

Sept. 14, 1926.

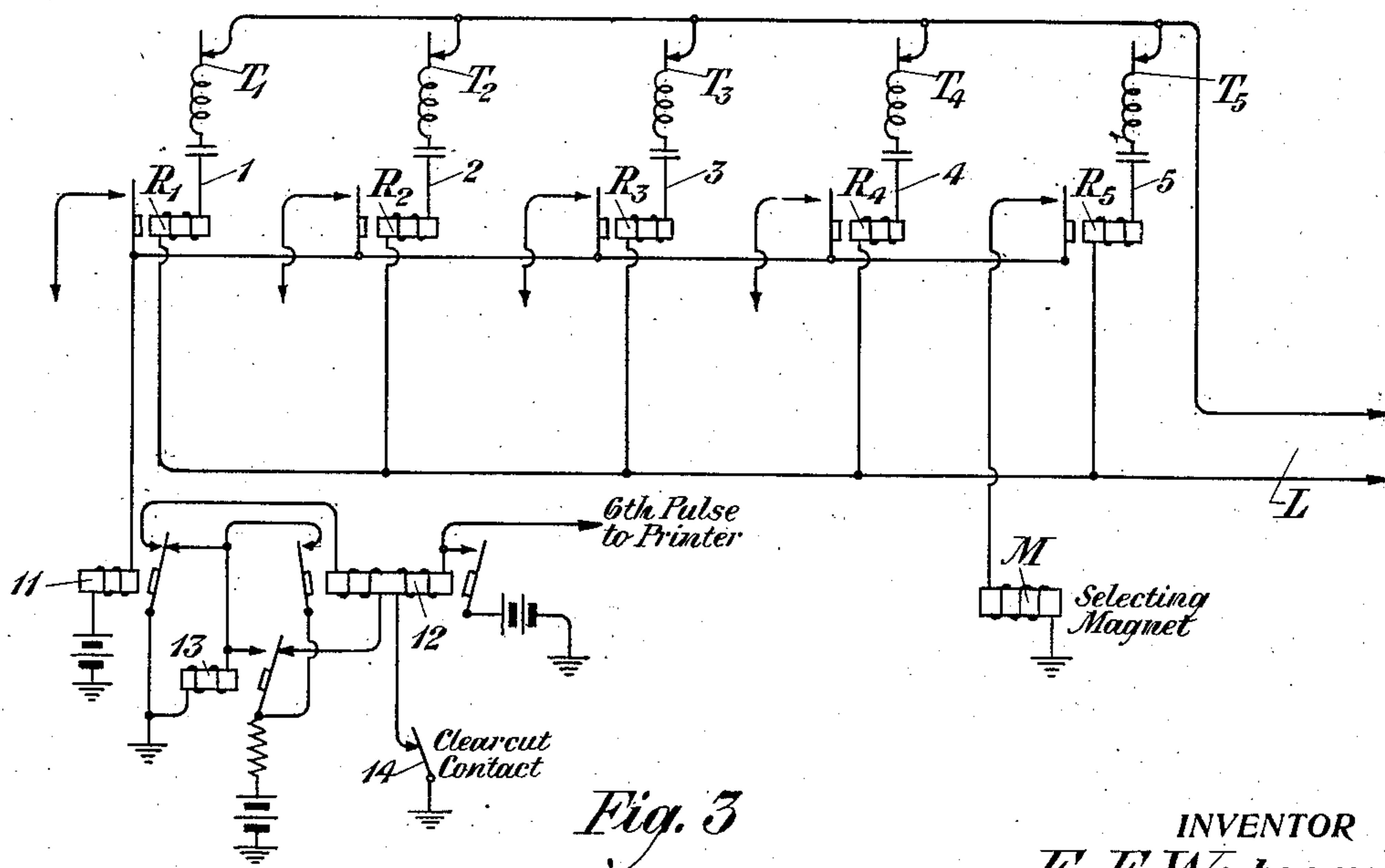
