May 23, 1939. H. C. ROBINSON 2,159,107

STOCK QUOTATION SYSTEM

Filed Oct. 17, 1932 6 Sheets-Sheet 1

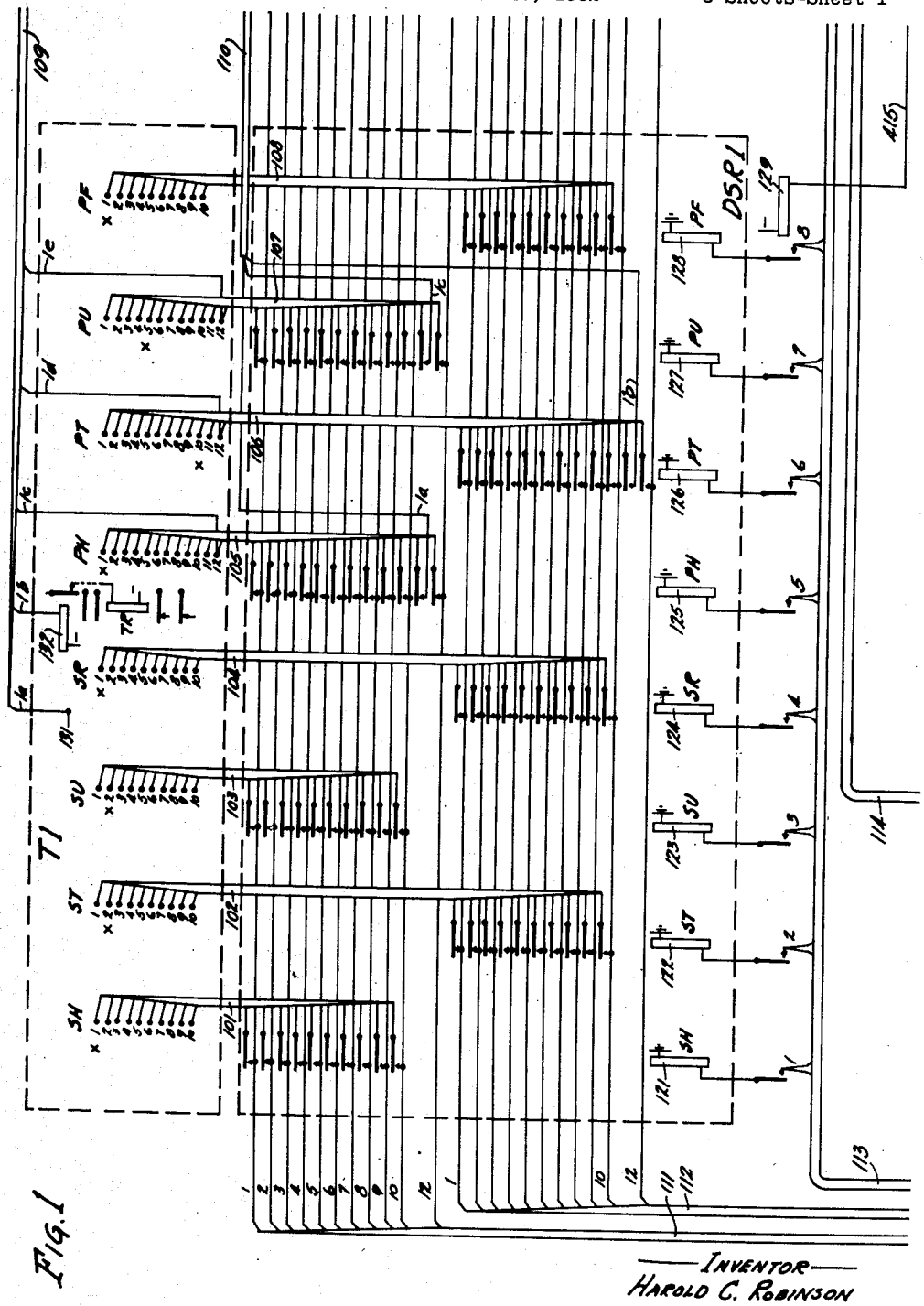


FIG. 1

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STOCK QUOTATION SYSTEM

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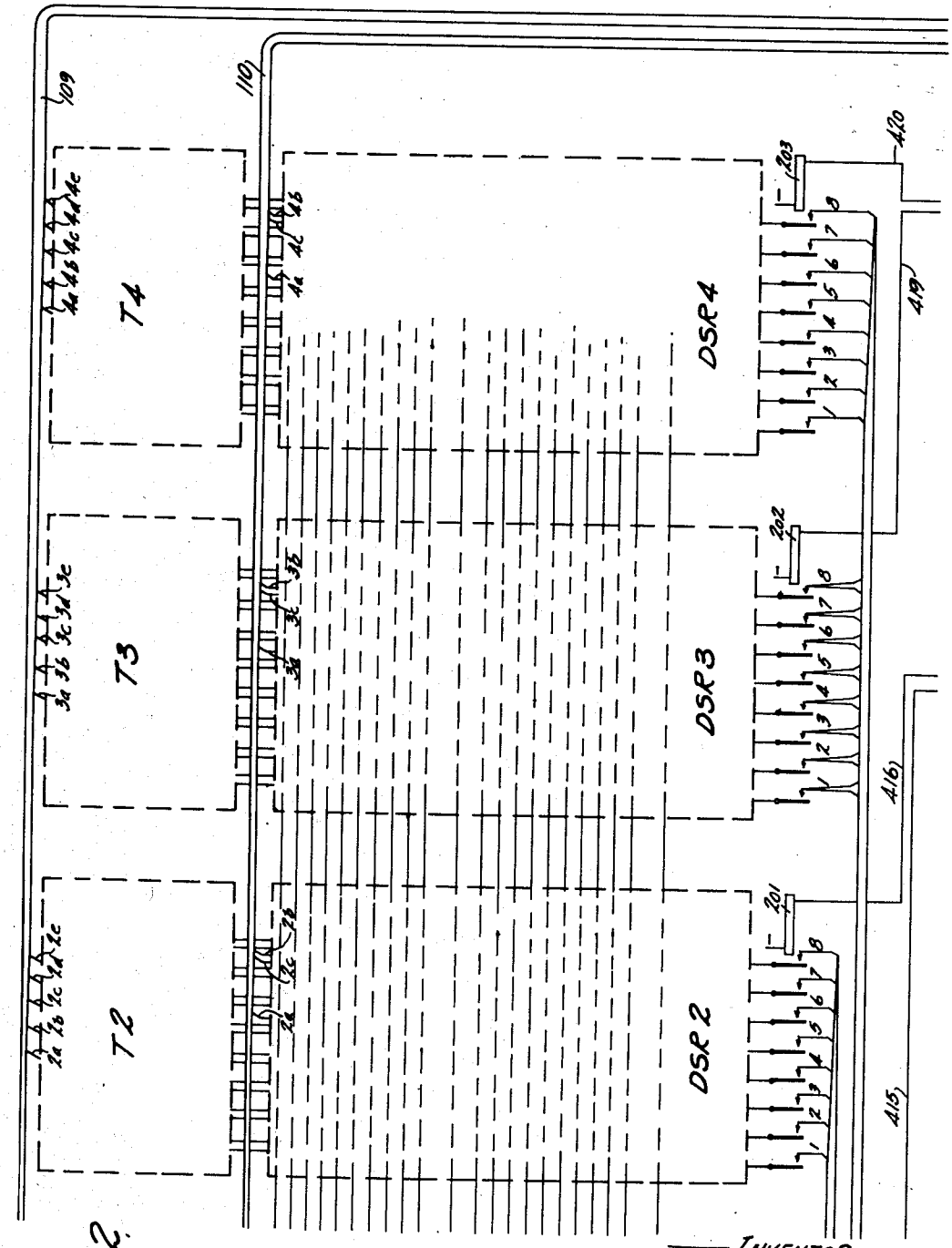


FIG. 2.

