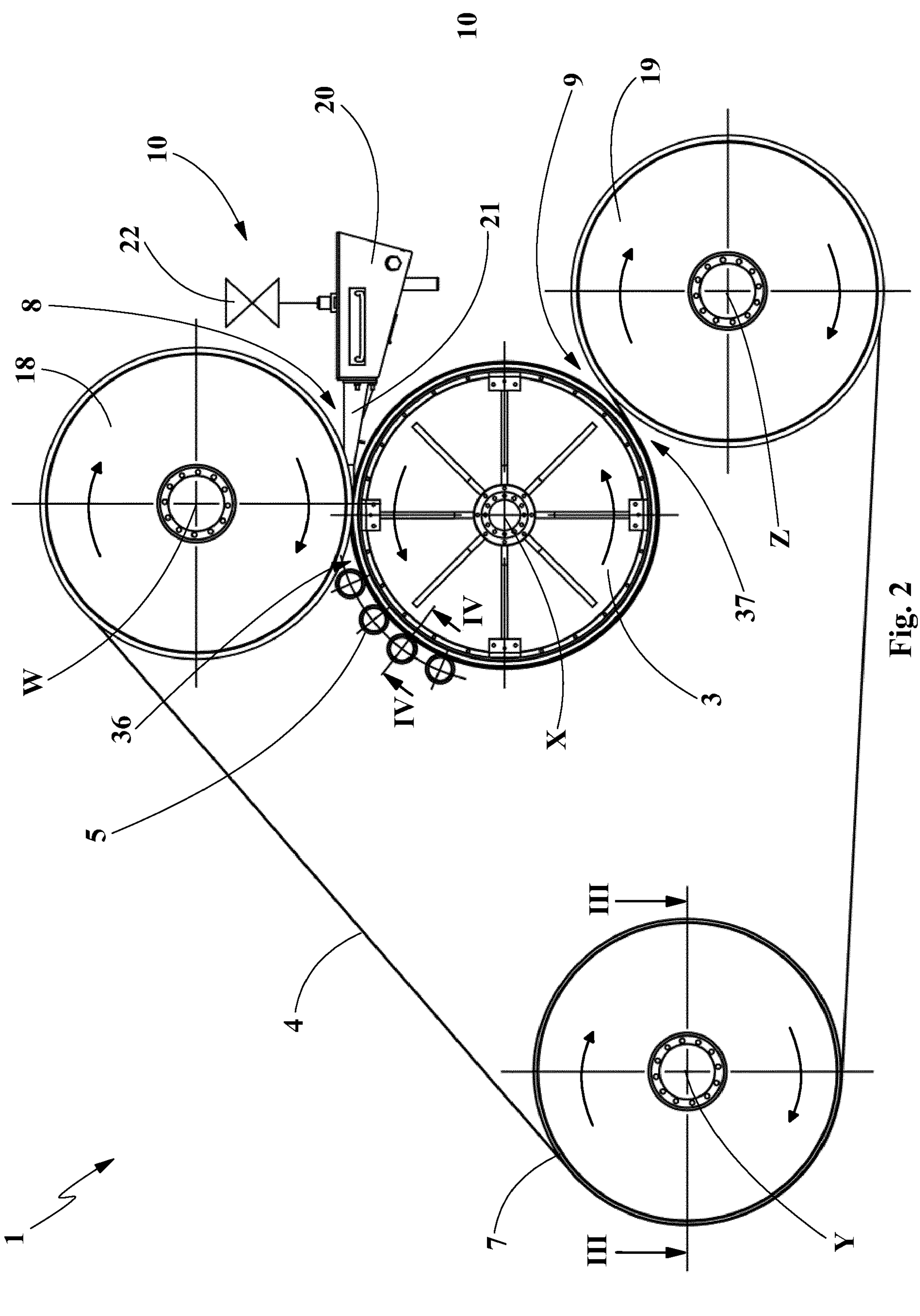

Fig. 2

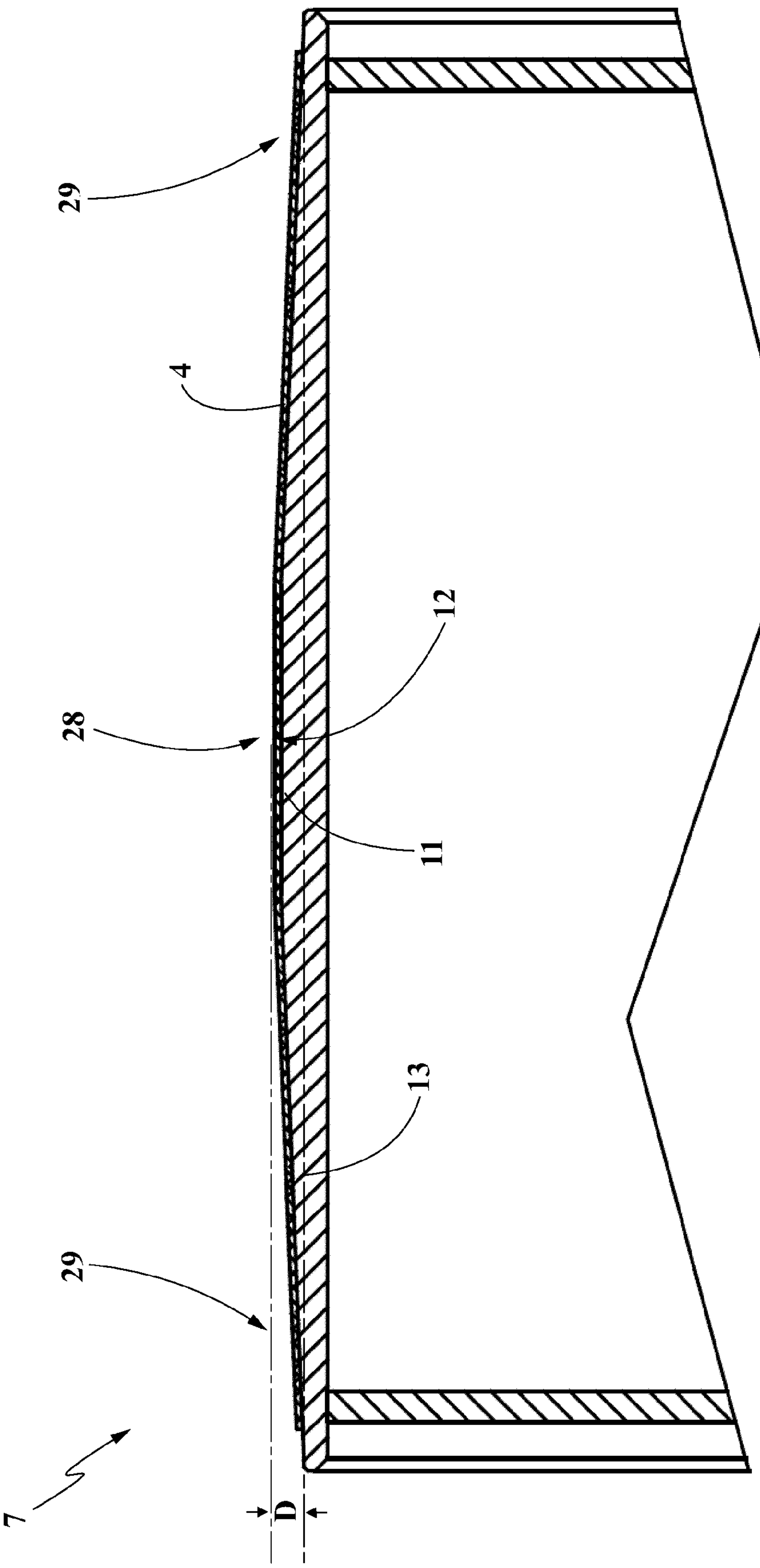

Fig. 3

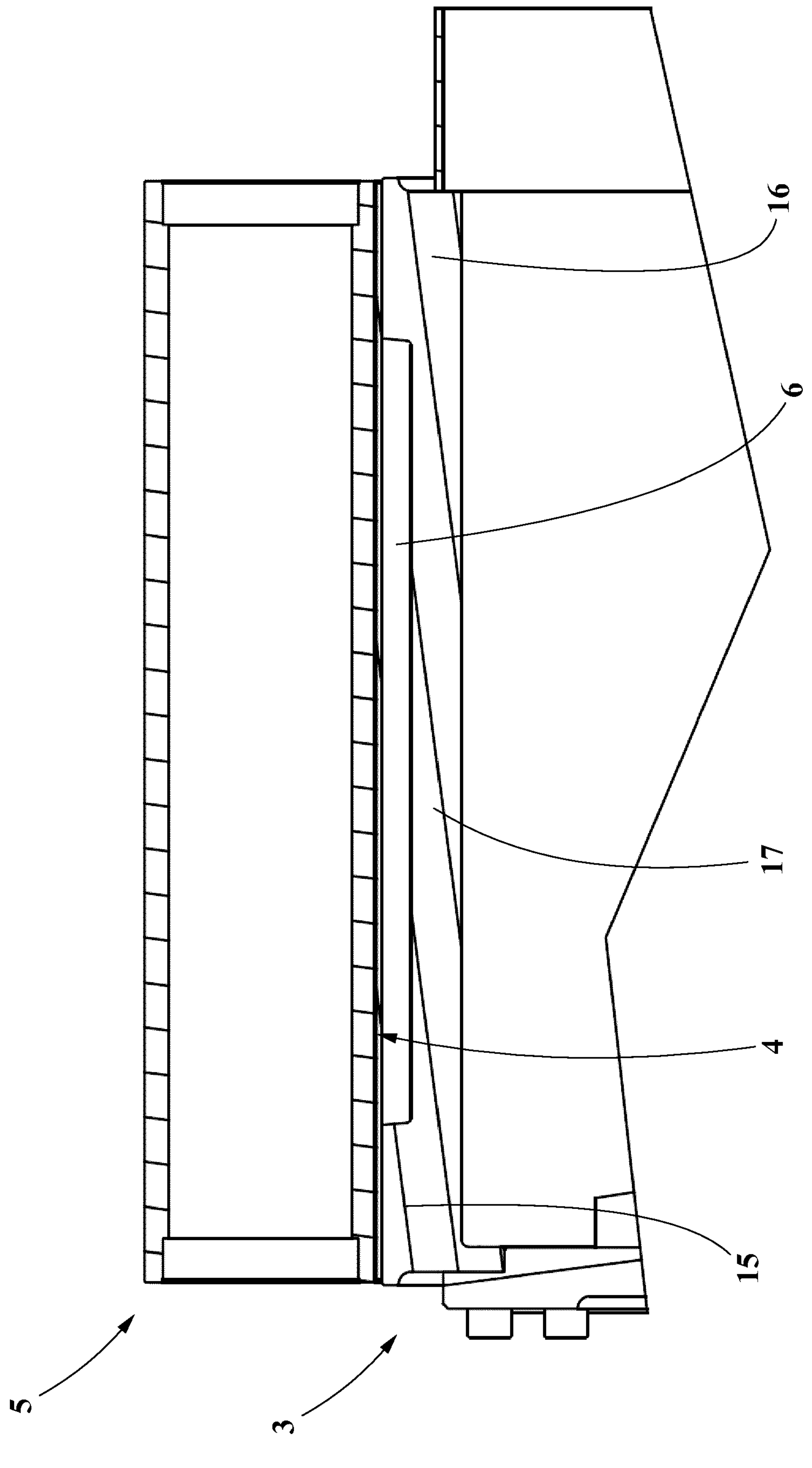

