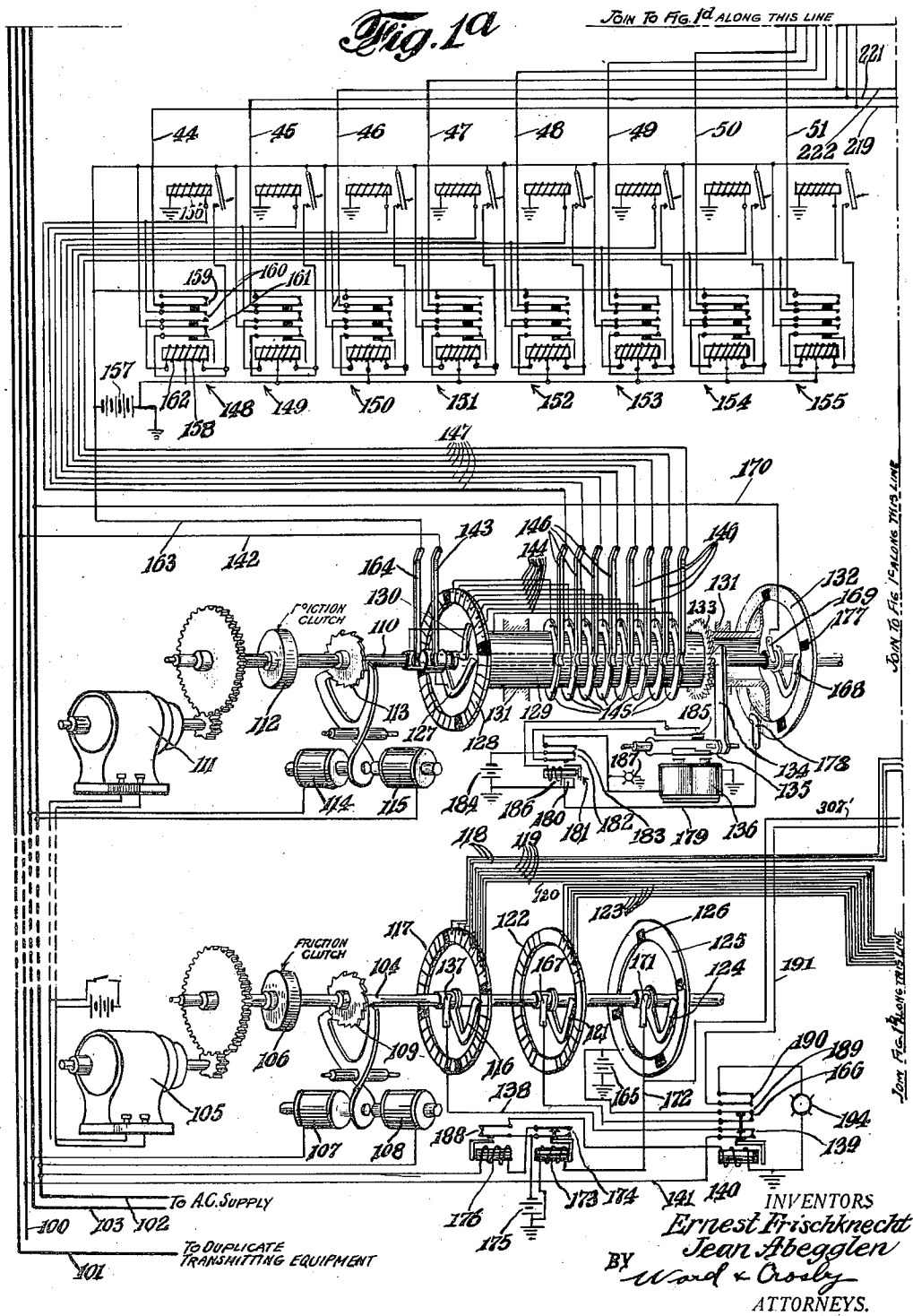


2,052,539

Original Filed March 1, 1923 7 Sheets-Sheet 1

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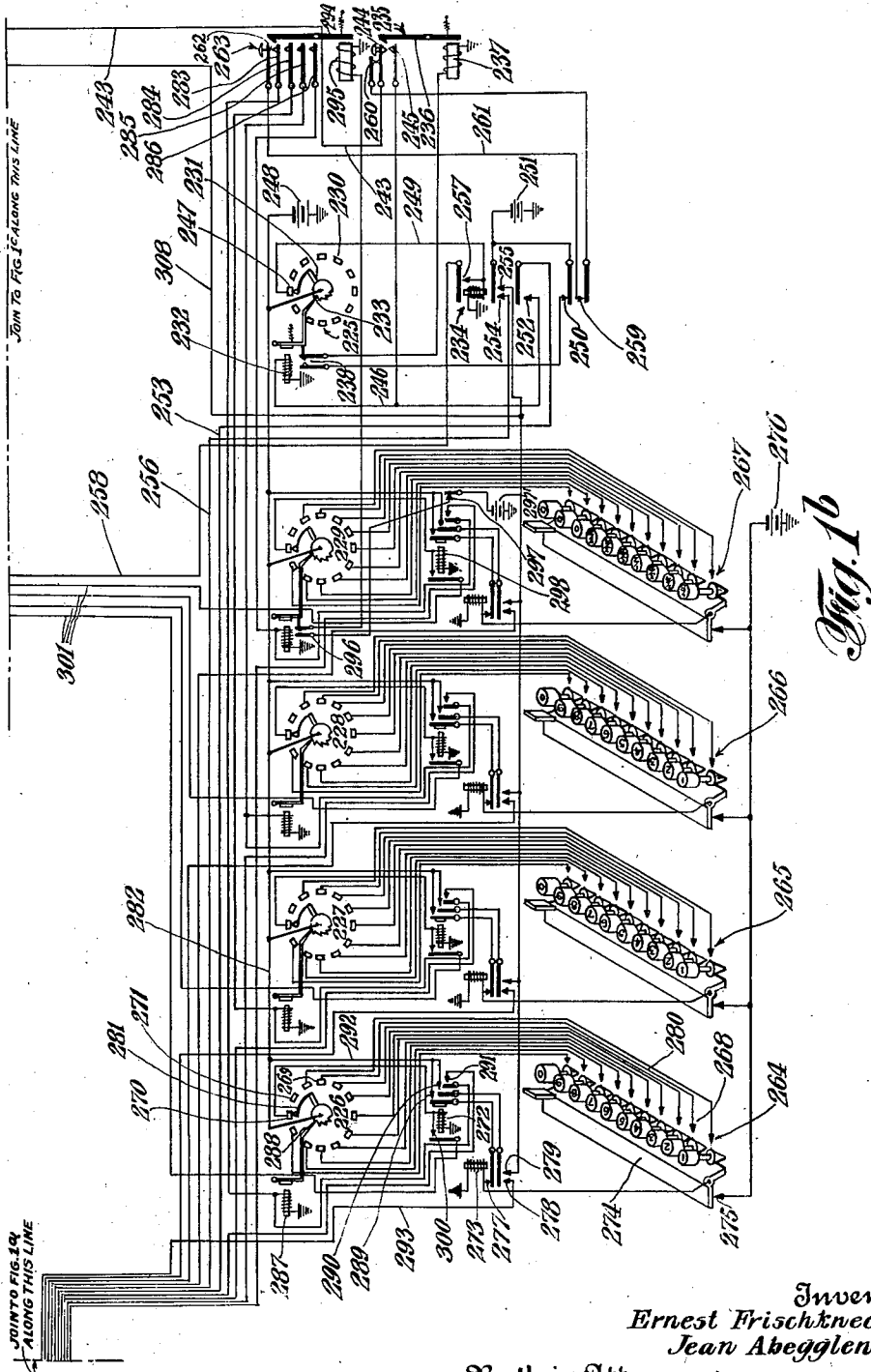
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2,052,539

ELECTRICAL INDICATING APPARATUS

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7 Sheets-Sheet 2



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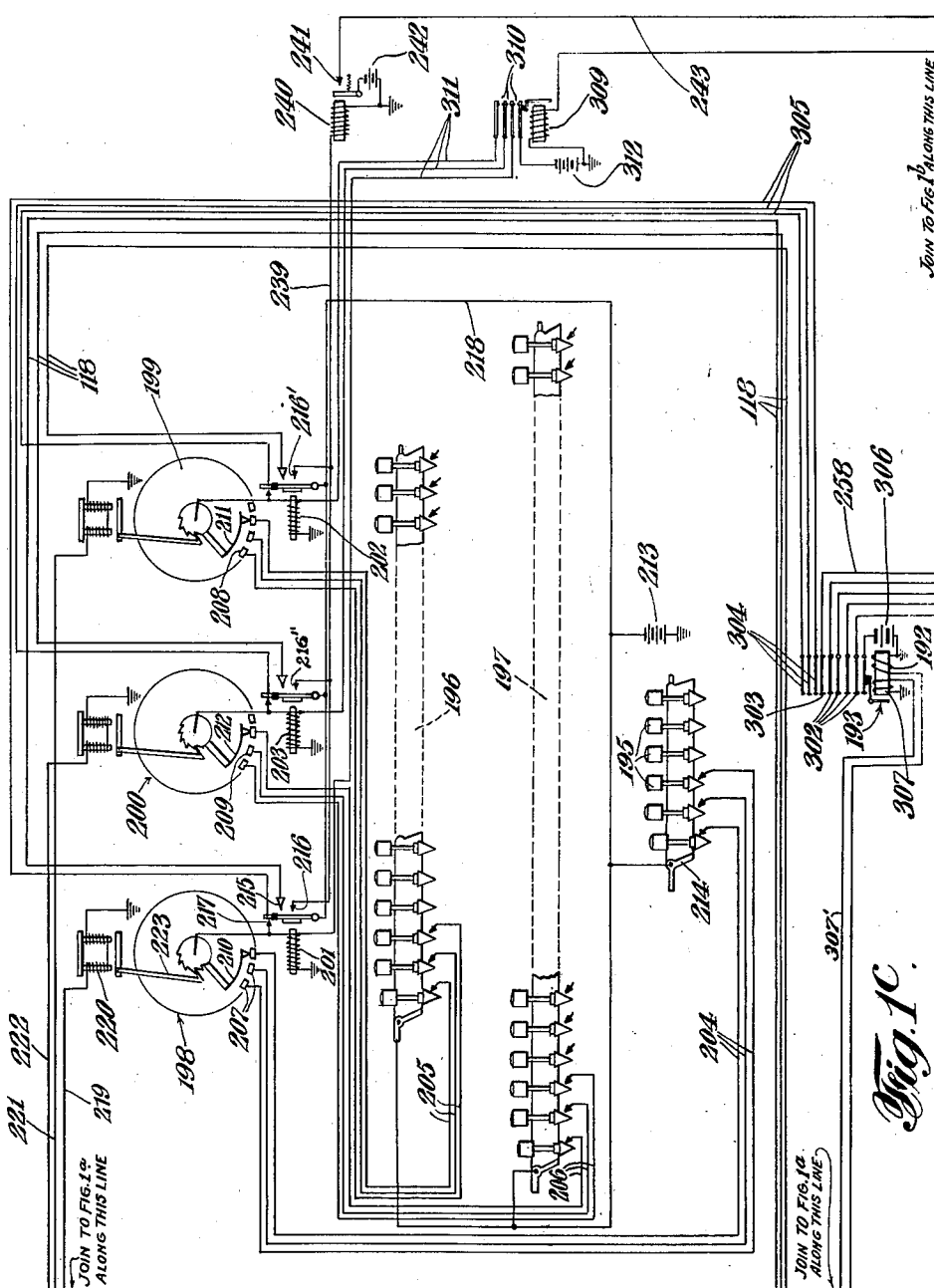
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7 Sheets-Sheet 4

