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(71) Applicant: Geurtsen, Gerhardus Joseph  
Alouisius  
7391 MB Twello (NL)

(72) Inventor: Geurtsen, Gerhardus Joseph Alouisius  
7391 MB Twello (NL)

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(54) Heat source, container provided with such a heat source and motor vehicle, provided with such a container and heat source

(57) The invention relates to a heat source (1), for converting mechanical energy, generated by a motor vehicle, into warm air that may be used for keeping

warm food products, stored in a container. The heat source consists of a liquid filled vessel (2), an operationally driven stirrer (5) placed inside the vessel (2), a heat exchanger (6) and an operationally driven ventilator (7).

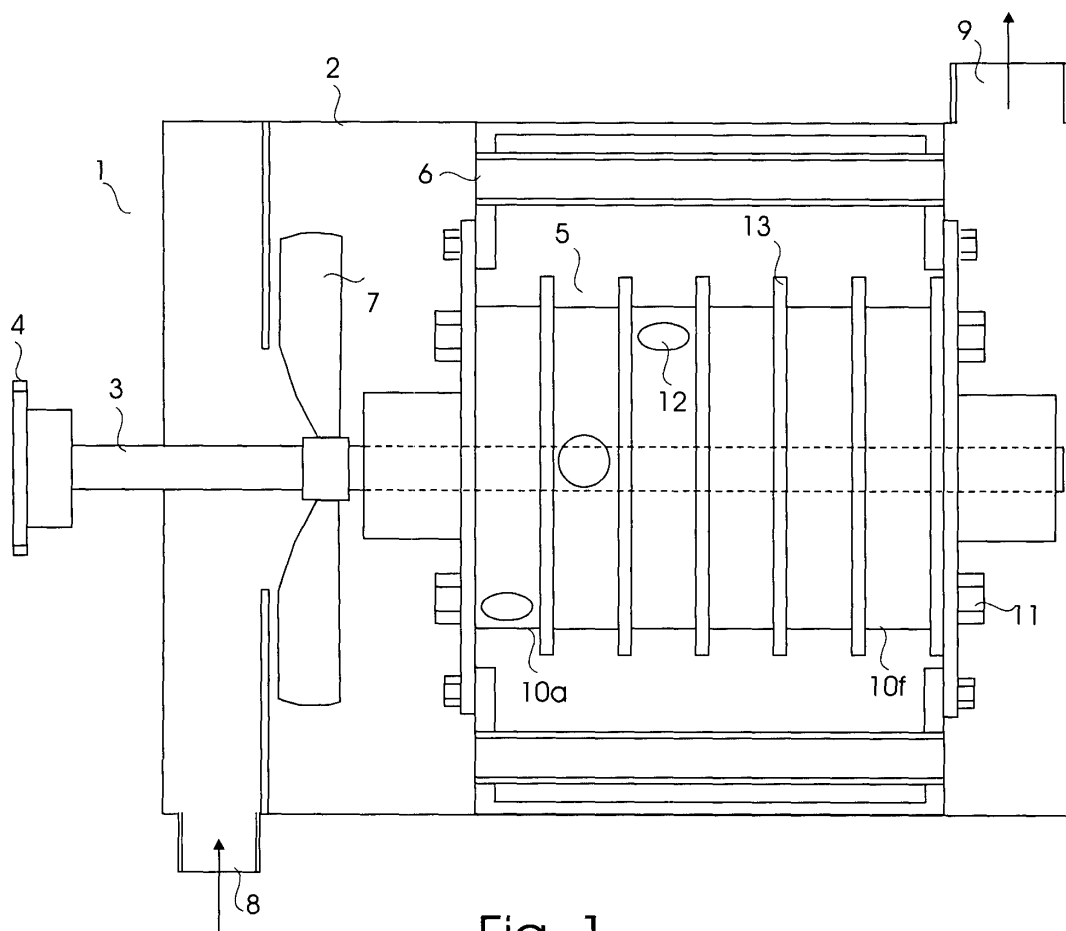


Fig. 1

## Description

**[0001]** The invention relates to a heat source, for converting mechanical energy into heat and more in particular into a flow of warm air. A heat source of this kind is not immediately obvious, as mechanical energy is in fact more valuable than heat in general and warm air in particular. Nevertheless the heat source according to the invention solves a very specific problem, in particular keeping warm food products which are produced on a central point and which are subsequently delivered with the aid of motor vehicles and more in particular with mopeds or scooters, like for example pizza's. In order to keep a pizza in an optimal condition up to the moment of delivery, it is necessary to place it in transit in a flow of dry air having a temperature of about eighty degrees celsius. This means that a capacity of about 500 watts is needed. Such a capacity may in principle be generated electrically or one may generate the necessary heat with the aid of a burner. The heat source according to the invention uses available and often surplus motor power of the motor vehicle with the aid of which the food is delivered.

**[0002]** A compact embodiment of the invention which may be realised in an easy manner is characterised in that the heat source consists of a vessel filled with a liquid, a stirrer placed in the vessel, arranged to be connected to drive means, a heat exchanger and a ventilator arranged to be connected to drive means.

