C. L. BOPP.

COMPOSITE TELEGRAPH AND TELEPHONE SYSTEM.

APPLICATION FILED OCT. 17, 1907.

1,002,803.

Patented Sept. 5, 1911.

3 SHEETS—SHEET 1.

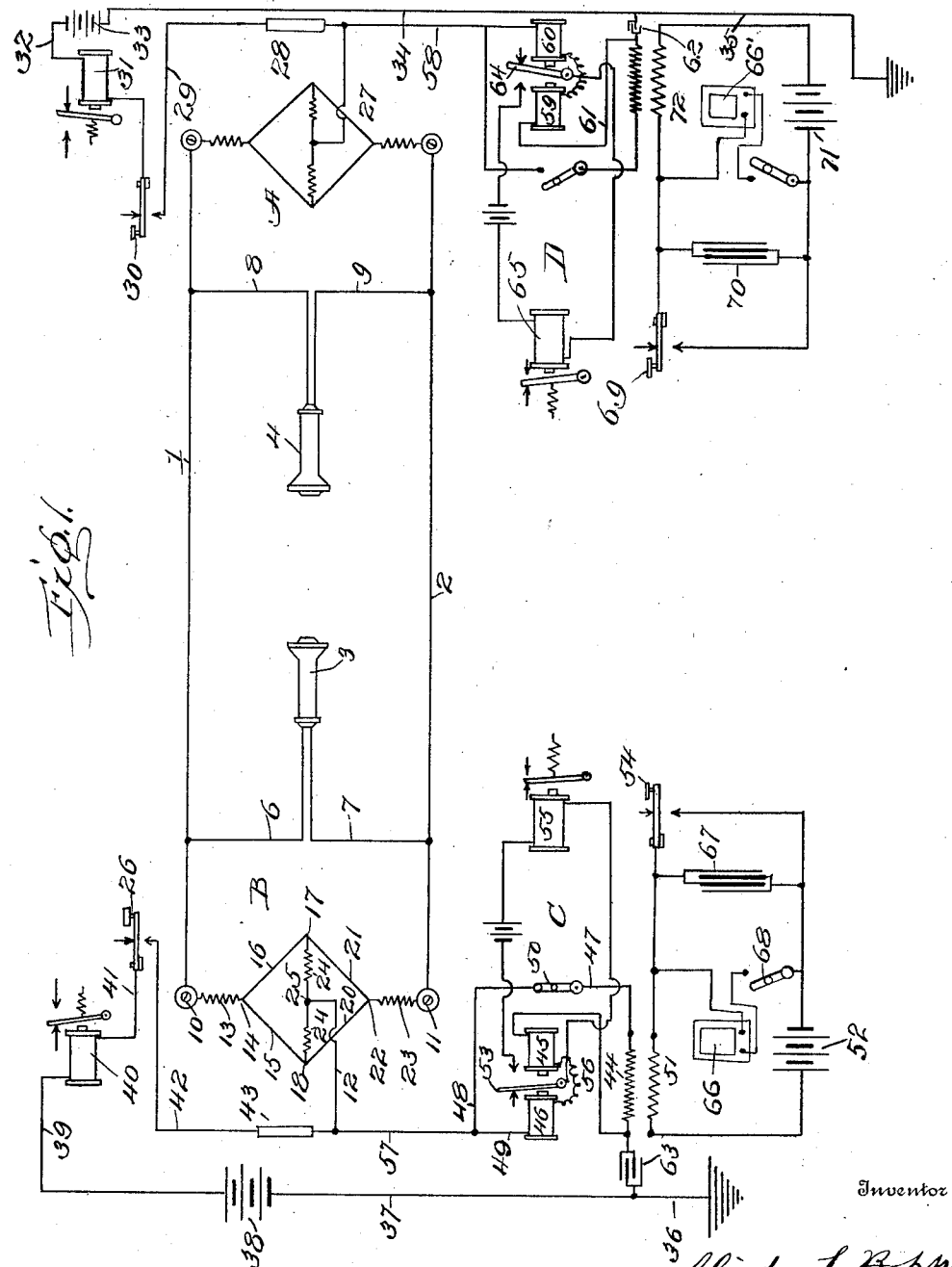

Fig. 1.

