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(54) **Titre : Method for processing the trunks of oil palms to produce wood products.**

(57) **Abrégé :**

The invention relates to a method for processing and utilizing the wood of oil palms such that, by means of appropriate measurements through the use of ultrasound, X-ray technology, or natural frequency measurement, the density distribution of the trunk wood is detected, and when cutting, sawing, and further processing the palm wood a distinction is made between regions of different density of the wood, so that in particular wood having a largely homogeneous density is produced and then, depending on the density of the segments of wood to be processed, the wood and wood products produced are further processed, stored, and ultimately used.

Fig. 3

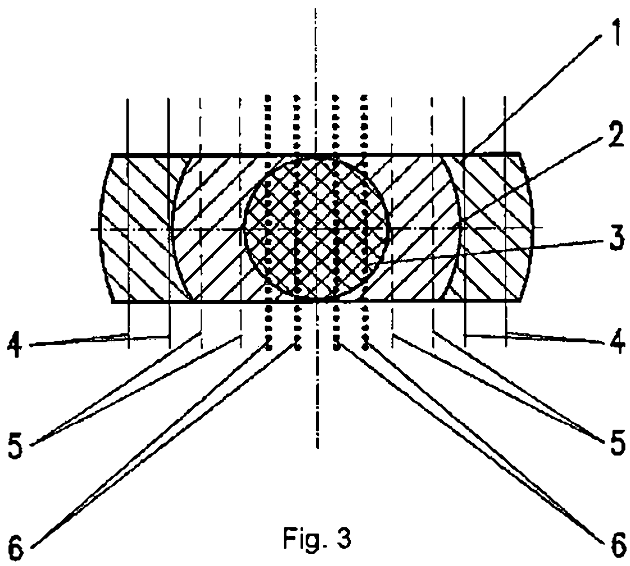


Fig. 3

METHOD FOR PROCESSING THE TRUNKS OF OIL PALMS TO PRODUCE WOOD PRODUCTS

According to the information available here, the global acreage used for oil palm is more than 20 million ha and counting. The so-called oil palm plantations are designed exclusively to utilize the palm oil produced by the palm trees in question; it is used primarily for producing food, but also for producing cosmetics, basic chemicals, and fuels. Said palm oil is extracted from the pulp of the fruits of the oil palm. Palm oil is particularly in demand for the production of food because it comprises more than 50% saturated fats.

The processing of palm oil into industrially usable products has been criticized in particular because the extraction of palm oil is partly associated with the corresponding clearing of natural forests and is also suspected of producing greenhouse gases in this context.

These palm plantations are also criticized because the utilization of the oil palms focuses exclusively on the extraction of palm oil, but the trunk material of the palm tree remains unused when a plantation is replanted and is usually distributed, chopped up, in the plantation and left to rot.
This in turn is accompanied by increased infestations of insects and fungi, which then in turn infest the newly planted oil palm plantations.

Some of the felled trunks of the oil palms are also burned, which in turn is associated with the release of greenhouse gases through said burning and also contributes significantly to air pollution.

Proceeding from this environmentally destructive situation, the inventive solution proposes efficient and material use of the palm oil trunks, more precisely the oil palm wood.

In this context, CN 109 822 704 A already discloses a method for processing compressed oil palm wood. The previously compressed oil palm wood is further compressed by means of a hot pressing process, so that it is possible to use the oil palm wood commercially.

Also known from WO 2019 017 772 A1 is cutting up and compressing palm trunks, then drying them at a high temperature, and then impregnating them in order to obtain usable palm wood.

Before going into the inventive method, it is advisable in this context to discuss some special features of the oil palms.

First, palm trees differ from conventional trees, such as coniferous and deciduous trees, which are dicots. In contrast, an oil palm is monocot, like grass or bamboo, for example.

Thus, oil palms differ from the aforesaid coniferous and deciduous trees in that they do not have any secondary growth thickness, which forms growth zones or the so-called annual rings due to a cambium layer under the bark.

In contrast to this, the aforesaid palms have extended longitudinal growth from bottom to top, starting from the shoot, as well as a growth in thickness in the cell walls due to so-called cell wall layers, which in turn is associated with an increase in density in the cells as the palm ages. Furthermore, palm trees have no branches.

The so-called palm fronds are lost during the longitudinal growth of the palm trunk, so that only the fronds at the upper end of the palm remain biologically active and are retained. The trunk of a palm tree thus grows mainly from the bottom up and has no branches.
The structure of the trunk of the palm tree is homogeneous and comprises relatively hard vascular bundles embedded in a soft cell structure.

Another special feature of the structure of the oil palm is that it has a different density distribution compared to a classic tree trunk. The density distribution of the wood is highest in the lower region of the trunk of the oil palm, decreasing then as trunk length increases.

In a mature palm, more or less three density zones can be identified along the length of the trunk, viewed from bottom to top and from inside to outside. Depending on age, diameter, and cultivation area, the trunks have a density difference between approx. 180 kg/m³ and 650 kg/m³.

Essentially, 3 density classes can be distinguished as follows:

Density class	Density	Proportion
I	> 350 kg/m³	20 – 30%
II	200 – 350 kg/m³	30 – 40%
III	< 200 kg/m³	35 – 45%

The specification of the "proportion" in the table above relates to the proportion of the specific density class in the entire trunk of an oil palm.

A segment of about 12 m of the entire trunk length is suitable for further processing and utilization of the trunk of the oil palm.

This usable segment of the oil palm trunk is cut into trunk subsegments of between 2.5 and 6.5 m. In addition, the trunk segments obtained in this way are provided with a mark that marks the direction of growth of the trunk segment. Indicating the direction of growth provides information about the decreasing density and can therefore be taken into account during later processing of the trunk wood.

In principle, the trunks are cut uniformly, i.e. either in the direction of growth or against the direction of growth, so that the direction of growth of a package of wood that has already been sawn is uniform in each case.

When cutting the trunks, a distinction is made between two different methods of cutting, specifically

- Rigid cutting with trunk classes pre-sorted according to trunk diameter, wherein only trunk diameters of one trunk class are processed, i.e. the cutting tools are not adjusted during the cut;
- Flexible cutting with mixed trunk diameters, by means of adjustable sawing machines which can be adjusted depending on the trunk diameter, wherein the trunk diameter is always measured before being cut and the sawing machines are adjusted accordingly.

Regardless of the cutting method chosen, the density zones of the trunk segments are determined by means of ultrasound, natural frequency measurement, or X-ray technology before cutting. It is not necessary to carry out such a determination of the respective dense zones for each individual trunk of a palm tree. On the contrary, it can be assumed that for trunk segments that have grown on an identical plantation and have a similar or equal diameter and a similar and equal age can be considered more or less identical or at least similar, so that a few corresponding measurements are sufficient to determine the specific cutting technique at least for a majority of a plantation.

- Rigid cutting with trunk classes pre-sorted according to trunk diameter, for processing one and the same trunk class, wherein the cutting machines are not adjusted during the cutting
- Flexible cutting with mixed trunk diameters, wherein in this case machines with adjustable saw units are used for processing different trunk diameters, that is, different trunk classes

For cutting the palm wood to size, the density zones of the trunk segments can be determined by means of an ultrasound and/or natural frequency measurement and/or using X-ray technology without the need for cutting the trunk segment to be processed.

At first glance, it can be assumed that trunk segments having a similar or identical diameter, of similar or the same age, and coming from the same growth region, have more or less identical or at least very similar density distributions. This means that for cutting to size it is not necessary to determine the density zones of each trunk, but instead that the density zones for comparable trunks can be determined more or less by means of a single measurement. However, additional samples can be used for further verification.

The determination of the density zones is checked again and again using random samples and is further refined using further evaluations. In this way, it is possible to correlate the density zones over the specific trunk length in order to thereby adequately take into account the decreasing density of the trunk, more precisely of the trunk wood of a palm tree, over the length of the trunk. As a result, the different density zones can be determined with the required accuracy in this manner.

Using this information, a so-called density-oriented cut can then be made in the trunks of the oil palms. Essentially, a distinction is made between three different density zones, specifically low density, medium density, and high density.
By means of the method described in the foregoing of separating the density zones, wood packages with approximately the same density can be cut to size. These wood packages, each with an approximately homogeneous density, can then also be dried and further processed according to their properties.

