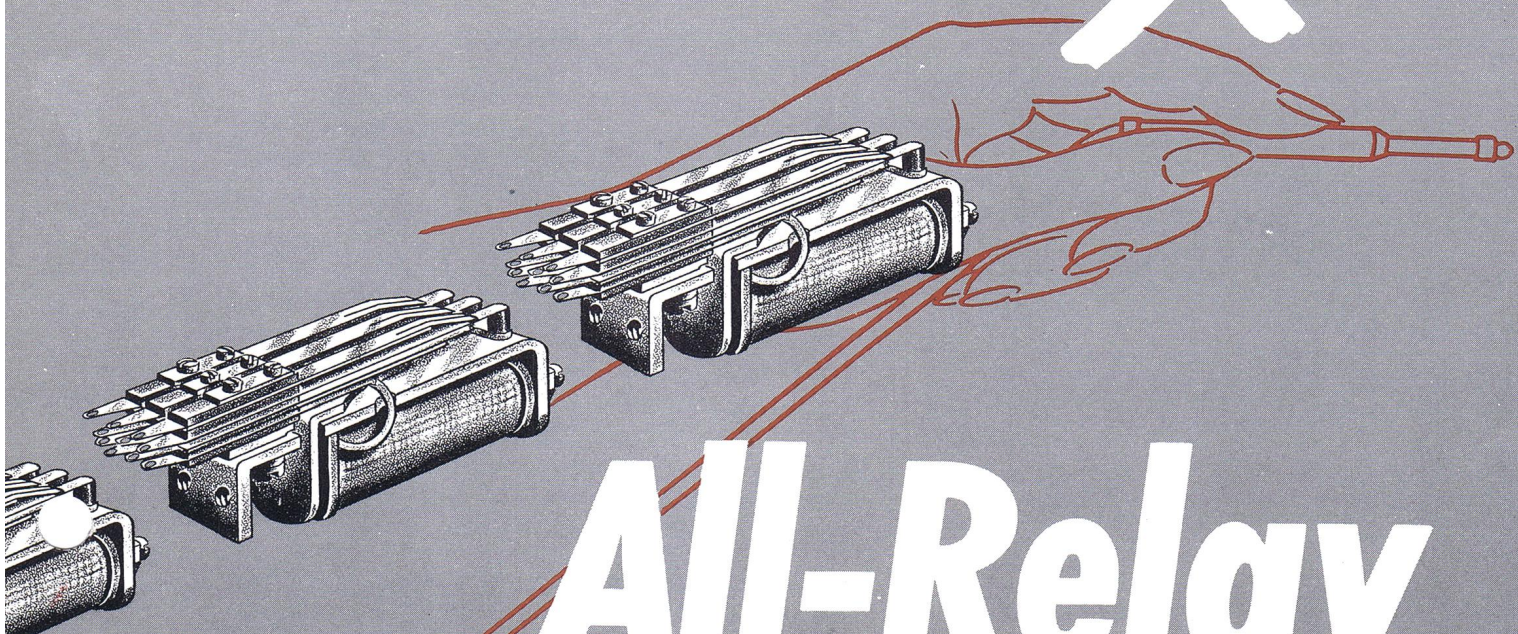


NORTH



All-Relay

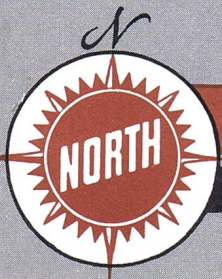
Community Dial

Automatic Exchanges

Speed Communication

Cut Costs

Release Skilled Help from Local Calls



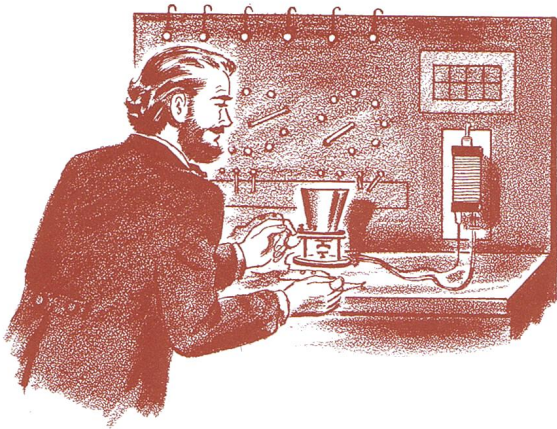
THE NORTH ELECTRIC MANUFACTURING COMPANY

Originators of ALL RELAY Systems of Automatic Switching

701 South Market Street, Galion, Ohio, U.S.A.

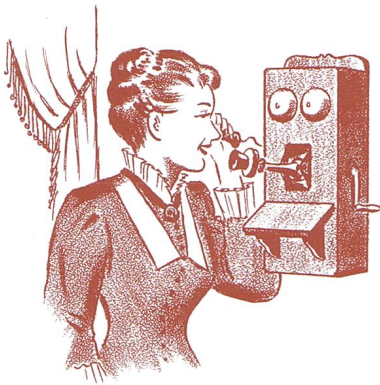
TCI Library - <http://www.telephonecollectors.info/>

NORTH All-Relay—Tireless— Errorless Brain of Modern Telephony



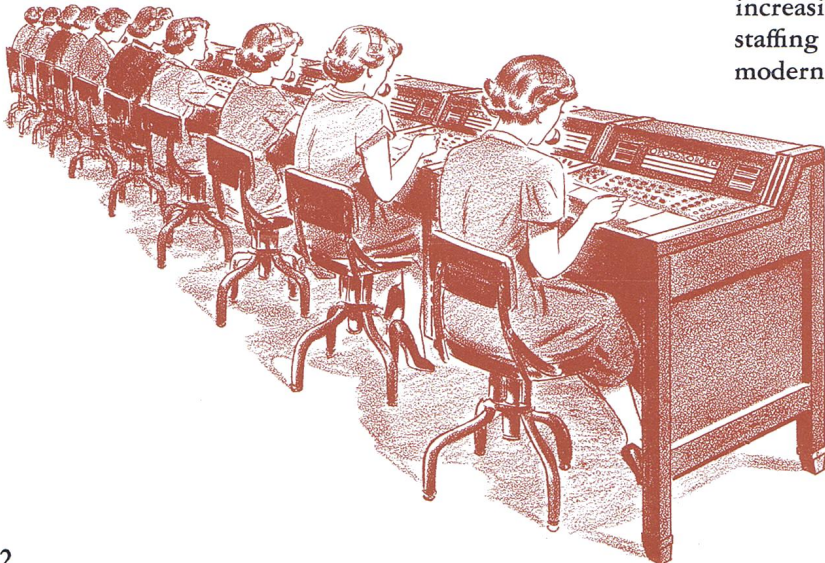
Since that memorable occasion more than 76 years ago when human voices were for the first time communicated by wire between two distant points (a mile apart) two developments have occurred which doubtless would amaze even the far-reaching imaginations of Alexander Graham Bell and Thomas A. Watson, principals in the first experiment.

Their discovery, which we now identify rather casually as "telephony" has revolutionized the business and social life of the entire world. At the same time the phenomenon of sound transmission, which so startled contemporaries of Bell and Watson, today is taken for granted to the extent that the average teen-ager is apt to complain about a thirty-second delay in completing a long-distance call to a girl-friend.



During the lifetime of the originators, telephony expanded by great strides in the seven-league boots of public demand. From the day on which more than two telephones were in use in a community, the problem of switching has been a key factor in development. From crude connector panels at which "operators" walked up and down in search of the right connections, to sleek compact switchboards with thousands of jacks within reach of each position, hand "switching" continued to progress, until a saturation point was reached.

The combined effect of expanding traffic loads, increasing urgency for speed and the problem of staffing manual exchanges with good personnel at modern living standards threatened to halt the de-



In addition to the completely automatic switchboards described in these pages, North produces the latest and finest of attendant desks, manual switchboards, toll boards and components.

velopment of telephonic communication. The automatic switchboard and the dial telephone came into being to save this situation.

Pioneers in All-Relay Systems

The first automatic switchboards were of the "mechanical operator" type, employing machine motions to hunt calls and complete connections. North's first efforts in manufacturing dial-automatic equipment were, like other manufacturers, along these lines. However, as a result of close observation of the early mechanical devices, it was apparent that improvements must be made to reduce maintenance requirements. This company's engineers, believing that complete departure from mechanical action was the answer, were the first to develop a system operated entirely by relays.

Swift and efficient switching without supervision by brain or hand is now general practice in the U. S. rather than the exception. This is no reflection upon the skill and effectiveness of the brains and hands which have handled millions of calls over the years—and still do in a surprising number of communities.

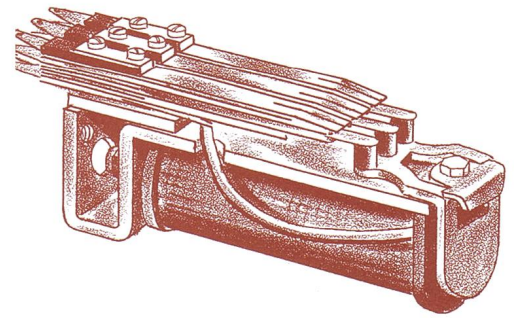
Rather, the rapidly accelerating tempo of change-overs to automatic exchanges is the inevitable effect of the tightening economics of telephony. The value of a local telephone call to your subscriber is such that it cannot bear the charges necessary to pay for transferring it by hand at present day costs, and allow for profit.

Basic Simplicity of Relays

The answer is to provide dependable dial automatic service with a North All-Relay Exchange, engineered to match your present plant and expandable to all future needs. Information contained in these pages is intended to show you how the tireless, errorless, virtually wageless "brain cells" of a North All-Relay System handle every detail of call switching more swiftly, more dependably and at lower long term cost than other exchanges—manual or automatic.

The "brain cells" of a North Exchange, referred to above, are electrical relays, the simplest of all actuating devices. There are no mechanical switches or other parts subject to appreciable wear. The only

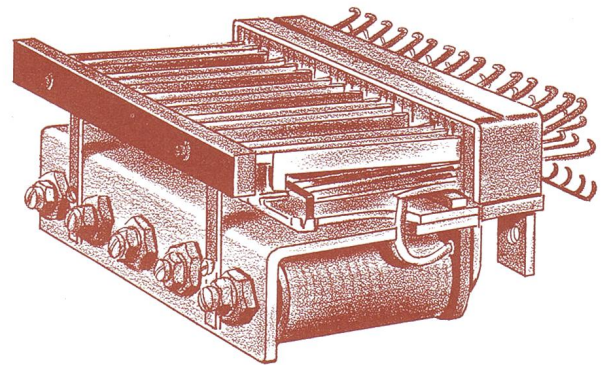
(Continued on Page 4)



Typical North relay of the simple sturdy type which serve as switching "brains".

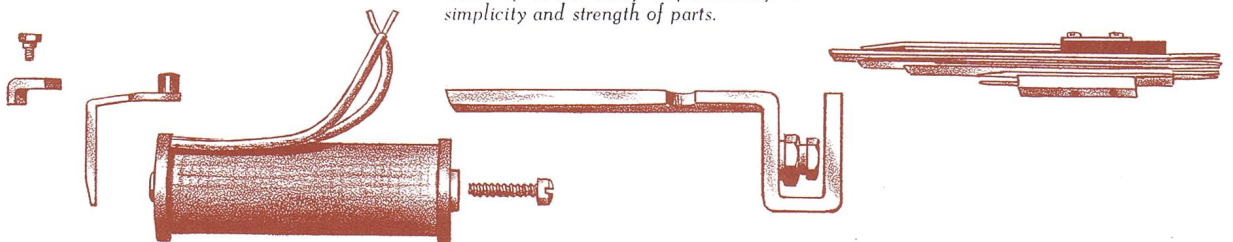


Split-spring double contacts with precious metal points assure positive, clean action.



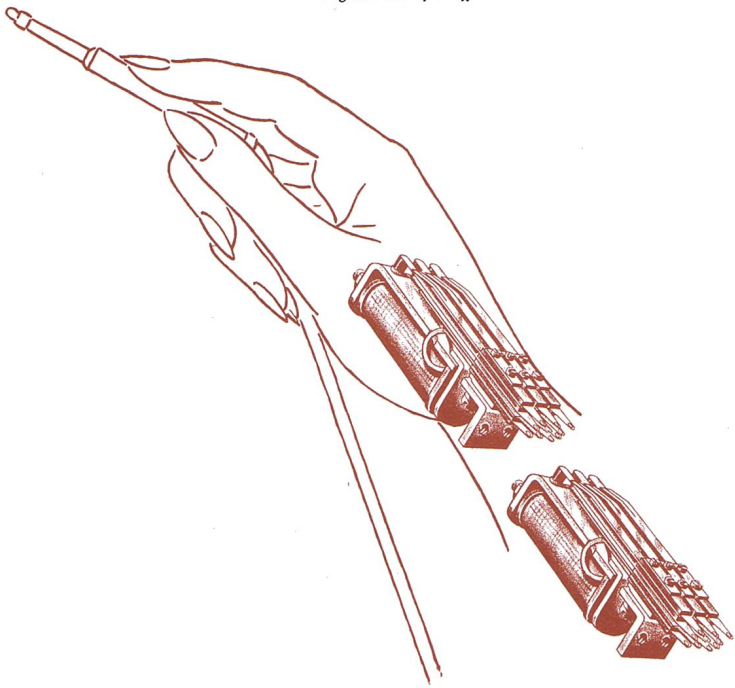
North multiple relays are built to withstand all the punishment of time and traffic.

