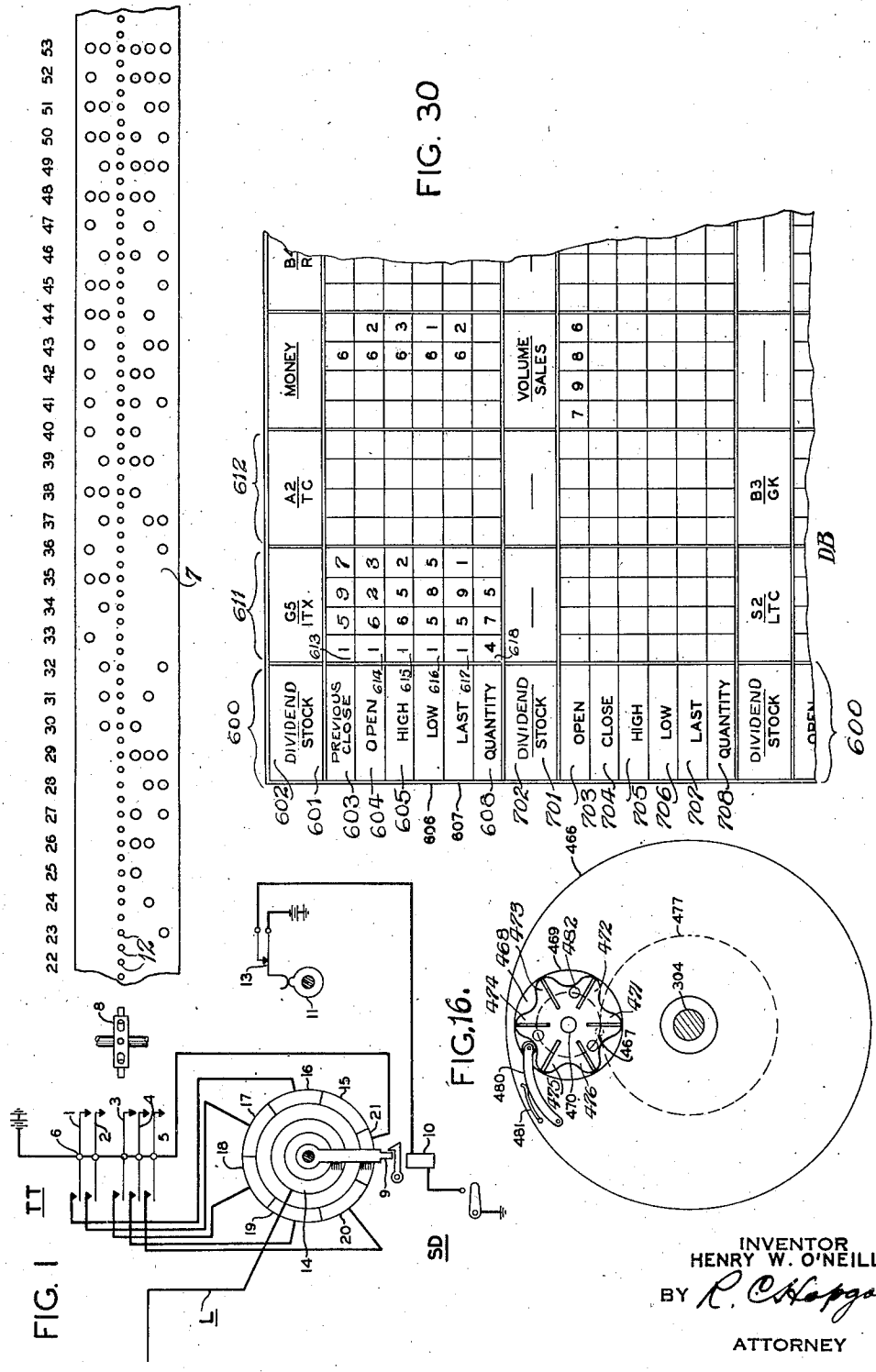
Feb. 19, 1935. H. W. O'NEILL 1,991,984

STOCK QUOTATION BOARD

Filed Dec. 31, 1930 9 Sheets-Sheet 1



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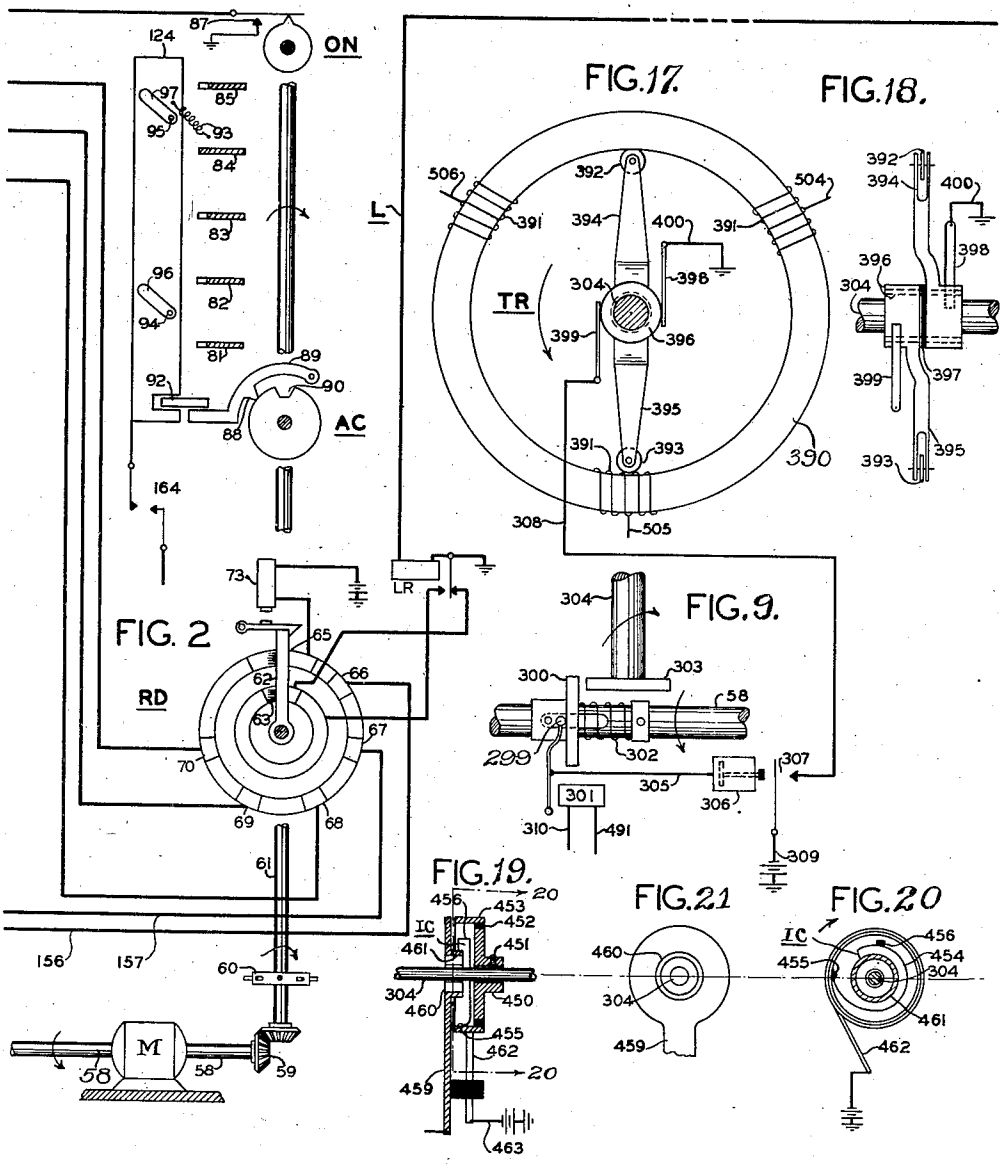
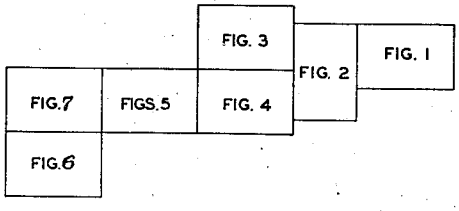


FIG. 31.



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FIG. 8.

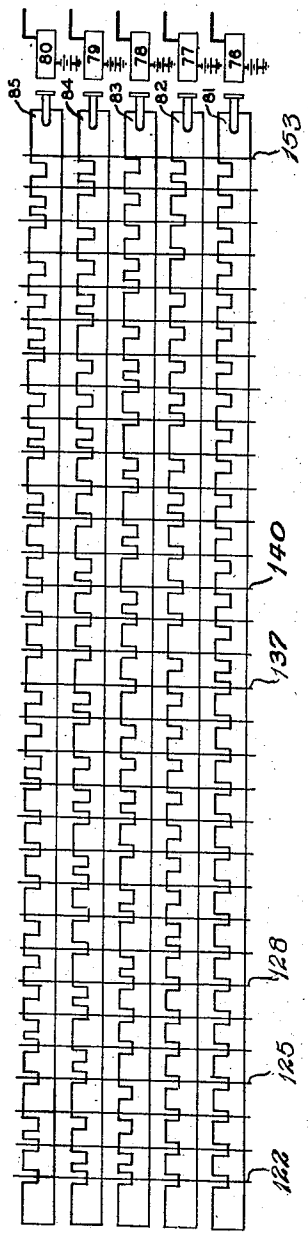
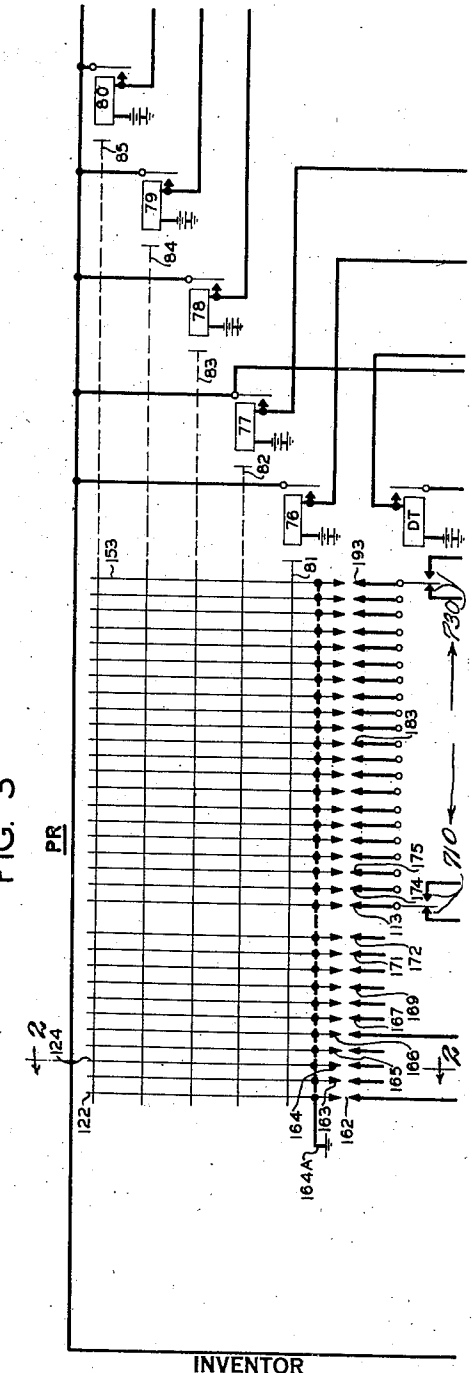


FIG. 3

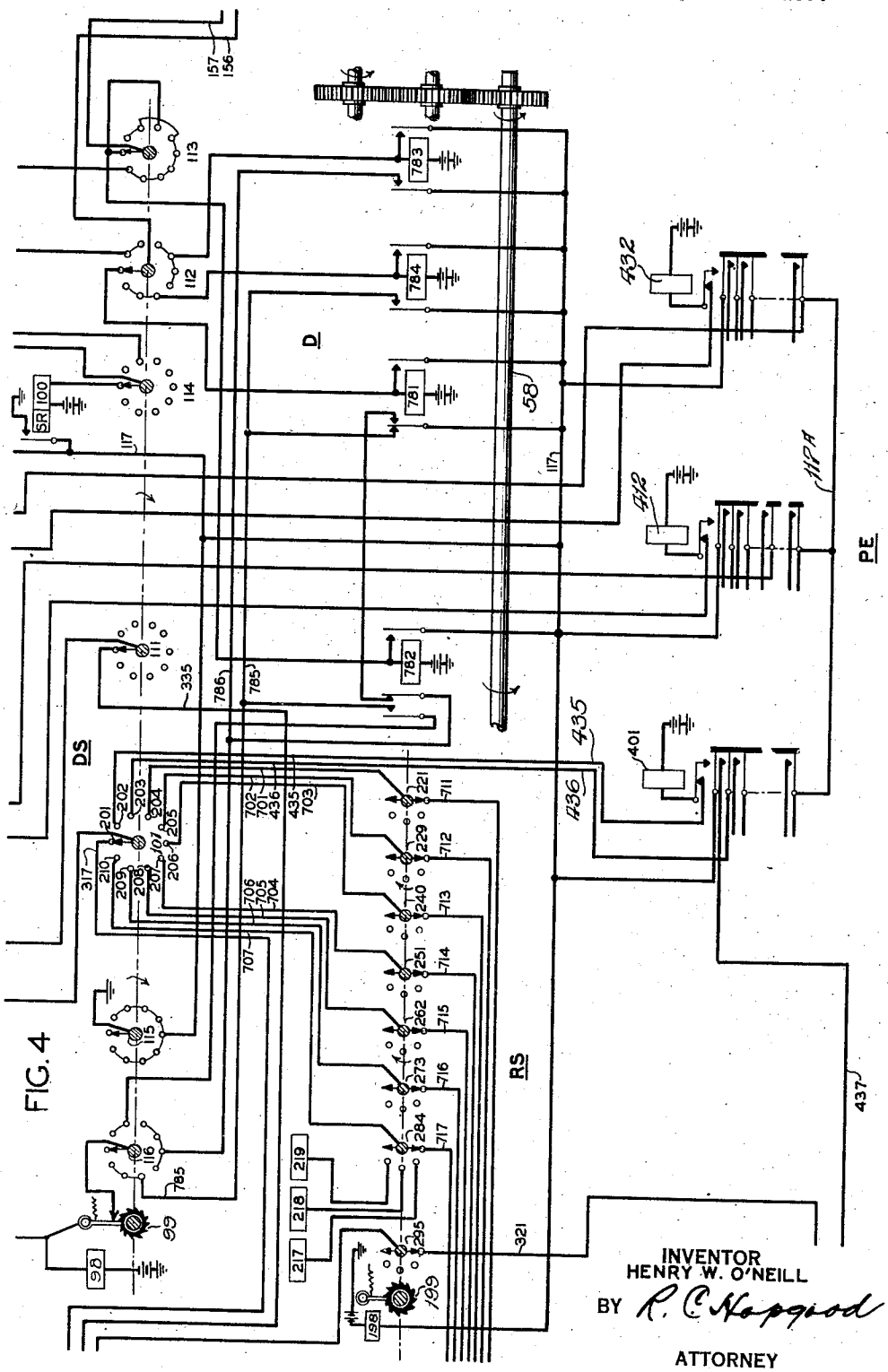


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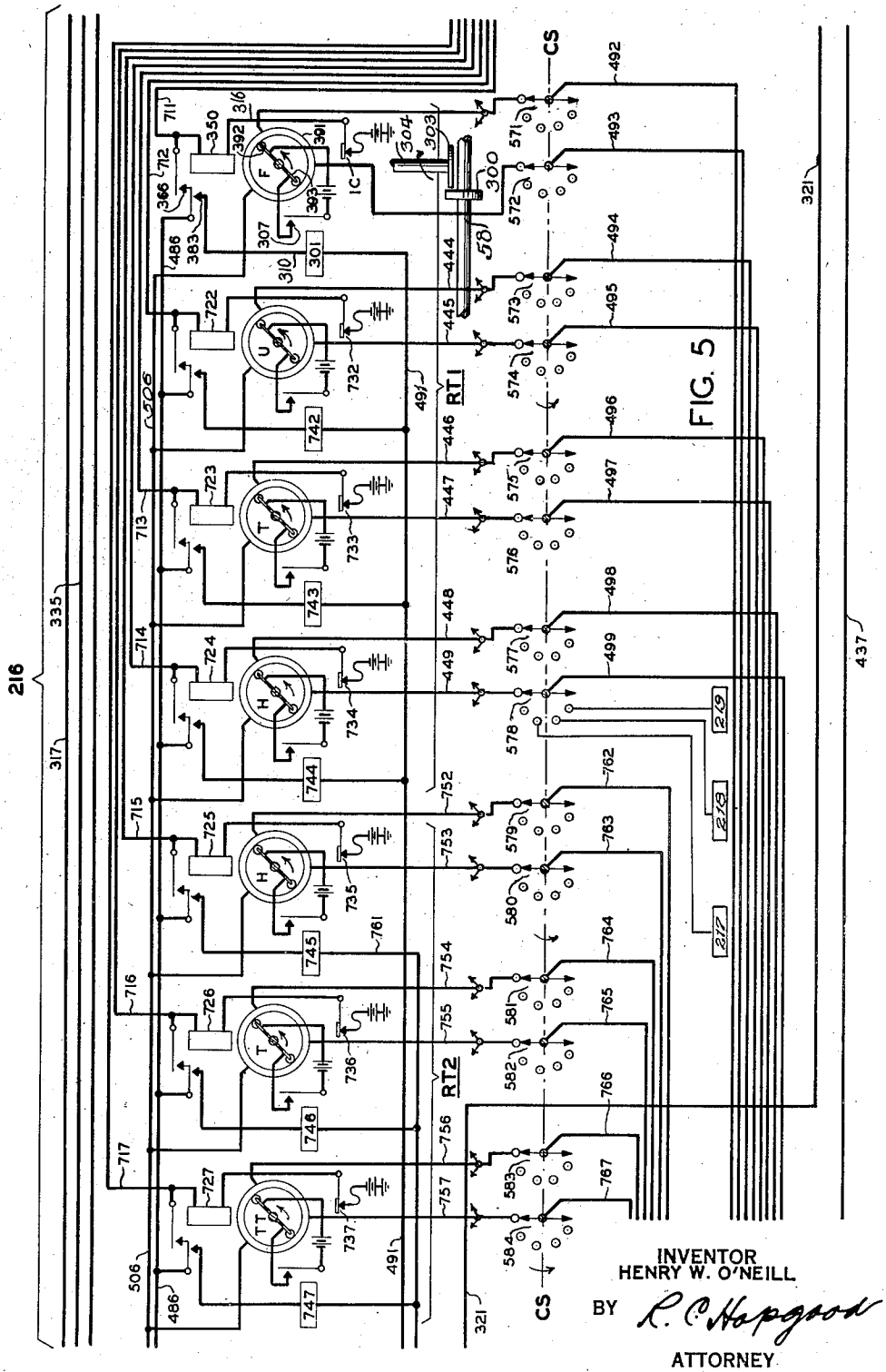


