

Feb. 15, 1944.

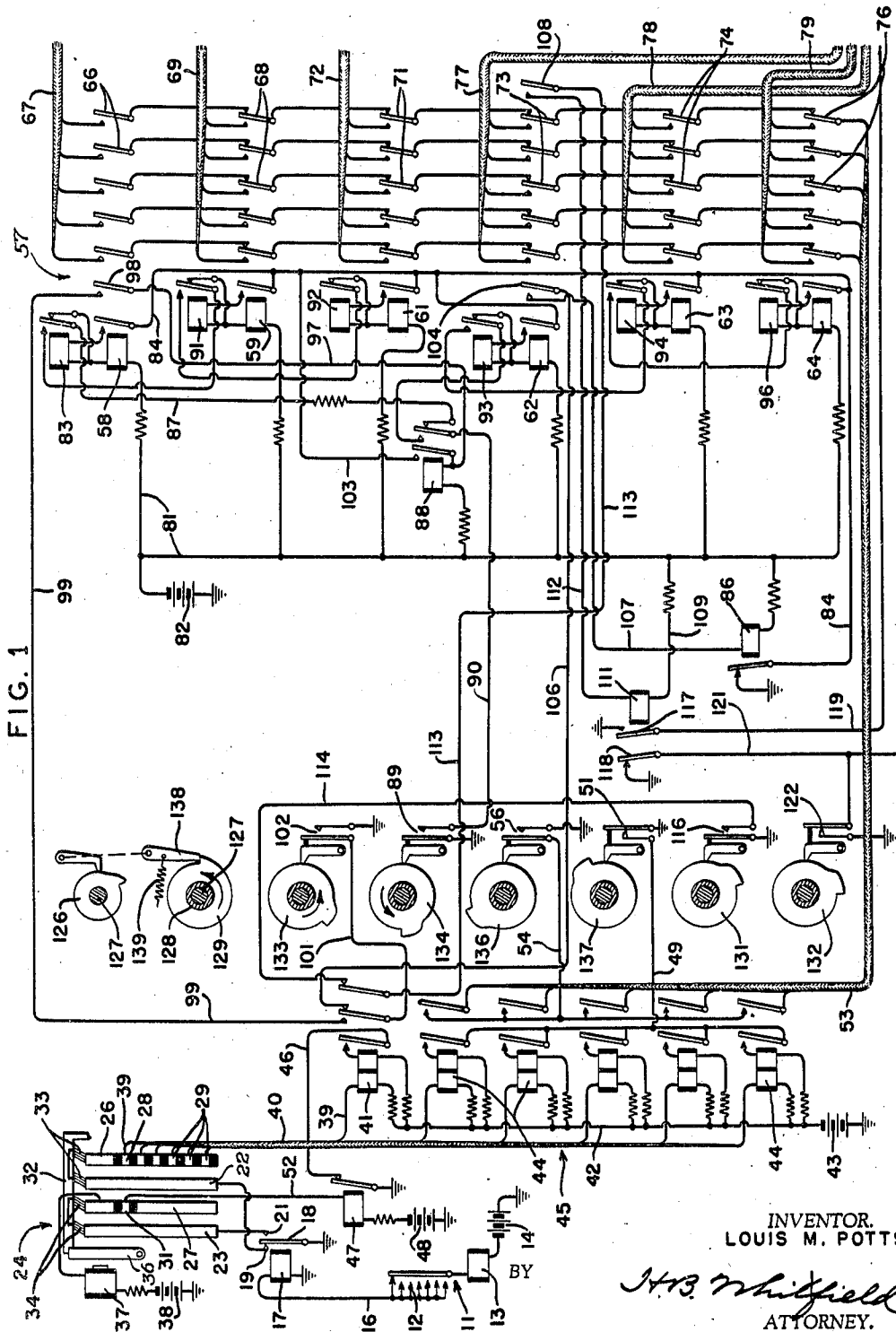
L. M. POTTS

2,341,568

MESSAGE TABULATING APPARATUS AND SYSTEM

Filed Sept. 11, 1939

4 Sheets-Sheet 1



Feb. 15, 1944.

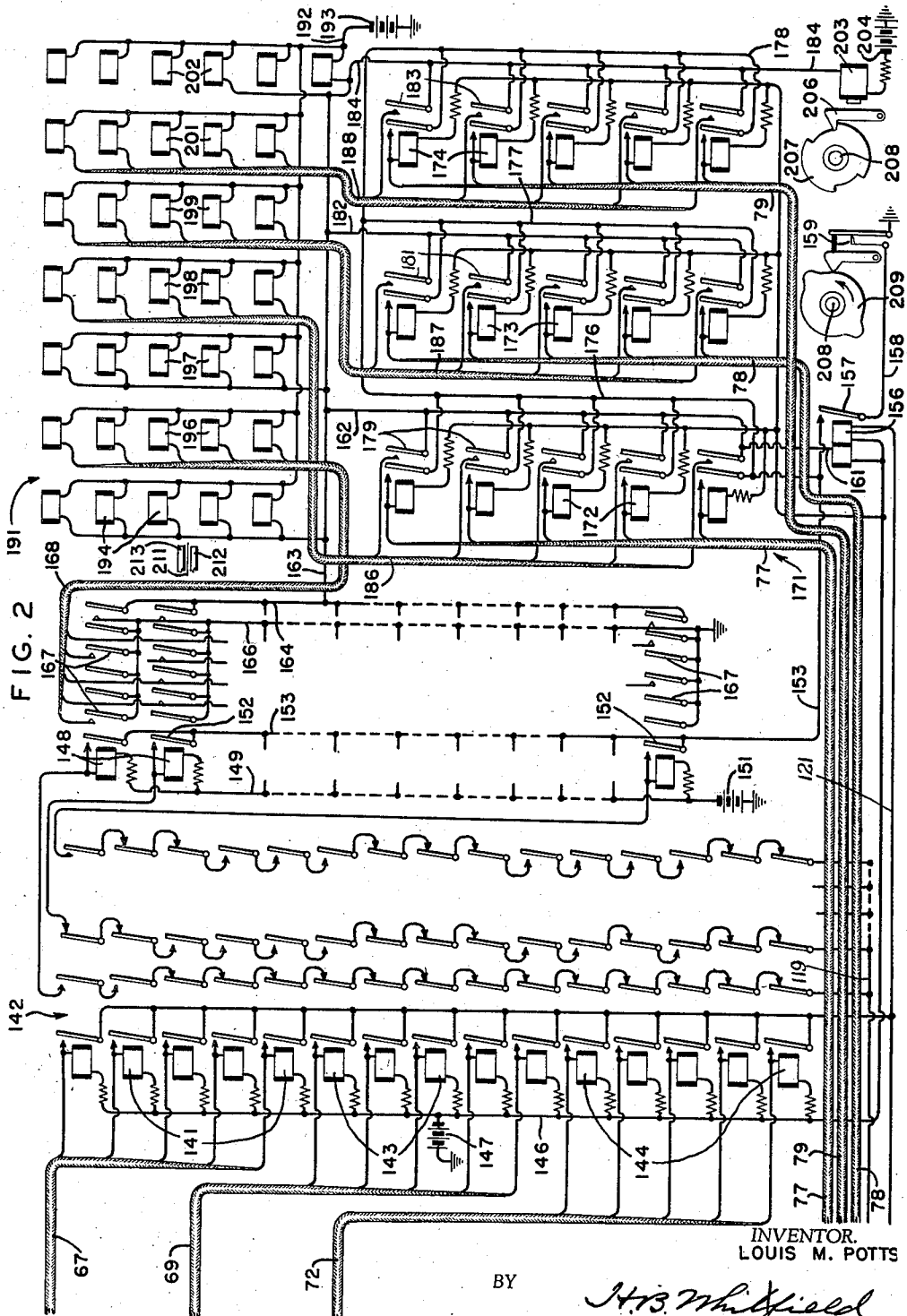
L. M. POTTS

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MESSAGE TABULATING APPARATUS AND SYSTEM

Filed Sept. 11, 1939

4 Sheets-Sheet 2



Feb. 15, 1944.

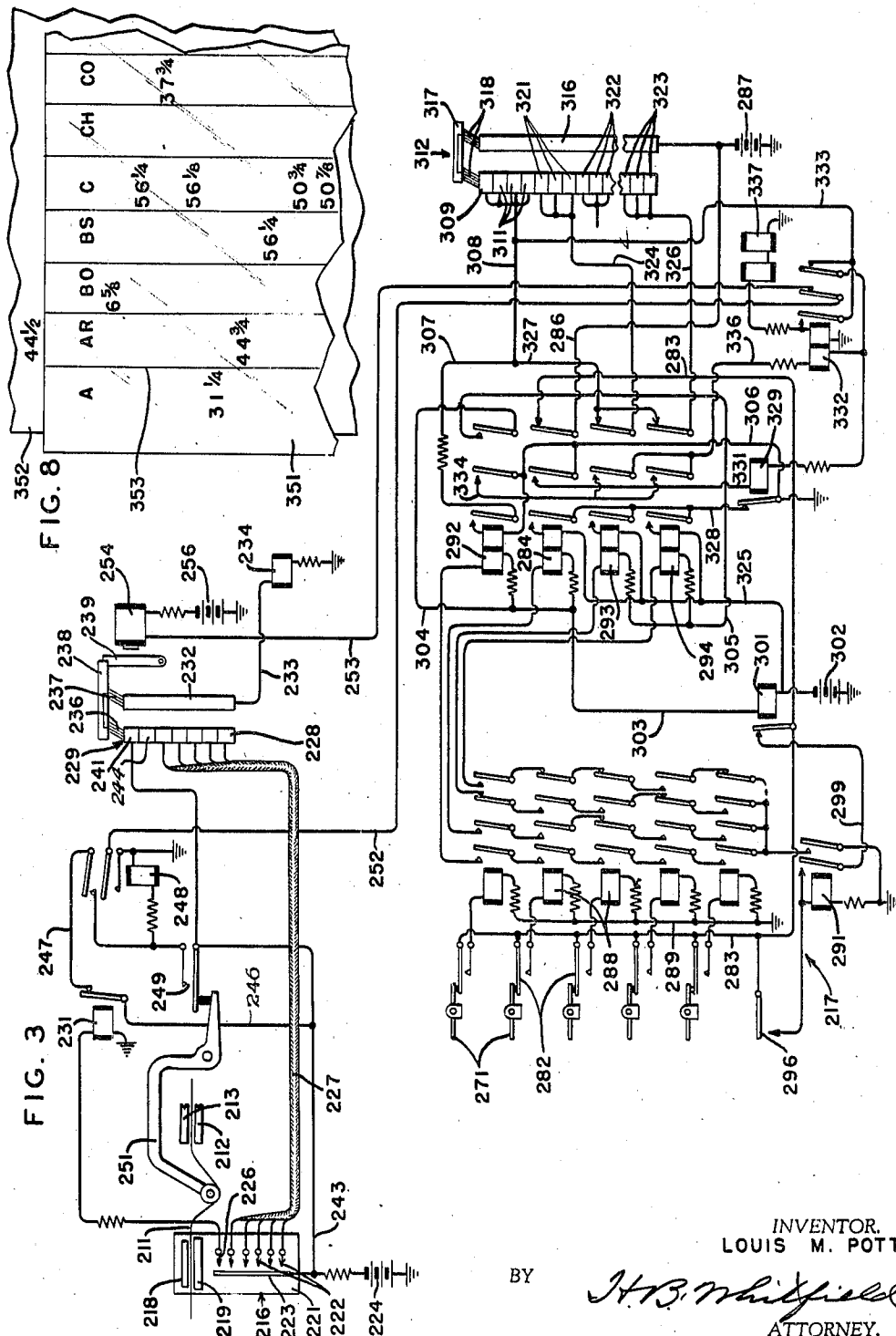
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2,341,568

MESSAGE TABULATING APPARATUS AND SYSTEM

Filed Sept. 11, 1939

4 Sheets-Sheet 3



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2,341,568

MESSAGE TABULATING APPARATUS AND SYSTEM

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4 Sheets-Sheet 4

FIG. 4

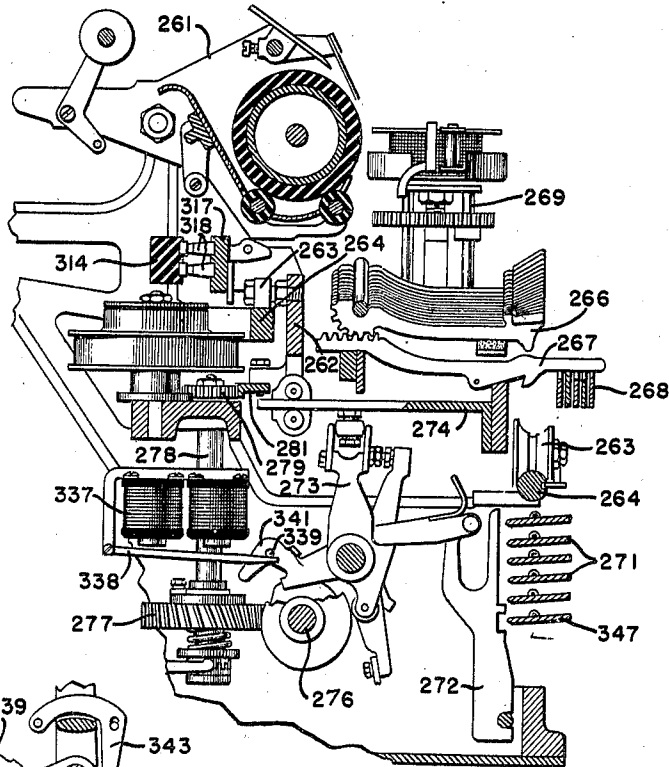


FIG. 6

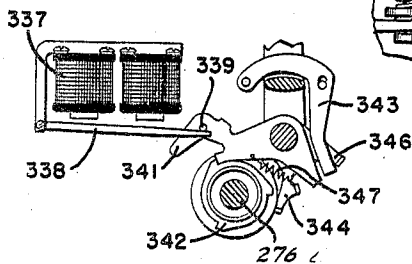


FIG. 5

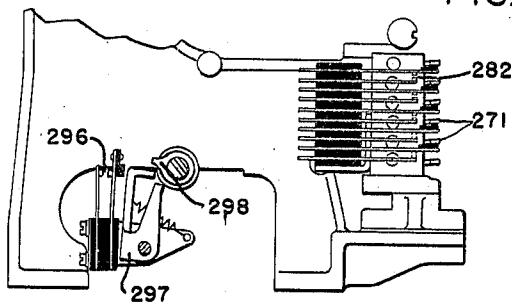


FIG. 7

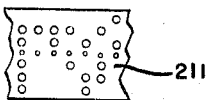
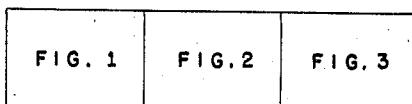


FIG. 9



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UNITED STATES PATENT OFFICE

2,341,568

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Application September 11, 1939, Serial No. 294,257

46 Claims. (Cl. 178—4)

This invention relates to printing telegraph systems and apparatus and particularly to apparatus for printing message material in tabular form.

