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EUROPEAN PATENT APPLICATION

(43) Date of publication:
30.03.2005 Bulletin 2005/13

(51) Int Cl.7: F01D 11/04

(21) Application number: 03021606.3

(22) Date of filing: 24.09.2003

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT RO SE SI SK TR
Designated Extension States:
AL LT LV MK

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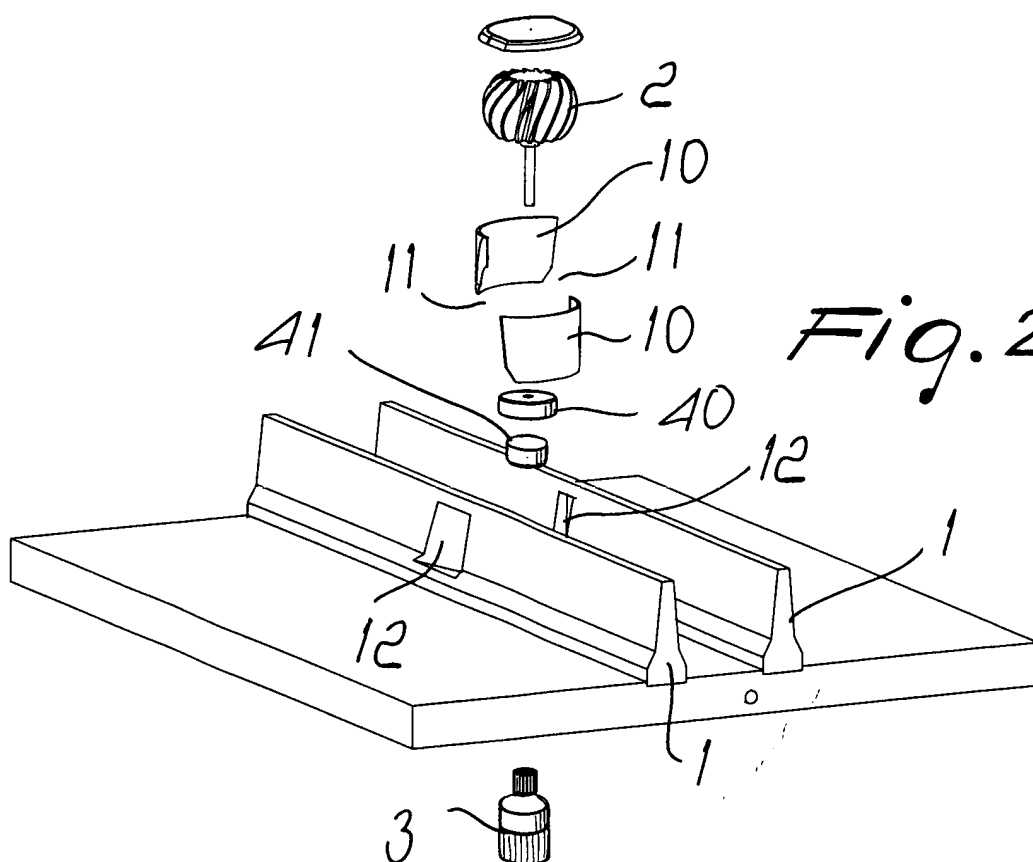
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(54) Electric power generator driven by the draft of passing vehicles

(57) An electric power generator driven by the air stream produced by the passage of vehicles in general is presented, which comprises at at least one side of a path affected by the passage of vehicles in general, a

vane-type turbine (2) connected to a generator (3). The power generator further comprises an air conveyance element (10) that accommodates the vane-type turbine (2).



Description

[0001] The present invention relates to an electric power generator driven by the air stream produced by the passage of vehicles in general.

[0002] As is known, attempts to generate electric power by utilizing the air stream produced by the passage of vehicles in general have already been made.

[0003] These solutions, disclosed for example in US-5,272,378 and UK-2,278,645, have not proved to be capable of yielding satisfactory results and therefore have not had a practical outcome.

[0004] The main problems that were observed in the solutions of the background art arose from the fact that the rotating element, which captured the air stream, remained exposed; therefore, in addition to creating an unpleasant aesthetic impact, it constituted a hazard for anyone passing in the nearby area.

[0005] Furthermore, the solutions adopted have not been found to be capable of providing an acceptable performance and therefore have not been followed up.

[0006] The aim of the invention is to eliminate the drawbacks noted above by providing an electric power generator driven by the air stream produced by the passage of vehicles in general which is first of all arranged so as to not be exposed, so that it causes no environmental impact, and furthermore does not constitute a hazard, since the rotating parts are adequately protected.

[0007] Within this aim, an object of the invention is to provide an electric power generator that is capable of optimizing the utilization of the air stream, thus allowing to provide an energy recovery that is assuredly desirable from a practical and commercial standpoint.

[0008] Another object of the present invention is to provide an electric power generator that thanks to its particular constructive characteristics is capable of giving the greatest assurances of reliability and safety in use.

[0009] Another object of the present invention is to provide an electric power generator that can be obtained easily starting from commonly commercially available elements and materials and is also competitive from a merely economical standpoint.

[0010] This aim and these and other objects that will become better apparent hereinafter are achieved by an electric power generator driven by the air stream produced by the passage of vehicles in general, according to the invention, which comprises, at at least one side of a path affected by the passage of vehicles in general, a vane-type turbine connected to a generator, characterized in that it comprises an air conveyance element that accommodates said vane-type turbine.

[0011] Further characteristics and advantages of the invention will become better apparent from the description of preferred but not exclusive embodiments of an electric power generator driven by the air stream produced by the passage of vehicles in general, illustrated

by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is an installation diagram of the electric power generator according to the invention;

Figure 2 is an exploded perspective view of the electric power generator;

Figure 3 is a perspective view of the protection element on a concrete median barrier;

Figure 4 is a partially sectional top plan view of the embodiment of Figure 3;

Figure 5 is a view of the protection bars provided on a concrete median barrier;

Figure 6 is a plan view and a sectional view of the air conveyance element that accommodates the turbine;

Figure 7 is a schematic perspective view of a hollow-shaft turbine;

Figure 8 is a sectional view, taken along the line VI-VII of Figure 7;

Figure 9 is a perspective view of a turbine with helical vanes;

Figure 10 is a perspective view of a turbine with helical vanes having a variable cross-section;

Figure 11 is a perspective view of a turbine with flat vanes that are inclined with respect to the axis;

Figure 12 is a perspective view of a spherical turbine with helical vanes;

Figure 13 is a perspective view of a turbine with vanes having a rectilinear cross-section;

Figure 14 is a perspective view of a hemispherical turbine;

Figure 15 is a perspective view of a substantially cylindrical turbine;

Figure 16 is a schematic view of the cover with openings for discharging the air of the air conveyor;

Figure 17 is a schematic perspective view of the generator applied with a barrier of the guardrail type;

Figure 18 is a top plan view of the embodiment of Figure 17;

Figure 19 is a schematic exploded perspective view of a generator with a turbine having a horizontal axis;

Figure 20 is a perspective view of the generator of Figure 19; and

Figure 21 is a sectional view, taken along the line XXI-XXI of Figure 20.

[0012] With reference to the figures, the electric power generator driven by the air stream produced by the passage of vehicles in general, according to the invention, is preferably installed at a roadside and, in the case of a dual-carriageway highway, it is installed at the center between the protective barriers, so that it is affected by an air stream in two opposite directions determined by the passage of vehicles on both carriageways.

[0013] A highway path is shown in the specific exam-

ple, but the path may obviously be of any kind, such as a railroad track, an airport runway and so forth; in any case, all those situations in which there are vehicles generating an air stream that can be utilized.