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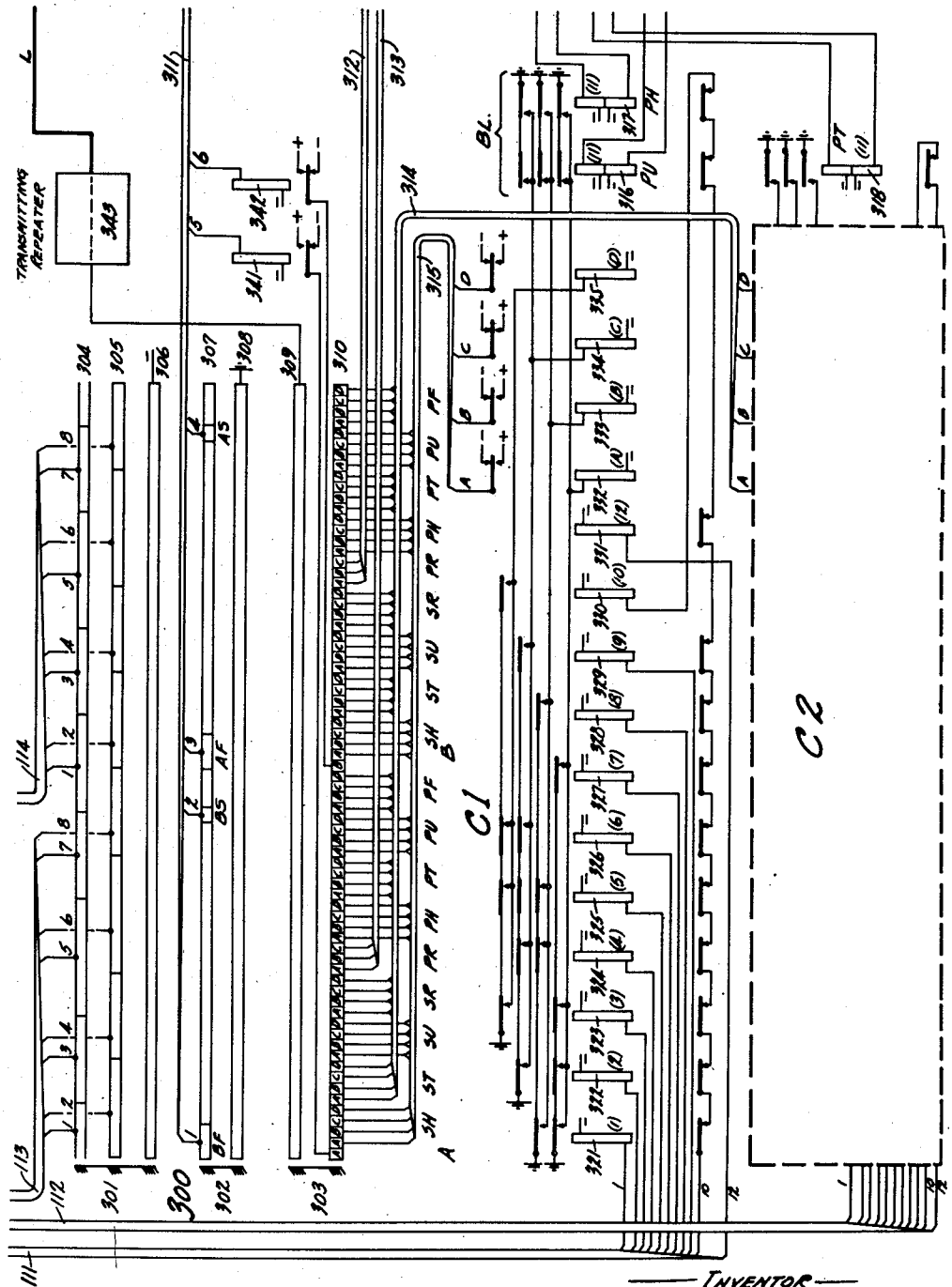


Fig. 3

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STOCK QUOTATION SYSTEM

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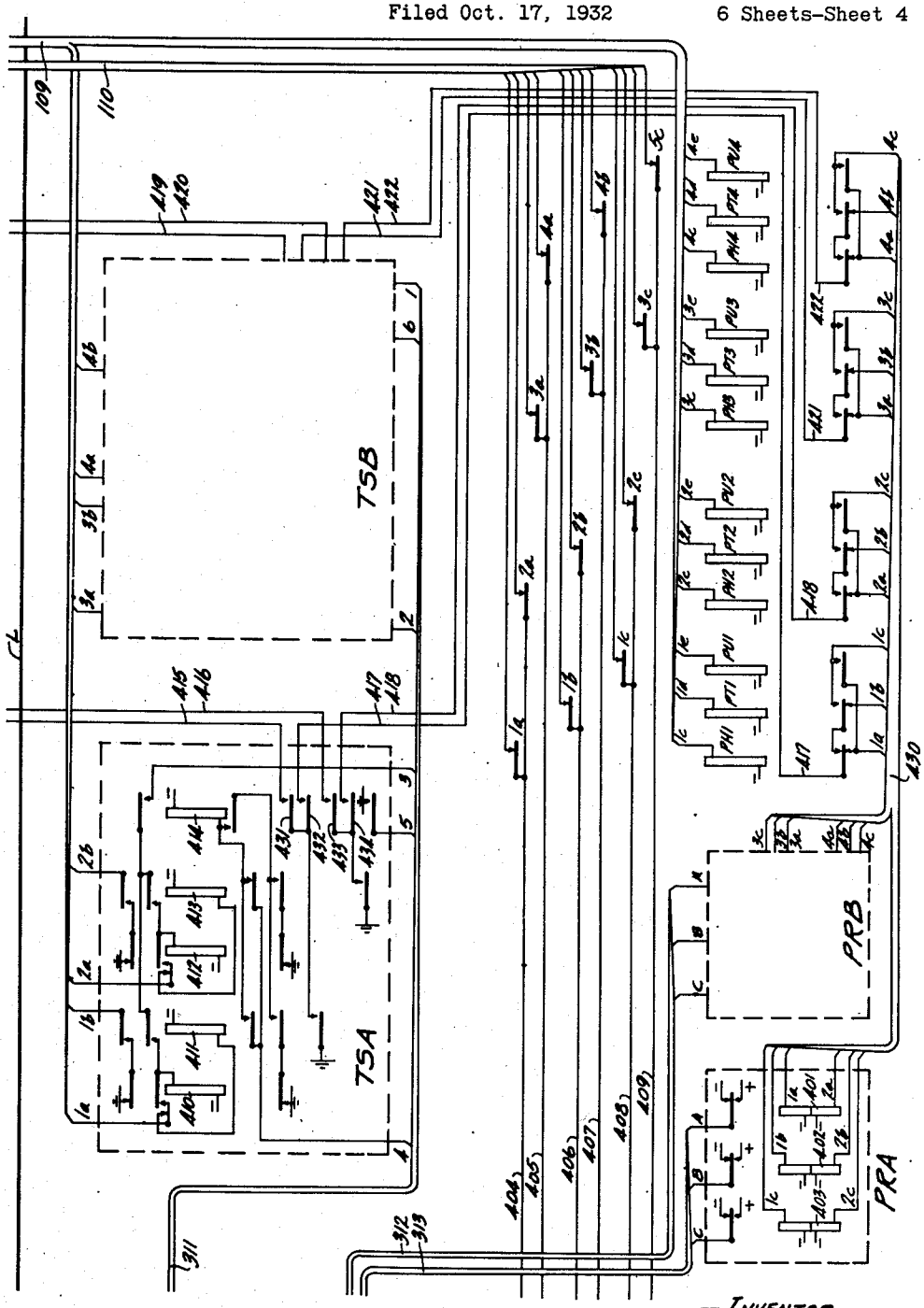


