The Ericsson Bulletin

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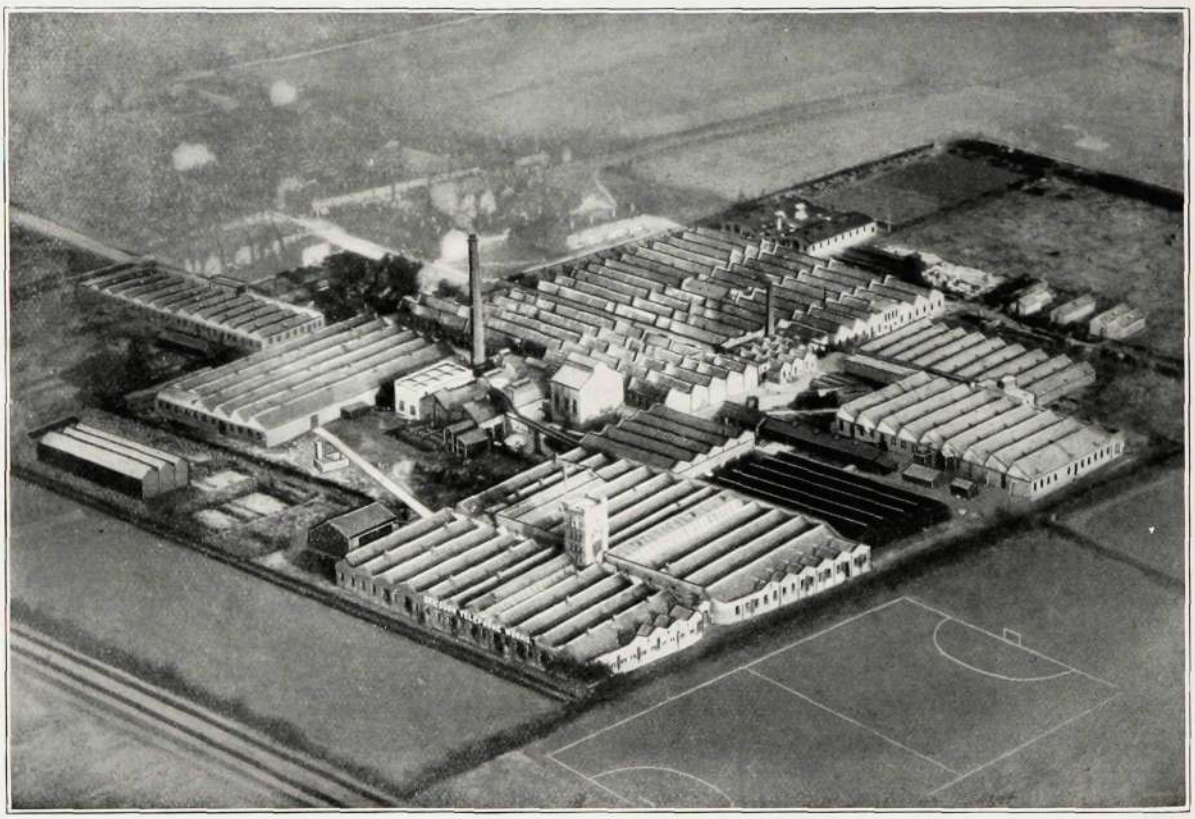


Aerial View of the Works, Beeston, Nottingham

Ericsson Telephone Works

Ericsson Telephone Works—Switchboard Plug Moulding and Finishing Department

HE manufacture of moulded switchboard plugs was described and illustrated in the previous issue of the Bulletin. Above is an illustration showing the layout of the department where these plugs are made. On the right hand bench are the electric ovens where the moulds are heated until the insulating material becomes plastic, the correct temperature being controlled by means of a metal which melts when the insulation is at the correct consistency for moulding.

The ovens are of the straight-through type so that the operators, on the row of presses in front, can readily remove the moulds which when ready are placed in the presses where the insulating material is forced into all cavities. In order to cool the moulds to a handling temperature, after the moulding operation is completed, the presses are equipped to circulate water which also passes through ducts arranged in each mould.

The sequence of operations on the presses necessitates four presses per operator.

On the centre bench the surplus insulation is removed from the plugs and the tips are firmly rivetted up. The plugs are then passed to the machining section on the left of the picture where they are carefully turned to the correct profile, each plug being tested with gauges to maintain the close tolerances set for this class of work.

At the far end of the finishing bench on the left may be seen the high voltage testing cabinet.

From Tree to Telephone

THE supremacy of timber as one of the main materials used in the manufacture of telephone exchange equipment and instruments has been seriously challenged during the last few years. Automatic apparatus, housed in steel framework, and moulded synthetic resin products have become the greatest rivals to the familiar switchboards and wooden instruments.

Nevertheless, as a visit to our Cabinet Factory would show, wood still plays a very important part. It has many desirable advantages which retain it in high favour, apart from the general appeal of well finished cabinet work. There are practically no limits to size and shape as in the case of mouldings. Ability to withstand severe usage, ease of repair and the wide varieties of instruments which may be obtained at low cost to please individual taste and requirements are points which in themselves will no doubt ensure the continuation of woodwork in the telephone industry. Even in the case of apparatus of uniform design, monotony is relieved by ever differing markings of the grain and the depths of colour.

The cabinet maker has many types and sources of timber from which to choose. A short description of the most important in telephone manufacture will doubtless be of interest.

Mahogany.

This is by far the most largely used wood for exchange and subscribers' apparatus, and it is specified extensively by the British Post Office. It possesses uniformity of grain and texture, may readily be machined and has good hardness and strength. Supplies are obtained from several parts of the British Empire. The West Coast of Africa exports large quantities, Lagos and Benin being sources of the most favoured varieties. The trees grow to very large dimensions, many of the logs received in this country being four feet square and twenty feet long. These logs are hewn square by natives who are experts with the axe. Although shaped by hand, large logs will not vary more than, say one half inch in width over the whole length.

Timber Arriving at the Works
Drying Sheds which also contain the Seasoning Kilns are in the background

Cutting into boards is usually left to be carried out in this country as the Coast arrangements are somewhat primitive and large modern machines as used here are not generally available.

Mahogany of very fine quality has been imported from British Honduras for over two hundred years. Close grained, stable and uniform in colour, this wood is used for large exchange and other switchboards. The industry is now becoming highly developed and supplies are accurately graded. On an average, over 10 million feet per annum are exported by British Honduras to various parts of the world.

Mahogany is used also for the manufacture of telephones, bell cases, mounting boards, and desks. A fine example of workmanship in this wood may be seen in the Ericsson loudspeaking intercommunication master set, which is excellent in design and finish. (Bulletin No. 3, page 14).

Teak.

This wood is dark in colour when seasoned, is heavy, strong and has an oily appearance. Being immune from insect attack, it is a very important material for the manufacture of equipment for use in tropical countries. Portable sets and mining switchboards exposed to damp or outside conditions give excellent service when constructed from teak.

Again many sources of supply are available, but the best known and most used for telephone work is British Burma from the Port of Rangoon. The timber is shipped both in the log form and as sawn boards and is usually partly seasoned. There are extensive forests of teak in Burma and the work is carried out by natives under expert supervision. For haulage or transport, elephant power is used and these animals are specially trained for the work. Naturally they are greatly valued by the owners and may cost between £600 and £700 each.

Teak is rather more difficult to machine than the average wood. Joints are not readily secured by glue owing to the oily surface, so that additional strength is obtained by the use of non-ferrous screws. Finishing also presents certain difficulties although if precautions are observed, the usual types of varnishes may be applied. The most serviceable method is finally to wax polish the surface, and this process is specified by many Colonial Authorities, particularly where equipment must withstand severe use and be maintained by partly skilled native operators.

Oak.

A comparatively limited amount of this timber is used for telephone work, although it is one of the few hardwoods of which supplies grown in this Country may be obtained. Canada, Africa and India also export various types of oak.

The timber, when quarter sawn, usually shows a very attractive figuring and is much prized on account of this, apart from its hardness and strength. This class of timber is chosen by many railway companies because it will withstand very hard service and unlike mahogany it is difficult to mark.

Hard Whitewoods.

In this class we find beech, maple and ash as the woods used for the miscellaneous parts where fineness of grain and strength are of prime importance. Ladders for exchanges, jack spacers, fanning strips, terminal boards and blocks of many types are suited ideally by these timbers. They

are capable of being machined to a smooth finish and when drilled give clean and sharp edges.

Mention might also be made of pearwood which is noted for its fine turning properties and its high electrical insulation. This wood holds a small amount of moisture and is suitable for terminal mountings exposed to damp conditions.

Soft Woods.

Parts such as battery boxes, and rear doors of switchboards which are not seen when in service are naturally made from the less expensive woods. Columbian pine and other Canadian products of similar type are used extensively for these purposes.

Much is being done and remains to be done in the development of Empire timbers. The British Post Office has given every encouragement to the use of lesser known types. Names such as chuglam, pyinma, haldu and Tasmanian myrtle are unfamiliar though attractive woods of the mahogany type and are worthy of more extensive use. Australian and New Zealand woods of various kinds are now establishing themselves in our markets and there is no doubt that as methods of production, grading and distribution are developed, their use will be extended considerably. With present-day manufacturing conditions it is, of course, essential that supplies are available in this country at short notice.

