

Oct. 26, 1937.

O. MYERS

2,096,819

COMMUNICATION SYSTEM

Filed Sept. 17, 1931

15 Sheets-Sheet 1

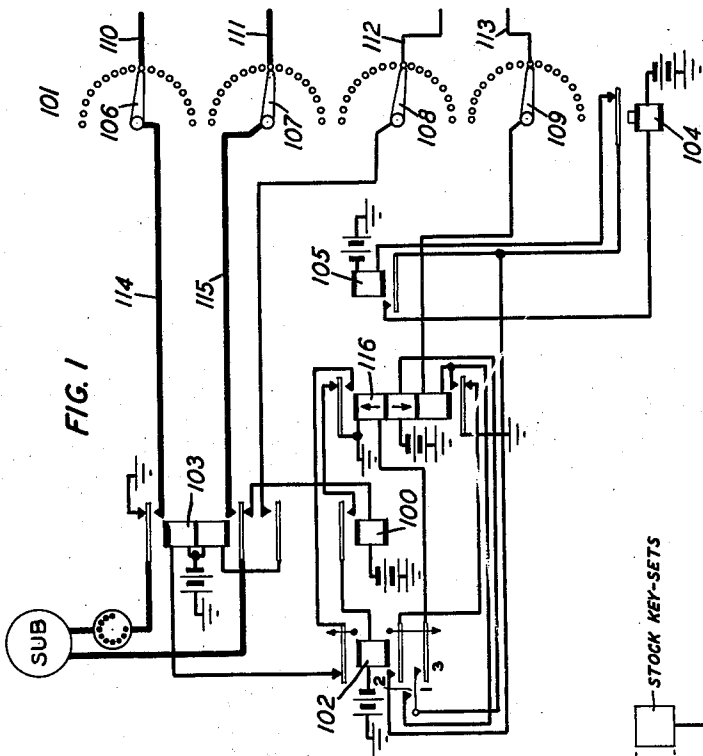
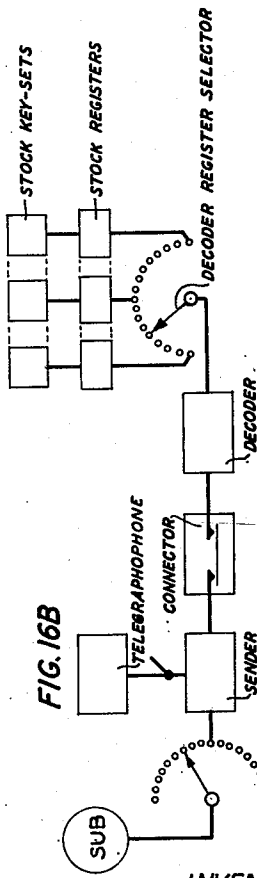
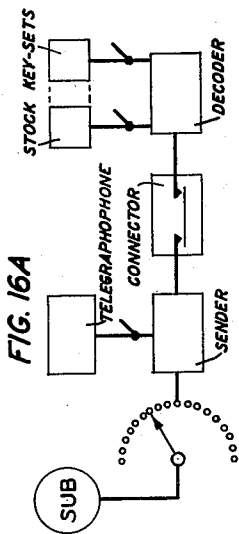


FIG. 17

FIGS. 1, 16A, 16B, 17	FIG. 2	FIG. 3	FIG. 4	FIG. 9	FIG. 10
	FIG. 5	FIG. 6	FIG. 7	FIG. 11	FIG. 12
			FIG. 8	FIG. 13	FIG. 14
				FIG. 15	



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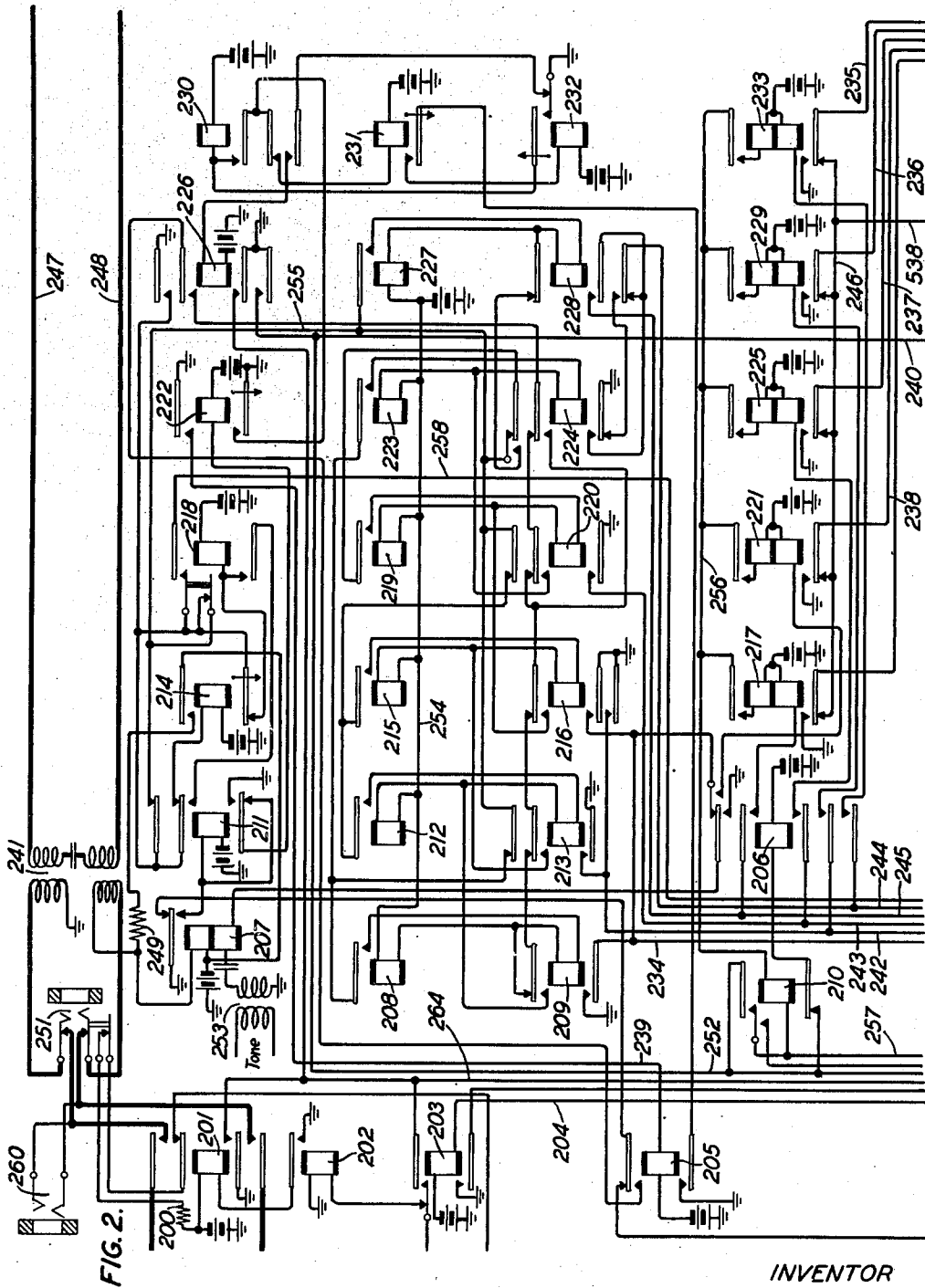
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COMMUNICATION SYSTEM

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15 Sheets-Sheet 2



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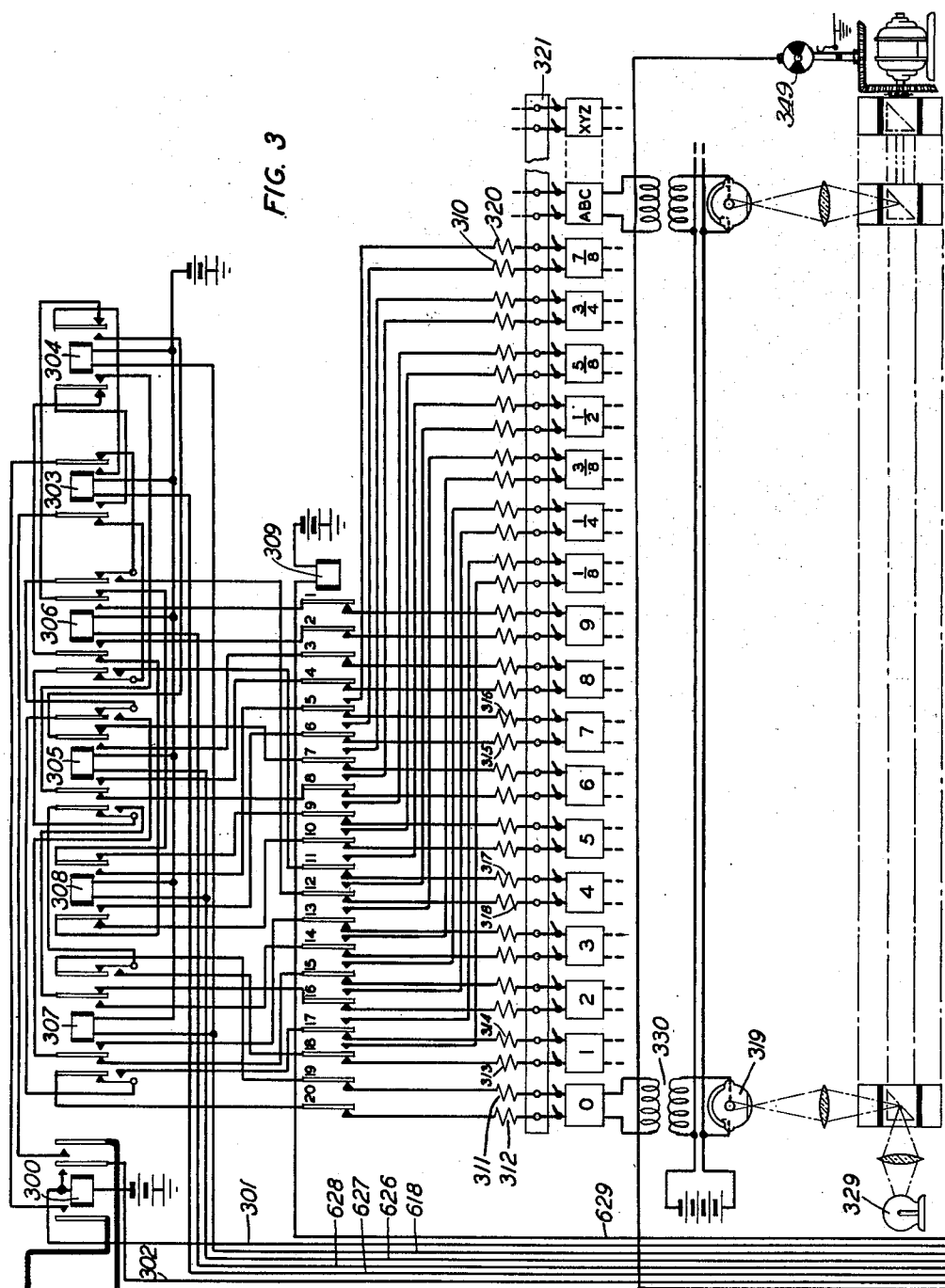
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COMMUNICATION SYSTEM

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15 Sheets-Sheet 3



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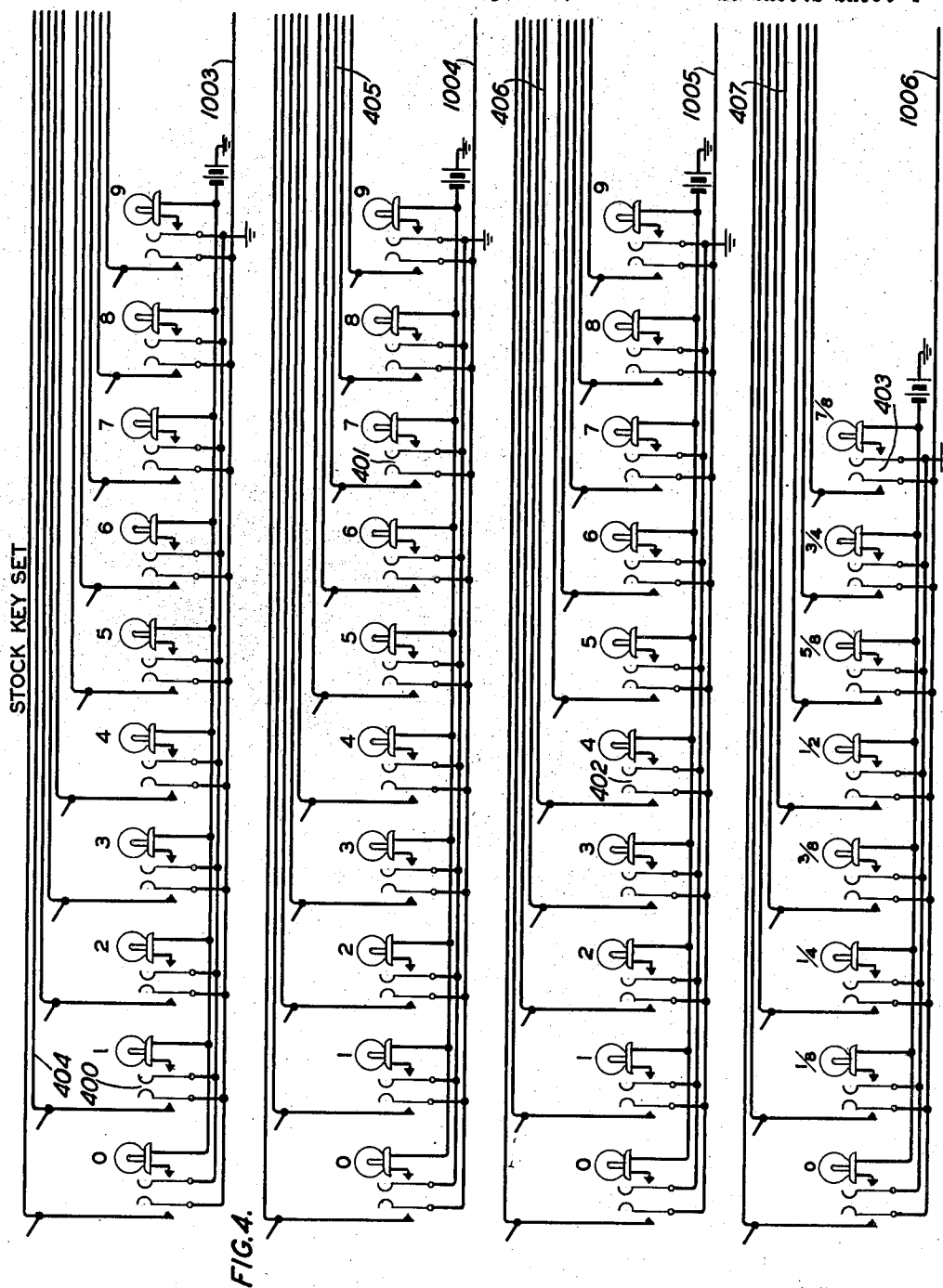
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COMMUNICATION SYSTEM

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15 Sheets-Sheet 4



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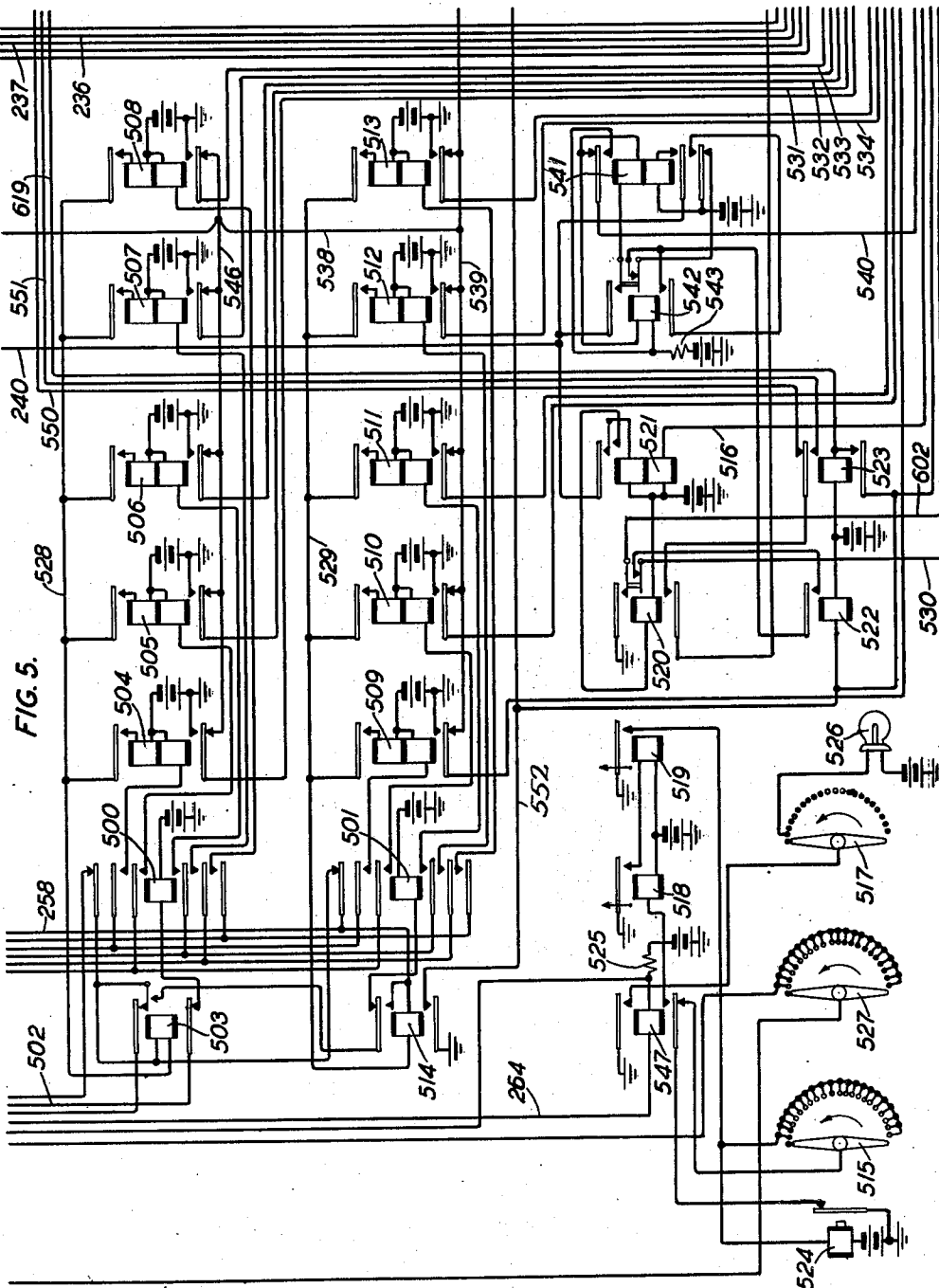
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COMMUNICATION SYSTEM

