(No Model.) 2 Sheets—Sheet 1.

W. KLINKERFUES.

APPARATUS FOR METEOROLOGY.

No. 248,183. Patented Oct. 11, 1881.

Fig. 3.

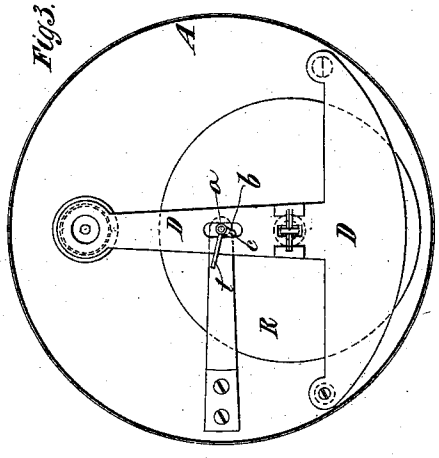


Fig. 4.

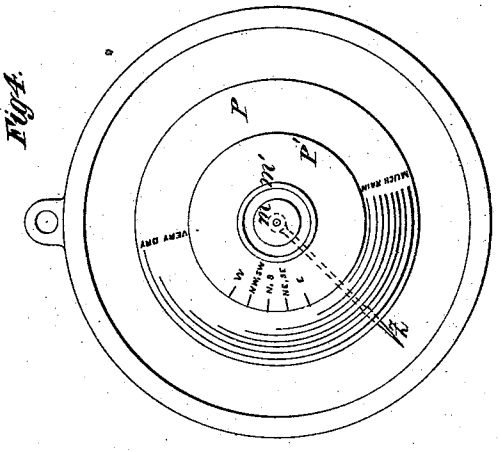


Fig. 1.

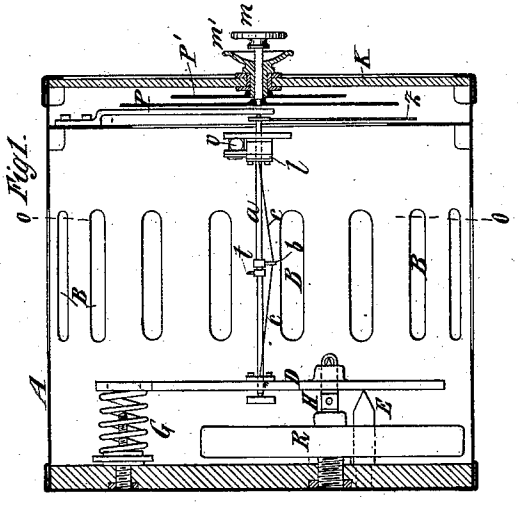
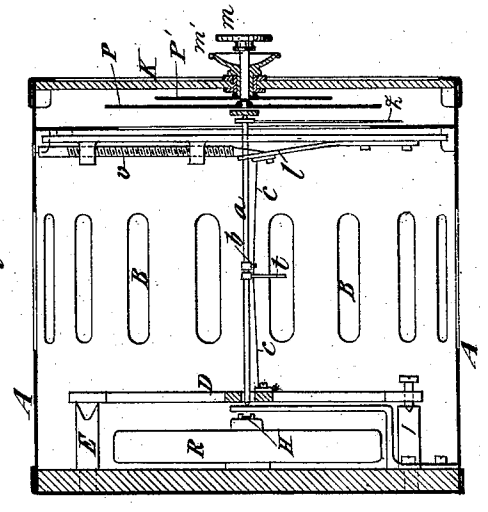


Fig. 2.



WITNESSES

Thos. Haynes

George H. Botts

INVENTOR

Wilhelm Klinkerfues

by his Attorneys

Brown & Brown

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 2 Sheets—Sheet 2.

W. KLINKERFUES.

APPARATUS FOR METEOROLOGY.

No. 248,183. Patented Oct. 11, 1881.

Fig 9.

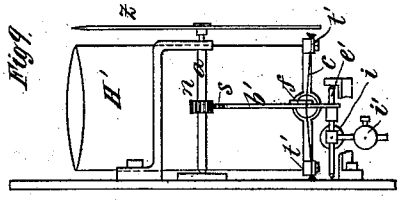


Fig 10.

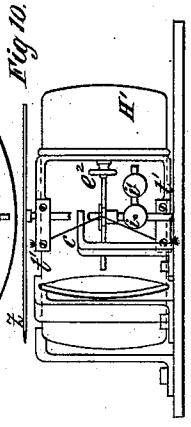


Fig 8.

