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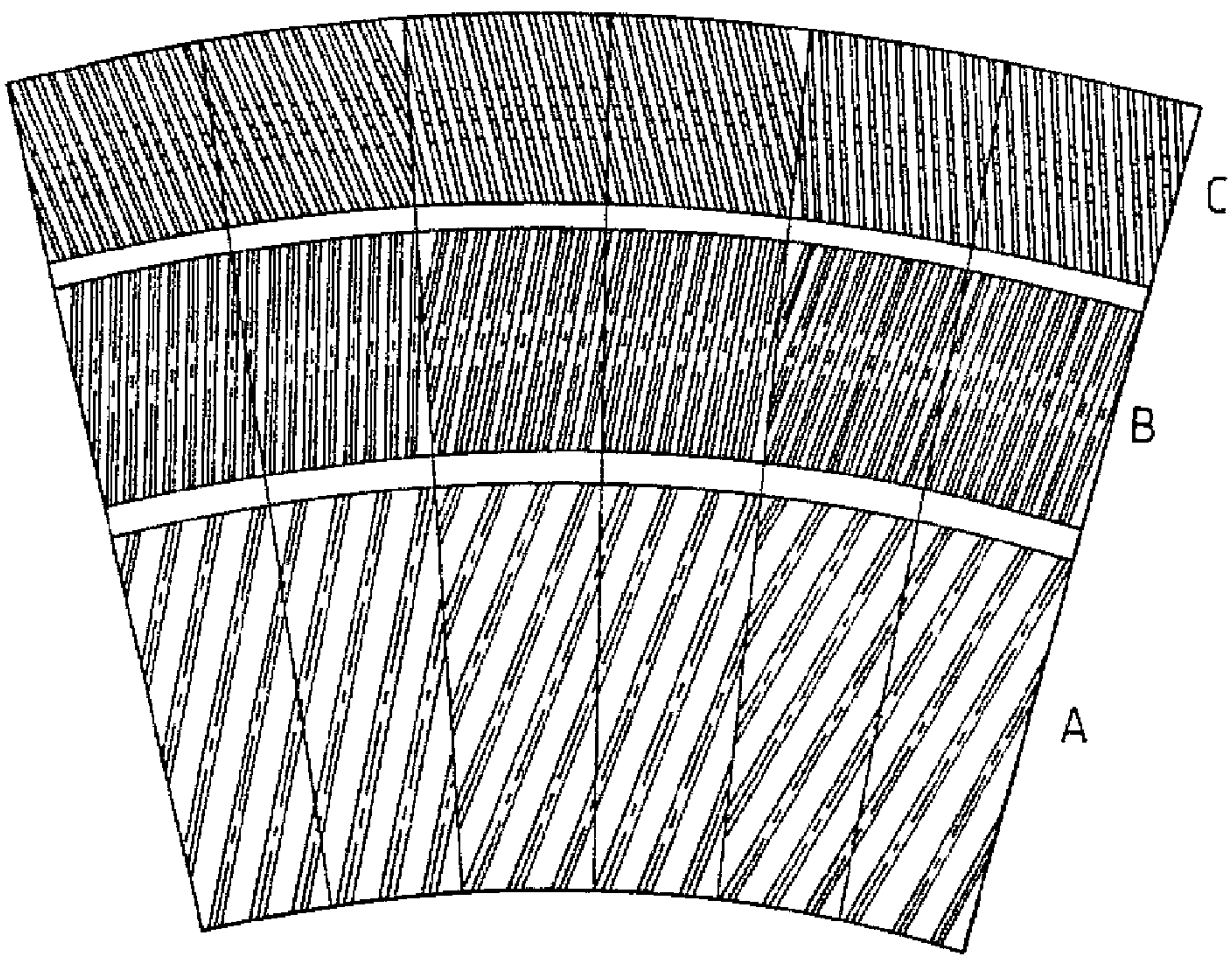

