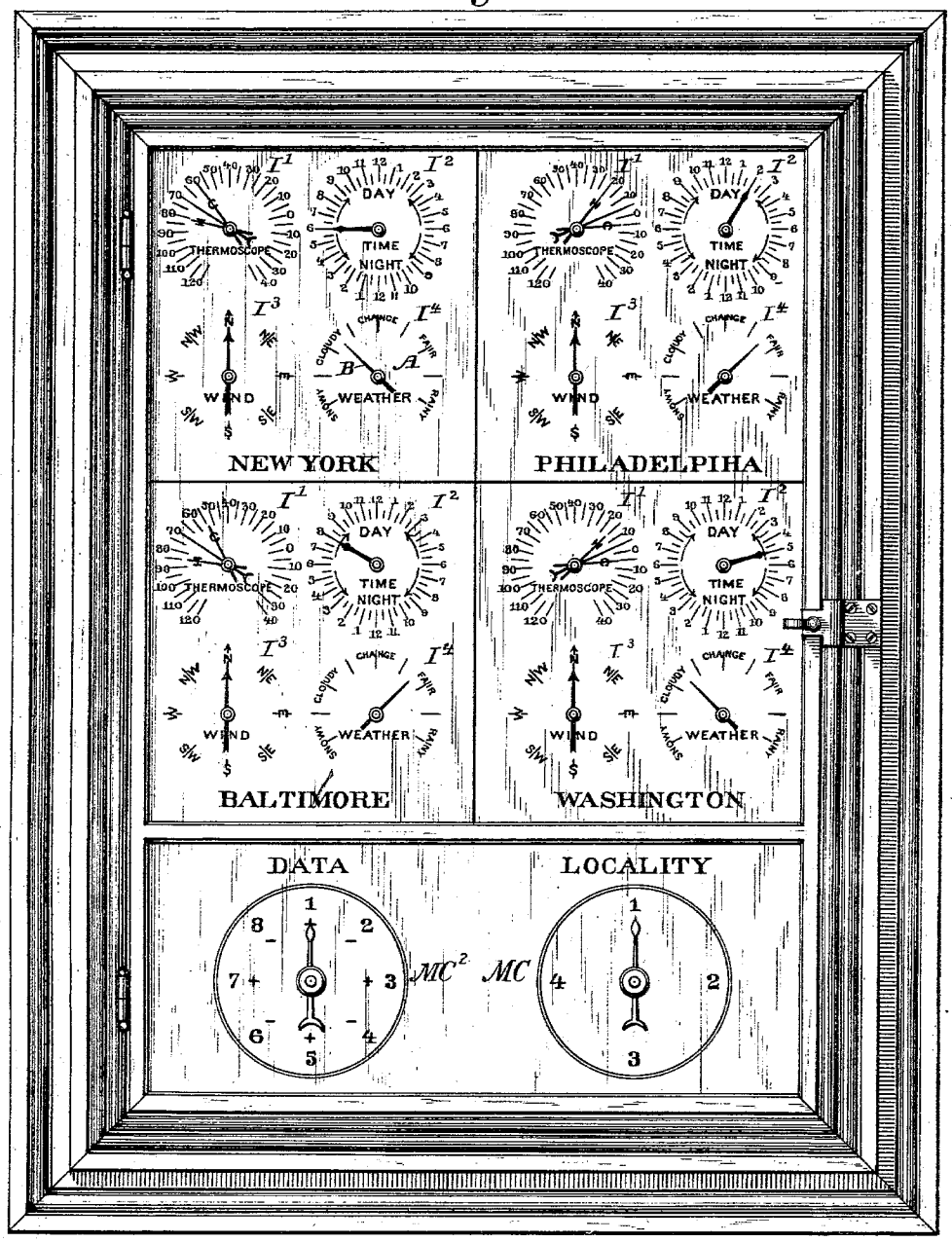
(No Model.) 4 Sheets—Sheet 1.

H. J. HAIGHT.

ELECTRIC INDICATING SYSTEM AND INSTRUMENT.

No. 473,174. Patented Apr. 19, 1892.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

