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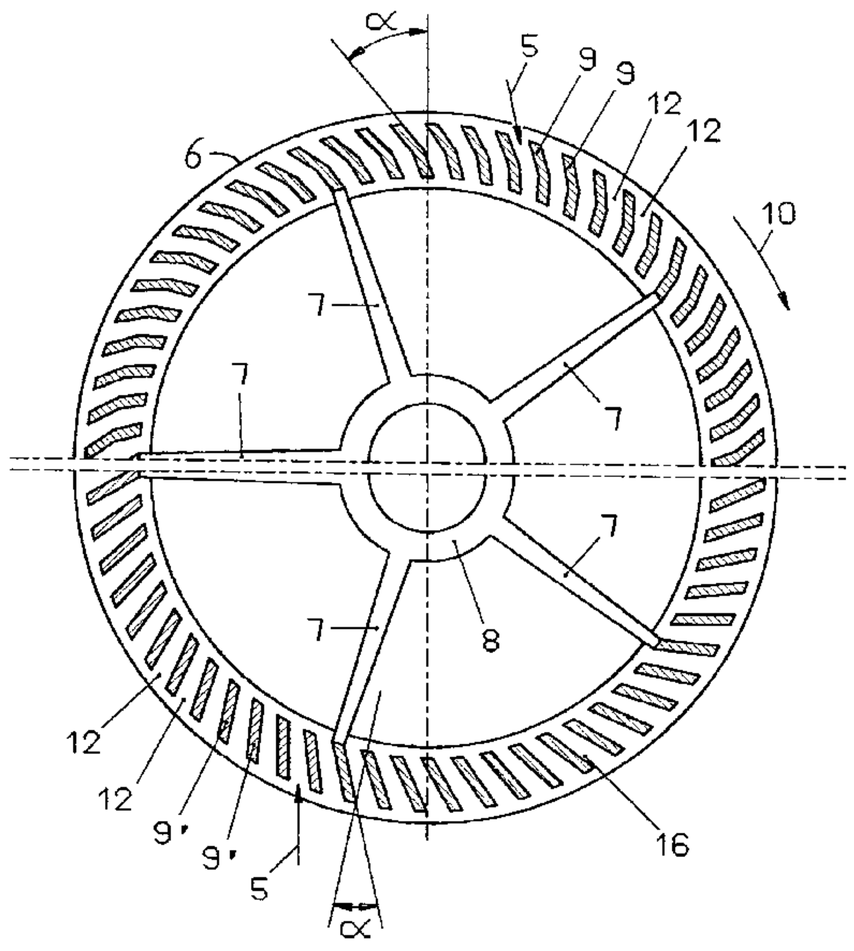

(57) Abrégé/Abstract:
Separator wheel for an air separator which at its periphery has channels through which separation air loaded with fine material flows into the separator wheel from the outside to the inside. The separation air loaded with fine material is discharged from the separator wheel in axial direction. Channels in axially different radial planes have different angles (α) of incline to the radial direction of the separator wheel. The angle of incline (α) of the channels near the outflow end of the separator wheel is greater than the angle of incline (α) of the channels remote from the outflow end. The incident flow of separation air which is loaded with fine material toward the outer port of channels is influenced by the slope of the channels relative to the radial direction of the separator wheel. The channels are aligned in axially different radial planes at different angles (α) to the radial direction of separator wheel. This results in more uniform separation properties.

SEPARATOR WHEEL FOR AN AIR SEPARATOR

ABSTRACT

Separator wheel for an air separator which at its periphery has channels through which separation air loaded with fine material flows into the separator wheel from the outside to the inside. The separation air loaded with fine material is discharged from the separator wheel in axial direction. Channels in axially different radial planes have different angles (α) of incline to the radial direction of the separator wheel. The angle of incline (α) of the channels near the outflow end of the separator wheel is greater than the angle of incline (α) of the channels remote from the outflow end. The incident flow of separation air which is loaded with fine material toward the outer port of channels is influenced by the slope of the channels relative to the radial direction of the separator wheel. The channels are aligned in axially different radial planes at different angles (α) to the radial direction of separator wheel. This results in more uniform separation properties.

SEPARATOR WHEEL FOR AN AIR SEPARATOR

The invention relates to a separator wheel for an air separator which on its periphery has channels, through which separation air loaded with fine material flows into the separator wheel from the outside to the inside. The separation air loaded with fine material is discharged in axial direction from the separator wheel.

Separators are designed to separate the separation material into fine material and coarse material; this can be done for example as described in EP-A1 552 837 by flow taking place through the separator wheel of an air separator roughly radially from the outside to the inside, after which the separation air loaded with fine material is discharged in axial direction from the separator wheel. The rotation of the separator wheel and the resulting centrifugal forces in the channels or in the area of the outer ports of the channels accelerate the coarse material to the outside so that it cannot pass to the inside together with the separation air and the fine material.

