F. ECAUBERT.

ESCAPEMENT REGULATOR.

APPLICATION FILED DEC. 26, 1908.

965,507. Patented July 26, 1910.

Fig. 1.

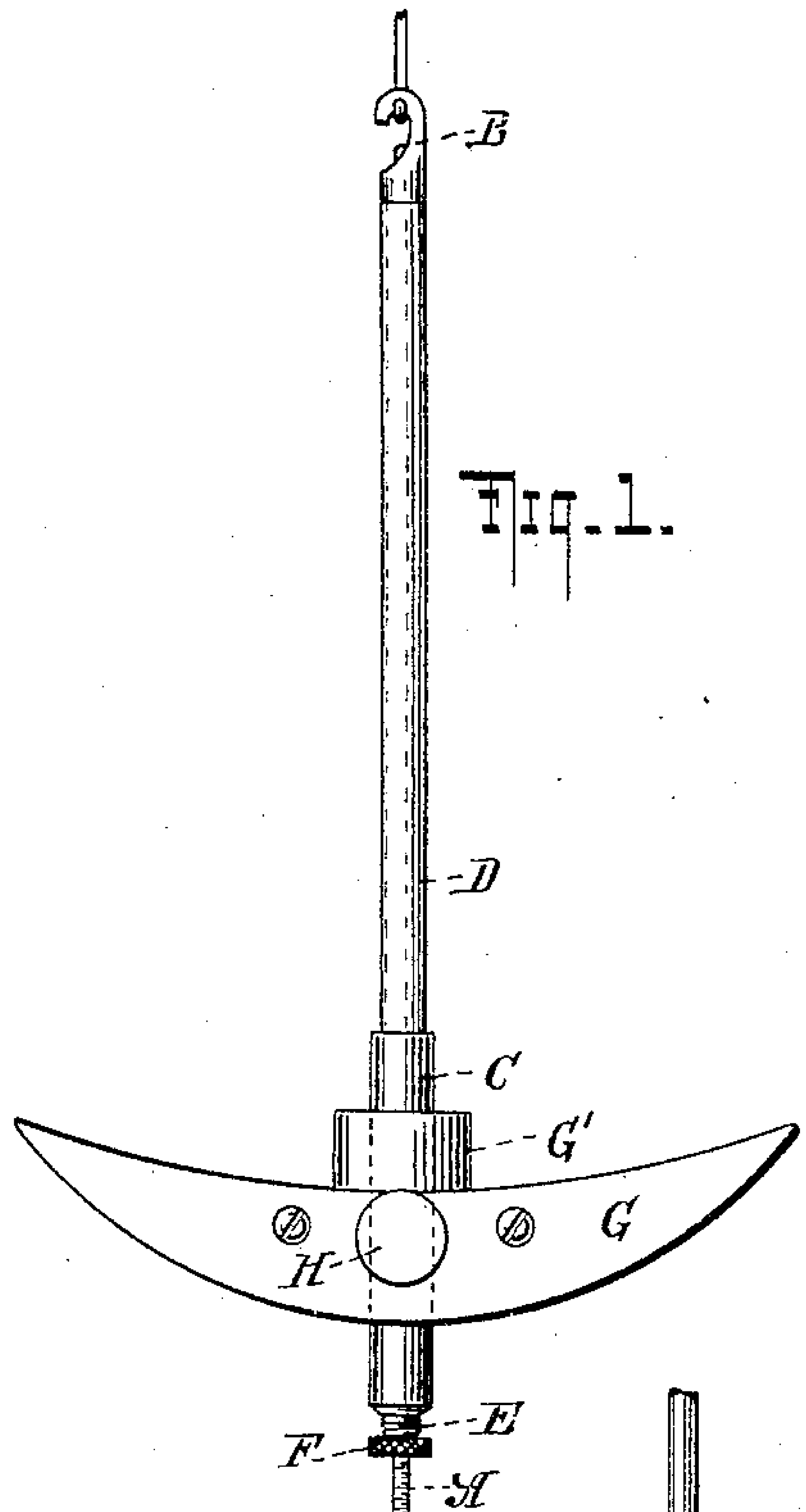


Fig. 2.