This so-called separation of the wood according to density zones enables further processing of the wood packages, depending on their specific density. Thus different drying programs with individual temperatures and drying times are used depending on the specific density zone.

As a result, the cut subsegments are then processed into finished products having different specific properties, that is, depending on the density, either into lightweight slabs having a low density or into solid slabs having a high density or into wood products that are made up of different layers, such as three-layer slabs with mixed medium/high density (MD, HD), mixed medium/high density (MD, HD) composite lumber, or cross laminated lumber with alternating layers of strips of different densities glued lengthwise and crosswise.

The invention is explained in greater detail below using specific exemplary embodiments illustrated in the drawings, in particular with regard to the further processing of the trunks of the oil palm.

In the drawings:

Fig. 1: depicts the trunk of an oil palm, in section, with different density zones;

Fig.2: depicts the trunk of an oil palm, in section, with different density zones as well as the cutting pattern for separating the boards having high density and for separating the boards having medium density in the so-called preliminary cut;

Fig 3: depicts the trunk of an oil palm, in section, with the cutting patterns according to Fig. 2, and with the cuts for separating boards having low density in the so-called re-cut;

Fig. 4: depicts the trunk of an oil palm with the cutting patterns according to Fig. 2, and with the cuts for separating wood of high/medium/low density in the so-called sharp cut;

Fig. 5: depicts the conically tapering trunk of an oil palm, having a conical trunk shape, as well as a corresponding density-oriented, fiber-parallel cut along the outer contour of the trunk of this oil palm during the preliminary cut and the re-cut, respectively.

Fig. 1 shows the trunk of an oil palm in section, wherein it is possible to identify the different density zones or classes of the oil palm using the different hatch marks of the section.

The outer wood 1 of the oil palm, that is, the outer growth zone of the oil palm, has the highest density (HD) as seen across the section of the trunk. It has a density of

>350 kg/m³. The wood portion of this quality in the palm makes up about 20-30% of the trunk wood.

The next inner wood layer (2), having medium density (MD) of 250-350 kg/m³, accounts for 30-40% of the trunk of the oil palm.

The innermost layer of the trunk forms the largest portion of the trunk of the oil palm. It makes up 35-45% of the trunk wood. However, it is also the portion of wood having the lowest density (LD). The trunk density in this region is <200 kg/m³ to 350 kg/m³.

The above information shall be understood to be only by way of an example, since the values can vary depending on the age of the palm tree, its diameter, and its growth area.

Proceeding from the knowledge of this density distribution, the trunks of the oil palm are cut along their useful trunk length of approx. 12 m into trunk segments between 2.5 and 6 m.

In preparation for further processing, the direction of growth of the trunk segment obtained in this way is marked. The information about the direction of growth provides an indication of the direction in which the density of the trunk wood decreases and can therefore also be taken into account during further processing.

Accordingly, the trunks are each cut uniformly, i.e., either in the direction of growth or against the direction of growth. This ensures that each of the wood packages obtained can be arranged and stored in a uniform direction of growth.

The wood packages obtained in this way are then cut further, with a rigid cut taking place with trunk classes pre-sorted according to trunk diameter, so that it is always only trunk diameters of one trunk class that are processed. This has the advantage that the sawing machines used do not have to be adjusted during the cut.

Alternatively, it is also possible to make a flexible cut with mixed trunk diameters, wherein then machines must be used that are equipped with adjustable saw units so that the respective trunk diameter can be set as a function of the thickness of the trunk and then the cut is made. To this end, the trunk diameter of each trunk is usually measured in advance.
The saw units used in this case are usually already equipped with appropriate measuring instruments.

In a further step, the different density zones of the trunk segments are then determined, preferably by means of an ultrasound measurement, natural frequency measurement, or X-ray technology. By using trunk segments with more or less the same density distribution, the density zones for each individual trunk segment can be determined very precisely, wherein the quality of this determination may be further improved using appropriate random samples. As a result, trunk segments with more or less the density of preceding segments are available for further processing.

In addition, the trunks are then cut in a density-oriented manner such that more or less wood packages with approximately the same density are formed. In this context, a distinction is again made between the 3 density zones, that is, high density (HD), medium density (MD), and low density (LD).

By identifying different density zones, subsequent individual thermal drying of the cut wood, as well as individual further processing of the wood, can then take place.

By defining different density zones, the pieces cut to size can then be processed into finished products with different specific properties, that is, for example, lightweight slabs having a low density, solid wood slabs having a high density, and three-layer slabs having mixed density components. In this respect, wood products tailored to the respective application can be produced as a function of the specific requirements.

According to Fig. 2, a distinction can first be made between three different density zones (1, 2, and 3) within the trunk segment to be processed, specifically, the outer trunk part, of high density (HD), and the middle trunk part, of medium density (MD), as well as of the inner trunk region, which is of low density (LD).

As expected, the first cut is made into the trunk wood in the outer region, in accordance with the solid lines shown in Fig. 2, which therefore represent the cutting lines for each cut into the trunk segment.

The mixed density boards are then cut to size, wherein the cutting lines are shown as broken lines in Figure 2. Woods of high or medium density are obtained in this way. A so-called model remains as residual material.

In accordance with to Fig. 3, the inner trunk region, that is, the density zone having low density according to the dotted lines drawn in Fig. 3, is also cut from the model, also either from the outside inward or from the inside outward, that is, is processed into boards.

In the case of the cuts mentioned, the respective board thicknesses are selected such that as precise a separation of the density zones explained as possible is ensured, that is, such that as much as possible of the higher density classes can remain in the respective board section. This is understood as the so-called density-oriented cut of the trunks.

In accordance with Figure 4, the trunks are first processed from the outside, wherein in this connection cuts are first made for separating high-density (HD) boards and then medium-density (MD) boards.

Finally, the inner region having the lowest density is also cut, according to the dot-dash lines (7), into boards that have all three density classes (HD, MD, LD). The boards are then trimmed and cut into strips. The three density classes are separated from one another as precisely as possible. Alternatively, in accordance with Figure 4 the trunk can also be cut into boards in one pass using the so-called sharp cut. The boards are then trimmed and cut into strips. The three density classes are separated from one another as precisely as possible in accordance with Fig. 7. This also creates strips that contain two density classes (HD and MD or MD and LD). A total of 5 density classes (HD, HD/MD, MD, MD/LD, LD), each having different elasto-mechanical properties, are available for processing the strips into final products. The boards can be cut into strips of densities that are as separate as possible before drying or after drying.

The remaining model already mentioned is also cut into boards according to the dot-dash lines in Fig. 3. These boards are also sorted according to their respective density levels, wherein the boards obtained in this way then are then sorted and stacked according to density.

In order to obtain a maximum amount of wood comprising a so-called HD/MD material, it is also possible to make a cut in accordance with Fig. 5, taking into account the conical course of the trunk, by making the cut parallel to this conical course of the trunk. In this way, homogeneous density zones can be created over the entire length of each trunk segment. As a result, a conical offcut of homogeneous low density (LD) is obtained in this way. It is more or less an offcut whose usability is questionable.

In return, however, a higher volume of HD/MD quality is obtained from the trunk of the oil palm.
The conical trunk segments produced in this way can then in turn be further cut to size in accordance with Fig. 6, specifically parallel to the conical course of the board. This results in conical strips that have a maximum volume of HD/MD material and that, after drying, are glued in accordance with Fig. 8 in a conical shape and alternating growth orientation to form boards

In accordance with Fig. 7, boards can be cut to size such that they are of high density 1 on the wane side, while further inwards the wood is of medium density 2, and while the inner board wood is only of low density 3.

As already mentioned, Fig. 8 depicts conically cut boards (8) in HD/MD quality and glued to form boards after they have dried.

Fig. 9 shows a corresponding stack for drying the wood, wherein a layer of wood strips (9) glued lengthwise is arranged alternatingly with a layer of wood strips glued crosswise in between, followed by a further layer (11) of strips glued crosswise, the underside thereof resting on a further layer of strips (12) glued lengthwise.

Finally, Fig. 10 shows, again in a perspective view, a stack of boards with board layers arranged one above the other and already glued together.