Basis of North relay dependability is simplicity and strength of parts.



(Continued from Page 3)

Speed and precision mark the handling of calls by North's automatic "head and hands" regardless of traffic.



moving part is an armature supported on a knife-edge bearing and operated by direct application of magnetic force in the relay coil and frame. This produces a minimum of motion in the armature, sufficient to actuate the contacts dependably. Because of the knife-like bearing surface and minute motion there is negligible friction.

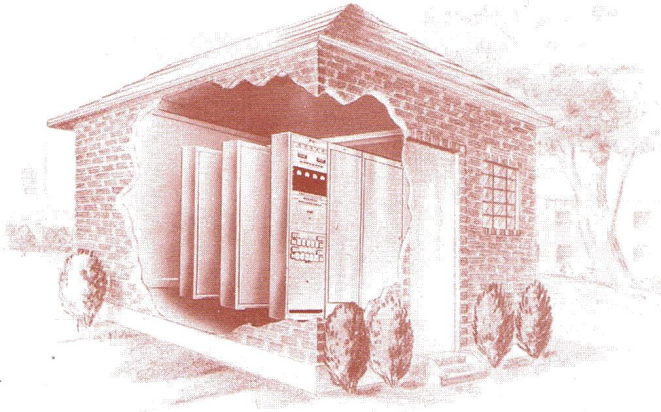
Any owner of a North All-Relay System will testify that a prime factor in its superior performance is a high ratio of continuous operation to low maintenance and repair demand. This is primarily due to the minimum amount of wear and the low degree of sensitivity to dust, moisture and temperature inherent in North CX type relays. This important extra stability is based upon:

1. Strong, sure coil activation of the armature, closing and opening circuits with a firm and constant contact pressure.
2. Slit springs, with double-point contacts which open and close with a self-polishing "slide tight" action. This keeps the precious metal points cleaned of foreign material.
3. A special moisture resisting method of assembling spring and separator pileups that insures against warping or misalignment under a wide range of temperature and humidity changes.

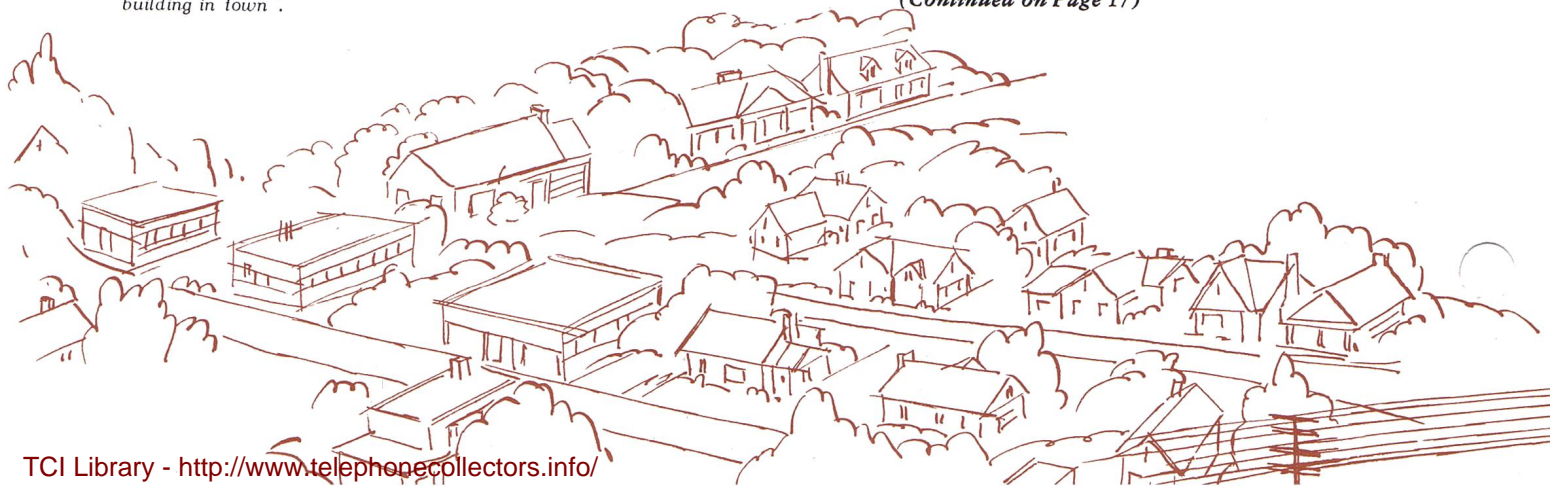
How All-Relay Operates

In every North All-Relay switchboard various groupings of relays designated as line-finders and connectors correspond to the eyes and hands of operators in a manual system. When a receiver is lifted on any line, the finder picks up the incoming signal with a lightning swiftness and its associated connector is ready to accept the called number (in dial pulses) long before an operator could identify a calling jack, pick up the answering plug, insert it and ask for the number. As the number is dialed the pulses are counted through the connector relays, again with the speed of lightning, and when the last

(Continued on Page 17)



A simple, unattended exchange, housing a North Automatic may be the "... biggest little building in town".



NORTH All-Relay CX 1,000—10,000

for exchanges of 200 lines and over, or for any exchange subject to continuous growth, the North CX 1,000—10,000 is recognized as the universal equipment. Its expandability has no limit, yet equipment for as few as 150 lines can be employed



Typical installation of a North All-Relay CX 10,000 exchange initially equipped with 1,000 lines.

as a starting installation on a practical investment basis where expansion is definitely anticipated.

North All-Relay systems of this type are operating profitably in all parts of the country with initial installation of 150, 200, 550, 1,500, 7,000 and 10,000 lines per exchange. In almost every case, lines have been added several times.

While any North exchange can be expanded if the need arises, the CX 1,000—10,000 series represents equipment that is specially designed for continuous growth. It is wired at the factory in a manner to permit ready additions whether in groups of ten or in hundreds. Additions to it are made at less cost than with any of the models designed primarily for systems of known limits.

General description of the basic equipment which applies to the CX 1,000—10,000 series will be found on Page 8. The amount and arrangement of such equipment depends upon the special needs of the system for which it is intended.

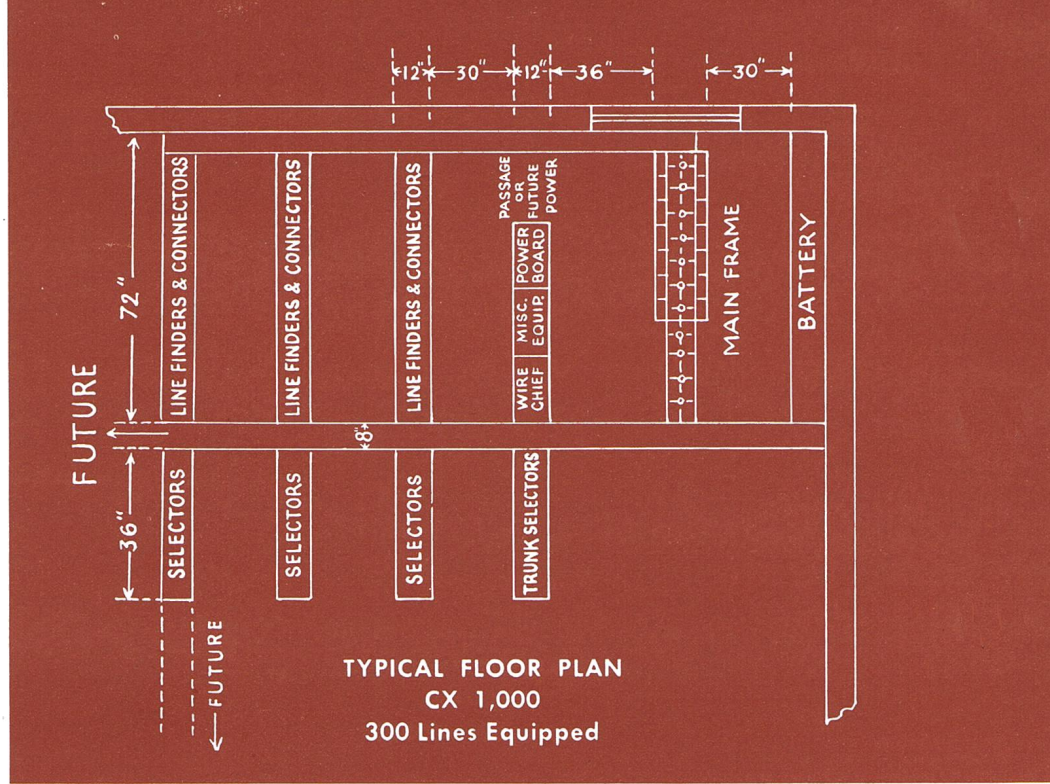
(Continued on Page 6)



(Continued from Page 5)

The North All-Relay system has greatly simplified exchange installation by standardizing certain units from which an unlimited variety of combinations can be made to fit the simplest or the most complex layout demanded in the field. Thus the equipment shown on this page as relating to the CX 1,000—10,000, while typical, does not in any way represent the complete variety of arrangements possible.

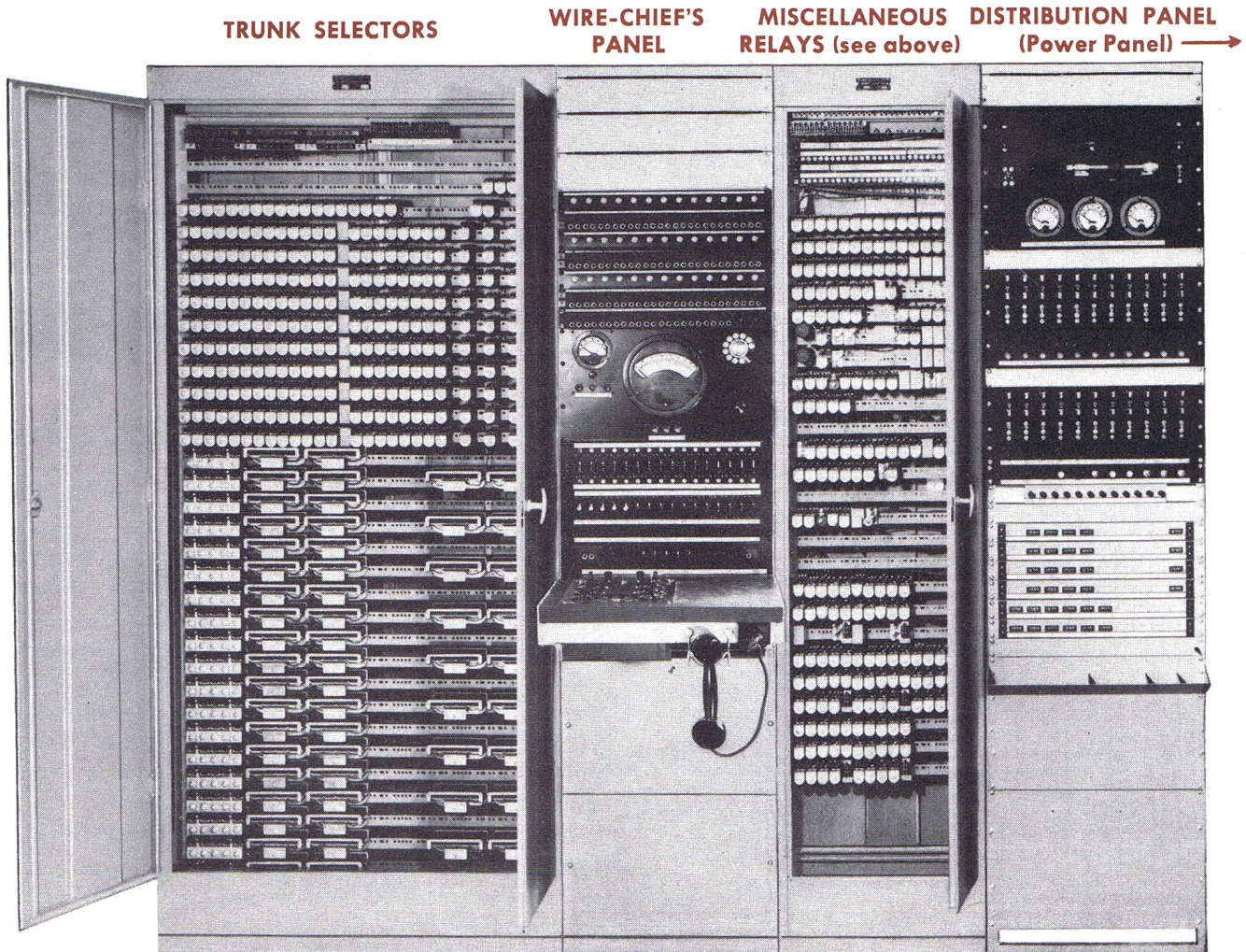
At the bottom of the page, for instance, is a grouping of units typical of the first installation of a CX 1,000 for an exchange of anywhere from 300 to 1,000 lines. This would be the front bay, including trunk selectors, wire-chief's panel, miscellaneous relays for ringing, dial and busy tones, supervisory equipment, etc., and the distribution panel. A power panel, including battery charging equipment, normally would be located adjacent to the distribution panel. In-



stallations of this type sometimes are powered by motor-generator sets or dry-plate chargers, with ample capacity for expansion. These

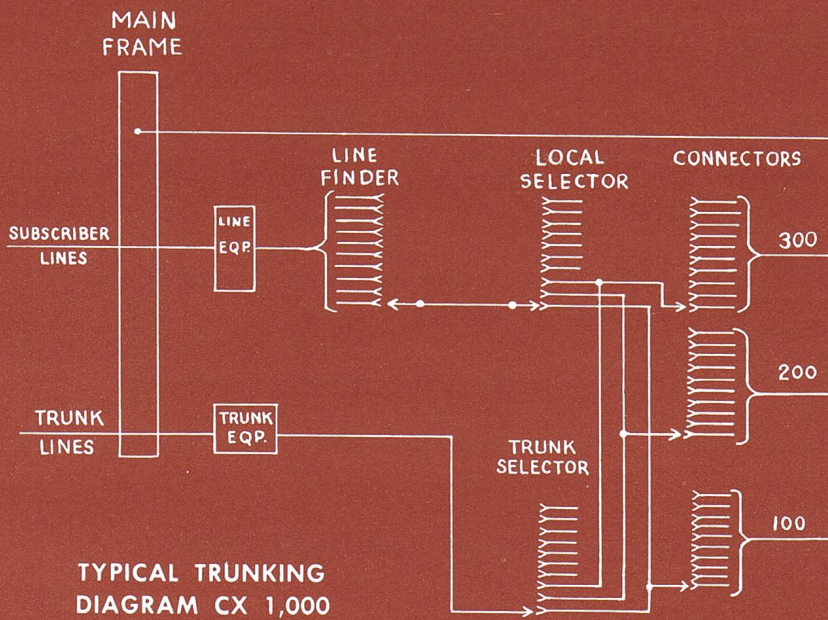
would be located in a power group, together with the battery.