Witnesses:
J. M. Fowler Jr.
A. L. Ritchin

Inventor
Clinton L. Bopp.
By Mason Fenwick & Lawrence,
his Attorneys

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

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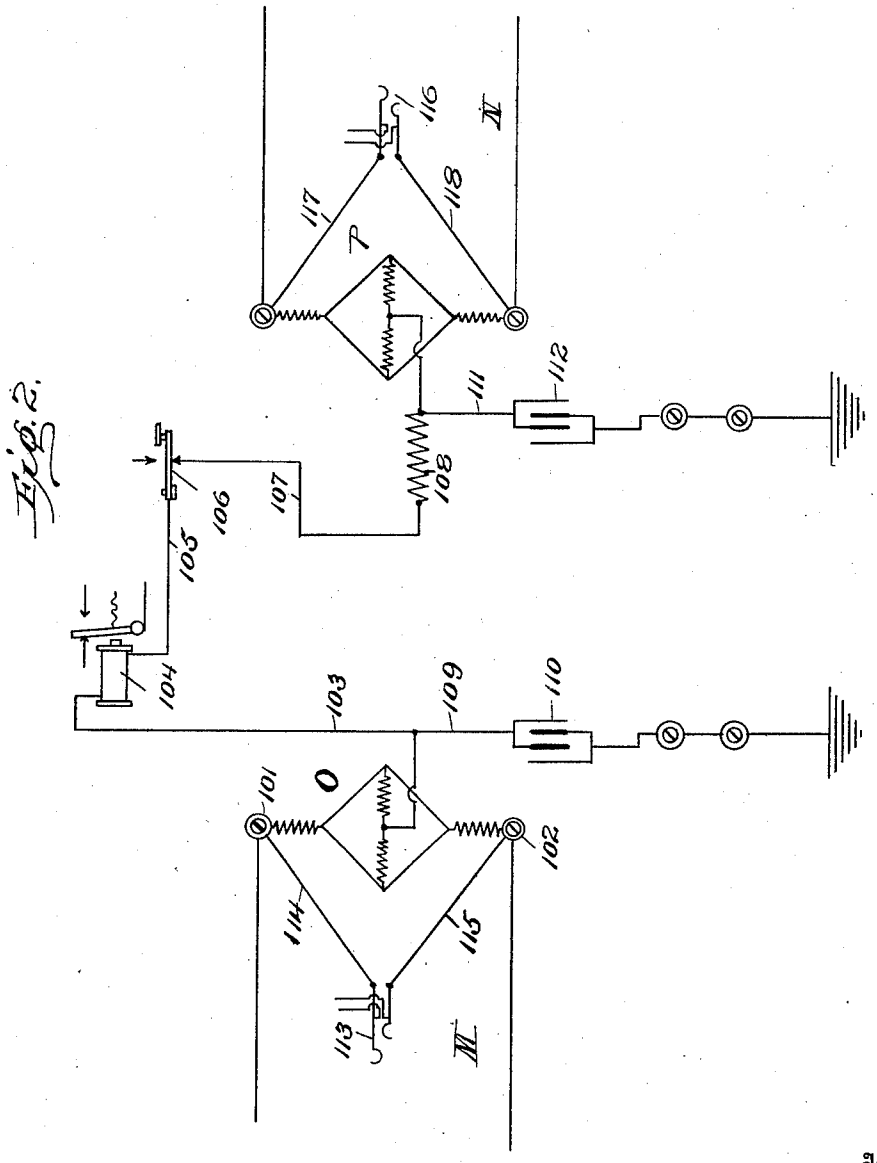
3 SHEETS—SHEET 2.

Fig. 2.



