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(54) Titre : PROCEDE ET APPAREIL PERMETTANT D'EVACUER DE L'HUILE D'UNE UNITE DE PRESSE A SABOT
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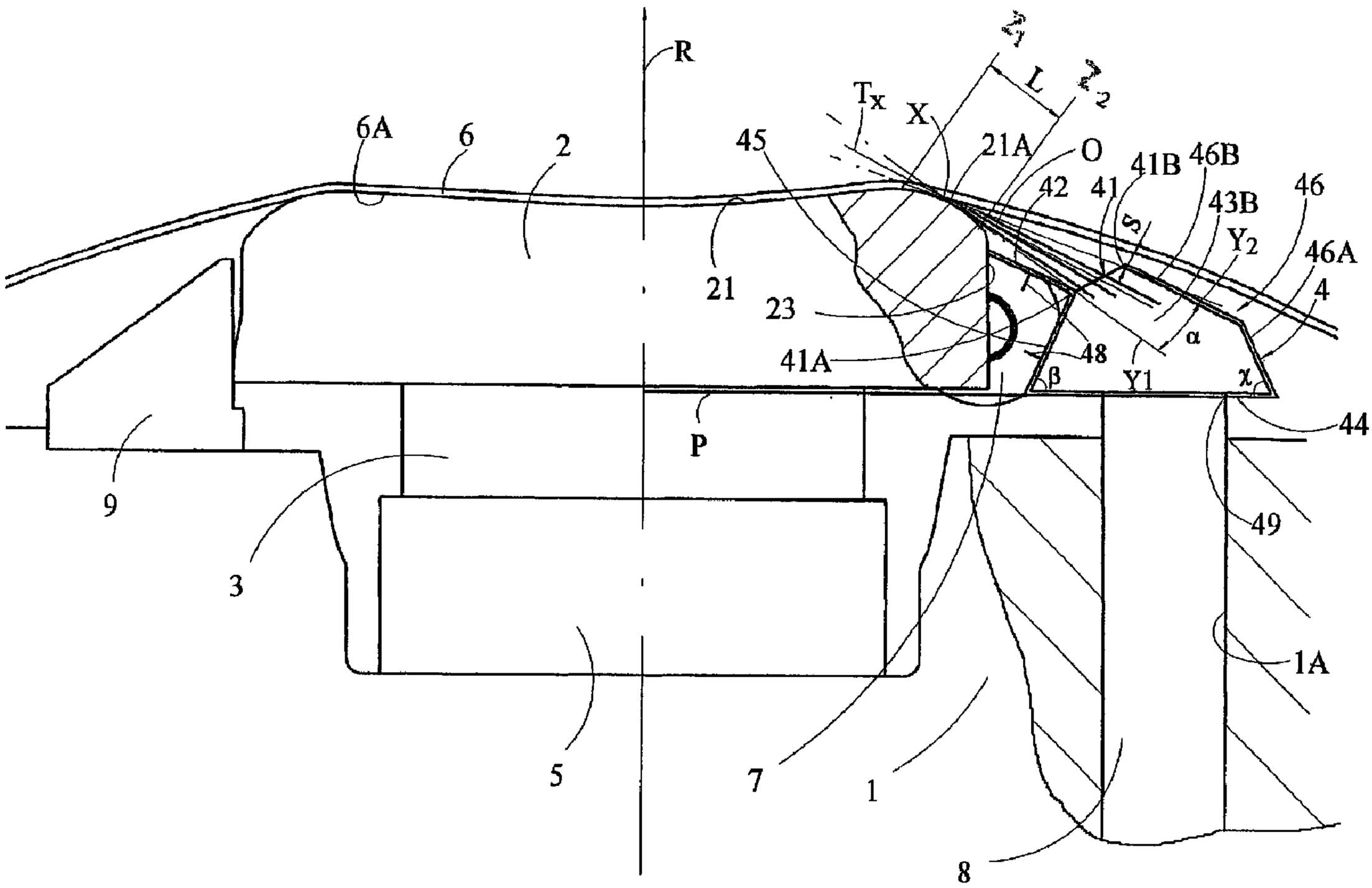

(57) Abrégé/Abstract:
A shoe press unit comprises a support beam, a shoe element movably supported on the beam, a pressing unit arranged between the beam and the shoe element for urging the shoe element away from the beam and toward a counter element, and a flexible belt

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(57) Abrégé(suite)/Abstract(continued):
that is arranged to slide over the pressing surface of the shoe element. An oil evacuation arrangement formed separately from the shoe element is affixed to the shoe element proximate an upstream edge region thereof. The oil evacuation arrangement has an inlet opening located such that a major portion of the excess oil expelled from between the belt and the shoe element passes through the inlet opening with a kinetic energy that is substantially undiminished from the initial kinetic energy of the oil as it exits from between the belt and the pressing surface of the shoe element.

