(No Model.) 4 Sheets—Sheet 1.

H. J. HAIGHT.

ELECTRO MAGNETIC TRANSMITTING AND DISTRIBUTING THERMOSCOPE.

No. 359,210. Patented Mar. 8, 1887.

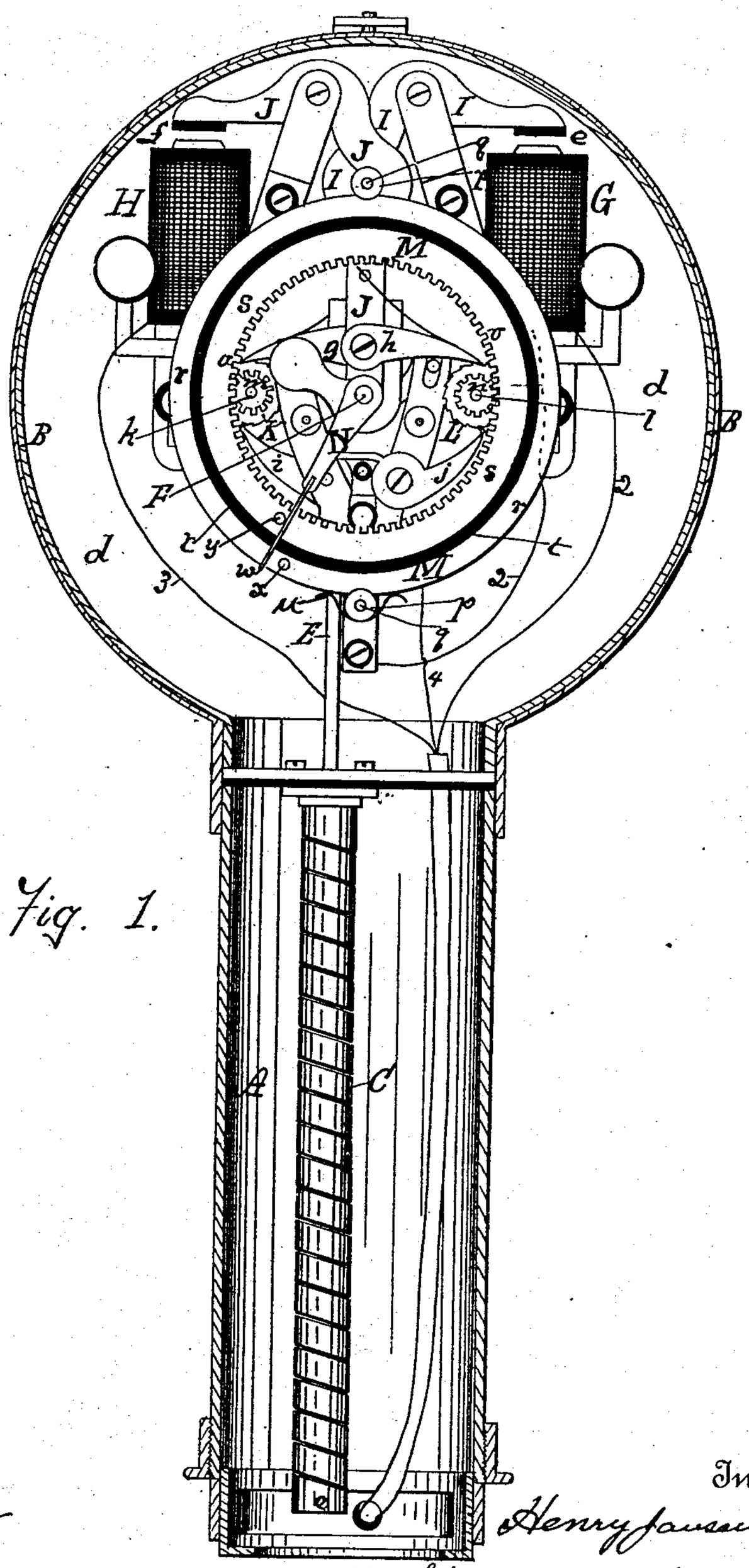

Fig. 1.

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(No Model.) 4 Sheets—S.

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Fig. 2.

