Oct. 20, 1925. 1,558,280

L. M. POTTS

SECRET SYSTEM OF TELEGRAPHY

Filed March 22, 1920 2 Sheets-Sheet 1

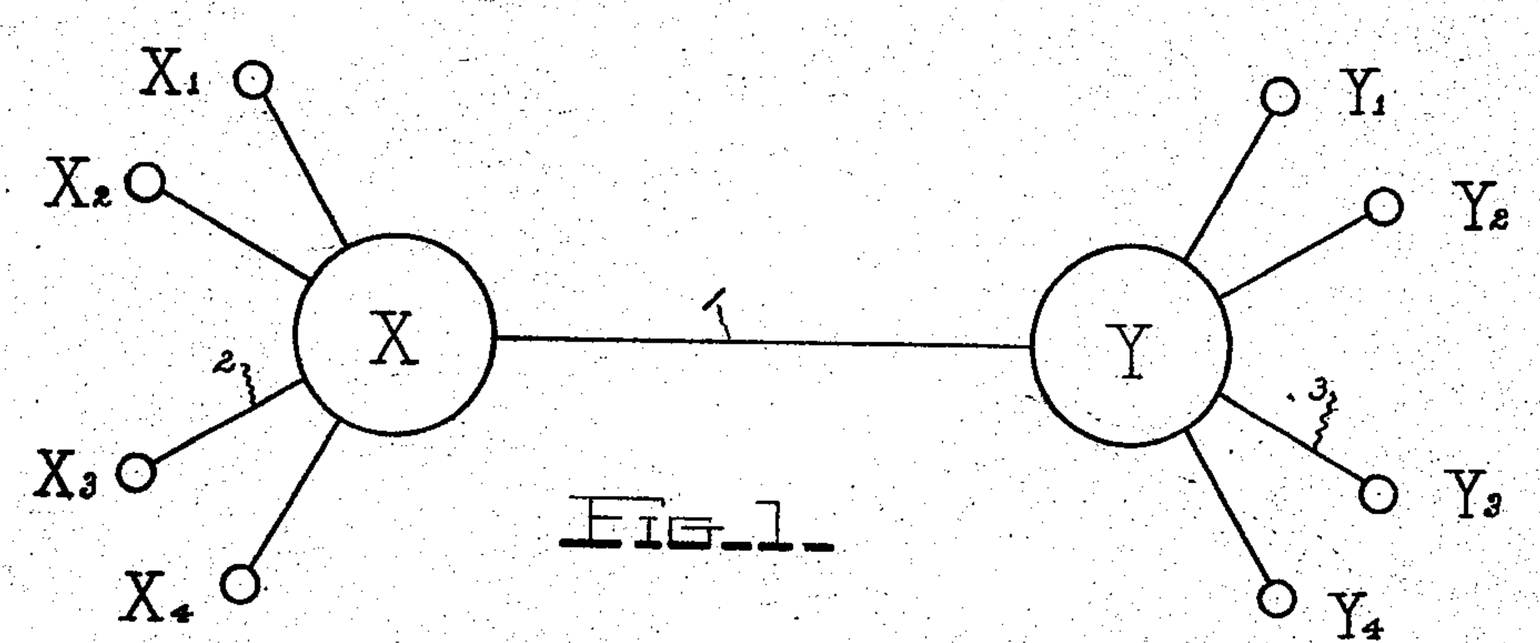

FIG. 1.