ABSTRACT

A shoe press unit comprises a support beam, a shoe element movably supported on the beam, a pressing unit arranged between the beam and the shoe element for urging the shoe element away from the beam and toward a counter element, and a flexible belt that is arranged to slide over the pressing surface of the shoe element. An oil evacuation arrangement formed separately from the shoe element is affixed to the shoe element proximate an upstream edge region thereof. The oil evacuation arrangement has an inlet opening located such that a major portion of the excess oil expelled from between the belt and the shoe element passes through the inlet opening with a kinetic energy that is substantially undiminished from the initial kinetic energy of the oil as it exits from between the belt and the pressing surface of the shoe element.

METHOD AND DEVICE FOR OIL EVACUATION FROM A SHOE PRESS UNIT

TECHNICAL FIELD

The invention relates to a method for oil evacuation from a shoe press unit, which shoe press unit comprises a beam, a shoe element arranged movably on said beam by means of a pressing unit and having a pressing surface, an oil evacuation arrangement provided at the movable shoe element with an inlet opening, which evacuation arrangement is firmly anchored to said shoe element, so that they are movable as a unit, and a flexible belt interacting with said shoe element, oil being supplied during operation to lubricate between said pressing surface and said belt, an oil excess with kinetic energy being pressed out at an upstream edge region of said pressing surface, and an oil excess being evacuated from said shoe press unit by said oil evacuation arrangement.

The invention also relates to a device at a shoe press unit.

STATE OF THE ART

According to prior art, a device for a shoe press unit is known through US 5,084,137. Said shoe press unit comprises a beam, a shoe element with a pressing surface, which is movably arranged to said beam through a pressing unit, and a flexible belt interacting with said shoe element. In order to reduce the friction and thus also the heat generation between the belt and the shoe, oil is supplied during operation in order to lubricate and cool between said pressing surface and said belt. The oil is supplied in an excess which is pressed out at an upstream edge region (on the belt entry side) of said pressing surface. The oil excess is then evacuated from said shoe press unit by an oil evacuation arrangement. According to US 5,084,137, the inlet opening to said oil evacuation arrangement is integrally arranged on a lower element being a part of the shoe element. Therefore, the evacuation arrangement moves together with the shoe.

A disadvantage with the oil evacuation arrange of US 5,084,137 is that the inlet opening is arranged in such a way that the kinetic energy, available in the oil which is pressed out, cannot be utilized, as the inlet opening is positioned in a region outside the region of the direct oil squirting which is brought about during operation when the excess is pressed out of the converging zone, which is formed between the edge region of the pressing surface and the belt. Yet another disadvantage is that the known arrangement permets oil to accumulate within the shoe press unit, as the oil evacuation arrangement

is not provided with any means that can prevent oil from flowing in different directions. This in turn leads to the oil which accumulates inside the shoe press being mixed with air, which makes evacuation of the oil more difficult and also means that extra subsequent measures have to be taken in order to separate the air from the oil before re-use. In addition, with the known arrangement, an undesirable heat emission will take place from the pressed-out excess oil before it is evacuated, which results in an undesirable temperature increase inside the shoe press unit. From the point of view of operation economy also, it is disadvantageous to have an accumulation of oil inside the shoe press unit because this requires an increased power input.

Finally, the known design implies a cost increase, as the integrated evacuation arrangement must be manufactured of a part of the units of the shoe press element by means of expensive treatment methods

BRIEF DESCRIPTION OF THE INVENTION

It is an object of the present invention to eliminate or at least to minimize at least some of the abovementioned disadvantages, which is achieved by means of a method for oil evacuation from a shoe press unit, which shoe press unit comprises a beam, a shoe element arranged movably on said beam by means of a pressing unit and having a pressing surface, an oil evacuation arrangement provided at the movable shoe element, with an inlet opening , said oil evacuation arrangement being firmly anchored at said shoe element, so that they are movable as a unit, and also a flexible belt interacting with said shoe element, oil being supplied during operation to lubricate between said pressing surface and said belt, an oil excess with kinetic energy being pressed out at an upstream edge region of said pressing surface, and an oil excess being evacuated from said shoe press unit by said oil evacuation arrangement, characterized in that said inlet opening is arranged in such a manner to the shoe element that a large part of said oil excess enter into said inlet opening with substantially maintained kinetic energy.

The invention affords many advantages. In the first place, the positioning and arrangement of the oil evacuation arrangement means that a large part of the kinetic energy from the pressed-out oil is useful for evacuation of excess oil. Moreover, the invention makes it possible for the temperature in the shoe press unit to be kept at a lower level because a large part of the hot oil is evacuated without having time to give off its heat inside the shoe press unit. Furthermore, the efficient evacuation results in a reduction in the energy consumption for operation of the shoe press unit because no or only an insignificant quantity of excess oil accumulates inside the shoe press unit.

