

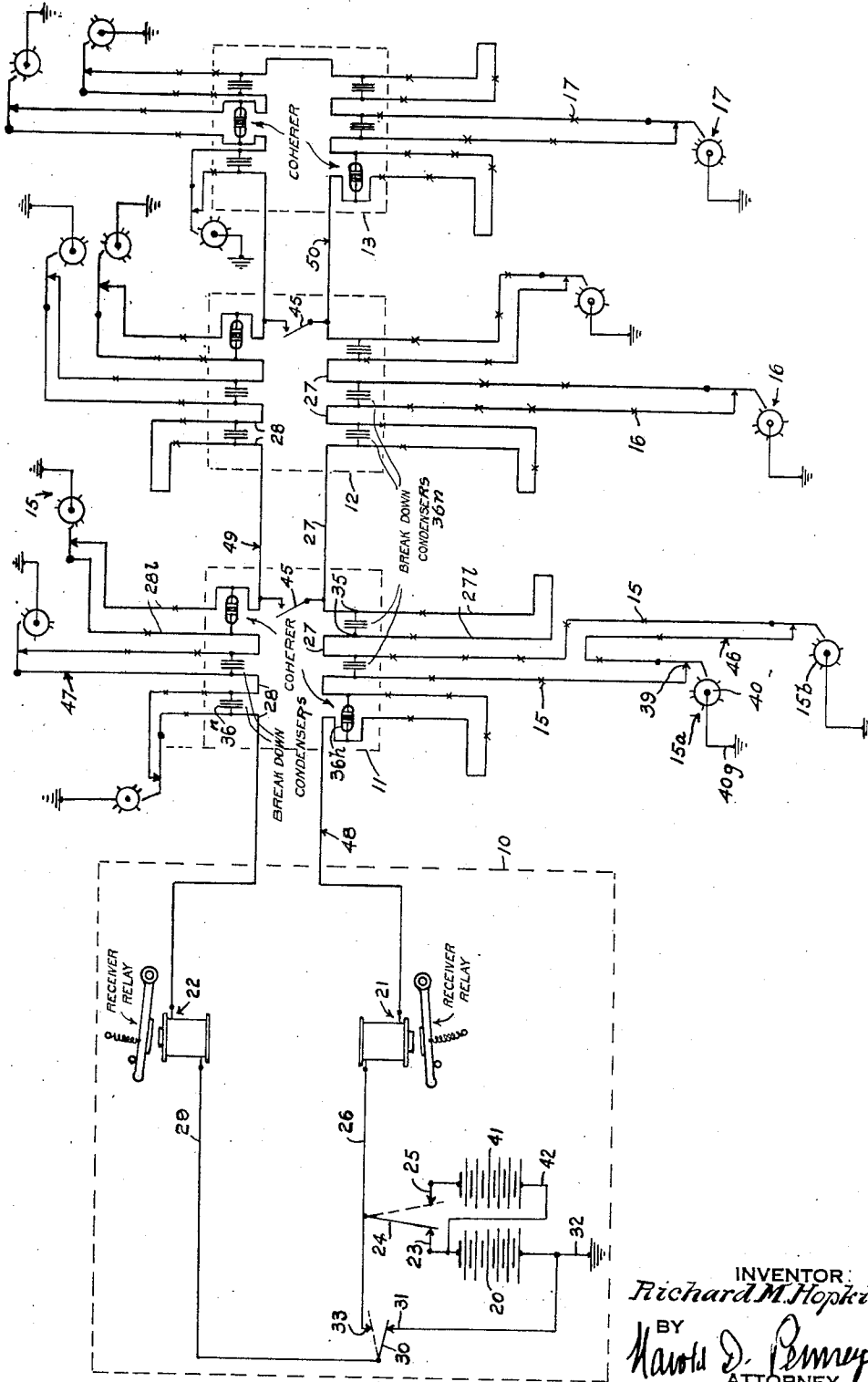
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ELECTRICAL SIGNALING SYSTEM

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ELECTRICAL SIGNALING SYSTEM

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This invention relates to signaling systems and more particularly to electrical signaling systems of the McCulloh type though it is noted that in some of the claims the invention is not limited to McCulloh systems.

One object of the invention is to provide an improved system of this kind in which the supervised main line is formed into transmitter loops provided with means for shunting out any one of said loops which may become broken, whereby the main line will continue to be supervised.

Other objects of the invention are to provide an improved system of this kind in which the main line itself is looped, so that when a break occurs in the main line, the remote and less remote portions of the line may be successively shunted out, thereby to locate the break.

Additional objects of the invention are to improve generally the simplicity and efficiency of such systems and to provide a simple system of this kind which is convenient and reliable in operation, and economical to manufacture and install.

Still other objects of the invention will appear as the description proceeds; and while herein details of the invention are described in the specification and some of the claims, the invention is not limited to these, since many and various changes may be made without departing from the scope of the invention as claimed in the broader claims.

