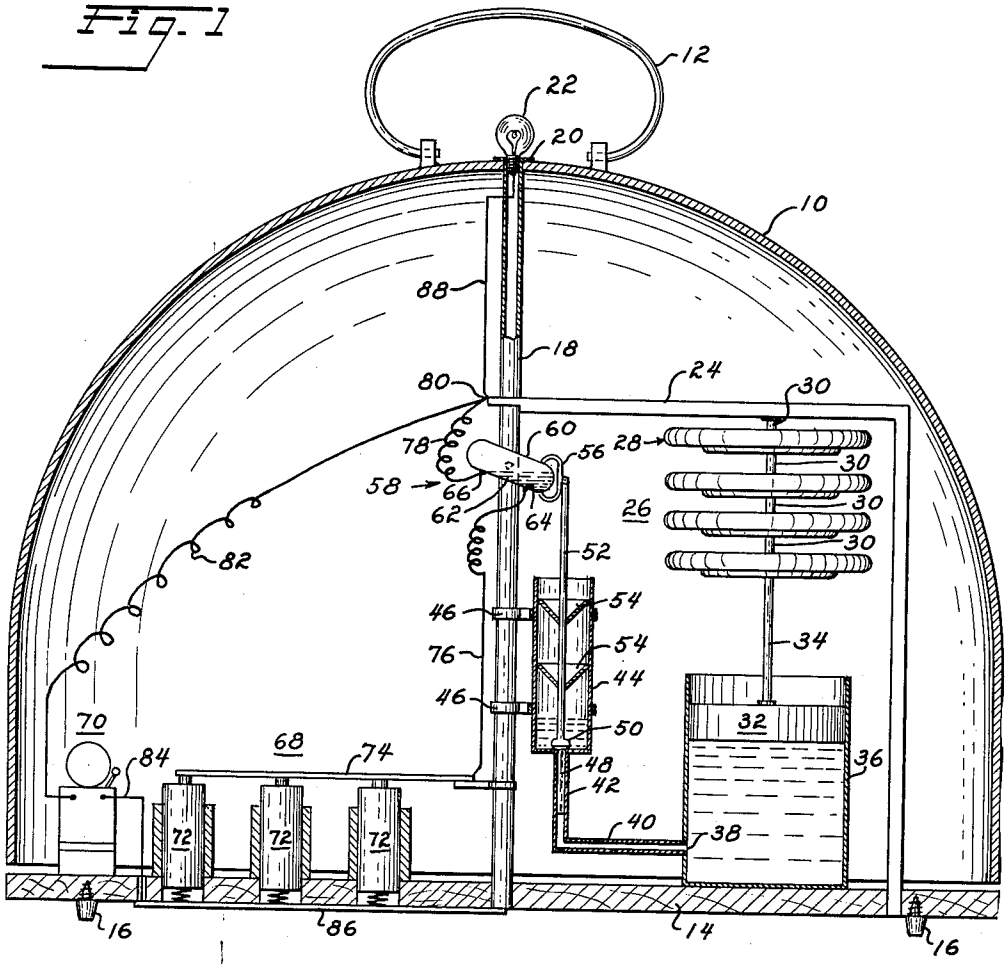
April 10, 1962 G. M. WILSON 3,029,422

TORNADO ALARM

Filed April 20, 1959

Fig. 1



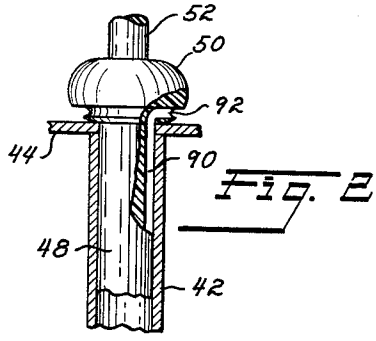


Fig. 2

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TORNADO ALARM

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This invention relates to tornado alarms and more particularly to a tornado alarm responsive to the rate of change of pressure in the area surrounding a tornado.