A problem with this type of separator arises due to the higher flow velocities or greater pressure difference at the axial outflow end of the separator wheel, which results in coarser separation material being removed than in the middle area of the separator wheel adjacent the outflow end or the area remote from the outflow end. Consequently, separation or classification of the separation material into coarse material and fine material is not exactly as desired and unsatisfactory.

At the axial ends of the separator wheel, due to the edge flow, much larger particles are entrained than is the case in the middle of the separator wheel. In interaction with the separator housing backflows also occur which cause undefined separation as a result. If the practical results are compared to the theoretical calculations after Stokes, it can be easily recognized that in practice the largest particles in the fine material are larger by several fold than under ideal conditions, science itself however having proven that particle sedimentation after Stokes takes place.

To solve this problem, in EP-A1 552 837 it was suggested that within the separator wheel a distributor tube be placed in which there is a plurality of openings, the size of the openings increasing more and more away from the axial outflow end of the separator wheel. Due to the smaller openings near the outflow end the flow resistance is higher than in the area remote from the outflow end, so that in this way more constant behaviour of the flow velocity or the acting underpressure is achieved within the separator wheel over its axial length.

However, the solution suggested in EP-A1 552 837 has the disadvantage that power consumption of the separator is increased by the openings in the distributor tube which act as flow limiters; this is especially disadvantageous at high flow velocities. Moreover, the larger particles should be repelled upon entry into the channels on the periphery of the separator wheel and this is not done in this approach.

Therefore the object of the invention is to make available a separator wheel of the initially mentioned type with which separation behaviour as constant as possible can be achieved over the axial length of the separator wheel.

This object is achieved in a separator wheel of the generic type by orienting the channels in axially different radial planes at different angles of incline to the radial direction of the separator wheel.

The varied angular incline of the channels in the axially different radial planes on the outside periphery of the wheel influences the repulsion of the stream of particles from the separation air over the axial length of the separator wheel to varying degrees.

Repulsion at the outer periphery of the rotor very effectively influences not only the separation air, but also the particles. In order to appropriately take into account the flow behaviour which is three-dimensionally very different or to prevent the passage of overly large particles in areas along the rotor, it is advantageous to influence to varying degrees the repulsion in axially different radial planes by

channels oriented at different angles to the radial direction of the separator wheel.

Thus the invention utilizes the circumstance that the incident flow of separation air which is loaded with fine material toward the outer port of the channels is influenced by the incline of the channels to the radial direction of the separator wheel. When the channels in axially separate radial planes are respectively aligned at different angles to the radial direction of the separator wheel, the aforementioned more uniform separation properties can be achieved with the separator wheel without the need for additional means, such as a distributor tube according to EP-A1 552 837, which cause flow or pressure losses.

In particular, in one preferred embodiment of the invention which is characterized in that the channels are sloped from the inside to the outside and against the direction of rotation, the angle of incline of the channels on the outflow end of the separator wheel is larger than the angle of incline of the channels away from the outflow end. With this embodiment very good separation behaviour of the separator can be achieved, since the aforementioned repulsion affects not only on the separation air, but also on the particles to be separated.

In the following, preferred embodiments of the invention are described by way of example only and with reference to the drawings.

Figure 1 schematically shows a longitudinal section through an air separator with a separator wheel having three segments;

Figure 2 shows a left side view of the air separator of Figure 1;

Figure 3 shows a partial cross-sectional view of a separator wheel according to the invention with five segments;

Figure 4 shows an axial cross-section through a first embodiment of a separator wheel segment in accordance with the invention;

Figure 5 shows an axial cross-section through a second embodiment of a separator wheel segment in accordance with the invention;

Figure 6 shows a radial section through one part of the separator wheel segment of Figure 5 taken along line VI-VI.

Figures 1 and 2 schematically show an air separator with a separator wheel 20 according to the invention. Separator wheel 20 is accommodated in a housing 21 with inlet 23 for separation air laden with the separation material and outlet 22 for coarse material. The separation air carrying the separation material is discharged through axial outlet 24.

It goes without saying that instead of housing 21 shown and described in Figures 1 and 2, other forms of housings can also be used, and that the separation air and separation material can also be supplied to housing 21 separately from one another.

Figure 3 shows separator wheel 20 according to the invention partially in cross section; it is composed of five separator wheel segments 1, 2 and 3. Separation air with separation material is supplied to separation wheel 20 in the direction of arrows 5 and separation air which is loaded with fine material is discharged from the separator wheel at outflow end 13 in the direction of arrow 4 through outlet 24.