On the facing page are shown typical units of succeeding bays in



NORTH All-Relay CX 1,000: TYPICAL ARRANGEMENT OF FRONT BAY

CX 1,000 FLOOR AND TRUNKING DIAGRAMS



The typical CX 1,000 floor plan shown at far left is but one of a wide variety of arrangements possible with the equipments shown on these pages. It is considered one of the most practical from the standpoint of compactness, ease of supervision, and convenience for future expansion.

It should be noted that buildings for this equipment can be economically constructed. The only heating required is that for the personnel, as North CX relays operate efficiently over a wide range of temperature variation.

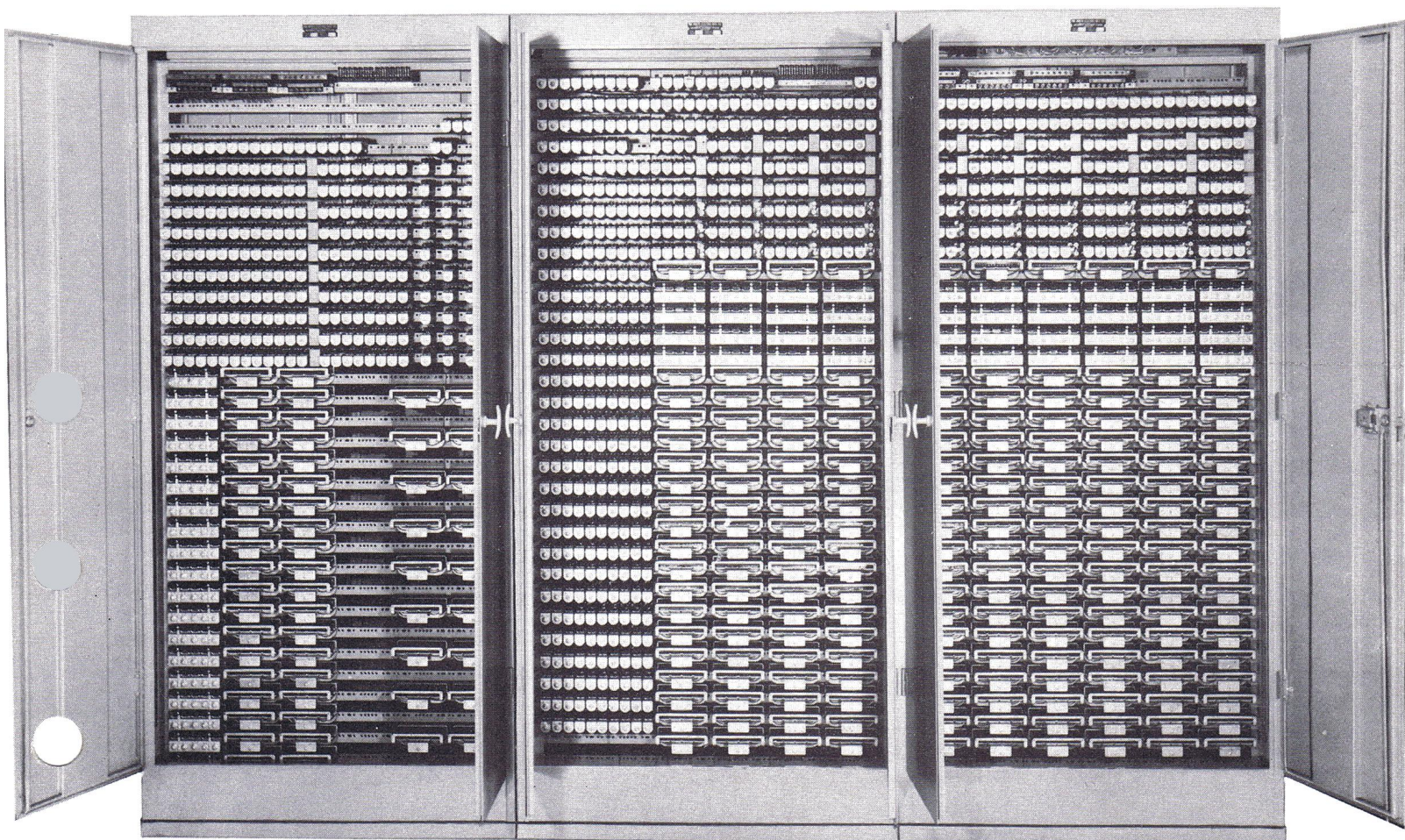
At left on this page, a typical trunking diagram of a standard North System. For diagram of toll ticketing see Page 16.

such an exchange, each representing 100 lines plus associated links sufficient to handle traffic on the basis of the grade of service speci-

fied. Operation of the CX 1,000—10,000 is exactly as in the general description of North All-Relay on the adjoining pages.

SELECTORS

LINE FINDERS AND CONNECTORS



NORTH All-Relay CX 1,000: TYPICAL ARRANGEMENT OF LINE BAYS

BASIC GENERAL SPECIFICATIONS

NORTH ALL-RELAY CX AUTOMATIC EXCHANGES

TYPE OF SWITCHING:

Non-mechanical. All circuits selected and distributed by electrical relays without hunting action.

CAPACITY:

Individual exchanges designed for all capacities from 10 lines to 10,000 lines. Some small switchboards are designed for fixed ultimate capacity based on known future needs, all others for unlimited expansion.

TRUNKING:

Unlimited. Engineered individually for each community's specific Busy Hour requirements. Based on engineering studies of existing traffic and future probability curves.

POWER:

Common battery type: Has 24-cell, 48-volt wet battery and self-regulating, selenium dry-plate charger operated from commercial power supply of 110 Volt or 220 Volts 60 Cycle single phase. Chargers have capacity as required, depending upon size of exchange. May also be operated with motor-generator sets.

Ringling voltage can be powered from 110 volt circuit with DC powered standby equipment.

All power equipment (except battery) centralized, on factory assembled and wired power panels.

RINGING:

Can be arranged for Code, Synchronomic, Harmonic, Decimonic or Superimposed ringing.

RINGER LOAD:

Up to 10-party selective or 20-party code on metal-

lic lines. Single wire grounded lines can be handled specifically, if desired.

SUBSCRIBER LOOP RESISTANCE:

Loop resistance of lines up to 1,000 ohms; with long line adaptors up to 2,000 ohms.

LINE INSULATION RESISTANCE:

Insulation between conductors of lines in a CX exchange 15,000 ohms and from line to ground 10,000 ohms.

INTER-OFFICE LOOP RESISTANCE:

Conductor loop resistance on inter-office trunks approximately 1,200 ohms. On composite operation, 1,800 ohms; on simplex, 2,500 ohms. Longer lines handled with special equipment as required.

CONDUCTOR INSULATION RESISTANCE:

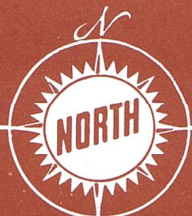
Inter-office trunk insulation 30,000 ohms in all types of operation.

SERVICE FEATURES:

Automatic lock-out of lines developing shorts, receiver left off hook and other similar conditions. Automatically restored when cause of trouble is removed. Limited or unlimited reverting calls. Premature impulse cancellation. Timed conversation disconnect; available on option. Tone signaling. All dial, busy, pay-station or special operator signaling tones are provided as desired.

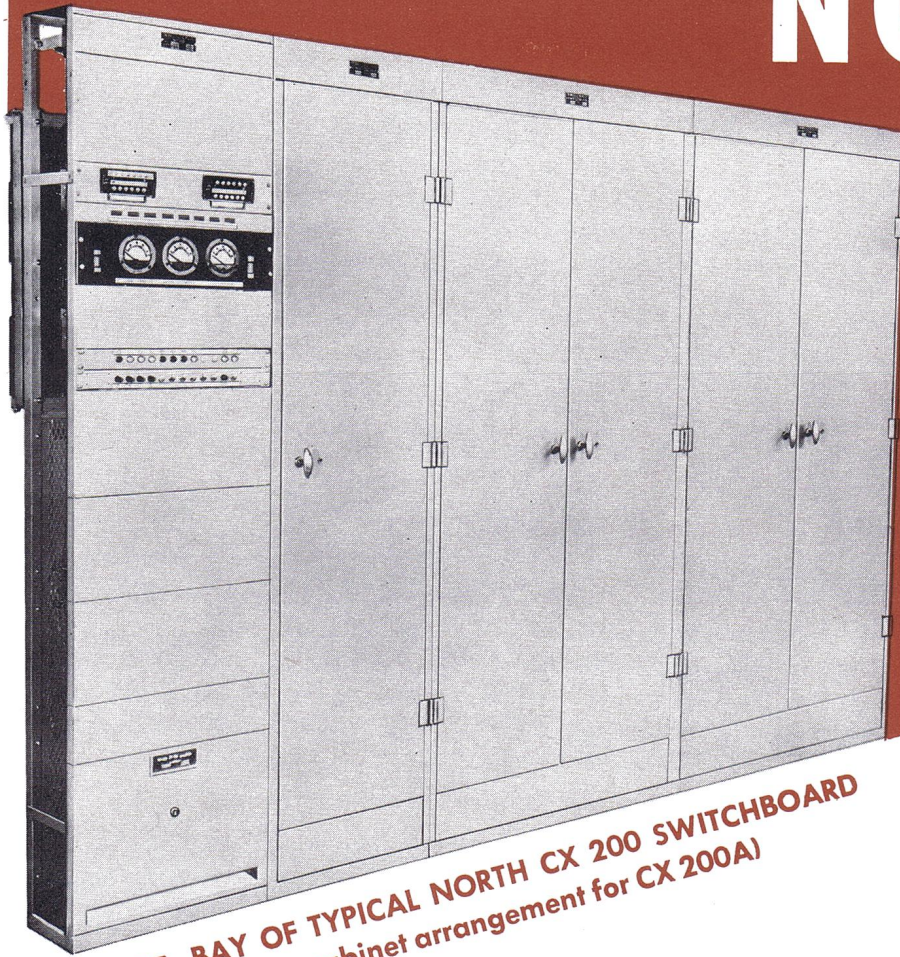
TELEPHONES:

North telephones (see Page 13, or complete line in separate catalog) or any standard common-battery type telephone with ten-impulse dials are suitable.



THE NAME . . . NORTH . . . which has stood through many years for the finest in automatic switching equipment, now also stands for complete service in telephone line supplies and hardware. Every type of supply needed for construction, maintenance and service of a telephone plant, inside and out, is available through this one, dependable source. Ask your North representative for full information on North line supplies.