According to further aspects of the method according to the invention:

- said upstream edge region is, at least partly, arranged to extend as a positively curved surface between a first and a second edge line, and an upstream contact line for said belt and said shoe element is positioned between said edge lines, said inlet opening being arranged so that the tangent for the surface of said contact line deviates maximum 15 degrees from at least one of the imaginary straight lines extending between said contact line and a lower and an upper delimiting surface, respectively, of the inlet opening, said deviation being preferably maximum 10 degrees and more preferably maximum 5 degrees;
- said inlet opening is arranged so that the tangent for said contact line coincides with one of said imaginary straight lines or extends between these last mentioned lines;
- said shoe press unit consists of a closed shoe press which is provided with an inner overpressure, said overpressure lying between 10-500 mbar, preferably below 200 mbar, and more preferably below 50 mbar;
- said oil evacuation arrangement is provided with a negative pressure acting from the shoe press unit in order to facilitate the evacuation of said oil excess;
- said oil evacuation arrangement in connection with said inlet opening is provided with a container with circumferential wall elements and an evacuation duct;
- the region between the lower delimiting surface of the inlet opening and the shoe element, at least to a substantial extent, is provided with partition means, whereby an oil flow between said shoe element and said lower delimiting surface is minimized or completely eliminated;
- the inlet opening is located at a distance of between 10 and 150 mm from said upstream edge region, more preferably maximum 100 mm; and
- the shortest distance between the upper delimiting surface of the inlet opening and the inner surface of the belt is made small enough to prevent any significant leakage therebetween, said distance during operation being between 0 and 10 mm, preferably below 5 mm.

The invention also relates to a device for a shoe press unit, which shoe press unit comprises a beam, a shoe element arranged movably on said beam by means of a pressing unit and having a pressing surface comprising an upstream edge region, an oil evacuation arrangement provided at the movable shoe element, and a flexible belt interacting with said shoe element, said upstream edge region comprising, at least partly, a positively curved surface extending between a first and a second edge line, and that at said curved surface there is an upstream contact line intended as contact line

between said pressing surface and said belt characterized in that said inlet opening is arranged in the shoe element in such a way that the tangent for the surface of said contact line deviates maximum 15 degrees from at least one of the imaginary straight lines extending between said contact line and a lower and an upper delimiting surface, respectively, of the inlet opening.

According to further aspects of a device according to the invention:

- said inlet opening is provided in a container with an evacuation duct, which container comprises circumferential wall elements and a bottom;
- the region between a lower delimiting surface of the inlet opening and the shoe element is provided with a partition means extending preferably substantially linearly;
- said partition means consists of a thin sheet metal, which is preferably integrated with one of said container walls;
- said circumferential wall elements comprise two wall elements extending parallelly to the longitudinal direction of the shoe element, wherein at least one upstream wall element forms an acute angle in relation to the plane containing the normal to the direction of motion of the shoe element and extending in a direction towards the shoe element;
- said wall element arranged with acute angle is divided into a lower and an upper section, wherein said upper section forms a more acute angle in relation to said plane than the lower section does;
- said circumferential wall elements and said bottom are made of thin sheet metal, the thickness of which is between 0.5 and 5 mm and preferably exceeds 3 mm;
- said evacuation duct is made of a tube which is mounted in the bottom of the container;
- the shortest distance S between the upper delimiting surface of said inlet opening and the inner surface of the belt is between 0 and 10 mm, preferably below 5 mm;
- the inlet opening is arranged at a distance of between 10 and 150 mm from the upstream edge region , more preferably maximum 100 mm from the edge region; and
- in said beam there is a recess, in which said evacuation duct can move freely.

It is realized that many advantages are achieved with the device of the invention, i.a. it is obvious that a preferred embodiment of the invention can be manufactured at a considerably lower cost than has so far been known, e.g. through US 5,084,137.

DESCRIPTION OF THE FIGURES

The invention will be described in greater detail below with reference to the appended drawings, in which:

Fig. 1 shows a preferred embodiment of the invention, partly in cross section, and

Fig. 2 shows a perspective view of a preferred component according to the invention.

DETAILED DESCRIPTION

Fig. 1 shows, partly in cross section, the principles of a shoe press unit according to the invention. According to principles known per se, the shoe press unit comprises a support beam 1, in which a recess is arranged for a pressing unit 3, 5 for a shoe element 2. The pressing unit 3, 5 consists in a manner known per se of a hydraulic piston 3, which is arranged in a sealing manner inside a hydraulic cylinder 5, so that the shoe element 2 can be moved hydraulically to and fro in a direction R, which is at right angles in relation to the extent of the shoe element 2 in the longitudinal direction. A support heel 9 is arranged at one short end of the shoe element 2. An endless, flexible belt/jacket 6 is arranged in a manner known per se so as to interact, by means of its one surface 6A, with a pressing surface 21 of the shoe element 2 and, by means of its other surface 6B, with a counter-roll 10. The endless belt 6 should rotate to the left in the figure. The heel 9 is therefore arranged at the downstream end of the shoe element 2. The shoe unit 2 is, according to the shown, preferred embodiment, symmetrically formed in each edge region of said pressing surface 21. In the upstream placed end of the shoe element 2 there is a marked end region Z_1-Z_2, which is a region with a positively curved surface 21A. As can be seen from the figure, the extension L of said edge region 21A is considerably shorter than the concave part 21 of the pressing surface. Within said edge region 21A there is a line X, in which contact first arises between the belt 6 and the pressing surface 21 of the shoe unit.