Inventor

Witnesses

J. M. Fowler Jr.

A. L. Kitchin

Clinton L. Bopp

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his Attorneys

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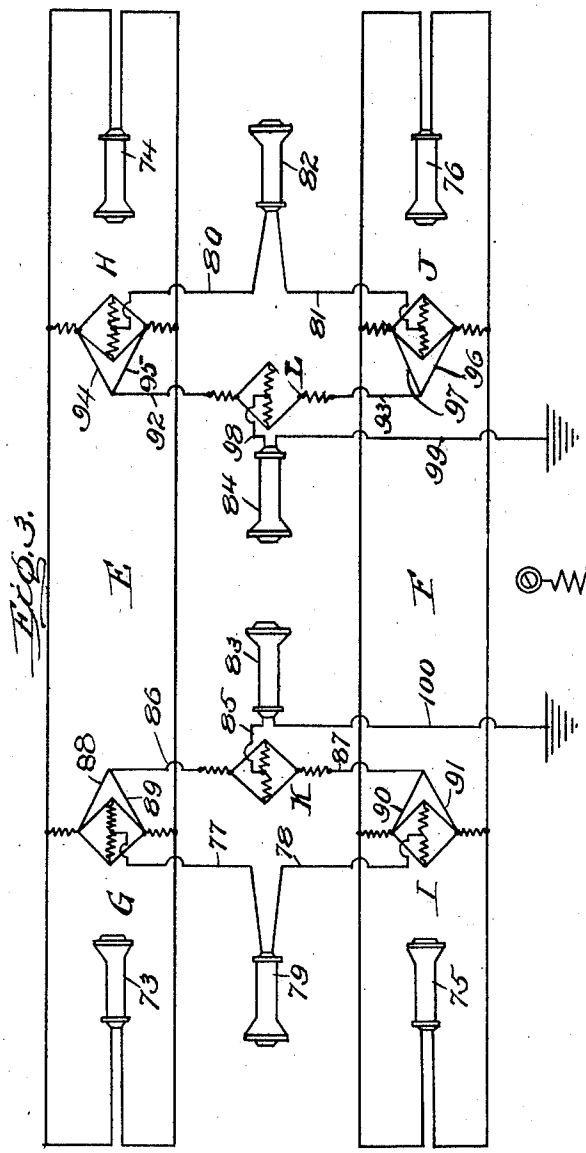

Fig. 3.

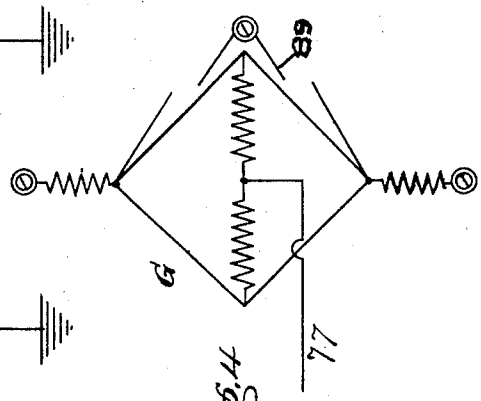

Fig. 4.

Witnesses

J. M. Fowler Jr.

A. L. Kitchin.

Inventor

Clinton L. Bopp.

By Mason Fenwick & Lawrence.

His Attorneys

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CLINTON L. BOPP, OF MEERS, SOUTH DAKOTA.

COMPOSITE TELEGRAPH AND TELEPHONE SYSTEM.

1,002,803. Specification of Letters Patent. **Patented Sept. 5, 1911.**

Application filed October 17, 1907. Serial No. 397,904.

To all whom it may concern:

Be it known that I, CLINTON L. BOPP, a citizen of the United States, residing at Meers, in the county of Stanley and State of South Dakota, have invented certain new and useful Improvements in Composite Telegraph and Telephone Systems; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in composite telegraph and telephone system, and particularly to that system in which a complete metallic circuit is provided for the telephone system, and a ground return provided for the telegraph system.

The invention comprises the production of a telephone line provided with a complete metallic system of wiring and means for connecting to said line or wiring telegraph sets designed to use the wiring of the telephone system as one line and the ground as the return.

The invention also comprises the production of a telephone line or system divided into divisions having respective terminals and means for repeating a message from one division of the line to the other which may be used in combination with means for using all or any of the divisions of the telephone system for sending telephone messages.

The invention further comprises the production of a plurality of divisions of a telephone system, and a plurality of telegraph sets connected thereto, each system being adapted to communicate over the line wires simultaneously without interfering with the other.

The invention still further comprises means for using a plurality of telephone systems in such a way as to provide phantom circuits as an auxiliary to the main line, and so arranged as to have their messages entirely independent thereof.

