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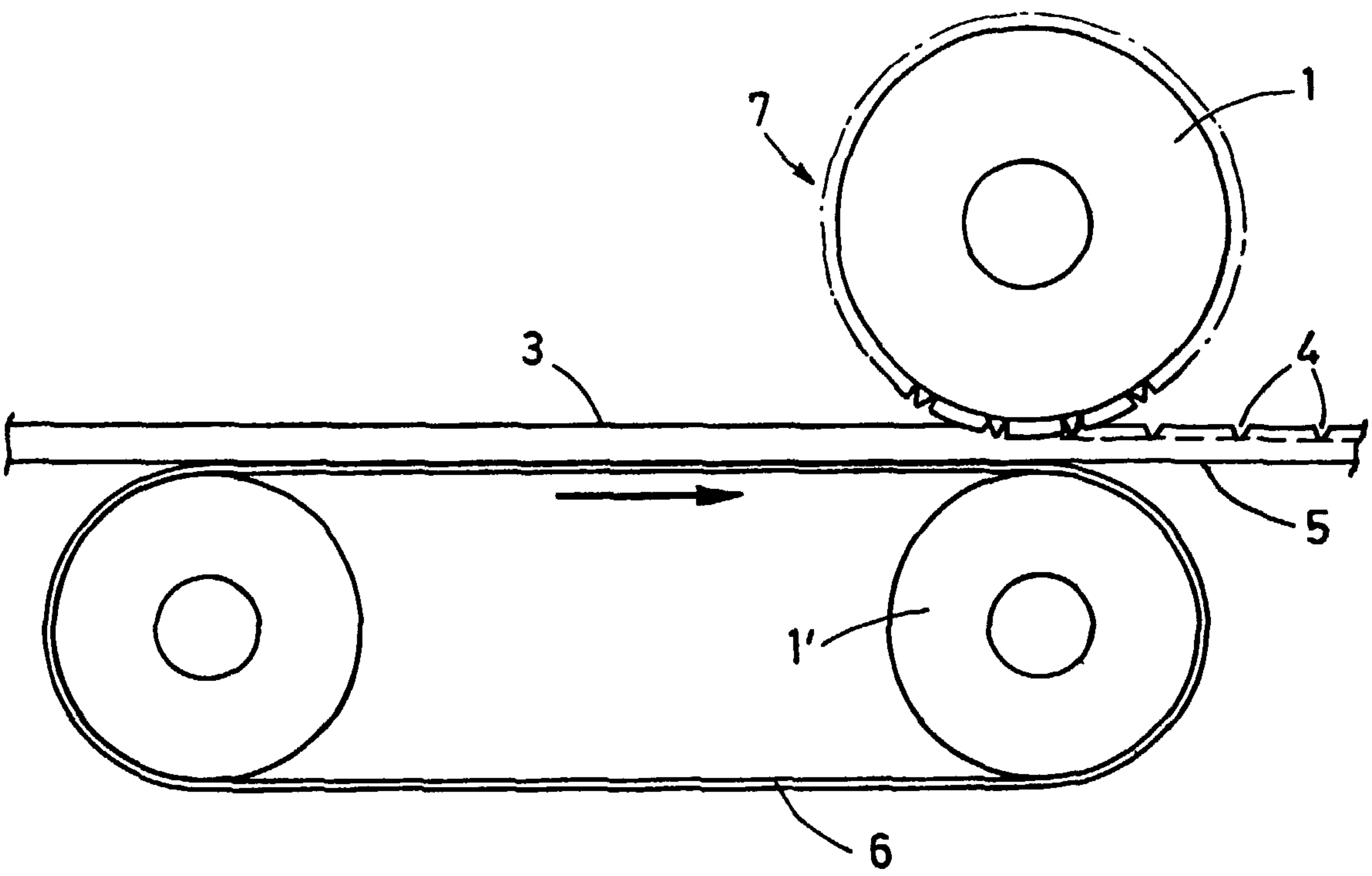
(54) Titre : PROCEDE ET DISPOSITIF POUR LA COULEE ET LE REFROIDISSEMENT DE METAL FONDU ET SA COUPE