[0014] Specifically with reference to Figures 1 and 2, a concrete median barrier is considered which is of the type known as "New Jersey"; a turbine 2 is arranged between the protective barriers, designated by the reference numeral 1, and generally drives an electric generator 3.

[0015] In constructive detail, a particular feature of the invention consists in that the turbine 2 is accommodated inside an air conveyance element, which is constituted by a housing 10 that surrounds the turbine 2 and is provided with diametrical openings 11 located at slots 12, which are formed directly within the concrete barrier 1 and preferably have a cross-section that tapers up to the opening 11, which is arranged at the end, as shown in Figure 6, of a duct 13 for conveyance inside the housing 10, which has a narrower cross-section, so that the impact of the air on the turbine 2 occurs at a higher speed.

[0016] In order to maintain high criteria of protection at the slot 12 having a tapering cross-section, it is possible to provide at the corner directed toward the direction of travel an insert 15 of the yielding type, so that damping occurs, with a consequent reduction of any damage, in case of impact with a vehicle.

[0017] Furthermore, as shown in Figure 5, it is possible to provide external bars 16 that both stiffen the barrier, which is weakened by the presence of the slot 12, and create a protection that prevents the insertion of foreign matter in the region affected by the vane-type turbine.

[0018] The vane-type turbine can assume various shapes; thus, for example, as shown in Figures 7 and 8, it is possible to provide a turbine 20 that is mounted on a hollow shaft 21 and has, between the various vanes 22, gaps 23 that facilitate the inflow of the air, which can be disposed of easily, for example by means of openings 25 that can be provided on the cover 26 arranged so as to close the housing 10.

[0019] Figure 9 shows a turbine 30 with helical vanes, which allows to optimize the angle of incidence of the air on the vanes in order to optimize the thrust and efficiency of the rotating body.

[0020] Figure 10 illustrates a turbine 31 with helical vanes having a variable cross-section, i.e., a cross-section that decreases axially so as to better allow to utilize the angle of incidence of the air both for abundant streams and especially for modest and inconstant streams of air.

[0021] Figure 11 illustrates a turbine 32 provided with flat vanes that are inclined with respect to the axis, so as to facilitate both collection and discharge of the air.

[0022] If the intake slot of the road barrier for air inflow is arranged in axial alignment with respect to the central cross-section, the inclination facilitates the outflow of

the air; if instead the opening of the barrier for air inflow is lower or higher than the central cross-section of the turbine, it is possible to achieve an improvement of the outflow in relation to the different angle of incidence of the air.

[0023] Figure 12 illustrates a spherical turbine 33, which ensures good uniformity of the motion for generating the centrifugal force that concentrates most of the weight toward the middle circumference.

[0024] Furthermore, the spherical shape of the turbine allows to collect in an optimum manner the air if the inlet of the road barrier is in axial alignment with the central cross-section of the turbine.

[0025] Figure 13 shows a turbine 34 with flat vanes arranged axially, which ensure outflow of the air, during progressive rotation, tangentially to the angle of incidence of its collection.

[0026] Figure 14 illustrates the turbine 35, which has a hemispherical shape, so as to collect most of the air in the region of maximum radial expansion of the vanes and allow outflow in the region of minimum expansion of the vane.

[0027] Figure 15 shows a cylindrical turbine 36, which allows to optimize air collection in the case of a large inlet of the road barrier with constant volumes.

[0028] Another particularity of the invention is further constituted by the fact that a spacer 40 is arranged in axial alignment with the turbine, as shown in Figure 2, and can act as a flywheel so as to even out the rotation of the turbine.

[0029] Furthermore, a very important element is constituted by the step-up unit 41, which is adapted to increase the turns transmitted to the electric power generator, accordingly increasing its yield.

[0030] Figures 17 and 18 illustrate a barrier of the guardrail type, designated by the reference numeral 50: in this case, on the guardrail there are holes 51, whose flaps 52 provide in practice an engagement element for the housing, again designated by the reference numeral 10, to the side of which deflectors 53 are arranged which are adapted to constitute an air stream conveyance element.

[0031] The deflectors 43 provide in practice a housing for collecting the air that arrives from the openings provided in the undulation of the guardrail and from the openings provided at the base of the road barrier and between the various undulated elements that constitute the guardrail.

[0032] The housing, moreover, is adapted to strengthen the guardrail proximate to the openings provided for collecting air and to prevent insertion of people and objects.

[0033] Figures 19 to 21 show another embodiment that is particularly suitable for separation barriers constituted by guardrails.

[0034] In this embodiment there is a turbine 60 that has a horizontal axis.

[0035] As shown schematically in the drawings, there

is a supporting body 61, which is for example U-shaped and on which there are coverings 62 that generate, as shown in Figure 21, an air passage chamber, inside which the horizontal-axis turbine is arranged.

[0036] The turbine is connected to a generator 63, with the optional interposition of a step-up unit.

[0037] Moreover, it should be noted that with this embodiment it is possible to provide a plurality of turbines arranged in line, which allow to increase considerably the amount of air recovered, or it is also optionally possible to provide a plurality of turbines having parallel axes, which mutually overlap and are connected together so as to increase significantly the amount of air that is recovered. With turbines having a horizontal axis, it is possible to provide optionally two or three impellers arranged so that they overlap each other and are connected by means of belts or gears. Connection by means of belts can be provided by using pulleys, optionally having a different diameter in order to take into account the different air streams that affect the turbines.

[0038] From what has been described above, it is thus evident that the invention achieves the intended aim and objects, and in particular the fact is stressed that a generator is provided which, in addition to being obtained so as to not produce an unpleasant environmental impact, allows to generate electric power with high efficiency.

[0039] One aspect that must not be neglected, moreover, is constituted by the fact that the generated electric power is a clean energy from a renewable source, which is remunerated at a higher price by the market.

[0040] One should also take into account the fact that the production of energy depends on vehicular traffic and accordingly the generator produces more energy during daytime, when traffic is most intense, therefore in the hours of highest energy consumption and higher price remuneration.

[0041] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0042] All the details may further be replaced with other technically equivalent elements.

[0043] In practice, the materials used, as well as the contingent shapes and dimensions, may be any according to requirements.

[0044] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. An electric power generator driven by the air stream produced by the passage of vehicles in general,

comprising, at at least one side of a path affected by the passage of vehicles in general, a vane-type turbine connected to a generator, **characterized in that** it comprises an air conveyance element that accommodates said vane-type turbine.

2. The generator according to claim 1, **characterized in that** in the case of a dual-carriageway highway it is installed in the center between the protective barriers.
3. The generator according to claim 2, **characterized in that** said protective barriers are concrete barriers.
4. The generator according to one or more of the preceding claims, **characterized in that** said air conveyance element comprises a housing that surrounds said turbine, which has a vertical axis, said housing being provided with diametrical openings arranged at slots formed directly inside said concrete barrier.
5. The generator according to one or more of the preceding claims, **characterized in that** said slots have a cross-section that tapers from the mouth directed toward the highway carriageway toward said opening.
6. The generator according to one or more of the preceding claims, **characterized in that** it has, inside said housing, a conveyance duct whose cross-section tapers continuously.
7. The generator according to one or more of the preceding claims, **characterized in that** it comprises, in said slots, at the corner directed toward the direction of travel, an insert of the yielding type in order to cushion the collision in case of impact with a vehicle.
8. The generator according to one or more of the preceding claims, **characterized in that** it comprises external bars arranged at said slot.
9. The generator according to one or more of the preceding claims, **characterized in that** said vane-type turbine comprises a turbine that is mounted on a hollow shaft and forms, between the vanes, gaps in order to facilitate air inflow.
10. The generator according to one or more of the preceding claims, **characterized in that** said flowing air is discharged through openings provided on a cover arranged so as to close said housing.
11. The generator according to one or more of the preceding claims, **characterized in that** said vane-

type turbine comprises a turbine with helical vanes.