To the right in the figure of the upstream end of the shoe element is a distribution chamber 7 which in a known manner supplies the pressing surface 21 with oil via ducts (not shown). At said distribution chamber there is an oil evacuation arrangement 4 which comprises a guide plate 42, a container part 45, 44, 46, 43A, 43B, an evacuation duct 8 and an inlet opening 41. The container part consists of a first longitudinal wall element 45, a plane bottom portion 44, a second longitudinal wall element 46 and two end walls 43A, 43B. The upstream longitudinal wall 46 is divided into a lower section 46A and an upper section 46B. The lower wall section 46A is arranged at an acute angle in relation to the bottom 44 and a plane P which contains the plane bottom surface 44.

According to the preferred embodiment, the angle χ is approximately 60-70°. The upper section 46B is arranged at a smaller acute angle in relation to said plane P. In this way, the upper section 46B is imparted an inclination which differs only by a few degrees from the tangent of the belt 6 in the region of said upper section 46B. The upper section therefore converges slightly towards the inner surface of the belt. The end 41B of the upper section forms the upper delimiting surface of the inlet opening 41, which is slot-shaped. It is important that this upper delimiting surface 41B is positioned close to, or in certain cases even in contact with, the inner surface of the belt 6, so that as small a gap as possible is formed between them. The downstream wall element 45 is also arranged at an acute angle in relation to said plane P. According to the preferred embodiment, it forms an angle β which is essentially the same as the angle χ of the other wall element 46A. End walls 43A, 43B are arranged at either short end of the container. The lower delimiting surface 41A of the inlet opening 41 is formed by the upper edge of the downstream longitudinal wall element 45. All the components forming part of the container are made of thin sheet metal. In the preferred case, the sheet is 2 mm thick. Extending at right angles from said lower delimiting surface 41A in the direction of and up to the shoe element 2 is a guide plate 42. The guide plate 42 is also made from thin sheet metal and it and the container are suitably made from one and the same piece of sheet metal which is suitably first stamped out and then bent into the desired final shape, after which the end walls 43A, 43B are connected in a sealing manner, suitably by means of welding, to the parts which have been bent up to form the container. Arranged in the bottom of the container is a circular hole 44A, in which an evacuation pipe 8 is arranged in a sealing manner. Suitably, the evacuation pipe 8 is made of a shape permanent material, e.g. metal, so that it cannot be compressed by the outer overpressure normally existing. The container portion is fixed by means of screw connections 48 to the distribution chamber 7 which is in turn connected (usually screwed) to one longitudinal side wall 23 of the shoe element. The evacuation arrangement 4 is therefore firmly anchored on the shoe element 2, so that these are movable as a unit. For the purpose of enabling movement of the shoe element and the evacuation arrangement 4, there is in the support beam 1 a recess 1A, inside which the evacuation pipe 8 can move freely upwards and downwards.

As already mentioned, the evacuation arrangement 4 is positioned with its upper delimiting surface 41B of the inlet opening 41 relatively close to the surface of the belt, so that the distance S between them during operation is sufficiently small to prevent any significant quantity of oil escaping between the opening 41 and the belt 6. The distance S should preferably not be permitted to exceed 10 mm. The inlet opening 41 should

moreover be positioned in such a manner that the quantity of excess oil which is pressed out can squirt directly into the inlet opening 41. According to the preferred embodiment, this is brought about by virtue of the fact that the tangent Tx of the positively curved surface at the contact line X between the belt 6 and the shoe element 2 extends between the lower delimiting surface 41A and the upper delimiting surface 41B. In this case, the geometries between said edge region 21A and the inlet opening should be arranged so that the tangent Tx (which can be considered to represent a kind of median vector for the oil excess which normally squirts out in a divergent manner) of said contact line X deviates by a maximum of 15° from at least one of the imaginary straight lines Y1 and Y2 which extend between said contact line X and the lower delimiting surface 41A and, respectively, the upper delimiting surface 41B of the inlet opening 41. Furthermore, the inlet opening 41 should be positioned close to the upstream edge region 21A, suitably between 10-150 mm, but more preferably at a maximum of 100 mm, from the edge region 21A.

The device according to Fig. 1 functions in the following manner. When the machine is started up for operation, the inner surface of the belt is provided with an oil film in order to lubricate between the belt 6 and the pressing surface 21 of the shoe element 2 but also in order to cool the shoe press unit. Oil supply usually takes place in a number of different positions, inter alia through the distribution chamber 7 which lubricates in the central zone of said pressing surface 21 and also usually at least somewhere else directly on the inner surface of the belt. In other respects, the shoe press unit is operated in a manner known per se, the shoe element 2 exerting, by means of the pressing unit 3, 5, a pressure against a counter-roll so that a fibre web lying in between is subjected to the desired treatment, for example dewatering. In this connection, the oil excess which accompanies the belt 6 to the upstream end of the shoe element will be pressed out of the converging zone formed between the inner surface 6A of the belt and the upstream edge region 21A of the shoe element. The excess oil O is in this way imparted kinetic energy and will squirt backwards, counter to the direction of movement of the belt, into the inlet opening 41 to be collected inside the container portion 43A, 43B, 44, 45, 46. By virtue of a slight overpressure inside the shoe press unit (when a closed shoe press unit is used), the oil collected in the container will be pressed out through the evacuation pipe 8. In certain applications, the evacuation pipe 8 is connected to an underpressure in order to ensure adequate oil evacuation. It is usual to try to operate a closed shoe press unit with an inner overpressure of less than 50 mbar.