**[0003]** A further favourable embodiment which needs little maintenance is characterised in that the liquid is oil. An additional advantage is that oil is available in different viscosities, which means that the characteristics of an existing stirrer may easily be adapted to an existing power source by selecting oil with a suitable viscosity.

**[0004]** A further favourable embodiment is characterised in that the vessel is at least substantially cylindrically shaped and that the stirrer comprises a number of disc-shaped rotors, mounted on a shaft which at least substantially coincides with a main axis of the vessel and which may rotate inside cylindrically shaped cavities. In order to increase the interaction between the rotors and the oil, each disc-shaped rotor is preferably provided with at least one sealing strip, mounted in the disc-shaped rotor, for obtaining a seal between the rotor and the corresponding cylindrically shaped cavity, while successive cylindrically shaped cavities are preferably separated by partitions. The stirrer now much resembles a pump, in the sense that the oil is circulated inside the cavities or inside the heat exchanger.

**[0005]** A favourable embodiment is according to another aspect of the invention characterised in that the disc-shaped rotors are placed eccentrically on the shaft or that the cylindrically shaped cavities are placed eccentrically round the shaft. The spaces sealed by the sealing strips will now become smaller and larger during rotation of the shaft, an effect which is counteracted by the non-compressible oil. This results in an enormous

increase of friction of the stirrer and in a corresponding heat generation, without a noticeable increase of wear.

**[0006]** A favourable embodiment with which a substantially constant frictional resistance may be obtained is according to another aspect of the invention characterised in that centres of the disc-shaped rotors or centres of the cylindrically shaped cavities are positioned on mutually different angles round the shaft.

**[0007]** A further favourable embodiment which enables a very compact construction of the heat source is characterised in that a wall of the vessel is provided with a number of ducts extending parallel to the main axis, and that the shaft is provided with a ventilator blade for supplying air to the ducts.

**[0008]** A further favourable embodiment which provides for a simple coupling to a power source is characterised in that an end of the shaft is provided with a gear wheel which may cooperate with a chain or a toothed belt.

**[0009]** A favourable alternative embodiment with which the characteristics of the heat source and the power source can be matched is characterised in that the shaft is provided with a transmission, provided with a gear wheel which may cooperate with a chain or a toothed belt.

**[0010]** The invention also relates to a container for transporting warm food products. The container is characterised in that it is provided with a heat source as disclosed in the previous paragraphs.

**[0011]** The invention also relates to a motor vehicle, provided with a container for transporting warm food products. The motor vehicle is characterised in that the container is provided with a heat source as disclosed in the previous paragraphs.

**[0012]** The invention will now be further explained with a reference to the following figures, in which:

- Fig. 1 represents a possible embodiment of a heat source according to the invention;
- Fig. 2 schematically represents an oil pump in a longitudinal cross section;
- Fig. 3A schematically represents a first embodiment of an oil pump in a transverse cross section;
- Fig. 3B schematically represents an alternative embodiment of an oil pump in a transverse cross section;
- Fig. 4 schematically represents an alternative embodiment of the invention;
- Fig. 5A schematically represents a container according to the invention for transporting food in side view;
- Fig. 5B schematically represents this embodiment in top view;
- Fig. 6 schematically represents a moped, provided with a container according to the invention.

**[0013]** Fig. 1 represents a possible embodiment of a heat source 1 according to the invention, consisting of

a cylindrically shaped vessel 2, through which a shaft 3 passes which may be driven via a gear wheel 4. In vessel 2, an oil pump 5 is mounted which is driven by shaft 3. Vessel 2 and oil pump 5 are filled with oil. In order to remove the heat generated by oil pump 5, vessel 2 is provided with ducts 6 and on shaft 3 a ventilator 7 is mounted which sucks in air via an inlet 8 and throws out heated air via an exit 9. Oil pump 5 consists in this embodiment of six segments 10a,...,10f which are kept together with the aid of tension rods 11. Each segment is provided with an eccentrically placed, cylindrically shaped cavity, in which a rotor, mounted onto shaft 3 may rotate. Each segment of oil pump 5 is provided with at least one opening 12, for making it possible to fill oil pump 5. Via the openings 12 also the oil outside oil pump 5 will be stirred sufficiently, so that a good heat transfer to ducts 6 will be obtained. In order to improve the heat emission of pump 5, each segment is preferably provided with a fin 13, as shown in the figure. If desired, each segment may be provided with an inlet and an outlet, as a result of which oil will be circulated outside the cavities and the heat transfer to ducts 6 may be further improved.

**[0014]** Fig. 2 schematically represents an oil pump 5 in a longitudinal cross section, with six segments 10a,...,10f which are kept together by tension rods 11. Each segment is provided with an eccentrically placed, cylindrically shaped cavity 14a,...,14f, in which rotors 15a,...,15f, mounted onto shaft 3 may rotate. Rotors 15a,...,15f are each provided with one or more sealing strips, not visible in the figure, which take along the oil. As in each segment the volumes separated by the sealing strips constantly increase or decrease and as oil is not compressible, the rotors experience a very large rotational friction and consequently much heat is generated, while the wear is not appreciable. As the friction of each segment strongly varies during one rotation, segments 10a,...,10f have been mounted preferably mutually rotated, as shown in the figure, in such a way that the friction couple will be more or less constant during one rotation.