An object of the invention is to provide for continuous movement of a character spacing carriage to printing positions which are selectable according to identification portions of message items.

Another object of the invention is to translate six unit permutation code signals into five unit code signals and interject function code combinations required by the tabulating printer but not contemplated by the six unit code signals.

The invention features a signal storing and translating mechanism by means of which a plurality of code combinations pertaining to the identification of a printing position are stored and are translated into a single code combination by which the printing position is selected.

For illustrative purposes, the invention has been shown as applied to the printing of stock quotations in columns upon page width record material, each column being assigned to a particular stock. The stock quotations are transmitted from a six unit code telegraph transmitter and are distributed by a receiving distributor to a primary set of signal storage relays. A switching mechanism associated with the primary storage relays transfers the signal combination to sets of relays in either of two secondary signal storage devices. One of the secondary storage devices is controlled to store signal combinations representing letters, and this device may have as many sets of code combination storage relays as the maximum number of letters in any stock designation for which prices are to be recorded. The other secondary storage device has sets of storage relays for storing the figures signal combinations representing a stock price to be recorded and may have as many sets of signal storage relays as the maximum number of digital positions that may be encountered in stock prices. In the particular embodiment of the invention shown and described, there are three sets of letter storage relays and three sets of price figure storage relays, but it will be understood that one or more sets of storage relays may be added to either of the secondary signal storage devices, as required.

The switching mechanism associated with the primary signal storage device transfers letter signal combinations to the first, the second, and then the third set of storage relays in the secondary storage device for letters. It transfers

figure signal combinations to the first, the second, and then the third set of figure storage relays in the secondary storage device for figures.

The secondary storage relays for letter signals have many contact tongues which the relays operate. These contact tongues may be considered as falling into groups, the corresponding tongues of all of the relays comprising one group. Each tongue is connected to the fixed contact of the adjacent corresponding relay tongue, and the tongues are so arranged to make or break contact, that for a particular combination of letter signals stored in the letter storage relays an electrical circuit is completed through all of the contact tongues and fixed contacts in the group, while for any other combination of letter signals in storage, the chain of contacts and tongues is interrupted at one or more points. Each group of contact tongues is differently coded so that not more than one chain contact circuit may be completed by any combination of letter signals in storage, and when stock identification letter combinations are stored for which the recording of prices is not desired, no chain contact circuit will be completed.

Each chain contact circuit includes a relay which has, aside from certain control contact tongues, five contact tongues to engage one or more fixed contacts arranged in position and number according to a single five unit permutation code combination. The permutational arrangement of fixed contacts in each chain contact controlled relay differs from the arrangement of fixed contacts in all of the other similar relays, and the fixed contacts of each such relays are arranged to control permutably five punch interponent controlling magnets in a multiple code perforator which may be similar to that disclosed in Patent 2,085,120 granted June 29, 1937, to L. M. Potts.

The sets of relays in the secondary storage device for figures control corresponding sets of punch interponent magnets in the multiple perforator. With the arrangement thus far described, one code combination representing a stock quotation designation and several code combinations representing the figures of a stock price may be stored in the sets of magnets in the multiple perforator. The perforator includes other sets of interponent controlling magnets that are permanently coded to represent and control the perforation of particular function signals, such as letter shift, figure shift, carriage return, and line feed. After the last figure signal combination of a stock price that is to be

recorded has been stored in the multiple perforator, the punch mechanism may be operated to effect the simultaneous perforation of all of the code combinations stored in the perforator.

From the tape perforator, the tape is fed into a tape sensing transmitter device in which the several code combinations perforated simultaneously in the multiple perforator are sent successively and are transmitted to a receiving printer. The spacing carriage of the receiving printer is provided with contact brushes which traverse a continuous conductive bar and a row of segments, as the carriage travels from beginning to end-of-line position. The segments are connected together electrically in groups, all of the contact segments are normally included in an electrical circuit which may be completed by the brushes supported by the carriage, but when a code combination is sent by the tape sensing transmitter which pertains to a printing position at which a stock price is to be printed, the contact segments associated with that position are isolated so that current will not traverse the brushes when they come into engagement with those segments. When a quotation is to be printed, the spacing carriage is set in motion and moves continuously as long as its brushes engage contact segments which have not been isolated from the electrical circuit. As soon as the brushes engage isolated contact segments, the carriage is arrested and the printing of the stock price at that position proceeds. Between the printing of one stock price, and the next received price, whether it pertains to the same stock or to a different stock, the spacing carriage is restored to its beginning-of-line position, and the line feed mechanism of the printer is operated. The page record which will be obtained from this printer will comprise columns of stock prices, each column containing prices relating only to a single stock, and all quotations pertaining to stocks, the quotations of which were not to be printed having been discarded ahead of the multiple perforator.

For a more complete understanding of the invention, reference may be had to the following detailed description to be interpreted in the light of the accompanying drawings in which,

Fig. 1 is a diagrammatic view showing the stock quotation transmitter, the receiving distributor, the primary storage relays, and their switching mechanism;

Fig. 2 is a diagrammatic view showing the secondary storage devices and the multiple perforator;

Fig. 3 is a diagrammatic view showing the tape sensing transmitter and the tabulating control circuits of the receiving printer;

Fig. 4 is an elevational view showing the stock quotation printer;

Fig. 5 is a detailed view showing the relation of the tabulating control circuit mechanism to the mechanical selecting apparatus of the stock quotation printer;

Fig. 6 is a detailed view showing the continuous carriage spacing mechanism of the printer;

Fig. 7 is a plan view of a fragment of tape containing perforations representing one stock quotation group of code signals.

Fig. 8 is a diagrammatic representation of copy produced by the stock quotation printer according to the present invention; and

Fig. 9 shows the method of arranging Figs. 1 to 3, inclusive, of the drawings to display a complete stock quotation printing system.

Referring now to the drawings, and particu-

larly to Fig. 1, the reference numeral 11 indicates generally a printing telegraph station including transmitting contact 12 and home recorder control magnet 13, connected in series between grounded line battery 14 and telegraph line 16. At its remote end, telegraph line 16 is connected to a line relay 17, which has its contact tongue 18 operable between marking contact 19 and spacing contact 21. Tongue 18 is grounded and contacts 19 and 21 are connected to continuous conductive rings 22 and 23, respectively, of a receiving distributor indicated generally as 24. Included in distributor 24 are segmented rings 26 and 27, the former having a plurality of electrically isolated segments, one of which is designated 28, and the remaining five being designated 29, and the ring 27 being electrically continuous, except for electrically isolated segment 31.

Distributor 24 has revolving brush arm 32 which carries a pair of electrically connected brushes 33 and a pair of electrically connected brushes 34, these brushes being insulated from arm 32. Brushes 33 engage distributor rings 22 and 26 and brushes 34 engage rings 23 and 27. The rotation of brush arm 32 is controlled by a stop lever 36 which serves as the armature for a magnet 37, the operating circuit of which extends from grounded battery 38, through the winding of magnet 37, electrically continuous portion of distributor ring 27, brushes 34, ring 23, line relay spacing contact 21, and grounded relay tongue 18 when the tongue is in spacing position. Thus, when transmitter 12 is in the rest position, and holds line relay 17 in the marking condition, the circuit of magnet 37 is open at spacing contact 21, magnet 37 is de-energized, and stop lever 36 engages brush arm 32 and holds the brushes stationary. Upon the starting of transmitter 12, line 16 is opened to establish the start pulse condition, which is spacing, line relay 17 is de-energized, the circuit of magnet 37 is completed at contact 21, stop lever 36 is attracted, and brush arm 32 is released for rotation.

Segment 28 of distributor ring 26 is connected by conductor 39 in cable 40 to one end of the operating winding of relay 41, the other end of which is connected by conductor 42 to grounded battery 43. Each of the segments 29 of distributor ring 26 is connected by an individual conductor in cable 40 to one end of the operating winding of an individual relay 44 of the primary set of storage relays 45, there being five of the relays 44. The other ends of the operating windings of relays 44 are connected to battery 43 by conductor 42. Relay 41 has a holding winding, one end of which is connected to battery conductor 42, and the other end of which is connected to the innermost contact of relay 41 which is a make contact. The tongue which co-operates with this contact is connected by conductor 46 to the single break contact of relay 47, the tongue of which is grounded. One end of the winding of relay 47 is connected to battery 43, and the other end is connected to isolated segment 31 of distributor ring 27. Each of the relays 44 has a holding winding, one end of which is connected to battery conductor 42, and the other end of which is connected to the innermost contact of the respective relays 44. The inner contact tongue of each of the relays 44 is connected by conductor 49 to one contact spring of normally closed cam controlled contacts 51, the other of which is grounded.

The speed of rotation of brush arm 32 is synchronized with the speed of transmission of tele-

graph signal impulses from transmitter 12 so that following the release of the brush arm 32, as line relay 17 responds to the start impulse, the segment 23, and the segments 29, are traversed in timed relation to the response of line relay to the signal impulses included in a signal combination. Printing telegraph permutation codes ordinarily consist of five or six selecting impulses of marking or spacing nature. For example, stock quotations are usually transmitted by means of a six unit permutation code, the first five selecting impulses of which determine the character to be printed and the sixth impulse of which determines whether the character will be a letter or a figure, it being understood that for stock quotation purposes some letters and marks of punctuation are selected as if they were figures. It has been found desirable in the present system to transmit the letter or figure shift impulse ahead of the five character selecting impulses. Therefore, the segment 23 is traversed by brushes 33 ahead of the segments 29 and shift signal storage magnet 41 is controlled ahead of storage magnets 44.

The innermost contact tongue of relay 41 is engageable, upon energization of the relay, with a fixed contact which is connected to the holding winding of relay 41, the other end of the winding being connected to battery conductor 42. In order for relay 41 to be held when it becomes energized, ground must be applied to its innermost contact tongue through conductor 46, which necessitates that relay 47 shall be in de-energized condition. It will be noted that line relay 17 applies ground through segment 31 of distributor ring 27 when the shift controlling pulse is spacing and applies ground to segment 28 of distributor ring 26 when the shift controlling pulse is marking. Segment 31 is connected to relay 47 by conductor 52, so that the circuit of relay 47 is completed and the relay is energized when the shift controlling pulse is of spacing nature, the holding circuit of storage relay 41 being interrupted by attraction by relay 47 of its armature. However, when the shift controlling pulse is of marking nature, the energizing circuit of relay 41 is completed by the application of ground to segment 28, and relay 41 becomes energized and attracts its contact tongues which are held due to energization of the holding winding, the relay 47 being then in de-energized condition.

Each of the storage relays 44 has a contact tongue in addition to its holding contact tongue which is connected to one of five conductors in a cable 53. Fixed contacts with which these contact tongues are engaged upon energization of any of the relays 44 are connected by conductor 54 to one of a pair of normally open cam controlled contacts 56, the other of which is connected to ground. Marking impulses are represented by energized condition of the relays 44 and spacing impulses are represented by de-energized condition of the relays.

Signal combinations stored in the primary storage device 45 are transferred to the secondary storage devices through a counting relay mechanism indicated generally by the reference numeral 57. The counting device 57 includes letter signal counting relays 58, 59 and 61 and figure signal counting relays 62, 63 and 64. Relay 58 has five contact tongues 65 that are engageable, upon energization of the relay, with fixed contacts individually connected to five conductors contained in a cable 67. Relay 59 has five contact tongues 68 which, upon energization of the relay, engage five fixed contacts individually con-

nected to conductors in a cable 69. Contact tongues 68 are engageable, when relay 59 is de-energized, with five fixed contacts individually connected to the contact tongues 66 of relay 58. Relay 61 has five contact tongues 71 which engage fixed contacts connected to the tongues 68, when relay 61 is de-energized, and which engage fixed contacts individually connected to five conductors in cable 72 when relay 61 is energized.

Relays 62, 63 and 64, which control the counting of figure signals, are provided with sets of five contact tongues 73, 74 and 76, respectively, which, upon energization of their respective relays, engage fixed contacts individually connected to conductors in cables 77, 78 and 79, respectively. The fixed contacts, which contact tongues 76 engage when relay 64 is in de-energized condition, are connected to the contact tongues 74 of relay 63 and the fixed contacts which these contact tongues engage when relay 63 is in de-energized condition are connected to the contact tongues 73 of relay 62, which is the first figure counting relay and which has the fixed contacts engaged by its contact tongues 73 when in de-energized condition connected to contact tongues 71 of the last letter signal switching relay 61. From the foregoing, it will be apparent that when all of the relays 58 to 64, inclusive, are de-energized, the contact tongues 66 of the first letter signals switching relay 58 are connected to the tongues 76 of the relay 64 through the contact tongues and back contacts of the intervening relays 59 to 63, inclusive. The conductors in cable 53 are individually connected to the contact tongues 76 so that in the rest condition of the apparatus, these conductors are connected directly to the contact tongues 66 and will, upon energization of relay 58, become connected to the individual conductors of cable 67.

One end of the winding of each of the relays 58 to 64, inclusive, is connected to a battery conductor 81 to which is connected one end of a battery 82, the other end of the battery being grounded. The other end of the winding of relay 58 is connected to one end of the winding of a pilot relay 83 and to a fixed contact which is engaged by the contact tongue of relay 83 when the relay is de-energized. The other end of the winding of relay 83 is connected to a fixed holding contact of relay 58 which is engaged by the innermost contact tongue when relay 58 is energized. The holding contact tongue of relay 58 is connected by conductor 84 to the single contact tongue of a release relay 86. When relay 86 is de-energized, its contact tongue engages a fixed contact which is connected to ground. The energizing circuit for relay 58 extends from grounded battery 82 through conductor 81, winding of relay 58, back contact and contact tongue of relay 83, thence through conductor 87, back contact and outer contact tongue of relay 88, and normally open cam controlled contacts 89 to ground. When relay 58 becomes energized over the circuits just described, it attracts its holding contact tongue which places relay 83 in series with relay 58 and establishes a holding circuit for the two relays from the grounded contact engaged by the contact tongue of relay 86 through conductor 84, thus replacing the ground supplied by cam controlled contacts 89, the relay 83 pulling up upon removal of the short circuit to ground at contacts 89. Upon the energization of relay 83, its contact tongue is attracted to disconnect conductor 87 from the back contact of relay 83 and to connect it to the front contact of the relay

which is connected to the contact tongue of a relay 91 which bears the same relation to relay 59 that relay 83 bears to relay 58.

