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(54) Titre : MEULE
(54) Title: GRINDING WHEEL

(57) Abrégé/Abstract:
This invention relates to a grinding wheel comprising a frame including a generally circular shape and adapted to rotate about a rotation axis thereof and a plurality of grinding assemblies radially located on the frame, each of the grinding assembly comprising a depth control element, a cutting element and a chip management element.

ABSTRACT

This invention relates to a grinding wheel comprising a frame including a generally circular shape and adapted to rotate about a rotation axis thereof and a plurality of grinding assemblies radially located on the frame, each of the grinding assembly comprising a depth control element, a cutting element and a chip management element.

GRINDING WHEEL

FIELD OF THE INVENTION

[0001] This invention relates to a grinding wheel for use with a grinder tool. The present invention more precisely relates to a grinding wheel with series of radially extending grinding assemblies.

BACKGROUND OF THE INVENTION

[0002] Grinding wheels are commonly used to grind and level material surfaces and generally have a limited life time and get worn out rapidly. They are rotating at fast speed and are generally creating a lot of dust while grinding the working material. Different types of abrasive materials can be used in the grinding wheel in correspondence with the type or material to be worked, the aggressivity of the work and the expected end finish of the material. Carbide powdered grinding wheel provide a longer lifetime but are generally more expensive.

[0003] Moreover, it is difficult to see the work done under the grinding wheel because it is not possible to see through the grinding wheel.

[0004] Furthermore, dept of cut of grinding wheels are difficult to control and is generally depending on the pressure applied to the grinding wheel.

[0005] Therefore, there is a need in the art for an improved grinding wheel over the existing art. There is another need in the art for such a grinding wheel that allows see-through operation to better see what is grinded. There is also a need in the art for an improved grinding wheel that is controlling the depth of cut and can manage cut chips material efficiently. There is also a need for a grinding wheel that can be economically manufactured.

SUMMARY OF THE INVENTION

[0006] It is one aspect of the present invention to alleviate one or more of the drawbacks of the background art by addressing one or more of the existing needs in the art.

[0007] Accordingly, an aspect of our work, in accordance with at least one embodiment thereof, provides an improved grinding wheel over the prior art.

[0008] An aspect of our work, in accordance with at least one embodiment thereof, provides a grinding wheel with an enclosed periphery that includes openings therein for seeing through work, the grinding wheel further comprises a series of generally radially disposed grinding assemblies including cutting elements, depth control elements and chip management elements.

[0009] An aspect of our work, in accordance with at least one embodiment thereof, provides a grinding wheel that can be embodied with an array of grinding assemblies, each comprising a radial cutting element, depth control element and chip management element.

[0010] An aspect of our work, in accordance with at least one embodiment thereof, provides a grinding wheel with an array of cutting elements including alternated series of teeth for alternatively cutting material with teeth that are sequentially alternated so that one tooth is engaging the material left between two adjacent preceding teeth and so on so forth.

[0011] An aspect of our work, in accordance with at least one embodiment thereof, provides a grinding wheel including a plurality of cutting element equipped with carbide or diamond teeth thereon and further including intervening recesses.

[0012] Another aspect of our work, in accordance with at least one embodiment thereof, provides a grinding wheel that is comprising between two and six grinding assemblies.

[0013] Other embodiments and further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

[0014] Additional and/or alternative advantages and salient features of the invention will become apparent from the following detailed description, which, taken in conjunction with the annexed drawings, disclose preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Referring now to the drawings which form a part of this original disclosure:

[0016] Figure 1 is a perspective view of a grinding wheel, in accordance with at least one embodiment thereof;

[0017] Figure 2 is a bottom plan view of the grinding wheel of Figure 1;

[0018] Figure 3 is a top plan view of the grinding wheel of Figure 1;

[0019] Figure 4 is a side elevational view of the grinding wheel of Figure 1;

[0020] Figure 5 is a side elevational sectional view of the grinding wheel of Figure 1;

[0021] Figure 6 is a partial sectional elevational view of the grinding wheel in accordance with at least one embodiment thereof;

[0022] Figure 7 is a bottom plan view of the grinding wheel in accordance with at least one embodiment thereof;

[0023] Figure 8 is a bottom plan view of the grinding wheel in accordance with at least one embodiment thereof;

[0024] Figure 9 is a bottom plan view of the grinding wheel in accordance with at least one embodiment thereof;

[0025] Figure 10 is a bottom plan view of the grinding wheel in accordance with at least one embodiment thereof;

[0026] Figure 11(A) is a partial sectional elevational view of the grinding wheel in accordance with at least one embodiment thereof;

[0027] Figure 11(B) is a partial sectional elevational view of the grinding wheel in accordance with at least one embodiment thereof;

[0028] Figure 11(C) is a partial sectional elevational view of the grinding wheel in accordance with at least one embodiment thereof;

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0029] A preferred embodiment of the present invention is described below with reference to the drawings.

[0030] A grinding wheel 10, in accordance with a possible embodiment, is illustrated in Figure 1 throughout Figure 5. The grinding wheel 10 comprises a circular frame 14 including a material having sufficient mechanical strength to sustain the mechanical stresses and the thermal stresses sustained by the grinding wheel 10 under operation. Suitable possible materials like aluminum, steel, stainless steel or other metallic materials can be contemplated for manufacturing the circular frame 14. The circular frame 14 is centered and adapted to rotate about a rotation axis 18 when the grinding wheel 10 is assembled and rotated with a grinder (not illustrated) or other drive portion. The circular frame 14 is embodied with an enclosed periphery 22 preventing undesirable engagement of the periphery of the grinding wheel 10 with external objects and also optimizing stress distribution in the grinding wheel 10 for improving the overall strength of the grinding wheel 10. The frame 14 includes a series of openings 26 therein for reducing the weight of the grinding wheel 10 and also allowing see-through operation of the grinding wheel 10.

Indeed, openings 26, when rotating, are allowing a user to see through the frame 14 to improve the vision of the work performed by the grinding wheel 10 from a variety of angles.

