Western Electric Coo, Incorporated, Equipment Jinginoering Branch. Hawthorne.
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Issue 2 BT-441139 Iune 25. 1923. (*) Toplacing all previous issues. (*)

This Mo Of O Sheet was prepared from Issue 19 of pu441133.
METHOD OF OPERATION
DISMRICI SED ACTOR CIRCUIE
From apecial "A" operator; for use where gero operators trunk have a 34 ohm sleeve. panel Machin Switching Systom.

## DEYELOPMYNT

lo PURPOSE OF CIRCUIT
1.1 This circuit is used by zero and intercepting operators for the purpose of establishing connections for, a subscriber who may beunable to disl or who may be entitled to A.B. toll services
2. WORKING LIHTMS
2. 1 Maximum cord sleeve resistance - 128 ohms.
2. 2 Haximum resistance for (I) relay over (INY) lead - 1220 ohms.

## OPERATION

3. PRINCIPAL MUNGIONS

The principal functions of this circuit are:
3.01 To select an idle sendero
3.02 To connect idie sender to operator's corde
3.03 To maintain a visible buay signal at operator'g positionse
3.04 To select an outgoing trunk to an incoming selector, mamal office, " 4 " operetor, desirs or recording position under control of the sender.

To satisfy the sender for talking selection.
3.06 To dismiss the sender when selection beyond has been completed.
3.07 to cut through the operetor's cord to the selected trank.

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    3.08 To restore to normal rollowing disconnection by operator.
    3.09 To pass back a migmal to the operator when an Mall paths
        busy" condition is encountered.
    3.10 Mo restore to normel in case of "wipe out" by operator.
    3.11 To restore associated incoming selector to normsi on
        "wipe out"。
4. CONNFCTIKG CIRCUIMS
    4.1 Standard zero and intercepting operator's cord circuit
        equipped with & dial having a maximum sleeve resistance of 128
        ohres.
    4.2 Any standard subscriber's sender.
    4.3 Any standara incoming selector*
    4.4 Any standard S.C.I. trunk to a manual ofP1ce.
    4.5 Any standard trunk to man operator's or to desks.
    4.6 Any standard outgoing recording trunk to long distance
        0y190.
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## DETAILHD DESCRIPNION

## 5. INITIAL OPRRATION - PLUG INSRRTRD

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When the plug of the intercepting and zero operator's calling core is inserted in a multiple jack of the district selector, the (SL) relay operates in the sleeve circuit and the (TRC) relay opere ates from battery through its inner winding, over the tip, through the cord circuit bridge, back over the ring, to groand on uan H. The (TRC) relay locks to ground at the (SL) relay operated, and operates the (L) relay through its outer windinge the (SL) relay operated. lights busy lamps at the operator's position. The (I) rolay opereted, advances thesitch to position 2. Ae the switoh enters position \(13 / 4\), battery at can 0 is comnected to the buey lawp circuit keeping the busy lamps 11ghted nutil the switch returus to normal.
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## 6. 3RNDER BELECTION

### 6.1 SRNDEFR IDLE

When the switch advances out of position 1 , the ( $工$ ) relay releases if the sender selector test brush (TST) is resting on the test terminal of an ldie sender. The (I) relay released, makes the selectod sender busy by comocting ground through the upper outer contact of cam $H$, break contact of the (L) relay, upper inner contact of cam $L$, lower outer contact of cam $K$ over the (TSM) lead to the associated sonder circuit.

### 6.2 SENDER BUSY

If the sender selector test brush is on the terminal of a busy sender the (1) relay locks from battery through its inner winding and make contact to ground on the (TST) lead over the cirouit traced sbove。 With the (L) relay operated in position 2, the 200-B selector magnet energizes from battery, winding and break contact, lower contacts of caro $C$, make contact of the (I) relay, cam I, to ground at cam H. Mhe selector brugh will continue to hunt over the other terminals until an idle sender is sound.