In the first embodiment shown in an axial view in Figure 4 separator wheel segments 1 and 2 consist of one carrier 6 which is joined to a hub 8 via five spokes 7. Carrier 6 is provided with a plurality of wheel blades 9, 9' which extend in the axial direction of separator wheel segment 1, 1' and define intermediate channels 12. Wheel blades 9, 9' are either straight, bent in the radial direction of separator wheel segment 1, 1', as is shown using wheel blades 9, or curved. In the simplest embodiment, the wheel blades are constructed as flat rotor bars, as is shown using wheel blades 9' in Figure 4. In their radially outer area, wheel blades 9, 9' have an angle of incline α to the radial. The angle of incline α in the radially outer region of the blade 9, 9' has a much greater influence on the separation behaviour than the

angle of incline in the radially inner region of the blades and intermediate channels 12.

Wheel blades 9, 9' are sloped at angle α to the radial such that they are sloped from the inside to the outside against the direction of rotation 10 of separator wheel 20. This slope makes it more difficult for coarser particles of the separating material to flow through separator wheel 20 in the direction of arrow 5 from the outside to the inside, so that reliable separation is achieveable.

After the separation air carrying the fine material passes through channels 12 formed between wheel blades 9, 9' from the outside to the inside. The separation air loaded with fine material is deflected by about 90 degrees towards the axial direction of the separator, and flows towards the outflow end 13 as is illustrated by arrows 11 in Figure 3.

Separator wheel segment 3 in Figure 3 differs from the embodiments shown in Figure 4, which are representative of separator wheel segments 1, 2, in that carrier 6 is not joined to hub 8 via spokes, but via a continuous disk 14, as can be seen in Figure 3. This is necessary since separator wheel segment 3 is located on the end opposite the outflow end 13 of the separator wheel and, thus, closes that end of the separator wheel.

The angle of incline α of the blades 9, 9' is greater in separator wheel segments 2 and 3 than in separator wheel segment 1. The greater angle of incline of wheel blades 9, 9' or channels 12 formed between them increases the repulsion for the separation air particle flow so that the passage of larger particles is prevented and, thus, improved separation behaviour of the entire rotor for more accurate separation is achieved.

The separator wheel segment of the embodiment shown in Figure 4 is not exactly identical to the separator wheel segments shown in Figure 3 since the separator wheel segment shown in Figure 4 is an integral part in which blades 9, 9' are molded onto the carrier 6, while in the separator wheel segments shown in Figure 3 the blades 9, 9' are form fittingly

held between support disks 16, 16', 16'', as can be seen in detail in Figures 5 and 6.

To this end, the central support disks 16 are provided on their faces 25 with peripheral grooves 26 which receive the ends 27 of blades 9, 9'. To fix blades 9, 9' in their position on the support disks 16, a spacer 28 of overall annular shape is inserted into groove 26 on each side of support disk 16. To hold the ends 27 of blades 9, 9', spacers 28 have slots which are radially outwardly open and into which blades 9, 9' are inserted.

The end standing support disks 16', 16'' have a design similar to the central support disks 16. One groove 26 for holding blades 9, 9' is provided on the face directed towards the central support disks 16.

The above described structure of separator wheel 20 and especially of support disks 16, 16', 16'', between which blades 9, 9' are held by form-fit without penetrating them, has the advantage that the structure of separator wheel 20 is very stable throughout, since support disks 16 have high carrying capacity due to their continuous annular cross section. It goes without saying that this structure of a separator wheel of support disks and blades held by form-fit in between can also be used in separator wheels in which the channels between the blades have an essentially identical alignment over the entire length of the separator wheel.

As can be further seen in Figures 1 and 3, separator wheel segments 1, 2 and 3 are seated torsionally strong on shaft 15 which rotates separator wheel segments 1, 2 and 3 and is driven using a drive not shown.

The angle of incline of channels 12 formed between wheel blades 9, 9' is preferably between 30 and 45 degrees, but depending on the respective conditions, such as the particle size or the specific weight of the particles of the separation material or on the desired factional ratio between coarse and fine material, it can also be higher or lower, for example between 15 and 60 degrees.

In alternative embodiments not shown in the drawings it is also possible that instead of channels 12 formed between wheel blades 9, 9' there are openings, for example, holes, or that the separator wheel is not composed of individual segments which contain the channels, but that channels with different angles of incline in different radial planes are located in an integral separator wheel or in a single separator wheel segment.

In another embodiment not shown in the drawings, the separation air loaded with fine material can also be discharged on the two axial ens of the separator wheel via outflow channels in order to increase the efficiency of the separator according to the invention.

Changes and modifications in the specifically described embodiments can be carried out without departing from the scope of the invention which is intended to be limited only by the scope of the appended claims.

