

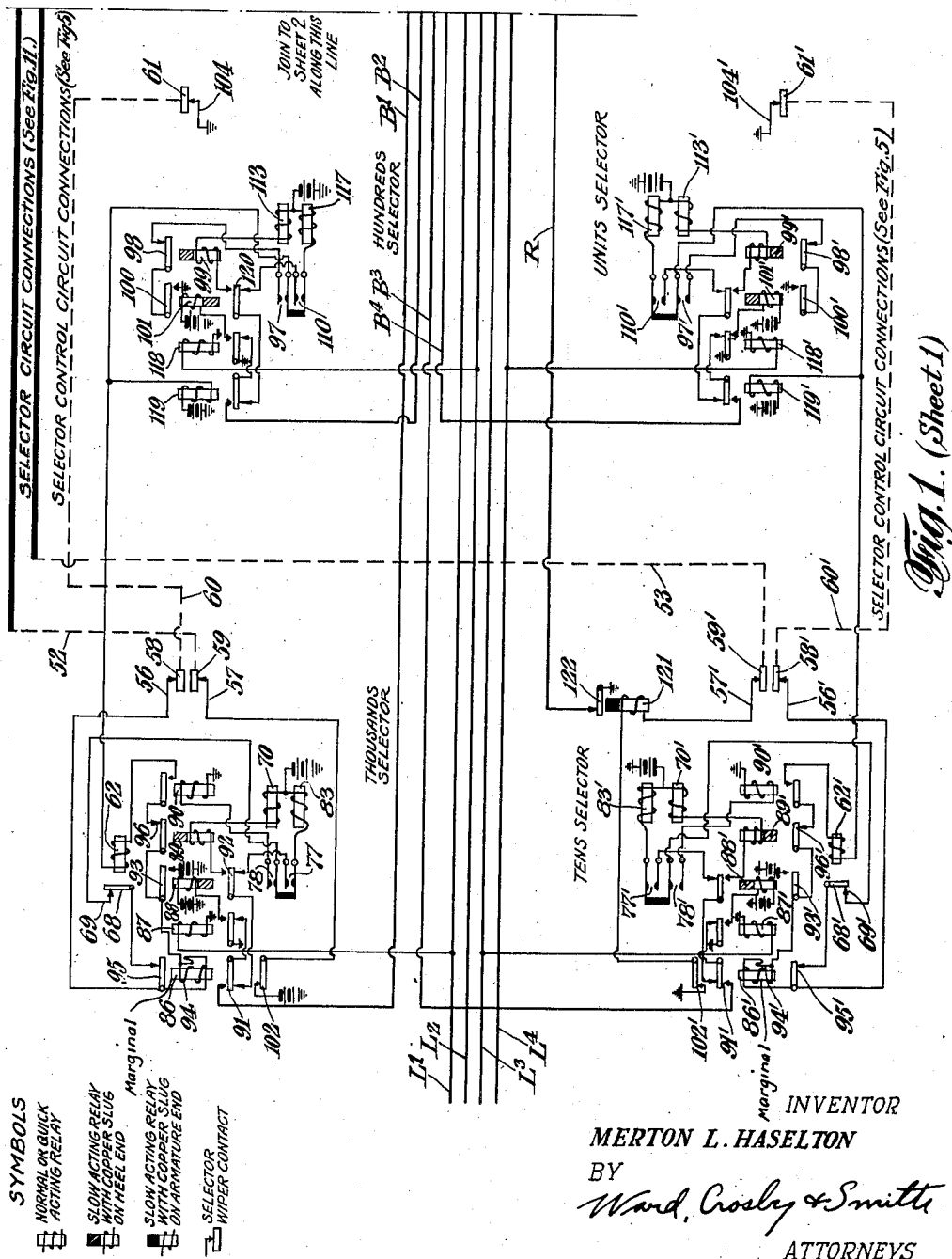
Dec. 13, 1932.

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1,890,876

ELECTRICAL SIGNALING

Original Filed Jan. 6, 1928 8 Sheets-Sheet 1



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1,890,876

ELECTRICAL SIGNALING

Original Filed Jan. 6, 1928 8 Sheets-Sheet 2

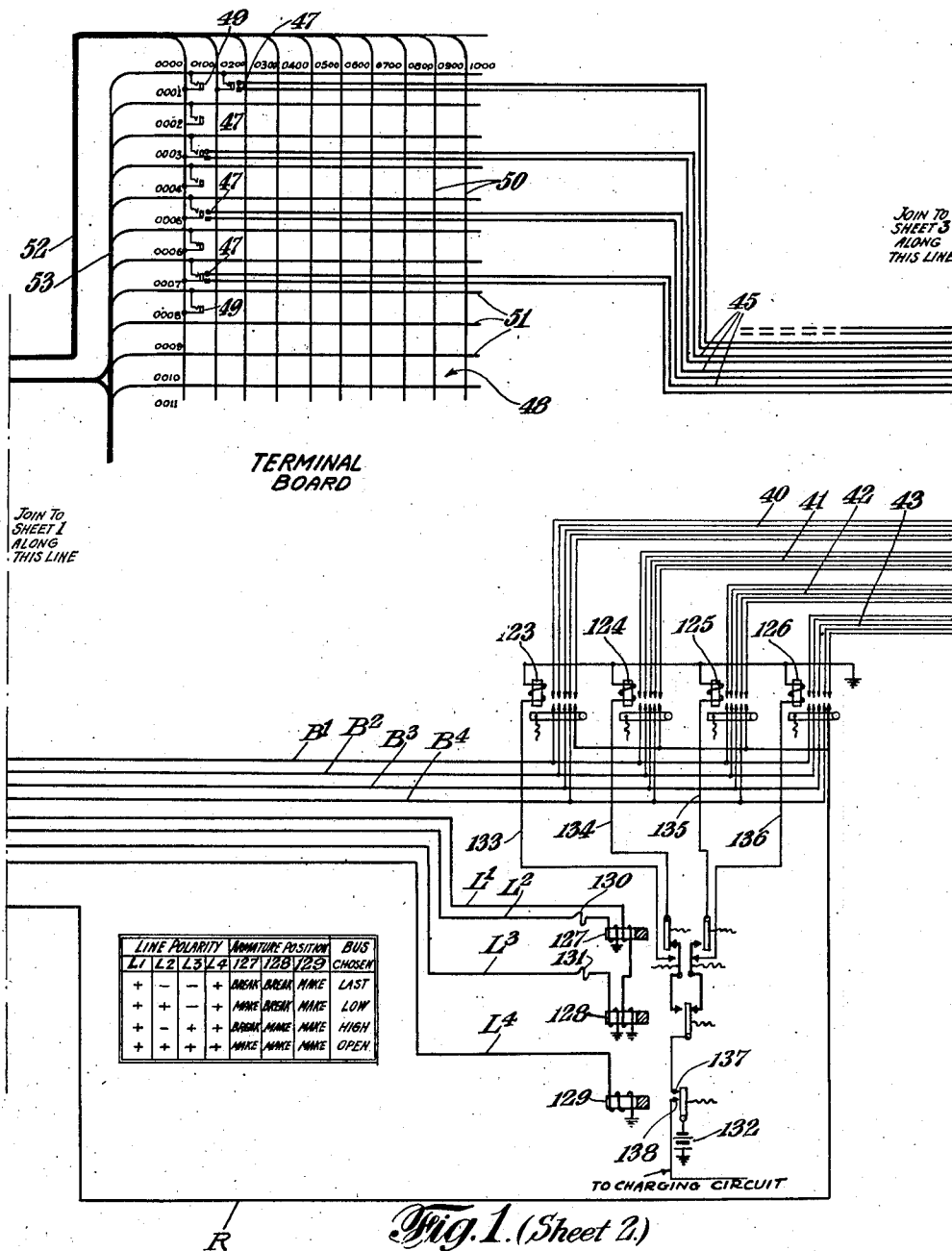


Fig. 1 (Sheet 2)

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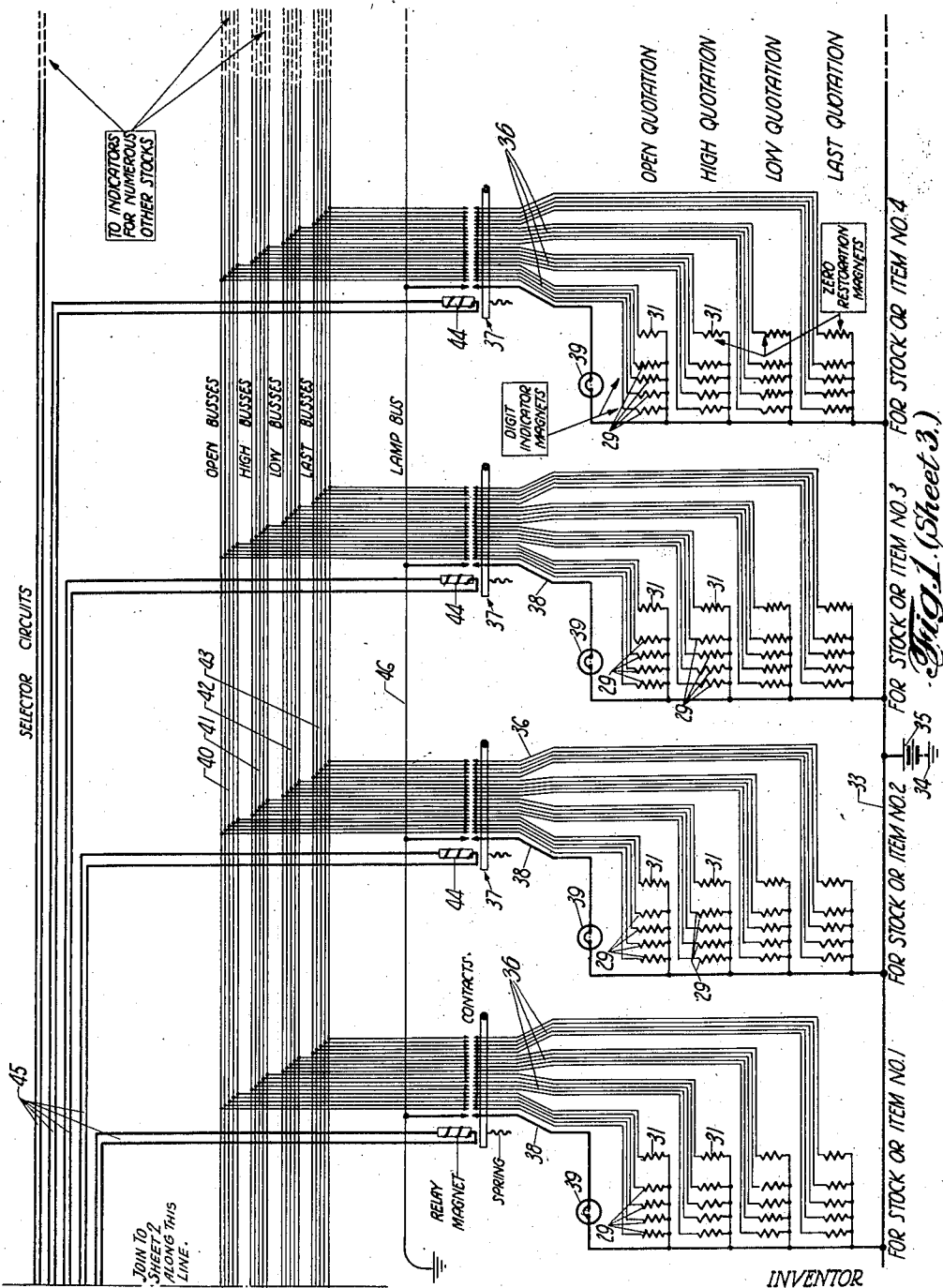
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ELECTRICAL SIGNALING

Original Filed Jan. 6, 1928 8 Sheets-Sheet 3



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FOR STOCK OR ITEM NO. 1
FOR STOCK OR ITEM NO. 2
FOR STOCK OR ITEM NO. 3
FOR STOCK OR ITEM NO. 4
Fig. 1. (Sheet 3.)

Dec. 13, 1932.

