CABLE ADDRESS "NORTHPHONE"

THE NORTH ELECTRIC MANUFACTURING COMPANY

GENERAL OFFICES AND FACTORY
GALION, OHIO
U. S. A.

MACHINE SWITCHING
TELEPHONE SYSTEMS

ORIGINAL PARTNERSHIP
ESTABLISHED 1864

Mr. M. H. Enschede
The Pacific Telephone & Telegraph Co.
620 Northern Life Tower
Seattle, Washington

Dear Mr. Enschede:

We have used several different circuits for handling magneto lines over our dial switchboards. These may be divided into three general classes.

1. The first class requires condensers in the magneto-phone ringers so that the line is normally clear, but provides a d-c loop (or d-c ground in the case of grounded lines) when a receiver is off the hook.

The ringing codes assigned to the phones must contain two or more rings. A single ring is used to reach the operator. If one of the phones rings a code, the circuit to the operator is not completed. This distinction is accomplished by a timing circuit. When a phone rings in, a circuit is prepared to the trunk; but if a second ring appears within less than three or four seconds, the previously prepared circuit is not completed.

On a call to the magneto line, ringing codes are sent out from the dial connector. When the subscriber lifts his receiver, the closing of the d-c line loop answers the call in the normal manner.

An example of such a circuit is the enclosed DC-3370. Although this circuit is unecessarily elaborate, it will serve to illustrate the operation. As there were no extra descriptions of this circuit in our files, I will attempt to make a brief description here.

When a phone rings in, relays D, E and F operate; then D and E release at the conclusion of the ring. Relay E is a vibrating reed type, whose vibrating contacts hold relays F and G until the vibration dies down and leaves the contacts open after three or four seconds. The contact adjustment (on E) is such that relay F releases before G.

When relay F falls, relay J operates. When the subscriber lifts his receiver, relays L and M operate. A d-c loop is completed on the switchboard side of the repeating coil thru make contacts of relays L and J, landing the call on the board. Methods of carrying the circuit thru to a trunk will be described later.

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If the subscriber had rung a code, the second ring of the code would have found relay E vibrating and relays F and G operated. Then relay H would have been operated thru make contacts of D and G. Lifting the receiver operates relays L and M, and locks H. Ground thru make contacts of H and M is applied to the "P" wire, making the line test busy to the switchboard. When the magneto phones hang up, relay L and the other operated relays are released.

On a call to the magneto line, relays B, A and B1 operate when the line is seized, and relay C repeats the ringing code. When the subscriber answers, the operation of relay L completes a loop to answer the connector.

A type of L relay can be used which would permit signaling over quite a high loop resistance. The more sensitive the relay, of course, the more it will be affected by line leakage.

In one instance, this circuit was used with a 45-volt radio "B" battery at each phone and "Y" wiring on the L relay. Although this is obviously awkward, it permits the circuit to operate on lines of very bad condition. By using a high-resistance L relay, the "B" battery drain is quite low unless line leakage is exceptionally bad.

2. A second general method of handling magneto lines has the advantage of not requiring the line and phones to be arranged to give d-c signaling, but has the disadvantage of not being satisfactory if there is much party-line use of the magneto line.

In this method, the magneto line is isolated from the switchboard from a d-c standpoint. When a phone rings in, a connection is completed and locked to a trunk. When the operator answers, the locking circuit is broken and the connection then remains solely under the control of the operator.

On a call to the magneto line, ringing codes are sent out from the connector. The magneto subscriber then rings a short ring to answer the call. The release of the connection is controlled solely by the calling party. (As a variation of this, we have used a circuit where the connector is automatically tripped after sending out the ringing code only once; then the magneto subscriber answers without performing any special operation.)

If a subscriber rings a code for another phone on his line, the call can be prevented from seizing a trunk by methods previously outlined. There appears to be no satisfactory method of making the line test busy while the parties are talking, however; thus the possibility exists of a connector ringing in on a party line conversation.

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A scheme to provide a busy test has been tried, but found unsatisfactory. When the subscriber rings a code, certain relays are locked up and make the line test busy. When the conversation is concluded, the subscriber rings off and trips the locked-up relays. Although this works all right technically, you can't depend on the subscriber to ring off.

3. The third method of operation is applicable when only the trunks, and not dial subscribers, are to call the magneto lines. It does not require d-c supervision from the magneto phones, but does require trunks that can provide two signaling paths.

Assume, for example, a trunk with simplex dialing and over which ringing voltage can be transmitted. When the operator dials the magneto line, she is connected to the line but no ringing occurs in the automatic exchange. She listens to see if the line is busy, and then rings manually. Her ringing voltage operates an a-c relay at the automatic end of the trunk, which relay transmits supervisory signals thru the dial link to operate a relay in the magneto line which rings on the line.

As an alternative, the operator's dialing could set up a tandem connection from trunk to magneto line, and the operator could ring thru the tandem. This would be more expensive than using the dial link for the connection, and thus would be recommended only if traffic were very heavy.

This general method could be applied most easily to simplex dial trunks and only a little less conveniently to loop dial trunks. Composite trunks would require some such scheme as 135-cycle ringing to provide the extra signaling paths, which probably would not be economically justified. It is also questionable whether dial-back trunks (regardless of signaling method) could be adapted to this scheme without undue complications.

With any of the above circuits, there are two methods of connecting the magneto line to the trunk. The first employs a group of relays to provide tandem connections from magneto lines to trunks without going thru the switchboard proper.

The second uses a "cut-thru" circuit in the links, so that when the magneto line lands on a finder, the finder terminal is so marked that the associated connector immediately seizes an idle trunk without any further signal. This operation can be accomplished very easily with our switchboard circuits, can be applied to any number of lines and trunks within reason, and requires no extra relays in the links; therefore it is the logical method to use unless the anticipated magneto line traffic is so heavy that you want to keep it off the links by employing a tandem scheme.

