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(54) TURBINE VENTILATOR

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(57) **ABSTRACT**

Disclosed is an improved ventilator comprising a turbine, and a fan configured to force air from a ventilated space, the fan being coupled to the turbine so that rotation of the turbine results in rotation of the fan at a rotational speed greater than that of the turbine.

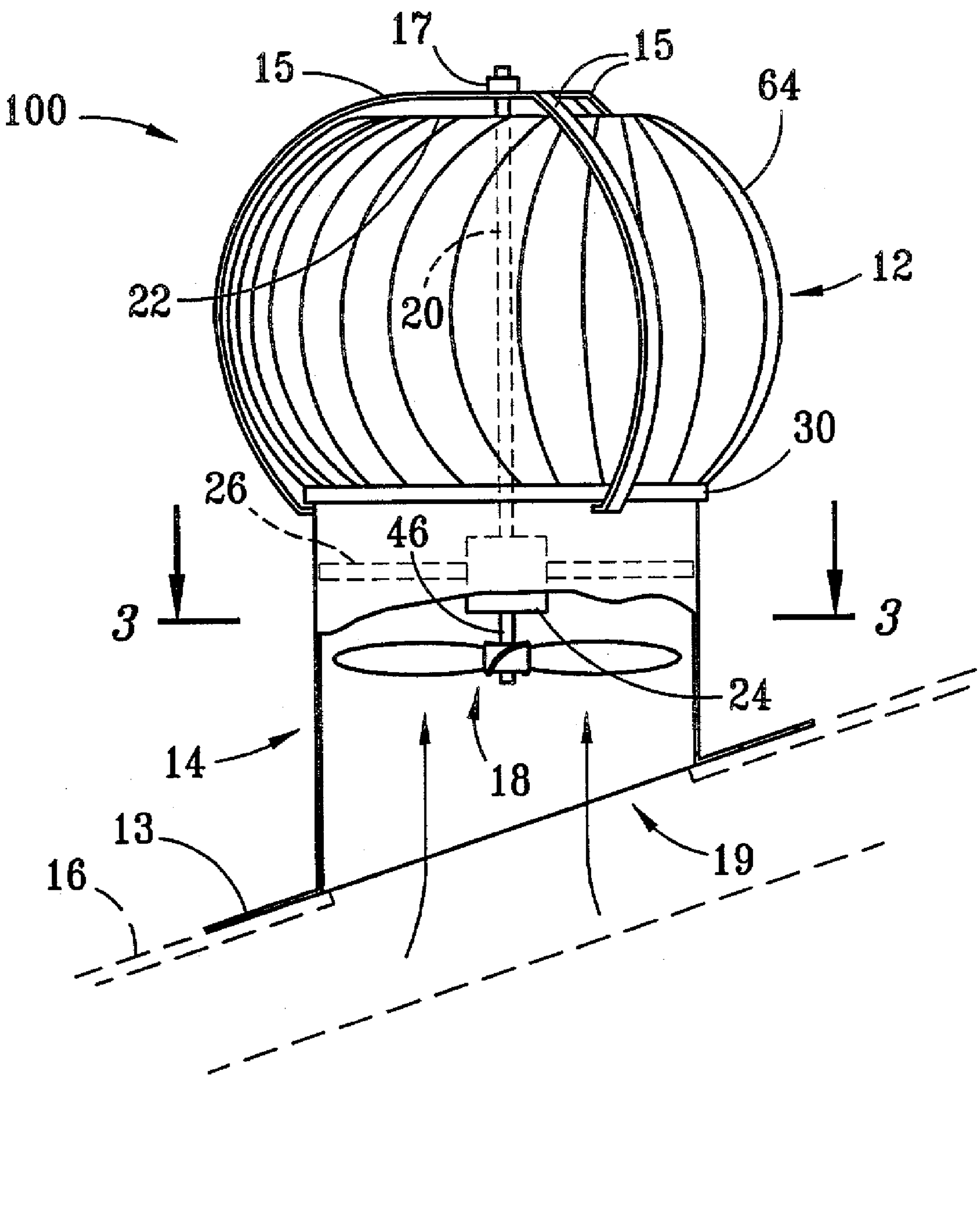


FIG. 1

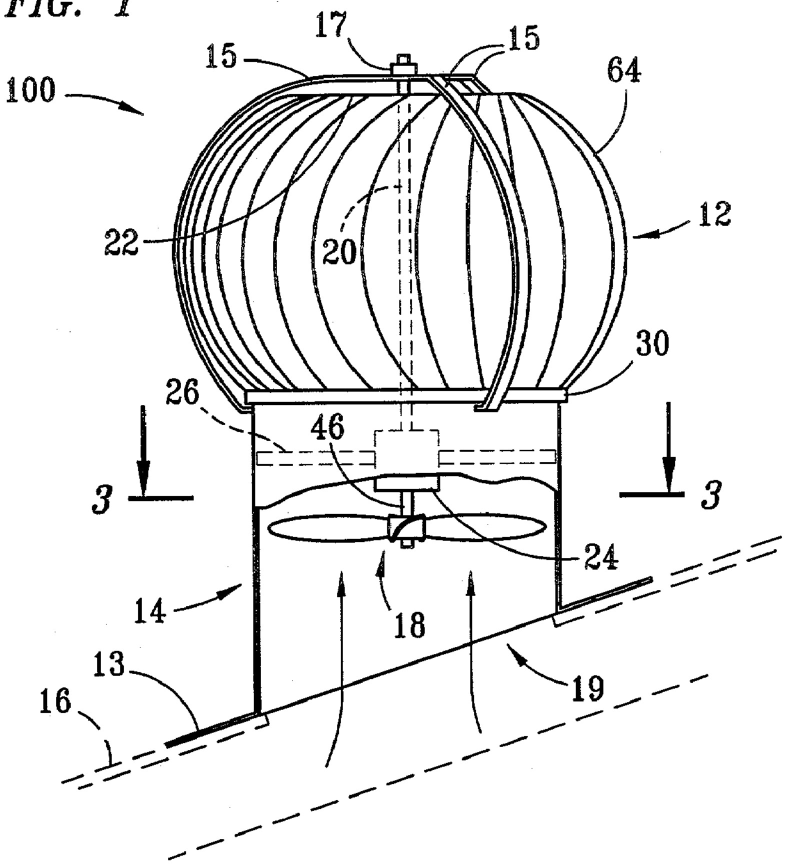

17
15
15
100
64
12
22
20
30
26
46
3
3
24
14
18
13
19
16

FIG. 2

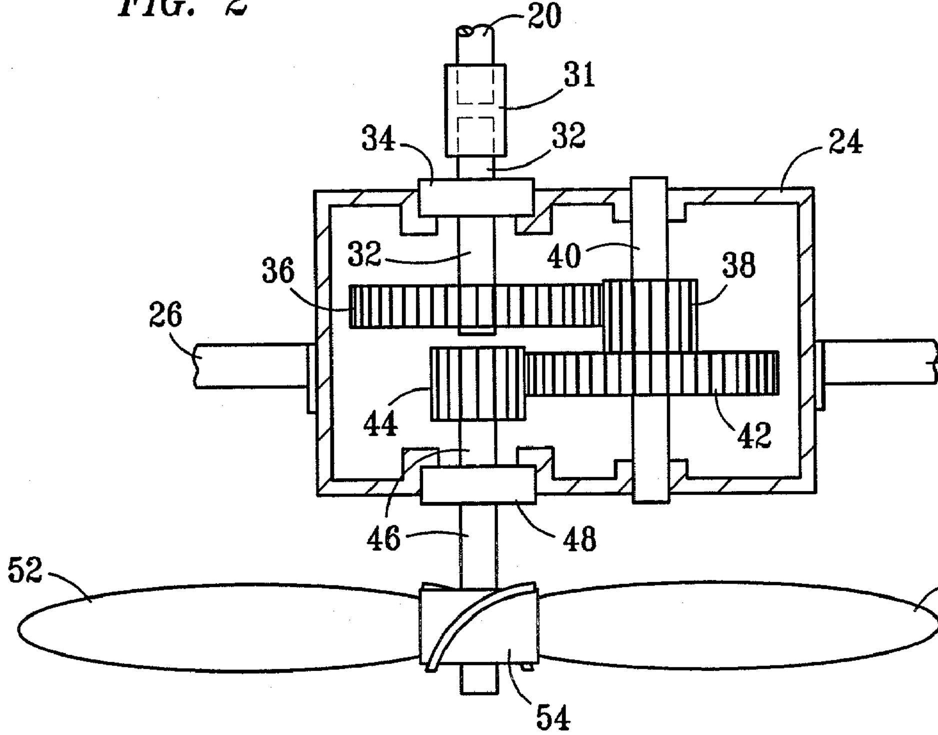

20
31
34
32
24
32
40
36
38
26
26
44
42
46
48
52
52
54

FIG. 3

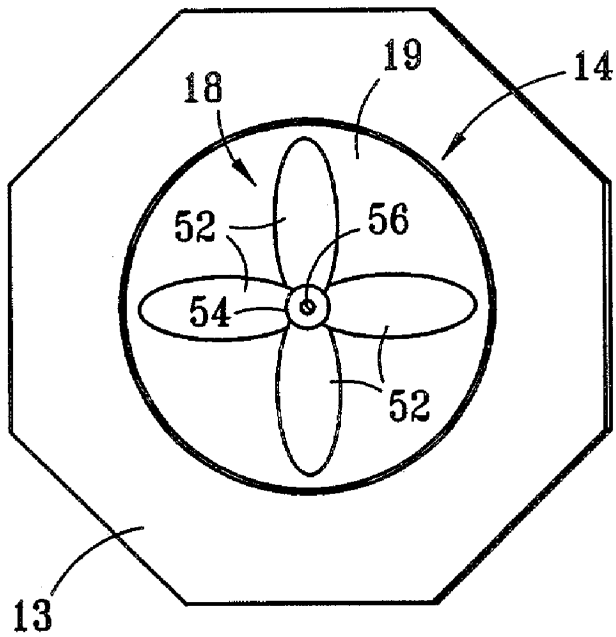
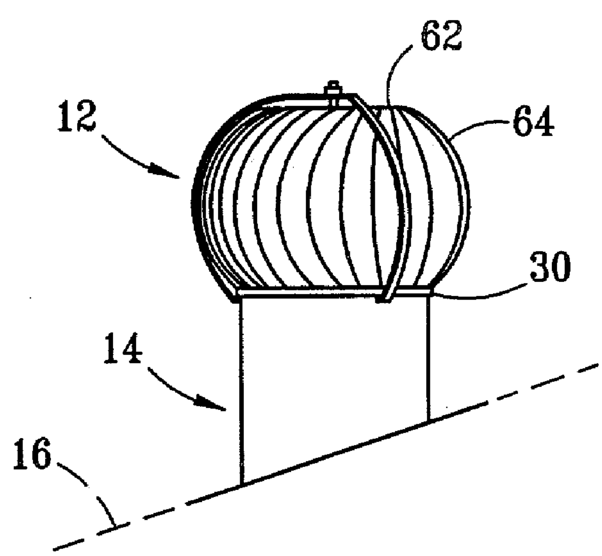


FIG. 4



TURBINE VENTILATOR

TECHNICAL FIELD

[**0001**] The invention relates generally to roof ventilators and in particular to an enhanced wind-powered turbine roof ventilator.

BACKGROUND OF THE INVENTION

[**0002**] Wind-powered turbine ventilators are widely used in a variety of ventilation applications. Turbine ventilators are especially suited for ventilation of the under-roof space of residential, commercial, and