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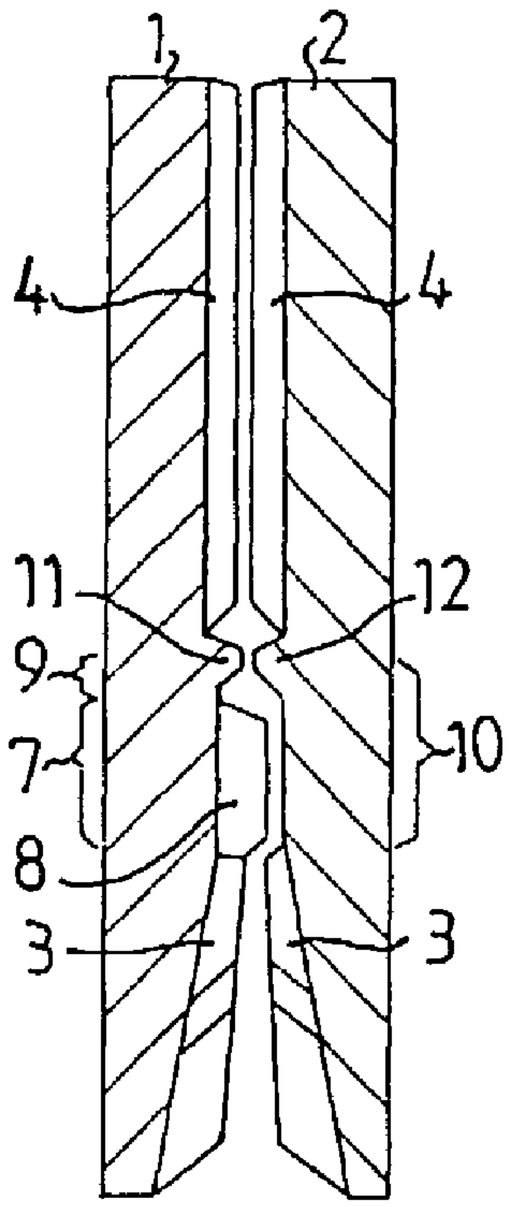
(54) Titre : PAIRE D'ELEMENTS DE RAFFINAGE COOPERANTS OPPOSES
(54) Title: A PAIR OF OPPOSED CO-OPERATING REFINING ELEMENTS



(57) Abrégé/Abstract:
A pair of opposed co-operating refining elements (1, 2) intended for a disc refiner for the disintegration and refining of lignocellulosic material in a refining gap between two opposed counter-rotating refining discs. The refining elements are intended to be placed directly in front of each other on opposed refining discs, and both refining elements (1, 2) are formed with refining surfaces with bars (3, 4) and grooves (5, 6). In order to prevent generated steam from flowing rearward in the refining gap, a first refining element (1), which is intended for a rotary refining disc, is formed with a first radially restricted zone (7) with elevated bars (8) and a second radially restricted zone (9) without bars directly outside the first zone (7). A second opposed refining element (2) is formed with a third radially restricted zone (10) without bars, which third zone (10) is located directly in front of the first and the second zone (7, 9) on the first refining element (1).

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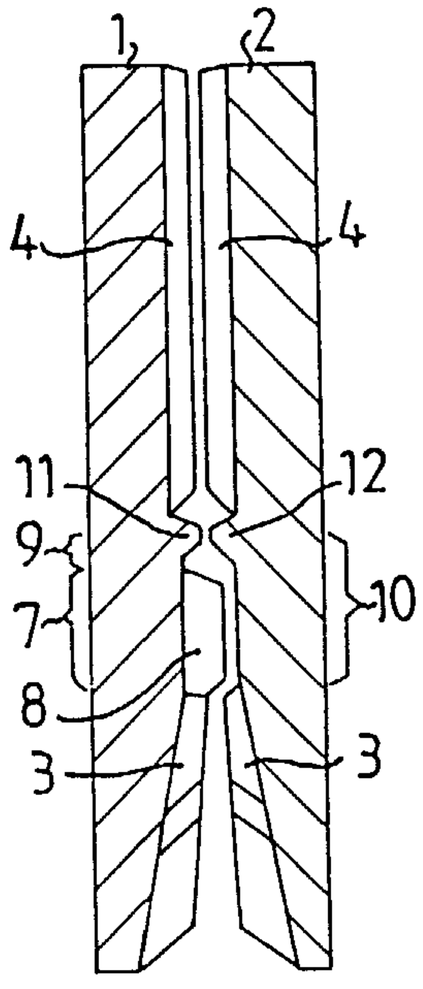
(54) Title: A PAIR OF OPPOSED CO-OPERATING REFINING ELEMENTS