(54) Title: METHOD AND DEVICE FOR CASTING AND SOLIDIFYING LIQUID METAL AND FRAGMENTING SAID METAL



(57) Abrégé/Abstract:
The invention relates to a method and a device for producing metal pieces with a predefined size from the liquid phase, more particularly pieces made of ferro-alloys or non-ferrous metals, comprising a strip casting facility that produces a continuos metal strip having a predetermined thickness and a breaking facility that fragments the strip into pieces. During casting and solidification, a pattern of breaking points is engraved on the surface of the strip using an embossing roller (1), said pattern determining the predefined optimal size of the pieces after the band has been fragmented.

Abstract

The invention relates to a method and a device for producing metal pieces with a predefined size from the liquid phase, more particularly pieces made of ferro-alloys or non-ferrous metals, comprising a strip casting facility that produces a continuos metal strip having a predetermined thickness and a breaking facility that fragments the strip into pieces. During casting and solidification, a pattern of breaking points is engraved on the surface of the strip using an embossing roller (1), said pattern determining the predefined optimal size of the pieces after the band has been fragmented.

Method and Device for Casting and Solidifying Liquid Metal and Fragmenting Said Metal

The present invention relates to a method and a device for casting and solidifying liquid metal, in particular ferro-alloys or non-ferrous metals, and for fragmenting said metals.

There is a need for a rapid and flexible method, and a corresponding device, for casting and solidifying liquid metals, in particular ferro-alloys and non-ferrous metals, and for their systematic fragmentation, with the aim of producing pellet-type products with definable dimensions, with minimal losses and impurities, as well as with a reduced outlay for energy and lower costs.

In the prior art, once they have been tapped from the oven in the liquid state, iron alloys or non-ferrous metals are usually cast in sand beds, and after they have solidified and cooled they are routed to a fragmenter, in which they are broken up and then graded into commercial grain sizes and packed.

In a first known method (Method 1), undersize particles, the quantity of which can amount to 25%, are returned to the oven and melted down. This Method 1 entails the following short-comings and disadvantages:

1. High energy, production, and maintenance costs with respect to the fragmenter and the screening machinery:

2. A low product yield because of a comparatively high proportion of undersize particles;

3. The large quantities of dust and noise is that are generated require a correspondingly large investment and significant resources for dust and noise control;

4. A considerable proportion of the impurities in the product is caused by the sand used in the casting bed.

5. Complicated logistics;

6. The high cost of the product caused by the additional smelting of the screened, undersized particles.

A further known method (Method 2) makes provision such that liquid metal is cast in bars by using a casting wheel, so that it can subsequently be reduced to the required grain size by crushing and screening. This Method 2 entails the following shortcomings and disadvantages:

1. The shortcomings and disadvantages set out in Points 1, 2, 3, 5, and 6 listed with respect to Method 1 also apply to Method 2, albeit to a lesser extent;

2. The throughput achieved by a casting wheel is restricted and inflexible, and this requires a longer casting time and, because of this, a higher tapping temperature, and these result in additional energy and refractory costs, or short availability times for the furnace;

3. High costs are caused by a ladle economy;

4. It is possible to affect the dimensions of pellets of the product only by adjusting the screening machinery; this cannot be done during the casting process.

US 4, 316,496 and the corresponding DE-OS 30 28 247 describe device and a method for generating a ferrous feedstock that is subsequently used in a smelting crucible or a smelting furnace.

In cross section, the device has an elongate channel-shaped substrate that is supported so as to be movable in the horizontal direction, and which continuously moves past a casting station, there being means provided on this to continuously pour molten ferrous metal onto the substrate so as to produce a solidified iron strip after it has cooled. Means are also provided to divide the solidified strip into segments, whose size makes them suitable for use as ferrous feed stock. The substrate should be of a thickness that is sufficient to extract heat from the strip that has been cast, so as to promote solidification of the strip.

