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CA 2960508 A1 2018/09/08

(21) 2 960 508

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(22) Date de dépôt/Filing Date: 2017/03/08

(41) Mise à la disp. pub./Open to Public Insp.: 2018/09/08

(51) Cl.Int./Int.Cl. *F23L 13/04* (2006.01), *F23L 3/00* (2006.01), *F23M 9/02* (2006.01)

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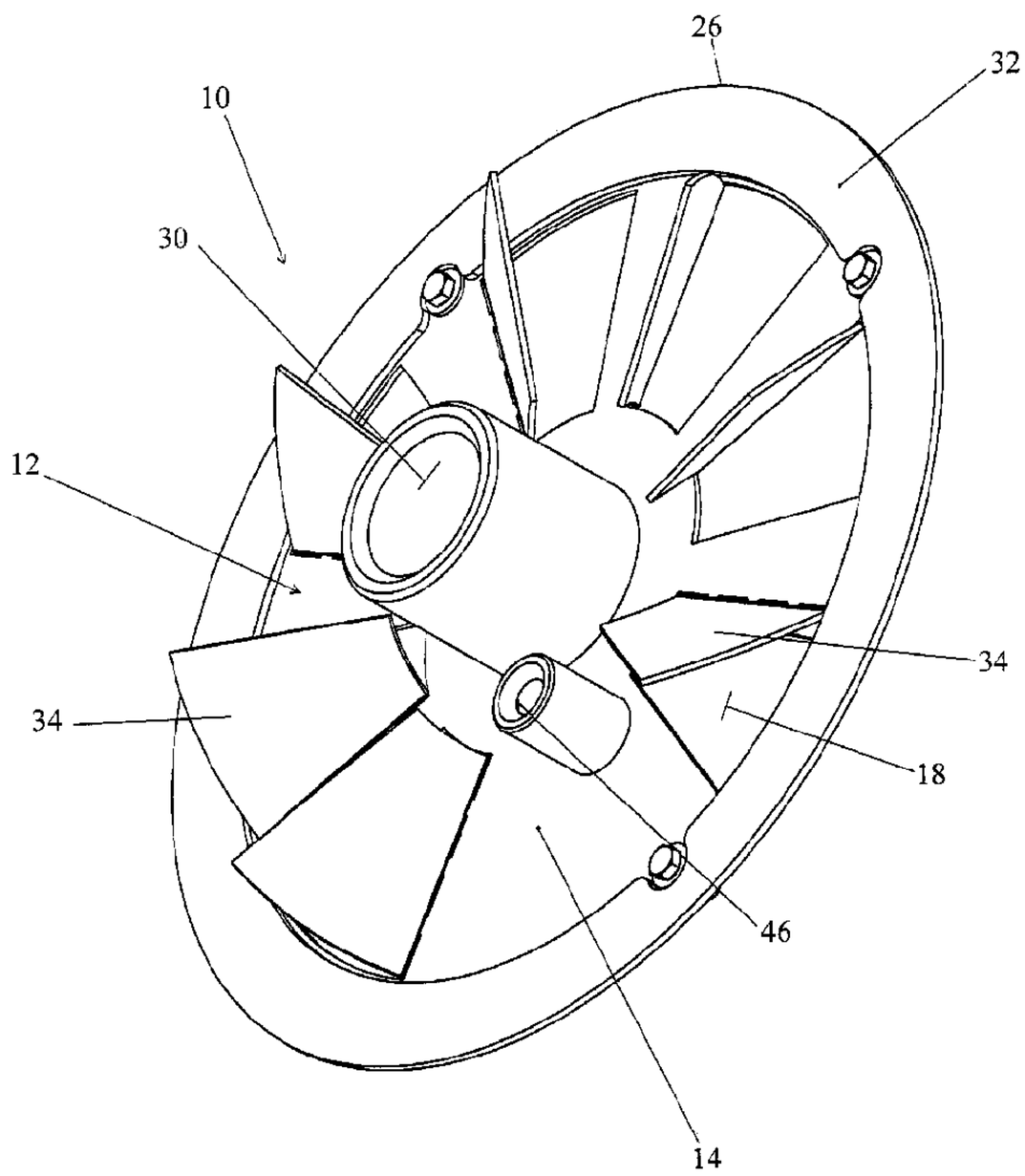
(54) Titre : REGISTRE D'AIR DESTINE A UN TUBE DE FUMEE
(54) Title: AIR DAMPER FOR A FIRE TUBE



(57) Abrégé/Abstract:
An air damper for a fire tube includes an air damper body with a fixed plate having a plurality of air flow openings and a rotatable plate having a plurality of air flow openings. The air damper body has an air inlet face, an air outlet face, and an outer circumference. A central burner passage is provided through the air damper body. This central burner passage is adapted to receive a burner body. A deformable circumferential seal is provided around the outer circumference of the air damper body. This circumferential seal is adapted to engage an inner circumference of a fire tube solely by friction.

ABSTRACT OF THE DISCLOSURE

An air damper for a fire tube includes an air damper body with a fixed plate having a plurality of air flow openings and a rotatable plate having a plurality of air flow openings. The air damper body has an air inlet face, an air outlet face, and an outer circumference. A central burner passage is provided through the air damper body. This central burner passage is adapted to receive a burner body. A deformable circumferential seal is provided around the outer circumference of the air damper body. This circumferential seal is adapted to engage an inner circumference of a fire tube solely by friction.

TITLE

[0001] Air Damper For A Fire Tube

FIELD

[0002] There is described an air damper which controls combustion air to a burner positioned in a fire tube.

BACKGROUND

[0003] United States Patent 4,702,692 (Burns et al) entitled "Air Reduction Controls for Oil-Treating Vessels", describes an air damper that has become a standard in the oil industry. This air damper consists of a fixed plate having a plurality of air flow openings and a rotatable plate having a plurality of air flow openings. By rotating the rotatable plate, the air flow openings in the rotatable plate can either be brought into register with the air flow openings in the fixed plate or the air flow openings in the fixed plate can be at least partially blocked by the rotatable plate. The air damper of Burns et al was welded in a duct that extended radially from a fire tube.

SUMMARY

[0004] There is provided an air damper for a fire tube which includes an air damper body with a fixed plate having a plurality of air flow openings and a rotatable plate having a plurality of air flow openings. The air damper body has an air inlet face, an air outlet face, and an outer circumference. A central burner passage is provided through the air damper body. This central burner passage is adapted to receive a burner body. A deformable circumferential seal is provided around the outer circumference of the air damper body. This circumferential seal is adapted to engage an inner circumference of a fire tube solely by friction.

