rANEL SYSTEMS<br>INCOMING SELECTOR CIRCUIT REVERSE BATTERY SUPERVISION REVERTIVE PULSING<br>4 PARTY SEMI-SELECTIVE RINGING AUTOMATIC START OF RINGING

## CHANGES

A. CHANGED AND ADDED FUNCTIONS
A.1 Provision to indicate a busy condi-
tion to traffic usage recorder circuit, when the switch is off normal, is added optionally.
D. DESCRIPTION OF CIRCUIT CHANGES
D. 1 Option "ZF" for connection to traffic usage recorder circuit is added.
D. 2 Option "ZF" is added to the Options Used table.
D. 3 Note 140 is added.
D. 4 Option "ZFn is added to cross-
connection Fig. K.

All other headings under Changes, no change.

## 1. PURPOSE OF CIRCUIT

l.1 This circuit is for use in establishing connections between subscribers
in panel or crossbar offices or in the completion of calls handled through panel or crossbar tandem or No. 4 toll office to subscribers in panel office areas.
2. WORKING LIMITS

## 2.1



### 2.2 Tripping Ranges:-

| Relay |
| :--- |
| Code |

114 AK
114 AK
114 KA
114 AK

| $\frac{\text { Ringing }}{}$ | Silent |
| :---: | :---: |
| A.C. | D.C. |$\quad$ Int.

Max. Ext. Ckt. Loop for Tripping Ring Int. Silent Int.

| $800 \omega$ | $730 \omega$ |
| :---: | :---: |
| $450 \omega$ | $730 \omega$ |
| $1000 \omega-1500 \omega$ | $1000 \omega-1500 \omega$ |
| $1350 \omega$ | $800 \omega$ |

3. FUNCTIIONS
3.01 Recognizes selection.
3.02 Makes brush selection.
3.03 Trips the selected brush.
3.04 Makes group selection.
3.05 Selects, and centers the multiple brushes on the terminals of the
first idle trunk in the selected group.
3.06 Ground the sleeve terminal of the selected trunk as soon as it is seized and until the switch advances beyond the talking position.

### 3.07 Closes the "TV of the incoming trunk to the "TW of the final

 selector and connects ground to the "R" of incoming trunk during the time the final selector is making selections.3.08 Recognizes the completion of final selections and signals the sender that all selections have been completed.


## DESCRIPTION OF OPERATION

5. SEIZURE
When a district or office selector
seizes the tip ring and sleeve terminals When a district or office selector
seizes the tip. ring and sleeve terminals
of this circuit, ground is connected to the sleeve terminal, making the circuit (L) relay operates following a trunk test circuit in series with the (STP) nstepping
 6. BRUSH - SELECTION

## $\stackrel{9}{9}$

 Mi 울 receiver is removed from the switch-
hook at the called station or when the
district selector releases the trunk.
3.13 Furnishes talking battery to the

3.14 Signals the district selector
when the called subscriber removes
the receiver from the switchhook.
3.15 Signals the district selector when
16 Turnishes repeating coil and con-

3.17 Returns the elevator to normal, resets the multiple brushes, and 3.18 Registers each revolution of the
3.19 If all of the trunks in the selected
3.19 If all of the trunks in the selected
group are busy when the selector
hunts for an idle trunk, the elevator stops on the top set of terminals in the
group (known as the overflow terminals)
and the selector functions as follows: (a) Signals the sender that an over-

- axnsoto yunxz seztusoovey ( 9 )

кq peseәtәx чәчм $\tau$ emxou of suxnzoy ( $p$ )

top of the frame on a trouble condi-
tion (tellitale) the circuit functions as


downloanded frơm: $T$
segments, the $A$ segments and brush intermittently connect ground to the tip side of the fundamental circuit, alternately closing and opening a short circuit around the stepping relay in the sender circuit, thus releasing and permitting the reoperation of the stepping relay. When sufficient impulses have been sent back to satisfy the sender the fundamental circuit is opened by the sender, releasing the (L) relay, which opens the circuit through the UP magnet, stopping the upward movement of the selector, and closes a circuit for advancing the switch to position 3 where a circuit is closed for operating the TRIP magnet.


