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TELEPHONE AND SIGNAL SYSTEM

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This invention relates in general to combined telephone and signalling systems, but more particularly to an improved type of signalling system superimposed on a telephone system.

5 In previous systems of this nature considerable difficulty has been experienced in arranging the signalling equipment so that it would not interfere with the normal operation of the telephone equipment when the line was engaged for tele-
10 phone purposes, while with the line engaged for signalling purposes the normal talking, impulse transmission, and ringing functions caused false operation of the signal mechanism. The principal object of the invention, therefore, is to provide an improved system wherein signalling and
15 telephone connections can be separately set up on a line circuit without in any way effecting the operation of apparatus except that intended to.

A further object is to provide a system wherein
20 a regular telephone line could, for example, be used to provide watchman's service so that a watchman upon going over his regular rounds could transmit to the central office over this tele-
phone line indications of the time or place of his rounds, or a store-keeper could be informed of
25 the opening and closing time of his establishment.

A particular feature is directed to the provision of neon glow lamps in the local signal circuit to permit signalling over the telephone line without
30 interfering with telephoning or vice versa.

A further feature is concerned with the arrangement of a filter circuit tuned to a frequency so as to permit the use of a telephone line for
either telephone or signalling purposes.

35 An additional feature is directed to the means whereby telephonic operations, such as talking, dialling, and ringing, occur over the line conductors in a loop circuit, while the special signalling functions are performed over the line
40 conductors in a simplex circuit.

Other objects and features together with those above will be pointed out more specifically hereinafter, reference being had to the accompanying drawing in which sufficient of the apparatus is
45 shown to enable the invention to be understood. Fig. 1 shows the invention applied as a tuned filter circuit to a telephone line, while Fig. 2 is a further embodiment utilizing the action of neon glow lamps.

50 The invention is applicable to telephone lines in either an automatic or a manual telephone system, but the substation telephone sets A and A' have been shown to include a calling device CD, while the telephone lines have been shown terminating in the squares to the right of the figures

to indicate the central exchange switchboard equipment for connecting the lines together. As this equipment forms no important part of the invention it has not been shown in detail, but
5 will be explained where necessary.

The embodiment of the invention disclosed in Fig. 1 will be first described. The substation A is an ordinary automatic telephone circuit having receiver R, transmitter T, and switchhook S, and
10 connected by the line conductors L to the switchboard equipment at the central office. Connections to other lines are effected in well known manner by means of the calling device CD which controls the automatic switches at the central
15 office by transmitting impulses over the line loop circuit. When the substation is called ringing current is extended from the telephone exchange over the line conductors L through the ringer G
and condenser C to actuate the ringer. An im-
20 pedance F is connected to the line conductors L at the exchange. This may be in the form of an ordinary repeating coil having four windings 24, 25, 26 and 27, each of low resistance but connected in series with the line conductors L so that
25 it is non-inductive to any current flowing over the loop circuit comprising the two line conductors L, the substation A, and the exchange equipment. The impedance F therefore represents a negligible loss in voice current transmission. All operations
30 which take place over the line conductors L, such as talking, dialling and ringing occur over the series loop circuit extending to the exchange.

The watchman's or special service equipment at the substation A comprises impedance coils 5 and 6 and condensers 7 and 8 connected to each
35 line conductor L. A step-down transformer TF and also the jack J is provided. In the operation of the system the watchman is provided with a bridging plug P which he inserts into jack J as he goes on his rounds on the premises of an
40 establishment. The plug P thereby connects a source of, for example, 110 v., 60-cycle frequency alternating current through the primary winding of the transformer TR. This current is stepped down to about 80 volts in the secondary
45 winding. This 80 volts is thereby connected from ground through the secondary winding over a simplex circuit including the condensers 7 and 8, impedances or choke coils 5 and 6, and out over the two sides of the line conductors L in parallel
50 to the central office. At the exchange the current passes through another pair of impedances or choke coils 9 and 10, condensers 11 and 12, condenser 13, winding of relay 14 to ground. Relay 14 is an alternating current relay which
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responds to the 80 volts current and attracts its armature 15 to connect ground to conductor 22.

The impedance coils 5 and 6, 9 and 10, together with the condensers 7, 8, 11, 12 and 13 are so arranged that they are particularly tuned to pass the 60-cycle current from transformer TR through them. This combination of filtering devices, however, will not permit the passage of dialling impulses, ringing current or other disturbances over the above traced circuit as they are of a lower frequency; dialling being ordinarily on the order of 10 cycles and ringing current on the order of 20 cycles frequency. No interference is therefore possible between the two services, telephoning and signalling on the same line. The impedance F in which the line conductors L terminate at the exchange, is connected in multiple with the choke coils 9 and 10. The windings 24, 25, 26 and 27 are connected to the line conductors in such a manner that they are inductive to the above traced alternating current simplex circuit. This inductive effect is required in order to force the 60-cycle alternating current to pass through relay 14 to ground instead of passing through the switchboard equipment to ground. It will be recalled that this impedance F, however, when used in a loop series circuit as in the telephone connection is non-inductive and permits the passage of the current in this case.