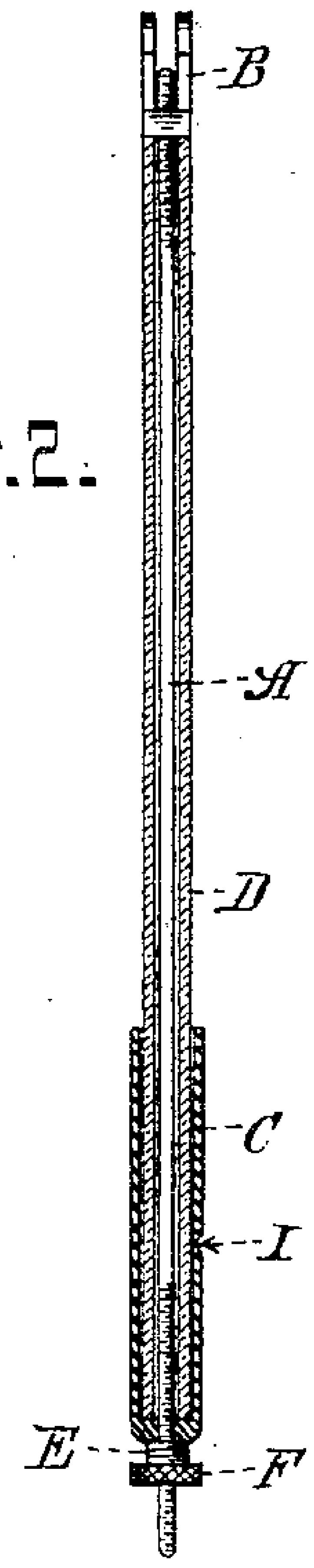


Fig. 3.

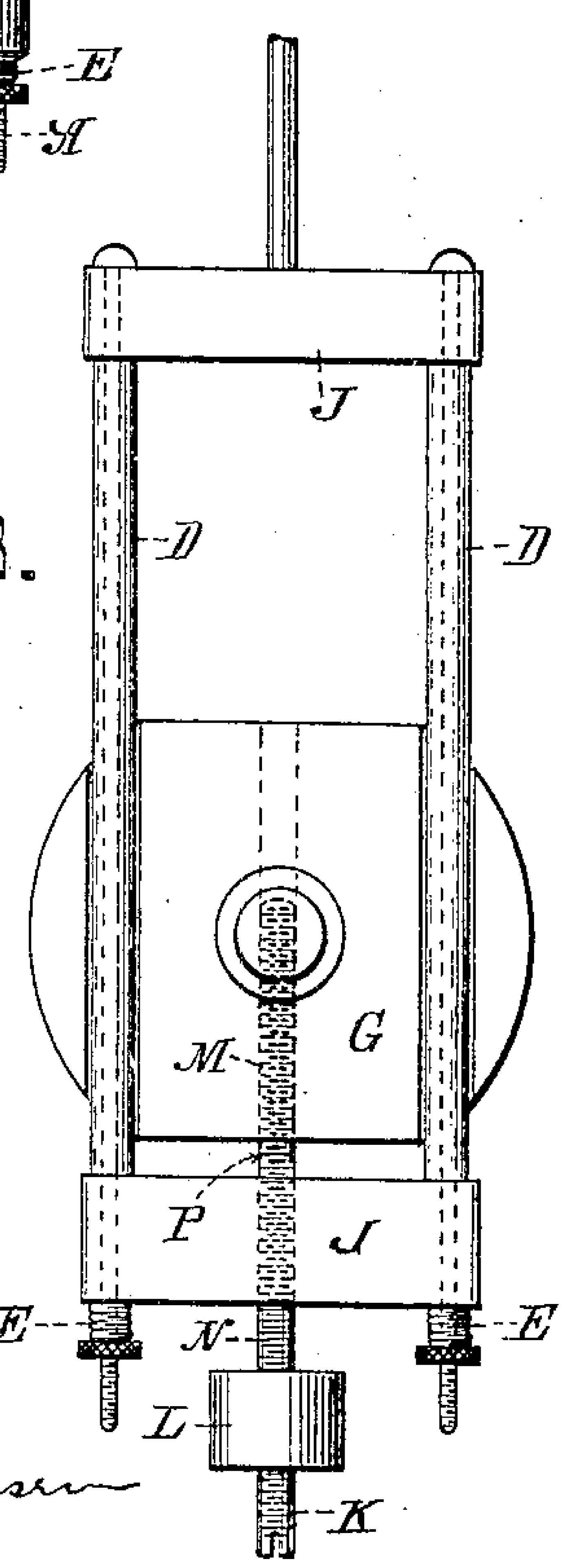
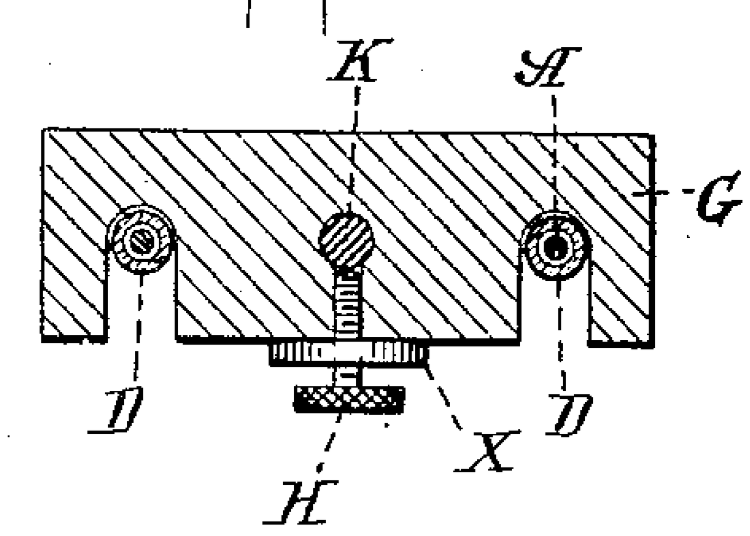