## 7. GROUP SELECTION

When the fundamental circuit is again closed through the sender, the (L) relay operates, advancing the switch to position 4. The UP magnet is again operated and the selector moves upward for group selection tripping the previously selected brush. As the selector moves upward, the B commutator segments and brush intermittently connect ground to the tip side of the fundamental circuit, alternately closing and opening a short circuit around the stepping relay in the associated sender circuit, thereby releasing and permitting the reoperation of the stepping relay, until sufficient impulses have been sent back to satisfy the sender. The fundamental circuit is then opened by the sender, releasing the (L) relay which opens the circuit through the UP magnet, stopping the upward movement of the selector, advancing the switch to position 5. As the switch advances out of position 4 the TRIP magnet releases.

## 8. TRUNK HUNTING

In position 5, the (L) relay operates through its secondary winding, advancing the switch to position 6. Should the first trunk in the group be idle when the switch advances from position $5-1 / 4$ the (L) relay releases, connecting ground from cam $K$ thru contacts of relay (L) and cam I to the $S$ terminal of the trunk as a busy condition and advancing the switch to position 7. If the first trunk of the group is busy when the switch enters position 6, the (L) relay holds through its primary winding from ground on the $S$ terminal and the UP magnet operates, causing the selector to move upward. When an idle trunk is found the holding circuit through the primary winding of the (L) relay is opened, but the (L) relay does not release immediately because of a circuit slosed through the "C" commutator brush and segment. The adjustment of the "C" commutator brush with relation to the tripped sleeve multiple brush, is such that it does not break contact with the "C" commutator
segment until slightly after the hoiding circuit through the primary winding of the (L) relay is opened, by the sleeve brush leaving the busy terminal and making contact with the sleeve terminal of the idle trunk. The (L) relay and the UP magnet therefore remain operated and the selector continues to travel upward until the "C" commutator brush breaks contact with the metal segment. At this time the brushes are slightly above the center of the selected terminals and the holding pawl enters the notch on the rack attached to the brush support rod. With the Circuit to ground on the "C" commutator opened, the (L) relay releases, disconnecting ground from the commutator feed bar "G" and releasing the UP magnet. The selector then drops back upon the holding pawl thus centering the brushes on the line terminals. During trunk hunting ground is connected to the "G" commutator through cam E and the front contact of the (L) relay. This is to prevent the reoperation of the (L) relay by the closing of a circuit from ground through the "C" commutator brush and segment as the selector drops into place. The release of the (L) relay advances the switch to position 7.

## 9. SELECTION BEYOND

In position 7, the (L) relay operates through its primary winding, advancing the switch to position 8, where the ( $\mathrm{I}_{1}$ ) relay holds over the ring side of the trunk to ground in the final selector. The tip of the fundamental is closed through cam $F$ from the final trunk to the sender and ground through the contact of the (L) relay is connected to the ring in order to complete the fundamental circuit.

## 10. INCOMING ADVANCE

After selection beyond has been completed, the final functions and removes ground from the ring, causing the release of the (L) relay which advances the switch to position 9. The (L) relay reoperates in position 9 over the fundamental circuit. This time the direction of the current over the tip and ring of the fundamental circuit is reversed and causes the associated sender to function and advance the district selector switch to talking position. The (L) relay operated, advances the switch through position 10, releasing the (L) relay. The A cam provides a path for advancing the switch to position 11.

## 11. TRUNK CLOSURE

## "N" Wiring

When the district selector switch enters the talking position the trunk is closed through the repeating coil and polarized relay in the district, operating
the incoming (A) relay. When "N" wiring is used the (L) relay operates from ground on the contacts of the (A) relay, thru cams D and E. The (L) relay,locks in position 11 and advances the switch to position 12.

## "M" Wiring

When "M" wiring is used the operation of the (A) relay operates the (D) relay which in turn causes the operation of the (L) relay for advancing the switch to position 12.

## 12. RINGING CALLED STATION

When option "Z" or "S" is used, the circuit operation provides for connection of ringing supply to the ring conductor toward the final selector for signaling the called station.