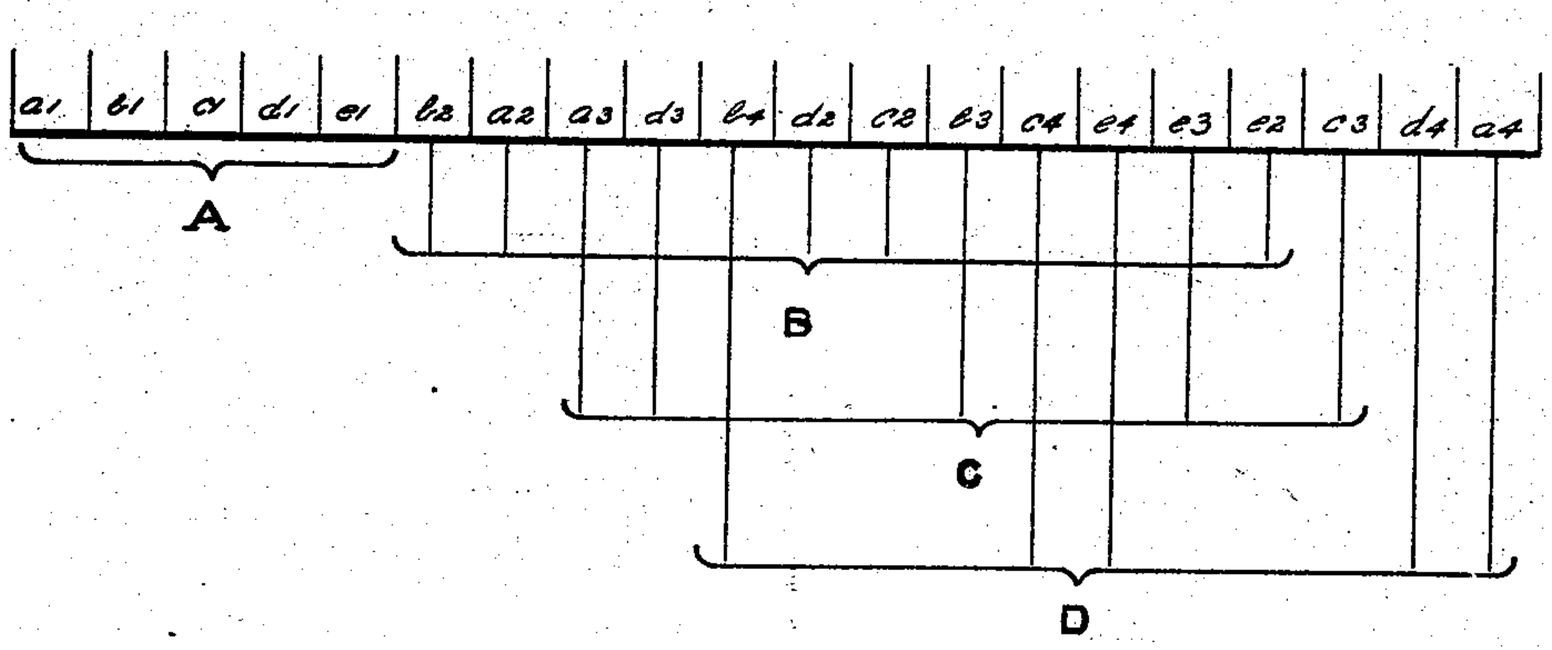

FIG. 2.

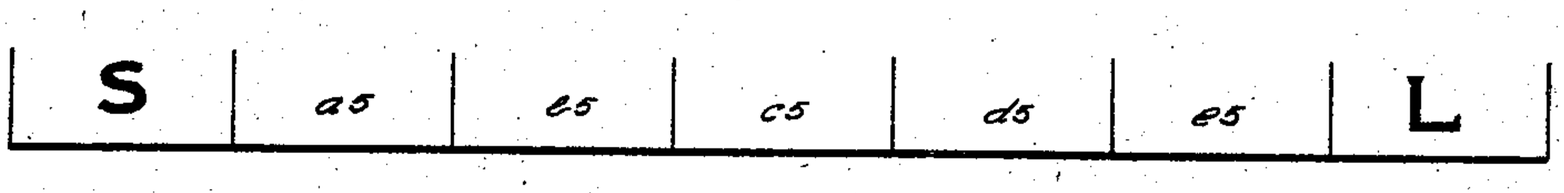

FIG. 3.