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15 Sheets-Sheet 5



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COMMUNICATION SYSTEM

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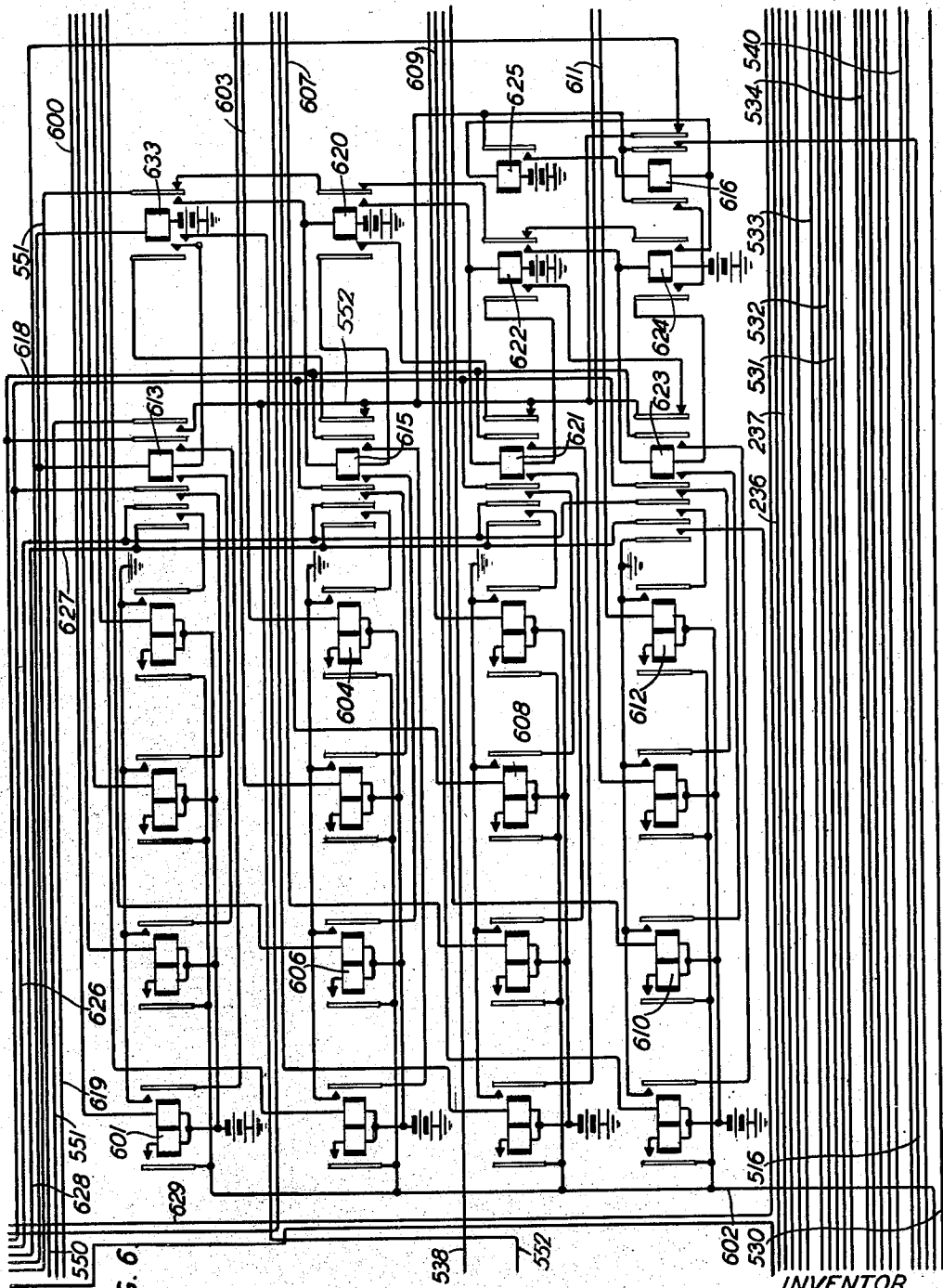


FIG. 6

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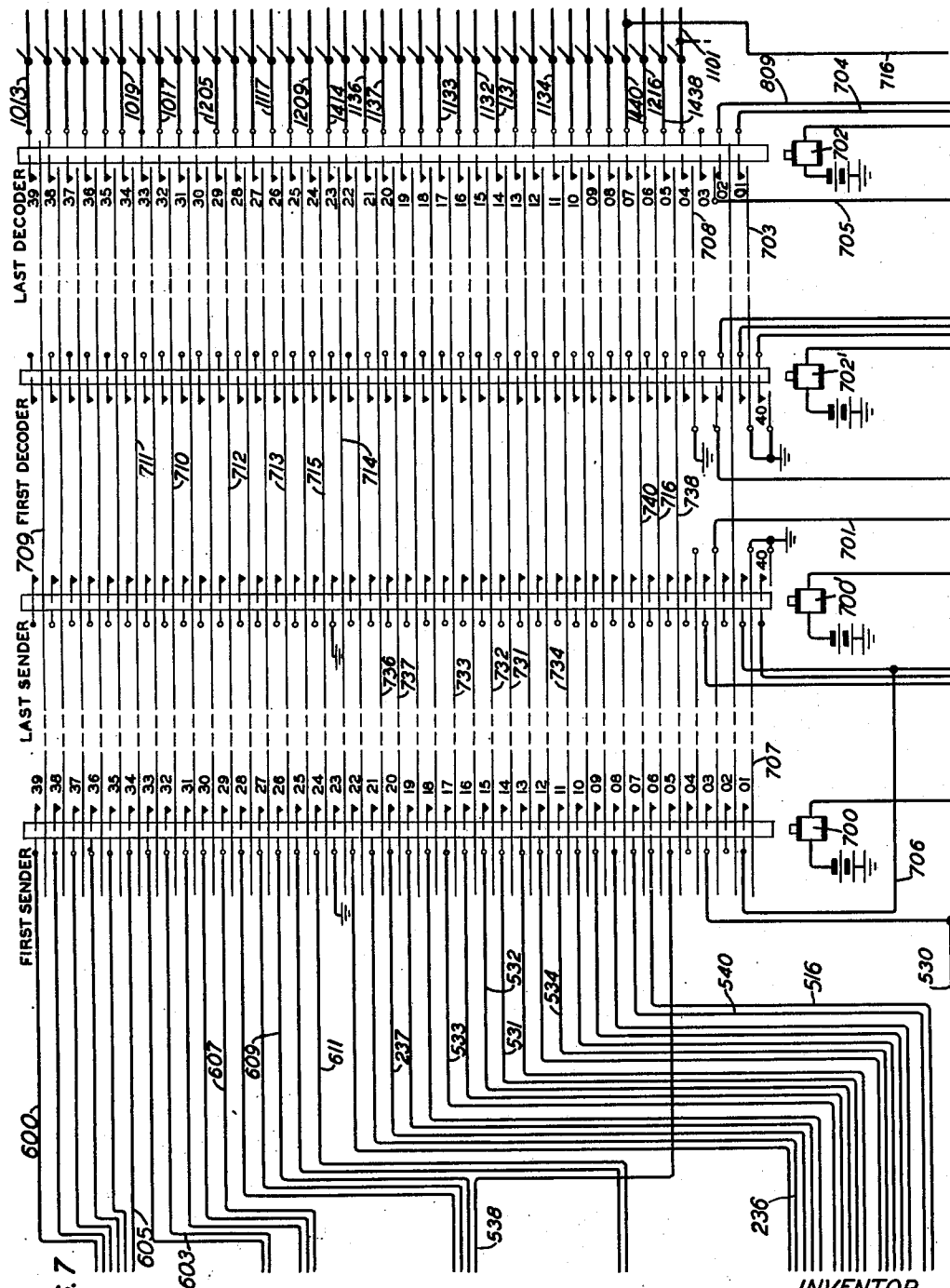
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15 Sheets-Sheet 7



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COMMUNICATION SYSTEM

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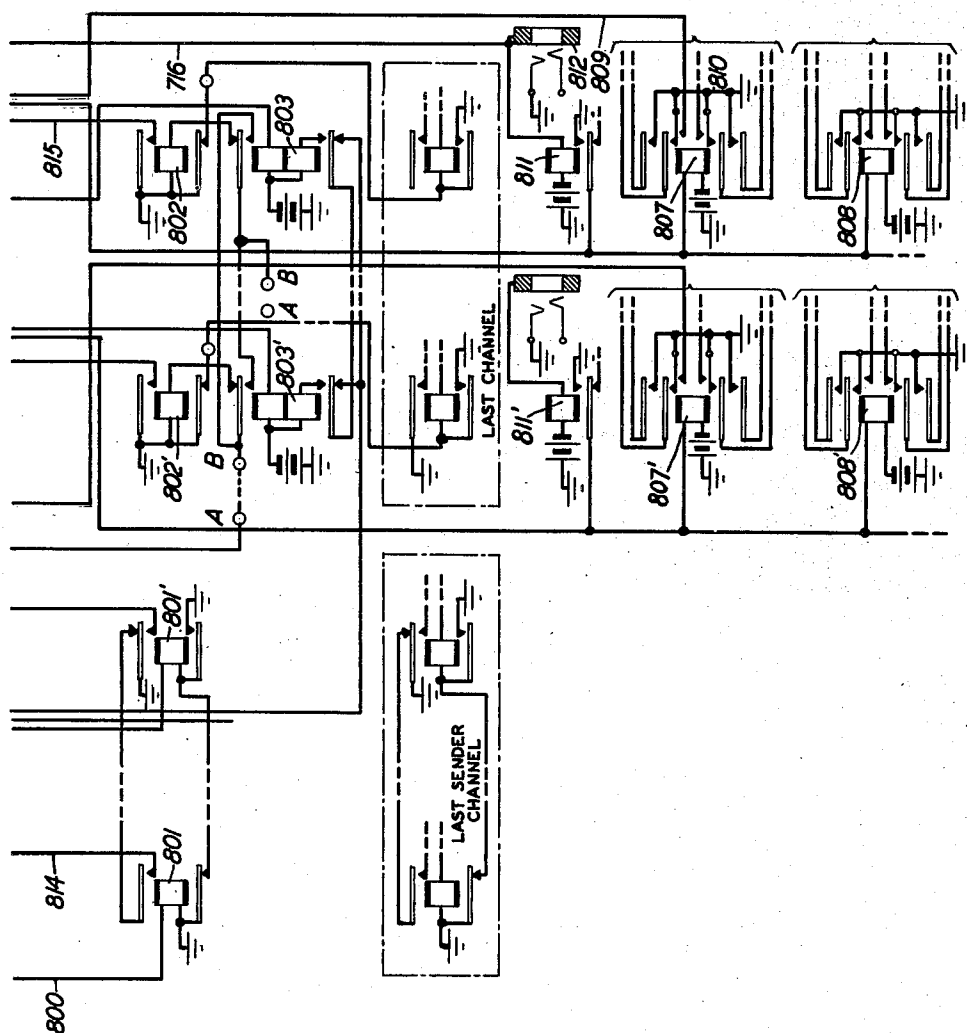


FIG. 8

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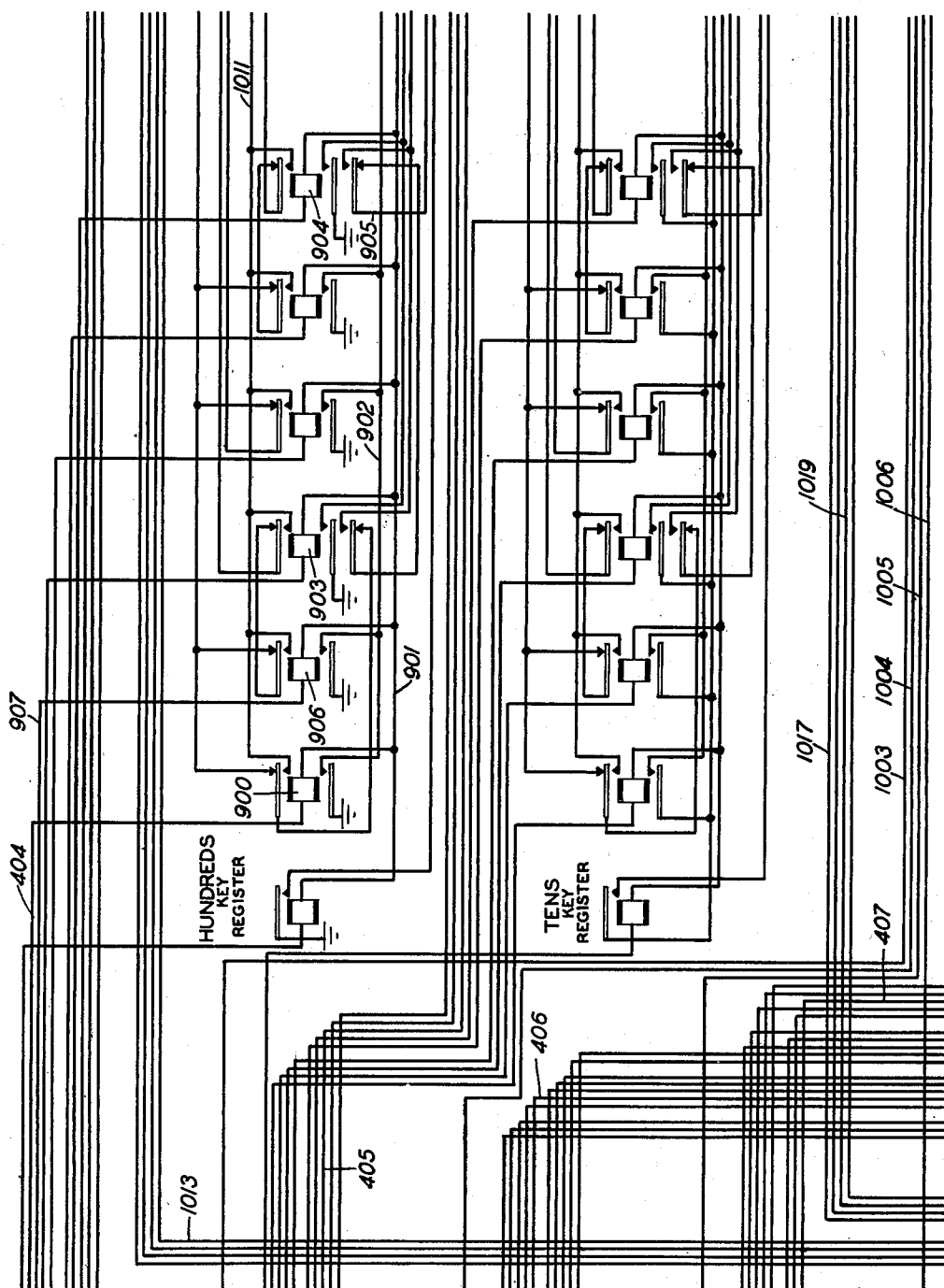


