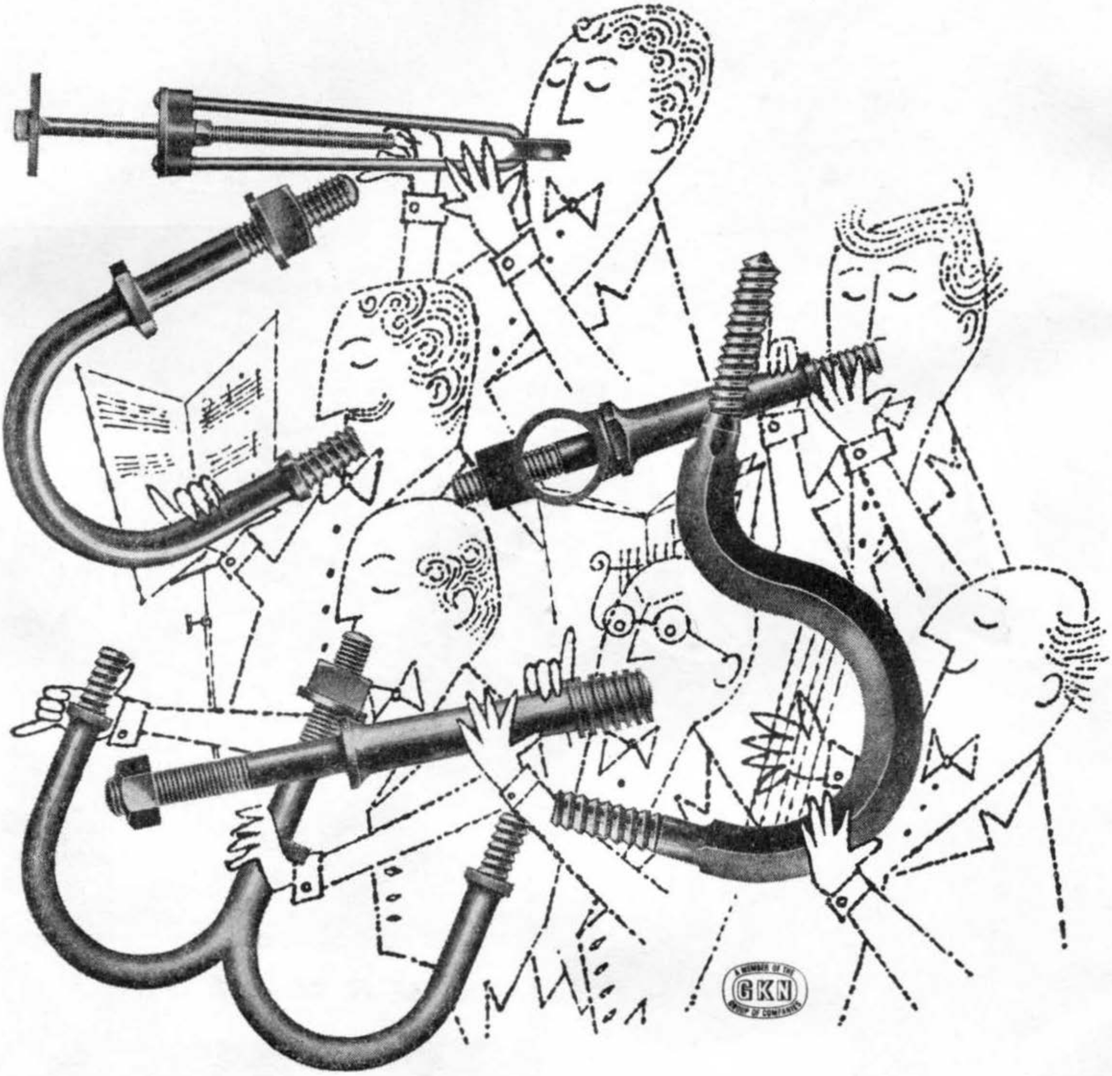
POST OFFICE

tele communications

JOURNAL

ONE SHILLING AND SIXPENCE

AUTUMN 1959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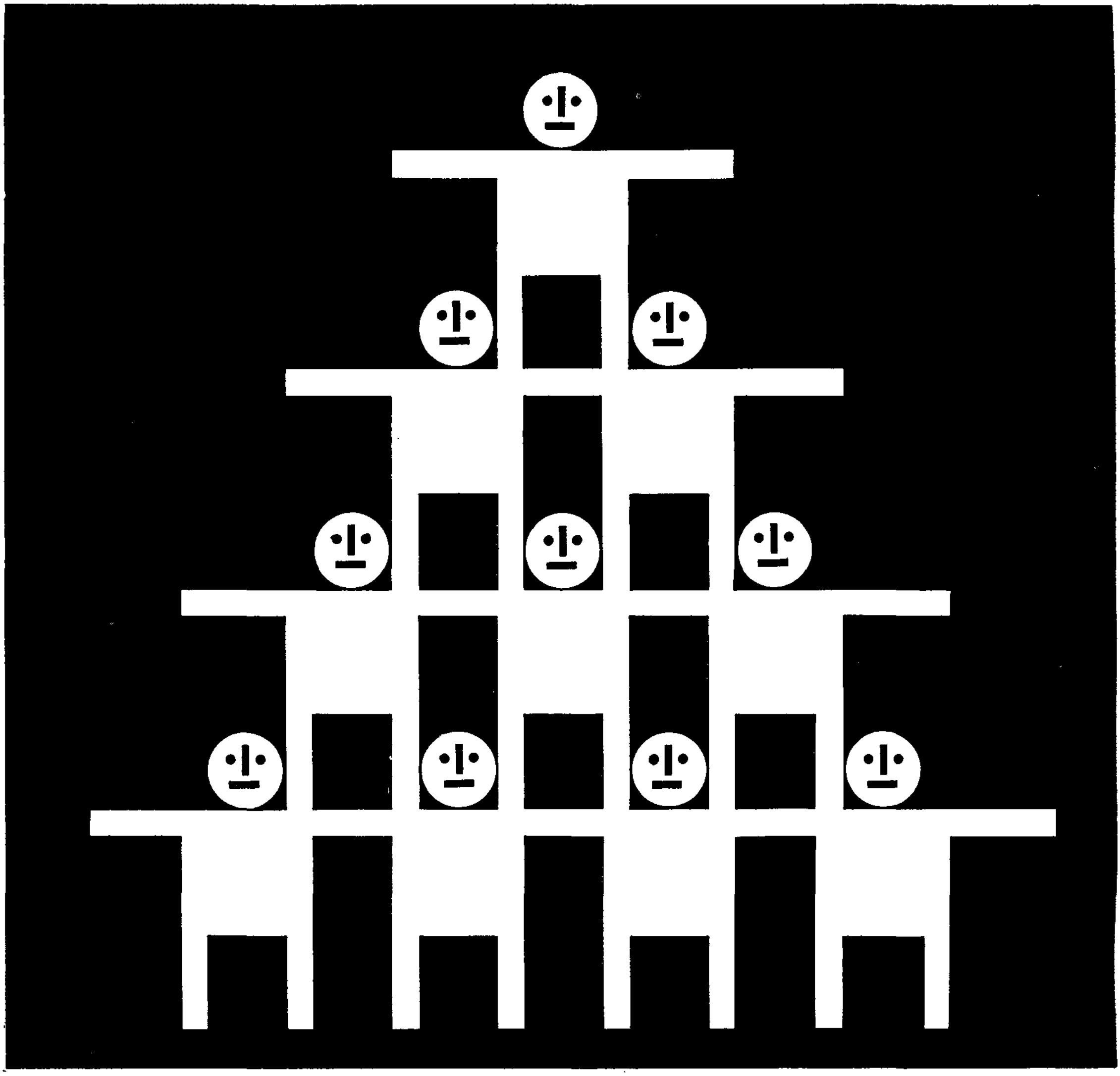

Post Office Telecommunications Journal

Published by the Post Office of the United Kingdom to promote and extend knowledge of the operation and management of telecommunications

Contents

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The Editor regrets that this issue is late owing to the recent printing dispute