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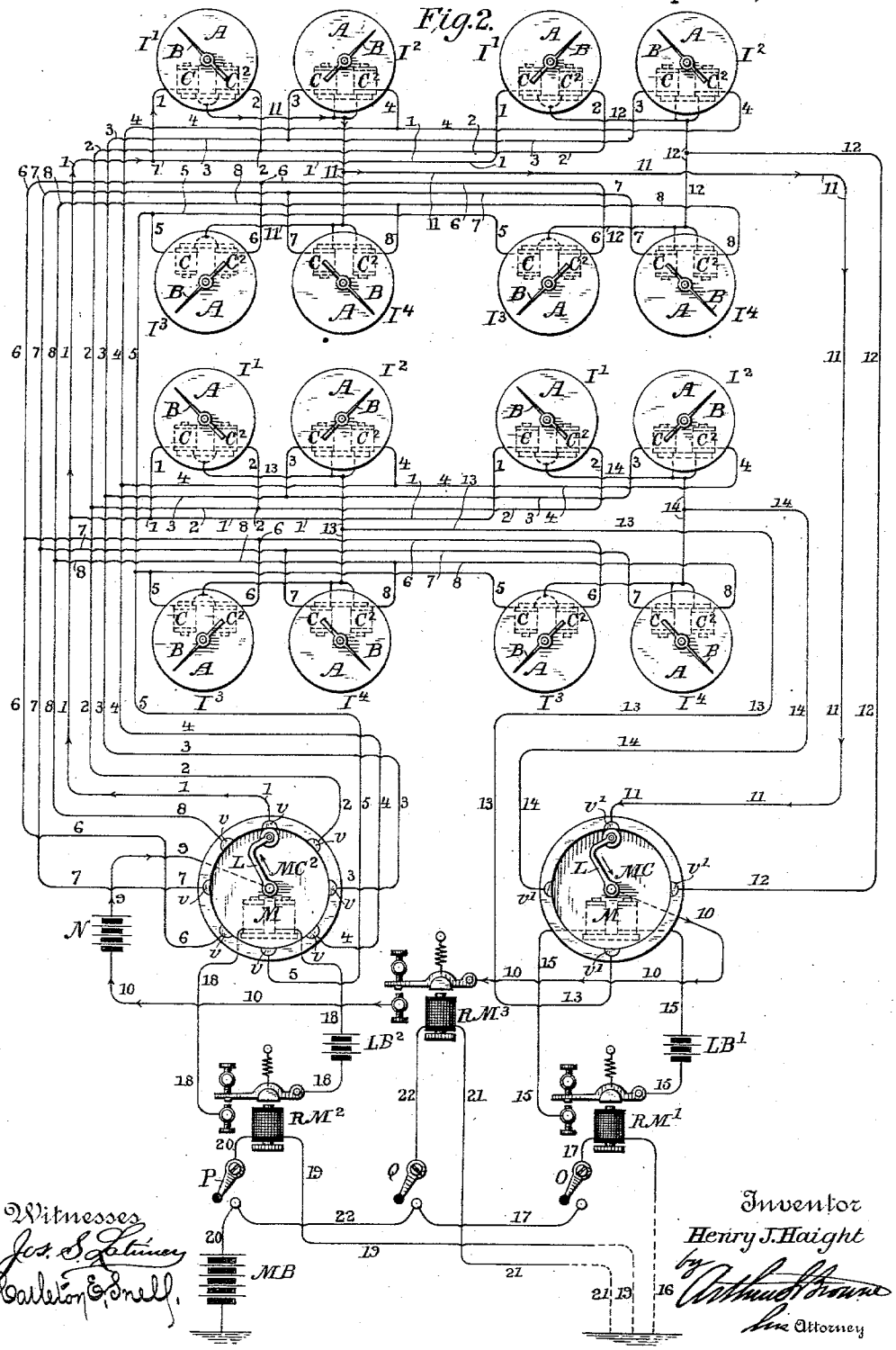
Fig. 2.