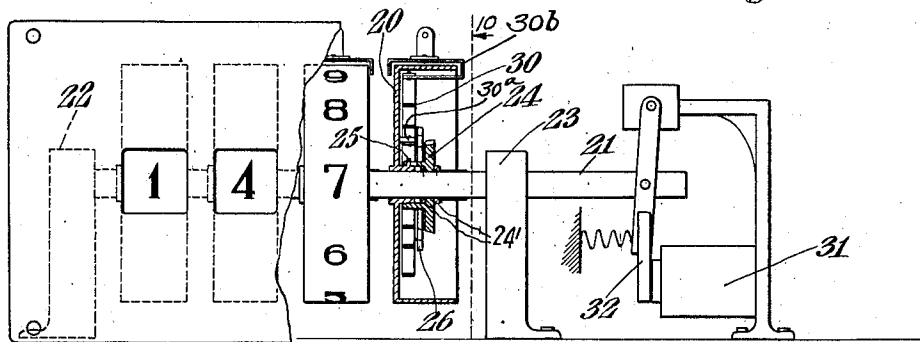
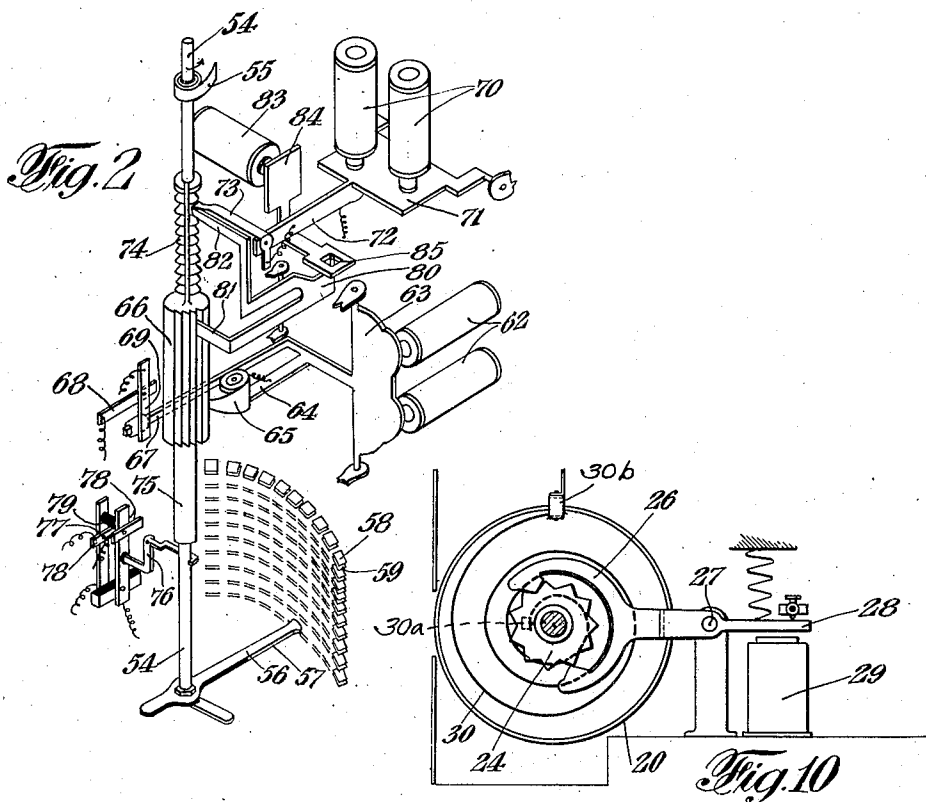
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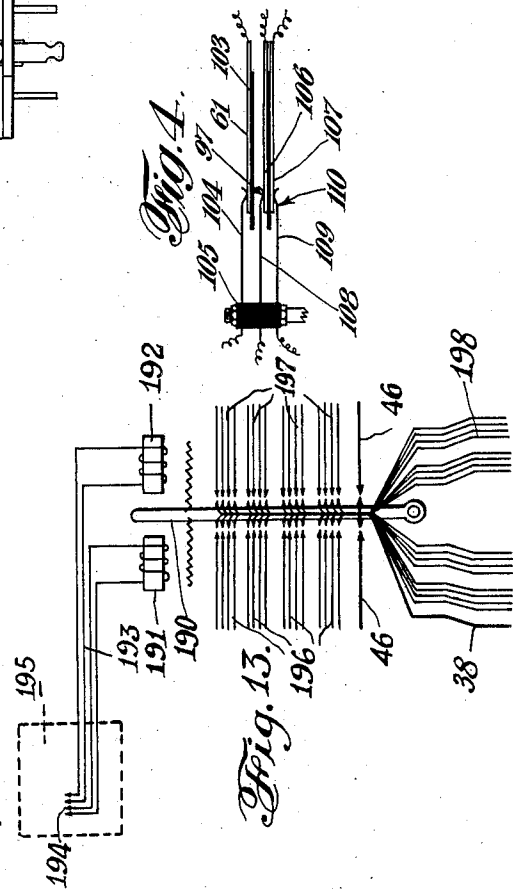
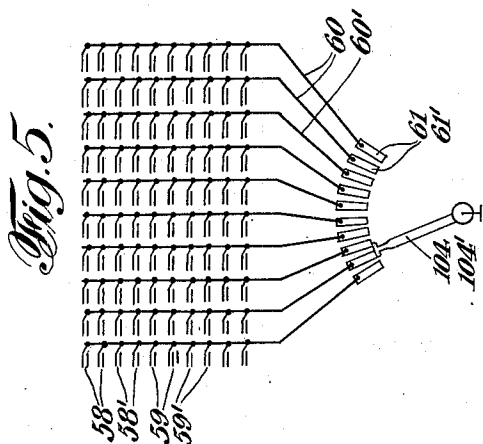
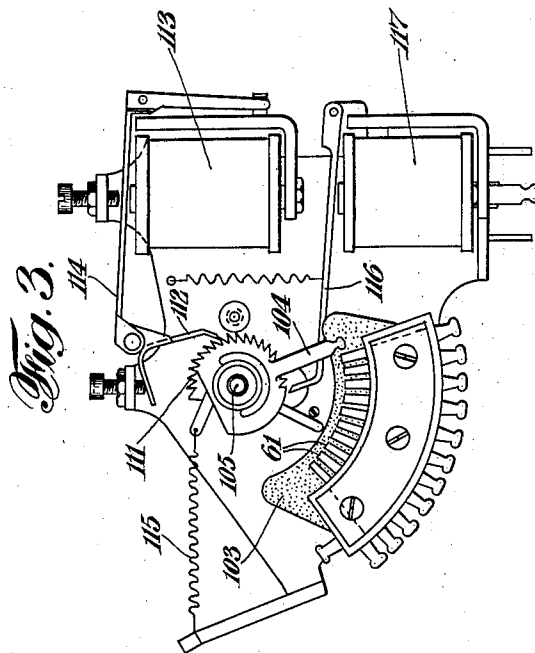
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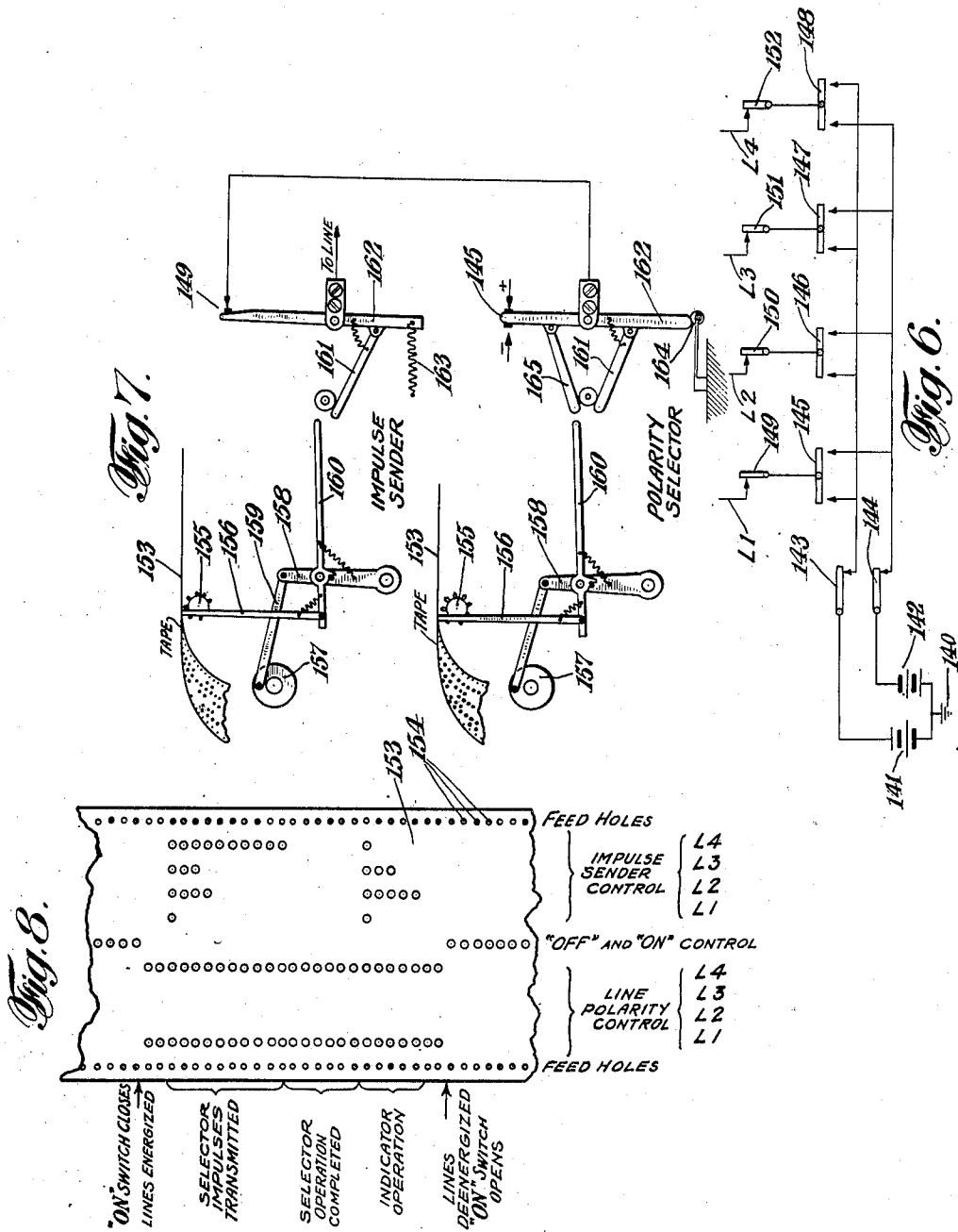
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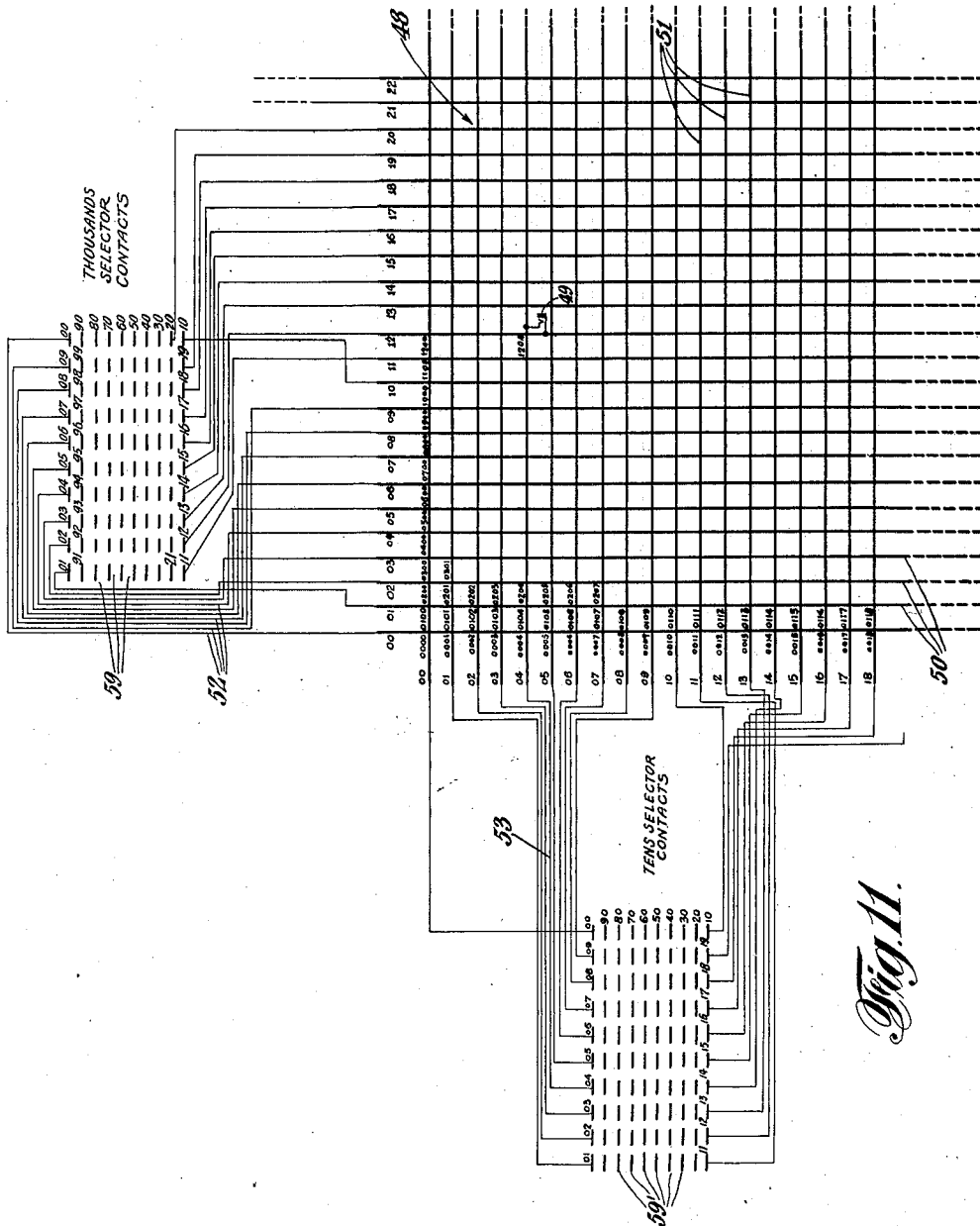
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Original Filed Jan. 6, 1928 8 Sheets-Sheet 7