FIG. 5

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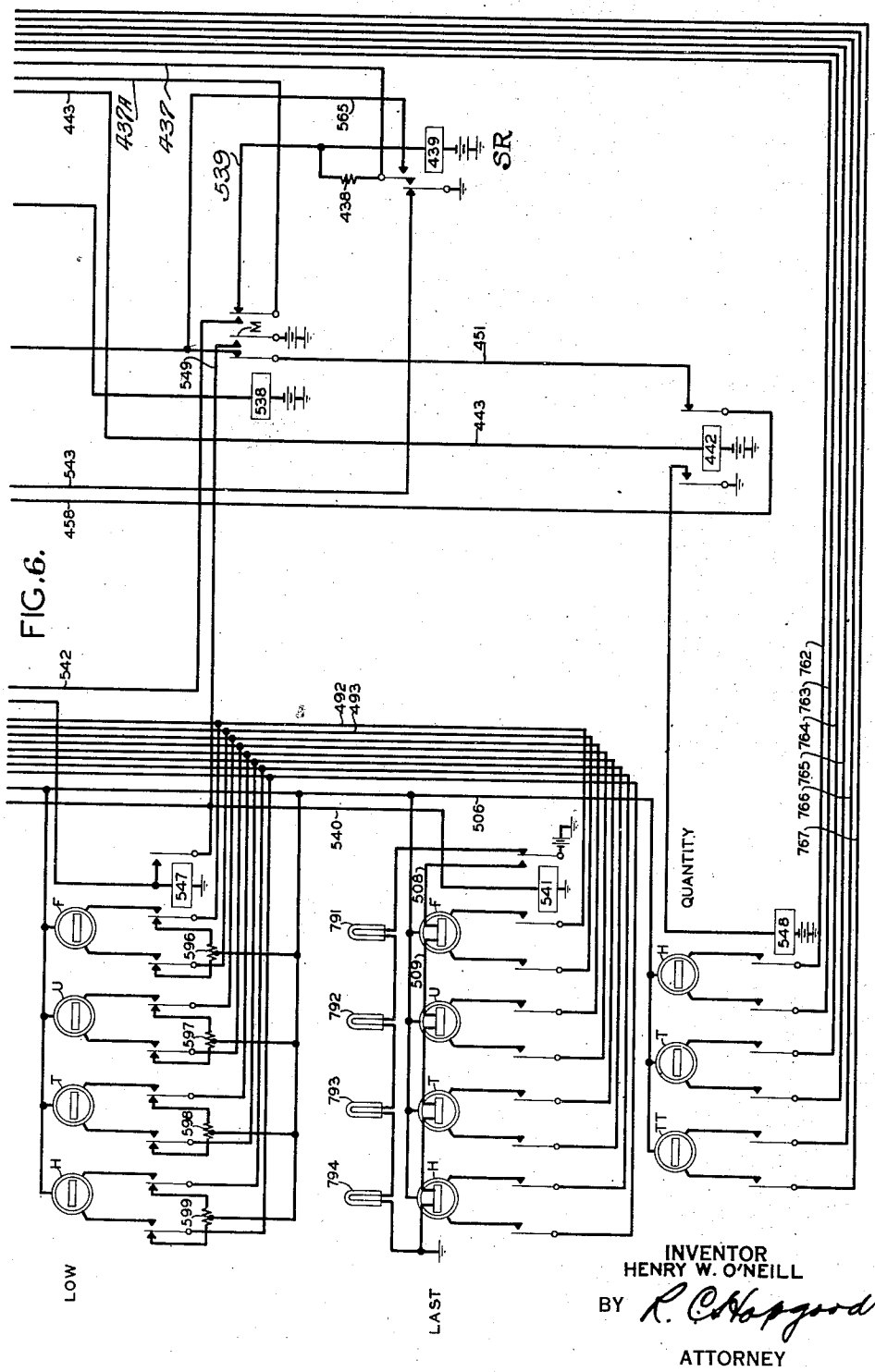


FIG. 6.

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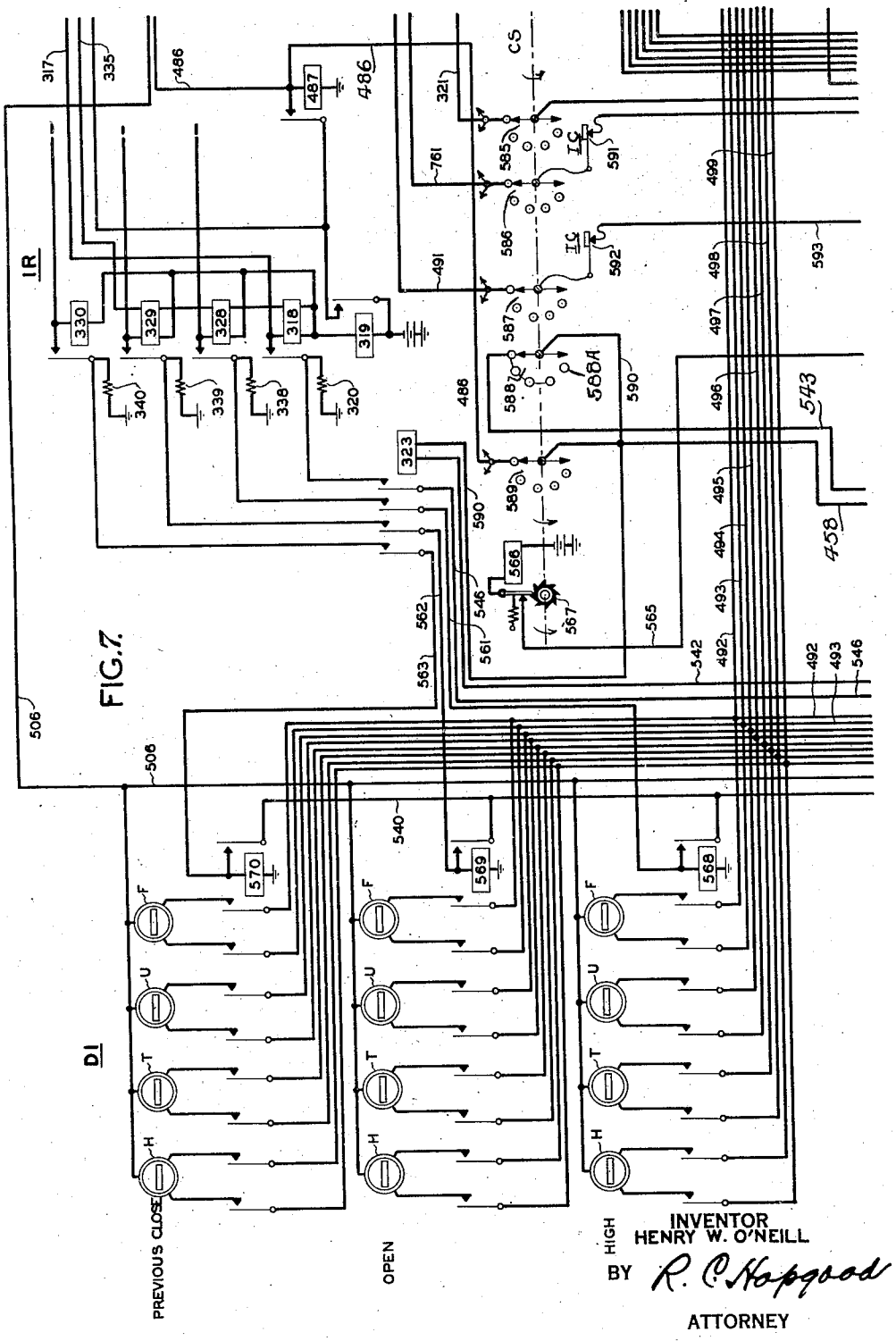


FIG. 7.

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FIG.12.

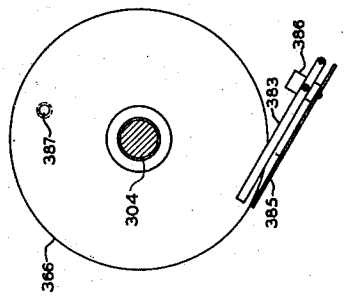


FIG.13.

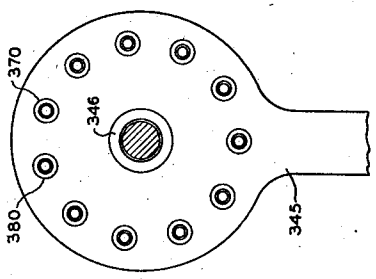


FIG.14.

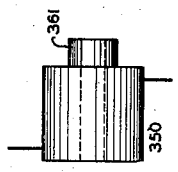


FIG.10.

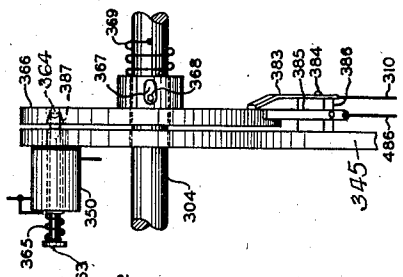


FIG.15.

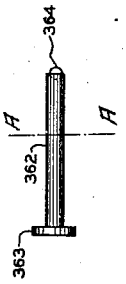
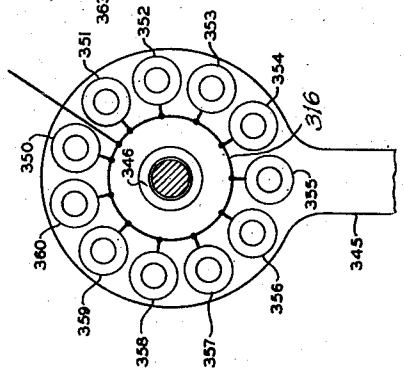


FIG.11.



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Patented Feb. 19, 1935 1,991,984

UNITED STATES PATENT OFFICE

1,991,984

STOCK QUOTATION BOARD

Henry W. O'Neill, Elmhurst, N. Y., assignor to International Communications Laboratories, Inc., New York, N. Y., a corporation of New York

Application December 31, 1930, Serial No. 505,801

7 Claims. (Cl. 177—353)

This invention relates to signalling systems, and more particularly to systems for the transmission, reception and automatic display of stock quotations, market reports and the like.

Under the present system, there is contemplated an extensive universal network of signalling channels for joining intra and inter city points in such a manner that a controlling point may govern transmission effects whereby, like indications may automatically and simultaneously be set up at a number of widely separated as well as at near or neighboring points.

The principal object of this invention is to provide improved apparatus and system for the more effective, reliable and economical handling of the transmission, reception and conversion of signalling effects into symbols or characters automatically to be exhibited on a display or quotation board.

Another object of this invention is to provide means whereby a smaller number of signals is required for the posting of the price and quantity items in certain cases, such as, where two quotations on different stocks are the same, where only one digit or fraction quotation differs from a previous quotation, and the like.

Still another object of this invention is to provide means for the reception and registration of stock quotations irrespective of the translation and display operations for previous quotations.

Another object of this invention is to provide means for reducing the transmission time of signals to a minimum, as by deleting parts of signals.

It is also an object of this invention to provide means for reducing the total number of signals effective to post quotations on the board.

Still another object of this invention is to provide means whereby the five-element code employed may be extended from thirty-two (32) selections to upward of fifty (50) possible choices.

Other objects and features of the present invention will appear from the following description taken in connection with the accompanying drawings in which:

Figure 1 shows diagrammatically a transmitter TT, and a sending start-stop distributor SD at a main originating point or transmitting station;

Figure 2 shows equipment at an inward point or station comprising a receiving start-stop distributor RD, off normal cam ON and an actuator cam AC which are controlled by the transmitting station of Figure 1, to, in turn, control a permutation relay mechanism PR of Figure 3;

Figure 3 shows the circuits of a permutation escapement in the form of a relay PR which is served by the equipment of Figure 2. A digit transfer relay DT is also shown in this figure;

Figure 4 shows a group of relays D in association with a digit switch DS which routes certain controls of the permutation relay of Figure 3 by way of a register selector switch RS to register translators of Figure 5, while a group of relays PE form a link for selections from Figure 3 to the equipments of Figures 6 and 7; and additionally, a schematic showing of groups of register translators 217, 218, 219, etc.;

Figure 5 shows at the right top four price register translators RT1 of group 216, and a portion of a hunting or connecting switch CS;

It also shows at the left top three quantity register translators RT2 of group 216 and another portion of the hunting switch CS;

Figure 6 shows master stock price and quantity selection relays and sets of indicator devices of group or register unit DI (Fig. 7) for exhibiting the items or features of a quotation; as for example, the low, last and quantity quotations;

Figure 7 shows indicator selection or shelf storage relays IR and other indicator sets for the previous close, open and high quotations associated with group DI;

Figure 8 is a schematic diagram to illustrate the order of the code-notching of the permutation or control bars of the permutation relay PR of Figure 3;

Figure 9 shows a clutch mechanism respectively employed in the driving shafts of the register translators of Figure 5;

Figures 10, 11 and 12 are respectively side, face and rear views of a stop magnet assembly for the register translators of Figure 5;

Figure 13 is a face view of a magnet assembly bracket of Figure 12;

Figures 14 and 15 show details of the coil and armature of the stop magnets of Figures 10 and 11;

Figure 16 is a face view of a stop disc which may be substituted for the stop disc of Figure 12;

Figure 17 shows a rheostat transmitter which forms a part of the register translators of Figure 5;

Figure 18 shows details of the brush assembly of the rheostat transmitter of Figure 17;

Figures 19, 20 and 21 are respective side section, rear and face section views of an inertia contact assembly, employed with the register translators RT1 and RT2 and the switch CS of

Figures 5 and 7 respectively and therein designated as IC;

Figure 22 is a view in side section of the point selecting motor for operating the display indicators DI of Figures 6 and 7;

Figure 23 is a section view on the line 23—23 of Figure 22;

Figure 24 is a schematic diagram of the field and armature windings of the motor of Figure 22;

Figures 25 and 26 are respectively face views of the upper and lower frame or support members of the motor of Figure 22;

Figure 27 is a side view of the field core of the motor of Figure 22;

Figures 28 and 29 are developed views of the indicator drums of the motors shown in Figures 22 to 27;

Figure 30 is a face view of a section of a quotation board to illustrate the display spaces to which the indicators of stocks may respectively be assigned, while

Figure 31 shows the order in which the various sheets of the drawings should be placed for convenience in tracing the circuits, some of which extend from sheet to sheet.

In a general description of the present invention, quotation signals over a line L from the transmitting station (Fig. 1) are in the form of character signals, each comprising a series of impulse intervals corresponding with a single revolution of the sending distributor SD and the receiving distributor RD (Figs. 1 and 2). Under each character signal, the permutation relay PR (Fig. 3) is effected momentarily to apply ground over one of its 32 sets of contacts; the particular contacts selected will depend on the permutative relation of the impulse intervals of the signal. The selective capacity of any transmission code, of course, depends on the number of impulse intervals or elements of which each signal may be formed. Although a transmission code of any desired capacity may be employed in the present system, the devices of the present embodiment have been co-ordinated for a five-unit transmission code which, of course, corresponds with five impulse-intervals over the main line or transmission channel L.

The first eleven contacts of the permutation relay PR can be routed by way of respective contact arms of the digit switch DS, through contacts 2 and 3 thereof, to the group of relays PE, while the remaining twenty-one controls are normally routed over contacts of the digit transfer relay DT also to the group of relays PE. The latter group of relays are inter-connected to afford permutative effects relative to a plurality of selections, and under the present five-unit transmission code, there may be thirty-two relays in this group while each relay may be provided with thirty-two sets of selective contacts. Thus, a first character signal may select and effect operation of any one of the thirty-two relays, while a second signal may connect energy over any one of the thirty-two contacts of the selected relay to effect response of a particular one of the group of thirty-two relays chosen, as the relays SR439, Figure 6. The latter relays are respectively associated with particular stocks and serve to prepare for connection of display indicators DI (Figs. 6 and 7) of the stock associated with the relay selected.

From the foregoing, it should be clear that under the present five-unit transmission code and the two-digit signalling procedure, thirty-two groups of stock relays having thirty-two relays per group or a total of ten-hundred and twenty-four such relays may be provided for individual selection.

Following a stock selection, the connecting switch CS is effected to find the output terminals of a particular register group on the input terminals of which the first eleven controls of the permutation relay PR may then be standing; the latter connection being determined by the position of the register selector switch RS. In the present embodiment of the invention, the four registers at RT1 may correspond with the item of price as the fractions, units, tens and hundreds places, while the registers at RT2 may correspond with the hundreds, thousands and ten-thousands places of the quantity item of a quotation. Ordinarily, transactions concern blocks of one hundred shares each so that no units or tens places are required for the quantity item.

