C. L. KRUM.

TRANSMITTER FOR ELECTRIC TELEGRAPHS AND THE LIKE.

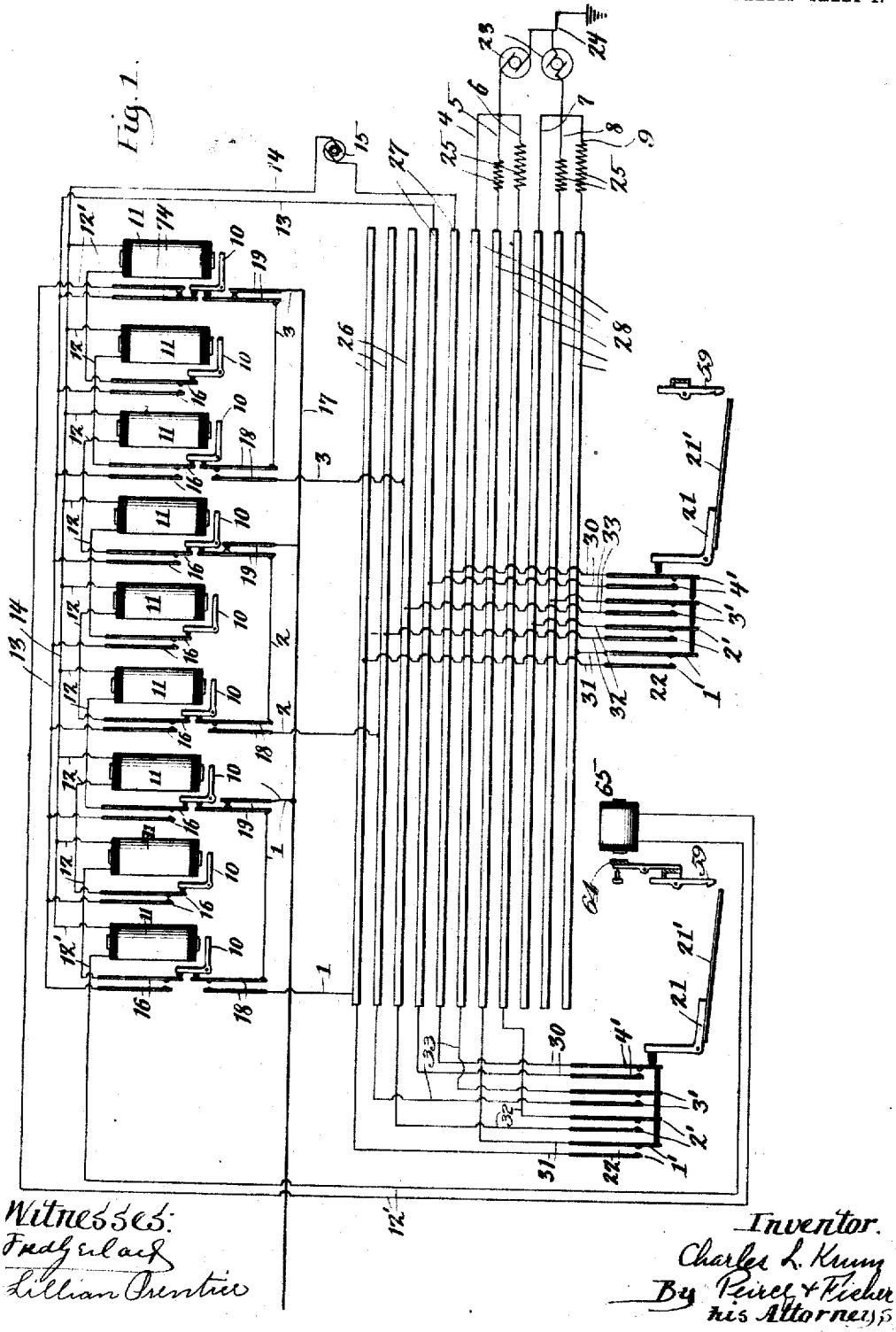
APPLICATION FILED APR. 11, 1904.

929,602.

Patented July 27, 1909.

4 SHEETS—SHEET 1.

Fig. 1.



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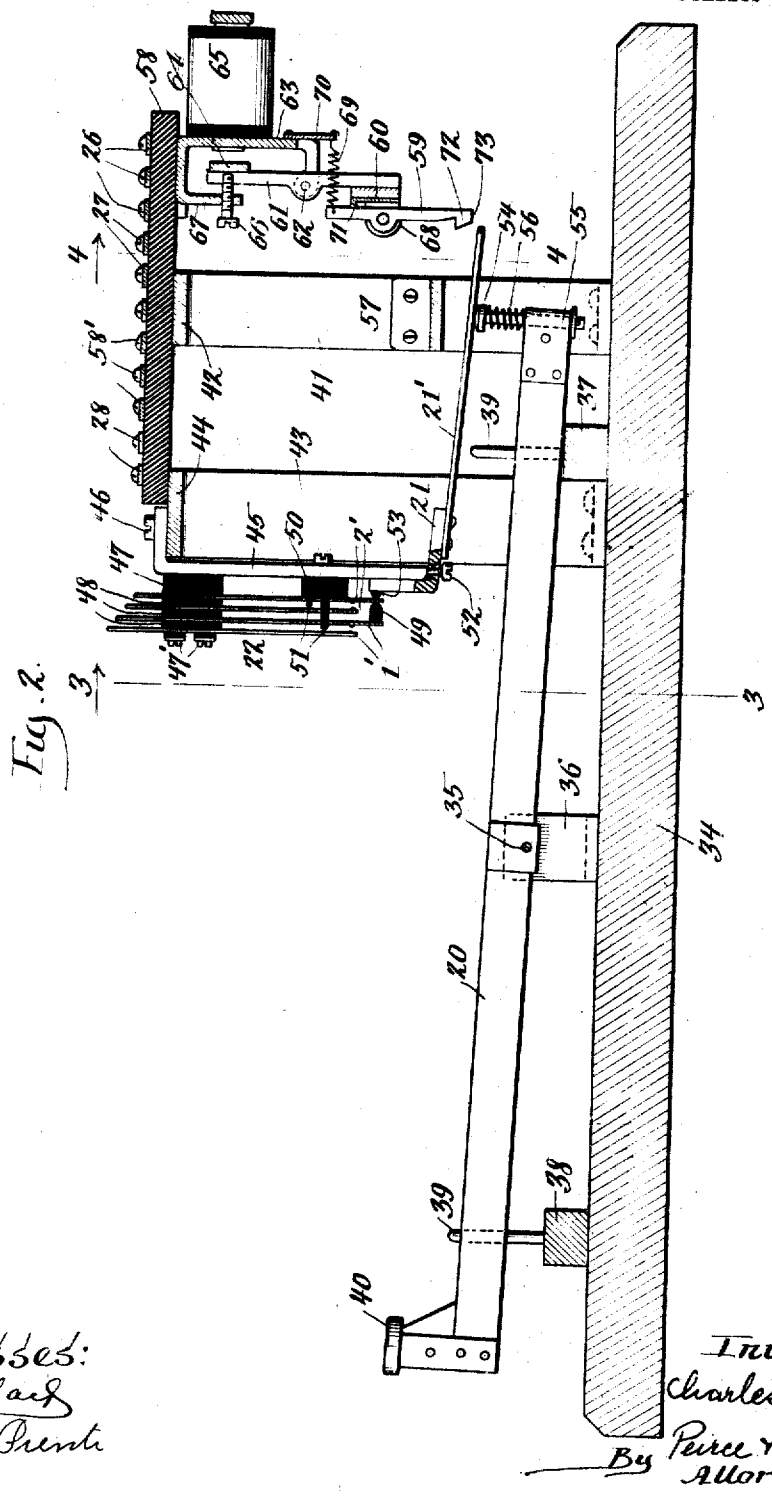

