

1,144,560.

Patented June 29, 1915.

3 SHEETS—SHEET 1.

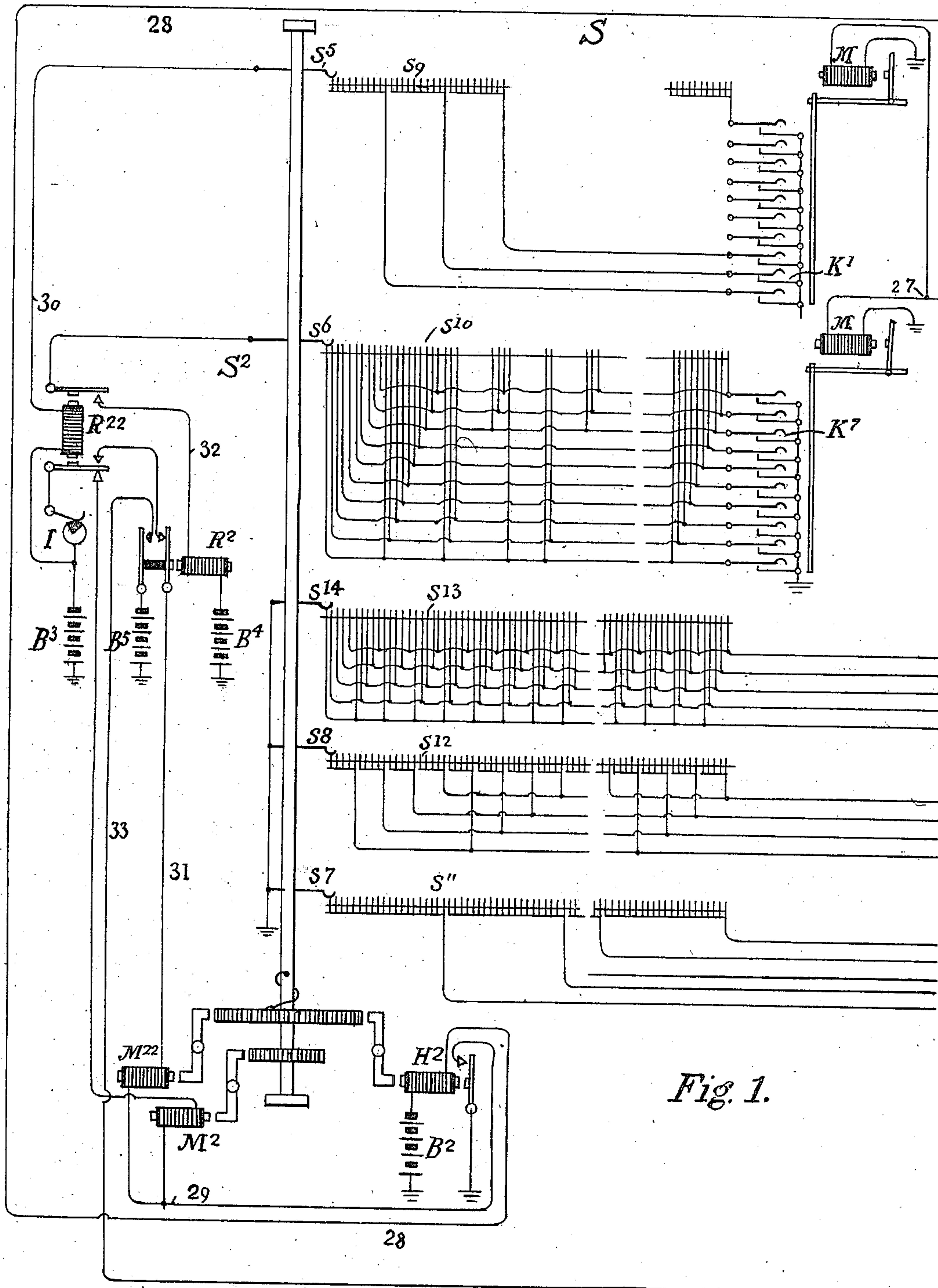


Fig. 1.