C L A I M S

1. Separator wheel for an air separator wherein, separation air loaded with fine material is discharged in the axial direction from the separator wheel, comprising radial channels provided along the periphery of the separator wheel through which separation air loaded with fine material flows from the outside of the separator wheel to the inside, the channels in axially different radial planes having different angles of incline (α) to the radial direction of the separator wheel.

2. Separator wheel according to claim 1, wherein the separator wheel has a jacket surface and the channels are formed as openings, especially holes, in the jacket surface.

3. Separator wheel according to claim 1 or 2, wherein the channels are defined by essentially axially aligned wheel blades.

4. Separator wheel according to one of claims 1 through 3, wherein the separator wheel includes at least two separator wheel segments and the channels of one separator wheel segment are aligned at a different angle (α) of incline to the radial direction than the channels of the other separator wheel segments.

5. Separator wheel according to one of claims 1 through 4, wherein the angle of incline (α) of the channels to the radial direction changes in radial direction from the outside to the inside of the separator wheel.

6. Separator wheel according to claims 3 and 5, wherein the wheel blades are curved.

7. Separator wheel according to one of claims 1 through 6, wherein the channels are sloped from the inside to the outside and opposite the direction of rotation of the separator.

8. Separator wheel according to one of claims 1 through 7, wherein the angle of incline of the channels is between about 15 and about 60 degrees, especially between 30 and 45 degrees.

9. Separator wheel according to one of claims 1 through 8, wherein the angle of incline (α) of the channels near an outflow end of the separator wheel is greater than the angle of incline (α) of the channels remote from outflow end.

10. Separator wheel according to one of claims 1 through 9, wherein there are two outflow channels which adjoin the separator wheel axially on opposite sides and through which the separation air loaded with fine material is discharged.

11. Separator wheel according to one of claims 3 through 10, wherein the separator wheel segments are constructed as an annular disk-shaped carrier to which the separator wheel blades are molded projecting in the axial direction.

12. Separator wheel according to one of claims 3 through 10, wherein the wheel blades are form fittingly held between radially extending support disks.

13. Separator wheel according to claim 12, wherein the wheel blades do not penetrate the support disks.

14. Separator wheel according to claim 12 or 13, wherein the face of the support disks in the region of the outer periphery are provided with a plurality of recesses for respectively holding an end of one of the wheel blades.

15. Separator wheel according to claim 14, wherein the recesses are annular grooves and wherein the wheel blades are fixed in their position in the annular grooves by a spacer.