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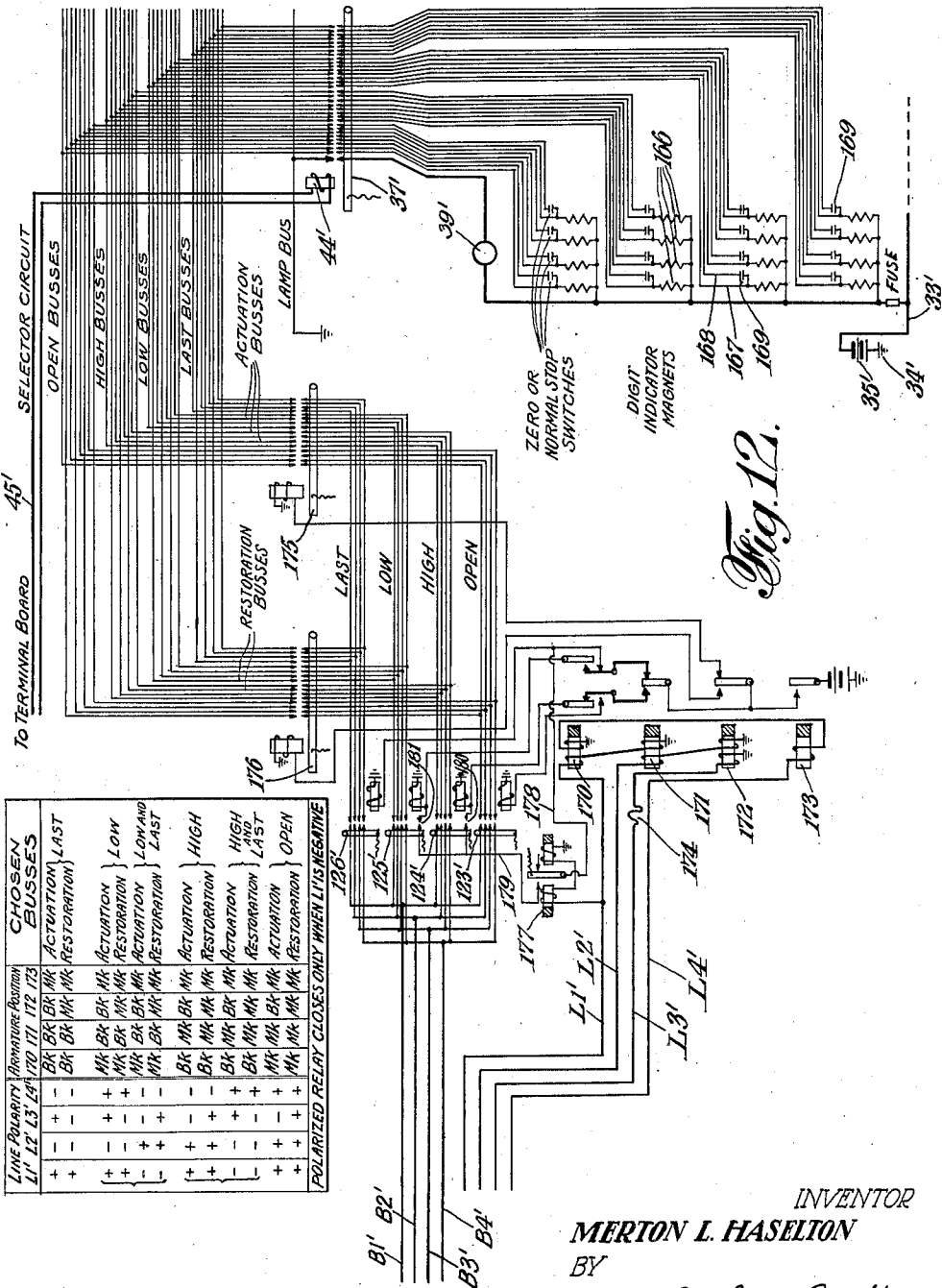
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UNITED STATES PATENT OFFICE

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WARE

ELECTRICAL SIGNALING

Application filed January 6, 1928, Serial No. 244,873. Renewed May 6, 1932.

This invention relates to electrical signaling and more particularly to signaling apparatus and methods whereby distinctive current variations representative of certain information may be transmitted from a central point or points to one or more receiving stations at which the information is to be displayed or posted or otherwise made available for use.

The invention according to one of its phases, although not restricted thereto, is particularly adaptable to the transmission of varying stock or commodity price quotations from a central point such as a stock exchange, to a plurality of brokers' offices, at each of which, quotations of stocks which are there of particular interest may be automatically posted on a bulletin board, the information being preferably made available, generally speaking, in the same arrangement as with the conventional types of manually attended stock boards, or "black boards" as heretofore used. However, with the apparatus of this invention the posting of quotations may be accomplished with greater rapidity and accuracy than with stock boards which are manually attended and in addition a substantial saving of labor is made possible since the equipment for numerous brokers may be operated from the central point by a single operator or group of operators.

The objects of my invention include the provision of apparatus of the above indicated class which will be adaptable with a wide degree of flexibility to various operating conditions and which will be accurate, rapid and dependable in operation.

Further and more specific objects, features and advantages will clearly appear from the following description taken in connection with the accompanying drawings and claims which form a part of this specification.

The invention comprises the novel signaling methods, features, circuit arrangements, and combinations of circuits and parts as hereinafter described, but by way of example only, as illustrative of certain preferred embodiments of the invention.

In the drawings Fig. 1, which extends over sheets numbered one, two and three, com-

prises a schematic diagram of the circuit arrangements, comprising one embodiment of the invention.

Fig. 2 is a perspective view showing somewhat schematically the operating parts and associated electrical connections of selecting mechanism such as may be used in the circuit arrangements of Fig. 1;

Fig. 3 illustrates a supplementary selecting device which may be used in connection with the mechanism of Fig. 2;

Fig. 4 illustrates an arrangement of contacts such as may be used in the device of Fig. 3;

Fig. 5 is a diagram of certain electrical connections running from the device of Fig. 3;

Fig. 6 schematically illustrates one form of transmitting circuit arrangement which may be utilized in connection with the circuits of Fig. 1;

Fig. 7 illustrates one example of transmitting device which may be used in connection with this invention;

Fig. 8 shows a section of transmitting tape having distinctively arranged perforations representative of quotations of various items, the perforations being arranged to cooperate with the mechanism of Fig. 7 to transmit the necessary current variations to actuate the apparatus;

Fig. 9 illustrates one example of a group of indicator units such as may be used for one quotation of four digits;

Fig. 10 is a sectional view of an indicator taken substantially along line 10—10 of Fig. 9;

Fig. 11 is a wiring diagram supplementing that of Fig. 1;

Fig. 12 shows a modification of the circuit arrangements of Fig. 1;

Fig. 13 shows the details of a modified form of circuit arrangement involving the invention in one of its phases.

With the conventional forms of manually attended brokers' boards, provision is ordinarily made for posting the quotations of numerous stocks, commodities, or other items, each quotation generally comprising four digits, namely, the hundreds, tens, units and a fraction value. The brokers' customers are

generally desirous of knowing the "open," "high," "low," and "last" quotations for each stock or item, and accordingly it is customary to provide space for such quotations, that is, for a total of 16 digits in all for posting the quotations of a single stock or other such item. It has heretofore been the custom of brokers to post quotations for a number of stocks in the neighborhood of one hundred or more, although a much larger multitude of stocks and commodities are dealt in on the various exchanges of the United States. However, each broker is ordinarily particularly interested in posting only the quotations of a chosen list of stocks and commodities, such list including a limited number of items which are of universal interest and also a number of more or less inactive stocks or stocks of lesser importance which are dealt in by the brokers' customers, or stocks to which the broker desires to direct particular attention. In order that the broker need not have a multitude of indicators providing for the quoting of all of the large number of listed stocks, a method and apparatus such as disclosed in the patent to Robert L. Daine, No. 1,658,516, dated February 7, 1928, may be utilized whereby each broker requires only a relatively limited number of indicating devices which will more conveniently fit into the limited space such as is ordinarily available in brokers' offices in the financial districts. Such indicators are arranged to be interchangeably connected to a terminal board so as to post any chosen small number of stocks which the broker may select from the large list for which service may be supplied to him by the use of the apparatus of this invention.

In order to electrically control the indicators at a plurality of brokers' offices from a distant point it is economically impracticable with the prevailing line wire costs, to provide separate line connections for giving quotation service for each of the multitude of listed stocks. Accordingly, it is desirable to provide means for sending current variations representative of the quotations of numerous stocks over a relatively small number of line wires, and to provide selecting means at each broker's office to identify the quotations of particular stocks and to prepare the corresponding indicators for energization. However, in thus reducing the number of line wires to a relatively small number, special attention must be directed to the necessary rapidity of operation of the indicators. Taking into the account the reasonable future requirements, provision should now be made in an apparatus of this class for sending quotations for more than a thousand different stocks or items, each of which must be individually identified by the selecting means. After such identification four digit indicators preferably should be actuated to show a particular quota-

tion, and in the event that the "high" or "low" quotations are to be simultaneously set up then as many as eight digit indicators may be actuated. With stock market transactions conducted at the present rate, provision must be made for transmitting from 30 to 60 new quotations per minute. Such speed of operation of a multitude of indicators at different offices, but all selected and actuated in a dependable manner over a relatively small number of line wires, necessarily requires novel circuit arrangements which have no counterpart in other classes of signaling apparatus.

According to my invention I have found it desirable to provide for each unit of signaling apparatus four line wires, or equivalent "impulse channels" which are associated with a common ground return circuit, and may be utilized first to simultaneously operate four selecting devices for choosing one particular stock to be quoted. Thereafter the same four line wires or "impulse channels" may be conveniently utilized to simultaneously, but independently actuate the four digit indicators of a particular quotation, that is, for example, the hundreds, tens, units, and fractional digit indicators if all of these need to be changed. Furthermore, if desired, the number of line wires may be further reduced by utilizing the well known principles of multiplex telegraphy whereby the current variations, in lieu of being transmitted over the four wires or a larger number of wires, may be transmitted over a single wire with a "ground" return or an equivalent return wire through the use of synchronous transmitting and receiving distributors at the sending and receiving stations. Such multiplex transmission may be found to be particularly desirable in instances where the line wires extend between widely spread cities. Such devices as used in high speed telegraphy may be utilized for this purpose, and since the construction of the same is well understood in the art the same will not be here described. However, one form of multiplex apparatus and arrangements for applying same, applicable to the subject matter of this invention in certain of its phases, are disclosed in the co-pending application of Ernest Frischknecht and Jean Abegglen, Ser. No. 258,219, filed March 1, 1928.

In some instances in order to provide the necessary speed of operation two sets of transmitting and receiving apparatus may be utilized, the two sets being substantially duplicates, and in the event that the line wires or other parts of one set become injured, service may be maintained on the other set. At other times the list of items may be apportioned between the two sets.

The current variations or impulses for selecting and actuating the indicators may take either the form of positive spaced impulses, or

may be in the form of undulations or interruptions in a sustained potential applied to the line wires. With the particular form of selecting devices described in connection with the example of the invention here disclosed the latter method is followed, that is, the distinctive current variations comprise short interruptions or reductions in the line wire potential. The selecting devices may be constructed with a sufficient number of contacts so as to select not only the desired stock but also the particular quotation as the "open", "high", "low" or "last", which has to be changed, or on the other hand only a smaller number of selector contacts need be provided where the selectors merely choose the particular desired stock. According to the embodiment of my invention here described, I have provided means whereby one of the quotations, either "open", "high", "low" or "last" is selected merely by the polarities of the several line wires. That is, the sustained potential applied to each line wire may be relatively positive or negative in respect to the other line wires, and accordingly, numerous combinations of polarities may be obtained, sufficient in number to readily choose between the "open", "high", "low" and "last" indicators, thus materially reducing the work to be done by the selecting devices and the time necessary for the operation thereof.

The method of using a maintained line potential not only simplifies the selecting problem in this manner but also makes possible in a simple manner the use of an adaptation of the well known "Strowger" "up and around" selecting devices as are well known in the art of automatic telephony switching. The construction and operation of such selectors is set forth in detail, for example, by H. H. Harrison in his book entitled "Automatic Telephony" published in 1924 by Longmans, Green & Co., and also by R. G. Kloeffler in "Telephone Communication Systems," Macmillan Co., 1925, Chapter XIV, and accordingly the constructional details of such selectors will not be here fully described, although such features as are necessary to adapt the same to my invention are hereinafter fully disclosed. Since this type of selector automatically restores itself to a normal position upon any extended interruption of the line potential, such selectors are particularly desirable for use with this invention inasmuch as such restoration to normal after each operation substantially precludes all possibility of cumulative errors or false quotations on the multitude of indicators. Furthermore, the circuits of such selections, as will be hereinafter further explained may be adapted to effect restoration to a zero or normal position, such indicator units as have been selected, and to connect such units to operating busses for actuation immediately upon completion of the selecting and restoration steps.

The circuit arrangements of Fig. 1 for the embodiment of the invention there shown will now be described together with the functions and construction of the various elements of the apparatus.

Indicating units

The indicating units per se may be arranged in sectional cabinets or otherwise, one desirable construction and arrangement being illustrated in the copending application of Robert L. Daine and René Guyé, Serial Number 246,474, filed January 13, 1928. Each of the digit indicators as explained in the said application may comprise a rotatable drum having on its periphery a series of characters, such as the figures one to nine, a blank space and zero, or various fraction characters, such drums being rotatable step-by-step in one direction by an electromagnet whereby the desired characters may be exhibited at the front of the board. Such indicators may be restored to zero or normal either by further step-by-step rotation, or if desired they may be more quickly restored to normal by suitable springs releasable by the operation of a trip magnet. The constructional features of a group of such indicators are schematically shown in Figs. 9 and 10 and will now be described.