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by his Attorney—
Thomas D. Lockwood

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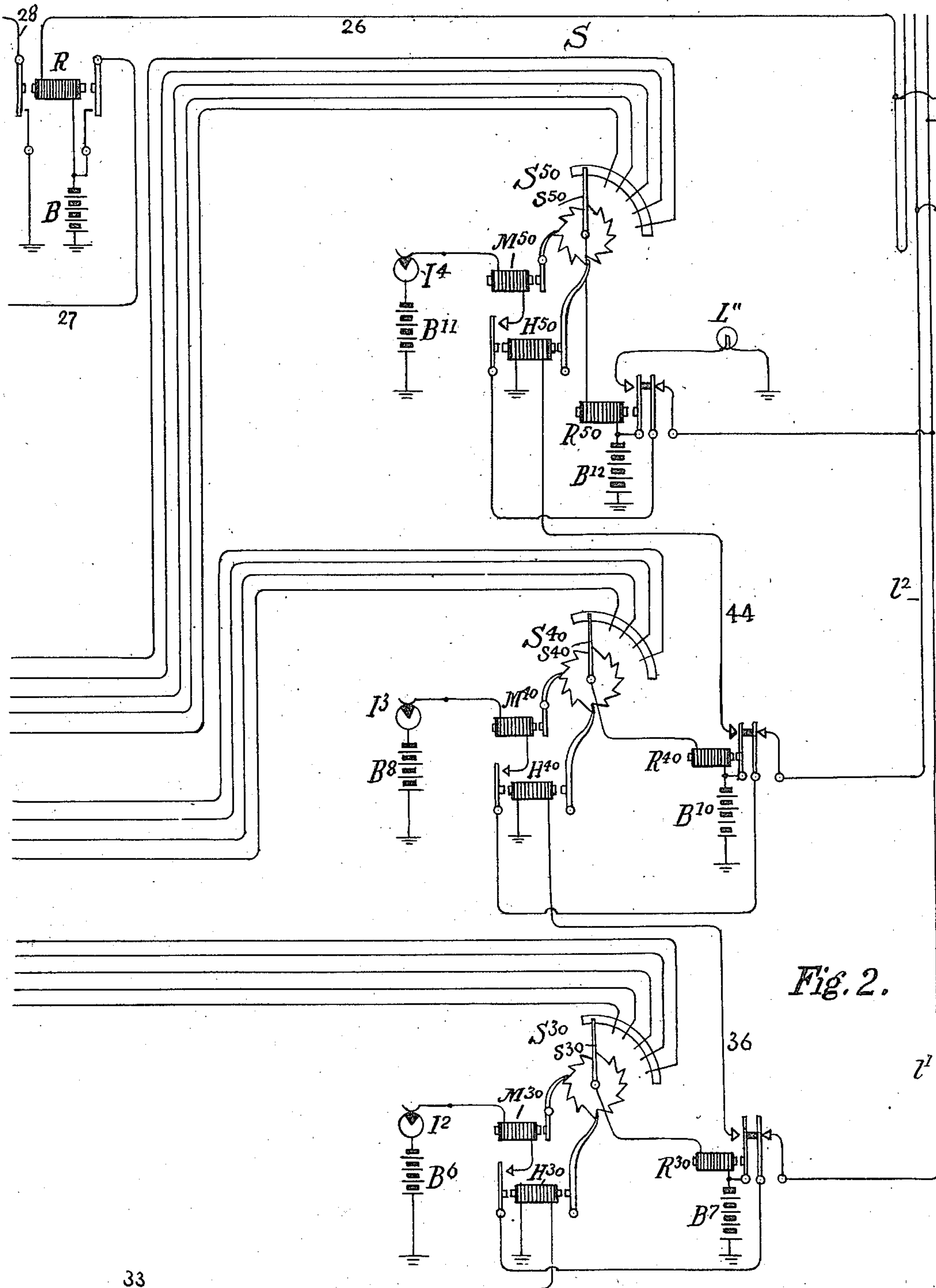


Fig. 2.

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INDICATING SYSTEM.
APPLICATION FILED SEPT. 17, 1913.

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3 SHEETS—SHEET 3.