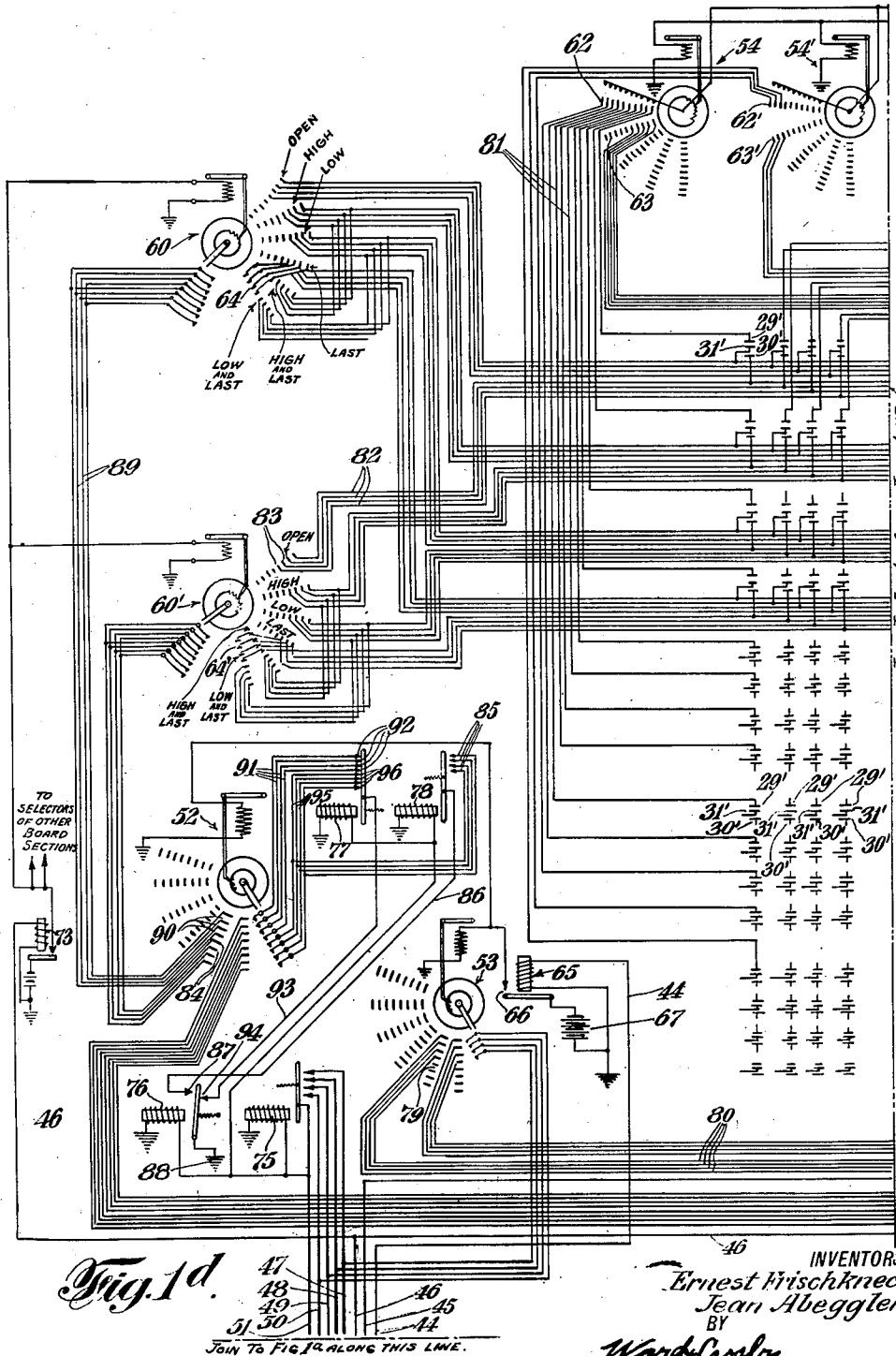


Fig. 1d.

JOIN TO FIG. 1c ALONG THIS LINE.

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7 Sheets-Sheet 5

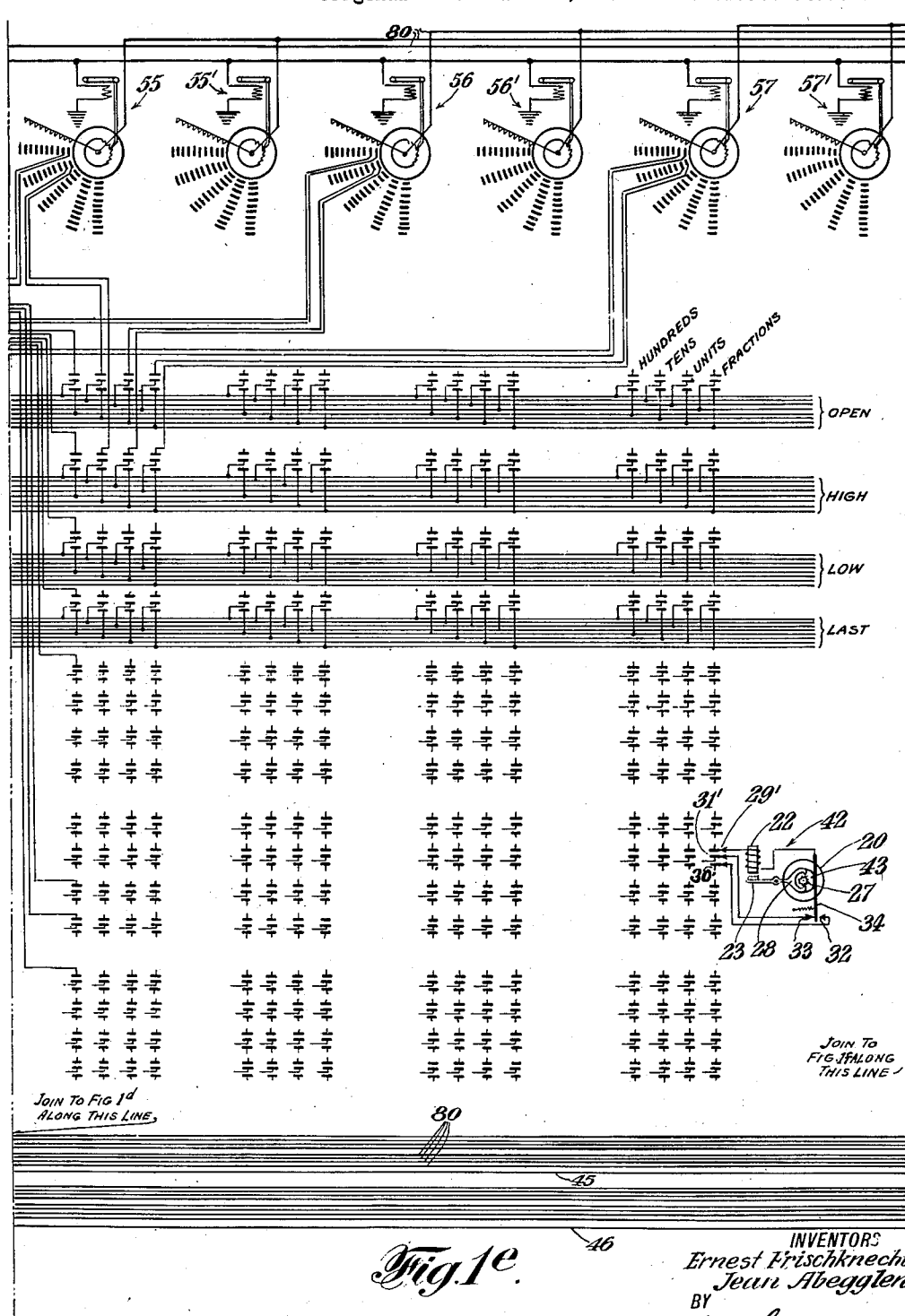


Fig. 1e.

46

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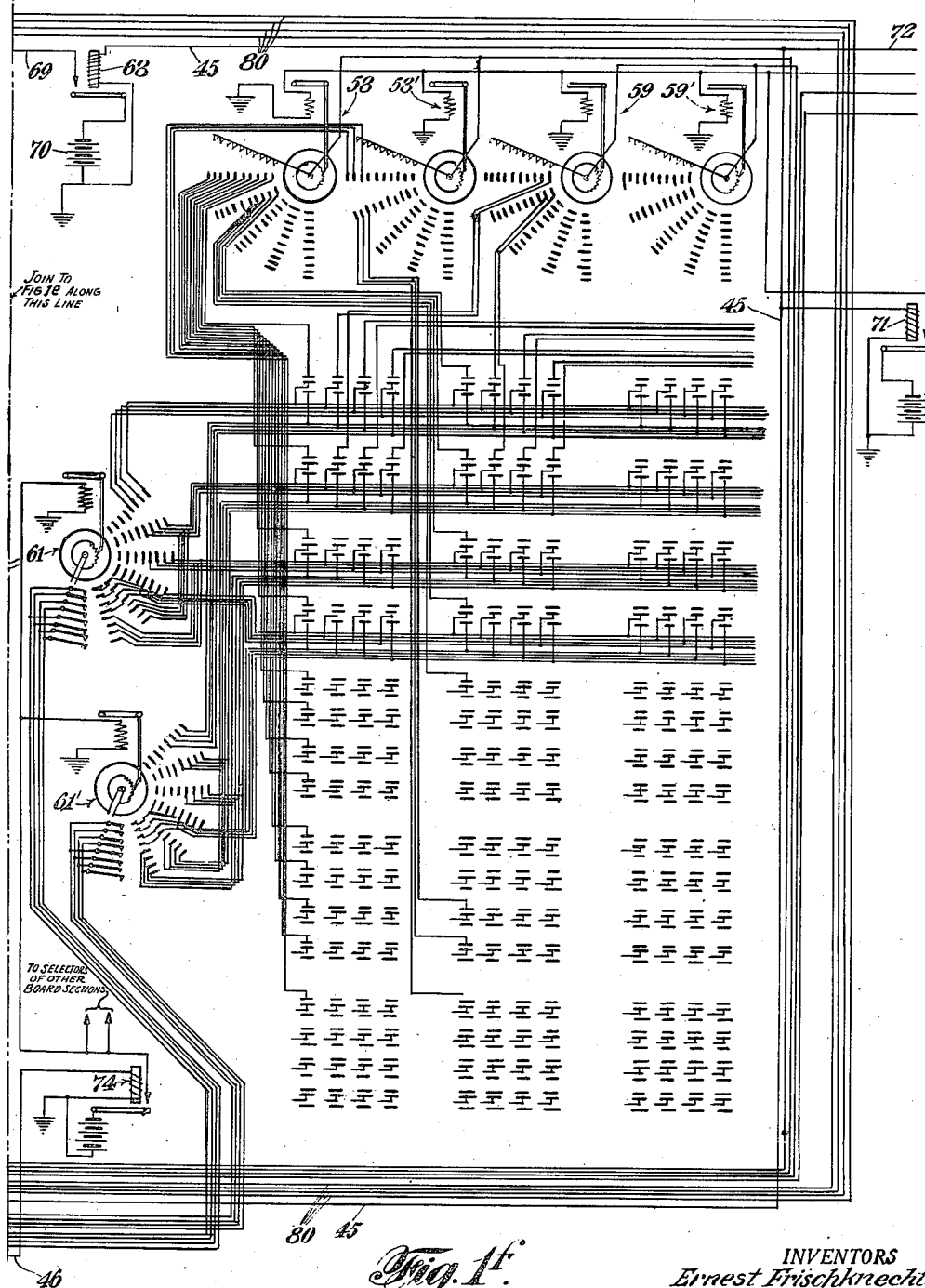
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7 Sheets-Sheet 6



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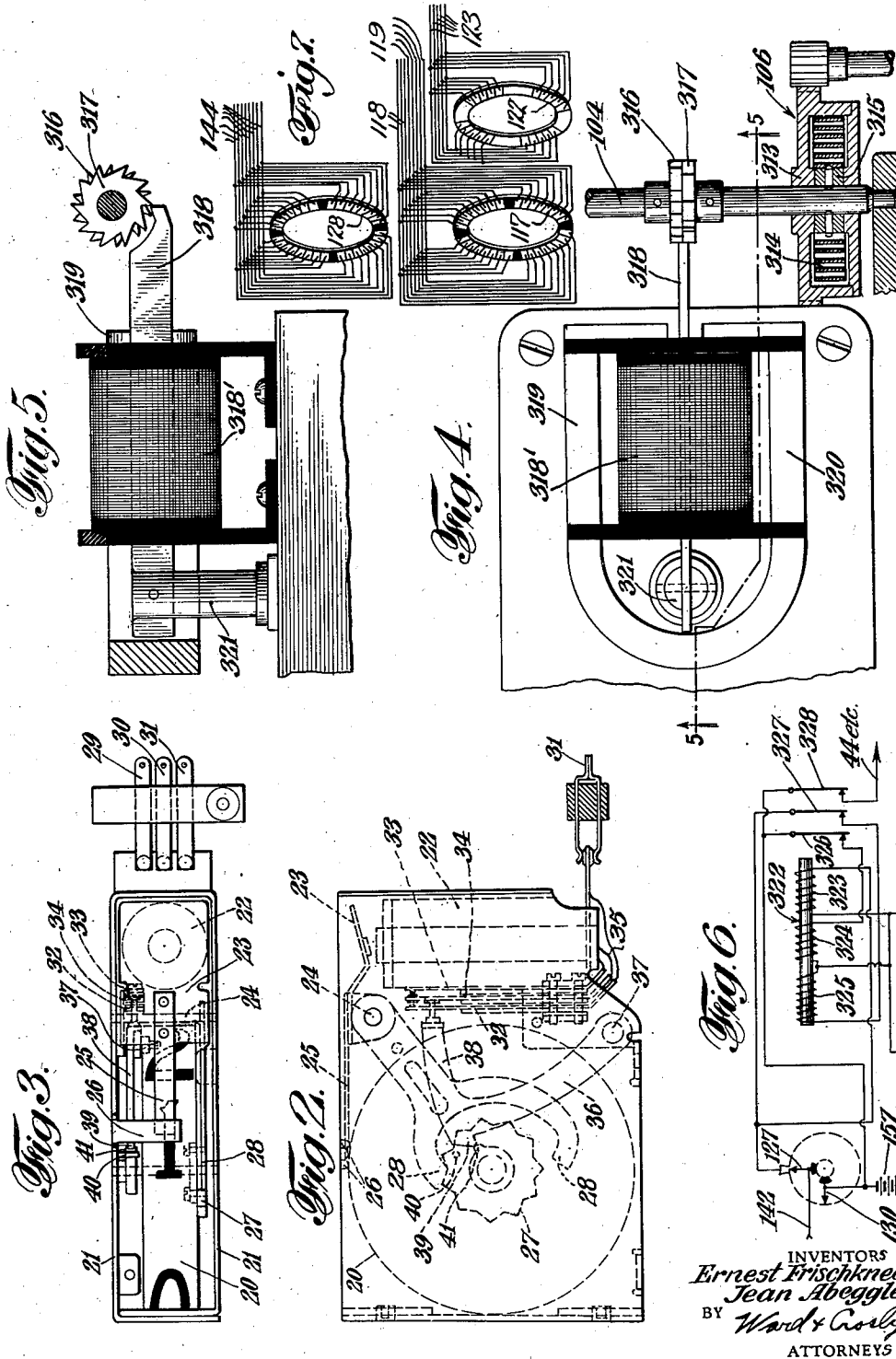
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7 Sheets-Sheet 7



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UNITED STATES PATENT OFFICE

2,052,539

ELECTRICAL INDICATING APPARATUS

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Application March 1, 1928, Serial No. 258,219.
Renewed July 23, 1934. In Switzerland April 5, 1927

20 Claims. (Cl. 177—353)

This invention relates to electrical signaling and more particularly to signaling apparatus and methods, according to which information concerning a large number of different items may be made available at a plurality of receiving stations, all controlled over a relatively small number of line wires from a central point or points.

