

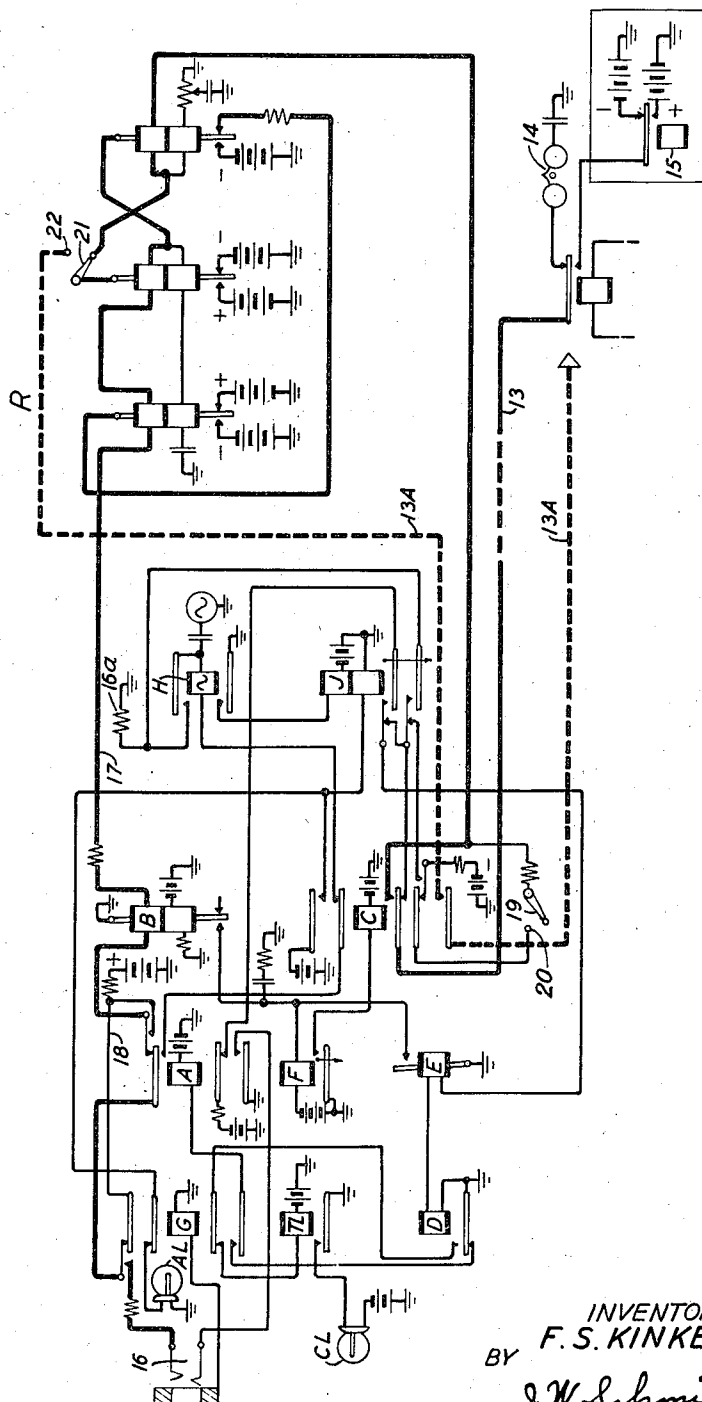
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TELEGRAPH LINE CIRCUIT

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TELEGRAPH LINE CIRCUIT

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10 Claims. (Cl. 178-74)

This invention relates to improvements in long toll subscribers' lines for connection to teletype-writer exchanges and switching points.

In furnishing service to subscribers it occasionally happens that certain subscribers are too far from the nearest exchange or switching point to be furnished service over a simple loop; an object of this invention is to provide for such service with adequate provision for calling and supervising connections with simple and effective equipment. Such service may be furnished over line circuits operating on a differential duplex, two-path polar or upset duplex basis. The system as described herein will be a differential duplex system; the principles thereof can and have been applied to the other types of transmission with but slight changes in the circuit arrangements.