(57) Abrégé/Abstract:
A pair of co-operating refining elements intended for use in a disc refiner for the disintegration and refining of lignocellulosic material in a refining gap between two opposed refining discs rotating relative to each other. The refining elements are intended to be positioned directly in front of each other on opposed refining discs. Both refining elements are formed with bars and grooves arranged in a number of restricted zones located radially outside each other, where each refining element comprises at least three zones (A, B, C). The bars in opposed inner zones (A) on the refining elements are angled 10-30° in different direction in relation to the radius of the refining elements, so that the bars on opposed refining elements cross each other. The bars in an intermediate zone (B) on both refining elements form an angle smaller than 15°, preferably smaller than 10°, with the radius. The bars in an opposed outer zone (C9) on the refining elements form an angle with the radius in the interval 10-30° in the same direction.

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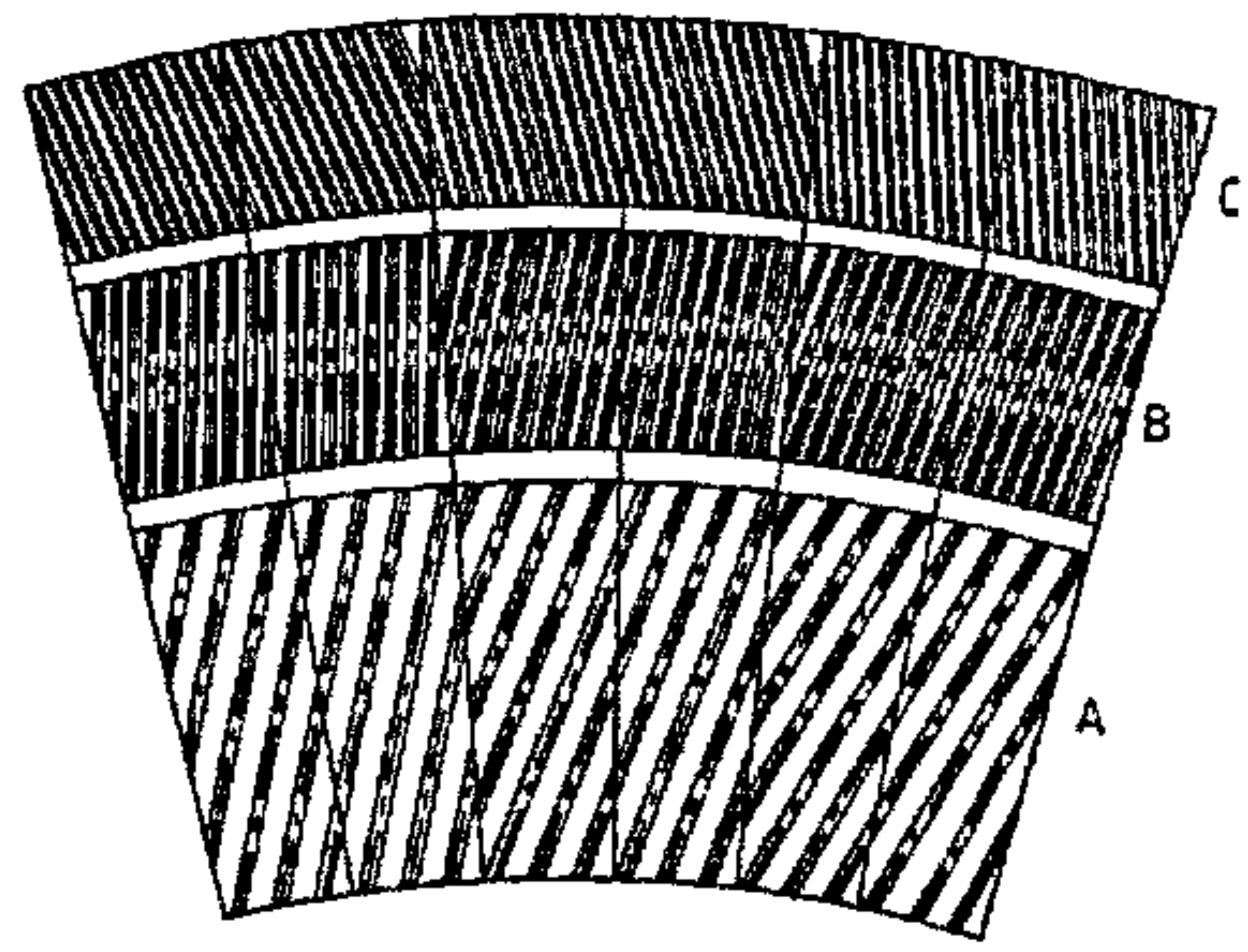
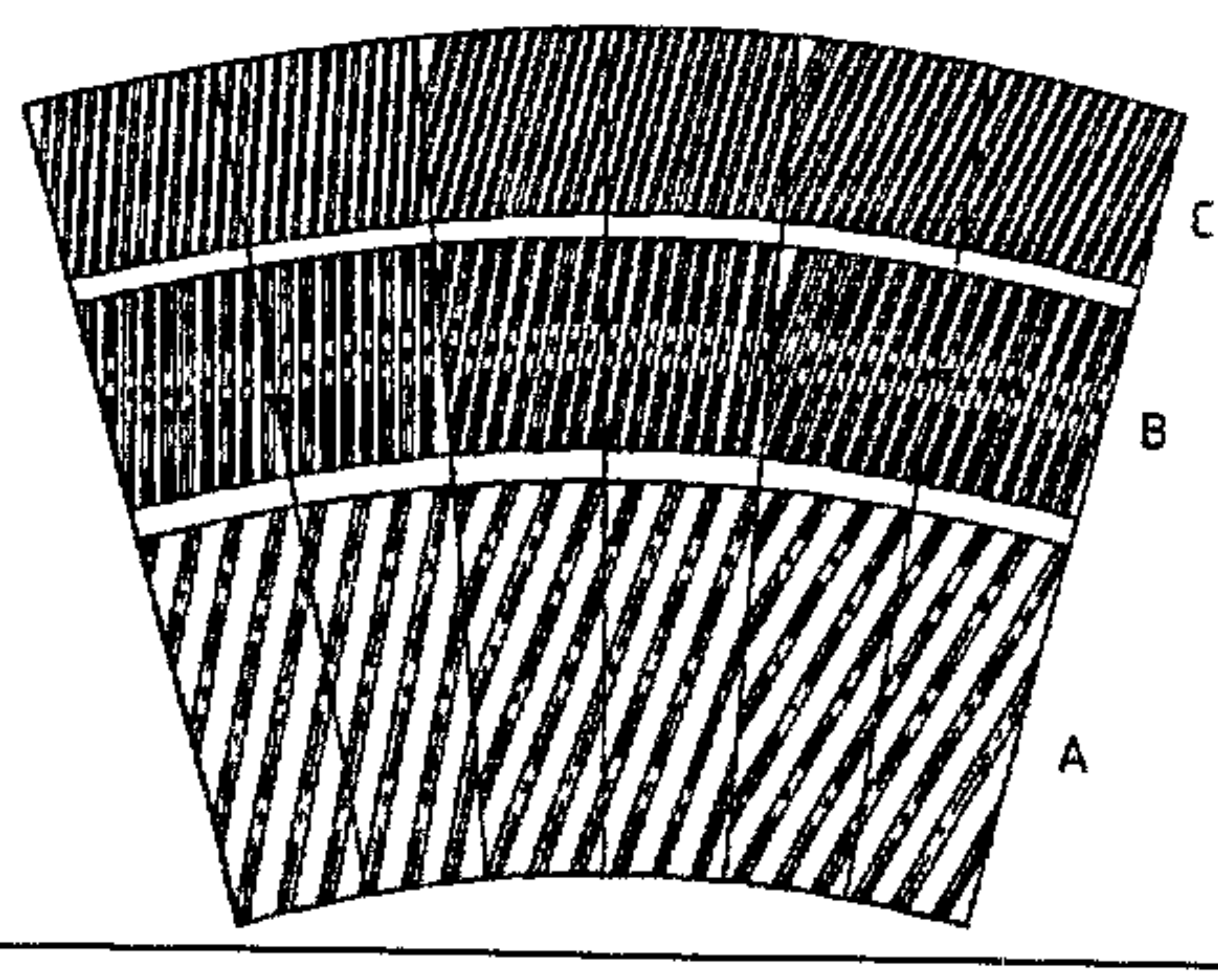
(57) Abstract