While not limited thereto, the invention is particularly adaptable to the transmission and posting of varying quotations or prices of a multitude of items such as stocks, bonds or commodities.

The transmission of the quotations may be controlled from central points, such as stock exchanges, and arrangements are provided whereby a large number of brokers may be simultaneously provided with quotation service for as many of the stocks or other items as are desired or of particular interest at each broker's office or other establishment having suitable receiving apparatus.

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

Further and more specific objects, features and advantages will more clearly appear from the following description taken in connection with the accompanying drawings and claims.

The invention consists in the novel signaling methods, features, circuit arrangements and combinations of circuits and parts as herein-after described, but by way of example only, as being illustrative of certain preferred embodiments of the invention.

In the drawings, Fig. 1 comprises a schematic diagram showing the circuit arrangements of one embodiment of the invention. This figure is divided into six parts. Fig. 1a somewhat schematically illustrates suitable rotary collecting and distributing devices which may be used for the multiplex transmission of the current variations utilized with the apparatus; at the top of Fig. 1a a group of impulse prolonging relay devices is schematically shown for prolonging the impulses delivered from the multiplex distributor. Fig. 1b schematically illustrates the circuits for transmitting impulses to actuate the receiving station indicators and to restore such indicators to a normal position prior to reactivation. Fig. 1c schematically illustrates apparatus and circuits for transmitting suitable current variations to select the indicators for particular stocks or items

for which new quotations are to be posted. Figs. 1d, 1e and 1f schematically show the apparatus and circuit arrangements as of a typical receiving station.

Fig. 2 is an elevational view of a typical indicating unit.

Fig. 3 is a plan view of the device of Fig. 2.

Fig. 4 illustrates certain parts used for synchronizing purposes in the multiplex transmitting mechanism.

Fig. 5 is a detail view taken substantially along the line 5—5 of Fig. 4.

Fig. 6 schematically illustrates an alternative form of impulse prolonging relay which may be used in lieu of those shown at the top of Fig. 1a, and

Fig. 7 is a detail of a part of a mechanism shown in Fig. 1a.

The apparatus of this invention may be operated for example in conjunction with quotation boards or the like apparatus, such as shown in the application of Robert L. Daine and René Guyé, Ser. No. 246,474, filed January 13, 1928, Patent 1,872,126, dated Aug. 16, 1932. Also if desired, the flexibility of the service rendered by the apparatus of this invention may be greatly enhanced by utilizing the invention covered by the patent of Robert L. Daine, No. 1,658,516, dated February 7, 1928, entitled "Methods and apparatus for indicating quotations or other items". Also, certain elemental circuits, arrangements and devices embodied in the apparatus hereinafter described may be constructed as disclosed in the patents to Francois Favarger 1,755,212, issued April 22, 1930, 1,787,620, issued January 6, 1931, and 1,993,704, issued March 5, 1935, and also in our copending Patent 1,852,994, issued April 5, 1932.

Certain phases of this invention are applicable to the apparatus and signaling methods disclosed in the copending applications of Merton L. Haselton, Ser. No. 244,873, filed January 6, 1928, Patent 1,890,876 dated Dec. 13, 1932 and Ser. No. 248,069, filed January 20, 1928, and also certain phases of the inventions of said Haselton applications are applicable to the signaling apparatus disclosed herein.

Where the information to be posted comprises stock quotations or similar items, it is desirable to make the information available, generally speaking, in the same arrangement as with the conventional types of manually attended stock boards or "blackboards" as heretofore used. The apparatus in the particular form hereinafter described is particularly adapted to that purpose,

although according to this invention the posting of quotations may be accomplished with much 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 a central point by a single operator or group of operators.

Each stock, bond or commodity quotation generally comprises four or a smaller number of digits, such as the hundreds, tens, units and fraction values, and for each item the broker's customers are generally desirous of knowing the "open", "high", "low" and "last" quotations. Accordingly for each item a total of 16 indicator units may be provided, the same being arranged in four groups, that is, the "open", "high", "low" and "last" groups, each group having 4 units.

Indicating units

According to the invention of said Daine Patent No. 1,658,516, each receiving station or broker's office may be provided with indicator units for a relatively small number of stocks, but such indicator units being arranged to be interchangeably connected with any one of numerous circuits identified respectively with a much larger number of stocks or items. Referring to Figs. 2 and 3, the constructional details of one form of indicator unit which may be used with this invention will now be described.

The price or quotation digits to be exhibited may be arranged around the periphery of a rotatable drum member as at 20. That is to say, for example, numerals from 1-9, 0, and a blank space may be successively arranged around the periphery of this drum so that such numerals will be exhibited one at a time at the front of the indicating board when the drums 20 are rotated. The drums may be rotated with a step-by-step movement, in this example such movement being always in the same direction whether the indicator is being "actuated" or is being "restored" to its normal or "blank" position. As shown, the drums may be mounted between frame members as at 21. Between the frame members an operating magnet as at 22 may be mounted to cooperate with an armature member 23 pivotally mounted as at 24; a leaf spring 25 engaging a suitable stop member as at 26 may be secured to the armature 23 to normally retain the same in a position spaced from the core of the magnet 22. Each of the drums 20 may be fixed in respect to a star wheel as at 27, which in turn is designed to be engaged by an operating fork or pawl member 28 secured to and operated by the armature 23. The star wheel 27 and operating fork 28 are preferably of the particular shapes and relative dimensions substantially as shown whereby the same may cooperate in a manner such that with each movement of the armature and the fork member, the star wheel 27 together with its drum member is advanced always in the same direction through an angle subtended by the space between two teeth of the star wheel—that is, the drum is advanced "one step". The star wheel preferably has a number of teeth equal to the number of digits or digit spaces to be exhibited at the periphery of the drum and hence in the example shown, 11 teeth are provided. Accordingly, whenever an electrical impulse is transmitted through the magnet, the drum is advanced through such an angle as to remove from exhibition one numeral

and to exhibit the next succeeding numeral or space.

The magnet 22 may be energized in various ways, as for example by either one or two coils, one coil providing for the "actuation" and the other for the "restoration" movements of the drum; if one coil is used, "actuation" impulses and "restoration" impulses respectively may be applied to the coil through different lead wires in a manner hereinafter described. A terminal 29, for example, may be provided for one end of the magnet coil to act as a common return for both the actuation and restoration circuits. Terminals 30 and 31 respectively may be connected to spring contacts as at 32 and 33 comprising parts of a two-way switch having an intermediate contact member 34 connected as at 35 with the remaining magnet coil terminal. The contact member 34 it will be observed is mounted so as to make contact alternatively with the contacts 32 and 33. To actuate the member 34, a contact operating member 36 may be pivoted to the frame as at 37 and formed with an extension as at 38 for engaging an insulating stud which acts to force the contact member 34 to a position out of contact with contact member 32 and into circuit-making position in respect to contact member 33 whenever the member 36 is suitably actuated. The member 36 may also be provided with a cam portion 39 normally resting against a stop pin 40 affixed to the frame, but such cam portion is also arranged to be engaged once during each revolution of the drum by a detent at 41 mounted to rotate with the drum 20. The detent 41 is so placed that when the drum exhibits a "blank" space or a desired equivalent, the detent will engage the cam portion 39 of the contact operating member 36 and cause the same to separate the contacts 32 and 34, a circuit thereupon being made between contacts 33 and 34. At other times the member 36 rests against the stop member 40, permitting the contacts 32 and 34 to remain in circuit-closing position.

With the above described construction a series of impulses may be sent through the circuits including terminal 29, the magnet coil, contact member 34, contact member 32 to terminal 30, which impulses will cause the drum to be rotated to exhibit the desired numeral. Of course if at the time the first of such impulses is transmitted, the circuit is made between contacts 33 and 34, then such first impulse must be transmitted through the circuit comprising the terminal 29, coil of magnet 22, contact member 34, contact member 33, to terminal 31. After such first impulse is transmitted, this circuit will of course be opened, whereupon the succeeding impulses must be transmitted through the circuit of terminal 30 as above described. The manner in which such impulse transmission is controlled will be hereinafter fully described. The manner in which these indicating units may be arranged to provide a suitable bulletin board is disclosed in said patent of Robert L. Daine et al, No. 1,872,126.

Receiving circuits

Each of the numerous receiving stations or broker's offices may be provided with a terminal board such as referred to in said Daine Patent No. 1,658,516, such terminal board having a total of 48 circuit terminals for each of the multitude of stocks or other items, service for which is to be provided. That is, 3 terminals as at 29', 30' and 31' (see Fig. 1e) may be provided for each

of the 16 indicating units for one stock. Assuming that one set of apparatus is arranged to provide quotation service for 600 stocks or items, the necessary terminals therefor may be conveniently divided into six sections or groups, terminals for 100 stocks being provided in each group. In Figs. 1d and 1e a part of one of such terminal board sections is shown. In these figures it will be understood that for simplicity many of the terminals have been omitted, but on a complete terminal board section the terminals may be arranged as shown in groups of 48, 20 tiers of such groups being provided, for example, in five horizontal rows. In Figs. 1d, 1e and 1f the terminals have been arranged in the same relative positions as the indicator units might be arranged, that is, in groups of four providing respectively for the four digits of each "open", "high", "low" and "last" quotation for the various stocks. In Fig. 1e an indicator unit 42 is schematically shown and the manner in which it may be detachably connected to terminals as at 29', 30' and 31', according to the invention of said Daine Patent No. 1,658,516 is apparent. (For simplicity of illustration, a cam member 43 is here shown in lieu of the switch operating member 36 above described, such cam member having a flattened portion permitting the contact terminal 34 to engage the contact 33 when the indicator is at its "blank" position, the cam member at other times serving to hold the terminal member 34 in contact with the terminal 32. Other indicator parts schematically shown in Fig. 1e bear the same reference numerals as corresponding parts in Fig. 2.)

In Fig. 1f a part of another of the terminal board sections is illustrated.

The receiving circuits may be controlled over 8 wires as at 44 to 51 inclusive, the control being effected by means of current variations in the form of groups of impulses sent from a transmitter over a smaller number of line wires, as hereinafter described. The functions performed by such impulse groups may be described as follows: First a series of selector impulses is transmitted for simultaneously actuating a plurality of selecting devices with step-by-step movements so as to choose the terminal connections for the particular desired stock and the particular quotations of such stock which are to be subsequently transmitted. Impulses for this purpose may be brought to the receiving circuits over wires 44, 45 and 46, each cooperating with a common ground return. After the desired terminal connections for the desired stock have been thus selected, if the indicators connected thereto are not already at the positions showing "blank" spaces, then it is first desirable to restore the indicator drums to normal, that is, to exhibit their "blank" spaces. Groups of impulses for this purpose may be brought to the receiving circuits through wire 51. Thereafter it is desirable to simultaneously but independently actuate the four digit indicating units for the particular quotation or quotations chosen in such manner as to indicate the new price or quotation. Impulses for this purpose may be brought to the receiving circuits over the four wires 47, 48, 49 and 50.

Selectors.—The receiving station selectors may be divided into through groups as follows:

First: Selectors 52 and 53 which operate to choose that one of the six terminal board sections upon which the terminals for the desired stock are located.

Second: Selectors as at 54, 54'—57, 57' inclu-

sive which operate to select the vertical rows or tiers in which the indicator terminals for the desired stock are located. In Fig. 1f the corresponding selectors for the terminal board section there shown are indicated at 58, 58', 59, 59'— others being omitted for simplicity.

Third: Selectors as at 60 and 60' which operate to control the circuit connections of the chosen indicators and serve to choose the horizontal terminal rows which include the terminals corresponding to the quotation indicators for the desired stock. For the terminal board section indicated in Fig. 1f the selecting devices corresponding to selectors 60 and 60' are indicated at 61 and 61'.

These selecting devices may all be constructed in any suitable known manner as for example substantially according to the step-by-step selector construction described in British patent to Favarger et Cie., No. 192,055, of April 3, 1924. Accordingly a detailed description of the construction of the same is here omitted. It may be noted, however, that each selector has a single "stepping magnet" and a ratchet and pawl movement controlled by an armature as schematically shown. The selectors 54, 54' to 59, 59' inclusive each have a single wiper arm carrying 10 contacts electrically connected as shown. The remaining selectors such as 52, 53, 60, 60', 61 and 61' also have a single wiper arm, but the contacts thereon may be electrically independent as shown, so far as the wiper arm itself is concerned.