[0005] As will hereinafter be further described, the use of circumferential seal has a dramatic beneficial effect on performance, when compared to the same assembly without a circumferential seal.

[0006] It is preferred that the rotatable plate is positioned at the inlet face of the air

damper body and the fixed plate is positioned at the outlet face of the air damper body. With this configuration, the rotatable plate is more readily accessed for the purpose of making adjustments.

[0007] It is preferred that the outlet face of the air damper body has outwardly projecting air deflectors overlying the air flow openings of the fixed plate. This configuration imparts a helical flow to air flowing through the air damper body.

[0008] It is preferred that a handle is provided on the rotatable plate. This enables a manual force to be exerted via the handle to rotate the rotatable plate thereby adjusting the position of the air flow openings of the rotatable plate relative to the air flow openings of the fixed plate.

[0009] It is preferred that an ignitor passage extend through the air damper body in parallel spaced relation to the central burner passage. This configuration enables an ignitor to be positioned to ignite combustion gas flowing through the burner body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] These and other features will become more apparent from the following description in which reference is made to the appended drawings, the drawings are for the purpose of illustration only and are not intended to be in any way limiting, wherein:

[0011] FIG. 1 is a front elevation view of an air damper for a fire tube.

[0012] FIG. 2 is a front perspective view of the air damper illustrated in FIG. 1.

[0013] FIG. 3 is a rear elevation view of the air damper illustrated in FIG. 1.

[0014] FIG. 4 is a rear perspective view of the air damper illustrated in FIG. 1.

[0015] FIG. 5 is a top plan view of the air damper illustrated in FIG. 1.

[0016] FIG 6 is a rear perspective view of the air damper illustrated in FIG. 1, positioned in a fire tube.

[0017] FIG. 7 is a front perspective view of the air damper illustrated in FIG. 1, positioned in a fire tube.

[0018] FIG. 8 is a side elevation view, in section, of the air damper illustrated in FIG. 1, positioned in a fire tube.

[0019] FIG. 9 is a detailed side elevation view, in section, of the air damper illustrated in FIG. 1 positioned in a fire tube.

DETAILED DESCRIPTION

[0020] An air damper, generally identified by reference numeral 10, will now be described with reference to FIG. 1 through FIG. 9.

Structure and Relationship of Parts:

[0021] Referring to FIG. 5, air damper 10 includes an air damper body 12 with a fixed plate 14 and a rotatable plate 16. Referring to FIG. 1 and FIG. 2 fixed plate 14 has a plurality of air flow openings 18. Referring to FIG. 3 and FIG. 4, rotatable plate 16 also has a plurality of air flow openings 20. Referring to FIG. 5, air damper body 12 has an air inlet face 22, an air outlet face 24, and an outer circumference 26. Air, indicated by arrows 28, enters air damper body 12 through air inlet face 22 and exits air damper body 12 through air outlet face 24. Referring to FIG. 2, FIG. 4 and FIG. 5, a central burner passage 30 is provided through air damper body 12. Referring to FIG. 8, central burner passage 30 is adapted to receive a burner body 100, as will hereinafter be further described. Referring to FIG. 1 through FIG. 4, a circumferential seal 32 is provided around outer circumference 26 of air damper body 12. Referring to FIG. 8, circumferential seal 32 is adapted to engage an inner circumference 102 of a fire tube 104 solely by friction.

[0022] Referring to FIG. 2, FIG. 4 and FIG. 5, it is preferred that rotatable plate 16 is positioned at inlet face 22 of air damper body 12 and that fixed plate 14 is positioned at outlet face 24 of air damper body 12. With this configuration, the rotatable plate is more readily accessed for the purpose of making adjustments.

[0023] Referring to FIG. 2 and FIG. 5, it is preferred that outlet face 24 of air damper body 12 has outwardly projecting air deflectors 34 overlying air flow openings 18 of fixed plate 14. This configuration imparts a helical flow to air flowing through air damper body 12.

[0024] Referring to FIG. 4 and FIG. 5, it is preferred that a handle 36 is provided on rotatable plate 16. This enables a manual force to be exerted via handle 36 to rotate rotatable

plate 16 thereby adjusting the position of air flow openings 20 of rotatable plate 16 relative to air flow openings 18 of fixed plate 14.

[0025] Referring to FIG. 4 and FIG. 5, in order to prevent air flow from circumventing air damper body 12, fixed plate 14 and rotatable plate 16 are loosely clamped together. The term "loosely is used, as the mode of clamping must not impede rotation of rotatable plate 16. The mode of clamping illustrated are nuts 40 and bolts 42. Bolts 42 extend through fixed plate 14. However, to facilitate rotation of rotatable plate 16, bolts 42 extend through slots 44 in rotatable plate 16.

[0026] Referring to FIG. 2, FIG. 4 and FIG. 5, It is preferred that an ignitor passage 46 extend through air damper body 12 in parallel spaced relation to central burner passage 30. This configuration enables an ignitor 106 to be positioned to ignite combustion gas flowing through burner body 100.

Operation:

[0027] Referring to FIG. 6 through FIG. 8, burner body 100 has a nozzle end 108 and a fuel gas source attachment end 110. In preparation for installation, burner body 100 is inserted into central burner passage 30 of air damper body 12 with nozzle end 108 protruding passed air outlet face 24 of air damper body 12 and fuel gas source attachment end 110 protruding passed air inlet face 22 of air damper body 12. Air damper 12 is then inserted into fire tube 104. When air damper 12 is inserted into fire tube 104, circumferential seal 32 engages inner circumference 102 of fire tube 104 solely by friction. Referring to FIG. 9, it can be seen that circumferential seal 32 deforms to create an air seal. Beneficial results have been obtained when circumferential seal 32 is made of a flexible, high temperature rated material, such as silicone. Referring to FIG. 8, either before or after insertion of air damper body 12 into fire tube 104 ignitor 106 extended through ignitor passage 46 and positioned relative to nozzle end 108 to ignite combustion gas flowing through burner body 100 to nozzle end 108.