[0031] The grinding wheel 10 is further equipped with a central opening 34, a central recess 36 and a pair of locking holes 38. The grinding wheel 10 comprises a plurality of grinding assemblies 30 disposed in a general radial arrangement from the rotation axis 18. The radial location and alignment of the grinding assemblies 30 is generally projecting from the rotation axis 18 in a direction toward the periphery 22 of the frame 14. The grinding assemblies 30 in the illustrated embodiment are radially projecting from the rotation axis 18 with a 0-degree angle so to speak as best illustrated in Figure 10. Other possible embodiments are contemplated with the grinding assemblies 30 radially projecting from the rotation axis 18 with the following angles:

Radial angle (Fig. 10)	Minimum angle	Maximum angle	Preferred low angle	Preferred high angle
Positive	0°	+45°	+5°	+10°
Slightly positive	0°	+30°	0°	+5°
Neutral (illustrated)	0°	0°	0°	0°
Slightly negative	-30°	0°	0°	-5°
Negative	-45°	-30°	-5°	-10°

Table 1

[0032] Each of the grinding assemblies 30, as embodied, comprises a radial cutting element 40, a depth control element 44 and a chip management element 48. It is contemplated by the present description to embody between two and six grinding assemblies 30 in various configurations on a grinding wheel 10 without departing from the scope of the present invention. Some of the possible configurations are illustrated in the Figures while others can be inferred by a skilled reader in the art of grinding wheels.

[0033] The openings 26 includes a substantially trapezoidal shape for removing a maximum of material from the frame 14 while allowing sufficient mechanical strength. There are two openings 26 between adjacent grinding assemblies 30 in the present embodiment. Two adjacent openings 26 are separated a wall member 52. The number, the size and the layout of the openings between two angularly adjacent grinding assemblies 30 can vary without departing from the scope of the present description.

[0034] One can appreciate the cutting element 40 is embodied as a carbide cutter 56 including a plurality of teeth 60 separated with intervening recesses 64 as it can be appreciated in Figure 1. Alternatively, the cutting element 40 could include diamond as a resistant hard-cutting material. Two adjacent cutting elements 40, from adjacent grinding assemblies 30.1, 30.2, for instance, have radially non-aligned teeth 60. Each tooth 60 cuts a groove that is leaving intervening material between two adjacent teeth 40 from the same cutting element 40. Optimally, the cutting element 40 that follows when the grinding wheel 10 is rotating is going to have an opposed layout of teeth 60 to cut the remaining intervening material left by the preceding cutting element 40. This provides a smooth and even grinded surface while alleviate some drawbacks from cutting elements having a different cutting pattern.

[0035] The combined effect of the cutting element 40, the depth control element 44 and the chip management element 48 can better be appreciated in Figure 6 illustrating a magnified portion of Figure 5. The grinding wheel 10 is rotating in a direction illustrated by arrow 68 where the surface 72 of the part 76 to grind is going to contact a reference surface 114 of the depth control element 44 to ensure a cut depth 80 equivalent of a distance between the depth control element 44 and the tip of the teeth 60. The dept control element 44 is embodied with a slope 110 and a reference surface 114 but could be embodied differently with another type of structure adapted to limit the depth of the cut made by the cutting element 40. The slope 110 is axially protruding/extending over a frame surface 16 of the grinding wheel 10 to prevent undesirable friction with the grinding wheel 10 and setting the cut depth 80 of each cutting element 40. A radius is preferably joining the slope 110 to a recessed portion 100 of the chip management element 48. This controlled cut depth 80 prevents the grinding wheel 10 to "bite" too hard in the part 76 that

is worked on and keeps a more even cut along the part 76 without preventing the cutting element 40 to functionally rotate. A chip flow 96 is guided in the recessed portion 100 of the chip management element 48. In the operational context of the grinding wheel 10, the chip is going to "flow" in the recessed portion 100 and is radially extracted thereof with the centrifugal force generated by the rotation of the grinding wheel 10. It is possible to appreciate from Figure 6 that the teeth 60 has a clearance angle 84 with almost no rake angle 88. Other desirable variations of the clearance angle 84 and the rake angle 88 can be optimized, adjusted and embodied for different materials and usage.

Material	Rake angle	Maximum depth	General depth	Minimum depth	Range min	Range max
Hooves	0° to +5°	0.023"	0.023"	0.021	0.02"	0.03"
Aluminum	0° to +5°	0.021"	0.019"	0.018"	0.018"	0.021"
Wood	0° to -5°	0.023"	0.023"	0.021	0.02"	0.03"

Table 2

[0036] Figure 7 and Figure 8 are illustrating other embodiments including a different number of grinding assemblies 30. One can appreciate the grinding wheel 10 can be embodied with different layouts of grinding assemblies 30 and openings 26. It is contemplated a grinding wheel 10 can accommodate from a single grinding assembly 30 to eight grinding assemblies 30 thereon. Preferably, a minimum of two grinding assemblies 30 would be recommended for keeping the grinding wheel 10 balanced since a counter balancing weight (not illustrated) would likely be required to maintain a balanced rotation. The counter balancing weight could be obtained by managing the number, the size and the location of the openings 26 or adding additional corresponding weight on the opposed side of the grinding wheel 10. In that respect, Figure 7 illustrates a grinding wheel 10 accommodating a pair of opposed grinding assemblies 30 with intervening openings 26. In contrast, Figure 8 illustrates another possible embodiment with six grinding assemblies 30 aligned in three pairs of grinding assemblies 30. These configurations are illustrating some possible embodiments and a skilled reader could infer other possible configurations that are not explicitly shown in the drawings.

[0037] Figure 9 is illustrating an embodiment of the grinding wheel 10 including four (4) equilaterally disposed grinding assemblies 30. The cutting element 40 in this embodiment is a straight single tooth cutting element 40 in contrast with the previously illustrated embodiment that is including a series of distinct tooth in the cutting element 40. The type of single-tooth design is adapted to equally slice and remove the predetermined thickness determined by the cut depth 88 illustrated in Figure 6.

[0038] Turning now to Figure 10 that is illustrating radial angles that are described in the present description. The radial angle is the angle of the cutting element 30 with respect to a perpendicular direction 118 from a transversal section of the axis of rotation 18. The radial angle can be positive 122 or negative 126 depending in which direction the cutting element 30 is positioned on the grinding wheel 10 with respect to the direction of rotation of the grinding wheel 10. Each cutting element 30 can be radially angled equally or be individually angled in a variety of angles. The illustrative ranges of the radial angle is presented in Table 1.

[0039] The cutting element 40 can have a variety of rake angles. For instance, as exemplified in Figure 11(A), the rake angle can be negative 130, generally for hard material to grind. The rake angle can be neutral when the front edge 142 of the cutting element 40 is aligned with the axis of rotation 18 as exemplified in Figure 11(B). Otherwise, the rake angle can be positive 138, generally for soft material to cut.

