

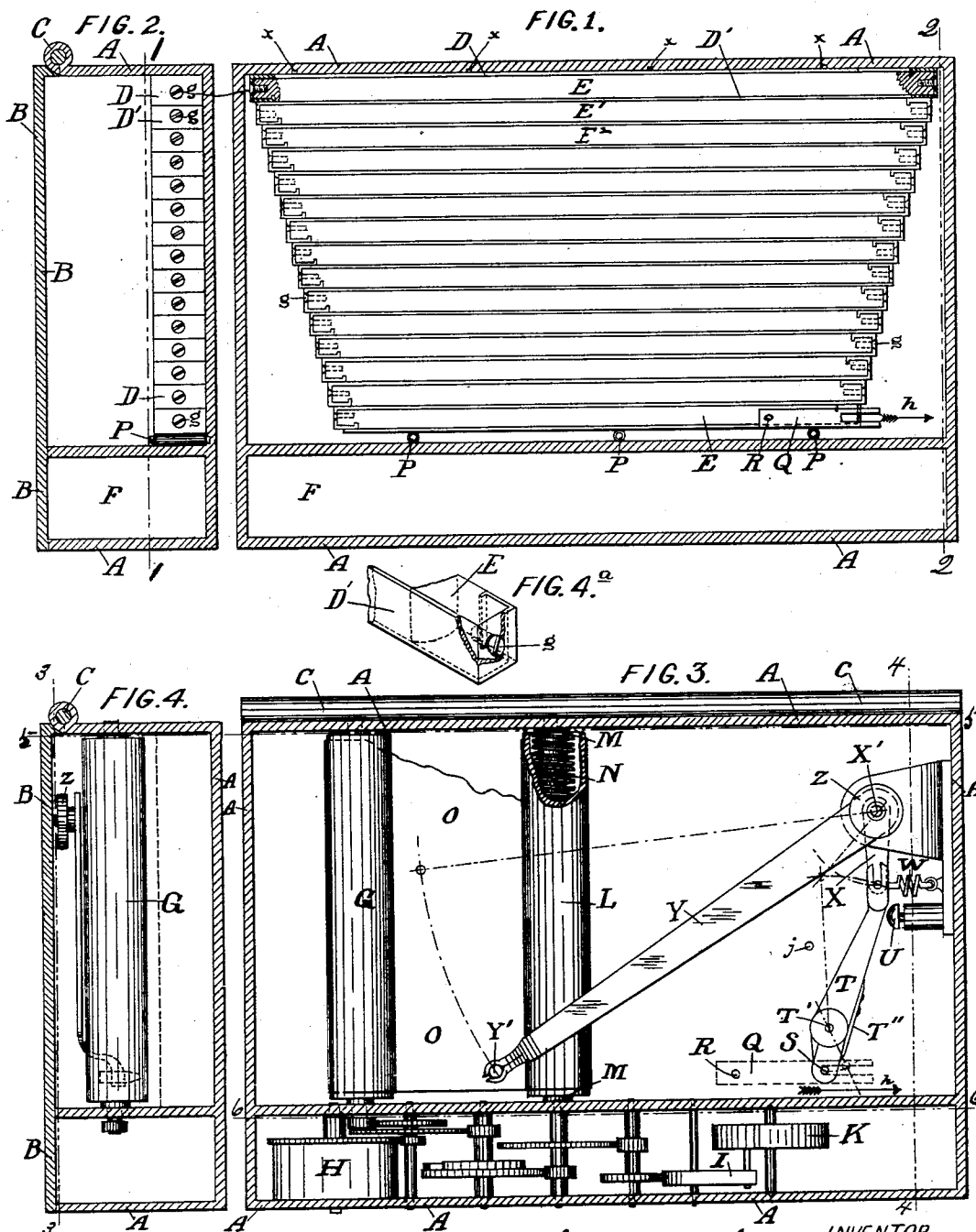
(No Model.)

2 Sheets—Sheet 1.

M. L. WILKINSON.
AUTOMATICALLY RECORDING THERMOMETER.

No. 593,503.

Patented Nov. 9, 1897.



WITNESSES.

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(No Model.)

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FIG. 5.