[0028] Tests were conducted to determine the relative efficiency of air damper 10, with and without circumferential seal 32. It was determined that air damper 10 with circumferential seal 32 outperformed air damper 10 without circumferential seal 32. The increase in efficiency depended upon the turn down rate of the combustion system. For example, when the combustion system firing rate was reduced to 40% of the maximum possible firing rate and rotatable plate 14 was rotated relative to fixed plate 14 to reduce the air flow through air damper body 12 to 40% of capacity (60% turn down), air damper 10 with circumferential seal 32 transferred up to 43% more heat into the process for the same quantity of gas consumed, as compared to combustion assemblies having air dampers without circumferential seal 32.

[0029] The gap about the periphery of the damper had never previously been considered a problem, because the air damper was never used to completely shut off the flow of air anyway. A peripheral seal was added, forcing all the air flow to pass through the damper. The effect on efficiency was then measured. Marginal increases in efficiency were measured at lower turn down rates. However, as the turn down rates became higher, unexpected increases in efficiency were measured. As set forth above, with a 60% turn down rate, up to 43% more heat is transferred.

[0030] In this patent document, the word "comprising" is used in its non-limiting sense to mean that items following the word are included, but items not specifically mentioned are not excluded. A reference to an element by the indefinite article "a" does not exclude the possibility that more than one of the element is present, unless the context clearly requires that there be one and only one of the elements.

[0031] The scope of the claims should not be limited by the illustrated embodiments set forth as examples, but should be given the broadest interpretation consistent with a purposive construction of the claims in view of the description as a whole.

What is Claimed is:

1. An air damper for a fire tube, comprising:

an air damper body comprising a fixed plate having a plurality of air flow openings and a rotatable plate having a plurality of air flow openings, the air damper body having an air inlet face, an air outlet face, and an outer circumference;

a central burner passage through the air damper body, the central burner passage being adapted to receive a burner body; and

a deformable circumferential seal around the outer circumference of the air damper body, the circumferential seal being adapted to engage an inner circumference of a fire tube solely by friction.

2. The air damper of Claim 1, wherein the rotatable plate is positioned at the inlet face of the air damper body and the fixed plate is positioned at the outlet face of the air damper body.

3. The air damper of Claim 2, wherein the outlet face of the air damper body has outwardly projecting air deflectors overlying the air flow openings of the fixed plate.

4. The air damper of Claim 2, wherein a handle is provided on the rotatable plate, whereby a manual force is exerted via the handle to rotate the rotatable plate thereby adjusting the position of the air flow openings of the rotatable plate relative to the air flow openings of the fixed plate.

5. The air damper of Claim 1, wherein an ignitor passage extends through the air damper body in parallel spaced relation to the central burner passage.

6. The air damper of Claim 1, in combination with a burner body, the burner body being positioned within the central burner passage of the air damper body, the burner body having a nozzle end protruding passed the air outlet face of the air damper body and a

fuel gas source attachment end protruding passed the air inlet face of the air damper body.

7. The air damper of Claim 6, in combination with a fire tube.

8. An air damper for a fire tube having an inner circumference and a burner body disposed therein, the air damper comprising:

an air damper body comprising:

a central burner passage adapted to receive the burner body;

a peripheral seal adapted to engage the inner circumference of the fire tube; and

a plurality of air flow openings disposed about the central burner passage with the size of the air flow openings adjustable;

wherein, in use, air flow between the central burner passage and the burner body is impeded, air flow between the peripheral seal and the inner circumference of the fire tube is impeded, and air flow through the air flow openings is user adjustable.