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Another trick I might mention, which would be applicable to the third method of operation previously described, is line blocking. This can be applied to any number of lines or trunks without restriction, and acts so that only an operator can reach the blocked lines. If a subscriber dials a blocked number, he receives a busy signal, but an operator dialing the same number completes the connection normally. Unless the number of blocked lines is large, this feature requires only one additional relay per link, and thus is not expensive.

A call from the magneto line to an operator and back to a dial subscriber would normally occupy two trunks. This can be avoided by using dial-back trunks (such as Zillah), permitting the operator to dial back over the same trunk on which she received a call. The dial-back circuits are rather elaborate and expensive, and thus would be used only where the amount of return traffic is so heavy that a definite saving in the number of trunk lines could be effected by this feature.

Each of our rather infrequent applications of magneto lines to dial boards has been more or less tailored to fit the particular installation; therefore we cannot give you a list of "standard" circuits covering the various possible magneto arrangements discussed above. From the principles outlined, however, you can possibly visualize the combination of features which would best fit your situations, and by giving us a brief description of the desired arrangement we could furnish appropriate circuits.

On a board with 10-party ringing, a maximum of 9 rings could be obtained on a magneto line, due to the fact that a single ring cannot be assigned. On a 20-party board, 19 phones could appear on the magneto line. The price difference between 10-code and 20-code jobs is quite small; so where you expect more than 9 magneto phones on a line, 20-code ringing should be specified on the board. (This would apply, of course, only if the magneto line were to be rung automatically from the dial switchboard.)

Although we have been working toward the publishing of bulletins covering the various features of our boards and circuits, we do not have anything too complete at present. The enclosed mimeographed description should give you an idea of the features commonly available. Also enclosed is an index of circuits used in Bell Company installations. This index is somewhat out of date, for boards now being manufactured contain several types of circuits which have been revised recently.

Yours very truly,

THE NORTH ELECTRIC MFG. COMPANY

W. H. Blashfield

W. H. Blashfield
Development Laboratory

March 28, 1946
WHBlashfield/mer

Enc. - Mimeographed description of
boards and circuits
Index of circuits

NORTH CX TYPE DIAL CENTRAL OFFICE EQUIPMENT

These notes describe briefly the "All-Relay" dial central office equipment manufactured by the North Electric Mfg. Co. This equipment is available in five general arrangements for use where suitable in the community dial office field.

GENERAL DESCRIPTION

In this type of office the switching operations are performed entirely by relays grouped into basic circuits called Line-finders, selectors, and connectors, each with the functions usually associated with such circuits. The combination of a line-finder and a connector or line-finder selector connector is known as a link.

CAPACITIES AND CLASSES OF SERVICE

The following are the maximum capacities in terminals for lines and trunks for the various arrangements:

Type		Capacity
CX-30		30
CX-60		60
CX-100 - 3 Digit		80 or less depending on trunking.
CX-100	4 Digit	100
CX-200	4 Digit	200
CX-1000	4 Digit	900 or less depending on trunking.

All lines are served on a terminal per line dial basis, with provision for the following general classes of service:

A. Metallic Lines

1. Individual
2. P.B.X. Trunk
3. Two-party Full Selective
4. Four-party Selective, Super-imposed Ringing
5. Four-party Semi-selective
6. Eight-party Semi-selective, Super-imposed Ringing
7. Ten-party bridged or divided Ringing
8. Twenty-party bridged or divided Ringing
9. Ten-party Full Selective Multi-frequency Ringing
10. Ten-party Semi-selective Multi-frequency Ringing
11. Post Payment Coin box

B. Ground return lines - Code Ringing with maximum of 20 stations

No provision is made for message rate lines except by individual line adapters. Normal operation is on a common battery basis, but local battery may be used if necessary.

TRUNKS TO OTHER OFFICES

Master or non-master office trunks may be provided for connection to any type of local manual or toll office, or to any type of D.S.A. board. Two-way dialling trunks may be provided working into any Standard type of office. The links are arranged for joint control of the release and full switch-hook supervision is provided, except on ringdown trunks which have disconnect supervision only. Except as noted under "3 Digit - CX-100" all trunk groups are reached by dialling a single digit.

Each trunk line, on CX-30 - CX-200, requires a line terminal, reducing the number of subscribers lines by the number of terminals used or reserved for trunks. (Numbers reserved for future trunks can be used for subscribers lines, if desired, until the additional trunks are installed.)

The trunk terminal numbering provided as standard is as follows:

	Single Digit	Terminal Number
First Group	"0"	20, 21, 22, - - - -
Second Group	"9"	30, 31, 32, - - - -
Third Group	"8"	40, 41, 42, - - - -
Fourth Group	"7"	50, 51, 52, - - - -

Other arrangements are possible but the terminal numbers should be consecutive and the first one should have unit digit "0".

Where more than ten trunks are required in one group, the complete 20 group is used with additional terminals added from the 30 group as required.

On CX-1000 a line-finder terminal is required as above, but as the trunks are reached from selector levels the connector terminals are not used, and can be assigned for use where the line-finder terminal is not required. (i.e. Alarm Checking)

When incoming trunk selectors are provided on CX-1000, no line terminals are required and all terminals can be used as subscribers lines.

NUMBERING PLAN

Subscriber Directory Numbers

CX-30 and CX-60

CX-30 and CX-60 equipment is made in two types, three digit or four digit dialling. There is no price differential between the two types of equipment. Note that four digit dialling must be used if 20 party service is required.

Trunk codes may be assigned to any desired group of line numbers of one or more lines starting with a line ending in "0". Trunk code "0" is