Under the price and quantity items of a quotation a single character signal corresponds with each of the places so that a total of four such signals are required for the price item, while three serve for the quantity item. The features of this system whereby a smaller number of signals are required for the price and quantity items in certain cases will presently be discussed. The switch DS steps one point following each character signal, therefore, as the wipers of this switch rotate over contacts 4—10 the first eleven controls of the permutation relay PR are successively connected to the seven register units of the sets RT1 and RT2 of group 216 (top of Fig. 5). Each of the register units comprises a plurality of selectable control magnets such as 350, 722, etc., on which an arriving signal may be stored, under the reception of a quotation over the signalling channel.

At a predetermined subsequent time, the translator portion of a register is rendered effective to energize polyphase connections to operate motors for control of the display indicators DI. The quantity item of a quotation will be exhibited by the three display units TT, T, H, labelled Quantity (Fig. 6), while under each quotation the price item will appear on the four display units labelled Last. The various features concerning the price item of quotations are recorded on the respective groups of indicators labelled previous Close, Open, High and Low (Figs. 6 and 7). Under the first quotation at the beginning of a day, the price item shall appear on the Open, High, and Low indicators, as well as on the group of indicators Last. The indicators Open will not ordinarily again be operated during the current day so that the registers, Open, may continue to indicate the price at which the stock opened on the current day. For the High and Low groups of indicators, however, any subsequent quotation which may differ from the first or opening quotation will require display on either the High or the Low groups as well as on the group of indicators Last, and of course, this will depend on whether the later price is higher or lower than the opening price.

During the day, therefore, any new High or any new Low price in a quotation will necessitate a change on the respective groups of indicators High or Low. The groups of indicators Previous close are required for but one indication and that the price for the Last or closing quotation of a day. Such quotation continues on display during the following day thereby indicating the price at which the stock closed on the previous day.

The group of relays IR, Figure 7, under control

of the permutation relay PR (Fig. 3) are respectively selectable under a single digit over the line circuit L (Fig. 1) to connect either the Previous open, Close, High or the Low groups of indicators for control under a quotation. A single digit may also effect joint selection of the three groups of indicators Previous open, High and Low so that they may be connected with the group of indicators Last in such a manner that the price item of a quotation may simultaneously be recorded for display by each of the four groups of indicators.

Following the reception of the signals of a quotation, the switch RS automatically advances one point to another group of registers which may correspond with the registers RT1 and RT2. The operations of translating and effecting display of a quotation are carried out locally and independently of the transmission channel and receiving equipment. Therefore, stock quotations may be under reception and registration irrespective of the translation and display operations for a previous quotation or quotations.

In the handling of quotations, it is important to reduce the transmission or channel time to a minimum for each quotation. The present system has been developed with particular regard to this feature, and, as co-ordinated, a maximum number of quotations may be transmitted and handled in a minimum length of time. After a quotation for a particular stock has been received and displayed on the indicators, which in each case are individual to a stock, the items remain exhibited until changed by a subsequent quotation which may differ from the previous quotation. For a later quotation transmission time may be reduced by sending only such places or portions of the items as may differ from the displays established by previous quotations. For example, assuming that the price indicators of a stock may be displaying the amounts 128⅜ as established by previous quotations, and, further, that a subsequent sale in that particular stock has been made at 128⅛, instead of sending the complete item of 128⅛, which would require four character signals, a saving of 75% in the total time for transmitting the price may be had by sending a single character signal to change only the fractions place from ⅜ and ⅛.

In a corresponding manner, it would only be necessary to send such places of the quantity item of a quotation as may differ from a quantity under display, as established by previous quotations. One of the features of the group of relays D (Fig. 4) is to afford this saving in time by establishing operations to permit the places for the value 128 in the price to stand undisturbed. Under a preferred procedure in the present system, the order of the transmission of the digits of the price and quantity items is progressively from the lower to the higher places. Thus in sending a price, the first signal may represent the fractions place, the second signal the tens place, etc., while for quantity, a signal for the lower or hundreds place may first be sent, the thousands next and the signal for the ten-thousands place last. For a sale that affects less than all of the places of price, or all of the places of quantity, the character signal which corresponds with the highest place to be changed under either of these items, may, with the present system, be divided and rendered effective for dual control. Such control means that in addition to establishing the proper selective effect on the respective register, a portion of the impulse intervals of the signal may become effective by way of the group of relays D to delete the remainder of either the price or the quantity item, thereby reducing the total number of signals required for the quotation.

The group of relays D serve to establish further conditions for reducing the time required for the transmission of quotations. Thus, for a sale where there is no change in the price, it is necessary to send only the item of quantity of stock involved. Therefore, a signal ordinarily employed for other selective purposes, is divided for dual control effects, whereby the relays D may establish circuit changes to render it unnecessary to send any portion of the price item. In turn, when it may be desired not to send the item of quantity, the divided or dual control signal may be rendered effective to delete the quantity item of a quotation and thereby effect a further appreciable saving in transmission time. In the present disclosure, however, the connective arrangement at the relays D is such that the quantity item will normally be deleted.

Before proceeding with a more detailed description of the operation of the present system, the features of the various devices and mechanisms will first be described. In Figure 1, only such portions of the tape transmitter TT and the sending distributor SD have been shown as may be necessary to a clear understanding of the system. Any standard five-unit code tape transmitter and start-stop sending distributor as commonly used in the printing telegraph art can be employed for sending the stock quotation signals in this system. A further explanation of the details of the tape transmitter shown in Fig. 1 may be obtained by referring to a pending application filed November 13, 1930 in the names of A. A. Clokey and G. S. Vernam, Serial No. 495,370. Other methods of sending suitable for use with five-unit code signals can be employed, such as the use of synchronized multiplex distributors, direct keyboard or so-called "metal storage" transmitters, as will be well understood by anyone skilled in the printing telegraph art; it is therefore not intended that this invention be limited to the type of transmitter herein shown. The mechanism shown in Figure 1 is intended to show in simplified form the essential features of one such suitable sending arrangement.

Five contactor levers, 1 to 5, of tape transmitter TT are pivotally supported at 6 so that the points at their free ends may trace respective paths along a transmission tape 7 advanced by a star wheel 8 of a feed mechanism (not shown) which may be geared also to the motor drive for the brush arm 9 of the sending distributor SD. Normally, the arm 9 is held latched by the armature of a stop magnet 10 against the tension of a friction clutch (not shown). A cam 11 may be understood as also attached to the shaft of the brush arm 9. Therefore, after the starwheel 8, operating through the feed perforations 12, has positioned the tape 7 to present a transverse row of the code perforations to the tracer points of the levers 1 to 5, the cam 11 will close contact 13. Thereupon response of magnet 10 releases arm 9 which may sweep over the segments 15 to 21, successively connecting these segments to the transmission channel L. A circuit from the grounded battery normally extends through stop segment 21, brush arm 9 and a slip-ring 14 of the distributor SD to the line conductor L, whence it may complete a circuit to ground through a line relay LR at the distant inward point (Fig. 2). When the brush crosses start segment 15, this

circuit is opened to release line relay LR. The five segments 16 to 20 respectively connect to circuits of the levers 1 to 5 so that any lever which may have entered a signal perforation in the tape 7, and thereby closed its contacts, will establish the associated grounded battery to the corresponding segment of the distributor.

In traversing such segment, therefore, the brush arm 9 will effect energization of the channel L with a corresponding "marking" impulse. The segment 21 is connected directly to the battery and during the interval the brush arm 9 may be passing over this segment and also while resting on this segment, due to its being relatched by the armature of the magnet 10, the mechanism of the permutation relay PR at the distant point (Figure 3) may be functioning to translate the selective signal formed of the five-impulse intervals established under the single revolution of the distributor arm 9. The five tape controlled contactors 1 to 5 and the five-distributor segments 16 to 20 correspond with a five-unit transmission code and each series of impulse intervals formed by one rotation of the distributor arm 9 may, for convenience, be termed a character signal. The signal perforations 22 to 53 in the tape 7 have been placed to correspond with the permutations required to select the respective 32 contacts 162 to 193 of the permutation relay PR of Figure 3. A signal corresponding with the position 22 on the tape 7 is without perforations, and such signal serves for selecting the first contacts 162 on the distant permutation relay. Signal perforations 23 select the second contact 163, etc., until the last signal perforations 53 effect selection of the last contacts 193 on the permutation relay.

Directing attention to Figure 2, a motor M drives a main shaft 58 which is connected through a bevel gear 59 and a slip clutch 60 to a branch shaft 61 which carries the brush arm 62 of the receiving distributor RD, an actuator cam AC and an off-normal cam ON. A "start" impulse originated by opening of the line circuit when the sending brush crosses start segment 15 (Figure 1) releases the line relay LR (Figure 2) as already described. Thereupon, ground over the inner contacts of relay LR, segment 63, arm 62, a start segment 65 to grounded battery over the winding of a stop magnet 73 effects response of this magnet simultaneously with crossing of the start segment 15 by the brush arm at the transmission point (Fig. 1). Thus, the arm of the sending distributor SD and the arm of the receiving distributor RD are released to travel substantially in unison in making a single revolution, following which the stop magnets 10 and 73 will respectively latch and arrest the arms in the positions in which they are shown over their respective segments 21 and 65.

The segments 66 to 70 of the receiving distributor RD are the selecting segments and respectively correspond with the segments 16 to 20 of the sending distributor SD. In turn, the tracer contactors 1 to 5 (Figure 1) correspond respectively with these segments which, from the distributor RD, may connect respectively to the control magnets 76 to 80 of the permutation relay PR (Figure 3). It should be noted that the connection from the segment 66 is routed over a sector 112 (Fig. 4) of the switch DS which serves to transfer this connection to the magnet 76 (Fig. 3) or to the relays D (Fig. 4), while the sector 113 serves in like manner to extend the conductor 157 associated with segment 67 either to the magnet 57 or to the relays D, as presently will appear. It should now be clear that during a single revolution of the distributors SD and RD, response of the magnets 76 to 80 (Fig. 3) may be had according to which ones of the levers 1 to 5 at the sending station may have been actuated by code perforations in the transmission tape 7 (Figure 1).

In describing such features of the permutation relay PR (Figure 3) as may be necessary to a clear understanding of the present system, Figures 8 and 9 as well as Figure 3 and portions of Figure 2 will be considered. Five code bars 81 to 85 are suitably assembled to be shifted longitudinally by the respective magnets 76 to 80 in order that selections may be made whereby, under a single character signal, notches in the five bars may be aligned for receiving one of the thirty-two transverse bars 122 to 153. The selected bar may then close the respective one of the sets of contacts 162 to 193. In the operation of this permutation relay PR, the cam AC (Fig. 2) is so positioned that, following the instant the contactor arm 62 of the distributor RD has passed over the selective control segments 66 to 70 and therefore initially effected response of any selected magnets 76 to 80 (Fig. 3), a tracer wheel 88 (Fig. 2) of the lever 89 may enter the depression 90 in the cam disc AC. The free end of the cam lever 89 abuts a universal bar 92 which extends parallel with the code bars and engages each one of the thirty-two transverse bars 122 to 153 as illustrated in Figure 2, which includes a cross-section view on the line 2—2 of Figure 3, looking in the direction of the arrows, and also a schematic showing of the distributor, the restoring means for the permutation relay PR and certain control means associated with the distributor drive shaft. As shown in this view, all of the bars excepting the bar 84 are notched to receive the transverse or contactor bar 124. Therefore, assuming that the rotation of the distributor arm 62, as just described, effected response of magnet 79 (Fig. 8), bar 84 would thus be shifted so that this notch may complete the alignment. At this instant, the cam AC (Fig. 1) releases the universal bar 92 to present all of the transverse bars 122 to 153 for acceptance by the code bars 81 to 85 and only the aligned slot for the bar 124 will be present. Thus, under tension of a spring 93 (Fig. 2) this bar may move diagonally under guidance of pins 94 and 95 within respective slots 96 and 97 and thereby close the associated set of contacts 164. For each of the bars 122 to 153, ground is supplied over a common wire 164A (Fig. 3) to the associated contacts, when they may be closed.

Advance of the shaft 61 (Fig. 2) to bring the brush arm 62 of the distributor RD over the "rest" or stop segment 65 also advances the cam AC substantially to the position in which it is shown in the drawings. This permits the lever 89 to move the universal bar 92 to return the contactor bar 124 and also to retain the bars 122 to 153 (Fig. 3) substantially free from the code bars 81 to 85. The working load for the magnets 76 to 80, in shifting the respective bars 81 to 85, is thus reduced to a minimum so that the permutation relay PR may be operated at a maximum speed with a minimum of energy and mechanical wear.

With the object of clearly indicating the relation of the code perforations in the tape 7 (Figure 1) and the resulting control effects on the permutation relay PR, lines have been drawn (Figure 8) to show the relation between the

transverse bars 122 to 153 and the code bars 81 to 85. Transverse bars 122, 125, 128, 137, 140 and 153 only of Fig. 8 and the associated code bar notches are shown in correct detail; the remaining transverse bars and code bar notches are shown for the purpose of completing the diagram only. The transverse bars just enumerated correspond to tape signals 22, 25, 28, 37 and 40 of the tape 7 shown in Fig. 1. This figure shows that when a code bar, or several code bars, have been shifted slightly in a longitudinal direction under a selection, associated notches will be in position to receive a particular transverse bar. In effect, the positions of the notches in the code bars correspond with the presence or absence of code perforations in the tape 7 (Figure 1). For example, the signal represented by position 25 on the tape 7 has one perforation only and that in the path of the middle or third tracer, whereby a single marking impulse only may be transmitted. Such impulse will result in response of magnet 78 (Figure 3) to shift the bar 83 so that the fifth transverse bar 125 may be received to close its associated contacts 165. The relation of the signals represented by the perforations 22 to 53 in the tape 7, relative to selection of the sets of contacts 162 to 193, should now be obvious and such clear conception of this relation should be of assistance to a ready understanding of the division of certain of the impulse intervals of composite digits, as presently will be described in connection with the terminating and deletion operations already mentioned.

In pointing out general features of Figure 4 in association with Figures 2 and 3, the off-normal cam ON (Figure 2) effects closure of the associated grounding contacts 87 on the instant the distributor arm 62 is released by the magnet 73, and these contacts are retained closed until the brush arm 62 has completed a revolution and been relatched in the position in which it is shown. The contacts 87 prepare a circuit for self-locking of any of the magnets 76 to 80 of the permutation relay PR, following their initial response. Ground potential over the contacts 87 also closes an obvious circuit for energization of a step control magnet 98 (Fig. 4) during periods the cam ON may be in motion. Following each character signal and the consequent release of magnet 98, the armature serves as a stepping pawl to advance a ratchet wheel 99 one tooth. Under a common shaft (not shown), the ratchet wheel 99 serves to advance the contactor arms of switch arcs 101 to 116 of the digit switch DS one step under each release of magnet 98. It will be noted that of the sectors 101 to 111, only two (101 and 111) are shown. It will be understood that the switches not shown are to be similarly connected and respectively associated with the permutation relay contacts designated 163 to 171. The interrupter contacts of the magnet 98 serve in connection with the terminating and deleting effects which presently will be described.

Following reception of the signals of each quotation, the brushes of the switch arcs 101 to 116 will have completed a revolution and returned to their normal positions in which they are shown in the drawings. Under the first character signal of a quotation, the contacts 87 of the cam ON (Fig. 2) also connect ground potential over the brush and arc contact of switch arc 114 (Fig. 4), thence over an obvious path to energize a slow-to-release relay 100. Response of the latter relay connects ground potential to a "holding" bus conductor 117, the purpose of which will presently appear.

As the brushes of the switch arcs 101 to 116 are fixed to a common shaft to operate in unison, the contacts of the arc 101 only will be designated and, as shown under the clock-wise movement of the switches, these segments are numbered 201 to 210. The eleven switch arcs 101 to 111, of which only those designated 101 and 111 are shown, serve for successively switching the first eleven contacts 162 to 172 of the permutation relay PR to different respective paths following each character signal of a quotation. The connections from each of these arcs follow a relatively uniform order. Therefore, complete circuits have been shown for the arc 101 only, from which it should be obvious how similar connections may be provided from the other arcs or sectors between 101 to 111.

During the reception of a quotation, ground potential will first be present on the bus conductor 117 (Fig. 4) over the contacts of relay 100 as already described, then, following the first step of the switch DS, grounding sector 115 of this switch will retain ground on this bus conductor. In addition to so-called holding effects for retaining relays of the groups D and PE, this ground also effects energization of a step control magnet 198 (Fig. 4) which operates a ratchet wheel 199 for simultaneously stepping the contactor arms of a plurality of arcs 221 to 295 of the register selector switch RS. This switch operates in substantially the same manner as the digit switch DS so that on each release of magnet 198 its armature will advance all of the brushes of the switch RS one point. The latter magnet continues energized from the beginning to the cessation of reception of the signals or digits of a quotation. Therefore, this switch may step once following each quotation and serves to transfer the controls of the permutation relay PR as routed by way of the digit switch DS, shown to a next or idle register group shown schematically as 217; other similar groups are also shown schematically and indicated as 218 and 219. Although any desired number of registers or register translators may be employed, the present embodiment of this system is arranged for four register translator groups. A first register group 216 (Fig. 5) comprises the registers RT1 and RT2, and it will be understood that within each of the spacers 217, 218 and 219 similar register translator groups may be present and shall be served by the switch RS in the manner illustrated for the register translator group 216.