A pair of co-operating refining elements intended for use in a disc refiner for the disintegration and refining of lignocellulosic material in a refining gap between two opposed refining discs rotating relative to each other. The refining elements are intended to be positioned directly in front of each other on opposed refining discs. Both refining elements are formed with bars and grooves arranged in a number of restricted zones located radially outside each other, where each refining element comprises at least three zones (A, B, C). The bars in opposed inner zones (A) on the refining elements are angled 10-30° in different direction in relation to the radius of the refining elements, so that the bars on opposed refining elements cross each other. The bars in an intermidate zone (B) on both refining elements form an angle smaller than 15°, preferably smaller than 10°, with the radius. The bars in an opposed outer zone (C9) on the refining elements form an angle with the radius in the interval 10-30° in the same direction.





Refining elements

This invention relates to the disintegration and refining of lignocellulosic material, such as mechanical pulp (TMP, CTMP), reject pulp, recycled fiber pulp a.o. in a disc refiner. The invention, more precisely, refers to refining elements for use in a refiner of this type.

A disc refiner comprises two opposed refining discs rotating relative to each other, one or both of which are rotary. A plurality of refining elements are arranged on the refining discs in a pattern of bars and intermediate grooves. The refining discs are positioned so that the refining elements form a refining gap, through which the fiber material is intended to pass outward from within whereby disintegration is carried out by the bars of the refining elements. The bars can be of various design and, thus, may be continuous or discontinuous and are of uniform or varying height. In certain cases serrated bars can be used.

The fiber material first is defibered in the refining gap between the refining surfaces, i.e. the fibers are freed, which takes place in the interior portion of the refining gap where the distance between the refining surfaces is the greatest. The refining gap narrows thereafter outward so that the desired working of the fiber material is obtained. Large energy amounts are required to bring about this working. The material concentration can be 3-50%, which implies that simultaneously large amounts of steam are generated by the water following along.

The refining surfaces are formed in different ways, depending on the desired degree of working and thereby on the desired pulp quality. The pulp quality is also affected by other factors, for example size of the refining gap, liquid content in the fiber material, feed, temperature a.s.o.

The appearance of the refining surfaces is of great importance, especially with regard to the fiber length of the material worked. At a substantially radial orientation of the bars on the refining surfaces, a large proportion of long and well fibrillated fibers in the pulp is obtained. This can be explained by the fact, that the fiber material orientates itself in the refining gap with the fiber direction substantially in parallel with the bar edges. Thereby defibering and working take place in that the fiber material substantially rolls between the bars on opposed refining surfaces whereby the fibers are freed and fibrillated in their entire length. This type of pulp receives high strength and thereby is particularly valuable in many connections, for example for newsprint. The energy consumption at the manufacture of this type of pulp is relatively high.

At an oblique orientation of the bars in relation to the radius, the proportion of long fibers in the pulp decreases, because in this case the bar edges exert a cutting effect on the fiber material. At the same time as the cutting effect increases, the fibrillation effect decreases. The strength properties of this pulp type certainly are lower, but the pulp is particularly suitable for use at the manufacture of fine paper qualities where forming, printability and opacity are appreciated.

The bar angle also is of importance for the feed of the material through the refining gap. When the bars are angled obliquely outward rearward in the rotation direction, an outward pumping action is obtained, while angling in the opposite direction yields a braking effect. The stay time of the material in the refining gap, thus, is affected by the angle of the bars.