A certain quantity of oil will not be removed but will instead follow the surface in the edge region 21A of the shoe element down towards the end wall 23 of the shoe element. By virtue of the guide plate 42, however, which bears against the end wall 23 of the shoe element, this quantity of oil will also be guided towards the inlet opening 41. In the embodiment shown in Fig. 1, gravity assists in this connection in bringing about this extra oil inflow to the container. It should be pointed out, however, that this is not a necessity because a certain underpressure can be brought about in the region adjacent to the inlet opening 41 so that this inflow of excess oil can take place even without the influence of gravity. The fact that the evacuation arrangement is arranged with the evacuation pipe vertical does not therefore constitute a limitation of the invention shown.

Fig. 2 shows in perspective the abovementioned container portion 43A, 43B, 44, 45, 46 in the form of a unit with a guide plate 42 and an evacuation pipe 8. It can also be seen that the guide plate 42 is provided with a number of holes 47 for arranging fixing screws 48. By virtue of the fact that the evacuation arrangement is sectioned and arranged at the shoe element 2, the inlet opening 41, which preferably extends along the entire width of the container, will always be optimally positioned in relation to the squirting oil irrespective of deflection of the beam 1.

The invention is not limited by what has been disclosed above but can be varied within the scope of the patent claims below. Therefore, it is clear, for example, that the evacuation arrangement can be made of many other materials than thin sheet metal, for example a polymer material. It is also clear that the inlet opening 41 of the evacuation arrangement can be divided (for example for reasons of strength) so that a number of to a greater or lesser extent elongate openings next to one another is formed. It is also clear that the component parts of the evacuation arrangement do not necessarily have to made of/from one and the same material, but can be made from a number of different components/materials, which can be arranged with/connected to one another in many alternative ways which will be self-evident to the person skilled in the art. It is also clear that it is only for the purpose of exemplification that the evacuation arrangement is arranged on a distribution block. The evacuation arrangement can of course be arranged directly on the shoe element 2 for example, along its side wall 23 for example. In some cases the evacuation arrangement can be firmly anchored to the pressing means of the shoe element, which means is movable together with the shoe element.

CLAIMS

1. A method for operating a shoe press unit having a beam, a shoe element movably supported on the beam and having a pressing surface, a flexible belt arranged to slide over the pressing surface of the shoe element, and a pressing unit operable to urge the shoe element in a direction away from the beam, the method comprising:

supplying oil between the belt and the pressing surface of the shoe element for lubricating therebetween, excess oil being expelled under pressure from between the belt and the shoe element at an upstream edge region of the shoe element such that the excess oil exits from between the belt and shoe element with an initial kinetic energy; and

capturing the excess oil expelled from between the belt and the shoe element with an oil evacuation arrangement formed separately from the shoe element and affixed to the shoe element such that the shoe element and oil evacuation arrangement move together as a unit, the oil evacuation arrangement having an inlet opening located with respect to the shoe element such that a major portion of the excess oil expelled from between the belt and the shoe element passes through the inlet opening with a kinetic energy that is substantially undiminished from the initial kinetic energy.

2. The method of claim 1, wherein the upstream edge region of the shoe element includes a convex curved surface and the belt is arranged to first contact the curved surface along a contact line X, and wherein the inlet opening is arranged such that a tangent T_x to the curved surface at the contact line X extends into the inlet opening.

3. The method of claim 2, wherein the inlet opening is bounded on two opposite sides by first and second delimiting surfaces that extend in a cross-machine direction of the oil evacuation arrangement, and wherein the inlet opening is arranged such that there is not more than about 15 degrees deviation between the tangent T_x and at least one of a first line Y1 that extends from the contact line X to the first delimiting surface and a second line Y2 that extends from the contact line X to the second delimiting surface.

4. The method of claim 3, wherein the tangent Tx substantially coincides with one of the first and second lines Y1, Y2.

5. The method of claim 1, further comprising pressurizing an interior of the shoe press unit with an overpressure of about 10-500 mbar.

6. The method of claim 1, further comprising exerting a vacuum on the oil evacuation arrangement for facilitating evacuating the excess oil from the shoe press unit.

7. The method of claim 1, wherein a first delimiting surface of the inlet opening is closer to the upstream edge region of the shoe element than an opposite second delimiting surface of the inlet opening, and further comprising discouraging oil flow between the shoe element and the first delimiting surface by at least one partition that extends from a surface of the shoe element up to the inlet opening.