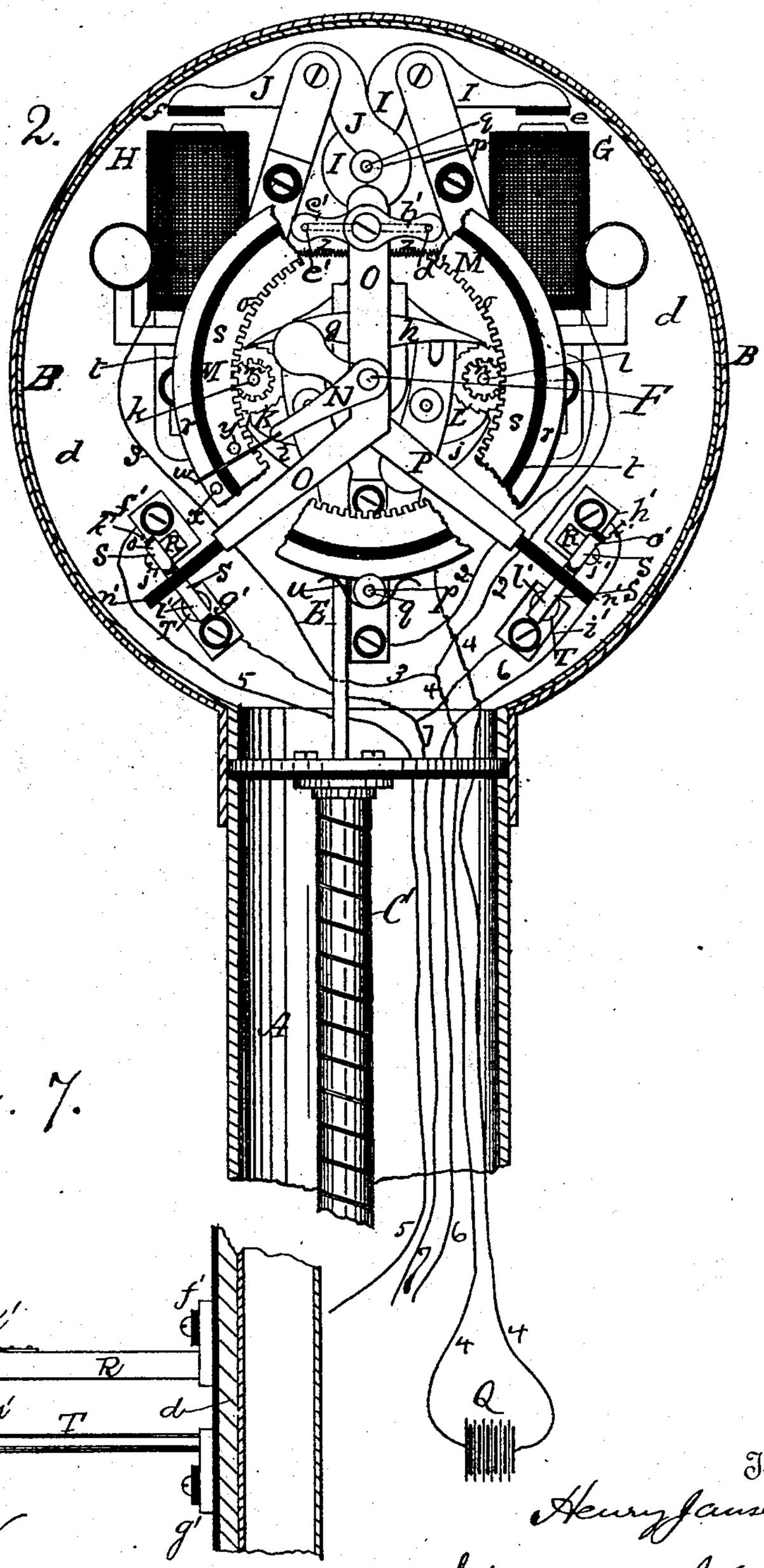

Fig. 7.

Witnesses

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(No Model.)

4 Sheets—Sheet 3.

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ELECTRO MAGNETIC TRANSMITTING AND DISTRIBUTING THERMOSCOPE.

No. 359,210. Patented Mar. 8, 1887.

Fig. 3.

