Introduction to AUTOMATIC EQUIPMENT *in Rural Exchanges*

The following paragraphs are written as an introduction to the subject of automatic equipment applied to the solution of rural exchange problems. These paragraphs are necessarily general in character, and intended, not as a complete treatise on the subject, but to give the manager of rural telephone areas such a general understanding of the possibilities as to permit him to write for specific information applying directly to his particular problem.

WHY AUTOMATIC?

Automatic equipment is made in many types, all of which aim to provide an economical mechanical substitute for the manually operated system, thereby saving wages and using an enduring piece of mechanism free from labor difficulties, personnel training, or need of heat, light and living quarters.

Among the advantages of automatic equipment are the following:—

1. Instantaneous service, because automatic equipment is unsurpassed in speed.
2. Twenty-four hour service, because automatic equipment is instantly available day or night.
3. Modernized and improved service, better transmission, and increased subscriber satisfaction.
4. Savings effected in operator's wages, light, heat and living quarters.

DEFINITION OF TERMS

The particular problems encountered in small rural exchanges suggest the use of either one of two types of equipment, namely, Remote Control, and Dial-automatic, which terms are here defined to eliminate the possibility of confusion.

Remote Control: This is a semi-automatic type of equipment; i. e., an equipment in which telephone calls cannot be made without the aid of an operator. However, the operator who controls the system may be located in a distant or remote exchange; hence the term Remote Control.

All calls originated at the controlled office must pass over a "Control Trunk" to the controlling operator who, after asking the usual "Number Please," sets this number up in the controlled office by dialling back over the control trunk.

This system has the advantage of using existing magneto telephones without change, nor does it necessitate any changes in the existing station-numbering and code ringing.

These advantages are, however, outweighted in most cases by the necessity of having a nearby exchange at which an operator is available. The service is slower although obtained at the expense of a fairly large investment, and when all is said and done, it is still magneto service. The many miles of exposed control trunk constitute a hazard to the operation of the system, and a bottleneck impeding the steady flow of traffic.

Dial-Automatic: This is a system whose functions are fully automatic, eliminating all operators.

It requires a dial on every subscriber's telephone, and changes the directory numbering and code rings, but the numbers are uniform three-figure or four-figure numbers, and ringing is entirely automatic. The speed of service is greatly increased as, not only can many calls be made simultaneously unhampered by the necessity of waiting for a control trunk and operator, but the system responds instantly at any hour of the day **or night**—it is AUTOMATIC, there are no operators to call, or arouse, or to finish other calls first.

There are no control trunks to expose the system to the hazards of storm and sleet, as it is self-contained and self-operating—a unit in itself. Communication with the outside is established over the regular and existing toll lines to adjacent exchanges, or to the toll center.

An investment in Dial-automatic equipment therefore gives maximum returns. It provides the speediest-known and best service available; it affects maximum savings in operating expense; it is the latest equipment with the lowest factor of obsolescence—therefore the best and safest investment.

TYPE OF EQUIPMENT

Considerable progress has been made in automatic telephone equipment, resulting in the introduction of refinements to simplify the product and its operation, to reduce maintenance requirements to a minimum, and to permit successful operation under adverse conditions of plant and climate.

In line with this, the North Electric Mfg. Company has pioneered in the development of "ALL-RELAY" equipment. This system, hundreds of which are now in service, is composed of relays exclusively, because throughout all the years of operating practice since the invention of the telephone, the relay has proven itself to be one of the most reliable of electrical devices, and this reliability is embodied in the "All-Relay" exchange.

The North Company's relays are based on the simplest of operating principles, are ruggedly constructed of high grade materials, and carefully engineered for their individual function in the circuit. They have but a **single moving member,** the armature which operates on a knife-edge bearing, free from friction, wear, or need of lubrication. Maintenance is thereby eliminated.

The North "All-Relay" system has, built into it, rugged reliability. Its inherent simplicity and freedom from delicate mechanical switches give it wide margins of operating safety unequalled by any other system. These factors of safety ensure continued service under adverse plant conditions, through storms, etc., and permit conversion to automatic operation without immediately rebuilding the outside plant. The economies effected in automatic operation may then be employed to rehabilitate the plant, where necessary.

CONVERSION TO AUTOMATIC

Conversion to "All-Relay" Dial-automatic, and the cost of so doing, may be considered under the following three headings:-

a). The Central Office Equipment.
b). The Outside Lines.
c). The Subscribers' Telephone Sets.

a). **Central Office Equipment.** The existing magneto switchboard and its manual operators are eliminated. In their place an automatic switchboard is installed which requires no operators.

This automatic switchboard is built complete at the factory, housed in a compact steel cabinet, and shipped complete and ready for installation. The line cable is soldered to the switchboard terminals within the cabinet and is of sufficient length to extend to the protector rack or main frame. This reduces installation labor to a minimum and permits installation to be made by the customer without the cost of a factory man.

All power equipment, consisting of the battery, charger, power panel, meters, switches and fuses, is built as a unit and shipped complete either attached to the switchboard or packed separately as desired.

This in-built battery charger is of The North Company's automatic self-regulating type, ensuring constant voltage under varying load conditions—factors indispensable for the correct charging of the battery and eliminating constant supervision and inspection trips.

The battery is furnished separately.

These items comprise the entire central office equipment which can be accommodated in minimum floor space, in the corner of a building, a rural residence or the like, thereby economizing on rent.

Neither heat nor temperature regulating equipment is needed.