(57) Abstract: A pair of opposed co-operating refining elements (1, 2) intended for a disc refiner for the disintegration and refining of lignocellulosic material in a refining gap between two opposed counter-rotating refining discs. The refining elements are intended to be placed directly in front of each other on opposed refining discs, and both refining elements (1, 2) are formed with refining surfaces with bars (3, 4) and grooves (5, 6). In order to prevent generated steam from flowing rearward in the refining gap, a first refining element (1), which is intended for a rotary refining disc, is formed with a first radially restricted zone (7) with elevated bars (8) and a second radially restricted zone (9) without bars directly outside the first zone (7). A second opposed refining element (2) is formed with a third radially restricted zone (10) without bars, which third zone (10) is located directly in front of the first and the second zone (7, 9) on the first refining element (1).

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A pair of opposed co-operating refining elements.

This invention relates to the disintegration and refining of lignocellulosic material, such as mechanical pulp (TMP, CTMP), reject pulp, recycled fiber pulp and the like in a disc refiner with plane or angled discs. The invention, more precisely, relates to refiner elements for use in a refiner of this kind.

A disc refiner comprises two opposed counter-rotating refining discs, one or both of which are rotary in a surrounding refiner housing. A plurality of refining elements is arranged on the refining discs. A refining element can also be assembled of several partial elements. These refining elements are formed with a pattern of bars and intermediate grooves. The refining discs are placed in such a way that the refining elements form a refining gap, through which, the fiber material is intended to pass from the inside out, at which passage the disintegration is carried out by the bars of the elements. These bars can be of different design. They can be continuous or discontinuous, with uniform or varying height. In certain cases toothed bars can be used.

In the refining gap between the refining surfaces the fiber material is defibered first, i.e. the fibers are separated. This takes place in the interior portion of the refining gap, where there is the greatest distance between the refining surfaces. The refining gap decreases thereafter outward, and at the same time the pattern of the bars becomes tighter in order to obtain the desired working of the fiber material. Large energy amounts are required to achieve this working. The material concentration can be 3-50%, which implies the generation of large amounts of steam from the water following along.

Part of the generated steam flows rearward inward to the inlet for the material, and another part flows forward outward to the outlet from the refining gap. The steam pressure increases from the inlet to a pressure maximum in the outer portion of the refining gap, and thereafter decreases toward the outlet. This maximum pressure, which can rise to 7-8 bar, implies that the steam generated in the refining gap outside the pressure maximum flows outward, while the steam inside the pressure maximum flows

inward. The rearward flowing steam causes disturbance of the fiber flow in the refining gap. This is inconvenient, because a non-uniform fiber flow results in uneven pulp quality.

Depending on the desired degree of working and, thus, pulp quality, the refining surfaces are given a different design. Other factors also influence the pulp quality, for example the size of the refining gap, the moisture content of the fiber material, the feed, the temperature, and other.