FIG. 9

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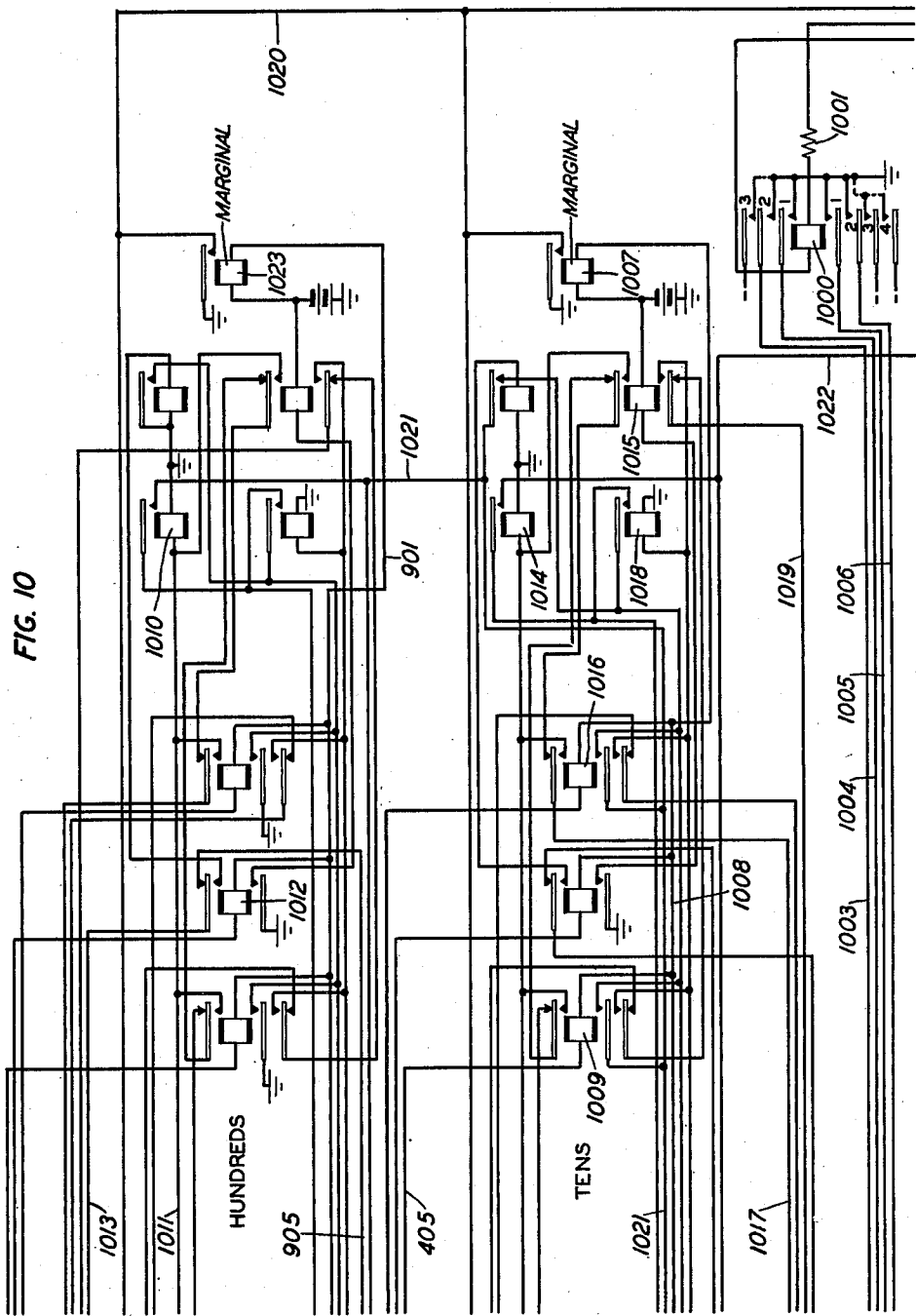
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COMMUNICATION SYSTEM

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15 Sheets-Sheet 10



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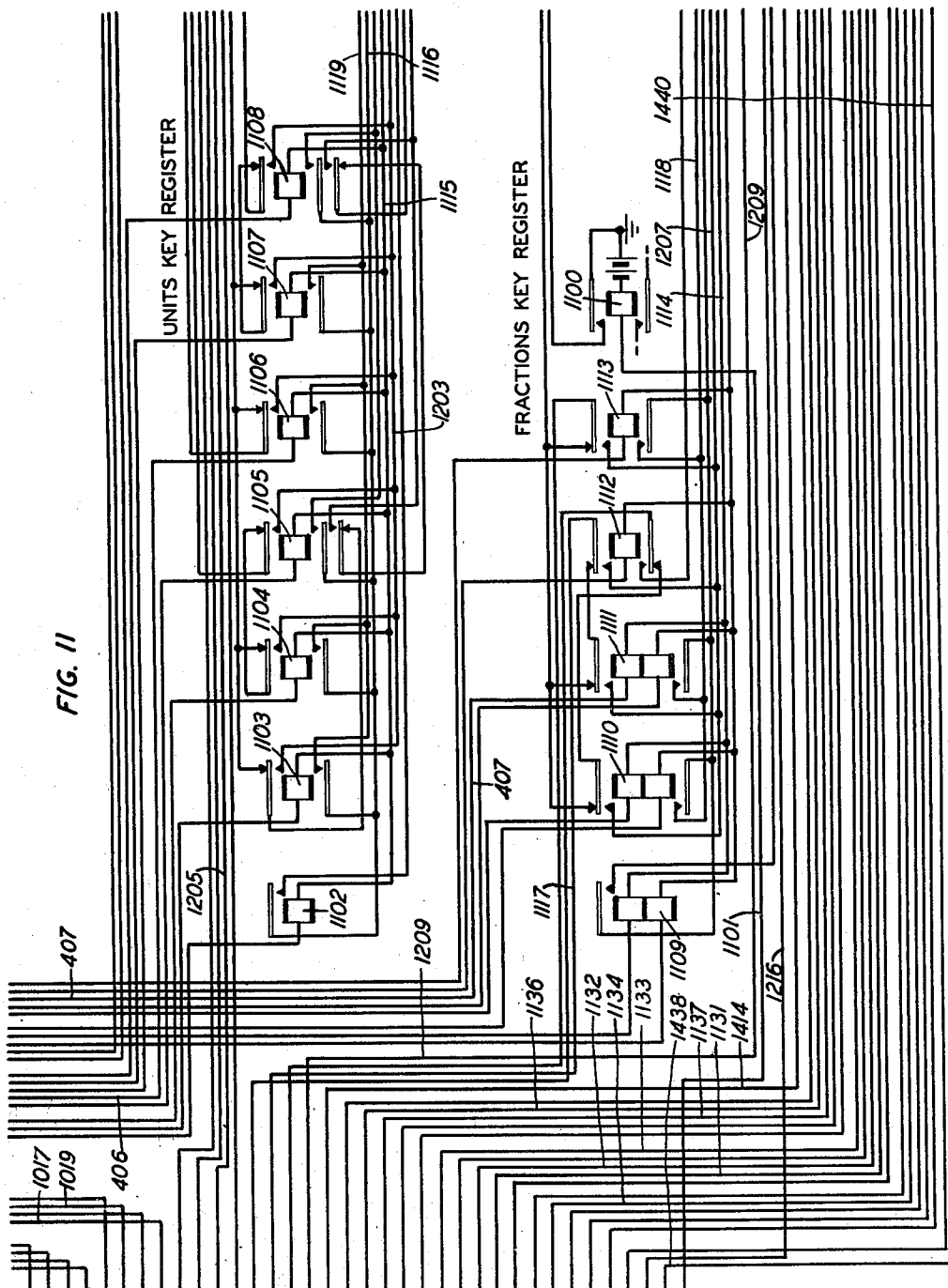
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COMMUNICATION SYSTEM

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15 Sheets-Sheet 11



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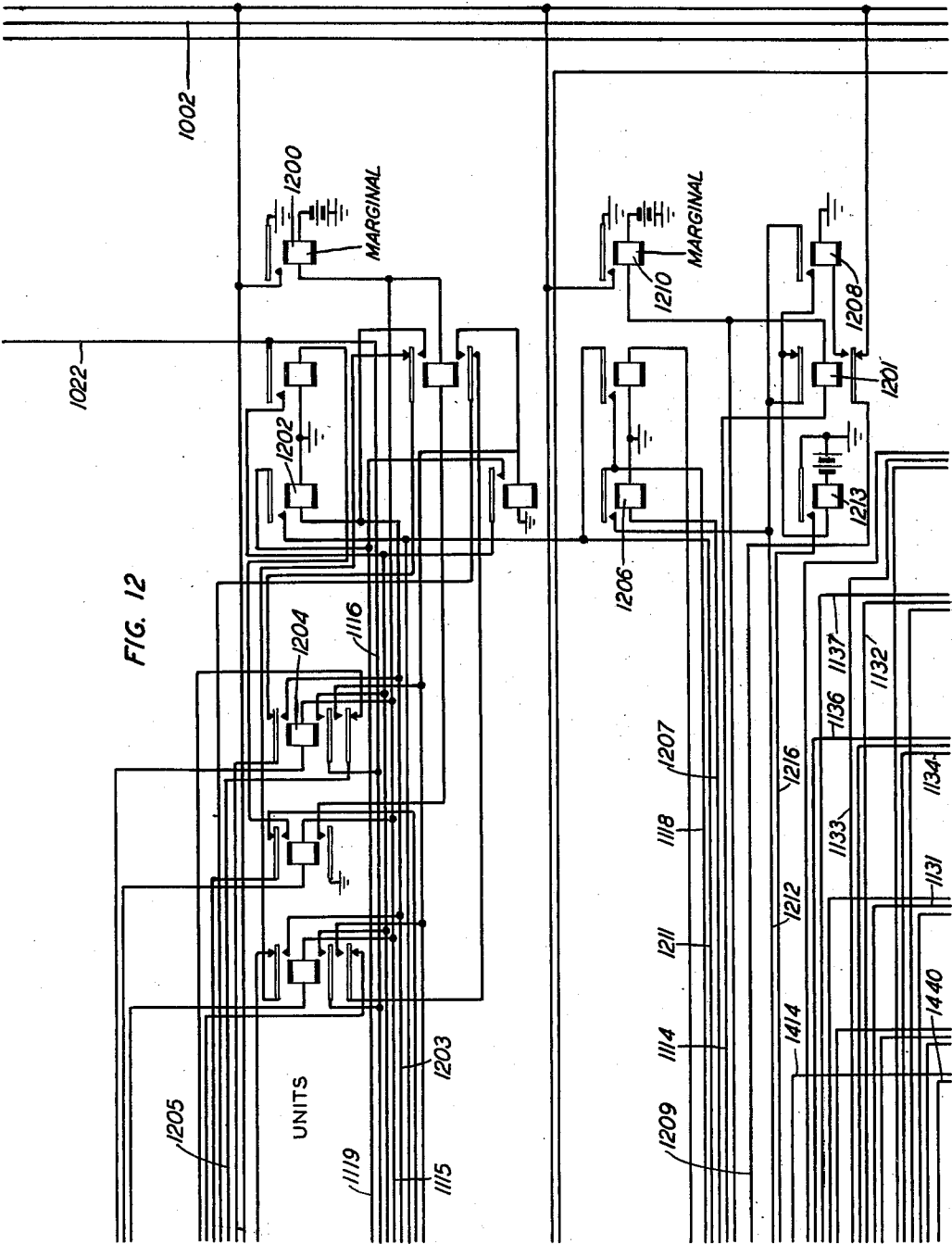
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COMMUNICATION SYSTEM

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15 Sheets-Sheet 12



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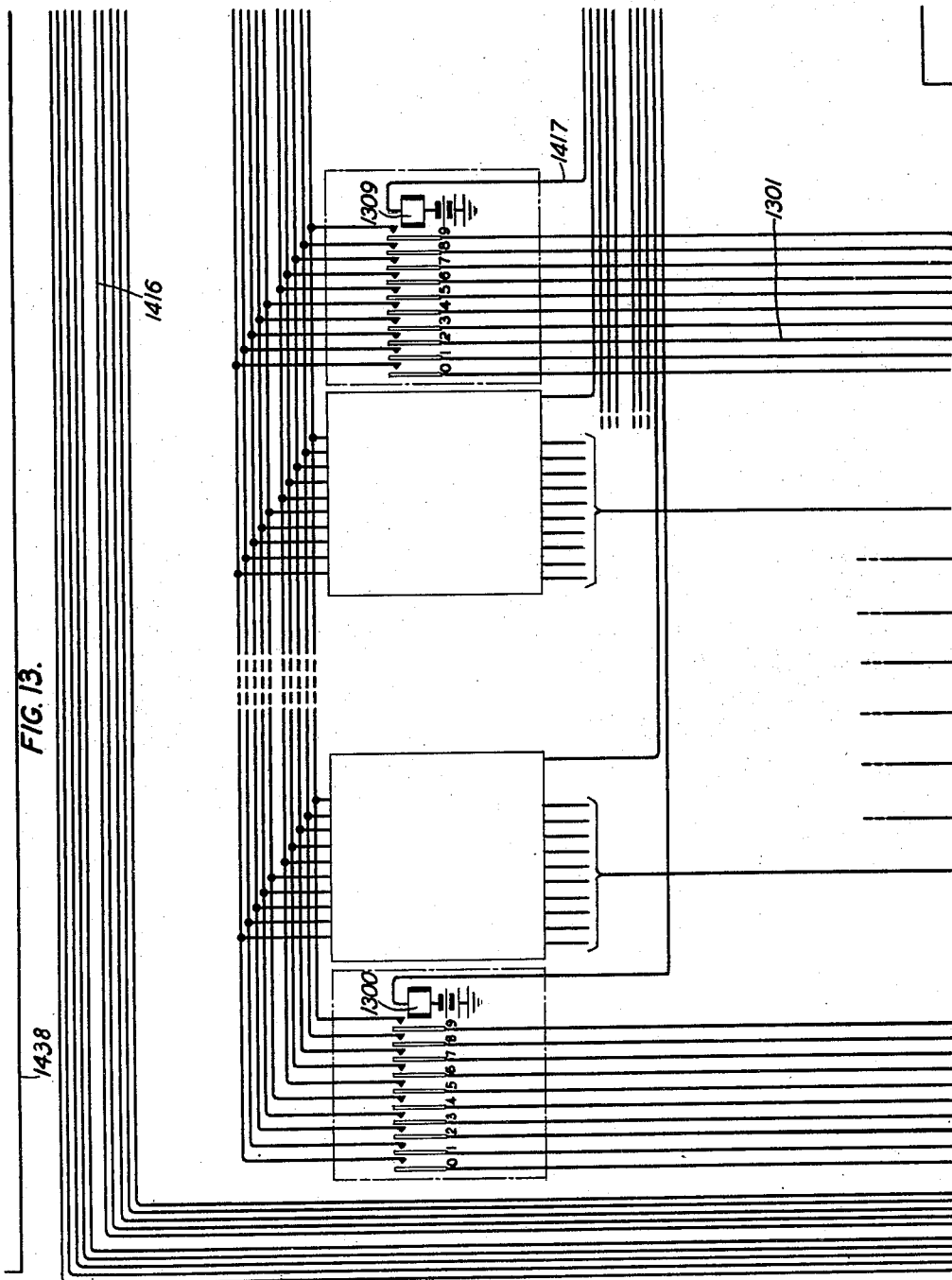
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15 Sheets-Sheet 13



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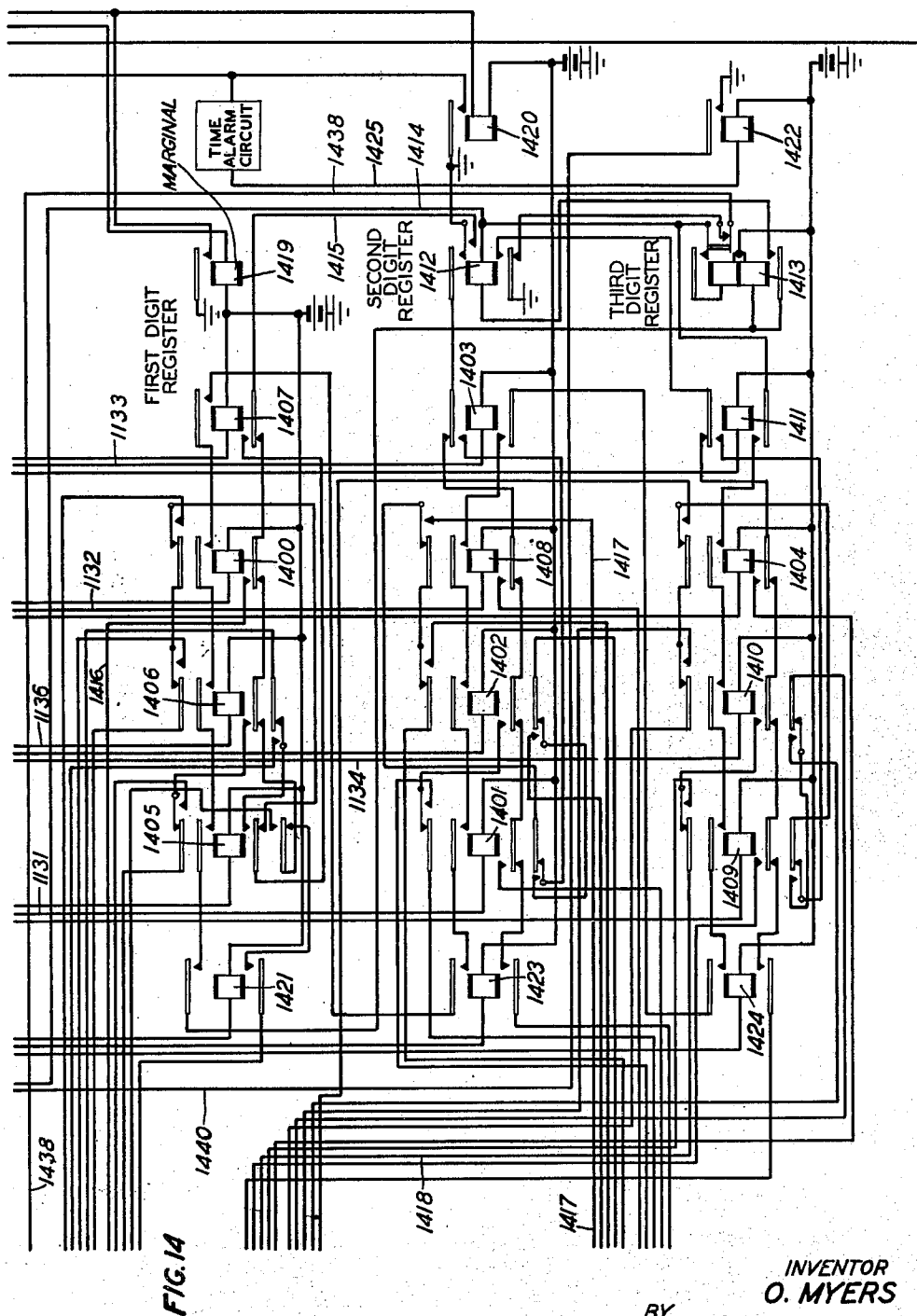
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COMMUNICATION SYSTEM