Relay 91 has a back contact which is connected to the winding of relay 59 and which is engaged by the contact tongue of pilot relay 91 to provide an energizing circuit for relay 59 from battery 82 through conductor 81, winding of relay 59, back contact and contact tongue of relay 91, front contact and contact tongue of relay 93, conductor 87, back contact and outer contact tongue of relay 88, and normally open cam operated contacts 89 where ground connection is applied when the contacts are closed. When relay 59 is energized, it attracts its holding contact tongue which applies ground from the contacts of relay 86 through conductor 84, and places relay 91 in series with relay 59, the relay 91 thereby becoming energized. Upon the energization of relay 91 its contact tongue is attracted, thereby opening the original energizing circuit for relay 59 and preparing a circuit for the energization of relay 61 because of the fact that the contact which the tongue of relay 91 engages, when the relay becomes energized, is connected to the contact tongue of a relay 92 related to the relay 61 in the same manner that relays 83 and 91 are related to relays 58 and 59, respectively. Relay 92 has no front contact to be engaged by its contact tongue, because it is not required to prepare an energizing circuit for another relay, the associated relay 61 being the last of the three letter signal counting relays.

The figure signal counting relays 62, 63, and 64 have associated with them the pilot relays 93, 94 and 96, respectively, the relay 93 being arranged to establish an energizing circuit for the relay 63, the relay 94 being arranged to establish an energizing circuit for the relay 64, and the relay 96 being arranged merely to interrupt the energizing circuit for the relay 64 when the holding circuit for that relay has been established through its innermost contact tongue and through relay 96 in a manner similar to the interruption of the energizing circuit of letter counting relay 61 by its pilot relay 92. It is to be noted that whereas the energizing circuits for the relays 58, 59 and 61 extend through the outer contact tongue and back contact of relay 88, the energizing circuits for relays 62, 63 and 64 extend from battery 82 through conductor 81 and include the front or make contact of relay 88 with which its outer contact tongue is engageable, from which the circuit will extend to cam controlled contacts 89 only when relay 88 is energized. From this it will be apparent that there are two sets of counting relays, the selective operation of which depends on the condition of relay 88, which, in turn, depends upon the position of the center contact tongue of relay 41. A counting operation started in the first set of counting relays need not be carried to the end of the set in order to switch to the operation of the second set. Such switching may be accomplished after the operation of only one or two of the relays 58, 59 and 61, by the energization of relay 41 and the closure of contacts 89. At any time during a counting operation in the second set of counting relays, the counting operation may be terminated by de-energizing relay 41 and closing contacts 102, which will complete the energizing circuit for relay 86, which will remove ground from the holding circuits of both sets of counting relays and from relay 88, and all of these relays will be released. Counting may then be started again in the first set.

The energizing circuit for relay 88 extends from grounded battery 82 through conductor 81, winding of relay 88, conductor 97, contact tongue 98 of relay 58, conductor 99, make contact and center contact tongue of shift and unshift signal storage relay 41 and conductor 101 to normally open cam controlled contacts 102, one of which is grounded. It will be apparent from this that relay 88 can be energized only after relay 41 has become energized due to the reception of a signal combination in which the shift or unshift controlling pulse is marking, and further that at least one letter signal combination must have been stored in the storage relays 44 and applied to the conductors contained in cable 67 by the operation of first letter switching relay 58 so that contact tongue 98 will have engaged its contact to complete the energizing circuit for relay 88. Upon the energization of relay 88 its inner contact tongue engages a make contact from which conductor 103 extends to ground supplying conductor 84 thereby establishing a holding circuit for relay 88.

When the relay 62 has become energized and its locking circuit is completed, two contact tongues which it controls and which are involved neither in the establishment of the locking circuit nor in the switching of the signal combination engage their associated fixed contacts. One of these, designated 104, is connected by a conductor 105 to the back contact which the center contact tongue of relay 41 engages when the relay is de-energized. The fixed contact which contact tongue 104 engages is connected by conductor 107 to the winding of relay 86. As long as the center contact tongue of relay 41 remains attracted, relay 86 will be in de-energized condition and the relay holding current traversing conductor 84 will continue. When relay 41 is released, which operation occurs upon the reception of a code combination pertaining to the selection of a letter and therefore having its shift or unshift controlling impulse of spacing nature, the energizing circuit for relay 86 will be prepared by engagement of the center contact tongue of relay 41 with its back contact and will be completed upon the closure of cam controlled contacts 102 to cause the attraction of the contact tongue of relay 86 and therefore the removal of ground from conductor 84. The holding circuit for the relays 58, 59, 61, 62, 63, 64, 83, 91, 92, 93, 94, and 96 is thus broken and these relays are released. It will be noted that since contact tongue 104 is associated with the first figure signal switching relay 62, the holding circuit for the several switching magnets will not be interrupted in response to any letters signal combination received from the transmitter 12 but will only occur in response to a letters signal combination which was preceded by at least one figures signal combination.

The other control tongue associated with relay 62 is designated by the reference numeral 108. The circuit which it prepares may be traced from battery 82 through conductors 81 and 100, winding of relay 111, conductor 112, fixed contact with which contact tongue 108 is engageable, tongue 108, conductor 113, outermost contact tongue of relay 41, fixed contact which it engages when relay 41 is de-energized, conductor 114, and normally open cam controlled contacts 116, one of which is connected to ground. Upon completion, at the contact 116 and by the outermost contact tongue of relay 41, of the circuit for relay 111 prepared by contact tongue 108 of relay 62, relay 111 becomes energized and attracts contact tongues

117 and 118. Contact tongue 117 is brought into engagement with a grounded fixed contact and contact tongue 118 is drawn out of engagement with a grounded fixed contact. Conductors 119 and 121 are connected to the contact tongues 117 and 118 respectively, and these conductors extend to apparatus which will be identified later. The conductor 121 is also connected to one contact of a pair of normally closed cam operated contacts 122, the other of which is connected to ground.

The shaft which carries brush arm 32 has secured thereto a timing cam 126, the shaft being designated by the reference numeral 127. Shaft 127 also carries a cam sleeve 128 to which rotation may be imparted from shaft 127 through a friction clutch (not shown). Cam sleeve 128 has secured thereto a stop disc 129 and a plurality of cams for controlling the previously identified sets of cam controlled contacts. The cams, numbered in the order in which they actuate their followers, as is clearly apparent from the angular distances between the apices and their respective followers, are designated by the reference numerals 131, 132, 133, 134, 136, and 137. Timing cam 126 is engaged by one end of a stop lever 138, the other end of which is normally interposed in the path of a shoulder of stop disc 129. Lever 138 is biased into engagement with timing cam 126 by tension spring 139.

When brush arm 32 is set in rotation by the withdrawal of stop lever 36 by magnet 37, timing cam 126 is also rotated and when its apex is presented to cam follower lever 138, lever 138 will be rocked counterclockwise to withdraw it from blocking relation with the shoulder of stop disc 129, thereby freeing cam sleeve 128 to be rotated by shaft 127. Secondary transfer cam 131 is the first to operate its follower thus closing the contacts 116 and applying ground to conductor 114 to effect the energization of relay 111 if contact tongue 108 of relay 62 is in engagement with its fixed contact and if the outermost contact tongue of relay 41 is in engagement with its back contact. If the circuit of relay 111 is open at the contact tongue 108 of relay 62 or at the outermost contact tongue of relay 41, closure of contact 116 by cam 131 will be an idle operation. It is to be noted that relay 41 is operated to attract or release its contact tongues in response to the shift or unshift impulse accompanying a code combination. Cam 131 should therefore be so timed to the rotation of brush arm 32 that the contacts 116 are closed during or after the traversal of segment 28 of distributor ring 26 by the brushes 33. The removal of the ground from conductor 121 of contact tongue 118 of relay 111 does not immediately change the electrical condition of conductor 121 because contacts 122 controlled by cam 132 are then closed. Prior to the release of contacts 116 by cam 131, relay unlocking cam 132 opens the contacts 122 thereby disconnecting conductor 121 from ground. Relay 111 has no holding circuit and therefore as soon as contacts 116 are released by cam 131, relay 111 releases its contact tongues removing the ground connection from conductor 119 and restoring ground to conductor 121 by contact tongue 118. The reason for the provision of two grounds for conductor 121 is that an operation is to be performed by the grounding of conductor 119 before ground is removed from conductor 121 and further so that when contacts 122 are opened by cam 132 at a time when relay 111 is de-energized the ground shall not be removed from conductor 121.

Counting relay controlling cam 133 becomes

effective to close contacts 102 after cam 132 has permitted contacts 122 to reclose. As previously set forth, the effectiveness of contacts 102 depends upon which positions the contact tongues of relays 41 occupy. The closure of contacts 102 when the contact tongues of relay 41 are released, results in connection of ground to conductor 106 and if contact tongue 104 of relay 62 is then engaging its fixed contact, relay 86 will be energized to remove ground from conductor 84 and thereby open the holding circuits of all of the magnets 58, 59, 61, 62, 63, 64, 83, 91, 92, 93, 94, and 96 in switching device 57. The closure of contact 102 when the contact tongues of relay 41 are attracted results in the connection of ground to conductor 99 and therefore the energization of relay 88 which remains energized through its holding circuit and prepares an energizing circuit for the relay 62.

Pulsing cam 134 closes contacts 89 shortly after contacts 102 have opened and thereby applies ground to conductor 90, the effect of which is to complete the energizing circuit for relay 58 or 62, depending upon whether relay 88 is de-energized or energized.

Primary transfer cam 136 closes contacts 56 after contacts 89 have reopened to apply ground to the fixed contacts that are engaged by the contact tongues of the relays 44 connected to the conductors in cable 53. Thus, ground is connected to each of the contact tongues 76 of relay 64 for which corresponding storage relays 44 are energized, and through cable 53 and the chains established by unattracted contact tongues 74, 73, 71, etc., to the lowermost attracted set of contact tongues of the switching relays and from those contact tongues to the conductors in one of the cables 67, 69, 72, etc. Preferably, the cam 136 is timed to close contacts 56 after the last selecting impulse of a signal combination has been received and applied to cable 40 by the distributor 24. Relay release cam 137 opens contacts 51 just before stop disc 129 is arrested, to remove ground from the holding circuits of the storage relays 44. The relays are thus released and conditioned for the storage of a new signal combination.

Referring now to Fig. 2 it will be observed that the five conductors contained in cable 67 are connected to the first set of five storage relays 141 in the secondary storage device for letters which is indicated generally by the reference numeral 142. Similarly the conductors in cable 69 are connected to the five relays 143 comprising the second set and the conductors in cable 72 are connected to the five relays 144 comprising the third set. The ends of the windings of relays 141, 143 and 144 that are connected to the conductors contained in the cables 67, 69, and 72 are also connected to holding contacts individual to the several relays 141, 143, and 144. A common battery conductor 146 extends from all of the relays 141, 143, and 144 to grounded battery 147. Each of the secondary storage relays 141, 143, and 144 has a holding contact tongue connected to the conductor 121, previously identified, which normally is connected to ground through contact tongue 118 of relay 111 and through contacts 122 (Fig. 1). The energizing circuits for relays 141, 143, and 144 are completed from battery 147 through the relays and through their cables 67, 69, and 72, respectively, then through the conductors in cable 53 when contacts 56 controlled by cam 136 are closed to connect ground to the primary storage

contact tongues of relays 141, 143, and 144 are interrupted when the grounds are removed from conductor 121 at contact tongue 118 and cam operated contacts 122.

Each of the relays 141, 143, and 144 is provided with as many additional contact tongues and fixed contacts to be engaged by the tongues as the number of columns in which message items are to be printed in tabular form. All of the tongues of the lowermost relay 144 except the locking contact tongue are connected to the conductor 119 to which ground is connected when contact tongue 117 is attracted by relay 111. The fixed contacts associated with the lowermost of the relays 144 are connected to the corresponding contact tongues of the relay 144 next above the lowermost relay. Similarly those fixed contacts are connected to the contact tongues of the next relay 144, counting upwardly. This arrangement continues across the entire group of letter signal storage relay contact tongues and contacts, and the fixed contact associated with each of the contact tongues of the uppermost relay 141 is connected to an individual code storage relay 146, all of the relays 148 having a common battery conductor 149 which is connected to grounded battery 151. In each interconnected row of contact tongues and contacts, certain of the contacts are positioned to be engaged by their contact tongues when the relays 141, 143, or 144 with which they are associated are de-energized, while others of the contacts are positioned to be engaged by their contact tongues when the tongues are attracted due to energization of the associated relay. The disposition of the contacts on one side or the other of their associated contact tongues is in accordance with codes, each chain of contact tongues and contacts being differently coded. Thus, with reference to a particular chain of contacts and contact tongues, when the relays 141, 143, and 144 are energized according to the coding of that chain of contacts and tongues so that all of the tongues which must be attracted in order to engage their contacts are attracted, and those which normally engage their contacts have remained unattracted, a conductive path will be established from the contact tongue 117 of relay 111 through conductor 119, through the completed conductive chain and the relay 143 associated with it, and then to the grounded battery 151. Current flows in this circuit to effect the energization of the particular relay 148 when ground is connected to contact tongue 117 by the energization of relay 111 (Fig. 1). The coding of the chains of contacts and tongues is such that only one conductive path will be completed to a relay 143 in response to any particular combination according to which the relays 141, 143, and 144 are energized. In this way any one of the relays 148 may be selected and operated in response to the telegraphic codes corresponding to stock designations comprising one, two or three letters. For any stocks, the quotations of which are not of interest in a particular receiving office and therefore are not to be printed, no chain of contacts and tongues is provided to be completed when the relays 141, 143, and 144 are actuated according to the codes representing those stocks. Thus, no relay 143 will be operated and the letter codes will merely remain in storage in the relays 141, 143, and 144 until the holding circuits for these relays are interrupted by the removal of ground from conductor

121 at contact tongue 118 and cam controlled contact 122.