According to the present invention, there is provided apparatus for refining lignocellulosic material comprising a first refining element adapted for mounting on a first refiner disk, and a second refining element adapted for mounting on a second refiner disk juxtaposed with said first refiner disk, said first and second refiner disks adapted for relative rotation with respect to each other whereby a refining gap is created between said first and second refining elements mounted on said first and second refiner disks, said first refining element including a first radially projecting refining surface including a first inner refining zone including a plurality of raised bars separated by a plurality of grooves therebetween, a second restricted radial refining zone disposed radially outward of said first inner refining zone and including a plurality of raised bars, a third restricted radial refining zone disposed radially outward of said second restricted refining zone and being devoid of any raised bars, and a fourth restricted radial refining zone disposed radially outward of said third restricted radial refining zone and including a plurality of raised bars separated by a plurality of grooves therebetween, and said second refining element including a

second radial refining surface having a fifth inner radial refining zone including a plurality of raised bars separated by a plurality of grooves therebetween, a sixth restricted radial refining zone disposed radially outward of said fifth inner radial refining zone and being devoid of any raised bars, and a seventh radial refining zone disposed radially outward of said sixth restricted radially refining zone and including a plurality of raised bars separated by a plurality of grooves therebetween, said sixth restricted radial refining zone being located in direct juxtaposition with said second restricted radial refining zone.

According to the present invention, the refining elements are formed so, that the main part of the steam generated in the refining gap is prevented from flowing rearward inward in the refining gap, but instead flows forward outward. This is achieved in that the bars of the refining elements are formed in such a way, that the material in the refining gap forms a steam lock, which moves the pressure maximum inward in the refining gap. Due to the fact that the main part of the steam flows outward together with the material, the disturbances of the fiber flow are minimized, and the quality of the pulp will be higher and more uniform.

An embodiment of the invention is described in greater detail in the following, with reference to the accompanying Figures, of which Figs. 1 and 2 schematically show the refining surface on each of the two co-operating refining elements according to the embodiment, and Fig.3 is a cross-section of the opposed elements.

Each of the opposed co-operating refining elements 1,2 according to an embodiment of the invention consists of a single element, which extends radially along the entire refining gap, or of at least two partial elements, each of

which extends radially, one after the other, along a portion of the refining gap.

Each of the refining surfaces of the co-operating refining elements 1,2 is provided with bars 3,4 and intermediate grooves 5,6. The first refining element 1, which is intended to be placed on a rotary refining disc, is formed with a first radially restricted zone 7

with elevated bars 8 located in the inner portion of the refining gap. Directly outside this first zone 7, a second radially restricted zone 9 without bars is located. Said zone 9, instead of having bars in a proper meaning, can be formed smooth or with an uneven surface intended to bring about a certain braking effect on the material in the refining gap. The second refining element 2, which is intended to be placed directly in front of the first refining element 1 on a stationary or rotary refining disc, is formed with a third radially restricted zone 10 without bars. Said third zone 10 is located directly in front of the first zone 7 and second zone 9. The third zone shall not have bars in a proper meaning, but can be smooth or be formed with unevennesses or the like intended to bring about a certain braking effect on the material in the refining gap. Outside these restricting zones 7, 9, 10, both refining elements 1, 2 are provided with bars 4 and grooves 6, which can have a conventional design. One refining element possibly can be formed with an elevated ridge 11, 12, which extends in circumferential direction after the second and, respectively, third zone 9 and 10, respectively.

The elevated bars 8 in the first zone 7 on the first refining element 1 extend into the third zone 10 on the second refining element 2, so that the tops of the bars 8 are located close to the surface of the refining element 2 in the third zone 10. The elevated bars 8 suitably are angled in relation to the radius of the refining element 1, so that they extend outward rearward, counted in the rotation direction of the refining element. The angle should be between 0 and 60°, suitably between 10 and 45°.

At the refining operation, the material is fed from the inside out through the refining gap formed between the two opposed refining elements 1, 2. In the innermost portion of the refining gap a first working of the material takes place, which is defibered without any considerable generation of steam. The material arrives thereafter at the restricted zones 7, 9, 10 where the material by the elevated bars 8 on the first rotating refining element 1 will be caused to rotate while at the same time by the centrifugal force being fed outward. When the elevated bars 8 are angled, the feeding effect is increased. In the space defined by the second zone 9 and the opposed third zone 10 there are no bars, which implies that the material is collected in the form of an allround material ring, which outwardly is braked by the bars 4 and/or ridges 11, 12 on the refining elements

1, 2. The material ring formed in this way is an effective flow obstacle for the steam generated during the working of the material between the bars 4 in the refining gap outside the material ring. The unevennesses, which can be arranged in the second and third zone 9, 10 have a certain braking effect on the material, which can facilitate the formation of the material ring in the space defined by the zones 9 and 10.