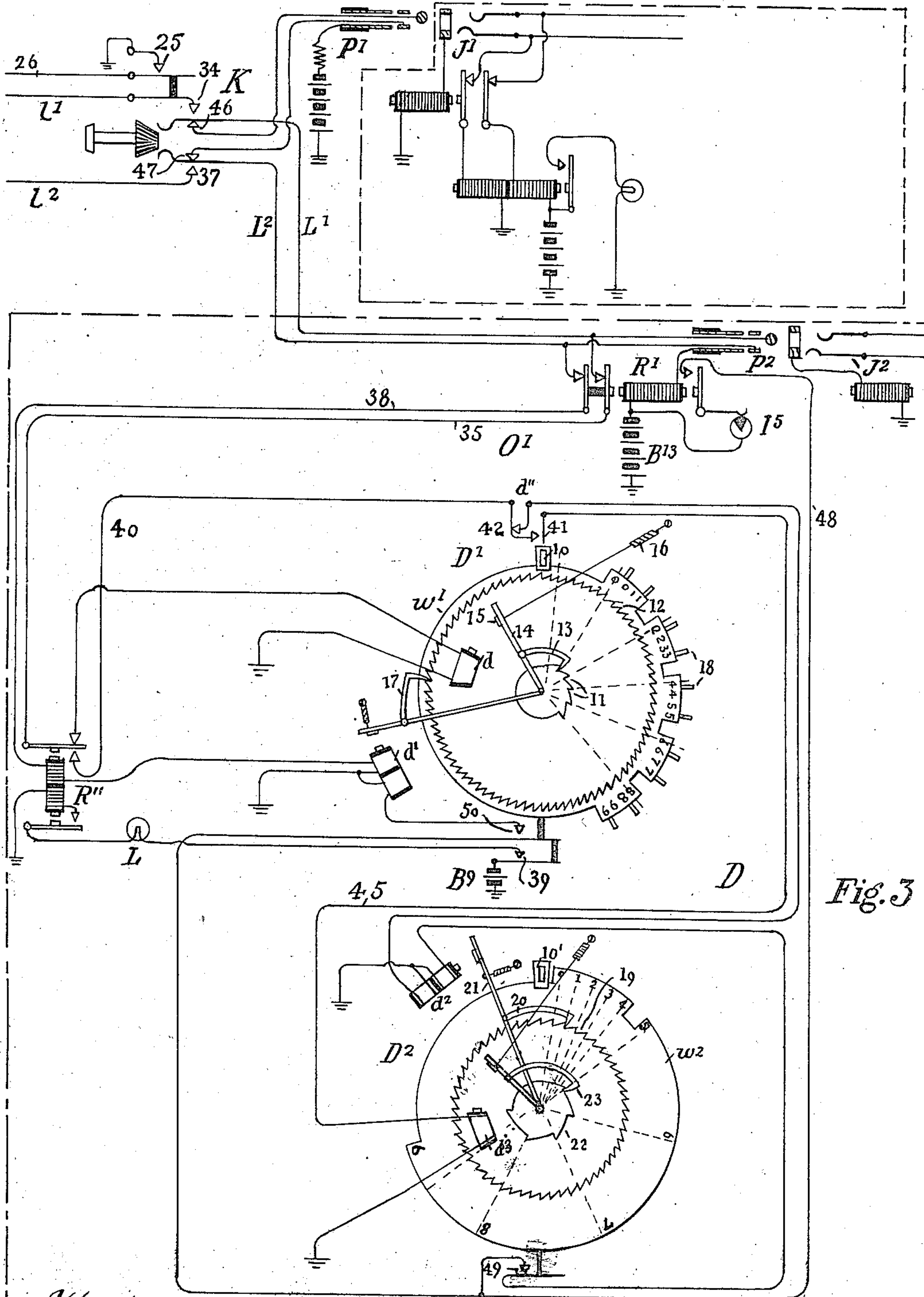


Fig. 3

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UNITED STATES PATENT OFFICE.

EDWARD C. MOLINA, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

INDICATING SYSTEM.

1,144,560.

Specification of Letters Patent. Patented June 29, 1915.

Application filed September 17, 1913. Serial No. 790,363.

To all whom it may concern:

Be it known that I, EDWARD C. MOLINA, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain Improvements in Indicating Systems, of which the following is a specification.