Fig. 4.



WITNESSES

G. V. Rasmussen

John A. Kehlenbeck

INVENTOR

FREDERIC ECAUBERT

BY

Briesen & Knauth

ATTORNEYS

UNITED STATES PATENT OFFICE.

FREDERIC ECAUBERT, OF NEW YORK, N. Y.

ESCAPEMENT-REGULATOR.

965,507. Specification of Letters Patent. **Patented July 26, 1910.**

Application filed December 26, 1908. Serial No. 469,433.

To all whom it may concern:

Be it known that I, Frederic Ecaubert, a citizen of the United States, and a resident of the city of New York, county of Kings, State of New York, have invented certain new and useful Improvements in Escapement-Regulators, of which the following is a specification.

The present invention relates to escapement regulators in which it is sought to compensate automatically for various changes in the relative position and mass of the parts of the regulator, due to the expansion or contraction thereof during atmospheric changes.

The object of the invention is to construct an escapement regulator which will neither increase or retard the speed of the movement by reason of changes in temperature.

In the drawings, I have shown my invention applied to a pendulum movement, but it is obvious that the advantageous structural features may be incorporated in other movements with like success.

In the drawings in Figure 1, I have illustrated the pendulum containing the new features of my invention. Fig. 2 is a sectional view thereof with the weight disconnected. Fig. 3 is a view of a modification of my invention, and Fig. 4 is a sectional view illustrating this device.

In the drawings, A represents a steel pendulum rod provided with the hooked head B on the upper end as the suspending means.

C represents a brass sleeve which supports the tube D. Through this tube D passes the rod A. The tube D is preferably of quartz, glass or some silicious material. The tube D is at all times clamped between the lower surface of the hooked head B and the bottom of the sleeve or shell C and thus constitutes a bracing member, *i. e.*, one that is constantly maintained under compression and which resists such compression as explained in the closing paragraph of this specification, thereby acting as a brace between the hooked head B and the bottom of the sleeve C. The sleeve may be integral with the weight but is illustrated as a separate piece for a clearer demonstration of the separate functions of these two parts. The spring E is continuously pressing against the bottom of the sleeve C, being maintained in active position by the nut F which screws upon the lower end of the rod A. The pendulum weight G may be supported upon the sleeve C (or rest directly on the spring E, if integral with the sleeve), by the set screw H.

In the construction illustrated in Figs. 1 and 2, it is apparent that as the temperature rises, the rod A will increase in length in a direction toward its free end. It is therefore necessary to compensate for variations due to the movement of the rod A. Inasmuch as the variations in length, due to temperature changes, also vary the distribution of weight with reference to the center of oscillation, there should be an additional compensation for weight. These compensations are in effect as follows:

First: Compensation for movement: The ratio of expansion of that material composing the suspension means which lies between the axis of oscillation and the top of the quartz tube is multiplied by its length. To this sum is added the sum obtained by multiplying the ratio of expansion, if any, of the quartz or glass tube. This sum divided by the ratio of expansion of the material composing the sleeve will show the exact distance from the bottom of the quartz tube, at which the center of gravity of the weight must be located upon the sleeve. In other words, to compensate for expansion of that portion of the rod A located between the axis of oscillation and the end of the tube D nearest to it, and of the expansion, if any, of the tube D, a weight or weighted member is made use of to bear constantly against the other end of the tube D. In this manner the center of gravity of the weight is made stationary during all temperature changes with reference to the point of oscillation and compensation for movement is effected.