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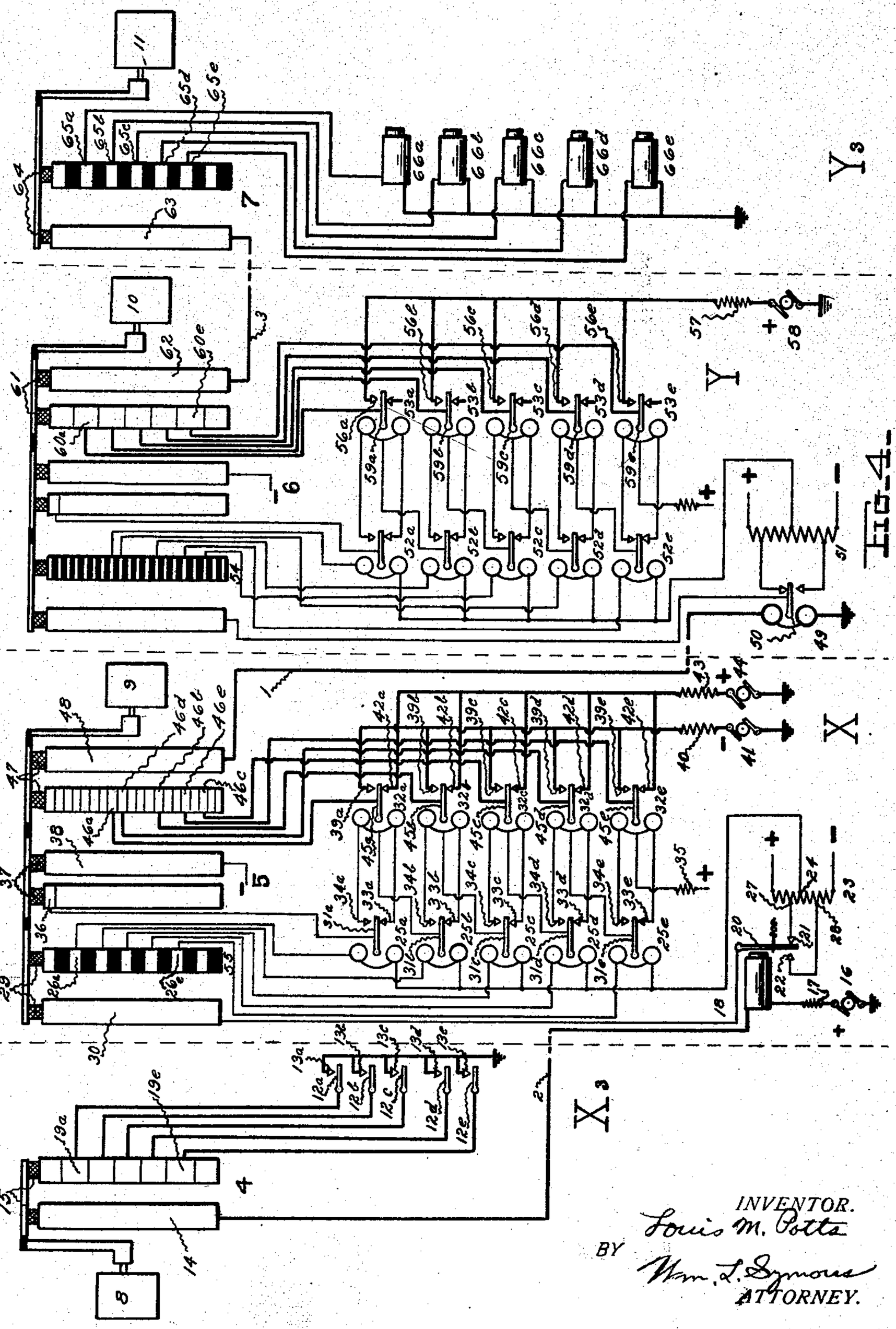

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Patented Oct. 20, 1925. 1,558,280

UNITED STATES PATENT OFFICE.

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SECRET SYSTEM OF TELEGRAPHY.

Application filed March 22, 1920. Serial No. 367,787.

To all whom it may concern:

Be it known that I, LOUIS M. POTTS, a citizen of the United States of America, residing at Baltimore, State of Maryland, have invented certain new and useful Improvements in Secret Systems of Telegraphy, of which the following is a specification.