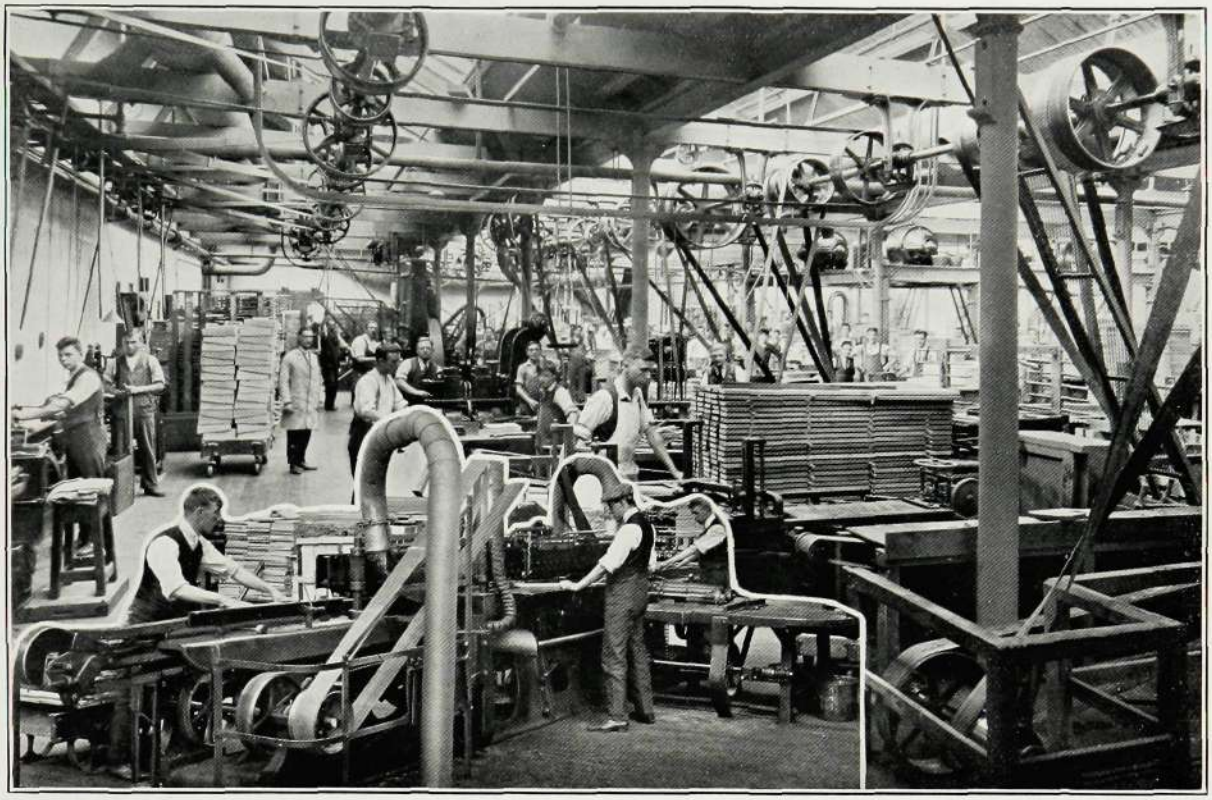
Seasoning of Timber.

This is the first and most important treatment which the wood receives before being machined and assembled. Seasoning does not, of course, mean simply the drying of the material. The actual object of the process is to adjust accurately the moisture content of the wood to the amount which is retained under normal atmospheric conditions. At the same time the operations must be carried out under conditions that will not strain or otherwise damage the structure of the fibres. The efficiency with which the seasoning is carried out determines to a large extent the stability of the finished cabinet work and its freedom from warping, shrinkage or expansion. Certain grades of timber are more sensitive than others, and even the direction of sawing the original log has a marked effect on the tendency to warp.

Most woods in service in factories, offices or homes are found to take up a definite amount of moisture. This is usually 9% to 11% by weight and the figure varies but little from season to season. Decided changes may occur in the volume of timber, dimensions increasing or decreasing with corresponding variations in the water percentage. For example, wood containing 15% moisture would shrink when put into service, while if the figure were 6% when manufactured the finished parts would expand when the moisture increased to its normal figure.

Modern requirements rarely permit the natural seasoning of timber. The wood in this case is simply stacked so that air has access to the whole of the surfaces and the moisture gradually adjusts itself to normal conditions. The much more rapid kiln-drying is generally employed for factories where time is limited. Contrary to certain beliefs, excellent results are obtained, equal to or even better than those given by the natural process.

Each stage of the seasoning is carried out under careful control at our Beeston factory. As soon as the timber is received, a test is made to determine the moisture content which may be as high as 50% of the total



The Machining Section of the Cabinet Making Department with the Special Jointing Machine Inset

weight—usually, however, the amount is about 25%. These figures give an indication of the time which will be needed before the material is ready for use.

The latest type of drying kiln is used by the Ericsson Company. The timber for seasoning is first loaded on to steel trucks, suitable spacing strips being inserted between the boards to permit free circulation of air. A number of representative boards are selected and from each of the ends test pieces are cut and accurately measured for moisture content. From this result is calculated the weight that the boards will possess when containing the desired 9% of moisture. By regularly weighing these pieces and by reference to a graph, the progress of the timber while being seasoned may be constantly observed. After loading the trucks are hauled into the kiln which is then sealed.

The actual adjustment of the moisture content is carried out by an efficient apparatus for circulating a uniform mixture of air and steam. The proportions may be varied to give the desired temperatures and humidity. On the sides of the kiln, travelling baffles are fitted and these direct the stream of vapour through the individual spaces between the boards. When the bottom of the stack is reached, the flow is reversed, so that the air and steam passes in the opposite direction. This procedure gives very uniform results, each sequence occupying about one minute.

No attempt is made to commence drying the timber immediately as this would tend to seal the surface, resulting in a dry exterior

The Sanding and Fitting-up Section of the Cabinet Making Department

with a wet centre. The kiln is first saturated with steam, and air is not introduced until the temperature is raised to the desired degree. As air is gradually introduced, the percentage of humidity and the temperature are consequently lowered. Drying commences gradually at this stage and the test pieces are weighed daily until the wood contains the desired moisture content. A final short period of steaming to relieve strains in the boards completes the process. After cooling, check tests are made on boards selected at random, and the timber is then ready for machining.

The whole time occupied by the seasoning is from ten to twenty days, depending upon the original moisture content, the thickness and the type of timber. The tests already described are supplemented by practical cutting trials which ensure that the boards are free from strain.

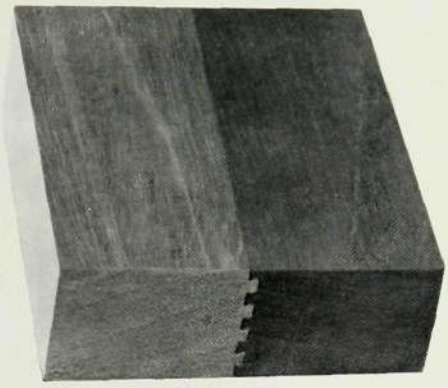
The high temperatures attained during kiln seasoning effectively kill any grubs or larvæ which may be hidden away. This advantage is of considerable importance as naturally seasoned timber may give trouble in this respect.

Cabinet-making.

A wide range of machines is necessary for the manufacture of telephone equipment from wood. Our Beeston factory is equipped with modern and efficient tools which produce a wide variety of work. Large quantities of parts are also provided for the wireless and other electrical industries, a high standard of workmanship and finish being maintained.

The boards are first cut to the required lengths and then issued to the cabinet shop for the various processes of manufacture. As a typical example of the numerous operations which the wood undergoes, we may follow the progress of a switchboard.

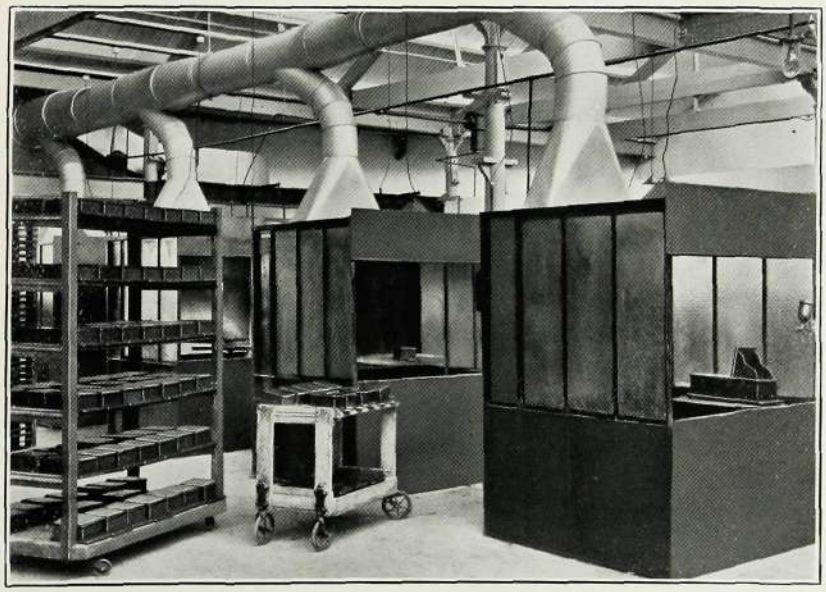
Firstly, the material is carefully examined, being graded so that the colour and type of grain on the completed work will match to give a natural appearance. This needs judgment coupled with experience and has no small bearing on the final effect obtained.



An example of the fine and accurate work produced on the Special Jointing Machine

The boards then pass through a series of machines, and as it is rarely possible to obtain sound timber of adequate width they are joined together by an ingenious jointing machine. This is a caterpillar-like device which automatically carries out the whole process. On being fed into the machine simultaneously at both ends, the boards are propelled towards the centre of the bed plate where they are joined in pairs. Before they reach each other, dove-tail shaped grooves are cut into the edges along their whole length. These faces are then coated with a thin layer of glue and eventually are fitted together by sliding, board to board. As a matter of fact, the machining is so accurate that the pieces of wood are secured firmly even without the joint being made permanent by glue. This process is found to be practically the only one which gives trouble-free results on equipment used in tropical countries.