8. The method of claim 1, wherein the inlet opening is located at a distance of about 10-150 mm from the upstream edge region of the shoe element.

9. The method of claim 1, wherein a distance between the belt and a delimiting surface of the inlet opening nearest the belt is not greater than about 10 mm during operation.

10. A shoe press unit, comprising:

a beam;

a shoe element movably supported on the beam and having a pressing surface and an upstream edge region;

a pressing unit for urging the shoe element in a direction away from the beam;

a flexible belt arranged to slide over the pressing surface of the shoe element, oil being supplied between the belt and the pressing surface for lubricating the belt, an excess oil being expelled under pressure from between the belt and the shoe element at the upstream

edge region of the shoe element such that the excess oil exits from between the belt and shoe element with an initial kinetic energy; and

an oil evacuation arrangement formed separately from the shoe element and removably affixed to the shoe element proximate the upstream edge region thereof such that the shoe element and oil evacuation arrangement move together as a unit, the oil evacuation arrangement having an inlet opening located with respect to the shoe element such that a major portion of the excess oil expelled from between the belt and the shoe element passes through the inlet opening with a kinetic energy that is substantially undiminished from the initial kinetic energy.

11. The shoe press unit of claim 10, wherein the upstream edge region of the shoe element includes a convex curved surface and the belt is arranged to first contact the curved surface along a contact line X, and wherein the inlet opening is arranged such that a tangent T_x to the curved surface at the contact line X extends into the inlet opening.

12. The shoe press unit of claim 11, wherein the inlet opening is bounded on two opposite sides by first and second delimiting surfaces that extend in a cross-machine direction of the oil evacuation arrangement, and wherein the inlet opening is arranged such that there is not more than about 15 degrees deviation between the tangent T_x and at least one of a first line Y1 that extends from the contact line X to the first delimiting surface and a second line Y2 that extends from the contact line X to the second delimiting surface.

13. The shoe press unit of claim 12, wherein the tangent T_x substantially coincides with one of the first and second lines Y1, Y2.

14. The shoe press unit of claim 10, wherein the oil evacuation arrangement includes a container having a bottom and a plurality of wall elements upstanding from the bottom and defining a first delimiting surface of the inlet opening spaced relatively farther from the belt and a second delimiting surface of the inlet opening spaced relatively closer to the belt, the bottom of the container having an oil evacuation duct provided therein.

15. The shoe press unit of claim 14, wherein the oil evacuation arrangement further comprises at least one partition extending from a surface of the shoe element to the inlet opening for discouraging oil flow between the shoe element and the first delimiting surface.

16. The shoe press unit of claim 15, wherein the partition comprises sheet metal.

17. The shoe press unit of claim 16, wherein the container bottom and wall elements comprise sheet metal and the partition is formed integrally with one of the wall elements.

18. The shoe press unit of claim 14, wherein the oil evacuation duct is received in a recess in the beam such that the duct can freely move within the recess relative to the beam.

19. The shoe press unit of claim 14, wherein the second delimiting surface of the inlet opening is spaced not more than about 10 mm from the belt during operation.

20. The shoe press unit of claim 10, wherein the inlet opening is spaced about 10-150 mm from the upstream edge region of the shoe element.

