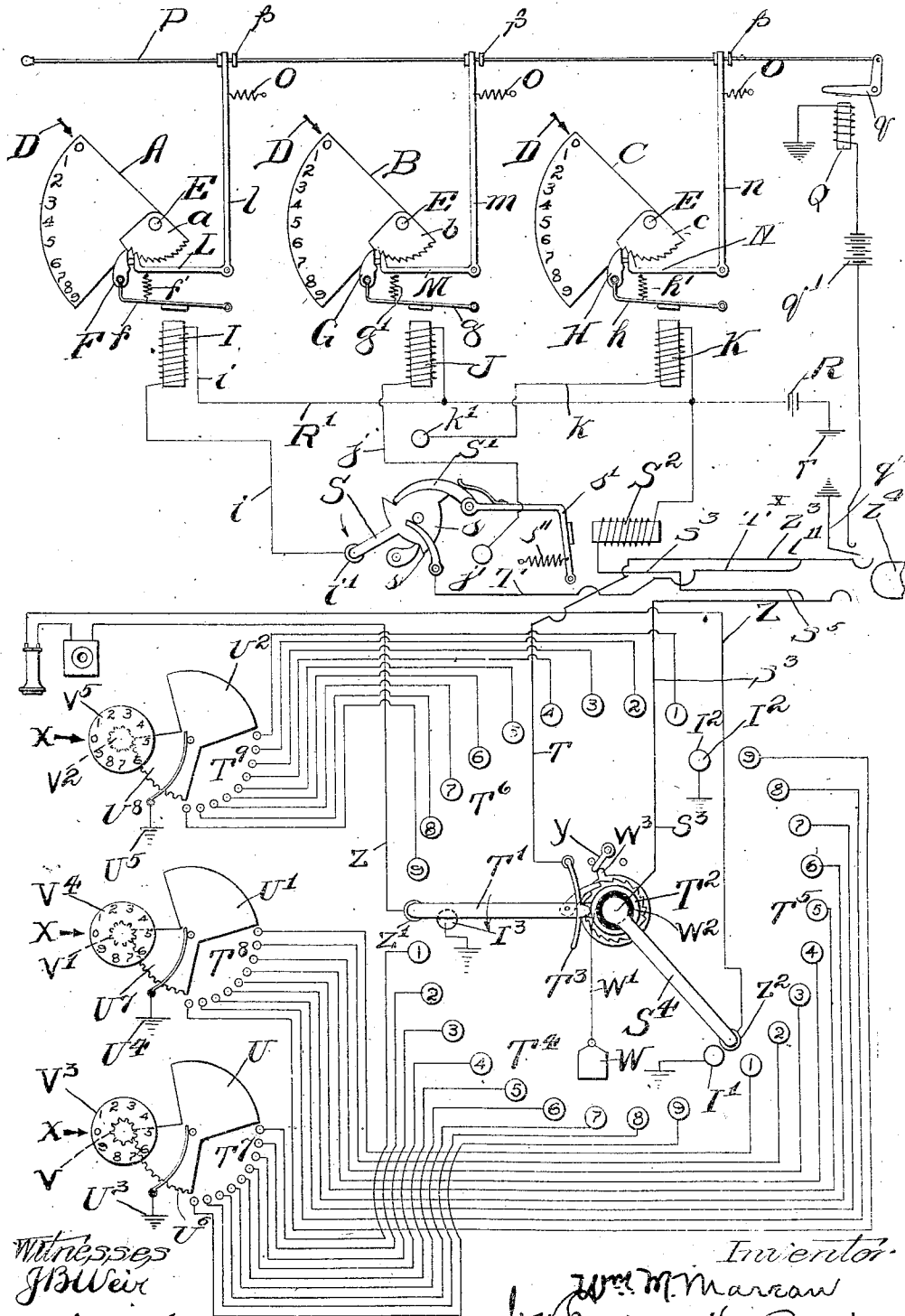


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W. M. MAREAN.
TELEPHONE EXCHANGE.
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TELEPHONE-EXCHANGE.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILLIAM MARVIN MAREAN, a citizen of the United States, residing at Belvidere, county of Boone, and State of Illinois, have invented certain new and useful Improvements in Telephone-Exchanges, of which the following is a full, clear, and exact specification.

This invention relates to telephone-exchanges whereby the subscriber informs the operator at the central exchange of the particular number of the connection such subscriber wishes; and the invention has for its primary object to provide improved means for imparting such information to the central operator visually instead of orally, and thereby eliminate the necessity of a telephone at the central station and the probability of the operator misunderstanding the number.