Each of the relays 148 is provided with a holding contact tongue 152 connected to conductor 153. Conductor 153 is connected to the fixed contact of a relay 156 which has an operating winding and a locking winding. Both of the windings of relay 156 are connected to conductor 146 to which battery 147 is connected and the other end of the operating winding is connected to conductor 166 to which the chain circuits controlled by relays 143 are connected, so that when armature 117 is attracted by relay 111 (Fig. 1) one of the relays 148 may be energized and relay 156 is energized through its operating winding to cause the attraction of its contact tongue 157 into engagement with its fixed contact. Contact tongue 157 is connected by conductor 158 to one of a pair of normally closed cam operated contacts 159 the other of which is connected to ground. Upon the operation of relay 156, the holding circuit for relays 148 is completed from battery 151 through conductor 149, through the fixed contact of the operated relay 143, through its contact tongue 152, conductor 153, contact tongue 157 of relay 156, conductor 158 and normally closed contacts 159 to ground. The holding circuit for relay 156 extends from battery 147 through conductor 146, holding winding of the relay, conductors 161, 162, 163, and 164 to the outermost contact tongues of all of the relays 148 and in the case of an energized relay 148 through the fixed contact engaged by the attracted outermost contact tongue to conductor 166 which is connected to ground. From this it will be observed that the holding circuit for an operated relay 143 includes the contact tongue 157 of relay 156 and that the holding circuit for this relay includes a contact tongue associated with each of the relays 148. It will be apparent that the opening of contacts 159 will interrupt the circuit of an operated relay 148 which will release its contact tongues thus opening the holding circuit for relay 156 which will likewise become released.

In addition to the contact tongue for its own holding circuit and the contact tongue for the holding circuit of relay 156, each of the relays 148 has five contact tongues which are connected to ground conductor 166. The sets of five contact tongues of the relays 148 are designated by the reference numeral 167 and various permutational combinations of fixed contacts are provided for the contact tongues 167, no two relays 148 having the same combinations of contacts. Corresponding code contacts of all of the relays 148 are connected to common conductors and the five code contact conductors enter a cable 168. The cable 168 extends to punch interponent controlling magnets in a tape perforator which will be described later.

The secondary signal storage device for figures is indicated generally by the reference numeral 171 in Fig. 2 and this storage device consists of three sets of storage relays 172, 173, and 174, each set consisting of five relays. The five conductors in cable 77 are connected individually to the windings of relays 172 and to holding contact for those relays. Similarly, the conductors contained in cable 78 are connected to the windings of relays 173 and to their holding contacts and the conductors contained in cable 79 are connected to the windings of relays 174 and to their holding contacts. Common battery conductors for the relays 172, 173, and 174 are connected to bat-

tery conductor 146, which as previously set forth is connected to grounded battery 147. The holding circuit for relays 172 extends from grounded battery 147, over conductor 146, winding of relay 172, the left-hand armature and front contact thereof, front contact and armature 157 of relay 156, conductor 158, and contact 159 to ground. The holding circuit contact tongues for the relays 173 and 174 are connected to the conductors 177 and 178 respectively, which in turn are connected to conductor 176. In addition to the locking contact tongues, the relays 172 are provided with individual code contact tongues 179 all of which are connected to the conductor 162. The relays 173 have similar code contact tongues 181 connected to a conductor 182 and the relays 174 are provided with individual code contact tongues 183 connected to conductor 184. The conductors 182 and 184 and as previously set forth, the conductor 152 are connected to conductor 163 which may be grounded through the outermost contact tongue of any storage relay 148 which may become energized. The five fixed contacts which may be engaged by the code contact tongues 179 are connected to five conductors which enter a cable 186, the five contacts that may be engaged by the code contact tongues 181 are connected to five conductors which enter a cable 187 and the five contacts which may be engaged by the code contact tongues 183 are connected to five conductors which enter a cable 188. The cables 186, 187, and 188 lead to punch interponent controlling magnets of a tape perforator which will now be described.

A tape perforator which may be similar to that shown in Patent 2,085,120, granted June 29, 1937, to L. M. Potts is indicated generally in Fig. 2 by the reference numeral 191. The tape perforator according to the patent has several sets of punches for simultaneously perforating several code combinations in a tape. According to the disclosure of the patent, each set of punches comprises six punches whereas in the present disclosure only five punches to a set are required, since a five unit code affords thirty-two usable combinations and even though certain of the combinations are used for selecting functions sufficient code combinations remain for selecting all of the printing column positions on a page on which stock quotations are to be printed in tabular form. There is one exception to the provision of five punches to a set, a sixth punch being required in one set, the extra punch pertaining to a special control, and not being a permutational element of a code combination. The selection or nonselection of any punch in any group is controlled by an individual magnet and accordingly the seven banks of punch controlling magnets, each bank consisting of five magnets, have been shown in Fig. 2 by way of representing the multiple code perforator 191. Each of the magnets in the multiple code perforator 191 has one end of its winding connected to a conductor 192 to which is connected grounded battery 193. The ends of the magnets thus connected may be described as the battery ends of the windings and the other ends will be described as the ground ends.

The first set of five magnets, identified by the reference numeral 194, have their ground ends connected to conductor 163 so that these five magnets will be energized when the outermost contact tongue of any one of the relays 148 is attracted. The magnets 194 will thus control their punch interponents to cause a full mark-

ing code of five perforations to be punched by the perforating mechanism. In the operation of a permutation code printing telegraph apparatus employing a five unit code the all-marking combination which the magnets 194 will set up is generally assigned to control the letter shift function.

The magnets in the second set, identified by the reference numeral 196, have the ground ends of their windings connected to the five conductors contained in cable 168. They may thus become energized in permutational combination according to the combinations of code contacts associated with the various storage relays 148.

The magnets in the third group, designated by the reference numeral 197, have the ground ends of all but the third magnet permanently connected to ground conductor 163. The ground end of the third magnet is left unconnected. The code combination which this set of magnets establishes pertains to the figures shift function and the signal, upon being received by a printing telegraph recorder, positions the apparatus for the printing of figures.

The magnets of the next three sets, designated 198, 199, and 201 are connected to the set of five conductors contained in the cables 186, 187, 188, respectively. These cables receive the figures signal storage conditions from the figures signal storage relays 172, 173, and 174 respectively and the magnets 198, 199, and 201 are energized correspondingly in permutational combination to control the perforation of corresponding signal combinations.

The last set of magnets, designated 202, is the one which has a sixth magnet, and the set has only two of its magnets connected to ground conductor 163; namely, the fourth and sixth. The remaining four magnets of the set are left unconnected on the ground side. The code combination which is perforated in response to the operation of these magnets pertains to the carriage return and line feed functions of a printing telegraph recorder and controls the advancement of the page and the restoration of the spacing carriage to the beginning of line position. The sixth magnet, and the perforation which it causes to be made in the tape do not pertain to the permutation code contemplated by the other five magnets in the group or set, but pertain to indication of the fact that the accompanying permutation code combination, namely the carriage return and line feed signal, is the last in a succession of signal combinations comprising one stock quotation group. The perforation is in the margin between the edge of the tape and an outermost longitudinal row of code perforations.

The sets of magnets 194, 197 and 202 and the sixth magnet associated with the set 202 are permanently coded and are independent of any signal combinations received and stored. They operate invariably upon each operation of the perforator to cause the function signals hereinbefore identified and the quotation end indicating signal perforation to be punched in the tape.

Since the energization of punch controlling magnets 194, 196, 197, and 202 is controlled through contacts associated with relays 148 which are individually locked upon being energized and since the magnets 198, 199, and 201 are energized through circuits completed by contact tongues associated with the relays 172, 173, and 174 which also become held in energized condition, the punch controlling magnets

will remain energized as long as any one of the relays 148 and combinations of the relays 172, 173, and 174 are energized.

At the time that ground is connected to conductor 163 it is simultaneously connected to conductor 184 which is connected to conductor 163. At the end of conductor 184 is connected one end of the winding of a start magnet 203 for the perforator 191 the other end of the winding of the magnet 203 being connected to grounded battery 204. The armature 206 of start magnet 203 is in the form of a latch which may engage either of two recesses in a stop disc 207. Disc 207 holds the operating shaft 208 of perforator mechanism 191 stationary until start magnet 203 becomes energized, when it attracts armature 206 and permits disc 207 and shaft 208 to rotate through one-half revolution, whereupon shaft 208 is rearrested by armature 206, the perforation of all of the code signals pertaining to a stock quotation being performed in each half revolution of shaft 208. Following the perforation of the code signals and before the arrestment of shaft 208, the punch pins are retracted, usually by springs, and the tape is advanced a distance equal to that occupied by seven code combinations by tape feed mechanism (not shown). A contact controlling cam 209 is carried by shaft 208 and rotates with disc 207. Cam 209 is provided with two apices and near the end of one-half revolution in the direction indicated by the arrow, and after the perforating operation has been completed, it opens the normally closed contacts 159 thereby removing ground from conductors 158, 153, 176, 177 and 178, thereby releasing all of the relays 148, 172, 173, and 174. The ground is thus removed from conductor 163 and the energizing circuits for all of the punch interponent controlling magnets and for the perforator start magnet 203 are interrupted as is also the holding circuit for relay 156.

The apparatus shown in Figs. 1 and 2 comprises a complete system for receiving stock quotations from well-known types of stock quotation transmitters, for selecting certain of the stock quotations for printing, and rejecting others, and for preparing a record storage medium containing signals pertaining to those quotations that are to be recorded, necessary function controlling signals required for the operation of a page printer being included in the record storage medium along with the stock quotation signals. The operation of this apparatus will now be described.

For the purposes of the following description, let it be assumed that all of the apparatus is in the condition shown in Figs. 1 and 2; namely, with all of the relays de-energized at the time that signals begin to be received from transmitter 12 by line relay 17. This would not be a true operating condition, as it will be found from the description that certain stored conditions are not cleared out when the signal combinations corresponding to the stock quotation have been perforated in the tape, but remain in storage until the next stock quotation begins to be received. The assumed condition may be that which exists when starting the apparatus at the beginning of the day. The stock quotation will be assumed to be identified by three letters, and the price will be assumed to consist of three figures. Line relay 17, which is energized during idle conditions of the line, becomes de-energized by the start impulse associated with the signal combination pertaining to the first letter of the stock designation.

Ground is thus connected to distributor start magnet 37 through line relay contact tongue 18, contact 21, and distributor rings 23 and 27. Brush arm 32 and timing cam 126 are thus released, rotation being imparted from shaft 127 through a friction clutch. The first selecting pulse is also of spacing nature because the signal combination represents one of the letters designating the stock. Ground is, therefore, applied through contact tongue 18, contact 21, distributor ring 23 and segment 31 to relay 47, which becomes energized and attracts its contact tongue, thereby opening the locking circuit of relay 41. Since relay 41 is already assumed to be de-energized, the operation of relay 47 will be idle.

When brush arm 32 and timing cam 126 have rotated through less than 90 degrees, stop disc 129, secured to cam sleeve 128, is released by lever 138, for rotation. Following the operation of relay 47, which determines that relay 41 shall be de-energized, cam 131 closes contacts 116, thereby applying ground through conductor 114, through the outermost contact and contact tongue of relay 41 to contact tongue 108 of the first figure storage relays 62, but as this relay is assumed to be de-energized, contact tongue 108 is out of engagement with its contact and the operation of contact 116 by cam 131 is therefore idle. Had contact tongue 108 been engaging its contact, the relay 111 would have been energized to apply ground to conductor 119 and to disengage contact tongue 118 from its grounded contact.

After cam 131 has operated its contacts 116, cam 132 opens contacts 122, thereby removing one of the ground connections from conductor 121. This operation also has no effect since the ground at contact tongue 118 of relay 111 was not removed when contacts 116 were closed. By the time contacts 122 have been operated, letters selecting signal impulses are being applied to the distributor segments 29 and in response to marking impulses, the relays 44 become energized and holding circuits are completed through their holding windings, their holding contact tongues, and through the contacts 51.

During the reception of the selecting impulses, cam 133 closes contacts 102, thereby connecting ground to the middle contact tongue of relay 41 and the tongue then being in engagement with its right-hand contact, ground is connected to conductor 106 and to contact tongue 104 of relay 62, the effect of which would be, if relay 62 were energized, to energize relay 86 and remove ground from conductor 84. Since relay 62 is not energized at this time, it is apparent that the operation of contacts 102, under these circumstances, is idle.

Immediately after contacts 102 are reopened, cam 134 closes contacts 89 to connect ground to conductor 90 and to conductor 87 through the outer contact tongue and contact of relay 88, which is then de-energized due to the fact that relay 58 is de-energized, and its contact tongue 98 is disengaged from the contact connected to conductor 99. The ground connection supplied by contacts 89 is thus extended through conductor 87 and the contact tongue and contact of relay 83, and through the winding of relay 58 to battery 82, thereby energizing relay 58 which attracts all of its contact tongues 66 into engagement with the contacts connected to the conductors of cable 67, and which also attracts its contact tongue 98 and its locking contact tongue, the former of which has no immediate

effect due to the fact that conductor 99 leads to the left-hand contact of the center contact tongue of relay 41, which is not engaged by its contact tongue. Relay 83 is placed in series with relay 58 by the locking contact tongue of relay 58, and both relays remain energized, the relay 83 attracting its contact tongue to its left-hand contact, whereby conductor 87 is disconnected from the winding of relay 58 and is connected to the winding of relay 59 through the back contact and contact tongue of relay 91. By the energization of relay 58, a conductive path is completed from the code contact tongues of each of the relays 44 to the conductors in cables 67 and thus to the windings of relays 141 in the secondary storage device for letters 142.

When the last of the segments 29 has been traversed by brushes 33, cam 136 closes contacts 56 to connect ground to the code contacts of relays 44 and the ground will thus be connected to those of the code contact tongues which have been attracted, thereby supplying the ground connection through cable 53 and through the contact tongues 76, 74, 73, 71, 68 and 66 to the conductors in cables 67 and, therefore, to the corresponding relays 141 which become energized from battery 147 according to the code combination, and which become locked through the ground provided by conductor 121 and contact tongue 118 of relay 111. Thus, the code combination corresponding to the first letter of the stock identification is stored in relays 141 and thereafter cam 137 opens contacts 51 thus removing ground from the holding circuits for the relays 44 which become de-energized. A first cycle of operation of the brush arm 32 and of the cams controlled by stop disc 129 is completed.