In describing the register translators, the power drive for the translation portion of these devices will first be considered. The main shaft 58 of the motor M (Figure 2) extends to the register translators RT1 and RT2 (Figure 5), and for each of the units of the latter groups, the clutch mechanism shown in Figure 9 is employed. In Figure 9 a first clutch disc 300, slidably splined to the shaft 58 by a feather 299 may, under energization of an electro-magnet 301, be stressed against a retractile spring 302 operatively to engage a second clutch disc 303 attached to a shaft 304 which carries the rheostat brushes and other rotatable parts of a register transmitter, as presently will appear. In operating, the magnet 301 also forces a plunger 305 of a dash-pot means 306 to close a set of contacts 307. Although the magnet 301 has quick-to-operate and quick-to-release characteristics, the dash-pot 306 controlled thereby has quick-to-operate and slow-to-release

characteristics in order that the contacts 307 may be retained closed for an appreciable interval following the release of the magnet 301. The purpose of the contacts 307 and also the circuit for energizing the clutch magnet 301 will be described presently.

In describing the features of the register translator units, attention will first be directed to Figures 10 to 16. The banjo-shaped bracket 345, preferably of insulating material (Figure 11), has a central bore 346 which freely encircles the shaft 304 and forms an assembly base for eleven solenoids 350 to 360 circularly spaced thereon. The central supporting sleeve 361 of each solenoid projects beyond the coil at one end (Figure 14) and the eleven bores 370 to 380 in the bracket 345 (Figure 13) receive this projecting portion of the sleeve of each solenoid. By means of a "spinning" operation, the ends of these sleeves are suitably flared for securing the solenoids to the bracket member 345.

A plunger armature 362 (Figure 15) is provided with a head 363 at one end and a metal ball 364 freely "cupped" to be retained by the other end of the armature. The dotted line or mark AA near the center of the armature divides the ferric portion at the left from the non-ferric metal portion at the right of this mark on the armature 362. As assembled (Figure 10), the head 363 forms a shoulder to permit an encircling retractile spring 365 normally to retain the armature in the position in which it is shown. A "stop" disc 366 under a slot 367 and pin 368 is slidably connected to rotate with the shaft 304 and the spring 369 normally retains this disc adjacent the bracket 345 and free from the contactor brush 383, which is carried by a block 384 secured to the bracket 345. A second brush 385 attached by a block 386 to the bracket 345 is positioned to trace the periphery of the disc 366 in establishing electrical contact therewith.

As shown in Figure 11, one terminal of each of the solenoids 350 to 360 is connected common to a bus conductor 316 which is routed to grounded battery through an associated inertia contact unit shown in detail in Figures 19 to 21. The other terminal of each solenoid is connected to be selectable under momentary ground over the controls of the permutation relay PR, as routed over the digit switch DS and the register selector switch RS, Figures 3 and 4. The latter terminal of each solenoid is branched or half-tapped to the associated retractile spring 365 (Fig. 10), thus rendering this terminal common to the respective plunger armature as the armature 362.

Under energization, a solenoid thrusts its armature 362 through the respective bore of the assembly bracket 345 to engage the disc 366 and thereby force the latter to the right into engagement with the brush 383. In Fig. 5 the contacts 366 associated with solenoid 350 represent the connection between the disc 366 and the wiper 385 of Fig. 10, and the contact 383 represents the brush 383, Fig. 10. It is apparent that upon the operation of the solenoid 350 a locking circuit for the solenoid is completed from battery, inertia contacts IC, winding of solenoid 350, plunger 362 of the solenoid, contacts 366, or disc 366 and wiper 385, conductor 486 to ground through the winding of relay 487, Fig. 7. The clutch magnet 301, Figs. 5 and 9, is likewise operated upon the actuation of solenoid 350 over a circuit extending from battery, winding of price master relay 538, Fig. 6, conductor 533, inertia contacts IC, wiper of sector 587 of switch CS, conductor 491, winding of clutch magnet 301, conductor 310, contacts 383, Fig. 5, to ground of conductor 486. Under engagement of the clutch, the shaft 304 rotates the disc 366 (Figs. 10 and 12) until its "stop" bore 387 (Figure 12) aligns to receive the plunger of the solenoid which may be energized. Thereupon, the spring 369 thrusts the disc 366 to the left to receive the stop pin armature while also clearing the disc from the brush 383 thus opening the circuit of the clutch magnet 301, Figs. 5 and 10. The shaft 304 is consequently arrested. The shaft 304 carries the brushes of the associated rheostat transmitter and it should now be clear that the solenoid magnets 350 to 360, in effect, constitute regiser or storage means for selective digits received from over the signalling channel L and, further, that these solenoids also serve as governing means for operatively controlling the shaft 304.

The stop disc 466 of Figure 16 may be substituted for the disc 366 of Figure 12 in situations where it may be desired to provide that, for each operation of a register translator, a complete revolution of the brushes of the transmitter rheostat TR (Fig. 17) shall always be had. The single revolution will be added to the travel from the position where the brushes of the transmitter rheostat may have been at rest to the position corresponding with that of a selected one of the solenoid stop magnets 350 to 360 (Fig. 11). The additional travel increases the range through which the armature may come into alignment with the travelling consequent poles set up in the field of the motor, presently to be described.

The disc 466 (Fig. 16) differs from the disc 366 (Fig. 12) principally in that at certain times a mask plate 468 will be positioned to cover the stop bore 467 which corresponds with the stop bore 387 of the disc 366 (Fig. 12). Within a recess 469 in the face of the disc 466, the plate 468 is seated to rotate about a bearing 470. A plurality of ribs on the teeth 471 to 476 (Fig. 16) may respectively come into the circular path indicated by a line 477. This path corresponds with the "trace" of the armature plunger of any solenoid as the solenoid 350 (Figure 10), which may be under energization while the shaft 304 may be under operation in revolving the disc 466. Let it now be assumed that the disc 466 is positioned in substitution of the disc 366 in Figure 11 and is in motion while the solenoid 350 is energized. Following the instant the ridge of tooth 471 (Fig. 16) reaches the armature 362 of solenoid 350, the plate 468 will be revolved and, as no opening is present between the tooth 471 and the tooth 472, the plate 468 will serve as a mask to prevent the plunger 362 from entering the stop bore 467 in the disc 466. When the tooth 471 reaches a point beyond the range of the plunger, the plate 468 is so positioned by the spring pressed roller arm 480 that the next tooth 472 is in the path 477. The disc 466 may now continue through a complete revolution and, when the tooth 472 arrives at the plunger armature 362, the plate 468 will be advanced until the bore 482 registers with the stop bore 467, whereupon the plunger 362 will be received therein to arrest the disc 466. On release of the solenoid 350 as already described, the pawl or jockey arm 480, in tracing its path to the lower-most portion of the respective depression in the edge of the plate 468, will cause this plate to be advanced to the point where the next tooth 473 will just come within the path 477 (Fig. 16) of any one of the plungers of the solenoids 350 to 360 (Fig. 18). The stop control bores

in the plate 468 lie at the rear of every other tooth 472, 474 and 476, while no bores are present for the other teeth 471, 473 and 475. Therefore, from the foregoing it should now be clear that under selection and energization of any one of the stop solenoids 350 to 360 and the resulting operation of the shaft 304, one complete revolution of the stop disc 466 may always be had before any stop solenoid may be rendered effective to arrest the motion of this disc.

In describing the converter or transmitter portion of the register translator, whereby direct currents are changed into polyphase alternating currents for operating the motors of the display indicators DI (Figures 6 and 7), reference will be had to Figures 17 and 18. An annular core 390, preferably of insulating material, is provided with a winding 391 consisting of a single layer of resistance wire to form a circular rheostat. The inner wall of this winding is suitably scraped or surfaced to form a conducting path to be traversed by oppositely positioned brushes in the form of contactor rollers 392 and 393, respectively carried by the arms 394 and 395. The latter arms are fixed to rotate with the shaft 304 but are electrically separated therefrom by an insulating sleeve 396 (Fig. 18) and from each other by a washer 397. Stationary brushes 398 and 399 are positioned respectively to contact with circular hub or shank portions of the arms 394 and 395 for supplying direct current energy to the winding 391 of the rheostat. The circuit for the direct current is under control of the contacts 307 of the clutch assembly shown in Figure 9 and Fig. 5. Three paths branching from respective points spaced 120° apart on the rheostat form a polyphase circuit which may be selectably connected to the individual motors of respective stocks, as subsequently will be traced.

In describing the inertia contact assembly IC, Fig. 5, employed with the register translators RT1 and RT2, Figure 5, and also with the connecting switch CS, Fig. 5, attention will be directed to Figures 19 to 21. A hubbed support disc 450 (Fig. 19) attached by set screw 451 to the shaft 304 has a tubular washer 452 of insulating material about its periphery which in turn is encircled by a collector-ring 453. To the inner wall of the latter ring, one end of a spring brush 454 is secured at a point 455. Near the free end of the brush 454 a weight 456 is attached. A bracket 459, of "banjo" form, has a central bore 460 to encircle the shaft 304 from which, however, it will be held electrically insulated. A hub-like extension 461 on the bracket 459 serves as a collector-ring to be traversed by the free end of the brush 454 while a stationary brush 462 is attached by an insulating block 463 to the bracket 459. Under clock-wise rotation of the shaft 304, weight 456 will tend to press the brush 454 into contact with the ring or hub 461 while on sudden arrest of the shaft 304, effected as already described, by the stop mechanism of Figures 11 to 14, the centrifugal effect on the weight 456 will result in lifting the brush 454 momentarily from the ring 461. As already mentioned, energy from grounded battery through this inertia contact unit forms a common supply for the stop or storage magnets 350 to 360 (Figure 11), so that arrest of the shaft 304 and the resulting momentary separation of an associated set of inertia contacts IC will permit release of such magnets.

For use with the connector switch CS, Fig. 5, the control of the inertia contacts IC is inverse to that just described in connection with the register translator. The inverse effect requires that, during periods the driving shaft may be in motion, the contacts shall be retained open and may be closed only after the mechanism has come to rest. Thus, certain paths are disconnected during periods the hunting switch CS may be in motion while, conversely, such paths will be closed when the switch CS has found and come to rest on the output terminals of a desired group of register translators. This inversion of control may be had merely by resorting to counter clock-wise instead of clock-wise rotation of the shaft 304 (Figures 19 to 21). For example, under counter clock-wise rotation of the shaft 304 (Figure 20), centrifugal effects will cause the weight 456 to lift the free end of the spring brush 454 from the collector-ring 461. It should thus be clear that on any shaft having a predetermined direction of rotation, either one of the two alternate circuit control conditions of the inertia contact unit may be had merely by facing the assembly in either right-hand or in left-hand relation, relative to its assembly on the shaft.

In describing the features of the polyphase motors of the display devices DI, reference will be had to Figures 22 to 29. An annularly formed core 500 (Fig. 24) of ferric metal is provided with three magnetizing coils 501, 502 and 503 (Figure 24), the terminals of which are inter-connected according to the well known "mesh" combination of polyphase control. Conductors 504, 505 and 506 form a three-wire circuit which may be routed through certain switching devices, presently to be described, to the translator rheostat TR (Figure 17) where they connect, as shown, in mesh relation to the winding of this rheostat.

Under closure of the contact 307 (Figure 9) direct current to the brush members 392 and 393 (Figure 17) may, under rotation of the shaft 304, set up polyphase currents of substantially sine-wave form in the field windings 501, 502 and 503 of the motor CM (Fig. 24). An armature 510 of ferric metal carries a winding 511 which, at a proper moment, is energized by direct current so that the resulting magnetic poles set up therein may cause this armature predeterminedly to be influenced according to the magnetic sense of the poles set up in the field of this motor. The armature may be of H form (Figure 22) with plates 514 and 515 of insulating material attached across its extremes. These plates carry spindles 516 and 517 journalled centrally in the circular portion of two metallic brackets 518 and 519. As shown, terminals 512 and 513 of the armature winding connect respectively to the spindles 516 and 517, whence they make electrical contact respectively with brackets 518 and 519 to which exterior leads 508 (Fig. 25) and 509 (Fig. 26) may be attached.

Supporting studs 522, 523 and 524 (Fig. 27) are suitably secured to the field core 500 at points intermediate windings 501, 502 and 503. These studs may be inserted in the three respective bores 525, 526 and 527 shown in the lower bracket 519 and serve for supporting the field of the motor. Circular grooves 529 and 530 (Fig. 26) in the upper face of the lower bracket 519 receive the rims of an annularly formed cup-like unit 531 which preferably may be of copper. This unit 531 houses the field assembly over its windings and serves to present a smooth and uniform wall for the gap-space between the field and the armature 510, and also forms a similar uniform

and smooth walled gap-space between the field winding and the inner surface of a display drum 534. The walls of the shield 531 are in the magnetic circuit and therefore serve to damp or give a dead beat effect relative to rotation of the armature 510 of the motor. The display drum 534 is in the form of a cup inverted over the field and armature assembly of the motor, and is attached to the upper plate 514 of the armature 510. The outer side wall or face of the drum is divided into eleven spaces in which the characters 1 to 9 and 0 appear, with one space left blank as partly shown in Figure 28. This marking is suitable for the display drums of the places of the quantity item and all excepting the fractions place of the price item of quotations. For the fractions place, nevertheless, price drums having the same marking may be employed, in which case the 8, 9 and 0 spaces would remain idle and never be used. Therefore, the stop solenoids for the latter three places would always remain idle, or such solenoids may be dispensed with on the registers of the fractions places. When used for the fractions places, the numerals should be distinguished by color or have a different color for the background, in order that the readings may readily be differentiated from the integral places of the price item.

Under an alternate arrangement for marking the display drums of the fractions places, the circumference of the drums may be divided into eight spaces, seven of which shall correspond with fractions places in eighths, while one blank space will be provided as partly shown in Figure 29. The windows or exhibit openings of the face of a display board may be of greater width for the fraction places than for the other places of the price and quantity items, so that the visibility or distinctness range for all of the places shall be substantially uniform. The display drum 534 being integral with the armature 510, it follows that when the motor is controlled by polyphase currents from the transmitter rheostat TR (Figure 17), the drum may be positioned at such points as may correspond with the consequent poles in the field of the motor as established by the position in which the brushes of the transmitter rheostat may have selectively been brought to rest, as hereinbefore described. Therefore, assuming that two lines 535 (Figure 25) mark the side boundaries of a sight range for viewing the display surface of the drum 534, it should now be clear that under a certain relation of the position of the stop magnets 350 to 360 (Figure 11) and the numerals on the surface of the drum, any predetermined one of the latter markings may selectively be positioned for view within the limits of the lines 535.

The armature 510 of the motor CM is adapted to a limited longitudinal motion as well as rotary motion. Normally, the spring 520 retains the armature lifted longitudinally as shown in Figure 22 for the purpose of seating a locking-pin 521 carried by the plate 514 in a respective one of the bores 550 to 560 in the upper bracket 518 (Figure 25). As circularly spaced, the latter bores respectively correspond with positions in which the characters on the drum 534 may be presented for view at the sight space 535. In the recording of a quotation, energy through both the field and the armature windings of the motor CM first stresses the armature 510 downwardly until the stop pin 521 is removed from a respective bore 550 to 560, in which it may have been seated under a previous selection. Thus freed, the armature may then revolve and come to rest in a position corresponding with the position in which the brushes of the transmitter rheostat may have been arrested under translation of a registered selection, as hereinafter will be described. Following this, the circuits of the motor CM are automatically disconnected and the spring 520 may thrust the armature upward so that the stop pin 521 may enter the respective one of the stop bores 550 to 560. Thus the display drum 534 may exhibit the selected character until it may be changed by a subsequent quotation.

The downward stroke of the armature 510 may be so proportioned to the length of the stop pin 521 that the latter may serve as a "clock-pawl" in tracing a circular path on the under surface of the bracket 518. This path is provided with sloping approaches to the bores 550 to 560 as by suitably counter-sinking these bores, as shown in the drawings. The clock-pawl effect, while serving to damp the armature, also will have the effect of quickly centering the armature at a selected point. The stop pin 521 is electrically insulated by being seated in the plate 514 which, as already mentioned, is of insulating material. The brackets 518 and 519 may be fixed to, but electrically insulated from, suitable supports (not shown), so that conductors 508 and 509 respectively attached thereto may serve as exterior leads for connecting the armature winding 511.

In describing a preferred arrangement for grouping the display devices of a plurality of stocks or securities, attention will now be directed to Figure 30 of the drawings. Therein, a suitable frame means comprises an assembly to form respective rectangular spaces in which display devices corresponding with the devices DI of Figures 6 and 7 are provided. The respective spaces form uniform vertical and transverse rows throughout the face of the display board DB. Only the upper left-hand corner of a board has been shown, as it is believed that this will be sufficient to a clear understanding of the order, arrangement and significance of this equipment. At the left-hand margin of the board, a vertical designation space 600 forms a column for successions of eight items which give significance to respective lateral alignments 601 to 608, 701 to 708, etc., with respect to stocks which are assigned throughout vertical sections of the board. In the first transverse or lateral designation space 601, the item Dividend is shown in the first vertical designation space 600, the item G5 in the second vertical designation space 611, and the item A2 in the third vertical designation space 612, the items G5 and A2 just mentioned indicating the dividend rate for particular stocks. In the second transverse designation space, under the first vertical designation space 600 the item Stock is shown, and in the second vertical designation space 611 the item ITX is shown, and in the third the item TC is shown, the abbreviations representing different stocks.