The surface of the substrate is provided with a row of projections that are spaced equidistantly apart. It is also possible to provide a roller, the surface of which incorporates depressions, and which is arranged above the beam, downstream from the casting station. This roller is installed at a distance from the surface of the metal that is sufficient to keep the roller in contact with the strip that has been cast and to emboss depressions into this when the strip solidifies.

In the method used to produce a ferrous feedstock that is subsequently routed to a smelting furnace, the continuously cast iron material is cast from a casting station onto a channel shaped substrate and is moved continuously past the casting station in order to form a solidified metal strip; the solidified strip is separated from the substrate and—in the solidified state—is divided into segments of a size that makes them suitable for the required feed stock.

Proceeding from the prior art described heretofore, it is the objective of the present invention to propose a method and a device that corrects the above cited shortcomings and difficulties.

This objective has been achieved with a method for producing metal pieces, in particular from ferro-alloys or non-ferrous metals, from the liquid phase as in Claim 1, by using a strip casting plant that produces an endless strip of predeterminable thickness, as well as a fragmenter that breaks the strip into pieces; a pattern of predetermined breaking points being impressed in the surface of the strip during casting and solidification, said pattern ensuring the predetermined, optimal size of the pieces of product when the strip is fragmented.

One configuration of the method according to the present invention provides that the pattern of the predetermined breaking points is produced, for example, by welding profile elements onto an embossing roller.

When this is done, it can be advantageous to exploit the fact that the pattern of predetermined breaking points is produced by elements that are of a material that has physical characteristics that differ from those of the material of the embossing roller, e.g., greater thermal conductivity.

In addition, the method according to the present invention is characterized in that the casting speed (V_g) as well as the position and distance of the embossing roller with the pattern that is to be produced is controlled by a regulating system as a function of the properties of the product that is to be cast, its tapping temperature, and the desired thickness (d), and the diameter (D) of the roller with the embossing pattern, according to the formula set out in Claim 4.

It is also an advantage that the embossing roller with the embossing pattern be cooled.

It is advantageous that a method for controlling the production method used for metal pieces, in particular those of ferro-alloys or non-ferrous metals, from the liquid phase, which includes the use of a strip casting plant for producing an endless strip of a predetermined thickness, as well as a fragmenter for breaking the strip into pieces of predetermined dimensions, acquires the metal temperature and casting speed through sensors, the data so acquired being routed to a control system, e.g., a computer, for further processing, as a result of which the position, speed of rotation, and the depth of penetration of the embossing roller(s) is adjusted.

A device for manufacturing metal pieces from the liquid phase, in particular from ferro-alloys or non-ferrous metals, by the method according to the present invention, includes a strip casting plant for producing a metal strip of predetermined thickness, and a fragmenter that breaks the strip into pieces, in which, in the case, for example, of a single belt strip casting plant, there are additional rollers for embossing a pattern of predetermined breaking points during the casting and solidification of the strip.

Other versions of the device according to the present invention are set out in the secondary claims.

Details, features, and advantages of the present invention are set out in the following description of an exemplary embodiment that is shown in the drawings appended hereto. These drawings show the following:

Figure 1: A side view of the device according to the present invention;

Figure 2: A section of the embossing roller of the device as in Figure 1, in cross section (2a) and in plan view (2b);

Figure 3 A plan view of a pattern of embossing elements applied to the embossing roller.

The device shown in Figure 1, as viewed from the side, that produces metal pieces 5 of defined dimensions from a continuously cast strip 3 from a strip casting plant (not shown herein) moves the strip 3 on an endless conveyor belt 6, which is preferably of metal, to the embossing station 7.

This embossing station has an upper embossing roller 1 that has embossing elements 2 (Figure 2) welded onto it and this embosses a pattern of predetermined breaking points 4 into the metal strip that is passing below it before said strip has solidified.

A backup roller 1' rotates beneath the embossing roller 1 of the conveyor belt 6 so as to generate the roller counterpressure that is necessary in order to complete the embossing process.

In Figure 2a, the enlarged cross section taken on the line I-I shows the embossing elements 2 that protrude from the surface of the embossing roller 1 at the section line. The associated plan view shown in Figure 2b indicates their position in the form of a rectangular pattern on the surface of the roller.