12. The generator according to one or more of the preceding claims, **characterized in that** said vane-type turbine is provided with helical vanes that have a variable cross-section. 5
13. The generator according to one or more of the preceding claims, **characterized in that** said vane-type turbine comprises a turbine with flat vanes that are inclined with respect to the rotation axis. 10
14. The generator according to one or more of the preceding claims, **characterized in that** said vane-type turbine comprises a spherical turbine. 15
15. The generator according to one or more of the preceding claims, **characterized in that** said vane-type turbine comprises a turbine with straight vanes that are arranged axially. 20
16. The generator according to one or more of the preceding claims, **characterized in that** said vane-type turbine comprises a turbine that has a substantially hemispherical configuration. 25
17. The generator according to one or more of the preceding claims, **characterized in that** said vane-type turbine comprises a cylindrical turbine. 30
18. The generator according to one or more of the preceding claims, **characterized in that** it comprises, between said vane-type turbine and said generator, a spacer that is adapted to act as a flywheel in order to even out the rotary motion of the turbine. 35
19. The generator according to one or more of the preceding claims, **characterized in that** it comprises a step-up unit between said electric motor and said vane-type turbine. 40
20. The generator according to one or more of the preceding claims, **characterized in that** said protective barrier is of the guardrail type, with perforations whose flaps form in practice an engagement element for the housing that accommodates said vane-type turbine. 45
21. The generator according to one or more of the preceding claims, **characterized in that** it comprises deflectors that affect the lower part of said guardrail in order to convey the air that circulates at a lower level. 50
22. The generator according to one or more of the preceding claims, **characterized in that** said vane-type turbine has a substantially horizontal rotation axis. 55
23. The generator according to one or more of the preceding claims, **characterized in that** it comprises, on said vane-type turbine having a horizontal axis, coverings that form an inlet that is open toward the edge of the path affected by the flow of vehicles.
24. The generator according to one or more of the preceding claims, **characterized in that** it comprises a plurality of turbines having a horizontal axis which are arranged substantially in line.
25. The generator according to one or more of the preceding claims, **characterized in that** it comprises a plurality of vane-type turbines having a horizontal axis, which are arranged so as to overlap each other with a parallel axis and a mechanical interconnection between the shafts of the individual turbines.
26. The generator according to one or more of the preceding claims, **characterized in that** said turbines having a parallel axis are connected together by means of belts that wind around pulleys associated with the shaft of the corresponding turbine.
27. The generator according to one or more of the preceding claims, **characterized in that** said pulleys have mutually different diameters.

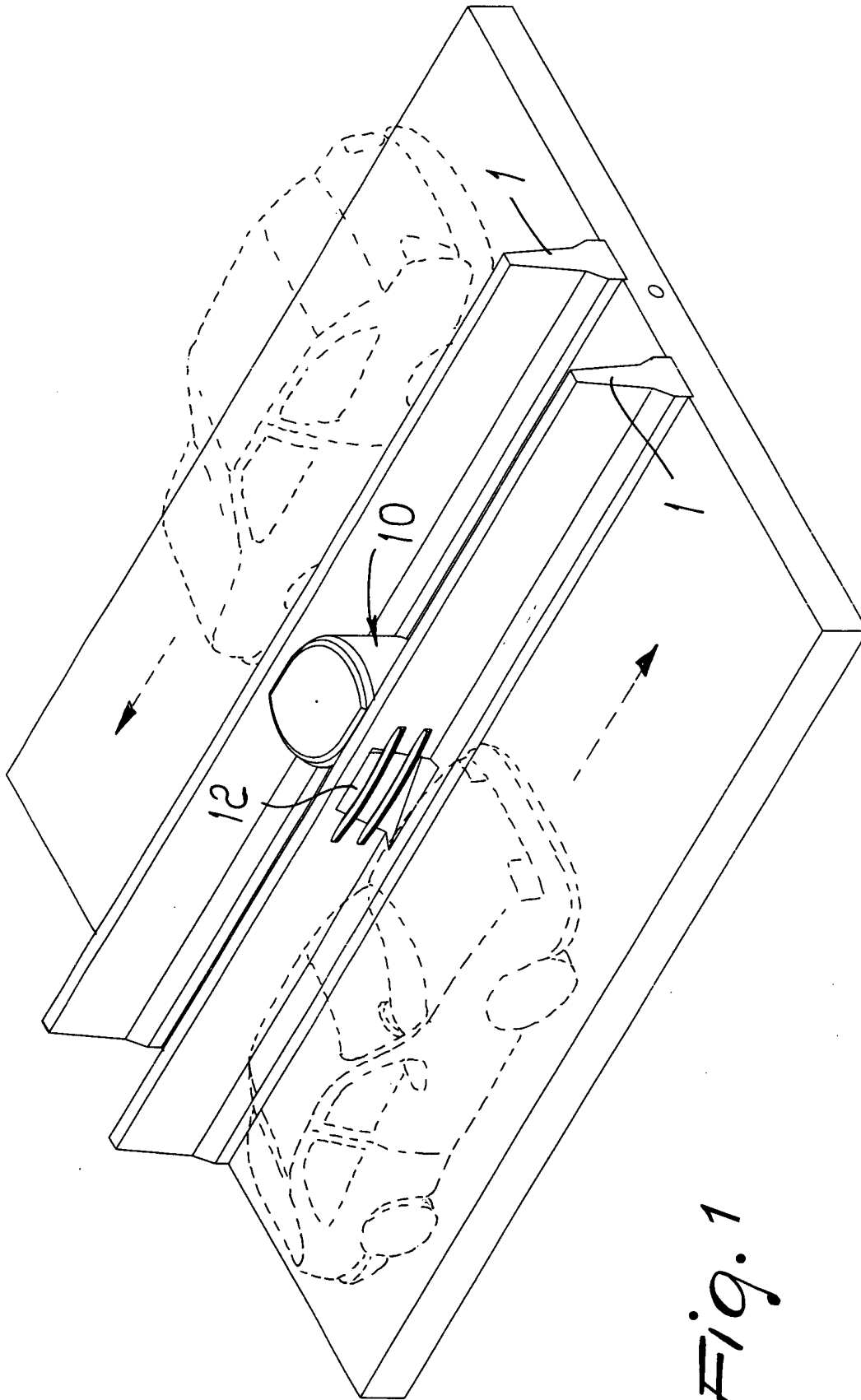
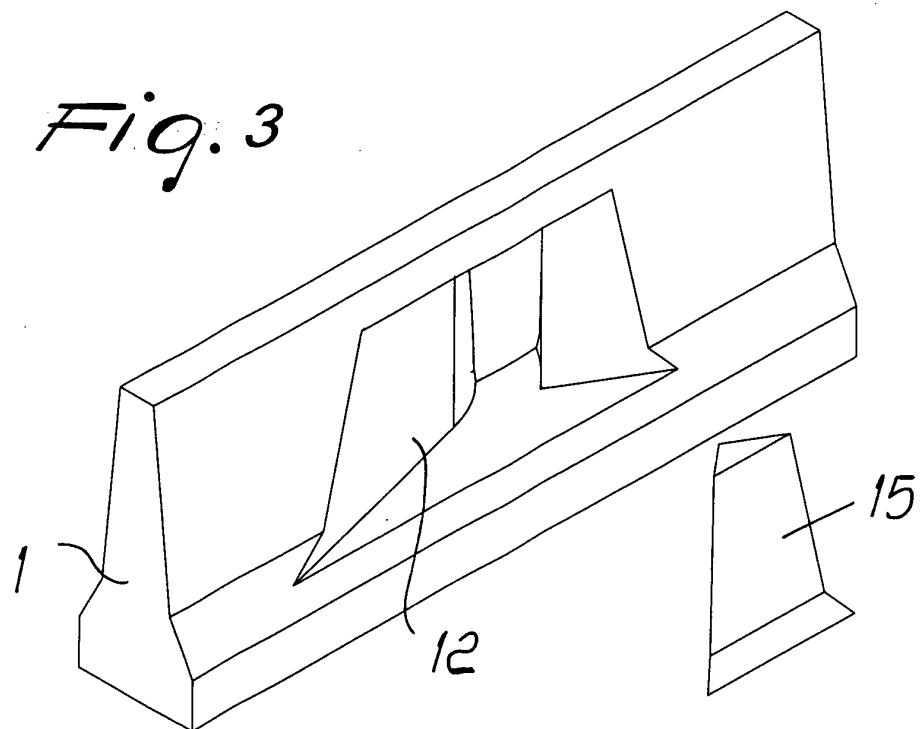
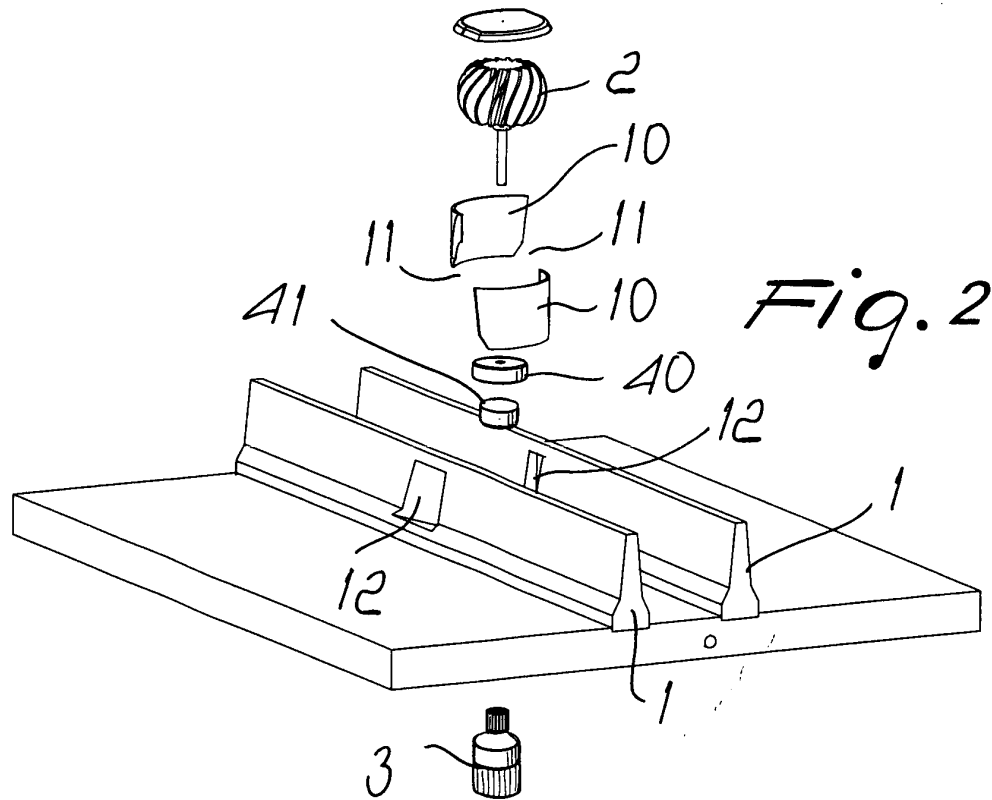