Second: Compensation as to weight is effected by adding to the weight above its center of gravity material G′ whose weight expanding upwardly is equal to the calculated increase in weight due to the downward expansion of the rod A. This is very readily calculated, and is afterward never increased or diminished.

The stationary point with reference to the center of oscillation is indicated in the drawing by the depression I, into which fits the set screw H of the weight G, which is located at the center of gravity of the weight.

The success of this device is very largely due to the fact that spring E maintains the tube D in a constant relation with reference to the point of suspension, and that the lengthening of the pendulum rod A has no effect on the weight and is independent of the tube D. Referring to Figs. 3 and 4, the members are brought into play with respect to a pendulum provided with two parallel tubes D in the particular arrangement shown. The springs E shown in those figures are located at the bottom of the pendulum, but this arrangement may readily be reversed whenever necessary or essential. If only one of the rods is reversed, the upward expansion of one counteracts the downward expansion of the other. The rods may, in some cases, pass beyond the axis of oscillation in which case expansion in both directions from said point partially balances each other. The tubes D are shown to be tubular in construction but the silicious material D may be a solid piece by the side of which the rod A passes. J, J, are two cross pieces connected to the tubes D. The lower cross-piece J is screw-threaded to receive the screw K, which in this embodiment of the invention carries the weight nut L at its lower end, the weight of the screw K and nut L being exactly alike.

The relative weight of the screw K and the nut L must be so proportioned that the movement of one can be exactly counteracted by the hand and eye. In other words, the weights of these two parts must be readily measurable.

The screw K is composed of two metals, M and N joined together at P the upper portion being made, for instance, of brass or bronze, and the lower portion of steel, these two substances having different co-efficients of expansion. The screw K passes through a threaded aperture of the weight G, the threads of which apertures correspond to those of the aperture in J. The set screw H holds the weight G in any desired position upon the screw K. This peculiar construction enables me to accomplish the following results.

According to the general rules heretofore annunciated, a relatively permanent position, with respect to the center of oscillation is first determined for the weight upon the screw K, and the weight is attached to the screw K at this point, by the set screw H. If the compensation has not been correctly calculated, then the screw K may be screwed up or down without changing the relative position of the weight G with reference to the other portions of the pendulum. If the pendulum compensates too much for the expansion of the rods A, then the screw is turned up so that a portion of the steel part of the screw K would come above the bracket J, thereby giving that portion of the screw K above the bracket J a smaller amount of expansibility. For each turn of the screw upward, the nut L is correspondingly turned back so that not only the weight but also the position in the weight L with reference to the center of gravity of the weight G will always be the same.

If the screw weighs as much as the nut, then for each turn of the screw the nut is turned in opposite direction. So long as the difference in weight is measurable in integrals, and the relative weight known, it is obvious that this measurable quality of the relative weights is important in affording an easy and convenient adjusting means. To regulate the speed of running I prefer to add or take away some weight at the center of gravity of the weight G, as for instance, the washer X on the set screw.

Various modifications will readily suggest themselves to accomplish the proper adjustment of the weight G with reference to the other portions of the pendulum without departing from the essence of the invention. By virtue of the peculiar arrangement of my quartz rod, it is obvious that the said rod may be either of one piece or of many pieces, and also that if the said rod should break, it will not interfere with the proper operation of the pendulum since the spring would crowd the two parts together at all times and make them act as a single piece. This is due to an avoidance of all tensile strain on the glass or quartz and to the constant compression to which this part is subjected, whereby its use which heretofore was not possible or known, is permitted. Glass or other brittle material has not heretofore been practically used for pendulums, because the weight was hung on the glass and whereas I contrariwise suspend the weight on a metallic member whose tensile strength is trustworthy.