The inventive features for the accomplishment of these and other objects are shown herein in connection with an electric signal system which briefly stated, includes a supervised line, portions of which are formed into transmitter loops passing from the line, the ends of each loop being adjacent and provided with a normally non-conductive break-down condenser, coherer or other device interposed between said adjacent ends of the same loops. Means are provided at the central station for raising the voltage of the line, whereby when a loop becomes broken, said high voltage may be applied to the break-down device of the broken loop thereby to break down the resistance thereof, shunt out the broken loop and again render the line continuous. These and other features will be described in detail hereinafter.

In the accompanying drawing showing, one type of system by way of example, the figure is a diagram of the system showing the break down devices therein as labeled.

This invention is shown in combination with a McCulloh signal system in combination with a

central station 10, a plurality of sub-stations, 11, 12, 13 and a plurality of subscribers stations 15, 16, 17 for each sub-station, some of the subscriber stations being indicated by x's on the line loop.

As is usual with a McCulloh system, a normal-voltage main grounded current source 20 and a pair of receiver relays 21, 22 are provided at the central station. A transfer switch 23, 24, 25 is provided for a purpose to be explained and has a normally engaged contact 23 connected to the ungrounded terminal of the source. The main line 26, 27, 27', 28, 28', 29 passes from the transfer element 24 of said switch through one receiver relay 21, through all of the sub-stations in one direction as at 27, then back through all of the sub-stations in the opposite direction as at 28, through the other relay 22 and switch elements 30, 31 to ground at 32, whereby the line is supervised. The transfer element 30 interposed in said line near the ground is at times shifted to 33, thereby disconnecting the ground from the in-leg 29 of the line and connecting said leg 29 to grounded terminal of the source 20 as is usual for McCulloh operation.

Each portion 27 or 28 of the line in each sub-station is formed into subscriber loops 27' or 28' passing from the sub-station through the subscriber stations, ends of each loop being provided with terminals 25 adjacent to each other in the sub-station, between which is connected a break-down device such as a break-down condenser 36 or coherer 36' normally non-conductive on normal voltage, thus interposed between said adjacent ends of the loop, whereby the current normally passes through the loops and not through the break down device, and whereby no current passes through the device when a loop first becomes broken.

Each subscriber station 15, 16, 17 is provided with a suitable transmitter comprising a normally closed code switch 39 and a normally disengaged grounded code wheel 40 adapted during transmission to engage and open the code switch in the usual well known manner.

A supplemental current source 41 having one terminal connected to the normally disengaged contact 25 of said transfer contact and the other by conductor 42 to said ungrounded terminal of said main source, is disposed in such manner that when the transfer element 24 is shifted to the normally disengaged contact 25, said sources will add their voltages; whereby when a loop 27' or 28' is broken, and deenergization of said relays 21, 22 indicates a broken line, the element

24 may be shifted to contact 25 so that the sum of said voltages will be applied to the break-down device associated with the broken loop. The sum of the voltages is sufficient to break down the resistances of the device, and thereby shunt out the broken loop and again render the line continuous.

A normally open switch 45 in each sub-station, except the end station, is adapted when closed to connect the opposite portions 27, 28 of the line at such sub-station. The switch is disposed between its sub-station and a more remote sub-station, whereby when a break occurs in an unlooped portion of the line more remote from such station, said break may be shunted out, and the near portions of the line may continue to form a continuous supervised circuit.

The operation will be readily understood from the foregoing. Normally the system works as a regular McCulloh system, that is, current finds a path from the source 20, through the switch 23, 24, the recording relay 21 the line 27, subscriber's loops 27i, 28i, subscriber's stations 15, 16, 17, relay 22, switch 30, 31 to ground 32. No current passes through the break-down devices 36h or 36n. Thus so long as the magnets of relays 21, 22 are energized it is known at central station that the lines and loops are in order. That is, they are supervised.

Subscriber stations 15, 16, 17 consist of transmitters and a normally closed switch, and are adapted to be intermittently opened by the grounded code wheel 40, to intermittently break the above circuit and intermittently deenergizes relays 21 and 22 to operate the recording receiver.

The coherer 36h or break-down condenser 36n or other suitable break-down device normally does not let any current pass, but will break down and allow current to pass continuously if the voltage across it be much raised.

If by chance a break in a loop should occur, for instance at 46, the magnets of relays 21 and 22 would become and remain deenergized, notifying central that there was a break somewhere; but the increased potential across the break down device 36 due to the break in the loop is by itself insufficient to break down the device 36. It is therefore necessary that central shift the switch element to the dotted line position, thus adding the voltages of sources 20 and 41. This high voltage is high enough to break down the resistance of the break down device 36h or 36n, thus shunting out the broken loop from the main circuit 27, 28, energizing relays 21, 22. The switch element 24 is then restored to the full line position, thus allowing the stations of all the other loops to function normally as above described. A repair-man would be sent to repair the loop.

If the increased potential across the break down device due to the break in the loop were of itself sufficient to break down the device 36, then this device 36 would break as a result of the opening of the switch 39 on operation of the transmitter.