FIG. 4

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STOCK QUOTATION SYSTEM

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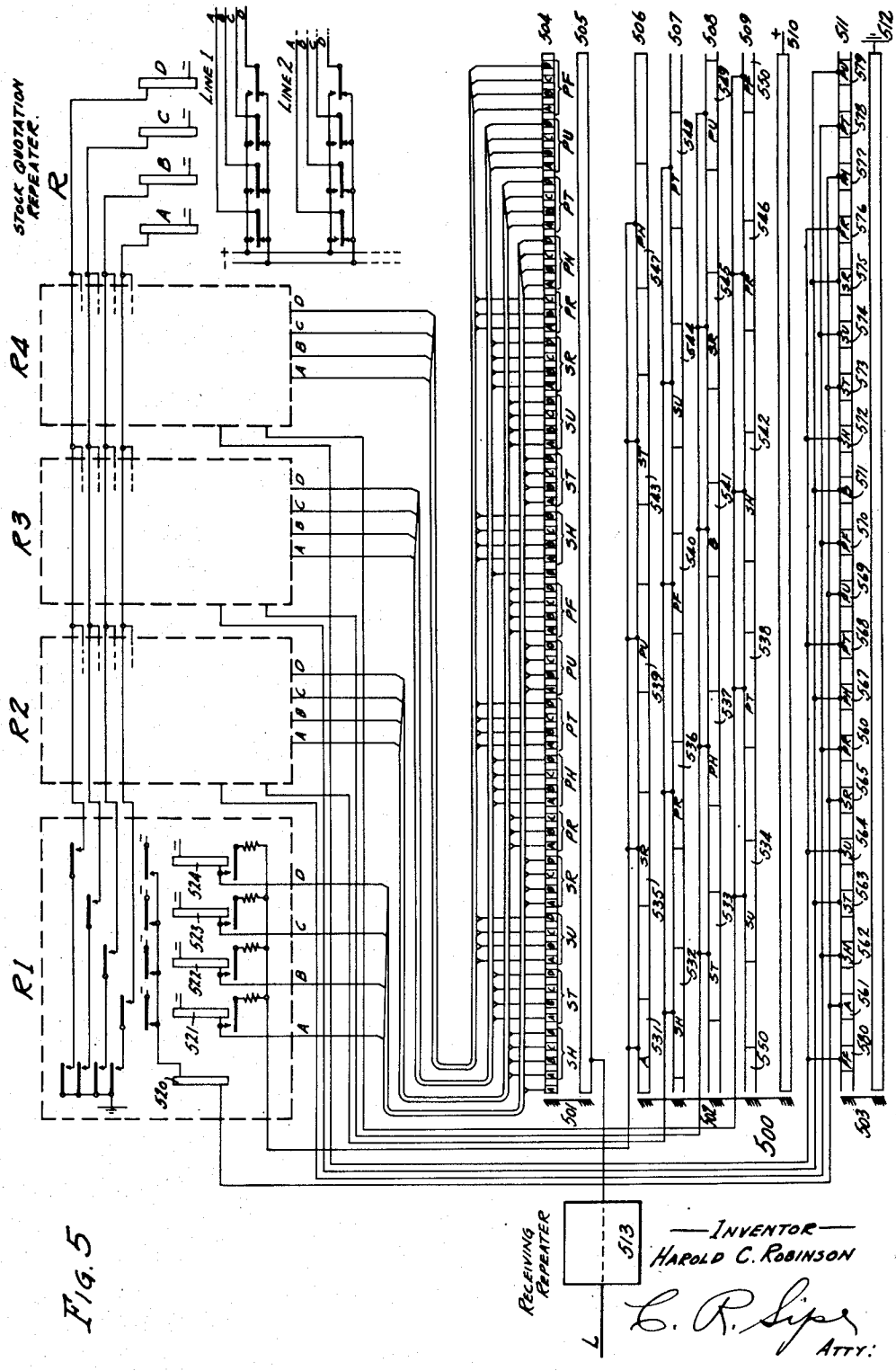


FIG. 5

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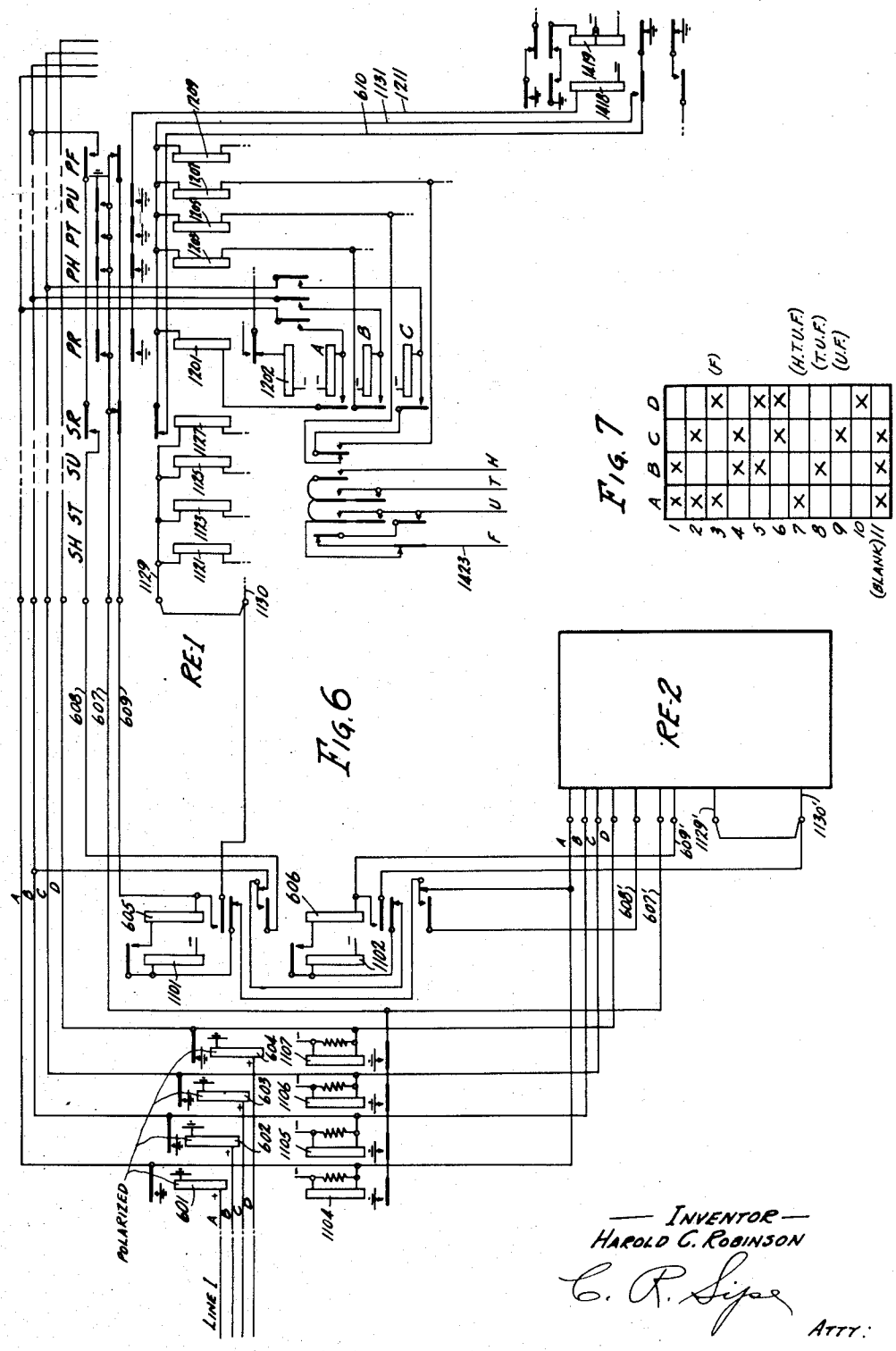


FIG. 6

FIG. 7

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Patented May 23, 1939 2,159,107

UNITED STATES PATENT OFFICE

2,159,107

STOCK-QUOTATION SYSTEM

Harold C. Robinson, Chicago, Ill., assignor, by mesne assignments, to Associated Electric Laboratories, Inc., Chicago, Ill., a corporation of Delaware

Application October 17, 1932, Serial No. 638,054

7 Claims. (Cl. 177—353)

The present invention relates to stock-quotation systems in general, but is concerned more particularly with stock-quotation systems wherein quotations set up at a transmitting station in one city are transmitted to stock-quotation receiving boards in such city and are also transmitted to stock-quotation receiving boards located in a distant city.