When the material is fed into the refining gap at a pressure of, for example, about 1 bar, and the pressure in the surrounding refining housing, for example, is about 3 bar, then arises in the refining gap a pressure maximum, which can amount to about 8 bar. This pressure maximum, according to the invention, can be moved to the radial position, which is defined by the material ring formed in the refining gap in the space defined by the second radially restricted zone 9 in the first refining element 1 together with the directly in front located portion of the third radially restricted zone 10 in the second refining element 2. The steam generated in the refining gap outside the material ring is then forced to flow outward together with the material, whereby the working and material flow become more uniform and, thus, the pulp quality is improved and made more uniform.

The invention, of course, is not restricted to the embodiments shown, but can be varied within the scope of the claims with reference to description and Figures.

Claims:

1. Apparatus for refining lignocellulosic material comprising a first refining element adapted for mounting on a first refiner disk, and a second refining element adapted for mounting on a second refiner disk juxtaposed with said first refiner disk, said first and second refiner disks adapted for relative rotation with respect to each other whereby a refining gap is created between said first and second refining elements mounted on said first and second refiner disks, said first refining element including a first radially projecting refining surface including a first inner refining zone including a plurality of raised bars separated by a plurality of grooves therebetween, a second restricted radial refining zone disposed radially outward of said first inner refining zone and including a plurality of raised bars, a third restricted radial refining zone disposed radially outward of said second restricted refining zone and being devoid of any raised bars, and a fourth restricted radial refining zone disposed radially outward of said third restricted radial refining zone and including a plurality of raised bars separated by a plurality of grooves therebetween, and said second refining element including a second radial refining surface having a fifth inner radial refining zone including a plurality of raised bars separated by a plurality of grooves therebetween, a sixth restricted radial refining zone disposed radially outward of said fifth inner radial refining zone and being devoid of any raised bars, and a seventh radial refining zone disposed radially outward of said sixth restricted radially refining zone and including a plurality of raised bars separated by a plurality of grooves therebetween, said sixth restricted radial refining zone being located in direct juxtaposition with said second restricted radial refining zone.

2. The apparatus of claim 1 wherein said plurality of raised bars and said plurality of grooves in said fourth radial refining zone and said seventh radial refining zone directly abut said third restricted radial refining zone and said sixth restricted radial refining zone, respectively.

3. The apparatus of claim 1 or 2 wherein said first refining element includes a first circumferentially extending ridge disposed radially outward of said third restricted radial refining zone.

4. The apparatus of any one of claims 1 to 3 wherein said second refining element includes a second circumferentially extending ridge disposed radially outward of said sixth restricted radial refining zone.

5. The apparatus of any one of claims 1 to 4, wherein at least one of said third and sixth restricted radial refining zones includes an uneven surface.

6. The apparatus of any one of claims 1 to 5, wherein said plurality of raised bars in said second restricted radial refining zone are disposed at an angle between 0° and 60° with respect to the radius of said first refining element.

7. The apparatus of any one of claims 1 to 6, wherein each of said first and second refining elements comprises a single element extending radially along said entire refining gap.

8. The apparatus of any one of claims 1 to 6 wherein each of said first and second refining elements comprises at least two partial refining elements extending in sequence radially along said entire refining gap.