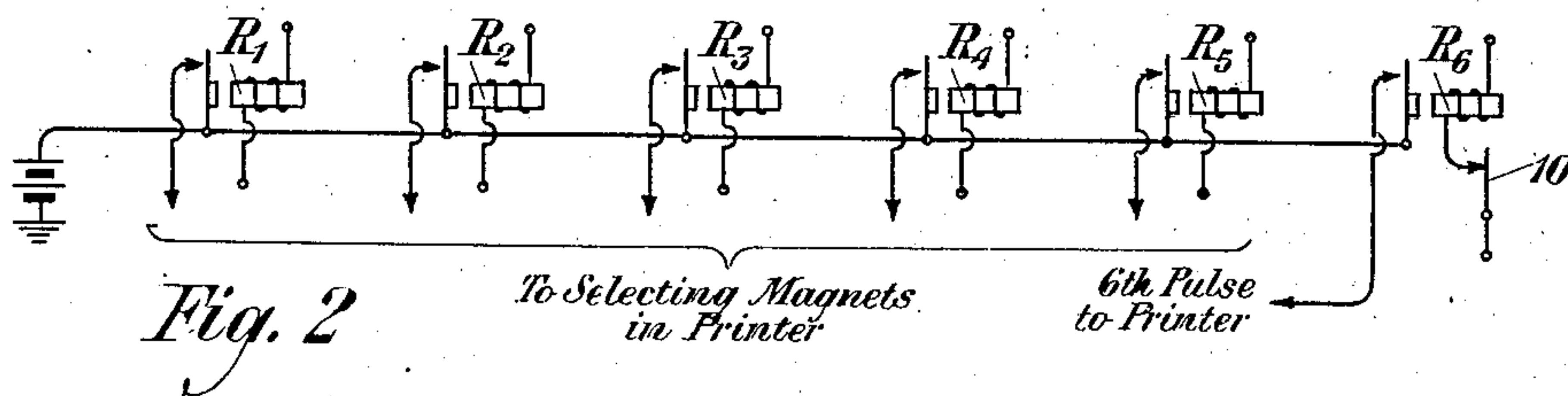
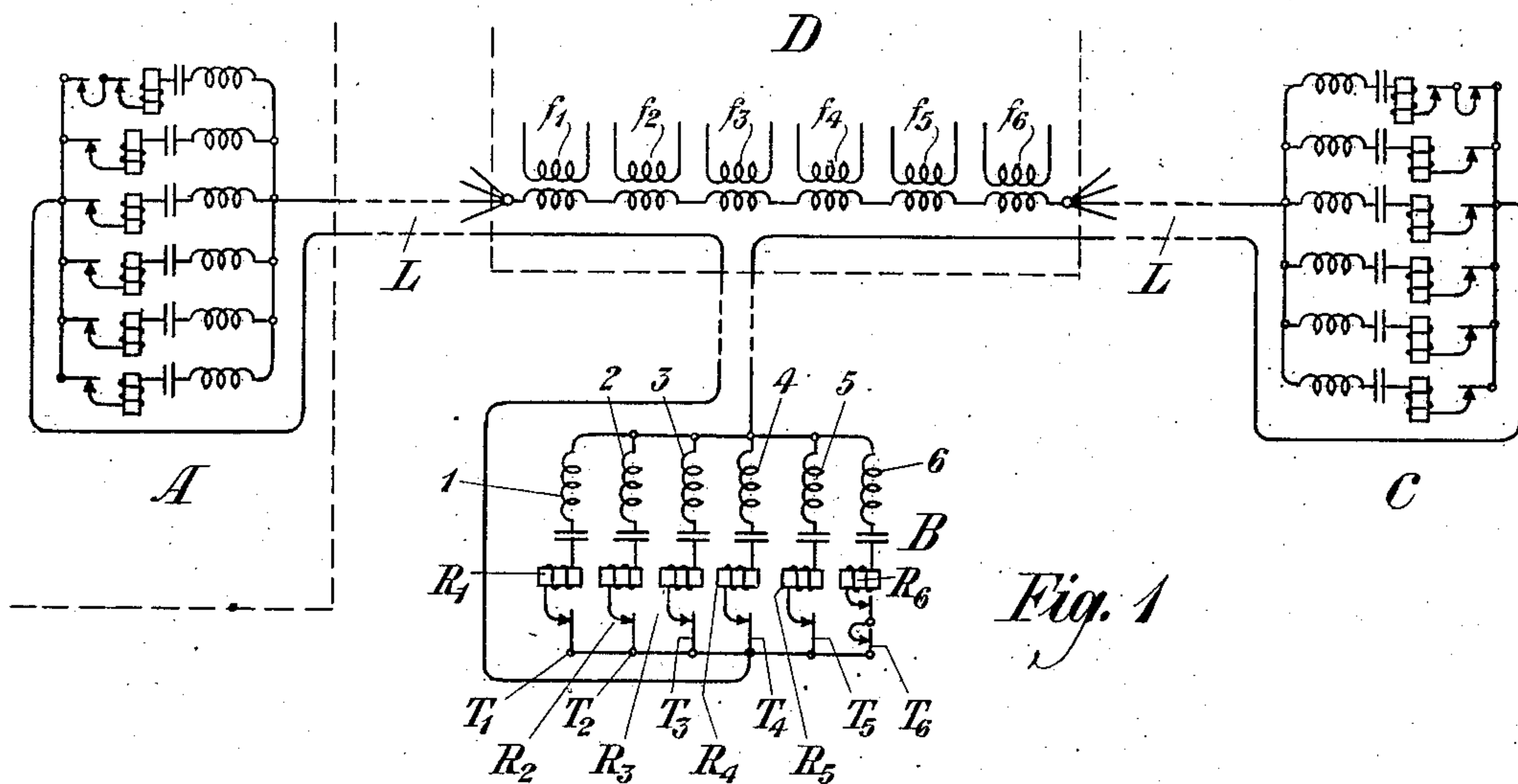
1,599,445