I claim as my invention:

1. In an escapement regulator, the combination of an expansible rod tending to expand in a direction away from the axis of oscillation, expansible mechanism connected with said rod to cause a weight to move toward the axis of oscillation by reason of the expansibility of said mechanism, a weight mounted upon said mechanism and means composed of material having a relatively low coefficient of expansion interposed between the oscillating end of the rod and the axis of oscillation, said means being detachable with reference to the weight and adapted to maintain the center of gravity of the weight at a substantially constant distance from the axis of oscillation.

2. In an escapement regulator, the combination of an expansible rod and a comparatively non-expansible member, a bearing surface near one end of the rod for the non-expansible member, a spring so located with reference to the rod and non-expansible member as to continually crowd the non-expansible member against the bearing surface while leaving the rod to expand freely and independently thereof, and a weight-

carrying member having an expansible tendency to bring the weight nearer to the axis of oscillation by reason of expansion, the last named member being interposed between the spring and the non-expansible member.

3. In an escapement regulator, the combination of an oscillating arm, a weight, a bracing member parallel with the oscillating arm, a member upon which the weight is mounted, and a spring for constantly maintaining said member in contact with said bracing member, the said spring simultaneously forcing apart the end of the oscillating arm and the weight supporting member.

4. In an escapement regulator, the combination of an oscillating expansible rod, a comparatively non-expansible rod adjacent thereto, a weight-supporting expansible member adjacent to said two rods and a spring bearing at one end against the first-named rod and at the other end against the last named member, said last named member being interposed between the spring and second-named rod, and a support for the spring connected with the first-named rod.

5. In an escapement regulator, the combination of an expansible rod tending to expand away from the axis of oscillation, a comparatively non-expansible rod located adjacent thereto, a spring for maintaining the non-expansible rod in a comparatively constant position with reference to the first named rod, mechanism connected with said two rods to support a weight, the said mechanism consisting of a screw composed of metals of different expansibilities, and an adjustable weight upon said screw of an integrally proportional weight with reference to the weight of the said screw.

6. In an escapement regulator the combination of an expansible rod tending to expand away from the axis of oscillation, a comparatively non-expansible rod located adjacent thereto, a spring for maintaining the non-expansible rod in a comparatively constant position with reference to the first named rod, mechanism connected with said two rods to support a weight, the said mechanism consisting of a screw composed of metals of different expansibilities.

7. In an escapement regulator, thermostatic means for compensating for temperature induced variations in the size of the regulator, said thermostatic means comprising an adjustable member composed of a plurality of pieces of metal of different expansibilities, joined end to end, said means being adapted to regulate the thermostatic means by bringing into play more of one and less of the other metal in accordance with its adjustment.

8. In a temperature regulator, the combination of a straight metal rod connected with the oscillating axis, a stop connected with said rod, a straight vitreous member bearing at one end against said stop and being subject to compression strain at its other end, means connected with the rod for exercising said pressure, a weighted member placed between the end of the compression member and the pressure means, the expansion of the weighted member from its center of gravity toward the axis of oscillation equaling the expansion of the rod and compression member away from said axis of oscillation.

9. In an escapement regulator, thermostatic means for compensating for temperature induced variations, adjusting mechanism for said means, said thermostatic means comprising a compensating member, and a movable auxiliary weight to maintain the same effective load for all adjustments, the relative weight of the adjusting mechanism and of the auxiliary weight being measurable in integral proportion, and means for adjusting the auxiliary weight on the adjusting mechanism in exact proportion to the integers of their relative weight.

10. In an escapement regulator, a combination of an expansible oscillator connected with the oscillating axis, a stop connected with said oscillator, a straight member of silicious material compressed between the stop and the pressure exercising means, means connected with the oscillator for exercising pressure, a weighted member whose center of gravity is located at a point between the stop and the pressing means.

11. In an escapement regulator, the combination of a plurality of rods parallel with each other and connected with the axis of oscillation, resisting members of lesser or no expansibility, an abutment capable of yielding constantly in the direction of the length of the members, and an unyielding abutment, said resisting members being held in constant engagement with the yielding and the unyielding abutment and a weight between the said abutments.

12. In an escapement regulator, the combination of a suspended oscillating member, a weight, thermostatic devices, and an adjustably movable member connecting the weight and the suspended member, the said movable member being adjustable lengthwise and being adapted in accordance with its adjustment, to bring into play between the center of the weight and the point of suspension varying quantities of two metals of different expansibilities.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses, this 24th day of December, 1908.

FREDERIC ECAUBERT.

Witnesses:

JOHN LOTKA,

JOHN A. KEHLENBECK.