Fig. 4

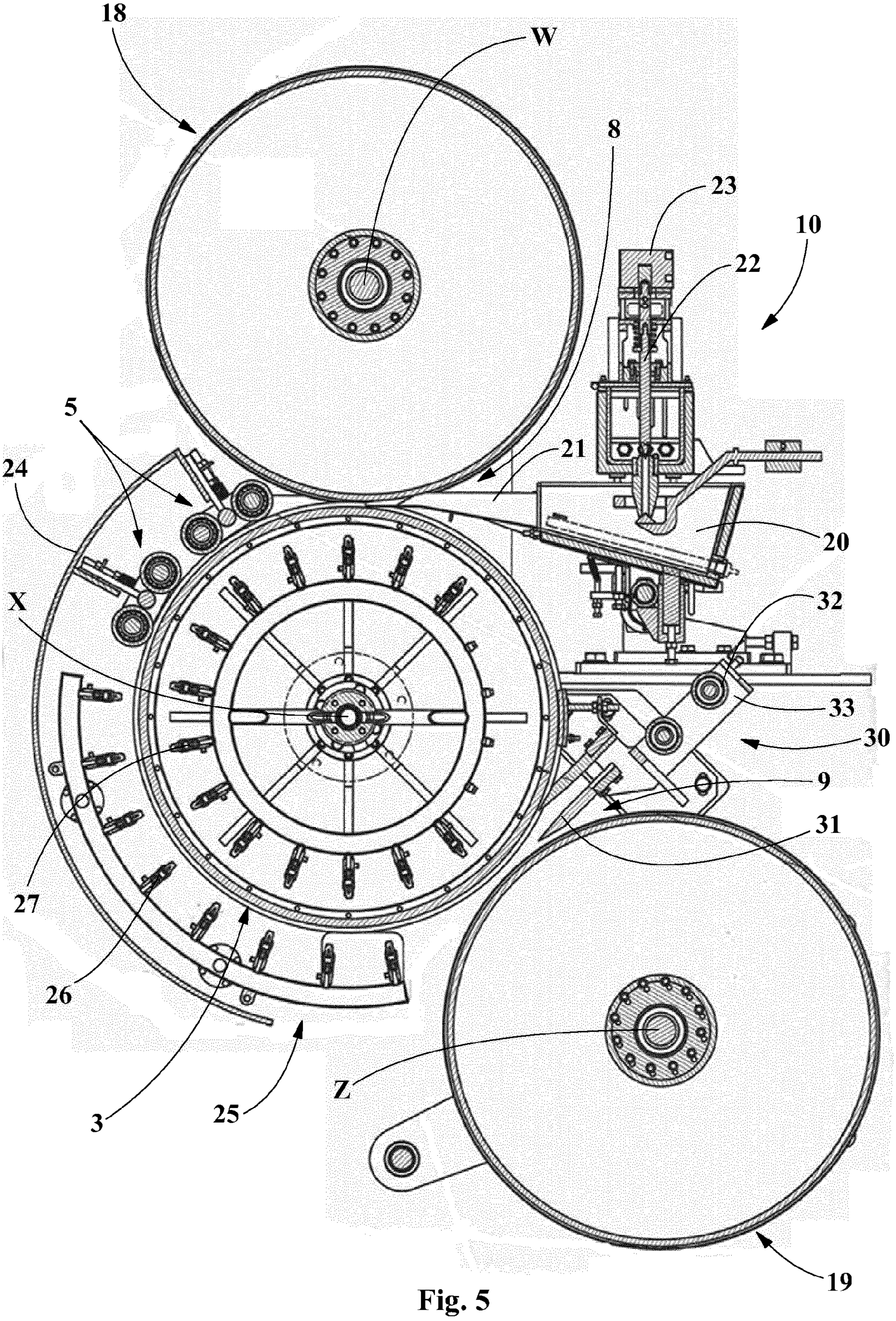

Fig. 5

Europäisches Patentamt
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EUROPEAN SEARCH REPORT

Application Number
EP 18 15 8405

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search	Date of completion of the search	Examiner
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