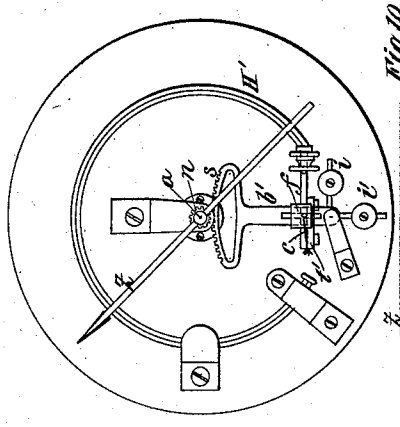


Fig 7.

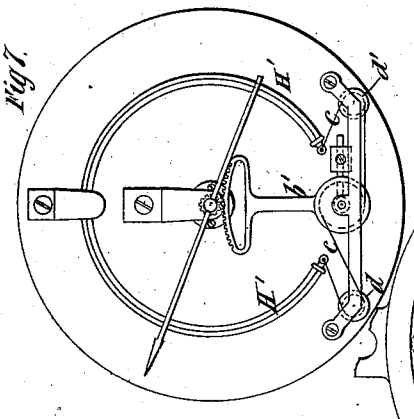


Fig 5.

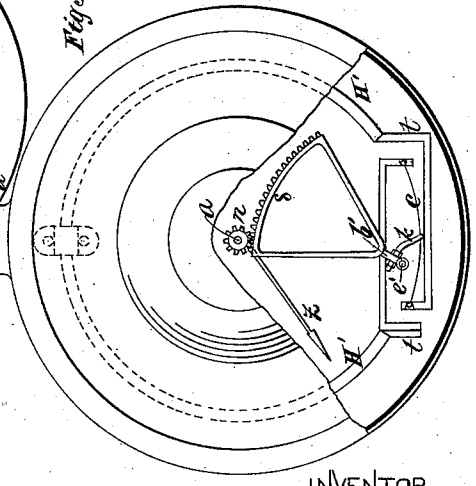
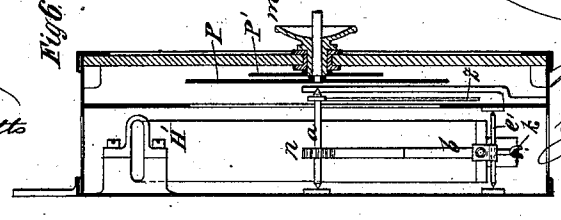


Fig 6.



WITNESSES

Fred't Haynes

George H Botts

INVENTOR

Wilhelm Klinkerfues

by his Attorneys

Brown & Brown

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

WILHELM KLINKERFUES, OF GOTTINGEN, GERMANY.

APPARATUS FOR METEOROLOGY.

SPECIFICATION forming part of Letters Patent No. 248,183, dated October 11, 1881.

Application filed August 2, 1881. (No model.) Patented in England December 22, 1880.

To all whom it may concern:

Be it known that I, WILHELM KLINKERFUES, doctor of philosophy, of Gottingen, in the Empire of Germany, have invented certain new and useful Improvements in Apparatus for Practical Meteorology, of which the following is a specification.

My invention consists in an instrument which is constructed for predestinations of dry, changeable, or rainy weather, and enables direct observations to be taken, based upon the combined influence of air-pressure, air-moisture, and direction as well as changes of wind. The instrument requires either the metallic aneroid-box (Vidi's system) or aneroid-ring (Bourdon's system) of an aneroid-barometer, and according to the application of one or the other of these parts the construction must be modified. If a vacuum-box after Vidi's system is applied, the following is a description of the instrument:

Upon an axle which serves as shaft for the indicating-hand of the instrument an arm or lever is fastened, and gives an inertia for turning the axle. Within a short distance of the axle and parallel, or about parallel, to it a string of hygroscopic threads—*p. i.*, human hair—is fastened and connected to the arm by means of an eye or other suitable device. The arm exerts a certain pressure on the hygroscopic string, which latter consequently forms a convex curve. The convexity enlarges and diminishes with the degree of the relative moisture of the air, and accordingly the hand falls and rises.

The hygroscopic string is fastened at one end to the diaphragm of the metal vacuum-box of a holosteric barometer, and its degree of convexity is subject to the influence of air-pressure. If the air-pressure rises, the degree of convexity diminishes, while the convexity is larger if the air-pressure falls. The relative influence of the diaphragm of the hygroscopic string upon the motion of the hand can be adjusted by altering the length of the string or by other simple and known mechanical means of adjustment.

Instead of attaching the indicating-hand direct to the axle of the instrument, the turning motion of the axle may be transported to the hand by an intermediate segment and small pinion, and this gives a means of increasing the movement of the hand, if desirable.