The object in view is the production of a device for producing means for a telephone system in which the telephone sets have a complete metallic circuit and telegraph sets having a ground return, the telegraph sets being so arranged that two or more different sets may be used at each end of the line.

Another object in view is the production of means for producing a telegraph and telephone system having means for producing phantom circuits in the telephone system that will use the same line wires and be adapted to operate independently of each other without any of the messages being confused.

A still further object in view is the production of a composite system of sending messages comprising a metallic telephone system in combination with a telegraph system provided for the transmission of three different messages over the same division of the line wire at the same time or at different times as may be desired, independently of each other.

With these and other objects in view, the invention comprises certain novel constructions, combinations and arrangements of parts, as will be hereinafter fully described and claimed.

In the accompanying drawings:—Figure 1 is a diagrammatic view of a metallic telephone system connected up with my improved telegraph connections. Fig. 2 is a diagrammatic view showing how two metallic telephone systems are connected up for permitting the passage of telegraph messages from one telephone system to the other. Fig. 3 is a diagrammatic view of two telephone sets provided with metallic wiring and having connected thereto connecting devices for forming phantom circuits. Fig. 4 is an enlarged detail diagrammatic view of a bridge or duplex device formed according to the present invention.

In providing means for sending signals over wires it is very desirable to send as many signals over a single wire as possible without confusing the same and to this end I have provided various connections and means for using one complete metallic circuit for both a telephone and telegraph system in connection with the ground as a return. In the present invention a special telegraph device is provided which is de-

signed to be used for sending telegraphic messages as well as the ordinary devices used in the Morse system.

Referring more particularly to the drawings 1 indicates one line of a metallic circuit and 2 the other line, to which are connected telephone sets 3 and 4 of any usual or preferred construction. Telephone set 3 is connected to wires 1 and 2 by wires 6 and 7 and set 4 is connected to wires 1 and 2 by wires 8 and 9. In operation telephone sets 3 and 4 are used in the ordinary way, the electrical impulses passing through line wires 1 and 2, and connecting wires 6 and 7 and 8 and 9. As line wires 1 and 2 and the connecting wires are of much less resistance than the means connected thereto, the telephonic messages will simply go from one telephone set to the other without interference.

Connected to line wire 2 are bridges or duplex apparatuses A and B. Bridge B is connected to line wire 1 by binding post 10 and to line wire 2 by binding post 11 so that any current passing over telegraph wire 12 will divide and pass onto line wires 1 and 2 of the telephone system and use the same as a single wire, there being a ground return provided as hereinafter more fully described. Connected to binding post 10 is a resistance 13 which in turn is connected at point 14 to wires 15 and 16. Connected to wires 15 and 16 at points 17 and 18 are wires 20 and 21. Wires 20 and 21 converge and are connected together at 22 and have connected thereto at point 22 a resistance 23 which, in turn, is secured to binding post 11 or wire 2. Wires 15 and 16 are designed to be of the same resistance and also wires 20 and 21 of the same resistance so that any current passing over any of the wires or through resistance 13 and 23 will be of the same potential or voltage at points 17 and 18. Connected to wires 17 and 18 are resistances 24—24 which are designed to be of the same ohmic resistance so that current passing over wire 12 to points 17 and 18 is evenly divided at point 25. By this construction currents from telephone sets 3 and 4 are choked back by the coils of resistance in bridge B as the same has an easier path to flow from one set to the other. However, the telegraph impulses from key 26 are designed to pass over wire 12 and through bridge B to line wires 1 and 2 and from thence to bridge A and through A to wire 27, from wire 27 to resistance in the form of choke coil 28, wire 29 to key 30 to relay or sounder 31 and wire 32, battery 33, and wires 34 and 35 to the earth. From the earth the current can flow back to wires 36 and 37, battery 38, and wire 39 to sounder or relay 40. From sounder 40 the current continues to flow through wire 41, key 26, wire 42, and choke coil 43 back to choke coil 28, thus completing the circuit. When the circuit has been traced from wire 12 to the circuit and back again, of course, it will be understood, that the current starts from the batteries when the circuit is closed but will travel in the way just set forth. Bridge A is constructed exactly the same as bridge B and also the surrounding connections and mechanisms are of the same kind, and messages going from key 30 over wire 27 to bridge B and key 26 will travel in a similar manner to messages from key 26 to key 30, and in view of this fact no further description will be needed in regard to bridge A and surrounding parts. From this it will be seen that two metallic line wires 1 and 2 of the telephone set are used as a single wire by the telegraph set and the ground is used as a return. The current used in the telegraph set is simply a pulsating current of any desired potential as is usual, but of sufficient tension to pass through the various resistances interposed in the circuit. The telephone currents of sets 3 and 4, however, will be choked back as the same are of alternating nature and cannot readily pass through the choke coils 28 and 43. The relay or sounder 40 and the key 26, together with relay 31 and key 30, are of the usual type of the ordinary Morse system and may be of the kind for sending a single message or two or more messages which may be desired. By this arrangement the ordinary Morse system can be connected up to the telephone system without interfering in the least with the same, or causing the telephone system to interfere with the telegraph messages.