Known refining elements are formed so as to produce desired properties of the pulp. This implies in many cases that compromises must be made with regard to the design of the refining surfaces in order to bring about a suitable balance between fibrillation and cutting of the fibers and, respectively, between feeding and braking.

The present invention implies that the refining elements can be formed so that they yield an optimum pulp and at the same time minimize the energy consumption. To this end, co-operating refining elements are formed with bars and grooves in a number of restricted zones located radially outside each other where each refining element comprises at least three zones. According to the invention, the bars in an opposed inner zone on both refining elements are oblique in different directions in relation to the radius of the refining elements (deviation 10-30°), so that the bars on opposed refining elements cross each other. The bars in an intermediate zone are substantially radial (deviation $< 15^{\circ}$, preferably $< 10^{\circ}$), and in an outer zone the bars form an angle with the radius in the interval 10-30° in the same direction. The bars on opposed refining elements can here be substantially in parallel.

The bars can be divided into several radial zones, each comprising one or several groups of bars where the bars substantially are mutually in parallel within each group. Alternatively, the bars within one zone can form substantially the same angle with the radius. It is also possible to arrange the bars so that their angle changes successively across the refining surface.

The invention is described in greater detail in the following, with reference to Figs. 1 and 2 showing schematically the refining surface on each of the two co-operating refining elements according to the invention.

The refining surfaces of the co-operating refining elements shown are divided into three zones where each zone comprises a portion of the radial extension of the refining surface, viz, an inner zone A, an intermediate zone B and an outer zone C. Each zone is provided with bars forming an angle with the redius of the refining element. The bars are arranged in a pattern tightening radially outward from one zone to another.

The angle in the inner zone A shall be 10-30° in relation to the radius. When the refining elements are used in a refiner, the bars shall be angled for outward feed. In this zone A, feed is desired to take place at the same time as a first defibering of the material is aimed at. The refining elements are formed so that the distance between opposed refining elements in the refiner in this inner zone A is of such a size that neither cutting nor fibrillation takes place to a significant degree.

The angle in the intermediate zone B shall be $\leq 15^\circ$, preferably $\leq 10^\circ$, in relation to the radius. The bars, thus, shall be substantially radial. The distance between opposed refining elements in this zone is shorter, and a certain working of the fibers takes place. The bar angle implies a balancing between feeding and working.

In the outer zone C the final working of the fibers takes place. The bar angle in relation to the radius can here vary between 10° and 30°, and the bars on opposed refining elements shall be directed in the same direction in relation to the redius. The bars here can be substantially in parallel. This implies, that the fibrillation effect increases and the cutting effect decreases, and at the same time the stay time is extended due to the fact, that the bars on one refining element counteract the feed.

All this together results in effective working, implying that a desired pulp quality can be obtained at a lower energy input. Full size tests, for example, have shown that the engine load could be lowered from 10,5 MW to 9 MW at maintained pulp quality.

The bars in each zone A, B and, respectively, C can form one or several groups where the bars within each group are mutually in parallel.

Instead of dividing the refining surface into three radial zomes, more zones can be arranged. It is also possible to change the bar angle successively along the refining surface. The bars then can be straight or arched.

The invention, of course, is not restricted to the embodiments shown, but can be varied within the scope of the invention idea.

CLAIMS:

1. A pair of co-operating refining elements, intended for use in a disc refiner for the disintegration and refining of ligno-cellulosic material in a refining gap between two opposed refining discs rotating relative to each other, where the refining elements are intended to be positioned directly in front of each other on opposed refining discs and where both refining elements are formed with refining surfaces comprising bars and grooves arranged in a number of restricted zones located radially outside each other,

wherein each refining element comprises at least three zones;

the bars in an inner zone on the opposed refining elements form an angle of 10-30° in different directions in relation to the radius of the refining elements, so that the bars on the opposed refining elements cross each other;

the bars in an intermediate zone on the opposed refining elements form an angle smaller than 15° with the radius; and

the bars in an opposed outer zone on the opposed refining elements form an angle of 10-30° with the radius in the same direction.

2. The pair of refining elements as defined in claim 1, wherein the bars in the outer zone are substantially in parallel.