After careful inspection, the boards pass through the flattening and planing machines which are fitted with high speed rotary steel cutters. These produce a smooth level surface and the material now has an attractive appearance as the true character of the wood is revealed. Next comes the process which adjusts the width to within the required limits, followed by a sand-papering operation which is carried out by passing the boards between revolving steel cylinders fitted with the abrasive material.



A Section of the Finishing Department for Small Cases and Parts

Not until these stages are passed does the switchboard commence to assume a really discernable form. Bandsaws, aided by guides in the form of templates, produce uniform curves for the sides. Moulding machines with shaped rotary cutters prepare the neatly designed ornamental rails. Joints for fitting the parts together are prepared on mortice and tenon machines, while complicated recesses are produced by an interesting machine

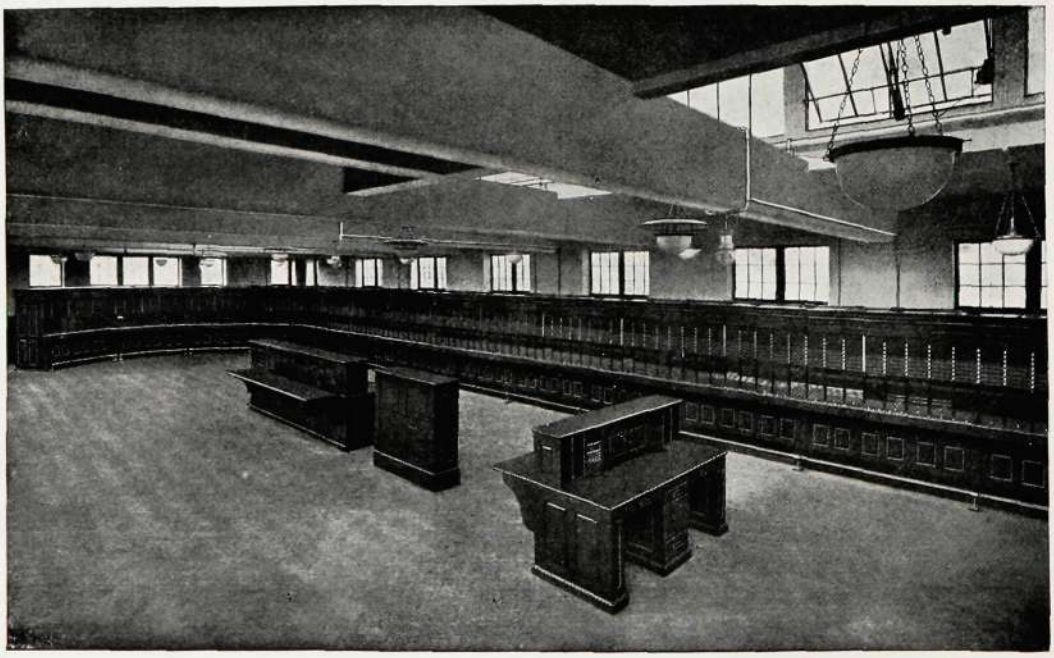
where the cutting is performed by means of an eccentric drill revolving at a very high speed.

Preparations are made on drilling machines for the fitting and housing of the actual telephone apparatus, and the parts are then ready for fitting up. Accurate machining facilitates this process and before long the switchboards are ready for hand sand-papering and final inspection.

Lastly, the products are placed in the hands of the finishing department where high grade cellulose finishes, applied by spray, soon transform the appearance of the woodwork. The methods used in this department have been described in a previous issue of the "Ericsson Bulletin." The wood cases are then ready to be fitted up with apparatus and wired as complete switchboards.

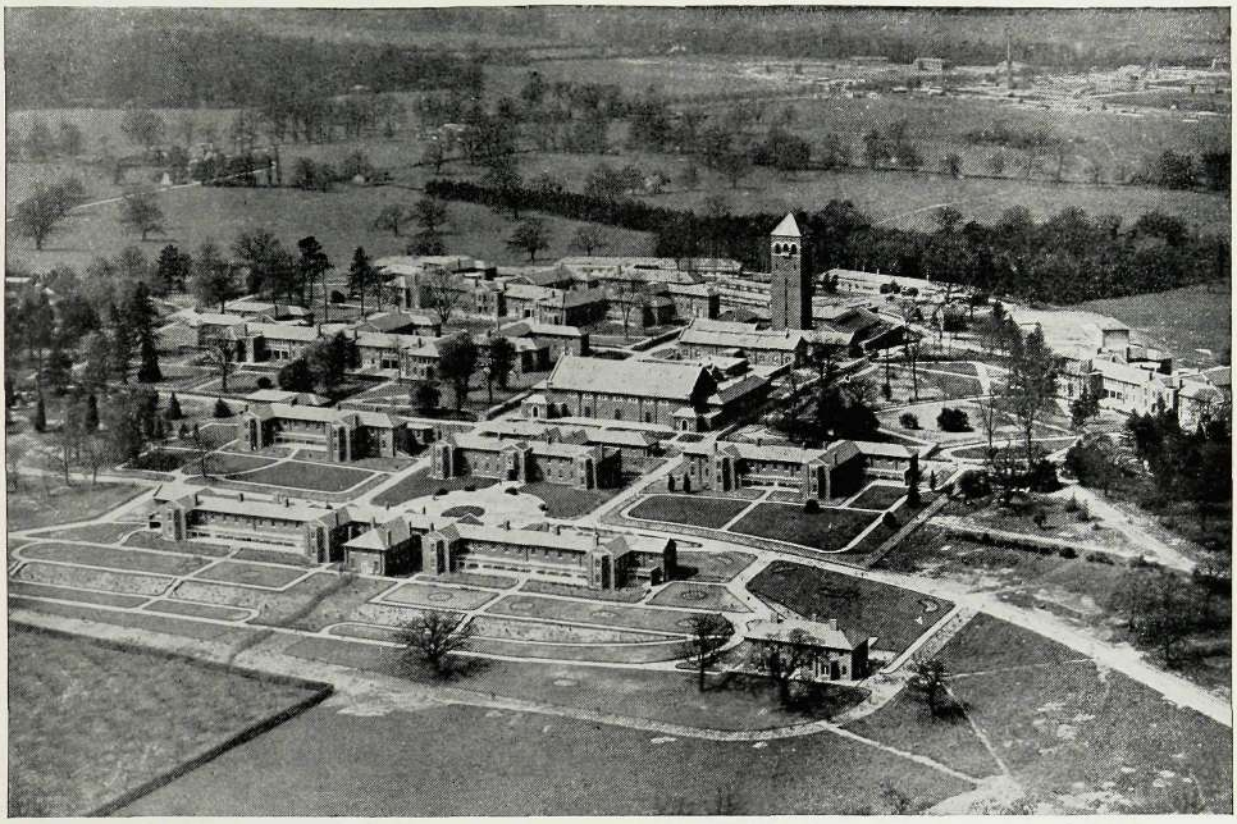
A few examples of Ericsson Telephones, Switches, and Small Switchboards in a Variety of Woods

It will be seen that experience and equipment enable the Ericsson Company to produce a wide range of cabinet work of superior quality, and the highest satisfaction in service is assured by the care taken at every stage.



An Exchange Switchboard and Desks in Honduras Mahogany

Middlesex County Hospital, Shenley.



An aerial view of the Middlesex County Hospital, at Shenley, Hertfordshire.

ON May 31st of this year, His Majesty the King accompanied by the Queen inspected and formally opened the newly-erected Middlesex County Council Mental Hospital at Shenley, Hertfordshire, an aerial view of which is above.

The layout, furnishing and scientific equipment makes this magnificent new hospital the most up-to-date institution of its kind in the Country. Erected at the cost of over half-a-million pounds, the buildings, together with extensive grounds, cover 500 acres. The site is 420 feet above sea-level and is located in the midst of beautiful rural surroundings.

It may be of interest to mention that the whole contract was completed within twenty-two months and that it involved the laying of thirteen million bricks, two miles of reinforced concrete subways, over nine acres of suspended concrete floors and roofs, thirty-seven thousand super yards of reinforced concrete roads, and seven and a half acres of reinforced concrete pavements and areas together with the excavation of fifty thousand cubic yards of earth. The general contractors were Messrs. John

Laing & Son, Ltd., and the Architect, W. T. Curtis, Esq., F.R.I.B.A.

The hospital has accommodation for two thousand patients and five hundred staff, and apart from the main buildings it is laid out on the "villa" system, with small nursing units each housing from twenty to forty-five patients. The units are more or less self-contained with wards, dining and day rooms, sun galleries, duty rooms, clinics, stores, ward kitchens, and electric service lifts. This arrangement allows a careful grading of patients.

The administrative buildings, kitchen, stores, boiler house, water tower and laundry are arranged on a central north and south axis, the infirmaries and convalescent villas for male and female patients being situated on the east and west sides respectively. The accommodation for nurses, doctors and general staff is somewhat removed from the general scheme. All the buildings are connected by sub-ways conveying heating, water, electric light, and other services from the central portion of the layout. In the patients' quarters an approach to communal comfort has been the first consideration, the element of strangeness being eliminated as far as possible.

A notable feature is the magnificent recreation hall, with seating accommodation for one thousand people, a fully-appointed stage, and an operating box for the projection of talking pictures. The seats are designed so that they are easily removed for storage in the space underneath the stage, enabling the hall to be used for dancing or social functions. Adjacent is a very fine club room with servery recess in direct contact with the main central kitchen, and it is here that visitors may meet the inmates on visiting days.

In the enormous kitchens, with their modern labour-saving equipment, meals can be cooked for two thousand five hundred people at one time by means of steam and electricity. In the proximity of the central kitchen provision has been made for cold storage with separate refrigeration rooms for milk, fish, etc.; steward's stores; a central boiler house block incorporating an all-electric bakery equipped to do any type of baking required; and a large laundry capable of dealing efficiently with forty thousand articles per week.

The nurses' home is completely self-contained and has its own electrically-controlled kitchen.

