

2018

PATENT ATTORNEYS
EXAMINATION

PAPER E

Patent Attorney Practice in New Zealand
Including Interpretation and Criticism of Patent
Specifications

Regulation 158(1)(e)

Duration: 4 hours (plus 10 minutes for reading)

Question

Documents

- Granted New Zealand patent NZ 987654 owned by Yokoburi Enterprises, priority date 8 June 2015, filed 8 June 2016.
- **Description of client's product, with drawings**
- Prior art document US 3,826,135 (D1) published 18 October 2008
- Prior art document US 5,531,114 (D2) published 2 July 1996
- Online brochure from Pioggia SA, dated April 2015

Facts

Your client Harold Regen **has come to you with a new product he's developed.**

Harold is a retired industrial chemist who has started making agricultural products. He is new to the industry, but very enthusiastic and full of good ideas.

He has developed a new rain gauge for farmers, called the '**Green-Gauge**', which he thinks is going to blow all the other products out of the market. He tells you that existing rain gauges are very flimsy, and are made out of materials that discolour or break down over time. **They can't** handle the heavy rain and wind conditions found on many New Zealand farm properties, or stand up to the occasional nudge from inquisitive stock or wildlife.

Harold tells you that it is a recognised problem that a fixed vertical rain gauge may not accurately **record rain level, because it can't capture rain falling at an angle due to wind.** For accurate reading, a rain gauge needs some way to capture rain falling at an angle. A common way to do this is to enable the vessel that collects the rain to move with the direction and velocity of the wind, so that the opening of the vessel is always pointing in the direction from which the wind and rain is coming. Prior art rain gauges achieve this in different ways, but Harold thinks he has come up with something new. He provides you with some drawings he has made of the Green-Gauge, and a description of how it works.

Harold's rain gauge has been designed to be robust and accurate. It is made of heavy duty environmentally friendly plastic in a distinctive shade of green which is resistant to UV damage. It is a closed system with a fixed receiving cup, which avoids any evaporation or loss of rain. He has also reinforced the receiving cup with a cover held in place by screws, to **ensure that the collected rain can't be disturbed or lost if** no one can get there immediately to check the level. Harold also points out that, **because it doesn't** hold rain, the cup remains responsive to the wind. In other designs he trialled the weight

Question

of the collected rain weighed down the gauge too much to get an accurate measurement.

Harold has coated the inside of the tubing and the collection vessels of the Green-Gauge with a top-secret compound he has recently developed that repels water by disturbing surface tension. This ensures that all of the rain entering the collecting cup travels to the receiving cup for measurement. Harold thinks that his compound may have wider industrial application.

Harold is keen to start selling his rain gauge, but he is familiar with the patent process from his previous career and wants to be sure **his rain gauge doesn't infringe** anything. He has found a granted patent he thinks may be a problem (NZ 987654), owned by scientific instruments company Yokoburi Enterprises. You do some more searching and find two patents which could be relevant to a validity analysis of NZ 987654. You also find a brochure on the internet advertising a collection vessel with a flexible funnel, distributed by agricultural products company Pioggia SA. Harold says that this kind of vessel is common in the agricultural products industry.

Harold asks you to advise him on whether he risks infringing NZ 987654 by selling his rain gauge and, if so, what he can do about it.

Questions

Provide advice to Harold on the following:

1. Would manufacture and sale of Harold's Green-gauge rain gauge infringe patent NZ 987654? Consider all claims. 35 marks
2. What are Harold's **options** for challenging the validity of NZ 987654, and would he be successful? Consider all claims. 50 marks
3. What might Yokoburi Enterprises do to improve its position? 5 marks
4. Make a recommendation to Harold. What other issues should Harold be aware of, and what actions could he take to improve his position? 10 marks

DYNAMIC RAIN GAUGE ASSEMBLY

FIELD OF THE INVENTION

This invention relates to rain gauges. More particularly, it relates to a dynamic rain gauge assembly which is responsive to the velocity and direction of rain fall such that
5 the rain gauge assembly is capable of accurately collecting and measuring rain fall under dynamic weather conditions.

BACKGROUND OF THE INVENTION

Rain gauges have long been used as part of man's attempt to analyse and understand his environment.

10 The most common form of rain gauge currently available is a graduated clear plastic or glass tube or cylinder which, when placed outdoors, does a fairly decent job of measuring rain fall. In fact, the clear plastic or glass graduated cylinder is very accurate in its measurement when rain fall is fairly perpendicular to the earth or ground. But
15 because rain fall is typically the result of violent weather conditions in which the wind is blowing and the rain is driving in any direction but straight downwardly, the clear plastic or glass cylinder becomes quite inadequate for its intended purpose.

Under those conditions, which can be quite dynamic, the driving wind and the concomitant rain comes from different directions and at different angles relative to the perpendicular. This rain, which is driven by the speed and direction of the wind, can also
20 quickly and suddenly change directions under storm conditions. Under those storm conditions, the typical rain gauge is a very inaccurate way to measure rain fall.

The reason for this is that the rain, when analysed from a cross section of the dynamic perpendicular direction in which it falls, typically sees a circular opening to the rain collecting cylinder. To the contrary, the rain falling at a substantial angle to the
25 perpendicular sees the circular opening to the graduated cylinder as anything but a perfect circle. Instead, it sees an ellipse. And the greater the angle at which the rain is being driven, the greater is this elliptical effect. That is, the square area of the ellipse as seen by the driving rain is proportionately smaller than the square area of the circular opening of the graduated cylinder as the angle relative to the perpendicular becomes
30 greater.

A number of devices have been constructed in an attempt to take a rain gauge-like device and somehow try to keep it pointed in the direction of the driving rain. And they attempt to do this while the rain gauge-like device is filling the device. See, for example, U.S. Pat. No. 5,531,114 issued to Frager and U.S. Pat. No. 3,826,135 issued to
35 Hollmann.

We have found that such devices have a fundamental problem. As the rain gauge begins to fill, it is doomed to fail as an accurate measuring device because the weight of the rain which is collected tends to weigh down and defeat the wind direction devices which are also incorporated in those devices.

- 5 Further, it is critical to the accurate performance of the device to separate the rain collecting and the wind reacting elements of the device from one another.

Accordingly, it is an object of this invention to provide a rain gauge assembly which accurately collects and measures rain fall regardless of the direction or velocity of the driving rain.

- 10 It is another object of this invention to provide such an assembly which separates the rain collecting and the wind collecting elements of the assembly.

It is yet another object of this invention to provide a rain gauge assembly which utilizes a minimal number of elements to accomplish the intended result.

It is still another object to provide such an assembly which is easy to assemble and use.

15 SUMMARY OF THE INVENTION

According to one aspect of the invention there is provided a rain gauge assembly comprising:

a rain collection receptacle,

- 20 a collection receptacle housing, the housing being configured to cooperatively receive and support the rain collection receptacle within the receptacle housing, the rain collection receptacle being movable with respect to the housing, the rain collection receptacle having a collector portion that is movably attached to the rain collection receptacle, and

means for presenting the collector portion to falling or driving rain.

- 25 Preferably the means for presenting the collector portion is attached to the collector portion.

Preferably the presenting means includes a wind deflector being attached to and extending downwardly from rain collection receptacle.

Preferably the wind deflector comprises a pair of wind deflecting fins.

- 30 Preferably the deflecting fins are positioned at a 90° angle to one another whereby one deflecting fin reacts to wind direction to rotate the rain collection receptacle and the

other deflecting fin reacts to wind velocity to present said rain collector aperture in rain collecting relation to falling or driving rain.

Preferably the rain collection receptacle has suitable measurement graduations to allow for easy visual assessment of rain level.

5 According to a further aspect of the invention there is provided a method of accurately measuring rain level with a rain gauge assembly comprising:

a support,

a rain collection receptacle,

10 a collection receptacle housing, the housing being configured to cooperatively receive and support the rain collection receptacle within the receptacle housing,

the rain collection receptacle being movable,

a collector portion that is movable relative to the rain collection receptacle

means for presenting the collector portion to falling or driving rain;

15 the method comprising presenting the collector portion to driving or falling rain, collecting rain in the collector portion, retaining rain in the rain collection receptacle, and determining the rain level from a visual assessment of the rain collection receptacle.

The foregoing and other features of the present invention will be further apparent from the detailed description which follows.

BRIEF DESCRIPTION OF THE DRAWINGS

20 FIG. 1 is a right side perspective view of a rain gauge assembly constructed in accordance with the present invention and showing the assembly as it would appear in a non-vertical driving rain storm condition.

FIG. 2 is an enlarged view of the housing portion of the assembly shown in FIG. 1.

25 FIG. 3 is a right side perspective View of the rain gauge assembly shown in FIG. 1 and showing the assembly in a vertical rain fall non-wind condition.

FIG. 4 is a top plan view of the rain gauge assembly under the conditions shown in FIG. 3.

FIG. 5 is a top plan view of the wind deflecting fin portion of the assembly also shown under the conditions depicted in FIG. 3 and taken along line 5-5 thereof.

30 FIG. 6 is an enlarged right side perspective view of the means utilized to retain the assembly receptacle within the housing and allow it to rotate therewithin.

DETAILED DESCRIPTION

Referring now to the drawings in detail, FIG. 1 illustrates a dynamic rain gauge assembly, generally identified 10, constructed in accordance with the present invention.