It will be understood that the selectors 52 and 53 are common to all six sections of the terminal board, whereas the other selectors are arranged in groups, one group for each section, eight of the selectors as at 54, etc., being provided for each section and one each of the selectors as at 60 and 60' being provided for each section. It will be observed that the selectors 54, 54', etc., are connected to operate in pairs and accordingly if desired, each pair, as for example 54 and 54' may be constructed as a single unit, in which event 20 contacts, instead of 10, will be provided at each step and on each wiper arm. From the drawings it will be observed that these 20 contacts as at 62 and 62' at each step on the selectors such as 54 and 54', etc., may be connected respectively to the 20 terminals 29' of one vertical tier on the terminal board. Likewise, the 20 contacts as at 63 and 63' of the adjacent selector step may be connected to an adjacent vertical tier of terminals 29' corresponding to a different group of stocks or items. It will be further observed that the contacts of selectors 54 and 54' serve to provide the circuit connections to the hundreds indicator unit terminals, the contacts of selectors 55 and 55' serve to provide the circuit connections for the tens indicator terminals and likewise the selectors 56 and 56' and 57 and 57' respectively provide the electrical connections for the units and fraction indicator terminals. Since provision is made for tiers of terminals corresponding to 20 different stocks in each board section, each of the selectors 54, 54', etc., may be provided with 20 positions (only 5 of which are indicated for simplicity).

It will be observed that the selectors such as at 60 have their contacts connected to cooperate with terminal board contacts or terminals such as at 31', whereas the selectors 60' cooperate in a similar manner with terminal board contacts as at 30'. It will be further observed that six positions are indicated for the selectors 60, 60', etc.,

such positions corresponding respectively to the "open", "high", "low", "last", "high and last" and "low and last" indicator unit terminals. That is, for example, at the "low and last" position 8 contacts 64 may be provided on the selector 60, 4 of such contacts being connected respectively to the fractions, units, tens and hundreds terminals 31' of a "last" quotation group, the other 4 contacts 64 being connected respectively to the fractions, units, tens and hundreds terminals of the "low" group. In a similar manner the contacts at the other 5 indicator positions for the selectors 60 are connected to cooperate with the "open", "high", "low" and "last" indicator terminal groups, whereby the 4 selected indicators for any one of such 4 groups may be operated depending upon the position of the selector 60. Also, if the "last" quotation comprises either a new "high" or a new "low" price or value, the "high" or "low" indicator terminals, as the case may be, may be connected so that the corresponding indicators will operate in conjunction with the "last" indicators. It will be observed that the selector 60' is likewise provided with contacts 64' similar in number and arrangement to the contacts 64 and connected to the terminal board in like manner except that the connections from selector 60' run to terminals 30', whereas the connections from selector 60 run to terminals 31'. Four of the contacts at each of the "open", "high", "low" and "last" steps on the selectors 60, 60', etc., are not used and may be omitted, except for manufacturing convenience.

It will be observed that the contacts at the six positions indicated for the selectors 60, 60', etc., provide only for the choosing of indicator terminals for one horizontal row of stocks, while it will be recalled that as above stated, five horizontal rows of stocks may be provided for on each terminal board section. Therefore, the complete selectors 60 and 60' would have contacts at 30 different positions, only six of which are here indicated for simplicity of illustration.

That is, four additional groups with six positions for each group may be provided and associated with the four remaining horizontal rows of terminal groups on the terminal board (only four out of the five horizontal rows of terminal groups are indicated). Selectors such as 60 will therefore have 30 steps with provision at each step for connecting either 4 or 8 circuits. The selectors 54 and 54' on the other hand, need have but 20 steps, provision being made by each pair of such selectors for bringing together 20 circuits at each step.

As shown, the single selector 52 may have provision for 6 steps of 8 contacts each. The selector 53 may also be a 6 step selector, but only 4 contacts need be provided at each step, although if desired, for manufacturing convenience, the selectors 52 and 53 may be made alike with but half of the contacts of the latter actually used at each step.

The step-by-step movements of the three groups of selectors 52 and 53, 54, 54', etc., and 60, 60', etc., may be controlled respectively by the three wires 44, 45 and 46. The selectors 52 and 53 may be operated through the medium of a relay 65, the magnet coil of which as shown, has its terminals connected respectively to ground and to the wire 44. The relay 65 serves to actuate relay contact 66 which places a source of current as at 67 in circuit with the stepping magnets of the selectors 52 and 53, return circuits being provided from each of the stepping magnets through

ground to a grounded terminal of the battery 67, as indicated. Accordingly, whenever an electrical impulse is applied to wire 44, relay 65 will actuate the contact 66 and apply a more powerful impulse directly to the stepping magnets of selectors 52 and 53. A group of such impulses will serve to advance these selectors to the position corresponding to the terminal board section on which the terminals for the stock to be chosen are located. In a similar manner the wire 45 may be connected to operate a relay as at 68, which in turn is adapted to impart impulses to a wire 69 from battery 70 for operating selectors 54, 54'—57, 57' inclusive. Each of the other sections of the terminal board may be similarly provided with relays controlled over the wire 45. For example, relay 71 is connected to control the selectors 58, 58', 59, 59', etc. The wire 45 may be extended as at 72 to the corresponding relays of other sections of the terminal board. Accordingly while the selectors 52 and 53 are being advanced with step-by-step movements, the selectors 54, 54', etc., may be simultaneously advanced in a similar manner by groups of impulses transmitted over the control wire 45. In a similar manner, control wire 46 is arranged to control selectors as at 60, 60', 61, 61' respectively, through the medium of relays as at 73 and 74. The relays 73 and 74 may be conveniently arranged as shown to each control the corresponding selectors of two other terminal board sections in addition to the sections which are here shown in part. It will thus be apparent that by the use of the three control wires 44, 45 and 46, the three groups of selectors may be simultaneously but independently controlled so as to choose the terminals for the desired quotations which are to be changed to the exclusion of all other terminals on the terminal board.

The manner in which the indicators are actuated after the selecting operations are completed, will now be explained in detail. We may assume that at least certain of the indicator units which have been selected by a previous selecting operation are positioned to exhibit certain numerals and not their "blanks". Therefore, a convenient method of posting a new quotation is to first restore all selected indicators to exhibit "blanks" and then the operator may send groups of impulses over the control wires 47, 48, 49 and 50 respectively, corresponding in number to the numerals of the new quotation, no subtracting or adding in respect to the previous quotation being then necessary. The circuits established for such "restoration operation" are as follows: For restoration purposes a group of impulses equal to or greater in number than the number of possible positions of each indicator is transmitted over the control wire 51 for the purpose of advancing each indicator as previously selected to its "blank" position, regardless of its previous position. That is to say, as many as 10 impulses will be available at each chosen indicator so that for example, if the indicator previously exhibited the numeral "1", such 10 impulses would advance the indicator so as to exhibit successively each of the numerals from 1 to 9 and 0 and finally "blank". On the other hand, if the indicator previously exhibited the numeral "9", then only two of such impulses would be necessary to advance the indicator from 9 to 0 and from 0 to "blank". Thereupon the additional 8 impulses would be rendered ineffective by reason of the operation of the two-way switch above described in connection with the indicator construction. 75

Of course, if desired, the indicator drums might be arranged to rotate in a direction opposite to that above suggested so that if the indicator previously exhibited the numeral "1", then but a single "restoration" impulse would be necessary to restore that indicator to "blank".

The impulses over control wire 51 each energize control relays as at 75, 76, 77 and 78. Relay 75 has four "make" contacts, which upon actuation of the relay cause the four wires 47, 48, 49 and 50 to be all connected to the control wire 51. The four wires 47, 48, 49 and 50 in turn, it will be noted, are extended to the wiper arm of selector 53. Selector 53 will thereupon serve to electrically connect the control wires to its bank of contacts which correspond to the terminal board section previously selected. For example, if the wiper makes contact with a bank of contacts at 79, the circuits will continue through wires 80 to the wiper arms of selectors 54, 54'—57, 57' inclusive. Then assuming that these wiper arms are in positions to contact with banks of contacts such as at 62 and 62', the circuits will continue through wires as at 81 to the terminals 29' of the first vertical row of indicator terminals. The impulses received over the control wire 51 will therefore impulsively energize indicator magnets 22. With such of the indicators as are not exhibiting blanks, the circuit will be continued through the indicator switch contacts 34 to contacts 32, thence through wires as at 82 to selector 60'. Assuming that the selector 60' is so positioned that its wiper makes contact with a bank of contacts as at 83, then it will be observed that circuits are made only through the magnet coils of the four indicators for giving the opening value for the stock, the indicator terminals of which are in the first vertical row as well as the first horizontal row. Therefore, only these four indicators will be supplied with "restoration" impulses. From the contacts 83 the "restoration" circuits are continued through the wiper of selector 60' to a corresponding bank of contacts 84 on the selector 52, thence through the several corresponding insulated wiper contacts of selector 52 to a group of contacts 85 at relay 78. The relay 78 being energized, as above stated, its armature connects all of the contacts 85 through a wire 86 to a "make" contact 87 of relay 76. Since relay 76 is also being energized by the impulses as above stated, the contact 87 will be connected by the relay armature with the ground at 88, forming a return circuit cooperating with the control wire 51 in a manner hereinafter described.

Assuming that certain of the four indicators which are thus supplied with "restoration" impulses are already at their normal positions, or after several impulses arrive at their normal positions, then the circuits from such "restored" indicators will be continued not through indicator contacts 32, but through contacts 33, which in turn are associated through terminals 31' with selector 60. At selector 60 the circuits will be continued through the selector wiper arm in the same manner as at selector 60', thence through wires as at 89 to a corresponding group of contacts 90 on the selector 52, the contacts 90 being in the same bank as the contacts 84. From the contacts 90 the circuits are continued through the corresponding insulated wiper arm contacts, through wires 91 to a group of four contacts 92 on relay 77. However, the "restoration" impulses will have energized relay 77, as above stated, causing the circuits as just traced to be opened at the contacts 92. Accordingly such indicators as

have arrived at their normal positions will not be energized by further "restoration" impulses. As soon as ten "restoration" impulses have been received, all four of the indicators will of course have been restored to normal ready for resetting to post a new quotation.

The circuits for resetting the same four indicators will now be traced. The "restoration" impulses having been completed, the relays 75, 76, 77 and 78 will no longer be impulsively energized. Therefore, although the "restoration" impulses were carried to the four indicators as a group, the "actuation" impulses will be carried over the four control wires 47, 48, 49 and 50 independently, since the relay 75 is de-energized. From the wires 47, 48, 49 and 50 the four circuits continue independently through the four wires 80 respectively to the four pairs of selectors 54, 54', 55, 55', 56, 56', 57, 57'. If it is assumed that these selectors are in the same positions as during the "restoration" action above described, then these four circuits will continue through the four pairs of selector wiper arms respectively to the hundreds, tens, units and fractions terminals of the indicators which have been previously "restored". Therefore over these four circuits groups of "actuation" impulses may be transmitted to each of the four indicators independently and simultaneously if desired, a sufficient number of impulses being provided in each group to "actuate" the corresponding indicator step-by-step to a position indicating the desired numeral for showing the new quotation or price. These four circuits are continued through the indicator contacts 34, the first impulse of each group passing through the contacts 33 inasmuch as the indicators are at normal or "blank" at the time the first impulses are transmitted. From the contacts 33 the circuits will be continued through selectors 60 and 52 in a manner above described, thence through wires 91 to contacts 92. At this time the relay 77 not being energized, all four of the contacts 92 will be grounded through the armature of relay 77, through a wire 93, a break contact 94 of relay 76, and ground connection 88. It will be understood that the ground connection 88 forms a common return path for the impulses arriving over the control wires 47, 48, 49 and 50. The selector 60 cooperating with the selector 52 and the contacts 92 therefore provide a path for completing the circuits for the first impulses of each group sent to the four indicators. However, after the first impulse, each of the four indicators will of course be moved from normal or "blank" position so that thereafter indicator circuits will be made only through indicator contacts 32, which cooperate with selector 60' as above explained. Accordingly, all "actuation" impulses after the first will follow circuits through selector 60', contacts 84 (at selector 52) and thence through connecting wires 95 to another set of contacts 96 under the control of relay 77, the contacts 96 being at this time all grounded by the armature of relay 77 in the same manner as contacts 92. Therefore, each of the four indicators will be energized and moved step-by-step to the desired positions by sending the proper number of impulses over these circuits. After the four indicators are thus actuated, the receiving circuits are ready for the selection of a new stock in the manner as above described.

It will be understood that the "high", "low", "last", "high and last" and "low and last" indi-

cators would be actuated in a similar manner if the selectors 60 and 60' has been actuated to choose the same. Also, it will be understood that selected indicators associated with other terminal board sections would have been actuated in a similar manner had the selectors 52 and 53 been moved to other banks of contacts.