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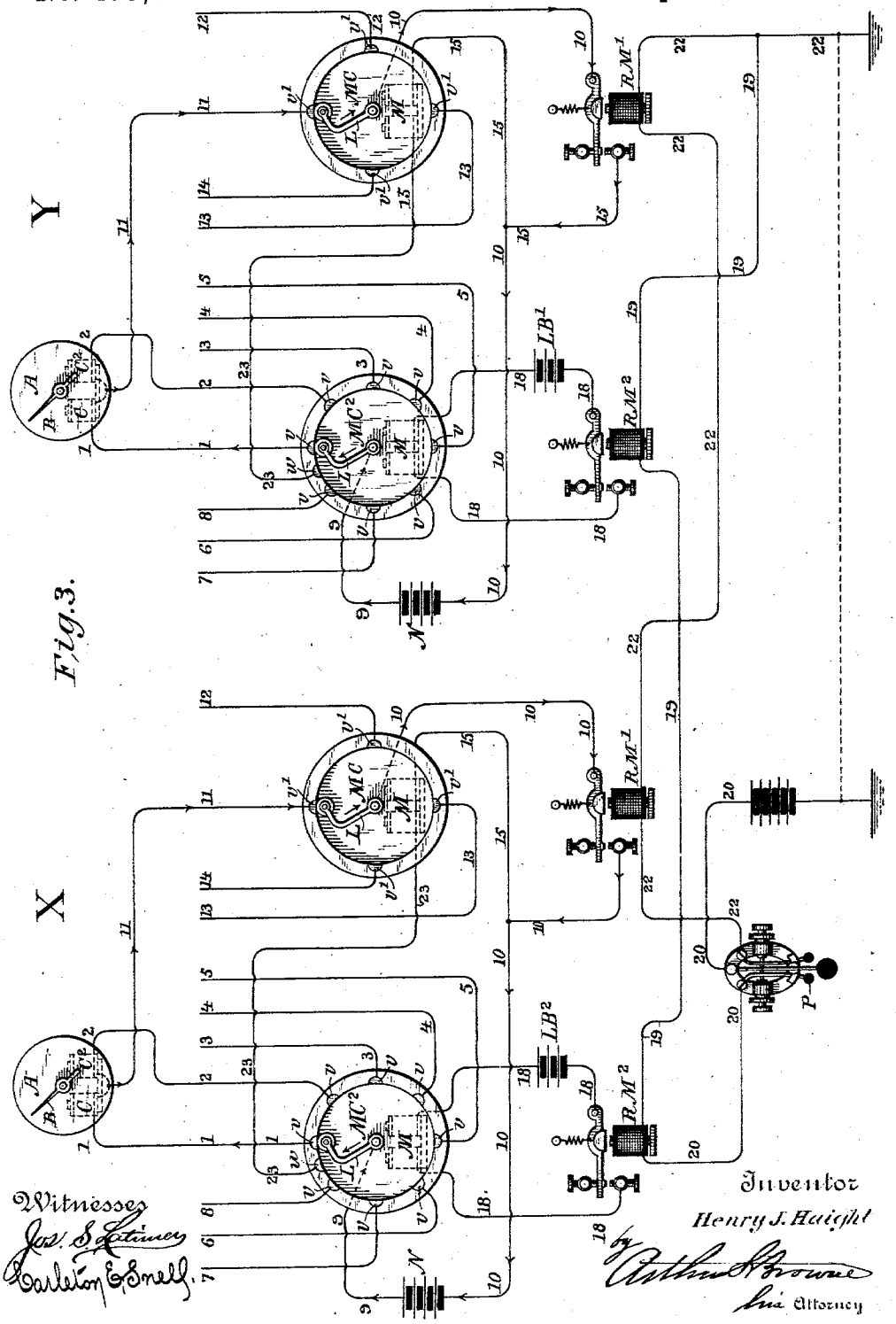

Fig. 3.

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(No Model.) 4 Sheets—Sheet 4.

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ELECTRIC INDICATING SYSTEM AND INSTRUMENT.

No. 473,174. Patented Apr. 19, 1892.

Fig. 4.

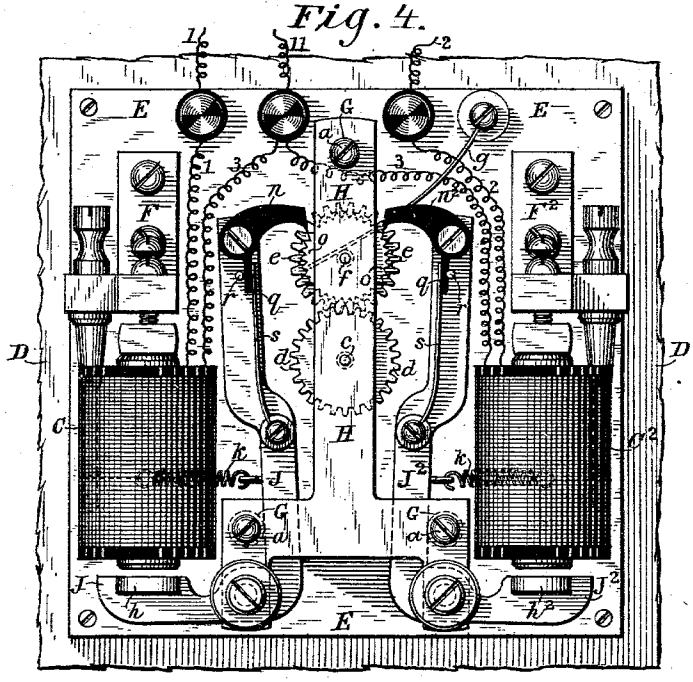


Fig. 5.