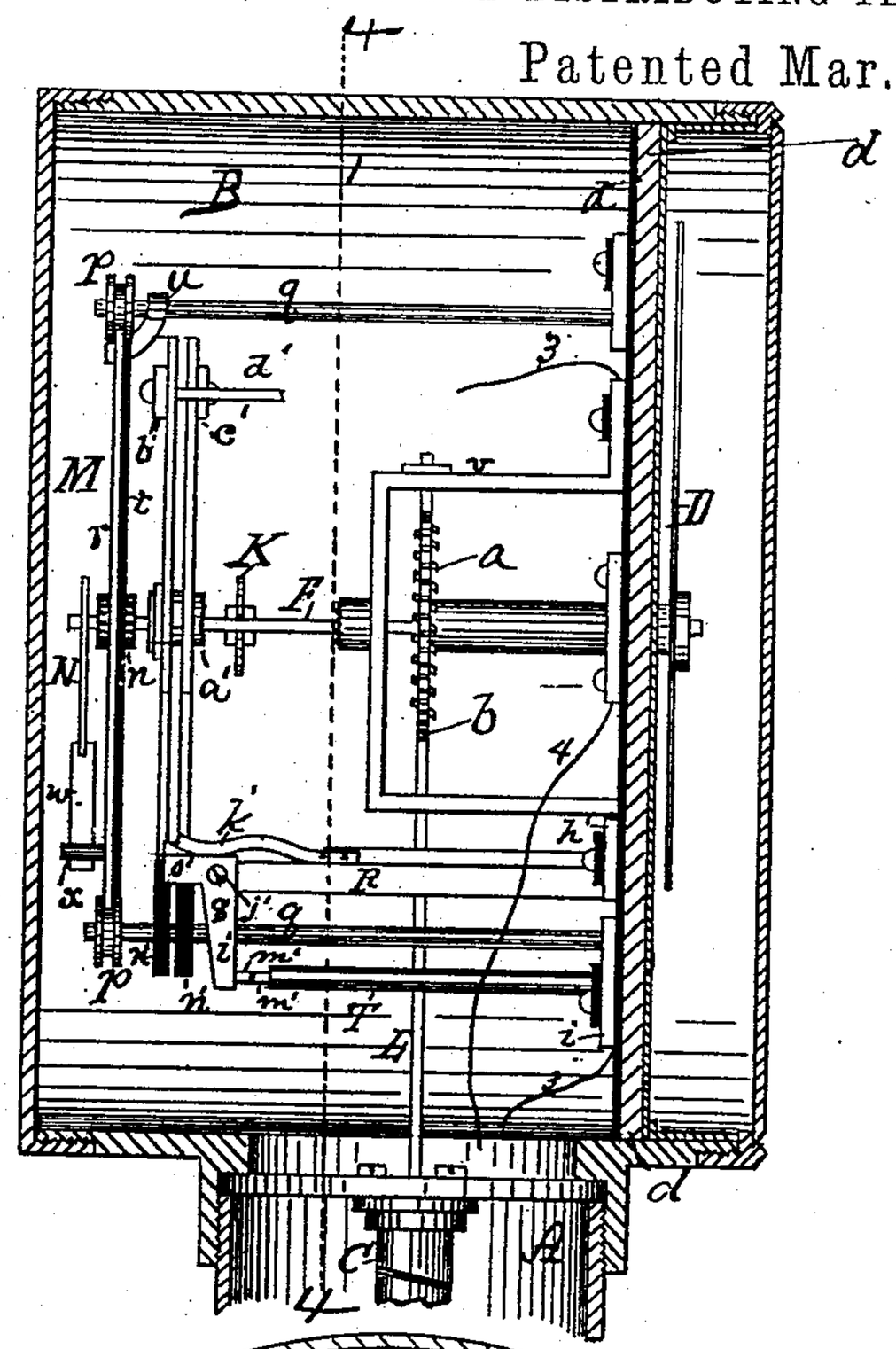
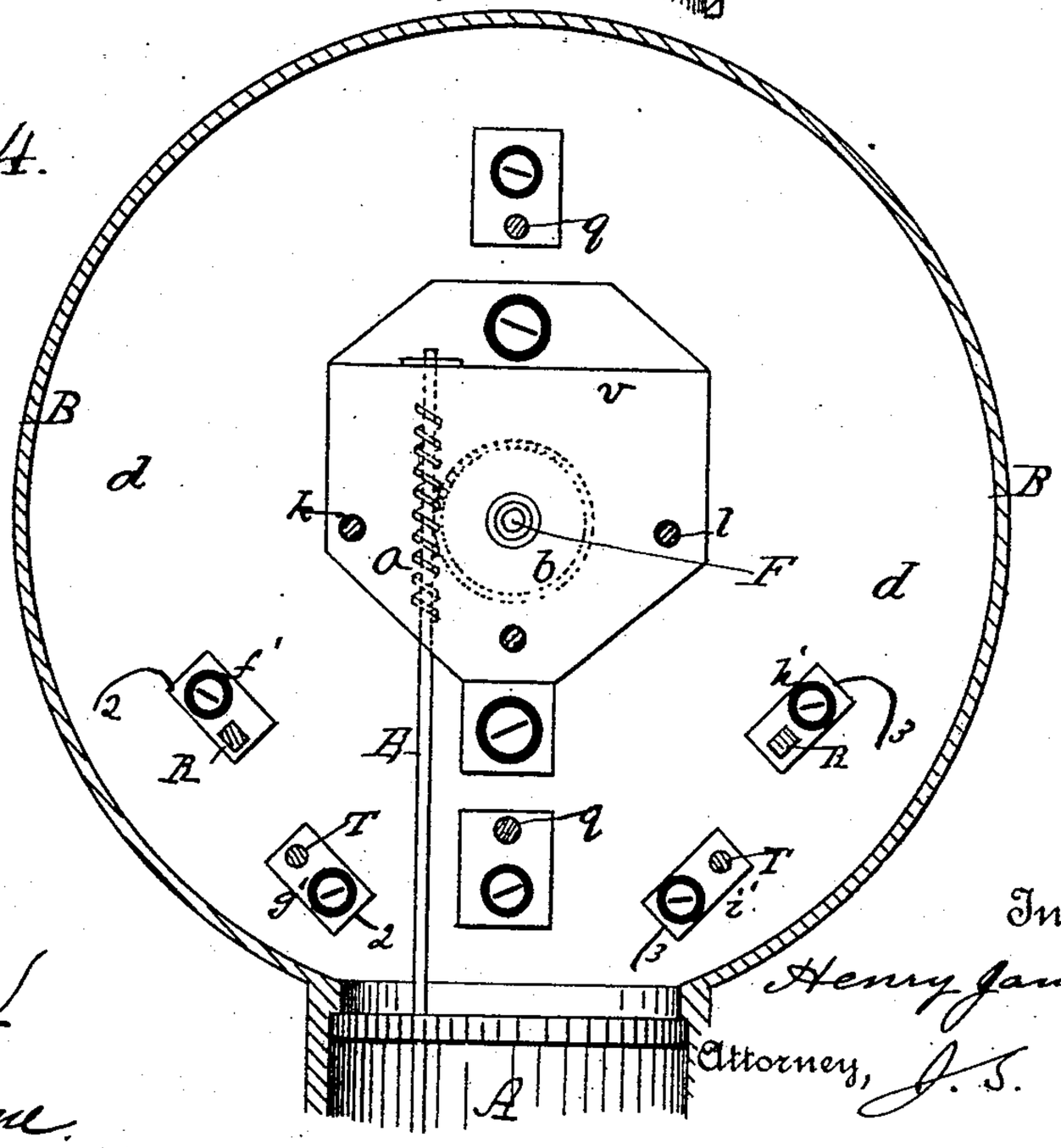