This invention relates to telegraph systems.

An object of the invention is to provide an arrangement whereby message impulses will be unintelligent to unauthorized persons.

It has been proposed to give a number of private subscrbers the use of the different channels of a multiplex and also to use the different channels of a multiplex for the telegraph business of a number of smaller towns, adjacent to a large city, so that each of the towns will have direct communication with a distant large city by the use of a single trunk line between the two large cities. Especially in the case where the multiplex is to be used by a number of private subscribers, it would be very undesirable for one subscriber to receive a message or any part of a message intended for another subscriber. It is the usual practice to divide the segments on the distributing sunflower device of a synchronous multiplex into groups of equal numbers of segments, the segments of a group being consecutive and all arranged in the same order to represent the different elements of the code. It is evident that in the case of a four channel multiplex there will be four positions of the distributors in which one group would match up with a group at the other end of the line, so that in case the multiplex were used for four private subscribers, any subscriber at one end might receive the messages from any of the other subscribers at the other end of the line. The present invention proposes methods which obviate the above difficulty. While the invention is here described with reference to a multiplex in which synchronized distributors are used, it is to be understood that the method is also applicable to other telegraphic methods.

Referring to the drawings:

Figure 1 is a schematic diagram of a trunk line distributed to a number of stations.

Figure 2 is a diagram of the grouping of the impulses on the trunk line.

Figure 3 is a diagram of the grouping of the impulses on the branch lines.

Figure 4 is a diagram of the electrical connections.

In Figure 1 X and Y represent two central stations connected by a trunk line 1. Associated with central station X are four substations, X_1, X_2, X_3 and X_4, and associated with central station Y are four substations Y_1, Y_2, Y_3 and Y_4. The trunk line 1 may be operated by any suitable system of multiplexing. We shall assume that it is multiplexed in such a way that there are four channels and that normally substation X_1 communicates with substation Y_1, substation X_2 with substation Y_2, substation X_3 with substation Y_3 and substation X_4 with substation Y_4. The method is here described in connection with a system using the well known five unit code, although it is to be understood that the method is not limited to any particular code. It is usual in multiplexing to group the segments according to the group A in Figure 2 and to group them all alike so that the groups B, C and D would be exactly like group A. It will be noted, however, that in Figure 2 each of the groups B, C and D are different from the group A and also from one another, both in the sequence of the impulses and in their arrangement. If there is a sending commutator arranged according to Figure 2 and a receiving commutator arranged also according to Figure 2, and if the two commutators are shifted with respect to one another, it will be noted that in any position other than the correct one only one segment of any group will match up with the corresponding segment of another group. All the other segments will match up either with a segment of another group or with a different segment of the same group. Also in any other position than the correct position, not more than three seg-

ments of one group will match up with three segments of any other group, so that if the sunflower devices get out of step the messages will be hopelessly confused and no subscriber can read a message not intended for him. Figure 3 shows the normal arrangement of segments on the branch lines which is the same in all cases and is standard.

The electrical connections of one particular kind of apparatus for carrying out the method will now be described. In Figure 4 X and Y represent two central stations connected by a main line 1 and X_3 represents a substation connected with central X by a line 2 and Y_3 represents another substation connected to central Y by a line 3. At each of the stations X_3, X, Y and Y_3 are sunflower devices 4, 5, 6 and 7, the trailers of which are driven by suitable synchronizing devices 8, 9, 10 and 11, which keep all of the trailers at the different stations on corresponding segments at the same time and might, for example, be similar to the devices shown in my Patent No. 1,517,381, granted Dec. 2, 1924. The segments of sunflower device 4 are connected consecutively to a series of movable contacts 12^a, 12^b, 12^c, 12^d and 12^e. The contacts 12^a to 12^e may be operated in any suitable manner. For example, they may be operated as described in my Patent No. 1,517,381, granted Dec. 2, 1924. The contacts 12^a to 12^e, when moved forward, engage contacts 13^a to 13^e, all of which are connected together and to ground. Collecting ring 14 is connected to line 2. As trailer brushes 15 are rotated, impulses will be transmitted over a circuit as follows: positive pole of generator 16, resistance 17, coil of main line relay 18, line 2, collecting ring 14, trailer brushes 15, segment 19^a to 19^e, contacts 12^a to 12^e, contacts 13^a to 13^e, to ground and return to the negative pole of generator 16.