### 6.3 SKNDER MADE BUSY

When an idle sender is pound, the (L) relay releasas, making the selected terminal busye The release of the (L) relay removes the short circuit from the (CI) relay which operates from ground through lower, contacts of cam Ni to battery through the break contact and windine of the 200-B selector magnet. Under this condition the $200-\mathrm{B}$ selector does not recelve sufficient current to operate. The (CI) relay operated, holds the sender busy irom ground through its make contact over the (thy) lead, and closes the leads to the T, $R$ and $S C$ brushes a

## 6. 4 CORD EXTKNDED TO SEKDFA

With the switch in position 2 , the tip and ring of the intercapting and zero operator's cord cireuit is extended to the tip and ring of the sonder through oams $P$ and $S$ and cam $Q$, thereby permitting a tone from the sender to be sent back to the operator as an indication that the connection is ready for dialinge The (L) relay released in position $\mathcal{L}_{\text {, }}$ edvances the switch to position

3 from ground on cam $H$, through the upper inner contact of cay I, break contact of the (L) relay, cam B, to battery through the A magnet. In position 3,48 volt battery is connected to the (SC) lead for the purpose of operating the sender (SC) relay to advance the sender. This circuit is from battery. Cam U. 500 ohm resistance, cam J. (CI) relay operated to the (SC) lead. After the dialing period the fundamental circuit is closed for operating the (L) relay and the stepping relay in the sender circuit. This circuit is from ground through the stepping relay in the sender circuit, Pri brush of the sender selector, operited (CI) relay, lower contacts, of cam I to battery through the inner winding of the (L) relay. The (i.) relay operated in posi= fion 3 locks through its make contact and cam it to the same ground and advances the switch to position 4 from ground on cam If through the upper inner contact of cam I. mare contact of the (I) relay, cam $B$, to battery through the $R$ magnet.

## 7. BEDSH SmLEOTIOK

### 7.1 BRUSH SELECMED

With the switch in position 4, the (UP) magnet energizes from ground on cam $H$ upper inner contact of cam I maise contact of the (I) relay, cam $C$, to bettery through the (UP) magnet. The (UP) magnet operated causes the selector elevator to move upward for brush selection. As the selector moves upwerd in poaition 4; carrying the commutor brushes over the commatator segments, the (A) segment and brush intermittently connect eround to the tip side of the fundamental circuit, through cams $K$ and $I_{g}$ holding the (L) relay operated through its inner winding but successivaly short-circiling the stepping relay in the associated, sender circuit, thus releasing and permitting its reoperation, until the proper brush has been selected. When suificient ime pulses have been sent back to atisfy the sender. the fundamental circuit is opened, releasing the (I) relay, advancing the switch to position 5, as described for advancing the switch to position 3.

### 7.2 BRUSE TRIPPRD

Wi th the witoh in position 5 and with the proper brush selected. the trip maget (TM) operetes from ground on cam in in order to trip the selected brish as the selector moves upward

Por group solection. In position 5, the (L) relay again operates and locks over the fundamental circuit as described in position 3 , advancing the switch to position 6 .

## 8. GROUP 3ELECTION - GROUP SEL ECTETD

Win the switch in position $6_{0}$ the (UP) magnet again operates as described under Brush Selection, carrying the selector elevator upward for group selection and tripping the selected brushes. as the selector moves upward for group selection, carrying the commutator brushes over the comutator segments, the B segment and brush intermittently connect ground to the tip side of the fundamental circuit, through cam $L_{\text {, }}$ holding the (I) relay operated through its inner winding but successively short-circuiting the stepping relay in the associated sender circuit, thus releasing and permitting its reoperation, until the proper group has been selected. Then sufficient impulsos have been sent back to satisfy the sender, the fundamental circuit is opened, releasing the (L) relay, The (L) relay released, advances the switch to position 7 . With the switch in position 7 , the (1) relay operates through cam I and advances the switch to position 8 from ground through the make contact of the (SL) relay, operated (TRC) relay, inner contacts of can $\mathbb{R}$, make contact of the (I) relay, cam $B$, to battery through the R magnoto
9. TRUNTK HUNTING

### 9.1 GIRST TRUNK IDLS

In case the first trunk of a group is idle, the (L) relay relesses when the switch advances out of position $71 / 4$.
9.2 FIRSY TRUNK BUSY