Fig. 2.

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4 SHEETS—SHEET 3.

Fig. 4

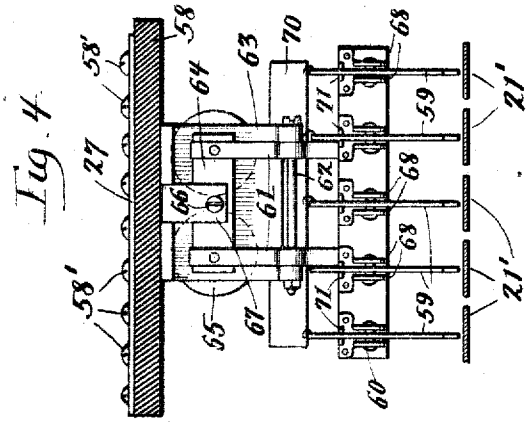
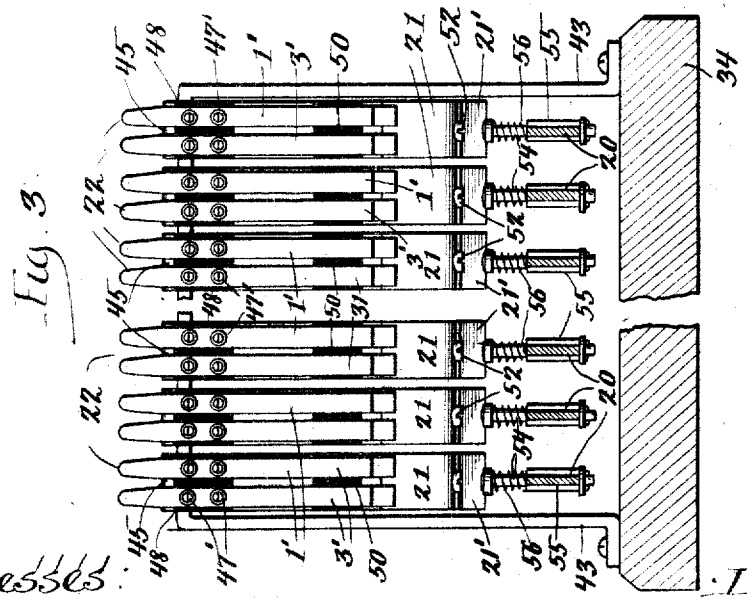


Fig. 3



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4 SHEETS—SHEET 4.

Fig. 5.

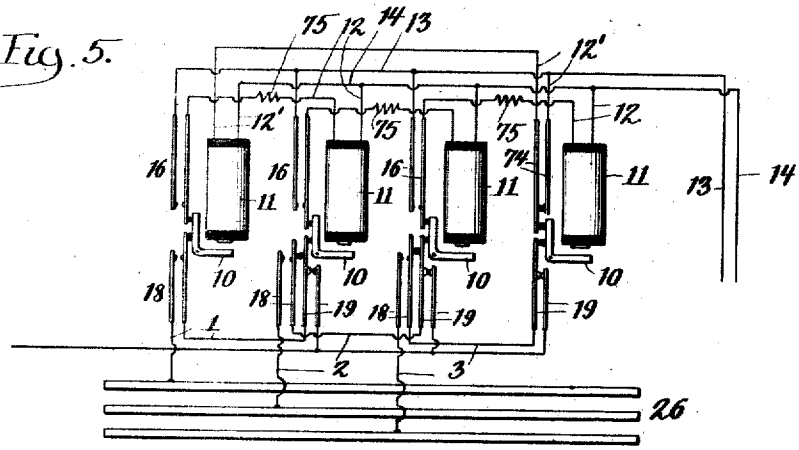
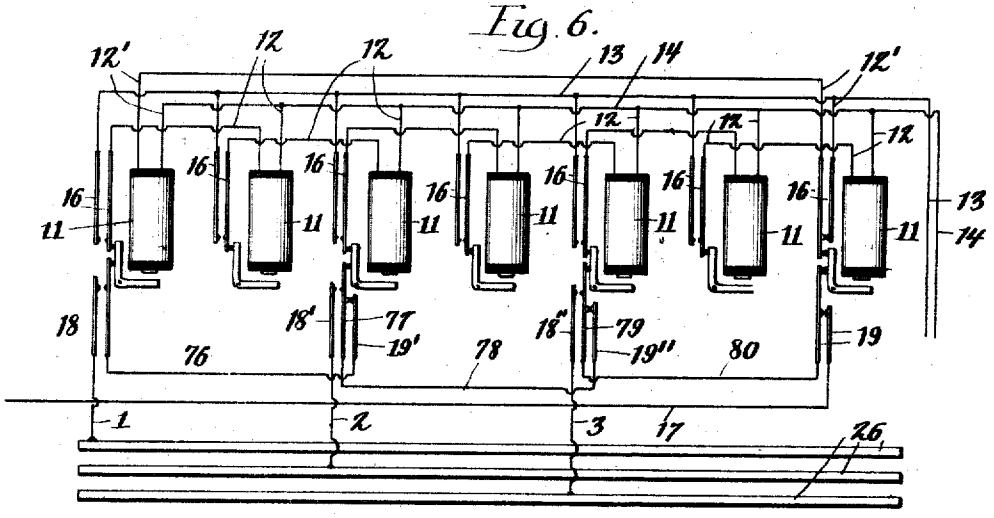


Fig. 6.