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15 Sheets-Sheet 14



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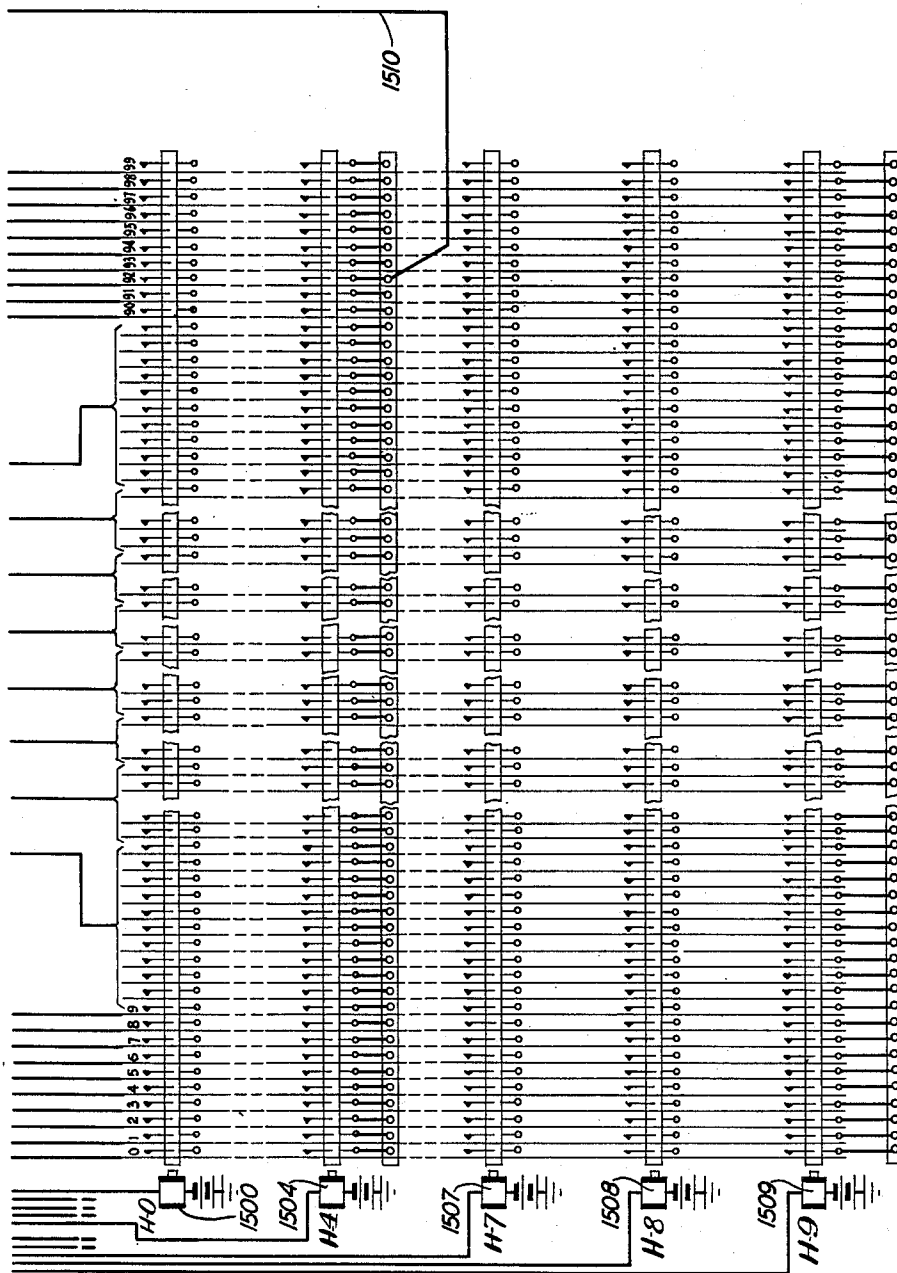
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COMMUNICATION SYSTEM

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15 Sheets-Sheet 15



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UNITED STATES PATENT OFFICE

2,096,819

COMMUNICATION SYSTEM

Oscar Myers, Brooklyn, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application September 17, 1931, Serial No. 583,275

6 Claims. (Cl. 177—353)

This invention relates to a communication system and more particularly to an automatic information system adapted to be used for the transmission of intelligence.

5 Broadly considered, the object of the invention is to obtain an efficient, automatic information service whereby those who subscribe to the service may, upon the proper manipulating at the originating station of a calling device, obtain an information response at said station wherein the character of said response is controlled by an impulse code assigned thereto.

10 More particularly, the present invention comprises a telephone system in which an automatic subscriber may, by dialing a suitable impulse code into an automatic central agency, receive back in the telephone receiver a telegraphophonic response controlled by the code that was dialed.

15 As an illustration of the manner in which the invention may be applied, one embodiment of it is herein completely described with reference to a specific kind of information system; that is, to a stock quotation system in which the "sale" price of a particular stock is telegraphophonically transmitted by the central automatic agency to the calling subscriber in response to the dialing of an impulse code assigned to that stock.

20 It is understood, however, that the invention is not limited to a stock quotation system nor to a telephone system as it is apparent from the principle of the disclosure herein contained that the breadth of its application is limited only by the number of possible impulse codes and the character of the information which may be associated with each code. It is also apparent from the disclosure herein contained that the invention may be applied to any electrical network operating on an impulse registration basis wherein the registration of a series of impulses may be translated into any form of information which can be transmitted to the originating station either telegraphophonically or by any other suitable means.

25 In accordance with the invention, therefore, one specific embodiment of which is disclosed herein by way of illustration, this is accomplished in the following improved manner:

30 The automatic information system herein contemplated comprises an automatic telephone line, a register sender, a telegraphophone and a de-

coder. The sender is used for the registration of the impulses transmitted from the subscriber's dial and may be of the type used in automatic telephone switching systems such as, for example, the type shown in Patent No. 1,616,182 granted 5 February 1, 1927 to O. C. From. The decoder, comprising a group of relays and cooperating circuits, is connected to the sender at the proper time and receives and records the registration dialed into the sender. This record is then translated into the operation of a relay individual to the impulse code, there being a relay in the decoder for each impulse code available to the subscriber. The contacts of the code relay control the various electrical circuits which form the 15 electrical equivalent of the information to be transmitted. The decoder contemplated in this invention is similar to the one shown in the pending application of R. Raymond and W. J. Scully, Serial No. 543,510, filed June 11, 1931, 20 Patent No. 1,862,549 dated June 14, 1932, and is modified only with respect to such details as are necessary to disclose and carry out the principles of this invention.

25 In general the system works in the following way: A subscriber who has access to the automatic stock quotation information service, upon wanting to obtain, let us say, the latest stock quotation sale of a stock which is listed by a code of three digits, removes his receiver from the hook 30 and immediately thereafter a sender is attached to the line. Dial tone is then transmitted thereover to indicate to the subscriber that he may proceed to dial. The subscriber then dials the three digits of the stock code and the dial impulses are registered on the three separate registers in the sender. When the impulses of the third digit are dialed the sender is automatically connected to an idle decoder through the medium of a connector and the impulse registration in the sender is transmitted and locked on a group of register relays in the decoder. The impulse registration in the decoder is thereafter translated to operate the code relay in the decoder corresponding to the impulse code. 45

Some of the contacts of the code relay are controlled through a series of keys of a key-set which may be set at a keyboard at the stock post in the stock exchange where the trading in the stock takes place, or any other suitable place; 50

there being, according to one embodiment of the invention, one key-set for each stock. Through the contacts of these keys are controlled storing registers in the decoder which operate when the keys are depressed and the corresponding code relay operated. The operation of one key in each of the hundreds, tens, units and fractions series of a stock key-set closes circuits through the contacts of the said operated code relay to the storing registers in the decoder. The storing registers, in turn, cause the operation of register or "memory" relays in the sender and thereby retain a record of the number depressed on the keys. As soon as the "memory" relays in the sender are operated and locked, the decoder disconnects and is thereby made available for use with other senders. The operation of the "memory" relays in the sender closes circuits which serve to connect a telegraphophone to the subscriber's line by way of the sender whereby the electrical information locked in the "memory" relays causes the telegraphophone to pronounce to the subscriber the sale price of the stock whose code he dialed. When the subscriber restores, the sender is disconnected from the calling line, the telegraphophone from the sender and both return to normal.

There are other new and novel features which form a part of this invention as will be seen from the following description and appended claims.

A clearer conception of the scope and purpose of the invention can be obtained from a consideration of the following description taken in connection with the attached drawings in which:

Fig. 1 shows the subscriber or stock-broker's line switch circuit;

Figs. 2, 5 and 6, taken together, comprise the register sender;

Fig. 3 shows the telegraphophone machine and sender switching circuit;

Fig. 4 shows a stock post stock key-set;

Figs. 7 and 8, taken together, comprise the connector circuit;

Figs. 9 to 15, inclusive, is the decoder or translator circuit;

Fig. 16—A is a diagrammatic representation of the present embodiment of the invention;

Fig. 16—B is a diagrammatic representation of another arrangement of the invention; and

Fig. 17 shows how Figs. 1 to 15, inclusive, are to be arranged with respect to each other in order to disclose the invention completely.

It is assumed for the purpose of illustration only that the present embodiment of the invention is adapted exclusively to an automatic stock quotation system although, as already stated, it will be evident from the description following hereinafter that the invention is not limited to such a system but may be adapted for transmitting to a calling point any kind of information which can be represented by a code of impulses.

The stock-broker or subscriber, in order to obtain the quotation of a desired stock, removes the telephone receiver from the hook. A circuit is then completed from ground on the top back contacts of relay 103, over the line loop, bottom inner back contacts of relay 103, winding of relay 100 to battery. Relay 100 operates and closes an obvious circuit for relay 102. Relay 102 operates and closes its bottom outer contacts 1 and 2 with contact 3 in the order indicated. With the closure of contacts 1 and 3 a differential circuit is closed from ground through the top winding of relay 116, contacts 1 and 3, middle winding of relay 116 to battery. These two windings of relay 116, being differential with respect to each

other, will not cause the relay to operate in the above traced circuit. With the closure of contact 2 with contacts 1 and 3 the bottom winding of relay 116 is connected in parallel with each of said differential windings, the other end of said bottom winding extending to brush 109. Relay 102 also closes a circuit for relay 105 extending from battery through the winding of relay 105, interrupter contacts of magnet 104 of selector switch 101, bottom inner contacts of relay 102, to ground on the bottom back contacts of relay 116. If relay 116 has not operated in the meanwhile as explained later. Relay 105 operates and a circuit is closed for magnet 104 of sender selector switch 101 extending from battery through the winding of magnet 104, contacts of relay 105, bottom inner contacts of relay 102 to ground on the bottom back contacts of relay 116. Magnet 104 operates, breaks its interrupter contacts and thereby causes the release of relay 105. The release of relay 105 causes magnet 104 to release and, on the releasing stroke of the armature of said magnet, brushes 106, 107, 108 and 109 are advanced in the well known manner to the next terminals in each of the respective associated arcs. The release of magnet 104 and the consequent reclosure of its interrupter contacts, reestablishes the circuit of relay 105. Relay 105 operates and the previously traced circuit of magnet 104 is once more reestablished causing said magnet to operate and advance said wipers to the next succeeding terminals as already described. The operations of relay 105 and switch magnet 104 continue until an idle sender is found.

Now an idle sender is characterized by the presence of battery potential through resistance 200, bottom make contacts of jack 251, top back contacts of relay 201 to conductor 113 and the above operations take place supposing the sender selector switch 101 to be standing on and advancing over terminals of the arc associated with brush 109 from each of which said battery potential has been removed by the busy condition of the associated sender as more fully explained hereinafter. When the switch brushes have advanced to a set of terminals having said battery potential connected to conductor 113 a circuit is closed from battery, resistance 200, top back contacts of relay 201, bottom make contacts of jack 251, top inner contacts of relay 201, conductor 113, brush 109, lower winding of relay 116, to bottom contacts of relay 102, ground through the top winding of relay 116 and, in parallel therewith, to battery through the middle winding of relay 116. Relay 116 operates very quickly, opens at its bottom back contacts the circuits of relay 105 and switch magnet 104 causing them both to release and locks momentarily in a circuit from ground on its bottom front contacts, lower winding of relay 116 to battery on conductor 113. With the operation of relay 116 the circuit of relay 102 is opened, causing this relay, after a brief interval, to release. With relay 102 released a circuit is closed from ground on the top front contacts of relay 116, back contacts of relay 102, top winding of relay 103 to battery. Relay 103 operates, opens the circuit of relay 100 which releases, locks over a circuit from battery through its bottom winding and bottom outer contacts, brush 108 and associated terminal, conductor 112, normally made contacts of relay 203, winding of relay 202 to ground. Relay 202 operates in this circuit and, in turn, causes the operation of relay 201. Re-

lay 201 removes the battery potential from conductor 113 causing the release of relay 116.

It is evident that if, at the time the subscriber initiates the call, the sender selector switch 101 is connected with an idle sender, relay 116 will operate immediately, contact 2 on relay 102 is closed and no circuit would then be available to operate switch magnet 104, thereby causing it to remain, as it should, on the terminals of the idle sender to which it is connected.

When relay 103 operates as already described, the subscriber's line is extended into the sender over a circuit path which may be traced from battery through the top winding of relay 207, left bottom winding of repeating coil 241, bottom inner contacts of jack 251, bottom outer contacts of relay 201, conductor 111, brush 107, conductor 115, bottom inner front contacts of relay 103, the line loop, top front contacts of relay 103, conductor 114, brush 106, conductor 110, top outer contacts of relay 201, top contacts of jack 251, left upper winding of repeating coil 241 to ground. Relay 207 operates and closes an obvious circuit for relay 211 which also operates. Relay 211 operates slow-release relay 222 over a circuit from ground on its bottom contacts and relay 222, in turn, causes the operation of slow-release relay 231 in a circuit extending from ground on the bottom contacts of relay 222, bottom middle back contacts of relay 230, winding of relay 231 to battery. Over its top contacts relay 222 closes a circuit to the winding of relay 205 by way of conductor 239 thereby causing this relay to operate also. Relay 205 causes the operation of slow-release relay 232 in a circuit from ground on the bottom contacts of relay 205, contacts of relay 231, winding of relay 232 to battery. Relay 232 causes the operation of relay 230 which locks over a circuit through its bottom inner contacts to ground on the bottom contacts of relay 222. The operation of relay 230 opens the circuit of relay 231 and the consequent release of this relay, after an interval, releases relay 232. When relay 232 releases, a path is closed from battery through the winding of relay 226, bottom outer contacts of relay 239 to ground on the normally made contacts of relay 232. With the operation of relay 226 an operating circuit is closed from battery through the winding of relay 218, back contacts of relay 214, to ground on the top outer contacts of relay 226. Another circuit is also closed from battery through the winding of relay 206, bottom contacts of relay 210, conductor 252 to ground on the bottom outer contacts of relay 226. Relay 206 operates and connects ground over its top middle front contacts, lower winding of relay 207 and condenser, secondary winding of tone coil 253 to ground. Due to this circuit a tone is induced through the upper winding of relay 207 and transmitted over its circuit path, above described, to the subscriber's telephone receiver, indicating to him that the central office equipment is ready and that he may proceed to dial the code of the stock whose sale price he desires to ascertain.

When the subscriber rotates the dial, which is the same as the well known subscriber's dial used in automatic telephony and then releases it, the dial returns to normal and, in doing so, creates a series of open impulses over the line corresponding in number to the first numerical digit of the desired code.

