(No Model.)

# D. DRAPER.

## RECORDING THERMOMETER.

No. 369,171. Patented Aug. 30, 1887.

Fig. 2.

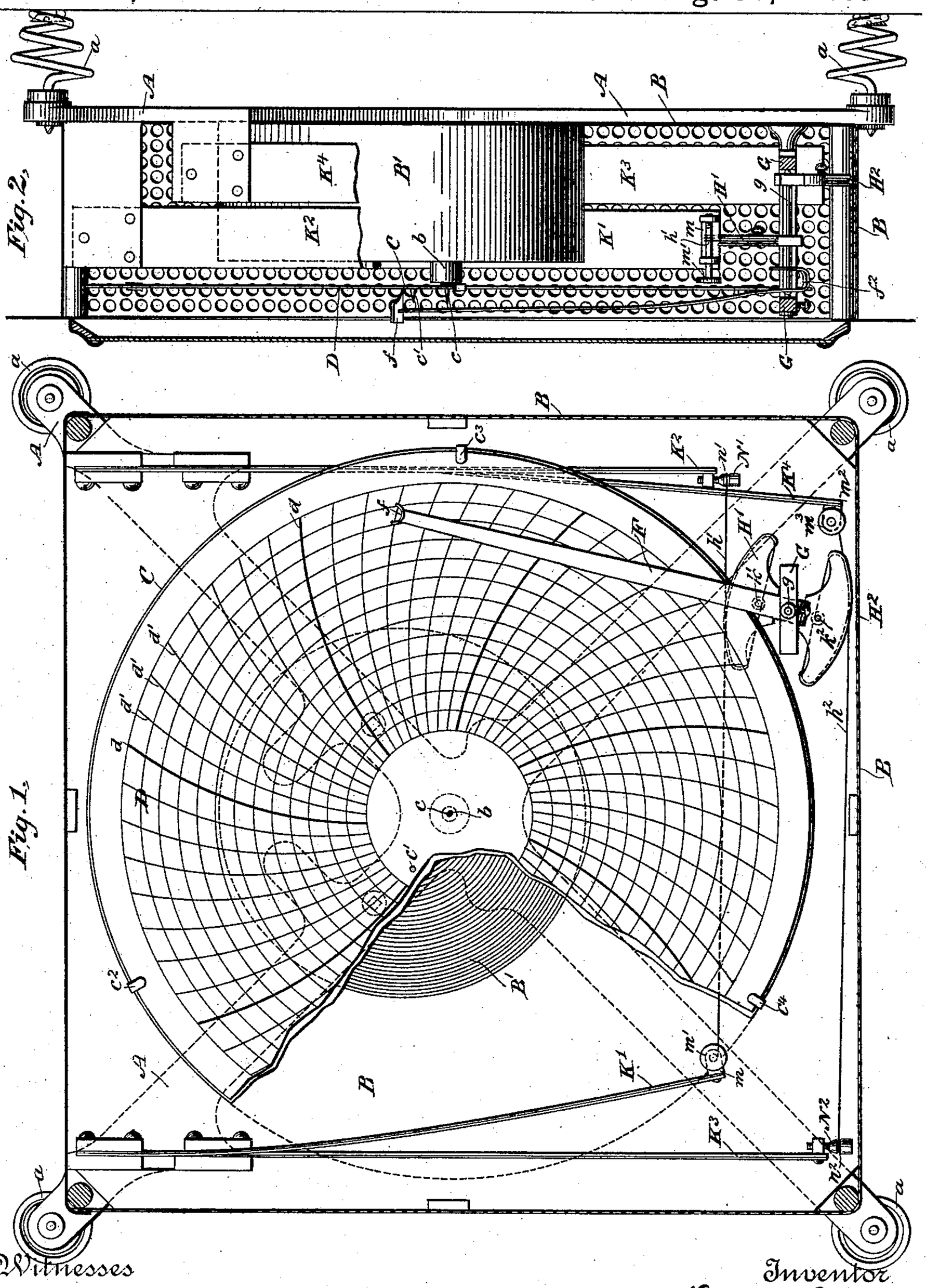


Fig. 1.

Witnesses

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## RECORDING-THERMOMETER.

SPECIFICATION forming part of Letters Patent No. 369,171, dated August 30, 1887.

Application filed April 12, 1887. Serial No. 234,486. (No model.)