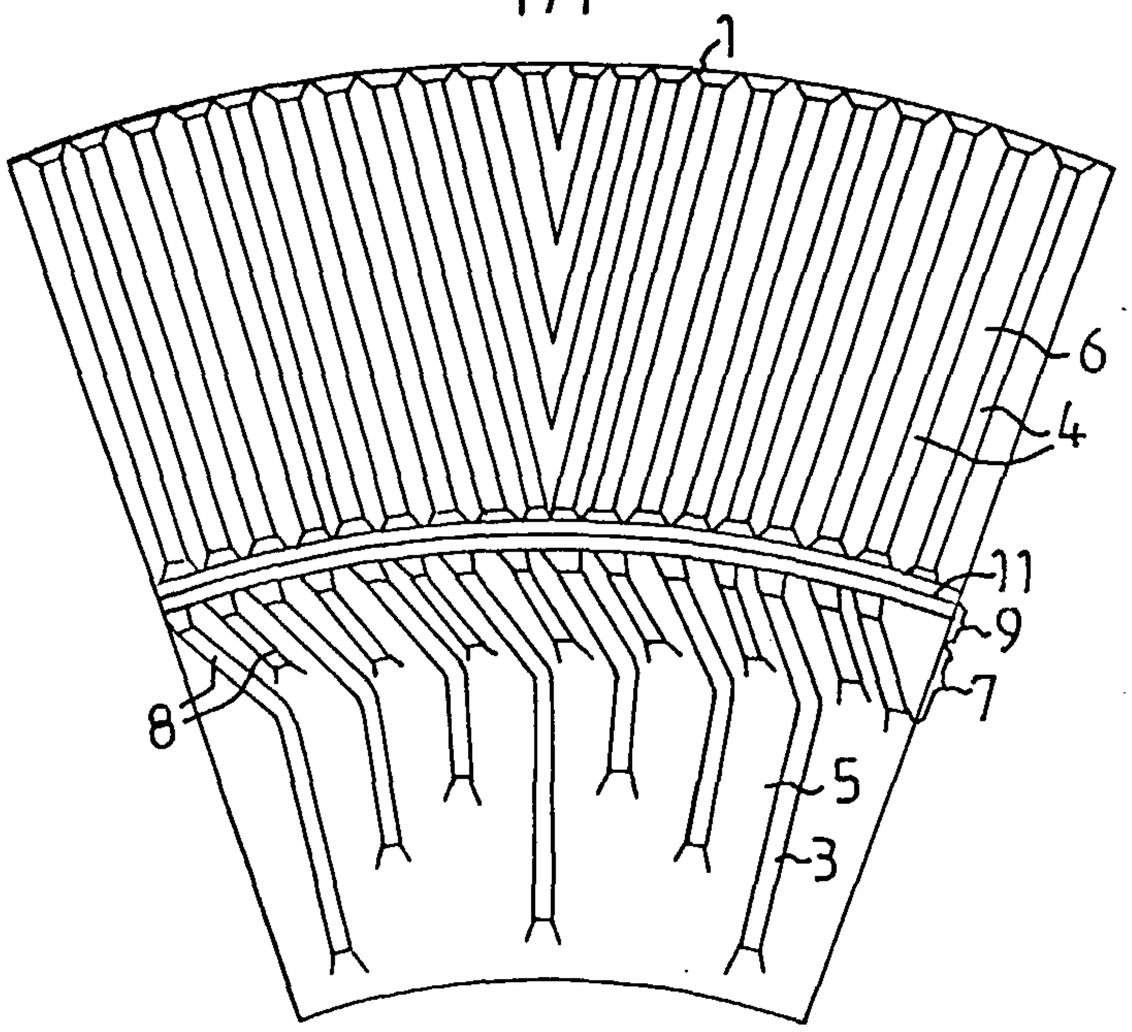


FIG. 1

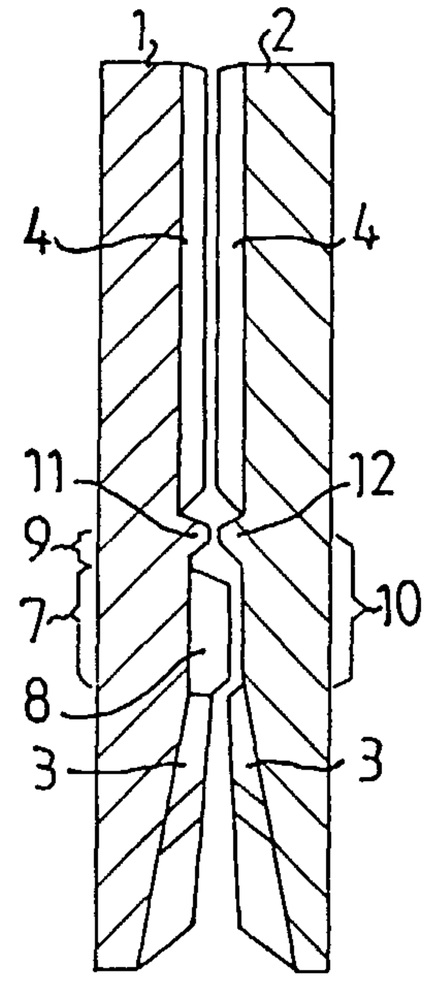