In addition to the ordinary Morse instrument used I provide especially constructed systems or apparatuses C and D to be used independent of the Morse devices for sending and receiving telegraphic messages. Sets C and D are of identical construction, therefore, it will be only necessary to specifically describe one. In constructing the special kind of telegraph instrument as C and D I use a transforming induction coil preferably similar to the coil described in my Patent No. 844,240 in which high tension or comparatively high tension currents and also alternating and pulsating currents are provided from a direct current. In the transforming coil I connect the secondary winding 44 thereof to relays 45 and 46 by means of wires 47, 48 and 49, and switch 50. By this means whenever there is an impulse or current passing through primary winding 51 from battery 52 the armature 53 of relays 45 and 46 will be moved. The armature 53 is magnetized so as to be of the polarized type of relays in order to only be moved by an impulse of current in one direction. By this

means whenever key 54 is operated and the circuit of battery 52 is completed, armature 53 will be attracted by relay 45 and close the circuit of a local sounder 55 and cause the same to operate in the usual manner. When key 54 is released and the circuit for battery 52 opened and current dies down in winding 51 a reverse current will be generated in winding 44 and consequently a reverse current will be passed through relays 45 and 46 as the same are connected by wire 56. This will open the circuit of local sounder 55 as will be evident. In this way sounder 45 is operated every time that key 54 is closed and then opened again. At the same time that current flows through relays 45 and 46 part of the current will be divided and pass upward through wires 57 and 12 and from thence through bridge B, wires 1 and 2, bridge A, wire 27, and wire 58, relays 59 and 60 of set D, wire 61, condenser 62, wire 35 to the ground, through the ground to wire 36 and from thence to winding 44 through condenser 63. As current flows in this circuit through relays 59 and 60 armature 64 is moved and closes the circuit of a local sounder 65. In this way whenever key 54 is opened and closed sounder 65 is opened and closed as well as sounder 55 so that the operator at the sending key may hear his own message as well as the operator at a distant station. In the circuit for battery 52 is arranged the primary winding 51, key 54, buzzer 66 and condenser 67.

The buzzer 66 is provided in order that when the operator at one station desires to call the other station, by closing switch 68 the buzzer is operated and a constant series of impulses is sent over the line to operate the relay 65 at the other end. When the station called has answered, the switch 68 is then opened and key 54 is used to send the message. The condenser, as will be evident, is designed to lessen or entirely kill the sparking at key 54. Buzzer 66 may be thrown into and out of operation as desired by the switch 68. By this construction current from battery 52 has but a short circuit so that the same may, without difficulty, provide ample current for winding 51 for causing sufficient current to be generated in the secondary winding 44 for operating relays 45 and 46 and 59 and 60. It will, of course, be evident that key 69, condenser 70, battery 71 and primary winding 72 are similar in construction and operation to the corresponding parts in set C.

By the present construction and arrangement of various means several messages may be sent over the same wire at the same time without in the least interfering with each other. The operator at key 26 may be sending a message at the same time that the telephone set is in use and yet the operator at key 30 receives the same in the usual manner. Also at the same time the operator at key 54 may send a message to the operator at key 69 without interfering with the other two messages. By this method it will be seen that three messages may be easily sent over the same wire at the same time when the ordinary Morse system is used. It will be noted, however, that the telephone messages are transmitted over a complete metallic circuit while the various telegraph messages, both of the ordinary Morse system and my improved device, will be provided with a ground return, though, of course, if it is desired, another wire might be added to be used in place of the ground.