The water tower, rising from the group of buildings which represent the power centre of the whole hospital, forms the central feature of the scheme. It is one hundred and forty feet high and dominates the surrounding buildings and district. It accommodates a storage of seventy-five thousand gallons of both hard and soft water which is pumped from the storage reservoirs, some three hundred yards away, for distribution to all buildings. The reservoirs, with which is incorporated a water treatment plant, receive their supply by pumping from a well.

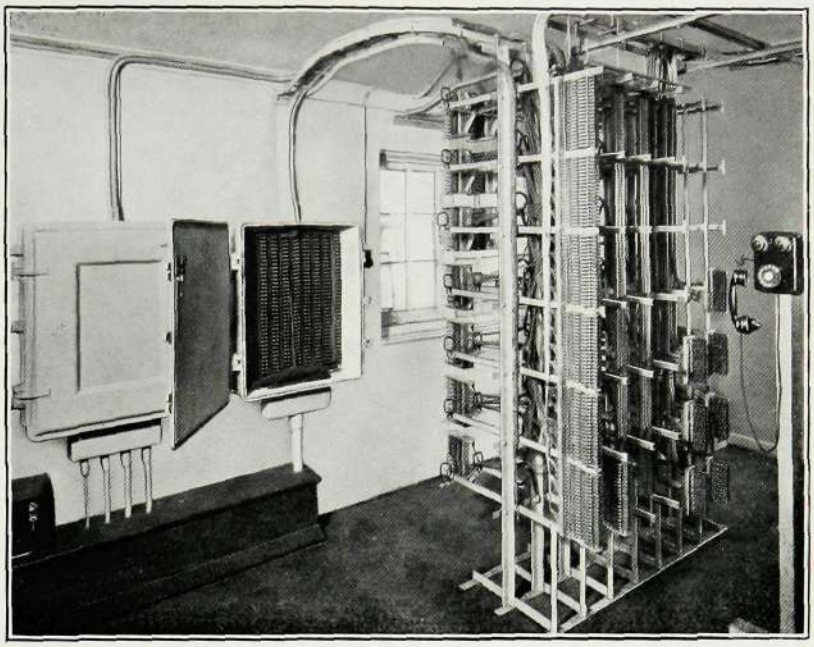
The heating is a low pressure hot water accelerated system, distributed to surface heat panels, which form the dadoes in the hospital buildings, and are almost entirely unnoticeable.

Patients can find a suitable outlet for their constructive abilities in the occupational buildings which are fitted up to allow various trades and crafts to be pursued.

Abundant provision has also been made for recreation, as, in addition to the large

entertainment hall, special facilities are provided for participating in outdoor games such as cricket, football, hockey and tennis. A "rediffusion" wireless service, with the main set located in the hospital itself, is also provided in all the main rooms.

Before concluding this brief outline of the appointments in this modern institution, one cannot but mention the beautiful gardens which are interspersed over the whole plan and add to the surroundings that touch of beauty and peace which is so restful and curative.



Test Boxes and the combined Main and Intermediate Distributing Frame

It will be realised from the foregoing that every aid to efficiency has been employed in the equipment of this hospital, but it would naturally be incomplete without an equally up-to-date communication system. In order therefore to ensure the highest grade of telephone equipment, the Middlesex County Council entrusted the Ericsson Company with the entire arrangement to manufacture, provide and install a private automatic exchange, lines and instruments which would best meet the telephone requirements. The whole of the installation work on site was carried out by the Company's installation staffs, and some idea of the magnitude of this work will be appreciated when it is realised that the total weight of cable was eighteen and a half tons, and consisted of ten miles of internal twin lead covered cable, multiple paper insulated lead covered cable laid in ducts, and multiple lead covered armoured and jute served cable laid direct in the ground. If the separate twins were laid end to end the total length used on site would be one hundred and fifty miles.

The paper insulated multiple cables are terminated in cast iron test boxes with wiped joints at the entrance glands. The total number of soldered connections made at the test boxes and on the line side of the main frame amounted to approximately twelve thousand five hundred. A feature of the internal wiring of the various buildings is the inconspicuous way in which the wiring has been executed; great care and discretion were used in determining the location of the numerous runs.

Regarding the exchange equipment, the site allotted will accommodate a maximum of four hundred lines although the initial requirements are only one hundred and forty lines. The initial switching equipment provides for a maximum of fifteen simultaneous conversations.

Two 100-line units are fitted and the system is extendible by means of additional units to a maximum of one thousand lines. A view of these units together with the power board is illustrated.

A three-digit numbering scheme is employed. The apparatus utilized conforms to British Post Office standards and comprises fifty-point rotary line switches as line finders, and two-motion switches of the heavy duty 100-outlet type as group and final selectors. Relays with twin gold-silver contacts have been used throughout in order to cut down to a minimum the troubles which might arise from dust.

The apparatus racks consist of complete units for serving one hundred lines, and accommodate the line and switching equipment together with the necessary alarms; they are of the single sided, open type.

A combined main and intermediate distribution frame is fitted, thus providing a central terminating point for incoming cables and also a means of protecting the exchange apparatus. This frame is shown in the illustration together with the jointing boxes.

Standard British Post Office tones are given, and there is a comprehensive alarm scheme which can be extended as desired to a position remote from the exchange.

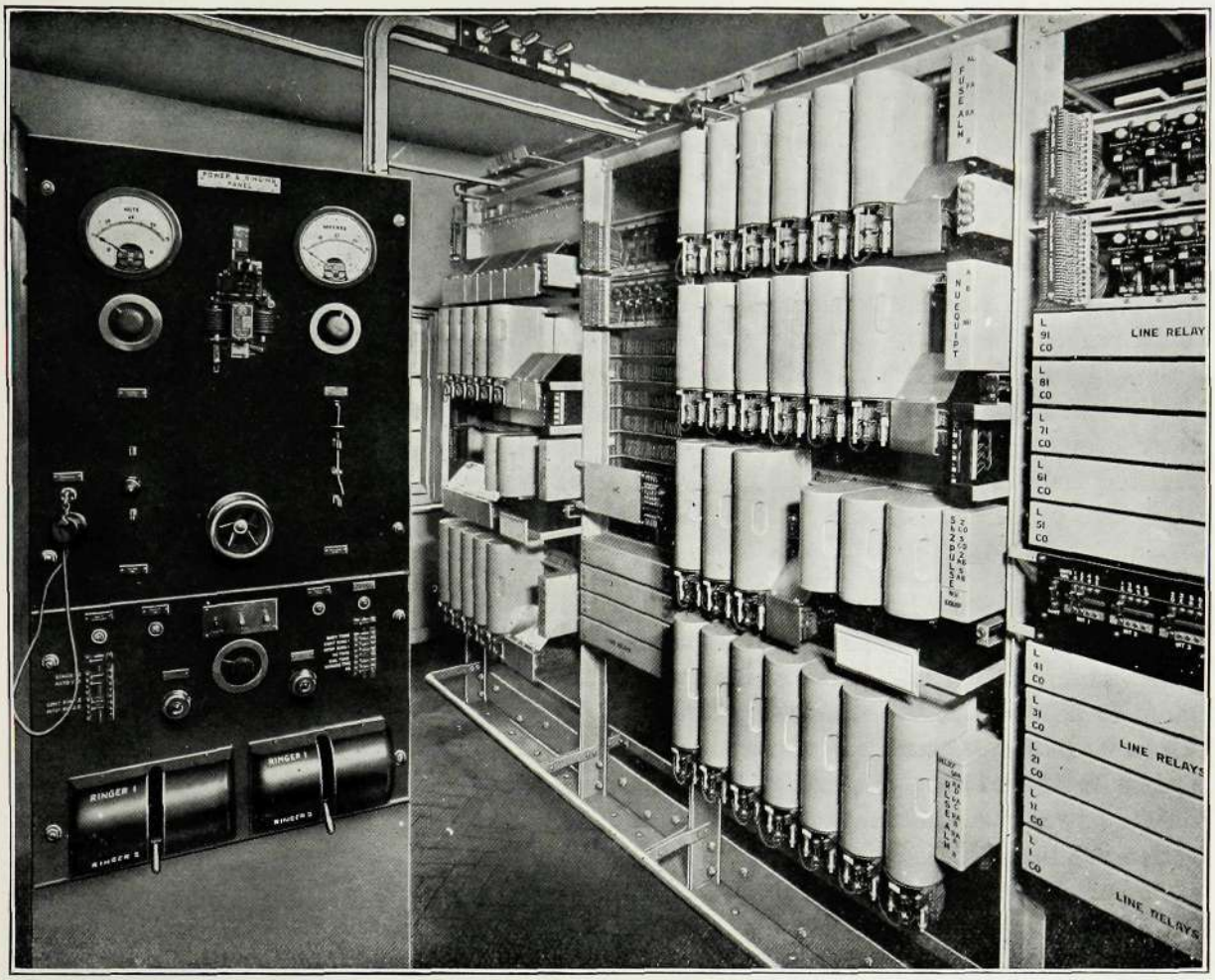
A small portable tester allows a quick routine of all the switching and line equipment to be made.

The exchange is served by duplicate fifty-volt secondary batteries, each having a capacity of two hundred ampere hours at the ten hour rate of discharge.

The batteries, accommodated in an adjoining room as shown in the illustration, are charged by means of a motor generator set; the motor, which is run from a four hundred and fifteen volt, fifty-cycle, three-phase supply, being controlled by a starting pillar mounted adjacent to the machine.

Ringing current and tones are supplied by duplicate machines, the machine which normally serves the exchange being run from the single-phase main supply and the other from the battery serving the exchange. Automatic change-over equipment is fitted to bring the battery-driven ringer into service in the event of failure on either the primary or secondary side of the mains-driven ringer.