FIG. 3

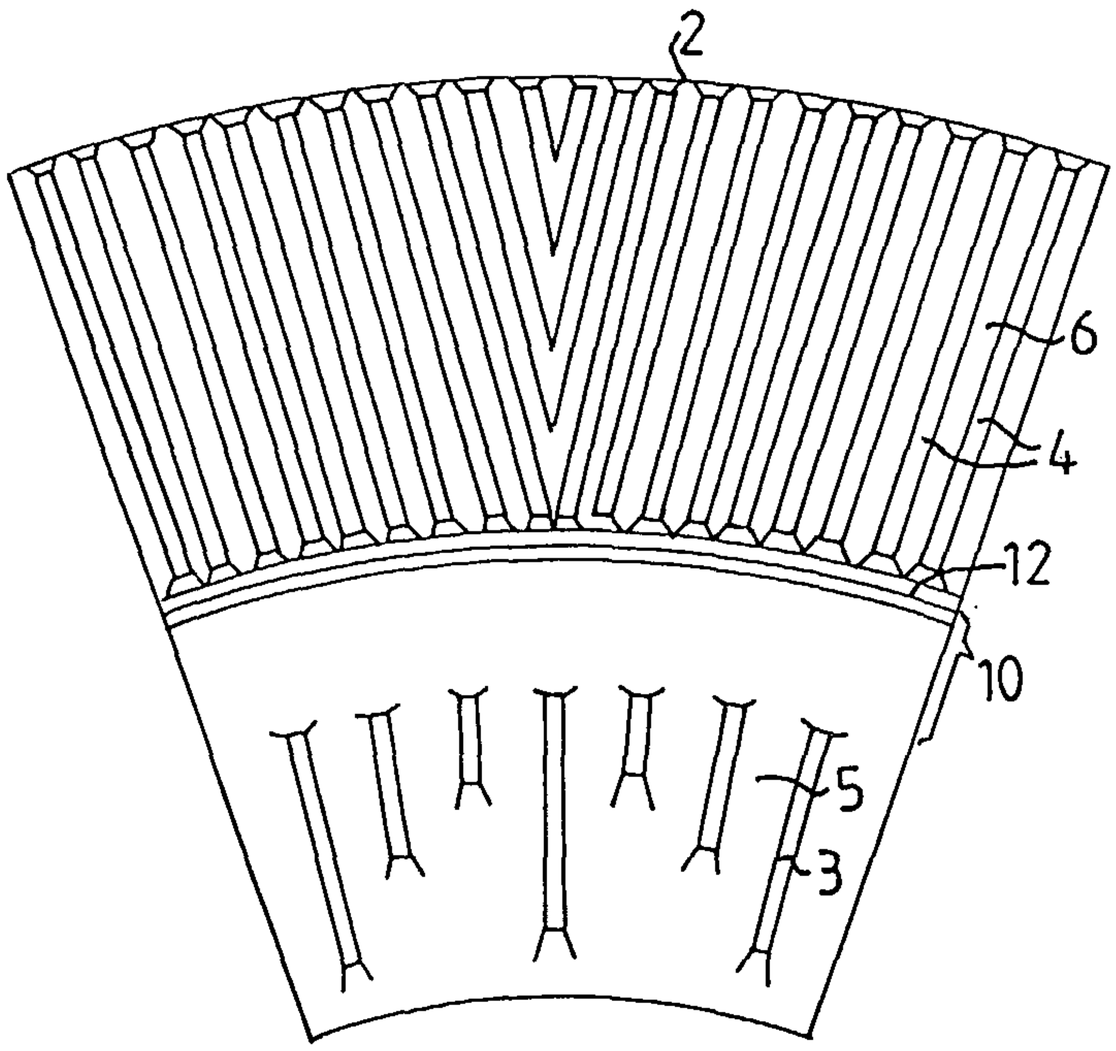