[0040] While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention is not to be limited to the disclosed embodiments and elements, but, to the contrary, is intended to cover various modifications, combinations of features, equivalent arrangements, and equivalent elements included within the spirit and scope of the appended claims. Furthermore, the dimensions of features of various components that may appear on the drawings are not meant to be limiting, and the size of the components therein can vary from the size that may be portrayed in the figures herein. Thus, it is intended that the present invention covers the modifications and variations of the invention, provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A grinding wheel comprising:

a frame including a generally circular shape and adapted to rotate about a rotation axis thereof, the frame including openings therein; and

a plurality of carbide grinding assemblies radially located on the frame, each of the grinding assembly comprising

a depth control element;

a cutting element; and

a chip management element,

wherein each cutting element is radially projecting from the rotation axis.

2. The grinding wheel of claim 1, wherein the cutting element is welded on the frame.

3. The grinding wheel of any one of claims 1 and 2, wherein the openings are symmetrically distributed in a circular array on the frame.

4. The grinding wheel of any one of claims 1 to 3, wherein the cutting element includes a single tooth.

5. The grinding wheel of claim 4, wherein the single tooth includes a continuous profile.

6. The grinding wheel any one of claims 1 to 5, wherein the cutting element is rectilinear in a radial direction thereof.

7. The grinding wheel of any one of claims 1 to 6, wherein the grinding wheel includes four angularly equidistantly distributed thereon.

8. The grinding wheel of any one of claims 1 to 7, wherein a virtual projection of the front edge of the cutting element is intersecting the rotation axis.

9. The grinding wheel of any one of claims 1 to 8, wherein the cutting element includes a neutral radial angle.

10. The grinding wheel of any one of claims 1 to 9, wherein the cutting element includes a negative rake angle.

11. The grinding wheel of any one of claims 1 to 10, wherein the depth control element includes a convex curved profile.

12. The grinding wheel of any one of claims 1 to 11, wherein the chip management element includes a concave curved profile.

13. A rotative apparatus comprising:

a motor; and

a drive member operatively connected to the motor; and

a grinding wheel,

the grinding wheel comprising:

a frame including a generally circular shape and adapted to rotate about a rotation axis thereof; the frame including openings therein; and

a plurality of carbide grinding assemblies radially located on the frame, each of the grinding assembly comprising

a depth control element;

a cutting element; and

a chip management element,

wherein each cutting element is radially projecting from the rotation axis.

14. The rotative apparatus of claim 13, wherein the cutting element is welded on the frame.

15. The rotative apparatus of any one of claims 13 and 14, wherein the openings are symmetrically distributed in a circular array on the frame.

16. The rotative apparatus of any one of claims 13 to 14, wherein the cutting element includes a single tooth.

17. The rotative apparatus of claim 16, wherein the single tooth includes a continuous profile.

18. The rotative apparatus of any one of claims 13 to 17, wherein the cutting element is rectilinear in a radial direction thereof.

19. The rotative apparatus of any one of claims 13 to 18, wherein the grinding wheel includes four angularly equidistantly distributed thereon.

20. The rotative apparatus of any one of claims 13 to 19, wherein a virtual projection of the front edge of the cutting element is intersecting the rotation axis.

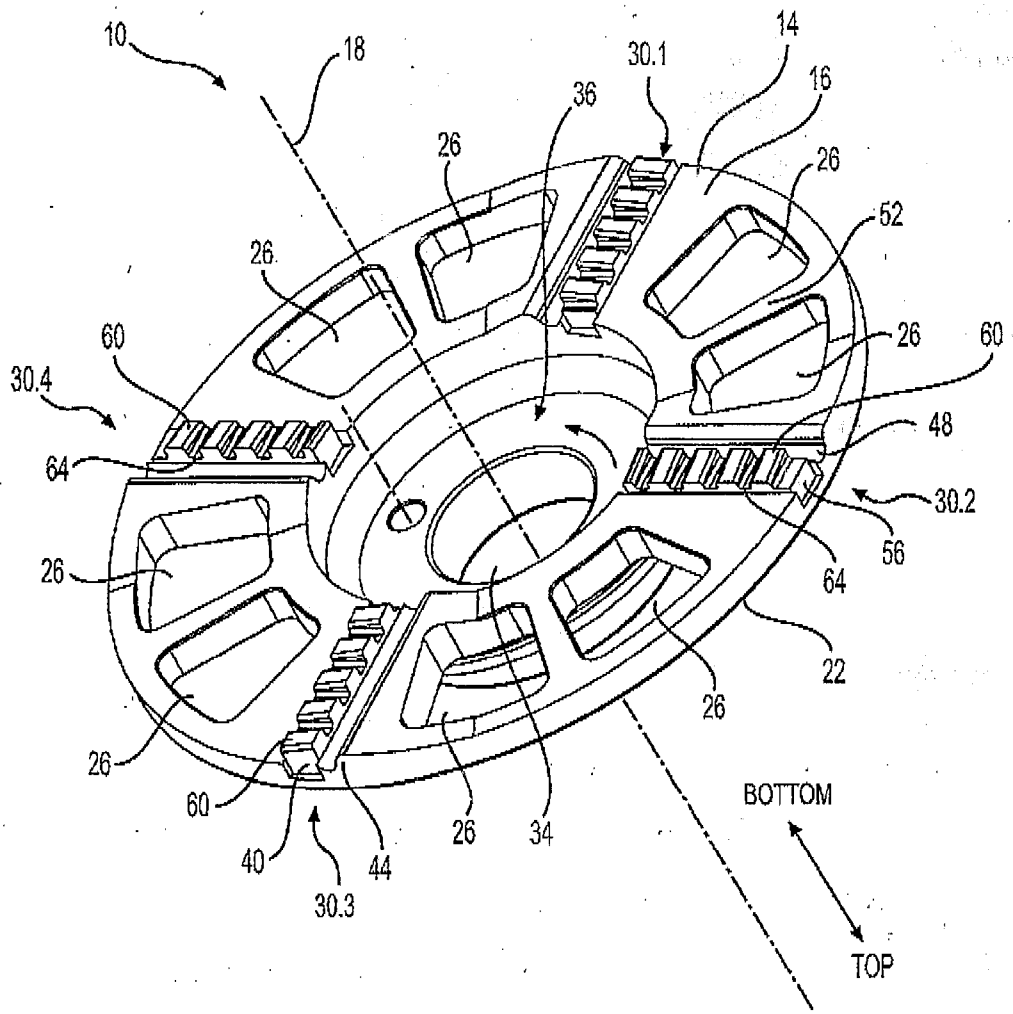
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FIG. 1