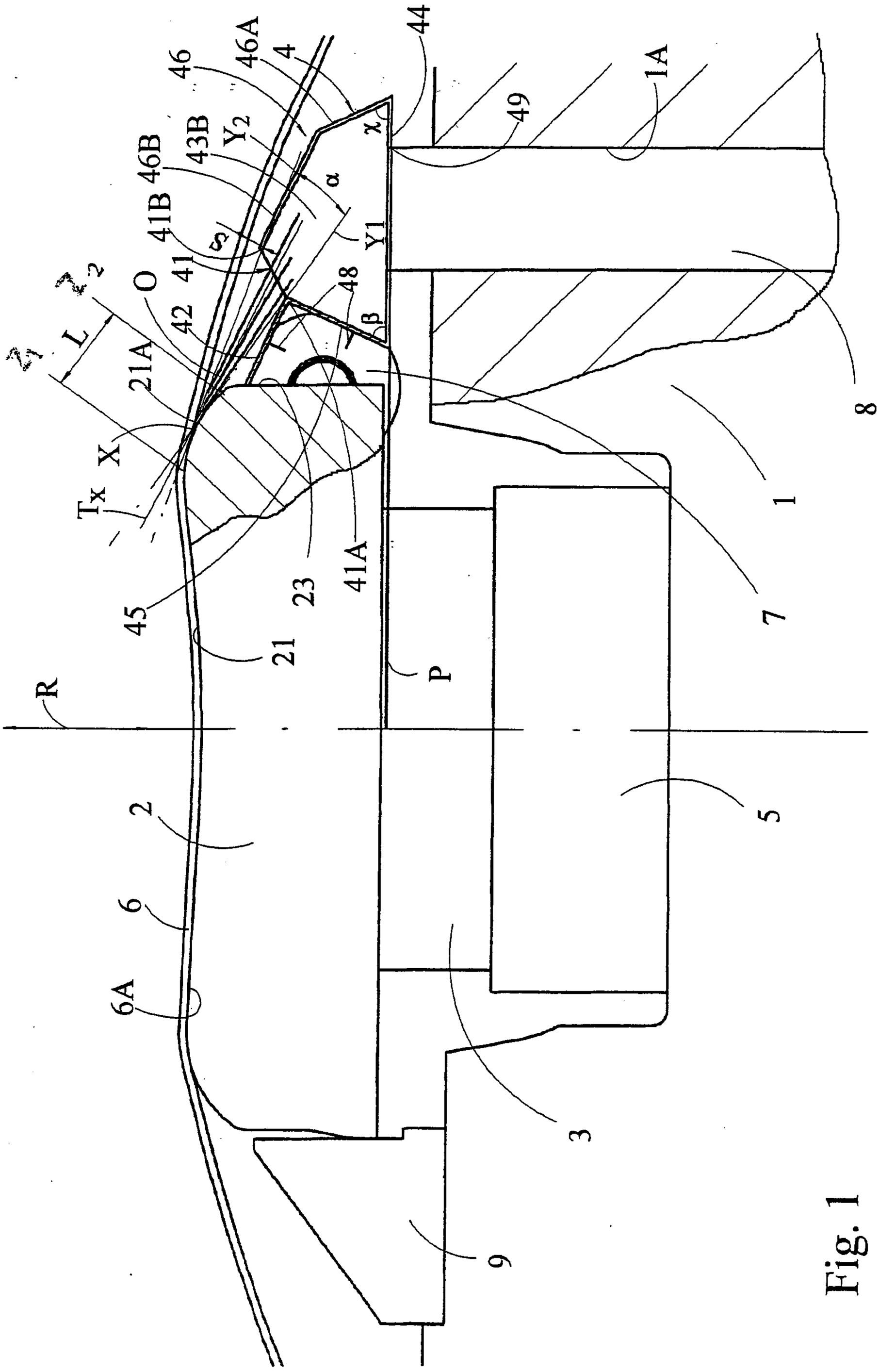
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Fig. 1