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UNITED STATES PATENT OFFICE.

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TRANSMITTER FOR ELECTRIC TELEGRAPHS AND THE LIKE.

No. 929,602. Specification of Letters Patent. Patented July 27, 1909.

Application filed April 11, 1904. Serial No. 202,682.

To all whom it may concern:

Be it known that I, CHARLES L. KRUM, a citizen of the United States, and a resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Transmitters for Electric Telegraphs and the Like, of which the following is declared to be a full, clear, and exact description.

The invention relates to transmitters for electric selective or signaling systems by which a device or devices at one or more distant stations may be selectively operated and is particularly applicable in connection with automatic operating telegraphs in which varied combinations of code impulses, in keeping with the different signals are to be transmitted over the line.

The improvement seeks to provide a simple and effective apparatus by which the combinations of code impulses or signals may be rapidly transmitted with distinctness and regularity and the invention consists in the combinations and arrangement of parts hereinafter set forth, illustrated in the accompanying drawings and more particularly pointed out in the appended claims.

In the drawings Figure 1 is a diagrammatic view of the improved transmitter and operating circuits therefor. Fig. 2 is a longitudinal section through the controlling mechanism for the transmitter. Figs. 3 and 4 are detail cross-sections on lines 3—3 and 4—4 respectively of Fig. 2. Figs. 5 and 6 are diagrammatic views of modified arrangements for the operating relays and circuits.

The present improved transmitter comprises automatic switch mechanism preferably actuated by a set of relays to impart a succession of impulses to the line in connection with mechanism, preferably actuated by a set of finger-keys, for controlling the operation in accordance with the different signals to be transmitted. The automatic switch mechanism preferably comprises a series of pivotally mounted switch shifters 10 actuated by a set of relays 11. Suitable means are provided for actuating the several relays and switch shifters in order to impart a succession of impulses to the line. For this purpose, the coils of the several relays are arranged upon multiple arc branches 12 extending between the conductors 13 and 14 of a power or local circuit deriving current from a dynamo or battery 15; or from any other suitable source. In each of the several energizing branch circuits 12, with the exception of the branch circuit 12' for the first relay of the set, are interposed a pair of normally open spring contacts 16 and the contacts in the energizing circuit of each relay is controlled, as shown, by the switch shifter 10 of the preceding relay. That is to say, the first relay and switch shifter are arranged to close the energizing circuit through the second relay of the set; the second is arranged to close the energizing circuit through the third relay, and so on. So that, when the first relay of the set is energized, the rest will be successively energized to automatically operate the several switch shifters 10 in order. Suitable means are arranged to be actuated by the several switch shifters 10 so that, at each operation of the set, a succession of impulses will be imparted to the line. For this purpose, the line 17 is provided with a series of branches in accordance with the desired number of impulses to be transmitted at each operation. Three such branches, indicated by the numerals 1, 2 and 3, are shown in the present arrangement. A pair of normally open contacts 18 are interposed in each of the line branches and, in the arrangement shown in Fig. 1, these contacts are arranged to be closed by the operation of the first, fourth and seventh switch shifters and relays of the set. So also, a pair of normally closed contacts 19 are interposed in each of the line branches 1, 2 and 3 and these contacts are arranged to be open by the operation of the third, sixth and last switch shifters and relays of the set. By this arrangement, the line branches will be successively opened and closed at each operation of the set of relays and switch shifters. It will be understood of course, that the number of line branches and the number of controlling switch shifters may be varied as desired.

Suitable controlling mechanism is provided for closing the energizing circuit through the first relay of the circuit and for variably modifying the impulse transmitted to the line in accordance with the different

characters and signals. This controlling mechanism preferably comprises a series of finger-keys 20 and a series of switch shifters 21 corresponding to and operated by the several finger-keys. Each switch shifter 21 is arranged to operate a set of contacts 22 and preferably, a separate set of contacts is employed for each character or signal to be transmitted. In the diagram Fig. 1, for the sake of clearness, only two sets of these controlling contacts are shown. It will be understood however that there will be as many sets as there are characters or signals and a corresponding number of switch shifters and actuating finger-keys. In the arrangement shown, the several sets of contacts 22 are each made up of four pairs, 1′, 2′, 3′ and 4′ of normally open spring contacts, all of which are closed by the operation of the corresponding switch shifter 21 to suitably connect the line branches 1, 2 and 3 with a series of battery branches in accordance with the signal or character to be transmitted, and also to close the energizing circuit of the first relay 11 and thus initiate the automatic operation of the set of relays.

Six battery branches 4, 5, 6, 7, 8 and 9 are shown in the present arrangement, but any suitable number could be employed. Battery branches 4, 5 and 6 are connected to one side of a split battery or dynamo 23 or other suitable source of current, and battery branches 7, 8 and 9 are connected to the opposite side of such battery or dynamo. A conductor 24 connects the split battery or dynamo 23 with the ground or with a return line wire. Different resistances 25 are interposed in battery branches 5, 6, 8 and 9 so that current impulses of three different strengths, both positive and negative, may be transmitted by suitably connecting the battery branches to the line.

For convenience in making the connections, the several circuits and branches are connected to terminal distributing bars. Line branches 1, 2 and 3 are connected one to each of the distributing bars 26; conductors 13 and 14 of the local and power circuit are connected respectively to the separate distributing bars 27 and the battery branches are connected one to each of the distributing bars 28. To the several distributing bars 26, 27 and 28 the separate sets of controlling contacts 22 can be conveniently connected in accordance with the different signals to be transmitted. The pair of contacts 4′ of each set 22 are connected by conductors 30 with the distributing bars 27, so that, whenever any of the switch shifters 21 is actuated, the local or power circuit from the source of current 15 will be closed through the first relay 11 to initiate the operation of the set of relays. This circuit may be traced from the source of current 15 by conductor 14 through the energizing branch 12′ which includes the first relay 11 of the set, and which also includes the magnet 65 and the contact 74, and which leads to the conductor 13, thence by conductor 13 to one of the distributing bars 27 by conductors 30 and contacts 4′ to the other distributing bar 27, and thence back to the battery or dynamo 15. The pairs of contacts 1′, 2′ and 3′ of each set are variably connected to the terminal bars 26 and 28 of the line and battery branches. For example, in the set of contacts shown to the right in Fig. 1, the first pair 1′ are connected by conductors 31 to the terminal distributing bars of line branch 1 and battery branch 9; the pair of contacts 2′ are connected by conductors 32 to the distributing bars of line branch 2 and battery branch 7 and the pair of contacts 3′ are connected by conductors 33 to the distributing bar of line branch 3 and the battery branch 8. When this particular set of contacts is operated, the local or power circuit from battery 15 is closed and may be traced therefrom by conductor 14 to the multiple branch 12′ through the first relay 11, and from thence by the conductor 13 to one of the distributing bars 27, through the conductors 30 and pair of contacts 4′ to the other distributing bar 27, and from thence back to the battery or dynamo 15. The first switch shifter 10 of the set will then be operated to close the pairs of contacts 16 and 18. By closing the pair of contacts 16, the energizing branch 12 of the local or power circuit through the second relay will be closed from the source of current 15 to one of the distributing bars 27 by conductors 30 and contacts 4′ to the other distributing bar 27, thence by conductor 13 to the switch contacts 16 controlled by the first relay magnet 11 and thence through the branch 12 and second relay magnet to the conductor 14 and back to the source of current 15. By the operation of the second relay, switch contacts 16 in the energizing circuit of the third relay will be closed, and so on until all of the relays 11 of the set have been actuated.