The Battery Room



The Power Control Panel and Automatic Equipment

The power control panel is equipped with the necessary meters to read voltages and current in either the charging or discharging circuits, generator control gear, switches for battery selection, tone test equipment and the ringer automatic change-over apparatus. The two ringing machines are also mounted on the power control panel.

The following special operating features are incorporated on this installation :—

(*a*) Either party release after a period of 30 seconds.

(*b*) Automatic release of the connection if a subscriber seizes a switch but does not dial after a period of between 30-60 seconds.

(*c*) Automatic release of the connection if the subscriber takes more than 30-60 seconds between the digit impulse trains.

The whole of the telephone equipment was manufactured and installed within sixteen weeks from the date of order, and was cut into service on the 22nd December, 1933. The installation has given entire satisfaction, thus conforming to the traditional Ericsson standard.

Electrically Controlled Numerical Display Indicators

EVER since the totalisator became popular, numerical indicators consisting of groups of electric lamps lit in selected combinations have been familiar objects to many people. Although such indicators are probably unequalled in their own field, their comparatively heavy current consumption and the fact that they are not readily adaptable to small sizes prevent their universal adoption.

The Ericsson Company has developed a new system of numerical indication which avoids these objections and enables figures of almost any size from about one inch upwards to be displayed. Although the new Ericsson indicator can be applied with success to the electric totalisator, the fact that no power is consumed except while the figures are actually being changed renders it suitable for use in a much wider field. Accompanying this article are illustrations of a large installation for indicating current quotations of stocks and shares, but the system is equally applicable to railway platform arrival and departure indicators, and all other cases in which it is required to display variable information to the public at a minimum of cost and effort.

Ericsson indicators, their mounting arrangements and their control circuits, are the subject of pending patent applications.

The Ericsson Indicator Unit

In its simplest form, the indicator is built up from units designed to display at will any one of the ten digits. Other types capable of dealing with twelve different characters, and even with a complete alphabet, will be referred to later.

Attempts have been made in the past to accommodate the various figures which it is required to display upon the edge of a circular drum. Obviously, the diameter of such a drum must be large compared with the size of the figures, and it is therefore impossible to display several rows of figures close together. In order to avoid this difficulty, the drum has been discarded in the Ericsson indicator in favour of an endless flexible band upon which the figures are printed in bold type. As the display surface is perfectly flat, the figures on adjacent indicator units do not tend to mask one another, and the angle from which a complete indicator board can be satisfactorily viewed is very wide.

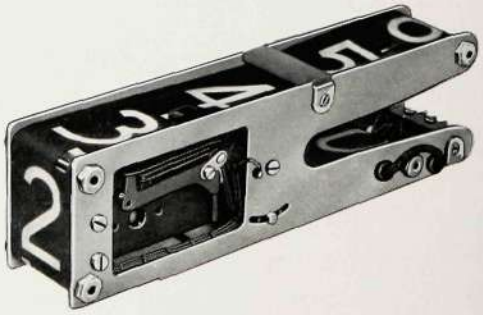


Fig. 1—Indicator Unit (common drive type)

Figure 1 shows a typical indicator unit. In this example, the band has twelve sections, one for each of the numerals 1 to 9 and 0, one blank section, and one section occupied by a special flexible joint in the band. A great deal of care has been devoted to the selection of the best kind of material for the band and the most suitable method of joining it to ensure long life and easy movement.

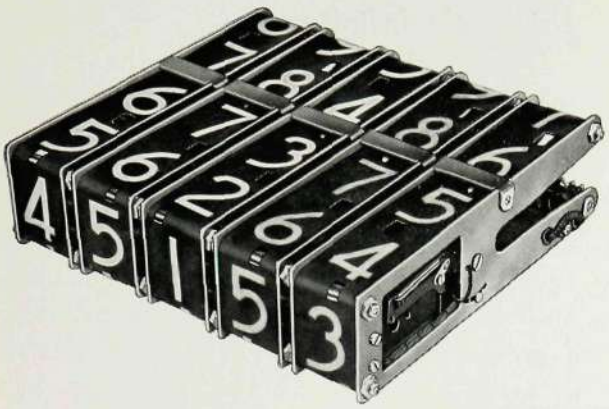


Fig. 2—Block of Indicator Units

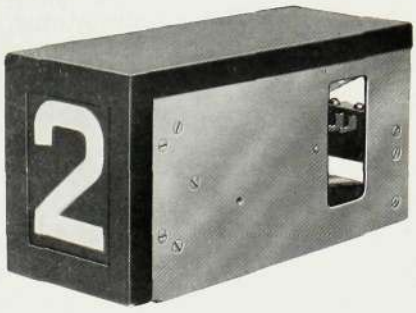


Fig. 3—Indicator Unit (individual drive type)

A block of five indicator units is shown in Figure 2, while Figure 3 is an illustration of another type of unit to which reference will be made later.

Tests have proved that the most easily read figures are those in white on a black ground, and this is the standard type. When it is required to distinguish one set of figures from another, the best colour for the second set is a rather yellowish orange. Any other colours, and also black figures on a white ground, can, of course, be supplied if required.

Assembling the Indicator Units

Ericsson indicator units can be assembled into blocks of any desired number. For

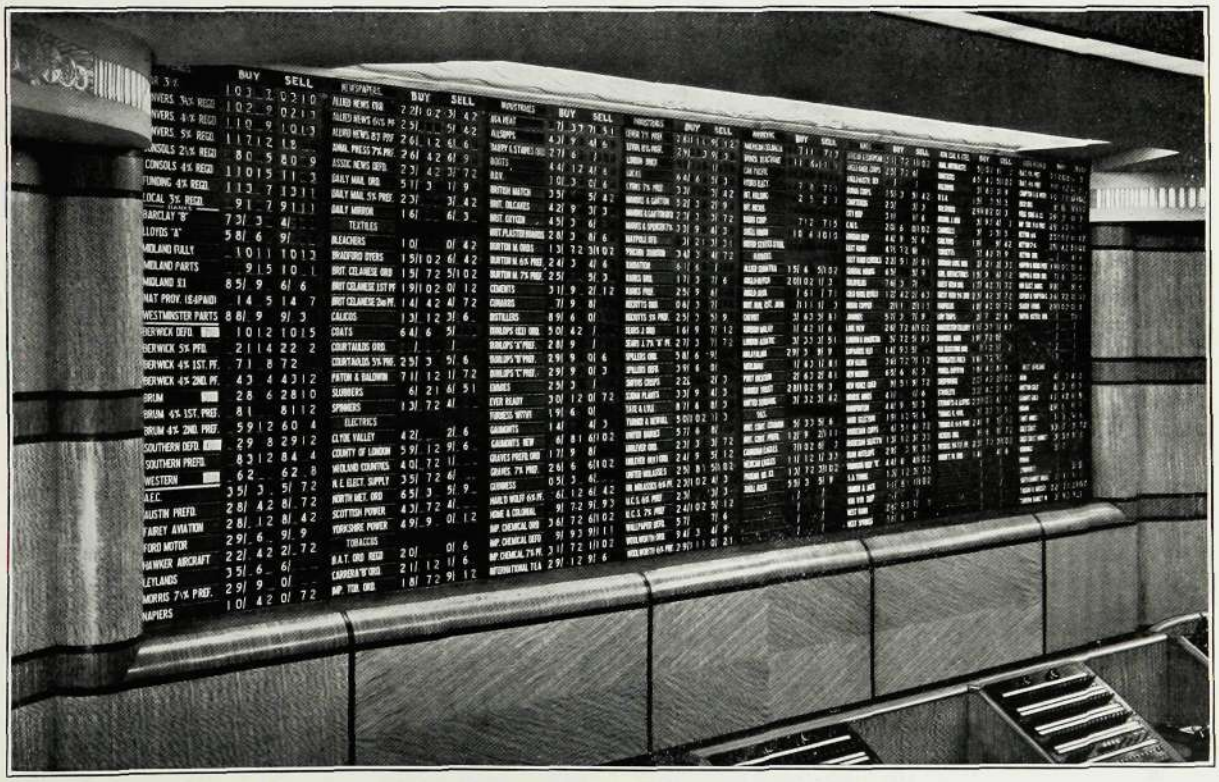


Fig. 4—Stock Quotation Indicator Board

displaying stock exchange quotations, blocks of four or five are usually required, the particular arrangement of the indicators and the marking of the bands being dependent upon the way in which the stock in question is quoted. For train departure and arrival indicators, four units (two for the hours and two for the minutes) are necessary; for "minutes late" indicators, two units, and so on.

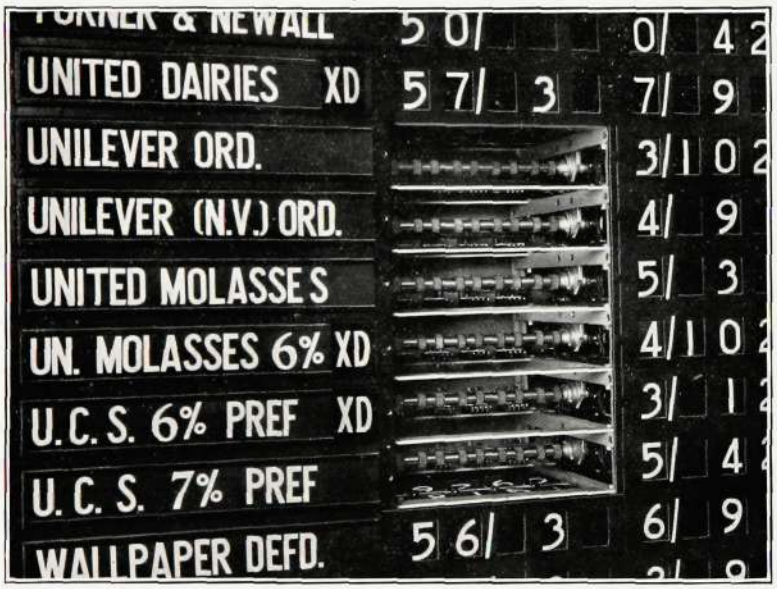


Fig. 5—Enlarged Portion of Indicator Board

Figure 4 shows a large indicator installed by the Company in a stockbroker's office, and Figure 5 shows part of the surface in greater detail. In Figure 5 some of the blocks of indicator units (which in this instance are of the type illustrated in Figures 1 and 2) have been removed. This indicator displays separate "buy" and "sell" quotations for each of 264 stocks at the same time. Note particularly the legibility of the quotations and the manner in which the indicator units can be grouped closely in both directions in order to make the maximum use of the available space.