Fig. 4.



Witnesses
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(No Model.) 4 Sheets—Sheet 4.

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ELECTRO MAGNETIC TRANSMITTING AND DISTRIBUTING THERMOSCOPE.

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Fig. 5.

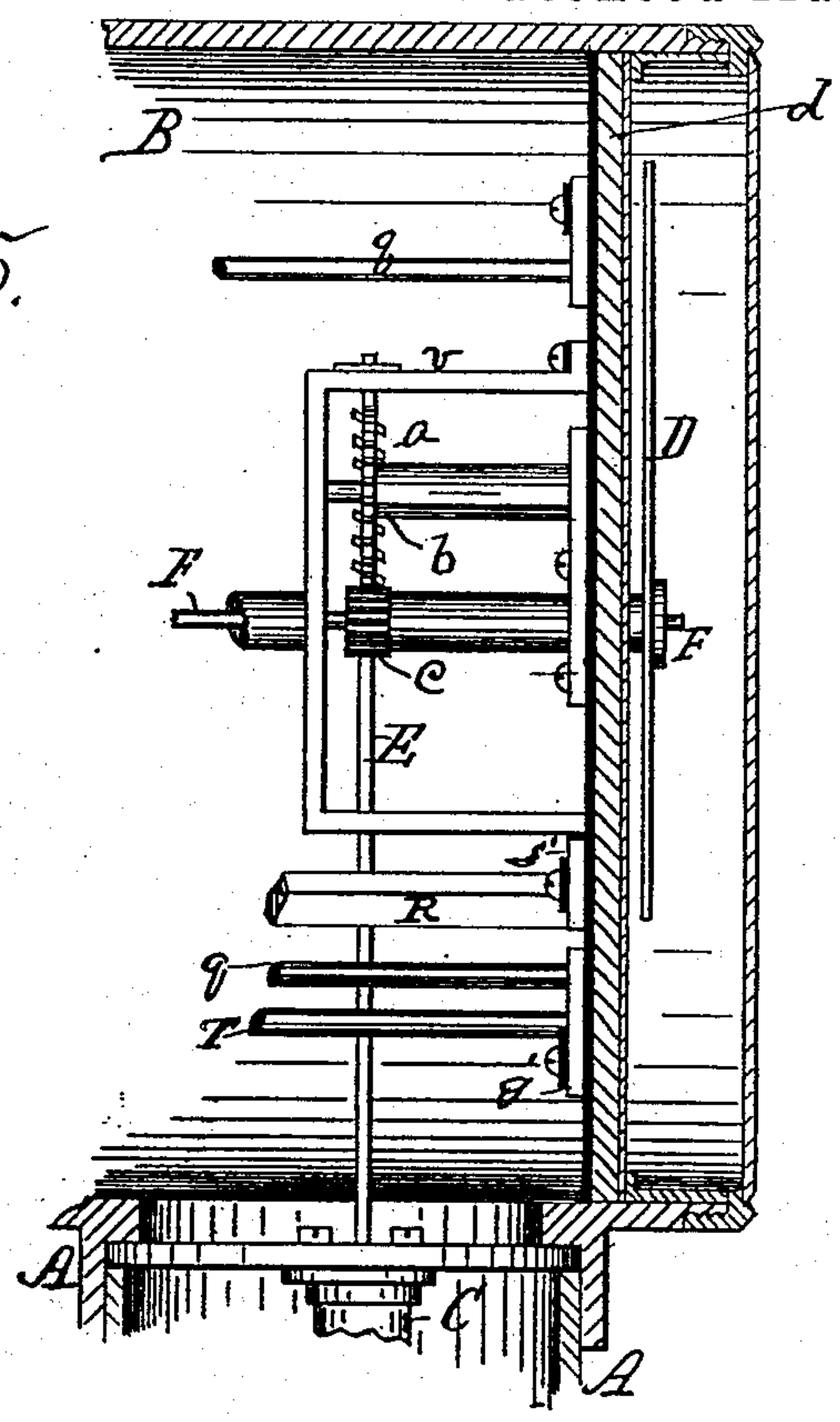
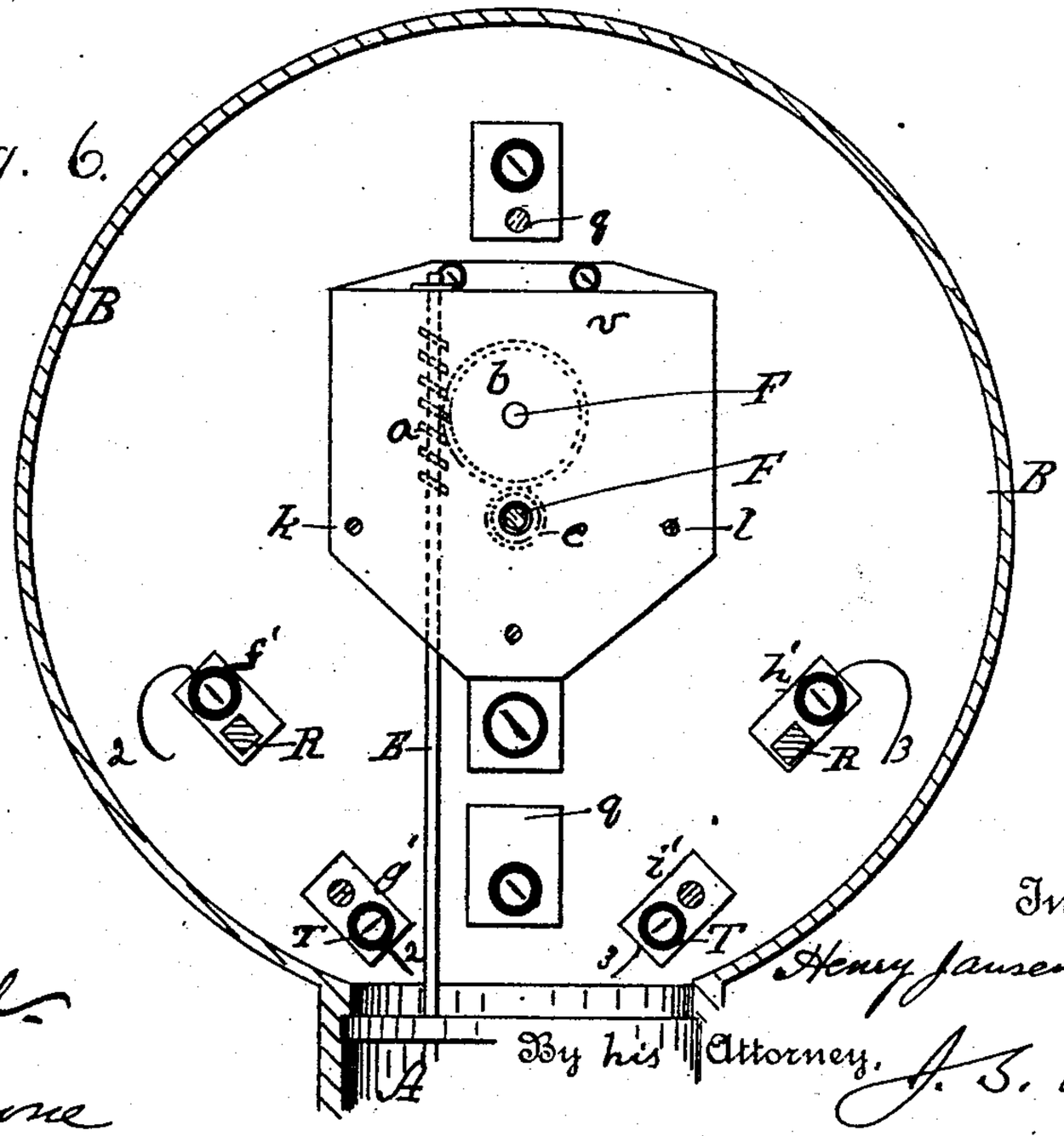