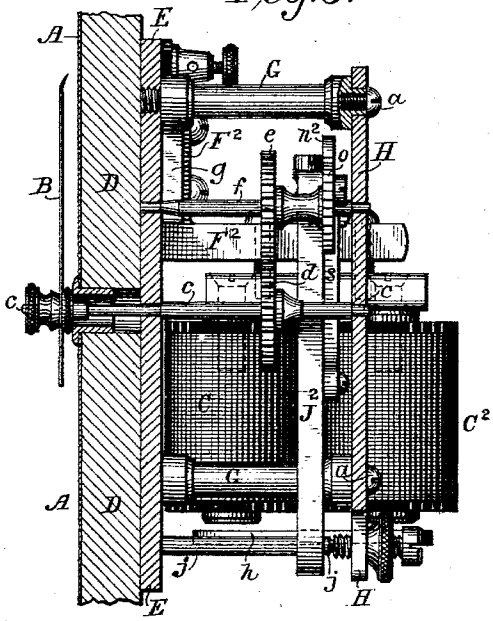
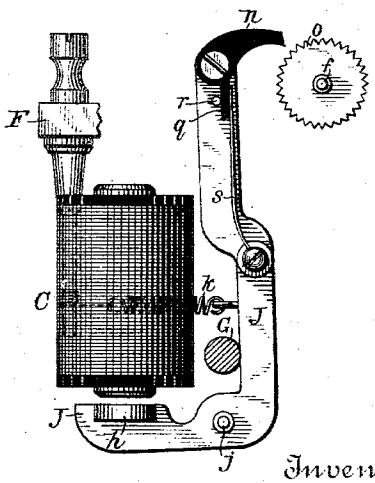


Fig. 6.



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UNITED STATES PATENT OFFICE.

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

ELECTRIC INDICATING SYSTEM AND INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 473,174, dated April 19, 1892.

Application filed December 15, 1891. Serial No. 415,134. (No model.)

To all whom it may concern:

Be it known that I, HENRY JANSEN HAIGHT, of the city, county, and State of New York, have invented certain new and useful Improvements in Electric Indicating Systems and the Instruments Therefor, of which the following is a specification.

The object of the invention is to provide a system for the intertransmission between a plurality of stations by electrical means of information which is capable of being rendered intelligible through the movements of the indices of electric indicating-instruments.

The present invention consists in improvements on the systems and instruments set forth in Letters Patent of the United States Nos. 442,880 and 442,882, granted to me December 16, 1890; No. 454,867, granted to me June 30, 1891, and in application for Letters Patent of the United States, Serial No. 330,612, filed by me February 7, 1891.

The new system comprising a portion of the present improvements is especially designed for the purpose of enabling a variety of data concerning each of several subjects to be transmitted. For example, the system may be applied to the transmission of the meteorological data of a number of localities, and for convenience of illustration and description the improved system will be so described.

The invention consists, also, in improvements upon the electric indicating-instruments employed and in improvements upon the multiple-circuit closers employed.

The present improvements are illustrated in the accompanying drawings, wherein—

Figure 1 is an exterior view of a casing equipped with a number of the indicating-instruments and two of the multiple-circuit closers. Fig. 2 is a diagram of the electric circuits at one station. Fig. 3 is a diagram showing the electrical connections between two stations. Figs. 4, 5, and 6 are views in detail of the indicating-instrument.

I will first describe the improvements in the indicating and multiple-circuit-closer instruments, and will then describe the improvements in the system.

Electric indicating-instrument.—This instrument is in most respects substantially similar to the indicating-instrument described in my application Serial No. 380,612, or in Letters Patent of Great Britain, No. 20,522, granted to me December 16, 1890. The features of improvement consist principally in the construction of the instrument whereby a number of the parts heretofore employed (particularly the pawl-lifting mechanism) are dispensed with.

The instrument comprises as its primary features a properly-graduated dial or reading-scale A, an index B, capable of a step-by-step movement in either direction, two actuating electro-magnets C C^2, and mechanism intermediate between said magnets and said index. The excitation of magnet C causes the movement of the index in one direction, while the excitation of the other magnet C^2 causes its movement in the opposite direction. The scale, index-magnets, and actuating mechanism are all supported on a suitable supporting-plate D of insulating material—such as wood—and to the rear of this plate D is rigidly secured a metallic plate E. On opposite sides of this plate E are rigidly mounted two metallic brackets F F^2, which support the magnets C C^2, respectively. Also rigidly mounted on the plate E are three perpendicular metallic posts G G. A T-shaped bridge H is rigidly secured to the outer ends of the posts G by screws *a* *a*, so that said bridge is held parallel with the plate E and in rigid and immovable connection therewith. On this rigidly mounted and secured bridge H and the plate E are mounted all the actuating mechanism intermediate between the magnets C C^2 and the index B. Consequently the rigid support of the bridge H is of the highest importance. The index B is secured to a shaft or spindle *c*, (so as to rotate therewith,) which is journaled in bearings formed by the plate E and by the bridge H. This shaft or spindle *c* carries at its rear end, between the plate E and the bridge H, a pinion *d*, which meshes with a pinion *e*, carried by a shaft *f*, journaled at opposite ends on the metal plate E and bridge H, the shaft *f* being parallel with the shaft or spindle *c*. The shafts *c* *f* are held in any position in which they may be left by a spring *g*, which bears frictionally against the shaft *f*. By rotating pinion *e* alternately in opposite directions the pinion *d* (and with it the shaft *c* and index B) will be rotated alternately in opposite directions. To enable the pinion *e* to be rotated in one di-