Driving the Indicators

Two methods, based upon the fundamental principles of the two main types of automatic telephone exchange, are employed for driving the indicators. The most suitable type of drive depends upon such factors as the size of the figures, the frequency of operation, the amount of space available, and the method of control required. The more important features of the two systems are indicated in the next two paragraphs, and we are always ready to submit details of the most appropriate and economical arrangements for particular cases.

Common Drive System

In the first, or common drive system, a rotating shaft is situated behind each row of indicator units, each group of which is accurately positioned with regard to rubber rollers carried by the shaft. These rollers rotate close to the band on each indicator unit without actually touching it. Each unit carries a small roller controlled by an electromagnet, and when the magnet is energised the band is nipped between this roller and one of those on the rotating shaft. In this way the band is driven by the shaft until the required position is reached, when the magnet is de-energised and the band brought to rest immediately. The shaft can be arranged to rotate either continuously or only when it is required to change the reading of an indicator, the choice being dependent upon the frequency with which changes are likely to be made. The backs of the indicators and one of the motors for driving the shafts are visible in

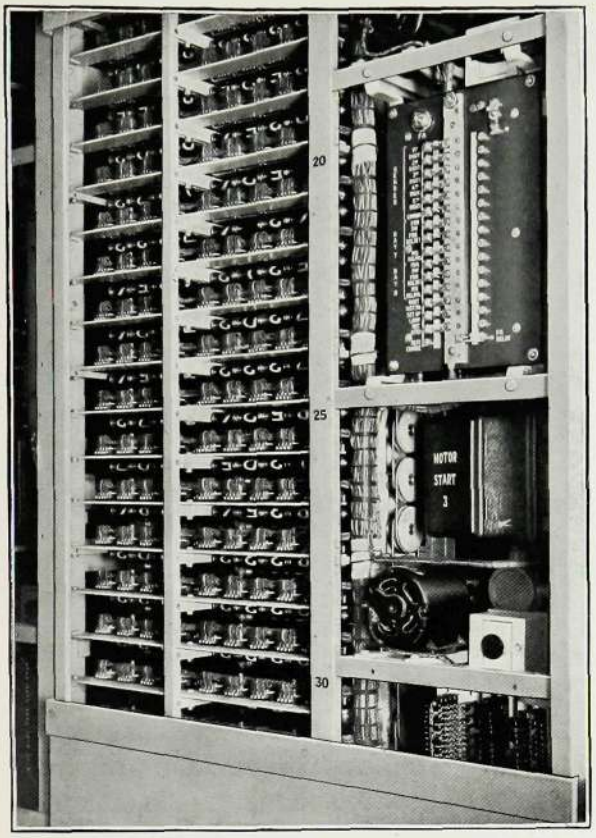


Fig. 6—Rear of Common Drive Indicator

Figure 6, which is a rear view of part of an indicator board employing this type of drive.

Individual Drive System

In this system the rotating shafts are dispensed with and each indicator unit is driven by a self-contained impulse-driven motor of special design. These motors, which have only one moving part and are extremely simple and robust, drive the bands by means of small sprocket wheels engaging with perforations similar to those employed in cinematograph film. The indicator shown in Figure 3 is of this type.

Stopping the Band

Each indicator unit carries electrical contacts capable of positively determining the position of the band at any time, so that when the appropriate control circuit is closed the band moves forward automatically until the required indication is reached and then stops practically instantaneously. Owing to the very small mechanical inertia of the band, only a few thousandths of a second are required to bring it completely to rest.

Controlling the Indicators

The form taken by the electrical control circuits depends entirely upon the use to which the indicator is to be put, and circuits can be designed to fulfil any possible conditions required in practice. Our long experience in the design of automatic telephone circuits and, more recently, of electric totalisator circuits, enables us to deal with any given case in the cheapest and most efficient manner. In particular, novel methods of using electrical conductors in combinations instead of individually allow us to reduce the amount of wiring and the

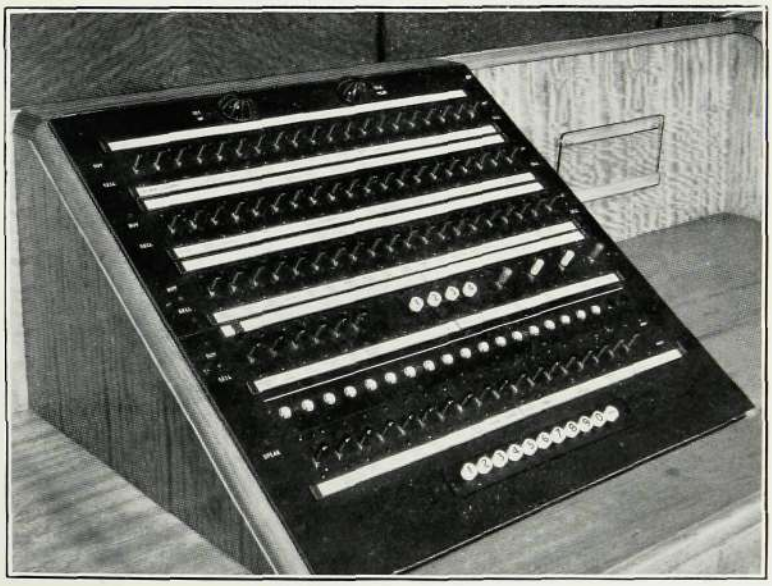


Fig. 7—Control Panel

number of contacts required to a minimum, thereby achieving a considerable saving in first cost and reducing maintenance charges to an almost nominal figure.

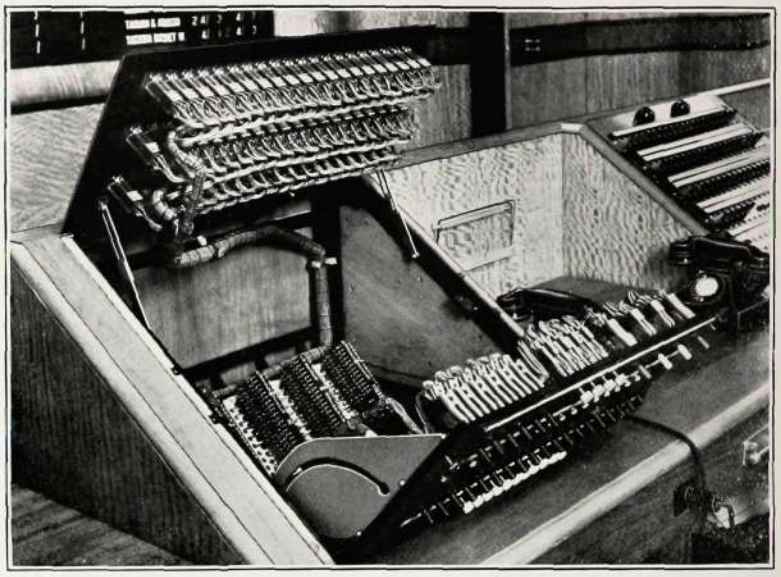


Fig. 8—Control Panel (open)

Figures 7 and 8 show a typical control panel, the front being lifted in Figure 8 to expose the internal wiring. The group of indicators which it is desired to control is selected by throwing a key in one of the horizontal rows, the new indication then being set up by pressing the white buttons at the foot of the panel according to the digits required. The four white buttons in the centre of the fourth row of keys enable any number of the indicator units in the selected group to be left unchanged without retransmitting their readings on the numerical buttons.

Control panels of this type are employed for the stock quotation indicator shown in Figure 4, and in Figure 9 the indicator and control desk may be seen together. Each operator is provided with a telephone over which the quotations to be set up on the indicator are received, and on each key panel one row of keys is devoted to the control of the telephone circuits. In this installation the control desk is situated directly in front of the indicator, but there is actually no limit to the distance between them, the only connection required being an electric cable having the necessary number of conductors.

Any number of indicators can be controlled in parallel, thereby allowing the indications to be repeated in as many places, widely separated or otherwise, as may be desired. The control circuits are based upon the latest telephone practice, and the whole of the wiring and associated electrical apparatus conforms to the severe standards set by the British Post Office for automatic telephone exchange contracts.

Rotary Switch Control

The miniature switch shown in Figure 10 offers an alternative method of control. When it is rotated to any number (as indicated either by an arrow on the mounting panel or in a small window through which only one character is visible at a time) the indicator at once takes up a corresponding position. As the setting can be ascertained at any time by an inspection of the switch, this method of control is particularly convenient in cases in which the indicator is not visible from the controlling point. Sixty-four of these small switches can be mounted on a panel only one square foot in area.