NORTH ALL-RELAY CX 200



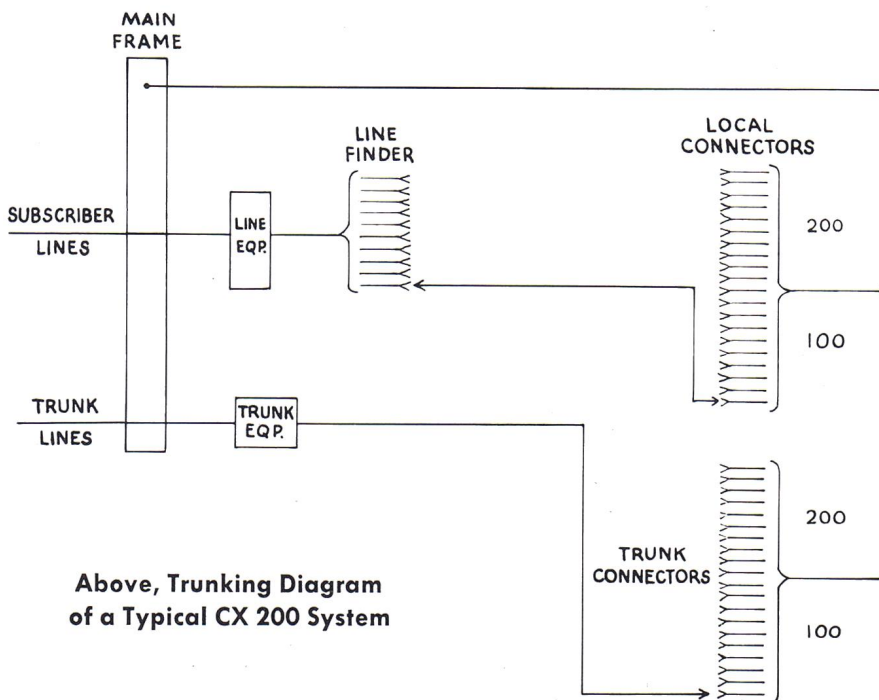
FIRST BAY OF TYPICAL NORTH CX 200 SWITCHBOARD
(Same cabinet arrangement for CX 200A)

North CX 200 designates a combination of standard North automatic switchboard units as engineered for systems with pre-determined ultimate capacity. Such a system is expandable, but not basically designed for the unlimited growth for which the CX 1,000, 10,000 is more suitable.

Initial installation of a CX 200 may be any number of lines up to 200 and expansion within that range is simple and economically practical. North systems of this type are operating in a wide variety of small and medium-sized communities with anywhere from 30 to 200 lines in service. The line finders and connectors have a 200 line capacity and do not use selectors, thereby resulting in a lower cost, in most sizes.

Owners of these systems testify that their records of operating cost are remarkably low, particularly in housing and maintenance. They are typical of North All-Relay systems in that they require no expensive special heated or air-conditioned space. They are unusually resistant to temperature variations,

(Continued on Page 10)



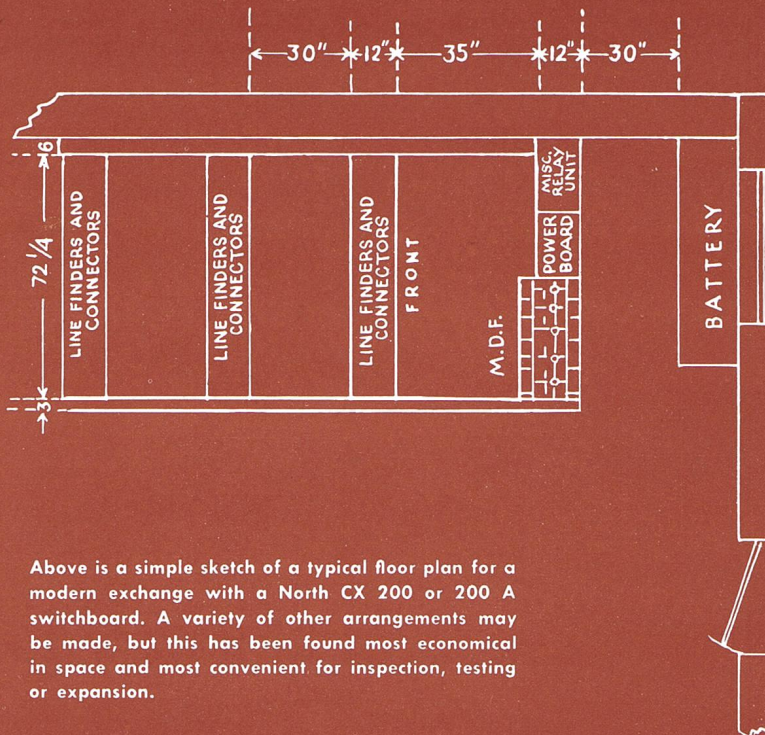
**Above, Trunking Diagram
of a Typical CX 200 System**

(Continued from Page 9)

require a minimum of maintenance attention, thus can be located in low-cost, even remote, small buildings unattended save for occasional inspection.

The basic equipment applying to North exchanges in the CX 200 series is outlined on Page 8. The amount and arrangement of such equipment depends upon the requirements of each installation.

The switchboard illustrations shown in these pages, while typical, do not represent the complete variety of arrangements available in CX 200 equipment. For example, the group of standard units shown below is typical of an initial installation designed for a system of 60 lines, anticipating a substantial future growth. This would represent the front bay, incorporating the power panel, which includes a battery charger



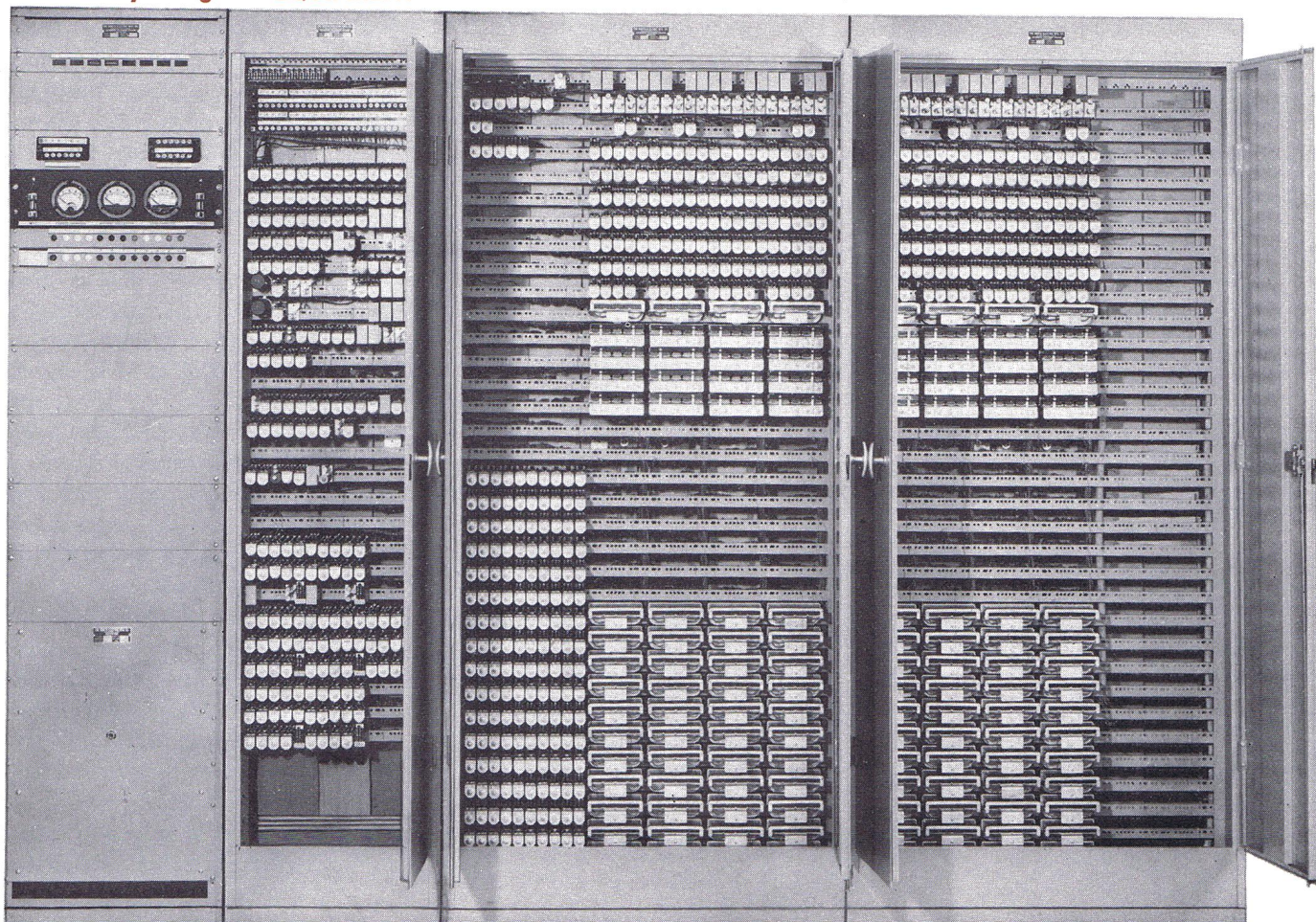
Above is a simple sketch of a typical floor plan for a modern exchange with a North CX 200 or 200 A switchboard. A variety of other arrangements may be made, but this has been found most economical in space and most convenient for inspection, testing or expansion.

of ample capacity to serve the expanded system; miscellaneous relays for dial, busy and ringing tones; supervisory equipment, etc.,

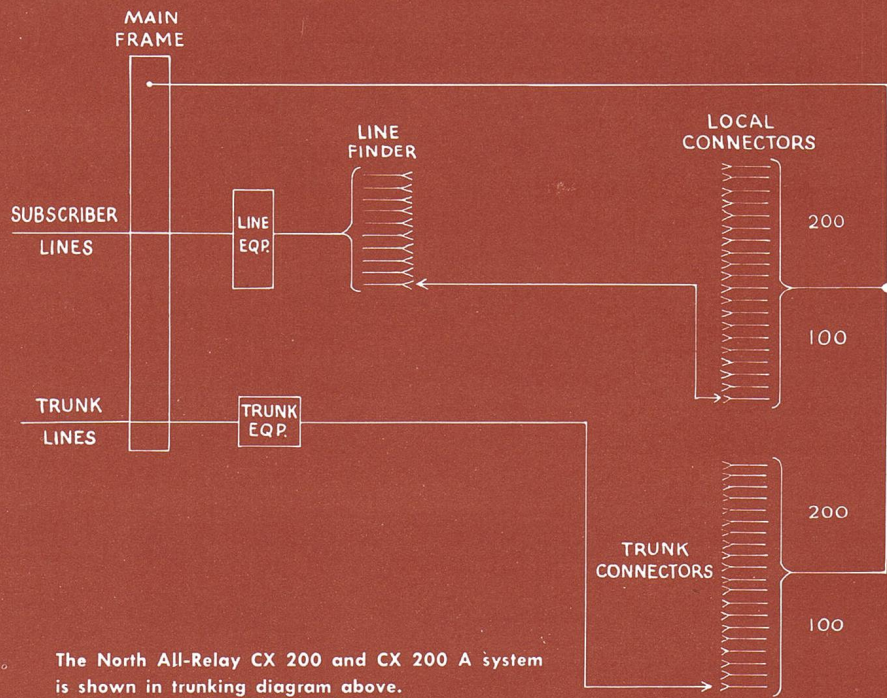
in addition to main switchboard. As shown, this initial installation (example 60 lines) can be quickly and easily expanded to a

POWER BOARD MISCELLANEOUS
with battery charger **EQUIPMENT**

LINE FINDERS AND CONNECTORS



NORTH All-Relay CX 200: TYPICAL ARRANGEMENT, FRONT BAY



The North All-Relay CX 200 and CX 200 A system is shown in trunking diagram above.

NORTH CX 200 A . . .

In communities where the specific need is for a switchboard of 100 to a maximum of 200 lines, the North All-Relay CX 200 A is ideally suited. This type of board is similar to the CX 200 in that the line finders and connectors have a 200-line capacity and do not require selectors. The physical layout differs somewhat in the location of lines and links.

This system has price advantages under certain trunking conditions. Normally, 200 lines are considered its ultimate capacity, although it can be expanded further.

Basic equipment specifications are detailed on Page 8. (The same as CX 200). The amount and arrangement of such equipment depends upon the type of system in which each switchboard is to be used.

The CX 200 A equipment is installed in exactly the same cabinets as the CX 200, and lays out for the same floor plans, as illustrated on Page 10. A typical layout of the first bay is shown below.