In order to completely understand the opera-

tion of the sender circuit incident to the response of the dial impulses, the description of the circuit operations will be based on the assumption that ten impulses are transmitted. The first impulse results in a momentary opening of the operating circuit of relay 207 thereby causing this relay to release. Relay 211 likewise releases and a circuit is established for slow-release relay 214 from ground on the top outer contacts of relay 226, top inner back contacts of relay 211, winding of relay 214 to battery. Relay 214 operates and, over its top contacts connects non-inductive resistance 249 in parallel with the top winding of relay 207 so that relay 207, in responding to dial impulses, as explained hereinafter, will be made more sensitive than it otherwise would be in the circuit including the two windings of repeating coil 241. With the operation of relay 214, relay 218 releases. A circuit is also established from ground through the back contacts of relay 207, top front contacts of relay 205, top inner contacts of relay 226, top inner back contacts of relays 224, 220, 216, 213 and 209, winding of relay 208, conductor 254, to battery. Relay 208 operates and establishes a locking path for itself through the winding of relay 209, contacts of relay 208, top outer contacts of relay 213, conductor 255, normal contacts of relay 218 to ground on the top outer contacts of relay 226. Relay 209, however, does not operate at this time due to the presence of the operating ground for relay 208 on one side of its winding and the ground above traced on its other side. When the impulse terminates by the reclosure of the line loop, relay 207 reoperates, the operating ground for relay 208 is removed and hence also from one side of the winding of relay 209, and relay 209 operates in the locking circuit of relay 208. Both relays are now locked to an aforesaid ground on the top outer contacts of relay 226. When relay 209 operates a circuit is closed from ground on its bottom contacts, conductor 234, top outer front contacts of relay 206, bottom winding of relay 221 to battery. Relay 221 operates but otherwise performs no function at this time.

When relay 207 reoperates, relay 211 may or may not operate depending upon the rapidity with which succeeding impulses are received. Since, however, relays 214 and 222 are both slow-to-release, neither of them will release, the former releasing only after a train of impulses has been received at which time the relay 211 will remain operated for a comparatively longer period, while the latter remains operated not only during the reception of impulses but also during the period between impulses since relay 211 will then remain uninterruptedly energized.

The second impulse releases relay 207 again and a path is now closed from ground through the back contacts of relay 207, top front contacts of relay 205, top inner contacts of relay 226, top inner back contacts of relays 224, 220, 216 and 213, top front contacts of relay 209, winding of relay 212, conductor 254, to battery. Relay 212 operates and closes a locking circuit for itself through the winding of relay 213, contacts of relay 212, top outer contacts of relay 220, to ground on conductor 255. Relay 213, however, is short-circuited by the presence of the operating ground for relay 212 on one side of its winding and the aforesaid locking ground on the other side so that this relay does not operate at this time. When the open period of the impulse is terminated, relay 207 operates, the aforesaid operating ground for relay 212 is removed from the wind-

ing of relay 213 and this relay now operates in the locking circuit of relay 212, above traced. Relays 212 and 213 are now locked. With the operation of relay 213 the locking circuit of relays 208 and 209 is opened at the top outer contacts of relay 213 and relays 208, 209 and 221 release. Relay 213 closes a circuit from ground on its bottom contacts, conductor 242, bottom middle contacts of relay 206, bottom winding of relay 228 to battery. Relay 229 operates but otherwise performs no useful function.

When the third impulse is being transmitted, relay 207 releases and a path is closed from ground on the back contacts of relay 207, top contacts of relay 205, top inner contacts of relay 226, top inner back contacts of relays 224, 220 and 216, top inner front contacts of relay 213, winding of relay 215, conductor 254 to battery. Relay 215 operates, establishes a locking path through the winding of relay 216, contacts of relay 215, top outer back contacts of relay 220, to ground on conductor 255. Relay 216 does not operate in this circuit at this time due to the presence of operating ground for relay 215 on one side of its winding and the above traced locking ground on the other. When the open period of the impulse is over and relay 207 reoperates, said operating ground is removed and relay 216 operates in the locking circuit above described. Relays 215 and 216 are now locked in addition to relays 213 and 212. Relay 216, over its inner bottom contacts, closes the previously traced circuit of relay 221 which now reoperates but again performs no useful function.

On the fourth impulse relay 207 releases and a path is closed from ground on the back contacts of relay 207, top front contacts of relay 205, top inner contacts of relay 226, top inner back contacts of relays 224 and 220, top front contacts of relay 216, winding of relay 219, conductor 254 to battery. Relay 219 operates and establishes a locking path for itself through the winding of relay 220, contacts of relay 219, top outer back contacts of relay 224 to ground on conductor 255. Relay 220 is short-circuited by the operating ground for relay 219 and does not, therefore, operate at this time. When the impulse is over, relay 207 reoperates, said short-circuiting ground is removed and relay 220 operates in the locking circuit of relay 220 above traced. With the operation of relay 220 and the consequent opening of its top outer back contacts, the locking circuit of relays 212, 213, 215 and 216 is opened and these relays release. Relays 221 and 229 likewise release. Relay 220 closes a circuit from ground on its bottom contacts, conductor 243, bottom inner contacts of relay 206, winding of relay 225 to battery. Relay 225 operates but performs no useful function.

On the fifth impulse, the release of relay 207 closes a circuit path from ground on the back contacts of relay 207, top front contacts of relay 205, top inner contacts of relay 226, top inner back contacts of relay 224, top inner front contacts of relay 220, winding of relay 223, conductor 254 to battery. Relay 223 operates and establishes a locking path for itself through the winding of relay 224 and contacts of relay 223, top outer contacts of relay 213, to ground on conductor 255. Relay 224 does not operate in this path at this time due to the fact that it is short-circuited by the operating ground for relay 223. When the impulse is terminated and relay 207 reoperates, said short-circuiting ground is re-

moved and relay 224 operates in the above traced locking circuit.

When relay 224 operates, the locking circuit of relays 219 and 220 is opened at its top outer back contacts thereby causing these relays to release. Relay 225 likewise releases. A path is also closed from ground on conductor 255, top outer front contacts of relay 224, top contacts of relay 228, winding of relay 227 to battery. Relay 227 operates and establishes a locking circuit for itself from ground on conductor 255, contacts of relay 227, winding of relay 228 to battery through the winding of relay 227. Due to the fact that the operating ground for relay 227 is also present on one side of the winding of relay 228 through its own top contacts, relay 228 does not operate at this time. Relay 224 also closes a circuit from ground on its bottom contacts, bottom outer back contacts of relay 228, bottom outer back contacts of relay 206, bottom winding of relay 233, to battery. Relay 233 operates but performs no useful function at this time.

On the sixth impulse, relay 207 releases and a circuit is established from ground on the back contacts of relay 207, top front contacts of relay 205, top inner contacts of relay 226, top inner front contacts of relay 224, top back contacts of relays 216, 213, 209, winding of relay 208, conductor 254, to battery. Relay 208 operates and at the termination of the impulse relay 209 operates and locks in series with relay 208 in the manner described for the first impulse and relay 221 again operates as before.

On the seventh impulse, a circuit path is closed from ground on the back contacts of relay 207, top front contacts of relay 205, top middle contacts of relay 226, top inner front contacts of relay 224, top inner back contacts of relays 216 and 213, top front contacts of relay 209, winding of relay 212, conductor 254 to battery. Relays 212 and 213 now operate in the manner described for the second impulse and relay 229 also operates.

With the operation of relay 213, relays 208, 209 and 221 release. Relays 223 and 224 likewise release with the result that the short-circuiting ground to the winding of relay 228 is removed at the top outer front contacts of relay 224 causing relay 228 to operate in the locking circuit of relay 227 above described. Relay 233 momentarily releases but again reoperates over a circuit now completed from ground on the bottom back contacts of relay 224, bottom outer front contacts of relay 228 to conductor 244.

On the eighth impulse a previously traced circuit is closed for relay 215 and, at the termination of the impulse, relay 216 operates and locks in the locking circuit of relay 215. Relays 221 and 229 again operate over the previously traced circuits.

On the ninth impulse relay 219 operates and at the termination thereof relay 220 operates and locks in the locking circuit of relay 219 and relay 225 again operates. The operation of relay 220 releases relays 212, 213, 215 and 216 as already described and relays 229 and 221 also release.

On the tenth or zero impulse, relays 223 and 224 operate and lock as described for the fifth impulse and relay 224 now closes a circuit from ground on its bottom front contacts, bottom inner front contacts of relay 228, conductor 245, top inner contacts of relay 206, bottom winding of relay 217, to battery. Relay 217 operates but performs no useful function. With the operation of relay 224 relay 233 releases.

The following table shows, in recapitulated form, the relation between the number of im-

pulses and the number of pairs of counting relays operated for each of said number of impulses.

Number of impulses	Operated relays
1	208, 209.
2	212, 213.
3	212, 213, 215, 216.
4	219, 220.
5	223, 224.
6	227, 228, 208, 209.
7	227, 228, 212, 213.
8	227, 228, 215, 216.
9	227, 228, 219, 220.
0	227, 228, 223, 224.

Each digit of the stock code comprises a group of impulses from a single impulse to ten impulses. When, therefore, the dial has returned to normal after the transmission of the impulses of the first digit of the code, the time interval necessary for the subscriber to rotate the dial for transmitting the impulses of the second digit of the code is utilized to register in the sender the registration of the first digit. It will be assumed for the purpose of illustration that the code in question is represented by the designation 492. When the dial has returned to normal after transmitting four impulses, relay 207 is reoperated over the line loop and remains up during the above mentioned interval, and relay 211 reoperates. Relay 214 now releases and causes the reoperation of relay 218 over an aforetraced circuit; relay 218 locking over the top inner contacts of relay 211 to ground on the top outer contacts of relay 226. During the operated condition of relays 219 and 220, relay 225 was operated as already described and, with the receipt of further impulses in the series of the first digit, would have released. But with the termination of the series of impulses of the first digit after the fourth impulse is received and the consequent operation of relay 218, a locking circuit is established for relay 225 through its top winding and contacts, conductor 256, winding of relay 210, conductor 257, top outer back contacts of relays 500 and 501, conductor 258, top contacts of relay 218 to ground on the top outer contacts of relay 226. Relay 210 operates in the locking circuit above traced and is itself locked over a circuit through its top contacts, conductor 252, to ground on the bottom outer contacts of relay 226. The operation of relay 210 causes the release of relay 206 thereby opening the operating path to each of the first digit register relays, namely, relays 217, 221, 225, 229 and 233. A circuit is also closed from ground on conductor 252, top contacts of relay 210, conductor 502, bottom contacts of relay 503, winding of relay 500 to battery. Relay 500 operates and prepares paths to the operating windings of the second digit register relays, namely, 504, 505, 506, 507 and 508. When the subscriber manipulates his dial for transmitting the nine impulses of the second digit, the line relay 207 follows the impulses, relay 214 operates and relay 218 releases, all as previously described. Relays 505 and 508 operate and, at the termination of the nine impulses of the digit 9, the release of relay 214 and the consequent operation of relay 218 establishes a locking circuit for relays 506 and 508 from battery through the top windings and top contacts of relays 506 and 508, conductor 528, winding of relay 503, top outer contacts of relay 501, conductor 258, top outer contacts of relay 218 to ground on the top outer contacts of relay 226. Relay 503 operates in

said locking circuit and locks in series with relays 506 and 508 through the top contacts of relay 503 to an aforetraced ground on conductor 252.

While the operation of any of the relays 504, 505, 506, 507 and 508 has not been described, it will be easily seen that they function in the same way as the corresponding relays of the first register, that is, relays 217, 221, 225, 229 and 233 in that they each momentarily operate on the reception of the impulse and release on the reception of the succeeding impulse while the appropriate register relay will lock through the winding of relay 503 to register the last impulse received prior to the operation of relay 218.

The operation of relay 503 releases relay 500 thereby opening the path to each of the windings of the second digit register relays. When relay 503 operates, a circuit is also closed from battery through the winding of relay 501, top back contacts of relay 514, top contacts of relay 503 to an aforetraced ground in conductor 252. Relay 501 operates and prepares paths to the operating windings of the third digit register relays, that is, relays 509, 510, 511, 512 and 513.

The subscriber now manipulates his dial for digit 2 and thereby transmits, in the manner described, a series of two impulses. When the impulses are all transmitted, and relay 214 released and relay 218 operated, a locking circuit is closed for relay 512 through its top winding and top contacts, conductor 529, winding of relay 514, conductor 258, top contacts of relay 218 to ground on the top contacts of relay 226. Relay 514 operates in this locking circuit and, with the closure of its top contacts, provides another locking circuit for itself and the register relay 512 to ground on conductor 252. The operation of relay 514 opens the circuit of relay 501, which relay releases and thereby opens the path to each of the relays of the third register.

The code representing the stock has been limited, for the purpose of describing the present embodiment of the invention, to a three digit code. Consequently after the reception of the impulses comprising the third digit of the code no more impulses will be transmitted and relay 218 will remain operated. It is understood, however, that the invention is not limited to any specified number of digits and the code may be restricted or expanded to eliminate or include as many digits as will be found necessary by the number of different items of information to be transmitted to a calling line. Under such circumstances the sender can be easily modified to eliminate unnecessary registers or include others for the registration of further digits, as the case may be, and their operation will be identical with that of the registers described above.

When relay 201 operated, as already described, a circuit was closed from ground on the bottom inner contacts of this relay, conductor 264, winding of relay 547, resistance 525 to battery. Relay 547 operates in this circuit and closes a circuit from ground on the interrupter contacts of switch magnet 524, bottom front contacts of relay 547, winding of slow-release relay 518 to battery. Relay 518 operates and, in turn, causes the operation of slow-release relay 519. Relay 519 operates switch magnet 524. Magnet 524 breaks its interrupter contacts and opens the circuit of relay 518 which, after an interval, releases. Relay 518 opens the circuit of relay 519 which, after an interval, also releases. With the release of relay 519, the circuit of the switch magnet 523 is opened, allowing the switch to release

and advance brushes 515, 517 and 527 one step. With the closure of the magnet's interrupter contacts, the above cycle of operations is repeated and brushes 515, 517 and 527 are advanced another step. Now if the sender has not completely performed all its functions, as further described hereinafter, by the time brush 517 is advanced to the last terminal of its associated contact arc, a circuit is closed from ground on the top contacts of relay 547, brush 517 and associated terminal, lamp 526 to battery. Lamp 526 lights and gives warning that the sender identified by the glowing lamp has not completely functioned in the time measured by the advance of the switch, whereupon an attendant will investigate the cause for the delay by plugging a telephone circuit provided with talking battery in the known manner into jack 260 to ascertain if the subscriber is still on the line. Should the challenged line bring forth no response the sender is then removed from said line by inserting a plug in jack 251 which opens the contacts of the jack. The circuit of relay 207 is now opened and causes the sender to restore to normal in a manner more particularly described hereinafter and removes resistance 200 and battery from test conductor 113 thereby causing the sender to test busy. Should the attendant obtain a response to the effect that the subscriber has dialed the code, then he knows that the sender is in trouble and will take it out of service in the manner described above, at the same time requesting the subscriber to restore his receiver and try again, which operation will cause the line switch circuit of Fig. 1 to operate and seize another idle sender.

The time interval between successive steps of the switch brushes is determined, of course, by the releasing times of relays 518 and 519. This time interval may be changed by reducing or increasing the number of relays such as 518 and 519, or by any other suitable means so that the overall time taken from the instant the sender is seized to the time lamp 526 is lighted may be of any value sufficient to permit the sender to complete all its operations.

Seizure of the connector

When relay 514 operates a circuit is closed from ground on its bottom contacts, conductor 552, winding of relay 522 to battery. Relay 522 operates and closes a circuit from battery on the bottom outer back contacts of relay 541, top normally made contacts of relay 542, contacts of relay 522, top normally made contacts of relay 520, conductor 530, conductor 800, winding of relay 801 in the sender connector to ground. Now the sender connector, shown in Figs. 7 and 8, comprises a common cut-through channel for a group of senders having access to the channel through the medium of multi-contact relays. By the operation of the multi-contact relay individual to the sender seeking access to the channel, each group of conductors connected to the contacts of the multi-contact relay is connected to a conductor of a group of common conductors of the channel. Only one such connection can be made at a time; otherwise two senders would be connected in multiple. Consequently, when relay 801 of the sender seeking access to the connector is operated as described, the multi-contact relay controlled by relay 801 is or is not operated depending upon whether any other sender is connected to the connector channel at the time. Accordingly, if the channel is free from operative association with any other sender, a circuit is

closed from ground on the back contacts of relay 801' which is the same as relay 801 except that it forms a part of the circuit of the last sender in the group having access to the channel, through the back contacts of similar relays of intermediate senders, front contacts of relay 801, which is assumed to be a part of the circuit of the first sender having and seeking access to the channel, conductor 811, winding of multi-contact relay 700, to battery. If, on the other hand, another intermediate sender is at the time connected to the channel, the series chain circuit traced above would not have been closed as it would have been opened at the back contacts of the associated intermediate relay, like relay 801. In such an event, the sender seeking access to the channel is delayed until the intermediate sender will have released. The delay, however, is not consequential since, as explained hereinafter, the time during which a sender is connected to a channel is small, being about a fraction of a second. It will be noted that the operating ground for all other relays like 801 and 801' is carried through the bottom back contacts of relay 801 so that when relay 801 has operated, the operating ground for all other relays in the chain is cut off. Consequently so long as relay 801 is unoperated, all of the senders in the channel except the first can simultaneously operate their respective relays 801, but only one of them, that is, the one lowest in the preference chain, closes the circuit of its associated multi-contact relay; all the other relays remaining energized but not closing the circuit of their respective multi-contact relays until each of the previous ones in the chain has released.