The scales in front of the instrument, along which the hand moves, consist of two concentric disks, which can be turned by the observer without influencing the motion of the hand. The smaller or inner disk is furnished with a scale at its periphery, showing the different directions of the wind. This scale is called the "wind-scale." The outer scale, which is called the "weather-scale," shows at its periphery all gradations of the weather from dry to much rain.

Instead of marking the gradations by letters or by words only, a scale changing accordingly from white to dark may be used. The indicating-hand may be arranged to move partly behind, between, or before the scales, as convenient.

The scales can be made of glass or other transparent or non-transparent material.

The mode of practical application of this instrument is as follows: When it is desired to take a prognosis of the weather for the following day, the weather-scale must be turned in the forenoon so as to bring the present weather in coincidence with the indicating-hand, and at the same time the wind-scale must be turned in a position to bring the present wind direction likewise in coincidence with the hand of the instrument. In the afternoon the hand will have made a movement in either one or other direction, and will, in case no change of wind has occurred in the meantime, directly show the weather that may be expected for the following day. In case the direction of wind has changed, the weather-scale must first be turned so far as to bring the character of the weather of the forenoon in coincidence with the new wind direction. The hand will then show the coming weather. In a fully analogous way a prognosis taken in the forenoon is to be based upon the adjustments of the scales in the afternoon of the preceding day.

Instead of a metallic vacuum-box, after Vidi's system, a ring, after Bourdon's system, can be used for producing movements of the hand by the changes of the air-pressure. The dimensions of the instrument will be smaller, and the construction and adjustment be simplified, if Bourdon's ring is used. The Bourdon ring carries at its ends projections, be-

tween which the hygroscopic string is fastened. This string supports at about its middle a short lever or a metallic arm, which is in connection with the indicating-hand of the instrument, and, in an analogous manner to that before described, operates the hand in front, between or behind two scales of a similar construction as those before described, the greater or smaller convexity of the string depending on the influence of the air-pressure and the relative moisture of the air.

The accompanying drawings represent both modes of carrying out this invention.

Figures 1, 2, 3, and 4 are drawings of an instrument constructed with Vidi's box, and Figs. 5 to 10 are illustrations of an instrument with which Bourdon's ring is used.

Similar letters of reference designate corresponding parts in all the figures.

Fig. 1 is a longitudinal section of the instrument; Fig. 2, a similar section, taken in a plane at right angles to the plane of the first said section. Fig. 3 is a transverse section upon the line *o o*, Fig. 1; and Fig. 4 is an outer front view of the instrument.

A is a metal casing, with openings B B, which allow the atmosphere sufficiently free entrance to the acting parts influencing the indicating-hand *z*.

a is the shaft, to one end of which hand *z* is fastened.

c is a hygroscopic string, preferably made of human hair, and *b* a short arm or lever fastened to shaft *a*, which arm rests upon or is attached to string *c*. By the arm *b*, and if necessary, in addition, by another lever or weight, *t*, fastened to *a*, the string *c* is pressed down in a convex curve, as will be seen from Fig. 1. The string *c* is attached at one end to the lever D, that is in connection with the diaphragm of the aneroid-box R of the instrument in a manner similar or equivalent to that used for common aneroid-barometers. Figs. 1 and 2 show this construction, in which lever D is supported at one end by the edge of bracket E, and at the other end by the spiral spring G, while H is the connecting mechanism between the lever and diaphragm. The other end of the string *c* is attached to an adjustable spring-arm, *l*, or other adjustable part of the casing. In the construction shown, *v* is an adjusting-screw with a conical point, by means of which the free end of the spring *l*, to which the string *c* is fastened, can be brought nearer to or farther from the box R, as may be found necessary, either for slackening or for tightening the string *c*.

K designates a protecting glass plate in front of the instrument.

The operation of the instrument is as follows: If the air-pressure rises, the diaphragm of box R is pressed inward, and consequently the string *c* is strained in accordance with the movements of the diaphragm, and the arm *b* is lifted. The shaft *a* is consequently turned to the right, and the finger *z* rises on the weather-scale P. At the same time with the movements of the diaphragm the string *c* is influenced by the changes of the relative moisture of the air, and if this moisture diminishes, the string is strained and moves, in addition to the influence of the aneroid-box hand *z*, farther upward on scale P, while it must rise less, or will fall if the degree of relative moisture increases during a rise of the air-pressure. The graduated lines on the scale P illustrate the different conditions of the weather, from much rain upward to very dry.