The rotatable drums bearing the digits are indicated at 20 and may be rotatably mounted in respect to a shaft 21 which in turn may be mounted in bearings 22 and 23. Each of the drums 20 may be provided with an operating star wheel as at 24 fixed against rotation in respect to the drum as by a slot and pin connection 25. The star wheels 24 may by the use of collars as shown at 24' be fixed against longitudinal movement in respect to the shaft 21 but are free for rotational movements in respect thereto, and are also free for only a limited longitudinal movement in respect to the drums 20 by reason of the connections 25. Each of the star wheels 24 may cooperate with an actuating fork as at 26 pivoted at 27 and having an armature 28 acted upon by actuating magnets as at 29, whereby impulsive energization of the magnets will cause the corresponding drums to be advanced step-by-step in one direction and against the action of spiral springs as in 30, one of which is provided within each indicator drum. One end of the spring 30 may be suitably connected to the indicator wheel as indicated at 30a Figs. 9 and 10, and the other end may be anchored to a stationary indicator guide 30b which, if desired, may be secured to the casing or to any stationary part to hold the indicator against lateral displacement as the shaft 21 and ratchet discs 24 are shifted to the right in Fig. 9. The digit indicators may thus be mounted in groups, one group for each quotation comprising four units which are individually and simultaneously operative by the various elec-

tromagnets 29. So long as the star wheels 24 are in engagement with the forks 26, the springs 30 are precluded from acting to restore the drums to normal. However, when the star wheels are taken out of engagement with their forks, the springs are free to immediately restore their respective drums to a normal setting. In order to move the star wheels out of engagement with the forks, it is merely necessary to move the shaft 21 longitudinally through a short distance and this may be accomplished by a tripping magnet as at 31, acting through an armature 32 connected to the shaft in a manner obvious from the drawings. Accordingly when the tripping magnet 31 is energized, the four indicating drums for one quotation may be at once simultaneously restored to normal in preparation for a new setting.

It may be here noted that such restoration to normal is particularly advantageous with this apparatus, inasmuch as cumulative errors in succeeding quotations are thereby avoided, and furthermore the operator in controlling the system need not take the necessary time to examine the setting for the previous quotation before taking the necessary steps to post the new quotation. Subtraction or adding of quotation values and the possibility of errors in so doing are thereby eliminated, with a considerable saving of time. Other suitable forms of digit indicators are disclosed and claimed in my copending application, Serial Number 276,883, filed May 11, 1928. And other indicating units of this general type are disclosed in the patent to Farvarger, 1,787,620, dated January 6, 1931.

In Fig. 1, sheet three, it will be noted that the actuating magnets 29 are schematically indicated in sub-groups of four, such sub-groups also being arranged in groups of four so as to provide for the indicators showing the "open", "high", "low" and "last" quotations for each stock. Also in this figure one of the tripping magnets 31 will be noted adjacent to each of the sub-groups of four. All of the magnet coils 29 and 31 as shown may have one terminal connected to a common return bus as at 33 which in turn may be grounded at 34 through a source of current 35. The opposite terminals may be provided with individual lead wires as at 36. The lead wires 36 for each stock may extend to a twenty-one contact relay as at 37, there being twenty magnet coils including the actuation coils and tripping coils, requiring twenty lead wires for each stock or other item, an additional lead wire 38 being provided, if desired, to energize an indicating lamp 39 which may be lighted during actuation of the indicators for the particular stock chosen. Such lamps serve to attract attention to the part of the broker's board where quotation changes are taking place. The relays 37 serve to connect the various groups of lead wires

36 respectively to groups of "open", "high", "low" and "last" control busses 40, 41, 42, and 43. Relays 37 are normally open, but upon the choosing of a particular stock, by the selecting devices hereinafter described, the corresponding relay 37 will be actuated by reason of the energization of the relay magnets as at 44. The terminals of the relay magnets 44 may be connected to selector circuits as indicated at 45. The relays 37 when actuated also serve to connect the lead wires 38 of the lamps 39 to a common lamp bus 46 which may be grounded as shown. One lamp terminal is therefore grounded whenever the corresponding relay is actuated, the other lamp terminal as shown may be connected with the common return bus 33. Therefore whenever a relay 37 is actuated, the battery 35 acting through the ground 34 will cause the corresponding lamp 39 to be lighted.

Interchangeable selector circuit arrangement

As above stated, in the aforementioned patent of Robert L. Daine, means are disclosed whereby a limited number of digit indicators may be provided with interchangeable connections cooperating with the much larger number of terminals identified with a multitude of stocks or other items. The use of such an arrangement is here illustrated in the drawings somewhat schematically at the upper part of Fig. 1, sheet two.

The selector circuits 45 above referred to, may each be provided with quick-detachable plugs as at 47. It will be understood that although only five of the selector circuits 45 and indicators for four stocks are shown for simplicity on sheet three, a complete assembly of the apparatus would embody a number much greater than four. If desired the circuit wires 45 may be extended to a considerable distance away from the indicator board, as for example to a special compartment or closet in the broker's establishment. In such a separate compartment a switch board as at 48 may be provided with a number of terminal jacks 49 equal to or substantially equal to the total number of listed stocks or commodities for which quotation service is transmitted. The switch board 48 may be provided with a plurality of vertically extending busses 50 and also a plurality of horizontally extending busses as at 51. It will be noted that one of the terminal jacks 49 is provided at the intersection of each vertical bus with each horizontal bus. As will be hereinafter described, one set of selecting devices may be provided to choose any one of the numerous vertical busses, whereas another and separate set of selecting devices may be provided to choose any one of the horizontal busses, such groups of busses respectively being electrically connected to the selecting devices by multi-wire cables as at 52 and 53. Accordingly the two sets of selectors

may conjointly act to choose any desired one of the terminal jacks 49 to the exclusion of the others. Although but a relatively small number of vertical and horizontal busses 50 and 51 are indicated in the drawings, as many as one hundred vertical busses and one hundred horizontal busses may be conveniently installed and controlled by suitable selectors such as hereinafter described. Such a number of busses, it will be observed will provide for a total of ten thousand terminal jacks, or in other words provision may thus be made for ten thousand stocks or other items. On the other hand, with the plug and jack arrangement only a relatively limited number of indicators and indicator circuits equal to a small number of stocks chosen for posting by each broker need be provided, and yet the plugs and jacks may be made interchangeable to afford great flexibility of service. Also according to my invention, although the indicator units for each stock may require numerous lead wires and busses, the circuit connections to the interchangeable plugs require no more than two wires, and accordingly the multitude of terminal jacks may be mounted in a relatively small space and the plugs may be of a conventional size and easy to manipulate. It will be understood that whenever a particular terminal jack 49 is selected and energized, providing there is a plug inserted in such jack, the corresponding relay 37 will be energized, whereupon all of the indicator units for the stock or item corresponding to such relay will be connected to the actuating busses 40, 41, 42 and 43.

Selector mechanism

As above noted, four line wires may conveniently be utilized and these are designated by the characters L1, L2, L3 and L4 (see Fig. 1, Sheet one). The selector mechanism as shown on sheet one may conveniently be grouped into four parts, each part being respectively controlled by one of said line wires. These parts of the selector mechanism may be designated respectively as the thousands, hundreds, tens and units selectors. The thousands and hundred selectors are arranged to select over the multi-wire cable 52 any desired one of the vertical busses 50, whereas the tens and units selectors are arranged to select, over the cable 53, any desired one of the horizontal busses 51. In addition the thousands selecting mechanism, after completing its selecting action serves to bring the line wire L1 into operative relationship with an indicator operating bus B1 which bus as will hereinafter be further explained, carries the impulses for controlling the hundreds digit indicator of the quotation selected. The hundreds selector mechanism serves, after completing its selecting operations to bring the line wire L2 into operative relationship with indicator oper-

ating bus B2 over which the tens digit indicators are actuated. The tens selector mechanism after completing its selecting function, brings the line wire L3 into operative relationship with indicator operating bus B3, over which the control of the units digit indicators is accomplished. Lastly, the units selector mechanism, after completing its selecting operations serves to bring the line wire L4 into operative relationship with indicator operating bus B4, over which the fraction digit indicators are actuated as will hereinafter be more fully explained.

The tens selector mechanism in addition, after completing its selecting operations, opens a bus R after the return to normal of the particular indicator units selected has been effected.

The moving parts of a selecting device such as may be used for the thousands and tens selectors are illustrated diagrammatically in Fig. 2. A rotatable and vertically movable shaft is indicated at 54. This shaft is normally urged by a spring 55 toward a position of rest in the direction indicated by the arrow. The shaft is also normally brought to rest by gravity in its lowermost position. A wiper having two contact arms 56 and 57 is secured to the lower end of the shaft 54 and is designed to engage with the chosen pair of a group of one hundred pairs of selector circuit contacts, each pair comprising a control contact as at 58 and an indicator contact as at 59 for engaging, respectively, the control wiper 56 and the indicator circuit wiper 57. It will be noted that the contacts 58 and 59 may be arranged in the customary cylindrically shaped bank, ten vertical tiers of contact pairs being provided, each tier having ten pairs of contacts. Each of the indicator contacts 59, respectively is brought into electrical connection by the lead wires 52 with one of the vertically extending terminal board busses 50. (See Sheet 2.) The manner in which such connections may be made is more fully shown in Fig. 11, which will be hereinafter described in further detail. The control contacts 58, respectively, are electrically connected through the lead wires 60 to proper corresponding contacts 61 located on the hundreds selector device. Through the connections 60 the thousands selector functions as a major selector and the hundreds selector as a minor selector, and as will be further explained, the tens selectors and units selectors, respectively, bear the same relationship.

Reverting to the mechanical features of Fig. 2, rotating magnets 62 are provided with an armature 63, which, acting through a supporting arm 64 and a spring pressed pawl 65, serves to rotate the shaft 54 against the action of the spring 55 with a step by step movement, the pawl 65 engaging a ratchet wheel or toothed portion 66 of the

shaft. The arm 64 is also provided with a switch operating branch arm 67 so that whenever the magnets 62 are energized contacts 68 and 69 are separated so as to break any circuit there-between. The step by step vertical movement of the shaft is effected by the action of the vertical magnets 70, which act through an armature 71. The arm 72 carries a spring pressed pawl 73, which is arranged to engage the ratchet portion 74 of the shaft so as to move the shaft upwardly whenever the vertical magnets 70 are impulsively energized.

The shaft 54 may be provided with an enlarged portion 75, which, when the shaft is in its lowermost and normal position, engages a switch operating bell crank 76. The bell crank 76 serves to operate two sets of switch contacts 77 and 78, which contacts correspond to those known as "off normal switches" in the machine switching art. These two switches may be connected by an insulating piece 79 so that the two operate together, and whenever the shaft 54 is in its lowermost or normal position these two switches are both in open circuit position but as soon as the vertical magnets raise the shaft as much as one step upwardly both switches 77 and 78 move to circuit closing positions. A double dog 80 may be pivotally mounted in a suitable manner such as indicated and has two arms 81 and 82, respectively, for engaging the toothed portions 66 and 74 of the shaft 54 so as to follow up the pawls 65 and 73, respectively, and retain the shaft temporarily in the angular and vertical position into which it is brought by the rotating and vertical magnets, respectively. The double dog 80, however, is under the control of the release magnet 83, having an armature 84. The armature 84 is operatively linked as at 85 with the dog 80 in a manner whereby energization of the magnet 83 effects the release of the double dog, permitting the shaft 54 to rotate to normal angular position and to drop into normal vertical position, the pawls 65 and 73 being normally held out of contact with the shaft.

Features of construction of the selector device of Fig. 2 which are not herein specifically or fully shown and described may be provided according to the practice followed in the telephone switching art and as more fully set forth in the textbooks above mentioned.

Referring to the circuit arrangements shown in Fig. 1, Sheet 1, and particularly the thousands selector, the various magnets and switching parts, the functions of which are above described, are there indicated by corresponding reference numerals. In addition, a plurality of relays 86, 87, 88, 89 and 90 may be associated with this selecting device. Certain of these relays are quick act-

ing, both at the "pick up" and at the release thereof. The armatures of others are provided with copper slugs in a manner well known in the art so as to render the relays slow to operate. These may be distinguished by the symbols as set forth on Sheet 1. As is well known, a copper slug on the relay magnet core may be placed on the end nearest the armature to effect a delayed "pick up"; conversely, if a slug is placed on the magnet core end opposite from the armature, (the "heel" end), the "pick up" action may be rapid but the release action will be delayed. These two types it will be noted have been symbolically distinguished in Fig. 1 by the use of cross hatched and black armature portions.

The operation of the circuits of the thousands selector will now be described. This selector, as above stated, is operated over line wire L1, while its rotary motion is controlled by the hundreds selector, which is actuated over line wire L2. As above explained in connection with Fig. 2, the vertical magnets 70 and the rotary magnets 62, respectively, are designed to bring the switch wiper arms 56 and 57 first to the proper vertical position and then to the proper angular position, so that the wipers will engage the desired pair of contacts 58 and 59. If the line wire L1 is energized with a maintained potential, for example, fifty volts, relay 87 picks up and causes the relay 88 to be energized through a circuit, including the ground and battery as indicated, the magnet of relay 88, the "make" spring of relay 87 to ground. Relay 88 thereupon prepares but does not complete an additional circuit for the reception of subsequent impulses. This circuit comprises the ground and "make" spring of relay 87, the "make" spring at 91 of relay 86, the "make" spring at 92 of relay 88, the magnet coil of series relay 89, the coil of vertical stepping magnet 70 to battery and ground.