Figure 3 is a plan view of the embossing roller 1, in which the predetermined breaking points 4 can be seen at the lighter points. When the embossed strip passes through the fragmenter the strip will break into fragments 5 that are of predetermined dimensions.

Patent Claims

1. Method for producing metal pieces (5), in particular from ferro-alloys or from non-ferrous metals, from the liquid phase, by using a strip casting plant that produces an endless metal strip (3) of predeterminable thickness (d), and a fragmenter that breaks the strip (3) into fragments (5), a pattern of predetermined breaking point (4) being embossed in the surface of the strip (3) as the strip is cast and solidified, this pattern determining the predetermined, optimal size of the pieces of product when the strip (3) is broken up.

2. Method as defined in Claim 1, characterized in that the regulating system is controlled according to the formula: $V_g = f(d,t,x,D)$, wherein

V_g	=	casting speed
d	=	thickness of the strip
t	=	casting temperature of the metal
x	=	position of the roller with the embossing pattern
D	=	diameter of the roller with the embossing pattern.

3. Method as defined in Claim 1 or Claim 2, characterized in that the pattern for the predetermined breaking points (4) is produced from a material with different physical characteristics, i.e., higher thermal conductivity, than the material used for the embossing roller and, for example, by welding profile elements (2) onto an embossing roller (1).

4. Method for controlling the production of metal pieces (5) in particular of ferro-alloys or non-ferrous metals, from the liquid phase, that comprises the use of a strip casting plant for the production of an endless metal strip (3) of predeterminable thickness (d) and a

fragmenter, that breaks the strip (3) into pieces, characterized in that the metal temperature and casting speed are acquired by sensors and routed to a control system, e.g., a computer, for further processing, by which the position, speed of rotation, and depth penetration of the roller (1, 1') with the embossing pattern are adjusted.

5. Method as defined in one of the Claims 1 to 3, characterized in that the roller(s) (1, 1') is (are) cooled.

6. Device for producing metal fragments (5) from the liquid phase, in particular from ferro-alloys or non-ferrous metals, for completing the method according to the present invention, which comprises a strip casting plant for producing an endless metal strip of predeterminable thickness (d), and a fragmenter for breaking the strip (3) into fragments (5), characterized in that in a single belt strip casting there are additional rollers (1, 1') for embossing a pattern of predetermined breaking points (4) as the strip is being cast and solidifying.

7. Device as defined in Claim 6, characterized in that the roller (1) with the embossing pattern can be adjusted along the cast strip.

8. Devices defined in Claim 6 or Claim 7, characterized in that the space between the surface of the transport cast strip (6) and the roller (1), and its depth of penetration can be adjustable between 0 and 90% of the thickness of the strip (3).