The equipment does not require any special protection from lightning or other extraneous currents. Standard main frame practice is recommended, and in most cases the existing frame is re-used.

b). **Outside Lines.** Existing lines can be used, whether grounded or metallic.

North "All-Relay" equipment features wide margins of operating safety which permit it to operate successfully under conditions heretofore believed impossible for automatic systems. It will operate on lines with poor insulation or high resistance, and lines loaded with twenty subscribers. This saves the cost of rebuilding the outside plant initially, and maintains service while accumulating sufficient money out of the savings effected to pay for rehabilitating the lines and replacing instruments one by one.

Metallic lines and grounded lines can be combined in one exchange without deviating from standard operating practice, without complicating the directory, and without investing in expensive line adapter equipment.

c). **Subscribers' Telephones.** As stated above, existing magneto telephones can be re-used, by the simple addition of a dial. Where not already provided, a 1-MF condenser is required in the ringer circuit. The telephone is then ready for use with the North "All-Relay" Dial-automatic system. The crank is no longer needed and should be removed.

From long experience in converting exchanges to "All-Relay" operation, it has been found that the best and most economical plan is to take the surplus instruments in stock, to clean them, install the dial and condenser in the workshop, and possibly re-varnish them for appearance' sake. They are then taken out and installed in the subscribers' premises, and the old sets returned to the shop for similar treatment.

The time required to convert each telephone in the shop varies from 10 to 20 minutes, not counting the time of cleaning and varnishing. The cost of the necessary material is $4.80 per telephone.

When these changes are made on the subscribers' premises, the cranks are left on and the telephones continue to be used on the old magneto manual basis. At the time of the cut-over to automatic service the cranks are removed and the subscribers instructed in obtaining all connections by use of the dial.

AUTOMATIC OPERATION

The method of making calls is simple and speedy, as the system operates on the common battery principle.

1. Consult the directory for the correct number.
2. Lift the receiver from the hook.
3. Dial the complete number as found in the directory.
4. Listen for the ringing tone and for the called subscriber to answer, as his bell will be rung automatic and intermittendly until he answers or until you hang up.
5. If the called line is busy, a busy tone will be heard in the receiver as soon as that line is dialled. Replace the receiver on the hook and call again later.
6. When conversation is terminated simply replace the receiver on the hook. This severs the connection. The system is then ready to make other calls immediately.

EQUIPMENT COST

The cost of the automatic central office equipment depends upon a number of variable items, and can only be given when details of local requirements are furnished. Question blanks are provided for this purpose, and estimates can be obtained without any obligation to purchase.

As a guide in using these forms it should be remembered that it is desirable to reduce to the very minimum the number of active lines to be installed on an automatic basis. This is done by regrading subscribers on the party lines as much as possible. Such practice is warranted by the greatly improved quality of automatic service, which makes it possible to regrade a number of the existing one-party line subscribers on a two or four party line basis, without changing the rate. This results in reducing the number of automatic lines required, and therefore in keeping the capital investment down to a minimum.

SWITCHBOARD SIZES

North "All-Relay" exchanges are available in all sizes from 10 lines to 10,000 lines, and multiples thereof.

THERE IS AN "ALL-RELAY" EXCHANGE FOR EVERY PURPOSE AND FIELD CONDITION.

The sizes most adaptable to rural exchange areas are as follows:

STANDARD HOUSING

CX- 20 — 20 lines capacity, ultimate.
CX- 30 — 30 lines capacity, ultimate.
CX- 60 — 60 lines capacity, ultimate.
CX-100 — 100 lines capacity, expansible.

POLE MOUNTED EXCHANGES

PCX-20 — 20 lines capacity, mounted on one pole.
PCX-30 — 30 lines capacity, mounted on H pole structure.

These various capacities are able to meet any situation by providing, not only the number of existing working lines, but also a comfortable margin for possible future expansion.

TOLL AND LONG DISTANCE

As has been explained previously, the "All-Relay" exchange eliminates the need of local operators, and the subscribers obtain their calls by dialing one another.

However, Toll and Long Distance still require the services of an operator.

On small exchanges it is not economical to retain an operator or force of operators for Toll and Long Distance alone, and arrangements must be made to provide these services at a nearby exchange.

NETWORK EXCHANGES

When the telephone company owns a number of exchanges, it is to be expected that there will be a company-owned exchange in the near vicinity of the exchange to be converted to automatic. This nearby exchange is then made the toll center for traffic to and from the converted exchange.

Subscribers on the automatic exchange reach the toll point by dialling "O". This signals the operator at the toll point, who makes out the ticket and completes the call in the regular manner.

Calls to the automatic exchange are routed through the toll point, where the operator plugs into the outgoing trunk to the automatic exchange and dials the required number in the same manner as local calls are made.

ISOLATED EXCHANGES

When the telephone company owns a single exchange only, or an isolated exchange, the toll lines therefrom all terminate on the switchboards of other companies.

In such an event arrangements must be made with these connecting companies for the handling of toll and long distance as described above.

Many North"All-Relay" installations are operating under an arrangement whereby the connecting company, such as the Northwestern Bell Telephone Company, owns the toll points and lines, handles and tickets all outward traffic, and does this **without decreasing** the amount of commission and toll revenue paid to the indenpendent company.

IMPORTANT

It is imperative that the toll situation be investigated in the light of the above before time and money are spent on obtaining estimates of conversion cost, as everything depends upon a satisfactory access to Long Distance lines.