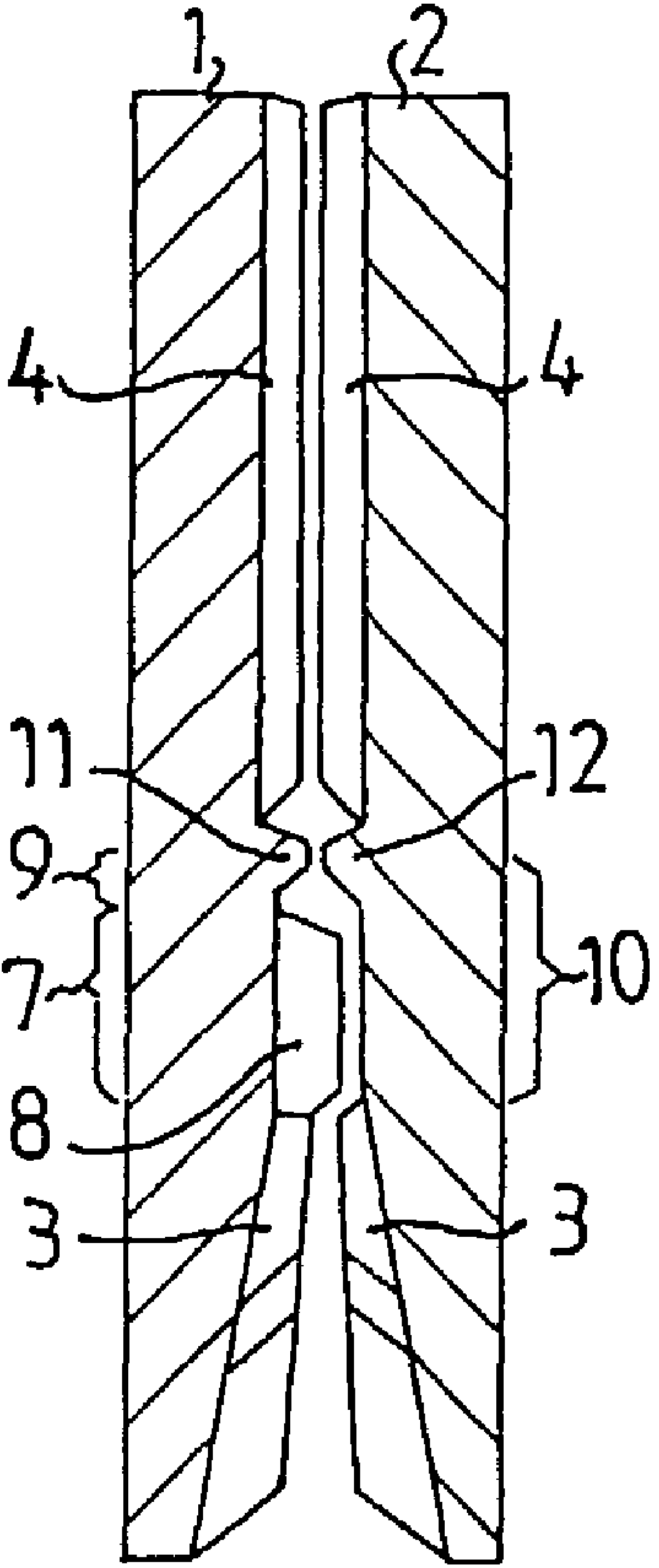


FIG. 2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