Multi-contact relay 700 operates and closes its contacts with the common channel conductors. To one of these contacts, namely contact 03, is wired conductor 530, and, by the operation of relay 700, this conductor is extended to conductor 701, thereby extending the battery on conductor 530 to the terminal marked A in Fig. 8.

As already stated, the connector circuit is simply a connecting medium for the purpose of temporarily connecting a sender to a decoder. Since the sender has recorded on a group of relays the stock code registration and the decoder has the circuit means of translating this registration into circuit conditions which can be transmitted back into the sender and thereafter used by the telegraphophone to convey the desired information to the subscriber, the function of the connector is to establish various circuit paths through which the registration in the sender can be transferred into the decoder and the translated information transmitted into the sender. The decoder and sender are then disconnected from one another and the decoder may then be utilized by some other sender for the performance of a similar function.

The connector, shown in Figs. 7 and 8, shows but one channel with its associated group of control circuits. In the actual operation of the invention, however, the connector may comprise as many channels as are necessary to accommodate the total number of senders available to the subscribers. Not all of the senders could be arranged on one channel because all of the senders in a channel are connected in a preference chain of access through their respective relays 801. Since accessibility to the channel is by one sender at a time and each of the other senders must wait until the previous one disconnects, it is evident that if more than a predetermined

number of senders were placed on one channel, those in the more remote preferences would be delayed a considerable period before gaining access to the channel. It is easy to see that even if this limitation did not result in congestion, there would be the more serious obstacle of overcoming the condition wherein, with heavy traffic, some of the senders would be excluded altogether from accessibility to the channel since the senders in the earlier preference will have discharged their respective calls, obtained others and re-established connections to the channel again before the senders in the remote preference will have obtained an opportunity to connect with the channel. The practical limit of the number of senders which can obtain accessibility to a decoder over one channel is governed by the number in which the sender of the most remote preference can obtain accessibility to the channel within the time it takes the sender of the earliest preference to obtain one connection to the channel, complete its functions and obtain thereafter another stock registration. Since the time in which a sender is operatively connected to the channel is relatively small, the number can be roughly computed by dividing the time taken by a sender to function with the channel, discharge and re-register, with the holding time of the sender to the channel. When the total number of senders is greater than this number, additional channels like Fig. 7 and the associated control circuits can be added.

The decoder or decoders, when more than one is used, are accessible to each channel. In Fig. 7, multi-contact relays 702 and 702' each represent a decoder, two of them, the first and last, being shown in the drawings. The contacts of these relays are connected to various circuit elements of the decoder, shown in detail in Figs. 9 to 15, inclusive. If there is more than one channel, these conductors are multiplied to the corresponding multi-contact relays, similar to relay 702, of the same decoder in the other channels. As in the case of the senders where each sender has a definite preference of accessibility to a channel, likewise each decoder, where more than one channel is involved, has a definite preference of connection to each of the channels. Since a decoder can be operatively connected to but one channel at a time, a certain preference or order is given a decoder in the case of simultaneous calls in each channel. The preference chain lock-out circuit of the decoder comprises a relay 802 for each channel to which the decoder has access and the manner of determining the order of preference is by connecting together for each decoder terminal A with terminal B in the channel for which the decoder is to be first preference. In each decoder the conductor wire to terminal A may be cross-connected to terminal B in any other channel so as to give the decoder so cross-connected first preference to that channel. In this manner the preferences of the decoders may be distributed amongst all channels. For example, if there were, say, three decoders and 15 channels, the first decoder may be cross-connected to terminal B in the last or channel 15, giving this decoder first choice preference to channel 15, the second decoder could be cross-connected to terminal B of channel 10, giving the second decoder first choice preference to this channel, while the first decoder could be cross-connected to terminal B in channel 5, giving the first decoder first choice preference to this channel. Should there now be three simul-

taneous calls from three senders, each located respectively in the 15th, 10th and 5th channels, each of these senders would immediately be connected to a decoder. For other than simultaneous calls, of course, a sender would be connected to the first idle decoder available in its channel regardless of the vertical preference of the decoder. In Fig. 8, the connecting circuit for each of the two decoders is shown in full for the first channel only and diagrammatically illustrated for the last channel. In Fig. 7 the conductors connected to the multi-contact relay of the last decoder only are shown extending into the decoder proper, the first decoder being only diagrammatically represented by its multi-contact relay.

Referring back to the operation of the circuit, it will be recalled that when multi-contact relay 700 operated, indicating the condition wherein the associated sender is to be connected to a decoder, battery was extended to conductor 701. A circuit is now completed to relay 802' of the first idle decoder available in the channel. If we were to assume that the first decoder is idle, then the circuit is traced from battery on conductor 701, terminal A, terminal B, top back contacts of relay 803', winding of relay 802' to ground. Relay 802 operates in this circuit. Since, however, the drawings show only the last decoder having its multi-contact relay contacts connected to the decoder proper, it will be assumed that all decoders except the last are busy in other channels. Under such circumstances relay 803' of each busy decoder is operated in every channel except the one to which the associated decoder is connected as described hereinafter, and, instead of the circuit above described being completed to relay 802', it is completed to relay 802 of the last decoder. This circuit is traced as follows: Battery on conductor 701, terminal A, terminal B, top front contacts of relay 803', through the front contacts of other relays identical to relay 803' of the other busy decoders, top back contacts of relay 803, winding of relay 802, to ground. Relay 802 operates and closes a circuit for operating multi-contact relay 702 from ground on the front contacts of relay 802, conductor 815, winding of relay 702, to battery. Relay 702 closes its contacts to the connector channel conductors. A circuit is now completed from ground on conductor 703, contact 01 of multi-contact relay 702, conductor 704, winding of relay 807 and winding of relay 808 to battery. Both of these relays operate. Now relays 807 and 808 close circuits to operate relay 803 in every other channel except the one in which the decoder has been connected to the channel by the operation of relay 702 for that channel, there being one relay 702 and one relay 803 in each channel to which the decoder can be connected. If it is assumed, to illustrate the operation of the circuit, that the channel shown in Fig. 7 is not the one to which the decoder has been connected by the operations described above, then the operation of relay 807 closes a circuit from ground on conductor 810, top innermost contacts of relay 807, conductor 809, back contacts of the transfer contact 02 of relay 702 in the assumed unoperated channel, conductor 705, top winding of relay 803 in said channel, to battery. Similar circuits are likewise closed over the other conductors connected to the other contacts of relays 807 and 808 to different relays 803 in the various channels. The operation of these relays in these channels serves to protect the decoder against

seizure by transferring the start circuit of relay 802 to other decoders.

In the channel in which the decoder has been connected by the operation of relay 702, the circuit for relay 803 has been opened by the operation of relay 702 and the consequent breaking of contact 02, so that relay 803 does not operate. There is, however, no possibility of any other sender in this channel seizing the decoder just taken into use or any idle decoder, because the sender now connected to the channel and to the decoder maintains battery on conductor 701 and the unoperated condition of relay 803 causes the circuit for relay 802 to be maintained without any possibility of advancing conductor 701 to the circuit of any other relay like 802 of any idle decoder in the same channel.

Should it become necessary, for maintenance reasons, to take a decoder out of service, relay 811 is operated by connecting the ground on the ring of jack 812 to the sleeve of said jack. Relay 811 causes the operation of relays 807 and 808 and these relays in turn operate relay 803 in every channel as previously described.

Returning, now, to the operation of the decoder, as soon as relay 702 operates, a circuit is closed from ground on channel conductor 708, contact 04, conductor 1101, winding of relay 1100 to battery. Relay 1100 operates and closes its top contacts to an alarm circuit which measures the time interval during which the decoder is held busy by a sender, and otherwise causes the disconnection of the decoder as more fully described hereinafter. This alarm circuit is not shown as it forms no part of this invention but is the same as the decoder time alarm circuit of the decoder disclosed in the application of Raymond-Scully, referred to above.

The first operation which takes place between the decoder and the sender as soon as the decoder is connected to the sender through the connector, is the transmission into the decoder of the equivalent of the stock code record contained in the register relays of the sender. In order to simplify the illustration of the manner in which the decoder receives the record as well as the rest of the operations of both the sender and decoder, it will be assumed that the code to be translated by the decoder is the same as that assumed to have been dialed by the subscriber, that is 492. In accordance with the sender registration operations described above, digit 4 is registered by the operation and locking of relay 225, digit 9 by the operation and locking of relays 506 and 508, and the digit 2 by the operation and locking of relay 511. When, therefore, the relays 700 and 702 are operated and their respective contacts make with the common channel conductors, the following circuits are closed between the sender and decoder: The first circuit is from ground on the bottom front contacts of relay 225, conductor 237, contact 20 of multi-contact relay 700, channel conductor 737, contact 20 of multi-contact relay 702, conductor 1137, winding of relay 1400 of the first digit register, to battery. Relay 1400 operates. Another circuit is closed from ground on the bottom front contacts of relay 506, conductor 532, contact 15 of multi-contact relay 700, common channel conductor 732, corresponding contact 15 of relay 702, conductor 1132, winding of relay 1408 of the second digit register, to battery. Relay 1408 operates. Still another circuit is closed from ground on the bottom front contacts of relay 508, conductor 533, contact 17 of multi-con-

tact relay 700, common channel conductor 733, corresponding contact 17 of multi-contact relay 702, conductor 1133, winding of relay 1403 of the second digit register to battery. Relay 1403 operates. Yet another circuit is closed from ground on the bottom front contacts of relay 512, conductor 534, contact 11 of multi-contact relay 700, conductor 734, corresponding contact 11 of relay 702, conductor 1134, winding of relay 1410 of the third digit register, to battery. Relay 1410 operates.

With the operation of relays 1400, 1403, 1408 and 1410 in the digit register circuits of the decoder from operated contacts of those register relays in the sender which responded to dial impulses, the stock code record is registered in the decoder. The other relays in the first, second and third digit registers are used for registering other digits of which the code may be composed.

In the meanwhile and during the time that the above mentioned relays are operating through their respective circuits, a ground is connected to conductor 538 which may be traced from ground on the bottom back contacts of relay 1412, top normally made contacts of relay 1413, conductor 1438, contact 05 of multi-contact relay 702, common channel conductor 738, contact 05, of multi-contact relay 700 to conductor 538. This conductor is, in turn, connected to the bottom back contacts of all the register relays in the sender through the branch conductors 539, 546 and 246. It will be found on inspection of the relays of this register that the armatures making with these back contacts, like the armatures of relays 225, 505, 506 and 508 are all traceable to battery paths through the windings of the register relays of the decoder in Fig. 14 in the following order:

First register

Armature of relay 217—winding of relay 1421
Armature of relay 221—winding of relay 1405
Armature of relay 225—winding of relay 1400
Armature of relay 229—winding of relay 1406
Armature of relay 233—winding of relay 1407

Second register

Armature of relay 504—winding of relay 1423
Armature of relay 505—winding of relay 1401
Armature of relay 506—winding of relay 1408
Armature of relay 507—winding of relay 1402
Armature of relay 508—winding of relay 1403

Third register

Armature of relay 509—winding of relay 1424
Armature of relay 510—winding of relay 1409
Armature of relay 511—winding of relay 1404
Armature of relay 512—winding of relay 1410
Armature of relay 513—winding of relay 1411

It is evident, therefore, that as soon as the sender and decoder are connected together through the medium of the connector channel, not only relays 1400, 1408, 1403, and 1410 will have operated from ground on the bottom front contacts of the operated register relays of the sender, but all the other relays in the decoder digit registers will also operate over circuits traceable to the ground on conductor 538 and extending to the winding of each of the relays in the decoder register through the bottom back contacts of all the register relays in the sender which were not operated by the dial impulses. All of the decoder digit register relays, shown in Fig. 14, will operate, therefore, either from the front contacts of the operated register relays or

from the back contacts of the unoperated register relays in the sender. A path is now closed from battery through the lower winding of relay 1413, top inner front contacts of the digit register relays viz., 1421, 1405, 1406, 1400, 1407, 1423, 1401, 1402, 1408, lower front contact of relay 1403, top inner front contacts of relays 1424, 1409, 1410, 1404 and the lower front contact of relay 1411, conductor 1414, contact 23 of multi-contact relay 702, common channel conductor 714, to ground on contact 23 of relay 700. Relay 1413 operates in this circuit, breaks the path of the ground on conductor 1438 thereby causing all the digit register relays operated from circuits controlled by this ground to release, locks over its top winding and contacts to ground on conductor 1414, and, through its bottom operating winding and bottom contacts closes a series circuit through the winding of relay 1412 to ground on conductor 1414. Relay 1412 will remain short-circuited, however, until at least one of the register relays operated from ground on conductor 1438 has released and, when this happens, the short-circuit is removed and relay 1412 operates.

The operation test of relay 1413 is made through all of the operated contacts of the digit register relays of the decoder in order to ascertain the continuity of all conductors between the sender and the decoder through which a registration in the sender is transmitted into the decoder. It is important that the correct registration be transmitted into the decoder without any possibility of falsifying the code record due to any trouble condition in the decoder; otherwise there would be no assurance that the information transmitted back to the subscriber, as described hereinafter, is the information corresponding to the code originally dialed by him. If any of the conductors should be open, for example, then relay 1413 would not operate and the decoder would function no further. In such an event the time alarm circuit which started functioning when relay 1109 operated, counts off, by any suitable means, a prescribed time interval measuring the period allowed to the decoder for completely operating in cooperation with a sender. If, prior to the expiration of this time, the decoder has not released and returned to normal, said time alarm circuit grounds conductor 1425 and thereby causes the operation of relay 1422. A circuit is now completed from ground on the contacts of relay 1422, conductor 1440, contact 07 of multi-contact relay 702, common channel conductor 740, contact 07 of multi-contact relay 700, conductor 540, top back contacts of relay 541, winding of relay 542, resistance 543 to battery. Relay 542 operates and, in opening its top inner contacts, removes battery from conductor 530, thereby releasing relay 801. Relay 801 causes the release of multi-contact relay 700 and the release of relay 700 opens the circuit of relay 802. The release of relay 802 causes the release of multi-contact relay 702. With the release of multi-contact relays 700 and 702 the sender is disconnected from the decoder. The decoder, however, does not restore to normal. Conductor 1440 is multipled to conductor 716 and the trouble release ground on conductor 1440 extends to conductor 716 and causes the operation of relay 811. Relay 811 now causes the operation of relays 807 and 808 and these relays, in turn, cause the operation of a relay, such as relay 803, in every channel to which the decoder has access, in the manner already described. Thus the defective decoder is prevented from translating a registered

code if the check test fails and the decoder is kept out of service by the ground on conductor 1440 until the time alarm circuit is restored to normal in the manner fully described in the application of Raymond-Scully mentioned above.

In the meanwhile, the operation of relay 542 causes a circuit to be closed from ground on conductor 240, top outer contact of relay 542, top winding of relay 541, winding of relay 542, resistance 543 to battery. Relay 541 operates in series with the winding of relay 542 and locks over its lower winding and bottom inner contacts to ground on conductor 240. With the operation of relay 541 battery is again extended to conductor 530 over the following path: Battery through the bottom outer front contacts of relay 541, bottom contacts of relay 542, contacts of relay 522, top normally made contacts of relay 520 to conductor 530. Ground on conductor 530 reestablishes the circuit of relay 801 and the previously described operations now take place for connecting the sender to another decoder since the decoder to which it was previously connected is held busy as already described. In this manner the sender is given the benefit of a second trial, that is, a new trial with another decoder if the first one to which it was connected is found defective on test.

If the decoder, instead of having an open register conductor, were to have one of said conductors grounded, the sender would again be disconnected from the decoder in trouble and operate for a second trial. Under such circumstances when relay 1412 operates, it removes ground from the check conductor 1438. The register relays in the decoder which were operated from circuits established by ground on this conductor through the back contacts of the unoperated relays in the sender now do not release. For, under the assumed condition of a trouble ground on one of the connecting conductors, the removal of ground from conductor 1438 will not disturb the circuit of the relays operated from circuits controlled over conductor 1438 since the ground on the assumed conductor in trouble would back up through the back contacts of the unoperated relays and cause the digit register relays to remain operated. Under such circumstances none of the digit register relays will release and consequently relay 1412, instead of operating, will remain short-circuited by ground on conductor 1414 on one side of its winding and the same ground on the other side carried through the bottom contacts of relay 1413 and the previously traced path through the operated contacts of all the register relays. With the failure to operate relay 1412 the further operations of the decoder are stopped and when the proper time interval has elapsed, relay 1422 operates as previously described to dismiss the decoder and cause the sender to take a second trial with another decoder.