Coast Radio Jubilee

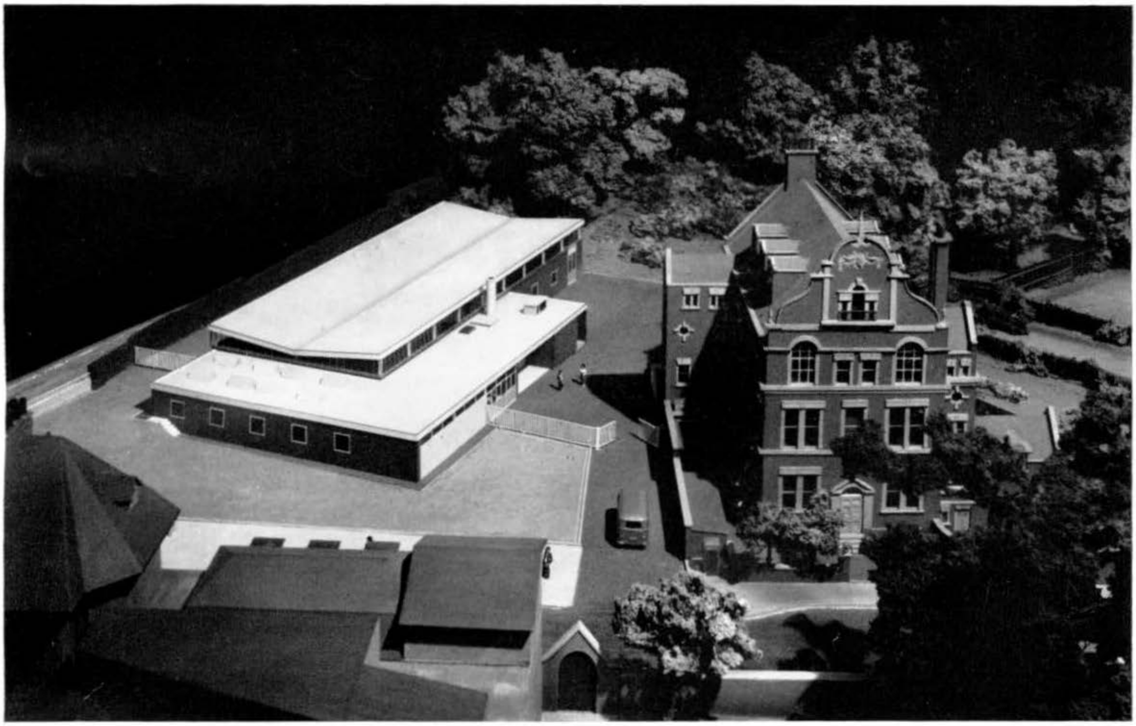
"THE FRIENDLY TELEPHONE" HAS BEEN SO EVIDENTLY the telecommunications topic of the year that anyone may be forgiven for imagining that it is entirely a new idea. But on September 29 the men who operate the coast radio stations will be celebrating the completion of 50 years of a service which many landsmen may overlook but which to seamen and sea travellers is perhaps the friendliest service any Administration can offer. The Post Office Ship-Shore Service enables crews and passengers on the high seas to keep in touch with home and, through its Distress and "Medico" services, it is instrumental in saving lives at sea in times of disaster or sickness.

In this issue Mr. G. F. Wilson outlines the development of the service from telegraphy to telephony, showing how it serves the shipping of the world wherever it may be.

The Post Office, besides running the coast stations, ensures efficiency at the other end of the circuits it operates; radio operators on British ships have to hold certificates of proficiency from the Post Office, and radio equipment on British ships of more than 500 tons has to be approved by Post Office inspectors. Foreign ships may also call on the Post Office to inspect their equipment.

Increasing air travel may reduce the annual traffic in passengers' ship-shore telegrams, but the Post Office Coast Radio Stations, in conjunction with corresponding stations in other countries, are still essential—and, indeed, "for those in peril on the sea", vital—to world shipping.

During last year alone more than a million messages and 110,000 telephone calls to and from ships passed through the Post Office Coast Radio Stations—and it is fair to say that the stations have played their full part in reducing the annual toll of the sea from 1,000 to 100 during the past 50 years.