If the first trunic of the group is busy, ground on the S terminal of the busy trunk holds the (L) relay operated through cam $E$ and inner winding of the relay. With the (I) relay hold operated in position 8, the (UP) magnet is operated from ground on cam $H$, through the upper inner contact of car I, make contact of the (L) relay, to battery through cam $C$ and the UP ragnet. The (UP) magnet operated, causes the eelector elevator to hunt for an idie trunk. When an $1 d 10$ trumk is found, the circuit through the inner winding of the (I) relay is opened.
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but the relay does not release lumediately on account of a circuit being closed from ground on the (C) commatator braeh and segments through the outer contacts of cam R to battery through the outer winding of the (I) relay. Whon the brushes are centered on the trunic terminals, the circuit through the (C) commatator segment is opened and the (L) relay releases. in turn opening the circuit through the UP magnet which tops the selector the selector brushes on the terminals of the selected trunk. The (L) relay released, also advances the switch to position 9.

## 9.3 man comprtator

The adjustment of the (C) commatator bruah with relation to the tripped sleeve multiple brush, is such that it does not break contact with the (C) commatator segment until slighty after the holding olrcuit through the innor winding of the (L) relay is opened, by the sleeve brush leaving the busy itminal and making contact with the sleeve terminal of the idle trunk. The (UP) magnet, therefore, remains operated and the selector continues to travel upward until the brushes are carried slightly above the ceater of the trank terminala, allowing the looking pawl to enter the notoh on the rack attached to the brush support rod. at this time the holding circuit through the outer winding of the (i) relay is opened at the (c) commatator, releasing the relay. The (L) relay released, disconnects ground from the commatator feed bar (G). and releases the (UP) megnet. The selector then drops into place, thus contering the bsushes on the trunk terminelso During trunk hunting, in position 8 only the commatator feod. ground is supplied through cam C, from geound on the armatiure of and under control of the (L) relay. This is to prevent the reoperation of the (L) relay by the closing of a circuit between the (C) commatator brush and segment, on the overthrow of the selector, or as it drops into place.

### 9.4 SETECNED TRUNK MaDP BUST

Whan an $1 d 10$ trunk has been foumd and the (I) relay released, temporary ground is imendietely connected to tho (S) terminel of the trunk, through the upper outer contact of can y , breat contact of the (L) relay, lower outer and upper inner comtacta of cam E. through the ( 0 ) segment. mekiag the trante biusy to

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> all other hunting selectors . When the switch enters position $81 / 2$, permanent busy ground is oonnected to the ( 5 ) terminal of the selected trunk through the upper contacts of cam E and the ( 0 ) comatator segment.

### 10.1 CLOSURE OF PONDANMTTAL

With the switch in poaition 9 , the (1) relay operates from ground in the sender circuit through the (SC) brash of the sender selector, lower outer and upper inner contacts of cam y to battery through the inner winding of the (I) relay. The I relay operated, advances the switch to position 10 from ground on cam Ho with the switch in position 10 , the fundemental circuit is established for selection beyond, by the closure of leads FI and FR through the upper inner contacts of cam F, and lower contacts of cam $G$, respectively, to the tip and ring of the selected trunk.

### 10.2 CORD DISCOYMTCTITD FROM SEHDERR

When selection beyond has been completed, the circuit through the (L) relay is opened, releasing the relay. The (D) relay released, adrances the switch to position 11. As the switch advances out of position $10 \mathrm{I} / 2$, the sender circuit is disconnected from the intercopting and sero operator's cord circuit by opening the circuit through the lower outer contact of cam 3 and the upper outer contact of cam be

## 11.

## TAKKING SELPCTION

With the switch in position 11, the associated sender circuit connects ground through the (FT) brush of the sender selector, make contact of the CI relay. lower contacts of cam I to battery through the inner winding of the (I) relay. The (L) relay operated locke to the same ground and advances the awitch out of position 11. The switch continues to advance until the (I) relay is released by the operation of the sender oircuit. As the switch advances, ground is intermittently connected to the tip side of the fundamental circuit through the outer contacts of cam $\bar{E}$, cam $L$ and operated (CI) relay, holding the (I) relay operated through its inner winding but successively short-circuiting and permitting the re-operation of the
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stepping relay in the sonder circuit. When surficient palses have been sent back to satisfy the sender. the fundamentel oireuit is opened. releasing the (J) relay. The release of the (L) relay opens the circuit through the (R) wagnet stopping the awitoh in position 12, 13 or 14 depending on the talking selection required.