FIG 1

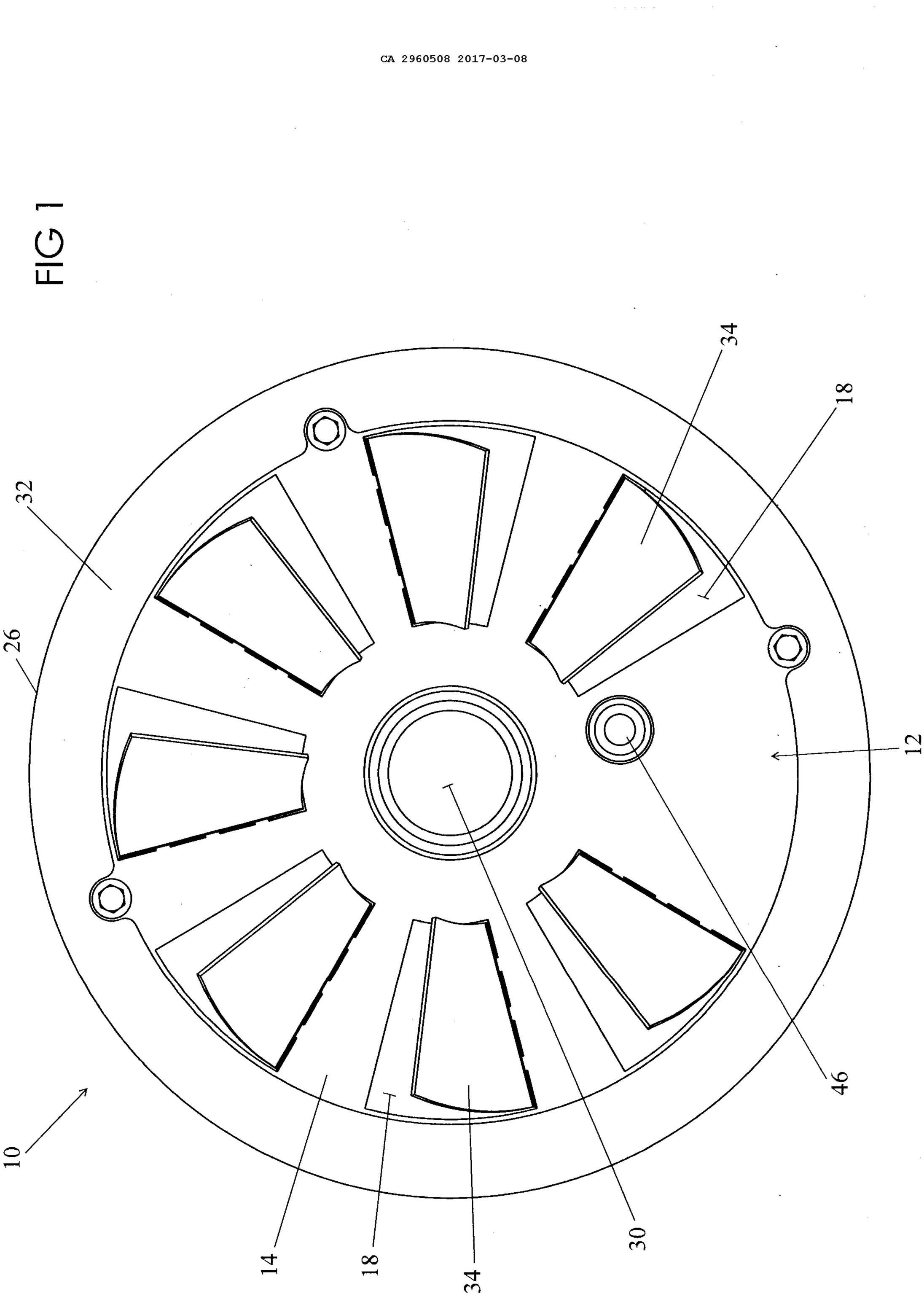


FIG 2

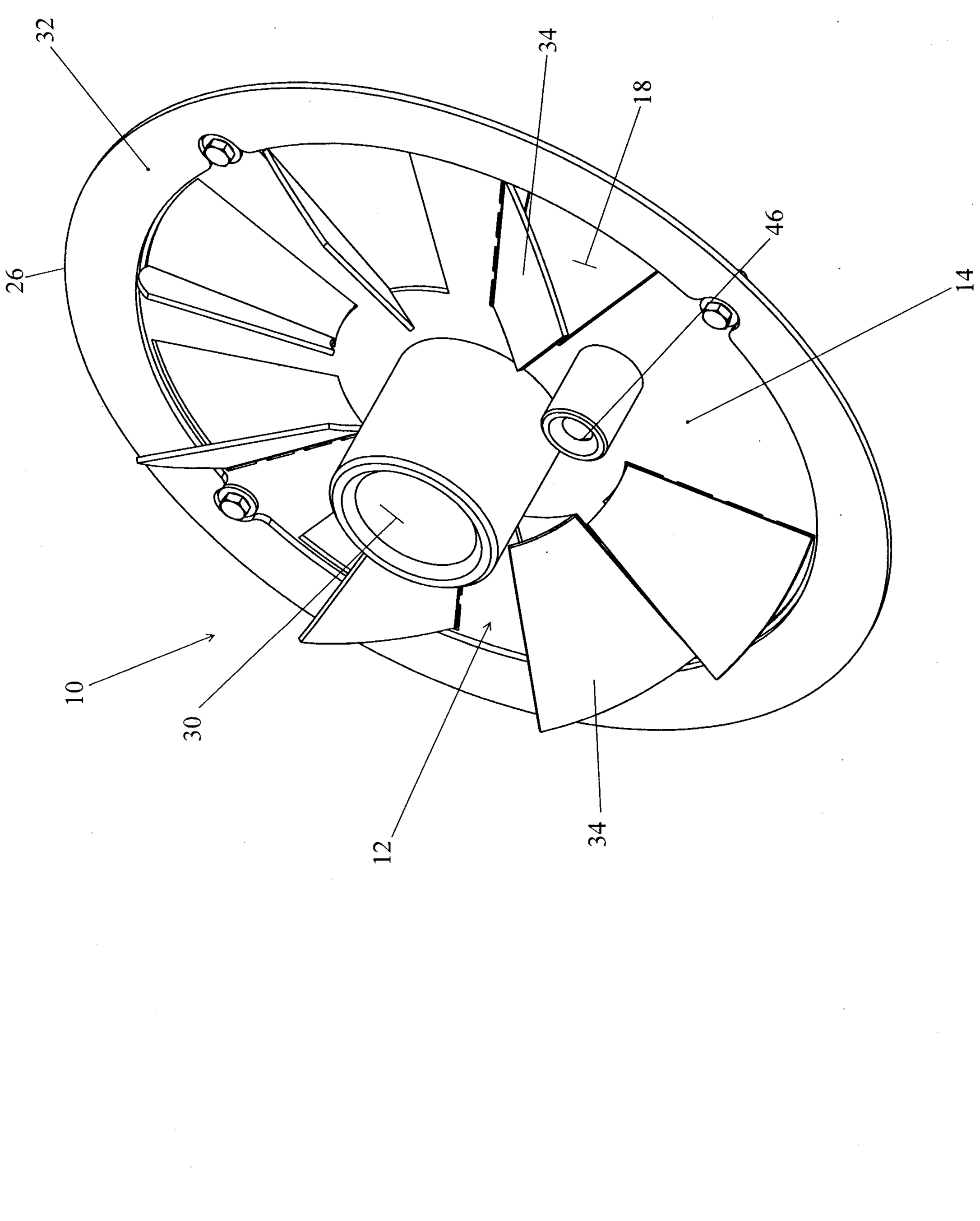