New Exchange Design Cuts Costs

A 10,000 line automatic telephone exchange for Altrincham, Cheshire is (with a new Head Post Office at Hitchin) among the first results of the Post Office–Ministry of Works Joint Research and Development Group. The Group, set up in 1957 with Mr. W. K. Mackenzie, former Deputy Director, Midland Region, heading the Post Office side, is charged with examining the design of buildings at reduced cost, to make available capital investment go further.

The estimated cost of Altrincham Exchange, £27,000 (main building £2. 15s. per foot super gross—external works and services, £5,000) is less than half the cost of a conventional exchange meeting the same operational needs.

The Group designed both a single-storey and a two-floor building but adopted the single-storey plan because estimates showed it was likely to cost 5 per cent. less. Given a large site where single storey buildings were acceptable, conditions were more favourable than might always be encountered but the results pointed the way towards a substantial reduction in the cost of many future exchange buildings.

Only 1.2 per cent. of the total space will be for circulation; 98.8 per cent. will be working space.

Independent work by the Post Office Engineering Department on exchange equipment and plant design helped to reduce substantially the space required for equipment. Cables enter just above ground level, thus eliminating the need for the usual basement cable chamber, and are carried on bearers along the inner face of the apparatus room external wall. Cables will be encased above floor level, with removable panels. Main rectifiers will be used for power supply instead of the bulkier motor generator equipment.

Among other features the apparatus room will have continuous windows at high level which give lighting throughout without the need for roof lighting. The apparatus room has a light steel frame of encased boxed stanchions at 12′ 8″ intervals in the side walls, and 25′ 4″ intervals generally down the centre.

The design will enable extension with minimum disturbance to switching equipment.

Building is planned to start in October.

Subscriber Trunk Dialling and the New Coin-Box

A. V. Leaver

This is the sixth article in our series on STD. In our next issue we shall publish an article on the tariff aspect

THE PRESENT MULTI-COIN-BOX (FIG. 1), which succeeded the "pennies only" box with its manually operated buzzer, was brought into use in 1925. Although it was designed for automatic as well as manual exchanges, there were at the time little more than a score of automatic exchanges and dialling generally was limited to first fee local calls. About 19,000 call offices were in use, but many were attended, and there were only just over 1,000 outside kiosks.

Since then, the number of public call offices has increased to more than 73,000, including 65,000 kiosks, and the current revenue from call offices is £12 millions a year. In addition, there are nearly as many subscribers' coin-box installations. The general policy of automatisation and the extension of the subscribers' dialling range, combined with the rapid growth of coin-box installations and traffic, has focused attention on the need to increase the range of dialling from coin-box lines beyond the first fee area, and the introduction of subscriber trunk dialling has given a further impetus to this step. The possibility of extending dialling up to the multimetering range from existing coin-boxes had been considered just after the war, but the relatively high cost and the technical complications involved made it impracticable.

Modern Trends

The present coin-box has served its purpose well and, although the extension of the first-fee area which came in with group charging on January 1, 1958 increased its dialling range, it is now inadequate to cope with modern developments in the automatic telephone service. It is outdated compared with designs and developments in other countries. The modern trend is to dispense with buttons, and buttonless boxes are in use, or are being developed, in the U.S.A., Sweden, Germany, Holland and Switzerland. The range of dialling from coin-boxes, with automatic timing,