A certain amount of time is of course required to magnetize each relay in turn so that as a set of relays operate, the normally opened and closed contacts 18 and 19 will be operated in order to successively close and open the several line branches 1, 2 and 3. This operation takes place when any of the finger keys are operated. That is to say, any one of the finger keys which represent the different characters will close the circuit through the first relay 11. The first relay then closes this circuit through the second and the second through the third so that when any key is operated the set of relays are automatically energized in succession to successively open and close the line branches 1, 2 and 3. The nature of the impulses thus transmitted is varied for each of the different characters

by variably connecting the several battery branches with the line branches. When the contacts 18 in line branch 1 are closed, the current may be traced from dynamo or battery 23 through battery branch 9 to its distributing bar 28 by conductors 31 and contacts 1′ to the distributing bar of line branch 1, thence through the line branch 1 and the contacts 18 and 19 therein to the line 17, and thence back through the ground or return wire to conductor 24 and battery 23. In this manner a relatively weak, negative impulse will be first transmitted over the line. This circuit will be broken as soon as the third relay of the set is operated to open the switch contacts 19 in line branch 1. When the fourth relay of the set is energized the contacts 18 in line branch 2 will be closed and the current may be traced as follows: from battery 23 through the battery branch 7 to its distributing bar 28 by conductors 32 and contacts 2′ to the distributing bar of line branch 2, through line branch 2 and the contacts 18 and 19 therein to the line 17 and back through ground or return wire to the battery, so that a strong, negative impulse is imparted to the line. The circuit is broken as soon as the sixth relay of the set is actuated to open the contacts 19 in the line branch 2. Similarly, when the seventh and ninth relays of the set are energized, line branch 3 will be successively closed and opened and inasmuch as this line branch is connected to battery branch 8 by conductors 33 and contacts 3′, a negative impulse of medium strength will be transmitted to the line. In this manner, the pairs of contacts 1′, 2′ and 3′ in each of the different sets may connect the several line branches 1, 2 and 3 with any of the battery branches so that different combinations of positive and negative impulses of different strengths may be transmitted in keeping with the different signals or characters. For example, in the set 22 shown to the left in Fig. 1, the conductors 31 from the pair of contacts 1′ connect the distributing bars of line branch 1 and battery branch 5, the conductors 32 from the contacts 2′ connect the distributing bars of line branch 3 and battery branch 7 and the conductors 33 from the contacts 3′ connect the distributing bars of line branch 2 and battery branch 4, so that the signal transmitted to the line when this set of contacts is operated, will consist of a positive impulse of medium strength followed by a strong positive impulse and a weak impulse. The pair of contacts 4′ of this set, as with those of all the other sets of contacts, are connected to the distributing bars 27 of the local or power circuit which is thus closed to effect the automatic successive operation of the set of relays 11 and switch shifters 10.

By providing the automatically operated switch shifters and relays, the circuit is rapidly opened and closed to transmit the successive impulses with great regularity and distinctness. The character of the transmitted impulses are conveniently modified in keeping with the particular code employed by the set of finger-keys and switch shifters operated thereby.

It will be understood that the number of line branches, operating relays, battery branches and controlling contacts for connecting the line and battery branches may be varied as desired and that the connections effected by the controlling switch shifters between the line and battery branches may be varied in keeping with any suitable code.

Any suitable mechanical arrangement of the finger-keys and switch shifters operated thereby may be employed, but that illustrated in Figs. 2, 3 and 4 is preferred. This arrangement comprises a base-board 34 and the finger-keys 20 are mounted upon a pivot rod 35 supported by uprights 36 upon the base-board. The finger-keys 20 are preferably pivoted on the rod 35 between their ends, as shown and the rear end of the keys normally rest upon a cross stop-bar 37 at the rear of the base-board. At the front end of the base-board, a second cross stop-bar 38 limits the downward movement of the forward end of the keys. Guide pins 39 upon the stop-bars 37 and 38 may be employed if desired to prevent undue lateral play of the finger-keys 20. The forward up-turned ends of the keys are provided with finger-pieces 40 which may be marked with the different characters or signals and arranged in banks as the finger-keys of an ordinary typewriter. At or near the rear ends of the finger-keys 20, uprights 41 on base 34 carry, at their upper portions, a cross bar 42. In front of uprights 41 a second pair of uprights 43 are secured upon the base-board 34 at their upper ends by a cross bar 44. On this cross bar 44 are secured a series of depending strips 45 each provided with laterally bent upper ends through which pass screws 46 which hold the strips in place upon the cross-bar 44. On the front face of each of the front strips 45 is mounted one of the sets 22 of the controlling contacts. As above stated, each set of contacts comprises four pairs and are most conveniently arranged upon the corresponding strip 45 in two rows (see Figs. 3 and 4) with four contacts in each row. The upper ends of the several spring contacts are secured to an insulated block 47 upon the supporting strip 45 by screws 47′ and are insulated from one another and from the screws by the strips 48. One of the contacts of each pair is extended below the other (see Fig. 3) and these extended contacts are properly spaced from one another by an insulating block 49. An insulating block 50 upon the face of the supporting strip 45 is provided with projecting abut-

ments 51 which extend through openings in the contacts and properly space the shorter contacts of each pair. All the contacts are so arranged that their lower ends tend to press inwardly toward the face of the supporting strip 45 but the insulating block 50, with its abutments 51 and the insulating block 49, properly space the several contacts apart so that all of the pairs are normally held in open position.