FIG 3

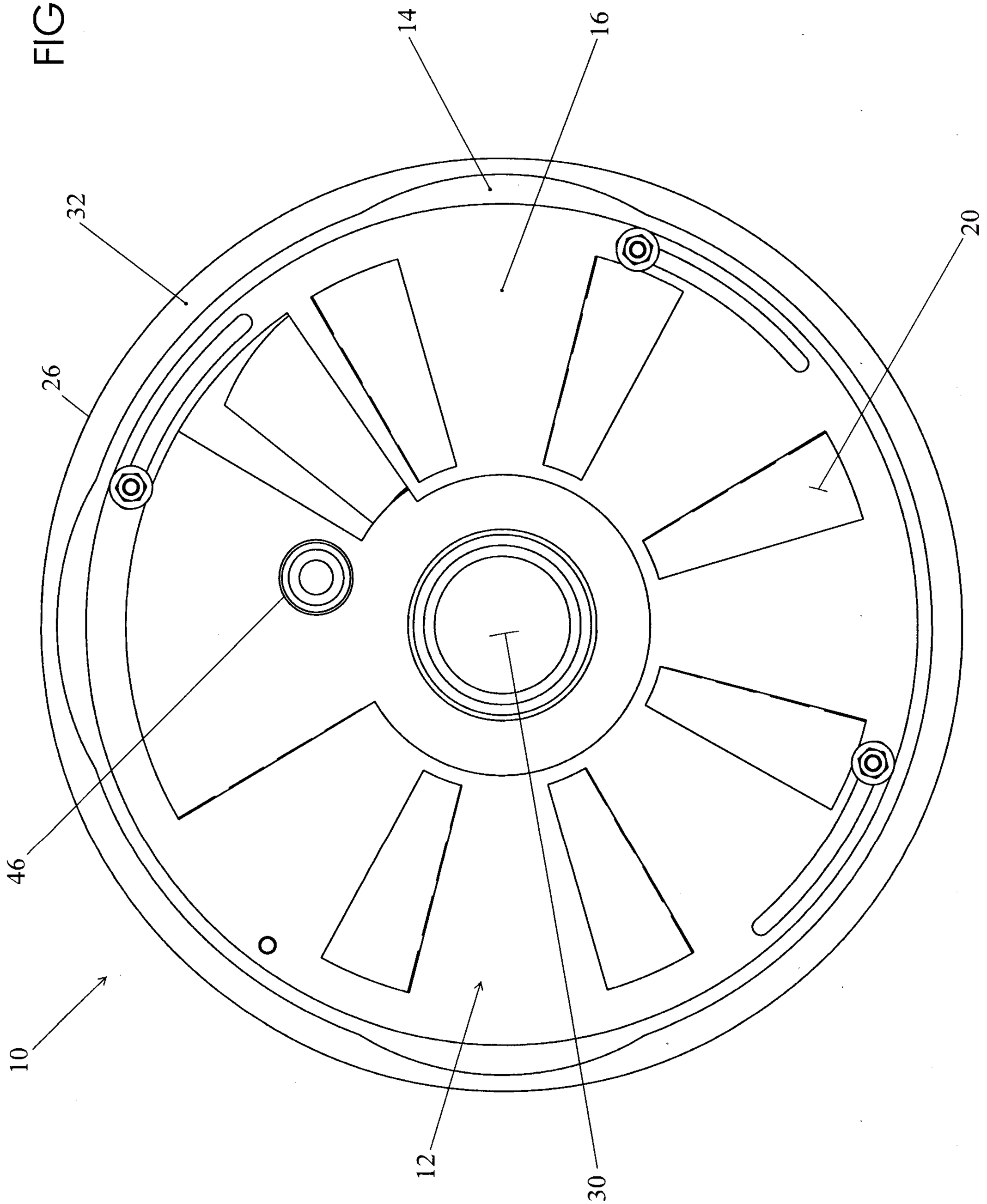
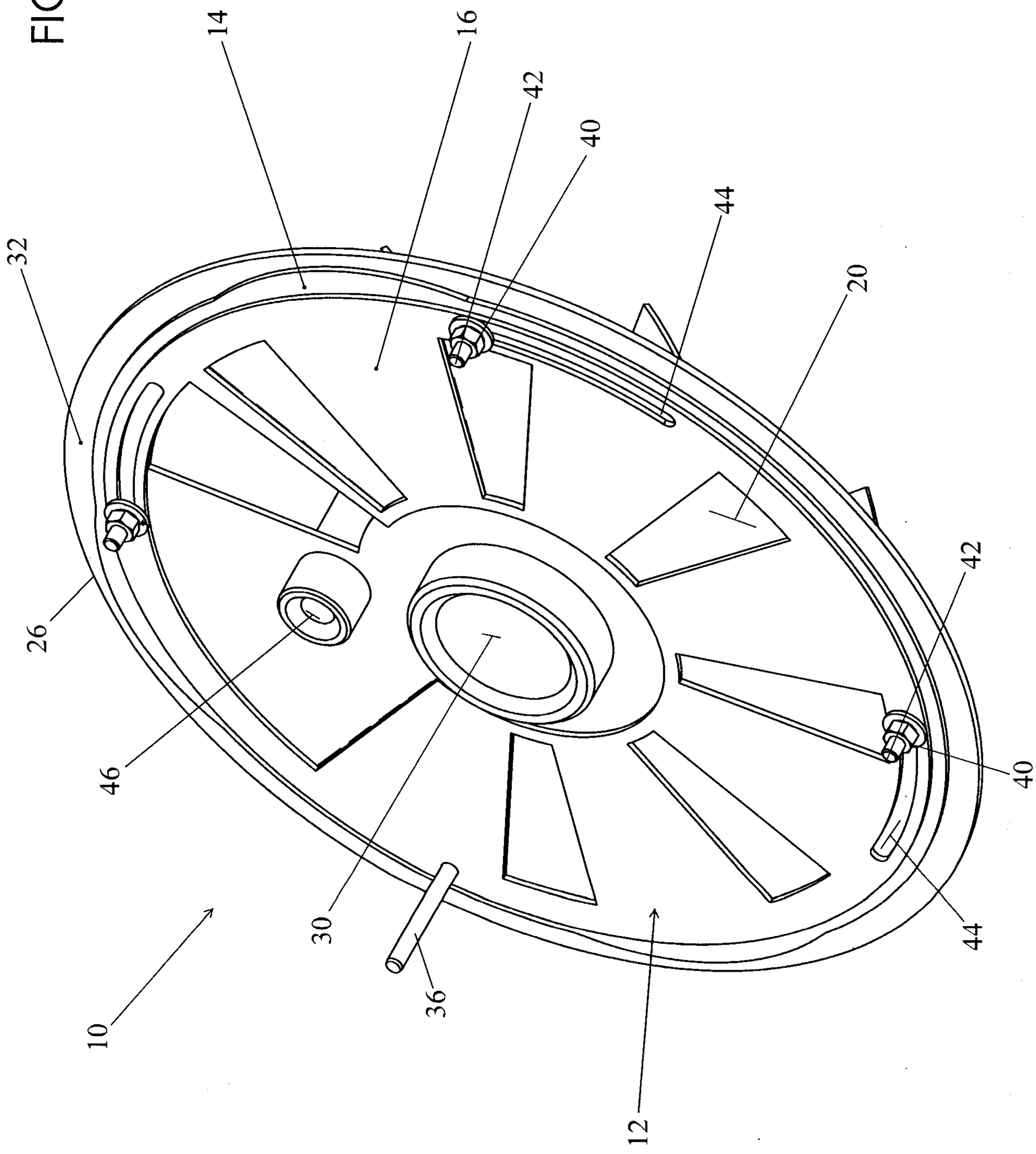