As trailer brushes 15 are rotated impulses will be transmitted over line 2 according to the signal to be sent and tongue 20 of relay 18 will oscillate between contacts 21 and 22. A resistance 23 is connected between the positive and negative sources of current supply. The middle point 24 of resistance 23 is connected to one terminal of each of the coils of a series of relays 25^a to 25^e, the other terminals of which connect to five consecutive segments 26^a to 26^e according to the arrangement shown in Figure 3. Contacts 21 and 22 are connected to points 27 and 28 on resistance 23 midway between its middle point and its positive and negative terminals. As tongue 20 is operated by the signals transmitted over line 2 positive or negative impulses will be transmitted through each of the relays 25^a to 25^e, as trailer brushes 29 rotate in synchronism with trailer brushes 15. Continuous direct current flows through resistance 23 and positive or negative impulses will be transmitted through a circuit from middle point 24 through the coils of one of the relays 25^a to 25^e, through a segment 26^a to 26^e, trailer brushes 29, collecting ring 30, tongue 20, contacts 21 or 22, to point 27 or 28 on resistance 23. After trailer brushes 29 have completed a revolution, the series of relays 25^a to 25^e will have their tongues 31^a to 31^e set forward or backward in combination corresponding to the combination in which contacts 12^a to 12^e were set at the beginning of the revolution.

A series of auxiliary relays 32^a to 32^e, one corresponding to each of the relays 25^a to 25^e, have one terminal of their back coil connected to a contact 33^a to 33^e on a corresponding relay 25^a to 25^e and one terminal of their forward coil connected to a forward contact 34^a to 34^e on a corresponding relay 25^a to 25^e. The remaining coil terminals of relay 32^a are connected together and connect to tongue 31^b of the relay 25^b, and the remaining terminals of relays 32^b, 32^c, 32^d are connected in a similar manner and to tongues 31^c, 31^d and 31^e respectively, and the remaining two terminals of relay 32^e connect together and to a resistance 35 to the positive terminal. The tongue 31^a of relay 25^a is connected to segment 36. After all of the tongues 31^a to 31^e have been set, trailer brushes 37 pass over segment 36 and transmit an impulse over a circuit traced as follows: positive terminal, resistance 35, forward or back coil of relay 32^e, forward or back contact of relay 25^e, according to the position of tongue 31^e, forward or back coil of relay 32^d, forward or back contact of relay 25^d, and so on through the remaining relays of the series to segment 36, trailer brushes 37, collecting ring 38, to the negative terminal. This impulse will simultaneously set all of the tongues 45^a to 45^e in combination corresponding to the setting of the tongues 31^a to 31^e.

All of the forward contacts 39^a to 39^e of relays 32^a to 32^e are connected together and through resistance 40 to the negative pole of the generator 41 and all of the back contacts 42^a to 42^e of relays 32^a to 32^e are connected together and through resistance 43 to the positive pole of generator 44. The tongues 45^a to 45^e are connected to segments 46^a to 46^e in the arrangement as indicated in group C of Figure 2. As trailer brushes 47 rotate, a series of impulses corresponding to the impulses transmitted over line 2, but in a sequence corresponding to group C Figure 2, will be sent over line 1. The circuit may be traced as follows: negative pole of generator 41 or positive pole of generator 44, resistance 40, or resistance 43, contacts 39^a to 39^e or contacts 42^a to 42^e, tongues 45^a to 45^e, segments 46^a to 46^e, trailer brushes 47,

collecting ring 48, line 1, coils of relay 49, to ground and back to the other pole of generator 41 or 44. By these impulses the tongue 50 of relay 49 will be vibrated according to the setting of the tongues 45^a to 45^e.