Fig. 1



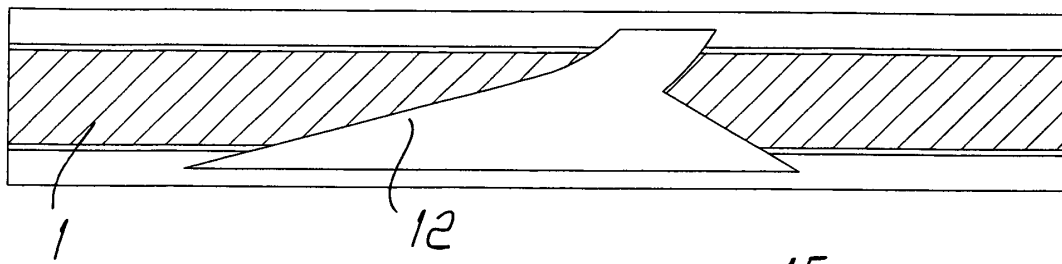


Fig. 4

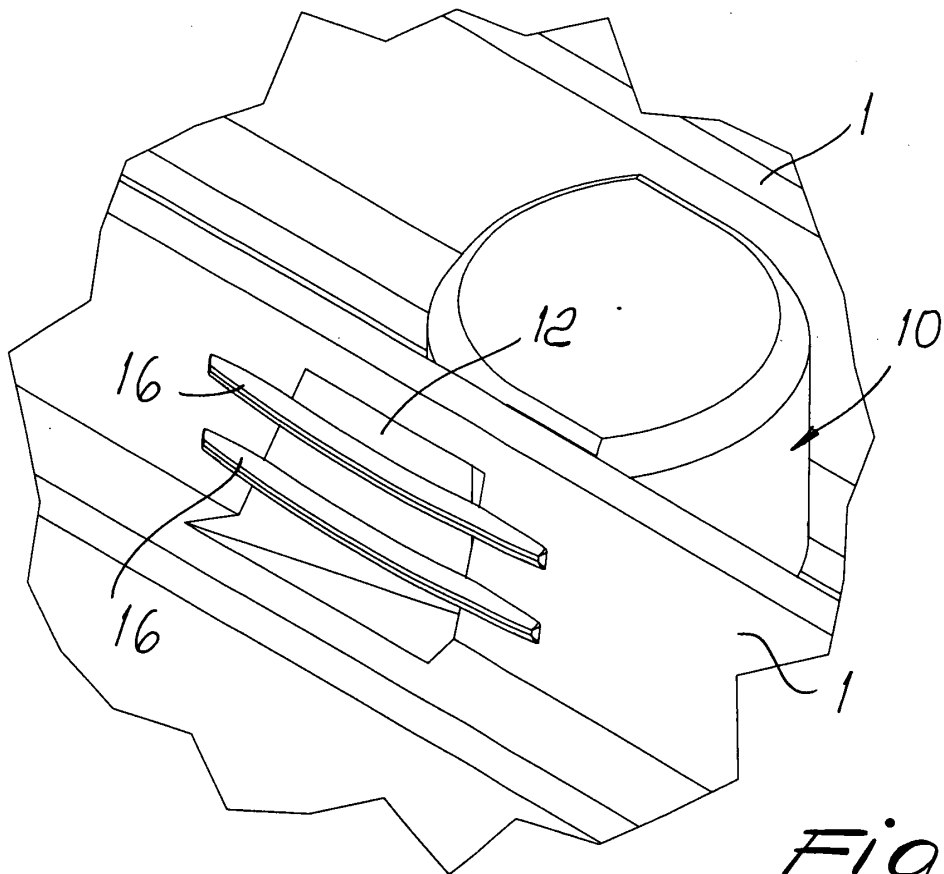
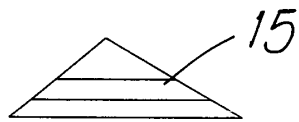