FIG 4



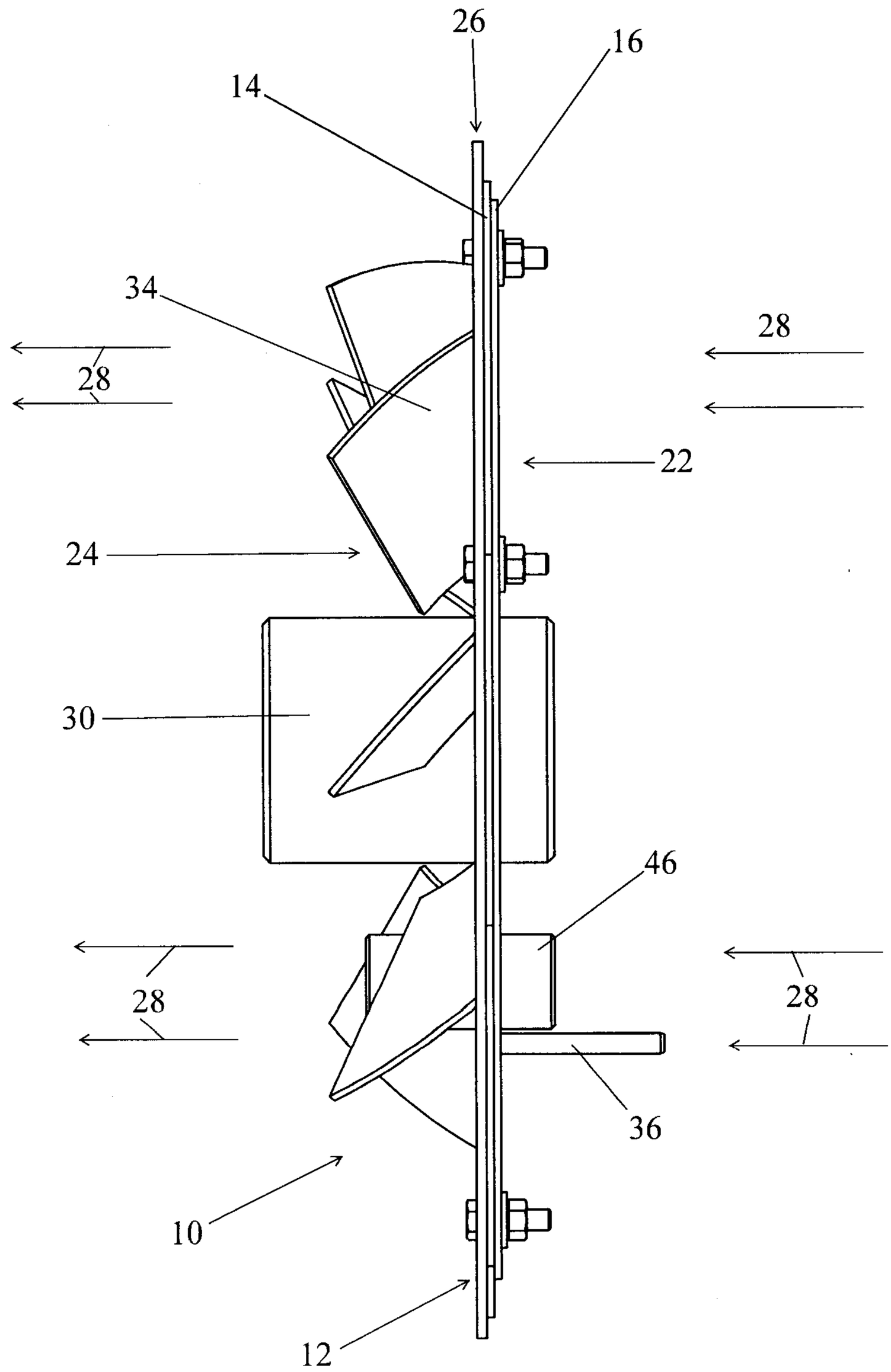


FIG 5

FIG 6