At central Y there is a resistance 51, a relay 49, a group of relays 52^a to 52^e and an auxiliary group of relays 53^a to 53^e, all of which are operated in a manner similar to the corresponding parts, resistance 23, relay 18, relays 25^a to 25^e, and auxiliary relays 32^a to 32^e, at central station X, the only difference being that segmented ring 54 has twenty segments instead of seven as in the case of segmented ring 55 at station X, and the relays 52^a to 52^e are operated in a sequence corresponding to group C of Figure 2 instead of the sequence as shown in Figure 3, as is the case with relays 25^a to 25^e.

All of the forward contacts 56^a to 56^e of auxiliary relays 53^a to 53^e are connected together and through a resistance 57 to the positive pole of generator 58. The tongues 59^a to 59^e of relays 53^a to 53^e are connected separately to five consecutive segments 60^a to 60^e according to the arrangement shown in Figure 3. As trailer brushes 61 rotate, impulses will be transmitted over a circuit as follows: positive pole of generator 58, resistance 57, forward contact 56^a to 56^e of the relays 53^a to 53^e, tongues 59^a to 59^e, segments 60^a to 60^e, trailer brushes 61, collecting ring 62, line 3, collecting ring 63, trailer brushes 64, segments 65^a to 65^e, coils of magnets 66^a to 66^e, to ground and to the other pole of generator 58. As the trailer brushes 61 and 64 are rotating in synchronism, the impulses controlled by each of the relays 53^a to 53^e will be distributed at substation Y_3 to corresponding ones of the magnets 66^a to 66^e. The magnets 66^a to 66^e may be the combination magnets of the type printing recorder shown in my U. S. Patent No. 1,309,745.

What I claim is:

1. The combination in a telegraph system of a number of stations, a line interconnecting two of said stations, a rotating distributor at one of said stations, means including a plurality of relays arranged to cooperate with said distributor during a given revolution thereof for storing a plurality of separate groups of signal impulses, corresponding impulses in all groups being stored in the same definite order, a second plurality of relays, means rendered effective by the distributor at the end of said given revolution for transferring said groups of impulses from the first to the second relays, and means cooperating with said second relays and with the distributor during a subsequent revolution thereof for transmitting said groups of stored impulses over the line in such manner that the impulses of each group are sent in an order different from that of other groups.

2. The combination in a telegraph system of a number of stations, a line interconnecting two of said stations, a rotating distributor at one of said stations, means including a plurality of relays arranged to cooperate with said distributor during a given revolution thereof for storing a plurality of separate groups of signal impulses, corresponding impulses in all groups being stored in the same definite order, a second plurality of relays, means rendered effective by the distributor at the end of said given revolution for transferring said groups of impulses from the first to the second relays, means cooperating with said second relays and with the distributor during a subsequent revolution thereof for transmitting said groups of stored impulses over the line in such manner that the impulses of each group are sent in an order different from that of other groups, a rotating distributor at the second station, a group of relays cooperating with said last distributor during a given revolution thereof to receive and store said groups of impulses in the order in which they are sent over the line, other relays, and means cooperating with said last distributor during a subsequent revolution thereof for transferring from the first mentioned relays of the second station to said last mentioned relays and for storing thereon said groups of impulses in the same order in which they were originally stored in the first station.

3. In a telegraph system, a first and a second central office, a main line interconnecting said offices, lines incoming to said first office, means for sending a group of signal impulses over said incoming lines simultaneously, a rotating distributor at the first central office, relays cooperating with said distributor during one revolution thereof for storing in the same definite order the impulses of all of said groups, a series of polarized relays, a series circuit closed by said distributor at the end of said revolution for operating said polarized relays in one direction or the other according to the operation of said first relays to store on said polarized relays said groups of impulses, and means including connections between said polarized relays and said distributor for sending over the main line during the next revolution of the distributor groups of impulses in which the several impulses of each group occur in an order different from the order of any other group and different from the order in which any group was stored upon said relays.

In testimony whereof I affix my signature.

LOUIS M. POTTS.