United States Patent

[11] 3,589,044

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[54] TORNADO DEVICE
7 Claims, 7 Drawing Figs.

[52] U.S. Cl. 40/106.22, 35/49
[51] Int. Cl. G09f 13/24
[50] Field of Search 40/126, 106.21, 106.22; 35/10, 49; 73/147

[56] References Cited

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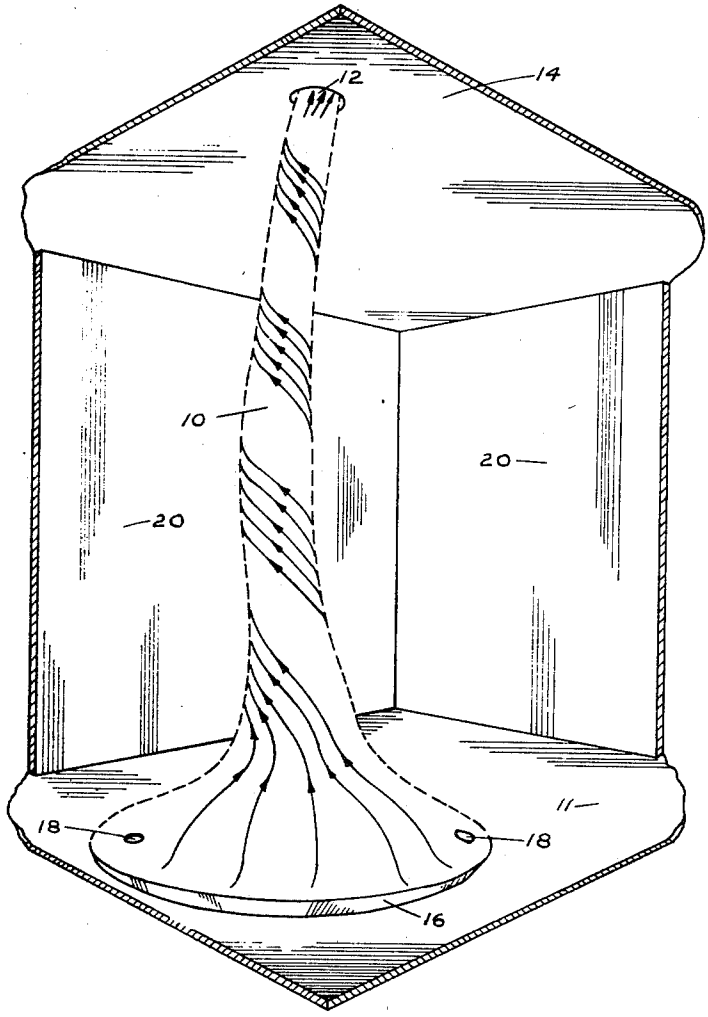
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ABSTRACT: Air moving apparatus arranged and operated as disclosed herein is capable of creating a visible tornadolike phenomenon for display, observation and study.