In telephone systems in which called substation lines are joined to calling lines through both automatic or semiautomatic and manual central stations or offices, it is customary to place before each "B" operator at the manual offices an indicating apparatus; which will respond to the conditions produced by the actuation of the subscribers' or "A" operators' selection controllers to display before said "B" operators the numbers of the wanted lines. Such a system is described in British patent to the Western Electric Company, Ltd., No. 18648 of 1911. When the selectors of the automatic or semiautomatic offices have non-decimally arranged terminals, and therefore call for the translation of the decimal conditions corresponding to the line designations registered at the controllers into different conditions directly governing selection, as is provided for in German patent to Telephon Apparat Fabrik E. Zwietusch & Co., No. 196696, published March 23, 1908, it is necessary that the operation of the controllers for substation lines into manual offices shall lead to the same effect as is registered upon them. That is, that the depression of decimal keys shall cause the display of a decimal number. It is possible to accomplish this by completely eliminating translation for lines to manual offices, setting up in connection therewith only decimal conditions, but this tends to undue complication. I simplify the procedure by uniformly translating the controller impulses, and then reversely translating to the decimal system such of these as are to govern the indicators of manual offices. This result is accomplished by means of a translating indicator which is provided with the usual characters for displaying decimal line designations, but which has selecting devices differently arranged, usually in accordance with the groups of impulses sent out from the translator.

The accompanying drawings show diagrammatically one embodiment of the invention in a much simplified form.

Figures 1 and 2 illustrate an "A" operator's controller, and Fig. 3 my improved translating indicator, together with the portions of the line equipment of calling and called lines; and a trunk or link circuit for connecting these.

The three sheets placed side by side with the figure numbers in order from left to right exhibit the system in the proper relation.

The letter S (Figs. 1 and 2) designates an operator's controlling apparatus, including the combined register-translator switch S^2 and the transmitting switches or steppers S^{30} , S^{40} and S^{50} . This may be united by means of a key K with a trunk L' , L^2 , having at an operator's position at a semiautomatic office O a plug P' for connection with the answering jack J' of a calling subscriber's line, and terminating at an operator's position at a manual office O' in a plug P^2 for cooperation with the multiple jack J^2 of the called subscriber's line. Joined to the trunk and situated before the operator to whom is assigned the plug P^2 is an indicator D, having thousands digit indicating mechanism D' and hundreds digit indicating mechanism D^2 . With the controller and indicator are associated various relays, signals and other auxiliary devices, the purpose of which is either fully disclosed in the patents previously referred to or will be made clear in the description of operation of the system. Other trunks or link circuits, it may be assumed, terminate in the usual trains of selectors through which the subscribers of the semiautomatic office may be reached, and with these trunks the controller may be associated through other keys K individual thereto. Except as giving a reason for initial translation, this automatic switching has nothing to do with my invention, and is not illustrated. If further information regarding such composite systems is desired, reference may be had to the British patent hereinbefore mentioned.

The selecting switches employed in the system of British Patent No. 18648 of 1911

are described in detail in British patent to McBerty, No. 16867 of 1911, they having sets of brushes traveling over successive levels of fixed terminals, any one of which brush sets may be tripped to actively engage the corresponding terminals. It may be considered that the present invention is to be used in connection with an automatic system adapted to select any one of ten thousand lines, and that the selectors have five levels of a hundred terminals each and include first and final selectors. In this arrangement there would be initial translation of the decimal thousands and hundreds groups in which the line designations are ordinarily expressed into five non-decimal primary groups of two thousand each, corresponding to one of the five levels of the first selectors; four secondary non-decimal groups of five hundred for each primary group, corresponding to one-quarter of the terminals in each of the five first selector levels, and giving twenty-five trunk terminals for serving each secondary group through a final selector; and five tertiary non-decimal groups representing, respectively, the hundreds in the five hundreds of the secondary groups and corresponding to the five brush sets belonging to the final selectors. To the tens and units selection in the hundreds terminals making up the different levels of the final machines no attention need be paid, as into this translation does not enter. To make the group relation obvious, the numbers of which the primary and secondary groups are composed are given below, and also the tertiary groups comprehended within the first primary group. The tertiary groups for the other four primary groups are, of course, similar to the first.