E. F. WATSON

ALTERNATING CURRENT PRINTING TELEGRAPH SYSTEM

Filed Sept. 17, 1924

2 Sheets-Sheet 1



INVENTOR
E. F. Watson

BY

for
ATTORNEY

Sept. 14, 1926.

1,599,445

E. F. WATSON

ALTERNATING CURRENT PRINTING TELEGRAPH SYSTEM

Filed Sept. 17, 1924

2 Sheets-Sheet 2

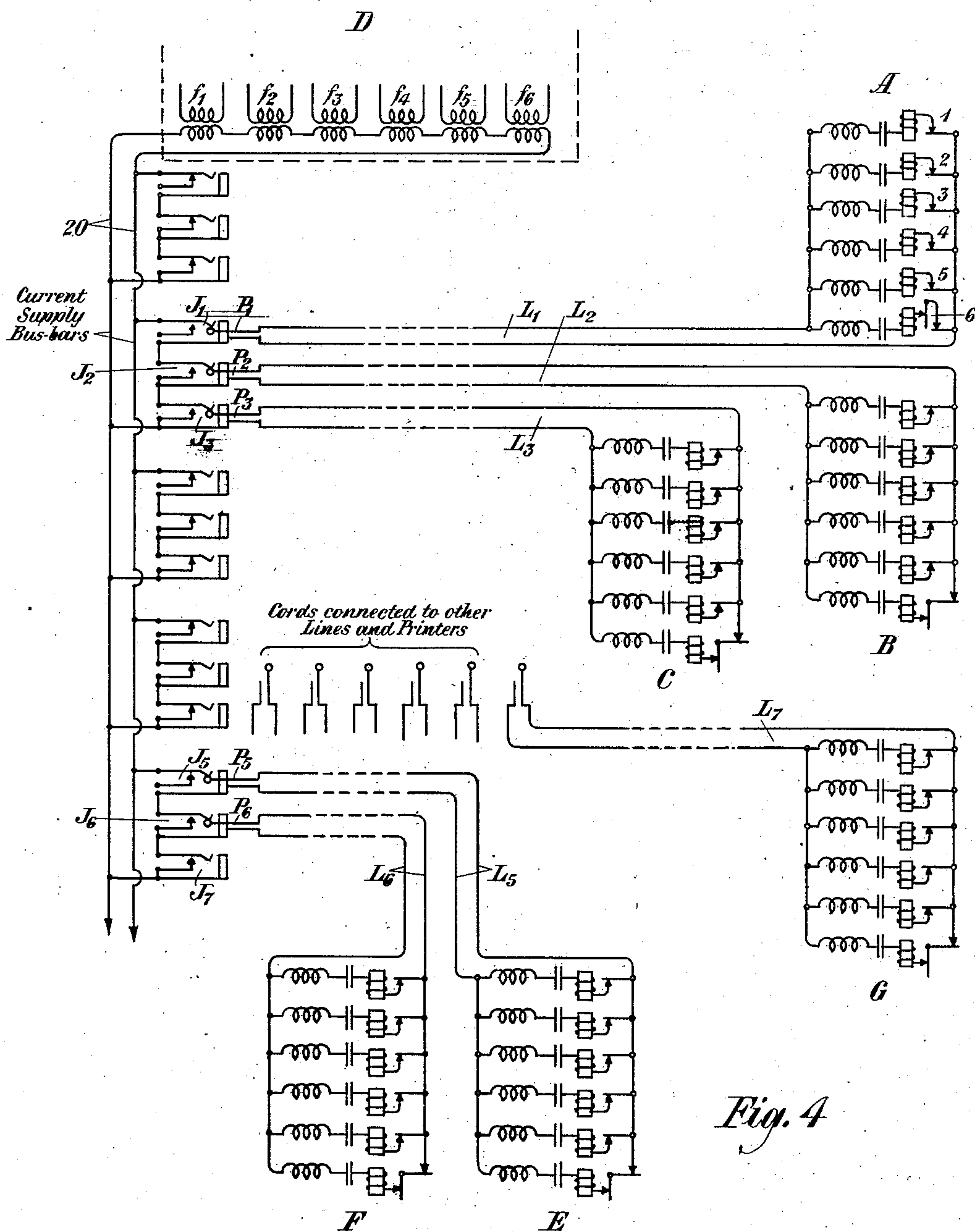


Fig. 4

INVENTOR

E. F. Watson

BY

g. f. h. c.

ATTORNEY

Patented Sept. 14, 1926.

1,599,445

UNITED STATES PATENT OFFICE.

EDWARD F. WATSON, OF LARCHMONT, NEW YORK, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

ALTERNATING-CURRENT PRINTING-TELEGRAPH SYSTEM.

Application filed September 17, 1924. Serial No. 738,228.

This invention relates to printing telegraph systems, and more particularly to printing telegraph systems in which alternating currents or so-called carrier currents are used for the transmission of signals. The present application is a continuation of the common subject matter of my application, Serial No. 379,887, filed May 8, 1920.

One of the objects of the invention is to provide a printing telegraph system in which the elements of a code combination are formed by carrier currents of different frequencies, these frequencies being supplied to the circuit at a central point and transmitted to the different local stations associated with the circuit in a manner analogous to the central battery supply of current to the sub-station in a telephone system. By such an arrangement the same source of supply current may be utilized for a number of different circuits, and signals may be transmitted between stations in each circuit without transmitting the signals to the other circuits supplied with current from the same source.

Another object of the invention is to provide a printing telegraph system in which the selective apparatus responsive to the code combination at each station shall be as simple as possible.

Still another object of the invention is to provide a printing telegraph system in which the use of distributors at both the transmitting and receiving stations is eliminated.

Other and further objects of the invention may be realized in an arrangement in which all of the local stations are included in a closed loop supplied with currents of different frequencies at some common point. At each local station a selective apparatus consists of a number of tuned circuits corresponding to the number of different selecting impulses required with an additional tuned circuit in certain instances to control the printing operation. In series with each of these tuned circuits is an alternating current relay. The selective operation of these relays in response to the transmission of different combinations of frequencies operates the printer. For sending purposes a transmitting contact is included in each tuned circuit, and by opening or closing different combinations of contacts, thereby opening and closing different tuned circuits at the

local station, the impedance for different frequencies is varied, so that the corresponding receiving relays at all of the stations will respond. By connecting a number of such loops in parallel to common busbars supplied with current from the same alternating current sources, signaling may take place in each loop without affecting the other loops, provided there is substantially no impedance in the circuit leading from the busbars to the source or sources of current.