5 The rain gauge assembly 10 includes a rain collection receptacle 11. The rain collection receptacle 11 contains indicia or markings 12 which indicate the amount of rain fall in inches or centimetres, as such is desired or required. The collection receptacle 11 is clear, to enable the rain level to be determined at a glance.

10 The collection receptacle 11 is retained in a generally vertical position by virtue of a support housing 21. The support housing 21 includes a support housing base portion 24 and a top ring portion 22 (see FIG. 2). The top ring portion 22 of the support housing 21 is maintained in position by virtue of a plurality of vertical posts 23. The vertical posts 23 are spaced such that the receptacle indicia 12 of the collection receptacle 11 are clearly visible through the support housing 21. In the preferred embodiment, there are four such vertical posts 23 utilised in the support housing 21. It is possible, however, to
15 obtain the result of this invention by utilising a support housing 21 which has a lesser number of vertical posts 23. The number of vertical posts 23 is not a limitation of the invention.

20 The collection receptacle 11 is functionally adapted to freely rotate within the confines of the support housing 21. The uppermost portion 13 of the collect receptacle 11 rotates within the top ring portion 22 of the support housing 21. The lowermost portion of the collection receptacle 11 utilises a receptacle cone 14 which comes to a point 15. See FIG. 6. The collection receptacle point 15 rests upon and is supported by the support housing portion 24. In this fashion, minimal frictional forces are experienced by the collection receptacle 11 as it rotates freely within the support housing 21.

25 The support housing 21 is attached to a support post 31 and an end screw 32.

The upper portion 13 of the collection receptacle 11 is attached to a flexible connector 6. The flexible connector 6, in turn, is connected to a collector funnel 5. The collector funnel 5 is, in turn, is connected to a cylindrical rain collector 2. The face 3 of the collector 2 is, by virtue of the construction of the present invention, intended to always present itself
30 perpendicularly to the direction of the falling or driving rain R. The collector 2 utilizes a collector aperture 4 for collection of the falling or driving rain R.

Rearwardly of, and affixed to, the collector 2 is a wind deflector support arm 7. The wind deflector support arm 7, in turn, is attached to a horizontal deflecting fin 9 and vertical deflecting fin 8 (see FIGS. 4 and 5). The vertical deflecting fin 8 is functionally adapted
35 to react to wind direction such that it causes the collection receptacle 11 to rotate

relative to the support housing 21, thereby ensuring the collector aperture 4 is pointing in the direction of the driving rain R. The horizontal deflecting fin 9 similarly reacts to the wind velocity by lifting the horizontal deflecting fin 9 thereby pushing the collector 2 downwardly toward the horizontal. In its most simplistic terms, the greater the wind force exerted upon the horizontal deflecting fin 9, the greater the amount that the collector face 3 will be tilted away from the vertical. As wind velocity drops, the forces exerted upon the horizontal deflecting fin 9 will lessen and the collector face 3 will raise to a generally perpendicular plane relative to the vertical.

In addition to the functional features of the deflecting fins 8, 9, each fin may also double as an advertising medium. The fins 8, 9 may bear the names or logos of sponsors, promoters or other novel decorative elements as such may be desired or required.

From the foregoing detailed description of the present invention, it will be apparent that there has been provided a rain gauge assembly which accurately collects and measures rain fall regardless of the direction or velocity of the driving rain, which separates the rain collecting and the wind reacting elements of the assembly from one another, which utilizes a minimal number of elements to accomplish the intended result, and which is easy to assemble and use.

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The principles of this invention having been fully explained in connection with the foregoing, I claim:

1. A rain gauge assembly comprising
a rain collection receptacle,
a collection receptacle housing, the housing being configured to cooperatively receive and support the rain collection receptacle within the receptacle housing,
the rain collection receptacle being movable with respect to the housing,
a collector portion that is movably attached to the rain collection receptacle, and
means for presenting the collector portion to falling or driving rain.
2. The rain gauge assembly of claim 1 wherein the means for presenting the collector portion is attached to the collector portion.
3. The rain gauge assembly of claim 2 wherein the presenting means includes a wind deflector being attached to and extending downwardly from the rain collection receptacle.
4. The rain gauge assembly of claim 3 wherein the wind deflector comprises a pair of wind deflecting fins.
5. The rain gauge assembly of claim 4 wherein said deflecting fins are positioned at a 90° angle to one another whereby one deflecting fin reacts to wind direction to rotate the rain collection receptacle and the other deflecting fin reacts to wind velocity to present said rain collector aperture in rain collecting relation to falling or driving rain.
6. The rain gauge assembly of claim 1 wherein said rain collection receptacle has suitable measurement graduations to allow for easy visual assessment of rain level.
7. A method of accurately measuring rain level with a rain gauge assembly comprising:
a support
a rain collection receptacle,
a collection receptacle housing, the housing being configured to cooperatively receive and support the rain collection receptacle within the receptacle housing,
the rain collection receptacle being movable,
a collector portion that is movable relative to the rain collection receptacle, and

means for presenting the collector portion to falling or driving rain;

the method comprising presenting the collector portion to driving or falling rain, collecting rain in the collector portion, retaining rain in the rain collection receptacle, and determining the rain level from a visual assessment of the rain collection receptacle.