However, while the break 46 is still thus cut out, the stations 15 in the broken loop may still function as follows: When the grounded wheel 40 rotates, contact is made with the normally closed switch 39. If the operating station is the station 15a just above the break 46 as indicated, current will find a path from the relay 21, through the code wheel 40 and the ground 40g of station 15a, through the ground 32 to source 20, thus intermittently shorting out line portions

28, 29 and the magnet relay 22, thus causing the relay 22 to record the signal. If it is the station 15b just below the break 46 that is operated, the relay 22 is intermittently shorted-out and records the signal.

If the break should occur at 47, the associated loop would be shorted out as above stated and the operation of any transmitter in such loop would short out the magnet of relay 22 as before explained.

If a break occurs at 48, the switch element 30 is shifted by hand to the dotted position, so that both line portions 26 and 29 are connected only to the ungrounded side of the source 20, and both relays 21 and 22 remain deenergized. When a signal is sent from any station, current intermittently passes from the source 20 through line portions 29, 28 and the code wheel and ground of the operated station, and through ground 32 to the source 20. This intermittently energizes H 20 and records the signal in the known manner.

If a break should occur at 48, 49 or 50 and the high voltage of source 41 be applied, nothing would happen, as the high voltage would be across the break at 48, 49 or 50 and not at 36h or 36n. Then the central would telephone and ask sub-station 12 to apply a short by closing the switch 45 of station 12. This would cut out sub-station 13, but suppose the break is at 49 (and not at 50 or 48), the magnets of relays 21 and 22 would still be dead. Then central would tell sub-station 11 to apply a short by closing the switch 45 at station 11. This would complete the circuit through the loops of station 11, which would thus locate the break 49, so that a repair man could quickly find it. When the break 49 is thus located but not yet repaired, the switch 30, 31 and the switch 45 may remain closed. In this condition the line and loops of sub-station 11 would be supervised and all subscribers of the supervised station 11 could operate normally. The others would operate through their ground, intermittently shorting out relay 22 as indicated above.

While herein a break-down device 36 is applied to the loop and operated by excess voltage from sources 20 and 41, the invention is not thus limited, the claims being broad enough to cover other shorting devices, such as a shorting device operated from central as by changing the polarity of the source 20, or by applying alternating current to the main line, or even by lowering the voltage applied to the main line. Also some of the claims are not limited to hand-operated means for changing the line current or voltage to apply the shorting means.

I claim as my invention:

1. In combination, a central station; a main grounded current source and a pair of receiver relays at said station; a main line passing from the ungrounded source terminal through one receiver relay, and back through the other relay to ground; said line between the relays being formed into loops; one or more normally closed transmitter code switches interposed in each loop; a normally disengaged grounded code wheel at each wheel having code teeth adapted to engage and open the code switch; switch means in the line near its ground for at times disconnecting the grounded end of the line from the ground and connecting it to said terminal; a normally non-conductive break-down device interposed between the ends of each loop; and a supplemental current source adapted to be interposed and added between the line and said ungrounded terminal; each break down device having sufficient resist-

ance to resist the voltage of the main source but not the added voltages of both sources, whereby when a break occurs in the loop, the voltages may be added to break down the device, and short out the loop.

2. In combination, a main grounded current source; a receiver relay; a line passing from the ungrounded source terminal through the relay to ground; said line between the terminal and relay being formed into loops; normally closed transmitter code switches interposed in each loop; a normally disengaged grounded code wheel at each switch adapted to engage and open such switch; a normally non-conductive break-down device interposed between the ends of each loop; means to at will increase the voltage of the current source; each breakdown device having sufficient resistance to resist the normal voltage of the main source but not the increased voltage.

3. In combination, a central station; a plurality of transmitters; a normal-voltage main grounded current source and a pair of receiver relays at the central station; a transfer switch having a normally engaged contact connected to the ungrounded terminal of the source; a line passing from the transfer element of the switch through one receiver relay, and formed into loops passing through all of the transmitters, the line then passing through the other relay to ground, switch means interposed in said line near its ground for at times disconnecting the ground and connecting both ends of the line to said transfer element and through it to the ungrounded terminal; each

transmitter comprising a normally closed code switch and a normally disengaged grounded code wheel adapted during transmission to engage and open the code switch; a normally non-conductive break-down device interposed between adjacent ends of each loop; a supplemental current source having one terminal connected to the normally disengaged contact of said transfer contact and the other to said ungrounded terminal, so that when the transfer element is shifted to the normally disengaged contact, the voltage of said sources will add their voltages; each break down device having sufficient resistance to resist the voltage of the main source but not the added voltages; whereby when a loop is broken, the sum of said voltages may be applied to break down the device thereby to shunt out the broken loop.

4. In combination, a main current source; a receiver relay; a main line passing from one source terminal through the receiver relay and back to other source terminal; said line being formed into loops; one or more normally closed transmitter code switches interposed in each loop; a normally non-conductive break-down device interposed between the ends of each loop; and means operable to increase the voltage of said source above normal; each break-down device having a resistance sufficient to resist the normal voltage of the main source and a resistance insufficient to resist the increased voltage; the resistance of the break-down device after breakdown being substantially negligible.

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