The invention may be more fully understood from the following detailed description when read in connection with the accompanying drawing, Figure 1 of which represents in schematic form the circuit arrangement of the proposed system; Figure 2 of which is a detail of the circuit arrangement of the selective relays, Figure 3 of which is an alternative form of sub-station, circuit, and Figure 4 of which illustrates in somewhat more detail how a plurality of independent loops may be connected to busbars to which a common source is applied.

Referring to the drawing, L designates a transmission circuit in the form of a closed loop, including sub-station apparatus at sub-station A, B and C. In the system illustrated, a code analogous to the Baudot code is employed, and in order to transmit this code, the loop circuit is supplied at a central station D with six different frequencies, five of which correspond to different elements of the Baudot code, and the sixth of which is to institute the printing operation in a well known manner. These frequencies may be applied to other loops in parallel with the loop illustrated as indicated by the multiple connections at the central office D.

The apparatus at each sub-station is identical, and as indicated at station B, consists of six tuned circuits, 1, 2, 3, 4, 5 and 6, each corresponding to one of the frequencies f_1 , f_2 , f_3 , f_4 , f_5 and f_6 supplied to the line circuit at the central office D. Alternating current relays R_1 , R_2 , R_3 , R_4 , R_5 , and R_6 are serially included in said tuned circuits with transmitting contacts T_1 , T_2 , T_3 , T_4 , T_5 and T_6 . An additional contact 10 is included in the sixth selective circuit. This contact is so arranged as to be normally closed, but to be open during the printing operation. The circuits controlled by the five selecting relays and the sixth pulse re-

lay are indicated in more detail in Figure 2. The five selecting relays, it will be noted, are each arranged to close a circuit through one selecting magnet of the printer when the selecting relay is de-energized. The selecting magnets and other apparatus of the printer are well known in the art, and need not be illustrated or described in detail, as they form no part of the present invention. The sixth pulse relay R_6 is arranged so that when it is de-energized a circuit is closed over a sixth pulse conductor to set the printer in operation in a well known manner to print the combination set up on the selecting magnets.

The operation is as follows: Normally, each of the six frequencies supplied at the central office flows over the circuit and at each sub-station finds a path of low impedance through the corresponding tuned circuit. If now, one of the stations, say, station B, is transmitting, certain of the transmitting contacts will be open, while others will be closed in response to the actuation of a key. The transmitting contact T_6 is opened each time a key is actuated. Assuming that transmitting contacts T_1 , T_3 and T_5 are open in addition to the contact T_6 at station B, the frequencies f_1 , f_3 , f_5 and f_6 will now flow over the line L through an impedance very much greater than that existing before, since the tuned circuits at station B which remain closed have a very large impedance for frequencies other than those frequencies to which they are tuned, consequently relays R_1 , R_3 , R_5 and R_6 are de-energized at station B due to the opening of their circuits, and the corresponding relays at the other stations are also de-energized because of the increased impedance for currents of the frequencies which normally flow through said relays. The circuits of the selecting magnets corresponding to the first, third and fifth selecting relays are operated at each station to set up the proper code combination on the printer and the corresponding character is printed by the transmission of the sixth pulse to the printer over the back contact of the sixth relay.

As the contact 10 in the sixth selective circuit is held open during the operation of printing any given character, the sixth selective circuit cannot be closed until the last character has been completely printed, and the printing of another character due to the setting up of a new combination on the selecting relays cannot take place until the combination previously set up has been printed by all of the printers on the circuit.

It will be obvious that loops other than the one described, connected to the common sources and provided with signaling equipment similar to that illustrated, will not be affected by the signals transmitted in the loop above described. This is for the rea-

son that the current flowing at any frequency through any loop depends upon the voltage drop across the common busbars to which the loops are connected in parallel and upon the impedance of the loop itself at that frequency. The voltage drop across the busbars is equal to the voltage of the common source and is not determined by the impedances of any or all of the loops. It is assumed, of course, that the connections from the busbars to the source have substantially no impedance in order that the condition just described may obtain.