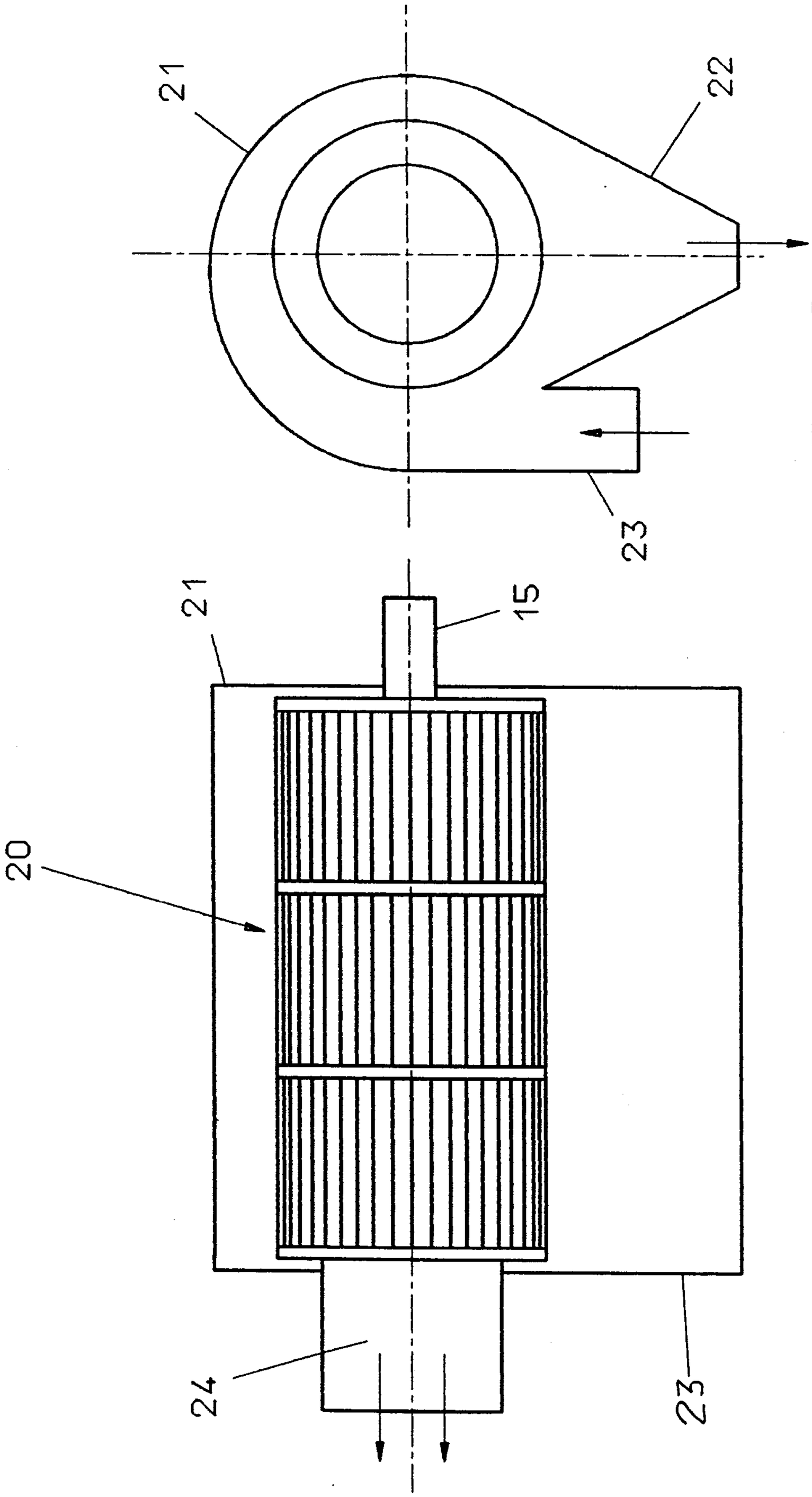

Fig. 2

Fig. 1

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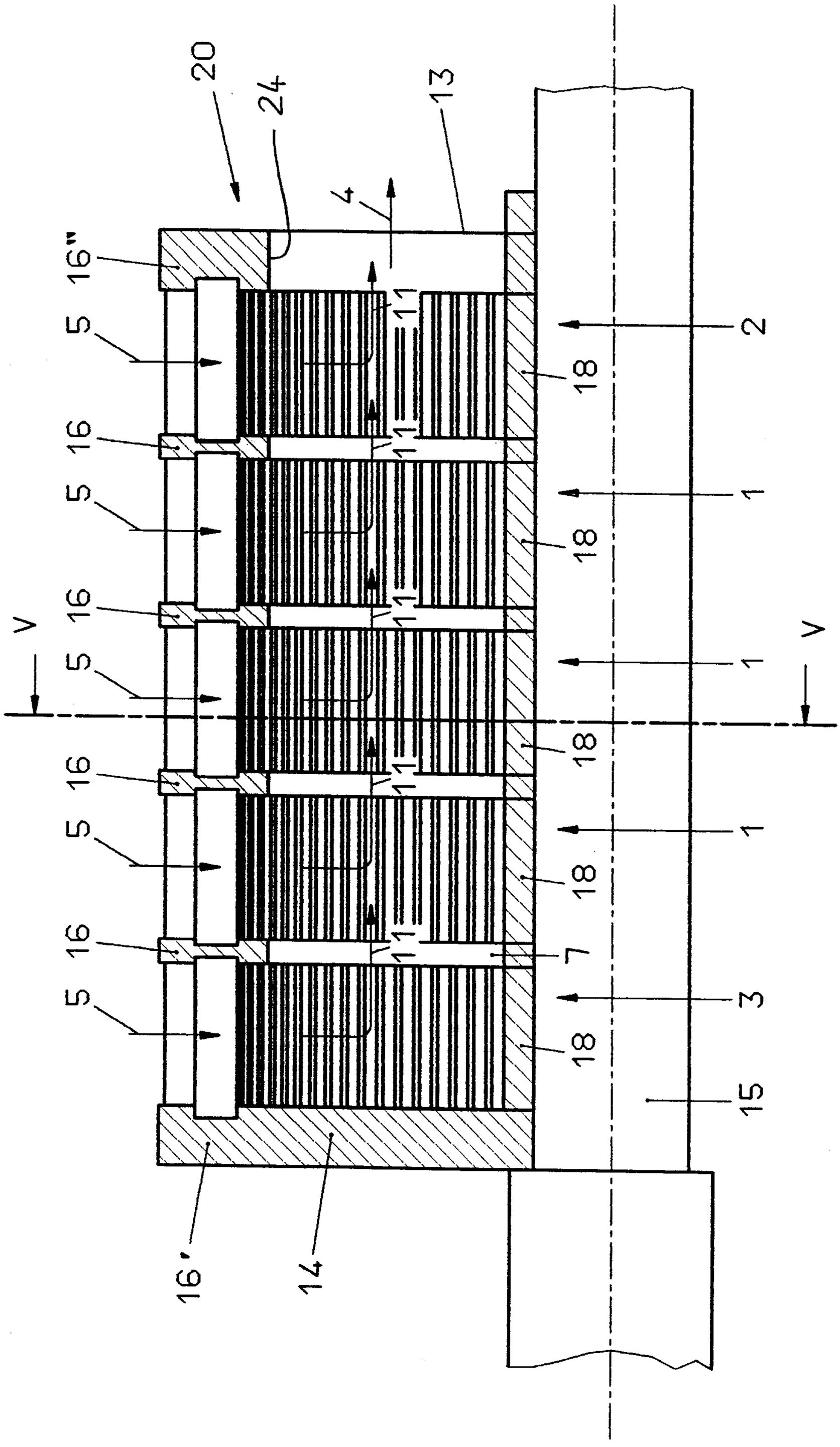