**[0015]** Fig. 3A schematically represents a first embodiment of an oil pump 5 in a transverse cross section through segment 10a and rotor 15a in Fig. 2. In the figure it becomes clear that every sealing strip 16 is pushed against the inner wall of segment 10a with the aid of a spring 17, as a result of which the oil volume is split up in four subvolumes. When shaft 3 is rotated, the actual volume of each subvolume will periodically become larger and smaller.

**[0016]** With the subvolume becoming smaller, the oil will force its way out along the sides of rotor 15a and between the sealing strips 16 and the inner wall of segment 10a. As the segments have been mounted mutually rotated, an at least substantially constant friction couple is obtained in this way, while the oil film which is constantly present between the moving parts will substantially prevent the occurrence of wear. In each segment an opening 12 is made via which oil may flow into

and out of oil pump 5. For the actual functioning the openings 12 are of little importance, but they are necessary in order to be able to fill oil pump 5 completely with oil. In the figures moreover ducts 18 are shown, via which the tension rods 11 pass in a longitudinal direction through oil pump 5 and which keep it together. Obviously, the same effect may be obtained if the segments 10a,...,10f are each provided with a cavity which is concentrically placed round shaft 3 and with rotors 15a,...,15f which are eccentrically placed round shaft 3.

**[0017]** Fig. 3B schematically represents an alternative embodiment of an oil pump 5 in a transverse cross section through segment 10a and rotor 15a in Fig. 2. In this embodiment, the openings 12 are each replaced by an inlet opening 12a and an exit opening 12b. With a rotational direction as shown in the figure, oil will be sucked in via inlet opening 12a and it will leave the oil pump via exit opening 12b. The advantage is that in this way an oil flow will be maintained inside oil pump 5, thanks to which the heat transport towards ducts 6 will significantly improve. Moreover, air bubbles that might be present in the cavities will be removed by this pumping action. Exit opening 12b is preferably chosen smaller than inlet opening 12a, which will cause a pressure build-up which may further increase the friction couple.

**[0018]** Fig. 4 schematically represents an alternative embodiment of a heat source according to the invention, consisting of the actual heat source 1 as described with a reference to Fig. 1 and a transmission system 19, known as such, which is mounted between heat source 1 and gear wheel 4. With the aid of transmission system 19 the number of revolutions of gear wheel 4 may be converted to a higher number of revolutions for shaft 3, which means that for a relatively low number of revolutions of gear wheel 4 still sufficient heat may be generated. Apart from that, the friction couple of heat source 1 may be increased if desired by filling oil pump 5 with a higher viscosity oil, by increasing the length of oil pump 5 and by increasing the number of segments placed in it, by narrowing the tolerances of the inside of the segments and of the rotors and by increasing the number of sealing strips 16 for each rotor.

**[0019]** Fig. 5A schematically represents a container 20 according to the invention in side view for transporting food 21. In this embodiment, container 20 is a box with thermal insulating walls and a lid 22 which may be opened, after which the food, in this case pizzas, may be put in or taken out. Onto a back wall 23 a heat source 1 is mounted, the warm air of which is conducted over food 21 via a partition 24 which is provided with a number of openings, not shown here, and which subsequently leaves container 20 via a number of openings, not shown here, made in lid 22. Heat source 1 is connected to a power source, not shown here, via a chain or toothed belt 25 and is placed underneath a cover 26. Fig. 5B schematically represents this container 20 in top view, with food 21, lid 22, back wall 23 partition 24, heat source 1 and chain or toothed belt 25.

[0020] Fig. 6 schematically represents a moped 27, provided with a container 20 according to the invention, a heat source 1 and chain or toothed belt 25. A coupling of chain or toothed belt 25 to motor block 28 of moped 27 may for example be realised by replacing a gear wheel which is used to drive a drive chain 29 by two mutually coupled gear wheels, of which a first gear wheel drives chain 29 and a second wheel drives chain or toothed belt 25.

## Claims

1. Heat source, for converting mechanical energy into heat and more in particular into a flow of warm air. 15
2. Heat source according to claim 1, **characterised in that** the heat source consists of a vessel filled with a liquid, a stirrer placed in the vessel, arranged to be connected to drive means, a heat exchanger and a ventilator arranged to be connected to drive means. 20
3. Heat source according to claim 2, **characterised in that** the liquid is oil. 25
4. Heat source according to claim 3, **characterised in that** the vessel is at least substantially cylindrically shaped and that the stirrer comprises a number of disc-shaped rotors, mounted on a shaft which at least substantially coincides with a main axis of the vessel and which may rotate inside cylindrically shaped cavities. 30
5. Heat source according to claim 4, **characterised in that** each disc-shaped rotor is provided with at least one sealing strip, mounted in the disc-shaped rotor, for obtaining a seal between the rotor and the corresponding cylindrically shaped cavity and that successive cylindrically shaped cavities are separated by partitions. 35 40
6. Heat source according to claim 5, **characterised in that** the disc-shaped rotors are placed eccentrically on the shaft or that the cylindrically shaped cavities are placed eccentrically round the shaft. 45
7. Heat source according to claim 6, **characterised in that** centres of the disc-shaped rotors or centres of the cylindrically shaped cavities are positioned on mutually different angles round the shaft. 50
8. Heat source according to claim 6 or 7, **characterised in that** a wall of the vessel is provided with a number of ducts extending parallel to the main axis, and that the shaft is provided with a ventilator blade for supplying air to the ducts. 55

9. Heat source according to claim 8, **characterised in that** an end of the shaft is provided with a gear wheel which may cooperate with a chain or a toothed belt.