The switch shifters 21 consist of L-shaped pieces fulcrumed as shown, upon the lower ends of the supporting strips 45. A screw 52 passes loosely through an opening in each shifter 21 and serves to hold it upon the lower end of the strip 45, but in such a manner that it is free to move thereon. The upper limb of each shifter engages the inner contact of each row upon the support 45 and is normally held by the pressure of the spring contacts against the face of the strip 45, as shown. An insulating abutment 53, upon the upper limb of the shifter is interposed as shown, between the latter and the contacts. A rearwardly extending arm 21′ is secured to, or formed in piece with the lower arm of each of the L-shaped switch shifters, and is arranged to be engaged by a suitable abutment upon the end of the corresponding finger-key 20. These abutments are preferably in the form of plungers 54 which are vertically movable through clamps 55 secured to the rear ends of the finger-keys. A spring 56 is coiled about each of the plungers and extends between the upper face of the clamp 55 and the head of the plunger so that the latter is normally held in uppermost position. When any finger-key is operated, the switch shifter is moved through the medium of the spring plunger 54 to close the four pairs of contacts of the particular set corresponding thereto. The spring plunger forms a yielding connection between the finger-key and the switch shifter and is so arranged that the contact springs may be firmly pressed into engagement during the greater part of the stroke of the finger-key. Moreover, the flexible connection eases and steadies the key action so that the finger-keys may be rapidly manipulated by the operator in sending a message. The upward movement of the rear ends of the shifters is limited by a transverse stop-bar 57 secured between the uprights 41 and extending above the rearwardly extending shifter arms 21′. In operation, these shifter arms are firmly pressed by the spring plungers on the finger-keys to hold the contacts firmly into engagement. Furthermore, it will be observed that the plungers 54 simply engage and are not connected to the switch shifters so that while the shifters and finger-keys move together from normal position they may be returned independently.

An insulating support 58 is conveniently mounted upon the cross-bars 42 and 44 and carries the distributing-bars 26, 27 and 28. Each distributing-bar is provided with a row of binding posts or screws 58′ to which the connections may be conveniently made.

Preferably suitable means is provided for locking any selected shifter in place until the signal is completed. For this purpose, a series of latches 59, one for each of the switch shifters, is mounted upon a transverse bar 60. The latter is carried upon a pair of arms 61 pivotally supported by a shaft 62 on a suitable support 63, which is conveniently secured to the under side of the insulated top plate 58. A cross-bar 64, between the upper ends of the arms 61 forms the armature of an electro-magnet 65, which is carried upon the support 63. A screw 66 is threaded through a downwardly extended lug 67 upon the support 63, engages the armature 64 and forms a back-stop therefor. The several latches 59 are each independently pivoted between a pair of lugs 68 upon the transverse bar 60 and a series of springs 69 extend between the upper ends of the latches and a plate 70 secured to the support 63. By means of this spring all the latches are normally held against stops 71 upon the transverse bar 60 and, since the springs are arranged below the pivot shaft 62, they also serve to hold the transverse bar 60 in its outermost, normal position with the armature 64 in engagement with its back-stop 66. The electro-magnet 65 (see Fig. 1) is interposed in the energizing circuit 12′ of the first relay 11. When any key is operated, the power circuit from battery or dynamo 15 is closed as above described, through the energizing circuit 12′ of the first relay and also, through the locking magnet 65, so that armature 64 is attracted and transverse bar 60 swung forward. By this movement the hooked, lower end of one of the latches 59 is brought beneath the rear arm of the selected shifter and it is thus held in position independently of its finger-key to hold the set of contacts in closed position. The lower end of each of the locking pawls 59 is provided with a beveled face 72 and with a squared face 73. If the circuit through the locking magnet 65 is closed before the switch shifter has moved to the end of its throw, arm 21′ on the shifter will engage the beveled face 72 of the corresponding latch and force it to move about its pivot against the tension of spring 69 until the hook of the latch can engage the under side of the arm. By thus independently mounting the several latches 59, any selected switch shifter can complete its stroke and be locked in shifted position, even though the circuit through the locking magnet 65 is closed before the end of its movement is reached. But, when any se-

lected shifter has been operated and locked, none of the other switch shifters can be operated since the lower, squared ends 73 of the locking pawls are swung over the rear ends of the switch shifter arms 21'.

A pair of normally closed contacts 74 (see Fig. 1) is interposed in the energizing circuit 12' through the locking magnet 65 and are arranged to be opened by the operation of the last switch shifter 10 of the set, so that as soon as the signal is completed the locking magnet 65 is deënergized, the selected shifter released and the corresponding set of contacts 22 returned to open position. The connections between the line and battery branches are thus opened and the local power circuit through the set of relays broken so that all parts of the apparatus are returned to normal condition in readiness to transmit the succeeding signals.

The transmitter is especially applicable for speedy work in connection with automatic or printing telegraphs. The finger-keys may be rapidly operated to establish the proper connections between the line and battery branches in accordance with the different characters and the switch mechanism operates automatically to successively connect the line branches to the line so that the speed and rapidity of transmission of any one combination of impulses are independent of the speed and regularity of the shift of the finger-key. By this arrangement the code impulses may be more speedily and rapidly imparted to the line than by transmitters in which the finger-keys are arranged to successively and directly connect the battery branches to the line. Moreover, with this arrangement in which the finger-keys and switch shifters operate to simultaneously make connection with the several battery branches instead of successively, the extent of depression of the finger-keys may be very slight and therefore can be rapidly operated.

It it is desired to repeat any particular signal or character, the corresponding finger-key is held depressed. The set of relays 11 will then operate in order as above described to transmit the signal. The last relay of the set opens the contacts 74 in the energizing circuit 12' in the first relay so that the set of relays are then successively deënergized and the switch shifters 10 returned to normal. When the last switch shifter 10 of the set returns to normal position and contacts 74 again closed the energizing branch circuit 12' through the first relay 11 of the set is again closed and the relays again automatically operate in order to transmit the signal.

The arrangement of the automatically operated set of relays may be widely varied without departure from the essentials of the invention. In the arrangement shown in Fig. 1 the first relay of the set serves to close the line branch 1 and the third relay of the set to open the same. The second relay is interposed merely to slightly prolong the impulse thus transmitted and thus insures that it will be made manifest at the receiving end of the line. For similar reasons, the fifth and eighth relays are interposed between the opening and closing switches of line branches 2 and 3. If desired, for transmitting long and short signals (dots and dashes) or in other words, variably timing the code impulses, certain of these interposed or "dummy" relays may be omitted or two of them may be interposed between the opening and closing relays of any line branch.