Several devices for indicating the approach of tornadoes have been devised but on the whole are unsatisfactory. In these prior devices the approach of a tornado has been determined by the use of barometric pressure sensing means when the barometric pressure drops to a predetermined value. As a result, these alarms might well be set off by normal changes in barometric pressure; a condition which is highly undesirable. In addition, another equally undesirable feature is that alarms of the above described type have to be adjusted with respect to the altitude of their particular location. Also, tornadoes have been known to occur without any specific low pressure areas. The only invariant condition associated with the approach of a tornado is an abrupt drop in pressure in the area immediately surrounding the tornado. This might be an area within a one or two mile radius of the center of the storm.

It is, therefore, an object of this invention to provide a tornado alarm which is not affected by normal ambient pressure variations.

Another object of this invention is to provide a tornado alarm which is not affected by any particular value of ambient pressure.

Still another object of this invention is to provide a tornado alarm which is responsive to the rate of change of barometric pressure.

Still another object of this invention is to provide a tornado alarm, the operation of which is independent of altitude.

Still another object of this invention is to provide a tornado alarm which is positive in operation and requires little or no maintenance.

These and other objects of this invention will become apparent from the following specification and drawings which relate to a preferred embodiment of my invention.

In the drawings:

FIG. 1 is a side elevation of the device.

FIG. 2 is a detailed elevation of a component in FIG. 1.

Referring in detail to the drawings, and more particularly to FIG. 1, the tornado alarm is shown as being contained in a substantially hemispherical outer cover 10 having a handle 12 thereon and mounted on a base member 14. A set of leg members 16 is provided to support the base member 14.

Mounted in the base member 14 is a hollow supporting shaft 18 which is perpendicular to the base member 14 and extends upward through the outer cover 10 where a flange 20 is used to lock it in position. Since the flange 20 is spread outwardly from the longitudinal axis of the supporting shaft 18 the upper end of the shaft is open and provides a socket for an electric light bulb 22.

A right angle bracket 24 is mounted between the supporting shaft 18 and the base member 14 having arms perpendicular to the shaft 18 and base 14, respectively.

Mounted between the top of the right angle bracket

24 and the base 14 is a pressure sensitive aneroid means 26 comprising a plurality of evacuated aneroid capsules 28 connected to the bracket 24 and interconnected one to the other by a plurality of rods 30 extending along the axis of expansion of the aneroids.

A piston 32 is suspended from the lowermost aneroid 30 by a piston rod 34 and is received in the open upper end of a fluid reservoir 36 which is filled with fluid up to the lower surface of the piston 32. The reservoir 36 is supported by the base member 14.

A fluid outlet 38 is provided near the lower end of the reservoir 36. A fluid flow line 40 is connected thereto which extends to a flow rate responsive device to be described hereinafter.

The flow line 40 extends upwardly as shown at 42 and is connected through the base of a cylinder 44 which comprises a second reservoir for the fluid in the flow line 40.

The cylinder 44 is shown mounted on the supporting shaft 18 by a pair of brackets 46.

The vertical flow line section 42 contains a piston having a lower cylindrical section 48. An integral upper section 50 which is substantially spherical is not contained in the flow line section 42 but acts as a stop which abuts the base of the cylinder 44 to limit the downward movement of the lower cylindrical piston section 48 into the flow tube 44.

An elongated stem 52 integral with the upper surface of the upper piston section 50 extends along the longitudinal axis of the cylinder 44 from the upper piston section 50 to a point outside of the cylinder.

Intermediate the ends of the stem 52 are a plurality of conical baffles 54 mutually concentric with the stem 42 and cylinder 44 and contained within the cylinder to prevent the escape of fluid therefrom in the event that the cylinder is tilted too far off its vertical axis. The baffles 54 also provide guide means for the piston in the event of piston movement.