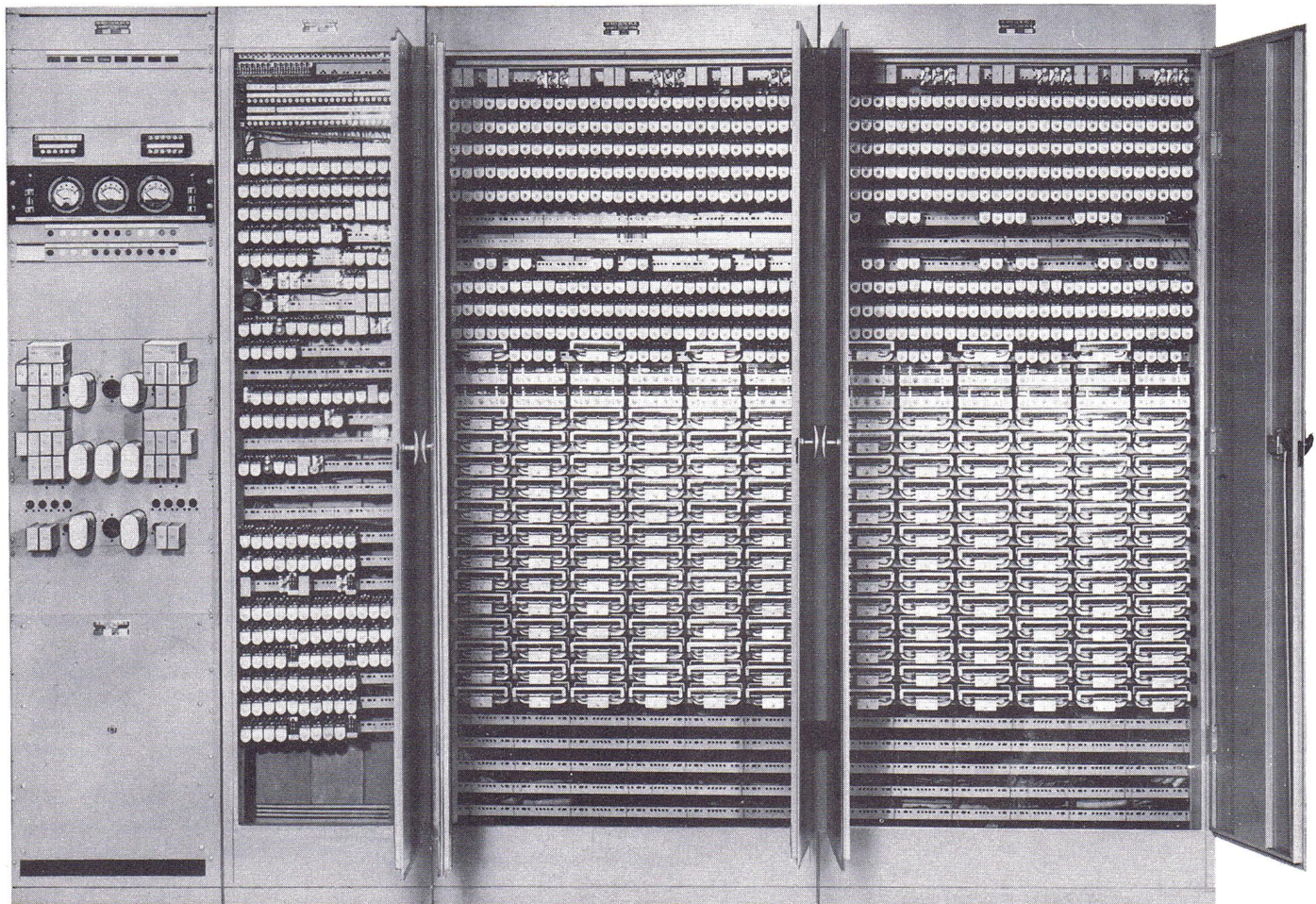
total of 100 lines. Additional bays would be located as indicated on the typical floor plan.

All cabinets are completely as-

sembled, wired and tested at the factory and are shipped ready to set up with simple tie-in cable connections.

POWER BOARD MISCELLANEOUS with battery charger EQUIPMENT

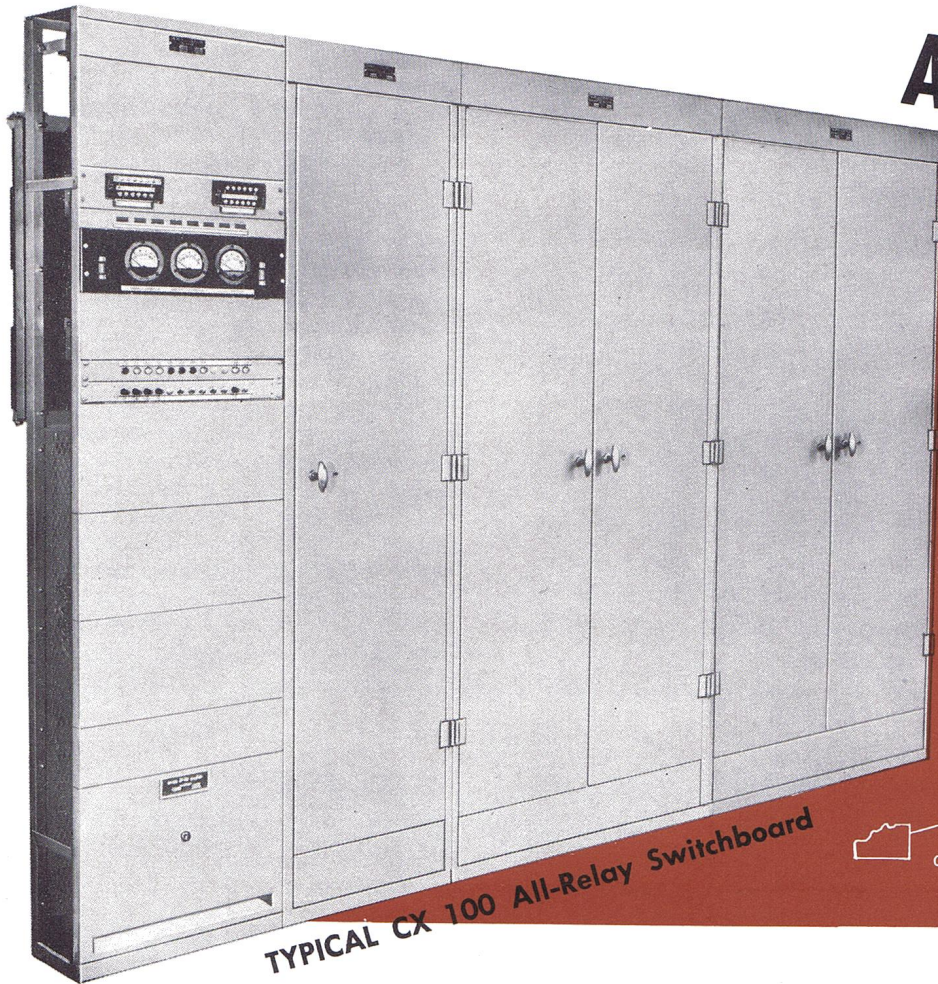
LINE FINDERS AND CONNECTORS



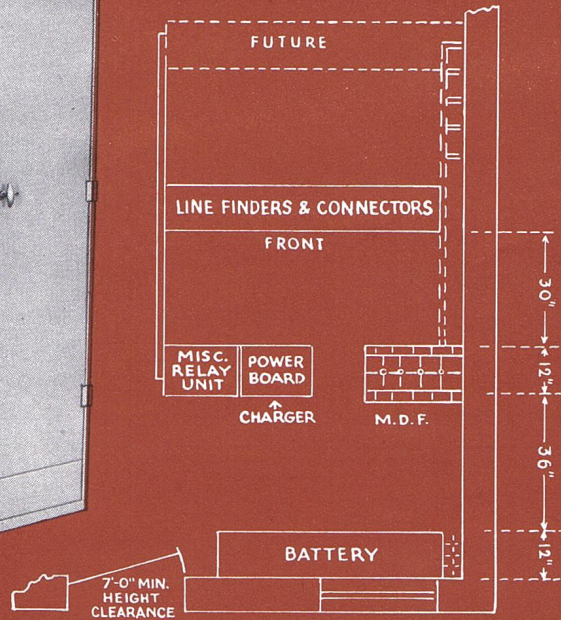
NORTH All-Relay CX 200A: TYPICAL ARRANGEMENT, FRONT BAY

CX-100 NORTH

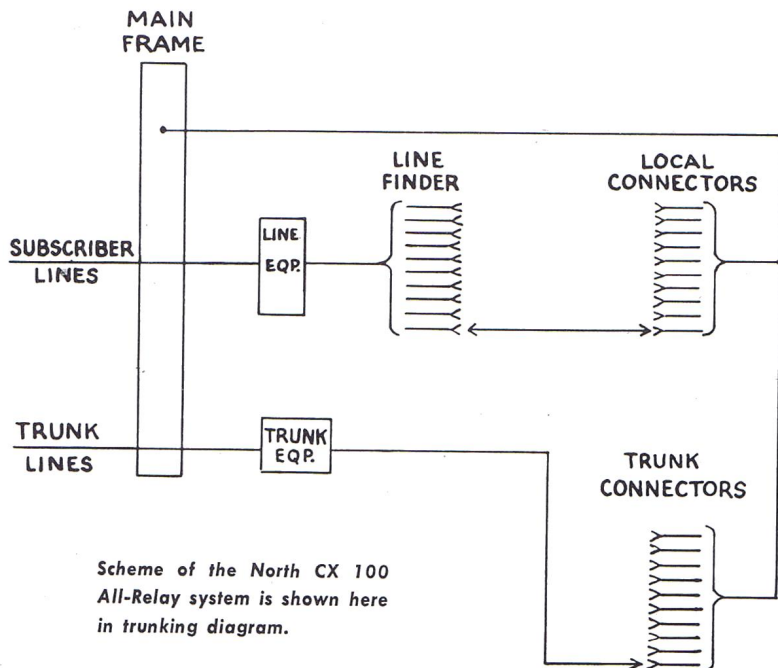
ALL-RELAY



TYPICAL CX 100 All-Relay Switchboard



Above is shown a typical floor plan for a North CX 100 switchboard which has proved to be most economical in space and most convenient for inspection, or expansion.



Scheme of the North CX 100 All-Relay system is shown here in trunking diagram.

CX 100 designates a combination of standard North switchboard components designed for any modern telephone system from 10 to 100 lines, where growth is anticipated. In other words, although smaller combinations of North All-Relay equipment are available, the CX 100 is recommended because of the flexibility of expansion within its capacity.

As shown at the top of this page, it is contained in a compact set of steel cabinets occupying a small amount of space and easily housed in a service room or small exchange building. Because of the unusual resistance of this equipment to temperature changes and its low maintenance requirements, this may be a remote, unattended building where the only heat required would be for personnel during infrequent inspections.

Details of the basic equipment for this board are provided on Page 8, the amount and arrangement of such equipment being

The general description of North All-Relay, Pages 2-4 and 17-19

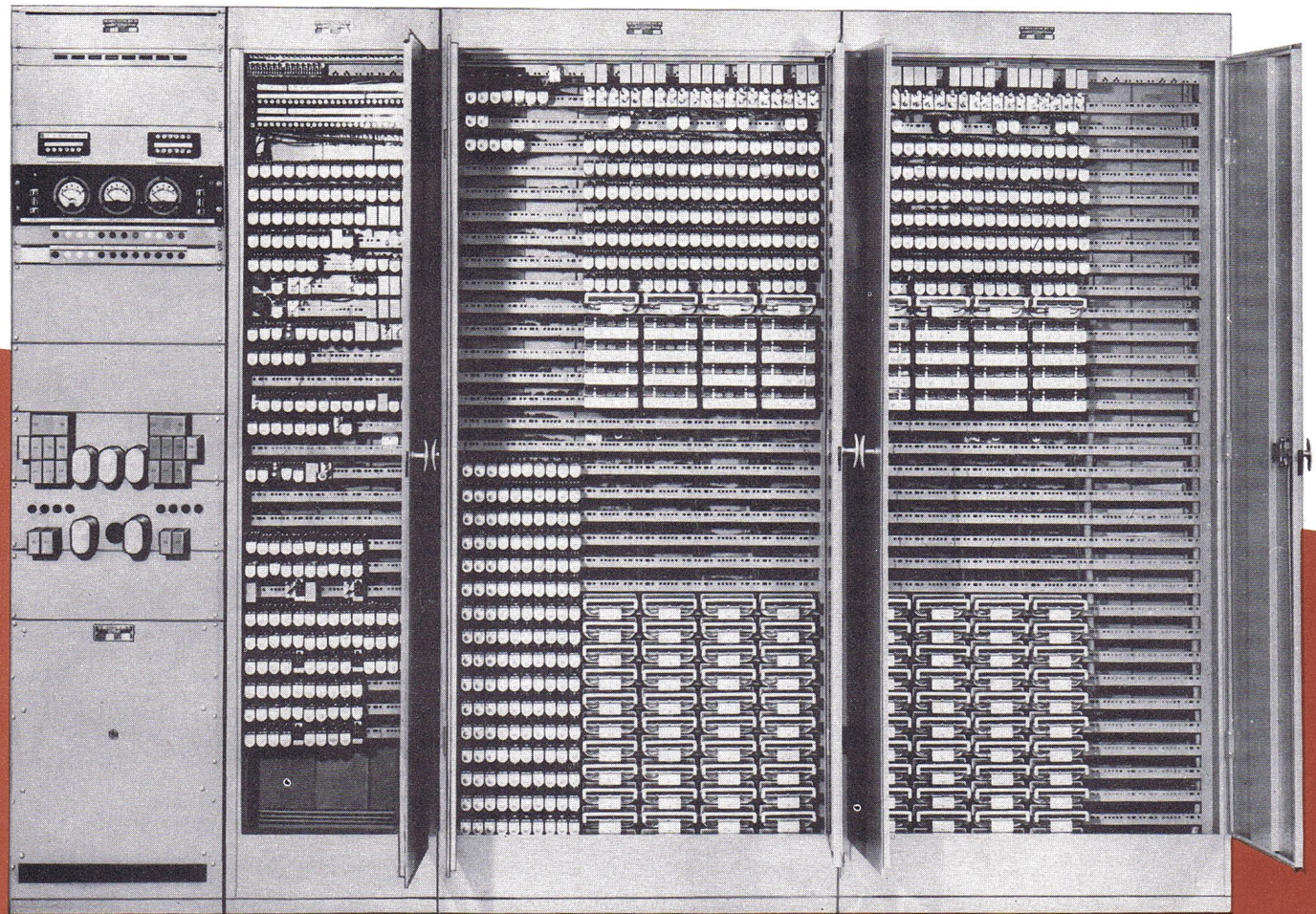
applies to all switchboards on these pages.