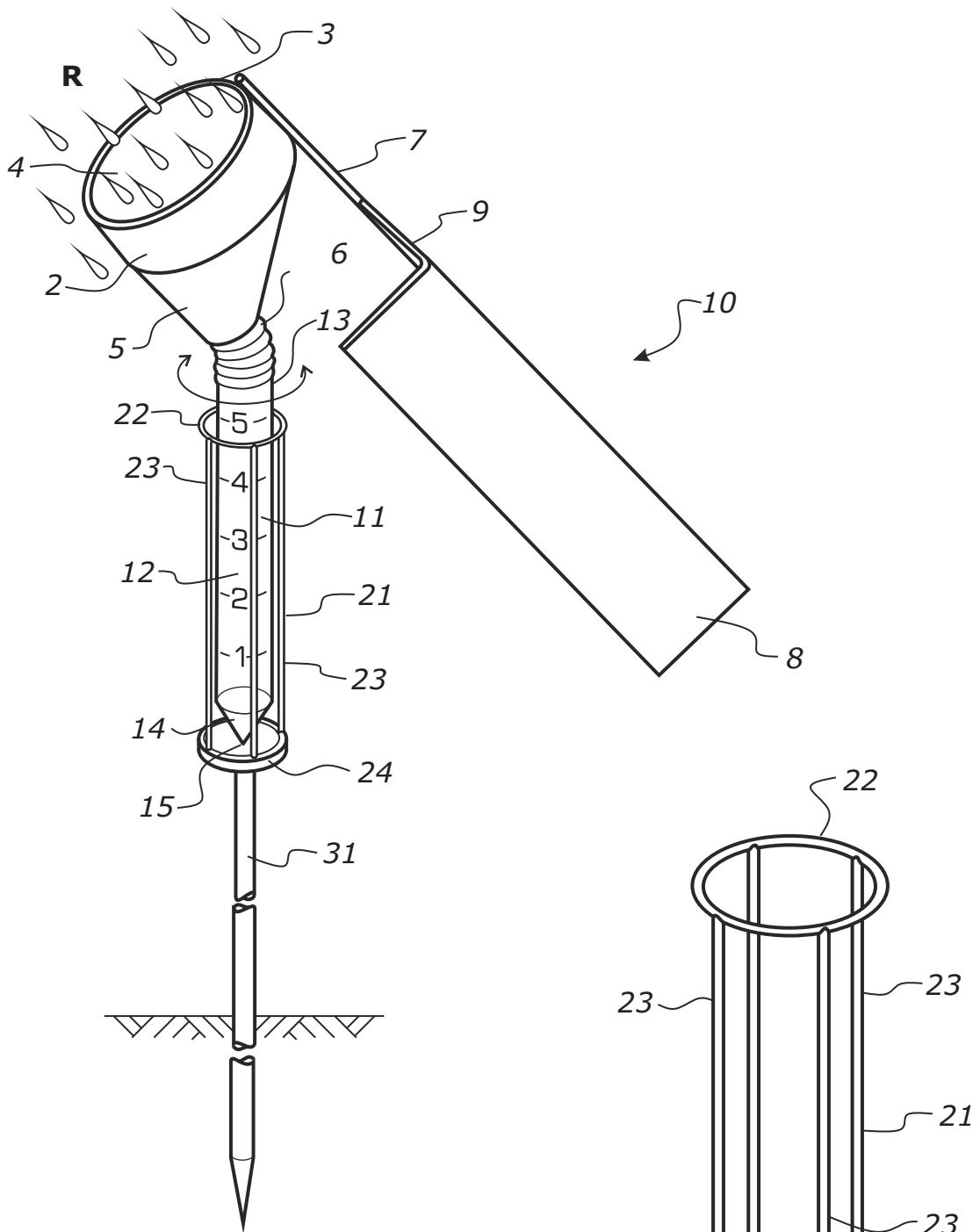


FIGURE 1

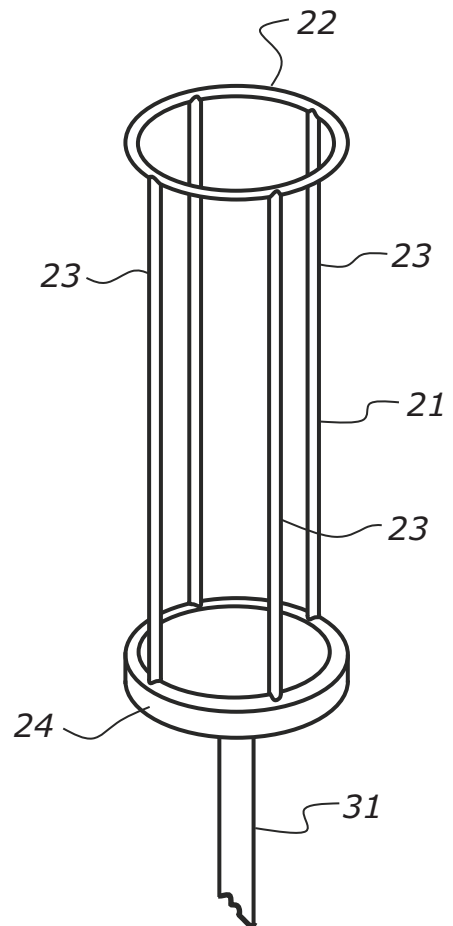


FIGURE 2

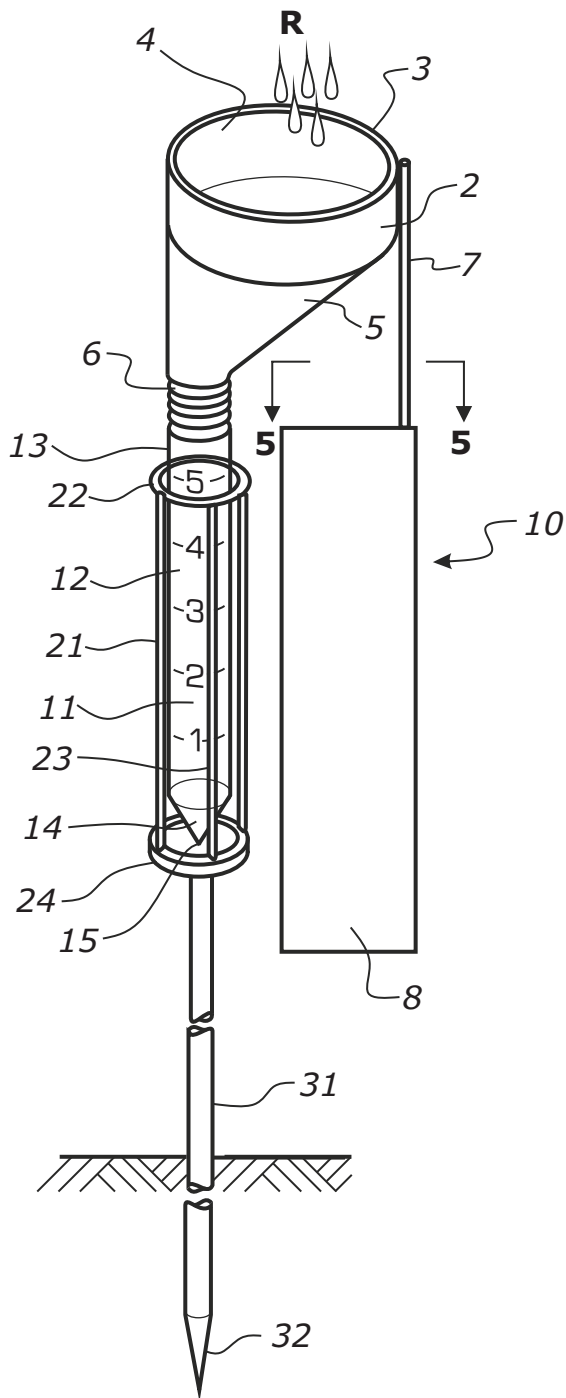


FIGURE 3

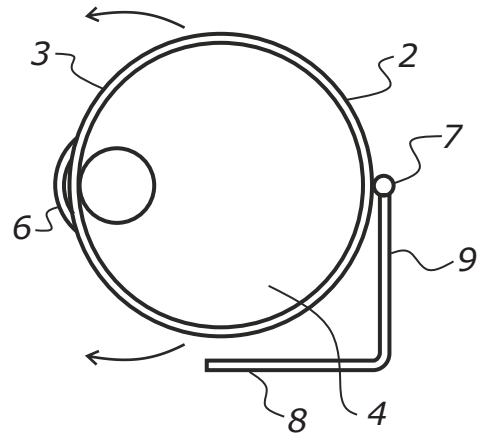


FIGURE 4

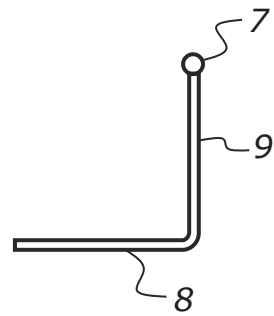


FIGURE 5

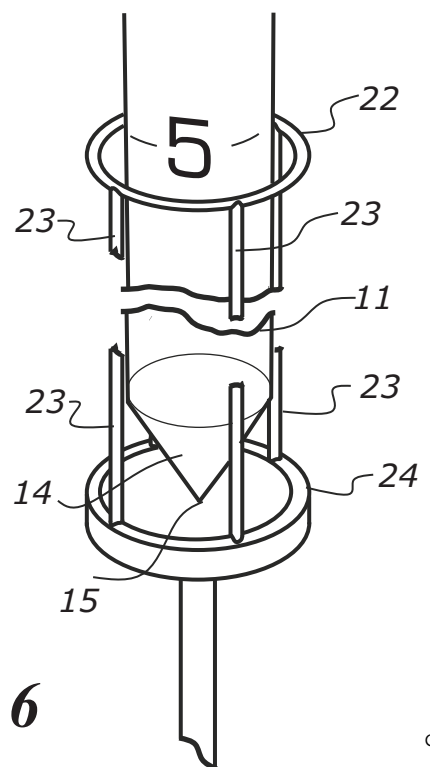


FIGURE 6

Client's product

The Green-Gauge has a cup for receiving rain, which moves in response to the wind so that the mouth of the cup is always pointing toward the wind. This prevents the wind from driving the rain across the top of the cup. The cup that receives the rain is connected to a cup that collects the rain, and from which a measurement of rainfall can be made.

Attached are drawings illustrating how the Green-Gauge works.

Figure 1 is a front elevational view.

Figure 2 is a vertical sectional view through the receiving cup taken on a line 2-2 of Figure 1.

Figure 3 is an enlarged vertical sectional view through the receiving and collecting cup and the communicating pipe between them.

Figure 4 is a fragmentary perspective view of one of the supporting posts for the upper portion of the Green-Gauge.

In these drawings the numeral 5 designates a hollow post rotatably supported at its lower end on a pin 6 rising from a suitable supporting structure 7. The upper end of the post is bifurcated as shown at 8 for receiving the lower end of a U-shaped frame 9 secured to the post by rivets or something similar.

The lower portion of the frame 9 has a weather vane 11 secured to it in a horizontal position.

The upper ends of the U-shaped frame 9 are formed with sockets 12 supporting the ends of an arc-shaped pipe 13. A tube 14 is formed at the lower central portion of the pipe 13 which communicates with a cover 15 and to which a collecting cup 16 is attached by set screws 17. The collecting cup has markings on the inside surface to enable measurement of rainfall. The markings, and therefore the rain level, can be viewed by unscrewing the collecting cup from its cover 15 to view the markings in the cup.

The outer ends of the pipe 13 are received in the lower ends of upwardly extending pipes 18 which have inwardly projecting extensions 19 at their upper ends.

The pipe extensions 19 receive the ends of a horizontal pipe 20, which can pivot within the extensions. The pipe 20 is formed with annular ribs 21 that abut the ends of the extensions 19 to prevent the pipe sliding horizontally in the extensions.

A vertically extending tube 22 rises from the pipe 20 and has on its upper end a receiving cup 23.

Client's product

A bracket 24 extends downwardly from the pipe 20. A blade 25 is mounted to bracket 24, the blade 25 being of sufficient weight to counter-balance the cup 23 and to maintain the cup in its upwardly extended position.

5 The receiving cup 23 is open at its top to form a mouth for receiving rainwater which passes down through the tube 22 and out at either end of the pipe 20 into the pipes 18 and 13 and then into the collecting cup 16.

10 The weather vane 11 extends at right angles to the plane of the blade 25 and so the surface of the blade 25 is maintained in a position transverse to the direction in which the wind is blowing and thus is effectively subjected to the pressure exerted by the wind. Due to the pivotal mounting of the blade 25 and the receiving cup 23 the wind will force the blade 25 in a direction to move the mouth of the receiving cup 23 in a direction toward the wind, as shown more clearly in Figure 2 of the drawings, whereby rain water will not be blown across the top of the receiving cup, but will enter the receiving cup so as to more accurately measure the amount of rainfall.