Attached to the upper end of the stem 52 is a C-shaped or other suitable switch actuating bracket 56 which is connected to a portion of an electric switch 58. As shown, the switch 58 comprises a capsule 60 pivotally mounted on the support shaft 18. Contained within the capsule 60 is a pool of mercury 62 which is adapted to engage either one or both of the switch contacts 64 and 66 depending on the position of the capsule 60.

The switch 58 controls an alarm circuit which includes a power source 68, an audible alarm 70 (shown as a bell or buzzer) and a visual alarm comprising the above described light bulb 22. The power source 68 may consist of a plurality of parallel connected dry cell batteries 72 as shown.

Beginning at the positive buss bar 74 of the power source 68 the audible alarm circuit may be traced through line 76, switch contact 64, mercury pool 62, switch contact 66, line 78, junction 80, line 82, terminals and motive means of the audible alarm 70 and line 84 to the negative buss 86 of the power source 68.

The junction 80 is shown on a portion of the right angle supporting bracket 24 so as to be insulated from the electrically conductive support tube 18.

The visual alarm circuit is in parallel with the audible alarm circuit and extends from the junction 80, through line 88, light bulb 22 and the support tube 18 to the negative buss 86 of the power source 68; the negative

buss 86 being in contact with the base of the support tube 18.

Referring to FIG. 2, the piston contained in the vertical flow line section 42 is shown in detail and will hereinafter be referred to as a rate of flow responsive piston 48—50.

The lower piston section 48 is shown as having an axially extending open peripheral slot 90 therein which extends the length of the lower section and intersects with a circumferentially disposed open slot 92 in the upper piston section 50.

For normal rates of fluid flow in the flow line 40 and the vertical flow line section 42, the opening intersecting slots 90—92 act as a bypass to vent fluid around the piston without causing movement thereof due to pressure building up in the flow line below the lower piston section 48.

In the event of abnormally high rates of flow, the pressure below the lower piston section 40 builds up since the bypass slots 90—92 cannot pass the increased volume of fluid which tends to flow therethrough. Thus, the flow rate responsive piston 48—50 must move vertically as a result of the pressure induced by the increased flow rate.

Operation

Referring to FIGS. 1 and 2, the operation of the above described tornado alarm is as follows:

During atmospheric pressure changes, a drop in barometric pressure will cause the aneroid capsules 28 to expand and transmit motion through the connecting rods 30 and piston rod 34 to the piston 32, forcing the piston 32 downward in the fluid reservoir 36 at a rate proportional to the rate of change of barometric pressure.

As a result of the downward movement of the piston 32, the fluid in the reservoir 36 displaced by this movement is forced through the reservoir outlet 38 and into the flow tube 40 at a rate of flow proportional to the rate of change of barometric pressure as transmitted through the piston rod 34 and piston 32 from the aneroid capsules 28.

For normal slow changes in barometric pressure, the flow rate of fluid in the flow tube 40 is such that the volume of fluid displaced by the piston 32 is passed through the vertical flow section 42 and the bypass slots 90—92 in the flow rate responsive piston 48—50 and into the cylinder 44.

In the case of rapid changes in barometric pressure such as the abrupt drop in pressure in the immediate area surrounding a tornado, the aneroid captules 28 cause the piston 32 to accelerate rapidly downward displacing a relatively large volume of fluid through the reservoir outlet 38 in a much shorter time, thereby greatly increasing the rate of fluid flow in the flow line 40.

As a result, the increased volume of fluid cannot be adequately passed through the bypass slots 90—92 in the flow rate responsive piston 48—50 and the piston must move vertically in the vertical flow section 42 in order to compensate for the increased pressure in the vertical flow section 42 due to the increased flow rate therein.

The upward movement of the flow rate responsive piston 48—50 displaces the vertical stem 52 thereon by the same amount. Thus, the switch actuating member 56 on the upper end of the stem 52, which is in contact with the capsule 60 of the switch 58, is moved upward to pivot the switch capsule counterclockwise as shown. When the switch capsule 60 is pivoted in this manner, the mercury pool 62 bridges the switch contacts 64—66 and closes the alarm circuit, sounding the alarm and indicating the approach of a tornado.