TCL Library - <http://www.telephonecollectors.info/>

**POWER BOARD
WITH BATTERY
CHARGER**

**MISCELLANEOUS
EQUIPMENT**

LINE FINDERS AND CONNECTORS



NORTH All-Relay CX 100: TYPICAL ARRANGEMENT, COMPLETE CABINETS

dependent upon the type of system in which it is to be used. A typical CX 100 installation, partially equipped, is shown with the cabinets open above. Although not spe-

cifically planned for systems of more than 100 lines, this board may be expanded beyond that capacity if the need arises. It is generally recommended, where greater ex-

pansion is specifically anticipated at the time of initial installation, that the first unit of a CX 200 or larger combinations be considered.



**NORTH DESK SET
UNIVERSAL BASE**

NORTH WALL SET

**PIN-UP OR DESK
SET COMBINATION**

STANDARD PAY STATION

NORTH Telephones: Simple, Efficient

NORTH telephones are available in both desk and wall types, universally adapted to dial operation, central battery manual service or magneto service. One interchangeable base, accommodates desk set, wall-set or ringer box, and meets all requirements of three different applications. The base is compactly arranged to house the ringer, coil and condensers in a simple layout that is easy to wire in, adjust and service.

The high quality of performance for which NORTH telephones are noted is due in a large degree to their advance circuit design. This is a high-efficiency anti-sidetone circuit incorporating a special three-winding induction coil which assures subscribers of a superior fidelity of transmission on rural circuits and long distance connections.

Hand-sets are "palm-fitted" and pleasingly balanced. Capsule type transmitter and receiver are high-fidelity units sealed from moisture, easy to replace. Naturalness of tone is pleasing to users.

Straight-line ringers supplied for individual or code ringing. Harmonic decimonic or synchronomic frequency-tuned ringers for selective or semi-selective systems; or the new NORTH superimposed ringer may be supplied. Circuits for either grounded or metallic ringing.

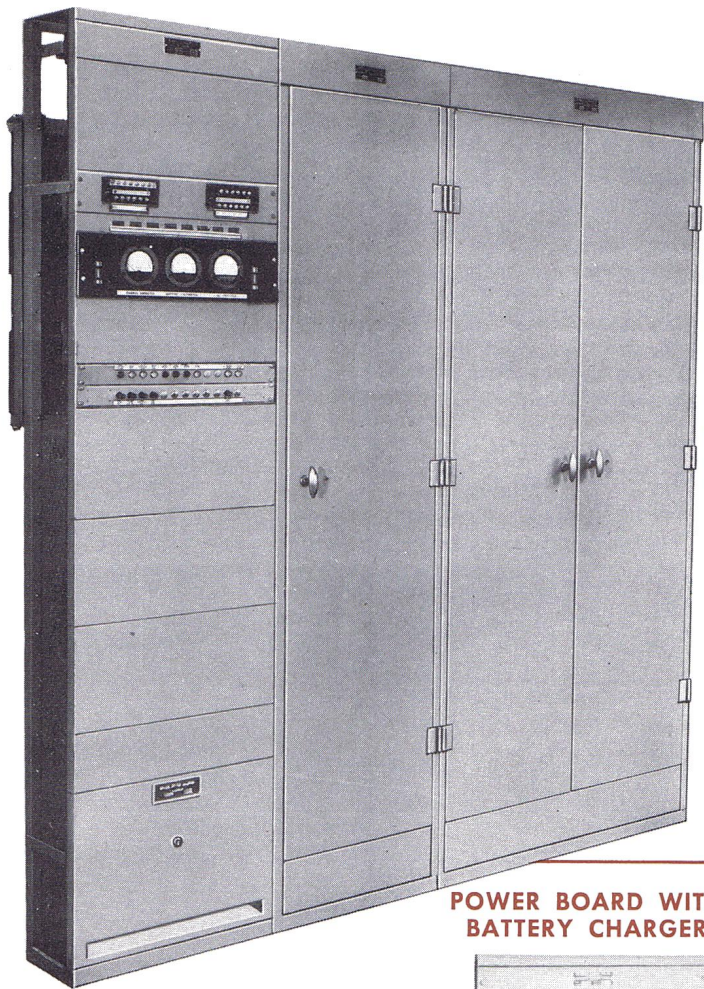
NORTH All-Relay CX 60

In the small automatic telephone system, where demand is not expected to go above 60 lines, and the utmost economy in initial cost is desired, the North CX 60 All-Relay exchange is the eminently practical switchboard. As shown at left, its sixty line capacity is completely and compactly enclosed in steel cabinets, less than six and a half feet over-all, including the power board, complete with battery charger.

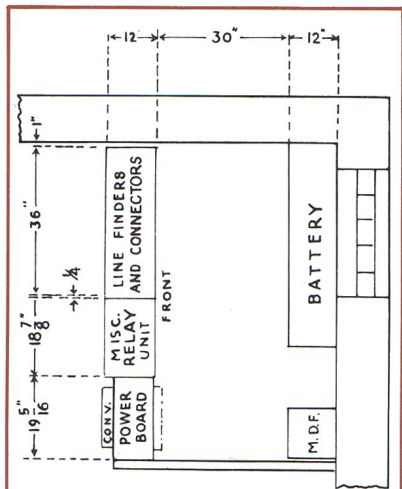
Together with its battery, and main distributing frame, it can be housed in a very small exchange building of low-cost construction. As with any North All-Relay equipment, it is not sensitive to temperature change, thus in all ordinary climates does not call for special heating.

Requiring a minimum amount of maintenance attention, it will operate entirely unattended except for occasional preventive inspection. Thus it is specially well suited to operation as a branch exchange of a modern network. General equipment specifications applicable to this unit will be found on page 8. Shown below is an open view of a typical arrangement of a CX 60, fully equipped.

This board is practical and profitable to operate with any system from ten to sixty lines. It can be easily transferred if outgrown, and always retains an unusually high resale value.

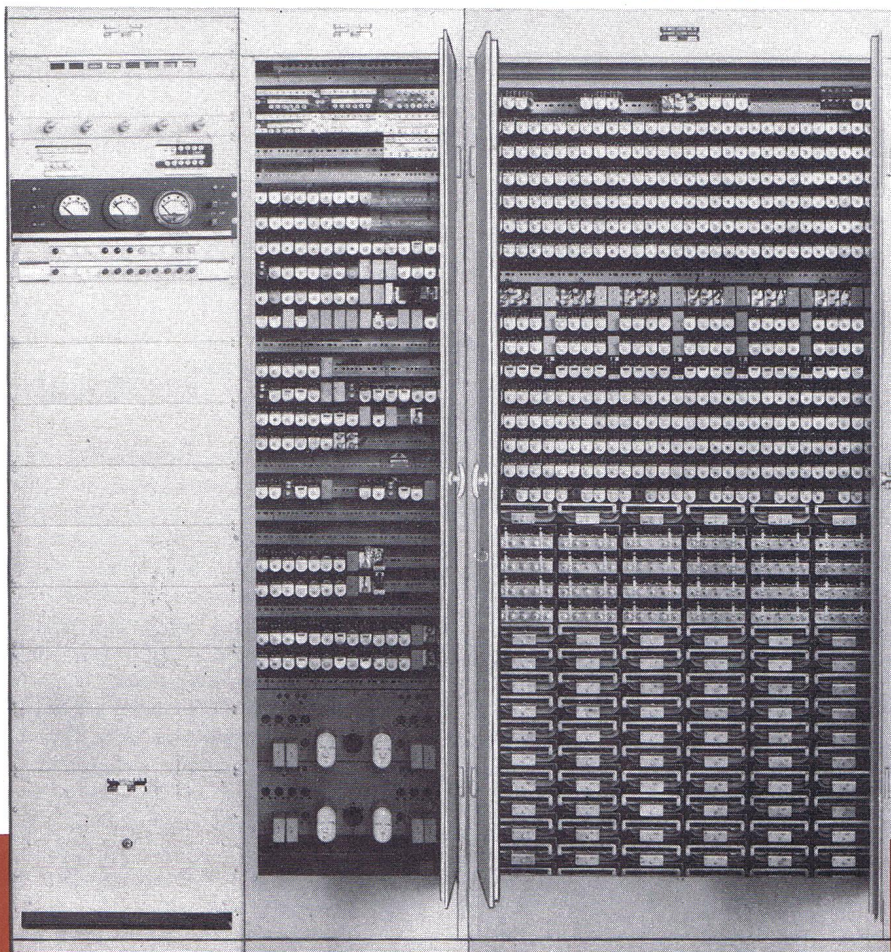


POWER BOARD WITH BATTERY CHARGER MISCELLANEOUS EQUIPMENT LINE FINDERS AND CONNECTORS



A typical floor plan, which has proved to be most economical in floor space, is shown above.

For a trunking diagram of this system, see diagram of the CX 100 on page 12, as they are identical.



NORTH ALL-RELAY CX 60: TYPICAL ARRANGEMENT, COMPLETE CABINETS

The general description of North All-Relay, Pages 2-4 and 17-19 applies to all switchboards on these pages.

NORTH All-Relay CX 30

Designed to serve automatic telephone systems of from ten to thirty lines, the North All-Relay CX 30 is a switchboard complete (except for battery and main frame) within the neat steel cabinets shown at left, (Approximately 55½ inches long). In some installations the MDF is made integral with the power panel for extra compactness.

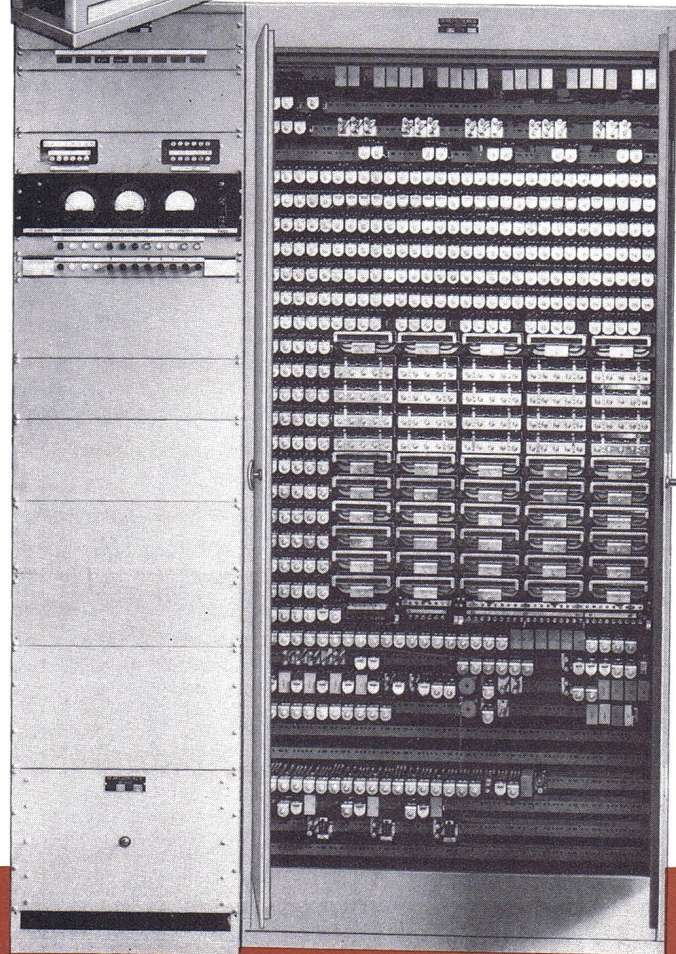
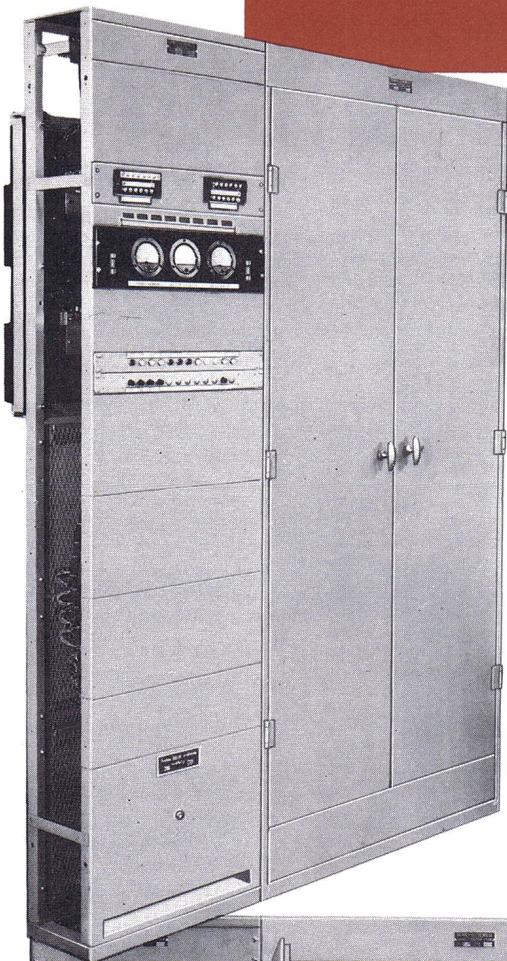
This simple and efficient unit offers the same freedom from high housing cost and the same minimum maintenance requirements as all other North All-Relay systems. Ideal for small communities with fixed maximum ultimate requirements, or as a small branch exchange or concentrating unit in a modern network. Its All-Relay operation and general equipment specifications are the same as other North switchboards shown in these pages, but not primarily designed for expansion beyond thirty lines. These boards are easily moved to new locations if outgrown and retain a high resale value.