The display space for each stock is set off into twenty-four squares and each one of the latter will be understood as corresponding with the sight space 535 (Figure 25) for viewing the characters of the display drums 534 (Figures 22 to 29). Each of the squares is occupied by a display indicator and the respective groups of four indicators of each lateral row will be understood as corresponding with a group of indicators as H, T, U and F of DI shown in Figures 6 and 7. In these figures, the labeling of the respective groups of indicators corresponds with the mark-

ings in the vertical designation space or column 600 (Figure 30). For purpose of illustration, figures to cover the several features of the items of quotations have been assumed and entered in the display space of the stock ITX. In the present art, the lateral rows 603 to 608, 703 to 708, etc., are commonly referred to as "shelves" and, for convenience, that term will hereinafter be employed in referring to them. Thus, for the shelf Previous close (603), the amount 1597 may indicate that the last sale on the previous day was at the price of $159⅞ per share for the stock ITX. It will be pointed out that the right-hand figure of the items of the shelves 603 to 607 signify fractional places in eighths. For the shelf Open (604), 1623 indicates that on the current day the first sale under the stock ITX was at the price of $162⅜. For the shelf High (605), 1652 indicates that during the current day up to and including the last sale the highest price for the stock ITX was $165¼, while in a corresponding manner the price 1585 on the shelf Low (606) indicates that the lowest price for this stock on the current day was $158⅝. The amount 1591 on the shelf Last (607) indicates that the last sale for this stock during the time this indication may be present on the current day was made at $159⅛ per share.

Under each quotation, the item of price is registered on the indicators of the shelf Last, irrespective of whether the price may or may not have also been caused to appear on the devices of the Close, Open, High and Low shelves. It will be mentioned that under the first sale of the current day the price will appear simultaneously on the devices of the several shelves, Open, High, Low and Last. The operations for such effects will be traced presently. On the lowermost shelf, Quantity (608), the figures 475 indicate, under certain operating procedure, that the last current sale at $159⅛ was for 47,500 shares of the stock ITX.

As already mentioned, the sales ordinarily are in lots of one hundred shares, and under sales of broken lots of less than one hundred shares the quantity is not registered. Under a quotation for such a sale, digits may be sent over the signalling channel L to erase the quantity item which may be present under the registration of a previous sale, by causing each one of the indicators of the shelf Quantity to display its blank face.

The headings in the column 600, for the respective transverse designation spaces 701 to 708 as shown, are duplicates of the headings for the transverse designation spaces 601 to 608 associated with the first or uppermost row of stock display spaces and serve for the stocks which may be assigned to the second transverse row of stock display spaces. Thus, it will be clear that successive transverse rows of display spaces extending to any desired distance to the right, may be added to accommodate substantially any desired total number of stocks. In a corresponding manner, the vertical rows of stock spaces 701, 702, etc., may continue downwardly.

For indicating the interest rate for loans, a space on the display board may be especially provided if desired. However, the features of the interest rate correspond substantially with the features of the price item of quotations and, for the sake of uniformity, one of the regular display spaces for a stock may be utilized to exhibit the loan rate for money. To illustrate this, the heading Money has been placed on the lateral 602 above a stock space in which various interest rates have been assumed and entered for convenience of description. Thus, on the shelf Previous close (603) the figure 6 indicates that at the close of the market on the previous day the interest rate was 6%; 62 on the shelf Open (604) indicates that the first loan on the opening of the market on the current day was at 6¼%. The right hand vertical row of indicators in the Money space correspond with fractions in eighths, the same as under the price item of quotations. The shelf High (605) displays 6⅜% as the highest previous rate on the current day, while 6⅛% on the shelf Low (606) corresponds with the lowest previous rate on the current day. The display 62 on the shelf Last (607) indicates that the last current loan was made at the rate of 6¼% interest.

It should now be clear that each of the stocks of a market may be assigned to a respective display space on a quotation board. The operations of choosing any one of the stocks so assigned will, for convenience of description, be referred to as "stock selection". As an aid to ready comprehension of the stock selection operation, the general plan may briefly be outlined by assuming that the stocks, as well as the various switching devices, are arranged in the order of groups of thirty-two stocks, each to correspond with the thirty-two contacts of the permutation relay PR. Thus, the display board may have a width to accommodate thirty-two stocks in each transverse row and a height to provide for thirty-two transverse rows. The uppermost transverse row may be indicated as the first group, thence progressing downwardly to the lowermost row which would be the thirty-second group of stocks. Each of the one-thousand twenty-four stocks is provided with a control or master relay and these relays are divided into groups of thirty-two relays (SR 439, Figure 6) to correspond respectively with the groups formed of thirty-two stocks.

There are thirty-two relays in the group of common selection relays PE (Figure 4) and each of these relays is provided with thirty-two selectable contacts which serve a respective group of the individual stock relays SR 439, Fig. 6. At a certain instant in the transmission of a quotation, the thirty-two relays of the group PE are connected respectively to the thirty-two contacts 162 to 193 of the permutation relay PR and therefore are selectable thereover, while during a following instant the thirty-two contacts of the permutation relay are connected to bus conductors which branch to respective ones of the thirty-two sets of contacts of each of the relays of the group PE. Therefore, while the first unit may select one of the latter relays, the second unit may effect a selection by way of the permutation relay PR and contacts of the selected one of the relays PE to cause initial response of a desired one of the individual stock relays SR 439, Fig. 6, which may be in a group of thirty-two relays served by the relay first selected in the group PE.

Following initial response of a stock relay 439 (Fig. 6) which may have been chosen, a hunting switch CS, individual to this stock relay, responds to find and prepare for connecting the respective groups of the display devices of the desired stock to the output terminals of the particular register translator group on which the items of the quotation will be or may have already been registered. Thus, it should now be

obvious that under the assumed "two-unit" code for effecting stock selection, the first unit may be termed a group selection agent for selecting any one of thirty-two groups of master relays 401, etc., 412, 432 of PE, Fig. 4, while, in turn, the second unit may select any individual one of the thirty-two stock relays 439, Fig. 6, of the group first selected.

Referring again to the transmission portion of this system (Figures 1, 2 and 3), the various points 22 to 53 on the tape 7 (Figure 1) may correspond with respective units and, for convenience of description, these preferably will be so termed hereinafter. Under absence of perforations in the tape for the digit 22, on the instant the feed mechanism has advanced the tape 7 so that the location of a unit of this character may come to the transmission position below the tracers 1 to 5 of the transmitter, the contacts 13 of the start circuit will close and the arms of the distributors SD and RD will be released to sweep through a single revolution as already described. Due to the absence of perforations in the tape 7, no current changes will take place over the line L and therefore the magnets 76 to 80 (Fig. 3) of the permutation relay PR may continue inert in their normal positions. Therefore, when the cam AC (Fig. 2) has rotated to the translation position and permitted presentation of the transverse bars 122 to 153 (Fig. 3) for acceptance by the code bars 81 to 85, only the first bar 122 may be received, as a slot for this bar is always present during periods the permutation relay PR may be in its normal position. Thus, the contact 162 of the relay PR (Fig. 3) may be closed under a unit where there is entire absence of selective impulses over the line and under which the so-called start impulse only is present for initiating operation of the start-stop distributors at each end of the signalling channel. It is now believed that sufficient description of the transmission portion of this system has been given for ready understanding of how the transmission of any one of the thirty-two units 22 to 53 may effect momentary closure of any one of the thirty-two contacts 162 to 193 respectively, of the permutation relay PR.

In a more detailed description of the system features of this invention, a quotation will now be assumed for the stock ITX and this quotation will further be considered as a new low price which would therefore be received on the shelf Low (606) as well as on the shelf Last (607, Figure 30). Complete items to form a full quotation will be considered and therefore the transmission will require ten successive character signals. The first character signal will serve to select the shelf Low, the second and third character signals will select the stock ITX, the next four character signals will record the price item, while the last three character signals will record the quantity item.

A price of $111⅛ and the number 11,100 for the quantity as indicated have been chosen, chiefly to simplify the transmission from over the channel L to ten repetitions of the same character signal 22, successively to close the first set of contacts 162 on the permutation relay PR (Fig. 3). Attention may thus be free for concentration on the recording and translating effects, all of which will be by way of the single switch sector 101 of the digit switch DS (Figure 4).

Under the first or shelf selection signal 22, momentary closure of the contacts 162 of the permutation relay PR connects ground potential over the contactor arm and segment 201 of switch sector 101 (Fig. 4), conductor 317 (Fig. 5), thence to grounded battery over the serially connected windings of two relays 318 and 319 (Fig. 7). Response of relay 318 closes an obvious circuit through a resistance 320 for locking these relays operated. Closure of the contacts of relay 319 (Fig. 7) connects grounded battery to the contactor arm of the sector 295 of the register selector switch RS (Fig. 4). This potential may be termed "marking battery" which identifies the position of the switch RS relative to the particular register translator group which may have its input terminals engaged at this time by this switch RS. The purpose of the marking battery and also further effects due to the operation of the shelf selection relay 318 (Fig. 7) will presently appear.

During reception of the signal for the shelf selection, the contacts 87 at the cam ON (Fig. 2) stood closed to retain the stepping magnet 98 (Fig. 4) of the switch DS operated over an obvious circuit. On cessation of this signal and separation of the contacts 87, release of magnet 98 advances the arms of switch sectors 101 to 116 of the digit switch DS one step to the respective next segments (202). In this position of the switch DS, the segment 66 of the distributor RD is connected over a conductor 156, Fig. 2, the arm and second segment of the arc 112 of the switch DS (Fig. 4) and an obvious circuit to grounded battery through the winding of the control magnet 76 of the relay PR (Fig. 3). In a corresponding manner, the segment 67 of this distributor is connected over a conductor 157 (Fig. 2) and the arm and second segment of the arc 113 to grounded battery through the winding of the magnet 77 (Fig. 3).

For the first character signal of stock selection, repetition of the signal 22 again effects closure of the contacts 162 of the relay PR (Fig. 4) to apply ground potential over brush and segment 202 of sector 101, conductor 435, thence to grounded battery over the normal contacts and winding of the relay 401 of the group of permutation effect relays PE. In operating, the transfer contacts of the relay 401 disconnect the lead 435 and lock this relay energized to the holding bus conductor 117 now grounded over the sector 115 of the switch DS which is in its off normal position, as already described. On cessation of the first signal of stock selection, release of magnet 98 advances the switch DS one point where all of the brushes' sectors 101 to 116 will be on their third contact segments 203. The contact arm of sector 114 (Fig. 4) upon reaching the third position will establish an obvious circuit through the winding of relay DT (Fig. 3). This relay will operate and lock to grounded conductor 117 (Fig. 4). Operation of relay DT at this time serves to transfer the permutation relay contacts 173 to 193 from the windings of the associated relays PE to the bus wires 117A connecting to the contacts of these relays.

Under repetition of signal 22 for the second character signal of stock selection, closure of the contacts 162 of relay PR (Fig. 3) connects ground over the brush and segment 203 of sector 101, conductor 436, the first set of selectable contacts of the relay 401, conductor 437 (Fig. 4), thence over a resistance 438 and the winding of the relay 439 (Fig. 6) to grounded battery. The latter relay may be considered as the master relay for the stock ITX.

Response of the relay 439 establishes an obvious self locking circuit which includes the resistances 438 (Fig. 6). The contacts of the relay 439 also connect ground potential over the conductor 565 (Figs. 6 and 7) to grounded battery over the interrupter contacts and winding of a step control magnet 566 (Fig. 7). Under self-interruption, the armature of this magnet acts as a stepping pawl to drive a ratchet wheel 567 to revolve a shaft (not shown), which carries the nineteen contactor arms of the switch sectors 571 to 589 of the hunting or connector switch CS.

Under control of the magnet 566 (Fig. 7), the switch CS continues to advance until the arm of the sector 585 finds the segment that is connected by conductor 321 (Figs. 4, 5 and 7) to the segment on which the switch arm of the sector 295 (Fig. 4) of the register selector switch RS may be standing at this time. Thereupon, the grounded battery prepared over the contacts of the shelf relay 319 (Fig. 7) may traverse the sector 295 of the switch RS, conductor 321, a contact and the brush of sector 585 of the switch CS, conductor 437A (Fig. 6), outer normal contacts of a relay 538, thence over a conductor 539 to a point intermediate the resistance 438 and the relay 439. This battery potential shunts the latter relay which thereupon disconnects the stepping magnet 566 and thus permits the switch CS to come to rest in the position corresponding with the segment on which the marking potential was found. This position is the position in which this switch is shown in the drawings, whereby the sectors 571 to 584 now join the output terminals of the group of registers 216 (Fig. 5) comprising sets RT2 and RT1 to conductors which stand ready for connection to the display devices of the stock ITX. For the present example, it may be assumed that the six groups of indicators generally denoted DI of Figures 7 and 8 are associated with the latter stock.

During the interval the switch CS was locating the output terminals of the register group 216, the transmission of the items of the quotation had continued without any interval or spacing between successive signals, and certain of such transmissions will now be described, as effects thereby set up permit completion of switching operations finally to connect the display devices of the stock selected. Following the third character signal of the quotations, which was the second or last signal of the stock selection, the digit switch DS will have advanced to its fourth contact point 204. Therefore, repetition of the signal 22 for the fractions place of the price connects ground potential over the contact 162 (Fig. 3) of the relay PR, brush and contact 204 (Fig. 4) of sector 101, conductor 701, brush and contact of sector 221 of the register selector switch RS, conductor 711 (Fig. 5), the winding of the stop control magnet 350, a conductor 316 to grounded battery over the recoil or inertia contacts IC. Under response, this magnet closes its locking contacts 366 (Fig. 5) to ground over a bus conductor 486, sectors 589 (Fig. 7), lead 590 and sector 588 of switch CS, conductor 543, and the normal contacts of the now deenergized relay 439.

Ground from relay 439 is thus substituted for the impulse of ground potential first received from the permutation relay PR and serves for retaining the magnet 350 energized. The latter magnet also closes its contacts 383 in branching ground over the winding of the associated clutch magnet 301 (Figs. 5 and 9), a bus conductor 491, a contact and the brush of switch sector 587 (Fig. 7), inertia contacts IC 592, a conductor 593 to grounded battery over the winging of the price master relay 538 (Fig. 6).

Under response, the battery contacts of relay 538 energize a bus conductor 540 (Figs. 6 and 7) to effect response of a connecting relay 541 (Fig. 6). The right-hand contacts of relay 538 transfer the connection of the marking battery present on the conductor 437A to a conductor 542 (Fig. 6), thence over the winding of the shelf master relay 323 (Fig. 7), conductor 590, the arm and a contact of sector 588 of switch CS, to ground over the conductor 543 (Fig. 6) and the normal contacts of the master stock relay 439.

Due to the locked position of the relay 318 (Fig. 7) as already described, response of the relay 323 (Fig. 7) permits its inner contacts to complete a derived circuit over a conductor 546 in connecting the shelf relay 547 (Fig. 6) to respond in parallel with the resistance 320 (Fig. 7). Under response, relay 547 locks to battery now present on the bus conductor 540, as already described. In addition to connecting the eight conductors 492 to 499 (Fig. 7) to the field windings of the respective motors of the display groups Low and Last, the relays 541 and 547 (Fig. 6) also close obvious paths for energizing the armature windings of the respective motors with direct current. At the instant the relay 547 closed its locking contact, battery potential from the bus conductor 540 became effective over conductor 546 (Fig. 7) to shunt down the relays 318 and 319. The latter relay thereby disconnects marking battery from the sector 295 (Fig. 4) of the switch RS, whereupon the relay 323 (Fig. 7) will be disconnected. The purpose of the associated marking battery relay 487 (Fig. 7) will appear as this description proceeds.

Attention will now be momentarily turned from the operations effected by response of the various relays, to an instant corresponding with cessation of the fractions signal of the assumed quotation, at which time the digit switch DS stepped to its fifth position, segments 205 (Fig. 4). It will first be pointed out that the four units comprising the price register group RT1 (Fig. 5) have been indicated from right to left, F, U, T and H to correspond with the fractions, units, tens and hundreds places respectively handled by these units, while the units of the group RT2 have been indicated H, T and TT to correspond with the hundreds, thousands and ten-thousands places of quantity items which are handled by the latter units.

From a system standpoint, clearness is served by the schematic form in which these devices have been shown in Fig. 5 and in order that the various mechanisms and circuit parts may readily be identified, they have, for the devices of the fractions place, been indicated by characters of reference similar to those employed for designating like parts in the several detail views, principally Figures 9 to 18. Each of the register translater units of the groups RT1 and RT2 are substantially identical, one unit with the others, so that the specific labeling of the parts of the fractions unit F and the detailed description thereof, which will presently be resumed, are believed sufficient to the purpose of this system description. Therefore, only a brief discussion of the system features of the other six register translator units will be given.

Accordingly, for the reception of the units signal when the switch DS (Fig. 4) is in its fifth position (on contacts 205) as above described, the remaining three signals of the price item and the

three signals of the quantity item may be received over the contacts 162 (Fig. 3) of the permutation relay PR, whence each path will be over a respective one of the following circuits: segments 205 to 210 (Fig. 4) of sector 101 of switch DS, conductors 702 to 707, sectors 229, 240, 251, 262, 273 and 284 of switch RS, conductors 712 to 717 (Figs. 4 and 5), stop magnets 722 to 727 and inertia contacts IC 732 to 737 to IC grounded battery.

Under response, each stop magnet 722 to 727, Fig. 5, in the manner described, effects energization of each respective clutch magnet 742 to 747. It will be pointed out that, although the stop magnets prepare circuits for the clutch magnets, the latter may not respond until the hunting switch CS has completed its operations in locating the output terminals of the register group, as group 216, and has come to rest, thereby effecting closure of the inertia contacts IC 591 and IC 592 (Fig. 7) for completing the circuits of the bus conductors 491 (Fig. 5) and 761 (Fig. 5), which respectively serve the clutch magnets of translators RT1 and RT2. The inertia contacts 591 and 592 (Figure 7) correspond with the contacts shown in Figures 19 to 21, which have already been described. These contacts are closed only during periods the switch CS may be at rest and conversely are open at all times while the switch may be in motion, irrespective of whether a hunting operation or a restoring operation may be in progress. The latter effect will presently be described.