With these ends in view the invention consists in certain features of novelty in the construction, combination, and arrangement of parts by which the said object and certain other objects hereinafter appearing are attained, all as fully described with reference to the accompanying drawing and more particularly pointed out in the claims.

The said drawing is a conventional or diagrammatic illustration of a telephone-exchange embodying an example of my invention.

In illustrating the invention all details of construction of the telephone-exchange well understood by those familiar with this art and not necessary for an understanding of this invention have been omitted for the sake of simplicity in illustration and brevity of description.

At the central exchange is located a numbering-machine comprising a plurality of digit-indicators the numbers on which when read with reference to their respective indexes indicate the number of the switch or connection which the subscriber wishes to obtain, and these digit-indicators are capable of actuation independently by the subscriber through the aid of an apparatus which of course for convenience is automatic in its operation, excepting in so far as to require the subscriber to impart to it the initial or starting action. The number of these digit-indicators employed will of course be dependent upon the number of subscribers in the telephone-exchange; but as a simple illustration I have shown three of the indicators,

thus making this example of the apparatus capable of use in an exchange whose subscribers' numbers do not exceed the hundreds. It will of course be understood, however, that to increase the number of the indicators above any plurality of them will require mere duplication of parts. In the conventional form of these indicators shown in the drawing they are represented as segments A B C, which stand, respectively, for units, tens, and hundreds, and each of which bears a cipher and the nine digits. Thus by moving these indicators A B C with relation to an index or the index with relation to the indicators the desired number may be made manifest. In the conventional form the index, which in practice might more conveniently be constituted by an opening in the casing inclosing said indicators, is here represented as a pointer D. In this exemplification of the invention the indicators A B C are pivoted on suitable pivots E and are capable of gravitating until their ciphers come opposite the points D, so that if rotated upwardly on their pivots their digits will successively come opposite said points, respectively, for indicating the number desired, and if subsequently released by the lifting means they will gravitate and resume their normal position with the ciphers opposite the pointers, as now shown in the drawing. To the end that they may be thus lifted step by step they are provided with segment-racks a b c, respectively, and engaging with these racks, respectively, are pawls or other suitable means F G H, mounted upon pivoted armature-levers f' g' h, which are connected to springs f' g' h' for moving the pawls into engagement with the segment-racks, and thus actuating the segments A B C, the pawls being moved in the opposite direction by electroresponsive devices or magnets I J K, respectively. The segments A B C are held to the positions in which they are thus placed by stop dogs or pawls L M N, all of which are suitably connected together, so that when one is released all will be released, and the releasing of these will also effect the release of the pawls F G H. Any suitable means may be employed for doing this. As a simple illustration of the idea the pawls L M N are shown on the ends of bell-cranks l m n, respectively, and so situated that when the cranks are rocked the pawls L M N will strike pawls F G H. The other arms of

the bell-cranks are connected to springs O, which hold the pawls L M N in engagement with their respective segments *a b c*, and are also connected to a single operating rod or handle P, having loose connections *p* therewith, so that the pawls may be simultaneously released, but may independently operate. The handle P is accessible to the operator at the central exchange, so that after the desired number has been indicated and the connection obtained the central operator may restore all of the segments A B C to the former or initial position.

The magnets I J K have their individual circuits *i j k*, respectively, one side of each of which is connected to a battery or suitable source of electricity R, which is shown as grounded at *r*, while the other sides of these circuits *i j k* are connected to individual contacts *i' j' k'*, respectively, arranged in a series which is preferably circular and central with respect to a revolving switch S, adapted to sweep over such contacts in succession, so that it will move from the first over the intermediate ones to the last and then from the last immediately back again to the first. This switch S is thus revolved by means under the control of the subscriber, and as an example of such a means a ratchet-wheel *s* is shown and is provided with as many teeth as there are contacts *i' j' k'*, three of such teeth being shown in this conventional illustration, although in practice it might not be feasible to operate a ratchet-wheel with only three teeth for this purpose, and it may be necessary, therefore, to duplicate the contacts *i' j' k'* successively in a circular series in order that the teeth of the ratchet may be duplicated and made shorter; but as this is a simple expedient obvious from the present disclosure it will be understood without further description and illustration. Suffice it to say that when the contacts are thus duplicated all of those which are intended to actuate the magnet I, for example, will be connected together, and those for the magnet J will be connected together, and so on. The ratchet-wheel *s* is electrically connected with one end of a main signal-circuit T in any suitable way, and the other end of said circuit T is electrically connected with a movable terminal in the form of a revolving arm T', having a hub T², engaged by a brush T³ at the end of wire T, and this arm or terminal T' sweeps successively over a plurality of series of contacts T¹ T⁵ T⁹, which correspond, respectively, with the units, tens, and hundreds indicators A B C, and which contacts in each series are numbered from 1 to 9, corresponding with the numbers on the indicators A B C for the sake of convenience in reading the drawing. These series of contacts are connected, respectively, with three series of contacts T⁷ T⁸ T⁹, each equal in number to the number of contacts in said first series, and ar-