Assuming, however, that no trouble conditions exist, that all of the relays in the decoder digit registers have operated, then the operation of relay 1413, as already described, removes ground from conductor 1438 and hence from conductor 538. All the relays in the decoder register which were operated from the unoperated register relays of the sender will release and the only ones remaining operated are those whose circuits are controlled from the bottom front contacts of the operated register relays in the sender, that is, those representing the code dialed by the subscriber. A circuit is now closed from ground on the top inner front contacts of relay 1412, con-

ductor 1415, bottom back contacts of relay 1407, bottom front contacts of relay 1400, conductor 1416, winding 1504 of multi-contact relay H—4 to battery. Multi-contact relay H—4 operates.

- 5 Fig. 15 shows five multi-contact relays of a group of ten such relays, each relay representing the one of the ten digits which may comprise the first digit of the code. The multi-contact relays have been termed H—0 . . . H—9 in order to indicate schematically which hundreds code digit the particular relay represents. Each of these relays carries 100 contacts and when a relay operates, these contacts engage a group of common conductors. Since the hundreds digit of the assumed dialed code is 4, the operation of relay 1400 in the decoder corresponding to this digit controls the operating circuit of relay H—4. On the other hand had the digit been any number other than 4, the operation of the proper ones of 20 relays 1405, 1406, 1408 and 1407 would have caused a circuit to be closed to whichever multi-contact relay in the group H—0 . . . H—9 would correspond to the digit.

- The entire group of 100 common conductors with which the contacts of multi-contact relays engage when one of these relays operates, is further divided into ten groups of ten conductors each, and each conductor of a group is connected to an armature of one of a group of ten relays, 30 two of which are shown in detail in Fig. 13. The armature contacts of relay 1309 are connected to the conductors of the ninth group of common conductors while the armature contacts of relay 1308 are connected to the zero group of common conductors. The intermediate relays with their connecting conductors are simply indicated as it is thought that two such relays will be sufficient to illustrate the rest since each group is connected to the armatures of its corresponding relay 40 in exactly the same way.

- To each separate contact of the 100 contacts of each multi-contact relay H—0 . . . H—9 is connected a relay such as relay 1000 in Fig. 10 and each such relay represents the translation of a code. Consequently, for a code combination of three digits, with each digit being any numeral from 0 to 9, the multi-contact relay arrangement of Fig. 15 could be made to provide for 10,000 possible translations. The winding of each translating relay is connected through a conductor such as 1510, to a contact of the multi-contact relay controlling all the codes having the same first digit, and more particularly to a contact making with a common conductor in the group of ten 50 common conductors having the same numerical designation as the second digit of the code. The actual contact in this group to which conductor 1510 is connected corresponds, numerically, to the third digit of the code. Thus in the code used for illustration, namely, 492, conductor 1510 of the translating relay 1000 would be connected to a contact in the group of contacts of relay H—4 which would engage the ninth group of common conductors and, specifically, to the second contact of the group. In other words, if each multi-contact relay carries 100 contacts and each contact were to be numbered consecutively, from 1 to 100, conductor 1510 would be connected to the ninety-second consecutive contact. In actual practice, 70 and assuming a full capacity of 10,000 codes, there would be 100 conductors like 1510 for each of the ten multi-contact relays or 10,000 conductors in all, and there would be a separate relay such as translating relay 1000 for each conductor.

- 75 The entire object of the translation, therefore,

is the selection and operation of some code translating relay, like relay 1000, which corresponds to the code dialed. Through the contacts of each of these translating relays, any information which the corresponding code represents, may be electrically controlled as more particularly described hereinafter. It will be remembered that the second or tens digit of the code is 9 and that such a digit resulted in the operation of relays 1408 and 1403 in the decoder second digit register. Consequently a circuit is closed from ground on the top contacts of relay 1412, top front contacts of relay 1403, bottom outer back contacts of relay 1401, top outer front contacts of relay 1408, conductor 1417, winding of relay 1309 to battery. Relay 1309 operates. The last digit of the code is 2 and results in the operation of relay 1410 in the decoder third digit register. Consequently, as soon as multi-contact relay H—4 and relay 1309 have operated, another circuit is completed from ground on the bottom front contacts of relay 1412, top back contacts of relay 1411, bottom back contacts of relay 1404, bottom inner front contacts of relay 1410, top outer back contacts of relay 1409, conductor 1418, No. 2 contact set of relay 1309, conductor 1301, contact No. 92 of relay H—4, conductor 1510 connected to contact No. 92 of relay H—4, winding of relay 1000, resistance 1001, conductor 1002, winding of relay 1419 to battery. Relay 1000 operates in this circuit, but relay 1419, 30 being marginal, does not.

It is seen, therefore, that the entire code of three digits is reduced to the operation of a relay individual to the code and that this is brought about first by the selection and operation of a multi-contact relay representing the first digit of the code; secondly by partly closing through the paths of a tens subdivision of ten conductors of the entire group of 100 conductors with which the contacts of said multi-contact relay make when operated and which tens subdivision represents the second or tens digit; and finally by the operation of the code relay itself through the path determined by the units digit setting of the decoder third digit register.

As already mentioned, there is one code translating relay like relay 1000 for each separate code or item of information which may be transmitted to a calling line, and this information is electrically controlled through the contacts of each of the said relays. In the present embodiment of the invention, which is adapted for use in transmitting the sale quotation of stocks traded in the stock exchange, a code translating relay like 1000 represents some particular stock and the information to be transmitted to a subscriber must necessarily be controlled through its contacts from that post on the stock exchange floor where the stock is bought and sold. At each post, therefore, there are provided for each stock traded thereat, four rows of mechanically locking keys, well known in the telephone art, with a pilot lamp for each key, as shown in Fig. 4. Each of three rows of keys has ten individual keys, one for each of the ten digits, while the fourth row contains but 8 keys, one for each $\frac{1}{2}$ and also one for zero. As the sales of each stock are reported to the post attendant the hundreds, tens, units and fraction keys of the stock key-set representing the quotation are depressed. Since the keys are mechanically locking, the registration will be preserved until it is changed to conform with the registration of a subsequent sale differing from the one already registered therein.

It will be noted that the present embodiment

of the invention is arranged for the registration and transmission of one quotation only, that is, the actual sale quotation, and therefore one stock key-set for each stock is provided. As will be evident from the further description of the operation of the invention, it is not so limited and may be expanded to include the registration and transmission of the "bid" and "asked" prices as well as the name or abbreviation of the stock. In such a case three key-sets for each stock will be necessary at the post where the stocks are bought and sold while the name of the stock may be controlled by the code relay as more particularly described hereinafter.

It will be supposed in this description, in accordance with the present embodiment of the invention, that Fig. 4 represents the key-set of a particular stock and that the record of the last sale in that stock is 174 $\frac{7}{8}$. In such a case, keys 400, 401, 402 and 403 are depressed and the lamps whose obvious circuits are closed by the depression of said keys are lighted to indicate the quotation of the last sale depressed on the keys. Since the keys are mechanically locking, the registration will remain until changed by the depression of a different key in each row.

When relay 1000, which in the description of the operation of the system responds to the dial code 492, operates, a group of circuits will be closed as follows: Ground on the top No. 2 contacts of relay 1000, conductor 1003, left contacts of key 400, conductor 404, winding of relay 900, conductor 901, winding of relay 1023 to battery. Relay 900 operates, but relay 1023, being marginal, does not operate at this time. Another circuit is closed from ground on the top No. 1 contacts of relay 1000, conductor 1004, left contacts of key 401, conductor 405, winding of relay 1009, conductor 1008, winding of relay 1007, to battery. Relay 1009 operates in this circuit but relay 1007, being marginal, does not. Another circuit is likewise closed from ground on the bottom No. 1 contacts of relay 1000, conductor 1005, left contacts of key 402, conductor 406, winding of relay 1106, conductor 1115, winding of relay 1200, to battery. Relay 1106 operates in this circuit but relay 1200, being marginal, does not. Finally another circuit is closed from ground on the bottom No. 2 contacts of relay 1000, conductor 1006, left contacts of key 403, conductor 407, upper winding of relay 1111, conductor 1114, winding of relay 1201, winding of relay 1210 to battery. Both relays 1111 and 1201 operate in this circuit, but relay 1210, being marginal, does not.

Thus as soon as relay 1000 operates, the sale registration on the stock key-set is immediately registered on a group of relays in the decoder through the particular translating relay individual to the stock code. In accordance with the other requirements which may be necessary when the "bid" and "asked" prices as well as the actual sale price are to be transmitted, there will be as many additional sets of contacts on relay 1000 as will be necessary to close circuits from the added "bid" and "asked" key-sets, that is, eight other circuits to eight additional decoding register circuits, identical to those shown in Figs. 9, 10, 11 and 12.

The manner of registering the stock sale information as described above represents but one of a variety of ways by which such an object can be accomplished, all of which are well known to the automatic telephone art. For example, it would be obvious to one skilled in the art to modify the circuit to have but one common group

of numerical keys for all the stocks traded at one post and an individual key for each stock. Under such circumstances, however, it would be necessary to have a storing register for each stock which is operatively attached to the trading post by circuits and apparatus responsive to the operation of the individual stock key. According to Fig. 16-B in such a case, the decoder can be modified by the addition of a register selector to the decoder so that upon the operation of relay 1000, the selectors would hunt for the particular register containing the record of the "bid", "asked" and sale quotation of the stock corresponding to relay 1000. An example of such register is shown in Patent No. 1,513,362 granted to L. M. Allen, October 28, 1924. It is thought, however, that a simple group of keys for each stock is the more economical and expeditious, but in either event, I do not wish to be understood as confining the invention to the keys only, but also to include any means well known to the telephone art for locking on electrical registers the registration of a number, a group of numbers, or their equivalent with means in the decoder for selecting any one of said electrical registers.

The operation of relay 900 closes a circuit from ground through the winding of relay 1010, conductor 1011, top front contacts of relay 900, bottom outer back contacts of relay 903, bottom 30 outer back contacts of relay 904, conductor 905, top back contacts of relay 1012, conductor 1013, contact 39 on multi-contact relay 702, common channel conductor 709, contact 39 on multi-contact relay 700, conductor 600, right winding of relay 601 to battery. Relay 601 operates in this circuit and partly closes a locking circuit over its left winding and contacts, conductor 602, to the top front contacts of relay 520. Relay 520, however, is not operated at this time, so that relay 601 holds operated over its energizing circuit as long as the decoder is connected to the sender. Relay 1010 also operates in the above traced circuit.

The operation of relay 1009 causes a circuit to be closed from ground through the winding of relay 1014, top front contacts of relay 1009, top back contacts of relay 1015, top back contacts of relay 1016, conductor 1017, contact 32 of multi-contact relay 702, channel conductor 710, contact 32 of multi-contact relay 700, conductor 603, right winding of relay 604, to battery. Relays 604 and 1014 operate in this circuit and relay 604 partially prepares a locking circuit for itself through its left winding and contacts to conductor 602. Another path is also closed from ground through the winding of relay 1018, bottom outer front contacts of relay 1009, bottom back contacts of relay 1015, conductor 1019, contact 34 of multi-contact relay 702, common channel conductor 711, contact 34 of multi-contact relay 700, conductor 605, right winding of relay 606, to battery. Relays 606 and 1818 operate in this circuit, the former preparing a locking path for itself through its left winding and contacts to conductor 602. Still another circuit is closed from ground through the winding of relay 1202, conductor 1203, top front contacts of relay 1106, bottom back contacts of relay 1104, conductor 1205, contact 29 of multi-contact relay 702, common channel conductor 712, contact 29 of multi-contact relay 700, conductor 607, right winding of relay 608, to battery. Both relays 608 and 1202 operate in this circuit, the former preparing a locking path for itself through its left wind-

ing and contacts to conductor 602. Yet another circuit is closed from ground through the winding of relay 1206, conductor 1207, top front contacts of relay 1111, top back contacts of relay 1112, conductor 1117, contact 26 of multi-contact relay 702, common channel conductor 713, contact 26 of multi-contact relay 700, conductor 609, right winding of relay 610 to battery. Both relays 610 and 1206 operate in this circuit, the former preparing a locking path for itself through its left winding and contacts to conductor 602. Finally another circuit is closed from ground through the winding of relay 1208, front contacts of relay 1201, conductor 1209, contact 24 on multi-contact relay 702, common channel conductor 715, contact 24 on multi-contact relay 700, conductor 611, right winding of relay 612, to battery. Both relays 612 and 1208 operate in this circuit, the former preparing a locking circuit for itself through its left winding and contacts to conductor 602.

In the operation of relays 601, 604, 606, 608, 610 and 612 the decoder has transmitted back into the sender the equivalent of the sale price of the requested stock as recorded on the stock key-set.

It will be remembered that in tracing the paths of the various circuits through the stock key-set, mention was made of the fact that relays 1023, 1007, 1200 and 1210, while each formed a part of a separate series circuit with its appropriate relays, nevertheless were marginal and did not operate. These relays are guard relays and are intended to serve the purpose of preventing the decoder, as far as possible, from transmitting back into the sender any information different from what is intended to be sent from the operation of the proper relay in each of the key registers shown in Figs. 9, 10, 11 and 12. One such relay in each of the hundreds, tens, units and fractions register is to operate for each registration and when this occurs, each of the marginal relays is a part of the series circuit for operating such relay and the said marginal relays do not operate. However, should there be some trouble condition in the decoder, for example, a ground on the other side of the winding of any of the relays in any of said registers, then, when the above mentioned register relay circuit is closed through the appropriate key of the stock key-set, there will be two such relays operated in parallel to each other and in series with the winding of the guard marginal relay. The quantity of current flowing through the circuit is now sufficient to operate the particular marginal relay affected. As an illustration, relay 900 in the hundreds register was described to operate in series with relay 1023 at which time relay 1023 did not operate. Suppose, however, that at the time the above traced circuit is closed, a trouble ground exists on the left terminal of the winding of relay 906, or anywhere along conductor 907. Under such circumstances, relays 900 and 906 would be connected in parallel to conductor 901 in series with relay 1023. Relay 1023 now gets sufficient current, operates and connects ground to conductor 1020 to which the alternate contact of each of the other marginal relays is also connected, and causes the operation of relay 1420. Relay 1420 closes its contacts and causes the time alarm to connect ground to conductor 1425 thereby operating relay 1422. Relay 1422 closes a previously described circuit from ground on its contacts over conductor 1440 to operate relay 542. Relay 542 operates and causes the release

of the decoder and a subsequent second trial by the sender in the manner described.

It is now apparent why the locking circuit of the register or "memory" relays in the sender and operating from circuits controlled by the key register relays were not locked as soon as operated. The translated record may be false as a result of a trouble condition and, in the event that the sender is to have a second trial, the translated record made by the defective decoder must be cancelled. At the time, therefore, the sender is disconnected from the decoder as a result of a trouble condition, relays such as 601, 606, 604, etc., will release and when the sender is again connected to another decoder a new record will be set up.

Assuming that none of the guard marginal relays operate, then as soon as the key registers of the decoder operate the corresponding "memory" relays in the sender, a circuit is closed from ground on the bottom contacts of relay 900, conductor 902, contacts of relay 1010, conductor 1021, bottom inner contacts of relay 1009, contacts of relay 1018, contacts of relay 1014, conductor 1022, conductor 1116, bottom contacts of relay 1106, conductor 1119, contacts of relay 1202, conductor 1211, bottom contacts of relay 1111, conductor 1118, contacts of relay 1206, conductor 1212, front contacts of relay 1208, winding of relay 1213 to battery. Relay 1213 operates and connects ground to conductor 1216. A circuit path is now traced from ground on conductor 1216, contact 06 of multi-contact relay 702, common channel conductor 716, contact 06 of multi-contact relay 700, conductor 516, lower winding of relay 521, to battery. Relay 521 operates and, over its top contacts, closes a circuit from ground on conductor 240 to the winding of relay 520 causing this relay to operate. Relay 521 locks over its top winding to ground on conductor 240. Relay 520, on operating, opens its top inner contacts and disconnects battery from conductor 530, connects ground to conductor 602 thereby completing the locking circuit of the operated "memory" relays in Fig. 6, operated from the decoder as previously described, while on its bottom front contacts it partly closes a path from interrupter 349 which is mounted on the telegraphophone shaft shown in Fig. 3, to perform functions hereinafter described.

The disconnection of battery from conductor 530 opens the circuit of sender connector relay 801 and causes the release of circuits which disconnect the sender, connector and decoder from each other as previously described.

Reference was heretofore made to the fact that an interrupter path was completed from ground on interrupter 549 to the bottom front contacts of relay 520. When the ground from this interrupter is extended to the bottom armature of relay 520, this circuit path is extended over the top back contacts of relay 523, conductor 550, winding of relay 633 to battery. Relay 633 operates and establishes a locking path through the winding of relay 613, left contacts of relay 633, right outer back contacts of relay 615, conductor 552 to ground at the bottom contacts of relay 514. Relay 613, however does not operate in this locking circuit at this time, due to the presence of the operating ground for relay 612 being connected to the other side of its winding. Relay 633, over its left front contacts, closes a circuit from battery through the winding of relay 300, conductor 301, left front contacts of relay 633, right outer contacts of relay 615 to an afore-

traced ground on conductor 552. Relay 300 operates and locks over its right inner contacts, conductor 302, right outer contacts of relay 616, to ground on conductor 552. Relay 300 closes its 5 outer contacts and extends the line conductors to the telegraphophone machine, diagrammatically shown in Fig. 3.