At the transmitting station current variations may be sent out in the form of undulations or drops in the potential maintained over the line wires, but for the purposes of operating a selecting device such drops of potential are of such short duration that the "slow to release" relays, as at 88 and 89, are unaffected thereby. The first of such impulses causes the relay 87 to release momentarily, thus closing the circuit last described above, causing the series relay 89 to be energized and also the vertical stepping magnet 70 which advances contact wipers 56 and 57 upwardly one step. Concurrently, the relay 89 picks up, and also the off normal switches 77 and 78 become closed, the switch 78 closing a circuit through relay 90 which picks up.

The circuit of relay 90 comprises ground, battery, "make" spring 93 of relay 88, magnet coil of relay 86, together with a non-inductive resistance 94 in parallel therewith, "break" 13

spring 95 of relay 86, switch contacts 68 and 69, off normal switch 78, magnet winding of relay 90, to ground. It should be here noted that relay 86 is so constructed in connection with the parallel resistance 94 that this relay does not pick up when in series with the relay 90, as in the circuit just described. Relay 90, as operated by the circuit just described, picks up and prepares a circuit through the rotating magnets 62, which, however, is not complete, being broken at the "break" contact 96 of relay 89 until such time as the last of the group of impulses is received, when, as hereinafter further explained, the relay 89 releases and completes the circuit picked up by relay 90. This circuit comprises ground battery, "make" spring 93 of relay 88, "break" spring 96 of relay 89, "make" spring of relay 90, rotating magnet 62, thence to the "off normal" springs of the hundreds selector, which will be hereinafter further described in detail, "break" spring at 98 of relay 99 of the hundreds selector, "make" spring at 100 of relay 101 of the hundreds selector, to ground.

This circuit is not completed in the hundreds selector until the series of impulses on the line wire L2 has been completed, as hereinafter explained, the circuit remaining open either at the "off normal" spring 97 or the "break" spring 98. Consequently, the rotating magnets 62 are not energized until the hundreds selector has completed its motion, and therefore the thousands selector wipers are also not rotated until such time. Upon completion of the movement of the hundreds selector, however, the rotating magnet 62 causes the thousands selector shaft to be rotated through an angle equivalent to one step, which places the wipers 56 and 57 in engagement with a pair of contacts 58 and 59 in the first vertical tier. Meanwhile, however, the vertical step by step movement of the thousands selector shaft has been completed by successive impulses acting upon the vertical magnet 70 so that the wipers are brought into engagement with the contact at the selected level in the thousands selector. At the same time that the rotating magnets 62 receive the first impulse the closing circuit of relay 90 is broken by the "break" springs of magnet 62, that is, contacts 68 and 69, and thereupon relay 90 opens the holding circuit of rotating magnet 62 by breaking such circuit at the "make" spring of relay 90. The magnet 62 therefore releases the contact 68 and in so doing again closes the circuit of relay 90 at the contacts 68 and 69.

Assuming now that there is no ground connection at the control contact 58 in the first tier thus engaged by the wiper 56, then relay 90 again picks up through the same circuit as formerly. Thus the rotating magnet 62 and relay 90 alternate, in picking up and releasing, and cause the wiper contacts 56 and 57 to

be rotated until the control wiper contact 56 comes to a control contact 58, which is grounded, such grounding having been effected by the operation of the hundreds selector through one of its control contacts 61, as is hereinafter further explained in connection with Fig. 5. When the control wiper thus encounters a grounded contact 58, the relay 86 is immediately picked up through the circuit comprising ground, battery, "make" spring 93 of relay 88, relay 86, control contact 58, circuit connections 60, one of the control contacts 61, to ground. This same ground, through the control contacts and wipers, short circuits relay 90, which is thereby prevented from again closing the circuit through the magnet 62, thus stopping the rotary motion of the wiper contacts 56 and 57. The relay 90 has one of its terminals constantly grounded, as shown, while its other terminal becomes then grounded through the "off normal" switch 78, switch contacts 68 and 69, "break" spring 95, control contacts and wipers and contact 61 at the hundreds selector.

It may be further explained that the relay 86 performs three functions, namely: first, it picks up and opens the circuit through the "break" spring 95 as an additional precaution precluding further actuation of the rotating magnet 62 in cooperation with the relay 90; second, relay 86 causes its "make" spring at 91 to prepare a circuit to the first indicator operating bus designated by the character B1, such circuit being as follows,—ground, "break" spring of relay 87, "make" spring at 91 of relay 86 to the indicator operating bus B1. Consequently, after the selecting operations are completed, any further short current interruptions or potential drops over the line wire L1 are transferred by the action of the relay 87 to the indicator bus B1 in the form of positive impulses, having no further effect upon the selector. Thirdly, the relay 86 when it picks up completes a circuit through its "make" spring at 102, the circuit comprising ground, battery, "make" spring 102, indicator wiper 57 and the corresponding circuit connection 52, thence to the terminal board as described in connection with Sheet 2, this latter circuit comprising the circuit over which the chosen stock is identified on the terminal board.

During the above described selecting operations, it will be observed that the relay 88 being a relay slow to release, has been closed continuously since the initial energization of the line wire L1 as it is not responsive to short impulses. The potential is maintained with short interruptions only on the line wires L1 and L2 from the time the selecting operations are initiated until not only the selection is completed, but the actuation of the chosen indicators is completed. Therefore the hundreds and thousands selectors may be re-

leased merely by the removal of the potential from the line wires L1 and L2. Such removal of the potential in the case of the thousands selector causes the relay 87 to be released a sufficient length of time to also effect the release of the relay 88. This action establishes a circuit through the release magnet 83 as follows: ground to "break" spring of relay 87, to "break" spring at 91 of relay 86, "break" spring at 92 of relay 88, "off normal" switch 77, release magnet 83, to battery and ground. The release magnet 83 when thus energized releases the double dog 80, as explained in connection with Fig. 2, and the selector shaft 54 is rotated as above stated, by the spring 55, and also drops by gravity, to normal position. Concurrently, with the release of relay 88, relay 86 is released, as its holding circuit is broken at the "break" spring 93 of relay 88. The thousands selector is therefore now ready to receive a further series of selecting impulses.

The hundreds selector may take the form of a simple rotary step by step switch as shown in Figs. 3 and 4. This switch may be provided with ten contacts, as at 61, positioned on an insulating support member 103 in an arcuate arrangement for cooperation with a wiper contact member 104 rotatably mounted upon a shaft 105. Beneath the contacts 61 a pair of segmental contact strips 106 and 107 are provided, insulated from each other and arranged to cooperate respectively with wiper contacts 108 and 109, also mounted to rotate with the shaft 105. The cooperating contact 106 and wiper 108 comprise the hundreds selector "off normal" switch 97 hereinabove mentioned, whereas the cooperating contact 107 and wiper 109 comprise an "off normal" switch 110, as indicated at the hundreds selector on Sheet 1.

The segmental contacts 106 and 107, as indicated by the dotted lines in Fig. 3, are co-extensive with the arcuate group of ten contacts 61, whereby contact is made with the segments 106 and 107 whenever the switch moves from its normal position, as shown in Fig. 3. The shaft 105 may be provided with a ratchet segment 111 engaged by an actuating pawl 112 which in turn is operated by a rotating magnet 113 having an armature 114 operatively connected to the pawl 112 in a manner readily understood from Fig. 3. The rotating magnet 113 is thus enabled to advance the wiper contacts 104, 108 and 109 together, with a step by step movement and against the force of the restoring spring as at 115. During such step by step movement the holding pawl 116 functions to prevent the spring 115 from restoring the wiper arms to normal. However, after the selecting and actuating operations are completed in the system, a release magnet 117 becomes energized, as will be hereinafter explained, which magnet retracts the holding pawl 116, permitting

the spring 115 to restore the switch to neutral or normal position. Further constructional details of step by step switches such as that of Fig. 3 may be found in chapter 2 of H. H. Harrison's book on "Automatic Telephony" above cited.

The operation of the electrical circuits pertaining to the hundreds selector will now be described. The function of this selector in effect is to provide a storage means for the impulses sent over line wire L2, which storage is effective until the thousands selector wiper contacts have arrived at the desired elevation in a position ready for angular or rotational movement. The hundreds selector thereupon controls the starting and stopping of such rotation of the thousands selector wiper contacts so that the same are brought into engagement with the desired pair of indicator and control contacts 58 and 59. The electrical operation of the hundreds selector is similar to the operation of the part of the thousands selector which accomplishes the vertical movement. When a potential (for example, 50 volts) is applied to the line wire L2, the line relay 118 is energized and picks up thereby, also causing the relay 101 to be energized over the following circuit: ground, "make" spring of relay 118, magnet winding of relay 101, to battery and ground. The relay 101 when thus actuated prepares but does not complete an impulsing circuit through rotating magnet 113 as follows: ground, "break" spring of relay 118, "break" spring of relay 119, "make" spring at 120 of relay 101, magnet coil of relay 99, to the winding of rotating magnet 113, thence to battery and ground. Upon the occurrence of the first current variation, that is, a drop in voltage of short duration occurring on the line wire L2, the line relay 118 is momentarily released, which completes the prepared circuit through the rotating magnet through relay 99 by reason of the closing of the "break" spring of the relay 118. The first short current variation therefore causes the rotating magnet 113 to rotate the shaft 105, and the wipers 104, 108 and 109, through an angle comprising one step. Concurrently, by reason of such angular advances of the wipers 108 and 109, the "off normal" switches 97 and 110 are closed. Since the rotating magnet circuit runs through relay 99 this relay is also energized. Since the relays 101 and 99 are of the slow releasing type, as indicated, they will remain in "picked up" condition while a series of current variations are being received. The succeeding current variations or impulses therefore will cause the rotating magnet 113 to advance the wipers through the desired angle to bring the wiper 104 into contact with a desired one of the contacts 61.

When this is accomplished and the series of impulses is completed the slow acting relay

99 will be released, permitting the circuit to be closed from a ground to the rotating magnet of the thousands selector as follows: ground to "make" spring 100 of relay 101, "break" spring 98 of relay 99, "off normal" switch 97 to the rotating magnet of the thousands selector as above described. This same circuit is also branched to relay 119 of the hundreds selector whereby, concurrently with the energization of the rotating magnet of the thousands selector, the relay 119 will be energized through the battery and ground, as indicated, adjacent thereto. The relay 119 in turn will, upon picking up, prepare an impulsing circuit from the "break" spring of relay 118 to indicator operating bus B2, as above referred to, and accordingly a further series of impulses as sent over the line wire L2 will be transferred to the indicator operating bus B2 and have no further effect upon the selecting devices. The circuit to the operating bus B2 is as follows: ground, "break" contact of line relay 118, "make" contact of relay 119, indicator operating bus B2 to the selected indicator or indicators, thence to battery and ground, as shown on Sheet 3 of Fig. 1.

The construction, operation and circuit arrangements of the tens selector and units selector, respectively, are the same as of the thousands selector and hundreds selector, corresponding parts being designated with the same numerals accompanied by prime marks. It will be understood that current variations sent over the line wires L3 and L4, respectively, serve to operate the tens and units selectors in the same manner as current variations on line wires L1 and L2 are utilized in connection with the thousands and hundreds selectors, and that the tens selector serves to establish, as above referred to, an impulsing circuit connection for indicator operating bus B3, while the units selector establishes a circuit connection for the indicator operating bus B4. The tens selector circuit arrangement is provided with an additional relay 121 for restoration to normal of the selected indicators prior to actuation thereof.

It will be noted that this relay is interposed in the circuit running from the "make" contact 102' to the selected indicator contact 59', and accordingly as soon as the indicator contact 59' is selected and engaged by the indicator wiper, the relay 121 is energized. However, it will be noted that relay 121 is shown as a relay which is slow to pick up as well as slow in releasing. Accordingly, after a current is established through the chosen contact 59', the twenty-contact relay 37 corresponding to such chosen contact will have ample time for actuation before the relay 121 picks up. As soon as the twenty-contact relay 37 of the chosen stock is actuated to connect in circuit the indicating units of such stock, a current will be established through the zero restoration bus R and the "break" contact

122 of relay 121. (A portion of this circuit will be hereinafter further described in connection with Sheet 2.) However, after a short interval the relay 121 will pick up, causing the zero restoration circuit to be opened at contact 122, but in the meantime the zero restoration magnets 31 will have tripped the indicating units, allowing the same to be restored to a normal position ready for reactivation over the indicator operating busses B1, B2, B3 and B4.

Upon completion of the operation of the thousands selector, it will be noted that the contacts at 102 serve to apply a battery and ground connection to the desired selector circuit connection 52 by way of the selected contact 59. Accordingly a battery and ground connection is thus applied to the selected vertical bus on the terminal board 48. On the other hand, it will be noted that upon completion of the selecting operations by the tens selector, the contact 102' serves only to apply a ground connection to the chosen selector circuit connection 53. That is, the selected horizontal terminal board bus is accordingly grounded whereby the chosen multicontact relay 37 will be provided with an energizing circuit extending from the battery and ground at contact 102, through the terminal board and multicontact relay, back through the terminal board and to the ground applied at contact 102'.