Method of multiplex transmission

According to our invention provision for giving quotation service for as many as 1200 stocks or other items may be made by providing no more than four line wires. In the particular example shown in Fig. 1a, line wires are indicated at 100, 101, 102 and 103. The wire 100 is provided to carry by multiplex transmission the impulses which are suitably distributed at the receiving stations to the 8 control wires 44-51 inclusive. The line wire 101 is provided to serve a similar purpose with duplicate transmitting equipment. That is, the apparatus here disclosed, as above stated, provides for quotation service for 600 items and accordingly duplicate equipment may be used to provide for a total of 1200 stocks or items.

The wires 102 and 103 are provided to carry an alternating current, say of 60 cycles, for purposes of synchronizing the multiplex transmission apparatus hereinafter described. The wire 102 may also be utilized to control certain emergency circuits hereinafter referred to. In instances where the same carefully regulated 60 cycle current is available both at the transmitting and receiving stations, the use of the wires 102 and 103 for synchronizing purposes may of course be obviated. From the foregoing it will be noted that a one wire quotation system is thus provided.

It will be understood that line wires 100-103 inclusive may run from the central transmitting station or stations to a plurality of brokers' offices or other places which are equipped with the receiving apparatus, the various receiving stations being connected in multiple with the line wires. The various parts of Fig. 1 of this application serve to illustrate a complete transmitting station in conjunction with a complete receiving equipment.

At the transmitter a rotatable collector shaft is indicated at 104, the same being driven by a suitable motor 105 acting through a friction clutch 106 which may be of a type which is herein after described in connection with Fig. 4. The alternating synchronizing current of line wires 102 and 103 is made to energize polarized magnets as at 107 and 108, which in turn control an escapement mechanism 109, the details of construction of one form of which are hereinafter described in connection with Figs. 4 and 5.

At the receiving station a rotatable distributor shaft 110 is provided and is likewise driven by a motor 111 through a friction clutch 112 similar to the clutch 106. The distributor shaft is also controlled by an escapement mechanism as at 113, which in turn is energized by polarized magnets as 114 and 115, which are under the control of the alternating synchronizing current supply of the line wires 102 and 103. The motors 105 and 111 of course may be driven by any suitable source of power, such as the ordinary lighting circuit, and it is unnecessary that these motors be driven at exactly the same speed so long as the speed of each is great enough to always rotate the collector and distributor shafts 104 and 110 as fast as the escapement mecha-

nisms will permit. The collector shaft 104 may carry a rotatable insulated contact brush as at 116 which cooperates with a stationary contact ring 117. The contact ring 117 it will be noted comprises four series of arcuately arranged contacts separated by spaces or insulation members. Eight contacts are provided in each of these four groups. Corresponding contacts in each of the four groups may be suitably connected (such connections being omitted for simplicity in the drawings). These eight contacts correspond respectively to the eight control wires 44-51 inclusive above referred to. The first three of these eight contacts are supplied with selector impulses over selector wires as at 118 leading from the selector apparatus shown in Fig. 1c. The next four contacts of each group are connected to four "actuation" circuit wires as at 119, providing for the hundreds, tens, units and fraction "actuation" impulse groups supplied by the "actuation" impulse counters shown in Fig. 1b. The last contact in each group on the contact ring 117 may be connected to a "restoration" wire as at 120 leading to the "restoration" impulse counting devices hereinafter described, and also shown in Fig. 1b.

The collector shaft 104 is provided with another rotatable insulated contact brush 121 which cooperates with a contact ring 122. The contact ring 122 likewise has four groups of contacts, corresponding contacts of each group being connected (these connections being omitted for simplicity). Five contacts are arranged in each of these four groups and the same may be connected by wires as at 123 to the "actuation" and "restoration" impulse counters of Fig. 1b. The purpose of the brush 121 and the contact ring 122 is to distribute impulses in proper sequence to the "restoration" and "actuation" impulse counters, as will be hereinafter described in detail. The intervening spaces between the groups of five contacts may be filled either by insulation or unused segments.

The collector shaft 104 is also provided with a third insulated contact brush 124 cooperating with a third contact ring 125. This ring may be provided with four insulation inserts, as at 126, located in alignment with the insulation pieces between the contact groups of contact ring 117. It will be noted that the brushes 116, 121 and 124 are also arranged in alignment. The purpose of the contact ring 125 is to control certain "locking" circuits, preventing the sending of impulses whenever the collector and distributor shafts 104 and 110 are out of phase, and also preventing the transmission of impulses of abnormally short duration, further reference to which will be made hereinafter.

The distributor shaft 110 is provided with a rotatable insulated contact brush 127 which cooperates with a contact ring 128. The brushes 116 and 127 and the contact rings 117 and 128 may be of like construction, except that the contact ring 128 may be mounted upon a rotatable cylindrical member 129, as distinguished from the ring 117 which is stationary. An additional rotatable insulated contact brush 130 is provided to cooperate with the ring 128, the brushes 127 and 130 being spaced apart with an angular difference equivalent approximately to the width of four of the contact segments. The purpose of the brush 127 is to distribute the impulses arriving over the line wire 100 to the various contacts on the ring 128. These contacts, it will be noted, are arranged in groups, with eight contacts in

each group, corresponding contacts of the various groups being connected, although for simplicity the latter connections have been omitted. The purpose of the brush 130 is to apply current successively to the various contacts of the ring 128 at a short interval just after the contacts have been engaged by the brush 127. The brushes 127 and 130 cooperate with means for prolonging the effect of the line impulses, in the manner hereinafter described.

The cylinder 129, which may be rotatably mounted in suitable bearings, schematically indicated at 131, carries, in addition to the contact ring 128, another contact ring 132 similar to the contact ring 125 above described and cooperating with the ring 125 in the control of circuits for preventing transmission of impulses whenever the distributor shafts are out of phase with the collector shaft 104. The cylindrical member 129 may also carry a ratchet wheel 133 cooperating with a pawl member 134, the latter being in turn operatively connected to an armature 135 under the control of magnets 136. The function of these elements is to cause the cylindrical member 129, together with its contact rings, to be rotated with a step by step movement to bring the distributor mechanism effectively into proper phase relationship with the collector mechanism at the transmitting station in the event that, for any reason, such phase relationship has been disturbed.

The electrical connections to the various collector and distributor contacts will now be described. At the transmitting station the rotatable brush 116 serves to successively engage the contacts connected to the wires 118 and 119, as above explained, and whenever such wires are energized, electrical impulses will be generated by or conducted through the brush 116, such impulses being conducted through a slip ring and brush at 137 to a connecting wire 138. Thence, if the collector and the receiving station distributors are in proper condition for transmission of such impulses, the same will be conducted through contacts at 139 at a relay 140, thence to line wire 100 by way of a connecting wire 141. At the receiving stations the impulses on line wire 100 are conducted by connecting wire 142 to a brush 143, making contact with the brush 127, as shown. Thence, the impulses are distributed over the contacts of ring 128 according to the timing of such impulses. The distributed impulses are then conducted over the eight connecting wires, as at 144, to a corresponding number of slip rings 145 mounted upon the cylindrical member 129. For simplicity, the connections 144 are shown schematically as being outside the cylindrical member 129, but it will be understood that in the actual construction of the apparatus such connections may be readily made within the cylindrical member. The distributed impulses are taken from the slip rings 145 by brushes, as at 146. The brushes 146 may be connected in turn, respectively, by wires, as at 147, to the group of impulse prolonging relays 148 to 155, inclusive. The relays 148 to 155, inclusive, correspond respectively to the control wires 44 to 51, inclusive.

Impulse prolongation

The manner in which the relays 148, etc. operate will now be explained.

Assuming that an impulse is applied to the first of the connection wires 147, such impulse will serve to momentarily energize a line relay, as at 156. This relay thereupon will "pick-up", thereby connecting a source of current 157 to a coil

158 of relay 148. Relay 148 thereupon "picks-up", closing three sets of contacts, as at 159, 160 and 161. Contacts 159 thereupon serve to connect the battery 157 to control wire 44, thus initiating the impulse on this control wire. At the same time, contact 160 prepares but does not complete a circuit for the de-energization of relay 148. This circuit comprises the corresponding contact on the ring 128, one of the wires 144, one of the brushes 146, and the first of the wires 147, and also a second coil 162 provided on relay 148, the other terminal of such coil being connected to ground. Meanwhile, the contacts 161 close a "stick circuit" for the relay 148. This latter circuit runs from battery 157 through contacts 161, thence through coil 158 to ground or the opposite pole of the battery. Meanwhile, the impulse initiated on the control wire 44 still persists. However, when the distributor brush 130 arrives at the particular contact of ring 128 through which these operations were initiated, the de-energization circuit of relay 148 becomes completed. This circuit extends from battery 157 through a connection wire 163 to a brush 164, thence to brush 130 to the designated contact on ring 128, thus completing the circuit through contacts 160, as above traced. This circuit results in the energization of relay coil 162 in such manner that its magnetization opposes that of coil 158, permitting relay 148 to then "drop out". Thereupon the contacts 159, 160 and 161 become separated, terminating the impulse on control wire 44 and restoring the circuits to normal. In a similar manner, each of the other relays 149 to 155, inclusive, become operative upon the distribution of impulses to the other contacts on ring 128. Therefore, when impulses properly timed are sent over the line wire 100, the corresponding number of similar impulses are imparted to the various control wires 44 to 51, inclusive, except that the latter impulses are of longer duration, that is, they are approximately four times longer than the impulses as transmitted over the line 100 in the particular example here shown. With such prolongation of the impulses, sufficient time and energy are made available over the control wires to actuate the selectors and indicators in the manner above explained.

During the normal operation of the apparatus at the transmitter, the brush 121 may be energized as from a battery at 165 through normally closed contacts 166 at relay 140 and through a slip ring and brush at 167. Therefore, each time that the brush 121 engages one of the contacts of ring 122, an impulse will be imparted to the corresponding connection wire 123, as will be hereinafter further referred to.

Correction of phase displacements

The manner in which the contact rings 125 and 132 cooperate in the correction of phase displacements will now be explained.

The distributor shafts 110 may be provided with rotatable insulated contact brushes, as at 168, connected as by a slip ring and brush 169 and a connection wire 170 to the line wire 102. When all of the distributor shafts 110 at the various receiving stations are in proper phase relationship in respect to the collector shaft 104 at the transmitting station, all of the contact rings 132 are at the same angular positions in respect to their brushes 168 as is the collector ring 125 in respect to its brush 124. The ring 125 is connected to the battery 165, so that, except when the brush 124 engages one of the insulation pieces 126, the brush

is connected to the battery. From this brush a circuit is provided through a slip ring and brush, as at 171, to a connection wire 172, thence through the coil of a relay 173 to ground (or the opposite terminal of the battery 165). This circuit when closed energizes the magnet of relay 173, causing its contacts, as at 174, to be opened. However, when the brush 124 engages one of the insulation pieces 126, the relay 173 is de-energized momentarily and the contacts 174 are closed. This prepares a circuit from ground through battery 175 through the magnet coil of a relay 176, thence to line wire 102. This circuit continues from the line wire at the receiving stations through connection wires, as at 170, thence to brush 168. Now, if the distributor shafts are in proper phase relationship, the brushes 168 at this time at the various receiving stations will all be located upon insulation segments 177 of the rings 132, and the circuit above traced will remain open at these segments and no phase correcting steps will be necessary. However, in the event that, for any reason, the distributor shaft should become out of phase with the transmitter, then at the time the circuit is prepared as above traced, the brush 168 of the displaced distributor will be in contact with the ring 132 and not in engagement with one of the insulation segments 177. Thereupon the circuit will be continued from the brush 168 through the ring 132, thence to a brush 178 to a connection wire 179 to a coil 180 of a relay 181, thence to ground. Relay 181 thereupon "picks-up", closing its two sets of contact members 182 and 183. The closing of contacts 182 closes a "stick circuit" for the relay 181 as follows,—battery 184, contacts 182, normally closed contacts 185 (under the control of the armature 135), magnet winding 186 of relay 181 to battery. The closing of the contacts 183 results in the energization of the magnets 136 through a circuit running from battery 184, contacts 183, magnets 136, thence through a ground return to battery. If desired, a signal lamp, as at 187, may be connected in multiple with the magnets 136. Thus, the momentary closing of the circuit through the line wire 102 and the brush 168 through the medium of the relay 181 causes the energization of magnets 136. The "stick circuit" above traced functions to prolong such energization a sufficient length of time to insure the proper operation of the armature 135, which, acting through its pawl 134 and the ratchet 133, causes the cylindrical member 129 to be rotated and advanced through an angle equivalent to one ratchet tooth. Meanwhile, the operation of armature 135 results in the opening of the "stick circuit" of relay 181 at contacts 185, thus de-energizing the magnets 136 at the proper time.

Meanwhile, at the transmitting station, the relay 176, which will have been energized by the circuit as closed through the line 102, will "pick-up", thus closing its contacts at 188. Through contacts 188 a circuit is closed from battery 175 through the magnet winding of relay 140, thence by a ground return to battery. The relay 140 thereupon "picks-up", opening its sets of contacts at 139 and 166, but closing additional sets of contacts at 189 and 190.

It will be observed that the opening of contacts 139 results in the opening of the circuit from the collector ring 117 to the line wire 100, thereby preventing the further transmission of "selector" or "actuation" impulses until the phase displacement is corrected. The opening of contacts 166

likewise operates to remove the battery 165 from the impulse generating ring 122, thus preventing further imparting of impulses to the impulse counters.