Fig. 5

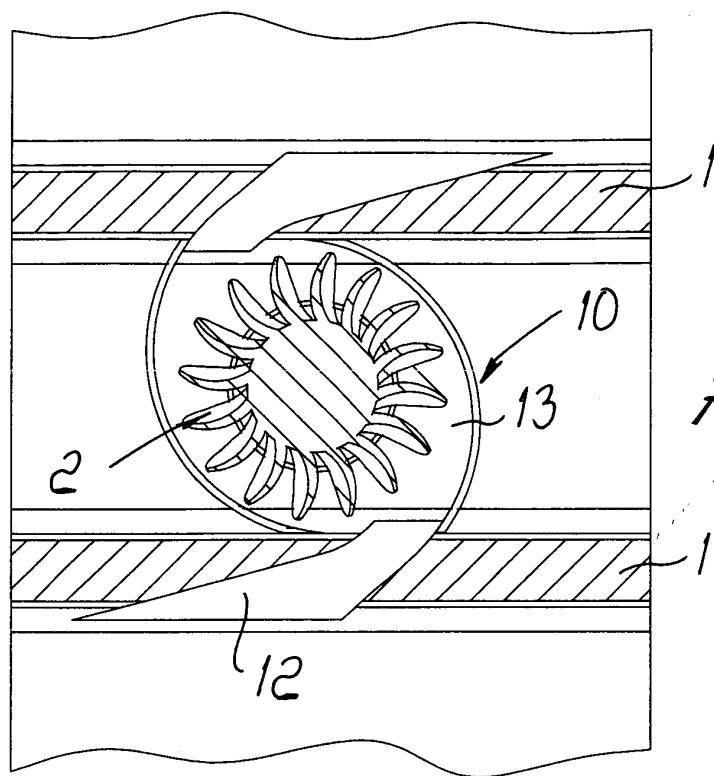


Fig. 6

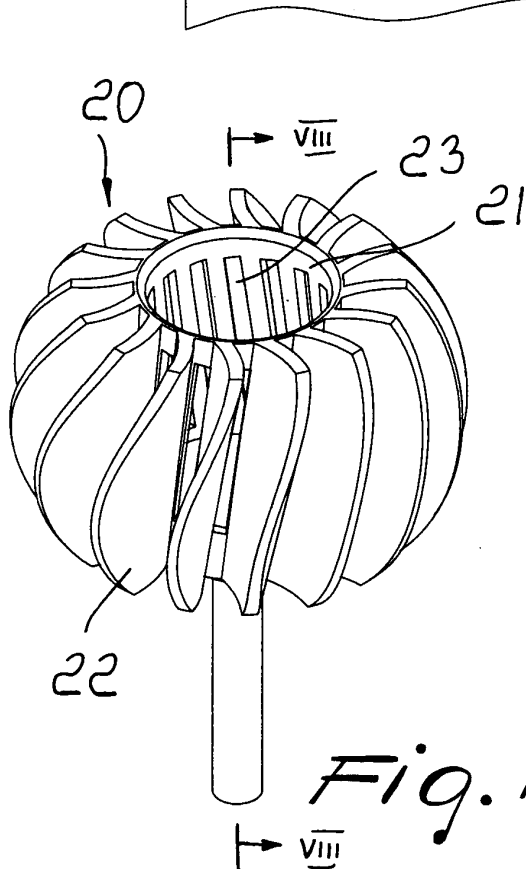


Fig. 7

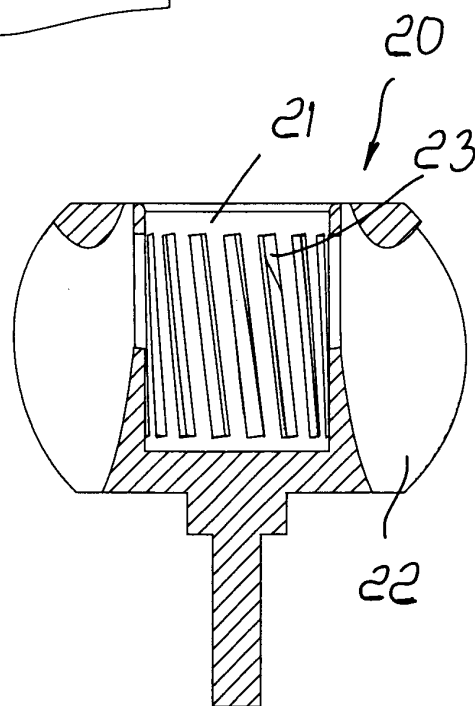


Fig. 8

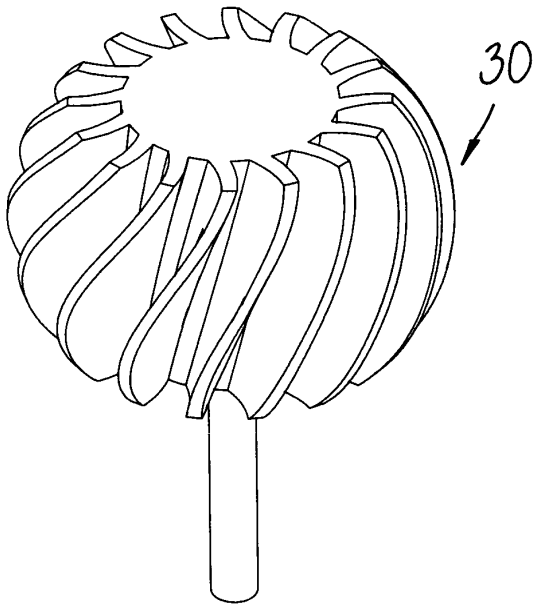


Fig. 9