In the single figure of the drawing the line equipment is shown in a circuit diagram; the jack 16 at the left indicates a form of circuit adapted for multiple switchboard; the subscriber's station circuit equipment may be of any form sending positive marking and negative spacing signals with the line circuit closed through a ringer 14 in the normally idle condition. The subscriber's station also includes a switch for turning on the power and closing the line, the usual teletypewriter sending contacts and receiving equipment of a teletypewriter, a sending relay 15, and a break key. Further details of such subscribers' circuits are disclosed in various pending United States patent applications but are not necessary here for a complete understanding of the invention.

The cord circuit for cooperating with the jack 16 may be of the type disclosed in the application of Locke and Kinkead, Serial No. 459,684, filed June 7, 1930, or patent to Kinkead et al. No. 2,024,581, granted December 17, 1935.

In transmission the subscriber's line 13 terminates at repeater R but in the idle condition it terminates in relays D and E of supervisory equipment over back contacts of relays C and J. The functions of the individual relays of the line equipment will now be described.

Relay B has one winding in the loop 17 between the switchboard and the repeater R and the other is in a local biasing circuit and repeats all signals to the relay F which is energized on a marking signal to relay B.

Relay F is of the slow release type; it holds operated on all teletypewriter signals but releases on break signals or open conditions of the subscriber's line.

Relay C connects the line to the line side of repeater R when energized, holds relay J operated and connects battery to the answering lamps AL. When released relay C connects the line 13 to contacts of relay J.

Relay J, when operated, holds relay D operated and when released connects the line 13 to windings of relays D and E. Relay J is slow release and during the release time it discharges the line through resistance 16a.

Relay D tests the line upon release of relay J to determine the station condition and remains operated when relay J releases if the current from the subscriber's station is positive (marking) or negative (spacing) but releases when the subscriber's station is idle. Upon operating relay D will close the lead to relay TL to light call lamp CL and to operate the night alarm (not shown) and upon release prepares a ground path for operating relay A.

Relay E is not operated to close its contact when relay J is operated but is operated when marking potential is applied to the line at the subscriber station. Operation of relay E operates relay F.

Relay F operates relay C; when relay F is operated it is held by relay C; relay F is slow release.

Relay H operates upon ringing current supplied from the cord over the tip of the jack and applies ringing current to line 13.

Relay G is a sleeve relay and is operated from battery in the cord circuit over the sleeve of jack 16; it opens the circuit to lamp AL and extends the communication circuit to jack 16 from winding of relay B.

Relay A upon operating cuts the communication path to relay B in preparation for operation of relay H and grounds the tip of the jack 16.

In the idle condition all relays are deenergized except relay B which holds its contact open under the influence of its biasing winding.

Subscriber calls

To call the subscriber applies positive potential to the line. Relays D and E operate. Relay D operates relay TL over back contact of relay G; relay TL lights lamp CL. Relay E operates relay F, which operates relay C. Relay C connects negative battery to the windings of relays D and E. Polar relay E releases, relay D remains operated. Relay C connects line 13 to the line side of repeater R. Repeater R supplies a path for current over lead 17 to the operating winding of relay B from the positive battery on lead 18. Relay B closes its contact to hold relay F oper-

ated. Relay C also connects battery to lamps AL and the winding of relay J. Relay J transfers the windings of relays D and E from negative battery over contacts of relay C to a path through the back contact of the inner lower armature of relay A, also connected to negative battery.

The operator answers by inserting a cord in the line jack. Relay G operates over the sleeve lead and disconnects lamp AL. Relay G also prepares the operating path of relay A and connects the communication path to the tip of the jack and cord. The office side of repeater R is now connected to the tip of jack 16 and the line side to the line 13 over contacts of relays C and J. Relay B follows all teletypewriters spacing signals but relay F holds operated.

The subscriber's station may now communicate with an operator on the cord circuit (not shown) or thereover to another line.