The relay 14 having been actuated over the line by the action of the watchman, places ground on conductor 22. This conductor may be extended to any recording means desired, for example, it may be used to make a registration at the central office identifying the line; it may cause a signal to be sent to a police station; indicate the opening and closing hours of a shop or store; or it may be used as illustrated in the drawing, for watchman's service to record the time and place of a watchman's report. The conductor 22 extends in the telephone exchange or watchman's headquarters to a time recording clock indicated at W. The time clock may be of the well-known Holtzer-Cabot magneto type having a chart 16 which revolves once in every twenty-four hours. The chart is ruled off in sections representing the time by radial lines and is also provided with as many concentric circles as there are watchman's stations in the establishment to be under control of the watchman. Each watchman's station or telephone line, therefore, corresponds to a circular space on the chart for recording his calls. Individual magnets are provided at the time clock for each watchman's station and each magnet is allotted to one of the circular spaces on the chart 16. The conductor 22 extends to magnet 20 and is energized by the ground from armature spring 15 of relay 14. The armature 21 of magnet 20 thereupon pricks the chart 16 in the circular space allotted to the magnet corresponding to the station A, and on a radial line representing the time that the call was made. Other magnets are operated in the same manner from other lines or stations on the same chart. The watchman having inserted the plug P into jack J to make his registration immediately withdraws the same to disconnect the source of alternating current from the line conductors L and permit relay 14 to restore. The magnet 20 therefore does not hold its armature 21 in contact with the chart 16 for too long a time, otherwise it may tear the same.

Referring now to the embodiment of the invention shown in Fig. 2 the substation A—1 has the same circuit arrangement as substation A of Fig.

1. The telephone line L—1 extends to the exchange and terminates in the telephone switchboard equipment therein. Attached to each side of the line L—1 at substation A—1 are the neon glow lamps 30 and 31. They are in turn connected to the secondary winding of step-up transformer TR—1, which is energized by the source of alternating current. At the exchange office a second pair of neon glow lamps 32 and 33 are attached to the line L—1 and connected to relay 35. These neon lamps, as is well known, normally present open circuits to normal telephone voltages and require fairly high voltage to operate or break them down. After having operated the resistance is so reduced that they require very little current to maintain them operated. It is therefore seen that by using neon lamps for the special signalling circuit no interference will occur or no transmission loss will take place when telephoning over the line.

In the operation of this system a watchman will insert the bridging plug P' into jack J' at the substation A—1 and thereby connect the source of 110 v., 60-cycle alternating current to the primary winding of the transformer TR—1. In the secondary winding this voltage is stepped up to about 350 volts. This 350 volts is connected from ground to both neon lamps 30 and 31, then it passes over the simplex circuit including both sides of line L—1 in parallel to the exchange office and the neon lamps 32 and 33. The other side of the neon lamps 32 and 33 is connected to the dry rectifier 34 and relay 35 to ground. The high voltage alternating current passing over this circuit "strikes" or flashes over all the neon lamps and permits the current to operate relay 35. This relay, however, is a direct current relay, but the rectifier 34 connected in shunt of the relay permits half the cycle of alternating current to pass through the relay by opposing the flow through itself, while the other half of the cycle passes freely through the rectifier, thereby depriving the relay 35 of current. The rectifier connected in shunt of the relay renders the relay slow acting and it therefore does not deenergize during the cycle in which it does not receive current. The arrangement of the rectifier 34 and relay 35 could be substituted for the alternating current relay 14 of Fig. 1 if desired. Relay 35 upon energizing operates its armature 36 to connect ground to conductor 23 extending to magnet 22 of the clock W. A registration is therefore made of the time and place of the call from substation A—1. The watchman withdraws the plug P' to restore the circuits to normal. From the foregoing arrangement it is seen that the neon lamps permit signalling to be performed over a telephone line without affecting the telephone equipment, due to the low current flow although the voltage is high. Similarly the voice currents, impulse transmission and ringing current transmission which take place in telephone connections do not affect the neon lamps as they present an open circuit condition to these comparatively low voltages.

Having described the invention, what is considered to be new and is desired to be protected by Letters Patent will be set forth in the following claims.

What is claimed is:

1. In a combined telephone and signal recording line, a loop telephone circuit and a simplex signaling circuit including portions of said line, a transformer having its secondary included in

the common branch of said simplex circuit at one end of said line, a source of alternating current, means for connecting said alternating current to primary of said transformer, means in
5 said simplex circuit for permitting the passage of said alternating current to said line and preventing the passage of direct current to said transformer from said line, an alternating current relay in said simplex circuit at the ex-
10 change end of said line, means in said simplex circuit for permitting the passage of alternating current to said relay and preventing the passage of direct current thereto, and recording means controlled by said relay, said relay
15 operated responsive to the connection of said alternating current to said transformer in transmitting a signal to operate said recording means.

2. In a combined telephone and signal line, a source of alternating current at one end of said line, a transformer, means for connecting said alternating current to said transformer when a signal is to be transmitted, a glow lamp
5 connecting said transformer with said line over a simplex circuit, said transformer when energized by said alternating current generating a high potential to operate said glow lamp, a relay at the other end of said line, a second glow lamp
10 connecting said relay with said line over said simplex circuit, said second glow lamp operated only by said high potential to operate said relay, and a recording means controlled by the operation of said relay to make a record each time
15 said alternating current is connected to said line.

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