The object of the present invention is the production of suitable circuit arrangements and related apparatus to enable inter-city transmission of stock quotations to be automatically effected under the control of a transmitter which is transmitting stock quotations to stock-quotation receiving boards local to the city in which the stock-quotation transmitter is located.

General Description

The present invention has been embodied in a system for operating a telegraph transmitter from the stock-quotation transmitting station of the National Teleregister Corporation in New York city, which telegraph transmitter transmits impulses representative of the stock quotations over a multiplex telegraph circuit to a telegraph receiver in a distant city, Philadelphia, for example. The telegraph receiver has circuits associated therewith for retransmitting the stock quotations over local circuits to the several stock-quotation boards in the same city.

Referring now to the accompanying drawings, comprising Figs. 1 to 7, they show by means of the usual circuit diagrams a sufficient amount of apparatus in a system embodying the principles of the invention to enable the invention to be understood. Figs. 1 to 4 show the four transmitters, T1, T2, T3, and T4, located in the transmitting station of the National Teleregister Corporation in New York city, together with the telegraph transmitter which transmits the stock quotations over the inter-city telegraph line L under the control of the above-mentioned transmitters.

Fig. 5 shows the telegraph receiver located on the distant end of the inter-city telegraph line L for the purpose of receiving the stock quotations and sending them out by way of the stock-quotation repeater R to receivers located, for example, in the offices of subscribing brokers.

Fig. 6 shows a sufficient amount of one of the receivers to enable the operation of the receiver to be understood, being a modification of the receiver shown and described in the application of Robinson et al., Serial No. 462,114, filed June 18, 1930. This receiver is also shown and described in British Patent No. 384,671.

Fig. 7 is a table showing the code in accordance with which the quotation digits are delivered to the receivers in the distant city, the receivers RE1 and RE2, Fig. 6, for example.

As is generally known to those familiar with the recent commercial developments in the art of transmitting and receiving stock quotations, the transmitting station maintained for the past few years in New York city by the National Teleregister Corporation includes four transmitters (transmitters T1, T2, T3, and T4, Figs. 1 and 2). Each of these transmitters includes sending apparatus operating under the control of key-controlled digit-registers to transmit groups of decimal impulses indicative of the selling prices of stocks or other similar items. A complete quotation, as transmitted by one of these transmitters, includes three so-called stock-code digits (a stock-hundreds digit, a stock-tens digit, and a stock-units digit); a stock-range digit (which has a value indicating whether the quotation concerns the previous closing price, today's opening price, the high price, the low price, the last price or a combination of these, such as high and last); and a maximum of four price digits (price-hundreds, price-tens, price-units, and price-fractions). The stock-code digits and the stock-range digit are transmitted first, accomplishing the selection of the desired stock and stock range. Next, a maximum of four so-called restoration digits are transmitted (ten impulses in each digit) to restore the hundreds, tens, units, and fractions registers in the selected stock and range to blank position, preparatory to the resetting operation. The final portion of the stock quotation is next transmitted and consists of the registered price digits. The impulses in the price digits go to the magnets of the selected indicators to advance them the proper number of steps to display the digits of the quotation. One form of transmitter such as described is shown in Patent #1,945,470, granted January 30, 1934.

In Fig. 1, eight groups of terminals are indicated (SH, ST, SU, SR, PH, PT, PU, and PF). These terminals connect to the corresponding bank contacts associated with the sending switches which control the sending of the several digits of a stock quotation. Terminals SH, ST, and SU are connected with the conductors or contacts that control the transmission of stock-hundreds, stock-tens, and stock-units digits, respectively; terminals SR are connected to the conductors that control the transmission of the stock-range digit; and terminals PH, PT, PU, and PF are connected to the conductors that control the

transmission of the price-hundreds, price-tens, price-units, and price-fractions digits. The above-mentioned terminals are connected with the telegraph transmitter through the conductors in cables 101–109. The transmitters T2, T3, and T4 are similarly connected to the telegraph transmitter, as indicated in Fig. 2.

As is well known, the volume of business transacted on the New York Stock Exchange is such that a single operator cannot ordinarily set up the quotations as fast as the transactions are made. Accordingly, arrangements are made for a maximum number of four operators to be engaged in setting up the quotations, each operator controlling the keys of a separate one of the transmitters T1 to T4, Figs. 1 and 2. In order to facilitate the allotment of quotations amongst the operators, the stocks are divided into two groups in accordance with their designations, and all quotations of the first stock group are handled by transmitters T1 and T2, while the quotations concerning the other stock group are handled by transmitters T3 and T4. In a similar way, two receivers are ordinarily provided at each broker's board, one receiver receiving quotations set up on transmitters T1 and T2, and the other receiving quotations set up on transmitters T3 and T4; a common indicating or display board is provided.

From the foregoing, it will be seen that it is necessary to maintain a distinction between the stock quotations sent out from transmitters T1 and T2 and the stock quotations sent out from transmitters T3 and T4. The way in which this distinction is maintained when the common line L is used will be described hereinafter. It may be pointed out that two separate transmission lines are provided in the New York territory, one over which the transmitters T1 and T2 transmit their quotations to the New York receivers, and another over which the transmitters T3 and T4 transmit their quotations. Suitable interlocking arrangements are provided so that the transmitters T1 and T2 cannot both be transmitting at the same time, and similar interlocking arrangements are provided in connection with the transmitters T3 and T4.

The telegraph line L extends from the transmitting distributor 300, Fig. 3, to the receiving distributor 500, Fig. 5, by way of the transmitting repeater 343 and the receiving repeater 513. The distributors 300 and 500 may be maintained in continuous synchronous operation by any desired method employed in multiplex telegraphy. The stock-quotation digits to be transmitted are applied to transmitting ring 310 of the distributor 300 by the coders C1 and C2, Fig. 3, operating alternately. The coder C1 includes control relays 321—331 and code relays 332—335 (corresponding respectively to the units A to D of the assigned code, Fig. 7). The coder C2 is similar to the coder C1.

The coders C1 and C2 are connected by means of the conductors in cables 111 and 112 to the contacts of the digit-sequence relays DSR1—DSR4, Figs. 1 and 2. The digit-sequence relays DSR1 are composed of relays 121—128, and they correspond respectively to the digits of a stock quotation as set up on the transmitter T1. The digit-sequence relays associated with the transmitters T2, T3, and T4 are similar to the digit-sequence relays DSR1.

The connecting relays 129 and 201—203 render the digit-sequence relays effective in the proper order, and are in turn controlled by the transmitter-sequence relays TSA and TSB. When connected up, the digit-sequence relays DSR1 or DSR2 are controlled over the conductors in cable 113 from the segments in the first half of the rings 304 and 305, while the relays in groups DSR3 and DSR4 are controlled over the conductors in cable 114 from the segments in the second half of the rings 304 and 305.

Relays PH1, PT1, and PU1, Fig. 4, are connected with the transmitter T1 and relate to the hundreds, tens, and units price digits. These relays are controlled in accordance with the number of price digits which are to be transmitted and they in turn control the price-range code relays 401—403, group PRA, to govern the transmission of a price-range digit (indicative of the number of price digits in the quotation). The relays PH2, PT2, and PU2 are similarly associated with the transmitter T2, and they also control the relays 401—403 as above pointed out. Similarly, the relays PH3—PU3 and PH4—PT4 are associated in a similar way with the transmitters T3 and T4, and they control relays PRB (similar to relays PRA) to effect the transmission of a price-range digit relative to any stock in the group handled by the transmitters T3 and T4.