3. The pair of refining elements as defined in claim 1 or 2, wherein the inner, intermediate and outer zones of

the refining surface each comprise one or several groups of bars where the bars in each group are mutually in parallel.

4. The pair of refining elements as defined in claim 1 or 2, wherein the bars in each zone form substantially the same angle with the radius.

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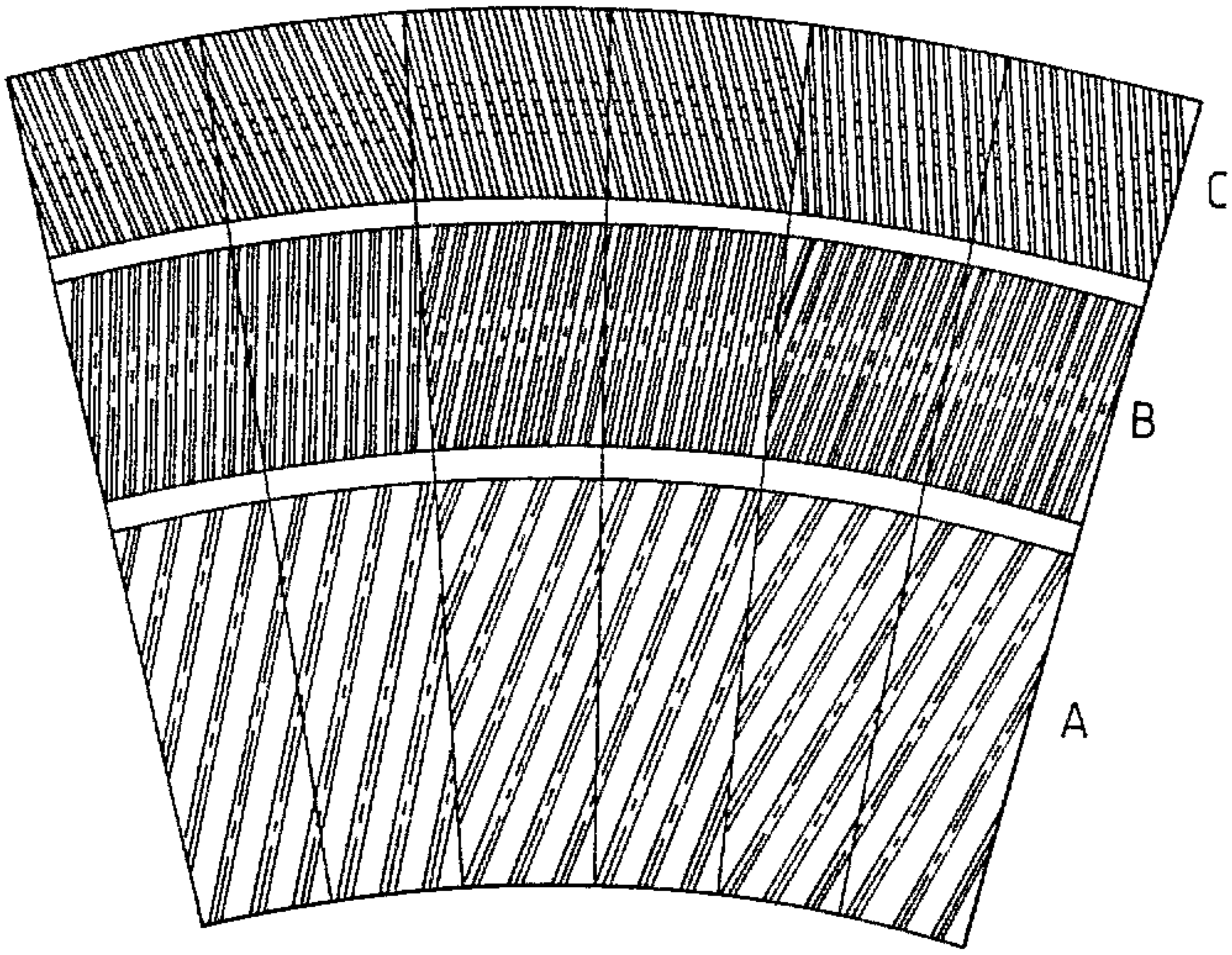