Fig. 3

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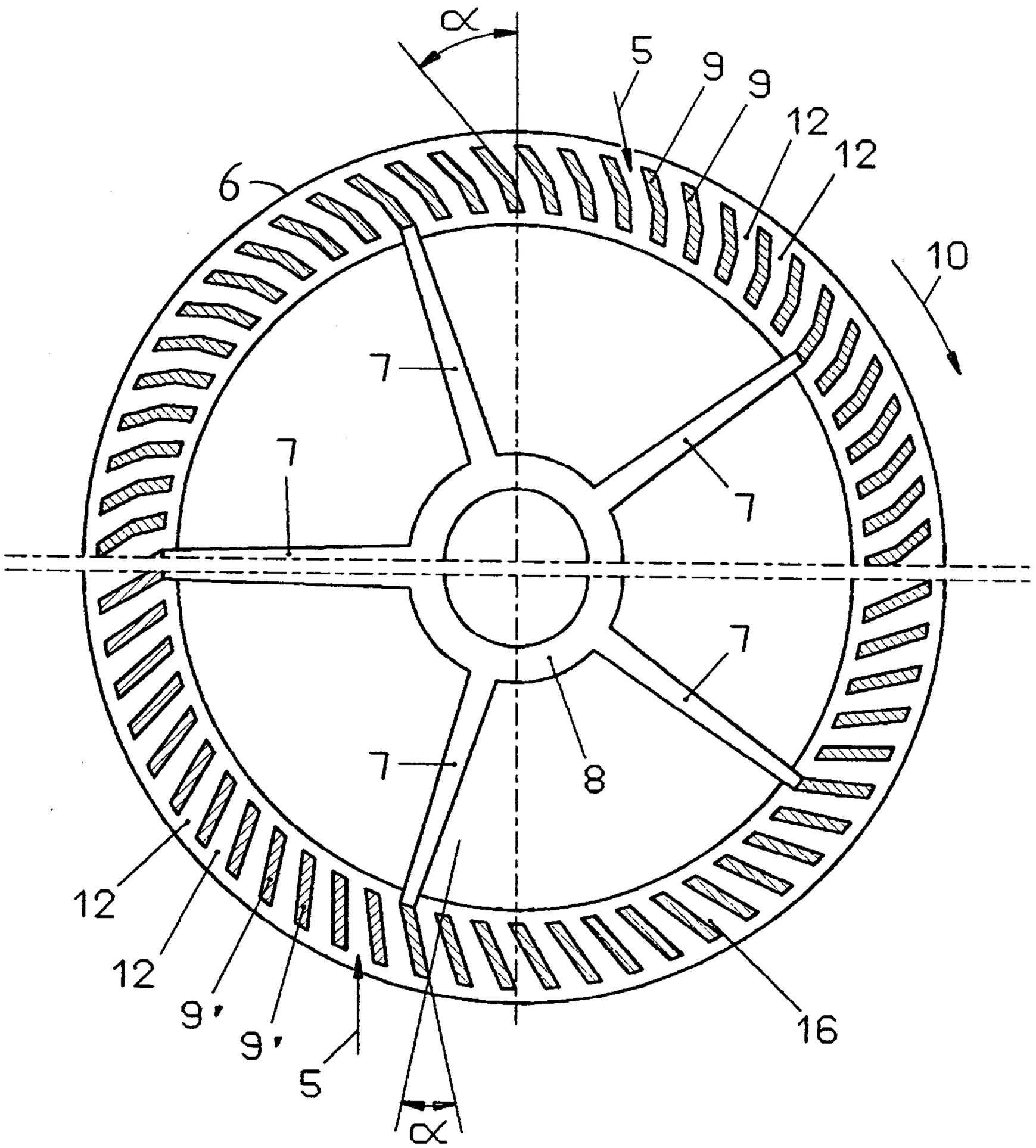