The relays 341 and 342, Fig. 3, operate to control the transmission of a so-called transmitter-identifying digit or receiver-selecting digit at the beginning of the transmission of the stock quotation.

It is to be noted that relays 316 and 317 are associated with the coder C1 and the relay 318 is associated with the coder C2. These relays control the sending out of the digit "blank" (corresponding to the eleventh digit value in the assigned code, Fig. 7). Relay 317 is operated to control the relays 332—334 when the price-hundreds digit is "blank" (which indicates that the price-hundreds register is to be restored to blank position); the relay 316 controls the transmission of the digit "blank" in the price-units position; and the relay 318 controls the transmission of the digit "blank" in the price-tens position.

The relays 316—318 are controlled through the contacts of the range-control relays shown in the lower right-hand corner of Fig. 4, the purpose and nature of which control will be explained more fully hereinafter.

At this point it may be mentioned that there is an eleventh key in the keyboard (in addition to digit keys 1 to 10) for setting up the eleventh digit indication "blank" on any one of the price registers PH, PT, and PU of a stock-quotation transmitter. The operation of this key for the price-hundreds digit, for the price-tens digit, or for the price-units digit results in a ground potential being placed on the eleventh conductor, Fig. 1, in each case. This ground potential is employed in the transmitter to prevent the transmission of indicator-resetting impulses, while permitting the transmission of a series of impulses to restore the indicator to blank position. In addition, a twelfth key is provided, which twelfth key causes the grounding of conductors 11 and 12 in groups PH, PT, and PU, Fig. 1. The grounding of conductor 11 has the above-mentioned result of preventing the transmission of resetting impulses, while the grounding of conductor 12 prevents the transmission of restoration impulses to the concerned indicator, with the result that the indicator is left in its previous position. As noted, the eleventh key is known as the "blank" key, while the twelfth key is known as the "no reset" key.

In addition, it may be pointed out that conductor 10 in each of the conductor sets SH to PF, Fig. 1, is normally grounded in the transmitter so as to prevent an overrun of the sender beyond the tenth-impulse position in the event of a faulty contact in the register.

The foregoing facts relative to the transmitter should be kept in mind as they have an influence on the design of the telegraph transmitter and upon the inter-relation of the circuits, as will appear hereinafter.

In the telegraph receiver of Fig. 5, the incoming impulses received by way of the receiving repeater 513 are distributed through rings 505 and 504 by brush 501 to the register relays in registers R1 to R4, each of the registers being rendered effective five times during a complete operation of the distributor 500 (corresponding to two complete quotations). The register R1 includes code relays 521—524 and the sending relay 520. Each of the registers R2, R3, and R4 is similar to the register R1. The rings 506—509 control the locking and unlocking of the operated code relays in the register, while the ring 511 controls the successive operation of the sending relays, such as sending relay 520 of the register R1.

The relays A to D of the stock-quotation repeater R are controlled through the contacts of the code relays of the registers by the sending relays such as relay 520 of the repeater R1. The repeater R repeats the stock-quotation signals over a number of lines, of which two lines are indicated. Each line is a four-conductor line comprising conductors A to D. Each line may extend through the line relays of as many receivers as desired.

The equipment of Fig. 6 includes the receivers RE1 and RE2. The receiver RE1 receives the quotations concerning the stocks in group 1 (transmitted by the transmitters T1 and T2, Fig. 1), while the receiver RE2 receives quotations concerning the stocks in group 2 (transmitted by the transmitters T3 and T4, Fig. 2). As pointed out hereinbefore, the receivers RE1 and RE2 are similar to the receivers in the hereinbefore-mentioned application of Robinson et al., sufficient of the circuits of the receiver RE1 being shown to clearly indicate the modifications which have been made in the receiver fully disclosed in the said Robinson et al. application.

It may be pointed out that the relays 601—604 are the receiving line relays; relays 1104—1107 are the slow-acting holding relays; and relays 1101, 1102, 605, and 606 are the relays which operate to select the receivers RE1 and RE2 for operation.

One feature disclosed in Fig. 5 and not found in the said Robinson et al. application is that the receivers are automatically cleared out for reoperation without the necessity for introducing a pause between successive quotations, while the introduction of a pause between successive quotations causes the release of the holding relays 1104—1107 and clears out the equipment in case the receiving operation has got out of synchronism with the transmitting operation.

Another feature of the receiving equipment is that ground potential is temporarily locked on the holding conductor associated with the slow-acting holding relays 1104—1107 while the price digits are being received, whereby the restoration of all of the holding relays in the event that one or more price digits are omitted does not cause a premature clearout of the receiver.

Detailed Description

The system having been described generally, a detailed description of the operation of the apparatus shown will now be given. For this purpose it will be assumed that the operator at the transmitter T1 has manipulated her keys so as to cause the stock quotation 1221, 1041 to be set up. The digits 1, 2, and 2 are the stock digits, set up on conductor groups SH, ST, and SU of the transmitter T1, respectively; the fourth digit (1) is the stock-range digit corresponding to the first conductor in group SR, while the last four digits are the price-hundreds, price-tens, price-units, and price-fractions digits, corresponding to conductor groups PH, PT, PU, and PF of the transmitter T1.

Operation of the telegraph transmitter

Coincident with the final key operation in setting up the quotation, terminal 131 in the transmitter T1 (associated with the start conductor of the transmitter T1) becomes grounded. Grounding the terminal 131 closes a circuit over start conductor 1*a* in cable 109 for start relay 411 in the transmitter-sequence group TSA, by way of contacts of the cut-off relay 410. When start relay 411 operates, it prepares operating circuits for relays 410 and 414 at its inner armatures and a locking circuit for relay 414 at its lower armature, while at its upper armature it applies ground potential to conductor 1*b* in cable 109, thereby operating relay 132, Fig. 1, to open a point in the circuit of the so-called "TR" relay in the transmitter T1 so as to prevent the transmitter T1 from clearing out and destroying the instant registered quotation before the quotation has been completely transmitted by the telegraph transmitter. This precaution, it may be pointed out, is not ordinarily necessary but may be necessary in case the digit values are all low and the distributor 300 happens to be quite a distance from its starting position when the set-up of the quotation in the transmitter is completed.

With start relay 411 operated as above pointed out, as soon as brush 302 of the distributor 300 arrives in a position to ground the A-start segment AS, start relay 414, common to transmitters T1 and T2, is operated over conductor 4 in cable 311 and through contacts of relay 411. Upon operating, start relay 414 closes a locking circuit for itself at its inner lower armature through contacts of the operated relay 411 and contacts of the unoperated relay 410. At its upper armature relay 414 prepares a circuit for cut-off relay 410; at armature 431 it operates connecting relay 129 through the lower contacts of start relay 411 and over conductor 415; at armature 432 it places a ground potential on conductor 417 so as to operate the desired combination of relays in the "A" price-range group (PRA) by way of the contacts of relays PH1, PT1, and PU1; and at its lower armature it extends a ground potential by way of conductor 5 in cable 311 to operate relay 341 to prepare for the transmission of a receiver-selecting impulse to select the receiver RE1, Fig. 6.

Now, when the continuously moving brush 303 arrives on the first segment in ring 310, it sends a positive marking impulse from the front contacts of the operated armature of relay 341 over the line L by way of the transmitting repeater 343.