10. Heat source according to claim 8, **characterised in that** the shaft is provided with a transmission, provided with a gear wheel which may cooperate with a chain or a toothed belt.

11. Container for transporting warm food products, **characterised in that** the container is provided with a heat source according to one of the claims 1 to 10.

12. Motor vehicle, provided with a container for transporting warm food products, **characterised in that** the container is provided with a heat source according to one of the claims 1 to 10.

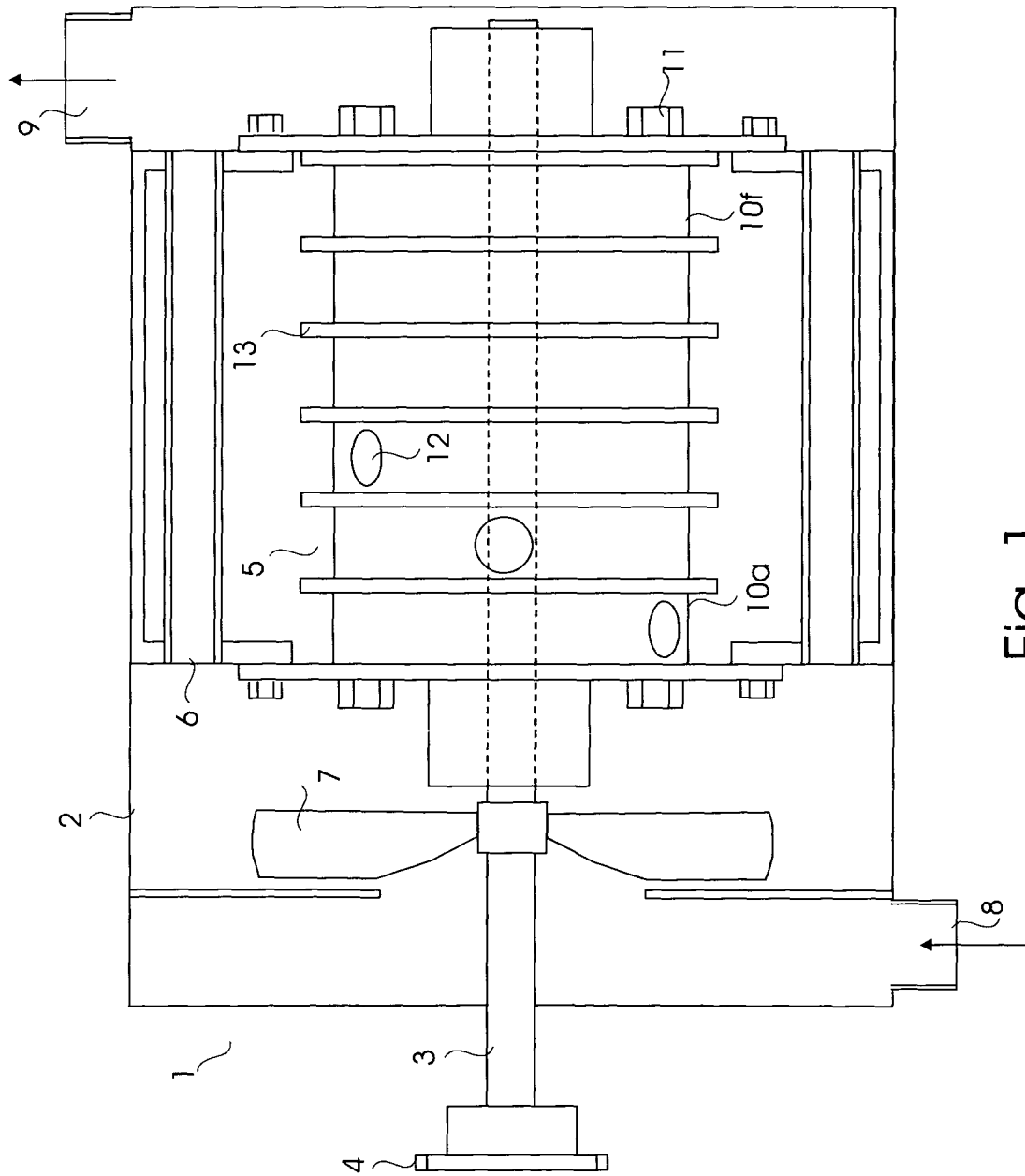


Fig. 1

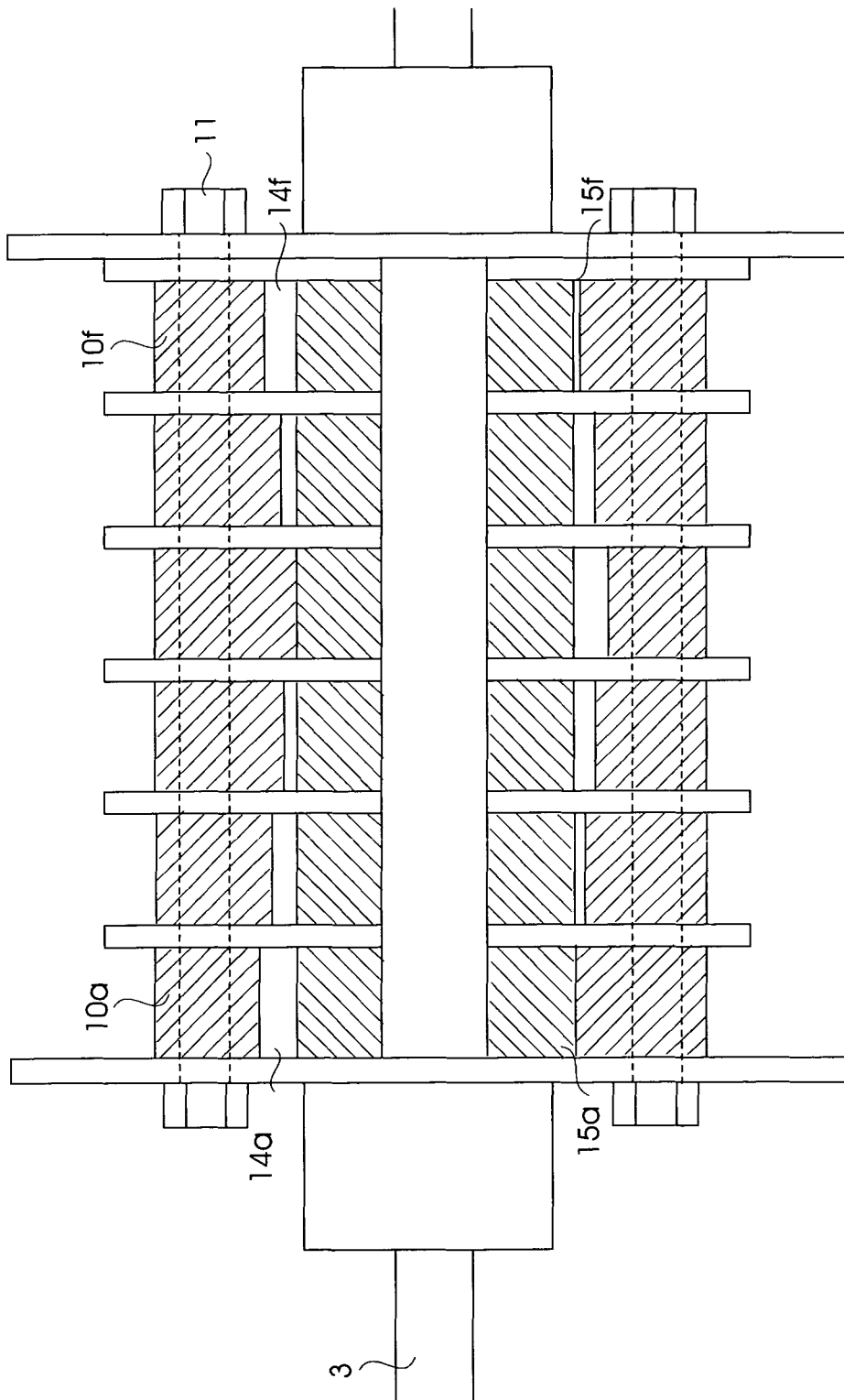
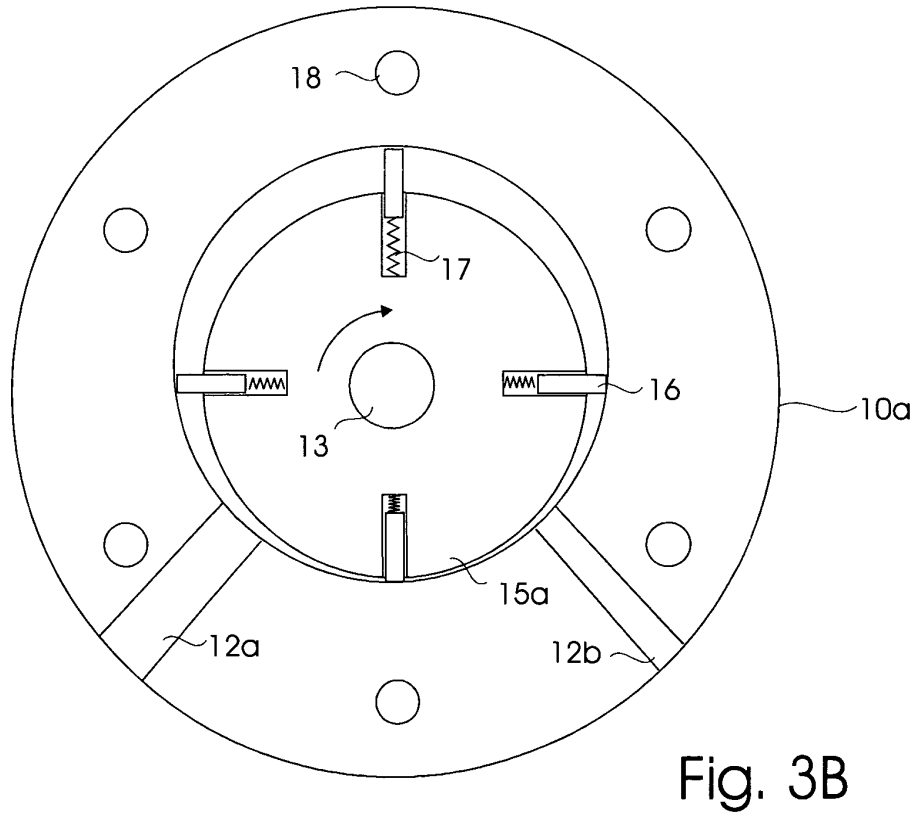
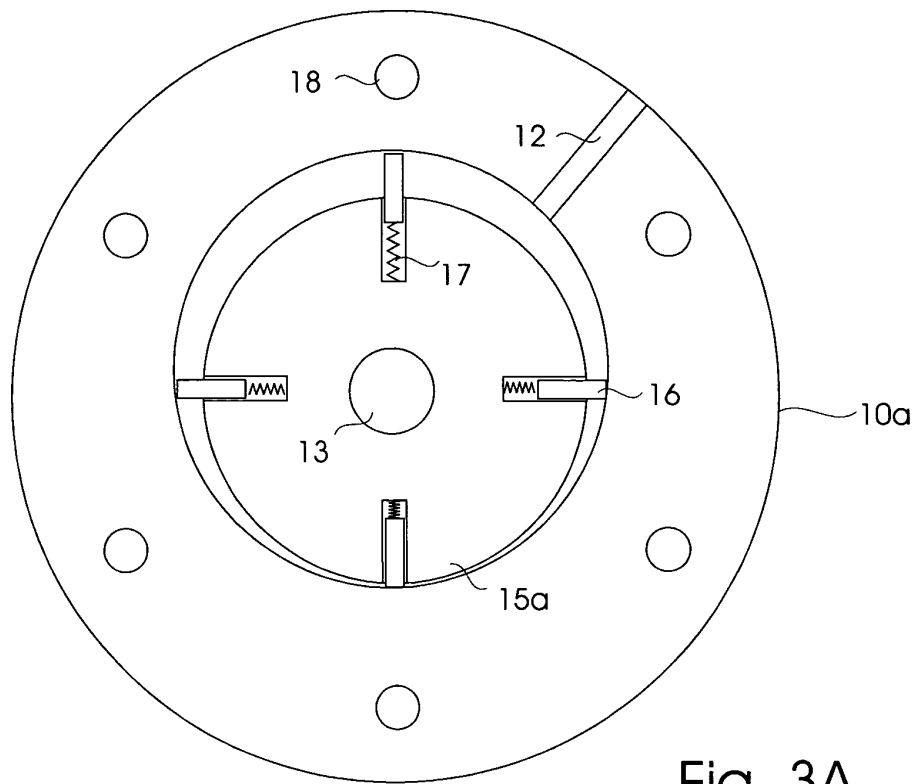