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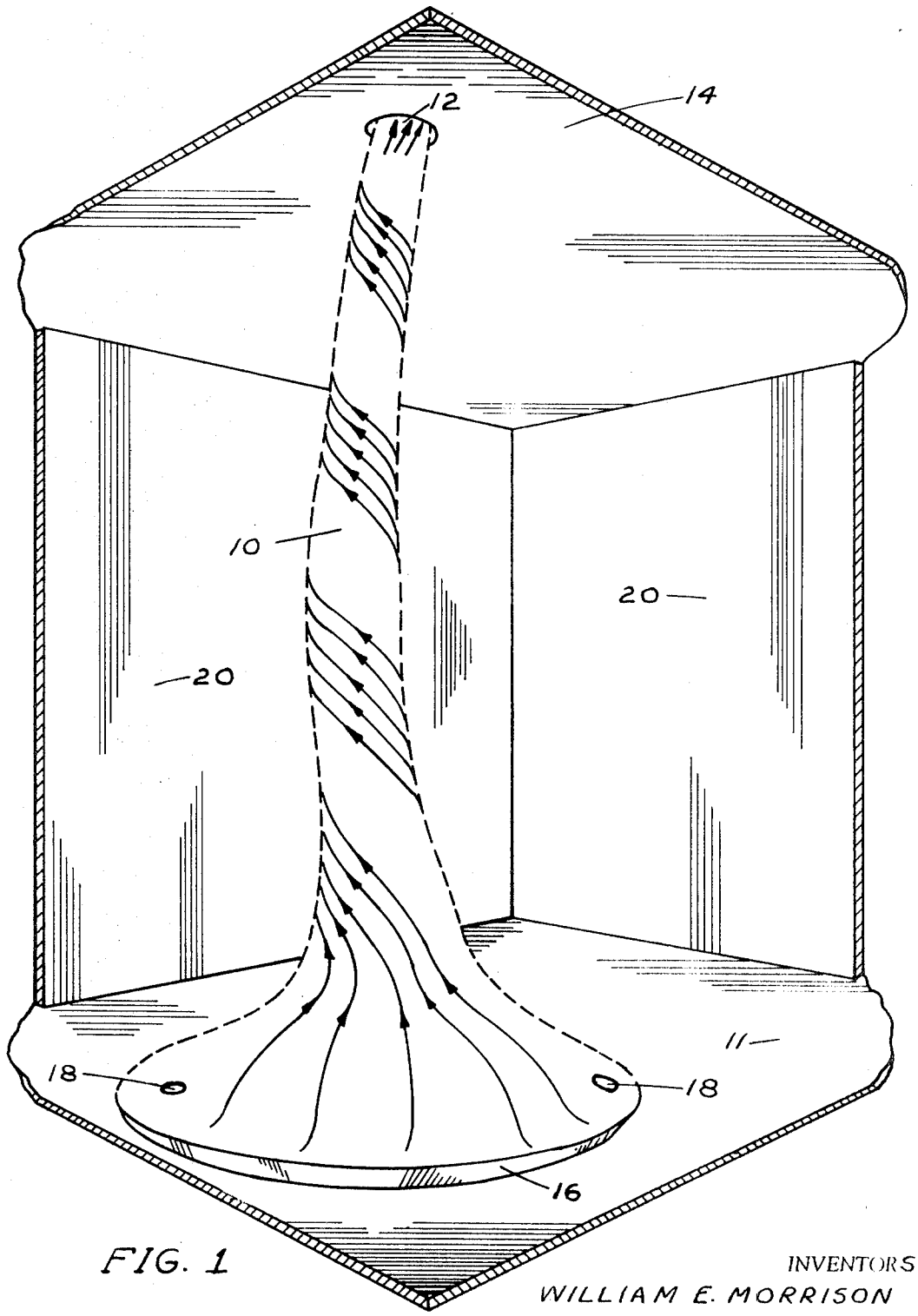


FIG. 1

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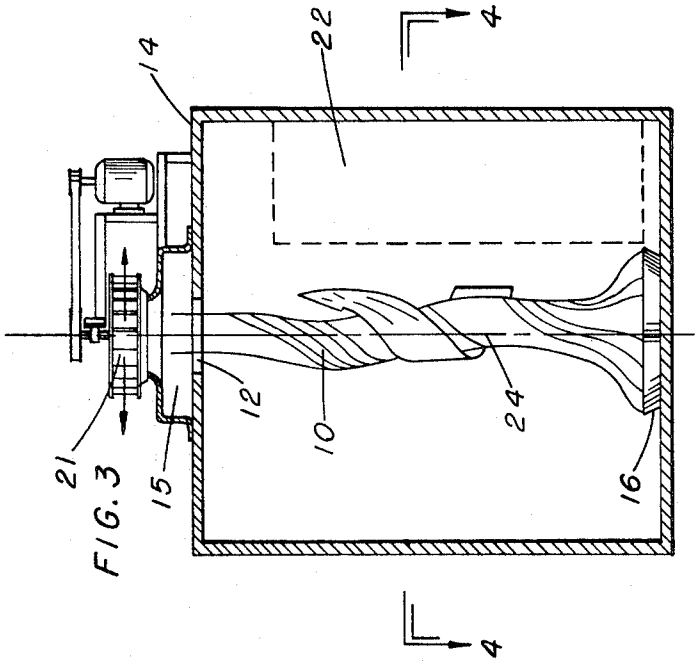