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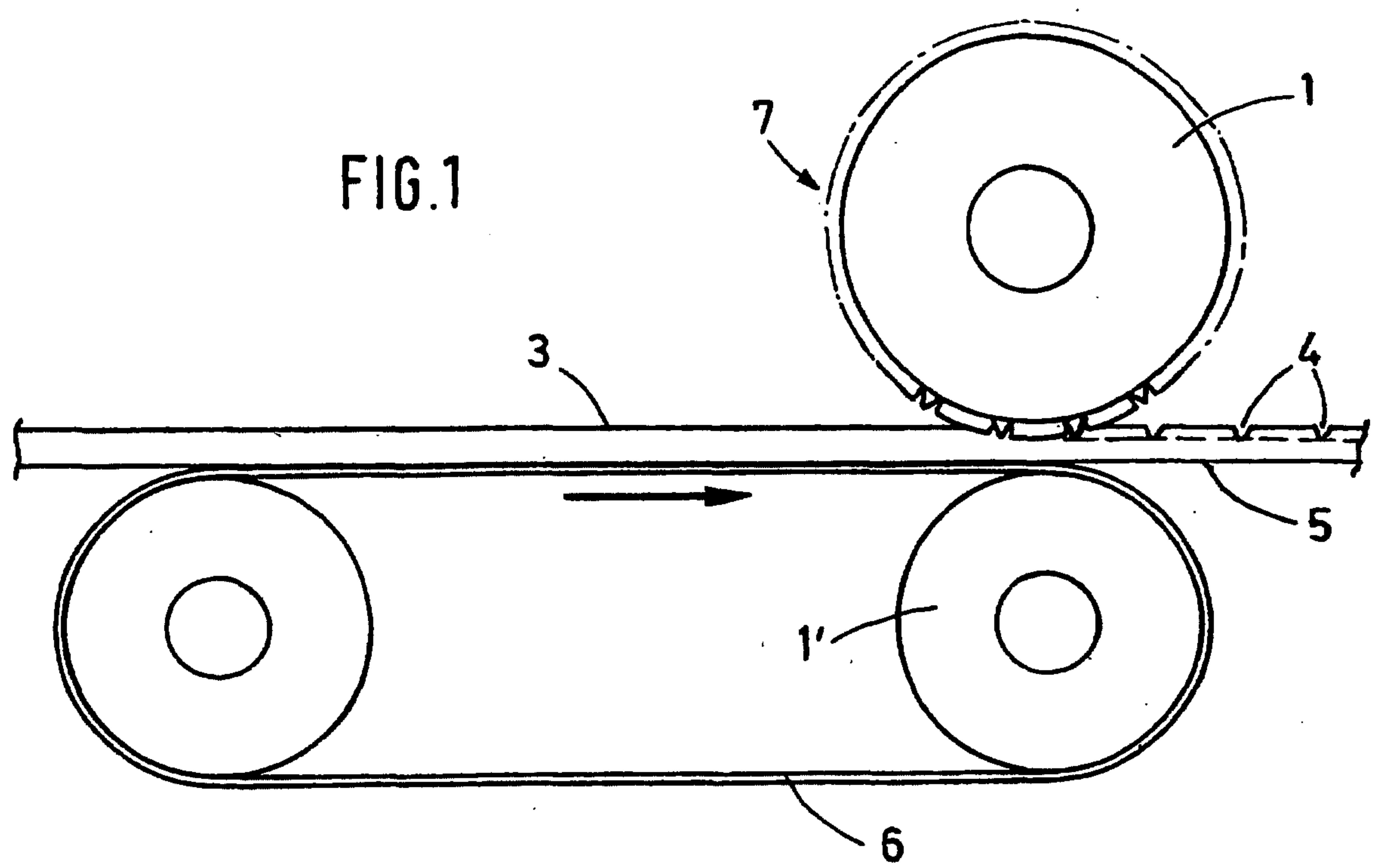
FIG.1