Fig. 2



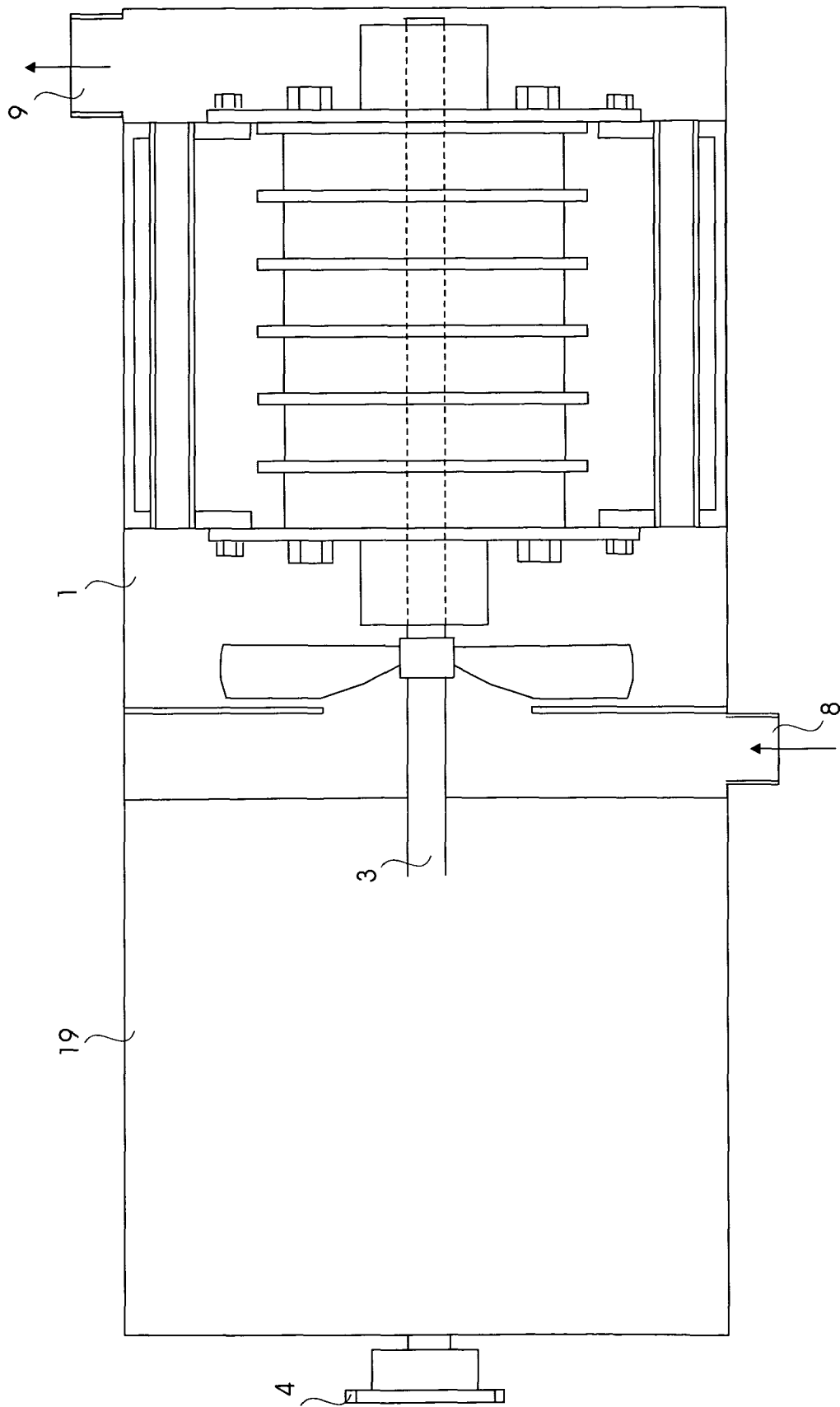