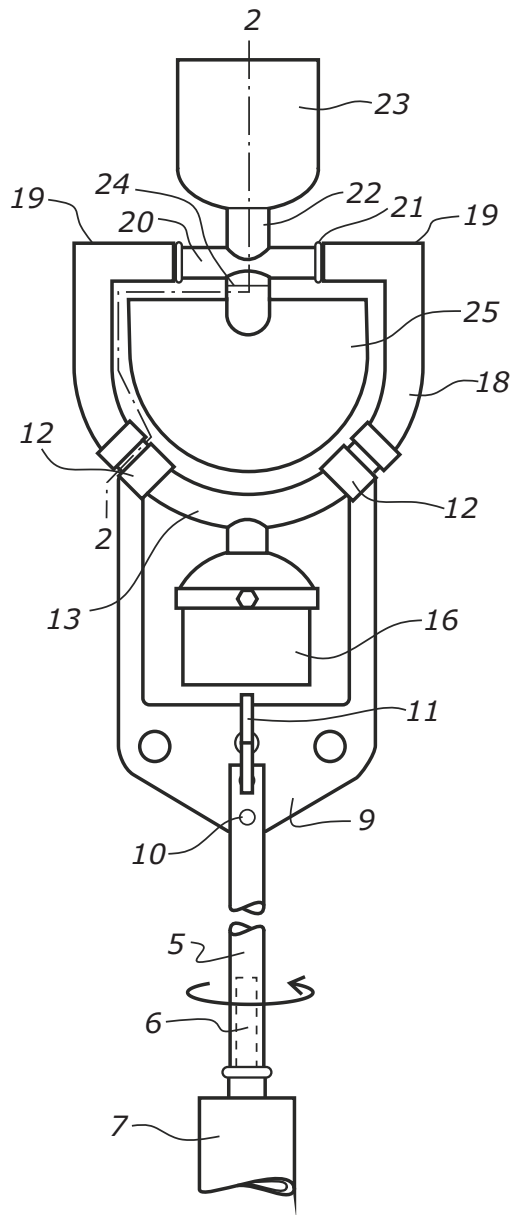


FIGURE 1

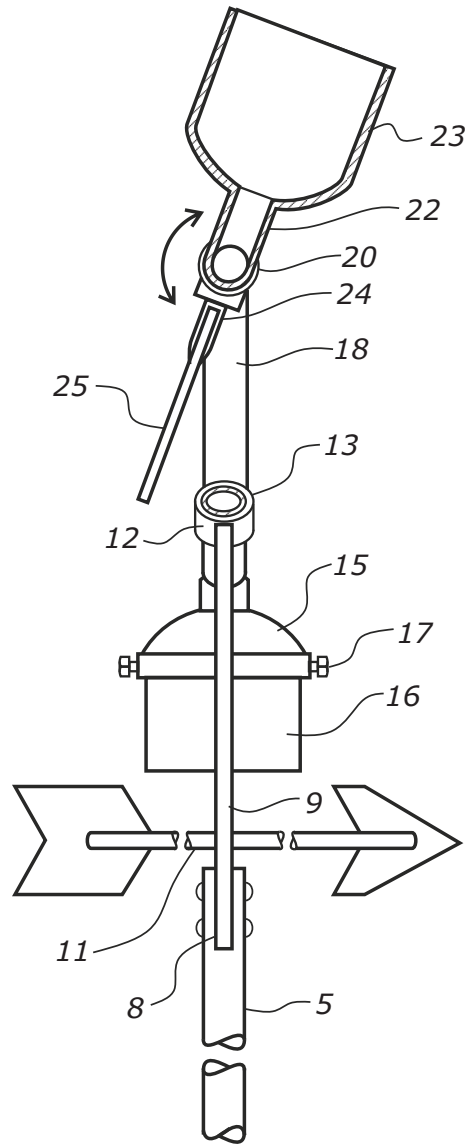


FIGURE 2

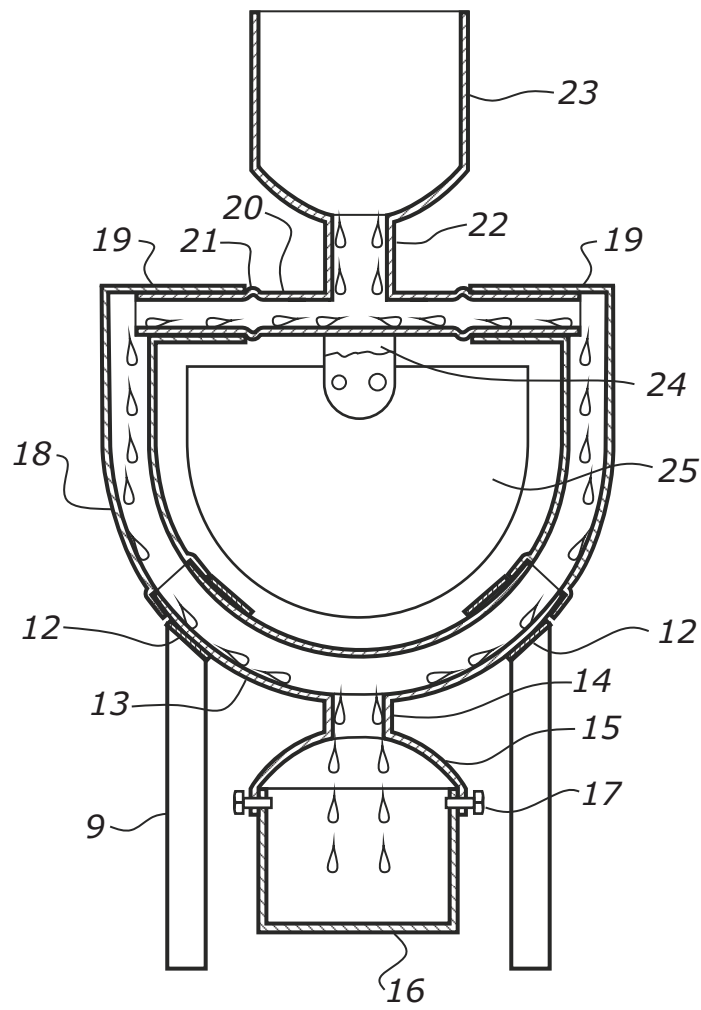


FIGURE 3

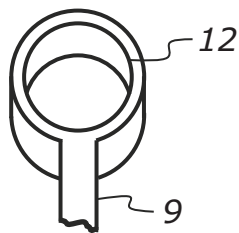


FIGURE 4

SWINGING RAIN GAUGE

BACKGROUND OF THE INVENTION

This invention relates to rain gauges and in particular, to a swinging rain gauge which is mounted to means movable in response to the velocity and direction of wind so that the rain gauge is enabled to collect and accurately measure rainfall regardless of the presence or the velocity or the direction of wind.

Prior art rain gauges do not have means to render them accurate in the presence of wind; and accordingly, if a wind is blowing while it is raining, the rain gauge is not capable of accurately measuring the rain fall since the rainfall will be moving in a direction at an angle to the opening to the rain gauge and not all of the drops will enter the rain gauge.

With the present invention, the rain gauge is mounted to a means which is responsive to both the velocity and direction of wind such that the rain gauge is maintained in a position with its axis parallel to the direction of the rainfall; and, accordingly, the rain gauge collects and accurately measures the rainfall regardless of the presence of wind, since the axis of the rain gauge is always maintained parallel to the direction in which the rain is falling.

In particular, the present invention concerns a combination rain gauge and wind velocity and direction indicator so that not only can the amount of rainfall be measured, but the direction and velocity of wind is indicated.

OBJECTS OF THE INVENTION

It is an object of this invention to provide a rain gauge which accurately collects and measures rainfall regard less of the presence of wind or of the direction or velocity of wind. Another object of the invention is to provide a rain gauge in combination with a wind velocity and direction indicating means.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in elevation of a rain gauge and wind responsive means in accordance with the invention showing the rain gauge and wind velocity means positioned to indicate a wind velocity of approximately 18 miles per hour.

FIG. 2 is an end view of the device of FIG. 1.

FIG. 3 is a top plan view of the device of FIG. 1.

FIG. 4 is an enlarged view in section taken along line 4-4 in FIG. 1.

FIG. 5 is an enlarged view in section with portions broken away taken along line 5-5 in FIG. 2.

FIG. 6 is an enlarged view in section taken along line 6-6 in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

In the drawings, wherein like reference numerals indicate like parts throughout the several views, a rain gauge in accordance with the invention is indicated generally at 10 in FIG. 1.

The rain gauge 10 comprises a base or attaching bracket 11 secured to a supporting surface S by means of a plurality of fasteners 12 extended through the bracket into the supporting surface. An elongate pivot shaft or rod 13 is connected to and extends vertically upwardly from the bracket 11, and a wind direction indicating fin 14 is pivotally attached to the shaft 13 by means of a pair of bushings 15 and 16 either secured to or integral with the fin 14 and rotatably positioned on the shaft 13. A cap nut 17 is positioned on the upper end of the shaft 13 to maintain the fin in position thereon as seen in FIG. 1.

A horizontal disc 18 having suitable indicia 19 thereon is secured to the bracket 11 at the lower end of the shaft 13 and cooperates with the fin 14 to indicate the direction of wind.

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A bifurcated or slotted wind velocity indicating vane or rain gauge support 20 is pivotally mounted to the fin 14 at the bifurcated end 21 thereof with the fin 14 received in the slot 22 in the vane 20. The bifurcated end 21 of the vane is secured to fin 14 by means of a threaded bolt 23 extended through an opening 24 in the fin adjacent the upper inner edge thereof, and a threaded cap bolt 25 engaged with the bolt 23 on opposite sides of the fin 14 and maintained securely together in threaded relationship by means of a lock washer 26. The bolt 23 and cap bolt 25 engage opposite sides of the fin 14, and the vane 20 includes a pair of bushings 27 and 28 either attached thereto or integral therewith at the bifurcated end 21 thereof which are pivotally received over the bolt 23 and cap bolt 25 to enable the vane to pivot relative thereto.