The circuit for relay 121 starts from the battery at the left of the thousands selector and continues over contact 102, contacts 57, 59, line 52, one of the pair of lines 45, relay 44, the other line 45, line 53, contacts 59', 57', relay 121, and contact spring 102' to ground. This circuit is completed after the thousands and tens selectors have completed their selection of lines 52 and 53.

"Open", "high", "low", and "last" selection

Referring to Sheet 2, the groups of "open", "high", "low" and "last" busses 40, 41, 42 and 43 are each provided respectively with circuit closing relays 123, 124, 125 and 126, each of such relays having five contacts, four of which correspond respectively to the circuits of the four digit indicating units and the fifth contact providing for the connection of the restoration bus R to the selected restoration magnet 31. That is, the hundreds, tens, units and fraction busses B1, B2, B3 and B4 may be connected by the relays 123, 124, 125 and 126, respectively, to either the "open", "high", "low" or "last" busses. As has been above explained briefly, the choice as between these four groups of busses is determined by the polarity of the potential initially established on the four line wires L1, L2, L3 and L4. These four line wires are connected to operating coils of three relays, as indicated, at 127, 128 and 129. As shown, the line wire L1 may be connected to one coil of the relay

127, the other terminal of such coil running to one coil of the relay 128 and thence to ground. The line wire L2 may pass through a compensating resistance 130 and thence through another coil of the relay 127 to ground. The line wire L3 may run through a compensating resistance 131, thence through a second coil of relay 128, to ground. The line wire L4 may run through a single coil of the relay 129 and thence to ground. The action of the relays 127, 128 and 129 is to connect a ground and battery as at 132 to any desired one of the circuit closing relays 123, 124, 125 and 126, respectively, through a corresponding one of the connecting wires 133, 134, 135 and 136. By such actuation of the circuit closing relays the polarities established on the line wires determine whether the indicator operating busses B1, B2, B3 and B4 are to be connected to the "open", "high", "low" or "last" busses.

The manner in which the line polarities actuate the relays 127, 128 and 129 will now be further explained in connection with the tabulation shown on Sheet 2. The two windings of the relays 127 and 128 may be substantially equal and independent, as shown, whereby they may assist each other, or substantially neutralize each other in effect, depending upon the line polarities. The relay 129 may have a single winding, its function being only to connect the battery 132 whenever the lines are energized and permitting the battery to be disconnected wherever the line wires are not energized. If desired, this relay may also be used to control battery charging equipment so that the batteries at the receiving stations may be charged only when the line wires are energized. For these purposes the relay 129 may be provided with a pair of "make" spring contacts 137 and 138. The contact 137 serving to connect the battery 132 to the "open", "high", "low" and "last" selecting or connecting relays, whereas the contact 138 may serve to connect the battery 132 to suitable battery charging apparatus. The relays 127, 128 and 129 may be all of the slow to release type whereby they will not be responsive to selecting and indicator actuating impulses. The relays 127 and 128 may be provided with contact actuating armatures retained by springs in one position and drawn by the relay magnets to their opposite positions, the relay 127 having a pair of armatures operating in unison, and the relay 128 having a single armature. The manner in which the armatures and their contacts are operated by the various polarities of the line wires is set forth in the tabulation of sheet two, which is self-explanatory and indicates the manner in which the polarities may be chosen so as to choose either the "open", "high", "low" or "last" at the will of the operator at the transmitting station.

Selector circuit connections

Referring to Fig. 11 it will be noted that two groups of selector contacts, each including one hundred contacts, are shown, one of such groups being representative of the indicator operating contacts 59 of the thousands selector and the other group being representative of the indicator operating contacts 59' of the tens selector. A typical portion of the terminal board 48 is here shown in further detail, together with the manner in which the contacts 59 and 59' may be attached thereto. The transmitting facilities, as will be hereinafter described, may preferably be provided with arrangements for transmitting pluralities of current variations equal in number to the corresponding selected digit. That is, assuming that it is desired to select a stock or item which has been given a predetermined designation such as number 1204, then over line L—1 a single current variation will be transmitted to advance the thousands selectors vertically one step. Over the line wire L—2 two current variations will be transmitted to actuate the hundreds selector, whereby the wiper on the thousands selector will be rotated two steps. Likewise ten and four current variations, respectively, will be transmitted over lines L—3 and L—4, causing the wipers on the tens selector to be elevated ten steps and rotated four steps. The result of these variations will be that the thousands indicator circuit wiper will engage the contact 59 bearing the miniature number 12 in Fig. 11. (The miniature numbers used in designating the contacts and terminal jacks are considerably smaller than the numerals used in designating other parts of the apparatus and should not be confused therewith.) At the same time the indicator circuit wiper on the tens selector will engage one of the contacts 59' designated by the miniature number 04 in Fig. 11. As shown in Fig. 11, each of the contacts 59 may be electrically connected by wires as at 52, with correspondingly numbered vertically extending busses 50, while each of the tens selector contacts 59' may be similarly connected by wires 53 to correspondingly numbered horizontally extending busses 51. Therefore the selecting operation as above described will result in the choosing of vertical bus number 12 and horizontal bus number 04. At the intersection of these two busses one of the terminal jacks may be located and such jack or terminal may be numbered 1204.

It will be observed that in the arrangement of the selector contacts and in the operation of the selectors the character zero is assumed to be ten, or in other words, ten current variations are utilized to select each zero character of a single designating number. This is made necessary by reason of the fact that zero impulses cannot be utilized to actuate the selectors, for if no impulses were transmitted,

the selector wipers would not be advanced into engagement with any of the contacts 59 and 59'. Therefore in the contact banks 59 and 59' all contacts the numbers of which include the character zero are located either in the top horizontal row or in the right hand vertical tier. That is, such contacts preferably assume the same position in the contact banks as they would assume if the zero were the number 10. However, in the arrangement of the numbered terminal jacks or terminals, it is of course desirable for such terminals to be numbered consecutively, tier after tier, starting from 0000, say at the upper left hand corner, and ending with 9999, say at the lower right hand corner. The manner in which the selector contacts may be connected to the terminal board busses to accomplish this arrangement is made clear from the typical connections shown in Fig. 11. In actual practice, at least upon the initial installation of the system, not all of the selector contacts 59 and 59' will be utilized. Therefore many of the contacts bearing higher numbers, and all of those including the character zero, might well be omitted in actual practice unless it becomes necessary to transmit quotations for many thousands of stocks.

By thus utilizing only the contacts numbered with the smaller digits the necessary number of current variations and the time required to transmit the same may be substantially minimized. For example, if each selecting step required 0.1 second, the entire operation of selecting one out of nine hundred stocks or other items may be accomplished in an average time of less than 0.5 seconds, including such time as is necessary for the slower acting relays to function. To secure the lowest possible average time of selection, stocks and items which are most actively dealt in in the markets should be given designating numbers including only the smaller digits, that is, such numbers as 1111, 1112, 1122, 1212. Thereby the minimum possible number of current variations for selecting purposes may be used.

Selector control circuit connections

The connections between the control contacts 58 of the thousands selector and the contacts 61 in the hundreds selector are shown in Fig. 5. It will be noted that each of the ten contacts 61 is connected to all of the contacts 58 of one vertical tier of selector control contacts. The contacts 58' and 61' for the tens and units selectors, respectively, may be connected in a manner identical with that of the thousands and hundreds selectors, as will appear from the double set of reference numerals of Fig. 5.

Transmitter

Any suitable form of current variation

transmitting devices, either manual, automatic or semi-automatic, may be utilized at the central transmitting point in order to provide sustained potentials of the desired polarity interrupted by the desired undulations of current or potential drops. The elements of a suitable transmitter are schematically illustrated in Fig. 6 and may include a ground connection 140, a source of current 141 for providing negative potentials to the lines, and a source of current 142 for applying positive potentials to the lines. Circuit opening switches as at 143 and 144, respectively, may be provided for the sources of current 141 and 142. Double throw switches as at 145, 146, 147 and 148 may be provided for bringing each of the line wires L—1, L—2, L—3 and L—4, respectively, into operative relationship with either of the sources of current 141 and 142. In addition, each of the line wires may be provided with impulse sending switches as at 149, 150, 151 and 152. If desired, suitable line relays for stepping up the transmitting current and/or voltage may be provided. The various switches shown in Fig. 6 may be operated by suitable keyboard mechanisms, the general principles of which are known in the art and form no part of this invention, or if desired, certain of the keys may be actuated manually and others by known forms of tape transmitting devices, or if desired, all of the transmitting switches may be controlled by a moving perforated tape in a manner hereinafter described in connection with Figs. 7 and 8. The principles of tape transmitting devices of this class for ordinary telegraphy, are set forth, for example, by John H. Bell in his paper entitled, "Printing telegraph systems", presented February 19, 1920, and published in Volume XXXIX, Part I, of the "Transactions of the American Institute of Electrical Engineers."

In Fig. 7 two typical tape control switch and operating devices are shown, one for operating an impulse sending switch and the other for operating a double throw or polarity selecting switch. The mechanism for operating the circuit opening switches 143 and 144 being identical with that used for the polarity selection (although provided with one contact instead of two) for simplicity is not shown. A moving tape is indicated at 153, the tape being provided with distinctive perforations representative of the quotations of various items. The edges of the tape may be perforated as at 154 for engagement with a suitable feed roller 155.

While in Fig. 7 the impulse sender for clearness is shown above the polarity selector and the showing of the tape and feed roller is repeated, it will be understood that in actual practice the impulse sender, the polarity selector, and the circuit opening switches will be located side by side and operated upon

from one tape and one driving mechanism. Referring to the impulse sender, a selecting pin is shown at 156 designed to engage the under side of the tape at such times as areas 5 are passing which have no perforations. However, when a perforation in the tape occurs over the selecting pin 156, this pin is caused to rise into such perforation and causes the impulse switch as at 149 to be 10 opened for transmitting a current variation in the form of a drop in the potential maintained on the line wire. A rotating member 157 is driven at such speed as to properly oscillate a lever 158 connected therewith by 15 a link 159. The lever 158 has pivotally mounted thereon a thrust lever 160, carrying at one end the selecting pin 156 and designed to engage at its other end a switch operating push rod 161, a switch arm being indicated 20 in 162 suitably attached to the push rod 161 and is provided with a spring 163 for holding the switch as at 149 normally closed. The thrust lever 160 is normally oscillated by the action of the rotating member 157 in an elevated position where it does not contact with 25 the push rod 161. However, when the selecting pin rises into a perforation in the tape, the thrust lever is then oscillated in the lower position where it will engage the push rod 30 161 for actuating the switch. Details of construction of apparatus of this type are well known and need not be here further described.

The polarity selector switch mechanism 35 may be generally similar to the impulse sender mechanism above described, and similar parts bear like reference numerals on the drawings. However, provision must here be made to operate a double throw switch. Accordingly, the switch lever 162 instead of 40 being provided with a retaining spring is engaged by a jockey roller member as at 164 for releasably retaining the switch lever in a position to apply either a negative or a 45 positive polarity to the line. Therefore an additional push rod as at 165 is also provided to operate the switch arm in the direction opposite from its operation when actuated upon by the push rod 161. Whenever the 50 polarity selecting pin 156 rises into a perforation in the tape the thrust lever 160 will engage the push rod 161, moving the switch so as to provide a negative polarity to the line. At other times when the selecting pin 55 engages no perforation in the tape, the thrust lever will intermittently engage the push rod 165 for maintaining the switch arm in such position as to apply a positive polarity to the line.

60 One possible arrangement of the perforations on the tape is shown in Fig. 8 merely by way of example. Space is provided as shown for four rows of line polarity control perforations respectively for lines L—1, 65 L—2, L—3 and L—4. That is, if there are

no perforations on the tape at these areas as the same pass over the selecting pins the positive line polarities will be then established, but whenever perforations are encountered 70 in such areas then negative line polarities will be established. The circuit opening switches 143 and 144 may be operated concurrently and controlled from a single perforated area designated on the drawing as 75 "on" and "off" control. That is, when perforations exist on this area the switches 143 and 144 are "off", and when no such perforations exist on this area the switches are in circuit closing position for establishing the 80 maintained potential on the lines of the polarity determined by the line polarity control. The areas of the tape which control the impulse sending switches are designated on the drawings "impulse sender control", an area 85 being provided respectively for each of the lines L—1, L—2, L—3 and L—4. When perforations exist in these areas the corresponding switches 149, 150, 151 and 152 will be 90 moved to circuit opening positions, thus causing potential drops on the corresponding lines. The functions of the succeeding groups of perforations for these various 95 items are shown in Fig. 8 to the left of the tape.

Although in the system as above described 95 provision is made for as many as ten thousand different stocks or other items, four digits to be indicated for each item, it will be understood that if provision is to be made 100 only for a lesser number of items, for example, one thousand, one of the four selector mechanisms might readily be eliminated, the remaining three being operable over three 105 line wires. In such case the hundreds digit of the stock or item quotation if desired might also be eliminated, since the proper hundreds digit for a particular stock or item is generally well known to the public, such 110 practice of eliminating the hundreds, and even the tens digit being sometimes followed in the operation of the well known stock 115 ticker system.

Although with a system as above described each line wire is provided with a 115 ground return, it will be understood that a fifth and common return wire might be provided in lieu of the use of ground connections.