### 11.1 SENDAR REL BASED

When the switch advances out of position 11, the (CI) relay locks from battery through the $200-\mathrm{B}$ selector magnet. winding of the (CI) relay, inner contacts of cam $N$, male contact of the (CI) relay, Lower inner and upper contaiets 01 cam if. maise contact of the (I) relay to ground through the lower inner and upper outer contacts of can E. When the (L) relay releases in position 12,13 or 14 , the (CI) relay releases, disconnecting the sender circuit and advancing the switon to position 15.
11.2 CORD FXTENDED TO TEUNI

When the switch eaters position 15. the cord circuit is closed through to the selected trank. In positions 12 to 14. the 502 ohm 180 AC resistance is bridged acrose the tundamental circuit for the purpose hereinafter deseribed under "Wipe ont".
12. DIBCONMECTION

### 12.1 QRMRADOR DISCONTHORS

The withdrawal of the plug of the intercepting and zero operator"s calling cord from the jack of the district circuit releases the (3L) relay, but the (TRC) relay remein operatod from batteryc through its outer vinding to ground on cam H. The busy lamp remains lighted under control of ground on can 0 . The (SL) relay released, advunces the switch to position 18 from ground on the break contact of the (SL) rolay through the lower contacts of cam $D$ to battery through the $R$ magnet. as the switch breaks position 17 the (IRC) relay releases and the (DOWi) magnet is oparated from ground through the upper com tacts or cam $D_{s}$ restoring the selector to normal. When the selector reaches normal the switch is advanced to position 1 by ground on the (Y) commutator through cam B. exinguishing the busy lamps and restoring the circuit to normal.

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### 12.2 REGISTERS

In position $171 / 2$, ground is supplied through the outer contacts of cam E, upper inner contact of cam I and lower inner contact of cam $K$ for operating a register in the selector group register circust in order to register the number of times the district is used. A circult la closed in positions 2/13 through the outer contacts of cam for the purpose of recording on a register the number of times that all districts are busy at the same time.

## OVERELOM

### 13.1 ADVAKCE OF SWIICH MO OVERFLOW POSICION:

If all the trunks in the selected group are busy, the solector while trank huating in position 8 . Will travel to the top of the group and rest on the overflow terminals. As there ia no ground on the sleave of the overflow terminal. the (I) pelay releases advancing the switch to position 9. With the switch in position 9 , ground on the (SC) lead of the sender circuit operates the (i) relay through its inner winding through the lower outer and upper inner contacts of cam Yo The (I) relay operated, advances the switch to position 10. The 2 comautator, when the selector is on the averflow teminals, advances the switch to position 11 through the upper contacts of cam K releasing the (I) relay. With the switch in position 11, the (L) reisy operates from ground on the 2 commatator brush and segment through the upper outer contact of csin K. Lower inner contact of cem 1 to battery through its inner winding. The (L) relay operated, locks to ground on the z commatator brush and segmento The (I) relay operated, advances the switch to position 16.

### 13.2 SIGMAL 20 OPREATOR

In position 16 a circuit is closed from grourd and make contact of the interrupter, can ${ }^{2}$, through the winding of a relay in the cord eiroust, inner contacts of cam $Q, 18_{4}-\mathrm{AC}$ reststance, to battery through cam 9 , causing the supervisory lamp in the cord circuit to plash as an overflow signal. The Withdrawal of the plug of the cord circuit restores thas circuit to normal as doseribed under "DISCONECTIOR".