As can be readily observed from the above description, my invention satisfies a long felt need in the art for a tornado alarm which is not prone to be actuated by atmospheric pressure conditions other than those definitely associated with a tornado. In addition, no adjustment for locational altitude variations is necessary.

It is to be understood that the embodiment of my invention as shown and described herein is for the purpose of example only and is not intended to limit the scope of the appended claims.

I claim:

1. A tornado alarm responsive to the sudden drop in atmospheric pressure preceding the arrival of a tornado comprising closed bellows type of pressure responsive means, motion transmitting fluid means during all pressure changes actuated by said pressure responsive means, switch means, switch operating means connected to and selectively responsive to the rate of motion of said motion transmitting fluid means, alarm means, and a source of electric power connected to said alarm means through said switch means whereby when said rate of change of motion of said motion transmitting fluid means exceeds a predetermined value said switch means acts to close the circuit between said power source and said alarm means.

2. The device as described in claim 1 wherein said switch means comprises a support means, a cylinder open at its upper end mounted on said support means, a fluid inlet at the lower end of said cylinder, rate of flow responsive piston means for said fluid inlet, a stem on said piston means extending substantially along the longitudinal axis of said cylinder, switch actuating means on the end of said stem opposite said piston means, and a switch mounted on said support means in operative relationship with said switch actuating means.

3. The device as described in claim 1 wherein said pressure responsive means comprises a plurality of aneroid means interconnected along a common axis of expansion.

4. The device as described in claim 1 wherein said motion transmitting means comprises a fluid reservoir having a fluid outlet at its lower end, a piston slidably mounted in the upper end of said reservoir in contact with the upper surface of the fluid therein and a piston rod connected between said piston and said pressure responsive means, whereby any motion of said pressure responsive means is transmitted through said piston rod and said piston to the fluid in said reservoir to induce a flow of fluid through said outlet.

5. In a tornado alarm, a rate of flow responsive means actuated by rates of flow therethrough in excess of a preselected critical value comprising a fluid flow line, a piston internally concentric with said flow line, an outlet in said flow line, an enlarged portion mounted on the upper end of said piston and seated on said outlet, a longitudinal slot in said piston, and a peripheral slot on said enlarged upper portion interconnected with said longitudinal slot on said piston whereby normal rates of flow in said flow line are bypassed around said piston by said slots and rates of flow in excess of a preselected critical value cause said piston to move in a direction acting to unseat said enlarged upper portion from said outlet.

6. In a tornado alarm, switch and operating means therefor comprising, in combination, a support means, a cylinder open at its upper end mounted on said support means, a fluid inlet at the lower end of said cylinder, rate of flow responsive piston means for said fluid inlet having a fixed opening for fluid flow in both ways therethrough at all times and in all positions of said piston means, a stem on said piston means extending substantially along the longitudinal axis of said cylinder, switch actuating means on the end of said stem opposite said piston means and a switch mounted on said support means in operative relationship with said switch actuating means whereby motion of said piston means in response to rates of flow in excess of a predetermined critical value is transmitted through said stem to said switch actuating means to operate said switch.

7. In a tornado alarm responsive to the sudden drop in atmospheric pressure preceding the arrival of a tornado,

in combination, closed fluid atmospheric pressure means responsive to the sudden drop in pressure, fluid flow means operatively connected with said pressure responsive means to produce a flow of fluid in said fluid flow means having a flow rate proportional to the rate of change of atmospheric pressure action on said pressure responsive means, rate of flow responsive switch means directly coupled to said fluid flow means and actuated in response to flow rates of said fluid flow in excess of a predetermined critical value, alarm means, and a power source connected through said switch means to said alarm means whereby, upon the approach of a tornado said switch means is actuated by the sudden drop in atmospheric pressure to connect said power source to said alarm means.

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