FIG.1

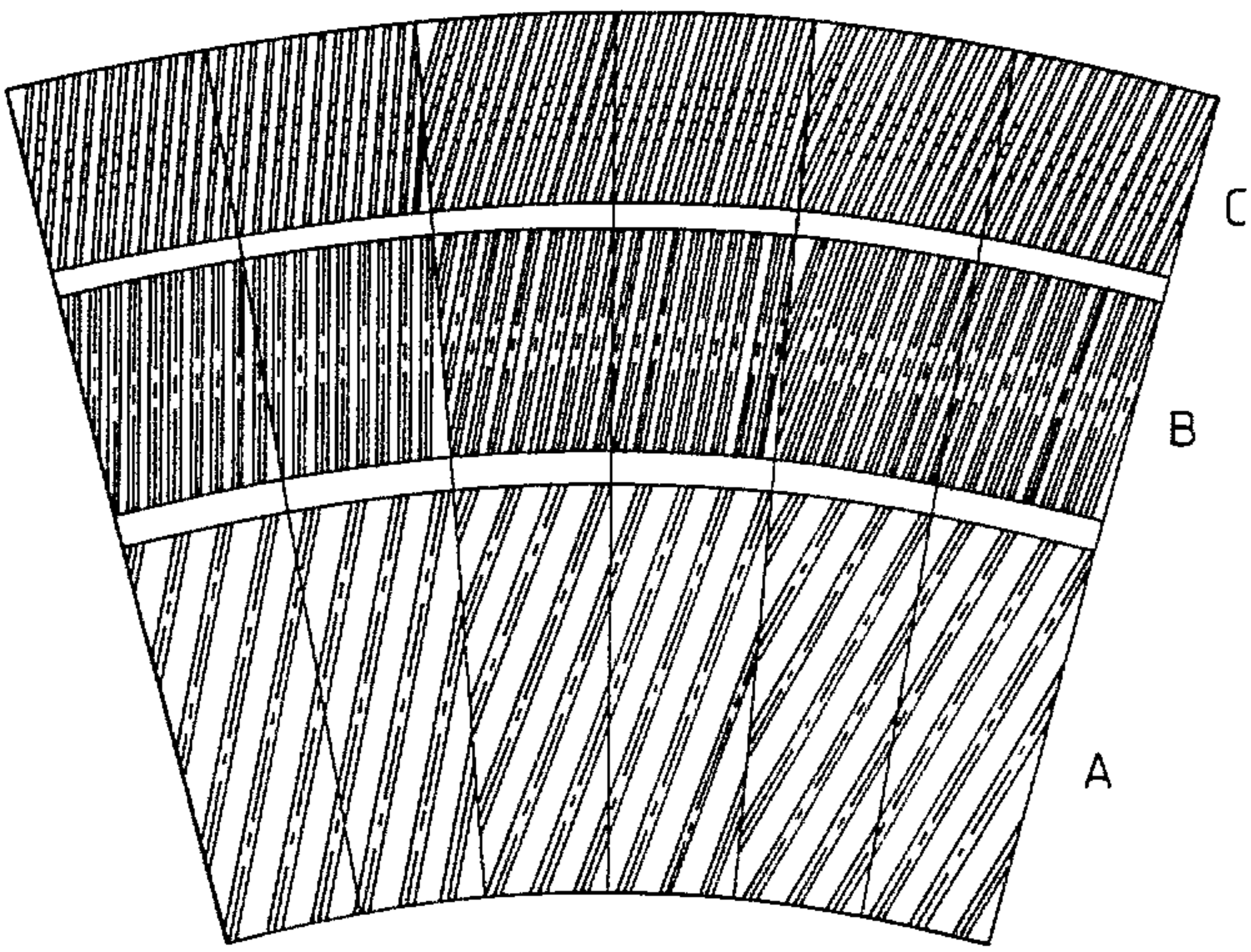