The code combination for the second letter in the identification of the stock, if there is more than one letter, is received in the same manner as the first and controls the apparatus in the same way except that when contacts 89 are closed by cam 134, ground is applied to the winding of counting relay 59, the energizing circuit for which was prepared by pilot relay 83 when it became energized, the relay 83 having remained energized along with relay 58. Upon the energization of relay 59, its holding contact places relay 91 in series with relay 59 and holds both of the relays energized. The energization of relay 59 results in the disconnection of contact tongues 68 from the contact tongues 88 of relay 58 and contact tongues 68 become engaged with the contacts connected to the conductors in cables 69 which extend to the windings of the second set of letters storage relays 143. The energization of pilot relay 91 prepares an energizing circuit for the counting relay 61 so that the latter relay will become energized if there is a third letter in the stock designation. Following the storage of the signal combination in the relays 44, cam 136 closes contacts 56 to transfer the signal combination through cables 53 and 69 to the relays 143 certain of which become energized according to the signal combination and remain energized due to the establishment of holding circuits and relays 44 are released by the opening of contacts 51 by cam 137.

If the stock identification should contain a third letter, the apparatus would operate as previously described to bring about the energization of relays 61 and 92, and the storage of a corresponding signal combination in the storage relays 144, Fig. 2. It will be assumed, however,

that there is no third identifying letter and that following the storage of the signal combinations in relays 141 and 143, the first figure of the price is transmitted by transmitter 12. The first impulse which follows the start impulse will be of marking nature to indicate that the signal pertains to a figure and when that impulse is received, line relay tongue 18 will connect ground to distributor ring 22 and through brushes 33 to segment 28, whereby relay 41 will become energized and a holding circuit therefor will be completed through its holding contact tongue and through conductor 46 and the contact tongue of relay 47 to ground.

The middle contact tongue of relay 41 will become disconnected from conductor 106 and will become connected to conductor 99 while the outermost contact tongue will merely become disconnected from conductor 114, but will not be engaged with any other conductor. The operation of contact 116 by cam 131 will be idle as before because the circuit of relay 111, which contacts 116 are arranged to complete, will now be open at the outermost contact tongue of relay 41 as well as at the previously mentioned contact tongue 108 of relay 62. The operation of contacts 122 will be idle because relay 111 is not energized and the ground at 118 is connected to conductor 121. The closure of contacts 102 by cam 133 following the reopening of contact 122 will result in the connection of ground through contacts 102 through conductor 101, middle contact tongue of relay 41, conductor 99, contact tongue 98 of relay 58, which at this time is maintained energized by its holding circuit, and winding of relay 88 which thereupon becomes energized to attract two contact tongues.

The innermost or left-hand contact tongue, completes a holding circuit for relay 88 from the ground provided at the contact tongue of relay 86 through conductor 84 and conductor 103. The outer or right-hand contact tongue of relay 88 becomes disconnected from conductor 87 which extends to the break contact of pilot relay 93, and engages a fixed contact which is connected to the contact tongue of pilot relay 93, thereby preparing an energizing circuit for the counting relay 62. Following the reopening of contacts 102, contacts 89 are closed by cam 134 to complete the energizing circuit for relay 62 prepared by relay 83. Relay 62 thus becomes energized and attracts its five code contact tongues 73, the contact tongues 104 and 108 and its holding circuit contact tongue, which places relay 93 in series with relay 62. Relay 93 attracts its contact tongue which prepares an energizing circuit for relay 63 from conductor 99. The attraction of contact tongues 73 results in their disconnection from contact tongues 71 of relay 61 and their connection instead with the five conductors contained in cable 77 which extends to the five relays 172 which comprise the first set of storage relays in the secondary storage device for figures 171.

No operation results immediately from the engagement of contact tongue 108 with its fixed contact, as the circuit of the conductor 113 to which contact tongue 108 is connected is interrupted at the right-hand contact tongue of relay 41. Also, no immediate results occur from the attraction of contact tongue 104, as the circuit which it prepares and which includes conductor 106 is at this time open at the middle contact tongue of relay 41. The closure of contacts 56 by cam 136 following the reopening of contacts 89

results in the connection of ground to those of the conductors of cable 53 for which corresponding ones of the relays 44 have been energized. Since the circuits of the conductors contained in cable 53 now extend through contact tongues 76, 74, 73, and conductors in cable 77 to the relays 172, corresponding ones of the last mentioned relays will become energized and held in that condition by their locking circuits.

If the stock price includes a second figure, the signal combination will be received by the line relay 17 and will be distributed to the relays 41 and relays 44 by distributor 24. During the reception of the signal combination relays 63 and 94 will become energized and locked in that condition to connect the contact tongues 74 to the conductors in cable 78 and to prepare an energizing circuit for the last of the figures counting switching relays 64. If the stock price includes a third figure which may, for example, be a fraction, the relays 64 and 96 will become energized, and the signal combination will be switched to the conductors of cable 79 and thence to the last set of figure storage relays 174 which will become energized and locked according to the signal combination.

At the conclusion of the transmission of the signals pertaining to the designation and price of a stock, the distributor brush arm 32 will come to its rest position and remain at rest unless and until transmitter 12 sends another signal combination, such as for example the signal representing the first letter of the designation of the next stock quotation. In the rest interval preceding the next stock quotation signal brush arm 32 and the cams controlled by stop disc 129 will be at rest. Relay 41 will be held in energized condition due to the fact that a marking condition of line relay 17 obtained when brushes 34 last traversed segment 31 so that relay 47 did not become energized to interrupt the locking circuit of relay 41. Relays 44 are de-energized due to having been released when cam 137 operated contacts 51 just before coming to rest, relays 111 and 86 are de-energized, as many of the letter counting relays 58, 59, and 61 and as many of the figure counting relays 62, 63, and 64 as there were letters and figures in the stock quotation just received are locked in energized condition, and the relays 141, 143, and 144 are energized and held in combinations corresponding to the letter signals identifying the stock, the relays 172, 173, and 174 being also energized and held according to the figure codes. The storage of the signal combinations is necessary for the reason that, until a signal having a letter shift impulse must be received by distributor 24, to determine that the previous figure signal was the last of a quotation. When transmission of quotations is to be interrupted for an interval, a dummy quotation consisting of at least one signal including a letter shift impulse and one signal including a figure shift impulse may be transmitted in order to clear out the last quotation by effecting the operation of the perforator. The signal having the letter shift impulse will accomplish this, but will operate the first of the letter signal counting relays. It should be such a signal as will not cause one of the relays 148 to be operated. The signal combination containing the figure shift impulse is required to clear the letter signal counting relays. It may be any signal including a figure shift impulse, because no relay 148 has been operated, and the perforator will therefore not be operated. The stored figure shift signal

will be deleted when the first letter signal of the next stock quotation is received.

Upon the release of distributor brush arm 32 in response to the start impulse of the first letter signal of the next quotation or of some other signal such as an idle signal in which the letter or figure selecting impulse is of spacing nature, segments 31 and 28 will be traversed by brushes 34 and 33 respectively, ground being applied to segment 31 to complete the energizing circuit for relay 47 whereby ground is removed from the locking circuit 46 of relay 41 and the relay is released. The impulse being of spacing nature ground does not become connected to segment 28 and therefore the energizing circuit 39 of relay 41 is not completed and relay 41 remains de-energized after the brushes leave segments 31 and 28.

Shortly after the release of cam controlling disc 129, cam 131 closes contact 116 as previously described to connect ground to conductor 114. A circuit may be traced from conductor 114 through the outermost or extreme right-hand contact tongue of relay 41 which is now in engagement with its fixed contact, through conductor 113, contact tongue 108 of relay 62 which is now energized and therefore holds contact tongue 103, which is still held attracted, through conductor 112, winding of magnet 111, conductor 109, and conductor 81 to battery 82. Relay 111 will thus become energized and as it has no holding circuit it will remain energized only for the duration of the time that cam 131 holds contact 116 closed. Relay 111 attracts its contact tongues 117 and 118, the former connecting ground to conductor 119 and the latter removing one of two grounds from conductor 121. Ground is thus connected through conductor 119 to one end of all the code chains of contact tongues and contacts which control the relays 148, and if the signals corresponding to the stock identifying letters have been such as to establish a complete conductive path to one of the relays 148, or stating it somewhat differently, if the signals stored in relays 141, 143 and 144 pertain to a stock in which the subscriber is interested and which is to be printed upon his stock quotation printer, the corresponding relay 148 will be energized. Also the operating winding of relay 156 will be energized and its armature will complete a holding circuit for the particular magnet 148 which has been energized and that relay in turn will complete the holding circuit for the relay 156. At the same time that the holding circuit for relay 156 is completed, ground is connected directly to those of the punch interponent controlling magnets that are permanently coded, ground is connected to punch interponent controlling magnets 196 through cable 168 according to the code established by the relay 148 that is energized, ground is connected to the punch interponent controlling magnets 198, 199 and 201 through cables 186, 187, and 188 respectively according to the energization of magnets 172, 173, and 174, respectively and ground is connected to the winding of perforator start magnet 203. Thus the perforator mechanism 191 is set in operation.

Before contacts 116 controlled by cam 131 re-open and release relay 111, contacts 122 are opened by cam 132 to remove the second ground from conductor 121. The holding circuits for storage relays 141, 143, and 144 are thus interrupted and those of the relays which had been energized are released. After contacts 122 have

reclosed, contacts 102 are closed by cam 133, ground is connected to conductor 101 and through the middle contact tongue of relay 41 which is in its right-hand or released position to conductor 106 and thence through contact tongue 104 of relay 62 and conductor 107 to relay 86 which attracts its contact tongue, removing ground from conductor 84. Conductor 84 is included in the holding circuits of counting relays 58, 59, 61, 62, 63, 64, 83, 91, 92, 93, 94, 96, and relay 88, so that these relays are all released and are restored to the condition originally described, which is the condition for the storing of the next stock quotation. From this point on the contacts controlled by cams 134, 136, and 137 operate in the manner previously described to energize relay 58, to transfer the signal combination which has just been received and stored in relays 44 through contact tongues 66 and cable 67 to relays 141, and to release relays 44 in preparation for reception of the next signal combination.

From the foregoing it will be apparent that the secondary storage device for letters 142 and all of the apparatus ahead of that device is released immediately after the perforating mechanism is set in operation. Those of the relays 172, 173, and 174 which have been energized remain in that condition for the reason that the punch interponent controlling magnets are not provided with locking circuits and the relays of the secondary storage device for figures 171 must remain energized until the signal combinations have been perforated in the tape 211. While the perforating operation is being carried on, the signal combination pertaining to the letters identifying the next stock quotations may be stored in the secondary storage device for letters 142.

The perforating operation is completed when shaft 208 has completed one-half revolution and is arrested by magnet controlled lever 206 co-operating with stock disc 207. Just before shaft 208 is arrested one of the two diametrically opposed apices of cam 209 actuates cam controlled contacts 159 to remove ground from conductor 158. Conductor 158 is part of the holding circuit extending through tongue 157 of magnet 156 and through conductor 153 to the holding contact tongues 152 of the magnets 148, so that the holding circuit of any one of the magnets that has been energized is interrupted and the magnet is released when the ground is removed at contacts 159. Conductor 158 is also included in the locking circuit of figure storage relays 172, 173, and 174 through conductors 176, 177, and 178, so that any of those relays which had been energized are released upon the removal of ground from conductor 158 and are permitted to return to normal condition thereby being prepared to be reset in accordance with a new price quotation, ground thereby being removed from all of the punch interponent controlling magnets contained in perforator 191 so that all of those magnets become de-energized.

Those of the perforator magnets that are permanently coded receive ground connection through the outermost contact tongue of any storage relay 148 which had been energized, as does also the locking circuit for relay 156. Upon the release of the previously energized storage relay 148 the locking circuit for relay 156 is interrupted as are also the circuits of all of the permanently coded perforator magnets, these being the magnets 194, 197, and 202. Just

before cam 209 is arrested its apex which had opened contacts 159 moves out of engagement with the cam follower and permits contacts 159 to reclose, thus reconditioning the locking circuits for the storage relays 148, 172, 173, and 174 for the control relay 156 and for all of the punch interponent controlling magnets in the perforator 191.

By means of the apparatus described up to this point a perforated tape may be prepared containing signal combinations representing the price quotations of selected stocks, each quotation being accompanied by a single identifying code combination, although the quotation as received from the transmitter may have included one, two, or three identifying letters, and the quotation is further accompanied by a letters shift signal combination, a figures shift combination, and a combined line feed and carriage return combination.

Referring now to Fig. 3, the reference numeral 216 indicates generally a tape transmitter and the reference numeral 217 designates the tabulating control apparatus for a page printer, which may be the type shown in Patent 1,904,164 granted April 18, 1933 to S. Morton et al. The printer shown in this patent when modified by the addition of the tabulating control mechanism to be described hereinafter, is somewhat related to Patent 1,620,286 granted March 8, 1927, to L. M. Potts. The tape transmitter 216 may be generally similar to the transmitter shown in Patent 2,057,111 granted October 13, 1936, to L. M. Potts; also it will be apparent that the transmitter shown in the patent includes numerous features that are not required in a transmitter adapted to the present invention.

Tape 211 passes between guide plates 218 and 219 in a tape reader mechanism 221 and the code combinations are there sensed by sensing levers (not shown) which control movable contacts 222 of which there are five in the present embodiment of the invention. Contacts 222 are engageable with a fixed contact 223 to which grounded battery 224 is connected. The tape reader has a sixth movable contact 226 to be controlled by a sensing pin (not shown) which senses the marginal perforation that appears in the tape accompanying the carriage return and line feed signal at the end of each quotation. The five code signal contacts 222 are connected individually to conductors in a cable 227 and at the opposite end of the cable the five conductors are connected to the five code segments of the segmented ring 228 of a transmitting distributor 229. The sixth movable contact 226 is connected to one end of the winding of a relay 231 the other end of which is grounded.

In addition to its segmented ring 228 transmitting distributor 229 is provided with a continuous conductive ring 232 which is connected by conductor 233 to selector magnet 234 of the tabulating printer. If the printer is located at the same station where tape transmitter 216 including transmitting distributor 229 is located, conductor 233 will be a local conductor but if the printer is located at a remote point conductor 233 may be a telegraph line. Segmented ring 228 is engaged by brush 236 and continuous ring 232 is engaged by brush 237, the brushes 236 and 237 being connected together electrically and being supported by motor driven brush arm 238 which is normally held arrested by latch 239. Besides the five code segments, segmented ring 228 includes also rest segment 241

which is connected to battery 224 by conductors 242 and 243 and start segment 244 which has no conductor connected to it.