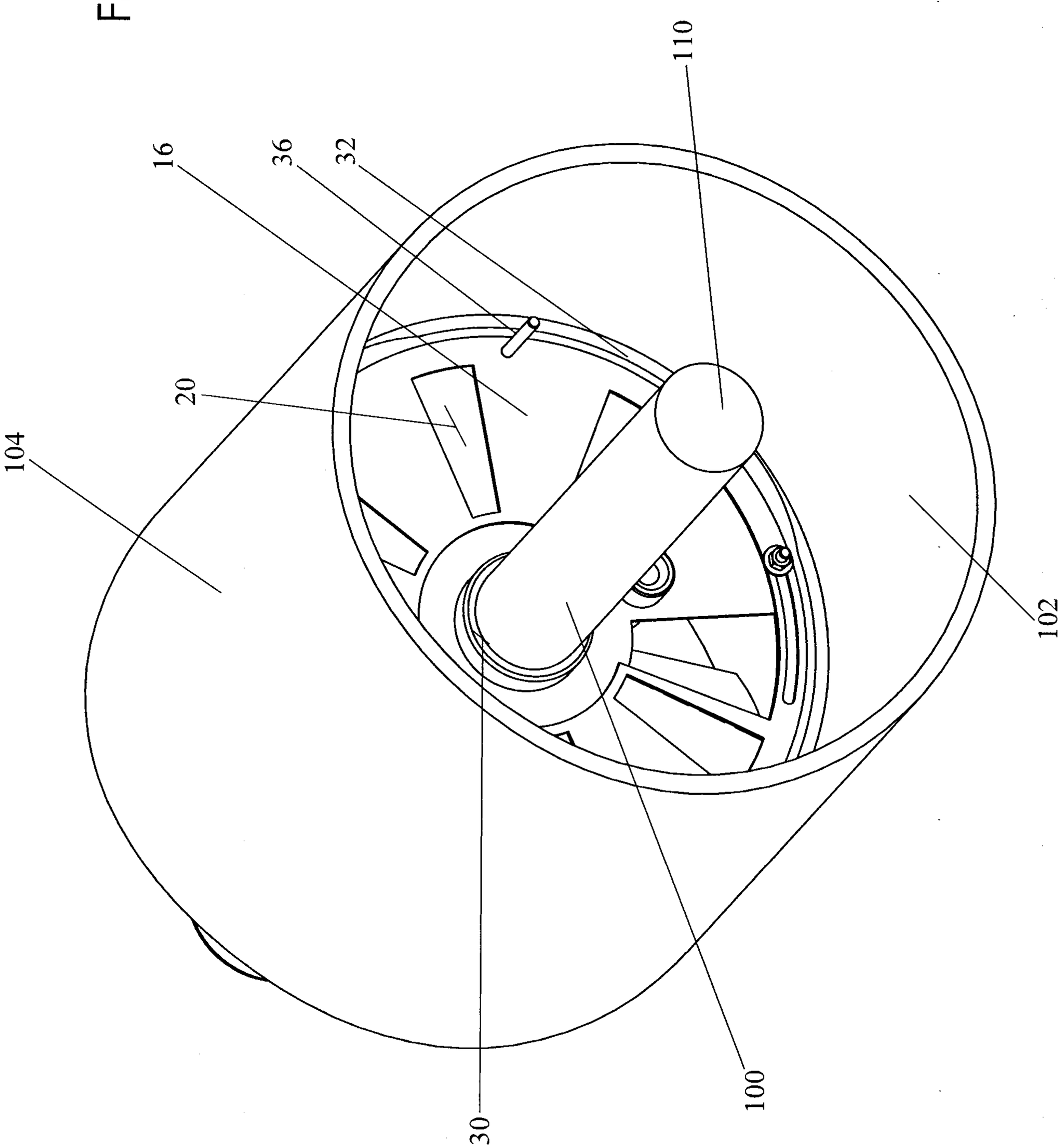
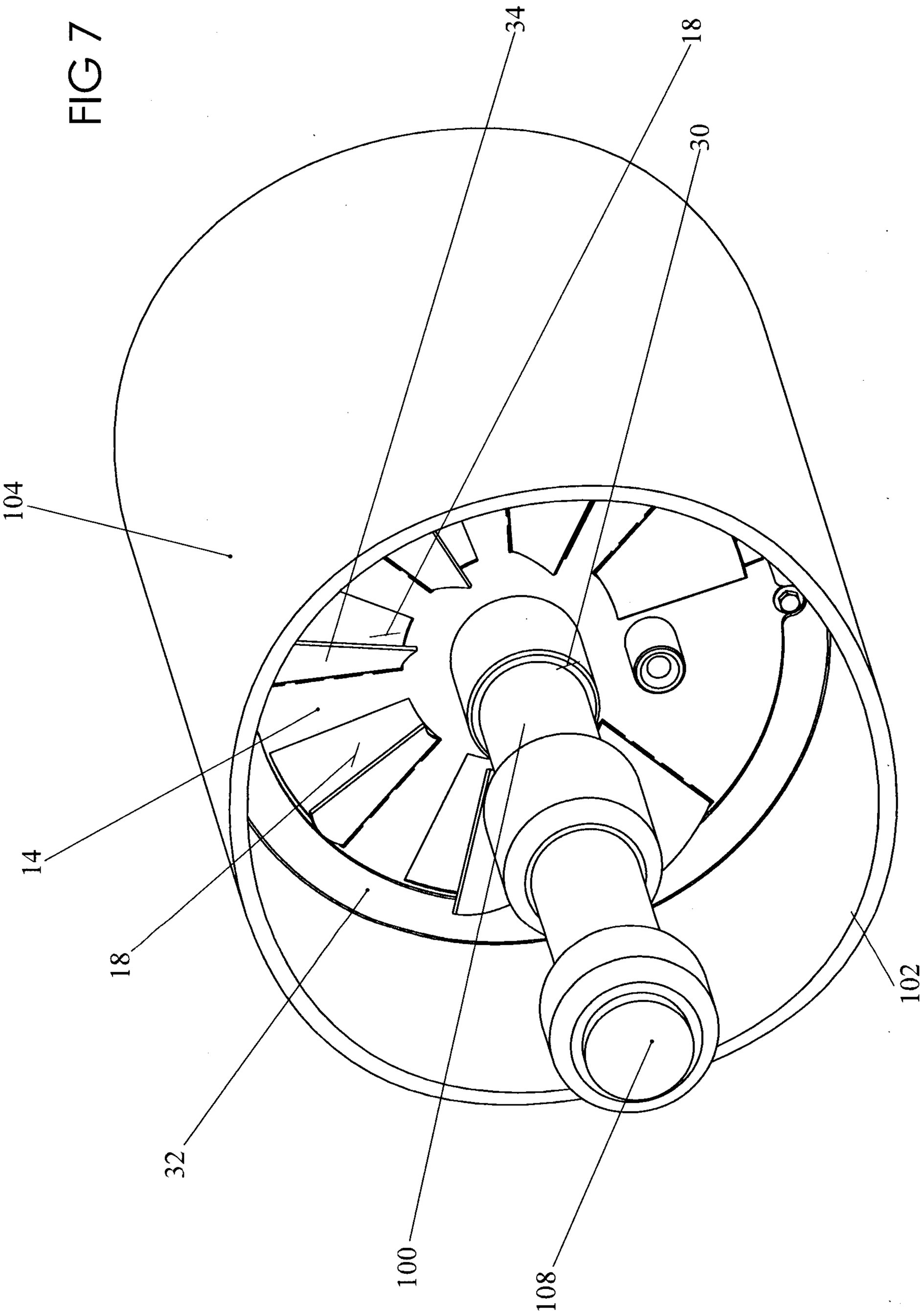