A modification of the system is shown in Fig. 3. In this modification only five tuned circuits are employed, and the printing operation is started whenever any one of these tuned circuits is opened. This, of course, prevents the use of a code combination in which all five selecting relays are held energized so that no printing magnets are actuated. In this case there would be nothing to start the printing operation. The system, however, has the obvious advantage that it eliminates one of the tuned circuits or channels required in the system previously described in order to start the printing operation for a combination in which the five character-determining relays are unreleased.

The operation of the arrangement shown in Fig. 3 is the same with respect to the actuation of the selecting magnets of the printer as that illustrated in Figs. 1 and 2, and need not be further described. Upon the release of any selecting relay in response to the transmission of a signal, as, for instance, the selecting relay R_5 , a circuit is completed from ground to the winding of the corresponding selecting magnet, such as M_5 , over the back contact of the selecting relay and through the winding of relay 11 to battery. Relay 11 at its front contact completes a circuit through the left-hand winding of relay 12 and over back contact of relay 13 to battery. Relay 12 at its right-hand front contact completes a locking circuit through its right-hand winding and over the clear-out contact 14 to ground. The sixth pulse to operate the printer is also transmitted at the same time. Relay 12 also completes a circuit from battery over its left-hand front contact and through the winding of relay 13 to ground. Relay 13 opens the initial energizing circuit of the relay 12. Relay 13 at its right-hand front contact completes a locking circuit through its own winding, and is consequently maintained energized until all of the selecting contacts T_1 to T_5 inclusive have again been closed upon restoring the transmitting key to normal. When this occurs, relay 11 is de-energized, and at its back contact short-circuits the winding of relay 13. Relay 13 is accordingly released and if the printing operation has been completed the three relays

11, 12 and 13 are again in normal condition ready to function in printing the next character. In case the transmitting contacts are held operated and the relay 11 remains operated after the printing operation is completed relay 13 will remain operated, and relay 12 will be released by the opening of its locking circuits by means of the clear-out contact 14. This will prevent the repetition of the printing operation in case the transmitting contacts are held operated for too long a period, since the relay 13 holds open the initial energizing circuit of the relay 12, and thus prevents printing the same character twice.

Fig. 4 shows in somewhat more detail the relation between a plurality of independent signaling loops supplied by a common source at D and how different signaling stations may be interchangeably connected in different loops so that the various stations may intercommunicate in separate groups. The various frequencies f_1 to f_n are supplied by suitable sources (not shown) at station D, the voltage from the sources being applied to the busbars 20. Across these busbars are connected a plurality of groups of jacks, such as groups J_1, J_2, J_3 and J_5, J_6 and J_7 . The individual jacks of each group have their contacts arranged in series with respect to each other, but the groups themselves are connected in parallel. In the idle condition of each group of jacks, one of the jacks, as, for example, J_1 , is open-circuited to prevent short-circuiting the busbars.

A plurality of local lines or loops, such as L_1, L_2 and L_3 , each provided with substation equipment similar to that of Fig. 1, as indicated at A, B and C, terminate in plugs P_1, P_2 and P_3 . By inserting these plugs in the jacks of groups such as J_1, J_2 and J_3 , the three signaling stations, such as A, B and C, will be connected in series across the busbars. The circuit extends from the right-hand busbar, over the tip conductors of jack J_1 and plug P_1 , over the upper conductor of the loop L_1 , through the substation apparatus at A, over the ring conductor of the loop L_1 , over the ring contacts of the plug P_1 and the jack J_1 , over the tip conductors of the jack J_2 and the plug P_2 , over the tip conductor of the loop L_2 , through the substation apparatus at B, over the ring conductor of the loop L_2 , over the ring contacts of the plug P_2 and the jack J_2 , over the tip conductors of the jack J_3 and the plug P_3 , over the tip conductor of the loop L_3 , through the substation apparatus at C, and then back over the ring conductor of the loop L_3 and the ring contacts of the plug P_3 and the jack J_3 to the left-hand busbar. Signals may be transmitted over the above circuit between the stations A, B and C in the manner described in connection with Fig. 1.