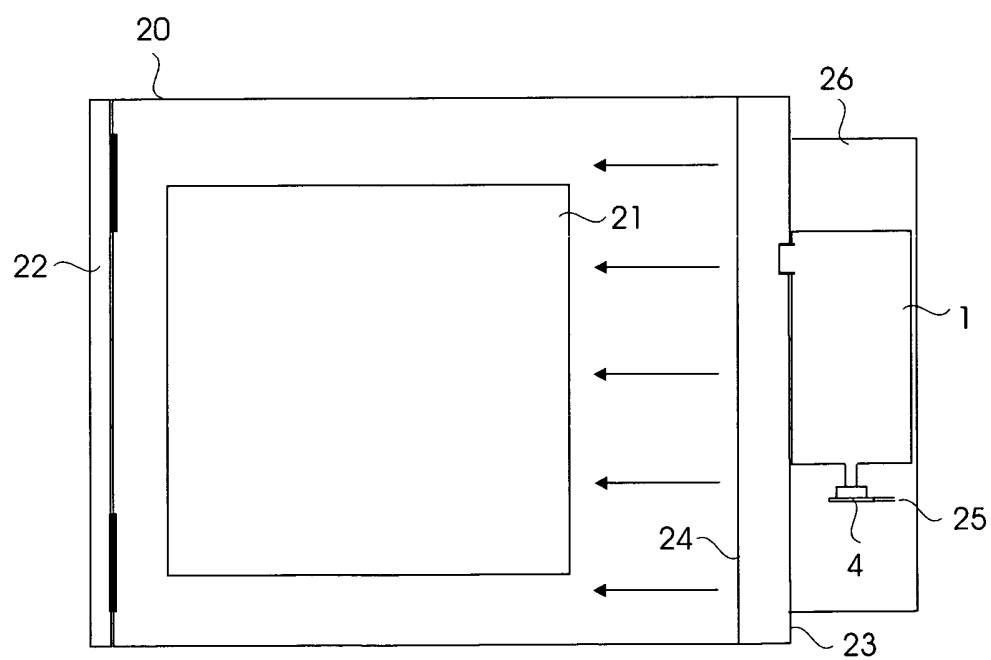
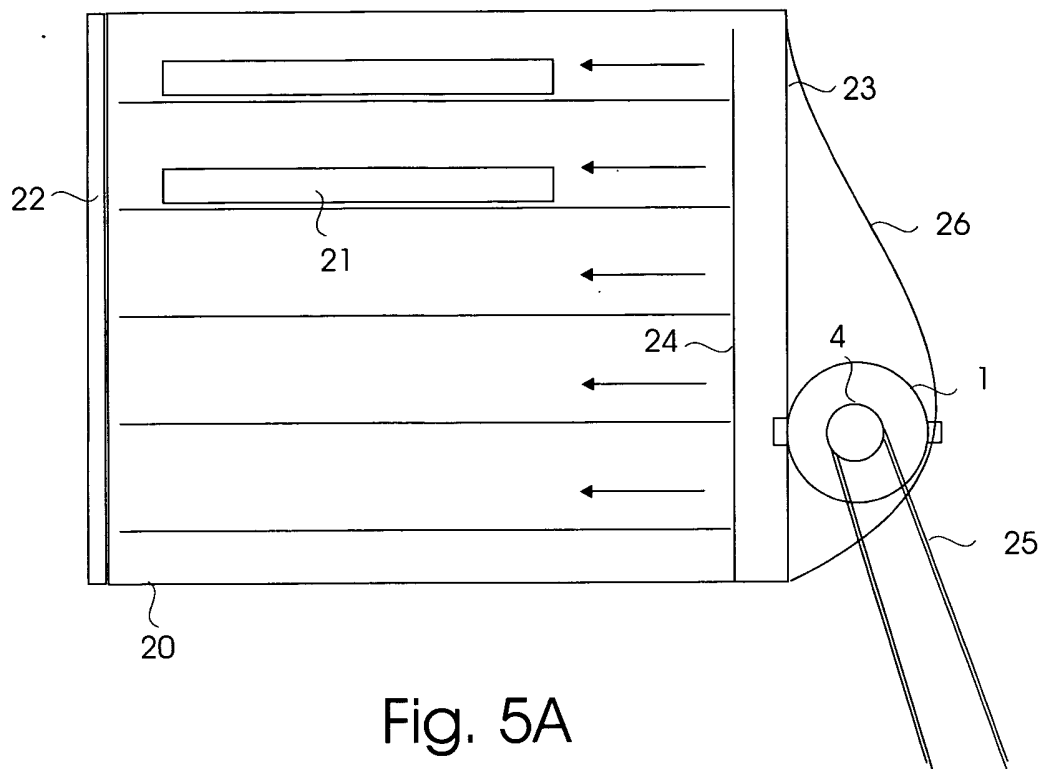