<i>Primary groups.</i>		<i>Secondary groups.</i>			
45	First 0000 to 1999	First 0000 to 0499			
		Second 0500 to 0999			
		Third 1000 to 1499			
	Fourth 1500 to 1999				
50	Second 2000 to 3999	First 2000 to 2499			
		Second 2500 to 2999			
		Third 3000 to 3499			
		Fourth 3500 to 3999			
		Third 4000 to 5999	First 4000 to 4499		
		Second 4500 to 4999			
		Third 5000 to 5499			
		Fourth 5500 to 5999			
55	Fourth 6000 to 7999	First 6000 to 6499			
		Second 6500 to 6999			
		Third 7000 to 7499			
		Fourth 7500 to 7999			
		Fifth 8000 to 9999	First 8000 to 8499		
		Second 8500 to 8999			
		Third 9000 to 9499			
		Fourth 9500 to 9999			
<i>Tertiary groups in secondary groups of first primary group.</i>					
60	<i>First.</i>	<i>Second.</i>	<i>Third.</i>	<i>Fourth.</i>	<i>Fifth.</i>
	1st. 0000/0099	0100/0199	0200/0299	0300/0399	0400/0499
	2nd. 0500/0599	0600/0699	0700/0799	0800/0899	0900/0999
	3rd. 1000/1099	1100/1199	1200/1299	1300/1399	1400/1499
	4th. 1500/1599	1600/1699	1700/1799	1800/1899	1900/1999

A description will now be given of the indicating apparatus D for reversely translating the non-decimal groups of selecting im-

pulses into decimal indications. A dial or wheel w' of the thousands indicating mechanism D' and a hundreds dial or wheel w'' of the indicating mechanism D'' are rotatably mounted adjacent to one another, and have arranged near their peripheries all the digits from 0 to 9. For the thousands dial these are duplicated, they being in five sets of four each, these sets being, respectively, 0, 0, 1, 1; 2, 2, 3, 3; 4, 4, 5, 5; 6, 6, 7, 7; and 8, 8, 9, 9. Upon reference to the group tables, it will be seen that this gives, divided into the five primary groups, the thousands digits of all the secondary groups in the order in which they appear for the numbers 0000 to 9999. Upon rotation of the dial w' any one of these thousands digits may be brought into registration with a sight opening 10 in a casing (not illustrated) in which the dials are mounted.

For the primary and secondary number groups there are corresponding non-decimal groups of translating or selecting members, here shown as consisting of five primary ratchet teeth 11, one for each primary group, and five groups of four secondary ratchet teeth 12, one tooth for each of the four thousands digits constituting the secondary groups. In addition to the twenty secondary teeth in the five groups there are intermediate teeth of the same size which serve to return the dial to its normal position, but which have nothing to do with the operation of translation. Coöperating with the teeth 11 is a pawl 13 pivoted to a lever 14, which lever carries the armature 15 of an electromagnet d . The lever is held normally retracted by a spring 16. The throw of this lever under the influence of the magnet d is such that for each energization of the latter the first of one of the primary groups of numerals is brought within one short step of the sight opening 10. Similarly, the teeth 12 are engaged by a pawl 17 oscillated by an electromagnet d' , and the digits of the particular primary group having been brought into proximity with the sight opening by the magnet d , the magnet d' is energized the correct number of times, from one to four, to step opposite the sight opening the thousands digit which begins the desired secondary group within the previously chosen primary group. Shown as situated near the sight opening 10 is a double contact device d'' , which is operated by a series of projections 18 on the dial w' when either the second or fourth numeral of a secondary group is aligned with the opening 10, but which is left in its normal position when the first or third digits appear. The purpose of this device will be explained in connection with the description of the associated mechanism.

The hundreds dial or wheel w'' , like the thousands dial, has all the ten digits ar-