LIST OF REFERENCE SIGNS

1	High density zone (HD)
2	Medium density zone (MD)
3	Low density zone (LD)
4	High density (HD) board separation cuts
5	Cuts for separating medium density (MD) boards
6	Cuts for separating low density (LD) boards
7	Cuts for separating the remaining segment model into boards having all three densities (HD, MD, LD)
8	Conically cut boards
9	Layer of strips glued lengthwise
10	Layer of strips glued crosswise
11	Additional layers of strips glued crosswise
12	Additional layers of strips glued lengthwise
13	Board layers arranged and glued above one another
14	Mixed density zone (HD, MD)

CLAIMS

1. Method for processing the trunks of oil palms to produce wood products, according to which different density zones, preferably 3 zones of different density, are identified along the trunk of the oil palm and across the section of the oil palm from the inside outwards, in that the density of the wood of one or more reference palms is determined by means of ultrasound detection, X-ray technology, or natural frequency measurement, wherein the density of the trunk of the oil palm decreases from bottom to top and from outside to inside, characterized in that essentially a distinction is made between 3 density degrees, specifically

> 350 kg/m³
$> 200 – 350$ kg/m³
< 200 kg/ m³

so that, as a result, trunk segments of the oil palm are defined with largely homogeneous density zones, wherein the density of the trunk of the oil palm decreases from bottom to top and from outside to inward, this being based on the fact that oil palms that grow more or less at the same location under more or less the same conditions and that have reached more or less the same age and more or less the same trunk diameter, so that their density distribution over the length of the trunk of the oil palm is more or less identical for each trunk of an oil palm within an oil palm plantation, so that for the further processing of the oil palm it can be assumed that the density distribution along the trunk of the oil palm will be homogeneous according to the segments determined above, wherein in this way single-ply panels, blockboards, door core panels, multi-layer panels, composite lumber, and cross-laminated lumber are produced in different qualities, specifically in high density (HD), mixed density (HD/MD), medium density (MD), as well as mixed medium density and low density (MD/LD), and low density (LD), such that door core panels having a thickness of 40 - 45 mm, a width of 700 - 1200 mm, a length of 1900 - 2200 mm are produced, wherein the middle layer of the door core panels is made of woods having either high density (HD), mixed density (HD/MD), medium density (MD) and mixed low density (MD/LD), or low density (LD) and are each glued crosswise or lengthwise, wherein edge areas are reinforced if necessary, for example for attaching hinges, wherein these reinforcements preferably comprise 40-100 mm wide strips of high density (HD) attached on one or both sides at the edges of the door core panel, and the rest of the door core panel is produced from mixed density (HD/MD), medium density (MD) low density (MD/LD) or (LD) woods, wherein specific layers of 1.0 to 3.0 mm veneer, MDF, or plywood of different types of wood having a thickness of 1.5 mm - 3.5 mm thickness are each produced having medium or high bulk density.

2. Method according to claim 1, characterized in that within the usable trunk segment a felled oil palm is cut along a usable trunk length of 12 m by means of a saw into trunk segments having at least approximately homogeneous density distribution of preferably 2.5 m to 6.5 m.

3. Method according to claim 2, characterized in that said trunk segments are each marked with an indication of the direction of growth of the respective trunk, so that the information about the direction in which the density of the trunk segment decreases is retained, for example for further processing of the wood.

4. Method according to claim 1 or 2, characterized in that the trunks of the oil palm are each cut uniformly, i.e. either in or against the direction of growth of the oil palm, so that the trunk segments or the wood boards produced are each sorted in a uniform direction of growth.

5. Method according to claim 3 or 4, characterized in that a distinction is made between 2 types of cuts, specifically,

- A rigid cut for processing with trunk diameters that are uniform to a few centimeters, that is, without adjusting the saws used;

- A variable cut for processing different trunk diameters using adjustable saw units, preferably using a recording device for measuring each trunk diameter.

6. Method according to one or more of the preceding claims, characterized in that due to the detection of different density zones within the trunk of the oil tree trunks to be processed, sorting into wood packages separated according to different density zones with at least largely identical density is ensured, so that, for example, further thermal processing of the trunk wood, in particular its drying time and/or drying temperature, is carried out by means of drying programs individually tailored to the specific wood density.

7. Method according to claim 6, characterized in that, after the drying phase has ended and depending on the respective density of the wood, said wood packages have at least a largely identical homogeneous density, the wood can be processed into products having different properties, such as lightweight building panels from the low-density wood, solid wood panels from high-density wood, three-layer panels from mixed woods having medium or high density, composite lumber from mixed woods having medium or high density, and cross laminated lumber having alternating layers of strips of different densities glued lengthwise and crosswise, in each case taking into account the intended use of the wood and its specific area of use and the resulting requirements for the wood product produced, such as high flexural strength or the lowest possible weight of the respective wood product.

8. Method according to claim 7, characterized in that first a first cut is made into the trunk of the oil palm, either from the outside inward, from the inside outward, or both at the same time, said cuts each remaining as much as possible within one density zone.

9. Method according to claim 8, characterized in that first the high-density boards are separated on both sides of the trunk, then the mixed-density boards are separated, so that finally the residual material of low density remains, that is, boards having at least largely homogeneous density are produced in each case.

10. Method according to claim 8 or 9, characterized in that the highest possible proportion of the higher density class remains in the respective board section.

11. Method according to claim 8, 9, or 10, characterized in that each respective first cut is made between the low-density material and the high-density material, so that two semi-circular trunk parts having medium and high trunk density are produced, and are then cut into individual boards, in turn are separated taking into account the respective density zones.

12. Method according to claim 9, 10 or 11, characterized in that, by means of a sharp cut carried out at the same time, the respective board thicknesses are each selected such that the separation of the density zones and thus the homogeneity of the respective board densities is again maintained.

13. Method according to one or more of preceding claims 8-12, characterized in that, before cutting, the trunks of the oil palms are pre-sorted according to diameter and the respective trunk segments, taking into account the respective density zones, that is, are pre-sorted according to their specific diameter and trunk segments, so that it is ensured that boards of the same or different board thickness are produced on the one hand, but each has at least largely homogeneous density.

14. Method according to claim 13, characterized in that the cuts into each trunk segment are each carried out centrally symmetrically to the conical course of each trunk segment.

15. Method according to claim 14, characterized in that alternatively the cut is made into the trunk segments parallel to the fibers in the conical course of the trunk, this in turn producing trunk segments having at least largely homogeneous density zones over the entire length of the trunk segment to be processed.

16. Method according to claim 15, characterized in that the aforesaid cut parallel to the fibers is carried out both in the preliminary cut of the trunk and in the re-cut or even only in the re-cut for the processing of the trunk of the oil palm.

17. Method according to claim 14 or 15, characterized in that the trunks or trunk segments of the oil palms to be processed are each trimmed such that a pentagonal or hexagonal section of the trunks or trunk segments to be processed results.

18. Method according to one or more of the preceding claims, characterized in that the boards produced according to the preceding claims by means of preliminary cut and re-cutting, that is, so-called trimming, are cut to size with adjustable saws and then stacked separately, that is, boards having high/medium density and, separated therefrom, boards having medium/low density.

19. Method according to one or more of preceding claims 1 18, characterized in that only the wane parts of the boards are separated during trimming, and these boards are then dried and only then, after drying, are the boards cut to size by means of saws into one or more strips of the same or different width, wherein the three density classes are separated from one another as precisely as possible.

20. Method according to one or more of the preceding claims, characterized in that the boards are not trimmed parallel, but instead are trimmed conically along the wane, so that only the wane zone is separated.

21. Method according to claim 20, characterized in that the conical boards are dried and, after drying, are glued in a conical shape to form panel layers.

22. Method according to one or more of the preceding claims, characterized in that the boards produced according to the preceding claims, while maintaining the direction of growth and thus corresponding to the course of the density gradient of the wood, are stored along the longitudinal axis and then sorted and stacked for subsequent drying, wherein the individual layers are separated by intermediate strips.

23. Method according to one or more of the preceding claims, characterized in that when stacking the boards produced it cannot be avoided that mixed boards of poorer quality, that is, having different densities, may be located under the stacked

boards, so it may be necessary to take this into account in the number or spacing of stacked strips in order to avoid sagging or deformation of the boards produced during drying.

24. Method according to claim 23, characterized in that the process of sorting and stacking the boards is monitored at least using random samples, in that corresponding density measurements are monitored, for example by using a natural frequency measurement, with or without moisture measurement, or using ultrasound measurement.