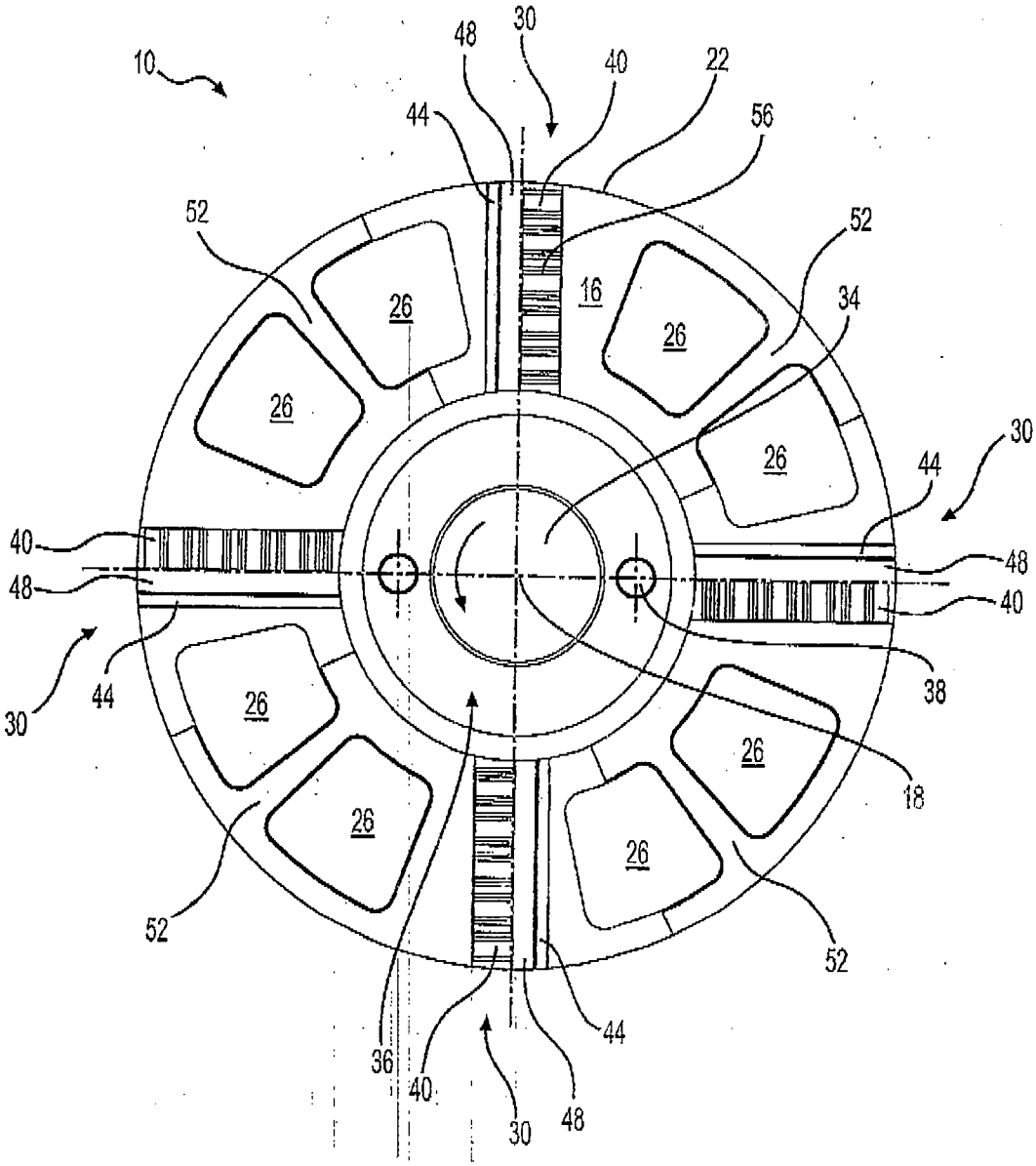

FIG. 2

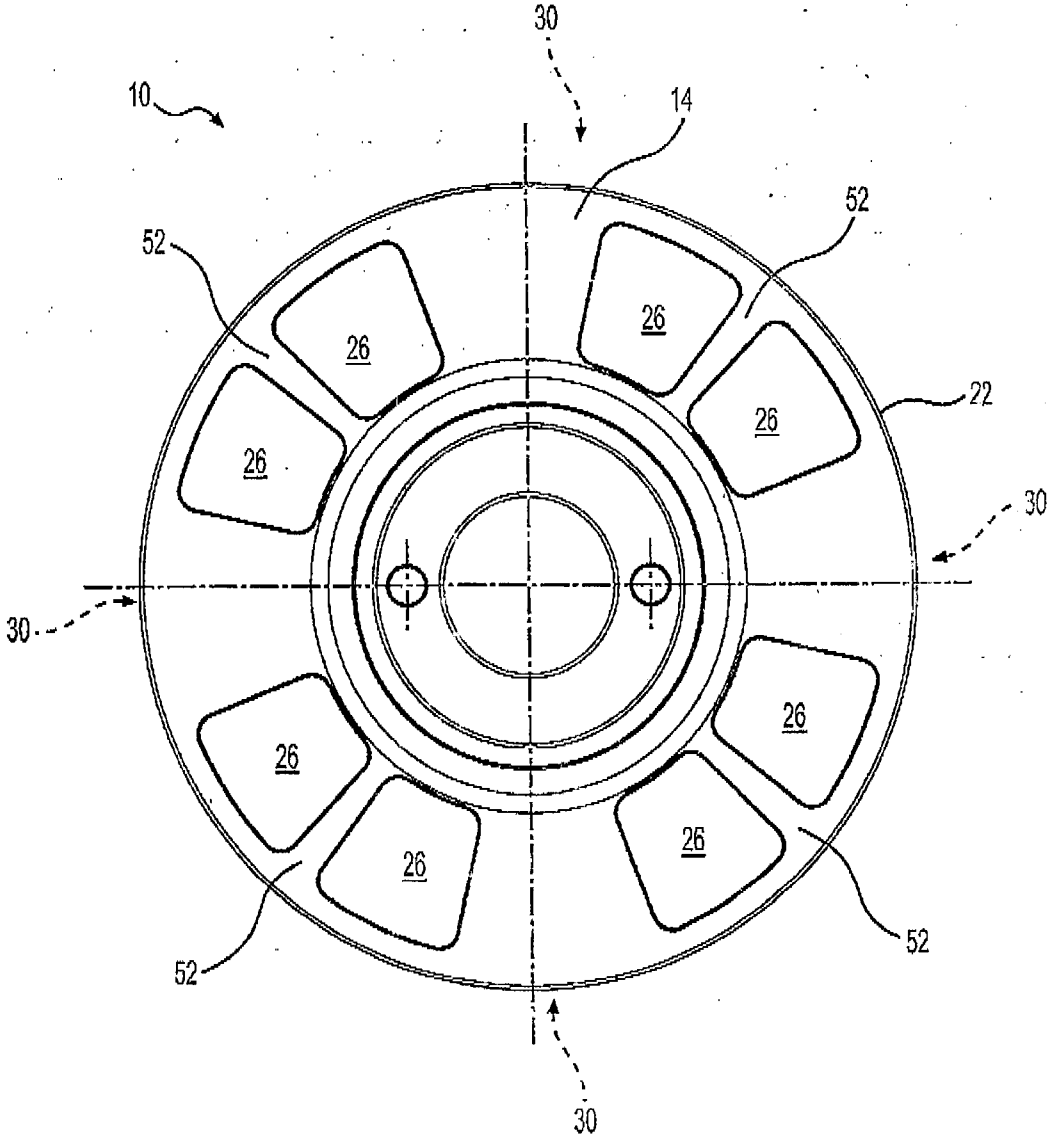

FIG. 3