rection the magnet C is provided. The armature *h* of this magnet is carried by a vibrating armature-lever J, which is carried by a rock-shaft *j*, which is journaled at opposite ends by suitable provisions in the bridge H and metal plate E. This armature-lever is vibrated in one direction when the armature *h* is attracted to the magnet C on the excitation of the same by the passage of an electric current and in the opposite direction by a spring *k*. The upper arm of the armature-lever J carries a pawl *n*, pivotally mounted thereon. This pawl engages with a ratchet-wheel *o*, (or, more properly speaking, a star-wheel,) fixed to the shaft *f*.

The location of the pawl *n* relative to the ratchet or star wheel *o* and its method of co-operation therewith constitute one of the essential features of the present invention. The extent of the movement of the armature-lever J should be always uniform and exact. Consequently provisions are provided for limiting its movement in both directions. In the construction shown the magnet C limits the movement of the pawl *n* toward the ratchet or star wheel *o*, while one of the posts G limits its movement in the opposite direction, the lever being normally held in contact with the post by the spring *k*. The pawl *n* is also in the normal position of the armature-lever maintained in a definite normal position. The pawl has a tail end *q*, which is normally held in contact with a fixed stop-pin *r* (carried by the armature-lever) by a spring *s*. When the armature-lever and its pawls are in their normal position, the pawl is entirely out of contact with the ratchet or star wheel and entirely out of the path of its teeth. Consequently the ratchet or star wheel is free to be rotated, the presence of the pawl offering no obstruction whatever; but when the armature-lever swings on its pivot the pawl swings in such an arc that it is brought in contact with one of the teeth of the ratchet or star wheel, and the extent of the movement of the pawl is such that in each movement of the armature-lever the pawl turns the ratchet-wheel (and consequently the index B) through a certain definite arc. When the armature-lever swings backwardly, the pivotal connection therewith of the pawl permits the latter to ride back idly over the teeth of the ratchet or star wheel, the spring *g* preventing backward rotation of the ratchet. Since the pawl *n* when inactive and idle is entirely out of contact with the ratchet or star wheel *o*, no "pawl-lifter," such as has heretofore been employed by me, is necessary to enable the ratchet or star wheel to be rotated in the opposite direction. In an exactly similar manner the magnet C^2 controls the movement of an armature-lever J^2, carrying its armature h^2. Lever J^2 is located on the side of the shafts *c f*, opposite to that on which the lever J is located, and it has a pawl n^2, (held in normal position by stop-pin *r* and spring *s*,) which is normally out of contact with the ratchet or star wheel *o*, and which co-operates with said ratchet or star wheel *o* (on the opposite side from the pawl *n*) to rotate the index B in the opposite direction. The relation of the armature-lever J^2 and its pawl n^2 to the ratchet or star wheel *o* is exactly the same as that of the lever J and pawl *n*, except that they are on the opposite side of the ratchet or star wheel. Consequently said pawl n^2 in its normal position offers no obstruction to the free rotation of the ratchet or star wheel, and no pawl-lifter for it is necessary.

The extent of movement of the armatures of the magnets in connection with the relative lengths of the two arms of the armature-levers, the number of teeth of the ratchet or star wheel and the proportionate sizes of the pinions *d e* determine the distance or step which the index B moves. The dial or scale A is graduated in accordance with the length of the step, and each graduation is determined by the particular unit of measurement which may be desired for the instrument. If, for example, it is a temperature-indicating instrument, this unit would be appropriately a degree of temperature. By successively magnetizing and demagnetizing one of the magnets, as C, the index may be moved any desired number of steps or degrees in one direction, and by successively magnetizing and demagnetizing the other magnet C^2 the index may be moved any desired number of steps or degrees in the opposite direction.

To enable the magnets C C^2 to be actuated, they are included in proper electric circuits. 1 is a circuit-wire leading to magnet C. 2 is a wire leading to magnet C, and 11 is a return-wire common to them both. Suitable binding-posts are shown for the connection of the circuit-wires.