Under quotations which include both the price and quantity items, the conductors to the sector 116 (Fig. 4) of the switch DS are disconnected, as by an operated position of the relays 781 and 782 later on to be described. For the quotation under discussion, it will be sufficient to assume that these relays now stand locked over respectively obvious circuits to the bus conductor 117 as grounded over the sector 115.

As just described, the items of the quotation have been registered or stored on the register group comprising sets RT1 (Fig. 5) or generally denoted 216, and following registration of the ten-thousands place on the register TT, which corresponds with the tenth or last signal of the quotation, the digit switch DS (Fig. 4) will step once to bring the arms of all the sectors 101 to 116 to their first segments, which are the segments on which they are shown in the drawing. This position of the arm of sector 115 disconnects the holding ground from the bus conductor 117, thereby releasing the relay 401, restoring the group of relays PE to normal. The magnet 198 is also disconnected and thereupon steps the switch RS a single point in transferring the first eleven controls of the permutation relay PR from the input terminals of the register group 216 to the input terminals of the next or idle register group as 217. The latter operations are substantially instantaneous so that no spacing interval is required between the quotation just described and a next successive quotation. Therefore, the transmission of the signals of another quotation may immediately take place to be received and stored on the register translators of the group 217 in a manner corresponding with that already described for the transmission and registration of the assumed quotation on the register group 216. In like manner the permutation controls may be connected to the register translator group 218, and subsequently to group 219 to record successive quotations, even though several register units as D1 may be in action to set up previous quotations.

Returning attention to the instant the fractions place of the assumed quotation was received on the register unit F (Figure 5), response of the clutch magnet 301 (see also Figs. 9 and 17) closed the contacts 307 to connect grounded battery to the contactor brush 393 for energizing the winding 391 schematically shown as a toroid at F (Fig. 5) and more clearly shown as transmitter rheostat TR (Figs. 9 and 17) over a path which includes the brush 392, rod 394, brush 398 and the ground connection thereto (Figs. 17 and 18). One limb of the three-wire control circuit from the rheostat TR comprises a bus conductor 506 which is connected common to all of the other transmitter rheostats of the system and also connected common to the field windings of all the display control motors (Figs. 6 and 7) of the system. Therefore, in connecting any transmitter to apply three-phase currents to any motor, it is only necessary to switch two conductors of any respective one of the three-wire circuits. For the fractions transmitter TR (Figs. 5 and 17), the two latter paths extend over conductors 504 and 505, contactor arms and segments of sectors 571 and 572 (Fig. 5) of switch CS, conductors 492 and 493 (Figs. 5, 6 and 7), thence to the field windings of the fractions motor F on the shelves Last and Low (Figure 7), as respectively connected by the operated positions of the relays 541 and 547, as already described.

The present energized condition of the clutch magnet 301 (Figure 5) serves to join the main shaft 58 (Figs. 2 and 5) to operate the branch shaft 304 (Figures 5 and 10) which carries the brushes of the transmitter rheostat TR (Fig. 17). Therefore, under the connections traced, the armatures of the control indicator motors as F of the register unit DI (Figs. 6 and 7) will seek to come into phase with the travel of the brushes as 392, 393 of the corresponding rheostat transmitter as F of set RT1 (Fig. 5 and RT of Fig. 17). The direct current energy passing locally through the armatures of the motors effects the unlatching operations (already described in relation to Fig. 22) to render the armatures free to revolve and come to rest in positions corresponding with the position in which the brushes of the corresponding transmitter may be brought to rest, due to the operated position of the stop magnet 350. As already described, the armature of the latter magnet mechanically arrests the shaft 304 (Fig. 10), whereupon the resulting separation of the inertia or momentum contacts IC disconnects the stop magnet 350 which, in releasing, disconnects the clutch magnet 301 (Figs. 5, 9 and 19–21). As previously stated, the dash pot means 306, Fig. 9, is slow to release and, therefore, holds contacts 307 closed for an interval after the release of clutch magnet 301, thus continuing the supply of energy to the transmitter rheostat TR, Fig. 17, for an appreciable interval, to insure that the armature of the connected display motors F (Figs. 6 and 7) arrives at the position corresponding with the selected stop point.

Under the assumed quotation, the selected position will present that face of the display control drum 534 (Figure 22) which carries the numeral 1, thereby indicating what is understood to be the fraction ⅛. In like manner, conductors 444 and 445, 446 and 447, 448 and 449 (Fig. 5) for the U, T and H register translator units terminate on corresponding segments of the switch sectors

573 to 578 of the connector switch CS and, in effect, may be considered as the output terminals of the register translator devices. As shown, the contactor arms of these sectors connect to corresponding pairs of conductors 494, 495; 496, 497; 498, 499 (Figs. 5 and 7), thence over contacts of the shelf relays as 541 and 547 (Fig. 6) to the field windings of the respective display motors U, T and H of the shelf groups as Last and Low, etc. In a manner similar to that already described in detail for the fractions register F, the translator portion of the U, T and H devices may function to set the respective display units to indicate the numerals 1, 1, 1, thereby displaying the quotation $111⅛ and show these on the shelves Low and Last of the stock ITX (Figure 30).

The release of the clutch magnets 301 and 724—744 of the price set of registers RT1 and the consequent restoration of the translator registers F, U, T and H, following the operations of setting the indicators, removes ground from the bus conductor 491 (Fig. 5). The opening of bus conductor 491 permits release of the price master relay 538 (Fig. 6) to in turn release the shelf relays 541 and 547, thereby disconnecting the price conductors 492 to 499 (Fig. 6) from the display control motors of the shelves Last and Low. The inner normal contacts of the master price relay 538 prepared a first section of a restoring circuit for the switch CS which will be described when it presently becomes effective.

The output terminals of the three register translators of the quantity item correspond with pairs of conductors 752, 753; 754, 755; 756, 757 (Fig. 5) which are fixed to aligned segments on the sectors 579, 580; 581, 582; 583, 584 of the connector or hunting switch CS. In turn, the contactor arms of these sectors serve pairs of conductors 762, 763; 764, 765; 766, 767 which may be traced over respective contacts of the quantity shelf relay 548 (Fig. 6) to the field windings of the respective motor indicators H, T and T—T of the shelf group Quantity. Relay 548 is energized at this time over an obvious circuit through the grounding contacts of the quantity master relay 442 (Fig. 6). The latter relay is energized in series with grounded battery, conductor 443, inertia contacts IC 591 (Fig. 7), contactor arm and segment of sector 586 of the switch CS to bus conductor 761, thence over three branching paths (Fig. 5) formed by the windings of clutch magnets 745 to 747 and the contacts of the respective stop magnets 725 to 727, to the bus conductor 486 now grounded as already traced. The signals of the quantity item now stored in the register translator group RT2 will be translated into polyphase currents for translation of stored signals of these registers and will cause the respective display devices (Fig. 6) to exhibit the numerals 1, 1, 1 on the shelf Quantity (Figure 6) of the stock ITX (Figure 30). As already mentioned, this will indicate that the sale at $111⅛ comprised 11,100 shares of this stock.

Following the translation of the quantity item of the assumed quotation, release of the stop and clutch magnets of the registers H, T and T—T effect the deenergization of the bus conductor 761 (Fig. 5), thereby releasing the relay 442 (Fig. 6) and in turn the relay 548. This disconnects the group of quantity bus conductors 762 to 767 from the motor devices of the indicators for the shelf Quantity, while the normal contacts of the master quantity relay 442 close the second and final section of the restoring path for the switch CS (Fig. 7). The latter circuit 451 (Fig. 6), and 465 (Fig. 7), comprises grounded battery through the winding of stepping magnet 566 (Fig. 7) and interrupter contacts thereof, conductor 565, inner normal contacts of the master price relay 538, conductor 451, normal contacts of quantity master relay 442, conductor 458, the arm and a segment of sector 588 (Fig. 6) of switch CS, conductor 543 (Fig. 6), thence to ground over the normal contacts of the master stock relay 439.

Under the successive self-interruptions of its control circuit the magnet 566 (Fig. 6) may advance the contactor arms of all the sectors 571 to 589 of the switch CS to their normal or home positions where they will be free from the output terminals of any of the groups of register translators as RT1 and RT2 (Fig. 5), or 217, 218, 219 (Fig. 4).

The foregoing operations complete the transmission, reception, storage and translation of the assumed quotation for the stock ITX, and the circuits of that stock as well as the circuits of the register translator group RT1, RT2 will now be at normal. Therefore, this stock may again be selected and effected by a quotation, the items of which may be routed by way of either one of the register translator groups RT1, RT2, or 217, 218 or 219, while the registers of RT1, RT2 as well as the registers of 217 to 219 stand available for handling the items of quotations for any of the other ten-hundred and twenty-four stocks which may be present on the display board (Figure 30).

It may be pointed out that under the quantity item the right-hand display space on the shelf Quantity (see Figure 30) is not ordinarily required and may be left vacant, excepting where very large lots of shares may be dealt in. For this, the space may be utilized by placing a display unit therein and adding a corresponding register translator to the group RT2, so that four places of quantity may be handled on the basis of lots of one hundred shares each. Under a different procedure, the fourth or right hand place would be available for recording lots of ten shares as in so-called broken lot sales.

As regards a current day, it begins with the first or opening sale relative to any individual stock and such opening sale, of course, may take place at any time between the beginning and ending hours of a market day. As already mentioned, the first sale for any stock is registered on the devices of the four shelves Last, Open, High and Low. In describing such a quotation let it be assumed that the first or opening sale for a stock SO, the dividend rate of which is $7 per share which could, as may be readily seen from the above, be indicated on the quotation board (Figure 30) comprises a lot of 11,100 shares at a price of $111⅛ per share. This quantity and also the price correspond with the items assumed and already described in the quotation which concerned only the display devices of the shelves Low and Last of the stock ITX. Therefore, for the present assumed quotation, the stock selection and the items of price and quantity may be transmitted, recorded and translated by way of the same register translator group RT1, RT2, in a manner similar to that already described for the previous quotation. Thus, attention may be directed to the shelf selection operations, which features comprise the only points of difference between the two assumed quotations. Accordingly, instead of the signal 22, the signal 26 will be required for the present assumed shelf selec-

tions. As shown in Figure 1, signal 26 is characterized by signal perforations in the third and fourth paths, whereby the tracer contacts 3 and 4 may, at a proper moment, close their contacts to energize the segments 18 and 19 of the distributor SD. From the previous description, it will be obvious that under this transmission, response of the magnets 78 and 79 of the permutation relay PR (Fig. 3) may be had momentarily to close the contacts 166 of the latter relay mechanism. Thus, ground is connected over the contacts 166, brush and first segment of the sector 111 (Fig. 4) of the switch DS, conductor 335 (Fig. 5), thence through the right hand windings of relays 329, 328 and 318 (Fig. 7) to grounded battery over the winding of the relay 319.

Under response of the relays 318, 328, 329 and also the relay 319, relays 318, 328 and 329 lock over obvious circuits which include their left-hand windings and respectively associated resistance units 320, 338 and 339. The relay 319 is retained in the common current supply for this locking circuit and applies marking battery to the sector 295 of the switch RS (Fig. 4). The shelf selection signal is thus retained stored on the relays 318, 328 and 329 (Fig. 7) until the stock selection has been made. For convenience of description it will further be assumed that the master stock relay 439 (Fig. 6) and the display indicators DI (Figures 6 and 7) are associated with the stock SO of the present assumed quotation. Therefore, under two transmissions of the signal 22 selection of the relay 439 may be had as already described and the magnet 566 (Fig. 7) may be caused to drive the switch CS from its home position to the position in which its contactor arms are shown in the drawing upon which relay 439 is released causing the release of relay 566, thereby stopping the switch CS.

At the latter point, the relay 439 (Fig. 6) will be shunted down by the marking or "stop" battery.

Following the two signals of the stock selection, the signals for the price and quantity items will be received and registered, thereby effecting response of the price master relay 538 (Fig. 6) which causes the operation of the master shelf relay 323 (Fig. 7) as pointed out above when describing the positioning of the first quotation. Thereupon, the three sets of contacts of the relay 323 close obvious circuits over respective conductors 546, 561 and 562, thereby causing the response of the shelf connecting relays 547, 568 and 569 (Figs. 6 and 7) in parallel with the respective resistance units 320, 338 and 339. The relay 541 for the shelf Last operates directly from the bus conductor 540 as shown.

Over the locking circuit of the shelf relays the respective conductors 546, 561 and 562 (Fig. 7) are brought to the potential of the grounded battery, thereby shunting down the shelf selection and storage relays 318, 328 and 329. This effects release of the relay 319 (Fig. 7) which removes marking battery from the circuit controlled by the switch sector 295 (Fig. 4), whereupon the master shelf relay 323 (Fig. 7) will be disconnected. Thus, the circuits of the group of storage relays IR for shelf selection operations are restored to normal in readiness for reception of signals of another quotation.

As described for the first assumed quotation, the quantity master relay 442 (Fig. 6) responds to effect energization of the relay 548 for connecting the bus conductors 762 to 767 (Fig. 5) of the quantity translators to the respective motors of the shelf Quantity (Fig. 6). Thus, the price item of the present assumed quotation may be recorded on the devices of the shelves Open, High, Low and Last, while the quantity item will be registered on the devices of the shelf Quantity, as shown by the entries in the display spaces of the stock SO as could be shown readily on Fig. 30.

On conclusion of the recording operations, release of the price and quantity master relays 538 and 442 (Fig. 6) permits the restoration of the circuits to normal while causing the switch CS (Fig. 6) to advance to its normal position. Following reception and storage of the items of the last assumed quotation, the switch RS (Fig. 4) advanced to an idle register translator group while the digit switch DS arrived at its normal position in readiness for reception of another quotation.

With the system herein disclosed, although no shelf selection signal is sent, still a shelf will be automatically selected, namely, the shelf designated Last of register unit DI (Fig. 6) if, for example, any of the price translator registers of set RT1 (Fig. 5) is selected, causing circuit 491 to be established after having been completed by the hunting switch CS and consequently enerizing master relay 538 (Fig. 6). Accordingly, contact M of relay 538 is closed placing battery on conductor 549 which in turn operates the Last shelf indicator relay 541, connecting the indicators of this shelf to their respective register translators (Fig. 5).

In like manner, the quantity shelf of a register unit as DI (Fig. 6) may be selected without transmitting a shelf selection signal. To this end, if any of the quantity register translators of set as RT2 (Fig. 5) is selected, the master quantity relay 442 (Fig. 6) operates, which in turn operates the quantity shelf relay 548. In this way the indicators of the quantity shelf are placed in circuit with the register translators of a set as RT2 (Fig. 5) and are operated thereby to predetermined positions of selection.

Where a selection is made for operating the indicators of the High or Low shelves of a register unit as DI, the indicators of the Last shelf will also be made effective with the indicators of the High and Low shelves. To carry out this performance, the left-hand winding of the High storage relay 328 (Fig. 7), if selected from the controls of the permutation relay PR (Fig. 3), will extend the conductor associated with resistance 338 (Fig. 7) to the master shelf relay 323, and when the latter operates the corresponding shelf indicator relay 568 will be energized. However, Last shelf relay 541 is always operated if there be a price selection in the quotation, and therefore the indicators of the High and Last shelves will be operated together.

Similarly, if the Low shelf storage relay 318 (Fig. 7) be selected from the controls of the permutation relay PR (Fig. 3), corresponding shelf relay 547 (Fig. 7) will subsequently be caused to operate, and inasmuch as Last shelf relay 541 (Fig. 6) operates if there be a price selection, the indicators of the Low shelf and the Last shelf will operate concomitantly and post the same quotation. In addition, all shelves of a register unit, except the previous close, may be operated to post the opening quotation simultaneously. This may be carried out by operating the right-hand winding of the Open storage relay 329 (Fig. 7) of group IR, which also operates the High and Low storage relays 328 and 318 to operate re-

spective shelf indicator relays 568 and 569 when the master shelf relay operates.

The resistance units 596 to 599 (Figure 6) shown connected from respective normal contacts of the Low shelf connecting relay 547 form artificial loads normally present on the respective pairs of control conductors 492 to 499. Thus, a uniform current drain condition for the register translators of the several groups is provided, as either the artificial load or the real load comprising the respective motors of the associated shelf will always be connected. Corresponding resistance units may be connected from the normal contacts of the relays 568, 569 and 570 (Fig. 7) of the other shelf groups High, Open and Close. However, artificial or compensating load resistances are not essential to the operativeness of the present system and whether it may be desired to employ such artificial loads usually will depend on the electrical proportions of the various register translators relative to the motor units.

The last or closing quotation for any stock merely means the last sale of that stock on the current day with respect to the use of that item on the following day. Thus it is possible that there may be but one sale of the shares of a stock during a market day in which event that sale would constitute both Open and Close as well as the High and Low features of the price. This, then, should render it obvious that following the close of a market day the record on a pilot or monitoring board or other suitable record source at the sending station, may be resorted to for information in sending transmissions to set the display indicators of the shelf Previous close, for each active stock, to display the price for the last or closing quotation respectively. For such transmissions, the transmitter TT (Figure 1) shall always be conditioned at the proper moment to send the signal 25 as the agent whereby contacts 165 (Fig. 3) will be selected and momentarily closed on the permutation relay PR, to connect ground over the associated sector of switch DS (Fig. 4) and a conductor (not shown) to energize the relay 330 (Fig. 7), as is well understood. Under the locked position of the latter relay as may be established in series with its associated resistance 340 and the winding of the relay 319, it results that at the instant the relay 323 responds as already described, its outer contacts will connect a conductor 563 to permit response of the shelf connector relay 570 over an obvious circuit, in parallel with the resistance 340. This connects the field windings of the motors of the shelf Previous close respectively with conductors 492 to 499 for receiving the price items of such quotation from a register translator group (Fig. 5) on which it may have been recorded.