industrial buildings. The popularity of wind-driven turbine ventilators derives from their relatively small initial costs, low maintenance requirements, and negligible operating costs.

[**0003**] Turbine ventilators reduce the cost of cooling a building by removing hot air from the under-roof space of a building. Because the effectiveness of a ventilator is a function of the amount of air the ventilator is able to remove from the ventilated space, it is desirable to increase the volume of air-flow through a ventilator. It is further desirable to increase airflow without increasing the size of the ventilation assembly, because larger ventilators are more expensive to manufacture, generally considered unaesthetic, and may take up otherwise useful space.

[**0004**] One solution found in the prior art is to use an externally-powered fan to force air through the ventilator. However, the use of an external power source inherently makes the ventilation apparatus more complicated to manufacture, and more prone to malfunction; translating into higher production and maintenance costs. Use of an external power source also makes the ventilator more expensive to operate than a wind-powered ventilator.

[**0005**] Another solution attempted in the prior art involves including a fan within the ventilation apparatus and connecting the fan by a rod directly to the wind-powered turbine. However, because the rotational speed of the turbine is relatively slow, the fan does not turn quickly enough to provide a sufficient increase in airflow.

SUMMARY OF THE INVENTION

[**0006**] The invention relates to an improved ventilation apparatus comprising a fan which is coupled to a turbine so that rotation of the turbine results in rotation of the fan at a greater speed of rotation than the turbine.

BRIEF DESCRIPTION OF THE DRAWINGS

[**0007**] For a more complete understanding of the present invention and the advantages thereof, reference is now made to the following description taken in conjunction with the accompanying drawings, in which:

[**0008**] **FIG. 1** illustrates a ventilation apparatus;

[**0009**] **FIG. 2** illustrates a gear assembly which may be used in a ventilation assembly;

[**0010**] **FIG. 3** depicts a turbine which may be used in a ventilation assembly; and

[**0011**] **FIG. 4** depicts a fan which may be used in a ventilation assembly.