ranged to ground any one or all of these contacts T⁷ T⁸ T⁹ are movable contacts of any suitable construction, (shown in the form of segments U U' U²,) which have ground connections U³ U⁴ U⁵, respectively. Thus it will be seen that if one of the contacts U U' U² be moved to connect one or more of its series of contacts T⁷ T⁸ T⁹ with the ground and the movable terminal T' be then caused to sweep over the series of contacts T¹ T⁵ T⁹ an impulse will pass into the main signal-circuit T every time said terminal or arm T' engages one of the contacts that is connected with the earth through one or more of the segments U U' U², and consequently a corresponding number of vibrations will result in one of the armatures *f g h*, according to which one of the contacts *i' j' k'* the switch S happens to rest on at that time. Therefore if the segment U which corresponds to the unit's segment A be placed in a position to overlap the two upper contacts of the series T⁷, for example, and the arm T' is then set in motion around its circular course the device, save for the movement of said arm T', will remain inactive until the arm reaches contacts number 1 and 2 of the series T¹, whereupon the circuit will be closed first through the contact 1 from battery R along a wire R', which is a part of the main signal-circuit and is connected to one side of all of the circuits *i j k* from said wire R' through the coil of magnet I and over circuit *i* to contact *i'*, assuming switch S to be in the position shown in the drawings, thence along switch S and circuit T to brush T³ and over arm T' and contact 1 of the series T¹ to the uppermost one of the contacts T⁷ and from this to the ground U³ over segment U, thus moving the segment A the distance of one notch for raising the number 1 opposite pointer D. When arm T' reaches contact number 2 of the series T¹, the circuit will take the same course, excepting that instead of passing from arm T' into contact 1 of series T¹ it will pass into contact number 2 of series T¹, and instead of passing from the uppermost one of contacts T⁷ it will pass from the next lower one of contacts T⁷ into segment U, and thereby impart a second impulse to the magnet I and lift segment A a second notch, bringing the number 2 thereon opposite the point D. Thus it will be seen that the number of impulses reaching the magnet I with the switch S in the position shown and the arm T' traversing contacts T¹ T⁵ T⁹ will depend absolutely upon the number of contacts T⁷ that are overlapped or engaged by the segment U. For convenience in determining the number of the contacts T⁷ T⁸ T⁹ that are overlapped by their respective segments U U' U² suitable actuating means with indexes may be provided for these segments, respectively. In the exemplification shown these segments U U' U² have segment-racks U³ U⁴ U⁵, which are engaged by pinions

V¹ V² V³, respectively, connected to rotary thumb buttons or wheels V³ V⁴ V⁵, each bearing the nine digits and cipher corresponding to the segments A B C and adapted to be rotated with reference to suitable pointers X for determining the position at which they are to be set for sending a given number of impulses to one or more of the magnets I J K.

Having described the manner of sending impulses along the main signal-circuit T R¹ to the magnet I, the means for shifting the switch S to the other contacts j' k' when it is desired to actuate the segments B C will now be described.

The ratchet s may be given a step-by-step rotation for bringing the switch S from one of the contacts to another by any suitable means, as a pawl S', connected to an armature s', arranged within the magnetic field of an electroresponsive device or magnet S², which is included in a switch-circuit S³, which connects at one end with battery R over wire R', so that when said circuit S³ is closed the pawl S' will be drawn back by a magnet S² and when broken the pawl will be advanced by any suitable means, as a spring s'', for imparting partial rotation to switch S for moving it from the contact i' to j', for example. The other end of switch-circuit S³ has a movable terminal in the form of a revolving arm S⁴, which is connected to move in concert with but insulated from the arm T' in any suitable way, and this movable arm S⁴ sweeps over a series of grounded switch-contacts I' I² I³, which are arranged in a circle but situated between the series of contacts T⁴ T⁵ T⁶ in such a manner that when the arm T' leaves one of said latter series the arm S⁴ will engage one of said switch-contacts before arm T' reaches the next one of said latter series, and consequently before the arm T' begins to send impulses over the main signal-circuit T by successively engaging its circular series of contacts the arm S⁴ will have already engaged one of the contacts I' I² I³ and shifted the switch S to the corresponding one of the contacts i' j' k', and thereby place the proper one of the electroresponsive devices I J K in circuit with the main signal-circuit T before such impulses are produced over the signal-circuit T. Thus assuming the parts to be in the position shown in the drawing with the signal-circuit closed through the unit's electroresponsive device I as a result of the arm S⁴ having passed over the contact I' the next movement of the arm T' will effect the closing of the main signal-circuit T intermittently as it traverses the series of contacts T⁴, as already described, and by the time arm T' passes from the last one of these contacts T⁴ the arm S⁴ will engage contact I² and send an impulse through switch-magnet S², thereby shifting the switch S onto the contact j' before the arm T' reaches the first one of the unit's series of contacts T⁵, and as the arm T'