Fig. 6.



Witnesses
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Inventor,
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By his Attorney. H. J. Brown.

UNITED STATES PATENT OFFICE.

HENRY JANSEN HAIGHT, OF NEW YORK, N. Y.

ELECTRO-MAGNETIC TRANSMITTING AND DISTRIBUTING THERMOSCOPE.

SPECIFICATION forming part of Letters Patent No. 359,210, dated March 8, 1887.

Application filed July 22, 1886. Serial No. 208,734. (No model.)

To all whom it may concern:

Be it known that I, HENRY JANSEN HAIGHT, a citizen of the United States, and a resident of the city, county, and State of New York, have invented an Improved Electro-Magnetic Transmitting and Distributing Thermoscope; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, making part of this specification.

In the present invention I apply to an electro-magnetic transmitting-thermoscope having the general form and construction the same as that for which an application for Letters Patent No. 200,458 has been filed by me, April 18, 1886, some of the features of construction and organization which I have set forth in my application No. 206,154, filed June 24, 1886, for an electro-magnetic receiving, transmitting, and distributing thermoscope. Such applied features in their new relation to a transmitting-thermoscope and other devices added thereto I now describe in this specification.

In the accompanying drawings, Figure 1 is a central vertical axial section of the vertical-cylindrical part of the transmitting-thermoscope and a vertical transverse section of the horizontal cylindrical part thereof, the thermostatic coil and the other parts within the double cylindrical case being shown in side or end elevation; Fig. 2, a vertical transverse section of the upper cylindrical part and a vertical axial section of the upper portion of the lower cylindrical part of the instrument, some of the interior parts being shown in side view, some of the parts being left out; Fig. 3, a vertical axial section of the upper cylindrical part and of the upper portion of the lower cylindrical part, parts of the interior work being shown in elevation; Fig. 4, a transverse vertical section of the upper cylindrical part of the instrument in a plane indicated by the line 4 4, Fig. 3; Fig. 5, a section in part corresponding to the section in Fig. 3, showing a modification of the construction of the connecting-gear between the shaft of the thermostatic coil and the index-shaft; Fig. 6, a section corresponding to the section in Fig. 4, showing the same modification as in Fig. 5; Fig. 7, a view in detail of a secondary circuit-closing device.

Like letters designate corresponding parts in all of the figures.

In the drawings, A represents the lower vertical cylindrical part, and B the upper horizontal cylindrical part of the case; C, the thermostatic coil in the lower cylindrical part; D, the index in the upper cylindrical part; E, the vertical thermostatic shaft or spindle, and F the horizontal index-shaft, as in my said application for a transmitting-thermoscope.

In the present organization I do not have a divided index-shaft, as in the said application, but connect the two shafts by a suitable positive gearing, by which the desired relative speed of the two shafts may be obtained.

In Figs. 3 and 4 I show a worm-gear, *a*, on the thermostatic-coil shaft E, gearing directly into a worm-wheel, *b*, on the index-shaft.

In the modified construction shown in Figs. 5 and 6 I show the worm-gear *a*, gearing into an intermediate worm-wheel, *b*, which in turn gears into a pinion, *c*, on the index-shaft. One or more thermostatic coils and worm-screws may be used.

In combining the organizations of the two inventions set forth in the two applications above referred to, I employ two electro-magnets, G H, Figs. 1 and 2, located in the upper cylindrical part of the instrument and mounted on the plate *d* back of the dial of the index D, the former magnet, G, being in the increasing-temperature circuit and the latter magnet, H, being in the decreasing-temperature circuit in the main line reaching to an observatory or station. These electro-magnets, through their armatures *e f* and their armature-levers I J, actuate, respectively, pawls *g h* and detents *i j*, which take into ratchet-wheels K L on shafts *k l*, all precisely in the same way and by similar adjustments as set forth in my aforesaid application No. 206,154. From this point of action the organization is different from that of the said application. Thus, the pinions *m n* on the shafts *k l* in the present invention gear into an interior set of gear-teeth, *o*, of an annular or ring circuit-closer, M, which is held in position by the said pinions, being at opposite sides thereof, and by two grooved friction-pulleys, *p p*, running on fixed pivots *q q* and