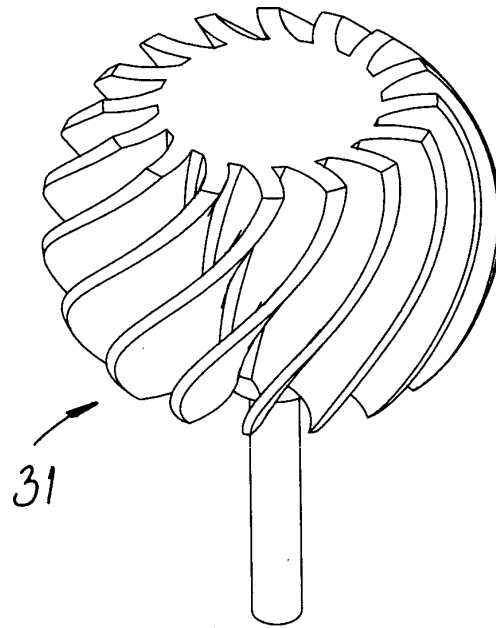


Fig. 10

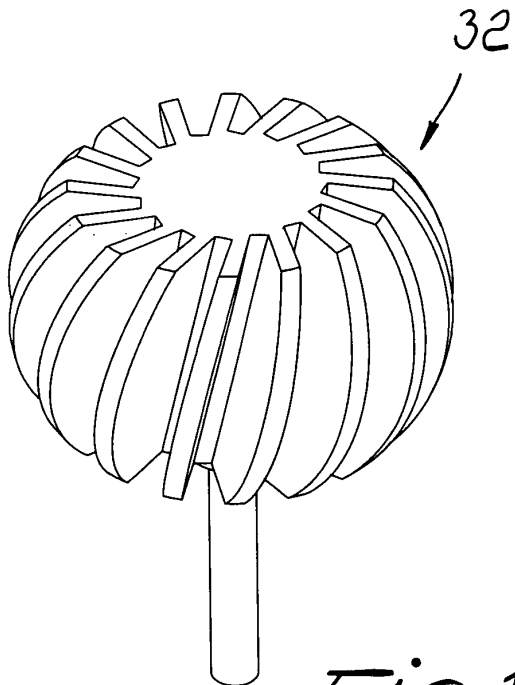


Fig. 11

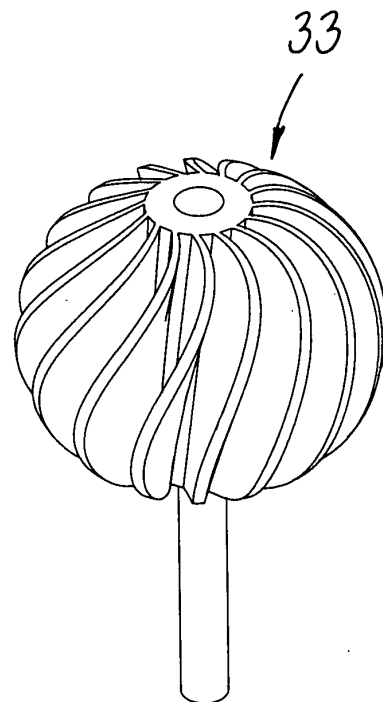


Fig. 12

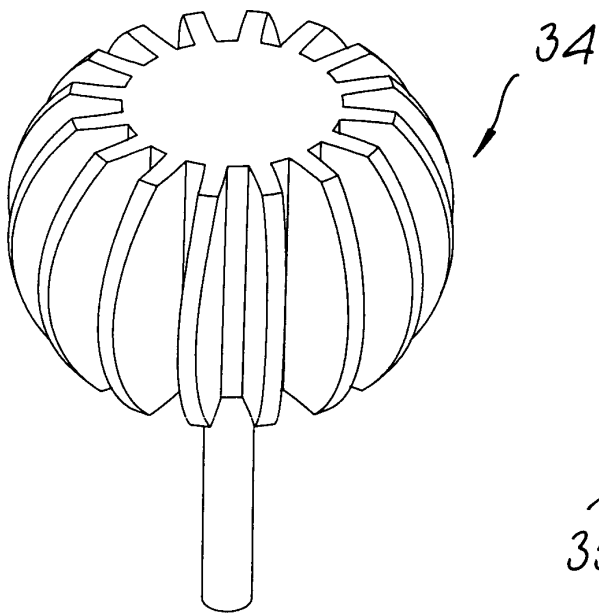


Fig. 13

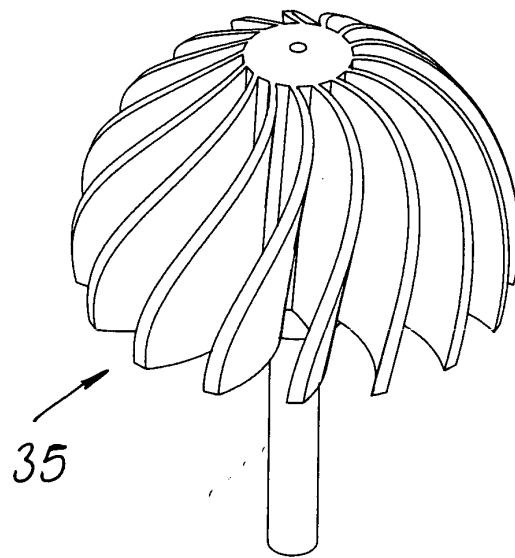