Multiple-circuit-closer instrument.—Two of these instruments are used at each station, and with a single exception both of the circuit-closing instruments are (or may be) identical in construction with the multiple-circuit closer set forth in my United States Patent, No. 442,882, above referred to. Consequently the multiple-circuit closer is shown in the accompanying drawings diagrammatically only, reference being made to said patent for further disclosure of its construction. The object of the multiple-circuit closer is to bring a number of branch circuit-wires, as 1 2, successively into communication with one pole of an electric generator. To this end it is provided with a circuit-closing arm L, which is in constant communication with an electric generator. This circuit-closing arm L is given a step-by-step movement in a single direction, so that it may be brought into contact with the several fixed electrodes *v*, with which the multiple-circuit closer is provided. Whenever the circuit-closing arm L is at rest, one of the branch wires, as 1, is in circuit. The step-by-step movement of the circuit-closing arm L is effected by means of an electro-magnet M and suitable intervening mechanism of

any well-known character. The magnet M is located in a local circuit which is controlled by means hereinafter specified.

The arrangement of the multiple-circuit closers and the indicating-instruments is shown in Figs. 1 and 2. In Fig. 1 are illustrated the instruments for a single station. It is assumed, for the sake of illustration and description, that the system is adapted for the transmission and indication of meteorological data. The number of indicating-instruments for each station will therefore depend upon the variety of meteorological data which it is desired to transmit and indicate and the number of localities to which the data refers. Assuming then that thermometric, wind, weather, and time indications are to be indicated for each of four separate localities (such as New York, Philadelphia, Baltimore, and Washington,) each station would be equipped with sixteen indicating-instruments, four for each locality. Fig. 1 is designed to illustrate such a system, showing, as it does, sixteen indicators, each instrument as a whole being lettered I′, I^2, I^3, or I^4. There are also at each station two multiple-circuit closers, (lettered as a whole MC and MC^2, respectively,) one of which MC is a locality-determining multiple-circuit closer, and the other MC^2 is a data-determining multiple-circuit closer.

The connections of the multiple-circuit closers MC MC^2 with each other and with the indicating-instruments are illustrated in the diagram, Fig. 2. Of the mechanism of each of the indicating-instruments there is shown in this figure only the index B and the actuating electro-magnets C C^2. The sixteen indicating-instruments are arranged in four groups (one group for each locality) containing four instruments for each locality, one instrument I′ being for thermometric indications, one I^2 for time, one I^3 for wind, and the other I^4 for weather. These four instruments in each group having eight actuating electro-magnets C C^2, there are consequently eight equally-spaced electrodes v in the data multiple-circuit closer, and there are eight wires 1, 2, 3, 4, 5, 6, 7, and 8, connecting the respective electrodes with the magnets C C^2 of all sixteen instruments.

The wire connections are as follows: The odd-numbered wires 1 3 5 7 are connected with the sixteen magnets C, while the even-numbered wires 2 4 6 8 are connected with the sixteen magnets C^2. The wire 1 is connected in multiple (by branch wires) with the magnets C of all four corresponding instruments I′ in each of the four groups. Wire 2 is connected in multiple (by branch wires) with the magnets C^2 of all four corresponding instruments I′ in each of the four groups. Wire 3 is connected in multiple (by branch wires) with the magnets C of all four corresponding instruments I^2 in each of the four groups. Wire 4 is connected in multiple (by branch wires) with the magnets C^2 of all four corresponding instruments I^2 in each of the four groups. Wire 5 is connected in multiple (by branch wires) with the magnets C of all four corresponding instruments I^3 in each of the four groups. Wire 6 is connected in multiple (by branch wires) with the magnets C^2 of all four corresponding instruments I^3 in each of the four groups. Wire 7 is connected in multiple (by branch wires) with the magnets C of all four corresponding instruments I^4 in each of the four groups, and wire 8 is connected in multiple (by branch wires) with the magnets C^2 of all four corresponding instruments I^4 in each of the four groups. The data multiple-circuit closer MC^2 accordingly has as many electrodes v as there are actuating-magnets C C^2 in each group of instruments.

The circuit-closing arm L of the data multiple-circuit closer MC^2 is connected by wire 9 with one pole of an electric generator N. Consequently the position of the circuit-closing arm L with reference to the several electrodes v determines which of the wires 1, 2, 3, 4, 5, 6, 7, or 8 is in circuit with the generator, and consequently determines which magnet C or C^2 of which of the instruments I′ I^2 I^3 I^4 is in circuit. The multiple-circuit closer MC^2 is thus appropriately termed a "data" multiple-circuit closer, since it selects or determines the character of the instrument which is in circuit and the particular magnet of that instrument. It does not, however, determine which of the groups of instruments is in circuit, since each electrode v is in electrical connection (by its wire and the branches thereof) with all four of the corresponding instruments I′, I^2, I^3, and I^4 of each of the several groups.