As it is of importance, when forming a prognosis of the coming weather, to be able to take into account the alterations of the direction of the wind within a certain time, a second small scale, P′, is placed in front of the instrument and concentrical to the scale P. This scale P′, which is called the "wind-scale," is furnished with divisions showing the different wind directions from north to south, and is used in the following manner:

When it is desired to take a prognosis of the coming weather for the next day, the scale P is turned in the forenoon by means of button *m* in either one or other direction, as required, to make hand *z* show on scale P the present state of weather, and scale P′ is by means of button *m′* afterward turned to make hand *z* likewise show the present direction of the wind. In the afternoon, if no change of wind has occurred in the meantime, hand *z*, which may during this time have risen or moved down on scale P, will directly show the coming weather for the next day. If, however, a change of wind has occurred, the weather-scale P must be turned to the right or left before taking the observation, according to the nature of the change, so as to bring the position of the scale P in coincidence with the wind direction of the afternoon. After this has been done hand *z* will show the coming weather.

Referring, now, to the other modification of my invention, Figs. 5 and 6 respectively represent a transverse and a longitudinal section of the instrument. Fig. 7 represents a transverse section of the instrument slightly modified in form; and Figs. 8, 9, and 10 respectively represent a transverse section, a longitudinal section, and a side view of the instrument still further modified. H signifies in all these figures the Bourdon ring, the action of which is commonly known. In Figs. 5 and 6 the ends *t* of the ring are furnished with arms, between which string *c* is suspended in an adjustable manner. According to the changes of the air-pressure, ends *t* are moved toward or from each other, in consequence of which the string *c* will form a deeper or plainer curve. At the same time the degree of convexity of this curve will be influenced by the moisture of the air, as before described.

According to the rise or fall of the curve of the string *c*, an arm, *k*, fastened to segment-lever *b′*, which turns on a pin, *e′*, will be lifted or lowered, and will by means of a toothed

sector, *s*, turn a pinion, *n*, fastened to shaft *a*, upon which the hand *z* is fixed.

Fig. 7 shows another manner of connecting the string *c* to the segment-lever *b'*. In this case two hygroscopic strings, *c*, are used. The strings are fastened at one end to opposite sides of a disk or arms of the lever *b'*, while the other ends of the strings, which are guided over rollers *d d'*, are fastened to the ends of the Bourdon ring H'.

Instead of fastening the Bourdon ring H' in the middle part of the frame or foundation of the instrument, as is shown in Figs. 5 to 7, one end of the ring may be fastened, in which case only the other end of the ring is movable and can follow the influences of the air-pressure. This construction, which is shown in Figs. 8, 9, and 10, allows of fastening the hygroscopic string *c* to the movable end of the ring only, between arms *t' t'*, fastened to the movable end of ring H' by means of a set-screw, e^2, or otherwise. The movements of the free end of ring H', resulting from the changes of the air-pressure, are imparted by a sector-lever mechanism, *b' s*, and pinion *n*, or by any other well-known mechanical appliance, to hand *z* of the instrument, while the changes of the length of the hygroscopic string resulting from the changes of the relative moisture are at the same time, and in addition, imparted to these movements, as will be understood by reference to Figs. 8, 9, and 10 of the drawings and the following description.

The string *c* passes through an eyehole of an adjustable sliding part, *f*, attached to lever *b'*, and forms a curve, as is shown in Fig. 10. By a counter-weight, *i*, which tends to turn lever *b'* in the right-hand direction, the string *c* is strained, while *i'* is another counter-weight to balance the upper part and gearing of lever *b'*. The string *c* shortens with the diminution of the relative moisture. It forces lever *b'* to the left, and the hand *z* rises, while it must fall as soon as the string *c* lengthens, in consequence of an increase of the relative moisture.

Numerous mechanical modifications of detail parts of the instrument may be applied; and I do not limit myself to the exact apparatus shown in the drawings, or confine myself to the exact details given.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a meteorological instrument comprising an aneroid box or ring, an indicating-hand, and a hygroscopic string, mechanism, substantially such as described, for imparting to said hand the combined or compensating movements of the diaphragm of said aneroid-box or of said ring, and the alterations in length of the hygroscopic string resulting from the relative moisture of the air, substantially as and for the purpose specified.

2. The combination, with the indicating-hand of the combined barometric and hygroscopic instrument hereinabove described, of a wind-scale, P', and a weather-scale, P, substantially as described, and as illustrated in the accompanying sheet of drawings.

WILHELM KLINKERFUES.

Witnesses:
WILLIAMS C. FOX,
JOHS. KRACKE.