Suitable indicia 29 is on the fin 14 adjacent an outer arcuate edge 30 thereof, and the vane 20 cooperates with the indicia 29 to indicate the velocity of wind.

A pair of graduated, elongate transparent receptacles or tubes 31 and 32 are mounted on the vane 20 on opposite sides of the fin 14 by means of a pair of spaced clamps 33 and 34 and 35 and 36 suitably secured to the vane 20 as by adhesive, welding, rivets or the like and positioned adjacent the upper end and lower end, respectively, of the tubes 31 and 32. The lower end of the tubes 31 and 32 rest against and are supported on L shaped angle brackets 37 and 38, respectively, suitably affixed to the vane 20, and the upper ends of the tubes extend to above the upper edge of fin 14 and so as to accurately collect rainfall free of interference with the fin or vane. The tubes 31 and 32 can be removed from the clamps 33 and 34 for emptying.

As seen in FIGS. 5 and 6, the tubes are identically constructed and only one tube, 31, will be described in detail.

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As seen, the tubes have an inwardly beveled open upper end 39 defining a sharp knife-like edge against which raindrops engage and are split to prevent splashing of raindrops into the tubes which would occur if the open end of the tube had a flat annular surface thereon. The opposite or lower end of the tube is closed at 40, and suitable indicia 41 is provided on the outer surface of the tube for indicating the amount of rainfall. For example, the indicia 41 may be marked in inches, if desired.

A baffle 42 is secured within the tube 31 adjacent the upper end thereof, and the baffle slopes downwardly as seen in FIG. 5 to enable rainfall to readily enter the tube but to prevent rainfall in the tube from splashing out of the tube as the tube moves in response to wind.

An opening 43 is provided past one edge of the baffle 42 for movement of rainfall therepast. An identical baffle 44 and opening 45 are in the other tube 32.

In a preferred embodiment, a removable funnel 45 is provided which engages with the top of the tube 39 above the opening 43 to better capture the rainfall.

By way of specific example, in a rain gauge constructed in accordance with the present invention, the fin 14, shaft 13, vane 20 and supporting structures and fasteners would all be constructed of aluminum, and the tubes 31 and 32 would be made of a suitable transparent plastic material. The fin 14 would be approximately 9 inches long and 7 inches high, and the vane would be approximately 2% inches wide. Both the vane and fin would have a thickness of approximately one quarter inch, and the bushings 27 and 28 at the bifurcated end of the vane would each have a length of approximately three-fourths of an inch. The tubes 31 and 32 would be approximately 6 inches long and five eighths of an inch wide.

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In connection with the above, it is pointed out that the size or area of the vane 20 upon which wind acts to move the vane to indicate wind velocity, and the weight of the vane and receptacles 31 and 32, in relation to the weight of rain water collected in the receptacles, is such that any error which results in the indication of wind velocity is insignificant. The weight of rain water collected in the receptacles will be on the order of a fraction of an ounce under most conditions, and thus will have practically no effect on the action of the vane under the influence of the wind. Moreover, the rainwater may be emptied when it reaches a level of about 2 inches, if it ever accumulates to such a level, and thus the weight thereof kept to an insignificant value. Further, when low wind velocities are encountered, the vane and receptacles are hanging nearly vertical, and the influence of the weight of any water in the receptacles is accordingly negligible, and when high or large wind velocities are encountered, the force thereof is obviously commensurately greater, so that the effect or influence of any rain water in the receptacles is negligible.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiment is therefore illustrative and not restrictive, since the scope of the invention is defined by the appended claims rather than by the description preceding them, and all changes that fall within the metes and bounds of the claims or that form their functional as well as conjointly cooperative equivalents, are therefore intended to be embraced by those claims.

40 What is claimed is:

1. In combination, a rain gauge and wind direction and velocity indicator, comprising a substantially vertical supporting rod, fastening means securing said supporting rod to a supporting structure, a substantially flat, planar, vertically disposed, wind operated

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directional fin rotatably supported at one vertical edge thereof to said rod and having an arcuate, convex edge opposite said one vertical edge, means supported on said rod adjacent said fin and having indicia thereon for cooperation with said fin to indicate wind direction as said fin is caused to rotate about said rod responsive to wind direction, a substantially flat, planar, wind operated wind velocity vane having a longitudinally extending slot therein with said fin disposed through said slot and substantially identical portions of said vane disposed on opposite sides of said fin, pivot means connecting an upper edge portion of the vane with an upper portion of said fin adjacent the vertical edge thereof for pivotal movement of said vane about an axis perpendicular to the plane of the fin so that a lower edge portion of the vane moves along the arcuate edge of the fin responsive to wind velocity, suitable indicia on the fin at the arcuate edge thereof to indicate the wind velocity, an elongate, tubular, rain collecting receptacle supported on each of said vane portions on opposite sides, respectively, of said fin, said receptacles thus maintained at all times with their axes parallel to the direction of rainfall, each of said receptacles having an open upper end and a closed lower end and having indicia thereon to indicate the amount of rainfall collected therein, the upper ends of the receptacles projecting above the upper edges of the fin and vane and having a knife edge configuration to define a precise, known area through which rain will fall, and baffle means in each receptacle to prevent splashing of collected rainfall from the receptacles.

2. A rain gauge as in claim 1, wherein the plane of said vane is perpendicular to the plane of said fin, and the axes of the receptacles are parallel to each other and to the planes of the fin and vane.

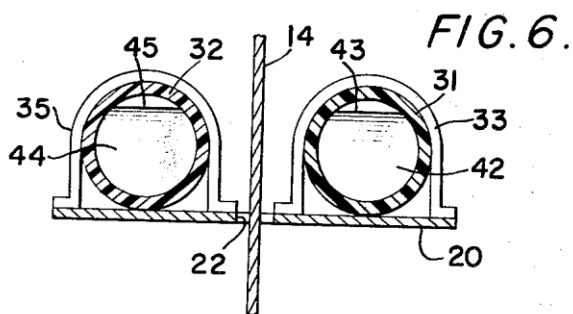
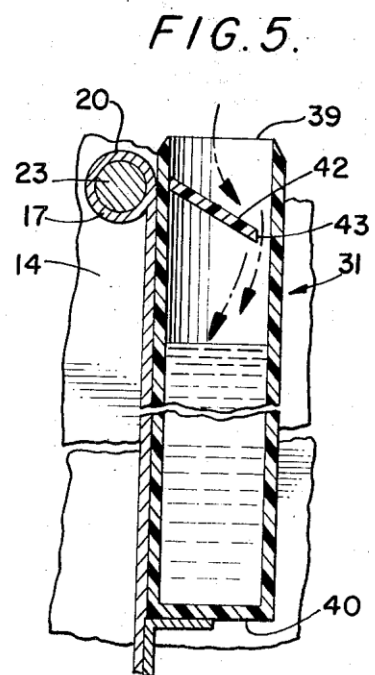
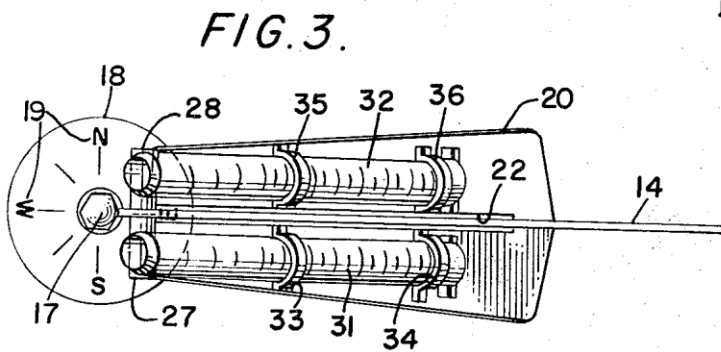
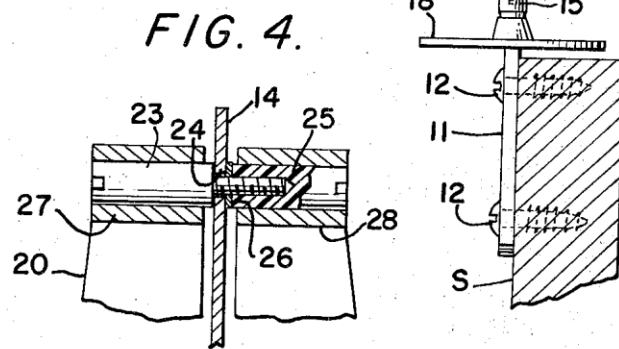
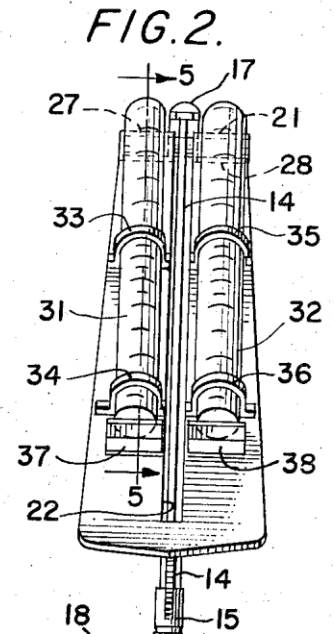
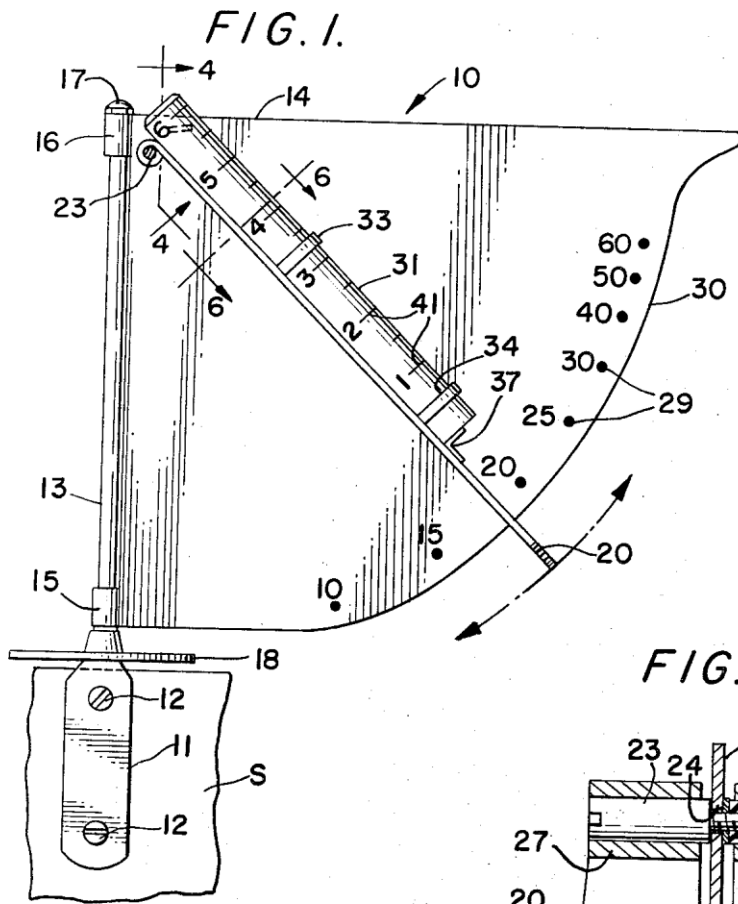
3. A rain gauge as in claim 1, wherein said fin is mounted for 360° rotation around said rod.