Since each group of instruments relates to a given locality, other means are necessary to determine the locality, and therefore the locality multiple-circuit closer MC is employed. The circuit-closing arm L of this multiple-circuit closer is connected by wire 10 with the opposite pole of the generator N, and it has as many electrodes (which are lettered v' to distinguish them from the electrodes v of the data multiple-circuit closer MC^2) as there are groups of instruments, and consequently as many electrodes as there are localities. It is therefore appropriately termed a "locality" multiple-circuit closer. As there are four localities provided for in the illustrated system, and consequently four groups of instruments, there are four electrodes v' in the locality multiple-circuit closer MC. Four return-wires 11, 12, 13, 14 connect the electrodes v' respectively with the several groups of indicators. The eight magnets C C^2 of the four indicators I′ I^2 I^3 I^4 of the first group (upper left-hand group, as shown in Fig. 2) are all connected in multiple (by branch wires) with the return-wire 11, and in a similar manner the eight magnets of each of the other groups are connected in multiple, by their return-wire 12, 13, or 14, with one of the electrodes v' of the locality multiple-circuit closer MC. Consequently in order

that any particular magnet of any particular one of the several indicating-instruments may be in circuit with generator N the conjoint action of the circuit-closing arms L L of the two multiple-circuit closers MC and MC² is necessary.

With the position of the circuit-closing arms L L shown in Fig. 2 the circuit is as follows: from battery N, through wire 9, to arm L of multiple-circuit closer MC², electrode *v*, wire 1, magnet C of instrument I′ of the upper left-hand group, wire 11, to electrode *v′* of multiple-circuit closer MC, arm L thereof, and wire 10, back to the opposite pole of the battery N. It is therefore evident that locality multiple-circuit closer MC must have as many electrodes *v′* as there are localities, that data multiple-circuit closer MC² must have as many electrodes *v* as there are magnets in the several indicators for each locality, and that consequently the product of the number of electrodes *v′* multiplied by the number of electrodes *v* must equal the total number of the magnets C C² of all the indicators at the station. Thus if there were twenty-four localities to be reported and six characters of indications for each locality there would be two hundred and eighty-eight of the magnets C C². Under the system shown in my patent, No. 442,882, hereinbefore referred to, this would have necessitated two hundred and eighty-eight electrodes in the single multiple-circuit closer there employed, and (since the multiple-circuit closing arm can move only in one direction) it might have required in the most extreme cases a making and breaking of the circuit which controls the movement of the circuit-closing arm two hundred and eighty-seven times in order to bring the desired electrode into circuit. By using the two multiple-circuit closers MC and MC², however, in the supposed instance the locality multiple-circuit closer MC would have twenty-four electrodes *v′*, and the data multiple-circuit closer MC² would have twelve electrodes *v*, and under the most disadvantageous circumstances it would only require making and breaking a circuit thirty-four times (twenty-three plus eleven) to bring the desired magnet C or C² into circuit—that is, if independent means were provided for operating the two multiple-circuit closers. Fig. 2 also shows electrical means for controlling the movements of the circuit-closing arms L L of the two multiple-circuit closers MC and MC², and also for moving in the proper direction the index of the particular indicating-instrument which is brought into circuit by means of the conjoint action of the two multiple-circuit closers.

The controlling-magnet M of multiple-circuit closer MC is in a local circuit 15, having generator LB′, said local circuit having a break controlled by a relay-magnet RM′. Relay-magnet RM′ is a circuit having line-wire 16 and a wire 17 leading to a main battery MB. A break in wire 17 is controlled by a switch or key O. By manipulating switch or key O the arm L of multiple-circuit closer MC is given a step-by-step movement, which brings it successively in contact with the several electrodes *v′*. By including a plurality of relay-magnets RM′ in series in the line 16 it is evident that a plurality of multiple-circuit closers MC at a plurality of stations can be operated in unison.

The controlling-magnet M of multiple-circuit closer MC² is in a local circuit 18, having generator LB², said local circuit having a break controlled by a relay-magnet RM². Relay-magnet RM² is in a circuit having line-wire 19 and a wire 20 leading to the main battery MB. A break in wire 20 is controlled by a switch or key P. By manipulating switch or key P the arm L of multiple-circuit closer MC² is given a step-by-step movement, which brings it successively in contact with the several electrodes *v*. By including a plurality of relay-magnets RM² in series in the line 19 it is evident that a plurality of multiple-circuit closers MC² at a plurality of stations can be operated in unison.

The local circuit, which includes the battery N, wires 9 10, arms L L of the two multiple-circuit closers, and one magnet of one of the indicating-instruments, has a break either in wire 9 or in wire 10, (it being shown in wire 10,) which is controlled by a relay-magnet RM³. Relay-magnet RM³ is in a circuit having a line-wire 21 and a wire 22 leading to the battery MB. A break in wire 22 is controlled by a switch or key Q. By manipulating key or switch Q the index B of the particular indicating-instrument in circuit is given a step-by-step motion forward or back, depending upon whether magnet C or C² is in circuit. By including a plurality of the magnets RM³ in series in the line 21 it is evident that a plurality of corresponding indicating-instruments at a plurality of stations can be operated in unison.