Although the above described selector 120 mechanism constitutes an adaptation of the "Strowger" single wiper "up and around" selectors, according to certain phases of the invention, many other forms of selectors 125 might be used with greater or lesser efficiency. For example, if desired, the "all relay" type of selector may be utilized, and a system embodying the use of such selectors comprises the subject of the copending application of Merton L. Haselton and Page S. 130

Haselton, Serial No. 256,160, filed February 23, 1928.

One of the above described systems may normally be operated at a speed substantially limited by the skill of the operator, but if a large number of quotations are to be transmitted in rapid succession, it may be necessary, as above stated, to provide duplicates or even three sets of such a system with a corresponding number of operators or groups of operators. If duplicate systems are used, the apparatus and connections may be duplicated in all particulars; or if it is desired to operate the brokers' indicators either by one system or the other, the multi contact relays 37 may be movable to either one of two positions so as to connect the indicators to the operating busses of either system, one form of such an arrangement being more particularly described and claimed in my copending application Serial No. 276,883 above referred to. If desired, the selector circuit plugs for the various indicators may have provision for four wires, that is, two wires to move the relays to one position and two to move the relays to the other position, one of such pairs being interchangeably associated with any terminal on one of the sets of apparatus and the other pair of such wires being interchangeably associated with any corresponding terminal on the terminal board of the other set of apparatus. The circuit arrangements for this embodiment are illustrated in Fig. 13, in which a two-way multicontact relay is indicated at 190 having operating magnets 191 and 192 controlled over selector circuit connections 193 running from a four-contact detachable plug 194 at the terminal board which is schematically indicated at 195. It will be understood that two of the plug contacts at 194 correspond to one of the dual systems, while the other two plug contacts cooperate with the other of the dual systems, whereby when the relay 190 is operated by way of one of the systems, the magnet 191 will be energized and when the relay is operated by the other system, the magnet 192 will be energized. These magnets respectively will serve to connect the indicator operating connections 198 either to the actuating busses 196 of one system, or to the actuating busses 197 of the other system. The connections for the lamp busses with this arrangement are indicated at 38 and 46.

Indicator operation

The indicator drums, as above stated, may be provided on their peripheries with ten characters, namely, one to nine and zero, a "blank" space also being provided between the one and zero characters. At the beginning of the day before any quotations have been posted the indicator units will be in position to exhibit only these "blank" spaces, which will convey the information that no

quotations have been yet given by such indicators. However, as soon as the indicators for a particular stock are selected by the selecting mechanism, the zero restoration mechanism will come into play and immediately move such selected indicators to first exhibit zero characters instead of the "blank" spaces. Thereupon as the desired number of current variations or impulses are sent over the line wires the selected indicators will be rotated step-by-step through a corresponding number of positions. For example, three current variations will rotate an indicator from zero to "blank", from "blank" to one, and from one to two. Thereupon the potential which has been maintained on the line wire during the selecting and the actuating operations will be removed in order that the selectors may be released. Such removal of the line potential has the effect on the actuating circuits of an additional counted current variation, and such additional current variation will therefore cause the selected indicators in the particular example above recited to be moved from positions exhibiting character two, into position for exhibiting character three, which character corresponds to the number of current variations actually transmitted by the operator. The effect of the removal of the potential from the lines is therefore compensated for and the operator is able to transmit a number of actuating current variations corresponding to the desired characters to be indicated.

After the closing of the markets at the end of the day it will be desirable to quickly restore all of the indicators to exhibit "blank" spaces. This may be accomplished by first restoring the indicators to their zero positions and then upon removal of the line potential the resulting effective single impulses will serve to advance these restored indicators from their zero positions to the "blank" positions ready for further operation upon the succeeding day.

It will be understood that the features of this invention are applicable to signaling systems where either less or more than four different groups of digit indicating devices are used for each item quoted. That is, instead of quoting the "open", "high", "low" or "last", it may be desired to merely quote the "high" and "low" or the "bid" and "asked" prices. Accordingly the expression "open", "high", "low" or "last", which I have used here for convenience, is not intended to be limited to these four specific price ranges but is intended to designate merely a plurality of ranges or equivalent indications applicable to one item.

While in the above described system provision is made only for the "open", "high", "low" and "last" quotations, it will be understood that similar provision might be made for exhibiting quotations of "yesterday's clos-

ing" values, various possible combinations of line polarities being sufficient in number to provide for the actuation of an additional bus relay similar to the relays 123, 124, 125 and 126.

Summary of operation

In the above description, the apparatus has been described beginning with the indicators and following out the various groups of circuits back to the transmitter. The operation of the circuits will now be recapitulated starting with the transmitter. As indicated in Fig. 6, the particular transmitter here disclosed comprises in general means for applying current variations of either polarity to each of the four line wires, in the particular example here shown the line wires being normally energized and the current variations taking the form of "negative impulses". Groups of impulses are applied respectively to the four line wires for the purpose of simultaneously operating the receiving station selectors. Thereafter further groups of impulses are applied to the four line wires respectively for operating the indicators for the four digits of the chosen stock or item. In both cases the relative polarities of the various line wires are chosen so as to operate the "open", "high", "low" or "last" indicators as desired.

At the receiving stations the initial groups of impulses from the four line wires respectively are conducted to the thousands, hundreds, tens and units selector circuits, shown in Fig. 1, Sheet 1, whereby a circuit is set up through the chosen busses on the terminal board of Fig. 1, Sheet 2, which circuit runs through the chosen multicontact relay 37 and energizes the same. Upon completion of this selecting operation, the selector circuits are "held up" and meanwhile the next groups of impulses arriving over the impulse channels are shifted respectively from the selector circuits to the busses B1, B2, B3 and B4 corresponding respectively to the hundreds, tens, units and fraction indicators. Meanwhile, the polarities of the line wires will have controlled the operation of the group of relays 127, 128 and 129 (Fig. 1, Sheet 2), whereby one or more of the "open", "high", "low" and "last" bus relays 123 to 126 is actuated for connecting the B busses to the "open", "high", "low" or "last" indicator magnets 29 by way of the selected multicontact relay 37, this selected multicontact relay being "held up" by reason of the energized condition of the selector circuits. At the moment that the chosen multicontact relay 37 is pulled up, the release bus R will be energized for a sufficient length of time to operate the proper tripping magnet 31, allowing the chosen indicators to be restored by their springs to the zero settings. Thereupon the release bus R will be de-energized by slow operating relay 121 and

the circuits will be ready for the reception of the actuation impulses. The actuation impulses arriving over the four line wires respectively, will advance the chosen indicators step-by-step so that their dials will each indicate numbers one less than the desired number to be exhibited. Thereafter, upon de-energization of the lines and consequent release of the selectors, one additional impulse in effect will be applied to the indicators, moving them to indicate the desired quotation.

An alternative arrangement, using a different form of indicator unit, is illustrated in Fig. 12, and the same will now be described.

If desired, according to this modification of the invention, the trip magnets of the above described indicators may be eliminated, and in that event restoration to normal may be effected merely by a further step-by-step advance of the indicators in the same direction as upon actuation. Each indicator unit then may be provided with a single operating magnet as at 166, such magnets having one terminal connected to a common return bus 33' and thence to battery 35' and ground 34'. At the other terminals of indicators a pair of such connections as at 167 and 168 may be provided, a switch as at 169 being provided in each of the circuit connections 168. The switches 169 may be designed to be opened whenever the indicator dials exhibit zeros. Thereafter any further impulses over circuit connections 168 will be ineffective as to the indicators to which the switches 169 are thus opened. The details of construction of this form of indicating unit comprise no part of this invention but are more fully set forth in the copending application of Robert L. Daine and René Guyé, Serial Number 246,474 filed January 13, 1928. A similar indicator is shown in the patent to Frischknecht, et al. 1,852,994, April 5, 1932. For the actuation of indicators of this type the same forms of selecting devices as above described may be used and the hundreds, tens, units and fractions indicator operating busses and line wires may be arranged in a similar manner as above described. Such parts in Fig. 12 as correspond in function to corresponding parts or similar parts above described are designated by the same reference characters and numerals, except that in Fig. 12 such characters and numerals are accompanied by prime marks. Of course, with the form of indicator unit of this modification the relay 121 and the bus R, together with their functions, are eliminated.

Instead of using the three relays 127, 128 and 129 in this modification of the invention four relays as at 170, 171, 172 and 173 may be used. The relays 170, 171, and 172 are each provided with two windings, while the relay 173 is provided with a single winding. As will be observed, line wire L-1 prime passes through the coils of relays 170 and 173

171 to ground. Line wire L—2 prime passes through the coils of relays 171 and 172 to ground. Line wire L—4 prime passes through the coils of relays 173 and 170 to ground. While line wire L—3 prime passes only through the coil of relay 172. Since line L—3 prime is in series with but one of the relay windings instead of two as are the other lines, a compensating winding 174 may be interposed in line L—3 prime. The "open", "high", "low" and "last" busses, respectively, may be provided with the circuit closing relays 123', 124', 125', and 126', as in the above described modification. In addition, a circuit closing relay 175 may be interposed in such of said busses as are used in normal actuation of the indicators and a separate circuit closing relay 176 may be interposed in such of said busses as are used in restoring the indicators to normal or zero. The relay 172 therefore has been provided to choose between the actuation and restoration busses by causing either relay 175 or relay 176 to be energized. The functions of the relays 170, 171 and 173 correspond in general to the functions of relays 127, 128 and 129, as above described, and these relays when energized with various combinations of potentials on the line wires serve to choose as between the "open", "high", "low" and "last" relays 123', 124', 125', and 126'. The manner in which such relays and the actuation and restoration relays are operated by various combinations of potentials is set forth in tabulated form in Fig. 12. It may be noted that for proper functioning of the relay circuits, the relay 173 should be released no later than the release of the other three relays adjacent thereto.

When certain quotations are sent it will be necessary not only to change the "last" quotation posted, but also to change either the "high" or the "low". If desired, in order to save time the "high" or "low" may be changed simultaneously with the changing of the "last" by using an additional relay such as a polarized relay 177, which as shown on the drawings, is operated by line wire L—1 prime. Whenever the line wire L—1 prime is of a positive polarity the relay 177 is ineffective, but when it is desired to actuate either the "low" or "high" in conjunction with the "last" the line wire L—1 prime is energized with a negative polarity. In order not to otherwise alter the actuation of the relays 171, 172 and 173, the polarities of the lines L—2 prime, L—3 prime and L—4 prime may be reversed simultaneously with the reversing of the polarity of line L—1 prime. The energization of relay 177 by the negative polarity of line L—1 prime serves to bring the magnet of the relay 126' (the "last" relay) into parallelism with either the winding of relay 124' or 125', whichever has been chosen. That is, when one desires to operate the

"high" or "low" with the "last" it is merely necessary to choose either the "high" or "low" and then if the line L—1 prime is of negative polarity the "last" indicators will also be connected for actuation. This parallel connection of the "last" relay with either the "low" or "high" is affected through the wires 178, "make" contact of relay 177, wire 179, thence to either "make" contact 180 of the "high" relay or 181 of the "low" relay, depending upon which has been actuated.

It may be noted that when the circuits are so connected as to cause restoration of the indicators to take place, a sufficient number of impulses or current variations is transmitted to restore the indicators to exhibit their zeros as above stated. Thereupon the line potentials may be relatively quickly shifted so as to connect the indicator actuating busses and to disconnect the restoration busses. Then the indicators may be actuated in the same manner as with the modification in the invention previously described. Or if it is merely desired to move the indicators to positions showing their "blanks", then the line potentials may be merely cut off, giving an effective impulse advancing the connected indicators from their zero positions to the "blank" positions.

The term "indicator" used in the specification and claims, and the term "register" used in the claims, are to include all equivalent devices on which amounts may be registered or set up.

Features of construction, circuits and circuit combinations disclosed in this application, but not covered by the more specific claims in this application, are disclosed and claimed in my copending divisional applications Ser. Nos. 418,801, 418,802 and 418,803 filed January 6, 1930.

While the invention has been described in great detail with respect to several particular preferred examples thereof which give satisfactory results, it will be understood by those skilled in the art after understanding the invention that numerous changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be acquired by patents of the United States is:

1. A signaling system comprising a plurality of electromagnetic indicators at a receiving station, said indicators being divided into relatively small groups, means for transmitting distinctive current variations for the selection and control of said indicators, line wires providing a number of impulse channels at least equal in number to the number of indicators of each group and extending from said transmitting means to the receiving station, a plurality of complementary

selecting devices at the receiving station operated respectively by current variations transmitted over said impulse channels, and electrical connecting means whereby said selectors act to choose at least one of said groups, and means for thereafter bringing said channels respectively into operative relationship with the various indicators of the group chosen.

2. A signaling system comprising a plurality of electromagnetic indicators at a receiving station, said indicators being divided into relatively small groups, means for transmitting distinctive current variations for the selection and control of said indicators, line wires providing a number of impulse channels at least equal in number to the number of indicators of each group and extending from said transmitting means to the receiving station, a plurality of complementary selecting devices at the receiving station operated respectively by current variations transmitted over said impulse channels, and electrical connecting means whereby said selectors act to choose at least one of said groups, and means for thereafter bringing said channels respectively into operative relationship with the various indicators of the group chosen, said transmitting means having devices for simultaneously transmitting current variations whereby the plurality of selectors, and thereafter the plurality of indicators of a chosen group, may be operated concurrently.