Fig.4

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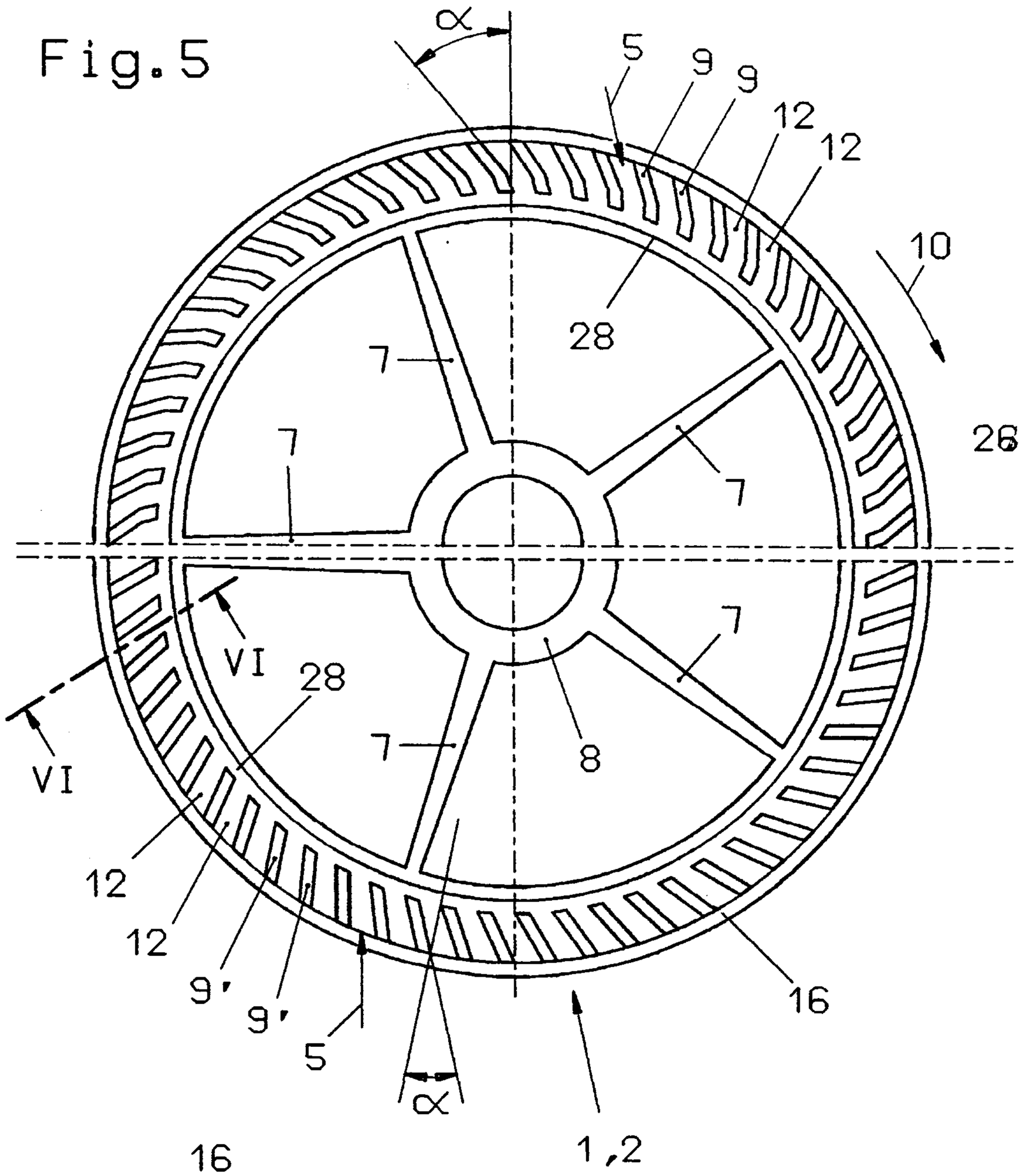
Fig.5