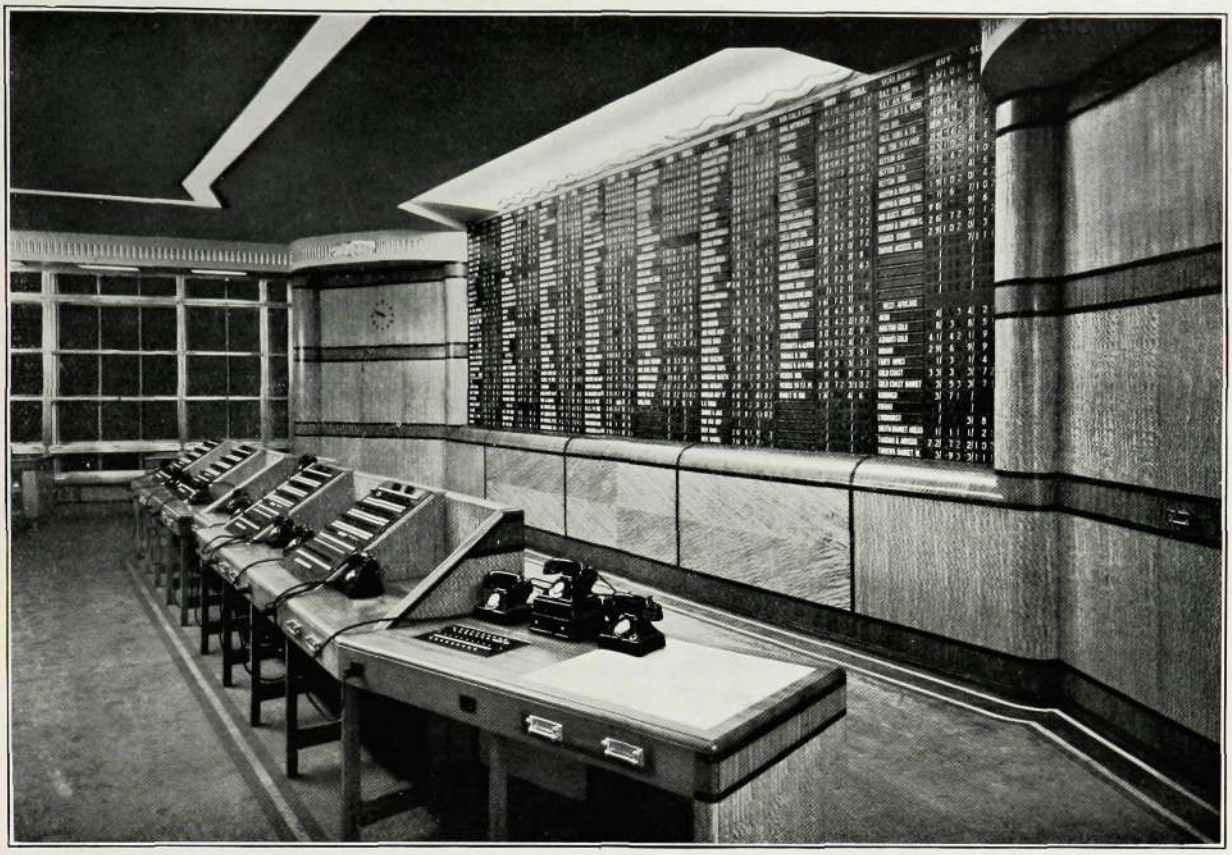


Fig. 9—Indicator and Control Desk

Interchangeability

A feature of all Ericsson indicators is their interchangeability. Any block of indicator units can be readily removed from the indicator board and replaced by a new block without affecting the operation of other units or interfering with the wiring. To provide this facility, the electrical conductors leading to each indicator unit are terminated at jack contacts of standard telephone pattern, the various connections being made automatically when the unit is placed in position. In the common-drive system, special provision is made to ensure that the mere placing of a block of indicator units in position brings them into proper relationship with the rotating shaft.

Fig. 10—Rotary Control Switch

Power Supply

The control circuits are normally designed to operate from a 50 or 100 volt D.C. supply, and a small secondary battery provides a suitable source of current. Alternatively, current may be obtained from any alternating current supply by means of a suitable transformer and rectifier. Alternating current supply mains are also suitable for the motors driving the rotating shafts in the common drive system.

Indicator Size

The dimensions of a complete indicator are naturally determined by the number of individual figures and their size. Owing to the features of design already mentioned, the number and size of the figures that can be displayed approaches very closely to the theoretical maximum for the space available.

By way of example, the indicator shown in Figures 4 and 9 displays over two thousand three hundred figures each one and a half inches high, the area actually occupied by the display surfaces of the blocks of indicator units being about seventy-seven square feet. These figures can easily be read at a distance of forty feet. Although for small numbers of indicator units it is naturally advantageous to make use of a standard size, it may be taken as a general rule that there is no technical difficulty in constructing indicators for figures of any height from one inch to one foot.

The number of different indications carried by a single indicator unit is normally ten, or eleven if a blank position is required. Special units for the display of larger numbers of characters can, however, be supplied ; thus, a single unit can be supplied for the " pence " figures in price quotations. Fractions in eighths, sixteenths, or other denominations can also be provided for, and it is even practicable to design a unit carrying all the letters of the alphabet, and thus to erect a remotely controlled sign capable of displaying at will any series of words within its capacity.

Another view of the Indicator shown in Fig. 4

Intercommunication Telephones with Exchange Facilities

THE type of telephone system which should be installed within an organization will naturally depend upon the type and number of calls to be made by the various departments. These calls may, in general, be split up into two classes—internal calls taking place between the departments within the organization, and external calls to and from departments and the main public exchange.

Up to the present time a subscriber has been faced with three alternative arrangements to cater for his telephone requirements; (1) to install a private intercommunication system when the majority of calls are internal, and have one or two public service telephones to cater for the few external calls; (2) to install a public service private branch exchange (P.B.X.), when a large number of calls from the various departments are external, and where an operator must be allocated to deal with these calls; and (3) to install an intercommunication system as (1) and also a P.B.X. as (2).

It has long been felt that there is a definite demand for a system which will combine all the facilities of the above, and offer additional advantages due to the combination. It must, however, be simple in operation, provide maximum flexibility with regard to additions and alterations, and be easy and cheap to maintain.

In close co-operation with the British Post Office Engineers, the Ericsson Company has now devised a system by means of which all the facilities of a P.B.X. and a direct intercommunication system are combined in a single instrument.

The instrument, as illustrated, follows the usual intercom practice of providing push buttons for establishing the necessary calls. The mechanism is enclosed in a bakelite moulded casework of distinctive appearance and registered design, and incorporates a much improved type of cradle and switch which has been designed with a view to eliminating the possibility of breakage. As will be seen from the various illustrations, the layout and arrangement give maximum accessibility to all

The Instrument

parts of the instrument for inspection and maintenance purposes. The complete button mechanism may be removed as a unit, leaving *in situ* the spring banks and cabling. Each spring bank is removable as a unit, and the relays are mounted on separate brackets so that they can be readily detached and thereby provide complete access to the relay springs. The relays are of the latest Post Office 600 type.

As a large percentage of normal intercom adjustments is in connection with the buzzers, it was deemed desirable to incorporate these in the external connecting blocks where they may be adjusted without interference with the instruments proper. As a final safeguard and to facilitate installation, the connecting block is arranged in the form of a plug and jack so that the complete instrument may be removed at will.

The Covers removed showing Interiors, Note the Buzzer Mounted on the Plug

The following facilities are standardized for the system :—

1. The same instrument is used irrespective of the type of public exchange.
2. Any instrument may be used as the master station.
3. Exchange calls are secret.
4. Engaged tests on " busy " exchange lines.
5. Exchange lines may be " held."
6. Exchange calls may be transferred direct from one station to another.
7. Supervision on exchange lines may be given at any selected positions.
8. Trunk offering facilities at master station.
9. Exchange calls may be barred to any stations at the discretion of the master station.
10. Calling and clearing are direct from any station to all types of public exchanges.
11. Local calls are non-secret.
12. Conference facilities on local calls.
13. Engaged test on stations engaged on exchange lines.
14. Simple external extension instruments

may be used, working on two lines only.

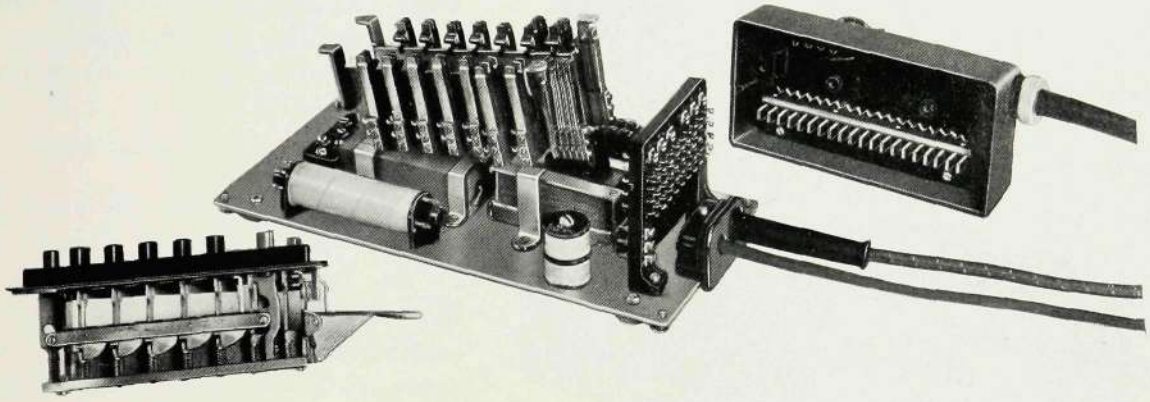
15. Power supply obtained over leads from nearest exchange.

16. Night working. A second choice master station may be given.

17. Independent release of each exchange line button.

18. One size case but two equipments, namely 1 exchange with 5 extensions, and 2 exchange with 10 extensions.

provides the necessary line conditions for C.B.S. No. 1, C.B.S. No. 2., and Magneto. In the case of automatic working each instrument is, of course, fitted with an automatic dial. The system has a working voltage of 18 volts and upwards, and this may be supplied by means of a power lead from the nearest exchange. When there is no power available at the main exchange—this would generally apply to magneto working—a small capacity local battery is required. To give a good factor of safety, all parts have been designed to operate on 12 volts.