FIG. 3

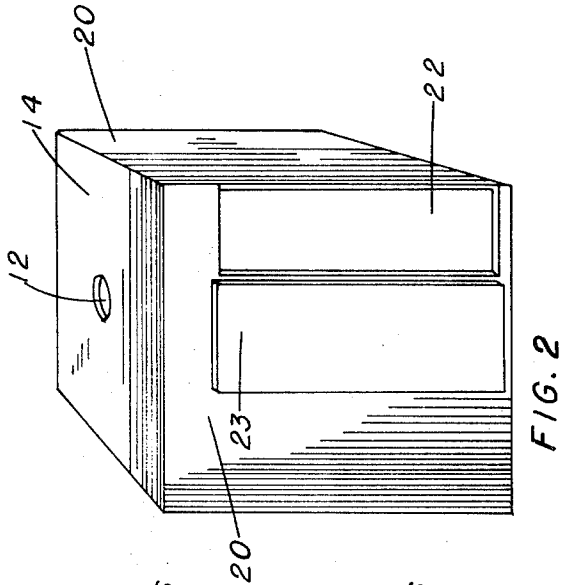


FIG. 2

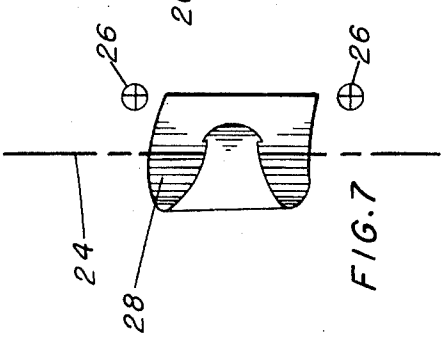


FIG. 7

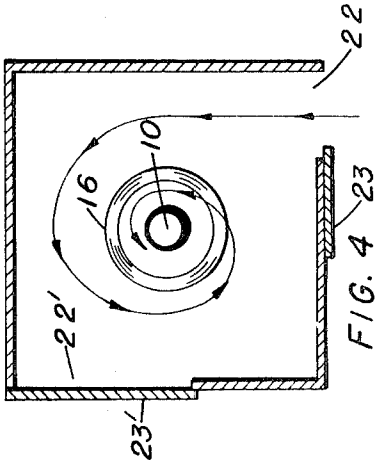


FIG. 4

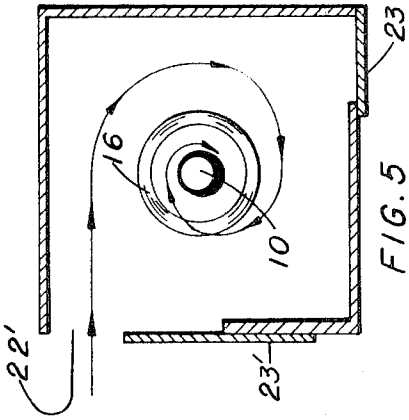


FIG. 5

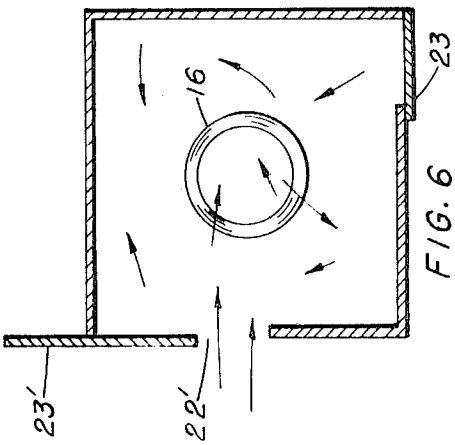


FIG. 6

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TORNADO DEVICE

In the drawings:

FIG. 1 is a perspective view of a "tornado" created according to our discovery or invention.

FIG. 2 is a perspective view of the chamber only in which the "tornado" is created.

FIG. 3 is a vertical section of an exhaust fan and the chamber shown in FIG. 2, with the door indicated in phantom.

FIG. 4 is a cross-sectional view taken along line 4–4 of FIG. 3 and showing counterclockwise flow of air.