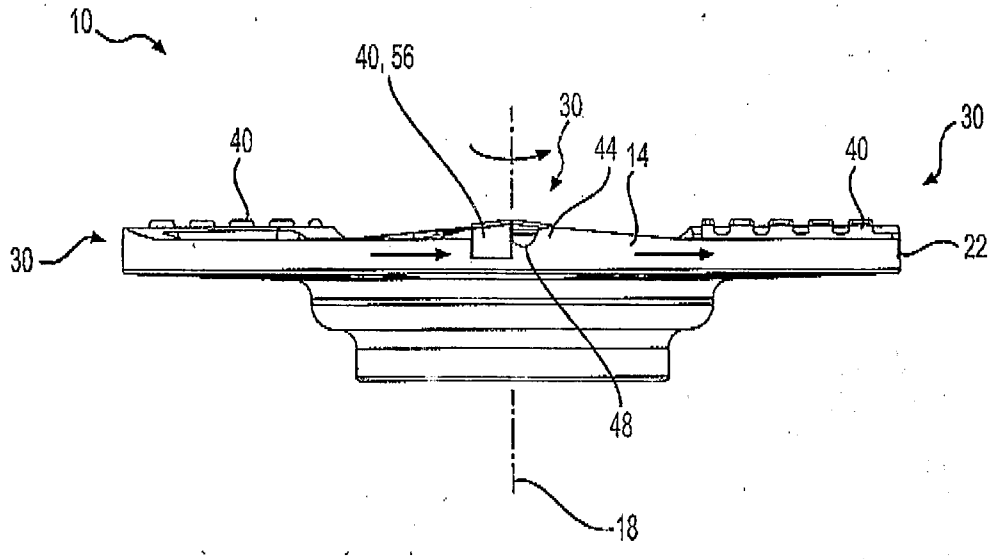

FIG. 4

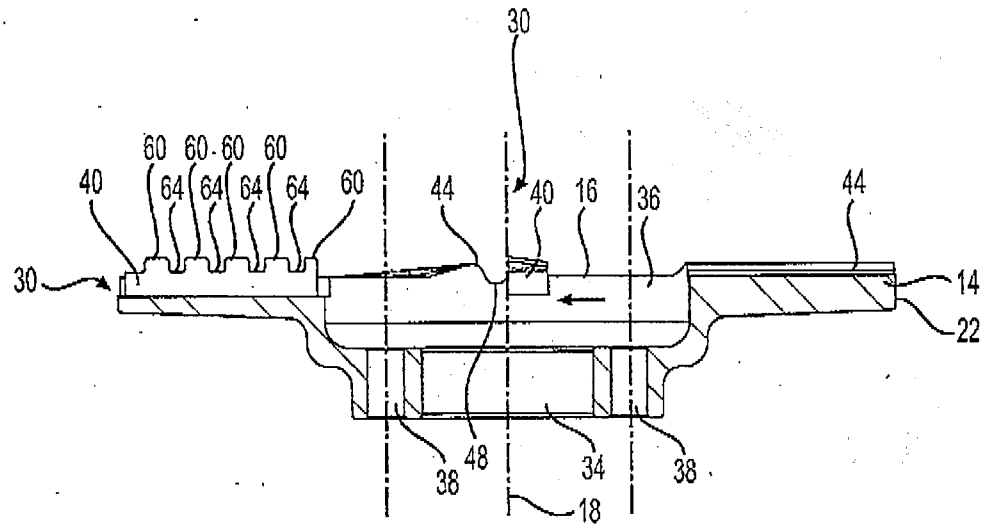

FIG. 5

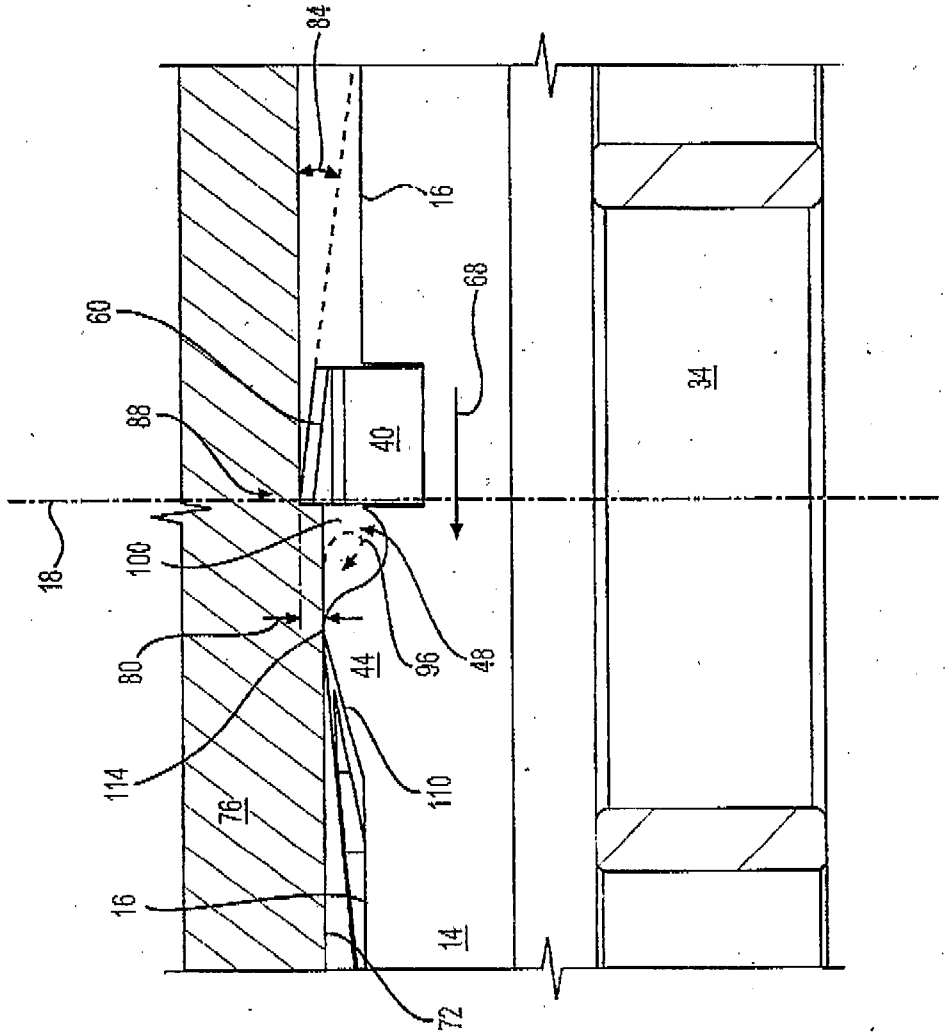