DETAILED DESCRIPTION

[**0012**] Referring to the drawings, **FIG. 1** shows a wind-powered turbine ventilator **100** embodying features of the present invention. In the embodiment shown in **FIG. 1**, the ventilator **100** includes a turbine **12** rotably mounted on a ventilation shaft **14**, which extends from a ventilation port **19** in a roof **16**. Flashing **13** is preferably used between the ventilation shaft **14** and the roof **16** to prevent precipitation from entering the building. The turbine **12** is preferably mounted to the ventilation shaft **14** using a plurality of support members **15**, which extend from the outer perimeter of the ventilation shaft **14**. The support members **15** are preferably connected at the opposite end to a bearing housing **17** at a point above the center of the turbine **12**. The top of the turbine **12** is preferably rotably mounted in the bearing housing **17** so that the turbine **12** is rotably supported above the ventilation shaft **14** by the support members **15**. A number of other methods of rotably mounting the turbine **12** above the ventilation shaft **14** are known in the art, and any method may be used which is effective for holding the turbine **12** in position above the ventilation shaft **14** while allowing rotational movement of the turbine **12**.

[**0013**] A fan **18** is positioned within or near the ventilation shaft **14**, preferably near the ventilation port **19**, and is preferably configured to force air from the ventilated space through the ventilation port **19**. The fan **18** preferably is coupled to the turbine **12** so that rotation of the turbine **12** results in rotation of the fan **18**. More preferably, the fan **18** is coupled to the turbine **12** so that rotation of the turbine **12** causes the fan to rotate at a greater speed of rotation than the turbine **12**, preferably at a ratio of at least approximately 1.5:1, and, most preferably, at a ratio of about 15:1. The fan **18** is preferably coupled to the turbine **12** so that the fan **18** rotates in the same direction as the turbine, but may alternatively be configured to rotate in the opposite direction.

[**0014**] Preferably, an axle **20** is mounted to the turbine ceiling **22**, preferably near its center. The axle **20** preferably extends downward from the turbine ceiling **22**, substantially in alignment with the axis of rotation of the turbine **12**. The axle **20** is preferably fixed in position with respect to the turbine **12**, so that the axle **20** rotates with the turbine **12**.

[**0015**] Referring to **FIG. 2**, the opposite end of the axle **20** is preferably configured to provide driving power to a gear assembly **24**. The gear assembly **24** is preferably held in a fixed position relative to the ventilation shaft by one or more braces **26**. The axle **20** is preferably connected by a coupler **31** to an input shaft **32**, which preferably extends through a bearing housing **34**. Toward the opposite end of the input shaft **32**, a first gear **36** is preferably mounted to the input shaft **32**. The first gear **36** is preferably configured to drive a second gear **38** mounted on a gear shaft **40**. The gear shaft **40** is preferably rotably mounted in the gear assembly **24** housing. A third gear **42** is preferably mounted on the gear shaft **40**, so that the third gear **42** turns in conjunction with the second gear **38**. The third gear **42** is preferably configured to drive a fourth gear **44**, which is preferably mounted on an upper end of an output shaft **46**.

[**0016**] Preferably, the circumference of the first gear **36** is approximately 4 times the circumference of the second gear **38**. The circumference of the second gear **38** is preferably about ¼ the circumference of the third gear **42**. The circumference of the third gear **42** is preferably about 4 times the circumference of the fourth gear **44**. However, any gear size ratios may be used that is effective for rotating the fan **18** at a greater speed of rotation than that of the turbine **12**.

[**0017**] The output shaft **46** preferably extends through a second bearing housing **48** to the fan **18**. The output shaft **46** is preferably used to drive the fan **18** and to provide support for the fan **18**. Alternatively, the output shaft **46** may be used only to provide a driving force to the fan **18**, and the fan **18** may be supported by another method, such as by use of additional braces (not shown) and a bearing assembly (not shown).