Prior to the transmission of the above-mentioned receiver-selecting impulse (by way of the first segment in ring 310), the stock-hundreds re-

lay 121 is operated through contacts of connecting relay 120, over conductor 1 in cable 113, at the last part of the previous rotation of the distributor 300, and remains operated during the first part of the following rotation. In addition, stock-tens relay 122 is operated over conductor 2 in cable 113 and the first segment in ring 305 as soon as the distributor 300 starts the new rotation. The operation of relay 121 connects the conductors 1 to 10 in cable 111 with the corresponding terminals in group SH of the transmitter T1, thereby operating one of the digit-relays 321—330 of the coder C1. In a similar way a digit-relay in the coder C2 is operated responsive to the operation of the stock-tens relay 122. Specifically, the first relay in the coder C1 is operated over the associated conductor 1 and the second relay (not shown) in the coder C2 is operated over the second conductor in cable 112, to code the first two digits 1 and 2 of the stock quotation. Relay 330 fails to operate, because its chain circuit is opened by relay 321. Responsive to the operation of relay 321 in coder C1, the A and B code relays 332 and 333 are operated to place positive marking potential on the A and B segments in the stock-hundreds group SH in the first half of the ring 310, while the A and C code relays (not shown) in the coder C2 are operated to place marking potential on the A and C segments in group ST in the first half of ring 310. As a result, the stock-hundreds and stock-tens digits are transmitted over the line L by the brush 303, following the transmission of the receiver-selecting digit over the first segment of ring 310.

As the operation of the distributor 300 proceeds, the conductors 3 to 8 in cable 113 are grounded progressively by brush 301, resulting in the progressive operation of the relays 125 to 128 in the digit-sequence relay group DSR1. The progressive operation of the relays in the group DSR1 is accompanied by the progressive restoration of the relays already operated, so that only two of the relays are operated at once and insuring that either of the coders C1 and C2, Fig. 3, is under the control of only one group of digit conductors at a time. The code relays in the coders C1 and C2 accordingly control the application of marking and spacing potential to the conductors in cables 314 and 315 so as to control the transmission of impulses in accordance with the digits set up on the transmitter T1.

Since the present quotation contains the full number of price digits, none of the relays PH1, PT1, and PU1, Fig. 4, is operated. As a result, the ground potential on conductor 417 is extended by way of conductor 1*a* in cable 430 to the upper winding of the A relay 401 in the price-range group PRA. Therefore, relay 401 is operated and places marking battery on the conductor *a* in cable 313 so that a marking impulse is transmitted in the A position of the price-range segment group in the first half of the ring 310.

Just before the brushes of the distributor complete the sending of the instant stock quotation, brush 302 passes over the B-start segment BS, to which conductor 2 of cable 311 is connected, thereby extending an operating potential to the common start relay in the group TSB corresponding to the common start relay in the group TSA, thereby operating such relay (in the event that a quotation is waiting) to prepare for the transmission of a stock quotation from either of the transmitters T3 and T4.

Upon a further advance of the brushes of the distributor 300, brush 302 grounds the A-finish segment AF in ring 307, thereby extending a circuit over conductor 3 in cable 311 to cut-off relay 410, by way of contacts of the operated relays 414 and 411. Relay 410 now operates and locks itself to start conductor 1*a* associated with transmitter T1, at the same time disconnecting start relay 411. Start relay 411 now deenergizes and opens the circuit of relay 414, whereupon relay 414 deenergizes. Relay 410 remains operated over conductor 1*a* for a short interval in case the transmitter T1 has not finished its operation, but falls back responsive to the restoration of start relay 411 in case the transmitter T1 has already finished its transmitting operation.

Upon the restoration of relay 410, the relay group TSA is in normal condition. Relay 132 in the transmitter T1 restores responsive to the restortation of start relay 411. It is to be noted that relay 410 breaks the circuit of relay 132 at its upper armature and the locking circuit of relay 414 at its lower armature at the same time that it disconnects start relay 411. By this operation, a quicker restoration of relays 132 and 414 is assured.

At this point it may be mentioned that the relays 412 and 413 co-operate with relay 414 in the manner described in connection with relays 410 and 411 to secure the proper telegraphic transmission of a stock quotation set up on the transmitter T2, while the transmitter-sequence relays TSB operate in conjunction with the transmitters T3 and T4 in the same manner as relays TSA operate in conjunction with the transmitters T1 and T2.

Operation of the telegraph receiver

In the telegraph receiver of Fig. 5, the distributor 500 is operating continuously and in synchronism with the distributor 300, and the receiving brush 501 is placing negative spacing potential on each of the segments of the ring 504 when no stock quotations are being received. While a stock quotation is being received, however, the negative spacing potential is replaced by positive marking potential in each marked code unit position.

The code relays in the registers R1 to R4, the code relays 521 to 524 of the register R1 for example, are connected at their upper terminals to the negative pole of the current source, with the result that they respond to a positive application of potential but not to a negative application of potential.

It may be pointed out that the rings 506—509 of the distributor furnish locking current for the relays in registers R1 to R4, respectively, the locking current being progressively connected and progressively disconnected from the locking circuits of the registers R1 to R4 by the brush 502 in a manner which is apparent upon inspection, the application of locking potential being made successively through segments 531—550 of rings 506—509. It is also to be noted that segments 561—580 in ring 511 are connected in regular order to the conductors leading to the sending relays of the registers R1—R4, sending relay 520 of the register R1 being shown. The brush 503 applies ground potential to the sending relays cyclically, operating any one of them that is associated with a register that has a digit set up therein.

From the description hereinbefore given, it will be seen that the receiver-selecting impulse

transmitted by way of the first segment in ring 310 of transmitter 300 is received over the first segment in ring 504 of the transmitter 500, operating the A relay 521 of the register R1. Relay 521 operates and closes a locking circuit for itself at its lower armature by way of ring 510 and segment 531 of ring 506, which two rings are bridged by the brush 502. As the brushes of the receiving distributor 500 continue to advance, the stock-hundreds, stock-tens, and stock-units digits are received and stored in the registers R2, R3 and R4.

As soon as sending brush 503 reaches the segment 561, a circuit is closed for sending relay 520, by way of the inner upper contacts of relay 521, whereupon relay 520 operates for the duration of the contact between brush 503 and segment 561. Upon operating, relay 520 closes points in the circuits of the relays A to D of the repeater R, but only relay A of the repeater is able to operate at this time because only the A relay 521 of the register R1 is operated. Relay A of the repeater R makes a momentary substitution of positive marking battery in place of negative spacing battery over the A conductor of each of the associated stock-quotation lines.

Upon the further movement of the brush 503, the segments 562, 563, and 564 are grounded in the order named, resulting in the momentary energization of the sending relays of repeaters R2—R4 to end out the stored stock-hundreds, stock-tens, and stock-units digits.

As may be observed, the locking circuits of the registers R1—R4 are opened in each case at about the same time that the circuit of the associated sending relay is opened, with the result that the registers are progressively restored as fast as the stored digits are retransmitted.

From the foregoing, it will be seen that the reception and retransmission of the stock-quotation digits at the telegraph receiver proceed together until all of the digits have been received and retransmitted over the stock-quotation line by way of the stock-quotation repeater R. More in particular, it may be pointed out that the registers R1—R4 are reoperated to store and control the retransmission of the stock-range, price-range, price-hundreds, and price-tens digits, respectively, and the registers R1 and R2 are again brought into play to store and control the retransmission of the price-units and price-fractions digits, while the registers R3 and R4 are immediately available to store and control the retransmission of the receiver-selecting digit and the stock-hundreds digit of the next succeeding stock quotation.

Operation of the stock-quotation receiving apparatus

In the receiving apparatus of Fig. 6, polarized line relay 601 responds to the first application of marking potential to the associated line conductor and closes an operating circuit over the associated conductor A for the first of the four shunted, slow-releasing relays 1104—1107. Relay 1104 is accordingly operated to place a ground potential on the holding conductor 607, thereby preparing a holding circuit by way of conductor 609 for transfer relay 605 and a holding circuit by way of conductors 607' and 609' for transfer relay 606.