NORTH All-Relay CX 10

The utmost in modern automatic telephone service can be brought to really small communities with the All-Relay equipment in the two small cabinets below. Units of this type are serving after years of operation in hundreds of locations where attendance is strictly a part-time matter, but subscriber service and profits are just as essential as in a larger exchange.

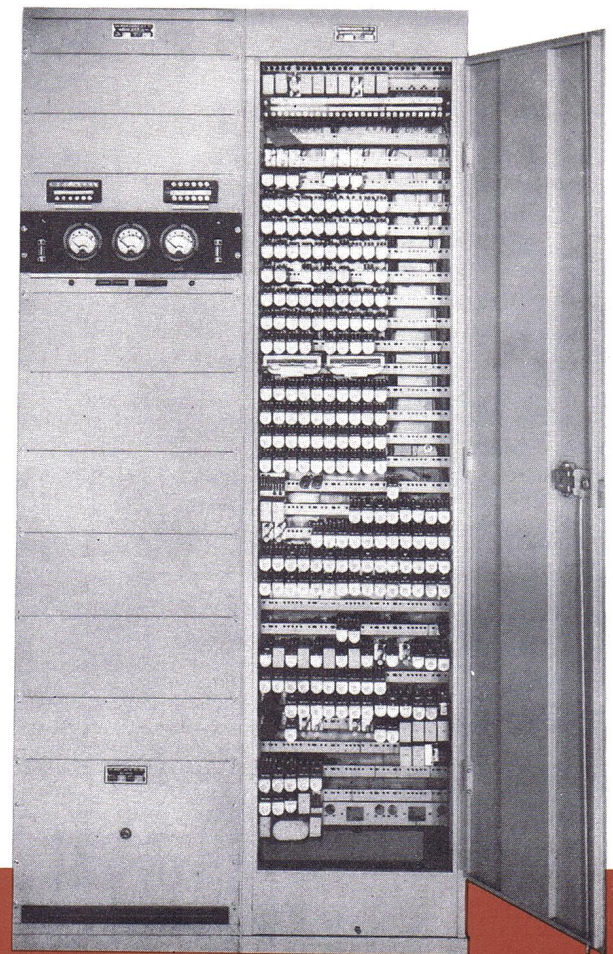
Its operating characteristics, within its limited capacity, are the same as other North switchboards described in these pages. An excellent unit for small outlying branch or concentration unit service. Because of its compactness it can be easily transferred if outgrown by demand, and used to open new outposts for an expanding network. It also has an exceptionally high resale value.

Shown at left is North's CX 30, a complete automatic switchboard for 10 to 30 lines in two compact cabinets. Below, the same unit shown in open view, equipped for 30 lines.



POWER BOARD WITH
BATTERY CHARGER

LINE FINDERS AND
CONNECTORS



POWER BOARD WITH
BATTERY CHARGER

LINE FINDERS AND
CONNECTORS

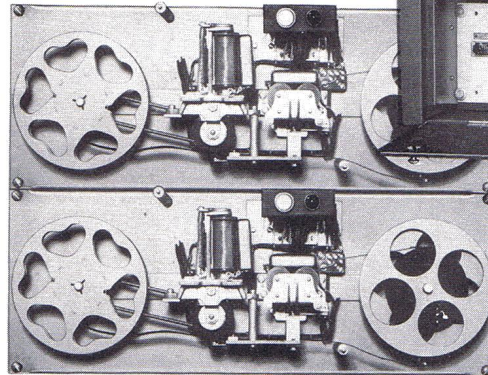
Automatic Toll Billing Records with the NORTH AuTollizer

North's system of automatic station-to-station toll supervision provides a method for reducing overhead on short-haul toll calls by eliminating all personnel supervision and hand work right up to the point of billing. It records toll charges automatically, directly on simple punched tape records, without costly storage circuits and translating equipment. Because of their simplicity and economy the tape recorders are set up one for each trunk.

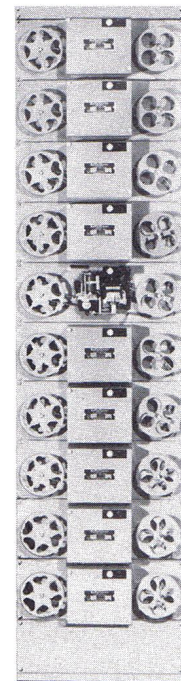
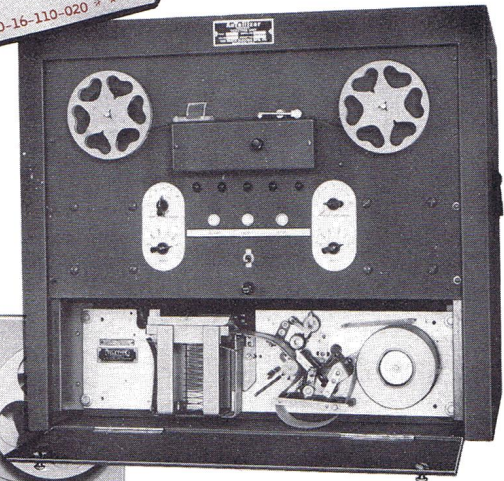
A simple electronic analyzing unit which is portable, but usually located at the billing office, "reads" the tape record, computes the cost and delivers a complete printed toll ticket. This system is vastly simpler than equipment formerly considered necessary to provide an exchange with an entirely automatic toll records, yet it provides all of the information commonly required.

For offices employing standard card punching equipment, the analyzing unit is supplied without the printer. It may be plugged into a card machine and the record placed directly on the cards.

Any office, regardless of size, will find this equipment a cost-cutting link between the toll call and billings to subscribers. Operators are freed from supervision of local toll boards to attend the more profitable long lines work, and a complete modern automatic service is provided for subscribers.

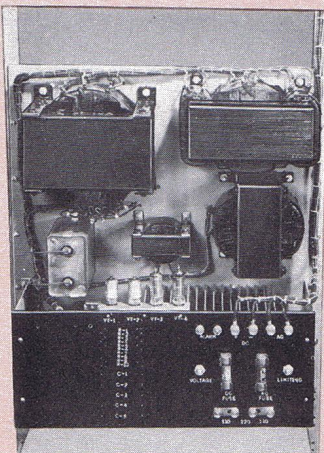


Above at right: North analyzing unit, with Teletype printer, provides complete toll billing information. Above: Simple mechanism of the AuTollizer tape punch recorder, shown without cover.



At right: Typical bank of North AuTollizer recording units. Low in cost, this system provides one for each trunk.

NORTH Battery Chargers ... Electronically Controlled



North battery chargers, with which North All-Relay switchboards are equipped, operate from 110 or 220 volts A.C., delivering regulated D.C. at 51.6 volts to continually float-charge 24-cell lead-acid batteries. Sensitive electronic controls of the latest type, developed in North's Laboratory of Telephony, assure constant battery voltage with full automatic protection against excessive overloads.

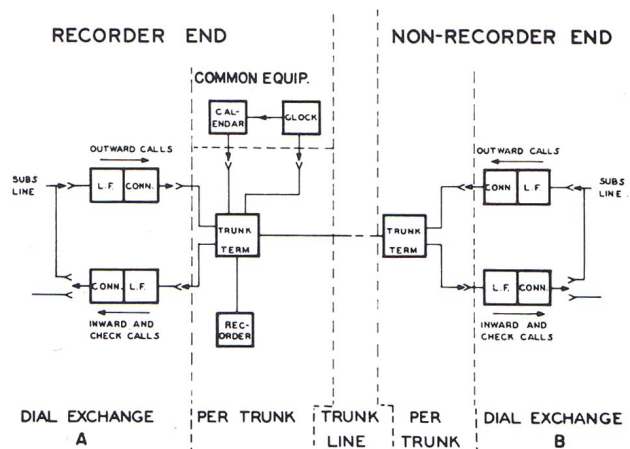
The basis of control is a magnetic reactor with the main power provided by the D.C. charging current and control power regulated by a vacuum tube. A fixed and accurate reference voltage is established with a "Voltage regulator" tube

consisting of two elements in a gas-filled bulb. When current flows between the elements in the form of a gas discharge, the voltage drop remains constant regardless of current value.

The reference voltage is compared to that of the battery under charge. When the battery voltage drops below the reference, the difference in voltage is applied to the grid of the controlling tube, whose plate current is used to regulate and control the output of the charger, and the rate of charge automatically increases. When the reference and battery voltage are in balance the rate of charge is reduced to constant.

A maximum current device is included, so that the charger cannot damage itself by excessive overloads. North chargers are available in a variety of capacities.

Below: Block diagram of typical North AuTollizer System.



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pulse comes from the dial the proper number or its busy signal is reached instantly.

This comparison of speed is cited to clarify the point that in an exchange with a high rate of busy hour calls this saving of finding and connecting time as compared to manual operation represents an important reduction in lost calls and a corresponding improvement in the exchange's "unit call" total, upon which earnings are based.

As a matter of fact, the speed of the relays is such that there is some saving in time even compared to most mechanical systems, due to the fact that no hunting action is involved. The simplest way to trace the operational procedure is to index the important relay groups and consider briefly the functions of each.

All-Relay Line-Finders

In this system all line-finders are accessible to all lines within each hundreds group. The selection of a calling line is accomplished instantaneously by an available line-finder without hunting action.

Guard circuits are provided to prevent double landings. Even distribution of incoming calls among the line-finders equipped is automatically handled by relays arranged in a pre-selection circuit.

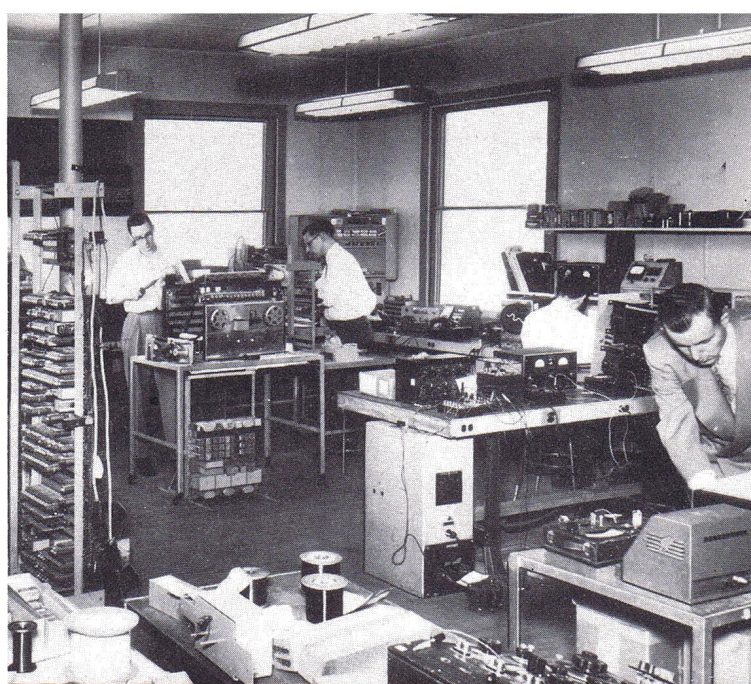
In North exchanges up to 100 lines, each line-finder is permanently mated with a connector. Thus the complete link is in circuit the instant a line-finder is seized. It remains occupied, completely protected against interference from subsequent seizures until the original call is disconnected.

All-Relay Connectors

The simple groups of relays arranged as connectors perform the function of "listening" to the number being sent from the dial at the calling station, by registering the impulses dialed, and counting through to a connection with the called number. No step-by-step hunting action is involved. All of the necessary functions of testing, ringing or signaling a busy line are performed automatically and instantaneously by relays.

All-Relay Selectors

In exchanges with more than 100 lines (except the "Broad-Span" type) the line-finders are associated with relay groups known as selectors, instead of directly with the connectors of the first 100 lines. The purpose of selectors is to distribute calls from the line-finders of one group of 100 lines to the connectors of the 100 group which contains the number being called. Here again the selection is accom-



Here is a corner of one of the test-instrument departments of North's Laboratory of Telephony where research and development are unceasing.

plished instantaneously by simple selection relays, without hunting action.

"Broad-Span" Selection

In North exchanges from 100 to 200 lines an alternate system known as "Broad-Span" may be used. In this arrangement the line-finders are linked with connectors across the board in such a way that the called number is reached in either 100 group without the use of selectors. This system has a price advantage for exchanges not expected to grow beyond 200 lines. Although this is normally assumed to be its ultimate capacity it can be expanded under certain conditions.

Types of Calls Handled

DIALING: North All-Relay boards are designed to be operated by any telephones equipped with standard ten-impulse dials. The contacting speed of the relays is more than adequate for normal dial action and is ideally suited to modern key-set toll sending. Usually metallic subscriber lines are loop dialing. Trunks are equipped for loop or composite dialing. The system may also be used on grounded lines.

Subscriber Service

LOCAL DIAL CALLS: All local calls are made by simply lifting the hand-piece and dialing the directory number of the desired station. Ringing will be instantaneous if the called line is idle and will continue intermittently until answered or abandoned. If the line is busy, a signal will be heard by the calling party.

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TONE SIGNALING: Standard dial, busy and ring back tones are supplied. Special tones are available for pay station, zoned service or other special applications where it is necessary for toll and information assistance.