Fig. 4



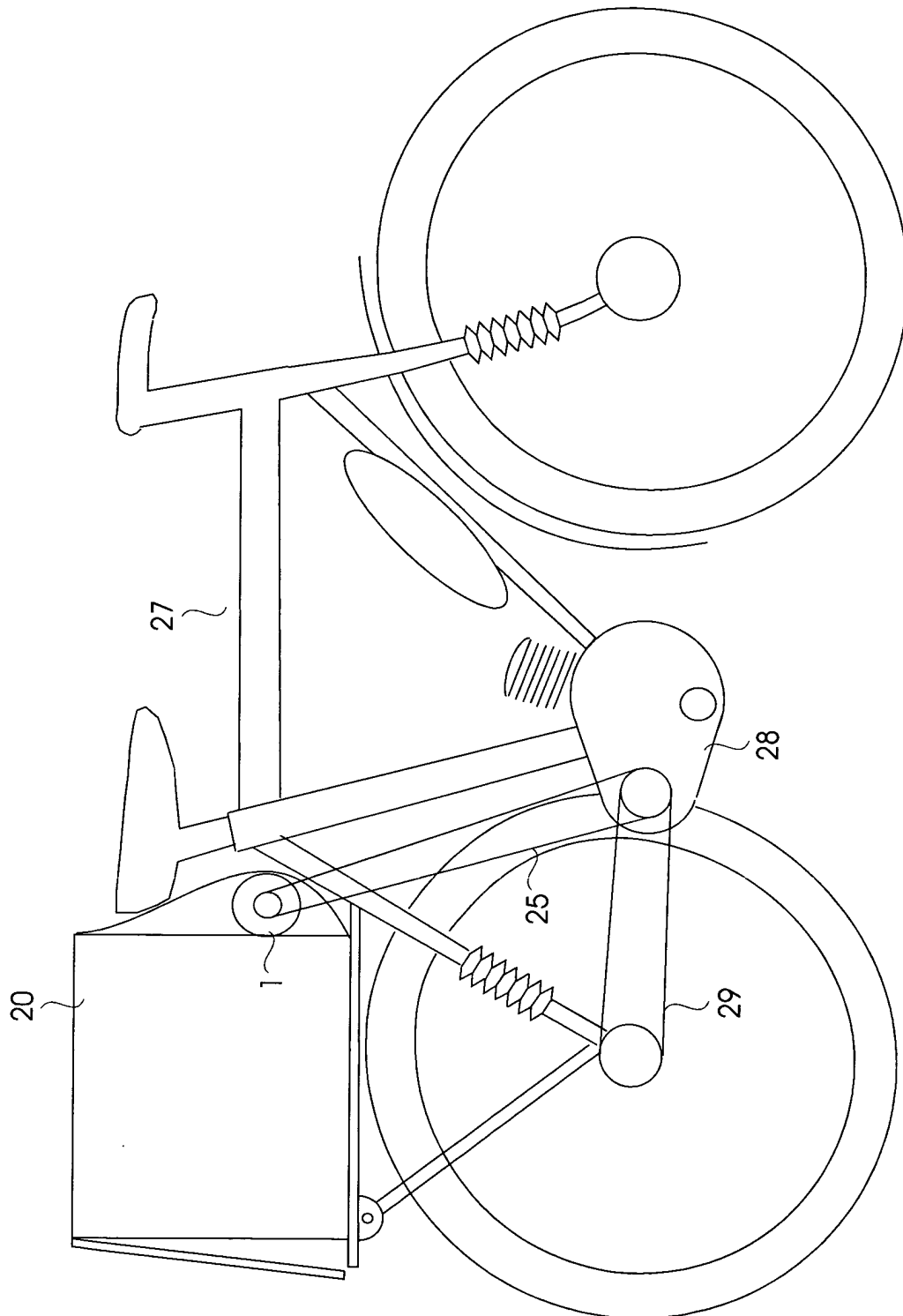


Fig. 6