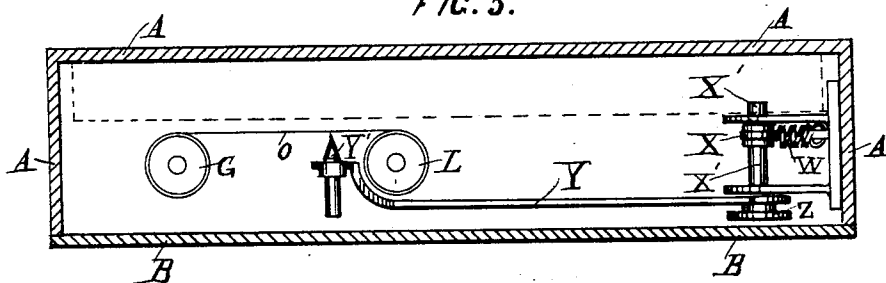


FIG. 6.

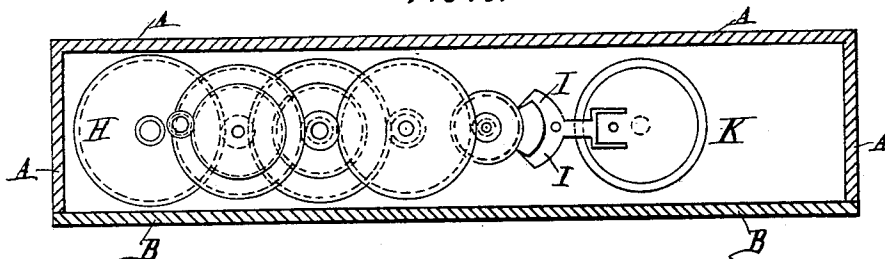


FIG. 7.

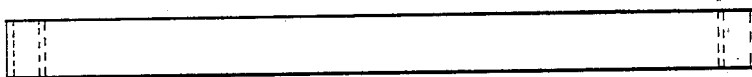
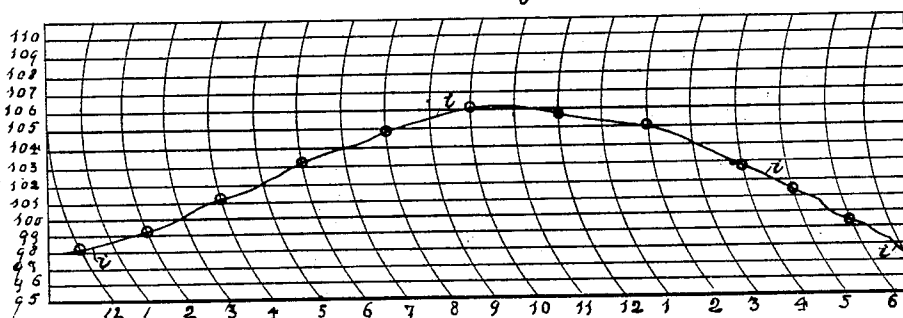


FIG. 8.



FIG. 9.



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MELVILLE LINCOLN WILKINSON, OF LOS ANGELES, CALIFORNIA.

AUTOMATICALLY-RECORDING THERMOMETER.

SPECIFICATION forming part of Letters Patent No. 593,503, dated November 9, 1897.

Application filed January 2, 1897. Serial No. 617,853. (No model.)

To all whom it may concern:

Be it known that I, MELVILLE LINCOLN WILKINSON, of the city and county of Los Angeles, in the State of California, have invented a certain new and useful Automatically-Recording Thermometer, of which the following is a full, clear, and exact description or specification, reference being had to the two annexed sheets of drawings, and to the letters marked thereon, forming part of the said specification.

My invention, which relates to an automatically-recording thermometer, has for its object to enable a diagram to be taken indicating the variations in temperature of a patient or sick person over any desired period—for example, during one hour or several hours.

The apparatus or instrument constituting my invention consists of a metallic box, the metal used for the construction of the box being preferably aluminium. This box is of rectangular form, flat, and otherwise generally of such shape and dimensions that when used for chemical purposes it can be conveniently applied to the more especially warm parts of the human body—such, for example, as the armpits, or anywhere between or upon the limbs or abdomen.

The apparatus or instrument may be larger or smaller when intended to be used for purposes of taking temperatures other than clinical.