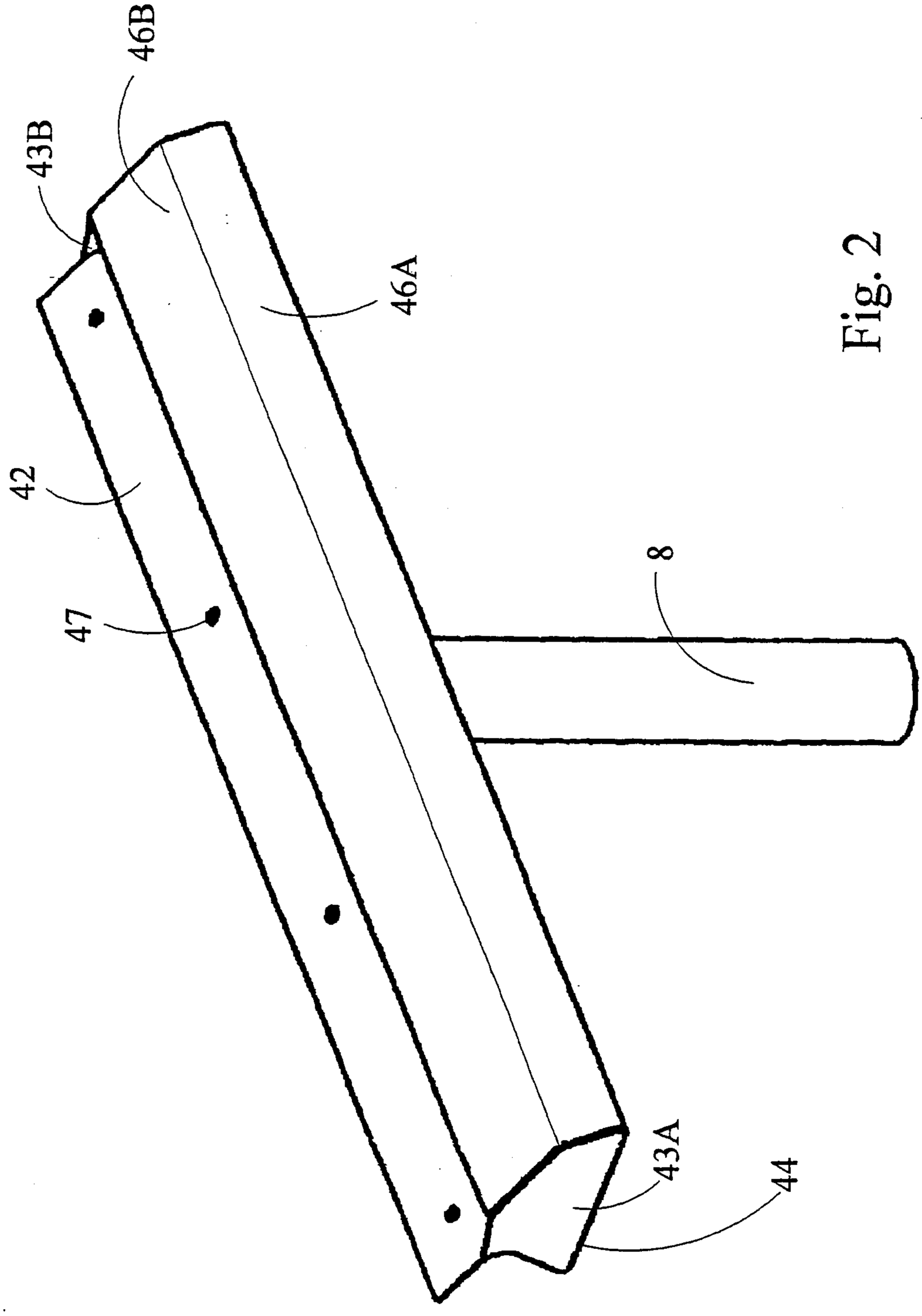
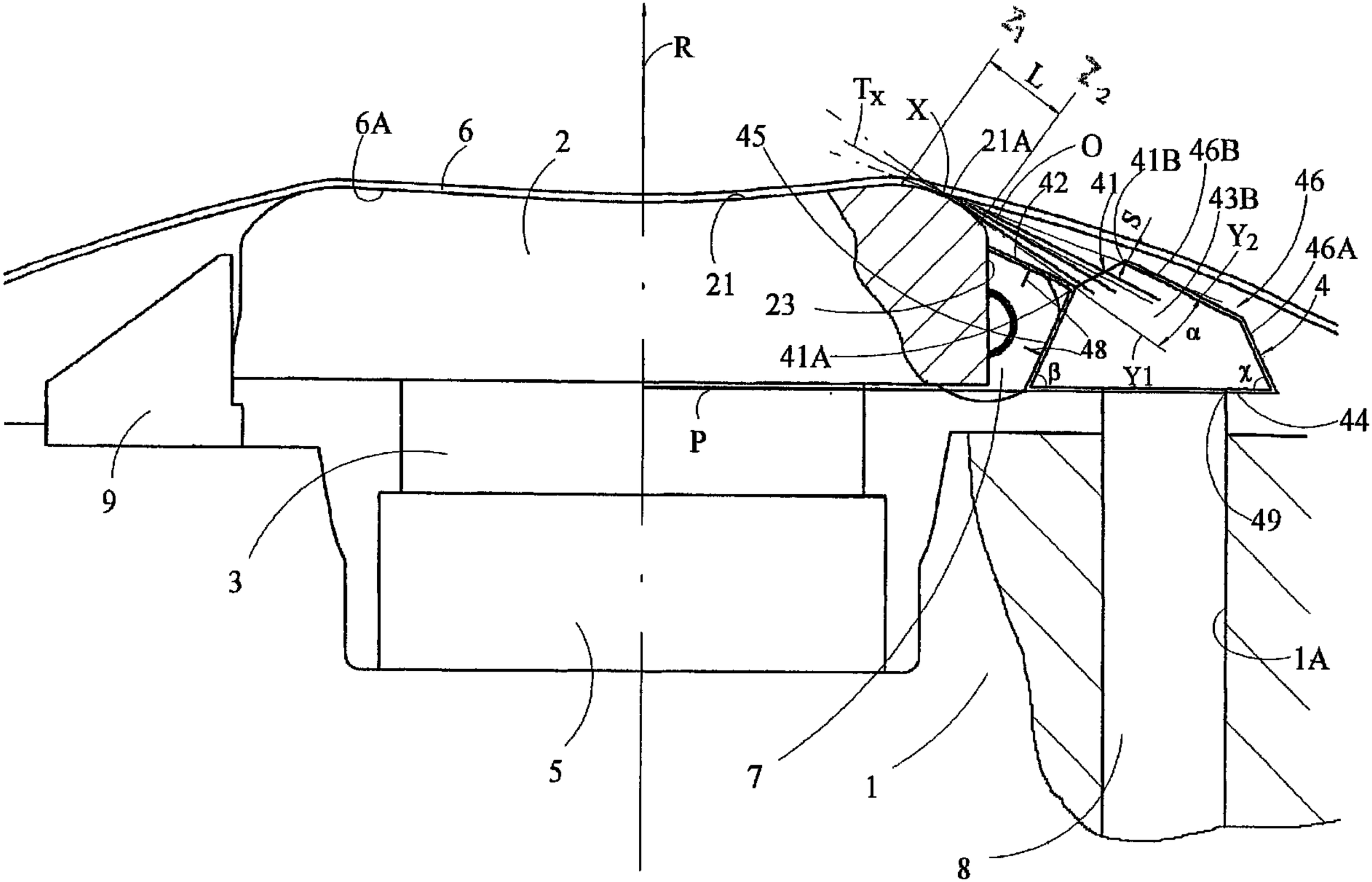


Fig. 2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