25. Method according to claim 24, such that as part of the drying process the wood is dried until a residual moisture content of 12-15% is reached, which is followed by a high-temperature treatment of the dried wood at a temperature of 120-170°C over a period of 12-24 hours, wherein this drying process is preferably followed by the cut surfaces being treated with a fungicide.

26. Method according to one or more of the applicable claims 21-25, characterized in that the dried boards are cut to size with the respectively required raw dimensions, taking into account the planned product dimensions, such that at least essentially boards of as pure a quality as possible of the mixed density classes high density (HD), medium density (MD) and medium density (MD), low density (LD) are produced in a quality that is as pure as possible.

27. Method according to claim 26, characterized in that said dried boards are sorted and stored according to density classes after they have been separated, again by means of weight measurement and/or natural frequency measurement, optionally with or without moisture and/or ultrasound measurement.

28. Method according to claim 26 or 27, characterized in that the strips or rods in the panels and in the composite lumber or cross-laminated lumber are arranged alternately, that is, in alternating directions of growth, such that the decreasing density in the direction of growth is evenly distributed over the panel or product width.

29. Method according to 27 or 28, characterized in that the strips or rods are arranged alternating, in each case in an alternating direction of growth.

30. Method according to claim 29, characterized in that blockboards are produced having a thickness of 40-45 mm, a width of 500-1250 mm, and a length of 1000-3000 mm, wherein the middle layers of the blockboards are produced from wood with either high density (HD), mixed density (HD/MD), medium-density and low-density (MD/LD), or low density (LD), and are each glued crosswise or lengthwise, and the top layers of the blockboards are made of 1.0 - 3.0 mm veneer, MDF, or plywood produced from different types of wood having a thickness of 1.5 mm - 3.5 mm, each with a medium or high bulk density.

31. Method according to claim 30, characterized in that door core panels having a thickness of 40 - 45 mm, a width of 700 - 1200 mm, and a length of 1900 - 2200 mm are produced, wherein the middle layers of the door core panels made of wood are produced with either high density (HD), mixed density (HD/MD), medium density (MD) and low density (MD/LD), or low density (LD), and are each glued crosswise or lengthwise, wherein if necessary edge areas are reinforced, for example for attaching hinges, wherein said reinforcements preferably comprise 40-100 mm wide strips of high density (HD) on one or both sides of the edges of the door core panel, and the rest of the door core panel is produced from wood of mixed density (HD/MD), medium density (MD), lower density (MD/(LD) or (LD), wherein the respective top layers are produced from 1.0 to 3.0 mm veneer, MDF, or plywood of different types of wood having a thickness of 1.5 mm - 3.5 mm thickness, each of medium or high bulk density.

32. Method according to claim 31, characterized in that multi-layer panels are produced in a combination of different quality classes, each with a cover layer thickness of 4-15 mm, the middle layer of 4-50 mm, a width of 500-2050 mm and a length of 1000-6000 mm, wherein the cover layers comprise strips glued lengthwise having the same or mixed width, and the middle layer comprises bars glued crosswise and having the same or a mixed width.

33. Method according to claim 32, characterized in that cross-laminated lumber is produced in a combination of different quality classes, each with a layer thickness of 20 - 40 mm, a width of 1000 - 3000 mm and a length of 2000 - 12000 mm, wherein the layers alternately comprise strips glued lengthwise and have the same or mixed widths, as well as rods glued crosswise and having the same or mixed widths, and the individual layers have the same or different density classes.