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4. A rain gauge as in claim 1, wherein the receptacles comprise a synthetic plastic material.

5 5. A rain gauge as in claim 1, wherein the receptacles each have suitable indicia on an outer surface thereof to indicate the number of inches of rainfall.

10 6. A rain gauge as in claim 5, wherein a pair of clamps are secured to said vane adjacent opposite ends of each receptacle, said clamps engaging and holding said receptacles to said vane.





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United States Patent [19]

[11] Patent Number: **5,531,114**

Fragar

[45] Date of Patent: **Jul. 2, 1996**

[54] RAIN GAUGE

2,935,872	5/1960	Misner	73/170.07
3,826,135	7/1974	Hollmann	73/170.07
4,665,744	5/1987	Smith	73/170.17
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[76] Inventor: **James R. Fragar**, 702 N. C St.,
Fairfield, Nebr. 68938

[21] Appl. No.: **408,733**

Primary Examiner—Richard Chilcot
Assistant Examiner—R. Biegel
Attorney, Agent, or Firm—Banner & Allegretti Ltd.

[22] Filed: **Mar. 22, 1995**

[57] **ABSTRACT**

[51] Int. Cl.⁶ **G01W 1/00**
[52] U.S. Cl. **73/170.17; 73/170.21**
[58] Field of Search **73/170.07, 170.17,**
73/170.21, 170.23, 170.11

A rain gauge comprising a graduated open end rain collection tube having fins on its lower end. The tube is pivotally mounted at its mid point on one end of a swivel arm rudder, the other end of said swivel arm rudder being mounted for rotation on the end of a support rod stuck into the ground. Wind on the rudder and fins causes the tube to tilt and turn into the wind with the open end facing the rain.

[56] **References Cited**

U.S. PATENT DOCUMENTS

916,060	3/1909	Thomson	73/170.17
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14 Claims, 2 Drawing Sheets