Break signal from subscriber station

A break signal holds relay B off its contact until relay F releases, which causes relay C to release. This opens the line 13 to the repeater which continues the spacing condition. After release of relay C and before release of relay J the line is connected to resistance 16a and discharged. When relay J releases resistance 16a is disconnected from the line. Windings of relays D and E are transferred back to the line; as the station is supplying negative voltage to the line, relay D remains operated and polar relay E remains released. At the end of the break positive polarity is applied to the line. Relay E reoperates, relays F, C and J reoperate, relay B closes its contact and communication may be resumed.

Break signal from cord circuit

Upon a break signal from the cord circuit or beyond the relay B opens its contact; this releases relay F, which releases relays C and J. Relay J connects the operating path for relays D and E to the line 13 but inasmuch as marking or positive polarity is applied to the line by the subscriber during the break period, the relay E is operated, which in turn reoperates relays F, C and J. Upon reoperation relay J causes relay E to release by virtue of negative battery supplied locally from the source on the back contact of the lower armature of relay C and front contact of relay J. If the break signal continues beyond this time this cyclic operation and reoperation may continue as the relay F again releases upon release of relay E until the break condition is terminated to reoperate relay B, which reoperates relays F, C and J. Communication may then continue.

Disconnect signal from station to operator

Consider now a disconnect signal from the subscriber station. The attendant at the station opens the line which releases relays B, F and C. Upon release of relay C and during the holding time of relay J, the charge on the line will pass to ground. Upon release of relay J, relay D will release and cause relay A to operate. Relay A, upon operating, opens the communication path, opens the path from battery to the upper armature of relay J, and connects ground to the tip of the cord to operate a supervisory lamp in the cord. The action of relay J in discharging the line is essential to prevent momentary operation of relay D which would interrupt the ground connection to the tip of the cord and

interrupt the lighting of the supervisory lamp. The momentary operation of relay E is also prevented so that relay F will not be reoperated.

If the subscriber station disconnects during the time a break signal is being transmitted from the cord circuit, relay B will already have been released and the release of relay E will cause the operation of relay A and ground the tip lead when during the releasing and operating sequence of the relays E, F, C and J as previously described the D and E relays are next connected to the line.

The operator pulls down the cord and the circuit returns to normal idle condition.

Recall from the subscriber to the switchboard operator

A recall signal is given by the station operator by operating a recall key which opens the line to direct current for an interval and then recloses it. Upon opening the line relay D will release as described under the heading above to operate the relay A and ground the tip of the cord. Upon reclosing the line the relay D reoperates and releases relay A which removes ground from the tip and causes the signal in the cord circuit to be a recall or flashing signal (in a manner well known in the art and described in the disclosures hereinabove mentioned).

A recall signal may be given to the switchboard operator during a break signal from the switchboard.

Calling the subscriber station

Assume the station idle. The operator plugs a cord plug into the jack 16. Relay G operates and because relay D is released the relay A will operate. The ring of the jack and plug is grounded. With the relay A operated the communication path will be opened at the upper armature. Alternating ringing current is applied from the tip lead of the cord to the relay H over a circuit from the tip to the upper make contact of relay G, make contact of relay A and inner upper back contact of relay C. Upon operating the relay H causes relay J to operate. Because relay D is released and relay A is operated no battery is supplied to windings of relays D and E by the contacts of relay J. Relays D and E remain released during ringing. The upper contacts of relay H apply alternating ringing current to the line 13 over a make contact of relay H and a back contact of relay C. After each release of relay H the resistance 16a will discharge the line to prevent any false operation of relays D or E. When the station answers the relay B operates, relay F operates, relay C operates and relay J operates; relay D operates and releases relay A which connects the operating winding of relay B to the tip of the cord for communication in the same manner as when the station called and the operator answered.

General

With slight circuit modifications the principles of the invention may be applied to two-path polar and upset duplex transmission over the subscriber line. The necessary modifications are disclosed in the copending application of Large and Locke, Serial No. 108,154, filed October 29, 1936. These modifications may be made a part of the present circuit by using the extra line conductor 13A, the extra armature and contact on relay C, by closing switch 19 to contact 20 and switch 21 to contact 22. The conductor 13, under this condition, transmits signals to the subscriber's station

and the conductor 13A receives signals from the subscriber's station which is disclosed in detail in the said application of Large and Locke.