passes over these contacts T⁵ a number of impulses will be sent over the signal-circuit T to the magnet J equal to the number of the contacts T⁵ that are overlapped by segment U', and by the time the arm T' passes from the last one of contacts T⁵ the arm S⁴ will engage contact I³ and thus close the switch-circuit S³ and shift the switch S onto the contact k', so that when the arm T' begins its excursion over the contacts T⁶ the magnet K will be in circuit with the main signal-circuit T, and as many impulses will be imparted to the magnet K while arm T' is traveling over contacts T⁶ as there are contacts T⁶ in circuit with the ground U⁵. It is of course understood that the arms T' S⁴ are so arranged that the latter will contact with the contacts in the inner circle only and the former with those in the outer circle only, and when the arm T' is in engagement with any one of the contacts T⁴ T⁵ T⁶ the arm S⁴ is not in contact with any of the contacts I' I² I³. The arms T' S⁴ travel continuously in the same direction, and when they come to rest they serve to automatically close the telephone-circuit Z by resting upon contacts Z' Z², respectively, so that the telephone-circuit is always in readiness for use when the motion of the arms T' S⁴ ceases. In order that the signal-circuit T and switch-circuit S³ may be opened when the telephone-plug (shown at Z⁴) is inserted in the usual telephone-jack (indicated at Z²) the circuit S³ is divided at the jack and one division runs to contact S⁵ and the other to one of the outer spring-contacts of the jack, and the wire of circuit T is also divided at the jack with one of its divisions connected to contact T^x and the other to the other outer contact-spring of the jack, so that when the plug is withdrawn circuit S³ will be closed through the jack and S⁵ and circuit T through the jack and T^x, and when the plug is inserted both of these circuits will be broken at S⁵ and T^x, respectively. In illustrating a telephone-circuit and the telephones I have omitted all the usual details of switches and connections that go to make up the telephone apparatus, but which are well understood in this art. It is apparent also that, if desired, the act of inserting the plug Z⁴ may cause the pawls L M N to release the racks a b c by a suitable connection—such, for example, as magnet Q, having an armature-lever q connected to rod P, a battery q', and switch q'', arranged to be closed by the outward movement of one of the outer springs of the jack Z². The arms T' S⁴ are thus revolved by any suitable motor mechanism, which I have conventionally illustrated by the weight W, shown as suspended by a cord W' from a drum W², and which drum is capable of being wound up in any suitable way, so that when released the rotative power thereof, will be imparted to the arms T' S⁴, which when not thus impelled remain at rest on the contacts Z' Z² by virtue

of their frictional engagement therewith or by any other suitable method. The drum W^2 is rotated toward the right, for example, in winding up the weight, and until a tooth or projection W^3 thereon engages one side of a stop Y , when if released the weight will cause it and the arms $T^1 S^1$ to revolve toward the left until the projection W^3 engages the other side of stop Y , the arms having in the meanwhile made a complete revolution and returned to their respective contacts $Z^1 Z^2$, where they remain while the weight is being again wound up and until the latter is released, whereupon they again start on their excursion around the series of contacts in the same direction as before and finally again arrive at the starting-point, as illustrated in the drawing. Hence when the subscriber wishes to call a certain number such subscriber sets the indexes or thumb-wheels $V^3 V^4 V^5$ to produce the number thereon with the figures thereof opposite the pointers X with the units, tens, and hundreds of such number arranged in the order of the arrangement of such members $V^3 V^4 V^5$, thus grounding as many of the contacts $T^4 T^5 T^6$ in each series as the number opposite the pointer X on the members $V^3 V^4 V^5$, respectively. The weight W is then wound up and released, and the result will be the reproduction of such number at the central exchange on the numbering-machine comprising the segments $A B C$ by the operation of the parts and the current passing over the circuits and connections, as before described.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. In a telephone-exchange, the combination of a numbering-machine comprising a plurality of character-bearing movable members located at the central exchange, independent electroresponsive devices and circuits for actuating said members respectively, a main signal-switch for connecting the main signal-circuit with any one of the first said circuits, a switch-circuit, means for closing said switch-circuit, means acting simultaneously with said means for sending a various number of impulses over said signal-circuit and means under the control of the subscriber for varying the number of said impulses at will.