The moving parts of the instrument consist of a series of bars formed of two substances or materials which have different coefficients of expansion. This series of bars is so arranged that while the first of the series is rigidly fixed at one end to the box or casing containing the moving parts of the instrument the lengthening of that bar by any increment of heat which it receives moves the rest of the series longitudinally and always maintains the parallel relationship of the bars through a distance corresponding to its own increment of length due to expansion, and alternatively any abstraction of heat from the said bar due to a lowering of temperature causes the said bar to shorten, thereby moving the whole series of bars longitudinally backward and also in parallel through a distance corresponding to its decrement of length due to contraction. As the extent of motion of any bar of such a

short length as can be practically used in an instrument of the kind here referred to is small, it follows that in order to effect a sufficient range of movement for the purpose of obtaining the necessary indication a series of bars placed parallel to each other and held together at their ends by bars of material having less expansibility than the material used for the set of bars first referred to will add the motion of its own expansion or contraction of each succeeding bar to the sum of the several expansions or contractions of the preceding bars of the series, less the sum of the differences due to the smaller expansion of the metal constituting the second series of bars. In this way, by means of such an arrangement, it follows that with a series of short bars the sum of their motions of expansion or contraction will produce a sufficient amount of movement in either an expanding or contracting direction, which, if applied to direct the motion of a lever carrying a pencil, would cause that pencil to move through an arc whose position at any moment in said arc is a precise indication of the temperature of the patient or sick person, so that if the pencil-point presses upon a properly-divided sheet of diagram-paper slowly traveling in contact with the pencil-point, said pencil-point will trace upon said traveling sheet of paper a diagram which becomes a permanent record of the variations of temperature of the patient or sick person over any desired period.

On the annexed sheet of drawings, Figure 1 is a vertical section of my improved automatically-recording thermometer, taken on the line 1 1, Fig. 2. Fig. 2 is a transverse section of the same on the line 2 2, Fig. 1. Fig. 3 is a vertical section of my improved automatically-recording thermometer, taken upon the line 3 3, Fig. 4. Fig. 4 is a transverse section, taken on the line 4 4, Fig. 3. Fig. 4^a is a perspective view of one end of the bars D and E, on an enlarged scale, more especially showing the construction of the respective bars at their end where they are joined together, and the joining-screw. Fig. 5 is a horizontal section on the line 5 5, Figs. 3 and 4. Fig. 6 is a horizontal section on the line 6 6, Fig. 3. Fig. 7 is a plan of one of the bars of least expansible material used in the series of expanding and contracting bars.

Fig. 8 is an edge elevation of Fig. 7. Fig. 9 is a diagram on a reduced scale, showing the curve of temperatures taken by my improved automatically-recording clinical thermometer.

5 It is here explained that for the sake of perspicacity the instrument shown upon the annexed drawings is larger than it would be made for practical purposes, being nearly or about double the natural size, and that the
10 diagram shown at Fig. 9, while larger than the diagram which would be obtained from the instrument of natural size, is somewhat smaller than the diagram which would be obtained from an instrument of the size shown
15 in the drawings.

In Figs. 1 to 6 the box or case of the instrument is marked A. This is constructed with the cover B at one side attached to the case A by means of a hinge C, so that the cover
20 B may be opened for the purpose of inserting the diagram-paper and for taking out the diagram from the interior thereof. Any kind of spring latch or clasp may be used for keeping the lid or cover B closed upon the casing
25 or box A.

At the upper end of the casing A and at the back thereof, as shown at Figs. 1 and 2, a metallic bar D is rigidly fastened by means of short projecting studs *x*, forming part of or
30 fastened to the bar D. These studs *x* enter corresponding holes in the side of the casing, as shown. The metallic bar D is formed with a hook at the left-hand end thereof, as seen in Fig. 1. This bar D is formed of a metal or
35 alloy which has a very small coefficient of expansion—for example, German silver. This bar D constitutes the one fixed point or portion of the thermometric system of bars which are used. Into the hook end of this bar D
40 one end of the bar E is fitted and firmly secured thereinto not only by the hook formation of the bar D, in the manner shown, but also by means of a screw *g* (shown at Figs. 1 and 2) being passed through a hole in the
45 hook-bar D and tightened into the end of the bar E. From this construction it follows that when the bar E is expanded or contracted by the addition or subtraction of heat it increases or diminishes in length correspondingly, and
50 by reason of the bar E having another bar D' of lower expansibility attached to its right-hand end the bar E, when expanded or contracted, moves the bar D' through the same range of motion and in the same direction
55 through which the bar E itself moves, corresponding to the variations in temperature. The metallic bar D'' of low expansibility has another bar E' of high expansibility attached to it at its left-hand end in the same manner
60 that the preceding bars E and D, respectively, are attached together, and the bars of the entire series shown in Figs. 1 and 2 alternate in their construction and attachment in the same manner, so that the net sum of the entire movements of the bars E of the series become added
65 together in the last bar E, the movements of the last bar E expressing all the accumu-