ranged about its periphery to be brought opposite a sight opening 10'. From the table of tertiary groups composing the first primary and first four secondary groups, it will be noted that the hundreds digits in the first and third secondary groups are successively 0, 1, 2, 3 and 4 and in the second and fourth secondary groups are 5, 6, 7, 8 and 9. Through the other primary groups the relation of the hundreds digits in the tertiary groups is precisely the same. Therefore to translate from the non-decimal groups of five, corresponding to the received indicator controlling impulses, to the decimal hundreds of the line designation, it is necessary to determine in which secondary group the hundreds digit occurs and then select one of five digits therein. For this purpose the numbers of dial w^2 are in two sets, those from 0 to 4 being closely placed at equal distances from one another, while those from 5 to 9 follow the second set, also uniformly but more widely spaced. Each set of numerals has a corresponding non-decimal set of five tertiary translating or selecting members, these being as in the thousands dial in the form of ratchet teeth. There are five small teeth 19 for the digits from 0 to 4, engaged by a spring retracted pawl 20 pivoted upon a lever 21 actuated by an electromagnet d^2 . For the second set, 5 to 9, there are five larger teeth 22 engaged by a long-throw pawl 23 under the influence of an electromagnet d^3 . The circuit connections of the magnets d^2 and d^3 are such that when the thousands digits for the first or third secondary group in any primary group appear at the opening 10 and the contact device d'' is normal, the magnet d^2 is traversed by the indicator setting impulses, but when the other set for the second and fourth secondary groups are in sight, and the contact device is operated, the impulses are transferred to the magnet d^3 .

In describing the operation of the indicating system, let it be assumed that the subscriber whose line ends at the jack J' of the semi automatic office O wishes to call a subscriber who is served by the manual office O' and the number of whose line is 1799. From the group tables it will be seen that this number falls within the first primary translated group, the fourth secondary group thereof and the third tertiary group of said fourth secondary group. The operator at O , upon observing the lighting of the calling subscriber's line lamp answers by plugging into the jack J' with the plug P' of an idle trunk and receives the call in the usual manner. She then operates the key K to associate her controller S with the trunk in use, and thereafter depresses the proper digit keys, of which only the second thousands key K' and the eight hundreds key K'' need be here considered. The actu-

ated digit keys place ground on the second thousands register contacts s^9 of the register-translator and on the eighth multiplied hundreds register contact s^{10} .

The key K closes a contact 25 energizing the initiating relay R of the controller from the battery indicated at B over conductor 26 to ground. Relay R at one front contact locks the controller keys through the magnets M from battery B by way of conductor 27, and at the other front contact completes a circuit for the retaining magnet H^2 of the register-translator S^2 from battery B^2 through conductor 28. This magnet applies its retaining pawl and by a front contact, conductor 29 and back contact of transfer relay R^{22} applies current impulses from the interrupter I and battery B^3 to the long-step or thousands motor magnet M^2 of the register-translator. The brushes of the registertranslator are now advanced until the brush s^5 reaches the grounded terminals s^9 . This energizes the transfer relay R^{22} , current flowing from battery B^3 through conductor 30, brush s^5 , terminal s^9 and key K' . Relay R^{22} at its back contact breaks the stepping circuit through magnet M^2 , and transfers it at the front contact to the short-step or hundreds motor magnet M^{22} through conductor 31 and the back contact of cut off relay R^2 . The brushes are again advanced until brush s^6 arrives at the eighth multiplied hundreds terminal s^{10} in the second set, corresponding to the second thousand, when the cut off relay R^2 attracts its armatures, because of a circuit through its winding from battery B^4 , conductor 32, front contact of relay R^{22} , brush s^6 , terminal s^{10} and the hundreds key K'' to ground. At its back contact relay R^2 severs the circuit of the hundreds stepping magnet, and by means of its front contact applies battery B^5 through conductor 33 to the retaining magnet H^{30} of primary group transmitting switch S^{30} . The system is now ready for sending translated or non-decimal setting impulses to the indicator.

When the retaining magnet H^{30} is energized, it operates the holding pawl of the primary transmitting switch and closes a path from battery B^6 and interrupter I^2 through primary motor magnet M^{30} , back contact of transfer relay R^{30} , controller lead L' , contact 34 of key K , trunk conductor L' , back contact of indicator cut off relay R' , conductor 35, back contact of indicator transfer relay R'' and motor magnet d of the thousands indicator mechanism to ground. The primary transmitting switch S^{30} and the thousands indicator dial w' now rotate in synchronism; the latter being moved in long steps by the pawl 13, so that the first of each of the sets of symbols into the opening 10. When one step has been scribed upon the dial is brought adjacent