As a further result of the operation of line relay 601, a circuit is closed over the associated A conductor and by way of contacts of relays 606 and 605 for selecting relay 1101, associated with the receiver RE1. Relay 1101 operates and closes a locking circuit for itself in series with transfer relay 605, so that relay 605 operates in series with relay 1101 as soon as the relay 601 restores. Upon operating, relay 605 disconnects relay 1101 from conductor A at its middle armature; prepares a circuit (to be later referred to) for relay 1102 at its lower armature; and at its inner armature it extends ground potential from conductors 607 and 609 to transfer control conductor 1130 and holding conductor 1129 of the receiver RE1.

As a result of the above-mentioned operation of relays 1101 and 605 in response to the operation of relay 601, the receiver RE1 has been selected for operation in substantially the manner explained in the Robinson et al. application hereinbefore referred to.

Responsive to the stock-hundreds, stock-tens, stock-units, and stock-range digit-impulses, the corresponding digits are registered on the registers SH, ST, SU, and SR (of which only the transfer relays, 1121, 1123, 1125, and 1127, are shown). When relay 1127 operates, it prepares operating circuits at its inner upper armature for the transfer relays 1201, 1203, 1205, 1207, and 1209, associated with the registers PR, PH, PT, PU, and PF, respectively. At its middle upper armature, relay 1127 opens one multiple connection in the holding circuit of the receiver RE1, while at its upper armature it closes a point in a selecting circuit for the relays 1102 and 606, associated with the receiver RE2.

At this time, connecting relay 1202 of the price-range register PR is operated responsive to the operation of relay 1127, and it connects the associated A, B, and C conductors to the register relays A, B, and C of the register PR. Then, when the price-range digit is received (constituting in the assumed example an impulse over the channel A), relay A of the register PR operates and closes a locking circuit for itself in series with transfer relay 1201. As a result, relay 1201 operates in series with the A relay of the register PR, as soon as the operating impulse subsides. When transfer relay 1201 operates, it closes a circuit at its inner upper armature over conductor 1211 for the start relay 1418 of the local sender (not shown); and it places ground potential on conductor 607 at its upper armature so as to maintain this conductor grounded for the time being independent of the continued operation of holding relays 1104—1107, for a purpose which will be explained more fully hereinafter.

Coincident with the receipt and registration of the price digits on the registers PH, PT, PU, and PF, transfer relays 1203, 1205, 1207, and 1209 are operated, respectively. At its inner upper armature relay 1209 finally disconnects conductor 609 from the holding conductor 607, permitting relays 605 and 1101 and transfer relays 1121, 1123, 1125, and 1127 to restore and the register relays (not shown) of the registers SH, ST, SU, and SR to clear out preparatory to the receipt of a subsequent quotation intended for the receiver RE1.

At the same time, relay 1209 at its upper armature connects the B channel (controlled by the B line relay 602) by way of contacts on relay 1127, the lower armature of the relay 605, and contacts of relay 606, to the selecting relay 1102 associated with the repeater RE2. This connection is made at this time, just upon the moment of the operation of relay 1209, so as to prepare a circuit im-

mediately for the operation of relay 1102 responsive to the selecting impulse of the next succeeding quotation. This circuit connection is replaced almost immediately at the lower contacts of relay 605 with a more direct circuit connection from the B conductor to relay 1102 through the normally closed contacts controlled by the lower armature of relay 605. It will be seen, therefore, that the receiver-selecting impulse of the next succeeding quotation can be received immediately at relays 1102 and 606 to effect the selection of the receiver RE2.

With the relays 605, 1121, 1123, 1129, and 1127 restored, the continued energization of relays 1201, 1203, 1205, 1207, and 1209 is dependent upon the new holding circuit established for these relays over conductor 1131 at the inner lower contacts of start relay 1418, and including the inner lower contacts of relay 1419. Relay 1419, it may be pointed out, is the relay which operates at the conclusion of the posting of the stock quotation. At its middle upper armature relay 1127 again prepares a holding circuit over conductor 609 for relay 605, in the event that the first impulse of the next quotation for the receiver RE1 arrives and operates relay 1101 before the quotation last received at this receiver has been completely posted and relay 1209 has restored.

As soon as the quotation received on the receiver RE1 has been finally posted under the control of the local sender (not shown), relay 1419 is operated by way of its lower winding and it closes a locking circuit for itself at its inner upper armature by way of the corresponding armature of relay 1418. At the same time, relay 1419 opens the holding circuits of relays 1201, 1203, 1205, 1207, and 1209. The relays mentioned now restore, together with the operated register relays in the registers PR, PH, PT, PU, and PF. Ground potential is now removed from start conductor 1211, whereupon start relay 1418 restores and permits relay 1419 to restore.

The quotation received at the receiver RE1 has now been completely disposed of and the receiver has been finally cleared out.

The receiver RE2, it will be understood, is similar to the receiver RE1 except that the upper armature of the relay therein corresponding to relay 1209 of the receiver RE1 is connected to conductor A instead of to conductor B, whereby a circuit for selecting relays 1101 and 605, associated with the receiver RE1, is prepared as soon as a quotation is completely registered in the receiver RE2.

Handling the digit "blank"

As has been pointed out hereinbefore, the keys at the transmitting keyboard include a "blank" key for the control of the setting up of a blank indication on either of the price-hundreds, price-tens, and price-units indicators in a selected group at the display board. The operation of the "blank" key for the price-hundreds digit, for example, results in the grounding of the eleventh conductor in the group PH (the transmitter T1). Since this eleventh conductor is grounded also, along with the twelfth conductor, when the so-called "no reset" key is operated, the eleventh conductor is taken through contacts on the relay PH1, Fig. 4, so that relay PH1 disconnects the eleventh conductor, when such relay is operated over the twelfth conductor in group PH of the transmitter T1. The remaining eleventh conductors are carried through contacts on the respective associated relays controlled over the twelfth conductors, as may be seen in Fig. 4.

It is to be noted that the eleventh conductors in groups PH, PT, and PU, Fig. 1, are carried through contacts of the relays 125, 126, and 127, whereby they are rendered effective in the proper sequential order, while the twelfth conductors of these groups, in addition to connecting to the coders C1 and C2 by way of the contacts of relays 125—127, are wired directly to the relays in the lower right-hand corner of Fig. 4 so as to control the transmission of the price-range digit, as will be pointed out more fully hereinafter.

Assuming now that the quotation being transmitted is such as to require the selected hundreds, tens, and units registers to be restored to blank position, the eleventh conductors in groups PH, PT, and PU in the transmitter T1 are each grounded. Under this condition, when the price-hundreds relay 125 in group DSR1 is operated, the grounded eleventh conductor in group PH is connected to conductor 1a in cable 110, thereby closing a circuit by way of the upper contacts of relay PH1, and conductor 404 for the upper winding of the price-hundreds "blank" relay 317. Relay 317 thereupon operates and brings about the operation of the A, B, and C code relays 322, 323, and 324 to bring about the transmission of A, B, and C marking impulses in the price-hundreds group. Similarly, the operation of relays 126 and 127 results in the successive connecting up of grounded eleventh conductors to conductors 1b and 1c in cable 110, and in the consequent successive operation of blank relays 318 and 316, Fig. 3, by way of contacts of relays PT1 and PU1, Fig. 4.

As explained in the hereinbefore-mentioned application of Robinson et al., the transmission of the digit "blank" results in the operation of a relay combination in the receiver to open the resetting circuit of the concerned indicator so as to leave the indicator standing in its blank position after it has been restored responsive to the first operation of the local sender.