#### Abstract

Option "Y" or "T" is provided when ringing supply is to be connected to the tip conductor toward the final selector for signalling the called station. This arrangement may be used when it is desired to increase the number of subscriber stations on existing lines without the addition of final terminals. This will be accomplished by the use of an additional office code and incoming selectors arranged to connect ringing supply to the tip conductor toward the final selectors, thereby permitting reaching the same final terminal number by dialing another office code but signaling a station on the opposite side of the line. Such an arrangement will permit providing a maximum of 4 stations per line but using the final selectors common to two groups of incoming selectors each of which are associated with a separate office code.


Option "S" is provided when 2 ring ringing current is to be used, to ring subscribers in groups 0 and 2 , and 1 ring ringing current is to be used to ring subscribers in groups 1 and 3, for the theoretical office, in order to increase the number of subscriber stations on existing lines without the addition of final terminals.

## 13. 4 PARTY SEMI-SELECTIVE RINGING

The P commutator bar of the 3 A or 3 J commutator is so arranged that the subscriber's lines, which are served by final selectors that terminate as trunks in bank terminals of groups 0 and 2 on the incoming frame, are signalled with a 1 ring code for "Z", "Y" or "T" option, or a 2 ring code for "S" option and the lines which are served by final selectors that terminate in groups 1 and 3 are signalled with the 2 ring code for " ${ }^{n}$ ", nY or "T" options or a 1 ring code for'ngn option.

### 13.1 NOne Ringn Ringing Code (Option

If the selected trunk is in a group which is signalled by the one ring code, the $P$ commutator ground is absent, and the (L) relay releases when the switch advances from position 11-1/4. With the (L) relay released, the (PU) relay operates immediately in position 12 and advances the switch to position 13. The (PU) relay locks under control of the (B) and (D) relays, (the (D) relay being under control of the (A) relay). In position i3. "one ring" ringing current is supplied for. signalling the called subscriber and ringing induction is transmitted to the calling subscriber thru the A condenser. When the receiver is removed from the switchhook at the called station, the (R) relay operates, thereby releasing the (PU) relay which in turn operates the (L) relay, thus advancing the switch to position 14. As the switch leaves position 13-1/2, the relay releases. In position 14, ground is supplied thru contacts $2 T$ and $3 T$ of the (L) relay to advance the switch to position 15 . In position $14-3 / 4 / 15$, the (L) relay operates thus advancing the switch to position 16.

## -13.2 "Two Ring" Ringing Tone (Option

If the selected trunk is in a group which is signalled by the two ring codes, the $P$ commutator supplies ground for holding the (L) relay operated from position $11-1 / 2$ to 13 . Under this condition, the (L) relay remains operated in position 12 and the (PU) relay operates in position 12 from ground supplied by the "pick-up" interrupter. The operation of the (PU) relay in this manner insures that both rings of the initial "two ring" cycle are obtained as well as the succeeding ringing cycles. When the (PU) relay operates, it locks under control of the (R) and (D) relays, (the (D) relay being under control of the (A) relay) and advances the switch to position 13 . In position 13 ground is supplied by contacts 1 T and 2 T of the (IL) relay causing the switch to advance to position 14. In position 14 , the (L) relay is locked operated thru contacts $3 T$ and $4 T$ of the (PU) relay and the called subscriber is signalled with two ring ringing current. Ringing induction is transmitted to the calling subscriber thru the A condenser in position 14. When the receiver is removed from the switchhook at the called station, the (R) relay operates thus releasing the (PU) relay which in turn releases the (L) relay and advances the switch to position 15. In position $14-3 / 4 / 15$ the (L) relay operates thus advancing the switch to position 16.


One or Two Ring Ringing Code (Option "S")

When option nSn is used, relay (PU) operates in position 12 from ground supplied by the pick-up interrupter regardless of the position of the (L) relay and advances the switch to position 13. As covered under paragraphs 13.1 and 13.2 , relay (L) is released in position 13 for final groups 0 and 2 and is operated in this position advancing the switch to position 14 for final groups 1 and 3. However, the ring 1 and ring 2 ringing leads being reversed at cam $U$, connects 2 ring ringing current to the line for subscribers served by final groups 0 and 2 and 1 ring ringing current to the line for subscribers served by final groups 1 and 3. The (PU) relay waiting for the (PU) interrupter in either case, assures that both rings of the initial 2 ring cycle are obtained when groups 0 and 2 are rung with 2 ring current. The advance of the ckt. to talking position when the subscriber answers is as covered in paragraphs 13.1 or 13.2