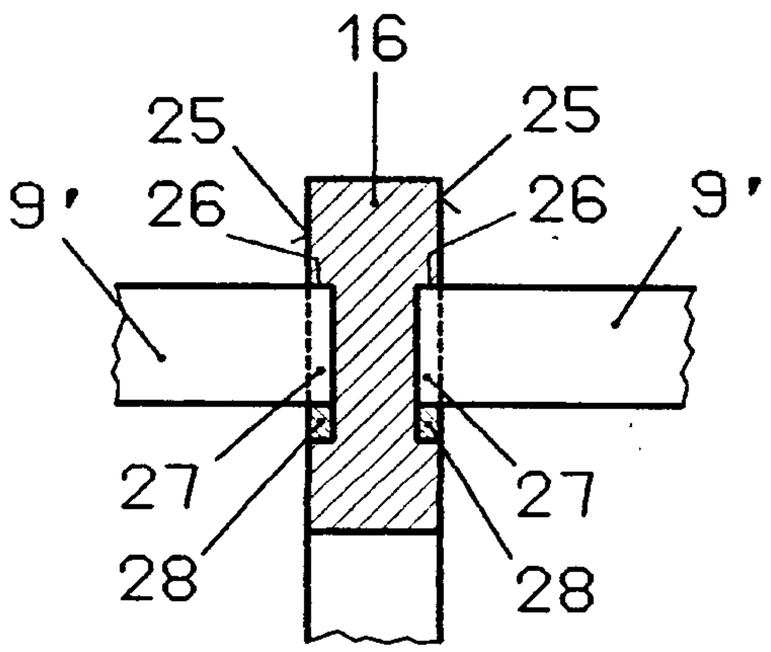


Fig.6

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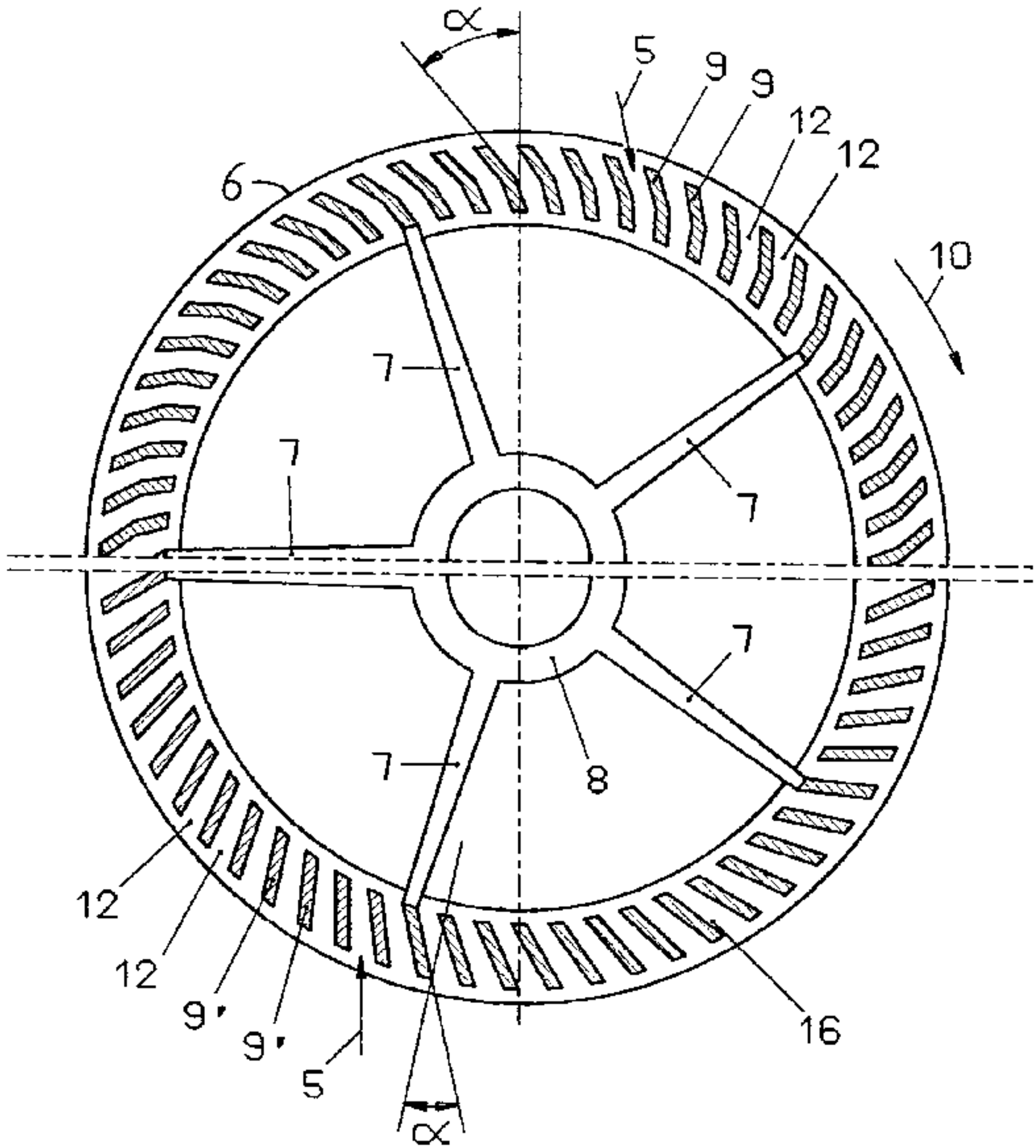
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