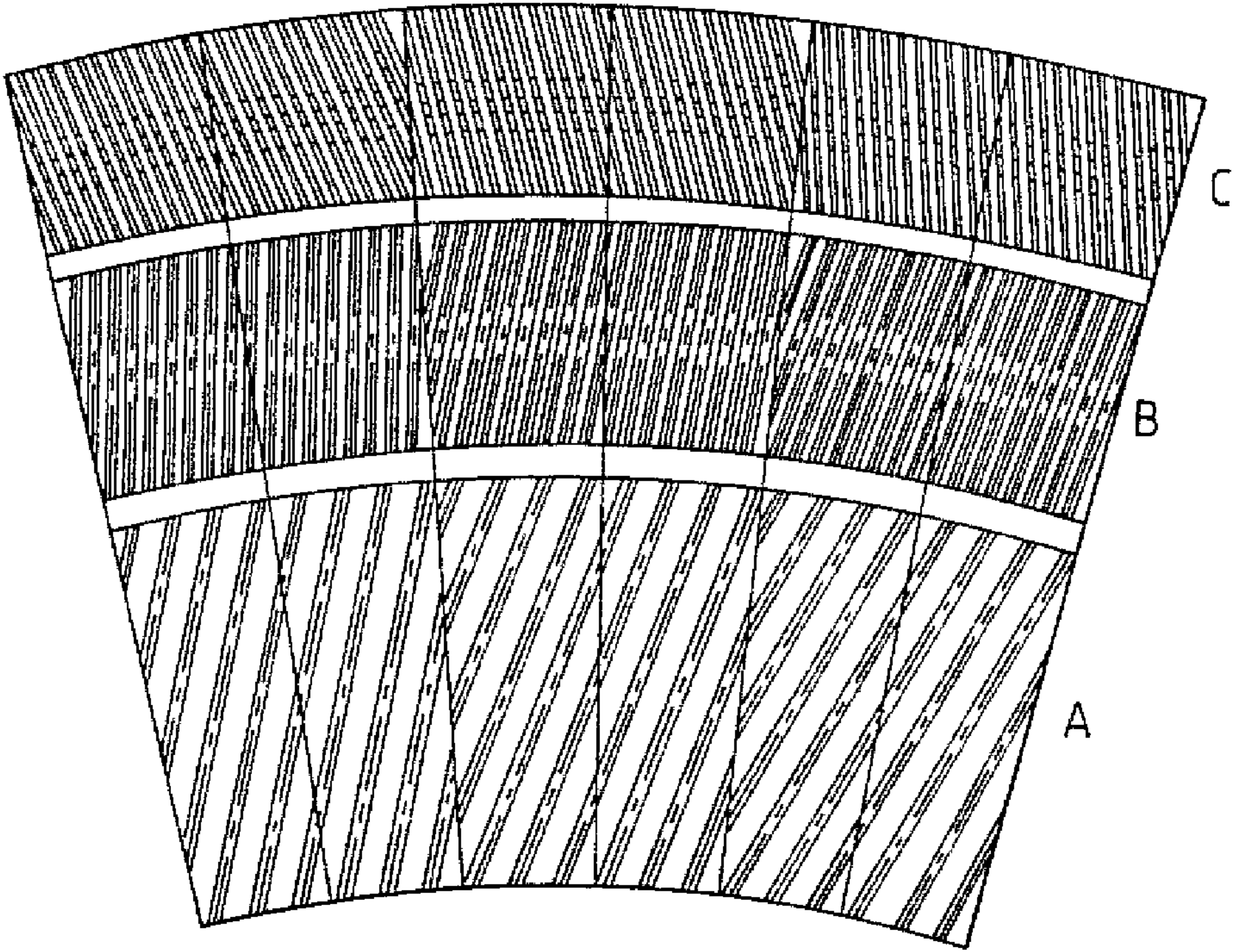


FIG. 2


C
B
A