For more speedy operation the arrangement of the relay set shown in Fig. 5 could be employed. The circuits through this set of relays are successively closed in the manner previously described and the last relay of the set serves to open the energizing circuit through the first relay. In this arrangement, the first relay is arranged to close line branch 1, the second relay opens the contacts 19 in line branch 1 and closes the contacts 18 in line branch 2. The third relay opens the line branch 2 and closes line branch 3 and the last relay opens line branch 3. The successive impulses may be prolonged if desired, by interposing choke coils 75 in the separate line branches or by interposing "dummy" relays in the manner previously described. The impulses could also be prolonged by arranging the pairs of contacts 16, 18 and 19 so that the line branches would be opened and closed just before the contacts 16 are closed to energize the succeeding relays. In the arrangement shown in Fig. 6 the line branch 1 is opened and branch 2 closed by the same relay, and branch 2 is opened and branch 3 closed by the same relay as in the arrangement shown in Fig. 5. But three contacts only are employed for successively opening and closing the branches. The first relay closes the contacts 18 in line branch 1, which is traced as follows: from its terminal bar 26, through the contacts 18, conductor 76 to contact 19' which normally engages contact 77, from thence by conductor 78 to switch contact 19'' in normal engagement with the contact 79, and from thence by conductor 80 to the normally closed contacts 19 and to the line 17. On the operation of the third relay contact 77 is shifted into engagement with contact 18', thus opening the line branch 1 and closing the line branch 2 from its terminal bar 26 through contacts 18' and 77, conductor 78 to contacts 19'' and 79, and conductor 80 through contacts 19 to the line. The fifth relay shifts contact 79, opens branch 2 and closes branch 3 from its terminal bar 26 through contacts 18'' and 79, conductor 80 through contacts 19 to the line. The last

relay of the set opens the contacts 19 and the energizing circuit of the first relay. Relays 2, 4 and 6 in this arrangement are merely interposed to slightly prolong the succeeding impulses.

It is obvious that numerous changes could be made in the arrangement of parts and details of construction, without departure from the essentials of the invention.

By the term "battery branches" in the following claims is meant branch conductors connected to any suitable source of current.

Having described my invention what I claim as new and desire to secure by Letters Patent, is:—

1. In transmitters for electric telegraphs and the like, the combination with a line circuit, of a set of line branches all normally disconnected from the line, means automatically acting to successively connect said branches to line, a set of battery branches, means for varying the strength and polarity of the current transmitted through said battery branches and controlling mechanism for variably connecting said line and battery branches.

2. In transmitters for electric telegraphs and the like, the combination with a line circuit, of a set of line branches all normally disconnected from the line, means automatically acting to successively connect said branches to line, a set of battery branches, means for varying the strength and polarity of the current transmitted through said battery branches, a series of finger-keys and a series of switch contacts controlled by said keys for variably connecting said line and battery branches.

3. In transmitters for electric telegraphs and the like, the combination with a line, of a set of line branches, means automatically acting to successively close and open said line branches, a set of battery branches, separate independent sets of switch contacts arranged to variably connect said line and battery branches and a series of operating finger keys, the switch contacts in each set being operated only by one of said finger keys.

4. In transmitters for electric telegraphs and the like, the combination with a line, of a set of line branches, means automatically acting to successively close and open said line branches, a set of battery branches, separate sets of distributing bars connected respectively to said line and battery branches, separate sets of switch contacts for variably connecting said sets of distributing bars and an operating finger-key for each set of contacts.

5. A transmitter for electric telegraphs and the like comprising a set of relays, means for operating said set of relays in order, means controlled by said set of relays for imparting a succession of impulses to the line at each operation of the set and a series of controlling keys for modifying the imparted impulses.

6. A transmitter for electric telegraphs and the like, comprising a set of relays, means for operating said set of relays in order, means controlled by said set of relays for imparting a succession of impulses to the line at each operation of the set, a set of key operated switch shifters for modifying the imparted impulses and means for holding the selected switch shifter in operative position until the succession of impulses transmitted thereby is completed.

7. A transmitter for electric telegraphs and the like comprising a set of switch shifters, means automatically acting to operate said switch shifters in order for imparting a succession of impulses to the line, a set of key actuated controlling devices for modifying the strength and polarity of the imparted impulses and means for holding the selected controlling devices in shifted position until the signals transmitted thereby are completed.

8. A transmitter for electric telegraphs and the like comprising a set of switch shifters, a set of relays automatically acting to operate said switch shifters in order for imparting a succession of impulses to the line and controlling key mechanism for variably modifying the imparted impulses.

9. A transmitter for electric telegraphs and the like comprising a set of switch contacts, electrical means for automatically operating said switch contacts in order to impart a succession of impulses to the line, key controlled devices for variably modifying the imparted impulses and means for holding the selected key controlled devices in operative position until the signals selected thereby have been transmitted.

10. A transmitter for electric telegraphs and the like comprising a set of relays, the energizing circuit of each being controlled by one of the preceding relays of the set, means controlling the energizing circuit of the first relay of the set, a set of switch shifters operated by said relays for imparting a succession of impulses to the line a set of keys and means controlled by said keys for variably modifying the imparted impulses.

11. A transmitter for electric telegraphs and the like comprising a set of relays, switch contacts in the energizing circuit of each of said relays controlled by the preceding relay of the set, whereby the set of relays will operate in order when the first relay is actuated, means compelling the complete operation of said set of relays when the first relay is actuated means controlling the energizing circuit of the first relay of the set, means operated by said relays for

imparting a succession of impulses to the line a set of keys and means controlled thereby for modifying the imparted impulses.

12. A transmitter for electric telegraphs and the like comprising a set of relays, switch contacts in the energizing circuit of each relay controlled by the preceding relay of the set, a set of switch shifters operated in order by the set of relays for successively closing and opening the line circuit to impart a succession of impulses thereto, controlling key mechanism for the energizing circuit of the first relay of the set and for modifying the imparted impulses and means for compelling the complete operation of said set of relays when the first relay of the set is operated.

13. In transmitters for electric telegraphs and the like, the combination with a line circuit, of a set of line branches a set of relays for successively connecting said branches to the line circuit, a set of battery branches, key mechanism for controlling the operation of said relays and for variably connecting said line and battery branches and locking means associated with said key mechanism for compelling the complete operation of said set of relays when any key is operated.

14. In transmitters for electric telegraphs and the like, the combination with a line, of a set of line branches all normally disconnected from the line, switch contacts in each of said line branches, a set of relays controlling said contacts, means for operating said set of relays in order to impart a succession of impulses to the line and means for modifying the imparted impulses.