The Interior with the Push-Button Mechanism Removed

The above will be better understood by a description of the system and its operation.

The instruments are installed on the "multiple" or "tee" system which is economical in cable and provides maximum flexibility for future alterations and additions. Any one station is selected and called the master station, and at this point is fitted an auxiliary apparatus unit containing the necessary exchange line call-indicating equipment. Two types of auxiliary apparatus units are supplied, one when the public exchange is C.B. working, and one when L.B. working. In the case of L.B. a suitable strapping arrangement

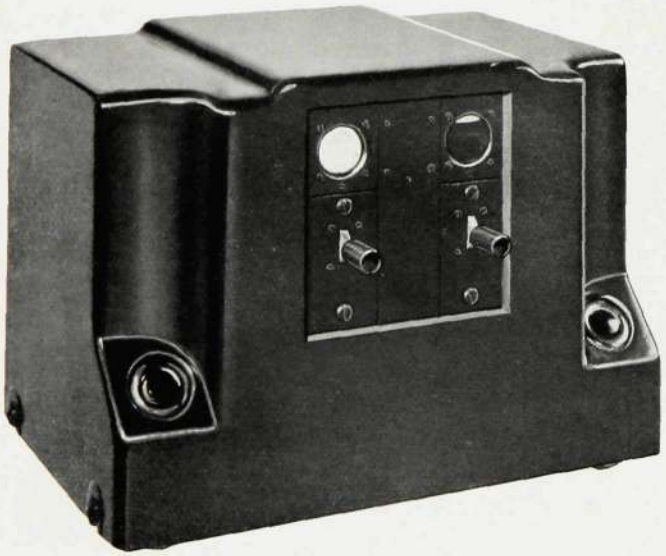
The use of the same instrument irrespective of the type of public exchange is very desirable from a stores point of view and also for maintenance purposes, as it would be undesirable to have a different type of instrument to install and maintain for each type of public exchange service.

The facility of being able to make any station the master station also tends to simplification of types and stocks, and provides maximum flexibility for night working and alterations, temporary or permanent.

An important feature is that all exchange

calls are secret to the station using the line, and great care has been taken to ensure that no interference or intrusion can take place when a station is engaged on an exchange line. Twisted pair conductors are provided in the cable and cords to guard against cross talk.

Any type of public exchange may be called direct from any station by removing the micro-telephone and depressing the appropriate exchange line button. Should the line be already engaged, the buzzer will operate to give a busy signal. It is desirable to test the line, before removing the micro-telephone, by depressing the button and getting the above test signal.



An Auxiliary Unit

The replacement of the micro-telephone will restore all depressed buttons and give the clear direct to the exchange in the standard manner. This is a very important feature as the same method of operating exchange calls is utilized irrespective of the type of public exchange, and ensures a clear being given in the case of magneto exchanges.

It was, of course, a comparatively easy matter in the case of C.B. and C.B.S. exchanges to arrange automatic call and clear, but quite a different arrangement had to be introduced for magneto exchanges. In the case of the latter the problem was solved by making use of the plan devised for the new group service scheme. This consists of a small relay set fitted at the magneto exchange to provide the necessary calling and clearing conditions. It is this small modification at the exchange that made it possible to standardize the instrument and also reduce the number of auxiliary units to two, namely, C.B. and L.B. as already mentioned above.

Calls incoming from the exchange are received by means of an indicator on the auxiliary apparatus unit at the master station; the micro-telephone is removed and the appropriate exchange line button depressed. Should the call be for another station, it may be transferred direct. To do this, the required station is rung by depressing the local button to its fullest extent. This operation will release the exchange line button, but, due to the construction of the latter, one of its spring banks will remain operated and "hold" the exchange line. When the required station answers, the number of the exchange line calling, i.e. No. 1 or No. 2, will be given by the master station, whereupon the former will depress the appropriate button, and as the exchange line is being held busy the call buzzer will operate, and give a tone which is fed back over the local lines to the master station to indicate that the call has

been taken up. The master station now replaces his micro-telephone and the call is connected direct to the second station. These calls may be further transferred to any other station, in a similar manner, and without reference to the master station.

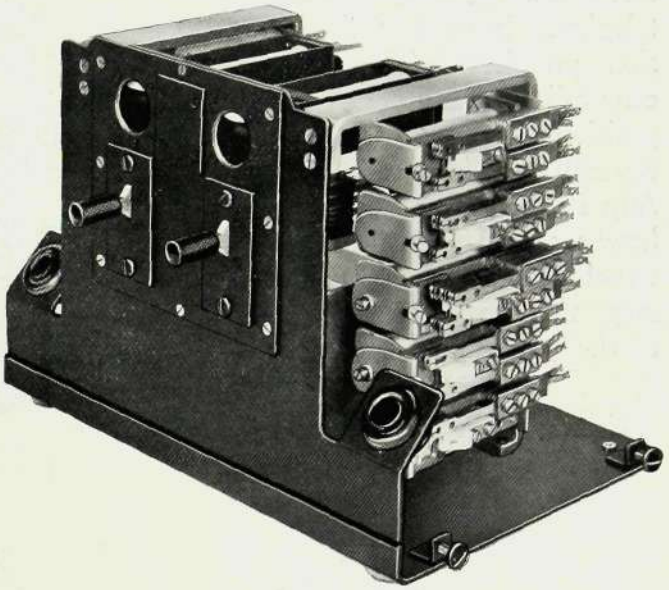
The feature of being able to " hold " an exchange line is very valuable when it is required to obtain information from another station whilst engaged on the exchange line. During the time the local call is taking place, the exchange line is held but the distant party cannot hear the local conversation; re-engaging the line, by re-pressing the exchange button, automatically restores the local button to normal.

Trunk offering facility to the master station, or supervision to a chief, is given by means of a small strap in the instrument. The removal of this strap allows the instrument to cut-in on an exchange line when it is engaged by another station.

Under certain conditions it may be desirable to allow some stations to use the exchange line only at the discretion of the master station. A very slight alteration in cabling, and a press button fitted on the master station auxiliary unit gives this facility; only when this button is momentarily depressed can the exchange line be used by the particular stations selected.

It is sometimes convenient to be able to release the " hold " on an exchange line without replacing the micro-telephone. For this purpose a small lever is fitted near each exchange button; by pressing this lever to one side the hold section of the button will be released without in any way interfering with the rest of the instrument.

Local calls between the various stations are made in the standard method of push button instruments, i.e. to call another station the micro-telephone is lifted and the appropriate button depressed to its fullest extent. This operates the calling buzzer at the distant station. The call is answered by removing the micro-telephone at the called station.



Auxiliary Unit Interior Showing Relays

If during a local call, it be found necessary to bring in other stations, the calling party depresses a special conference button on his instrument and can then call individually each of the required stations. Each station provides its own transmission bridge so that the transmission is not impaired by the conference as is usually the case.

Should a local call be made to a station

which is already engaged on an exchange line, the buzzer at the calling station will operate to give an engaged signal.

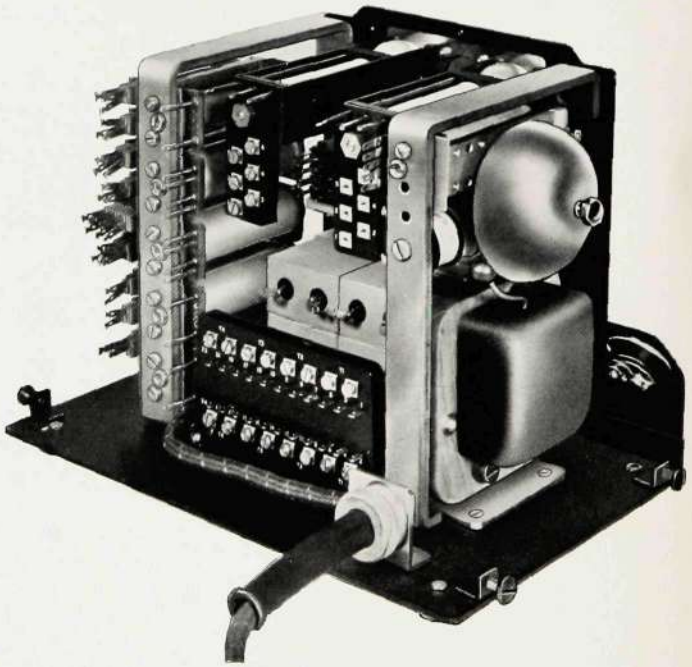
On some installations communication is required at a point some considerable distance from the main installation, and where the length of multiple cable which would be required becomes excessive. To cater for this condition, arrangements are made to provide what is known as external extension working. Only two wires are required between the extension and the main cabling, and a standard telephone is used at the extension premises. The extension can call to any one selected position, and at this position a small auxiliary unit is fitted. Any station on the system can, however, call direct to the external extension, and the latter may also be switched through to the public exchange.

Calling from the external extension is by means of an indicator on the auxiliary unit, and this same indicator is also used as a clearing indicator for exchange calls switched through to the external extension.

Arrangements have been made so that, for night service or similar reasons, the exchange calls may be transferred to a station other than the master station. To do this an auxiliary unit is fitted at the selected station, straps are permanently removed from the master station unit, where, by the simple operation of a key all calls are passed through direct to the other station.

In the case of an external extension, only the calling indicator is extended to the second choice master station, and this indication is incorporated on the exchange line auxiliary apparatus unit, thus the external extension can be given night service facilities by operating the key in the auxiliary apparatus unit.

From the above somewhat brief description it will be seen that the new Ericsson intercommunication system with exchange facilities, incorporates all the advantages of a normal intercom system, together with those of a P.B.X. Engaged tests are given where required, the use of an operator is reduced to a minimum and every station has the use of the equivalent of two telephones which in this new Ericsson system are actually combined in one instrument.



Auxiliary Unit Interior Rear View