Other substation loops may be plugged into other groups of jacks for independent intercommunication; for example, the loops L_5 and L_6 , terminating in substation apparatus E and F, are connected in series by inserting the plugs P_5 and P_6 in the jacks J_5 and J_6 of the group J_5, J_6 and J_7 . The substation apparatus E and F is now arranged in series in an independent loop, the loop, however, being in parallel with the loop including the substations A, B and C. Other loops and plugs are provided as indicated so that the various substations may be connected in groups, whereby the stations of each group may intercommunicate independently of the stations of other groups. The number of jacks in each group may be any number desired, three being shown in the drawing for purposes of illustration.

Assuming that there is substantially no impedance in the connections from the busbars to the sources, the voltage drop across the busbars at any frequency will be equal to the voltage generated by the generator of that frequency. The current flowing in any loop formed by inserting the plugs connected to individual stations into any group of jacks depends upon the series impedance of the loop at a given frequency and the voltage drop across the busbars at that frequency. Since the voltage drop across the busbars is not appreciably affected by what happens in any other loop connected across the busbars, a change in the impedance of any other loop at a given frequency does not affect the current flowing at that frequency in the given loop. Therefore, signals may be transmitted between the stations in the loop by interrupting combinations of selecting branches at the substations. This changes the impedance of the given loop at the several frequencies involved but does not affect the current flow in any of the other loops at those frequencies. Therefore, the signals may be transmitted in any loop without affecting substations in other loops.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention, as defined in the following claims.

What is claimed is:—

1. In a printing telegraph system, a transmission circuit, means for impressing a plurality of frequencies upon said circuit, a substation comprising a plurality of paths arranged in parallel with respect to each other and each being in series with said transmission circuit, means to render each path selective to a different one of said frequencies, a transmitting element and a receiving element in each path, said ele-

ments being serially included in the path and in series with each other, and means jointly controlled by said selective circuits for controlling a printing apparatus.

2. In a printing telegraph system, a transmission circuit, means for impressing a plurality of frequencies upon said circuit, a plurality of subscribers' stations associated with said circuit, each subscriber's station including a plurality of paths arranged in parallel to each other and each path being in series with respect to said transmission circuit, means to render each of the paths of each subscriber's station selective to a different one of said frequencies, transmitting means and receiving relays included in each selective circuit, said transmitting means and receiving relays being in series with each other and serially included in the selective circuit, and a printing apparatus jointly controlled by said relays.

3. In a printing telegraph system, a transmission circuit, means for impressing a plurality of frequencies thereon, a plurality of subscribers' stations, each subscriber's station including a plurality of paths, one corresponding to each frequency, said paths being arranged in parallel with respect to each other but each path being arranged in series with respect to said transmission circuit, means for rendering the paths of each subscriber's station selective to a different one of said frequencies, receiving relays in each of said selective paths, the receiving relays of a given substation being arranged to jointly control printing apparatus, transmitting means in each selective path, the transmitting means of the selective paths of a given subscriber's station being arranged to selectively control said selective paths to cause the actuation of corresponding relays at each of said stations, and the transmitting means and receiving relays of each path being arranged in series with each other and serially included in the path.

4. In a printing telegraph system, a transmission circuit, means to impress a plurality of frequencies thereon, one corresponding to each element of a printing telegraph code, a plurality of subscribers' stations associated with said circuit, each subscriber's station including a plurality of selective paths, one corresponding to each frequency, said selective paths being arranged in parallel with respect to each other but being serially included in said transmission circuit, a receiving relay in each of said selective paths, means whereby the relays in the paths of each subscriber's station jointly control printing apparatus, and transmitting devices in each path, said transmitting devices being arranged so that the transmitting devices of the paths of a given subscriber's station selectively control said se-

lective paths to cause the actuation of corresponding relays at each substation, the transmitting device and receiving relay of each path being arranged in series with each other and in series with the path.

5. In a printing telegraph system, a transmission circuit comprising a closed loop, means for impressing a plurality of frequencies upon said loop, each of said frequencies corresponding to one of the elements of a Baudot code, a plurality of subscribers' stations each including a plurality of paths, one corresponding to each frequency, the said paths of each substation being arranged in parallel with respect to each other and each path being in series with respect to the loop, means to render each path of each substation selective to a different frequency, transmitting keys in each path and receiving relays in each path, the transmitting keys and receiving relays being connected in series with each other and in series with the corresponding path, said transmitting keys being arranged to selectively control said selective paths to cause the selective actuation of corresponding relays at each station and the selecting relays of the paths of each substation being arranged to jointly control the operation of a printer.