bearing against the outer edges of the ring in positions a quarter of a circle distant from the said pinion, or thereabout. The organization of this annular circuit-closer and its operation in connection with associated parts are as follows: The ring is made with two metallic parts, *r s*, separated by an insulating-strip, *t*, inserted between them, as shown. The outer part, *r*, of the ring has metallic connection with one or both of the fixed pivots *q q* by one or both of the friction-pulleys *p p* and by one or two elastic metallic strips, *u*, attached to the said pivots and bearing against the periphery of the ring, and one or both of the said pivots are put in circuit by the wire 2 of the increasing-temperature electro-magnet G. The inner part, *s*, of the ring M has also metallic connection with the wire 3 of the decreasing-temperature electro-magnet H through one or both of the pinions *m n*, shafts *k l*, and a metallic supporting bridge or bracket, *v*, which is mounted on but insulated from the back plate, *d*, of the instrument, and in which the said shafts have their bearings, one end of the magnet-wire 3 being attached to the said bridge.

The arrangement of the parts thus far described is such that at each breaking and closing of the increasing-temperature circuit the annular circuit-closer M will be moved the distance of one degree of the temperature-scale in the proper direction by the action of the electro-magnet G in that circuit, and at each breaking and closing of the decreasing-temperature circuit the said annular circuit-closer will similarly be moved one degree of the temperature-scale in the opposite direction.

Thus far, however, no provision for closing and breaking the circuits has been described. Here a construction partly belonging to my electro-magnetic transmitting-thermoscope described in my application No. 200,458, above referred to, is employed. Thus the thermostatic coil C, its shaft E, and the index-shaft F, geared to the said shaft E, are used, whereby each change of one degree of temperature of the air in which the instrument is situated turns the said index-shaft F one degree of the temperature-scale in one or the other direction, according to whether the temperature is increasing or decreasing, these movements of the shaft corresponding and harmonizing with those of the annular circuit-closer M, above specified. Then upon the rear end of the index-shaft F is secured an arm, N, having an elastic tip or extension, *w*, which is arranged to touch either one of two pins or projections, *x y*, one projecting from the outer part, *r*, of the ring circuit-closer and the other projecting from the inner part, *s*, of the said ring, as shown in Figs. 1 and 2. The tip of the arm, as shown, extends between the said pins, and it is so arranged between them that it can have one degree of movement and a slight additional movement, as little as practicable, in moving from one to the other. The index-shaft F, on which this arm is mounted, is in metallic connection with the battery-wire or return-wire of both circuits, so that when the tip of the arm touches the pin *x* it closes the increasing-temperature circuit and when the tip touches the pin *y* it closes the decreasing-temperature circuit.

The movement resulting from the combined mechanisms above described is as follows: Suppose the temperature of the atmosphere where the instrument is located is increasing and that the pin *r* on the circuit-closer is one degree in advance of or away from the circuit-closing arm N, as soon as another degree of increasing temperature is reached, and consequently the arm has moved forward one degree, it touches the pin *r* and closes the increasing-temperature circuit. The armature-lever of the magnet G is thereby moved and the annular circuit-closer M is moved one degree, thus moving its pin *r* one degree away from the arm N again, and consequently again breaking the circuit. The next increasing degree of temperature again brings the arm into contact with the said pin *r* and again closes the circuit, with a repetition of the resultant action. Thus the movements are repeated as long as the temperature increases.

The movement is precisely the same in the opposite direction when the temperature is decreasing, the arm N then coming successively into contact with the pin *s* on the annular circuit-closer and being separated therefrom by the retreating movement of the said circuit-closer.

In Figs. 2, 3, 4, and 7 I show an additional device whereby a local battery is used for actuating the electro-magnets G H and by them the circuit-closer M, so that the main-line battery-wire may be relieved of this work, and thus be better adapted to transmit thermometric indications to long distances. All the parts above described are here retained, and in addition the following device is employed: Two vibratory, generally obtuse-angled, levers, O P, are mounted, as shown, upon a tubular pivot, *a'*, Fig. 3, around the index-shaft F, and they are connected to the armature-levers I J of the electro-magnets in precisely the same way as the ring or circular multiple circuit-closers set forth in my aforesaid application No. 206,154, namely, by means of arms *b' c'*, projecting laterally from respective levers near their upper ends, and wires or rods *d' e'*, connecting the said arms respectively with the armature-levers, as represented in Fig. 2. Here the wires 2 and 3 of the respective electro-magnets and return-wire 4 for the two are connected with the local battery Q, so that when the circuits are closed by the circuit-closing arm N this battery operates the annular circuit-closer M and also said arms O P, which are circuit closers and breakers for the main-line circuits in the following manner: The increasing-temperature wire 5 of the main line is parted at the instrument, and its two ends at the parting are respectively