REVERTING CALL: When a subscriber desires to call a party on the same line the directory number is dialed in the usual manner. The busy tone will be heard when the line is reached, at which time the calling party replaces the receiver, allows time for the called station to be rung before again lifting the receiver to talk.

As soon as the called party answers, the link which selected the line is released, ready for another call. Thus it becomes possible for reverting calls to be carried on simultaneously on all party lines without tying up links in the exchange. Calls by special reverting call number utilizing reverting call selectors are sometimes used in large systems.

LONG DISTANCE, INCOMING: Calls originating at distant offices for subscribers on an All-Relay exchange are made by the distant operator connecting to the automatic trunk circuit and dialing the number wanted. The toll line may terminate at the dial office on a line number, incoming connector or selector as required.

LONG DISTANCE OUTGOING: A directory number (usually a single digit) is assigned to each trunk group to other offices. All modern inter-toll dialing features are supplied. The subscriber dials the long distance number and an operator handles the call, provides supervision and makes the toll ticket.

Any North switchboard can be arranged for subscriber dialing directly to any directory number in any other automatic exchange in the exchange network by providing toll trunks with code numbers for such exchanges. This is accomplished by the use of North AuTollizer equipment for automatic ticketing and eliminates operator handling of this type of toll call. In cutting over an exchange where the existing trunks have been handling toll traffic without "held calls" on a manual basis there may be no immediate need for additional trunks to handle it on a dial-automatic operation. (North's AuTollizer is described on Page 16.)

EXTENDED AREA SERVICE: Subscriber access to other dial exchanges is made in a similar manner to that employed in long distance calls. However, the subscriber dials the complete number without operator assistance or toll accounting.

INFORMATION AND DIAL ASSISTANCE: Operator assistance, information or dialing may be supplied from a local or distant source over special lines or more commonly over toll lines to an attended office.

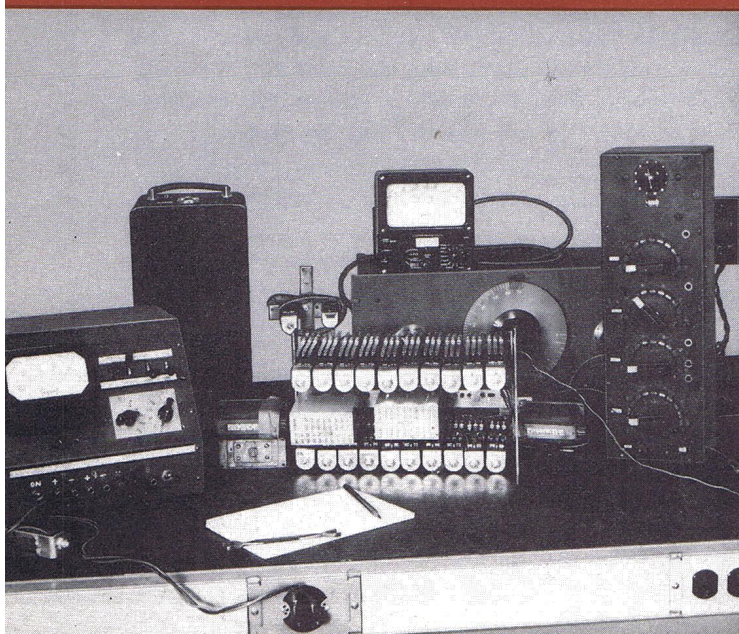
PAY STATIONS: The All-Relay system can be arranged for handling all types of pay station service. Post-pay or semi-post-pay type of service is usually provided for exchanges in small communities and pre-payment types in the larger populated sections.

All-Relay Service Features

LINE LOCK-OUT: Several important advantages are provided for All-Relay offices by the automatic line lock-out, among which are:

1. Automatic locking out of lines which develop direct shorts, or shorts or grounds of low resistance.
2. Automatic locking out of lines on which the receiver is inadvertently left off the hook.
3. Automatic releasing of connections artificially or intentionally established and left to ring indefinitely.
4. Automatic releasing of connections which, after termination of conversation, are maintained by shorts, or imperfect replacing of the receiver.
5. Automatic releasing of reverting call selections established, remaining unanswered, and allowed to ring indefinitely.
6. Automatic restoration to service of all locked-

Count in millions the number of times these relays, sampled from the North switchboard production line, will operate continuously under test in North's laboratory. Just one phase of the constant quality control which stands guard over All-Relay performance in the field.



out lines immediately upon removal of the cause of the lock-out.

TIME DISCONNECT: A "Timed Conversation Disconnect" is available as an optional feature for use in limiting the holding time to a predetermined length (usually 6 to 8 minutes) in exchanges where long conversations are common. This imposes a warning tone on the offending line. If the line is not then released, it will be severed automatically one minute later. This does not apply to toll calls.

PREMATURE IMPULSE CANCELLATION: This feature is a safeguard against wrong numbers resulting from careless handling of the instrument, "jiggling" the hook when removing the receiver, or from swinging shorts on the line.

RINGING EQUIPMENT: North exchanges may be equipped for Code, Harmonic, Decimonic, Synchronic or Superimposed ringing. Ringing of the called line is prompt, automatic and intermittent. The ringing trip is designed to operate instantaneously or during the silent period only, as desired.

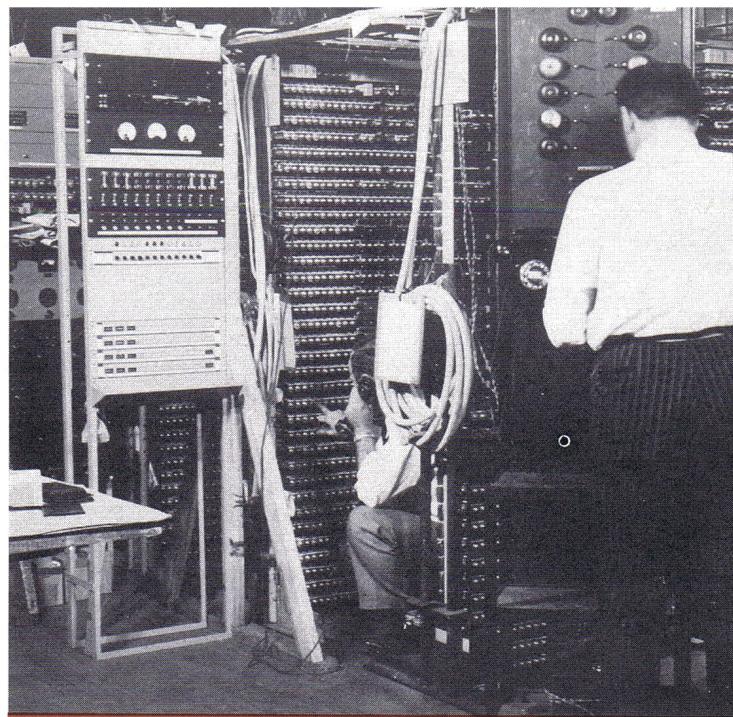
The ringing machines may operate from the D.C. exchange battery or from A.C. current or both, with automatic change-over equipment.

ALARM SENDING EQUIPMENT: Alarm checking and sending relays automatically "report" certain faults to the assistance operator or wire chief as required. Special trunks may be provided to the wire chief.

POWER EQUIPMENT: For ease of installation the power equipment in each North All-Relay Exchange is built into a compact unit designed for mounting at one end of the switchboard or for separate mounting according to local requirements. The power equipment includes the following items of equipment:

- (1) Power Panel Assembly, including metering, fusing, alarms, etc.
- (2) Ringing and Tone Equipment.
- (3) Battery Charger.
- (4) Wire chiefs line testing and metering equipment.
- (5) Main Distributing Frame.
- (6) Main Exchange Battery.
- (7) Battery Rack.

MAIN EXCHANGE BATTERY: The All-Relay system is operated on the common battery principle



With "mockups" such as this, every factory-assembled-and-wired North switchboard is set up and tested in operation before shipping.

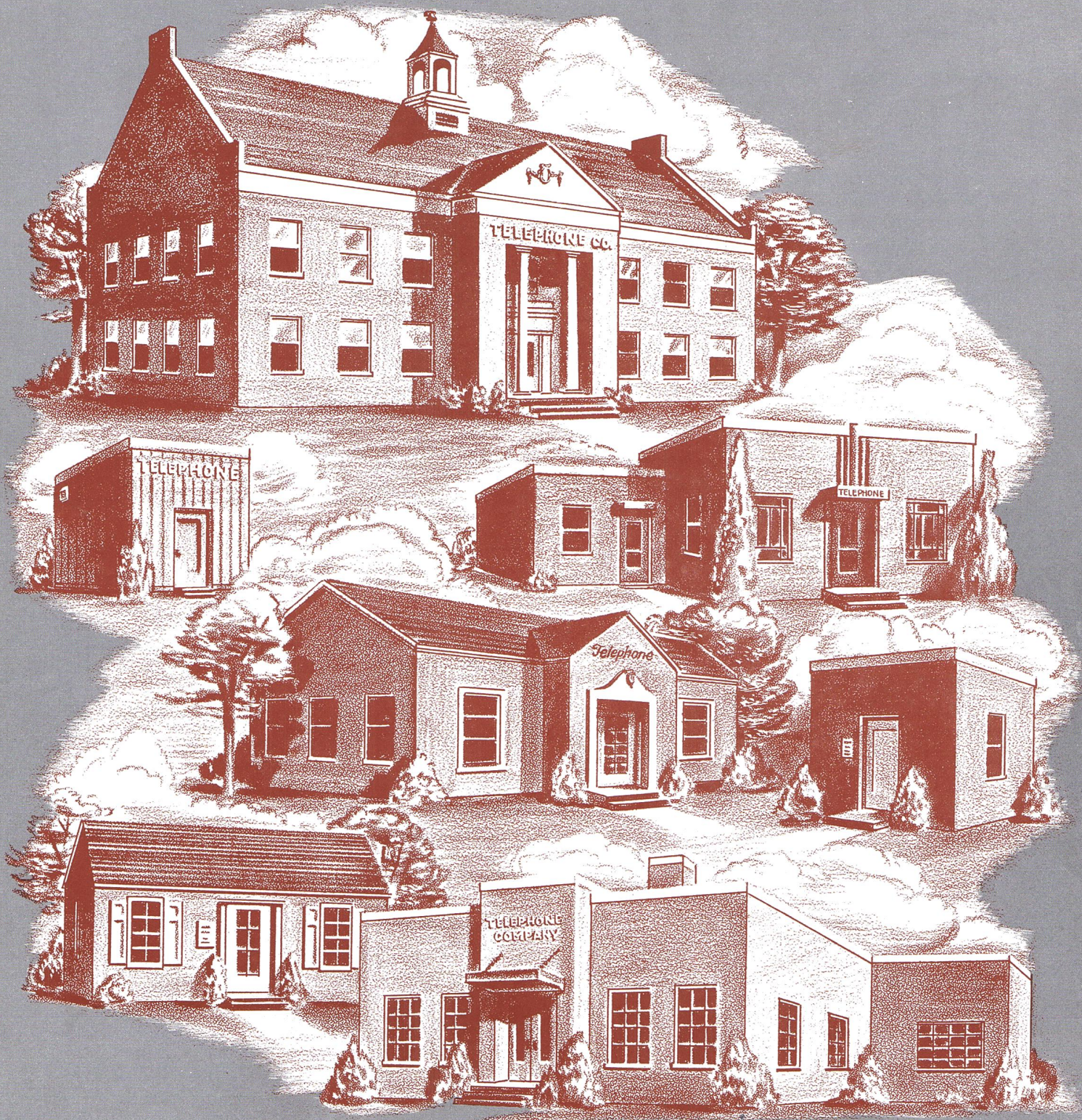
from a set of centrally located storage batteries. Margins of operating safety in this equipment are such that counter or end-cell equipment is not required. This battery consists of an approved make 24-unit "wet-cell" storage battery of adequate ampere-hour capacity to maintain a reasonable reserve in the event of failure of the commercial power.

BATTERY CHARGER: The battery charger usually furnished is a self-regulating selenium dry-plate type designed to reduce battery action to a minimum, thereby eliminating routine battery maintenance and prolonging battery life. It is designed for operation from the commercial current at 110 or 220 volts, 60 cycle, 1 or 3 phase. Capacities as required.

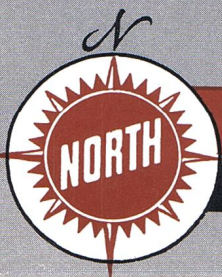
TELEPHONES: The recommended telephones for use with North All-Relay exchanges are those made by the manufacturers of the system—North Telephones (see separate catalog). However, any standard type of common battery telephones with ten-impulse dials also are satisfactory.

Standard dial-equipped pay-station phones either pre-pay or post-pay type are used.

The foregoing paragraphs convey in outline form a general description of the features common to North All-Relay exchanges. In the interest of brevity many details of All-Relay operation have been omitted from this outline. All modern features, especially those designed for maintenance-free service are available. In this North leads the field. For detailed specifications of individual switchboards in sizes from 10 to 10,000 lines, turn to pages 5 to 15.



North All-Relay switchboards operate dependably in remote un-attended cubicles as well as in the sleek corridors of a big exchange.



THE NORTH ELECTRIC MANUFACTURING COMPANY

Originators of ALL RELAY Systems of Automatic Switching

701 South Market Street, Galion, Ohio, U.S.A.

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