FIG 7



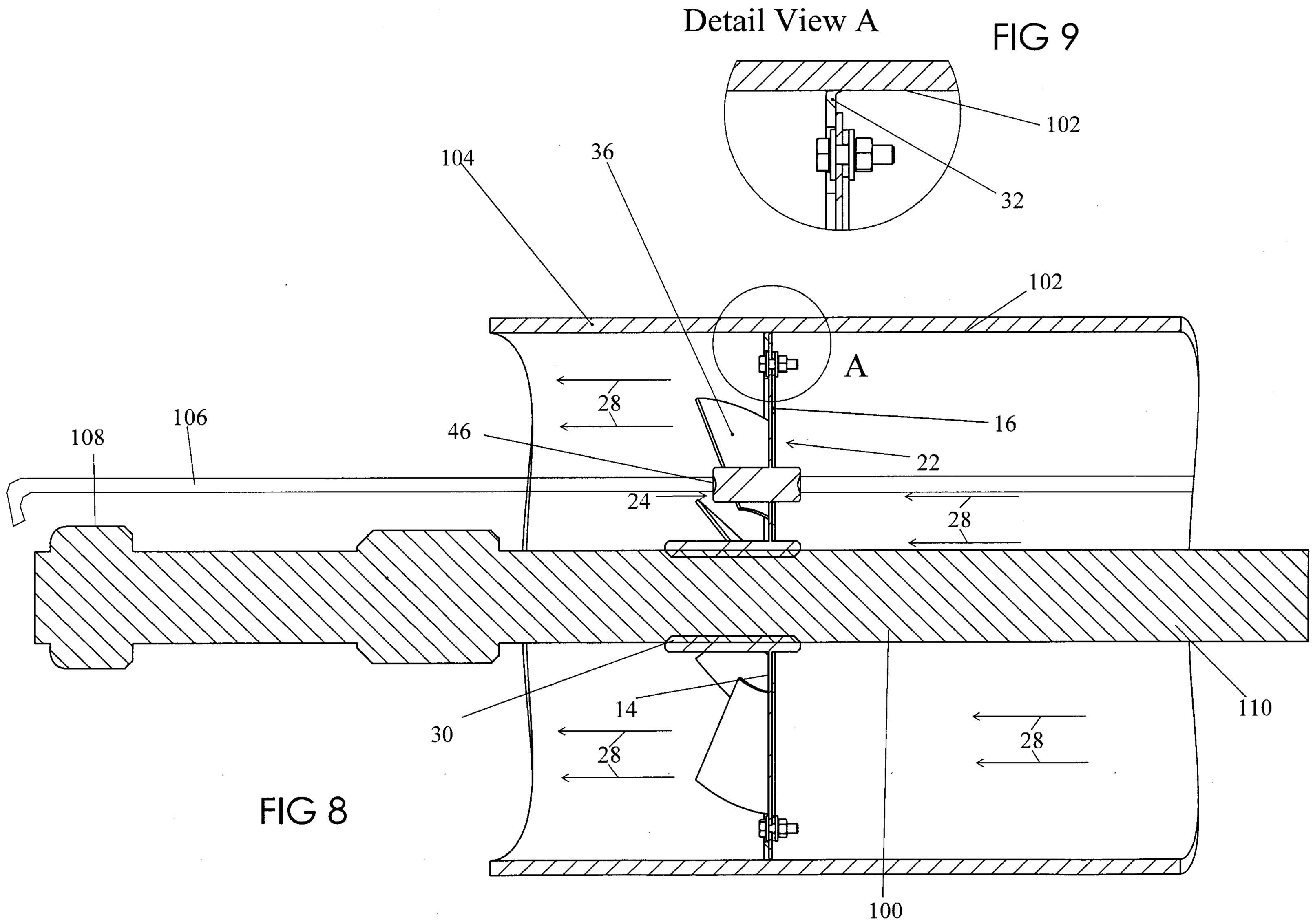
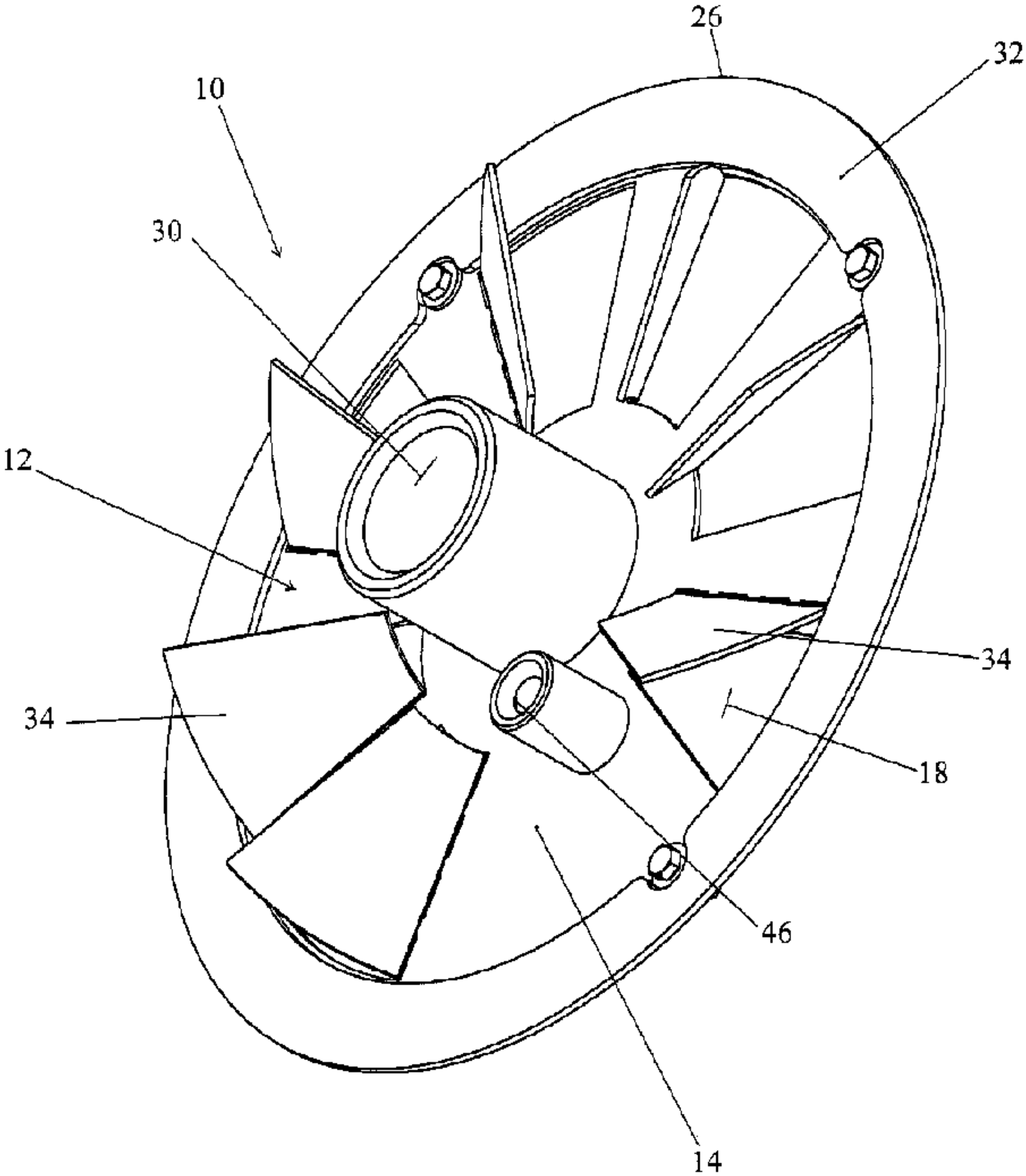


FIG 9

FIG 8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