lated variations of temperature which have occurred during the period of observation. The bars E are preferably made of hard rubber, for the reason of the larger coefficient
70 of linear expansion which that material possesses in comparison with the small coefficient of linear expansion which the other bars D, of German silver or other metal or alloy, possess.
75 I desire here to point out that I am aware that bars of metal of different expansibilities by heat have been previously proposed to be used for producing thermometric observations; but in all such cases the pairs of bars used have
80 been united together at short distances apart throughout their entire length, so as to produce when heated or cooled a curvature of each pair of such bars. In my system, however, they are not connected together in pairs,
85 nor are they in any wise attached together except at their ends, so that each bar is free to move and can only move longitudinally, while constantly maintaining the parallel positions of the several bars under the influ-
90 ences of variations in temperature, and it is the net sum of these longitudinal and parallel movements in either direction which is expressed in the last bar of the series that operates the pencil of the diagram-drawing
95 mechanism.

In the lower chamber F of the box A clock-driving gear is fitted, the purpose of which is to very slowly rotate the diagram-cylinder G. The particular construction of the driving
100 clock-gear is no essential part of my invention, and therefore may be changed in any of the well-known and commonly used variations of clock mechanism, the essential feature of the driving clock-gear being that of a
105 main-spring in the barrel H, which can be wound up to acquire potential and thence impart motion through a train of wheels, such as that shown in the drawings, to an escapement I and balance-wheel K at the other end
110 of the train. Besides the barrel G, operated by the aforesaid clockwork, the front part of the casing contains another barrel L, carried upon a fixed shaft M and attached thereto by means of a spiral spring N, (shown in the interior of the barrel L,) the upper part of which is broken away to enable said spring N to be seen. One end of the diagram-paper is attached to the spring-barrel L by means of a
120 strip such as is common to the diagram-barrels of indicating instruments, and the tension of the spring N always tends to wind the diagram-paper upon the barrel L. The other end of the diagram-paper O is attached to the barrel G by a similar fastening-strip, and
125 when the instrument is in operation the slow movement of the barrel G, actuated by the clockwork, causes the barrel G to wind the diagram-paper O onto itself and from the barrel L at a sufficiently slow progressive rate.
130

The lowest bar E of the series of hard-rubber bars rests upon rollers P, whereby it is enabled to move backward and forward with freedom, and its right-hand end has a con-

necting-piece Q attached to it by a pin R. Thus it will be seen that the series of bars of different expansibilities are maintained in their proper position in the casing by the studs α engaging with the corresponding holes in the side of the casing and by means of the rollers P, which prevent the series of bars from becoming disengaged with the casing, while at the same time permitting of their free longitudinal movements due to the variations in temperature to which the thermometric bars of the instrument or apparatus are from time to time subjected. The outer end of the connecting-piece Q is formed with a slot, as shown at Figs. 1 and 3, which engages with the pin S in the lower arm of the lever T. The lever T in its normal position rests at its upper end against an adjustable stop U, being pulled by means of the light spiral spring W. The upper end of the lever T engages with the lever X, carried upon the shaft X', and upon the shaft X' there is also attached the long lever Y, which is formed as a light spring, carrying at its outer end the pencil Y', whose point presses against the slowly-traversing diagram-sheet O. From this arrangement it will be seen that any motions of the series of bars corresponding to the increment of temperature will move the connection Q in the direction of the arrow h , Figs. 1 and 2, while any decrement of temperature will move the connecting-piece Q in the opposite direction. As any movement of the connecting-piece Q in the direction of the arrow h causes the lower end of the lever T, which is connected therewith by the pin S, to move in the same direction, this also causes the upper and longer end of the lever T to move on its axis in the opposite direction and to stretch the spring W. The lever X being engaged with the upper end of the lever T, as shown at Fig. 3, is also moved in the same direction and to the same extent as the lever T, thereby moving the shaft X' upon its axis, and correspondingly therewith causing the lever Y and pencil Y' to be moved upward on the face of the diagram-paper. The movements of the several parts whereby the diagram is drawn on the paper O is indicated by the several dotted lines and circular arcs in Fig. 3. When the observation has been taken, the variations of the movement of the pencil-point, brought about in the manner and by means of the instrument hereinbefore described, is drawn as an irregular curve i upon the diagram-sheet as indicated in Fig. 9 wherein the horizontal lines indicate temperatures and the segmental lines indicate hours.