FIG. 6

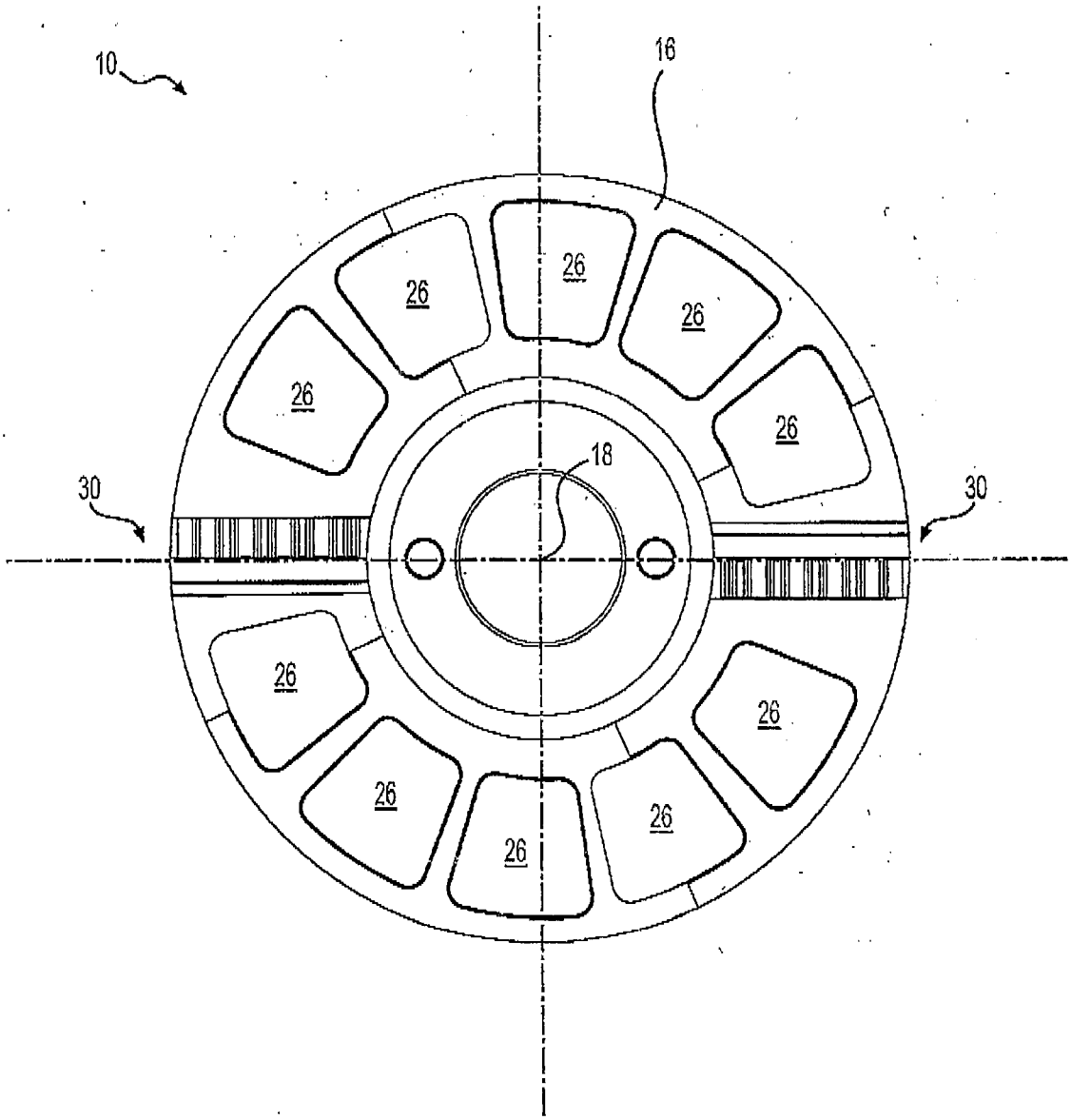

FIG. 7

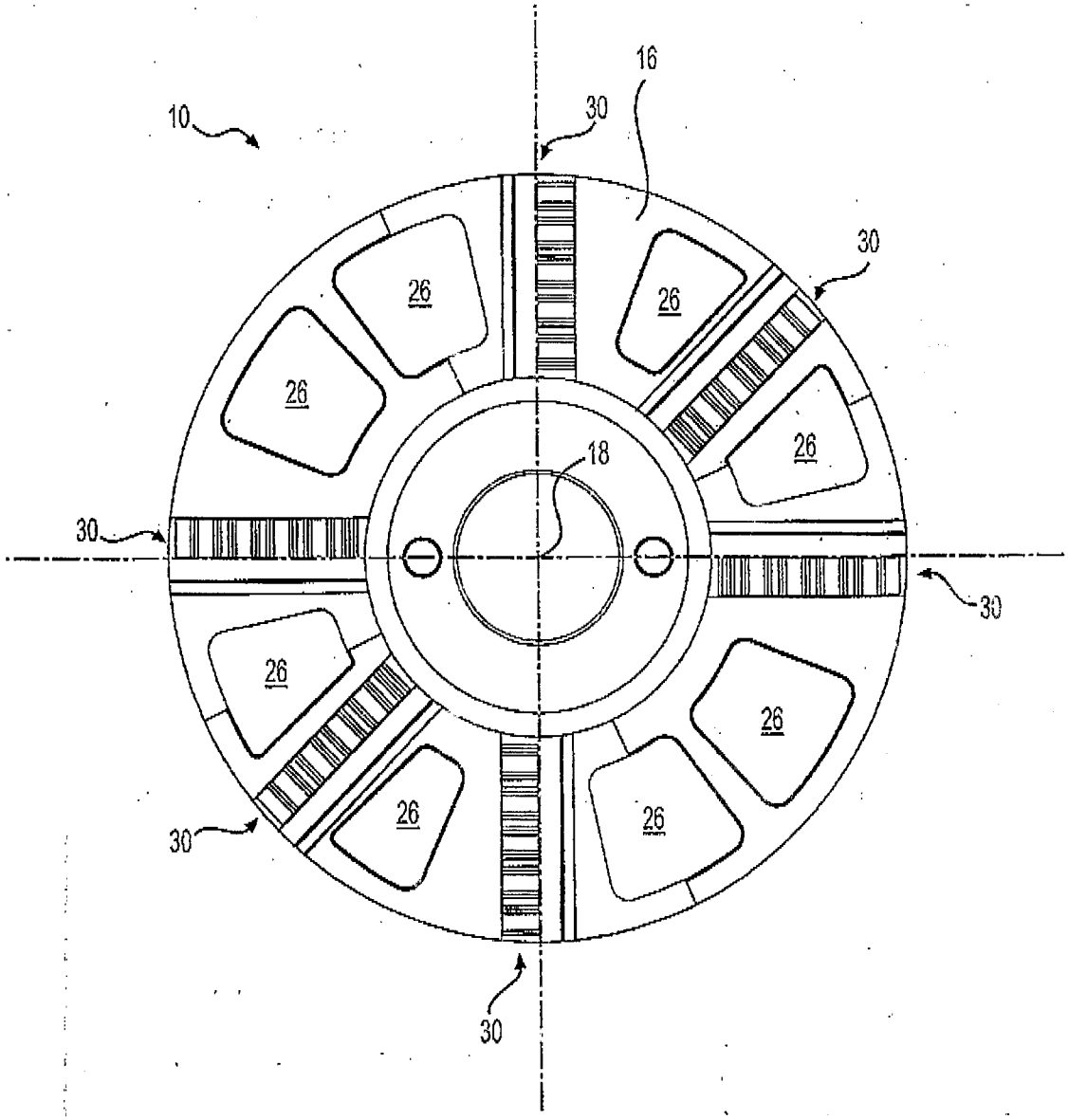