The single contact tongue of relay 231 is connected to battery 224 through conductors 246 and 243 and the single fixed contact with which it becomes engaged when relay 231 is de-energized is connected by conductor 247 to the outermost contact tongue of a relay 248. One end of the winding of relay 248 is connected to ground and the other end is connected to the fixed contact with which the outer contact tongue of relay 248 is engageable when the relay is energized and is also connected to one contact of a pair of contacts 249 controlled by a tape slack arm 251 in such a way that when the amount of tape between perforator 191 and tape reader 221 is below a predetermined value contacts 249 are open and when the amount of tape between the perforator and the tape reader is above a predetermined length the left-hand end of tape slack arm 251 will be lowered and contacts 249 will become closed. The other of the two contacts 249 is connected to battery 224 by conductor 243. From the foregoing it will be apparent that relay 248 will be energized at any time that contacts 249 are closed and may be held in energized condition after contacts 249 are opened by a holding circuit through its outermost tongue and through conductor 247, the contact and tongue of relay 231, conductors 246 and 243 to battery 224. When relay 248 has once been energized it will not be released until relay 231 has been energized to attract its contact tongue, and this operation occurs only when the sixth movable contact 225 of the tape reader engages conductive bar 223 due to the fact that the sixth sensing lever senses a marginal perforation accompanying a carriage return and line feed signal at the end of a stock quotation.

The innermost contact tongue of relay 248 is connected to conductor 252 which extends to the tabulating control mechanism of the printer as will presently appear. The fixed contact which the inner contact tongue of relay 248 engages is connected to ground. It may be stated however with reference to conductor 252 that it extends to one of a pair of normally closed contacts in the tabulating control circuit of the printer and from the other of the two contacts extends the conductor 253 to connect to one end of the winding of a start magnet 254 for releasing distributor brush arm 238 for operation, by the attraction of stop latch 239. The other end of the winding of start magnet 254 is connected to battery 256.

The tape reader and signal transmitting mechanism is shown in Fig. 3 in the rest condition with a loop of tape 211 between perforator 191 and tape reader 221 insufficient to effect closure of contacts 249 and with fixed contact 226 disengaged from contact bar 223 so that relay 231 is de-energized and its contact tongue is in engagement with its fixed contact. Moreover, relay 248 is de-energized because contacts 249 are open, and since the innermost contact tongue of relay 248 is included in the circuit of start magnet 254 for the transmitting distributor 229, magnet 254 is de-energized and brush arm 238 is held in rest condition by start latch 239 with its brush 236 engaging rest segment 241 which is always connected to battery 224 and thus holds the selector magnet 234 of the printer energized, so that the printer is at rest.

Upon the perforation of a set of signal com-

binations representing a stock quotation, tape 211 is advanced out of the perforator thereby increasing the slack between perforator 191 and tape reader 221 and permitting tape slack arm 251 to rock in counterclockwise direction and close contacts 249 whereby battery is connected to relay 248 and the relay attracts its contact tongues. It is frequently the custom to arrange the timing in tape transmitters so that the sensing pins shall be withdrawn and the tape advanced to bring the next signal combination into alignment with the sensing pins just before the distributor brush arm comes to rest. It will be assumed that this is the mode of operation in this instance, so that the first code combination of a stock quotation group is in position to be sensed by the sensing pins, but the pins are held retracted and therefore the contacts 222 and 226 are disengaged from contact bar 223 and relay 231 is de-energized, so that the holding circuit for magnet 248 requires completion only at its outermost contact tongue, and upon energization of the relay 248 the tongue is attracted and the holding circuit is completed. At the same time that the holding circuit for relay 248 is completed by its outermost contact tongue the energizing circuit for start magnet 254 is completed by the attraction of the innermost contact tongue, and brush arm 238 is released for rotation. Upon being so released, brush 236 moves off the rest segment 241 and onto start segment 244, thereby interrupting the circuit for printer magnet 234 which starts the printer in operation. At the same time the sensing pins are permitted to sense the code combination and code segments 228 are connected to battery 224 through cable 227 and through certain of the movable contacts 222 of tape reader 221 according to the code combination sensed. The code combinations contained in the tape are thus transmitted one after another to selector magnet 234 of the tabulating printer until the slack is taken up in tape 211 and contacts 249 have opened. The transmitter will not be arrested immediately upon the opening of contacts 249 because the holding circuit continues to be complete until contacts 226 are closed, due to the sensing of a marginal perforation which designates the code combination as the last in a quotation group. Upon the sensing of the marginal perforation, relay 231 becomes energized to interrupt the locking circuit of relay 248 which becomes de-energized and interrupts the circuit of start magnets 254 so that stop latch 239 is released and brush arm 238 is arrested as it completes a cycle of rotation. Because of the fact that it is desirable to complete the sensing and transmission of signals representing a stock quotation group before the tape transmitter is arrested, the tape slack arm 251 is arranged to open contacts 249 before tape 211 has actually been drawn taut by tape reader 221, thus providing slack tape to be taken up as the tape is advanced to complete the sensing of the stock quotation group.

The identity of the tabulating tape printer with the printer disclosed in Patent 1,904,164 of S. Morton et al. will be readily apparent by comparing Fig. 4 herein with the disclosure of that patent. The printer has a pivotally mounted platen carriage 261 the pivotal position of which determines the printing of figures or letters but which is not movable laterally of the printer. A type basket carriage 262 which is supported by rollers 263 resting upon rails 264 is movable transversely of the printer for letter spacing and

carriage return. Type basket carriage 262 supports type bars 266, pull bars 267, code bars 268, and ink ribbon apparatus 269. Code bars 268 are controlled by selector vanes 271 which in turn are controlled by a single magnet selector mechanism (not shown). Functions are controlled by function levers 272 which in turn are controlled by operating bail 273 which also operates print bail 274. Bail 273 is operated from main shaft 276 which also imparts character spacing movement to type bar carriage 262, through gear 277, shaft 278, pinion 279 and rack 281 under the control of spacing pawl 341.

As shown in Fig. 5, and also in the lower portion of Fig. 3, each of the selector vanes 271 has associated with it a pair of electrical contacts 282. Contacts 282 are arranged to be open when the selector vanes are positioned to correspond to a spacing condition and are closed when the vanes are moved into the position corresponding to a marking condition. Referring now to Fig. 3, it will be observed that the movable ones of the contacts 282 are connected to a conductor 283 which extends to a fixed contact normally engaged by the outermost contact tongue of a relay 284 and that from the contact tongue a conductor 286 extends to grounded battery 287. The fixed one of each of the contacts 282 is connected to one end of the winding of a relay 288 of which there are accordingly five. The other end of the winding of each of the relays 288 is connected by conductor 289 to ground. From this, it will be observed that whenever any of the contact pairs 282 is closed by its associated selector vane 271, its associated relay 288 will become energized over a circuit beginning at grounded battery 287 and extending through conductor 286, through outer contact tongue and fixed contact associated with relay 284, through conductor 283, contacts 282, and winding of associated relay 288 to ground through conductor 289.

Each of the relays 288 is provided with a plurality of contact tongues equal to the number of code storage relays 148 plus two additional contact tongues. The contact tongues of each of the upper four relays 288 are connected to the corresponding fixed contacts of the relay next below it and the contact tongues of the lowermost relay 288 are connected to the outer fixed contact of a relay 291, the outer contact tongue of which is connected to ground. The innermost fixed contact of the uppermost of the relays 288 is connected to one end of the operating winding of a relay 292, the next fixed contact is connected to one end of the operating winding of the previously identified relay 284 and those of the remaining fixed contacts of uppermost relay 288 that have been shown in the drawings are connected to one end of the operating windings of relays 293 and 294. It is to be understood that relays 288 have many more fixed contacts and contact tongues than have been shown in the drawings and that the additional fixed contacts associated with the uppermost of the relays 288 are connected to the operating windings of other relays similar to the relays 293 and 294.

Certain of the fixed contacts of relays 288 are arranged to be engaged by their associated contact tongues when the relays are de-energized and others are arranged to be engaged by their contact tongues when the tongues are attracted, the arrangements being similar to the arrangement of the fixed contacts of relays 141, 143 and 144 so

that as the relays 288 are energized in various permutational combinations, different conductive paths are established from the outer fixed contact of relay 291 to the relays 284, 292, 293 and 294 and the other relays corresponding to relays 293 and 294. Only one such conductive path may be completed in response to any permutational energization of relays 288 under the control of selector vanes 271. The innermost row of contact tongues and contacts is arranged to establish a conductive path to relay 292 in response to the signal combination perforated under the control of perforator magnets 194, which is the unshift signal. The next row of contact tongues and contacts is arranged to establish a conductive path when relays 288 are energized according to the signal combination perforated under the control of magnets 197, which is the shift signal. The remaining alignments of contact tongues and contacts shown are arranged to respond to codes perforated in the tape under the control of magnets 196 and the coding corresponds to those established by two of the relays 148. Other alignments of contacts and tongues will be coded to correspond to the codes established by others of the relays 148.

Relay 291, which connects ground to the tongues of the lowermost relay 288 by attracting its grounded outer contact tongue into engagement with its fixed contact, has one end of its winding connected to ground and the other end of the winding connected to one of a pair of normally open contacts 296 carried by the frame of the printer as shown in Fig. 5, and arranged to be closed momentarily by the lever 297 which trips the clutch for driving the main operating cam assembly, the lever 297 being operated by sixth cam projection 298 of the selector cam assembly. The other of the two contacts 296, which in Fig. 3 is the movable contact, is connected to conductor 283 which is normally connected to battery 287 through a previously identified circuit. Thus, upon the closure of contacts 296, relay 291 becomes energized and attracts its two contact tongues, the inner of which engages a fixed contact that is connected to the battery end of the winding of relay 291 to establish a holding circuit, the inner contact tongue being connected by conductor 299 to the fixed contact of a relay 301, the contact tongue of which engages its fixed contact when relay 301 is de-energized. The contact tongue is connected to conductor 283 for supplying a holding connection for the winding of relay 291 from battery 287.

One end of the winding of relay 301 is connected to battery 302 and the other end is connected by conductor 303 to the opposite ends of the operating windings of the relays 284 and 292 from those to which the first two fixed contacts of the uppermost relay 288 are connected, so that when contacts 296 close and relay 291 becomes energized, the energizing circuit for relay 284 or 292 extends from ground to the outermost contact tongue of relay 291, through a chain of contacts and tongues of relays 288, through the winding of relay 284 or 292, through conductor 303 and the winding of relay 301 to battery 302 which is grounded. The operating windings of relays 293 and 294 and all other similar relays are also connected to conductor 303 so that relay 301 is energized when the relay 293 or 294 is energized, but the connection is through conductor 305, through the outer contact and tongue of relay 292, and through conductor 304 to conductor 303. The outer contact and contact tongue of relay

292 are normally disengaged so that relays 293 and 294 can be energized only when relay 292 is energized.

Relay 292, which responds to the unshift code combination, has a holding winding, one end of which is connected by conductor 306 to ground and the other end of which is connected to the inner fixed contact of the relay. The innermost contact tongue of relay 292 is connected by conductor 307 and conductor 308 to a rest segment 309 and to a first group of interconnected segments 311 of a tabulating control commutator 312. Commutator 312 includes a row of segments supported by an insulating bar 314 (Fig. 4) extending across the printer and supported by the frame thereof, and a continuous conductive bar also supported by insulating bar 314, the continuous bar being identified 316. A brush carrier 317, secured to the movable type bar carriage 262, supports electrically interconnected brushes 318, one of which is in engagement with the row of conductive segments, and the other of which is in engagement with the continuous conductive bar 316. The row of conductive segments includes a segment for each character printing position and nonconductive mounting bar 314 is so positioned that when type bar carriage 262 is at its beginning-of-line position, one of the brushes 318 engages the rest segment 309 and when carriage 262 is in its extreme end-of-line position, the brush engages the last segment in the row. The continuous conductive bar 316 is connected to grounded battery 287 so that when brushes 318 engage segment 309 or any one of the segments 311, they extend the holding circuit from conductor 308 through conductive bar 316 to battery 287.

All of the segments in the commutator are interconnected in groups, such as the groups of segments 321, 322, and 323. The interconnected segments 321 are connected by conductor 324 to the outermost contact tongue of relay 293, the interconnected segments 322 may be connected to a similar relay (not shown) and the interconnected segments 323, which have been indicated as the last group of segments, are connected by a conductor 326 to the outermost contact tongue of relay 294. The outermost fixed contacts of relays 293 and 294 and of any similar relays are connected by conductor 327 to conductor 308 so that when relays 293 and 294 and all similar relays are de-energized and their outermost contact tongues engage their associated fixed contacts, all of the segments of the commutator are connected to battery 287 through continuous bar 316, brushes 318, interconnected rest segment 309 and segments 311, conductor 308, conductor 327, outer contacts and tongues of relays 293 and 294, and conductors 324 and 326. Upon the energization of either of the relays 293 and 294, the group of segments connected to the outer contact tongue associated therewith will be isolated from battery 287.

One end of the holding winding of each of the relays 284, 293 and 294 is connected by conductor 325 to grounded battery 302 and the other end of each holding winding is connected to the innermost fixed contact of the relay. The innermost contact tongue of each of the relays is connected by conductor 328 to the fixed contact of relay 329, the grounded contact tongue of which normally engages its fixed contact. One end of the winding of relay 329 is connected by conductor 331 to the middle fixed contact of relay 284, the contact tongue of which is connected to grounded

conductor 306 and the other end of the winding of relay 329 is connected to the outermost contact tongue of relay 332. The outermost fixed contact of relay 332 is engaged by the outer contact tongue when the relay is de-energized and is connected by conductor 333 to conductor 308, which is normally connected to battery through rest segment 309 and brushes 318. The center fixed contacts of relays 292, 293 and 294 are connected together by conductor 334. The center contact tongue of relay 292 is connected to grounded conductor 306 and the center contact tongues of relays 293 and 294 are connected by conductor 336 to one end of the operating winding of relay 332, the other end of which is connected to the outermost contact tongue of relay 332, to receive battery connection from conductor 333, as does relay 329. Since the energizing circuit for relay 332 extends through the center contact and tongue of relay 292 and through the center contacts and tongues of relays 293 and 294, it will be apparent that relay 292 must be maintained energized by its holding circuit at the time relay 293 or 294 is energized in order for relay 332 to be energized. Relay 332 has its innermost contact tongue connected to battery conductor 333 and the innermost fixed contact of the relay is connected to one end of its holding winding, the other end of which is grounded, and the innermost fixed contact is also connected to one end of the winding of electromagnet 337, the other end of which is grounded.