Fig. 14

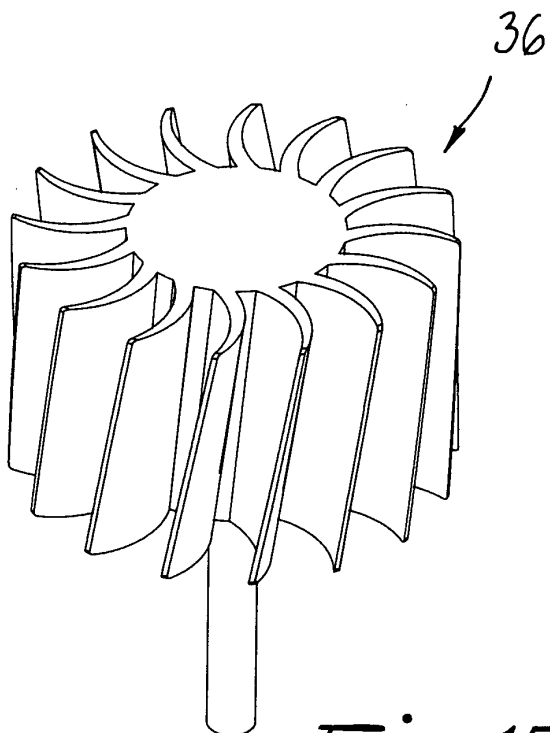


Fig. 15

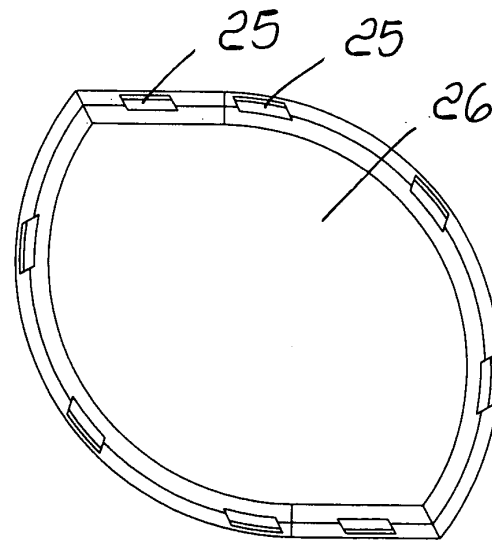


Fig. 16

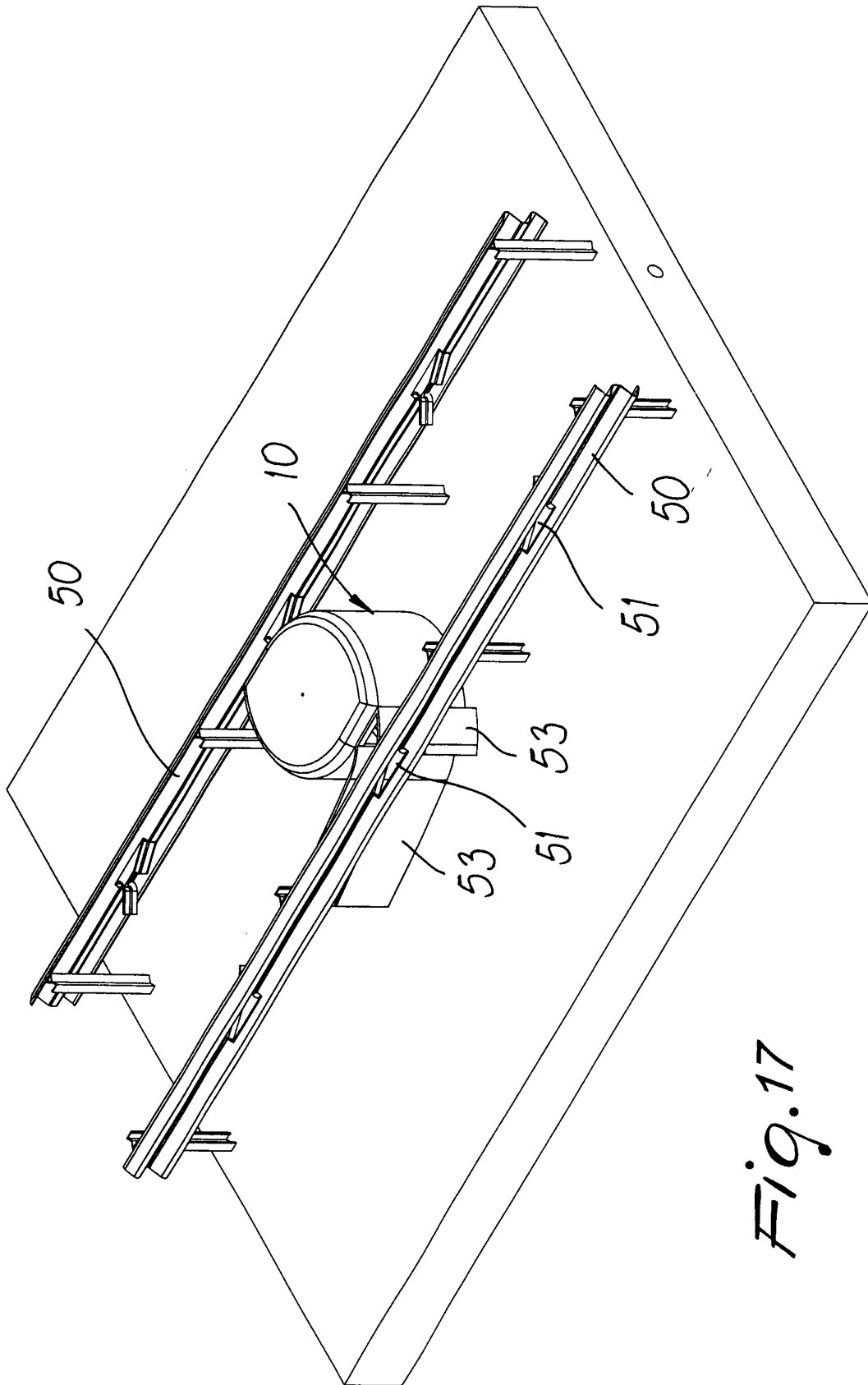
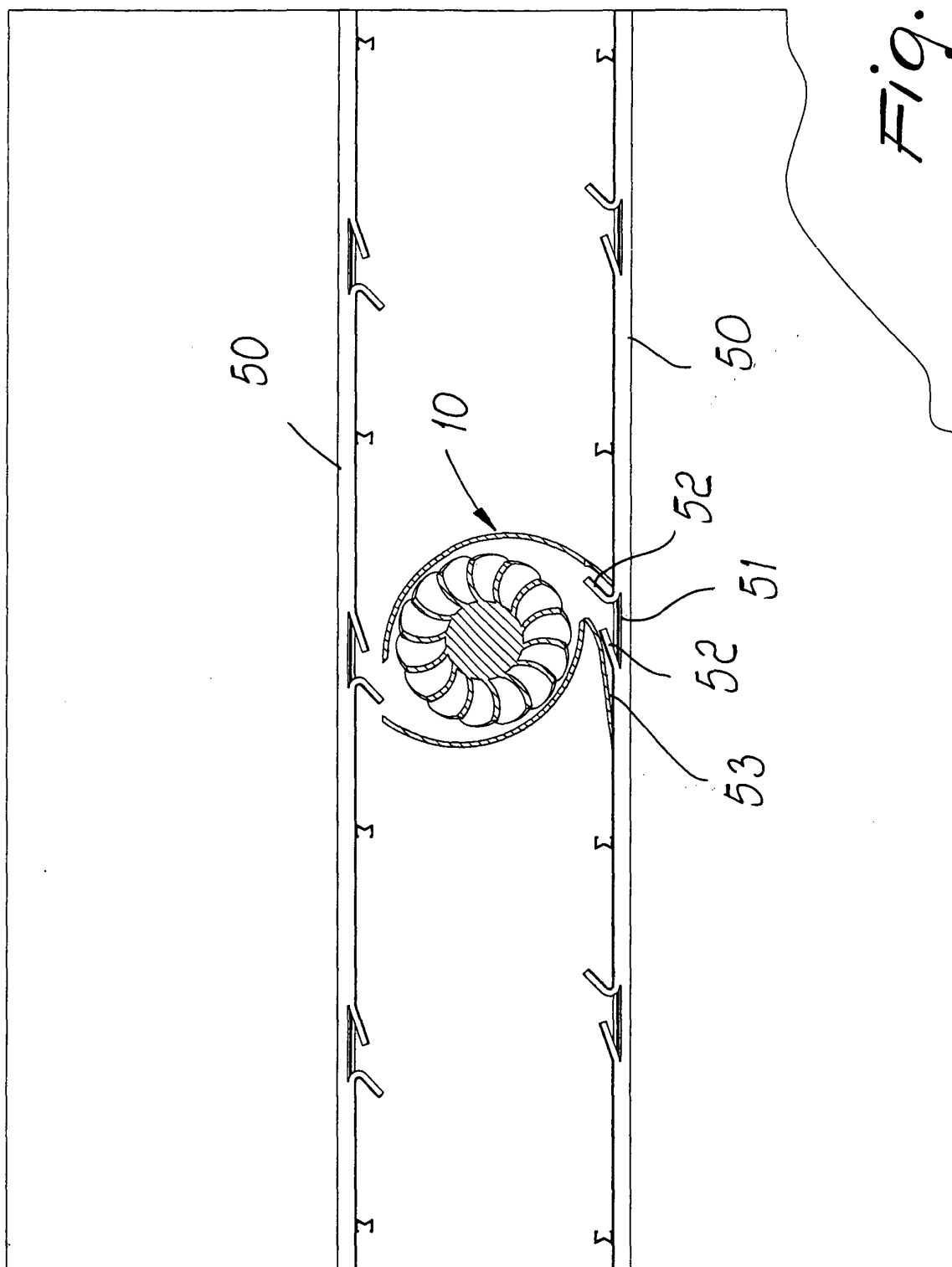
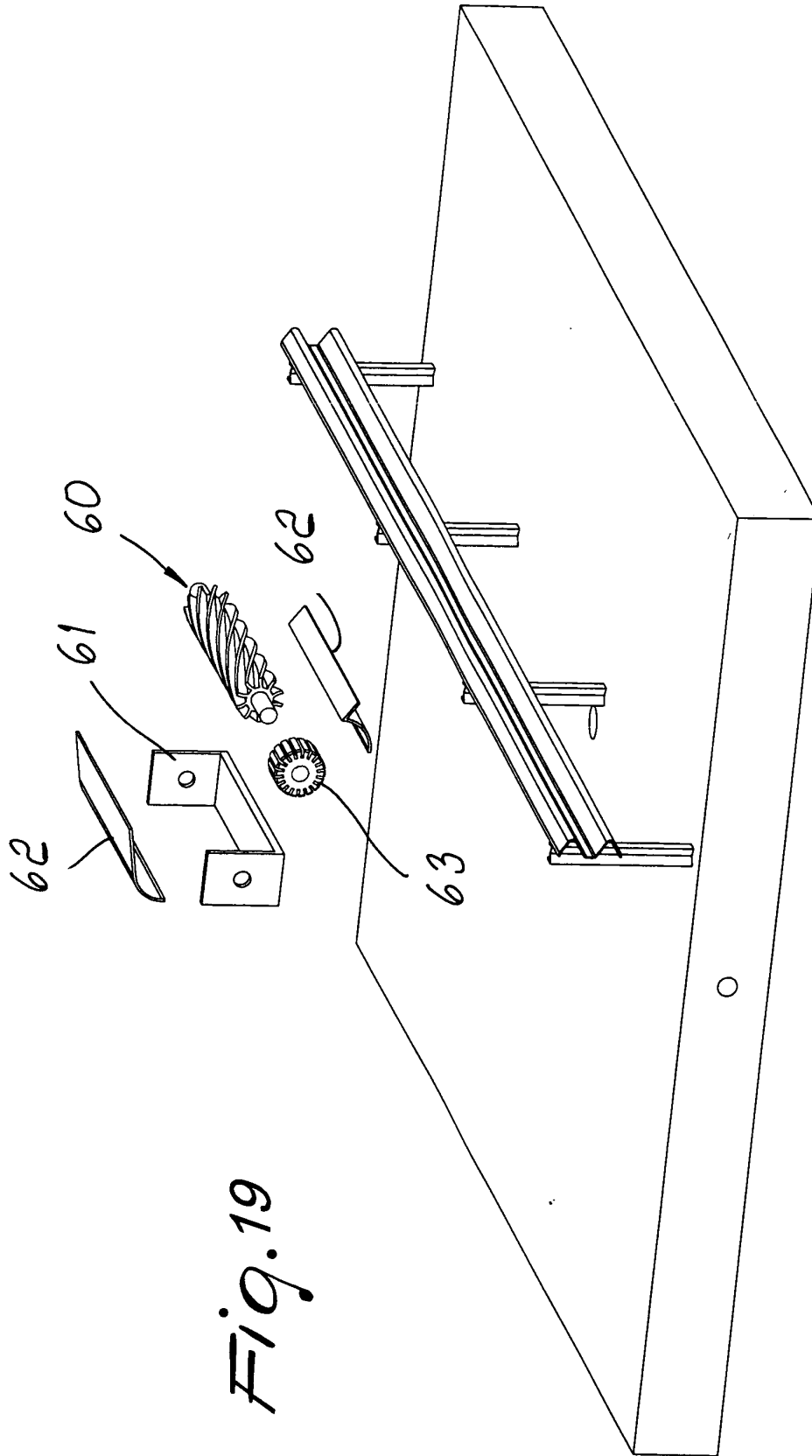