In providing connections for telegraph systems such as the bridges B and C I find that the same are well adapted to be used, not only in permitting the use of metallic telephone systems to be used for sending telegraph messages thereover, but also for furnishing means by which in two or more metallic telegraph systems a phantom circuit or circuits may be provided without the necessity of any additional wires.

In connecting and arranging the bridging devices for providing phantom circuits I preferably arrange the same as shown in Fig. 3. Referring more particularly to this figure, E represents a complete metallic telephone system to which are connected telephone sets 73 and 74 of any or preferred type. In proximity to the telephone system E is another telephone system F provided with any usual and preferred telephone sets 75 and 76. In using telephone sets E and F the same are designed to operate in the usual way and messages may be sent from one end of the system to another as may be desired. By using each system independent only two systems are provided and two circuits for the flow of current. Connected to the telephone system E near one end or at any desired point along the same is a bridge G constructed similar to bridges A and B. Connected to the opposite end of the system E or any desired point along the same is another bridge H of the same construction as bridge G. Bridges I and J are also provided along the system F of similar construction to bridges G and H and are designed to operate in connection with the same. Connected to bridges G and I by wires 77 and 78 is a telephone set 79 of any usual or preferred construction so that when using the same the two wires of telephone set E will act as one wire and two wires of telephone set F will act as the other wire. Secured to bridges H and J by wires 80 and 81 is a telephone set 82 which is designed to communicate with telephone set 79. In operation, current passing from telephone set 82 will travel

through wire 80, bridge or connecting device H to the two wires of the telephone set E through the same to bridge G and over bridge G through wire 77 to telephone set 79. From telephone set 79 current will then pass through wire 78, bridge I over the two wires of telephone system F to bridge J and from bridge J through wire 81 back to telephone set 82, thus completing a complete system. It will be observed that the current flowing in this way has no metallic circuit of its own in the strict sense but uses both wires of telephone system E as one wire for sending the message and both wires of the telephone set F for acting as a return so that the circuit is what I term a phantom circuit, as it is not provided with independent wires. This, as will be evident, forms a complete telephone system independent of systems E or F so that the two systems E and F with the bridging attachments secured thereto provide means for three circuits or systems.

By a slight addition to the bridges G, H, I and J, still another phantom circuit may be provided, the ground being used as a return, and all four wires of systems E and F being used as one-half of the circuit. In providing this phantom circuit with the ground as a return I use telephone sets 83 and 84. Assuming that a message is being sent from set 83 to set 84, the current will leave set 83 and pass through wire 85, and bridge or duplexing apparatus K and from thence divide and pass over wires 86 and 87 to bridges G and I, respectively. In passing to bridges G and I the current does not pass entirely through the bridges but by means of wires 88 and 89 and 90 and 91, respectively, simply pass through the outer resistance that connects the bridge proper to the line wires of the respective systems. By this arrangement the current is not compelled to pass through the balance wires of the bridge or the balanced resistances positioned within the bridge and consequently has an easier path to reach the line wires. Passing from the bridges G and I respectively over the line wires of systems E and F, the current passes through the resistances of bridges H and J respectively, and from the inner end of the resistances that connect the bridges proper to their respective line wires to wires 92 and 93 over wires 94 and 95 and 96 and 97. From wires 92 and 93, the current enters bridge L, which is of similar construction to the other bridges of the system and from thence over wire 98 to the telephone set 84. From telephone set 84 current passes by wire 99 to the ground, through the ground to wire 100 and over the same to set 83, thus completing the circuit. From this it will be clearly seen that the second phantom circuit provided uses all four of the line wires of systems E and F as half of its circuit and the ground as the other half or return. This will positively prevent any current from any of the other systems entering this system and consequently no disturbances of the messages can take place.