Electromagnet 337 is also shown in Figs. 4 and 6 and its pivoted armature 338 engages a pin 339 carried by spacing pawl 341. Spacing pawl 341 normally engages spacing ratchet 342 and holds it stationary. Ratchet 342 is driven from shaft 276 by a friction clutch (not shown) with which is associated a gear (not shown) which meshes with and imparts rotation to spacing shaft gear 277. For normal single-character spacing in the printer, a bail operated lever arm 343 rocks spacing pawl 341 clockwise to withdraw it from blocking engagement with ratchet 342 and, at the same time, a check pawl 344, which has an arm 346 engaging bail operated lever arm 343 on the opposite side from the point of engagement with spacing pawl 341, is rocked clockwise by tension spring 347 which interconnects spacing pawl 341 and check pawl 344 to limit the rotation of ratchet 342 to an amount which will give one character space. When magnet 337 is energized, pawl 341 is withdrawn from the path of the teeth on ratchet 342, but the check pawl 344 is not permitted to rotate clockwise because it is held by bail operated arm 343 which at the time is stationary. Thus, spacing ratchet 342 is permitted to rotate continuously as long as magnet 337 remains energized and holds pawl 341 disengaged from ratchet 342.

Referring now to Fig. 4, it will be observed that the printer has a sixth vane 347 similar to the five selector vanes 271. Vane 347 is controlled according to the shift and unshift signals, being presented in extreme counterclockwise position, as shown in Fig. 4, in response to unshift or letter case signals and being rocked to extreme clockwise position in response to shift or figure case signals. When vane 347 is presented in the position shown in Fig. 4, it permits clockwise movement of function lever 272 and through it restricts clockwise movement of bail 273 and the movement of print hammer pull bar operating bail 274 and of normal spacing arm 343 so that neither printing nor single character spacing will

be performed in response to signal combinations following the unshift signal. When vane 347 has been positioned in response to the figure shift signal, function lever 272 will be blocked and the movement of bail 273 will not be restricted so that the type bars 266 may be operated as selected to effect printing and spacing bail arm 343 may operate to effect single character spacing.

The operation of the printer, as modified by the control circuit shown in the lower portion of Fig. 3, will now be described. As transmitting distributor 229 begins to operate, it impresses signaling impulses upon conductor 233 and thus upon selector magnet 234 of the printer according to the first code combination in a stock quotation group which is the unshift or letters combination. Through the selector mechanism in the printer, selector vanes 271 are set under the control of selector magnet 234, the setting of the vanes 271 being in clockwise direction for all five, whereby all of the contacts 282 are closed and the magnets 288 are energized. Thus, all of the contact tongues associated with the relays 288 are attracted and for this particular signal combination, in which all of the selecting impulses are of marking nature, the conductive path is prepared for relay 292 through the innermost contact tongues and contacts of all of the relays 288.

Near the end of the receiving cycle, the selector cam assembly closes contacts 296, thus energizing relay 291 over a circuit extending from grounded battery 287, conductor 286, outermost contact and tongue of relay 284, which at this time is de-energized, conductor 283, contacts 296 and winding of relay 291 to ground. A holding circuit for relay 291 is established through the contact and tongue of relay 301, through conductor 299, and through the innermost contact tongue and contact of relay 291, and in addition the prepared circuit for the energization of relay 292 is completed by the engagement of the grounded outer contact tongue of relay 291 with the outer contact. Relay 292 thus becomes energized by current supplied from battery 302 through the winding of relay 301 and conductor 303, so that relay 301 also becomes energized and attracts its contact tongue, thus opening the holding circuit for relay 291 which becomes de-energized, if and when contacts 296 have reopened. As relay 292 becomes energized, it attracts its three contact tongues into engagement with their respective contacts. A holding circuit for relay 292 is established by the innermost contact and tongue from battery 287 through continuous conductive bar 316, brushes 318, rest segment 309, conductors 308, 307 and 306 to ground. The center contact and tongue of relay 292 prepares for the energization of relay 332 by closing the energizing circuit at one of the two points at which it is open, the circuit remaining open at the parallelly connected center contacts and contact tongues of relays 293 and 294 and all similar relays. The outermost contact and tongue of relay 292 prepare an energizing circuit for the relays 293 and 294 by interconnecting the conductors 304 and 305 that are included in the energizing circuits of those relays, but which are disconnected when relay 292 is de-energized.

The next signal combination to be applied to the selector magnet 234 is that which was established by one of the storage relays 143 and, therefore, identifies by a single code combination a stock which may have been identified by one, two or three letters as originally transmitted. No

character will be printed in response to this code combination as the sixth vane 347 was set in response to the unshift combination to prevent effective operation of the printing and spacing bails. Selector vanes 271 will be set according to the stock identifying code combination and corresponding ones of the relays 288 will be energized according to the closure of contacts 282. It will be assumed that the signal combination is such as to establish a conductive path through the third row of contact tongues and contacts, counting from the left, so that an energizing circuit will be prepared for relay 293. Upon the closure of contacts 296, relay 291 will become energized and locked and an energizing circuit will be completed for relay 293 from battery 302, through relay 301, conductors 303 and 304, outer contact and tongue of relay 292, and conductor 305 to the operating winding of relay 293 and thence to ground through the outer contact and tongue of relay 291. Relay 301 thus becomes energized along with relay 293 and opens the holding circuit for relay 291 which becomes de-energized. The innermost contact and tongue complete a holding circuit for relay 293 which extends directly to battery 302 without going through the winding of relay 301, but which includes the contact and tongue of de-energized relay 329. The middle contact and tongue complete the energizing circuit for relay 332 and the outer contact tongue disconnects segments 321 from conductors 308 and 327 and thus segments 321 are isolated electrically from all of the other segments which are connected together electrically through conductor 308, conductor 327 and the outer contact and tongue of relay 294 and all similar relays.

Relay 332, upon becoming energized, attracts its three contact tongues. The innermost contact tongue completes the holding circuit for the relay and also the energizing circuit for electromagnet 337. The outermost contact and tongue of relay 332 opens the energizing circuits for relay 329 which is not at this time energized because of the fact that its circuit is also open at the center contact tongue and contact relay 254, which is not energized. The center contact and tongue of relay 332 are connected to the previously identified conductors 252 and 253 included in the energizing circuit for start magnet 254 of transmitting distributor 229 and this circuit becomes opened at the center contact and tongue of relay 332 to release magnet 254 and thus arrest transmitting distributor 229 at the end of a cycle and delay the transmission of further signal combinations to afford the type bar carriage 262 (Fig. 4) time in which to space to the position at which the stock price is to be printed as selected by the tabulating control relay 293. The release of magnet 254 may not occur until after brushes 236 have moved off of rest segment 241 and have begun to transmit the next signal, which is the figure shift combination. Since this signal selects a function, and not a recording operation, the function may be performed while the carriage is spacing continuously to the selected printing position. The arrestment of brush arm 238 will occur before the transmission of the first figure signal combination has begun.

Electromagnet 337, upon becoming energized, attracts its armature 338 (Figs. 4 and 6) and lifts spacing pawl 341 out of engagement with spacing ratchet 342 which is permitted to rotate continuously, whereby continuous movement is im-

parted to type bar carriage 262 through shaft 276, gear 277, shaft 278, pinion 279 and rack 281.

As the carriage 262 travels towards its end-of-line position, brushes 318 move off of rest segment 309 and traverse segments 311, thereby continuing to supply holding current for relay 332. However, when brushes 318 encounter the first of the segments 321, they apply a battery connection from battery 287 to conductor 324, but since the outermost contact tongue of relay 293 is disengaged from its contact, the battery connection is not applied to conductor 327, 308, 307 or 333 and thus the relay 332, relay 292 and electromagnet 337 become de-energized, the type bar carriage 262 thus being arrested by restoration of spacing pawl 341 to effective engagement with spacing ratchet 342, the energizing circuit for start magnet 254 of transmitting distributor 229 being reclosed and the energizing circuit for relay 329 being reprepared at the outer contact and tongue of relay 332.

The next signal combination to be established in the selector vanes 271 is the figure shift combination. This signal combination results in shifting of the platen carriage 261 to its shift or figure printing position in accordance with the normal operation of the printer, the platen having previously been shifted to its unshift or letters printing position in response to the first signal combination of the group. The shift combination also establishes through the second row of contact tongues and contacts of relays 288, counting from the left, the energizing circuit for relay 284 which becomes energized and along with it relay 301 which interrupts the holding circuit for relay 291. Upon the energization of relay 284, a holding circuit is completed through its innermost contact and tongue. Its center contact and tongue connect ground to the winding of relay 329, but this relay does not become energized at this time because the segments 321, which battery supplying brushes 318 engage, are not connected to the conductive path comprising conductors 327, 308 and 333, relay 293 being still held energized by its holding circuit, and its outer contact tongue therefore maintaining the energizing circuits of relays 332 and 329 open. The outermost contact and contact tongue of relay 284 disconnect conductor 283 which extends to contacts 296 and to all of the contacts 282 from conductor 286, which is connected to battery 287, thus preventing magnets 288 from being energized as long as relay 284 remains energized.

The receiving printer has now been conditioned for the printing of figures and through its tabulating control circuit and apparatus shown in the lower part of Fig. 3, it has been conditioned for the printing of those figures in a particular vertical column pertaining to the stock, the price of which is to be printed, as a result of the selection of relay 293. The printing and spacing mechanism of the printer operate normally for the printing of the price, and the code combinations representing the figures of the price do not in any way affect the tabulating control circuits and apparatus because battery 287 is disconnected from the contacts 282 and 296 and the relays 288 cannot become energized.

After the last figure of the price has been received, the final code combination in the group is transmitted by distributor 229 to the selector magnet 234 of the printer, this being the combined carriage return and line feed signal. This signal has no effect upon the magnet 288 but it selects and sets in operation the line feed and car-

riage return function mechanism of the printer, thus causing type bar carriage 262 to be restored to its beginning-of-line position. Brushes 318 are thus moved back across segments 311 to come to rest upon segment 309. As soon as brushes 318 encounter segments 311, battery is again applied directly to conductor 308 and 333 and thus to the operating winding of relay 332 and to relay 329. Relay 332 does not become operated because its energizing circuit is now opened at the center contact tongue of relay 292 which was previously released. However, relay 329 does become energized through the center contact tongue of locked relay 284 and relay 329 attracts its contact tongue to remove ground from the holding circuit of relays 284 and 293 which become de-energized. Thus, the tabulating control mechanism is restored to normal condition, with all of the relays de-energized and with battery reconnected to one side of each of the pairs of contacts 282 and 296 in preparation for the reception of the next group of stock quotation signals.

Fig. 8 illustrates the kind of tabular recording of stock quotations that may be achieved with the apparatus according to the invention. All quotations pertaining to particular stocks are printed in their own vertical columns. Since the printer returns to its beginning-of-line position and line feeds the paper between any two successively received quotations, no two quotations are printed upon the same line. In any particular column, printed quotations may occur frequently or sparsely, depending upon the relative activity in the several stocks. Regardless of the spacing between any two quotations relating to the same stock, they may be observed merely by looking up or down the column to which they are assigned.

Fig. 8 also illustrates an arrangement by which the various columns and the stocks assigned thereto may be identified, so that the paper upon which the quotations are printed may be plain and unruled. The arrangement involves the use of a sheet 351 of transparent material, such as glass, Celluloid or other plastic material, preferably colorless. The sheet 351 is mounted so that paper 352 upon which quotations are printed passes upwardly behind the sheet 351 as it leaves the platen. The sheet 351 is vertically ruled, scored or otherwise provided with lines, as at 353, which establish visible columns in which the quotations appear, thus making easier the observation of quotations pertaining to any stock. The stock identifying symbols may be applied to sheet 351 near the top, and between the rulings, as shown in Fig. 8, thus completely identifying the columns and the quotations contained therein.

With reference to the tabulating control segments which the type bar carriage brushes engage, it is to be noted that the grouping of the segments in threes is purely for purposes of illustration. Some stock prices may consist of only a single digit and a fraction and such a quotation would require only two character spaces. Accordingly, only two segments would be required to determine the location and the space allotted to it and thus the width of the page would be utilized to the greatest advantage. Other stock prices may involve three digits and a fraction and, accordingly, four segments would be connected together electrically to represent the space allotted to quoted prices for that stock. It should be noted that for the accommodation of such quotations, an additional set of relays would be required in the secondary storage device for figures and correspondingly an additional set of punch

interponent controlling magnets would be required in the perforator 191. Such additions are entirely within the contemplation of the present invention.

Although a particular embodiment of the invention has been shown in the drawings and described herein, it is to be understood that the invention is not to be interpreted as limited to specific details disclosed, but is capable of modification and rearrangements within the scope of the appended claims.

What is claimed is:

1. In a message tabulating system, means for transmitting classifiable message material, means for classifying said message material, a single printing telegraph apparatus for printing the message material, and tabulating means in said apparatus for selecting in a single step the column for printing according to the classification of the message material.

2. In a telegraph system, a signal code receiving mechanism, means for storing received code signals individually, means for storing a plurality of code signals, means for transferring code signals from said first storing means to said second storing means, means for translating certain of the code signals in said second storing means to a single code signal, means for storing said single code signal, and means for recording simultaneously said single code signal and the remainder of the code signals in said second storing means.

3. In a telegraph system, a signal code receiving mechanism, means for storing individually all of the code signals received by said mechanism, means for registering and storing a plurality of code signals, and counting relay means for transferring code signals from said first mentioned storing means to said registering and storing means.

4. In a telegraph system, operable upon code signal combinations of two different classes, a signal receiving mechanism, means for storing individual signal combinations, means associated with said storing means for registering the class to which each signal combination belongs, means for storing a plurality of signal combinations of each class, counting relay means for transferring said signal combinations to said second mentioned storage means, and means controlled by said signal class registering means for controlling said counting relay means.

5. In a telegraph system operable upon code signal combinations of two different classes, a signal receiving mechanism, means for storing a received signal combination, means associated with said storing means to register the class to which the stored signal combination belongs, means for storing a plurality of signal combinations of each class, counting relay means associated with the storing means for each class for transferring said signal combinations to the respective storing means, and means controlled by said signal class registering means for activating first one and then another of said counting relay means.

6. In a telegraph system, a primary set of signal storage relays, a plurality of secondary sets of signal storage relays arranged into two groups, a set of counting relays associated with each group of secondary sets of storage relays for transferring signals to the secondary sets of storage relays, and means operable following the storage of a variable number of signals in one group of secondary storage relays for discontinuing the counting operation in the counting

relays associated with said one group and for initiating a counting operation in the other set of counting relays.