taken the brush s^{30} of the switch S^{30} finds a ground placed upon the first primary translator terminal s'' by the brush s^7 ; this brush, its companion secondary translator brush s^8 and tertiary translator brush s^{14} being in positions corresponding to the register brushes s^5 and s^6 and effecting translation of the conditions registered at the digit keys by virtue of the peculiar relation and cooperation of translator terminals and the terminals of the transmitting switches, as is fully described in the previously-mentioned German patent. The transfer relay R^{30} , energized from battery B^7 through the circuit completed by brushes s^{30} and s^7 , breaks the lead l' and closing its front contact connects battery B^7 through conductor 36 to the retaining magnet H^{40} of the secondary group transmitting switch S^{40} . Magnet H^{40} applies its holding pawl and closes the following circuit: From the pole of battery B^8 through interrupter I^3 , secondary group transmitting switch motor magnet M^{40} , front contact of retaining magnet H^{40} , back contact of secondary group transfer relay R^{40} , controller lead l^2 , contact 37 of key K, trunk conductor L^2 , back contact of indicator cut-off relay R' , conductor 38, one winding of transfer relay R'' and one winding of motor magnet d' of the thousands indicator mechanism D' to ground. Motor magnets M^{40} and d' operate synchronously to step the dial w' through short intervals until the transmitting brush s^{40} touches the fourth terminal, which is grounded at the fourth translator terminal s^{12} and brush s^8 . As in the case of the switch S^{30} , transfer relay R^{40} is operated to break the stepping circuit which includes the motor magnet d' of the thousands indicator dial. Said dial comes to rest with the fourth figure, l , of the first set opposite the opening 10. When relay R'' was traversed by the first impulse of the secondary indicator setting group it locked up from battery B^9 through off normal contact 39 of dial w' and lamp L. The latter is illuminated and notifies the operator that the designation of a line wanted is being displayed upon the indicator. The other armature of relay R'' shifts conductor 35 from motor magnet d of dial w' to the conductor 40 leading to the contact device d'' . As the fourth numeral of the set is alined with the sight opening 10 a projection 18 is in engagement with the contact device, closing its contact 41 and opening contact 42. Contact 42 joins conductor 40 with the short step motor magnet d^2 which selects the set of digits from 0 to 4. Contact 41, which is now effective, gives connection with the long step magnet d^3 controlling the display of the digits 5 to 9. The indicator is now ready to receive the tertiary group of impulses to set up the hundreds digit.

In addition to stopping the rotation of the switch S^{40} and dial w' , relay R^{40} by making its front contact supplies current from battery B^{10} over conductor 44 to the retaining magnet H^{50} of the tertiary group transmitting switch S^{50} . By this retaining magnet the holding pawl is put into operation, and battery B^{11} and interrupter I^4 are united to the motor magnet M^{50} of the transmitting switch S^{50} , and through lead l' , key contact 34, trunk conductor L' , back contact of cut off relay R' , conductor 35, front contact of transfer relay R'' , conductor 40, contact 41 and conductor 45 with the winding of the long step motor magnet d^3 of the dial w^2 . Synchronous operation of the switch S^{50} and dial w^2 results until three impulses have passed. The transmitter brush s^{50} then arrives at the ground furnished by the tertiary group translator terminal s^{13} and its brush s^{14} , when the cut off relay R^{50} is energized and the circuit of the motor magnet d^3 broken when the numeral 7 appears at the sight opening 10'. The decimal thousands and hundreds digits 1 and 7 of the called subscriber's line have now been displayed before the manual operator at the office O', by means of initiating decimal conditions at the semiautomatic operator's controller at office O, translated into non-decimal grouping in accordance with automatic practice and re-translated to the decimal system.

Disregarding the tens and units digits, and considering that as far as the novel portion of this system is concerned the indicator has performed its function, relay R^{50} through its front contact provides current from battery B^{12} for lamp L'' , which informs the operator at office O that the number has been displayed at office O'. She thereupon releases the trunk key K which opens its contacts 25, 34 and 37, and thereby releases the controller, the displaced elements of which return to normal. Contacts 46 and 47 of this key complete the continuity of the trunk conductors. The operator at office O' having noted the indication displayed, and after the usual test, inserts the trunk plug P^2 in the indicated jack J^2 . The connection is now complete and ready for ringing the called subscriber.