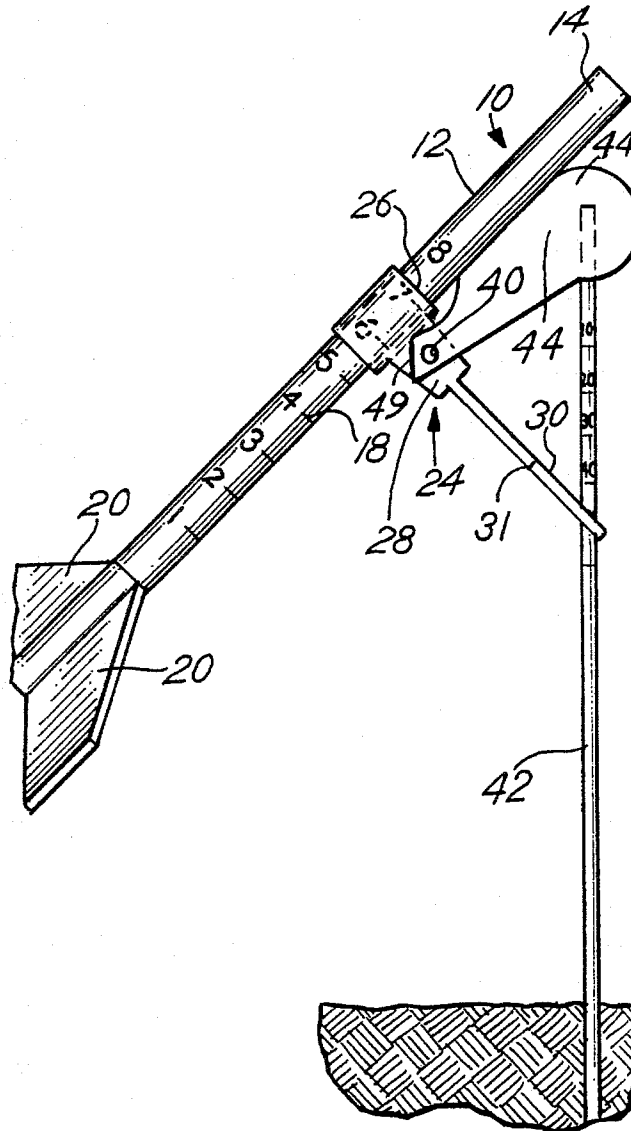


Fig. 1

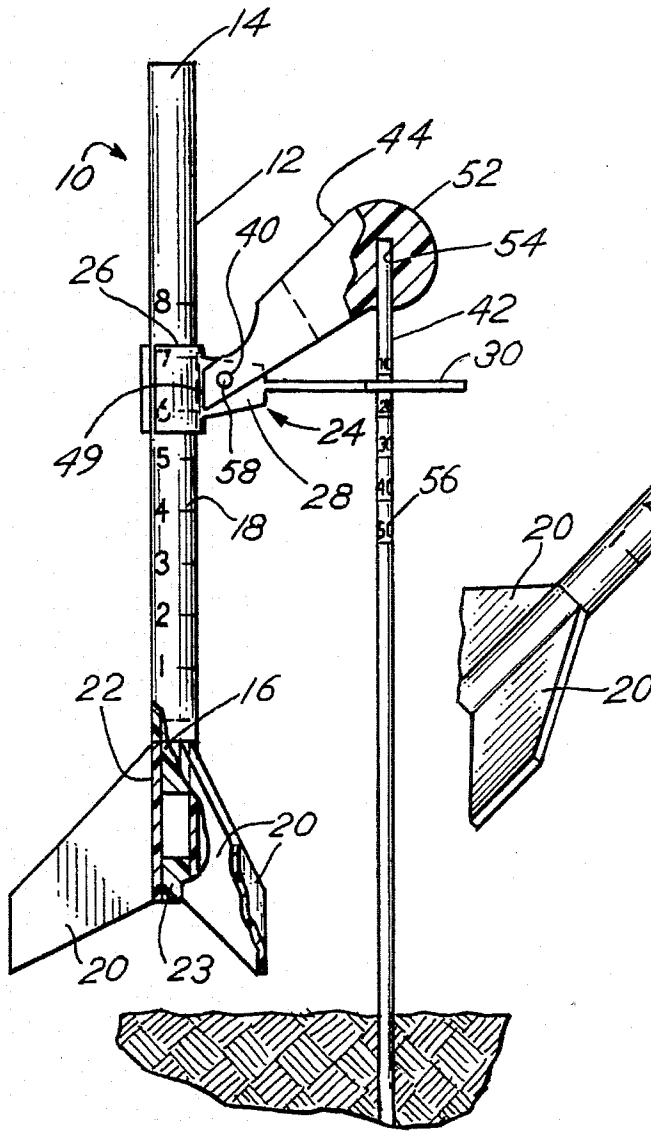
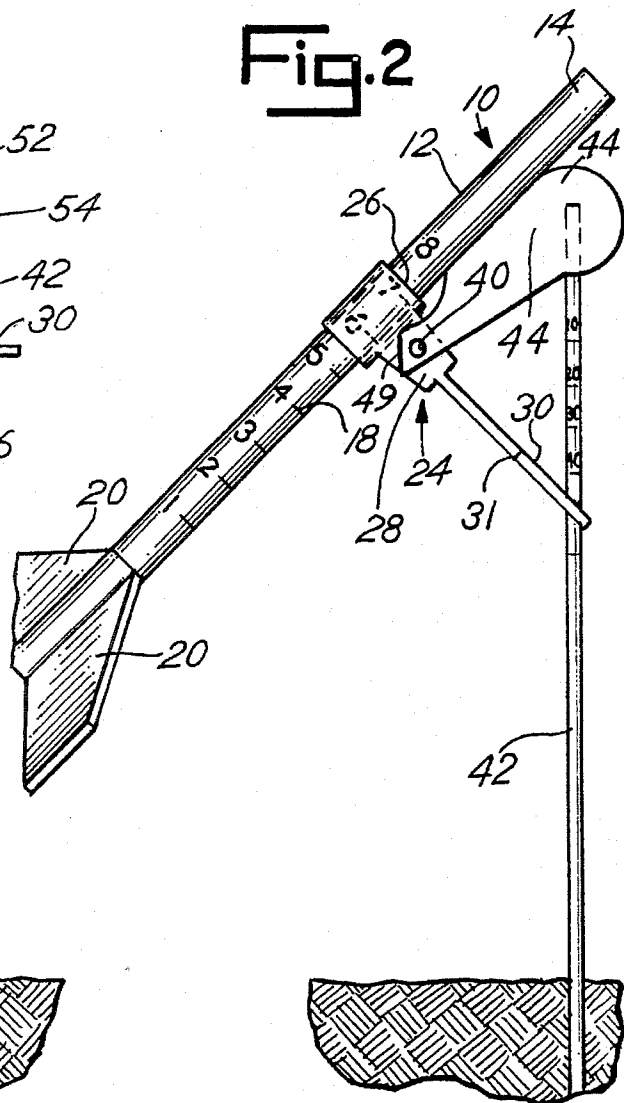
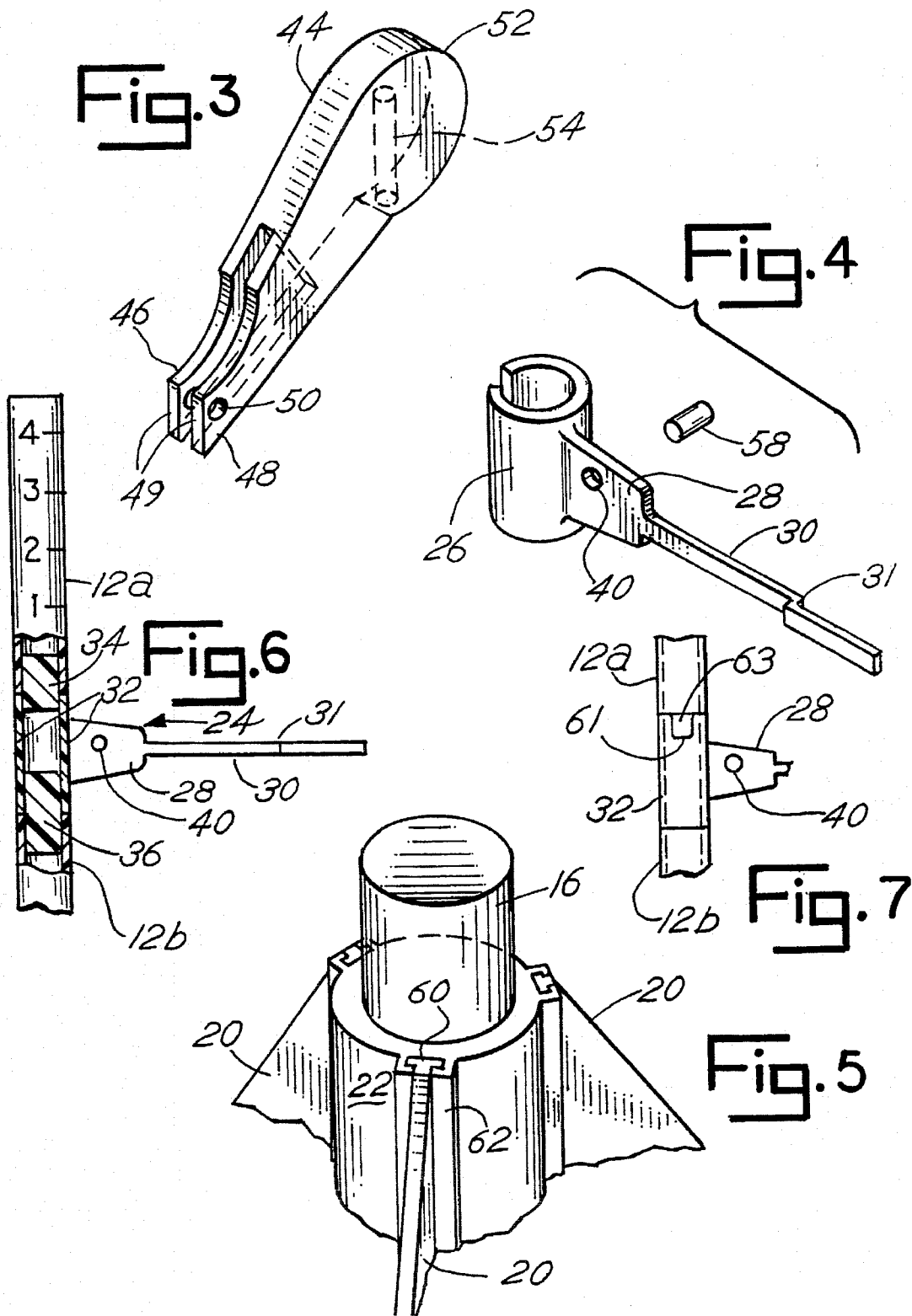


Fig. 2





1 RAIN GAUGE

This invention relates to an improved rain gauge for measuring rain fall accurately irrespective of the velocity of the wind carrying the raindrops across the gauge, which gauge also measures the wind velocity. 5

PRIOR ART

Rain gauges which tilt in the wind to present the mouth of the container at right angles to the direction of rainfall have been disclosed in many different forms. (Thomson U.S. Pat. No. 916,060; Johnson U.S. Pat. No. 1,407,068; Moore U.S. Pat. Nos. 2,384,954 and 2,520,557; and Quinteros U.S. Pat. No. 2,570,710.) These prior structures are complicated in construction, cannot be manufactured economically and the readings tend to be inaccurate. For example, the structures of Moore have so many surface areas in the collecting parts upstream of the actual measuring container that water will remain in these areas and not flow to the final collection container where the volume is measured. In some instances, parts are interposed between the rain and the collecting opening which adversely affects the reading. None of these prior art gauges simultaneously measure wind velocity. In recording weather information, it is desirable to ascertain the wind velocity as well as the amount of rainfall. 25

SUMMARY OF THE INVENTION

The object of the present invention is to provide a rain gauge construction of the type described which obviates the problems of the gauges previously disclosed, to provide a construction having few parts, primarily molded from plastic resins and which measures rainfall and wind velocity simultaneously. 35

The construction of the invention is characterized by a finned rain collecting tube which is mounted on one end of a swivel arm. The other end of the swivel arm contains a bearing bore which fits over the end of a mounting rod inserted in the ground. The swivel arm is preferably molded from smooth plastic material such as nylon or teflon which minimizes friction between the bearing and the upper portion of the rod on which the arm is mounted. By this means, the collecting tube will freely rotate through 360°; the specific angle depending upon the direction of the wind. 45

The means for mounting the collecting tube on the swivel arm consists of a tube support fixed to the tube, including an axle disposed at 90° to the axis of the tube. The inner end of the swivel arm next to the collecting tube is mounted on the axle. By this means, the tube, which is fixed in the tube support, will tilt about the axle when the wind blows against the fins on the end of the tube. A flange extending from the tube support terminates in an elongated pointer. The pointer extends normal to the axis of the cylindrical collecting tube across the face of the support rod. Wind blowing against the collecting tube causes the tube to swivel about the mounting rod and simultaneously tilt on the axle so that the open mouth of the collecting tube faces the rain being driven by the wind. The rain collected in the tube is measured by indicia on the surface of the tube. As the collecting tube tilts in the wind, the pointer moves down the surface of the rod which carries indicia indicating the speed of the wind in miles per hour. The tube support is fixed securely to the collecting tube and consequently there is no relative movement between the tube and the pointer extending from the tube support. 65

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The rain gauge construction, therefore, consists essentially of four parts: a collection tube, a tube support, a swivel arm, and a support rod, which can be manufactured at low cost and easily assembled.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view of the assembled rain gauge mounted on a rod which is driven into the ground.

FIG. 2 is a view like FIG. 1 with the collection tube tilted into the wind.

FIG. 3 is a perspective view of the plastic swivel arm which swivels on the end of the rod and carries a pin in the opposite end thereof about the axis of which the collecting tube tilts. 15

FIG. 4 is a perspective view of the tube support and the integrally formed pointer for indicating wind velocity.

FIG. 5 is a perspective view of the upper end of a fin construction in which the fins are removable from the fin tube. 20

FIG. 6 is front view, partially in section, of an alternative construction for the tube support and collection tube.