## 14. TALKING

As soon as the (PU) relay releases as described in paragraphs 13.1 and 13.2, provided $\mathbb{Z}$ and $S$ or $Z$ options are furnished, talking battery is connected to the line through the back contact of the (PU) relay operating the (S) relay. This talking circuit is effective until position 15 is reached, when the regular talking circuit is closed through, In position $14-3 / 4 / 15$, the (L) relay operates through its primary winding, advancing the switch to position 16. The (PU) relay operates in position 16 under control of the (S) relay and reverses the battery and ground supplied through the windings of the (A) relay, over the trunk. This reversal of current over the incoming trunk loop gives supervision, causing a charge to be made or the coin to be collected, as is required.

## 15. RETURN TO NORMAL

## When the receiver is replaced on

 the switchhook at the called station, the (S) relay releases, releasing the (PU') relay. The release of the (PU) relay again reverses the battery and ground connected to the incoming trunk for supervisory purposes. When the trunk is opened In the associated district, the (A) relay releases, releasing the (L) relay. The release of the (L) relay advances the switch to position 18 where the DOWN magnet operates, causing the selector to move downward. When the selector reaches normal position, the tripped multiple brush is reset and ground through the $Y$ commutator brush and segment advances the switch to position 1 , thus releasing the DOWN magnet.
## 16. OVERFLOW

When the trunk hunting in position 6, should all of the trinks in the group selected test busy, the selector will continue upward until the multiple brush contacts with the top set of terminals in the group, known as the overflow terminals. The sleeve commutator bar is open at overflow to prevent grounding the sleeve terminal of the multiple bank while the switch is moving out of trunk hunting position. The (L) relay releases when this terminal is reached and advances the switch out of trunk hunting position. In position 7 the (L) relay operates in local circuit advancing the switch to position 8 where it again releases, because the ring terminal is not connected to a final ground, advancing the switch to position 9. Reverse battery is connected to the fundamental circuit as previously described, but since the sender has not yet made final selections it is recognized by the sender as an overflow condition. The (L) relay operates as previously described, advancing the switch to position 11. The (A) relay operates in position 11 over the incoming trunk loop as before, the associated district having closed this circuit while advancing under control of the sender to the overflow position. The operation of the A relay operates the (L) relay ("N" wiring) or the (D) and (L) relays ( ${ }^{\prime N M}$ " wiring) advancing the switch to position 12 where the (PU) and (L) relays operate, as previously described in par-. agraphs 13.1, 13,2 and 13.3 for advancing the switch to position 14. The (A) relay releases when the associated district opens the fundamental circuit, releasing the (L) relay or the (D) and (L) relays, thereby advancing the switch to position 15. The operation of the (L) relay in $14-3 / 4 / 15$ advances the switch to position 16 . The overflow register, connected to the tip multiple bank terminal when " $Z^{\prime \prime}$ option is used, operates from generator and repeating coll ground as the switch passes thru position $13 / 16$. The $L$ relay releases, advancing the switch to position 18 where the DOWN magnet operates, returning the selector to normal where the tripped multiple brush is reset and the $Y$ segment advances the switch to position 1 as previoushy described in paragraph 15.

## 17. TELLTALE

If the selector travels upward to the top of the frame, known as "telltale" position, in any of the up-drive positions, ground through the $\mathbb{I}$ commutator and brush advances the switch out of the up-drive position. In position 3, the (I) relay operates over the furdamental. circuit, advancing the switch to position 4, where
the $X$ commutator advances the switch to position 5. The (L) relay operates again, advancing the switch to position 6, ground through the $X$ computator brush and segment, advancing the switch to position 7. The (L) relay operates as before, advancing the switch to position 8 , the $\mathbb{X}$ commutator advancing the switch to positior 9. The overflow signal is sent back to the sender and the selector returns to normal as previously described in paragraph 16.

## 18. SELECTOR GROUP REGISTER

As the sequence switch advanced thru position 10 ground thru cam I is connectad to the "miscellaneous register circuit" for the purpose of registering the call.
19. TRAFFIC USAGE RECORDER

Whenever the switch is off normal,
ground is removed from the "yen lead. This indicates a busy condition to the traffic usage recorder.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2325-JAF-EWO-DJ