6. In a printing telegraph system, a transmission circuit comprising a closed loop, means for impressing a plurality of frequencies upon said loop, each frequency corresponding to one of the elements of the Baudot code, a plurality of subscribers' stations having transmitting and receiving apparatus serially included in said loop, each transmitting and receiving apparatus comprising a plurality of selective circuits each corresponding to one of the frequencies impressed upon the loop, selective relays in each selective circuit for jointly controlling the printing operation and normally closed transmitting contacts, one in each selective circuit, the selective operation of said contacts opening the circuits of selective relays in certain of said selective circuits at the station where the transmitter is operated, thereby causing the selective relays to select the character to be printed, the opening of said selective circuits by the actuated contacts also increasing the impedance of the transmission circuit for the corresponding frequencies so that the corresponding relays in corresponding selective circuits at other stations are also actuated to select the same character to be printed.

7. In a signaling system, a plurality of transmission circuits, means common to said circuits for impressing a plurality of frequencies upon each of said circuits, means individual to each circuit for controlling the transmission of said frequencies over said circuit without affecting the transmission of said frequencies over other transmis-

sion circuits, and means individual to each circuit selective to the several frequencies.

8. In a signaling system a plurality of transmission circuits, means common to said circuits for impressing each of a plurality of frequencies upon all of said circuits, means individual to each circuit for individually controlling the transmission of each of said frequencies over said circuit without affecting the transmission of said frequencies over other transmission circuits, and means individual to each of said circuits individually selective to each of said frequencies.

9. In a printing telegraph system a plurality of transmission circuits, means common to said circuits for impressing a plurality of frequencies upon each of said circuits, substations associated with each circuit, one substation of each circuit including a transmitting apparatus for controlling the transmission of each of said frequencies without affecting the other transmission circuits, and another substation of each circuit including means selective to each of said frequencies, and means jointly controlled by said selective means for operating a printing apparatus.

10. In a printing telegraph system a plurality of transmission circuits, means common to said circuits for impressing a plurality of frequencies upon each of said circuits, a plurality of substations associated with each circuit, one of the substations associated with each circuit including a transmitting apparatus comprising means to selectively vary the impedance to each of said frequencies without affecting the other transmission circuits, and another of said substations for each circuit including a receiving apparatus comprising a plurality of selective circuits, each selective to a different one of said frequencies, and means jointly controlled by said selective circuits of each transmission circuit for controlling a printing apparatus.

11. In a signaling system, means for generating alternating voltages of a plurality of frequencies, a plurality of signaling loops connected in parallel to the common voltage

terminals of said generating means, a plurality of signaling stations in each loop, means at each station for controlling the transmission in the loop of current of the frequencies generated by said generating means without affecting the current of such frequencies flowing in the other loops, and means at each signaling station selective of the several frequencies.

12. In a signaling system, means for generating alternating voltages of a plurality of frequencies, a plurality of independent loops connected in parallel to the common voltage terminals of said generating means, a transmitting station and a receiving station serially connected in each loop, means at each receiving station responsive to changes in the impedance of its loop at the several frequencies, and means at each transmitting station to change the impedance of the loop in which it is located at any of the generated frequencies without affecting the current flow in the other loops at said frequencies, whereby the receiving station in any loop will respond to the transmitting station in that loop but will not respond to transmitting stations in other loops.

13. In a signaling system, means for generating alternating voltages of a plurality of frequencies, a plurality of loops connected in parallel to the common voltage terminals of said generating means, a transmitting station and a receiving station in each loop, each receiving station comprising a plurality of circuits individually selective of the several generated frequencies, means in each of said circuits responsive to a change in the impedance of the loop at the corresponding frequency, each transmitting station comprising means for individually changing the impedance of the loop at any frequency without changing the current flow in any other loop at that frequency, whereby signals may be transmitted between the stations in any loop without transmitting signals to stations of other loops.

In testimony whereof, I have signed my name to this specification this 15th day of September, 1924.

EDWARD F. WATSON.