FIG. 5 is a cross-sectional view similar to that of FIG. 4 but showing clockwise flow of air.

FIG. 6 is a view similar to that of FIGS. 4 and 5 except that consistent and continuous airflow pattern are not established.

FIG. 7 shows an arrow representing airflow relative to a vertical axis.

The term "tornado" as used herein means the phenomenon created by applicants' arrangement of a spiral helix formation or vortex column of rising air which is made visible to the human eye when a substance visible in air is introduced into the airstream. The tornado created hereby has use for academic scientific study of similar phenomenon occurring in nature, of which knowledge is quite limited. It has further use as an attractive and educational demonstration.

FIG. 1 is a pictorial representation of the tornado showing a visible vortex **10** or helical-spiral column rising from floor level **11** toward an opening **12** in ceiling or top wall **14**. A source for emitting a substance visible in air used herein is a shallow pan **16** containing hot water into which is placed dry ice **18**. Obviously other substance such as smoke could be introduced at or near floor level with similar results.

Within a closed chamber as defined by floor **11**, ceiling **14** and walls **20**, dry ice in a pan of warm water readily produces a layer of clouds sinking to the floor level and stacking upwardly. When air is exhausted through opening **12** by a power fan **21** (not shown in FIG. **1**) and air is admitted into the chamber at prescribed openings, the phenomenon of FIG. **1** is visible.

FIG. **2** shows the chamber only in which a tornado may be created. It is defined by walls **20**, ceiling **14** and a bottom wall or floor **11**. The chamber used in applicants' discovery or invention is generally cuboid of 8 to 10 feet on an edge. However exact dimension, shape or relationship is not controlling to establish the phenomenon herein. An air inlet such as the rectangular opening **22** may be provided with a hinged or sliding door **23** to vary inlet characteristics. As shown in cross-sectional FIG. **3**, an exhaust fan **21** is positioned on top wall **14** over opening **12** for removing air from the chamber. This fan is of any common type power driven roof exhauster which is capable of handling a substantial volume of air at relatively low static pressure. Air is permitted to enter the chamber through opening **22** in one wall as shown so as to continuously replenish the air drawn therefrom by the power exhauster.

FIG. **3** is the cross-sectional view of FIG. **2** but additionally shows an exhaust fan **21** in position and vortex **10** created thereby. Shallow pan **16** is located on floor **11** beneath exhaust port **12** and generally in line with normally vertical axis **24**. Vortex **10**, made visible by a substance such as smoke, is created by air entering the chamber through opening **22** and tangentially of axis **24**. Air is drawn into spiral motion and terminates in a helical-spiral column of air rising generally along axis **24**. This vortex revolves at 50—300 r.p.m. and rises vertically at 100—500 feet per minute. By the apparatus disclosed, a vortex in the range of 6 to 8 inches in diameter is created. An eye (not shown in drawings) in the range of 1½ to 3 inches in diameter is visible along the center of the column or vortex.

FIGS. **4**, **5** and **6** are cross-sectional views of FIG. **3** taken along line 4–4, but showing different air inlet arrangements. Walls **20** define an enclosure having an opening **22** tangentially directed with respect to axis **24**. The size of opening **22** in one of the walls is variable as for example by a sliding or hinged door **23**. As shown in FIG. **4**, air enters the chamber

tangentially generally along one wall and is drawn into counterclockwise rotation and into a tight swirling vortex **10** moving upwardly out through opening **12** by power exhaust fan **21**. As shown in FIG. **4**, entering air flows counterclockwise. Door **23'** is shown completely closing opening **22'**.

FIG. **5** shows the chamber of FIG. **4** but with door **23** closing opening or port **22**, and with door **23'** exposing opening **22'**. Air entering in FIG. **5** is drawn into clockwise rotation as shown by the arrows. As before a vortex **10** is created but in a different rotational direction.

In FIG. **6**, door **23** closed port **22**. Door **23'** is shifted so as to expose opening **22'** directed generally toward axis **24** (not tangentially thereof as in FIGS. **4** and **5**). When the entrance to the chamber is other than tangential, a directional pattern of airflow is not easily established, airflow this is indicated by the arrows shown in FIG. **6**.