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### 13.3 OVFRELOW REAISTMR

When the switch enters position $161 / 2$, a ofrcuit is closed to operate the overflow register from ground on the z commutator brush and segmont, lower contacts of cam y!; tip brumh to battery through the overflow register in the associated overilow register oirouit, not showns.
13.4 men coznoramos

The function of the "C" commatator segment is to maintain an idle condition on the multiple overflow terminals, so that more than one selector matop on overflow at one time; otherwise, the first selector reaching overflow would make the sleeve multiple terminals busy, thus causing succeeding selectors to continue upward into the next group of trunks. The "O" commatator segment is open at overplow, but the $S$ bar is continuous. Both the " $O$ " and " $S$ " commatator brushes are permanently strapped together and wired to the raltiple sleeve brush. When a selector is at overflow. the "O" commatator brush is resting on an open (dead) segment and, as the busy ground is fed through the "o" commutator bar only, this arrangement maintains a non-buy condition on the sleeve terminals. When necessary to combine two or more groups of trunks, the miltiple sleeve overflow terminals between the combined groups are made permanently busy by being connected to ground. As the "S" commtator bar is closed at overflow, the (D) relay is held operated at this time, and the selector therefore huats past the "made busy" terminals into the next groups
13.5 OVERRLOW DURTNG SEL RCTIOR BEYOND

When the switch is in position 10, and an overplow condition is encountered in the incoming circuit while making selection beyond reverse battery is sent back from the in coming circuit over the tip and ring of the fundamental circuit, through the inner contacts of cam $I$ and the lower contacts of cam $G$, over leads FT and FR operatiag a relay in the sender circuit and thereby removing ground from the 3C lead. releasing the (I) relay. The (L) relay released, advances the switoh to position 11. Wi th the switch in position 11, the sender ofrcuit supplies ground over the Fit

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lead, operating the (L) relay from battery through its inner winding, lower contacts of cam I make contact of the CI relay to ground over the ET lead ${ }^{\text {g }}$ The (L) relay operated, locks to ground on the FT lead, advancing the switch to position 16. From this point on, the overflow signalifng and discomnection operation are the same as previously described.

## 14. TRLL TALE

When the district selector goes to tell tale during selection the switch is advanced to position 11 from groumd on the $X$ commutator brush and segment to battery through the R magnet. The switch will remain in position 11 unless the trouble is such that a ground is on the tip of the fundamental circuit, inwhich case, the ( L ) relay operites from ground on the Fry lead advancing the switch to position 16, giving the overflow signal to the operator as described under "Overflow". "he operator then withdraws the plug of the zero and intercepting cord cirait from the jack and makes a new call. In case the switch remains in position 11, fallure to receive ringing induction would indicate to the subscriber and operator that there was a trouble condition.

## 15. WIPE OUT

### 15.1 BEPORE SELECMION BEYOND

In case the operator abandons the call by withdrawing the plug of the aalling cord from the district jack before the switch advances out of position 6, the (SL) relay releases, advancing the switch to position 7. from ground on its break contact. through the lower contacts of cam $D_{0}$ with the switch in position 7, ground on the breal contact of the (ill relay operates the DOWN magnet through the lower outer and upper inner contacts of cam $D$, restoring the elevator to normai. In position 7, the (TRC) relay operates through its outer winding, to ground at cam H, removing battery through its inner winding from the tip of the circuit when the operator has withdrawa the plug from the jack. When the elevator raaches normal. the "Y" segent carries the switch to position 8 . The R magnot energizes in position 8 from battery, winding cam $B$ normal (L) relay. cam H to ground advancing the switch to position 9. In position 9 the $\mathbb{R}$ magnet energizes through the $Y$ segment carrying the switch to position 1 , extinguishing the busy lamps.

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### 15.2 AFPER SELTCTION BEYOND

in case the operator abandons the call after the switch has lest position 7, truak huating and selection beyond is made as in regular call. When the switch advances to position 12, ground on the break contact of the (SL) relay through the lower contacts of cam D, advances the switch directiy to position 18. The selector and switch are than restored to normal as described under "DI3COMNECTIOT". As the switch passes position 12/14, the 500 ohm resistance is bridged across the sundamental circuit from lead (T) cams $P, P$ and $S_{\text {, }}$ through the 500 ohe resistance, came o and $G$ to lead (R) for the purpose of providing truak closure to the incoming selector.


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December 3, 1924*
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