3. Method of operating a large number of groups of electrical indicators which comprises providing a number of circuit paths at least equal to the number of indicators of each group, providing selector means controllable by impulses over said paths for bringing said circuit paths into operative relationship with any desired group of indicators, operating such group by electrical variations transmitted over said circuit paths, restoring such selecting means to a normal setting at a time between each operation, designating each group of indicators by a number having as many digit places as there are circuit paths utilized in the selecting operation, arbitrarily choosing for such number, digits only of relatively low values (for example, 1, 2 and 3), and transmitting over said circuit paths respectively small numbers of current variations corresponding to the designating digits, for operating said selector means.

4. An automatic indicating board for exhibiting and posting fluctuating market prices for numerous stocks or other items, comprising a large number of indicating units, a unit being provided for each of the several digits of a plurality of quotations such as "open", "high", "low" and "last" for each item, means for selecting and preparing for operation of the indicator units for any

chosen item, a plurality of circuit paths for transmitting current variations to actuate the indicating units, means controlled by the relative polarities of said current variations on the several paths for choosing as between such quotation indicating units as those for the "open", "high", "low" and "last" quotations, and means for transmitting distinctive current variations of the relative polarities thus established over said line wires for actuating the selected indicator units.

5. In an electrical system for transmitting and registering items of information, a plurality of groups of registers, each register comprising a plurality of registering elements, the registers of each group being adapted to receive information relating to the same item, electrical impulse transmitting channels corresponding in number to the number of registering elements in each register, electromagnetic means controllable by impulses over said channels for selecting the desired group of registers, other electromagnetic means responsive to impulses over said channels for selecting a particular register of the said selected group of registers, and a third electromagnetic means responsive to groups of impulses transmitted concurrently over said channels for actuating simultaneously said selected register elements in accordance with certain information relative to the item involved.

6. In an electrical system for transmitting and registering items of information, a plurality of groups of registers, each register comprising a plurality of registering elements, the registers of each group being adapted to receive information relating to the same item, electrical impulse transmitting channels corresponding in number to the number of registering elements in each register, electromagnetic means controllable by impulses over said channels for selecting the desired group of registers, other electromagnetic means responsive to impulses over said channels for selecting a particular register of the said selected group of registers, and means controlled by said first electromagnetic means for causing the elements of said selected register to be actuated concurrently in accordance with impulses transmitted over said channels.

7. In an electrical system for transmitting and registering items, a transmitter, a plurality of groups of registers each group comprising a plurality of registers, electrical impulse transmitting channels controlled by said transmitter, means for transmitting impulses over said channels means responsive to said impulses to prepare incomplete circuits to corresponding registers of all of the groups of registers, means for transmitting other impulses over the same channels, means responsive to said other impulses for completing circuits selecting a desired one, said groups

and extending said first mentioned circuits to an individual register of the group, and means responsive to further impulses over the same channels for producing resultant impulses in said first mentioned circuits to actuate the selected register in the selected group of registers.

8. In an electrical transmitting and registering system comprising a set of impulse transmitting channels, a plurality of groups of registers, each group containing a plurality of registers, means for selecting a group of registers, means for selecting a register within the group of selected registers, means for establishing and maintaining potentials on said channels, means responsive to said potentials for controlling one of said selecting means, means for interrupting said potentials, means responsive to said interrupted potentials for controlling the other of said selecting means.

9. In an electrical transmitting and registering system comprising a set of impulse transmitting channels, a plurality of groups of registers, each group containing a plurality of registers, means for selecting a group of registers, means for selecting a register within the group of selected registers, means for establishing and maintaining potentials on said channels, means responsive to said potentials for controlling one of said selecting means, means for interrupting said potentials, means responsive to said interrupted potentials for controlling the other of said selecting means, and means controlled by subsequent interruptions of potentials over said channels for actuating the selected register.

10. In an electrical transmitting and registering system, a plurality of groups of registers, each group containing a plurality of registers, means for selecting a group of registers, means for selecting a register within a group, a plurality of impulse transmitting channels, contact means for imposing and maintaining potentials in said channels, said second mentioned selecting means being responsive to said maintained potentials for preparing incomplete circuits to all registers corresponding to the register within the group desired to be selected, and other contact means for causing variations in said potentials, said first mentioned selecting means being responsive to said variations in said potentials to complete said circuits to the register of the desired group.

11. In an electrical transmitting and registering system, a plurality of groups of registers, each group containing a plurality of registers, means for selecting a group of registers, means for selecting a register within a group, a plurality of impulse transmitting channels, contact means for imposing and maintaining potentials in said channels, said second mentioned selecting means being

responsive to said maintained potentials for preparing incomplete circuits to all registers corresponding to the register within the group desired to be selected, and other contact means for causing variations in said potentials, said first mentioned selecting means being responsive to said variations in said potentials to complete said circuits to the register of the desired group and for subsequently causing electrical variations over said channels to actuate the selected register.

12. In an electrical transmitting and registering system, a plurality of groups of registers, each group containing a plurality of registers, means for selecting a group of registers, means for selecting a register within a group, a plurality of impulse transmitting channels, contact means for imposing and maintaining potentials on said channels, said second mentioned selecting means being responsive to said maintained potentials for preparing incomplete circuits to all registers corresponding to the register within the group desired to be selected, other contact means for causing variations in said potentials, said first mentioned selecting means being responsive to said variations in said potentials to complete said circuits to the register of the desired group and for subsequently causing electrical variations over said channels to actuate the selected register, and means operable after the selection has been made and prior to the actuation of the selected register for returning the selected register to normal home position.

13. In an electrical transmitting and registering system, a plurality of groups of registers, each group containing a plurality of registers, means for selecting a group of registers, means for selecting a register within a group, a plurality of impulse transmitting channels, contact means for imposing and maintaining potentials in said channels, said second mentioned selecting means being responsive to said maintained potentials for preparing incomplete circuits to all registers corresponding to the register within the group desired to be selected, other contact means for causing variations in said potentials, said first mentioned selecting means being responsive to said variations in said potentials to complete said circuits to the register of the desired group and for subsequently causing electrical variations over said channels to actuate the selected register, and means controlled by completion of the selecting operation for returning the selected register to normal home position prior to actuation of said register.

14. In an electrical transmitting and registering system, the combination of a plurality of groups of registers, each group containing a plurality of registers, a set of electrical impulse channels, means for selecting a group of registers and a register within a group,

means for causing electrical variations in said channels, said selecting means being responsive to said electrical variations for selecting a group of registers and a register within the group, means operable as an incident to and subsequent to the selection of a register to return said register to normal home position, and means controlled by subsequent impulses over said channels for actuating said selected register.

15. The combination of an electromagnetically operated register, actuation lines, means for connecting said register to said lines, electrical channels over which impulses are transmitted, said connecting means being responsive to said impulses to electrically connect said register to said lines, means operable as an incident to and subsequent to the effecting of said connection for returning said register to normal, and means also operable as an incident to effecting said connection for causing impulses over said channels to produce resultant impulses over said lines for actuating said register.

16. In an electrical transmitting and registering system comprising a plurality of groups of registers indicated by numbers of four denominations, normally open circuits for actuating said registers, group selecting switches for connecting said groups of registers to said circuits, a relay for operating each switch selecting means for preparing circuits to operate the relays associated with all groups of registers designated by the same two highest denominational digits, and other selecting means for preparing circuits to operate the relays associated with all groups of registers having the same digits in the two lowest denominational orders for their designating numbers, said selecting means completing a circuit over the relay associated with any desired group of registers.

17. In an electrical transmitting and registering system comprising a plurality of groups of registers indicated by numbers of four denominations, normally open circuits for actuating said registers, group selecting switches for connecting said groups of registers to said circuits, selecting means for preparing for selection of all groups designated by the same two highest denominational digits, other selecting means for preparing for selection of all groups having the same digits in the two lowest denominational orders of their designating numbers, said selecting means completing a circuit to actuate the desired selecting switch, and means for selecting and electrically actuating a desired register in said selected group of registers.

18. In an electrical transmitting and registering system, a plurality of groups of registers, actuating lines therefor, magnet controlled switches for connecting said registers to said lines, a plurality of selector cir-

cuits each comprising one branch adapted to be connected to a source of energy and another to the ground, all of said branches intersecting, plugs at the intersections of said branches for connecting said branches to opposite terminals of said magnets, a plurality of selecting devices for selectively connecting said branches to the source of energy and the ground, a plurality of main electrical channels for actuating said selecting devices, and means for causing impulses over said channels subsequent to effecting selection, for causing impulses over said lines to actuate selected registers.

19. In an electrical transmitting and distant indicating system for stock quotations, comprising in the receiving station a large number of groups of indicators each group comprising open, high, low and last indicators, common open, high, low and last bus lines for corresponding indicators, magnetically operated switches for connecting all of said bus lines to any desired group of indicators, a panel board through which circuits are made to actuate said switches, one end of two selecting lines controlling said panel, one end of a main common bus line, one end of the main impulse channels, and magnets controlled by said channels for selectively connecting said main common bus line to said open, high, low and last bus lines, and comprising in the transmitting station means for imposing positive and negative potentials on said main impulse channels for selectively connecting the main common bus line to the open, high, low or last bus lines, means for interrupting said potentials, means actuated by a first series of interruptions for selecting and establishing a circuit through the proper selecting lines to control the panel board and select a group of registers, means operable as an incident to the completion of the selection for returning the selected register to home position, and means for causing subsequent series impulses over said main impulse channels to cause similar impulses over said main common bus lines to actuate the selected register.

20. In an electrical transmitting and registering system, the combination of a plurality of registers, a plurality of main electrical channels, a plurality of group selectors, a plurality of selectors responsive to imposed potentials on said channels for selecting a register within a group, and means controlled by said potentials for conditioning the group selectors to respond to subsequent interruptions of said potentials.

21. In a receiving station the combination of a plurality of groups of electromagnetically operated indicators, each group including a plurality of sub-assemblies, selector means responsive to electrical variations for selecting any sub-assembly within any group of indicators by preparing electrical paths

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thereto, means responsive to electrical variations for operating said selected sub-assembly of indicators, means located wholly within the receiving station for restoring said selected sub-assembly of indicators to normal position, and means rendered operable as an incident to the selection of any sub-assembly of indicators within any group for causing said restoring means to operate.

22. In a receiving station adapted to be electrically controlled from a distant transmitting station, the combination of a plurality of groups of indicators relating to different stocks or items, each group of indicators including a plurality of sub-assemblies such as for indicating price ranges of stock, selector means responsive to electrical variations received for preparing restoration and actuation paths to any sub-assembly of indicators in any group of indicators, means located wholly in said receiving station and set in operation as an incident to the completion of the selection operation for activating said restoration paths to restore the selected indicators to normal, and means in said receiving station responsive to electrical variations received subsequently to electrical variations operating said selector means, for activating said actuation paths to operate said selected indicators to exhibit a new price.

23. In an electrical system for transmitting and registering items, a transmitter, a receiver comprising a plurality of groups of indicator assemblies, each assembly comprising a plurality of indicator elements each bearing a plurality of indicia, impulse operated electromagnetic operating means individual to each indicator element for moving the indicator element into its different positions, electrical impulse transmitting channels conducting impulses from said transmitter to said receiver, means responsive to impulses received over said channels for closing circuits at one point to any desired corresponding assemblies of all of the groups, and means responsive to impulses received over said channels for closing at one point all of the circuits to the assembly of a desired group, said first and second mentioned responsive means co-operating to place said circuits under control of electrical variations on said channels whereby electrical variations received will cause the transmission of impulses to the electromagnetic operating means of the indicator elements of the selected assembly to operate said indicator elements individually and to different or like extents.

24. A signalling system comprising a plurality of groups of electromagnetic indicators at a receiving station, each of said indicators having connections and means for actuating the same to give a plurality of indications and also having other circuit connections for restoring the indicator to non-indi-

cating position, a multicontact relay individual to each of said groups of indicators and serving to normally disconnect the indicator actuating and restoring connections, means for transmitting distinctive current variations for the selection and control of said indicators, a plurality of impulse channels extending from said transmitting means to the receiving station, a plurality of complementary selecting devices at the receiving station operated by current variations transmitted over said impulse channels, electrical connecting means whereby said selectors act to choose and energize one of said multicontact relays, means acting through the indicator restoration connections established by the operation of the selected multicontact relay for restoring the chosen indicators to non-indicating, and connections acting through the remaining contacts on said selected multicontact relay for thereafter causing control impulses received over said channels to independently actuate the several indicators of the group chosen.

25. A signaling system comprising a plurality of groups of indicators at a receiving station, each indicator bearing a plurality of indicia, impulse controlled operating means individual to each indicator for moving the indicator into its different positions, means for transmitting distinctive current variations for the selection and control of said groups of indicators, a plurality of impulse channels extending from said transmitting means to the receiving station, a plurality of complementary selecting devices at the receiving station operated by current variations transmitted over said channels, electrical connecting means whereby said selectors act to choose at least one of said groups of indicators, means for maintaining said selectors and connecting means in operating condition during operation of the selected group of indicators and for causing control impulses received over said channels to actuate the indicators of the group chosen, and means for restoring the selectors to normal and disrupting said connecting means upon completion of such actuation.

26. In a receiving station, the combination of a plurality of groups of electrically controlled indicating devices, a plurality of such devices being provided for simultaneous display of different information in respect to each of a large number of items, means responsive to electrical variations received from a distant point for placing any device in any group under control of electrical variations subsequently received, and means automatically set in operation upon selection of any desired indicating device for normalizing the selected indicating device.

In testimony whereof I have signed my name to this specification.

MERTON L. HASELTON.