*To all whom it may concern:*

Be it known that I, DANIEL DRAPER, a citizen of the United States, residing in Hastings upon Hudson, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Recording-Thermometers, of which the following is a specification.

The invention relates to the class of apparatus employed for giving a continuous record of the variations in temperature at any given point; and the object of the invention is to provide reliable, efficient, and certain means for giving a permanent record, which is exposed to view at all times during the period covered by the recording-cards.

The invention consists, in general terms, in placing upon a suitable arbor, driven at a constant speed by a clock-train, a suitably-prepared recording card or disk. This card is divided into sections by lines radiating from the center, adapted to divide it into days and hours, and, if desired, fractions thereof, and by concentric circles which serve to indicate the different degrees of temperature. Upon the card there rests a recording-pen, which is carried upon an arm moved toward and from the center of the card by the fluctuations of the variations in temperature. The recording-arm is carried upon an arbor supported in any convenient manner from a rigid back or frame, which carries also a clock mechanism; and this arbor is moved in one direction or the other by the combined action of four thermostatic strips as they are affected by the variations in temperature. Two of these strips are screwed at one side of the frame and two at the opposite side, while the free end of each strip is attached to the end of a fine wire, thread, or chain, connected with devices arranged and adapted to move the recording-arm. The strips act together in pairs. The wire of one pair passes over the face of a segmental lever screwed to the arbor of the arm, so that under an increase of temperature the two thermostatic strips combine to move the lever in one direction, and to move it in the opposite direction under the influence of a decrease of temperature. The remaining two strips, in like manner, carry a second wire or thread, which is connected with a second segmental lever upon the opposite side of the arbor of the recording-arm, and they combine with the other strips to secure a more reliable and certain movement of the arm and pen.

The strips are provided with suitable screws for adjusting the leverage.

The entire device is supported in a perforated case, which allows the air to circulate freely about the thermostatic strips. The case is preferably supported upon yielding springs, which prevent the arm from being moved by blows or accidental movements of the support carrying the case. This is of special importance when the instrument is used upon vessels or vehicles in motion. For the purpose of preventing the thermostatic strips from being affected by moisture and exposure to the atmosphere, they are preferably plated with nickel or gilded.

The invention will be described in detail in connection with the accompanying drawings, in which—

Figure 1 is a front elevation, partly in section, of the device; and Fig. 2 is a transverse section of the same.

Referring to the figures, A represents a frame, preferably of cast-iron, for supporting the case or box B. The sides of this box are perforated to allow air to circulate freely within. The frame A is supported upon yielding springs *a a*, which prevent shocks or jars from being communicated to the recording-pen. A suitable clock mechanism, preferably an eight-day movement, or even of greater capacity, is contained in a box, B′, inside the case B. Upon the hour-hand arbor *b* of this clock-frame there is carried a plate, C. This plate carries at its center a pin, *c*, and at a point a little remote from the center a second pin, *c′*, and also at its edge three or more clips, $c^2$ $c^3$ $c^4$. These are designed to hold the chart D, upon which the record is made. This chart is adapted to receive a record of the variations in the temperature for a period of one week. When the chart is to be put upon the plate, the central pin, *c*, is pushed through the central point of the chart, and the edges of the chart are slipped under the clips, while the pin *c′* prevents the chart from being turned. Radial lines *d d* divide the chart into divisions representing the days of the week, and intermediate lines, *d′*

$d'$, divide it into hours. Concentric lines $e$ $e$ divide the chart into other divisions, serving to indicate different degrees of temperature. The lines $d$ $d$ and $d'$ $d'$ are preferably curved to correspond with the arc described by the arm F, when it turns upon its center of support. This arm F carries at its end a recording-pen, $f$. It is designed that a sufficient quantity of ink to give the record for any desirable length of time shall be placed in this pen, and it will feed as required. The arm F is more or less resilient, and presses lightly against the surface of the chart.

The arbor $g$ is carried in a suitable frame or yoke, G, supported from the base of the case B. The recording-arm F is fastened upon this arbor in a suitable manner, preferably by a yoke, as indicated at $f^2$.