FIG. 7 is front view of alternative structure for securing the collection tube to the tube support. 25

DETAILED DESCRIPTION

The rain gauge of the invention is indicated generally at 10 and consists of a plastic tubular collection container 12 molded from a material such as polyvinylchloride resin. The tube has indicia molded in the surface thereof which indicate the amount of rain collected in the tube. The upper end of the tube 14 is open and the lower end is closed by a plug 16 which forms the bottom of the container. A fin tube 22 having three fins 20 spaced apart at 120° connects to the lower end of the plug 16 by reason of frictional engagement with the fin tube 22. The lower end of the fin tube may carry a calibrating weight 23 for adjusting the force required to tilt the collection tube. 30

A band-like tube support 24 molded from resilient plastic material comprises a split cylinder 26, an integrally formed flange 28, and a pointer 30. The support is molded as a unit. The split cylinder 26 can be slid over the end of the tube 12 by spreading the springy free ends of the split cylinder. The cylinder firmly grips the tube 12. An opening 40 extending through the flange 28 receives a pin or axle 58 which passes through concentric openings 50 in the bifurcated arms 46, 48 of the swivel arm 44 (FIG. 3). The arms 46, 48 on the inner end of the swivel arm 44 i.e. the end adjacent tube 12 are narrower than the other portions of the arm to accommodate the flange 28 of cylinder 26 when the tube tilts about the pivot pin 58. The collection tube is permitted to tilt in the direction of the swivel arm 44 at a maximum angle of approximately 45° before contacting the flat upper surface of the arm. The tube in tilted position is shown in FIG. 2. 45

The swivel arm 44 has flat sides like a rudder and is molded from a resin such as nylon or teflon which offers little frictional resistance to the rotation of arm 44 about the upper end of support rod 42. A blind bore 54 is molded in the outer end of the arm 44 and serves as a bearing about which the arm can swivel. Preferably, the rod 42 is made from rustproof metal such as chromium plated or zinc plated steel. The surface of the rod is smooth and the bearing 54, being made from a low-friction resin, rotates freely about the rod 42. The rod 42 carries indicia 56 indicating the speed of the wind in miles per hour as indicated by the position of the 65

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pointer 30 which moves downwardly as the tube 12 tilts about pin 58 in response to the force of the wind. The pointer 30 is offset at 31 to accommodate the width of rod 42.

The fins on the end of the tube 12 act similarly to the fins on an arrow, and together with the rudder-like swivel arm, serve to point the tube 12 into the wind. Rain falls into the open end 14 of the collection tube 12. The quantity can be measured by the markings on the surface of the tube 12 as the water fills the tube.

The fins 20, instead of being molded integrally with the fin tube 22, can be detachably mounted on the fin tube by means of the construction shown in FIG. 5. The external surface of the tube 22 has external elongated slots 62 molded onto the surface thereof. The inner ends of the fins 20 terminate in a T-shaped flange 60 which slides into the complementary slot 62. This facilitates removing the fins from the tube 22 for purposes of packing and shipping the rain gauge.

FIG. 6 shows an alternative construction for the tube support 24 in place of the split cylinder 26 gripping the tube 12. The tube support has a cylindrical portion 32 of the same diameter as the collection tube 12. In this construction, the collection tube is broken into two parts, 12a and 12b and the cylindrical portion 32 of the tube support 24 is connected to the ends of the segments 12a and 12b by means of plugs 34, 36. In this case, the plug or barrier 34 serves as the bottom of the collection tube container and the indicia are marked above this level as the zero point. The flange 28 and pointer 30 of the tube support 24 are formed the same as those elements in the construction of FIG. 1.

Means for locking the collection tube against rotation with respect to the tube support 24 is shown in FIG. 7. Tube portion 12a has a tongue 63 projecting from the lower end thereof which fits into a complementary slot 61 in the cylinder 32.

The inner ends 49 of the bifurcated arms 46, 48 of the swivel arm 44 extend vertically downward below the axis of the pin 58 extending through openings 40, 50. These vertical surfaces 49 bear against the opposing surfaces of tube support 24 and prevent the collection tube 12 from tilting in a direction away from the swivel arm 44 and the support rod 42. In other words, when there is no wind and the collection tube 12 is at rest, it assumes a vertical position with surface 49 in contact with the cylinder 26, as shown in FIG. 1. When the wind is blowing, the tube 12 tilts only in the direction of the swivel arm and the support rod 42. The maximum angle of tilt is about 45°. Thus, accumulated water in the tube is prevented from spilling out.

I claim:

1. A rain gauge comprising
 - a graduated plastic collection tube having an open end to receive rainfall and a closed end opposite said open end,
 - a plurality of spaced fins mounted on the tube adjacent said closed end,
 - a tube support fixed to said tube between said open end and said fins and extending radially from said tube,
 - a pin mounted in said tube support at a right angle to the axis of said tube about which said tube tilts,
 - a swivel arm having an inner and an outer end, supporting said pin at said inner end, said arm having a low friction bearing bore in said outer end, and
 - a support rod for insertion in the ground having an upper end disposed within said bearing bore, said upper end having a smooth surface to permit free rotation of said tube about said rod.
2. The rain gauge of claim 1 in which said tube support terminates at its outer end in a pointer extending across said

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rod, and said rod carries graduated markings indicating wind velocity, whereby tilting of said plastic tube by the wind causes said pointer to coincide with markings commensurate with the wind velocity.

3. The rain gauge of claim 1 in which said swivel arm has flat side walls, the inner end thereof being bifurcated and disposed on either side of said tube support.

4. The rain gauge of claim 3 in which said bifurcated arms terminate in flat surfaces which bear against said tube support below the axis of said pin to prevent said collection tube from tilting in a direction away from said support rod.

5. The rain gauge of claim 2 in which said fins are mounted on a fin tube approximately equal in diameter to said graduated plastic tube, said fin tube being connected to said graduated plastic collection tube by means of a plug which also serves as the closure for said closed end of the graduated plastic collection tube.

6. The rain gauge of claim 5 in which fins are detachably secured to said fin tube.

7. The rain gauge of claim 1 in which said swivel arm is molded from nylon or teflon.

8. The rain gauge of claim 5 in which includes a calibration weight in the end of said fin tube.

9. The rain gauge of claim 2 in which said collection tube consists of two separate axially aligned tubes, said tube support has a cylindrical part concentric with said separate tubes, and is connected to said separate tubes by plugs within said tubes.

10. The rain gauge of claim 9 in which one of said separate tubes has a tongue projecting from one end thereof and said tube support has a complementary slot into which said tongue fits.

11. The rain gauge of claim 2 in which said tube support is secured to said collection tube by a resilient plastic cylinder which embraces said collection tube, and includes a flange from which said pointer extends, said cylinder, flange and pointer being integrally molded from plastic as a unit.

12. A rain gauge comprising

- a graduated collection tube having an open upper end to receive rainfall and a lower end opposite said open end,
- a barrier in said collection tube between said upper and lower ends to form a bottom to support rain water in said tube,
- a plurality of fins mounted on and spaced around said lower end,
- a band-like tube support, fixed to said tube between said open end and said fins, and extending radially therefrom,
- a pin mounted in said tube support at a right angle to the axis of said tube about which said tube tilts,
- a swivel arm rudder having an inner end which supports said pin and an outer end having a blind bore therein, and
- a support rod, having one end disposed within said blind bore, about which said swivel arm rudder pivots.

13. The rain gauge of claim 12 in which said radial extension of said tube support consists of a flange, said inner end of said swivel arm rudder is bifurcated and said pin extends through said flange with its ends mounted in the bifurcated portion of said inner end.

14. The rain gauge of claim 3 in which said swivel arm has an upper flat surface which constitutes a stop to arrest the tilting of said collection tube to a maximum angle of about 45°.

* * * * *



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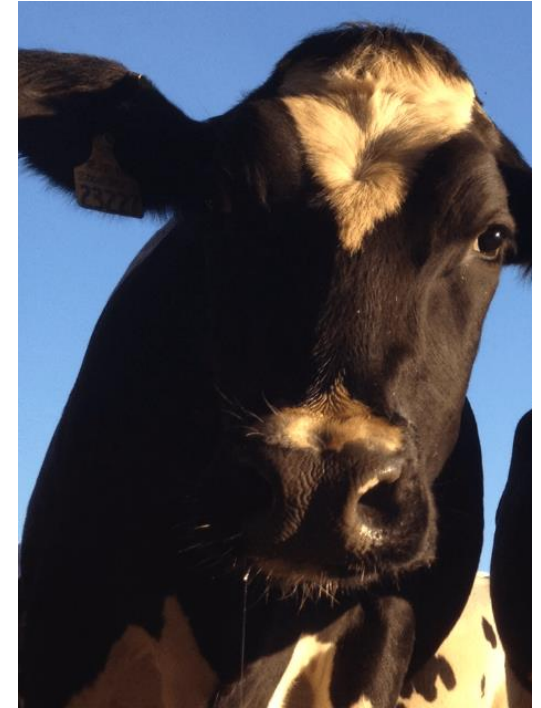
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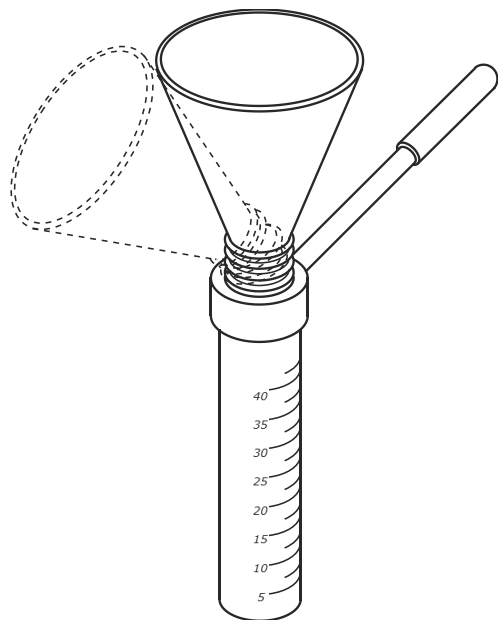
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