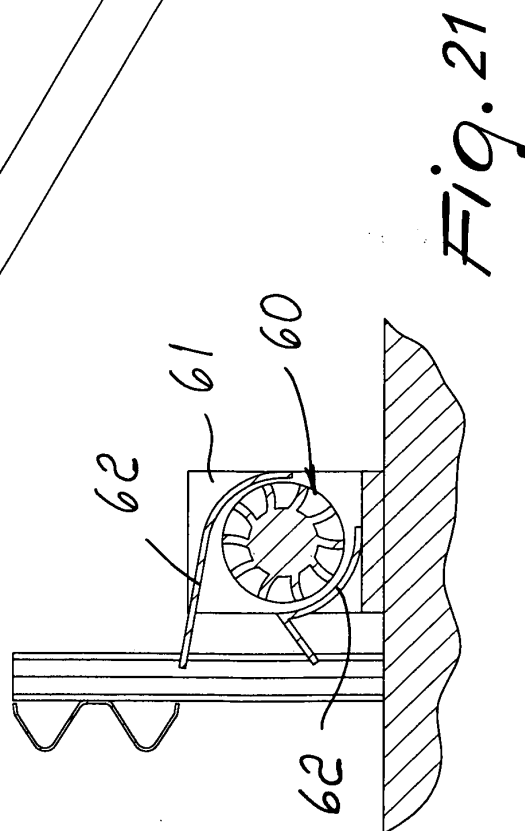
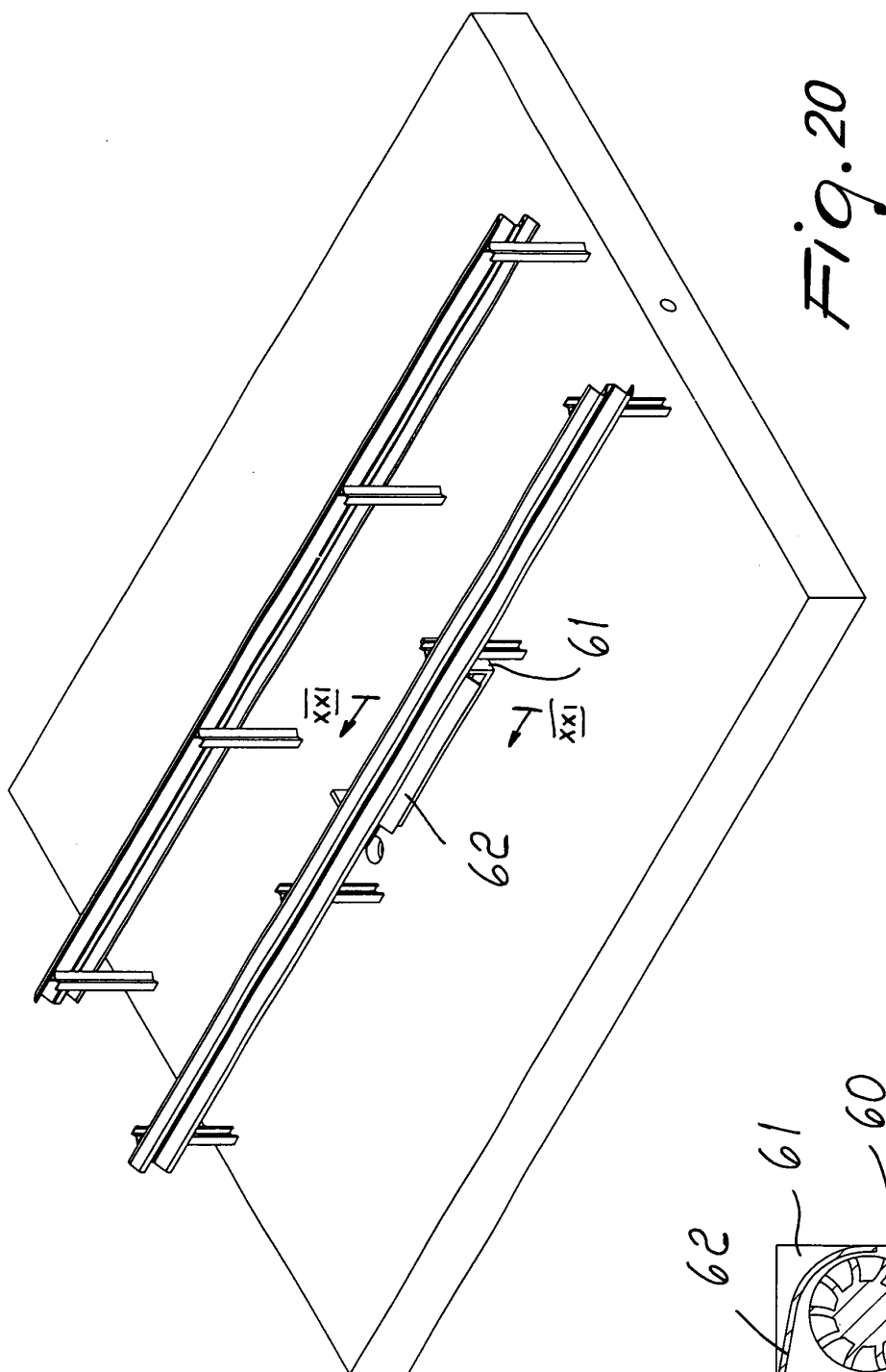


Fig. 17









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Application Number
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