2. In a telephone-exchange, the combination of a numbering-machine comprising a plurality of digit-indicators located at the central exchange, electroresponsive devices and circuits for said indicators respectively, a switch for closing said circuits respectively, contacts for said circuits respectively arranged in a series with the first next the last in the line of movement of said switch, said switch being movable continuously successively over said contacts from the first to the last and the last to the first, a main signal-

circuit and means under the control of the subscriber for actuating said switch and sending impulses over said signal-circuit.

3. In a telephone-exchange, the combination of a numbering-machine comprising a plurality of digit-indicators located at central exchange, a corresponding number of electroresponsive devices and circuits for actuating said indicators respectively, a main signal-circuit having a movable terminal, means for switching said signal-circuit to any one of the first said circuits comprising a switch-circuit having a movable terminal, a plurality of series of contacts corresponding to said indicators respectively and arranged in the line of movement of the first said movable terminal, and means under the control of the operator for grounding any number of said contacts in each series thereof.

4. In a telephone-exchange, the combination of a numbering-machine comprising a plurality of digit-indicators located at central exchange, a corresponding number of electroresponsive devices and circuits for actuating said indicators respectively, a main signal-circuit having a movable terminal, means for switching said signal-circuit to any one of the first said circuits, comprising a switch-circuit having a movable terminal, a plurality of series of contacts corresponding to said indicators respectively and arranged in the line of movement of the first said movable terminal, grounded contacts for said switch-circuit alternating with said series of contacts and means for moving said movable terminals in concert successively over their respective contacts.

5. In a telephone-exchange, the combination of a numbering-machine comprising a plurality of indicators located at central exchange, a corresponding number of electroresponsive devices and circuits for actuating said indicators respectively, a main signal-circuit having a movable terminal, means for switching said signal-circuit to any one of the first said circuits, a plurality of series of contacts corresponding to said indicators respectively and arranged in the line of movement of said movable terminal, a plurality of grounded independently-movable contacts for connecting electrically with one or more of the contacts of the said plurality of series of contacts respectively, and movable index members under the control of the operator, for said movable contacts respectively bearing numbers corresponding to the number on said digit-indicators respectively.

6. In a telephone-exchange, the combination of a telephone-circuit, a main signal-circuit leading to the central exchange, a visual indicator device located at central exchange comprising a plurality of movable indicators, and means under the control of the subscriber for sending impulses over said signal-circuit to any one of said indicators, compris-

ing means for subsequently and automatically closing the telephone-circuit.

7. In a telephone-exchange, the combination of a numbering-machine comprising a plurality of indicators located at central exchange, a corresponding number of electro-responsive devices and circuits for actuating said indicators respectively, a main signal-circuit, a plurality of series of indicator-contacts corresponding to said indicators respectively, means under the control of the subscriber for grounding one or more of said indicator-contacts, a plurality of grounded switch-contacts corresponding to said indicators respectively, a switch for connecting said signal-circuit with any one of said first circuits, a switch-circuit for said switch, movable terminals for said signal-circuit and switch-circuit respectively adapted to sweep over said indicator-contacts and switch-contacts respectively and movable continuously in the same direction, power-storing mechanism under the control of the subscriber and means for moving said terminals by the power thus stored.

8. In a telephone-exchange the combination of a numbering-machine comprising a plurality of character-bearing indicators located at central exchange, a corresponding number of electroresponsive devices and circuits for actuating said indicators respectively, a main signal-circuit, means for switching said signal-circuit to any one of the first said circuits comprising a switch-circuit, a plurality of series of contacts corresponding to said indicators respectively, means for successively connecting said contacts with said main signal-circuit, and means acting in concert with the last said means for closing the switch-circuit at periods between the time that the last one of said contacts of each series and the first one of the next succeeding series is connected with the signal-circuit, and means under the control of the operator for grounding one or more of said contacts of any one or more of said series.

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