7. In a telegraph system, a device for receiving equal length permutation code signals comprised of a predetermined number of impulses, means for storing successively said permutation code signals, a plurality of groups of means for storing equal length permutation code signals comprised of a lesser number of impulses than said received signals, means for transferring to the second mentioned storing means the number of impulses of a received permutation code signal which the second mentioned storing means accommodates, and means controlled by the remainder of the received permutation code signal for determining to which of the groups of the second mentioned storing means the transfer is made.

8. In a telegraph system, a device for receiving equal length permutation code signals comprised of a predetermined number of impulses, means for storing successively said permutation code signals, a plurality of groups of means for storing equal length permutation code signals comprised of a lesser number of impulses than said received signals, means for transferring to the second mentioned storing means the number of impulses of a received permutation code signal which the second mentioned storing means accommodates, means controlled by the remainder of the received permutation code signal for determining to which of the groups of the second mentioned storing means the transfer is made, and means associated with one of said groups of storing means for translating the codes stored therein into one permutation code signal.

9. In a telegraph system, operable upon code signal combinations of two different classes, a signal receiving mechanism, means for storing a variable number of code signal combinations of each class, means for translating the stored signal combinations of one class into one code signal combination, and means for recording said one translated code signal combination and the code signal combinations of the other class.

10. In a telegraph system, operable upon code signal combinations of two different classes, a signal receiving mechanism, means for storing a variable number of code signal combinations of each class, means for translating the stored signal combinations of one class into one code signal combination, and means for recording said one translated code signal combination, said code signal combinations of the other class, and a plurality of predetermined and invariable function code signals.

11. In a printing telegraph apparatus, a printing support for page width paper, a set of printing instrumentalities, means for producing relative movement between said set of printing instrumentalities and said paper support for character spacing, means responsive to telegraph signals of a certain class for activating said movement producing means continuously to select any of a plurality of groups of character spaces, and means responsive to telegraph signals of another class for selecting printing instrumentalities for printing in the selected group of spaces.

12. In a printing telegraph system a signal controlled printer having a character spacing carriage, means for imparting movement to said carriage, means for limiting said movement to single character spaces, means for disabling said limiting means whereby continuous movement is

imparted to said carriage, a commutator for controlling the extent of said continuous movement during each effectiveness of said disabling means, a transmitter connected to said printer, and means for arresting said transmitter during continuous movement of said carriage.

13. In a printing telegraph system, a signal controlled printer having a character spacing carriage, means for imparting movement to said carriage, means for limiting said movement to single character spaces, means for disabling said limiting means whereby continuous movement is imparted to said carriage, a commutator for controlling the extent of said continuous movement during each effectiveness of said disabling means, a transmitter connected to said printer, and means operated in conjunction with said disabling means for delaying the transmission of signals from said transmitter until the cessation of said continuous movement.

14. In a printing telegraph apparatus, a carriage movable for character spacing, means for imparting movement to said carriage, means for limiting said movement to single character spaces, means for disabling said limiting means whereby continuous movement is imparted to said carriage to any one of a plurality of positions, and signal controlled means for selectively determining any one of the plurality of positions at which the movement of said carriage is to be arrested.

15. In a printing telegraph apparatus, a set of printing instrumentalities, a carriage movable for character spacing, means for imparting movement to said carriage, means for limiting said movement to single character spaces, signal controlled selectable means for disabling said limiting means to selectively determine the extent of continuous movement imparted to said carriage, and means for disabling said printing instrumentalities upon the selection of said disabling means.

16. A method of recording message material on a page in tabular form which comprises character spacing in a single step to any of a plurality of column positions, recording the message material in the selected column position, and advancing the page whereby message material is recorded in only one column in each line.

17. A method of recording message material on a page in tabular form which comprises rapid-spacing recording instrumentalities in a single step to any of a plurality of column positions, recording the message material in the selected column position, and advancing the page and restoring the recording instrumentalities to the beginning of line position whereby message material is only recorded in one column in each line and the recording instrumentalities are invariably prepared for rapid-spacing to the next selected column position.

18. In a printing telegraph system for transmitting, receiving and recording message units comprising informative message material and classification identifying material, means for receiving and storing successively signal combinations representing the characters comprising said informative message material and said classification identifying material, means for storing concurrently all of the signal combinations representing said characters, a telegraph page printer having printing instrumentalities and a spacing instrumentality, means controlled by the concurrently stored signal combinations of the characters comprising the classification identi-

fying material for controlling said spacing instrumentality to select a column in which said informative message material is to be printed, means for disabling said printing instrumentalities during the selection of said column, and means for selecting and operating said printing instrumentalities according to the concurrently stored signal combinations representing the characters comprising said informative message material for printing said characters in the selected column.

19. In a printing telegraph system for transmitting, receiving and recording stock quotations, means for receiving and storing successively signal combinations representing a stock identification and a price, means for translating said stored stock identifying signals into a tabulating signal, means for storing concurrently said tabulating signal and said price signal combinations, a telegraph page printer, a tabulating mechanism in said printer operable in response to said stored tabulating signal for selecting a column of the page for the printing of the stock price, and printing instrumentalities in said printer controlled by said stored price signal combinations for printing said price in the selected column.

20. In a printing telegraph system for transmitting, receiving and recording message units comprising informative message material and classification identifying material, means for receiving and storing successively signal combinations representing the characters comprising said informative message material and said classification identifying material, means for storing concurrently all of the signal combinations representing the characters comprising said classification identifying signals, means for translating said stored signal combinations into a tabulating signal combination, means for concurrently storing the signal combinations representing the characters comprising said informative message material, means for transmitting successively said tabulating signal combination and said last-mentioned stored signal combinations, a telegraph page printer connected to said transmitter, tabulating means controlled by said tabulating signal for selecting a column, and printing instrumentalities responsive to said informative message material signal combinations for printing said material in said column.

21. In a telegraph system, operable upon code signal combinations of two different classes, means for successively receiving and storing signal combinations of both classes each including its class identifying condition, means for storing a plurality of signal combinations of each class, means for transferring signal combinations of each class to their respective storing means, said stored signals being thereby divested of their individual class identifying conditions, means for translating the signal combinations is one of the last-mentioned storing means into a single signal combination, and means for recording said single signal combination and an accompanying signal combination indicative of its class, and for recording the signals stored in the other of said last-mentioned storing means and preceding the first a signal combination indicative of the class of said signals.

22. In a printing telegraph system, means for receiving signal combinations each of which includes its own shift or unshift determining condition, means for storing said signal combinations successively, means for storing a plurality of signal combinations of each type divested of

their shift or unshift determining conditions, means for transferring said signal combinations from the first-mentioned storing means to their respective second-mentioned storing means and divesting the signal combinations of said determining conditions, means for translating the signals stored in one of said second-mentioned storage means into a single signal combination, means for preparing a perforated record of the translated signal combination and of the signal combinations stored in the other of said second-mentioned storing means, means included in said record preparing means for perforating before each such translated signal combination a signal combination corresponding to the shift or unshift condition of the original signal combinations from which said translated signal combination was derived, and means also included in said record preparing means for perforating before the first of the signal combinations corresponding to those stored in the other of said second-mentioned storing means a signal combination corresponding to the shift or unshift condition which accompanied those signals prior to their storage.

23. In a stock quotation printing system, means for receiving signals representing stock identifications and prices, means for storing said signals, means for translating the signals representing identifications of predetermined ones of said stocks into single identifying signal combinations, means for preparing a perforated record of said single identifying signal combinations and of the price signals accompanying the stock identification signals from which said single identifying signal combinations were derived, means for transmitting telegraph signals under the control of said perforated record, and means for receiving the signals generated by said transmitting means and for printing the quotations represented thereby.

24. In a stock quotation printing system, means for receiving signals representing stock identifications and prices, means for storing concurrently the signals pertaining to one quotation, means for preparing a perforated record of stock identification and price signals stored in said storing means, and means controlled according to stored signals representing the identifications of predetermined stocks for estopping the operation of said record preparing means.

25. In a stock quotation printing system, means for receiving signals representing stock identifications and prices, means for storing concurrently the signals pertaining to one quotation, means for preparing a perforated record of the stock identification and price signals stored in said storing means, means responsive to operation of said receiving means following the storing of a quotation for setting in operation said record preparing means, and means for clearing said storing means following the setting in operation of said record preparing means.

26. In a stock quotation printing system, means for receiving signals representing stock identifications and prices, means for storing concurrently the signals pertaining to one quotation, means for preparing a perforated record of stock identification and price signals stored in said storing means, means controlled according to stored signals representing the identification of predetermined stocks for estopping the operation of said record preparing means, and means operably responsive to operation of said receiving means following the storing of a quotation for clearing said storing means.

27. The method of tabulating stock quotations which comprises the steps of transmitting signals representing stock designations and prices of a large number of stocks, selecting certain stocks, translating the designations of the selected stocks into other designations corresponding to columnar positions on a page, transmitting the translated designations, retransmitting the corresponding prices, and recording the retransmitted prices on a page in columns according to the translated column designations.

28. In a printing telegraph system, means for receiving permutation code signals, means for storing a plurality of groups of said received permutation code signals, and means operable under the control of said stored signals for perforating in a record medium a plurality of groups of permutation code signals in a single operation.

29. In a printing telegraph system, means for receiving permutation code signals, means for storing a plurality of groups of said received permutation code signals, and means operable under the combined control of certain ones of said stored permutation code signals for perforating in a record medium a single permutation code signal.

30. In a telegraph system, means for transmitting a plurality of groups of signals representing a complete message, means for transmitting under the control of said plurality of groups of signals a second corresponding plurality of groups of signals, a recorder operated by said second plurality of groups of signals, and means for automatically adding to the second plurality of groups of signals appropriate groups of signals for controlling functions in the recorder so that extra spacing between messages recorded on the message material is provided.

31. In a telegraph system, means for transmitting a plurality of groups of signals representing a complete message, means for transmitting under the control of said plurality of groups of signals a second corresponding plurality of groups of signals, a page printing recorder operated by said second plurality of groups of signals, and means for automatically adding to the second plurality of groups of signals appropriate groups of signals for controlling functions in the recorder to perform a line feed operation after the recording of each message on the record material.

32. In a telegraph system, means for transmitting a plurality of groups of permutation code signals and means for making a single permutation code record which represents said plurality of groups.

33. In a telegraph system, means for transmitting signals representing information relating to a large number of items, means controlled by the signals for selecting only a limited number of the items, means for translating said signals into other signals and automatically adding to the translated signals other signals indicative of function operations and means for preparing a perforated control record corresponding only to the selected items.

34. In a telegraph system, means for transmitting two classes of signals, one corresponding to a shift condition and the other to an unshift condition, means for making a record on record receiving material, means controlled by the signals of one class for determining the record to be made, and means controlled by the signals of the other class for determining any one of a plu-

ality of locations on the record material at which the record is to be made.

35. In a telegraph system, means for transmitting two classes of permutation signals, one corresponding to a shift condition and the other corresponding to an unshift condition, means for making a record on record receiving material, means controlled by signals of one class to determine the record to be made, means controlled by signals of the other class to determine selectively the location of the record on the record material, means for determining the selection of the record to be made or the selection of the location for the record, the effectiveness of said means being dependent upon the shift or unshift condition of the recorder whereby either selection may be made by one permutation signal.

36. In a telegraph system, means for receiving permutation code signals in groups, each group corresponding to a separate item, two sets of signal counting relays, and means controlled by the signals to switch from one set of counting relays to the other after any received signal.

37. In a telegraph system, means for receiving a series of code signals, two sets of counting relays, means for generating a counting impulse for each code signal, and means for switching the impulse to one or the other of the sets of relays for any code signal.

38. In a telegraph system, means for transmitting a series of code signals, two sets of counting relays, means for generating a counting impulse for each code signal, and means controlled according to a single impulse of each received code signal for switching the counting impulse to one or the other of the sets of counting relays.

39. In a telegraph signal perforator, means for perforating in a single operation a plurality of groups of code perforations, each group corresponding to a complete message item, means for invariably perforating certain codes in predetermined positions in the record material, and signal controlled means for varying the codes perforated in the other positions.

40. In a telegraph system, means for transmitting a plurality of group of signals relating to a single item of information, means for storing all of said groups of signals comprising one item simultaneously, and means for recording the item of information while a plurality of groups of signals relating to the next succeeding item of information are being received.

41. In a recorder, recording mechanism, rapid letter spacing mechanism, means controlled by a special code signal for rendering the recording mechanism unresponsive to code signals, means responsive to any of a plurality of code signals for rendering the rapid letter spacing mechanism operative, means for stopping the rapid spacing mechanism variably according to the particular signal code by which it was started, means for

rendering the recording mechanism unresponsive, and means controlled by another special code signal for restoring the recording mechanism to code signal responsive condition.

42. In a telegraph system, means for transmitting groups of signal combinations of impulses, each group representing a complete message, means for transmitting under the control of each group a second corresponding group, and means for adding to the second group extra signal combinations of impulses.

43. In a telegraph system, means for transmitting signals representing information relating to a large number of items, means controlled by the signals for selecting only a limited number of the items, means for translating said group of signals to a second corresponding group, means for adding to the second group extra signal combinations of impulses, and means for preparing under the control of said second group and added combinations a perforated control record corresponding only to the selected items.

44. The method of tabulating item information which comprises the steps of transmitting signals representing item designations and related data of a large number of items, selecting certain items, translating the designations of the selected items into other designations corresponding to columnar positions on a page, transmitting the translated designations, receiving and retransmitting the corresponding data, and recording the retransmitted data on a page in columns according to the translated column designations.

45. In a printing telegraph machine, a carriage, means for advancing said carriage continuously to effect spacing movements thereof, a spacing mechanism to limit the movement of said carriage to a single character space at a time, selectively controlled means for rendering said spacing mechanism ineffective to limit the movement of said carriage to single spaces, stop means for limiting the movement of said carriage, and selectively controlled means responsive to a single selection for operating said stop means to determine the periods of ineffectiveness of said spacing mechanism.

46. In a printing telegraph apparatus, a selecting mechanism, a printing mechanism controlled by said selecting mechanism, a carriage coacting with said printing mechanism, a spacing mechanism for advancing said carriage one space at a time, a tabulating mechanism controlled by said selecting mechanism for causing said carriage to advance through a plurality of spaces at a time, stop means for arresting the advancement of said carriage, and means responsive to a single selection for operating said stop means to determine selectively the degree of advancement of said carriage.

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