The system as thus far disclosed is distinguished from my prior patents only in that two multiple-circuit closers having special relation to each other are employed. In Fig. 3, however, an arrangement of multiple-circuit closers at two stations X and Y is shown which dispenses with one of the three line-wires 16 19 21, one of the three local batteries LB′ LB² N, and one of the switches or keys O P Q. This is done by dispensing with my special means for operating one of the multiple-circuit closers, as MC. In Fig. 3 it is also indicated how the relay-magnets can be arranged in series in order to operate the instruments at two or more stations in unison. In this figure, for convenience in illustration, only one indicating-instrument at each of the stations X and Y is shown. The circuit-wires of the other indicating-instruments are, however, indicated. The arrangement of the circuits in this figure is the same as in Fig. 2, except as follows: Line-wire 16, relay-magnet RM², wire 17, and switch O (which control

the locality multiple-circuit closer MC) are omitted. Wire 15, leading from the controlling-magnet M of multiple-circuit closer MC, is joined to wire 10, and a wire 23 leads to said magnet M from an additional intercalated fixed electrode *w* on the data multiple-circuit closer MC^2. Consequently magnet M of locality multiple-circuit closer MC is in a local circuit, including wires 9 23 15 10, arm L of data multiple-circuit closer MC^2, electrode *w*, and the local battery N, which effects the movements of the indicating-instruments.

When the arm L of multiple-circuit closer MC^2 makes the step from the two adjacent electrodes *v v* on either side of the intercalated electrode *w*, the arm L, in passing over said electrode *w*, makes and breaks the circuit, including the magnet M of the multiple-circuit closer MC, and consequently the arm L thereof is moved one step at each complete rotation of the arm L of the multiple-circuit closer MC^2.

It may be here noted that the only difference in construction between the multiple-circuit closer here employed and that set forth in my patent, No. 442,882, consists in the intercalated electrode *w*, on which the circuit-closing arm L does not dwell.

As a convenient and preferred construction, all the instruments at a station are mounted in one casing, as indicated in Fig. 1, the operating mechanisms of each group of indicating-instruments $I' I^2 I^3 I^4$ being mounted on a single metallic plate E.

I claim as my invention—

1. A ratchet or star wheel capable of rotation in opposite directions, the rotary shaft or spindle carrying said star-wheel, and the spring *g*, bearing on said shaft or spindle, in combination with two oppositely-swinging levers on opposite sides of said ratchet or star wheel, each of said levers swinging through a definite and determined arc, a pivoted pawl pivoted to each of said levers, and a stop *r* and spring *s* on each lever, which co-operate to maintain said pivoted pawl in its normal position resting against said stop, each of said pawls in its normal position and in the normal position of its lever being entirely out of contact and interference with said ratchet or star wheel, but each of said pawls being brought into contact with one of the teeth of said ratchet or star wheel when its said lever is swung toward the same, thereby rotating said ratchet or star wheel, substantially as set forth.

2. A multiple-circuit closer MC^2, having a plurality of equally-spaced electrodes, a circuit-closing arm having a step-by-step movement which is brought successively into contact with and dwells upon each of said electrodes, and an additional electrode *w*, located in the path of said circuit-closing arm and between two of said equally-spaced electrodes, in combination with a second multiple-circuit closer MC, having a plurality of equally-spaced electrodes, a circuit-closing arm having a step-by-step movement, whereby it is brought successively into contact with and dwells upon each of said electrodes, and an actuating-magnet M, an electric generator N, an electric conductor connecting one pole of said generator with the circuit-closing arm of said multiple-circuit closer MC^2, an electric conductor 23, connecting said electrode *w* with said actuating-magnet M, and an electric conductor connecting said magnet M with the opposite pole of said generator, substantially as set forth.

3. A plurality of groups of electric indicating-instruments, each group of indicating-instruments having a plurality of said instruments, the indicating-instruments in one group corresponding with the instruments in the other group or groups, in combination with two multiple-circuit closers MC and MC^2, each having a plurality of electrodes, and a circuit-closing arm capable of a step-by-step movement, whereby it is brought successively into contact with and dwells upon each of the electrodes, each of the electrodes of one of said multiple-circuit closers, as MC^2, being connected in multiple with the corresponding electric indicating-instrument in each of said groups, and each of the electrodes of the other multiple-circuit closer MC being connected in multiple with all of the indicating-instruments in one of said groups, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

HENRY JANSEN HAIGHT.

Witnesses:

ARTHUR S. BROWNE,

CARLETON E. SNELL.