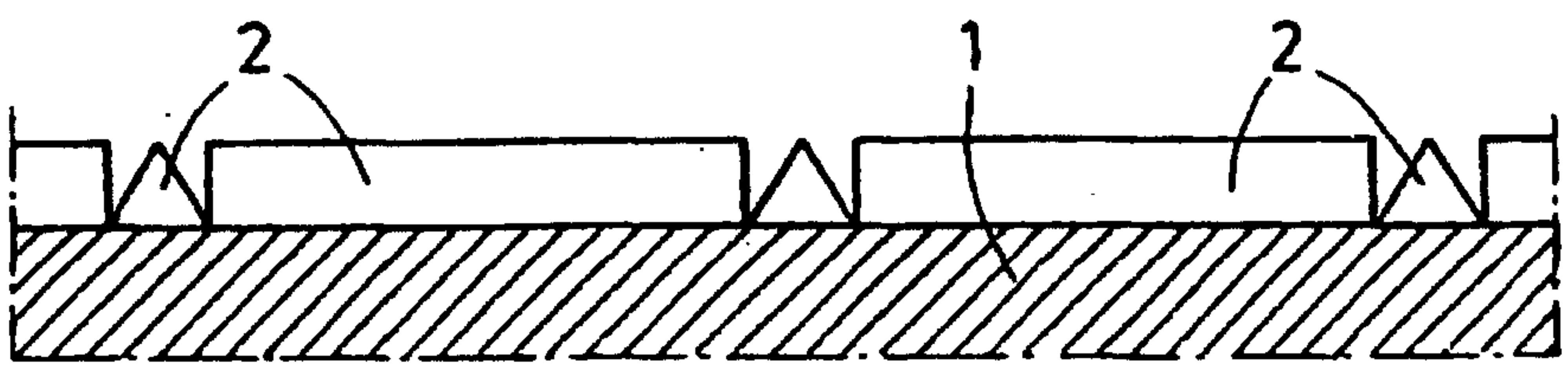


FIG.2a

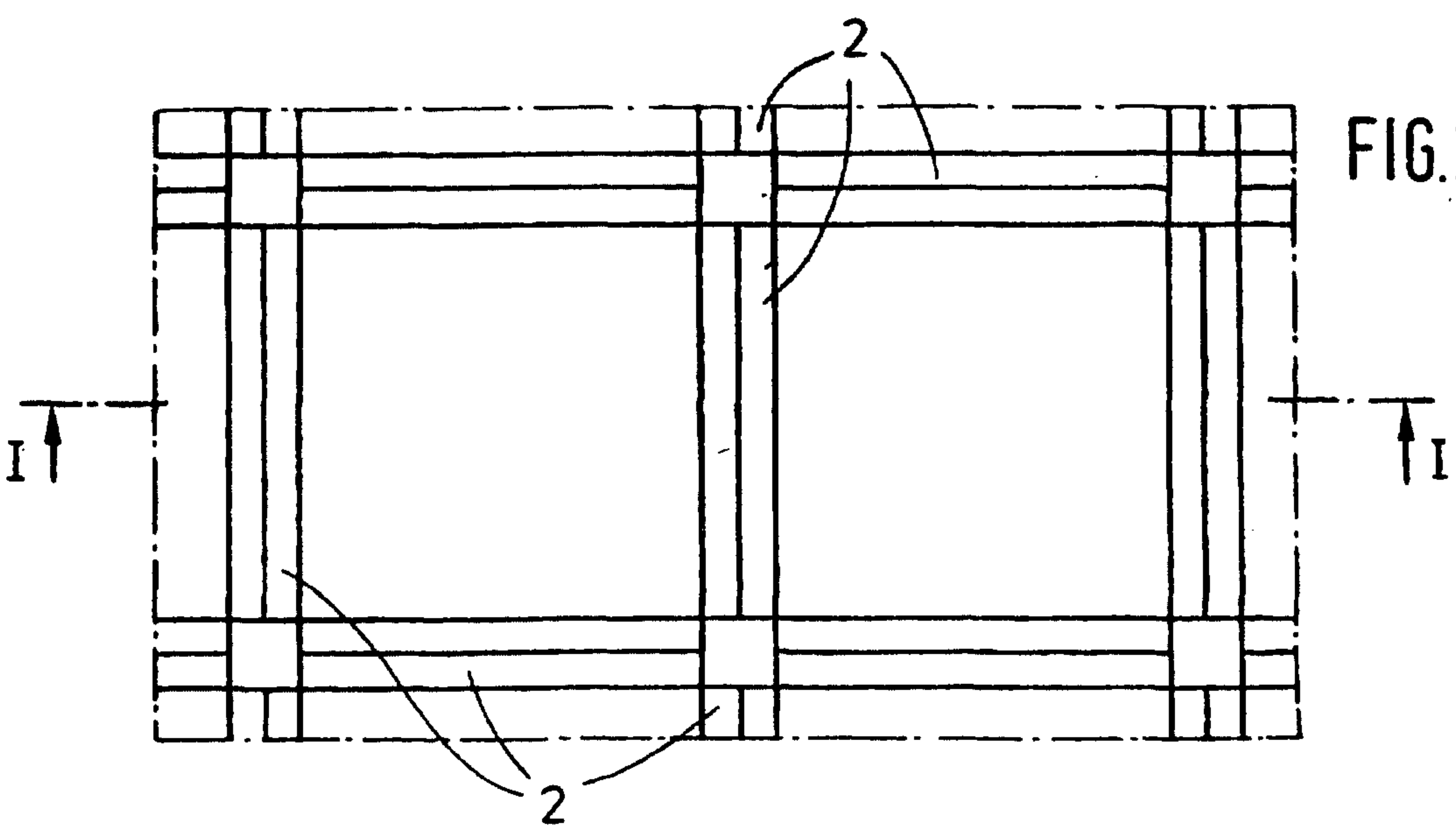