FIG. 8

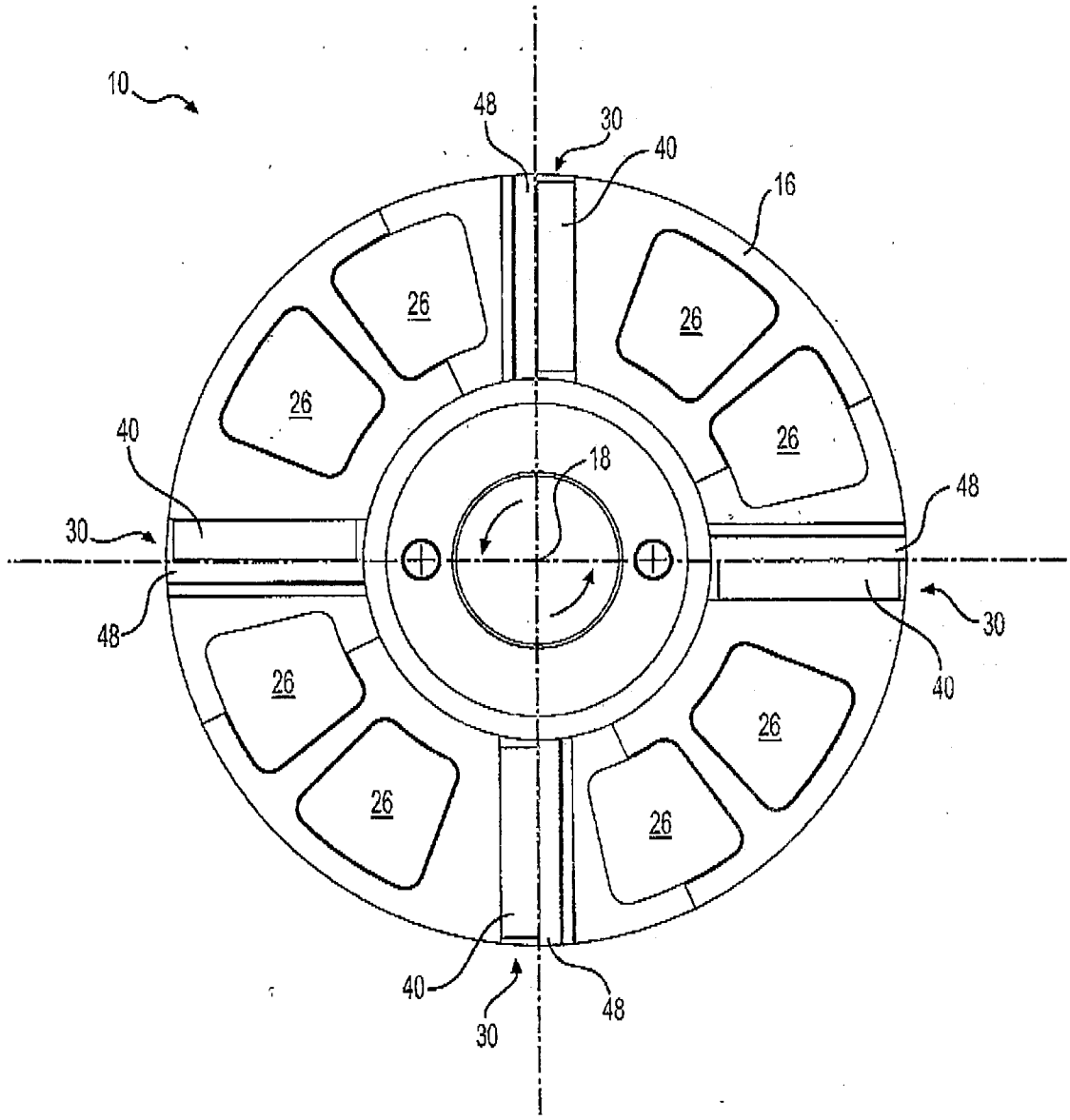

FIG. 9

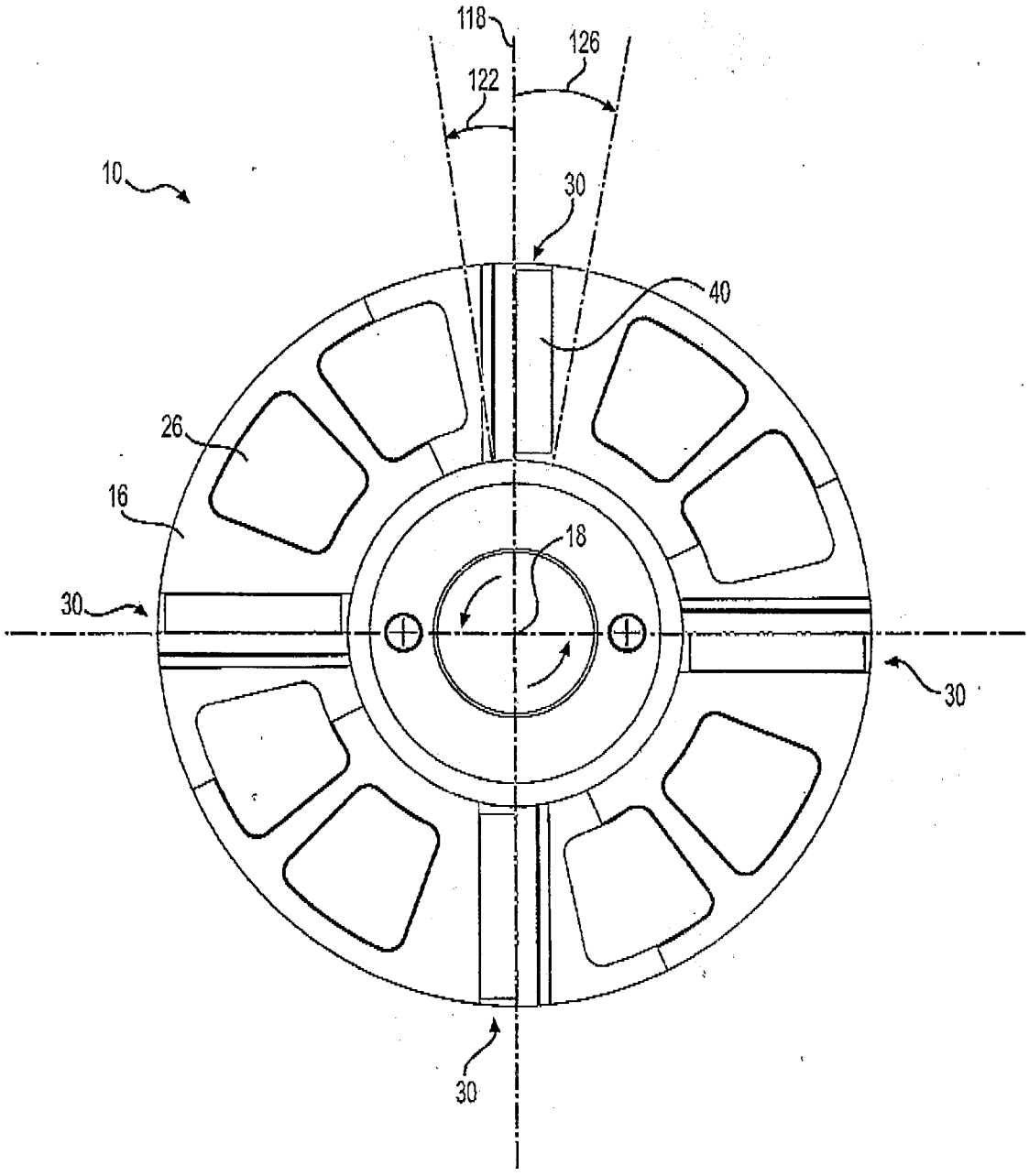

FIG. 10