15. In transmitters for electric telegraphs and the like, the combination with a line circuit, of a set of line branches, normally opened and normally closed contacts in each of said branches, a set of relays controlling said contacts and means for operating said relays in order to successively close and open said line branches to impart a series of impulses to the line.

16. In transmitters for electric telegraphs and the like, the combination with a line, of a set of line branches, a set of relays controlling said line branches for imparting a succession of impulses to the line, the energizing circuit of each of said relays being controlled by one of the preceding relays of the set, means for controlling the energizing circuit of the first relay of the set, means compelling the complete operation of the set of relays when the first relay is operated, and means for modifying the imparted impulses.

17. In transmitters for electric telegraphs and the like, the combination with a line, of a set of line branches, switch contacts in said line branches, a set of relays controlling said switch contacts, the energizing circuit of each of said relays being controlled by the operation of one of the preceding relays of the set, a set of battery branches, key controlled mechanism for controlling the energizing circuit of the first relay of the set and for variably connecting said line and battery branches and means for compelling the complete operation of said set of relays when the first relay is operated.

18. In transmitters for electric telegraphs and the like, the combination with a set of relays connected in multiple arc in a common circuit, switch contacts in the multiple arc branch of each relay controlled by one of the preceding relays of the set, means for controlling the flow of current through the first relay of the set, means compelling the complete operation of said set of relays when the first relay of the set is operated and means controlled by the operation of said set of relays for imparting a succession of variable modified impulses to the line.

19. A transmitter for electric telegraphs and the like comprising a set of switch shifters, means for actuating the same in order to transmit a succession of impulses to the line at each operation of the set and means controlled by the last shifter of the set for restoring said switch shifters to normal.

20. A transmitter for electric telegraphs and the like comprising a set of relays, means for operating said relays in order comprising switch contacts in the energizing circuit in each relay controlled by one of the preceding relays in the set, means controlled by the last relay of the set for restoring said relays to normal condition and means controlled by said relays for transmitting a succession of impulses to the line at each operation of the set.

21. In transmitters for electric telegraphs and the like, the combination with the key-operated switch shifters controlling the transmission of signals to the line, of means for locking any selected shifter and an electro-magnet controlled by said shifters for actuating said locking means.

22. In transmitters for electric telegraphs and the like, the combination with a set of switch shifters, means for actuating said shifters in order to transmit a succession of impulses to the line, controlling mechanism comprising a set of key-operated switch shifters, a lock for holding any selected shifter of the latter set and means controlled by the last shifter of the first mentioned set for releasing said lock.

23. In transmitters for electric telegraphs and the like, the combination with a set of relays, means for operating said set of relays in order to transmit a succession of impulses to the line, controlling mechanism comprising a set of key-operated switch

shifters, a lock for holding any selected shifter and means controlled by the last relay of the set for releasing said lock.

24. In transmitters for electric telegraphs and the like, the combination with a line, of a set of line branches, switch contacts in said line branches, a set of relays controlling said switch contacts, normally opened switch contacts in the energizing circuit of each relay controlled by the preceding relay of the set, whereby said relays will be operated in order to impart a succession of impulses to the line, a set of battery branches and controlling mechanism comprising a series of switch shifters and separate sets of contacts controlled by said switch shifters arranged to close the energizing circuit of the first relay of the set and to variably connect said line and battery branches.

25. In transmitters for electric telegraphs and the like, the combination with a line, of a set of line branches, switch contacts for closing and opening said line branches, a set of relays controlling said switch contacts, normally opened switch contacts in the energizing circuit of each relay controlled by the preceding relay of the set, a set of battery branches, a series of key-operated shifters, separate sets of switch contacts operated by said shifters for closing the energizing circuit through the first relay of said set and for variably connecting said line and battery branches, electro-magnetic means for locking any selected shifter, an operating circuit therefor arranged to be closed by the operation of any of said key-operated shifters and means controlled by the last relay of said set for opening the operating circuit of said locking means.

26. In transmitters for electric telegraphs and the like, the combination with a set of relays, switch contacts in the energizing circuit of each relay controlled by the preceding relay of the set, whereby said relays will operate in order, circuit closing and opening devices controlled by said relays for imparting a succession of impulses to the line and means for prolonging the interval between the operation of said circuit closing and opening devices.

27. In transmitters for electric telegraphs and the like, the combination with a set of relays, switch contacts in the energizing circuit of each relay controlled by the preceding relays, whereby said relays will operate in order, circuit closing devices operated by certain of said set of relays and circuit opening devices operated by other of said set of relays to impart a succession of variably modified impulses to the line, certain other of said set of relays being interposed between said circuit closing and opening relays.

28. In transmitters for electric telegraphs and the like, the combination with a single line circuit and with a series of finger-keys, of separate independent sets of contacts operated thereby, each set comprising multiple pairs of normally open contacts arranged to be simultaneously closed and only by the corresponding finger-key and means controlled by the several sets of contacts for transmitting a succession of impulses to the line.

29. In transmitters for electric telegraphs and the like, the combination with a single line circuit and with a series of finger-keys, of a series of switch shifters corresponding to and actuated one by each of said finger-keys, separate independent sets of switch contacts, one set for each switch shifter and finger key, each set comprising multiple pairs of normally open contacts arranged to be simultaneously closed by the corresponding switch shifter and means controlled by the several sets of circuits for transmitting a succession of impulses to the line.

30. In transmitters for electric telegraphs and the like, the combination with a set of finger-keys, separate sets of switch shifters corresponding to and operated by said finger-keys, each set comprising multiple pairs of spring contacts, an insulated mount for supporting and separating said contacts and insulating abutments engaging the free ends of said spring contacts to hold the same in normally open position, the multiple pairs of each set of contacts being arranged to be simultaneously closed by the corresponding finger-key.

31. In transmitters for electric telegraphs and the like, the combination with a set of finger-keys, of a set of switch shifters corresponding to and actuated by said finger-keys and yielding connections interposed between said finger-keys and switch shifters.

32. In transmitters for electric telegraphs and the like, the combination with a set of pivoted finger-keys, of a set of fulcrumed switch shifters corresponding to and actuated by said finger-keys and a set of spring plungers mounted on said finger-keys and engaging said pivoted switch shifters.

33. In transmitters for electric telegraphs and the like, the combination with a set of pivoted finger-keys, of a set of fulcrumed switch shifters corresponding to and actuated thereby, said switch shifters being arranged above said finger-keys and a series of cushioned springs interposed between said keys and shifters.