FIG.2b

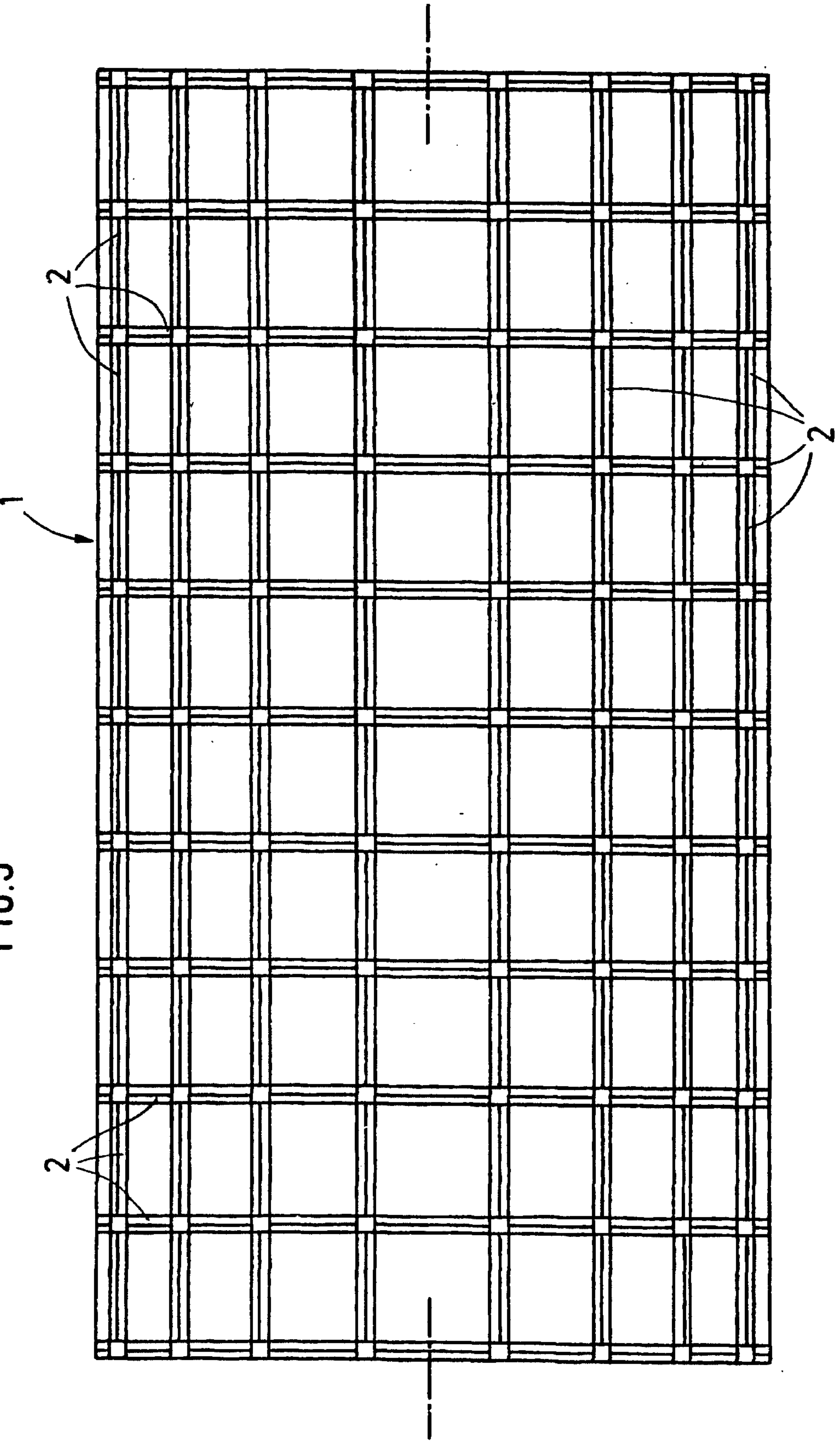