For individual selection of the indicators on the shelf High as required with certain quotations, the signal 23 shall be transmitted to select the contacts 163 (Fig. 3) of the permutation relay PR, whereby ground potential will be connected over a path through the associated sector of the switch DS (Fig. 4) and the left-hand winding of the storage relay 328, Fig. 7. Thereupon, circuit changes and effects will take place corresponding with those already described for this relay under the assumed opening quotations.

Infrequently it may be necessary individually to select the devices of the shelf Open as when an error from clerical or similar source may necessitate correction of the opening price of a stock as previously recorded. For such a shelf selection the signal 24 will be transmitted to effect ground over the contacts 164 (Fig. 3) of the permutation relay PR, thence over a path through the associated sector of switch DS (Fig. 4) and the left-hand winding of the relay 329 (Fig. 7) to effect initial response of the latter relay. Operations have already been described which correspond with those which will follow response of the relay 329 relative to affecting the recording devices of the shelf Open.

From the foregoing, relative to shelf selection operations, it should now be obvious that when the digit switch DS (Fig. 4) is in its first position, the choice of any one of the first four contacts 162 to 165 (Fig. 3) of the permutation relay PR will permit individual selection of either one of the switch or control relays 318, 328, 329 or 330 (Fig. 7) for respectively connecting the display devices of the shelves Low, High, Open or Close, and that for joint control of the devices on the shelves Low, High and Open the digit 26 may be sent to effect simultaneous operation of the three relays 318, 328 and 329 as already described. It should further be clear that shelf selection signals may be stored in the group of relays IR, not only until the hunting switch CS may have found the output terminals of the proper one of the register translator groups 216 to 219 (Figs. 4 and 5), but also until the actual registration of signals has been made over the input terminals of such register. The latter control is due to the fact that while the sector 568 (Fig. 7) of the switch CS prepares ground to one terminal of the shelf master relay 323, the latter relay may operate only on response of the price master relay 538 (Fig. 6) which will not receive energy until a register or registers effect response of one or more of the clutch magnets 301, 742 to 744.

For the indicators of the shelf Quantity, no shelf selection is required, the connecting relay 548 (Fig. 6) may respond only under registration of signals on the units of group RT2 (Fig. 5) with resulting response of any one or all of the clutch magnets 745 to 747 in series with the quantity master relay 442 (Fig. 6), which in turn controls the relay 548 hereinbefore described.

Under quotations that do not require a shelf selection, a spacing effect may be had by sending a signal which may correspond to any one of the permutation relay contacts which are not used for shelf selection, but which are connected to the sectors 101 to 111 of switch DS (Fig. 4). Although this signal may select contacts on the permutation relay PR (Fig. 3), no effect will result therefrom, as the first segment of the associated sector of the digit switch DS is not connected. Therefore, the revolution of the transmission distributors SD and RD under this signal merely affords operation of cam ON (Figure 2) for effecting a single operation and release of the step magnet 98 (Fig. 4), thus to advance the switch DS as already described. Under such a quotation, relay 487 (Figure 7), the winding of which is in a ground connection of the bus conductor 486 (Figs. 5 and 7), substitutes for the relay 319 (Figure 7) for connecting marking battery to the sector 295 (Fig. 4) of the register selector switch RS. The bus conductor 486 serves for locking the stop magnets and also the clutch magnets of the register translators of the groups as 216, 217 (Figs. 5 and 4) so that coincident with a registration, the relay 487 (Fig. 7) will respond to close an obvious circuit for connecting marking battery whereby the connecting switch CS may be brought to rest on the output terminals of the

proper register translator group, as hereinbefore described. On the instant the master stock relay 439 (Fig. 6) may be shunted down by the marking battery as already described, ground over its normal contacts, conductor 543, sectors 588 (Fig. 7) and 589 of switch CS to the bus conductor 486 shunts down the relay 487 to disconnect the marking battery. It will be pointed out that in the commercial handling of quotations under the features of this system, effects will normally be transmitted under the divided or hybrid signals already mentioned during the period alotted to the shelf selection operations. Such transmissions and effects will next be discussed.

In describing the features of the present system whereby economy in transmission or channel time is effected, as already mentioned, two general conditions may be realized and under the combination of the two conditions, a further or third condition is provided. Under the present sending procedure whereby the order of transmission of the signals is from the lower to the higher places of the price and quantity items, it is possible to terminate the price item after sending either the signal for the fractions, units or the tens places, and likewise the quantity item may be terminated following the sending of the signals for either the hundreds or the tens places. It should be clear from the quotation already assumed and described that when it is necessary to send signals for the last place of the price or the quantity items, such items are thereby automatically terminated or disposed of.

As the features just mentioned appear to be entirely new to the signalling art, terminology or nomenclature will herein be provided in the interest of clearness and conciseness. To this end, the first general condition has already and will hereinafter be referred to as "terminating" effects, the second condition as "deletion" effects and the third condition as "deletion-terminating" effects. In realizing these three conditions, the controls from the receiving distributor RD (Fig. 2) are so arranged that, during the period allotted by the digit switch DS (Fig. 4) for shelf selection operations, three elements only of a transmission signal may be effective with the permutation relay PR for effecting any one of the plurality of circuit changes required for carrying out a shelf selection. In turn, two of the elements of any such signal are rendered effective with the group of relays D (Fig. 4), thereby to set up any desired one of several switching combinations. One of the latter combinations serves for deletion of the price item of a quotation by providing that when the contactor arms of the digit switch DS arrive over the first segment in the price zone of this switch, the magnet 98 may act as a vibrator instantly to drive this switch through the price zone and into the quantity zone. Therein the item of quantity may be handled in a manner similar to that already described. Another combination of the relays D provides that on arrival in the quantity zone the magnet 98 may vibrate or buzz the switch DS through that zone to its first or normal position.

In a detailed description of the terminating and deletion effects, the first two signaling segments of the receiving distributor RD (Fig. 2) connect over respective conductors 156 and 157 (Fig. 2) to the contactor arms of the sectors 112 (Fig. 4) and 113 of the digit switch DS, while the first segment of each of these sectors connects respectively through the windings of relays 781 and 782 to grounded battery. As may be seen from the tape 7 (Figure 1) and also the "spot" markings for the code bars 81, 82, 83, 84 and 85, associated with relays 76, 77, 78, 79 and 80 (Figure 8), the arrangement of the five-unit code relative to control of the permutation relay PR (Fig. 3) is such that the first eight contacts 162 to 169 may be entirely controlled under permutations of but three of the elements of the signalling code. These elements are represented by the eight signals 22 to 29 (Fig. 1), the three tracers 3, 4 and 5 of the transmitter TT (Fig. 1) and the three code bars 83, 84 and 85 (Fig. 8.). In the first or "home" position of the digit switch DS, the first five contacts 162 to 167 of relay PR (Fig. 3) suffice for the five different shelf selections required. From the descriptions already given, it should be obvious that for transmitting permutations of the three elements, the last three signalling segments 18, 19 and 20 of the sending distributor SD (Fig. 1) and the corresponding last three segments 68, 69 and 70 of the receiving distributor RD (Fig. 2) only are required. Therefore, in effect, the first two elements of the first five signals 22 to 29 are never required relative to the permutation relay during periods the switch DS (Fig. 4) may be in its first or its fourth positions.

These two elements or impulse intervals correspond with the fingers 1 and 2 of the transmitter TT (Fig. 1) and their respective traverse on the tape 7, and also with the first two signalling segments 16, 17 (Fig. 1), and 66, 67 (Fig. 2), respectively, of the distributors SD and RD. In the tape 7, it may be seen that the signal perforations corresponding with the signals 33, 34 and 35 fall within the first two paths traced by the finger elements 1 and 2. Thus, under the spot marking of the code bars 81 and 82 (Fig. 8), it may be understood from this figure that, in effect, these signals are simple two element signals which may control the contacts 173, 174 and 175 (Fig. 3) of the latter relay during periods the sectors 112 and 113 (Fig. 4) of the switch DS may be in the positions to allot the two associated signalling segments 66 and 67 (Fig. 2) of the distributor RD to the magnets 76 and 77 (Fig. 3) respectively of the permutation relay PR. As connected under the present embodiment for illustrating these features, the sector 12 (Fig. 4) of the switch DS connects the first signalling segment 66 of the distributor RD with the magnet 76 only during periods the switch DS may be in its second and third positions corresponding with the positions 202 and 203 of sector 101. For all other positions of this switch the segment 66 will be connected respectively to the relays 783, 784 or 781 while the segment 67 (Fig. 2) will be connected over sector 113 (Fig. 4) with the magnet 77 at all times excepting when the switch DS may be in its first or fourth positions (corresponding to positions 201 or 204 of sector 101). In the latter positions the segment 67 will be connected to the relay 782.

The present order of the interconnections for the controls of the relays 781 to 784 (Fig. 4) of the group D is for an operating procedure under which the item of quantity will not ordinarily be sent under each quotation, and the relays D are therefore connected so that the quantity item will normally be deleted. For this, a connection may be traced from the interrupter contacts of the step control magnet 98 to the contactor arm of the sector 116 of the digit switch DS. It may be noted that on this sector the first or home segment is spare, while the other

nine segments are connected to form three groups. The two segments which form the first group correspond with the position of the switch DS during stock selection. The next group comprising four segments, corresponds with the item of price, while the last group of three segments corresponds with the quantity item of a quotation.

For convenience, the respective groups of segments will be referred to as the stock zone, price zone and quantity zone, and these three terms may apply to all of the sectors 101 to 116 of the switch DS. From the description already given, it should now be obvious that following respective signals for the various selections of shelf, stock and price, the contact arms of the switch DS will automatically arrive on its first contacts of the quantity zone, as contact 208 of sector 101. Thereupon, grounded battery is connected through the winding and contacts of magnet 98, sector 116, conductor 785 and the normal contacts of relay 781 to the holding bus conductor 117 now grounded over the sector 115. This effects vibration of the armature of the magnet 98 to operate the ratchet wheel 99 in driving the arms of sectors 101 to 116 of the switch DS until they have passed through and left the quantity zone, when they will be in the first position as shown in the drawings. At the latter point, the arm of sector 116 effects disconnection of the energizing circuit for the magnet 98 while the bus conductor 117 is disconnected at the sector 115, thereby restoring the circuits and apparatus to normal as already described.

Under a transmission for recording a quantity item only, the present connective arrangement requires that the relay 781 shall be operated in order to clear the normal deletion condition from the quantity item while in turn effecting deletion of the price item. Such a transmission may be effected under the period alotted by the digit switch DS for shelf selection. As no shelf selection will be required for this assumed handling of the quantity item only, the permutative combination corresponding with the signal 43 (Fig. 1) will be sent.

Although the signal 43 ordinarily serves for selection of the contacts 183 of the permutation relay PR, it may thus be effective only when the arms of the switch DS are in their second and third positions, which correspond with the stock selection zone. During any other position of the switch DS, this signal 43 may become a dual function signal. For the present assumed transmission, the first marking impulse of the signal 43 effects response of the relay 781 (Fig. 4) over circuits already traced, while the two marking impulses of the idle portion of this signal effect response of magnets 79 and 80 of the relay PR (Fig. 3). The resulting closure of the contacts 168 of the latter relay is without effect at this time, due to absence of connection to the first segment of the corresponding sector which serves this set of contacts, as hereinbefore described.

Under response, the relay 781 (Fig. 4) self-locks over an obvious path to the holding bus conductor 117 now grounded over the contacts of the preliminary ground relay 100 (Fig. 4). The latter relay is retained at this time over the contacts 87 of the cam ON (Fig. 2). In disconnecting conductor 785 (Fig. 4), the transfer contact of the relay 781 connects ground from the bus conductor 117 over the normal contacts of the relay 782 and a conductor 786 to the group of four segments of the sector 116. Following this first signal 43, the two signals of the stock selection may be sent, and following the second signal for that operation, the arms of the digit switch DS will automatically advance to their fourth segments which will be the first segment of the price zone. Thereupon, grounded battery is connected through the windings and contacts of the magnet 98 and sector 116 to the conductor 786 now grounded, due to the operated position of the relay 781. The magnet 98 will now vibrate to drive the arms of the switch DS over the four contacts (as 204 to 207) of the price zone and onto the first segment (as 208) of the quantity zone.

Due to disconnection of conductor 785 under the operated position of the relay 781, the switch DS will now be governed only by the signals of the assumed quantity item and these may be recorded and disposed of in a manner similar to that already described. At the conclusion of this assumed transmission, the switch DS will be in its normal position where conductor 117 will stand disconnected at sector 115 to permit restoral of the relay 781 in bringing the circuits to their normal positions.

Under the transmission just described, the deletion condition normally present on the quantity item was transferred to the price item. A transmission will now be assumed in which no deleting effects will be present so that the items of both quantity and price may be received and a shelf selection made for including the shelf High in the price display. For this shelf selection the signal 23 will be required while removal of all deletion effects will require operation of the relays 781 and 782 (Fig. 4) for which the combination corresponding with the signal 35 will be required. In combining the signals 23 and 35 to form a composite signal, an equivalent of signal 45 will be had. Under transmission, the first two elements or marking impulses of the latter signal will effect response of the relays 781 and 782 over circuits already traced, while the third marking impulse will effect response of the magnet 80 (Fig. 3) to close the contacts 163 of the relay PR and thereby provide for connecting the indicators of the shelf High which operations have already been described. Under operation, the relays 781 and 782 lock over obvious paths to the ground present on the bus conductor 117. The normal "cut-off" contacts of the relay 782 disconnect the conductor 786 in disabling the deletion effect for the price item as otherwise would now be established by the operated position of the relay 781. Thus the operated position of the two relays 781 and 782 removes ground from all of the groups of segments of the sector 116 of the switch DS and therefore the items of price and quantity may be transmitted, received and displayed as already described in connection with the first assumed quotation.

In describing the terminating feature of the present system, a transmission corresponding with the one last described, will now be considered and it will further be assumed that under the price item, only the fractions place will be required, while under the quantity item only the first or hundreds place will be sent. A hybrid signal corresponding with the signal 45 will first be transmitted to effect dual operations whereby the shelf High may be selected, and response and locking of the relays 781 and 782 (Fig. 4) will also be had. The stock selection signals may then be sent whereupon switch DS will be in its fourth position (segments 204)

for reception of the signals for the first place of the price item, and assuming that this fraction is 5/8, marking effects according to signal 26 will be required for closure of the contacts 166 on the permutation relay PR. As the price item is to be terminated following this signal, it is necessary under the interval of this cycle of the fractions signal also to effect response of the relay 783 (Fig. 4) of the group D. For this, a signal corresponding with the signal 33 will be combined with the signal 26 to form an equivalent of the signal 42. The first marking impulse of this signal may become effective over circuits already traced to the contactor arm of the sector 112 of the digit switch DS now on its fourth segment, thence through the winding of the relay 783 to grounded battery. On response of the latter relay, it locks over an obvious circuit to the bus conductor 117 now grounded. The other two marking intervals of the hybrid signal 42 respectively effect response of the magnets 78 and 79 to close the contacts 166 of the permutation relay. The arm of sector 111 which for the purpose of illustration has been shunted to serve the latter contacts, will now be on its fourth contact as 204 and connections not shown, may be understood as extending thence by way of a sector as 221 (Fig. 4) of the register selector switch RS to a fifth stop magnet (354, 354 to be understood but not shown on Fig. 5 but shown on Fig. 11) of a fractions place register which may be the unit F of the price group RT1 (Fig. 5).

On cessation of the signal 42, grounded battery is connected through the winding and contacts of step magnet 98 (Fig. 4), arm of sector 116 now on its fourth contact, conductor 786 and the contacts of the relay 783 to ground present on the conductor 117. The resulting vibration of the magnet 98 drives the arms of the switch DS over the contacts of the price zone to the first contact (as 208) of the quantity zone where this switch will stop, due to disconnection of the magnet 98 at the sector 116.

Assuming now that the desired indication for the first or hundreds place of the quantity item is also 5, representing 500 shares, the transmission may be under the same composite signal 42. Due to the switch DS (Fig. 4) being now in its eighth position (as 208) the first marking impulse of the transmission will be routed over the sector 112 to effect response of the relay 784 over an obvious circuit. The other marking impulse intervals of the signal 42 effect closure of the contacts 166 of the permutation relay and under the present eighth position of the switch DS this closure may become effective over the sector 111 of the switch DS and a sector (as 266 not shown but understood as being a part of the unit RS of Fig. 4) of the register selector switch RS to energize the fifth stop magnet corresponding with the magnet 355, shown in Figure 11 and understood to be part of the register unit H (Fig. 5) under the group of quantity registers RT2.

On cessation of this signal 42, the magnet 98 (Fig. 4) will be energized over its interrupter contacts, the sector 116, thence over the conductor 785 and the contacts of the relay 784 to ground now present on the bus conductor 117. Under vibration of magnet 98, the arms of the switch DS will be advanced to come to rest over the first contacts. There, the sector 115 disconnects the bus conductor 117 to release the relays 781—784, while the magnet 98 will also be disconnected at the sector 116. Thus, the receiving equipments will now be in their normal positions while the registered places of the price and quantity items may be translated and recorded on the desired stock in a manner corresponding with descriptions already given for similar operations.

From the foregoing description, it should now be obvious that the terminating effect may also be applied to the units and tens places of the price, or to the thousands place of the quantity item, thereby terminating a quotation relative to the remaining places of the respective items. Thus, there is effected important saving in channel or transmission time.