In addition to using the present invention for providing phantom circuits and thus increasing the use of the wire I provide means by which various systems or telephone lines may be connected up in series, that is, one system as an extension of the other. In addition to connecting the telephone system up for use as extended telephone lines I may also connect the same up in various ways by my improved means so that telegraph messages may also be sent over all the lines so connected.

In connecting up various telephone lines the same may be done in various ways, but in order to disclose one way of so connecting up the telephone lines I have disclosed means in Fig. 2 by which the same may be done with little expense. Referring more particularly to Fig. 2, M and N represent telephone systems of any desired kind as, for instance, system A as shown in Fig. 1. When two or more of the systems are connected up as seen in Fig. 2, they are known as sections of an extended system. Connected to system M is a bridge O of the type of bridge disclosed in Fig. 1 at B. Bridge O is connected to division or system M at binding posts 101 and 102 so as to provide a path for the flow of current from wire 103 to the telephone system. By this means when telegraph current or impulse passes over the line wires of division M the same will pass through bridge O and from thence to wire 103. From wire 103 current will pass through relay or sounder 104, wire 105, key 106, wire 107, resistance 108, and bridge P, connected to system N, over bridge P, to the line wires of division N, and from line wires of division N to the earth as described in regard to Fig. 1, through the earth back to line wires of system M, this completing the circuit. Wire 103 is connected by wire 109 to a condenser 110 and resistance 108 is connected by wire 111 to condenser 112. By the use of the condensers 110 and 112 either the ordinary Morse instruments, as key 106 and sounder 104, may be used, or my improved sets as indicated at C and D in Fig. 1 may be used or, if desired, both may be used. The telephone set M is provided with a socket 113 connected by wires 114 and 115 to binding post 101 and 102, respectively, so that a plug may be inserted in socket 113 and the line wires of division M may be connected to the line wires of division N through plug sockets 116, the socket 116 being connected to the line wires by wires 117

and 118 respectively. If desired, other means may be inserted or substituted for sockets 113 and 116 as, for instance, ordinary telephone sets. By this arrangement is will be clearly seen that any desired number of telephone systems may be connected up for forming continuous lines over which telephonic and telegraphic messages may be sent and the line act as a through line as well as for local purposes. In addition, if desirable, the telephone system may be connected up by plug and connecting wires of ordinary or preferred construction for connecting any two or more systems of telephone wires for permitting telephonic messages to be sent over as many systems as desired.

The present construction and arrangement of bridging devices and especially constructed telegraphic instruments, and means for connecting the same to the line and also for connecting the bridges to the line, provides various advantages that are of special value. By using my improved bridge and special construction of telegraph instrument a composite system is provided with means for sending two or more telegraphic messages over the telephone line wires at the same time that a telephone message is being sent. By slightly changing the arrangement of connection at the bridges as seen in Fig. 3, a telephonic system is provided in which four complete, independent circuits are established with the use of only two complete metallic circuits. Again, by slightly changing the connection of the bridges and the telegraph instruments two telephonic lines may be so connected up as to provide a through line for telegraph messages and also, if desired, a through line for telephonic messages.

From the construction and arrangement of the present invention together with the various combinations and arrangements of parts, a number of improved systems is presented and many desirable results accomplished.

What I claim is:—

1. In a composite telephone and telegraph system, the combination with a transmission line, of high tension current telegraph sets, each set comprising a transmitting induction coil, a polarized receiving apparatus and condenser connected with the induction coil, a local circuit containing a source of current, an open circuit telegraph key, a condenser bridging its contact points to lessen sparking, a buzzer, and telephone sets connected to the transmission line and arranged to communicate with each other.

2. In a composite telephone and telegraph system, a metallic circuit, telephone sets connected to the circuit and arranged to communicate, a bridging device connected to the ends of the circuit and comprising a pair of coils of equal resistance, a pair of wires of equal resistance connected at their ends to each of the resistances, a pair of balanced resistances connected with the wires intermediate of their length, a wire connected between the balanced resistances, a telegraph set of comparatively high potential connected with the last mentioned wire, an impedance connected with the last mentioned wire, and a telegraph set of comparatively low potential connected with said impedance.

In testimony whereof I affix my signature in presence of two witnesses.

CLINTON L. BOPP.

Witnesses:
BYRON S. PAYNE,
WALTER S. ROWE.