Fig. 1

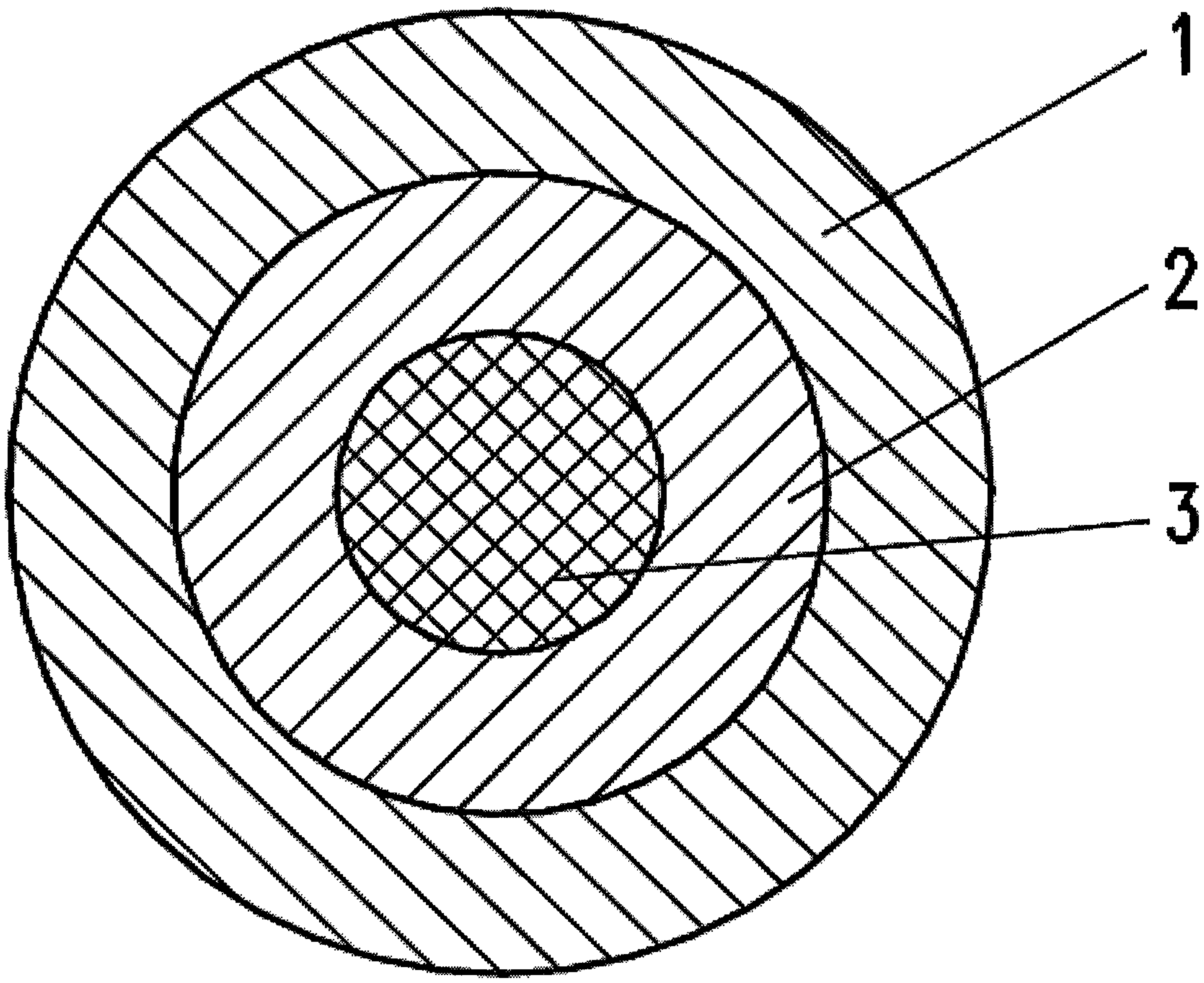


Fig. 2

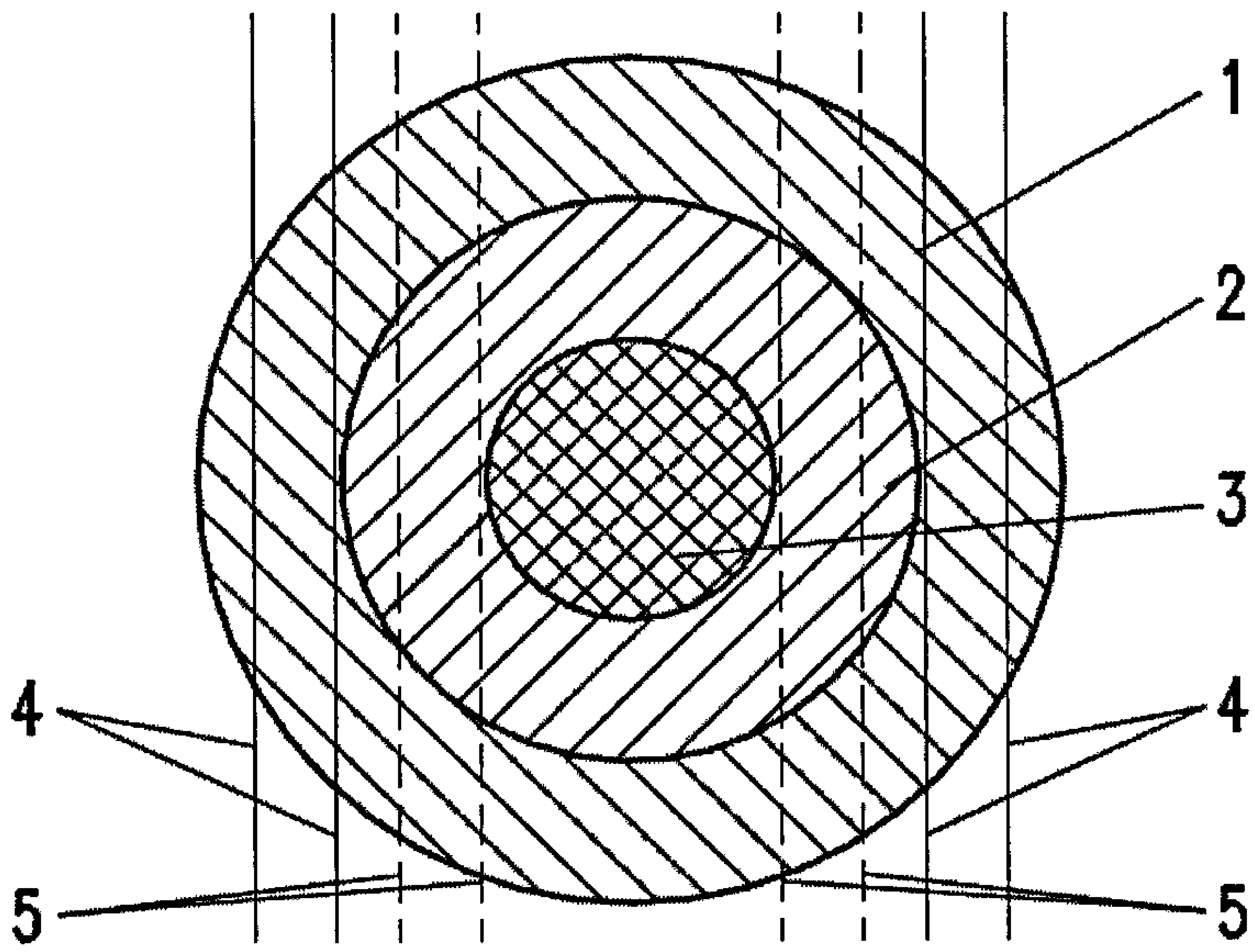


Fig. 3

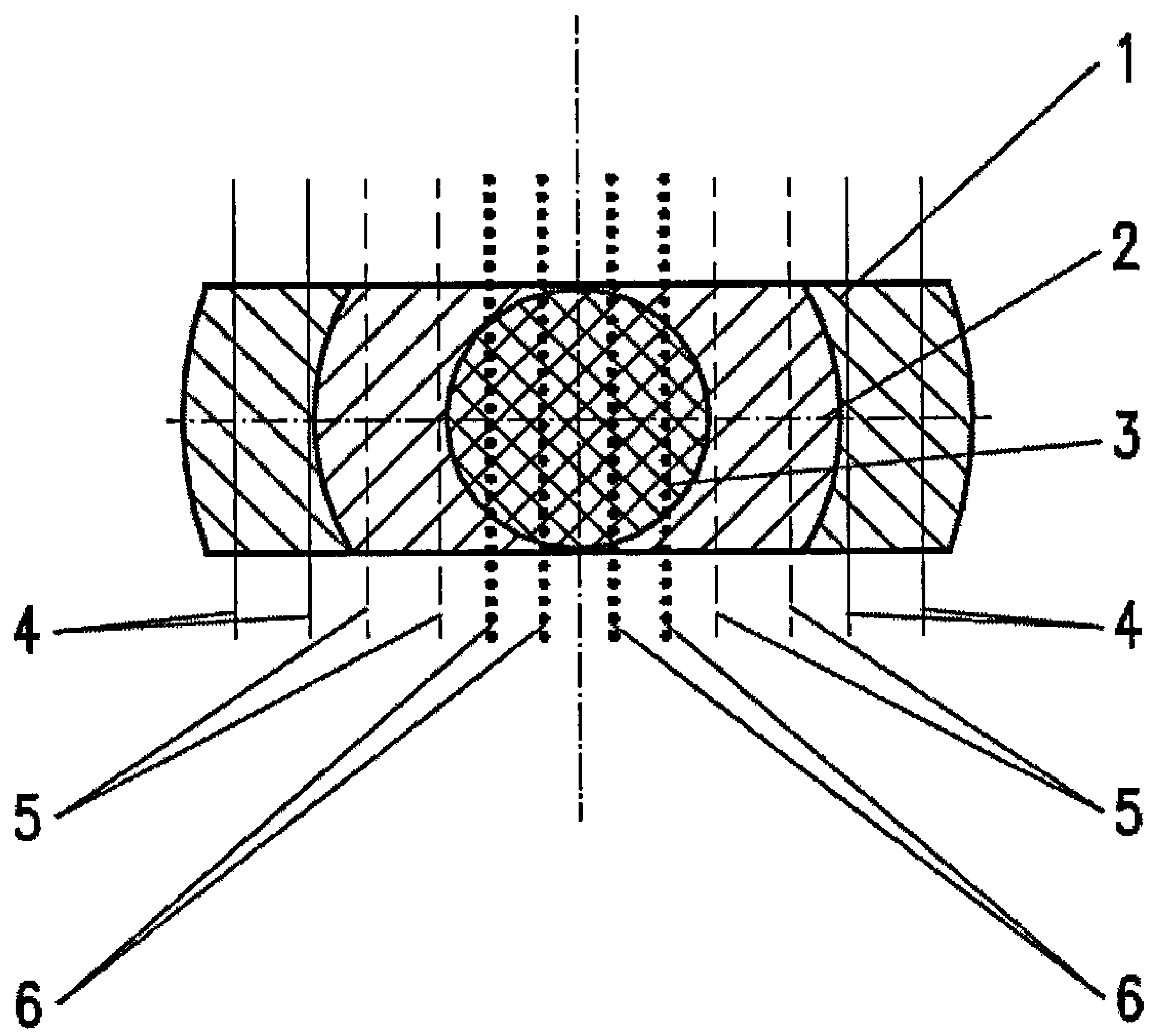


Fig. 4

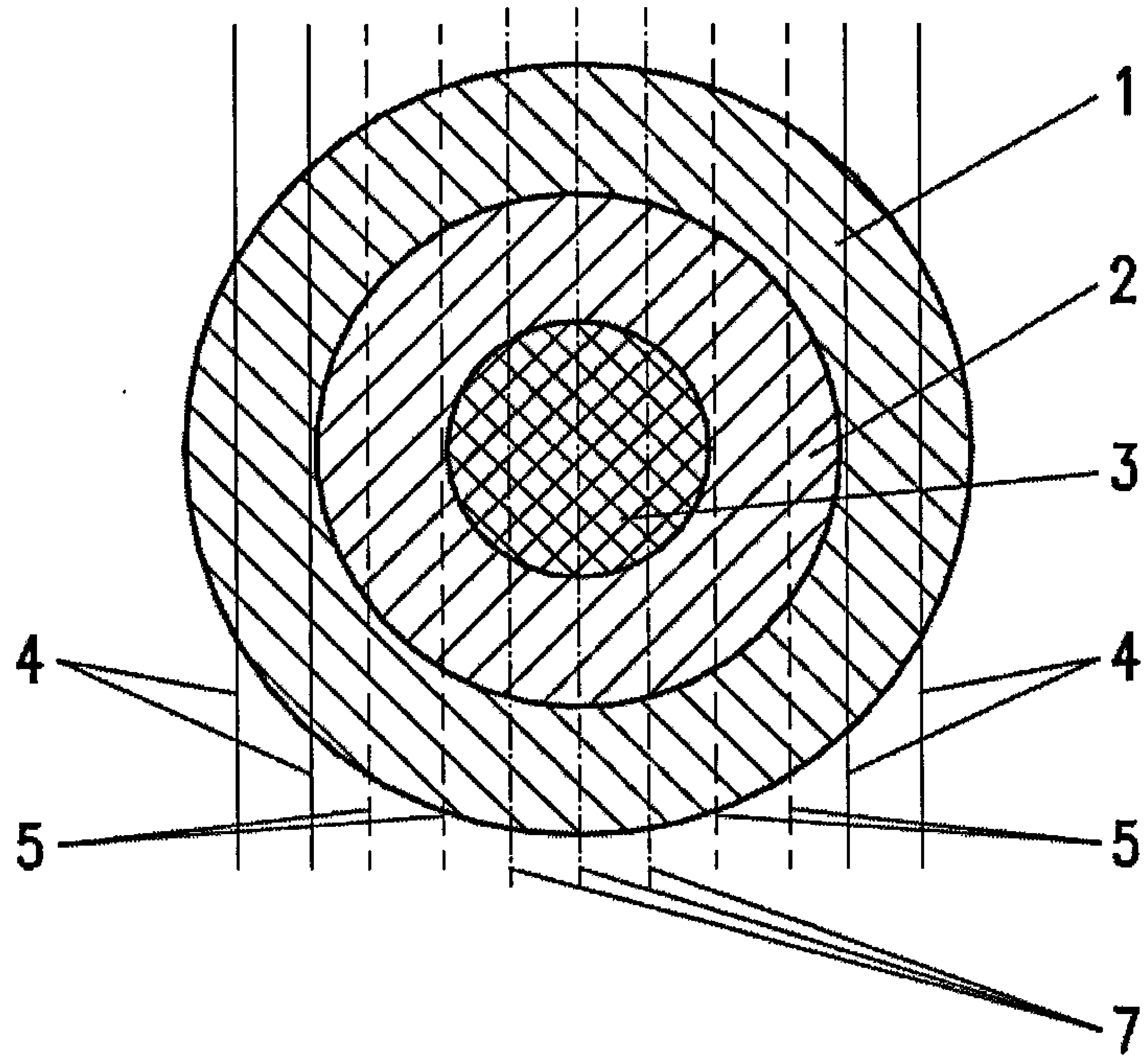


Fig. 5

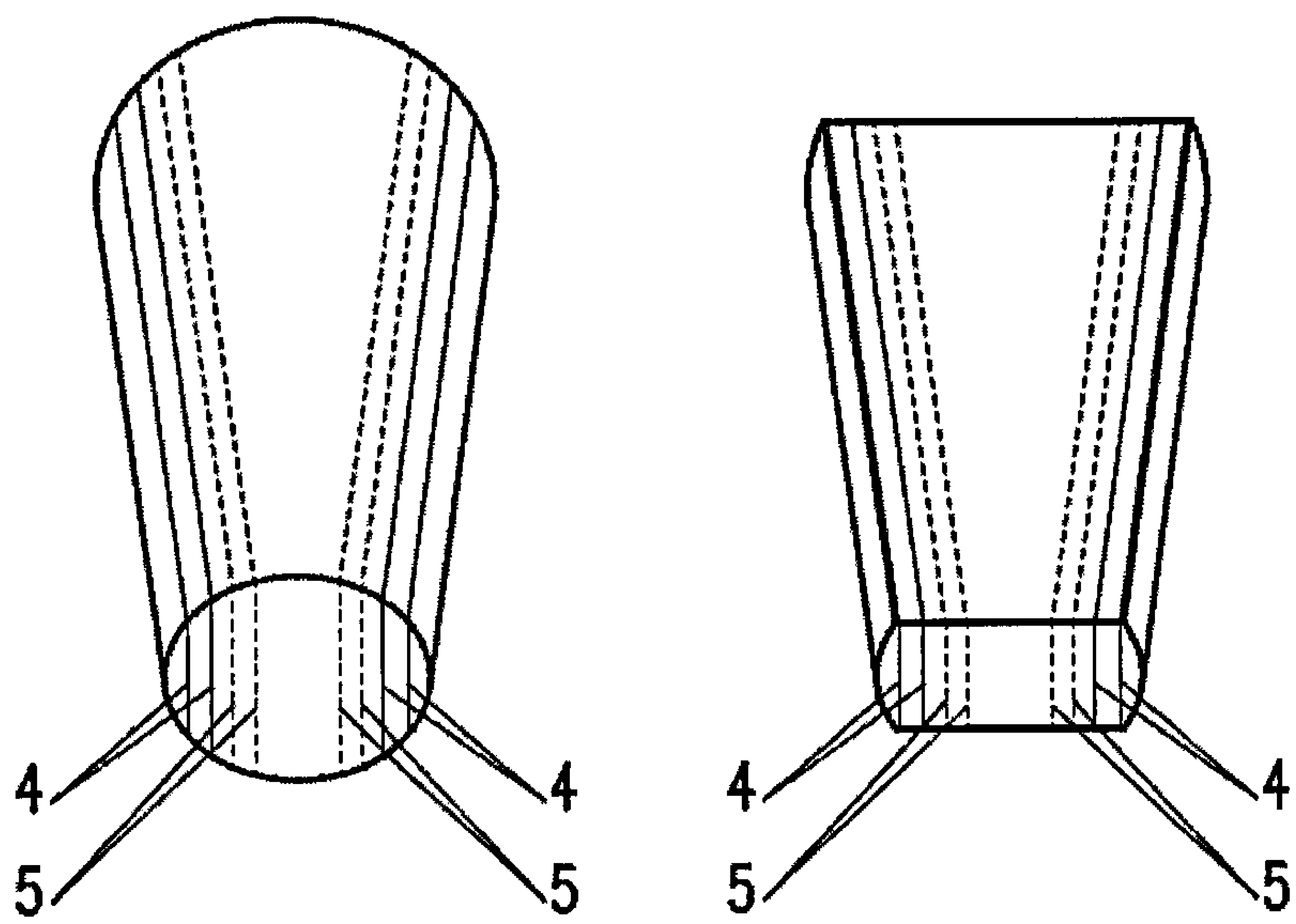


Fig. 6

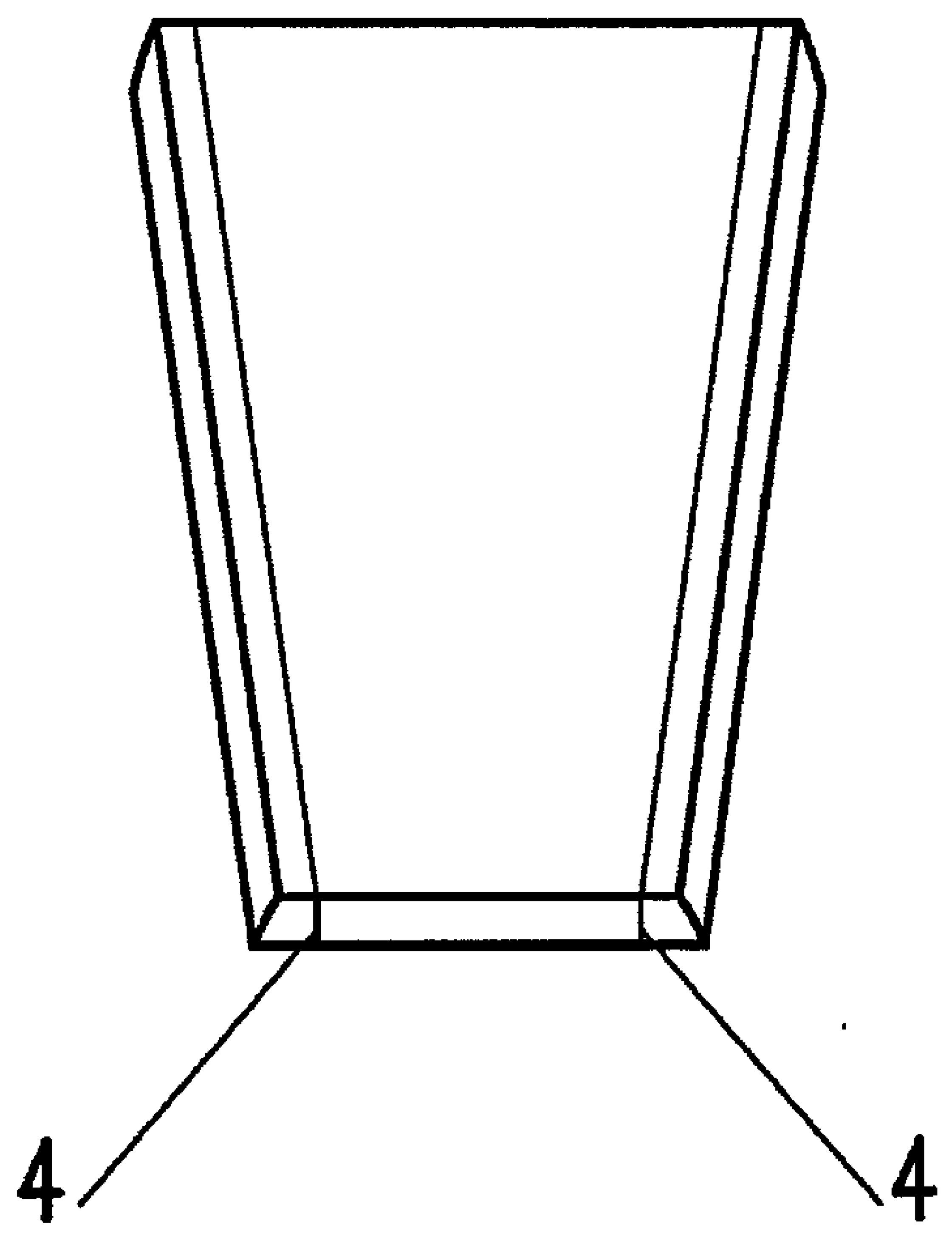