The closing of the contacts 189 causes a circuit to be closed from battery 165 through contacts 189, connection wire 191, to magnet winding 192 of a relay 193 (see Fig. 1c). The relay 193 when thus energized functions to prevent further transmission of "selector" and "actuation" impulses, as will be hereinafter described. The closing of the contacts 190 causes a circuit to be closed from battery 165 through contacts 189, contacts 190, to a warning signal lamp, as at 194, through a ground return to battery. The relay 140 as indicated may be provided with a copper slug or a short circuited winding, so that the relay will be slow to release.

Accordingly, the circuits established or broken by the contacts of the relay 140 will remain in that condition for a time sufficient to permit the brushes 124 and 168 to travel to the next insulation segments 126 and 177, respectively. Thereupon, if the phase displacement has been corrected by the single step advancement brought about by the magnets 136, then the brushes 124 and 168 will arrive at the insulation segments simultaneously, and in that event the circuit established through line wire 102 will be broken at one of the segments 177. This will permit the relays 176 and 140 to "drop out".

However, if the single step advancement of the cylindrical member 129 has been insufficient to correct the phase displacement, the circuit through line wire 102 will be again completed, causing the magnets 136 to be again energized for giving the distributor rings another corrective advancing step. If necessary, additional advancing steps will be applied in like manner until the phase displacement is corrected.

Meanwhile, the relay 140 will remain energized for continuing the warning signal 194 and for retaining the transmitting circuits inactive, as above described. Immediately upon complete correction of the phase displacements, however, the transmitter will continue in the normal way.

Transmission of selecting impulses

As above stated, the devices and circuits for transmitting selector operating impulses are shown in Fig. 1c. Three groups of operating keys may be provided as follows. To select the desired receiving station terminal board section, six keys, as at 195, may be provided corresponding, respectively, to the six terminal board sections above referred to. To select the desired vertical row on the terminal board, a group of twenty keys, as at 196, may be provided for controlling the actuation of the selectors, such as 54', etc., above described. To operate the selectors 60', etc., as above referred to, a group of thirty keys, as at 197, may be provided. The groups of keys 195, 196 and 197, respectively, are arranged to cooperate with impulse counting devices 198, 199 and 200. These impulse counting devices may be accompanied, respectively, by relays 201, 202 and 203. Each stock or other item, provision for which is made on the receiving station terminal boards, may be arbitrarily identified with three particular keys, one of each of the groups 195, 196 and 197. Accordingly, in selecting the indicators for a particular stock, the operator presses a proper key in each of these three groups. The groups of keys 194, 195 and 196, respectively, are

designed to each make contact with one of the groups of connection wires 204, 205 and 206. Each of these connection wires is associated with corresponding contacts, as at 207, 208 and 209, provided respectively upon the impulse counting or stepping devices 198, 199 and 200. The stepping devices are provided with wiper contacts 210, 211 and 212, respectively, which are connected to the windings of relays 201, 202 and 203, the other terminals of such windings being grounded.

The thirty keys 197 may bear a serial designation as 1 to 30, in which event key 1 may select "open" indicators in the upper horizontal row; key 2, "high" in said row; key 3, "low"; key 4, "last"; key 5, "high" and "last"; key 6, "low" and "last"; key 7, "open" indicators in the second upper horizontal row; key 8, "high" in the second upper horizontal row; etc.

The keys 197 may be labeled Op1, Hi1, etc., Op2 Hi2, etc. where 1 and 2 designate the horizontal row. Any range of any stock may be selected by pressing the proper section key, the proper vertical row key, and the proper horizontal row key, the proper keys for each stock being designated by a table, for example combined ranges "high" and "last" of stock XAX may be designated 356 to be set up respectively on keys 195, 196 and 197.

The operation of the stepping device 198 in conjunction with the keys 195 will now be described, the operation of the stepping devices 199 and 200 being similar.

The operating keys may be of a type well known in the art, arranged in groups as shown in such manner that one of the keys will normally be in depressed condition. When another of the keys is then pressed, the key formerly depressed will be automatically raised to normal position. Each of the keys when depressed serves to close the circuit as from ground through battery 213, contact bar 214, through the depressed key to one of the connection wires 204, thence to the corresponding contact at 207 to the wiper contact 210, relay coil 201, to ground. Relay 201 is accordingly normally energized, whereby a circuit will be normally opened at one of its contacts 215 and also at another of its contacts 216. A third contact, as at 217, will be normally in closed position. The contacts 216 and 217 are for certain control purposes hereinafter described. The contact 215 is located in the circuit of one of the connection wires 118 above referred to which runs to the collector ring 117. This circuit is, therefore, normally open, so that no impulses are normally transmitted from the collector ring contact corresponding to this circuit.

Assuming now that the operator desires to select a stock, the indicator terminals of which are located on the third terminal board section at the receiving stations, he will press the third key of the group 195, thus causing the first key (which is indicated in depressed condition) to be raised, opening the circuit through the corresponding connecting wire 204 and through the relay 201, but preparing another circuit through the third connecting wire 204 and through the third contact 207. Meanwhile, however, relay 201, upon being deenergized, will cause a circuit to be closed through contact 215 and through a connection wire 218, thence to battery 213 and the ground return above mentioned in connection with the receiving equipment. The four contacts on the collector ring 117 corresponding to the circuit of contact 215 will thereupon be ener-

gized, and accordingly four times during each revolution of the brush 116 impulses will be taken from the collector ring and applied to the line wire 100. These impulses will be applied to the corresponding distributor contacts at the receiving stations, and thence through the impulse prolonging relay 158 to the selector control wire 44. Meanwhile, every impulse arriving at the control wire 44 of the tell-tale receiver at the transmitting station will pass through a connection wire, as at 219 (see Fig. 1a), thence to a stepping magnet 220 of the stepping device 198.

It will be noted that additional connection wires, as at 221 and 222, are provided, respectively, for the selector control wires 45 and 46, in order to supply impulses to the stepping devices 199 and 200. Except for the connection wires 219, 221 and 222, the receiving station equipments are identical for the transmitting station checking board and the remotely controlled receiving equipments located at the various brokers' offices, the wires 219, 221 and 222 being, of course, omitted at the regular receiving stations.

With the above described circuits, the collector brush 116 in effect generates "selector" impulses on the line so long as relay 201 is de-energized and contact is made at 215. These impulses also, meanwhile, cause the stepping magnet 220 to be impulsively energized for advancing the wiper contact 210 with a step by step movement over the contacts 207, the wiper contact 210 being operatively associated with the stepping magnet by way of a ratchet and pawl device, indicated at 223. The stepping devices 198, 199 and 200 may be constructed in a manner generally similar to the construction of the receiving station selectors above described.

As soon as the wiper contact 210 is advanced so as to engage the third contact 207 corresponding to the key which has been pressed, a circuit will again be completed through relay 201, similar to the original circuit above described through that relay, except such circuit will run by way of the third key instead of the first. Thereupon relay 201 will "pick-up" and open the circuit at contact 215, whereupon no further impulses will be collected at the collector ring 117 and no further impulses will be delivered to the stepping magnet 220. Meanwhile, the receiving station selectors will have been advanced to their third contact bank for choosing the third terminal board section. Since the two additional selecting operations as performed by the stepping devices 199 and 200 are similar to that performed by the stepping device 198, such operations will not be described. It may be observed, however, that the stepping devices 199 and 200 may be actuated concurrently with the device 198 so as to concurrently transmit interspaced groups of "selector" impulses by the multiplex transmitting devices over the single line wire 100, thus concurrently adjusting the three groups of selectors at all of the receiving stations in preparation for actuation of the chosen indicators.

Transmission of "restoration" and "actuation" impulses

Referring to Fig. 1b, a "restoration" impulse counter is indicated at 225. Actuation impulse counters are shown at 226, 227, 228 and 229 for operating respectively the chosen hundreds, tens, units and fraction indicators.

The "restoration" impulse counter 225 may comprise a series of contacts 230, a wiper contact 231 cooperating therewith, the latter being operated

by a stepping magnet 232 acting through a suitable ratchet and pawl as at 233. A multi-contact relay 234 is associated with this impulse counter for controlling various circuits hereinafter described. This impulse counter may also be associated with a "starting switch" 235 having a locking member 236 controlled by a tripping magnet 237, the tripping magnet in turn being under the control of contacts at 238 at the stepping device.

The operation of this "restoration" impulse counter is as follows: Assuming that the selection of the indicators for the desired stock or other item has been accomplished by the operation of the selector impulse counters above described, upon completion of the action of the selector impulse counters all three of the relays 201, 202 and 203 (see Fig. 1c) will have "picked up". Therefore circuits will be broken between the armatures of these relays with all of the contacts as at 216, (corresponding contacts on the relays 202 and 203 are designated as 216' and 216'' respectively). However, pending the transmission of "selector" impulses, the contacts 216 have served to close the circuit from battery 213 through wire 218, contacts 216, etc., to wire 239, to a relay 240, thence by a ground return to the battery. Therefore, throughout the period of sending of "selector" impulses, the relay 240 is "picked up" maintaining a contact at 241 in open circuit condition. The function of the contact 241 as will be hereinafter explained, is to delay the transmission of any "restoration" or "actuation" impulses until the transmission of "selector" impulses is completed. As soon as all of the three contacts 216, 216' and 216'' are opened upon completion of the selector operation, it will be apparent that the relay 240 will "drop out", thus closing the circuit from ground through battery 242, contact 241, connection wire 243 to contact 244 of the "restoration" impulse starting switch 235 (see Fig. 1b). Now, assuming that the operator has pressed the starting switch 235 in preparation for starting the "restoration" impulse counter, then the contact 244 will be locked down by the member 236 so as to make contact with a contact 245. Therefore, the circuit from battery 242 will be continued through contact 245, connection wire 246, to the stepping magnet 232, thence by ground return to battery. Normally the wiper contact 231 makes contact with a contact 247, whereby a circuit is completed from ground to battery 248, through the wiper contact 231, contact 247, wire 249, through the coil of relay 234, thence to ground. The relay 234 is therefore normally "picked up". However, the energization of the stepping magnet 232 in the manner above described will result in the closing of contacts 238 by the action of the stepping pawl, thus completing a circuit through the trip magnet 237 as follows: ground, trip magnet 237, contacts 238, contacts 250 of relay 234, battery 251 to ground. This results in the immediate energization of the tripping magnet, thus tripping the locking member 236 and opening the stepping magnet circuit at the contacts 244 and 245. The stepping magnet 232 thereupon releases its armature, and the pawl and ratchet 233 advances the wiper contact 231 one step and out of engagement with contact 247, thus breaking the holding circuit of relay 234, permitting this relay to "drop out". Thereby a contact 252 of relay 234 causes a circuit to be closed from ground through the stepping magnet 232, contact 252, through connection wire 253, which is one of the impulse conducting wires 123 referred to in connection with Fig. 1a. The im-

pulse generating ring 122 thereupon at proper intervals imparts impulses to the wire 253, causing the stepping magnet 232 to be advanced successively over each of the contacts 230 and finally back to a position of rest on contact 247, whereupon relay 234 again "picks up". Meanwhile, however, contacts at 254 and 255 will have been closed, both being at the relay 234. At the relay 234 contact 254 closes a circuit from ground through battery 251, through a connection wire 256 which is the continuation of wire 120 referred to in connection with Fig. 1a. Therefore, throughout the time that the stepping device 225 is being operated, a potential will be applied to the contact on ring 117 corresponding to the wire 256 and consequently properly timed "restoration" impulses from the brush 116 will be imparted to the line wire 100, ten of such impulses being transmitted successively as a group for the purposes above described. The function of contact 255 is to "block" the transmission of "selector" impulses for the next quotation until after the termination of the operation of transmitting "restoration" impulses and the manner in which this is accomplished will be described hereinafter. The relay 234 has an additional contact at 257, which is normally closed and serves to maintain a circuit through a connection wire 258, contact 257, coil of relay 234 to ground. The remainder of this circuit will be traced hereinafter, but its purpose is to act as a "stick" circuit for the relay 234 preventing the release of the same for the initiation of "restoration" impulse transmission until the multiplex transmission collector is at a position to generate a complete impulse rather than a "clipped" impulse of short duration, as above referred to.

Relay 234 has an additional contact 259 which is normally closed, but is open during the sending of "restoration" impulses. When the "restoration" impulses are completed and the relay 234 "picks up", the contact 259 closes a circuit from ground through battery 242, contact 241, connection wire 243, starting key contact 244, and starting key contact 260, (now in closed circuit position), contact 259, wire 261 and contact 262 of a starting switch 263 which controls the sending of "actuation" impulses. At the completion of the transmission of the "restoration" impulses, this circuit permits transmission of "actuation" impulses to be started as will be hereinafter explained. The four "actuation" impulse counters operate in a similar manner and accordingly only the construction and operation of the impulse counter 226 and its associated circuits will be described in detail.

The details of construction of suitable stepping devices or impulse counters, such as may be incorporated in these circuits at 225-229 inclusive, are well known and accordingly the mechanical details of such devices need not here be further described. Each of the "actuation" impulse counters 226-229 has associated with it a bank of operating keys respectively, as at 264, 265, 266 and 267. It will be observed that these keys are each identified with indicia representing the corresponding digit, the four groups or banks of keys providing respectively for the hundreds, units, tens and fractions digits. While the fraction indicia are indicated as common fractions, it will be understood that if desired the decimal fractions or indicia might be used, since ten keys are provided in the fractions group as well as in the other groups.

