

UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM WITH AUXILIARY SIGNALING CIRCUIT.

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An object of my invention is to provide a new and improved system of signaling circuits in a telephone system. Another object of my invention is to provide a selective signaling system in such a way that there shall be comparatively little susceptibility of the system to inductive disturbances caused by ground potential differences. Still another object of my invention is to provide for utilizing a cable sheath for an auxiliary signaling circuit in a telephone system. These and other objects of my invention will become apparent on consideration of the example of the invention disclosed in the accompanying drawing, which is a diagram illustrating a central station and a subscriber's station and a system of circuits appertaining thereto.

In many telephone systems, the talking is done over metallic circuits but an auxiliary circuit or auxiliary circuits are provided for signaling by using one or both conductor pairs of the metallic circuit for one side of the signaling circuit and using ground for the return. The ground connection sometimes causes noise in subscriber's sets connected to exposed lines, due to the unbalance caused by the signaling apparatus and voltages to ground due to induction, or to potential differences between the central office ground and the ground at the subscriber's premises. Where single-phase alternating current railway systems are employed in the neighborhood, false operation of subscribers' bells may occur, due to induction or ground potential differences from the railway currents in the ground.

To obviate such difficulties, I propose to utilize the cable sheath as the return conductor instead of the ground. Referring to the drawing, a central station is shown at Q and a subscriber's station at S. Extending for a considerable part of the way between them is a cable with the sheath A and within it a plurality of conductor pairs such as B, and among these conductor pairs is one pair which leads to the subscriber's station S.

The portion of the cable to which the letter A is applied is represented as underground. At D the cable is brought up above the ground and continued overhead as at F. The connection of the conductors is made in the box E and the sections of the sheath A and F are metallically connected by a jumper G.

In the neighborhood of the subscriber's

premises, a plurality of conductor pairs such as H are brought out from within the cable sheath F to the terminal board I, and one pair of conductors J goes from this board to the subscribers's set S.

A series of binding posts K is placed on the board I and these are all connected by a conductor L to the cable sheath E. From one of these binding posts K, a conductor M goes to the subscriber's set S.

A lightning arrester N and fuses O are provided for the pair of main conductors J and for the auxiliary conductor M. This lightning arrester has the usual connection to ground as shown.

The subscriber's bell P is shown in the normal condition bridged across one of the conductors J and the conductor M. On lifting the receiver from the hook, the transmitter and receiver will be connected in the usual way across the two conductors J.

At the central station the switch R is arranged for party ringing to apply ringing current to either conductor of the pair B leading to the substation S. One side of the ringing generator at the central station Q is grounded as shown, and the cable sheath is also connected to ground at the central station Q.

It will be seen that the cable sheath affords a metallic connection extending a large part of the way between the central station Q and the subscriber's set S. This metallic connection is completed and extended by the jumper G, and the branch conductors L and M.

The beneficial effect of this new arrangement on induced disturbances may be seen by reference to the drawing which shows a disturbing conductor X having a voltage V to ground, to which the aerial cable F is exposed. A capacity C_1 exists between the disturbing conductor X and the sheath E and capacities C_a and C_b between the sheath and the two sides of the cable pair connecting the substation S and the central office Q.

If the bell P be connected to ground in the usual manner there is a direct path to ground via the capacities C_1 and C_a in series, one wire of pair H and of pair J, the induction coil, the receiver and the bell. This causes a disturbing noise in the substation receiver. If, however, the bell is connected to the sheath by the conductor M as shown, no direct path to ground through the receiver and bell exists,

and noise in the receiver will be due only to slight inequalities in the two sides of the pair and will be practically the same in magnitude as if the circuit were a single party line with
5 the bell connected across the pair.

Potential differences in the ground between the central office and at the subscriber's premises will have negligible effect on the signaling apparatus either with respect to noise or
10 false signaling, because such potential differences are not impressed on the signaling apparatus.

I claim:

1. In combination, two telephone stations,
15 a conductor pair extending between them to form a talking circuit, signaling apparatus at both stations, other conductor pairs, all said conductor pairs being comprised in a cable with a metallic cable sheath, and said
20 sheath forming with one of the conductors of said first mentioned pair a signaling circuit comprising said signaling apparatus.

2. In the transmission of speech and signals in a telephone cable system, the method
25 of obviating interference in transmitting the talking currents over a circuit formed by a conductor pair within the cable, which con-

sists in transmitting the signaling currents over a circuit formed by the cable sheath and one of the conductors of said pair. 30

3. In combination, two telephone stations, a cable sheath extending between them, a conductor pair within said sheath, a jumper metal-
35 lically connecting sections of the cable sheath, a subscriber's set with branch conductors from said conductor pair within the sheath and from the sheath itself, and signaling apparatus arranged for connection during
40 signaling periods in a circuit comprising the sheath and one of the conductors of the pair within the sheath.

4. In combination, a central telephone station, a subscriber's telephone station, a cable
45 sheath extending between them, a conductor pair within it for voice currents, means to apply ringing current between the sheath and one conductor of the pair at the central station, and means normally connecting a bell
50 between the same conductor of the pair and the sheath at the subscriber's station.

In testimony whereof, I have signed my name to this specification this 25th day of February, 1924.

RALPH G. McCURDY.