The two ends of the arbor $g$ bear in suitable journals or openings in the yoke G. It carries two levers, H' H², terminating in widening curved ends. The face of these ends or arcs are recessed, and receive thin wires, $h'$ and $h^2$, respectively. The wire $h'$ is fastened at one end to a thermostatic strip, K', and passes across the face of the arc, from which it is carried to and around a screw or pin, $k'$, and from this point around the other end of the second thermostatic strip, K². The two free ends of these strips K' and K² are thus bent toward each other by means of this wire, and any movement of one is necessarily communicated to the other. The other ends of the two strips K' K² are rigidly attached to suitable supports in the case B upon opposite sides of the clock-train. The strips are constructed in any well-known manner, of two metals, pressed, soldered, or otherwise fastened together, and they are so placed with reference to each other that any variation in temperature will cause the free ends of both strips to move in the same direction. The other strips, K³ K⁴, similar to the strips K' and K², are connected with each other by a cord, $h^2$, and with the lever H², which is similar to the lever H', in precisely the same manner, being passed twice across the face of the lever and wound about the pin or screw $k^2$. These two strips are supported in the same manner as the strips K' and K², and are placed upon opposite sides of the arbor $g$; but the sides of the strips presented to the arbor are the reverse of the strips K' and K², for the reason that the lever H² projects from the side of the arbor opposite to the lever H'. In this manner the four strips combine to move the arbor in the same direction under the influence of any variations in temperature.

In order that the four thermostatic strips may operate in perfect unison, and the maximum effect of their combined action be secured, it is important that both their leverage and the tension of the wires be properly adjusted. For adjusting the leverage the screws N' and N² are placed at the ends, respectively, of the strips K² and K³. The ends of the wires are looped about these screws in the grooves $n'$ and $n^2$, so that turning the screws does not change the length of the wires, but changes the points in the lengths of the strips at which the wires are attached, and thus adjusts the leverage.

For the purpose of adjusting the tension of the wires and equalizing the same between the two pairs of strips, the adjusting-screws $m'$ and $m^3$ are placed, respectively, at the ends of the strips K' and K⁴. These turn in the frames $m$ and $m^2$, as shown in the figures, and their operation will be easily understood.

The front of the case may be closed by a glass plate in any suitable manner.

The use of four strips has two advantages over the use of two strips: first, the instrument, when properly adjusted by means of the devices described, whereby both pairs of strips work in unison, is more sensitive and operates quicker under a given change in temperature, and, second, the instrument is more permanent in its adjustment and less easily deranged, because the movable parts are more rigidly held in place. This advantage is found in shipping. The instruments with four strips are found much less affected by transportation. These advantages are of course still greater over instruments having but one strip.

I claim as my invention—

1. The combination, with a clock-train and a thermometrical chart, of a recording-arm, an arbor carrying the same, a lever upon the arbor, and four thermostatic strips, two of which move in one direction and two in the opposite direction under the influence of variations in temperature, and connections between said strips and said recording-arm.

2. The combination, in a recording-thermometer, of four thermostatic strips, a recording-lever, and a mechanical connection between two of said strips and said lever, and an independent connection between the remaining two of said strips and said lever.

3. The combination, in a recording-thermometer, of four thermostatic strips connected in pairs, a recording-lever, two levers, each having its face formed in the arc of a circle, a wire or equivalent mechanical connection between each pair of said strips and one of said levers, and an adjusting device for regulating the tension of the wire connecting each pair of said strips.

4. The combination, in a recording-thermometer, of a recording-arm, a thermostatic strip, a cord or wire connecting said strip and recording-arm, and an adjusting device upon said strip consisting of a screw, N', having the groove $n'$ for changing the point of connection in the length of said strip with said cord or wire.

5. The combination, in a recording-thermometer, of the four bimetallic strips K', K²,

$K^3$, and $K^4$, the segments or levers $H'$ $H^2$, the cords $h'$ $h^2$, the adjusting-screws $N'$ $N^2$, and the adjusting-screws $m'$ and $m^3$.

6. The combination, in a recording-thermometer, of the four bimetallic strips $K'$, $K^2$, $K^3$, and $K^4$, the segments or levers $H'$ $H^2$, the cords $h'$ $h^2$, the adjusting-screws $N'$ $N^2$ $m'$ $m^3$, the frame A, the perforated case B, and the supporting-springs *a a*.

In testimony whereof I have hereunto subscribed my name this 9th day of April, A. D. 1887.

DANIEL DRAPER.

Witnesses:
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