Each of the keys is accompanied by an electrical

contact such as shown at 268, each of such contacts respectively being electrically connected to one of the contacts as at 269 on the impulse counters. Each of the impulse counters in addition to having ten of the contacts as at 269 corresponding to the ten keys, has a normal contact 270 and an insulating contact 271.

Each of the impulse counters has associated therewith a relay as at 272 which is normally energized and an additional control relay as at 273.

The operation of the impulse counter 226 will now be described. Assuming that the operator after having selected the indicators for the particular stock or item on which the new price is to be posted, desired to move the hundreds indicator to exhibit the figure "2", he will press the key 268 bearing the number "2". This will cause a contact bar 274 adjacent the keys to be tilted out of engagement with a contact 275, thus breaking a circuit from ground through a battery 276, through the magnet of relay 273. The relay 273, it will be observed, has three contact makers at 277, 278 and 279 and upon de-energization of this relay the contact at 277 will be broken, while circuits will be prepared through contacts 278 and 279. The pressing of the key 268 furthermore prepares a circuit from ground through the magnet coil of relay 273, contact bar 274, key number 2, contact 268, one of the connection wires as at 280, to the second impulse counter contact 269 where the circuit remains open until the contact 269 is engaged by a wiper 281. The wiper 281, it will be observed, is connected by a wire 282 to the battery 248, and thence to a ground return. The mere pressing of the key number 2 will not start the impulse counter. Therefore, the key may be pressed in advance and later at the desired or proper time the "actuation" starting key 263 may be pressed. Now, if the "restoration" impulses are complete the contact 262 of the starting key 263 will be energized from the battery 242 as above explained through contact 259. Therefore, upon pressing the starting switch 263, current will be applied to the various contacts as at 283, 284, 285 and 286. These four contacts respectively will serve to conduct the current from contact 262 to the stepping magnets of the four "actuation" impulse counters. Stepping magnet of impulse counter 226 is indicated at 287. When a current is applied to the stepping magnet 287, the circuit is completed by way of a ground return, as shown and the stepping magnet will therefore attract its armature and advance its pawl member as at 288 in preparation for "stepping" the wiper 281. As soon as the starting key 263 is released (in a manner hereinafter described), the stepping magnet will release its pawl 288, causing the wiper contact 281 to be advanced from the normal contact 270 to the insulated contact 271. This serves to break the circuit from ground through battery 248, wire 282, wiper contact 281, normal contact 270, coil of relay 272 to ground, thus resulting in de-energization of the relay 272 while the wiper contact moves to the inactive contact 271. The release of the relay 272 closes circuits through three of its contacts as at 289, 290 and 291. The closing of contact 289 prepares a circuit from ground through battery 248, wire 282, connecting wire 292, contact 289 to the open contact at 277 of relay 273. The concurrent closing of the contact at 290 completes a similar circuit from battery 248, except through the now closed contact at 278 to a wire 293, which is one of the "actuation"

impulse carrying wires running to the collector ring 117 shown in Fig. 1a. That is, this closing of the contact 290 causes current to be applied to the corresponding collector contact and therefore the transmission of impulses over the line wire 100 will begin such impulses being transmitted at the rate of four for each revolution of the collector shaft. Meanwhile, however, impulses will be applied to the stepping magnet 287 by way of a circuit through the contact at 291 which has just been closed by relay 272. This circuit extends from the collector contact ring 122 through one of the wires 123 to contact 291, thence through stepping magnet 287 and its ground return. These successive impulses which are applied to the stepping magnet at the rate of four during each revolution of the collector shaft cause the impulse counter wiper 281 to be "stepped" around in engagement successively with the contacts 269. When the wiper engages the second of these contacts, that is the one corresponding to the key which has been depressed, a circuit will be completed therethrough from the battery 248, through the contact 268 at the depressed key, and thence through the coil of relay 273, causing this relay to "pick-up". This results in the opening of contact 278 and the circuit of wire 293 preventing the further transmission of impulses and concurrently closing a "stick" circuit of the relay 273 through its contact 277 which is now closed. The circuit of contact 277 is completed through contact 289, thence through battery 248 and a ground return, so that although the impulse counter 226 is free to continue its stepping action, no further impulses will be transmitted through the line connection 293. The wiper 281 will continue to be "stepped" around until it arrives again at the normal contact 270, whereupon relay 272 will be again energized, thus opening the contacts at 289, 290 and 291. This cuts off the further application of impulses to the stepping magnet 287 and permits the relay 273 to be de-energized in preparation for the sending of the next quotation and opens the line circuit through 293 at the contact 290, thus maintaining this circuit open notwithstanding the closing of the contact 278 by reason of the de-energization of relay 273.

When the next quotation is to be transmitted, another of the keys 264 may be depressed, or if the digit 2 is to be used again, none of the keys 264 need be pressed since the two impulses corresponding to key number 2 will be sent out, upon again operating the starting switch 263. The pressing of one of the keys 264 may be made effective to cause the key previously depressed to be raised automatically by reason of the action of mechanical keyboard operating members which are well understood in the adding machine and other arts.

If desired, the starting key 263 may be provided with a latch member as at 294, which may be under the control of a release magnet 295. The circuit of the release magnet 295 may be conveniently controlled by the impulse counter for the fractions digits and may include a contact as at 296 normally open, but arranged to be closed upon energization of the stepping magnet. This circuit may be provided with an additional contact as at 297, normally closed when the relay 298 is normally energized. It will be understood that the relay 298 at the fractions impulse counter corresponds in function to the relay 272 above described in connection with the hundreds impulse counter. Assuming that the starting 75

switch 263 has been pressed and latched down by the member 294 as soon as the contact 262 is energized, the "actuation" impulse stepping magnets will simultaneously become energized including the stepping magnet at the fractions impulse counter. This will result in the closing of a circuit through the latch release magnet 295, contact 296, contact 297, battery 297', through a ground return to the magnet 295. The starting switch will thereupon be released, thus terminating the first or "starting" impulse for the "actuation" impulse counters.

Prevention of transmission of "clipped" impulses

It will be observed that each of the relays such as 272 and 298 is provided with an additional contact as at 300, such contacts being interposed in circuit connecting wires as at 301 running respectively to contacts as at 302 at relay 193 (see Fig. 1c). As above stated, the relay 234 of the "restoration" impulse transmitting device has a similar contact 257 associated with the connection wire 258 running to another contact 303 at the relay 193. The relay 193 is also provided with three additional contacts as at 304, with three connection wires as at 305 running respectively to contacts as at 217, which are under the control of the three selector controlling relays 201, 202 and 203. Now, whenever the relay 193 is energized, all of the contacts 302, 303 and 304 are brought together and carry current through a circuit from ground, battery 306, contacts 302, 303, 304, and to the various contacts as at 217, 257 and 300 respectively through the coils of the selector control relays, the "restoration" transmitter control relay and the "actuation" impulse control relays, and thence by ground returns to the battery 306. These circuits in effect comprise "stick" circuits for all of these control relays and prevent such relays from being released to initiate the transmission of impulses until such time as relay 193 is de-energized. Relay 193 in addition to the coil 192 above referred to may be provided with a coil 307 and whenever either of the coils 192 and 307 is energized, it is apparent that the transmission of "selector", "restoration" or "actuation" impulses cannot start.

It may be here noted that the coil 307 of relay 193 is controlled over connection wire 307', the circuit running to brush 171, thence through brush 124, contact ring 125 to battery 165, and through a ground return to coil 307. The operation of this circuit is as follows: Whenever the brush 124 is in engagement with the metallic parts of ring 125, the relay 193 will remain "picked up", thus maintaining closed the "stick" circuits of the various impulsing devices. However, as the brush 124 rotates, it will engage insulation segments 126 four times during each revolution and at such times the relay 193 will be de-energized (unless the coil 192 is energized because of phase displacement). Hence four times during each revolution of the collector shaft the relay 193 will be released so as to permit the impulse counting devices to start their operations. The relay 193 thus prepares the impulsing devices for action only at the times when the brush 116 of ring 117 is in engagement with insulating segments and therefore no impulses of unduly short duration can be instituted on the line wires even regardless of when the operator presses the digit keys.

A control circuit will now be described which has the function of preventing the transmission

of selector impulses until after the "restoration" and "actuation" impulses have been completed for the previous quotation. It will be recalled that the "restoration" control relay 234 has a contact 255 associated with the battery 251. The "actuation" control relays, such as 272, all have similar contacts as at 279 connected in parallel to a connection wire 308 running to a relay coil 309 and thence by a ground return to battery 251 and battery 248 (see Fig. 1c). The relay 309 has a group of normally separated contacts as at 310, each of which is interposed in a "stick" circuit for the corresponding three selector control relays 201, 202 and 203 respectively, connection wires 311 being provided for this purpose. The "stick" circuits are completed through a battery as at 312 and a ground return to the three selector control relays. Therefore whenever impulses are being transmitted either from any of the "actuation" impulse counters or from the "restoration" impulse counter, the relay 309 will be energized by way of one or more of the contacts 279 or 255 carrying currents either from the battery 248 or the battery 251. However, as soon as the transmission of "restoration" and "actuation" impulses is all completed, these contacts will be all opened, thus de-energizing relay 309 and permitting the contacts at 310 to be separated, thus releasing the "stick" circuits of the three selector control relays. Until this occurs, of course, the transmission of selector impulses is prevented even though selector keys have been pressed.

The action of the various impulse transmitting devices and the interlocking circuits will now be briefly summarized: The operator may first press three of the selector keys, that is one from each of the three groups, each of the keys pressed bearing indicia arbitrarily assigned to a particular stock or item. Thereupon as soon as the collector brush 124 arrives at one of the insulation segments on the collector ring 125, the relay 193 will be released providing the receiving devices are all in proper synchronism, but of course if certain of the receiver distributors are out of phase, the relay 193 will not be released and the transmission of impulses will be precluded pending an adjustment of the phase relationships. Assuming that no "restoration" or "actuation" impulses are being transmitted, the release of relay 193 will then permit the three selector control relays to be released, thus substantially simultaneously starting the transmission of interspaced groups of selector impulses for the three groups of selectors.

Meanwhile relay 240 will remain "picked up", preventing the starting of the transmission of either "restoration" or "actuation" impulses. Upon completion of the selector impulses from all the three selector stepping devices, however, the relay 240 will release, permitting the battery 242 to apply the necessary starting current to the "restoration" and "actuation" starting switches.

During the operation of the selector impulse counters, however, the operator will have had time to press the desired "actuation" keys and also the "restoration" and "actuation" starting switches, all of which may have been pressed indiscriminately as to order or sequence. In fact during this time, if the operator made an error in pressing one of the "actuation" keys, such error could have been corrected merely by pressing the proper key at any time before the transmission of selector impulses is completed.

Assuming that the operator has pressed both the "actuation" and "restoration" starting keys, the closing of relay contact 241 will initiate the transmission of "restoration" impulses by the impulse counter 225 providing the relay 193 is still de-energized. Of course at this time if the collector brush 124 does not happen to be on one of the insulation segments 126, the impulses will not begin until the collector brush actually arrives at one of the insulation segments 126 so as to release the relay 193. Of course "actuation" impulses cannot be initiated at this time, since "restoration" impulses have not been completed and the starting current to the starting switch contact 262 is cut off either at contact 259 or at contact 260 of the "restoration" starting switch. Therefore, the transmission of "restoration" impulses may normally proceed uninterrupted until the "restoration" impulse counter returns to its normal rest position. Thereupon, both contacts 260 and 259 will be closed, permitting the starting switch 263 to function, which in turn will cause "starting impulses" to be applied to the four stepping magnets of the four "actuation" impulse counters. The wiper contacts of the "actuation" impulse counters will all thereupon be moved to the insulated or "dead" contacts 271, but the stepping devices will not proceed with the actual transmission of impulses unless and until the various "stick" circuits are opened at the proper time at relay 193 to insure against "clipped" impulses, or the transmission of impulses when the receiving distributors are out of phase. When the relay 193 once releases, however, the impulse counters will be free to continue with a complete cycle of stepping movements unless stopped by a "phase displacement". Meanwhile, until the control relays as at 273 and 234 are all "picked up", no selector impulses can be transmitted by reason of the "stick" circuits closed by relay 309. Therefore, during this time the operator may choose and depress the proper selector keys for the next quotation and as soon as the "actuation" impulses are all completed, relay 309 will release the selector "stick" circuits allowing the selector impulses for the next quotation to begin immediately upon the next releasing of the relay 193.

In Figs. 4 and 5 details of construction of one form of escapement device and associated parts is shown and substantially this construction may be followed both in the transmitter collector and in the receiving station distributors. The friction clutch 106 is here shown in the form of a spring receiving receptacle 313, which is driven directly by the motor through suitable gear teeth as indicated. A suitable collar 315 may be fixed to the shaft 104 and a spiral spring 314 may be attached to the collar 315 at its inner end, but arranged so that its outer end frictionally engages the inside peripheral wall of the receptacle 313. A pair of escapement ratchets 316 and 317 may be affixed side-by-side upon the shaft 104 and arranged to be alternately engaged by a highly vibratory reed or pawl member 318 acting under the joint control of alternating current electromagnet 318' and the poles 319 and 320 of a polarized horseshoe magnet. The pawl member 318 may be mounted upon a post 321 so as to extend axially of the magnet 318'. The magnet 318' may be connected in circuit in lieu either of the magnets 107 and 108 or the magnets 114 and 115. Of course, the structures of Figs. 4 and 5 are here illustrated merely by way of example.