34. In transmitters for electric telegraphs and the like, the combination with a series of finger-keys and with a set of corresponding switch shifters actuated thereby, a set of latches for locking any selected shifter, a support whereon said latches are mounted and means controlled by said switch shifters for moving said support to lock any selected shifter.

35. In transmitters for electric telegraphs

and the like, the combination with a series of finger-keys and with a set of corresponding switch shifters actuated thereby, a set of latches for locking any selected shifter, a shifting support whereon said latches are mounted, an actuating magnet for said support and means operated by said switch shifters for controlling the energizing circuit through said magnet.

36. In transmitters for electric telegraphs and the like, the combination with a series of finger-keys and with a series of corresponding switch shifters actuated thereby, a shiftable support, a series of spring-held latches independently movable upon said support and means controlled by said switch shifters for actuating said support to lock any selected shifter.

37. In transmitters for electric telegraphs and the like, the combination with a line circuit, of a set of line branches, transmitter means automatically acting to successively connect said branches to line to impart a series of impulses thereto, a set of battery branches, a set of key controlled switches for initiating the operation of said transmitter means and for variably connecting said line and battery branches to modify the transmitted impulses and means compelling the complete operation of said transmitter means when the operation thereof is once initiated.

38. In transmitters for electric telegraphs and the like, the combination with a line circuit, of a set of line branches, transmitter means automatically acting to successively connect said branches to line to impart a series of impulses thereto, a set of battery branches, a series of finger keys, selecting switches controlled by said finger keys for variably connecting said line and battery branches to modify the imparted impulses, means controlled by said finger keys for initiating the operation of said transmitter means and a locking device controlled by said finger keys for compelling the complete operation of said transmitter means, after the operation thereof is once initiated.

39. In transmitters for electric telegraphs and the like, the combination with a line circuit, of a set of line branches, transmitter means automatically acting to successively connect said branches to line to impart a series of impulses thereto, a set of battery branches, a series of finger keys, selecting switches controlled by said finger keys for variably connecting said line and battery branches to modify the imparted impulses, means controlled by said finger keys for initiating the operation of said transmitter means, a lock for holding said selecting switches in shifted position and means controlled by the complete operation of said transmitter means for releasing said lock.

40. In transmitters for electric telegraphs and the like, the combination with a line circuit, of a set of line branches, transmitter means for successively connecting said branches to line to transmit a series of impulses thereto, a set of battery branches, a series of finger keys, switches controlled by said finger keys for variably connecting said line and battery branches and for initiating the operation of said transmitter means, a locking device for holding the selected switches in operative position and for preventing the operation of any other of said switches and means controlled by the complete operation of said transmitter means for releasing said lock.

41. A transmitter for electric telegraphs and the like, comprising a set of relays, means for operating said set of relays in order, means controlled by said set of relays for imparting a succession of impulses to the line at each operation of the set, a series of controlling keys for initiating the operation of said set of relays and for modifying the imparted impulses and means for compelling the complete operation of said set of relays when the operation thereof is once initiated.

42. A transmitter for electric telegraphs and the like, comprising a set of relays, means for operating said set of relays in order, means controlled by said set of relays for imparting a succession of impulses to the line at each operation of the set, a set of key controlled devices for initiating the operation of said set of relays and for modifying the imparted impulses and means for holding the said key controlled devices against movement during the operation of said set of relays.

43. A transmitter for electric telegraphs and the like, comprising a set of relays, means for operating said set of relays in order, means controlled by said set of relays for imparting a succession of impulses to the line at each operation of the set, a set of key controlled devices for initiating the operation of said set of relays and for modifying the imparted impulses, means for holding said key controlled devices in operative position and means controlled by the complete operation of said set of relays for restoring said key controlled devices to normal.

44. A transmitter for electric telegraphs and the like, comprising a set of relays, means for operating said set of relays in order, means controlled by said set of relays for imparting a succession of impulses to the line at each operation of the set, a set of key controlled devices for initiating the operation of said set of relays and for modifying the imparted impulses, a key controlled lock for holding said key controlled devices against movement during the operation of said set of relays and means controlled by the complete operation of said set of relays for releasing said lock.

45. A transmitter for electric telegraphs

and the like, comprising a set of relays, the circuit of each relay being controlled by one of the preceding relays of the set, whereby the set of relays will operate in order when the first relay is operated, means controlled by said set of relays for imparting a succession of impulses to the line, a set of finger keys, devices variably controlled by said finger keys for effecting the operation of the first relay of the set and for variably modifying the imparted impulses and means controlled by the complete operation of said set of relays for restoring said key controlled devices and the circuits of said relays to normal.

46. A transmitter for electric telegraphs and the like, comprising a set of relays, the circuit of each relay being controlled by one of the preceding relays of the set, whereby the set of relays will operate in order when the first relay is operated, means controlled by said set of relays for imparting a succession of impulses to the line, a set of finger keys, devices variably controlled by said finger keys for effecting the operation of the first relay of the set and for variably modifying the imparted impulses, means for holding said key controlled devices against movement during the operation of said set of relays and means controlled by the complete operation of said set of relays for restoring said devices to normal.

47. A transmitter for electric telegraphs and the like, comprising a set of relays, the circuit of each relay being controlled by one of the preceding relays of the set, whereby the set of relays will operate in order when the first relay is operated, means controlled by said set of relays for imparting a succession of impulses to the line, a set of finger keys, devices variably controlled by said finger keys for effecting the operation of the first relay of the set and for variably modifying the imparted impulses, a lock controlled by said finger keys for holding said devices against movement and means controlled by the operation of said set of relays for releasing said lock.

48. A transmitter for electric telegraphs, comprising a set of relays, the circuit of each relay being controlled by one of the preceding relays of the set, whereby said relays will operate in order when the first relay is operated, a set of switches controlled by said relays for imparting a succession of impulses to the line, a set of finger keys, a switch operated by all of said finger keys for controlling the operation of the first relay of said set, selecting switches variably operated by said finger keys for modifying the imparted impulses and means for preventing the movement of said key operated switches until the operation of said set of relays is completed.

49. A transmitter for electric telegraphs, comprising a set of relays, the circuit of each relay being controlled by one of the preceding relays of the set, whereby said relays will operate in order when the first relay is operated, a set of switches controlled by said relays for imparting a succession of impulses to the line, a set of finger keys, a switch operated by all of said finger keys for controlling the operation of the first relay of said set, selecting switches variably operated by said finger keys for modifying the imparted impulses, locking means controlled by said finger keys for preventing the movement of said switches and means controlled by the complete operation of said relays for releasing said lock.

CHARLES L. KRUM.

Witnesses:
ALBERTA ADAMICK,
LILLIAN PRENTICE.