Fig. 7

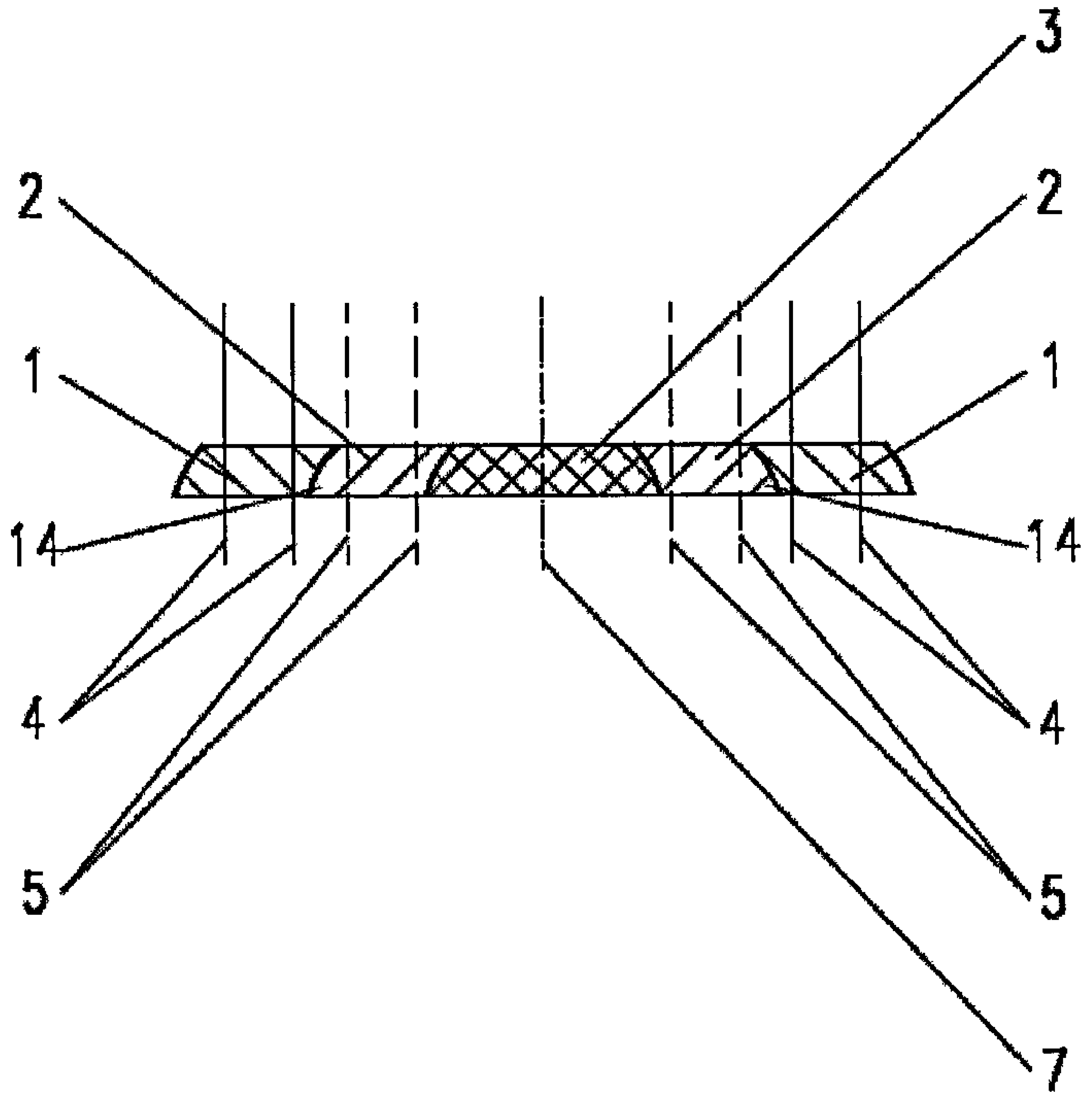


Fig. 8

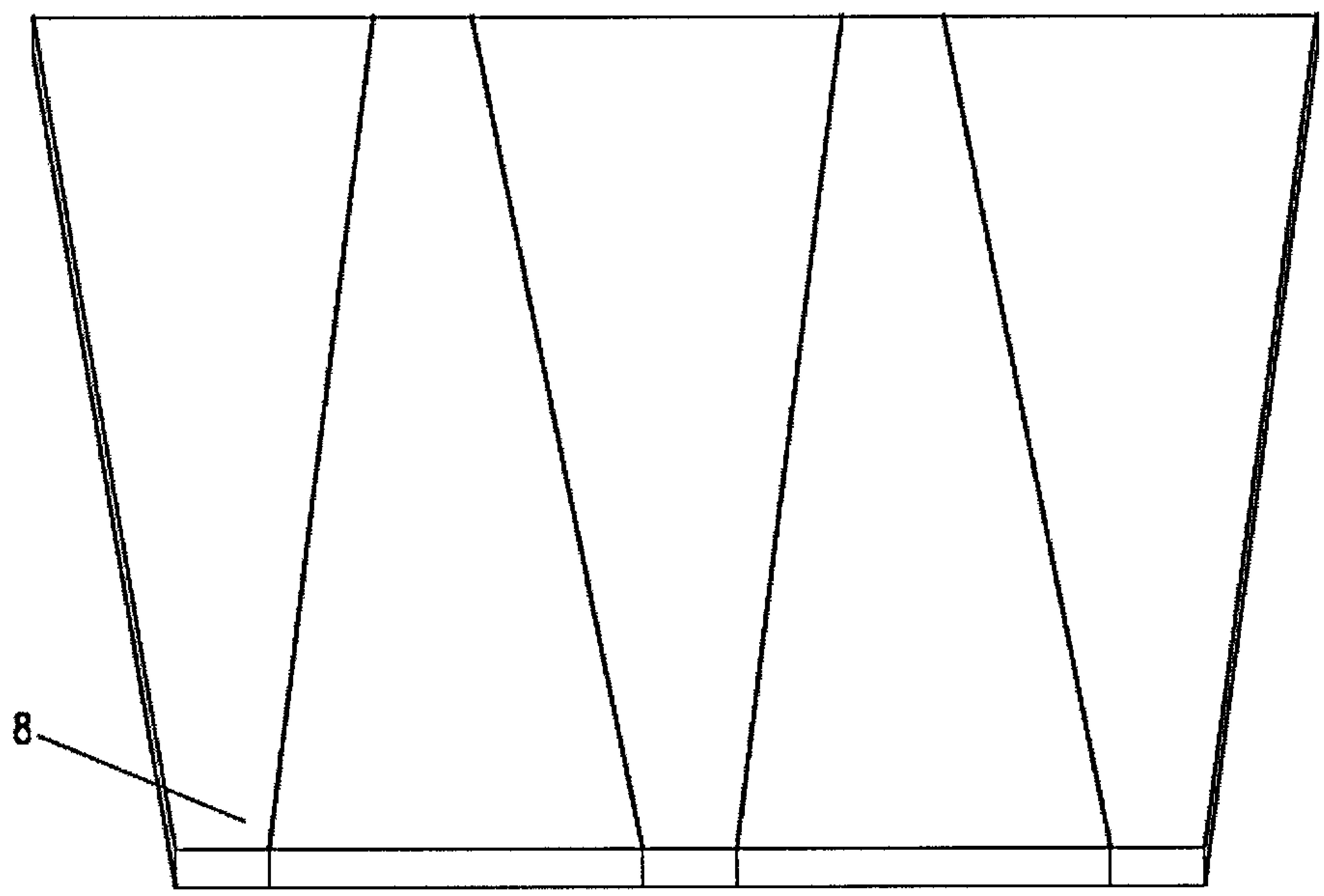


Fig. 9

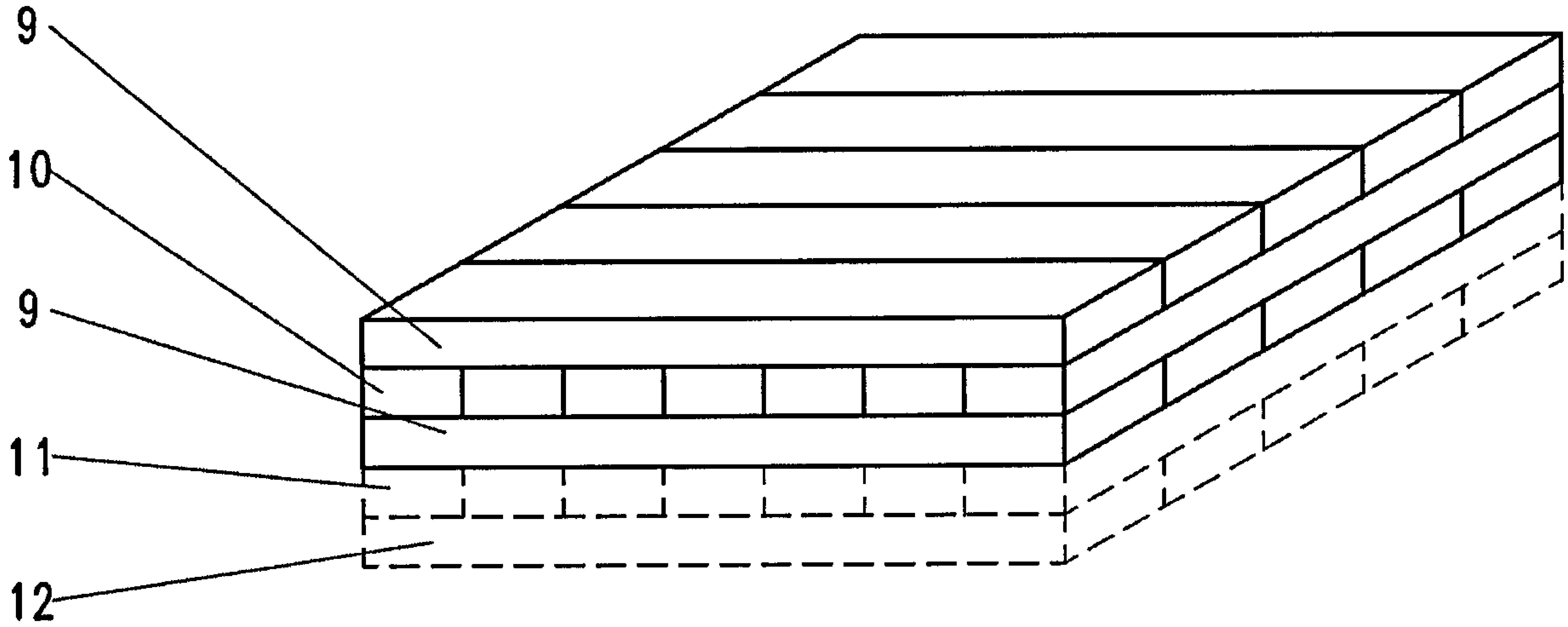
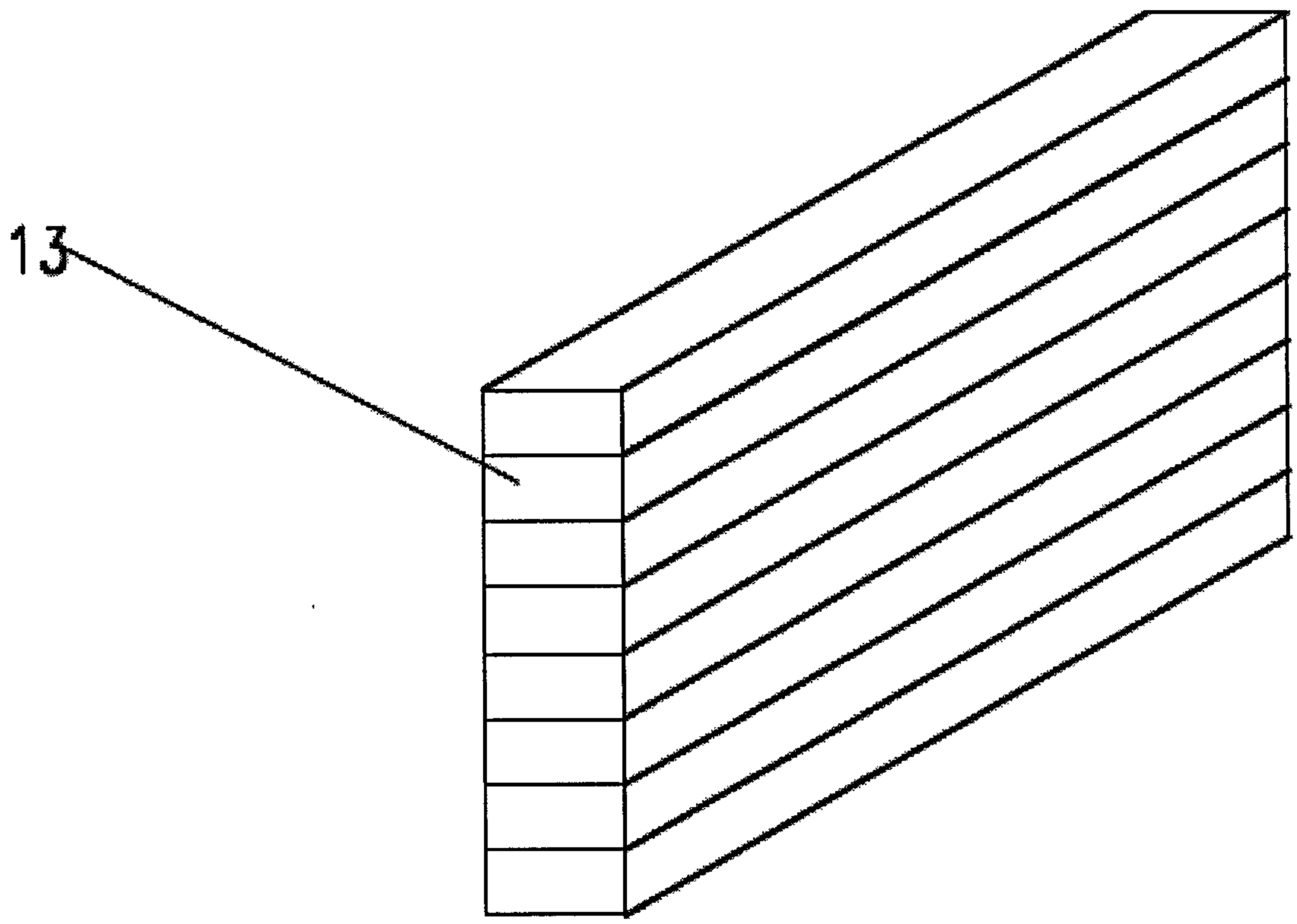


Fig. 10



ABSTRACT

The invention relates to a method for processing and utilizing the wood of oil palms such that, by means of appropriate measurements through the use of ultrasound, X-ray technology, or natural frequency measurement, the density distribution of the trunk wood is detected, and when cutting, sawing, and further processing the palm wood a distinction is made between regions of different density of the wood, so that in particular wood having a largely homogeneous density is produced and then, depending on the density of the segments of wood to be processed, the wood and wood products produced are further processed, stored, and ultimately used.

Fig. 3

Figur 3