The alternative form of impulse prolonging relay arrangement illustrated in Fig. 6 will now

be described. The manner in which the distributor brushes 127 and 130 are connected in this circuit will be apparent from the drawings. Also, the positions of the lead wire 142 and of the battery 157 are shown. However, instead of the two relays 156 and 148, etc., a single relay 322 is here provided having three windings 323, 324 and 325 and three contact makers 326, 327 and 328. When an impulse arrives over the connection wire 142 and passes over the brush 127, it will be observed that the coil 323 will be energized, causing the relay to initially "pick-up". Of course the energization of coil 323 will be only momentary but the consequent closing of the contact 326 establishes a "stick" circuit from the battery 157 through contact 326, coil 324 and through a return wire to the battery. At the same time the closing of contact 328 closes a circuit from the battery 157 to one of the various control wires such as 44. However, when the brush 130 arrives into engagement with the proper segment, a release circuit is closed from battery 157 through brush 130, contact 327, coil 325 and by return connection to the battery. Accordingly, the magnetization of coil 324 is neutralized allowing the relay to drop out, thus terminating the working impulse by the opening of contact maker 328.

The usual practice as followed in the design and arrangement of automatic electrical switching and control devices, circuits, etc., as known in the art, may be followed as to details which may not be herein specifically referred to or described in full.

The expression "indicator assembly" used in the claims applies to a plurality of associated indicator units which together constitute means for indicating a quotation including one or more digits, as for example the price \$67.4. By "ground circuits" is meant the circuits or leads over which ground is applied and by "energizing circuits" is meant the circuits or leads over which battery is applied.

While the invention has been described in detail with respect to particular preferred examples thereof which give satisfactory results, it will be understood by those skilled in the art after understanding the invention, that various 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 secured by Letters Patent of the United States is:

We claim:

1. In a stock quotation receiver including a plurality of groups of indicators, means for selecting any desired group for operation, a rotatable impulse distributor comprising segments over which restoration impulses are transmitted to the selected indicators and other segments over which resetting impulses are transmitted to the selected indicators, and means operated by said selecting means for operatively associating said indicators with said restoring and resetting segments.

2. In a quotation system, a transmitter, a receiver, a line interconnecting said transmitter and receiver, a plurality of groups of step-by-step indicators and selecting means for said indicators in said receiver, means including a rotary distributor in said transmitter for sending character code signals comprising selecting impulses, restoration impulses and resetting im-

pulses over said line to said receiver, means including a rotary distributor in the receiver for directing said incoming selecting impulses to operate the selecting means, said distributor directing the incoming restoration and resetting impulses to control the operation of the selected indicators.

3. In a quotation system, the combination of a transmitter including means for storing information as to stock designation and price, a receiver including a plurality of groups of indicators and group selecting means, a line wire interconnecting the transmitter and receiver, means in the transmitter for transmitting impulses over said line wire under control of said storage means, a rotatable distributor in the receiver comprising a plurality of segments over which selecting impulses are received to control the operation of the group selecting means and another plurality of segments over which impulses are received to control the operation of the selected indicators, and means connecting said selected indicators to the last named segments to cause the impulses received by the indicators to correspond in number to the indicator operating impulses sent by the transmitter.

4. In a stock quotation system comprising a transmitting mechanism and a distant receiving mechanism, said receiving mechanism comprising indicator assemblies for indicating prices of stocks, the assemblies being arranged in groups for the various stocks and the groups being arranged in sections, means in the receiving mechanism for selecting any section, means in the receiving mechanism for selecting any assembly in any section, a single line wire connecting the receiving mechanism to the transmitting mechanism, means in the transmitting mechanism for transmitting several series of selecting means controlling impulses over said line wire with the impulses of the several series transmitted in interspaced relation, and means in the receiving mechanism for allocating said impulses to the respective selecting means.

5. In a stock quotation system comprising a transmitting mechanism and a distant receiving mechanism, said receiving mechanism comprising indicator assemblies for indicating prices of stocks, the assemblies being arranged in groups for the various stocks and the groups being arranged in sections, means in the receiving mechanism for selecting any section, means in the receiving mechanism for selecting any assembly in any section, a single line wire connecting the receiving mechanism to the transmitting mechanism, means in the transmitting mechanism for transmitting several series of selecting means controlling impulses over said line wire with the impulses of the several series transmitted in interspaced relation, means in the receiving mechanism for allocating said impulses to the respective selecting means, and means cooperating with said allocating means for prolonging the impulses so allocated.

6. Automatic broker's board apparatus comprising a great plurality of electrical impulse operated digit indicators each made able to numerous positions to exhibit the various possible quotations of stocks, commodities or other items, means for controlling said indicators by groups of impulses sent over a single line wire comprising an impulse distributing device, a plurality of at least three selectors operatively associated with said distributing device for substantially concurrent operation by a series of selecting impulses re-

ceived over said line wire, and connections whereby said selectors cooperate to establish operating circuits for particular desired indicators, said circuits being also operatively associated with said distributing device whereby other groups of impulses as received may be distributed to the circuits of the indicators selected for actuating the same.

7. Apparatus for transmitting varying quotations as of stocks or other items from a central point and indicating and posting the same at a receiving station, comprising at said station a large number of electro-magnetically operated indicators one for each digit of each quotation to be posted, said indicators being associated by incomplete circuits according to a predetermined arrangement providing a plurality of groups, a line wire common to said groups and running to the central point from said station, selector means for partially bringing any desired one of said groups into operative relationship with said line wire, and at least two complementary additional selector means for each of said groups for choosing the indicators for any particular desired quotation to the exclusion of others to bring the same into full operative relationship with the line.

8. Apparatus for transmitting varying quotations as of stocks or other items from a central point and indicating and posting the same at a distant station, comprising a large number of electro-magnetically operated indicators one for each digit of each quotation to be posted at the station, said indicators being associated by incomplete circuits according to a predetermined arrangement providing a plurality of groups, line impulse channels each common to a plurality of said groups and running to the central point, selector means for partially bringing any desired one of said groups into operative relationship with one of said channels, and at least two complementary additional selector means for each of said groups for choosing the indicators for any particular desired quotation of that group to the exclusion of others to bring the same into full operative relationship with such channel.

9. An automatic broker's board comprising a great plurality of electro-magnetically operated digit indicating drums each movable to numerous positions to exhibit the various possible quotations of stocks, commodities, or other items as quoted in a market or markets, a line wire, means responsive to impulses sent over said line wire for selecting the drums for a particular item to the exclusion of others and for placing the circuits of the same in operative condition, means controlled at a distant point for transmitting selector impulses and indicator drum actuating impulses over said line wire, and a distributor switch synchronized therewith for distributing said impulses respectively to said selecting means and to the circuits for the drums selected.

10. An automatic broker's board comprising a great plurality of electro-magnetically operated digit indicating drums each movable to numerous positions to exhibit the various possible quotations of stocks, commodities, or other items as quoted in a market or markets, a line wire, means responsive to impulses sent over said line wire for selecting the drums for a particular item to the exclusion of others and for placing the circuits of the same in operative condition, means controlled at a distant point for transmitting selector impulses and indicator drum actuating impulses over said line wire, and a distributor switch synchro-

nized therewith for distributing said impulses respectively to said selecting means and to the circuits for the drums selected, said distributor switch being accompanied by supplemental switching means and relays for uniformly prolonging each impulse for a predetermined short period.

11. Automatic broker's board apparatus comprising a large number of electro-magnetically operated indicators for exhibiting varying quotations of stocks, commodities or other items at a receiving station controlled from a central point over a line wire, selecting means at said station, transmitting means at the central point operable over said line wire to actuate said selecting means for selecting indicators for a particular item to the exclusion of others and for placing the circuits thereof in operative relationship with the line wire, and a set of automatic impulse counters at the transmitter operative substantially concurrently over the circuits thus conditioned to actuate any particular indicators selected.

12. Automatic broker's board apparatus comprising a large number of electro-magnetically operated indicators for exhibiting varying quotations of stocks, commodities or other items at a receiving station controlled from a central point over a line wire, a plurality of individually operative digit indicators being provided for each item at said station, selecting means at said station, transmitting means at the central point operable over said line wire to actuate said selecting means for selecting indicators for a particular item to the exclusion of others and for placing the circuits thereof in operative relationship with the line wire, and a plurality of automatic impulse counters at the transmitter equal in number to the number of digit indicators used for exhibiting the quotation of a particular stock or other item, said counters being operative over the circuits thus conditioned to actuate the particular indicators selected.

13. Signalling apparatus comprising a plurality of electromagnetically operated indicators, control means therefor comprising a sunflower device, a contact brush associated with a line wire for distributing impulses therefrom to the various contacts of the sunflower in succession, a "stick" relay associated with the circuit of each of said contacts and with control circuits for the indicators, another contact brush positioned at an angle with said line brush to engage the sunflower contacts successively at equal predetermined intervals after their engagement with the line brush, said second named brush being associated with a circuit common to the various "stick" relays to effect the release of the same.

14. The combination of a receiving mechanism comprising a plurality of groups of indicator assemblies, a plurality of complementary electro-magnetically operated selecting means simultaneously operable to select any indicator assembly in any group, a transmitting mechanism comprising a plurality of impulse counters, one counter for each of said selecting means, a single line wire over which impulses under control of said counters are transmitted to the selecting means, means in the transmitting mechanism for transmitting the impulses under control of said counters concurrently, and means in the receiving mechanism for allocating said impulses to the respective selecting means.

15. The combination of a transmission mechanism including a multiplex transmission collector, a receiving mechanism including a multiplex dis-

tributor, means for synchronizing the distributor and collector, means in the transmission mechanism for controlling the automatic transmission of a plurality of series of impulses over said collector to said distributor, and means controlled by said collector and distributor when out of phase for preventing the transmission of any of said impulses.

16. The combination of a transmission mechanism including a multiplex transmission collector, a receiving mechanism including a multiplex distributor, means for synchronizing the distributor and collector, relays for controlling the transmission of a series of impulses, a relay for controlling the transmission of another series of impulses, relays for controlling the transmission of another series of impulses, and means controlled by said collector and distributor when out of phase for closing circuits for all of said relays for preventing transmission of any of said impulses.

17. The combination of a plurality of groups of electrical impulse operated indicators actuable to home position by a series of impulses, a selecting means for establishing restoration circuits to any group of indicators, selection impulse transmitting means for controlling said selecting means, settable means for controlling the number of impulses transmitted, automatic means for transmitting restoration impulses over the circuits established, means controlled upon initiation of the transmission of restoration impulses for preventing transmission of selection impulses while permitting a new set-up of said settable means, and means for restoring said preventing means upon completion of the transmission of restoration impulses for permitting an automatic initiation of said selection impulse transmitting means under control of the new set-up of said settable means.

18. Automatic broker's board apparatus comprising a great plurality of electrical impulse operated digit indicators, each movable to numerous positions to exhibit the various possible quotations of a stock, commodities or other items, each group including a plurality of assemblies of indicators for indicating the range prices of a stock, commodity or other item, means for controlling said indicators by groups of impulses transmitted over a single line wire comprising a rotatable impulse distributing device including a plurality of sets of segments, and a plurality of selectors each operatively associated with a set of segments of said distributing device for substantially concurrent operation by a corresponding number of series of interspaced selecting impulses received over said line wire for establishing operating circuits from other sets of segments of said distributing device to the indicators of any assembly of any group for operation of said indicators by impulses subsequently received by said distributing device.

19. Automatic broker's board apparatus comprising a great plurality of assemblies of electrical impulse operated digit indicators, each movable to numerous positions to exhibit the various possible quotations of stocks, commodities or other items, means for controlling said indicators by groups of impulses transmitted over a single line wire comprising a rotatable segmented distributor including a plurality of sets of segments, a plurality of complementary selectors each operatively associated with a different set of the segments of said distributor for operation by a corresponding plurality of series of interspaced selecting impulses received over said line wire,

and connections whereby said selectors cooperate to establish operating circuits for the particular assembly of indicators desired to other sets of segments of the distributor whereby other groups
5 of impulses received may be distributed to the circuits of the indicators selected for actuating the same.

20. Automatic broker's board apparatus comprising a great plurality of assemblies of electrically operated digit indicators, each movable
10 to numerous positions to exhibit the various possible quotations of stocks, commodities or other items, means for controlling said indicators by groups of impulses transmitted over a single line
15 wire comprising a rotatable segmented distribu-

tor including a plurality of sets of segments, a plurality of complementary selectors each operatively associated with a set of segments of said distributor for operation by a series of selecting impulses received over said line wire and
5 allocated to the selector by said distributor, and connections whereby said selectors cooperate to establish operating circuits for the particular assembly of indicators desired to other sets of segments of said distributor whereby other groups
10 of impulses received may be distributed to the circuits of the indicators selected for actuating the same.

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