[**0018**] Although the coupling mechanism shown in **FIG. 2** and described above is the preferable coupling means, the fan **18** may alternatively be coupled to the turbine **12** by other means. For example, a drive axle to the gear housing could be configured to engage a the turbine **12** at a bottom rim **30**, or the turbine **12** could be configured to drive a flywheel (not shown), which could in turn be used to drive a fan. Alternatively, the turbine **12** could be used to drive an electric generator (not shown), which could be used to generate electricity to drive an electric fan (not shown). In yet another embodiment, the fan **18** may be coupled to the turbine **12** by a hydraulic connection (not shown). In yet another embodiment, an external power source (not shown), such as solar power or commercially-available electricity, could be used in addition to wind power, to aid in ventilation when wind power is inadequate. Generally, any mechanism may be used for coupling the fan **18** to the turbine **12** that is effective for transferring energy from the turbine **12** to the fan **18** and for causing the fan to rotate at a greater rotational speed than the turbine **12**.

[**0019**] **FIG. 3** depicts a fan that may be used in a ventilator embodying aspects of the present invention. Preferably, the fan **18** comprises a plurality of fan blades **52** attached to a fan hub **54**. Preferably, the fan **18** has about four fan blades **52**, although any number of fan blades **52** may be used. A hole **56** is preferably defined in the fan hub **54** and the hole **56** is preferably configured to receive an output shaft **46**, as shown in **FIG. 1**. Many other fans, impellers, propellers, blowers, and the like are known in the prior art and may be used in the present invention.

[**0020**] **FIG. 4** illustrates a turbine that may be used in a turbine ventilator. The turbine **12** preferably comprises a plurality of turbine blades **64**, attached at an upper end to a roof **62** and attached at a lower end to a rim **30**. The turbine blades **64** are preferably curved outward from the center of the turbine **12**, and are preferably positioned at an angle with respect to the circumference of the turbine **12**. The turbine blades **64** are also preferably placed in close proximity to one another so that, in combination, the blades substantially prevent precipitation from entering the ventilation shaft **14**. Alternatively, a separate cover (not shown) may be place over the ventilation shaft **14** to block precipitation, or precipitation may be allowed to enter the ventilation shaft **14** and then directed into a drain (not shown). Other turbine designs are known in the prior art and may be used in the present invention.

[**0021**] Having thus described the present invention by reference to certain of its preferred embodiments, it is noted that the embodiments disclosed are illustrative rather than limiting in nature and that a wide range of variations, modifications, changes, and substitutions are contemplated in the foregoing disclosure and, in some instances, some features of the present invention may be employed without a corresponding use of the other features. Many such variations and modifications may be considered obvious and desirable by those skilled in the art based upon a review of the foregoing description of preferred embodiments. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the scope of the invention.

What is claimed is:

1. A ventilator comprising:

a turbine; and

a fan configured to force fluid from a ventilated space, the fan being coupled to said turbine so that rotation of the turbine provides a driving force for the fan and results in rotation of the fan at a rotational speed greater than that of the turbine.

2. The ventilator of claim 1 wherein the fan is mechanically coupled to the turbine.

3. The ventilator of claim 1 wherein the fan is coupled to the turbine by a hydraulic connection.

4. The ventilator of claim 1 wherein the turbine is configured to drive an electric generator, and wherein the electric generator is configured to provide electric energy to a fan motor, the fan motor being configured to drive the fan.

5. The ventilator of claim 1 wherein the fan is configured to rotate in the same direction of rotation as the turbine.

6. The ventilator of claim 1 wherein the fan is configured to rotate in the direction opposite the direction of rotation of the turbine.

7. The ventilator of claim 1 wherein the turbine is coupled to a gear assembly and wherein the gear assembly is configured to transfer rotational energy from the input drive shaft to the output drive shaft so that each revolution of the turbine results in more than one revolution of the fan.

8. The ventilator of claim 1 wherein the ventilator is configured so that each revolution of the turbine results in at least about 1.5 revolutions of the fan.

9. A ventilator comprising:

a turbine;

a fan configured to force fluids from a ventilated space; and

a gear assembly coupled to the turbine, and coupled to the fan, the assembly having one or more gears configured to transfer rotational energy from the turbine to the fan.

10. The ventilator of claim 9 wherein the one or more gears are configured so that each rotation of the turbine results in multiple rotations of the fan.

11. The ventilator of claim 9 wherein the one or more gears are configured so that each revolution of the turbine results in at least about 1.5 revolutions of the fan.

12. The ventilator of claim 9 wherein the gear assembly comprises a input shaft coupled to the turbine, an output shaft coupled to the fan, and wherein the one or more gears are configured to transfer rotational energy from the turbine to the fan.

13. The ventilator of claim 11 wherein the one or more gears are configured so that each rotation of the input drive shaft results in multiple rotations of the output drive shaft.

14. The ventilator of claim 9 wherein the one or more gears are configured so that each revolution of the input shaft results in at least about 1.5 revolutions of the output shaft.

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