The telegraphophone mechanism shown in Fig. 3 illustrates one form which such a mechanism may take and is connected in multiple to all the senders at the cross-connecting rack 321. It comprises a series of drums mounted on a shaft, said drum having opaque and partially transparent sections, the partly transparent sections being photographic records of the sound corresponding to the digits from zero to nine, the fractions from one eighth to seven eighths and the record of whatever other sounds that may be transmitted to a calling subscriber, such as, 20 for example, a record of the word "bid", that of the word "asked" and the record of stock name abbreviations such as ABC—XYZ, etc. The shaft also carries interrupter 349 shown in Fig. 3, and its interrupter contact is connected in multiple 25 to the bottom armature of relay 520 in each sender and performs a function which is described hereinafter. There is no limit to the number of drums which may be used; the limitation being governed exclusively by the number and diversification of oral pronouncements to be transmitted to the calling line. The light from a source, such as lamp 329, may be directed by any suitable means through the speech record to a photoelectric cell, such as 319, connected to one 35 side of a transformer, such as 330. The output currents from the transformer are amplified through amplifier units, such as 0, 1, 2, etc., and transmitted to the subscriber's line in the manner hereinafter described. The mechanism such as disclosed in Patent No. 1,645,573, patented 40 October 18, 1927, in the name of H. M. Bascom, may also be employed.

It will be recalled that the operation of relay 300 served to extend the calling line to the telegraphophone. This path may be traced as follows: Conductor 247, left contacts of relay 300, right back contacts of relay 303, right outer back contacts of relays 306 and 305, left outer back contacts of relay 307, back contacts of No. 20 50 contact set of relay 309, resistance 312 and one side of the amplifying unit 0, and other side of said amplifying unit, resistance 311, back contacts of No. 19 contact set of relay 309, right outer back contacts of relay 307, left outer back contacts of relays 305 and 306, left back contacts of relay 303, right outer contacts of relay 300 55 to conductor 248. The loop is completed through both secondary windings of repeating coil 241 in series with the connecting condenser. The talking circuit is inductively connected through the primary windings of said repeating coil over a previously described path including the top winding of relay 207 and the subscriber's substation apparatus. However, while the pronouncement 60 circuit to the line is closed to the telegraphophone as above described as soon as relay 300 operates, the above path is not necessarily closed to amplifier 0 but to whichever amplifier contains the sound record of the first number to be pronounced over the line which, in the case under 70 illustration, would be the hundreds digit of the stock quotation. Again, interrupter 349 is driven on the same shaft which carries the light sensitive sound records, as already noted, and its interrupter contact rides over a series of grounded

and insulating segments which, at the speed of the shaft, presents a grounded segment to the brush connecting with the armature of relay 520 during the interval when the light sensitive records are not exposed to their respective sources of illumination and an insulated or non-grounded segment a little before and during the time when they are so exposed. Consequently, when relay 633 operates from a circuit to ground on the interrupter 549, no pronouncement is possible over the 10 line, relay 613 remains short-circuited only during the period of no pronouncement. When, however, the speech surface of the record is rotated into position of exposure to the light, the interrupter advances to its insulating segment, the short-circuiting ground is removed thereby, relay 613 operates and locks in series with relay 633 to ground on conductor 552. A circuit is now closed from ground on the right contacts of relay 601, right inner contacts of relay 613, conductor 618, 20 winding of relay 304 to battery and in parallel therewith, winding of relay 307 to battery. Both relays 304 and 307 operate. Another circuit is closed from ground on conductor 552, right outer contacts of relay 613, conductor 619, winding of relay 523 to battery. Relay 523 operates, locks to ground on conductor 552 over its bottom contacts and, over its top contacts transfers the interrupter ground to the next group of cut-in relays 615 and 620 by way of conductor 551. In 30 the meanwhile the operation of relay 307 transfers the subscriber's loop circuit to amplifier No. 1 over the back contacts of the Nos. 17 and 18 contact sets of relay 309 and an oral pronouncement of the digit "one" is transmitted to the subscriber over the previously described circuits. The subscriber thus hears the pronouncement "one" as the hundreds digit of the stock quotation sale.

When the interrupter 349 next advances to a 40 grounded segment, that is, when the pronouncement period is over, a circuit is closed from ground on the interrupter contacts, top front contacts of relay 523, conductor 551, right front contacts of relay 633, winding of relay 620 to battery. Relay 620 operates, establishes a locking path for itself through the winding of relay 615 and left contacts of relay 620, right back contacts of relay 621, to ground on conductor 552. Relay 615, however, does not operate at this time, it being short-circuited by the operating ground for relay 615, above traced. When the interrupter advances to an insulating segment, however, the short circuit is removed and relay 615 operates and locks in series with relay 620. 55 Relay 615 opens its right back contacts and causes the release of relays 613 and 633 whose locking circuit is controlled through the said back contacts. The release of relay 613 opens the circuits of relays 304 and 307 causing these relays to release. In the meanwhile the operation of relay 615 causes circuits to be closed from ground at the right contacts of relay 606, left inner contacts of relay 615, conductor 626, winding of relay 308 to battery and in parallel therewith, winding of relay 305 to battery. Relays 305 60 and 308 operate. Also another circuit is closed from ground at the right contacts of relay 604, left outer contacts of relay 615, conductor 627, winding of relay 303 to battery. Relay 303 operates and in conjunction with relays 305 and 308, both operated, causes the pronouncement circuit of the tens digit to be closed from conductor 248 and right outer contacts of relay 300, left front contacts of relay 303, left back contacts of relay 75

304, left inner back contacts of relay 306, left front contacts of relay 308, No. 6 back contacts of relay 309, resistance 315 through the amplifier "7", resistance 316, No. 5 back contacts of relay 309, right front contacts of relay 308, right inner back contacts of relay 306, right back contacts of relay 304, right front contacts of relay 303, left contacts of relay 300, to conductor 247. Through the loops previously described, the subscriber now hears the oral pronouncement of the tens digit "7" of the stock quotation.

At the next closure of the interrupter 349, a circuit is closed from ground on the top front contacts of relay 623, conductor 551, right back contacts of relay 633, right front contacts of relay 620, winding of relay 622 to battery. Relay 622 operates and establishes a locking circuit for itself through the winding of relay 621, left contacts of relay 622, right back contacts of relay 623 to ground on conductor 552. Relay 621, however, does not operate at this time due to the presence of the operating ground for relay 622 from the interrupter 349 on one side of its winding. When the interrupter opens its contact, the shunt is removed and relay 621 operates and locks in series with relay 622 over the above traced circuit. The operation of relay 621 opens, at its right back contacts, the locking circuit of relays 615 and 620 and these relays release. The release of relay 615 releases relays 303, 305 and 308. In the meanwhile the operation of relay 621 closes a circuit from ground on the right contacts of relay 608, left middle contacts of relay 621, conductor 628, winding of relay 306 to battery. Relay 306 operates and causes the pronouncement circuit of the units digit to be closed in part from conductor 248 previously traced to the right outer contacts of relay 300, left back contacts of relay 303, left outer front contacts of relay 306, back contacts of No. 11 contact set of relay 309, resistance 317, through the amplifier No. 4, resistance 318, back contacts of No. 12 contact set of relay 309, right outer front contacts of relay 306, right back contacts of relay 303, left contacts of relay 300, conductor 247 and closed loop through repeating coil 241, previously traced. The subscriber now hears the oral pronouncement of the digit "4" of the desired stock quotation.

At the next closure of the interrupter 349 a circuit is closed from ground on the top front contacts of relay 623, conductor 551, right back contacts of relay 633, right back contacts of relay 620, right front contacts of relay 622, winding of relay 624 to battery. Relay 624 operates and closes a locking circuit for itself through the winding of relay 623, left contacts of relay 624, left contacts of relay 616 to ground on conductor 605. Relay 623, however, does not operate at this time due to the presence of the operating ground for relay 624 from the interrupter to one side of its winding. When the interrupter opens its contacts, the short circuit is removed and relay 623 operates and locks in series with relay 624 over the aforetraced circuit. The operation of relay 623 opens the locking circuit of relays 621 and 622 and causes them to release. The release of relay 621 opens the circuit of relay 306 which also releases. In the meanwhile a circuit is closed from ground on the left outer contacts of relay 623, conductor 629, winding of relay 309 to battery. Relay 309 operates and transfers the various paths of the switching relays 303 to 307 inclusive from the numerical announcing drums 1 to 7 to the fractional announcing drums

one eighth to seven eighths inclusive. Another circuit is also closed from ground on the right contacts of relay 610, left inner contacts of relay 623, conductor 626 to the windings of relays 305 and 308 as previously traced. Another circuit is closed from ground on the right contacts of relay 612, left next-to-the-outer contacts of relay 623, conductor 627, winding of relay 303 to battery. Relays 303, 305 and 308 operate and cause the pronouncement circuit of the fractional part of the quotation to be closed from one side of the talking loop and conductor 248 to the armature of the No. 6 contact set of relay 309 and from the other side of the talking loop and conductor 247 to the armature of the No. 5 contact set of relay 309, previously traced. Due to the fact that relay 309 is operated the announcement circuit is completed to announcing drum "7/8" from the front contact of the No. 6 contact set of relay 309, resistance 310, through amplifier "8", resistance 320, to the front contacts of the No. 5 contact set of relay 309. The subscriber now hears the fractional and last pronouncement "7/8" of the desired stock quotation.

At the next closure of the interrupter, a circuit is closed from ground on the interrupter over a previously traced path to the right contacts of relay 624, winding of relay 625 to battery. Relay 625 operates and closes a locking path for itself through the winding of relay 616 and right contacts of relay 625 to ground on conductor 552. Relay 616, however, does not operate at this time due to the presence of operating ground for relay 625 on one side of its winding. When the interrupter contact is opened, this ground is removed and relay 616 operates and locks in series with relay 625 over a previously traced circuit. The operation of relay 616 opens the locking circuit of relays 623 and 624 causing them to release while the opening of the right outer contacts of relay 616 opens the circuit of relay 300 thereby causing this relay to release. The talking circuit is now open and the subscriber hears no repetition of the sale quotation even though he may still be on the line.

It is apparent from the foregoing description that the switching circuit of the sender which transfers the talking line from one announcing drum to another of the telegraphophone is a function of the number of pronouncements to be made over the talking line and, in the present embodiment of the invention, has been limited to the number of groups of "memory" relays controlled from the translating relay 1000 of the decoder. The register circuit shown in Fig. 6, however, may be expanded in accordance with the additional pronouncements which it may be desired to transmit. If, for example, it be thought advisable to prefix the sale quotation by a pronouncement of the symbol or name of the stock in question the register circuit can be expanded to include a relay for each stock name and this relay can be made to operate directly from a circuit controlled through an additional pair of contacts of the translating relay such as relay 1000 which controls the translation for that stock in the decoder. Each such additional relay in the register circuit of Fig. 6 would then comprise a row of relays, such as the hundreds translating or "memory" register, and would be controlled by a pair of switching relays like relays 613 and 603. Under such circumstances the switching control circuit shown in Fig. 3 can be easily modified by one skilled in the telephone art to connect the talking line to the announcing

drum "ABC" under the control of the additional pair of switching relays and the relay in the register designating the pronouncement "ABC" and operated from relay 1000. In short, the gist of this part of the invention is the flexible provision of a "memory" relay or group of relays in the sender for every pronouncement to be made to a calling line and each of which relays or group of relays is controlled and operated by the translating relay of the decoder. The decoder translating relay may be made to carry as many pairs of contacts as is necessary to operate the particular combination of "memory" relays in the sender that are required for the total pronouncement. According to this, the invention can properly be expanded to transmit to a calling line any information for which an impulse code translating relay is provided in the decoder with the additional facilities in the sender register for storing the translated information and appropriate announcing drums in the telegraphophone mechanism for the equivalent translated information.

When the receiver is restored, relay 207 releases, in turn releasing relays 211 and 222. Relay 222 causes the release of relay 230, and relay 230 in turn, causes the release of relay 226. Since both relays 230 and 226 connect holding ground to various parts of the sender, the release of these relays disconnects ground from the various holding conductors and releases the relays holding to them. Relay 207 now closes a circuit from ground through its back contacts, top back contacts of relay 205, brush 527, commoned contacts of its associated arc, winding of relay 203, to battery. Relay 203 operates and opens the circuit of relay 202 which releases and, in turn, causes the release of relays 201 and 103. Relay 203, by the closure of its bottom contact applies ground to resistance 525, thereby short-circuiting and releasing relay 547. A self-interrupting circuit is now closed for timing switch magnet 524 from ground in its interrupter contacts, bottom back contacts of relay 547, commoned contacts and brush 515, winding of switch magnet 524 to battery. Switch 515 advances its brushes to the normal contacts whereupon ground is removed from the winding of relay 203 thereby causing it to release. The release of relay 201 opens the talking conductors and replaces battery through resistance 200 on conductor 113, thus restoring the idle test condition for the sender while the release of relay 203 removes ground from resistance 525. All parts of the sender and line switch circuit are now restored to normal.

What is claimed is:

1. In a signaling system, a transmitting and receiving device, a sender, a decoder, a plurality of translating devices in said decoder, means for registering in said sender a plurality of series of impulses originated by said transmitting device, means for operatively associating said sender with said decoder, means in said decoder responsive to said registered plurality of series of impulses to operate one of said translating devices, a key-set in said decoder for each of said translating devices, means in said decoder responsive to said operated translating device and to the setting of its corresponding key-set for storing the electrical equivalent of changeable information, means in said sender responsive to said storing means for recording said information, and means in said sender for transmitting to said receiving device a series of verbal signals characteristic of the information recorded in said sender.

2. In a telephone system, a sender, a decoder, a telegraphophone, a telephone station equipped with dial, means for establishing a connection between said telephone station and said sender, means for registering in said sender a plurality of series of dial impulses originated from said telephone station, means for operatively associating said sender with said decoder, a plurality of translating devices in said decoder, means in said decoder responsive to said registered series of dial impulses to operate one of said translating devices, a key-set in said decoder for each of said translating devices, means in said decoder responsive to said operated translating device and to the setting of its corresponding key-set for storing the electrical equivalent of changeable information, means in said sender responsive to said storing means for recording said information, and means for operating said telegraphophone for transmitting to said telephone station a verbal pronouncement of said information recorded in said sender.

3. In a telephone system, a calling line equipped with dial, a sender having impulse registers and a plurality of recording means, a telegraphophone operatively associated with said sender, a decoder, a plurality of translating devices in said decoder, a storing means and a key-set in said decoder for each one of said plurality of translating devices, means for connecting said calling line to said sender, means for connecting said sender to said decoder, means for operating said impulse registers by series of dial impulses from said calling line, means for selectively operating one of said plurality of translating devices in accordance with the setting of said impulse registers, means controlled by said operated translating device and the setting of said key-set identified by said translating device for operating the associated storing means to set the recording means of said sender in accordance with the setting of the associated key-set, and means in said sender responsive to said recording means for operating said telegraphophone to transmit verbal pronouncements to said calling line in accordance with the setting of said recording means.

4. In a telephone system, a calling line equipped with dial, a sender having impulse registers and a plurality of recording means, a telegraphophone operatively associated with said sender, a decoder, a plurality of translating devices in said decoder, a storing means and a key-set in said decoder for each one of said plurality of translating devices, means for connecting said calling line to said sender, means for connecting said sender to said decoder, means for operating said impulse registers by series of dial impulses from said calling line, means for selectively operating one of said plurality of translating devices in accordance with the setting of said impulse registers, means controlled by said operated translating device and the setting of said key-set identified by said translating device for operating the associated storing means to set the recording means of said sender in accordance with the setting of the associated key-set, and means in said sender responsive to said recording means for operating said telegraphophone to transmit a single verbal pronouncement to said calling line in accordance with the setting of said recording means.

5. In a stock price announcing system, calling lines, a central station, means for establishing a connection from any calling line to said central station, a registering device at said central station controllable from a connected calling line

for registering the code designation of any listed stock for which the current sales price is desired, a decoder having a code translation relay corresponding to each listed stock, means for selectively operating said relays in accordance with the code designation registered in said registering device, a plurality of stock sales posts each having thereat sets of numerical keys corresponding to the stocks traded in thereat upon which the current sales price of each such stock may always be registered, a storing register for each key-set, recording means in said registering device operable from any of said storing registers, means controlled by the operation of any translation relay for causing the setting of that storing register from its associated key-set corresponding to the stock indicated by the particular operated translation relay and for consequently causing the setting of said recording means to indicate the current sales price of that particular stock, a telegraphophone telephonically associated with said connected calling line, and means controlled by said recording means for causing said telegrapho-

phone to transmit to said calling line a verbal pronouncement of the current sales price of the stock corresponding to code designation registered in said registering device.

6. In a system of the character described, the combination of a plurality of groups of resettable devices, a plurality of groups of storage devices, means responsive to impulses received for seizing any group of resettable devices and for transferring the information in said group to an idle group of storage devices and for immediately thereafter releasing said seized group of resettable devices, means for transmitting impulses under control of said group of storage devices, and a second means responsive to impulses received for seizing said group of resettable devices at any time after said group has been released and during the transmission of impulses under the control of first of said groups of storage devices, for controlling another said group of storage devices, and means for transmitting impulses under control of said second group of storage devices.

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