The association of the plug P^2 with the jack J^2 closed, by way of the sleeve of the jack and corresponding contact of the plug, a circuit from battery B^{13} through the winding of indicator cut off relay R' . The latter at its back contacts frees the indicator from the trunk. At its front contact current passes from battery B^{13} and interrupter I^5 through conductor 48, then to ground by way of off normal contacts 49 and 50 and secondary windings of short step motor magnets d' , d^2 of the dials w' and w^2 in parallel. Said dials are thereby stepped on

until contacts 49 and 50 open in the normal position of the dials, which thereupon come to rest. At this time the off normal contact 39 is also broken, unlocking relay R'' which extinguishes the lamp L.

I claim:

1. Indicating apparatus comprising means for displaying characters arranged in accordance with one system of grouping, and means actuated by impulses belonging to a different system of grouping for operating said displaying means.

2. Indicating apparatus comprising means for displaying a line designation in characters arranged in accordance with one system of grouping, and electro-mechanical means actuated by current impulses belonging to a different system of grouping for operating said displaying means.

3. In a telephone indicator, means for displaying a line designation in characters arranged in accordance with one system of grouping, means for actuating the displaying means and responsive to impulses belonging to a different system of grouping, and translating means operatively associating the actuating means and the indicating means.

4. Indicating apparatus comprising means for displaying numerals belonging to decimal groups, and means for actuating the displaying means including selecting members arranged in non-decimal groups.

5. The combination with decimal indicating means, of electroresponsive actuating means including non-decimal groups of actuating members.

6. The combination with decimal indicating means, of a rotatable device having non-decimal groups of selecting members and controlling the setting of the indicating means, and electromagnetic devices for setting the rotatable devices.

7. A telephone indicator comprising a dial inscribed with numerals and provided with groups of teeth arranged in accordance with one system of grouping, a pawl coöperating with said teeth, and impulse driven means for actuating the pawl in accordance with impulses belonging to a different system.

8. An indicator comprising a plurality of indicating means, means for actuating the indicating means, one of the indicating means having plural actuating means, and means controlled by the operation of one of the indicating means for determining which of the actuating means shall affect another indicating means.

9. A plurality of indicating means, electromechanisms for setting each indicating means, there being a plurality of setting means for one of the indicating means, and means controlled in the setting of one of the indicating means for determining by

which of the electromechanisms another of the indicating means shall be energized.

10. The combination with plural indicating means, of means for actuating said indicating means including a plurality of electromagnets for one of the indicating means, and a contact device associated with one of said indicating means for controlling the electromagnets of another of said indicating means.

11. The combination with a plurality of number wheels, of means for rotating the number wheels including a plurality of electromagnets associated with one of said wheels, a contact device controlled by one of the wheels, and circuit connections whereby the operation of said contact device determines the energization of one of said electromagnets.

12. In a telephone system, a selection controller, means for translating conditions initiated at the controller to different conditions, means for reversely translating the changed conditions to the initial conditions, and indicating means under the influence of the reverse translating means.

13. In a telephone system, a selection controller, means for translating conditions initiated at the controller to different conditions, and an indicating apparatus including other translating means governed by the initial translating means and indicating means under the influence of said other translating means.

14. The combination with means for transmitting current impulses in predetermined groups, of an indicator under the influence of said impulses and comprising translating means responsive to the transmitted impulses, and character displaying means controlled by the translating means, the characters belonging to groups different from those of the transmitted impulses.

15. The combination with means for transmitting current impulses in predetermined groups, of an indicator under the influence of said impulses and comprising selecting means having elements arranged in groups corresponding to the transmitted impulses, and character displaying means controlled by the selecting means, the characters belonging to groups different from those of the transmitted impulses.

16. The combination with means for transmitting current impulses in non-decimal groups, of an electromagnet through which the transmitted impulses pass, a device operable by the electromagnet and having selecting members arranged in groups similar to the transmitted impulses, and decimal displaying means controlled by the selecting device.

17. In a telephone indicator, means for transmitting current impulses, indicating mechanisms having electromagnets for ac-

tuating the same, and means controlled by one indicating mechanism for determining the delivery of current impulses to one or another of the electromagnets of another
5 mechanism.

In testimony whereof, I have signed my name to this specification in the presence of

two subscribing witnesses, this 11th day of September, 1913.

EDWARD C. MOLINA.

Witnesses:

ROBERT W. MORRIS,
HAROLD H. DAVIS.