The operating essentials of the subscriber station, so far as supervision is concerned, are first, that the two lines 13 and 13A in the normal idle condition are connected together at the subscriber station and connected through an alternating current ringer and condenser to ground and that operation of the subscriber's recall key connects the two lines together and isolates them from the transmission circuit at the subscriber station.

The operation is not different than described for differential duplex operation. Note that when relay C is released the line receiving relay of repeater R is held to its spacing contact by negative battery supplied over the switch 19 and the back contact of relay C.

A general precaution in respect to this circuit is that relays D and E must be made a bit sluggish or alternatively the contacts of relay J must be adjusted to operate in proper sequence, or both.

What is claimed is:

1. A subscriber's telegraph toll line terminating circuit, a telegraph line therein normally terminating at a central office in relays, and relays operated as a result of closing said line to shift the termination to a telegraph repeater connected to means at said central office conditioned for flexibly extending said circuit.

2. In a system for telegraphing and supervising exchange connections over a subscriber's telegraph trunk line circuit, said circuit comprising a local station, an incoming line and a repeater, a contact in said line between said station and repeater, a relay controlling said contact, and a slow release relay controlling said relay.

3. In a system for telegraphing and supervising exchange connections over a subscriber's telegraph trunk line circuit, an incoming line, said line including a repeater for repeating signals arriving thereover to a local connecting circuit, said line being normally disassociated from said repeater and extending independently of said repeater through relay contacts to elements controlling line operation signals.

4. In a system for telegraphing and supervising exchange connections over a subscriber's telegraph trunk line circuit, an incoming line, said line including a repeater for repeating signals arriving thereover to a local connecting circuit, said line being normally disassociated from said repeater and extending through relay contacts to elements, said elements controlling line operation signals including a polar device and a non-polar device.

5. In a system for telegraphing and supervising exchange connections over a subscriber's telegraph trunk line circuit, an incoming line, said line including a repeater for repeating signals arriving thereover to a local connecting circuit,

said line being normally disassociated from said repeater and extending through relay contacts to elements controlling line operation signals, and connections whereby said relay contacts are under the control of a relay which is actuatable by said polar device to close said line to said repeater.

6. In a system for telegraphing and supervising exchange connections over a subscriber's telegraph trunk line circuit, an incoming line, said line including a repeater for repeating signals arriving thereover to a local connecting circuit, said line being normally disassociated from said repeater and extending through relay contacts to elements controlling line operation signals, and a polar device controlling said relay contacts to close said line through to said repeater, and devices for locking up said relay contacts under the control of said repeater.

7. In a system for telegraphing and supervising exchange connections over a subscriber's telegraph trunk line circuit, an incoming line, said line including a repeater for repeating signals arriving thereover to a local connecting circuit, said line being normally disassociated from said repeater and extending through relay contacts to elements controlling line operation signals, a relay for transferring said line from said elements to said repeater, a relay locked up to maintain said transfer, means for releasing said locked up relay to restore said line to said elements, and means to connect said line to ground for an instant prior to said restoration.

8. A subscriber's telegraph toll line circuit, a repeater therein, a jack terminating said line at a switchboard, a supervisory signal for said line at the terminus including said jack, relay means at said terminus, means at a remote point upon said line for opening said line, means at a remote point for reversing the polarity upon said line, and a relay in said relay means actuated to one position by opening said line and to another position by reversal of polarity thereof, and means whereby said signal is selectively actuated accordingly.

9. In a subscriber's telegraph facility for connecting a subscriber's premises with a central telegraph switching office in a manual telegraph switching system, said facility requiring a telegraph repeater for telegraph communication, the method for extending the distance range over which the subscriber has positive control over line operation signals, between said subscriber and the central station operator, which consists in disassociating said repeater from the telegraph path while said signals are being transmitted.

10. In a teletypewriter switching system, a subscriber's station, a central switching station, a telegraph path, normally open at said subscriber's station, connecting said stations, a telegraph repeater, individual to said path, and means in said path for switching said repeater into said path.

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