Handling abbreviated quotations

In some instances, a new quotation may differ from the one last posted for a given stock or item only in that the fractions digit has changed, in which case it is unnecessary to reset the hundreds, tens, and units indicators. In other cases, the units and fractions digits both may have changed, in which case it is necessary merely to reset the units and fractions indicators; while in still other cases, the tens, units, and fractions digits differ from the previous quotation, in which case the tens, units, and fractions indicators are to be reset. In order to illustrate how an abbreviated quotation is handled, it will be assumed that a quotation is being set up on the transmitter T1 which differs from the quotation last transmitted concerning the same stock only in that the fractions digit has changed. In this case, the operator depresses the "no reset" key referred to hereinbefore so as to cause a price-hundreds no-reset condition to be set up, and she depresses the same key for price tens, and also for price units. As hereinbefore explained, the construction of the transmitter T1 is such as to require the grounding of conductors 11 and 12 in the concerned one of the conductor groups PH, PT, and PU when the "no reset" key is depressed. In this case, therefore, the eleventh and twelfth conductors are grounded in all three of these conductor groups sets.

The grounding of the twelfth conductors in sets PH, PT, and PU closes circuits over conductors 1c,

1d, and *1e* in cable **109** for the price-range control relays PH*1*, PT*1*, and PU*1*, Fig. 4. At their upper contacts, relays PH*1*, PT*1*, and PU*1* open connections which prevent the energization of the relays **316—318**, Fig. 3, while at their lower contacts they connect conductor **417** to conductors *1a* and *1c* in cable **430**, thereby energizing the A and C price-range relays **401** and **403**. The energization of relays **401** and **403** predetermines the transmission of marking impulses in the A and C positions of the price-range digits. Relay **331**, together with the corresponding relay in the coder C2, prevents the transmission of marking impulses under the control of the zero relays (such as **330** of the coder C*1*) in the price-hundreds, price-tens, and price-units positions.

When the hundreds and tens indicators are to be left unchanged, and the units and fractions indicators are to be reset, relays PH*1* and PT*1* are operated, while relay PU*1* is not operated. In this case conductor **417** is connected to conductor *1c* only, causing the C relay **403** to operate and transmit a marking impulse in the C position of the price-range digit; when only the hundreds digit is to be skipped, relay PH*1* is operated and relays PT*1* and PU*1* are not operated, resulting in the transmission of a marking impulse in the B position of the price-range digit under the control of relay **402**.

In the receiver RE2, Fig. 6, when the price-range digit includes marking impulses in the A and C positions, the A and C relays of the price-range register PR are both operated. In this case, relay A locks itself in series with transfer relay **1201**, as hereinbefore described, while relay C locks itself through contacts of relay A in series with transfer relay **1207** of the price-units register PU. Accordingly, when the impulses constituting the price-range digit subside, relays **1201** and **1207** operate. Relay **1207** prepares for the operation of the price-fractions register PF responsive to the next digit, which in this case is the price-fractions digit. At the same time, at their outer armatures relays A and C in the price-range register PR disconnect the conductors U, T, and H from the fractions-restoration conductor **1423**, thereby preventing restoration of the hundreds, tens, and units selected indicators.

When relay C is operated alone in the price-range register PR (indicating that units and fractions digits are to be received) it locks itself by way of contacts of the nonoperated A relay in series with the price-tens transfer relay **1205**. Relay **1205** operates and prepares for the next digit to be received on the price-units register PU. At the same time, relay C connects the units and fractions conductors U and F together so that the restoration impulses are transmitted to the units selected indicator as well as to the fractions selected indicator.

When the price-range relay B is operated alone, it locks itself in series with the price-hundreds transfer relay **1203** to prepare for the receipt of price-tons, price-units, and price-fractions digits in the registers PT, PU, and PF, and it connects the units and tens conductors U and T to the price-fractions restoration conductor F, thereby preparing for the restoration of the units and tens selected indicators.

In the event that one or more of the "no reset" key operations take place for one or more of the digits relating to the hundreds, tens, and units price denominations, no impulses are received by relays **601** to **604** in the space allotted to the concerned digits. Under this condition, the slow-acting holding relays **1104—1107** may all restore during the no-impulse interval. In order to guard against a premature ungrounding of the holding conductor **607** under this condition, each of the transfer relays **1201**, **1203**, **1205**, and **1207** is arranged to ground the conductor **607** upon operation. As a result, as soon as any one of these transfer relays has operated, the relays **1104—1107** may all restore without causing any harmful results. At the same time, it should be particularly noted that the grounding of conductor **607** by these relays does not preclude the clearing out of the receiving equipment under abnormal conditions when the incoming impulses have ceased for the purpose of permitting synchronization. This is so because the same relays which place the additional ground potential on conductor **607** also start the operation of the local sender by grounding start conductor **1211**, and the local sender invariably clears out the relays **1201—1209** (as hereinbefore described) as soon as it has finished its operation and energized relay **1419**.

What is claimed is:

1. In a stock-quotation system, a stock-quotation transmitting station and a remote group of stock-quotation receiving stations, a telegraph transmitter located adjacent the transmitting station and a telegraph receiver located in the vicinity of the receiving stations, a telegraph line interconnecting said telegraph instruments, means for establishing two separate stock-quotation channels successively over said line, each channel having a capacity sufficient to enable all of the digits of a stock quotation to be transmitted thereover successively during a single continuous time period allotted to such channel, means under the control of the stock-quotation transmitting station for transmitting stock quotations by way of the telegraph transmitter over said line to the telegraph receiver over the said channels successively, a stock-quotation line extending from the telegraph receiver to the receiving stations, means at the telegraph receiver for retransmitting all received stock quotations in common over said stock-quotation line to the receiving stations, and means controlled from the stock-quotation transmitting station and located at the telegraph receiver for prefacing each stock-quotation transmitted over said stock-quotation line by a signal indicative of the channel over which the stock quotation is received at the telegraph receiver.

2. In a stock quotation transmitter, a plurality of sets of digit conductors, each set comprising selectable conductors individual to particular digits, respectively, a plurality of digit coders in said transmitter less in number than the number of sets of conductors, means for associating said coders with said conductor sets successively, each coder being used a plurality of times, to code the digits indicated by selected conductors, and means for transmitting each digit coded by said coders.

3. In a stock quotation transmitter, a sending distributor, a transmission line, a plurality of sets of contact segments in said distributor adapted to be successively connected to said line, there being sufficient of said sets to transmit all the digits of a stock quotation over said line, a duplicate plurality of contact sets in said distributor adapted to be connected to said line alternately with said first plurality, coding means common to both pluralities of contact sets for marking

each plurality of contact sets in accordance with the digits of a quotation, and means for connecting first the contact sets of one plurality and then those of the other plurality with said line as set forth.

4. In a stock quotation system, a telegraph line extending from a transmitting multiplex distributor to a receiving multiplex distributor, said distributors being provided with sufficient transmitting and receiving segments to provide two complete stock quotation channels over said line, each channel having sufficient capacity to provide for the code transmission of all the digits of a complete stock quotation, means on which stock quotations are set up for transmission over said channels, and means for transmitting the set up quotations over said channels alternately.

5. In a stock quotation system, means for transmitting the digits of a stock quotation over a single wire line by means of a multiple unit code, the code for each digit having the same number of units, a stock quotation receiver, a line extending to said receiver having as many conductors as there are units in said code, and means for retransmitting said digits over the second line by sending impulses over said conductors singly and in combination.

6. In an apparatus of the character described, the combination of a one-wire receiving distributor, a series of groups of storage relays operated by pulses over said receiving distributor, means for holding said relays operated, a four-wire retransmitting distributor for transmitting pulses over contacts of said storage relays when operated, means controlled by said receiving distributor for setting said retransmitting distributor in operation, and means also controlled by said receiving distributor for releasing said storage relays.

7. In an apparatus of the character described, the combination of a one-wire four-unit-code receiving distributor, storage relays adapted to be energized over said distributor, holding circuits for said storage relays, a four-wire four-unit code-retransmitting distributor operable to transmit pulses over contacts of said storage relays, means under control of said receiving distributor for setting said retransmitting distributor in operation, means also controlled by said receiving distributor for releasing said storage relays, and a channeling mechanism controlled by said distributors for retransmitting the four-unit code received as a channel-one or channel-two transmission.

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