Under the transmission last described, a saving of five-tenths or 50% of the channel time is realized by the use of the terminating effects. This saving is based on a total of ten signals for a full quotation in which recording or spacing would be required for each of the seven places which make up the price and quantity items, while three signals would be required for the shelf and stock selection operations. The use of the terminating effects eliminated five signals, as only one signal for shelf, two for stock, one for the fractions place of the price and one for the hundreds place of the quantity item or a total of five signals were required in the transmission.

In general and under the present assumed procedure where the item of quantity is normally deleted, the major portion of the quotations will concern only the fractions place of the price item with occasional requirement for the units place, so that a saving of 60% or 50% in transmission time may usually be had. For example, a saving of 60% or three-fifths of the transmission time is had when the fractions place of the price only is concerned in a quotation. Under such a transmission, no effect is required with the group of relays D (Fig. 4), until the fractions signal is sent. Such signal will be a hybrid or composite unit composed of the signal 33 and that one of the signals 22—29 which may correspond with the particular selection required in the fractions place. The concern here merely rests with the fact that a first marking impulse of this signal shall effect response of the relay 783 for deleting the remainder of the places of the price item. This will result in terminating the quotation as the quantity item stands deleted due to the normal position of the relays 781, as already described.

With the foregoing description as a background, brief mention of a few features of the connective arrangement should now insure a full and clear understanding of all points relative to the general plan as well as detail arrangement and circuit connections. In serving the first eleven controls, contacts 162–172 (Fig. 3) of the permutation relay PR, the eleven sectors 101–111 (Fig. 4) of the digit switch DS of which only sectors 101 and 111 are shown, allot the first five contacts 162–166 to the relays of group IR (Fig. 7) for the five shelf selection operations, then the first five and the next three contacts 167–169 are allotted to the eight selections for the fractions place of price items, while the first eight and next three contacts 170–172 are, in turn, allotted to the units, tens and hundreds places of price items and also to the three places of the quantity items. A three-element code, of course, has a permutative selective capacity of 8 separate choices. Therefore, that portion of the permutation relay which includes the first eight contacts 162–169 falls within the selective range of what, in effect, is a three-unit or three-element code, represented by the digits 22–29.

The three magnets 78, 79 and 80 (Fig. 8), and

associated code bars 83, 84 and 85, as shown, are sufficient for translations to the shelf and fractions zone of the permutation relay PR under the assumed three-element code. In order to cover the eleven selections required for the other places of price items and also the places of quantity items the equivalent of a four-element code is employed, and, as shown, this four-element code controls the magnets 77—80 and associated core bars 82—85 of the permutation relay PR. Therefore, during shelf and fractions allotments by the switch DS (Fig. 4), the remaining two elements of the five-unit code are separated from the other three elements and transferred from the permutation relay PR to the group of relays D. As may be seen by the connections from the segments of the sectors 112 and 113 of the digit switch DS, the separated elements comprise, in effect, a two-element transmission code which is directed to control the relays D.

During the higher digits of price and the quantity items the four-element code is used with the permutation relay, so that the remaining single element is separated and transferred from the latter relay to the relays D during all allotments excepting that of stock selection as shown by the connections at the sector 112. Under the derived two-element code, either the relay 781, the relay 782 or both of these relays may be chosen for establishing non-deletion or deletion effects, while during allotments to utilize the single element, either the relay 783 or the relay 784 may be controlled depending on the position of the switch DS. The latter operations, as already described, serve to terminate the items of price or quantity. Attention is particularly directed to the feature that the deletion and termination effects are carried out under the regular transmissions of a quotation, as provided by the feature of the dual or divided effects according to certain desired transmission digits. This, therefore, distinguishes from any procedure where separate transmission or intervals are required, thereby adding to the transmission time otherwise required for a quotation proper and thus largely offsetting any contemplated saving in channel or line time.

From the description already given it should now be obvious that no special arrangement or equipment is required for forming the perforations for the composite or divided digits in the tape 7, as such digits will be formed of the regular digits 33, 34 and 35 composited with digits 22, 23, 24, 25, 26, 27, 28, 29, which fall within the shelf selection zone of relay PR. Thus there may be had several permutative effects possible with the two-element code represented by the perforations or digits 33, 34 and 35 as derived from the present five-element code or digits under combination with the three-element digits represented by the perforations 23 to 29, Fig. 1.

Perforations corresponding with those for the digits 33 to 35 may also be combined with the digits 27, 28 and 29 which, with the digits 22 to 26, serve the range of the fractions place of price items. To illustrate the point that composite digits will always correspond with a regular digit of the five-element range, the combinations possible with the digit 33 combined with the digits 22 to 29 may respectively correspond with the regular digits 33, 36, 47, 40, 42, 41, 43 and 52. Combined perforations of digit 34 respectively with the digits 22 to 29 result in the equivalent of digits 34, 32, 31, 30, 39, 46, 37 and 49, while for the digit 35 the equivalent perforations are digits 35, 45, 44, 38, 48, 50, 51 and 53. By combining the digit 33 with the digits 30, 31 and 32 respective equivalents of the regular digits 38, 44 and 45 will be had. Thus, it should be obvious that under the present system there are available twenty-four digit cycles capable of independent selections under a three-element code and under a two-element code respectively, while three composite digits will be had which correspond with a single-element code and a four-element code. In the present system, therefore, the five-element code employed is extended from thirty-two selections which may be handled by the permutation relay PR, to upwards of fifty possible choices.

Under a quotation where no shelf selection operation may be required, perforations corresponding with the signals 33, 34 and 35 may be combined with perforations corresponding with the signals 27 or 29 as well as the combination with the signals 28, as already described. It may be pointed out that the reason for providing a combination with the signals 27, 28 or 29, or transmitting one of the latter signals where no shelf selection is desired, is due principally to the fact that the signal 22 is without perforations or marking elements. Therefore, it is necessary to avoid false selection of the contacts 162 on the permutation relay PR. Under the shelf selection allotment as afforded by the signal switch DS, no connections are provided from the corresponding contacts of the sectors 106 to 111 and no effects may be had relative to controls from the permutation relay under the signals 27 to 32 during such periods.

In further bringing out the connective relation of the switch DS and the stop magnets of the registers when the digit switch is in its fourth or fractions position, the eight controls 162 to 169 of the permutation relay (Fig. 3) will be routed over associated sectors as 101 (Fig. 4) of this switch and the sectors as 221 (Fig. 4) of the register selector switch RS to eight stop magnets as 350 (Fig. 5) of the fractions register F of the group RT1. These magnets may correspond with the magnets 350 to 357 as shown in Figure 11 of the drawings. Thus, under the fractions signal, selection may be made for displaying any one of the seven places of the fractions or the eighth space which is blank on the associated indicator. When the switch DS (Fig. 4) is in its fifth position, the units place of the price zone, the eleven controls 162 to 172 of the permutation relay will be routed to eleven stop magnets of the units registers as U (Fig. 5). Therefore, a signal may be sent to choose any one of the eleven stop magnets which, of course, correspond with the magnets 350 to 360 (Figure 11). Thus, indications may be controlled to display any numeral 1 to 9, 0 or the blank face of an associated indicator. In a corresponding manner, the single step advance of the digit switch DS following each character signal transmitted successively allots the eleven stop magnets of the tens and hundreds places of the price and the three places of the quantity item to the same eleven controls 162 to 172 of the permutation relay PR.

In serving the group of stock selection relays PE (Fig. 4), the full selectable capacity of the permutation relay PR has been utilized to afford choice of one-thousand twenty-four different stocks. It will be obvious, however, that for boards of less capacity, the grouping of the individual stock relays SR (Fig. 6) may be made

to conform to any desired reduction in the number of relays PE and in the number of contacts for these relays, or both a reduction in the number of relays and in the number of contacts employed. Intermediate relays are to be connected to the respective controls 174 to 192 of the relay PR in a manner corresponding with the connections shown for the relays 412 and 432.

The first set of transfer contacts 710 (Fig. 3) and the last set 730 of the digit transfer relay DT will thus serve for the relays 412 and 432 respectively, and the intermediate nineteen sets of contacts of the relay DT may be connected in like manner to serve the nineteen relays which will be understood to stand connectibly present between the relays 412 and 432. In situations where it may be desired, the relay DT may be replaced by providing twenty-one additional sectors for the digit switch DS and connecting the second and third segments of these sectors to the last twenty-one relays of the group PE in the same manner as that shown for connecting the relays 401 (Fig. 4) and 411 to the sectors 101 and 111 of this switch DS. In the stock selection zone, the first position of the switch DS and the normal position of the relay DT permit selection of any one of the thirty-two relays of the group PE; the contacts 162, 172, 173 and 193 respectively serve relays as 401. The second position of the switch DS in the stock selection zone and the operated position of the relay DT permit selection of any one of the thirty-two contacts of the relay first selected in the group PE, thereby effecting energization of the control relay of a selected stock as already described.

The lamps 791 to 794 for the shelf Last (Figure 6) serve in situations where it may be desired to illuminate the display drums of the respective places as the fractions, units, tens and hundreds places of a quotation item. The normal contacts of the connecting relay 541 establish an obvious circuit for energizing these lamps during display periods, and thus this relay may disconnect the lamps during the periods that recording operations may be in progress on the associated indicators. The recording operations take place in a relatively short interval of time so that under disconnection and relighting the lamps also serve substantially as visual signals for attracting attention to a stock on which a quotation may be under reception. It will be obvious that similar lamps may be provided for the other shelves Close, Open, High, Low and Quantity, and that such lamps may be connected for similar control over the normal contacts of the respective relays 570, 569, 568, 547 and 548, respectively.

The foregoing description should render it obvious that any desired order of sending the successive signals of a quotation may be followed, and that any predetermined order will depend on the connective relation of the various conductors to segments of the sectors of the digit switch DS. It should additionally be clear that a stock selection may be sent and stored on stock selection and master stock relays as 401 (Fig. 4) and 439 (Fig. 6) respectively, and while the switch CS (Figs. 5 and 7) may be hunting the allotted register group, a shelf selection signal may be sent and stored until the desired register is connected to the particular stock selected. In turn, the signals for the item of quantity may be sent before the signals for the item of price, and either of the latter items may be sent before the shelf and stock selection signals, or the price and quantity signals may be sent intermediate the signals of the price and quantity items. In situations where no quantity items will be handled, the registers RT2 and display indicators DI of the shelf Quantity and all of the associated equipment including the segments of the quantity zone on the sectors of the switch DS may be dispensed with. The only fixed requirement is that the composite signals for deletion must precede the signals which represent the item to be deleted.

In the relation of the various portions of the present system, the stock selection is substantially on a directly relayed basis, without storage, and when the order of sending may provide that a shelf selection signal shall follow the stock selection signals, the shelf selection will also be directly relayed, without storage delay. The register groups 216 to 219 (Figs. 5 and 4) are entirely independent of the shelf or stock selections as regards reception and storage of signals for these items of quotations. Under refinement of the motors of the display devices to such point that they may be capable of responding at speeds to meet the rate of signalling over a line or channel, or in situations where high speed transmission is not required, a single group of register translators, as the group 216, may be employed, and the groups 217 to 219 therefore dispensed with.

For this purpose, the register selector switch RS may also be dispensed with and the present connections therethrough may be changed to fixed connections between the switch DS and the register group 216. In turn, the sectors of the connector switch CS may then comprise simple two-segment units, one segment corresponding with the idle or home position and the other segment with the connections to the output terminals of the register 216 as shown.

As an alternate to the latter arrangement, a simple transfer relay corresponding with the digit transfer relay DT (Figure 3) may be substituted for the switch CS. The normal position of such a relay would correspond with the home position of the switch, while in its operated position the several contacts of the relay would establish the indicators of a selected stock with the output terminals of the assumed single register group 216. An inherent over-lap effect is afforded by the present register translators, which favors the use of a single register translator group. For example, while a signal may be under translation for the fractions place F, a signal for registration in the tens place may be under reception. In turn, during translation of signals for the last places of the price or quantity items, the stock and shelf selections of a successive quotation may be under reception. Thus an appreciable time is always present between the reception of the items of price and quantity of successive quotations.

It should further be clear that under a procedure wherein no shelf selection ever will be required, the corresponding contacts or zone may be eliminated from the sectors of the switch DS and the relays of group IR, shelf connecting relays 547, 568, 569 and associated equipment may be dispensed with. Then the signals for effecting the deletion operation may be sent as independent signals without being combined with other signals. The signals for terminating effects should, as described, always accompany and form a composite with the signal of the last transmission of a quotation item.

The above disclosure has been given by way of preference for clearness and understanding.

Hence, no unnecessary limitations should be understood and the appended claims should be construed as broadly as the state of the art permits.

What is claimed is:

1. In a stock quotation system, a plurality of price translators corresponding to the several orders of a price quotation, a plurality of quantity translators corresponding to the several orders of a quantity quotation, a permutation relay operable in accordance with received signals, a switch through which the price translator of the lowest order is normally associated with said relay, means responsive to each received signal for rotating said switch step-by-step to consecutively associate the price translators of a higher order and each of the quantity translators beginning with the lowest order with said permutation relay, and additional means responsive to received signals for restoring the switch to normal position after any of said price translators have been associated with said permutation relay in order to prevent association of the price translators of a higher order and the quantity translators with said permutation relay.

2. In a stock quotation system, a plurality of price translators corresponding to the several orders of a price quotation, a plurality of quantity translators corresponding to the several orders of a quantity quotation, a permutation relay operable in accordance with received signals, a switch through which the price translator of the lowest order is normally associated with said relay, means responsive to each received signal for rotating said switch step-by-step to consecutively associate the price translators of a higher order and each of the quantity translators beginning with the lowest order with the permutation relay, and additional means responsive to received signals for restoring said switch to normal position after any of said quantity translators have been associated with said permutation relay in order to prevent association of the quantity translators with said permutation relay.

3. In a stock quotation system, a plurality of indicating mechanisms adapted to display quotations on different stocks, said mechanisms being divided into a plurality of shelves, including a plurality of price shelves and a quantity shelf, each shelf comprising a plurality of indicators for the several orders of numerals, groups of translators, each group having a price translator for each order of the price indicators and a quantity translator for each order of the quantity indicators, a permutation relay operable in accordance with received signals, a preselector switch responsive to the termination of the setting of one translator group to associate the next translator group with said relay, means for variably setting any one of the translators in the selected group through said permutation relay, means normally preventing the setting of the quantity translators through said relay, other means selectively controlled by received signals for rendering said last mentioned means ineffective, stock selective means controlled by said permutation relay for selecting a predetermined indicating mechanism, means responsive to said selection for associating the price translators of the selected group with corresponding indicators on any price shelf or shelves of the selected mechanism, and the quantity translators with corresponding indicators on the quantity shelf, and means associated with each indicator and operable in accordance with the setting of its associated translator, for setting the indicator to a position corresponding to the setting of said translator.

4. In a stock quotation system, a plurality of indicating mechanisms adapted to display quotations on different stocks, said mechanisms being divided into shelves each comprising a plurality of indicators for the several orders of numerals in a quotation, each indicator comprising a drum integral with a magnetized armature and field coils within which said armature is rotatably positioned, a translator for each order of indicators, each translator being provided with a potentiometer having a plurality of taps, a permutation relay operable in accordance with received signals, stock selective means controlled by said relay for selecting a predetermined indicating mechanism, means responsive to said selection for connecting the taps of any translator with the field coils of a corresponding indicator in the selected mechanism, means controlled by said permutation relay for controlling the potential drop across the taps of any translator, whereby the field coils of any indicator in the selected mechanism are variably energized in accordance with the potential drop across the taps of the connected translator to set the armature of said indicator and its associated drum to a predetermined position.

5. In a stock quotation system, a plurality of price translators corresponding to the several orders of a price quotation and a plurality of quantity translators corresponding to the several orders of a quantity quotation, a permutation relay operable in accordance with received signals, a switch, means responsive to each received signal for normally rotating said switch step-by-step to consecutively associate said price translators with said permutation relay, additional means for restoring said switch to normal position after the last of said price translators has been associated with said permutation relay in order to prevent the association of the quantity translators with said relay, a group of relays to which portions of certain received signals are diverted by said switch, and means whereby said group of relays is effective, when operated in accordance with the diverted portion of a certain received signal, to cause said switch to rotate in a continuous motion to prevent the association of any of the price translators with said permutation relay and to rotate step-by-step to consecutively associate the quantity translators with said permutation relay.

6. In a stock quotation system, a plurality of price translators and quantity translators corresponding to the different orders of the price and quantity, respectively, a receiving distributor operable in accordance with received signals, a permutation relay and a group of relays associated therewith, a switch, intermediate said distributor and said permutation relay and group of relays, for diverting portions of certain signals received by said distributor from said permutation relay to said group of relays, means controlled by each received signal for causing said switch to rotate step-by-step and consecutively associate the price and quantity translators with said permutation relay, and means controlled by said group of relays for causing said switch to return to normal position at any time to prevent the association of any of said price and quantity translators with said permutation unit.

7. In a stock quotation system, a plurality of indicating mechanisms adapted to display quotations on different stocks, said mechanisms be-

ing divided into a plurality of shelves including price shelves and a quantity shelf, each shelf comprising a plurality of indicators for the several orders of numerals in a quotation, a group of translators having price translators for each order of the price indicators and a quantity translator for each order of the quantity indicators, a permutation relay operable in accordance with received signals, switching means normally adapted to successively associate each of said price translators with said permutation relay, a group of relays, selectively operable in response to portions of certain signals diverted from said permutation relay by said switching means to cause said switching means to rotate in a continuous motion for preventing said switching means from associating said price translators with said permutation relay and to cause said switching means to rotate step-by-step to successively associate each of said quantity translators with the permutation relay, stock selective means likewise controlled by said permutation relay for associating each of the price translators with corresponding price indicators on a shelf or shelves of a selected mechanism and each of the quantity translators with corresponding quantity indicators thereof, and means associated with each indicator operable in accordance with the setting of the translators associated therewith for setting said indicator.

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