connected with two post or stud plates, f' g', attached to but insulated from the plate d of the instrument, and therefore from each other. Similar post or stud plates, h' i', for parting the decreasing-temperature line-wire 6 are attached in a similar way to the plate d, the two sets of post or stud plates being suitably placed in different positions, as shown, to suit the positions of the lower ends of the levers O P. On the respective plates f' h' are secured projecting posts R R, upon the outer end of which, respectively, are pivoted at j' bell-crank levers S S, as shown in Fig. 7, and on the other plates, g' i', respectively, are secured studs T T. The relative positions of the post R and the stud T of each set are shown in the said Fig. 7, and the associated lever S is arranged to have one arm, l', bear upon the outer end of the stud, as shown, being pressed thereon by a light spring, k', or its equivalent. Thus the circuit through the wire is completed and held closed by this device. Platinum or silver contact-points m' m' are placed on the stud and lever, as shown in the same figure. Now the lower arms of the respective levers O P have their lower ends, n' n', (insulated so as not to interfere with the main circuits,) brought into such relation to the bell-crank levers S S as to bear against the other arm, o', of each, and that when the levers are moved by the respective magnet-levers I J they will lift the respective arms l' l' of the bell-crank levers from the stud T T and break the main-line circuits, one or the other, as the case may be. The breaking of the local circuit, which immediately follows this action of either lever O or P, causes the lever to be retracted, and thus the main circuit is immediately closed, again producing the requisite transmission of the temperature-indications to the distant observatory or station. The two circuit-wires 5 and 6 are connected with the single return or battery wire 7 of the main circuits.

It is obvious that it makes no difference whether the levers O P are caused to lift the levers S S by the direct positive action of the armature-levers I J of the electro-magnets or by the counter-springs z z of the armature-levers. In the arrangement shown in the drawings the latter way is shown, the springs z z moving the levers O P positively, and these springs are strong enough to overcome the lever-springs k' k'.

For local distribution this device may be in separate transmitting-circuits, the battery Q being a separate-line battery, and since these levers O P may be multiplied or have different branches, as with the circuit-closing wheels set forth in the said application No. 206,154, the present instrument is assimilated to that instrument in this particular, and thus may fulfill, as a transmitting-instrument, the same additional functions as the receiving-instrument therein set forth.

I claim as my invention—

1. In an electro-magnetic transmitting-thermoscope, the combination of a thermostatic coil, C, index-shaft F, means for connecting the said coil and shaft, circuit-closing arm N on the index-shaft, circuit-closing ring M, electro-magnets G H, armature-levers I J, and means for connecting the said armature-levers and circuit-closing ring, substantially as and for the purpose herein specified.

2. The combination of the thermostatic coil C, coil-shaft E, index-shaft F, geared to the coil-shaft, circuit-closing arm N on the index-shaft and provided with an elastic tip, w, ring circuit-closer M, constructed with two parts, r s, insulated from each other and respectively provided with contact-pins x y, electro-magnets G H, respectively in the increasing and decreasing temperature circuits, armature-levers I J, pawls g h i j, ratchet-wheels K L on shafts k l, and gear-wheels m n on the said shafts and gearing into the circuit-closing ring, substantially as and for the purpose herein specified.

3. The combination of a thermostatic coil, C, coil-shaft E, index-shaft F, worm a and worm-wheel b, connecting the said shafts, circuit-closing arm N on the index-shaft, circuit-closing ring M, made in two parts, r s, insulated from each other and respectively provided with contact-pins x y, electro-magnets G H, armature-levers I J, and means for connecting the said armature-levers and circuit-closing ring, substantially as and for the purpose herein specified.

4. The combination of the separate battery Q, electro-magnets G H in separate electric circuits connected with the battery, armature-levers I J, vibrating levers O P, respectively connected with the armature-levers, levers R R, adapted to open and close other separate line-circuits, and counter-springs z z and k' k', substantially as and for the purpose herein specified.

5. The combination of the coil C, index-shaft F, means for connecting the said coil and shaft, circuit-closing arm N on the index-shaft, circuit-closing ring M, electro-magnets G H, armature-levers I J, means for connecting the said armature-levers and circuit-closing ring, separate battery Q in the circuits of the said electro-magnets, vibratory levers O P, connected, respectively, with the said armature-levers, levers R R, closing other electric circuits, and counter-springs z z and k' k', substantially as and for the purpose herein specified.

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