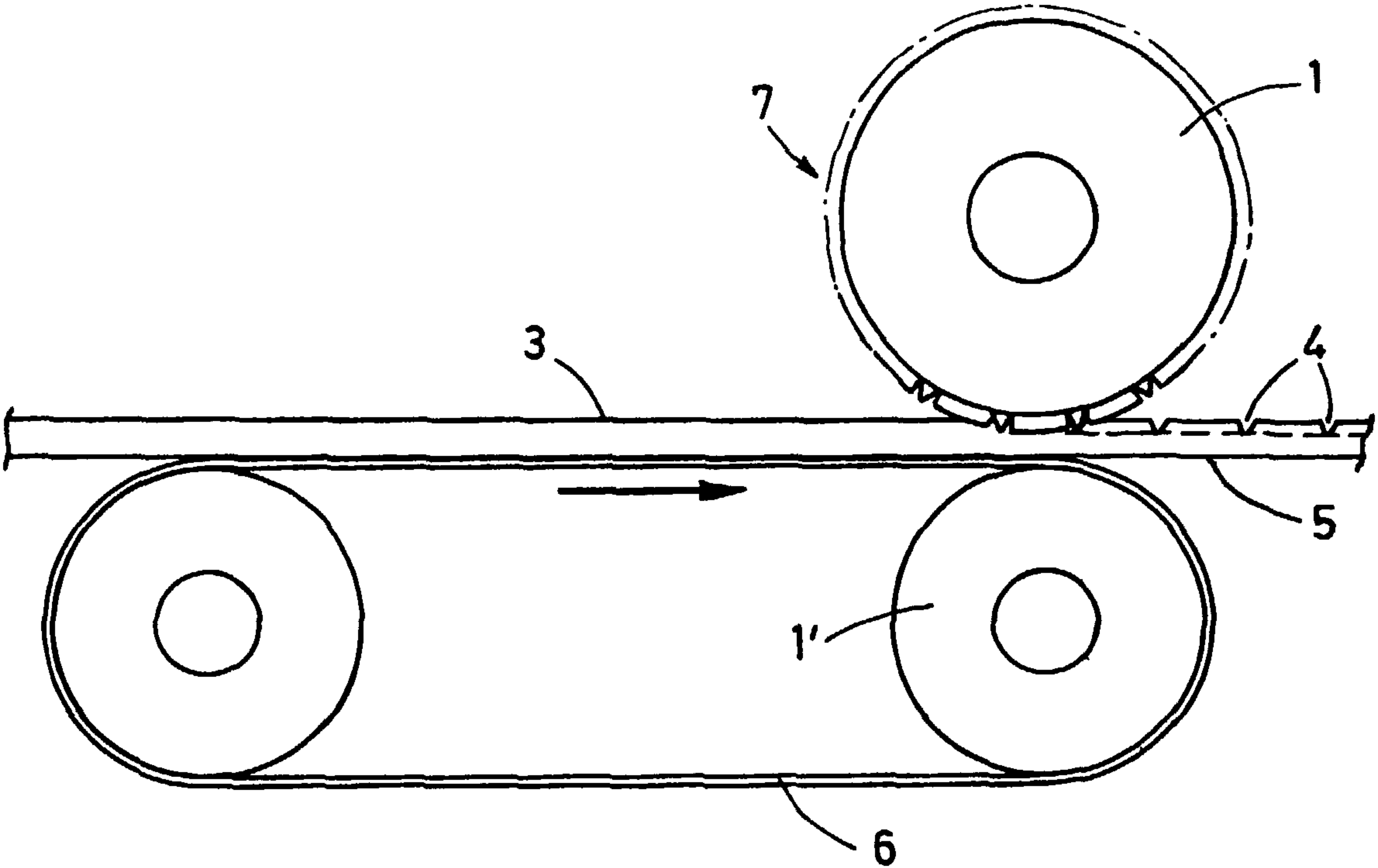


FIG.3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