FIG. 11A

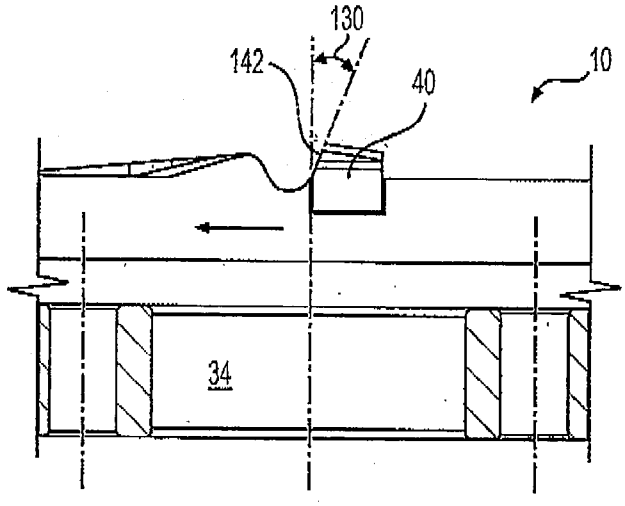

FIG. 11B

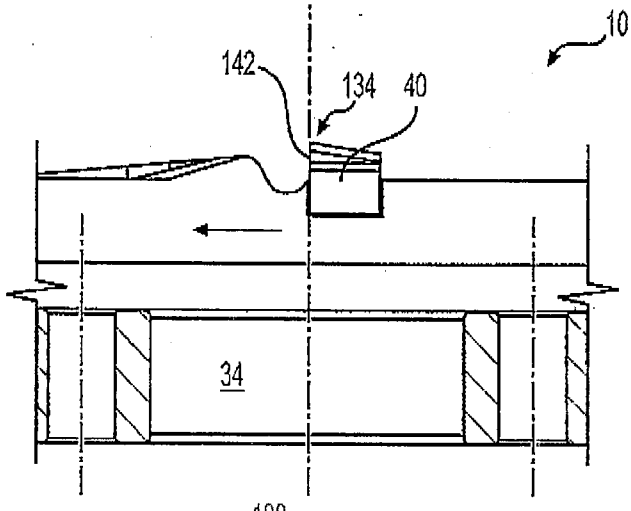

FIG. 11C