Airflow in the chamber is clockwise or counterclockwise depending upon established tangential entrance. This can be controlled by the physical arrangement. The direction of rotation of the impeller in exhaust fan **21** is not controlling on clockwise or counterclockwise rotation of vortex **10**. It is anticipated that means other than a power exhaust fan may be used to create a low pressure through exhaust port **12**.

FIG. **7** indicates airflow with respect to axis **24**. In all of the arrangements wherein clockwise or counterclockwise airflow is established and terminates in a vortex, tangential entry or the equivalent is established. Airflow into a chamber is indicated by symbols **26** in FIG. **7** to be away from the viewer and into the paper. The air currents as indicated by symbolic arrow **28** are drawn into movements about axis **24** and finally into a tight upwardly moving spiral-helix or vortex **10**. By an airflow passing in the general direction **26** with respect to axis **24**, a tangential relationship is established.

The entire column or vortex **10** may drift somewhat over pan **16** but returns and remains within the general area. The vortex has an eye, and this drifts with the column. The vortex may partially fade for an instance at its base or along its height, but will reform just as quickly.

Obviously it is within the limits of our invention or discovery to define the chamber in shapes varying from what we have disclosed. For example, the chamber could be cylindrical or round, or of any number of shapes all of which would establish tangential entry of air. Likewise, the exhaust means may be varied without departing from the principle disclosed. The intake and exhaust port may be varied in size and location somewhat and remain within the spirit of our disclosure.

The present invention may be embodied in other specific forms without departing from the spirit of our invention. We wish the breadth of the invention to be measured only by the claims herein:

We claim:

1. Apparatus for creating a contained visible tornado comprising:

a structure having walls means defining a chamber,

an opening in a top portion of said wall means facing generally along an axis extending to an opposite wall of said chamber and said opening communicating with power driven exhaust means for drawing air therethrough from said chamber,

another opening in a side portion of said wall means for admitting air into said chamber when air is removed through said first-mentioned opening,

said another opening admitting air into said chamber in a direction tangentially of said axis whereby air entering said chamber is drawn into a tight spiral helix motion defining a vortex generally about said axis and rising upwardly toward said exhaust opening,

means for inducing in said chamber a substance visible in air at a location remote from said first mentioned opening for visibly marking said vortex.

2. The claims subject matter of claim 1 wherein said exhaust opening is located on the top of said chamber and said inlet opening is located on a side of said chamber.

3. The claimed subject matter of claim 2 wherein said axis is generally vertically disposed.

4. The claimed subject matter of claim 3 wherein the inlet opening may be varied.

5. Apparatus for creating a contained visible tornado comprising:

a chamber defined by walls, ceiling and floor,

an exhaust opening in the ceiling communicating with a power air exhaust system for removal of air from the chamber,

a vertical inlet opening in one of the walls for admitting air into the chamber,

said exhaust opening facing into the chamber generally along a vertical axis extending substantially to the floor,

said inlet opening facing horizontally for admitting air of the vertical axis so that the air drawn into the chambers is in spiral motion which terminates in a tight rising helical vortex column resembling a tornado,

a substance visible in air introduced into said chamber adjacent the floor for identifying said vortex.

6. Apparatus for creating a contained visible simulated tornado comprising:

wall means enclosing the top, side and bottom of an empty chamber,

an opening in the top wall facing downwardly along an axis extending generally uninterrupted to the bottom wall and generally centrally of the sidewalls,

power driven air exhaust means in communication with the opening in the top wall for removing air therethrough from said chamber,

an opening in the side wall extending a substantial portion of the height thereof and facing in a direction to one side of said axis whereby air in being drawn therethrough to said chamber in response to air being drawn from said chamber by said exhaust means is drawn cyclonically into said chamber and into a helical-spiral vortex about said axis and exhausted through the opening in the top wall,

means for introducing a substance visible in air above the bottom as an aid in identifying said vortex.

7. The claimed subject matter of claim 6 further defined by said sidewall opening so located in the sidewall that a portion of the sidewall defines a surface for guiding entering air into cyclonic motion about said axis.