In order that the levers T and Y may not be moved to an abnormal extent, a stop j is provided, against which the lever T presses when it is moved to its maximum range, and to further prevent any fracture or injury to the instrument, which might take place through the further movement of the last bar E of the series tending to push the lever T

beyond this point, the lower part of the lever T is made separate from the upper part and movable around the same axis T', being pressed and maintained in its normal position by the flat spring T'', as shown at Fig. 3. This arrangement enables the lower part of the lever T to be moved beyond its normal position in such case by reason of the yielding of the spring T'', which forces the lower part of the lever T back to its normal position so soon as the abnormal temperature is removed.

Having now described the nature of my said invention and the best system, mode, or manner with which I am acquainted for carrying the same into practical effect, I desire to observe, in conclusion, that what I consider novel and original, and therefore claim as the invention to be secured to me by Letters Patent, is as follows:

1. The automatically-recording thermometer consisting of a box or case containing a series of parallel bars moving, or sliding longitudinally and always parallel to one another, fastened together at their ends only and alternately made of substances having different expansibilities, such as German silver and hard rubber, one end of the series of bars being fixed to the casing inclosing the apparatus, and the other end of the series of bars being supported on rollers so as to leave the entire series of bars free to move backward and forward longitudinally, corresponding with variations in temperature to which the series of bars is subjected, the said bars being always maintained and moving in parallel and sliding contact with each other, the movable end of the series of bars being connected to lever mechanism carrying a pencil-point whereby the ultimate motions of the series of bars corresponding to the variations in temperature, are inscribed upon a sheet of slowly-moving diagram-paper, actuated by clockwork, all operating together in the manner and for the purposes substantially as set forth.

2. The combination of the series of bars formed alternately of materials having different expansibilities, always maintained and moving longitudinally in parallel and sliding contact according to the variations in temperature, the bar forming one end of the series being fixed to the casing of the instrument, while all the other bars are free to move from said fixed point longitudinally and parallel, thereby imparting their sliding movement to all the succeeding bars of the series, the net sum of the motions of any preceding bars of the series so imparted to any succeeding bar or bars of the series being such that the longitudinal parallel movement of the last bar of the series so moved, is equal to the net sum of the longitudinal movements of itself and all the other preceding bars of the series so moved less the difference in longitudinal movement of the sum of the other bars of the series having least expansibility, said alter-

nate bars of different expansibility being connected together at their ends substantially as set forth.

3. The combination of the series of bars
5 connected together at their ends, and formed alternately of materials having different expansibilities, the rollers, the connecting-piece, the lever to which the connecting-piece from
10 the last bar imparts the movement of the series of longitudinally-moving parallel bars, the spiral spring, the lever on the shaft to which the pencil-carrying lever is attached,

the cylinders or drums carrying the diagram-paper, the clock-driving gear and the drum whereby the diagram-paper is unwound, all 15 operating together in the manner and for the purposes substantially as set forth.

In testimony whereof I have hereunto set my hand and affixed my seal in presence of two subscribing witnesses.

MELVILLE LINCOLN WILKINSON. [L. S.]

Witnesses:

H. S. ROLLINS,
St. JOHN DAY.

It is hereby certified that in Letters Patent No. 593,503, granted November 9, 1897, upon the application of Melville Lincoln Wilkinson, of Los Angeles, California, for an improvement in "Automatically-Recording Thermometers," an error appears in the printed specification requiring correction, as follows: In line 24, page 1, the word "chemical" should read *clinical*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 14th day of December, A. D., 1897.

[SEAL.]

WEBSTER DAVIS,
Assistant Secretary of the Interior.

Countersigned:

A. P. GREELEY,
Acting Commissioner of Patents.