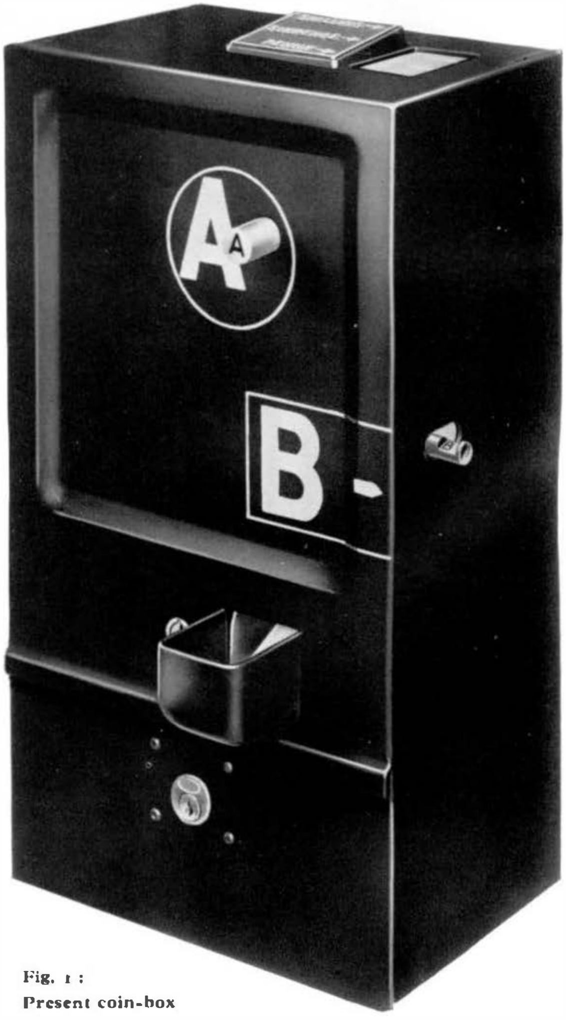


Fig. 1: Present coin-box

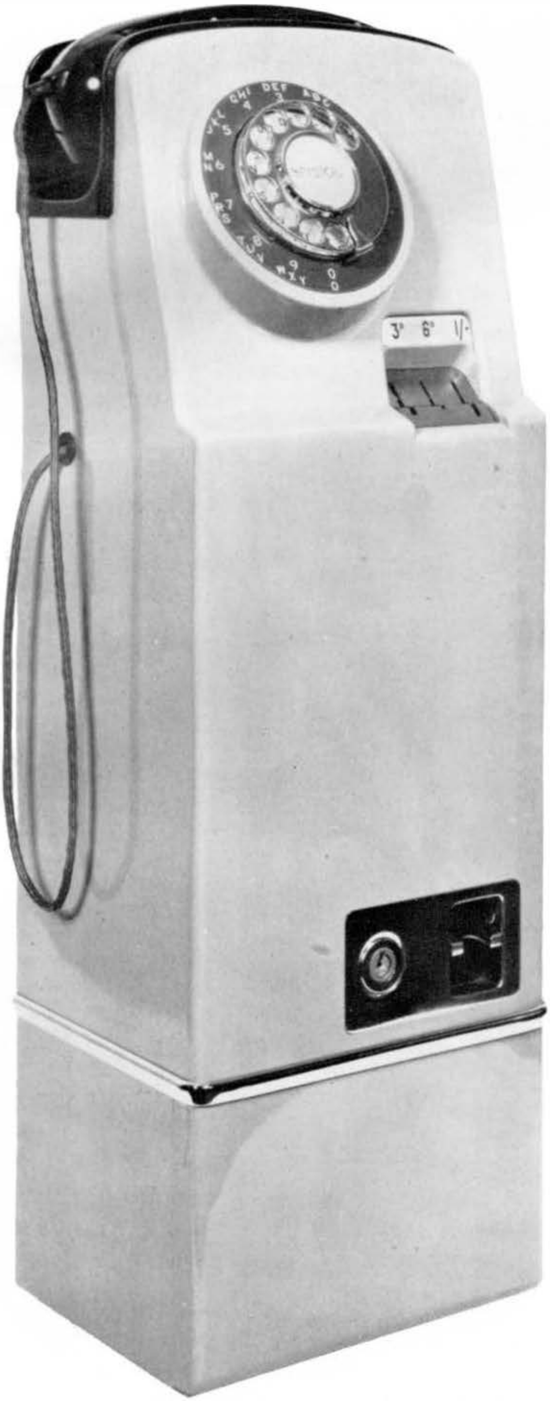


Fig. 2: The new coin-box

has also been extended and some countries have departed from the pre-payment method of working, using instead boxes in which the caller inserts the money after the connexion has been set up by dialling. Moreover, increases in the local call fee here have resulted in public pressure to provide a coin slot for threepenny pieces, and this involves an important change in design. It became apparent, therefore, that a new coin-box was required for use in this country.

The New Box

The new box (Fig. 2) which has now been designed, and is being tried in the Bristol STD Area, takes account of all modern developments and, in conjunction with new exchange equipment with which it is associated, is designed to give the maximum range of facilities to coin-box users. An important feature of the new box is that it dispenses with buttons, which have always tended to cause confusion to the public, and it should thus be simpler to operate.

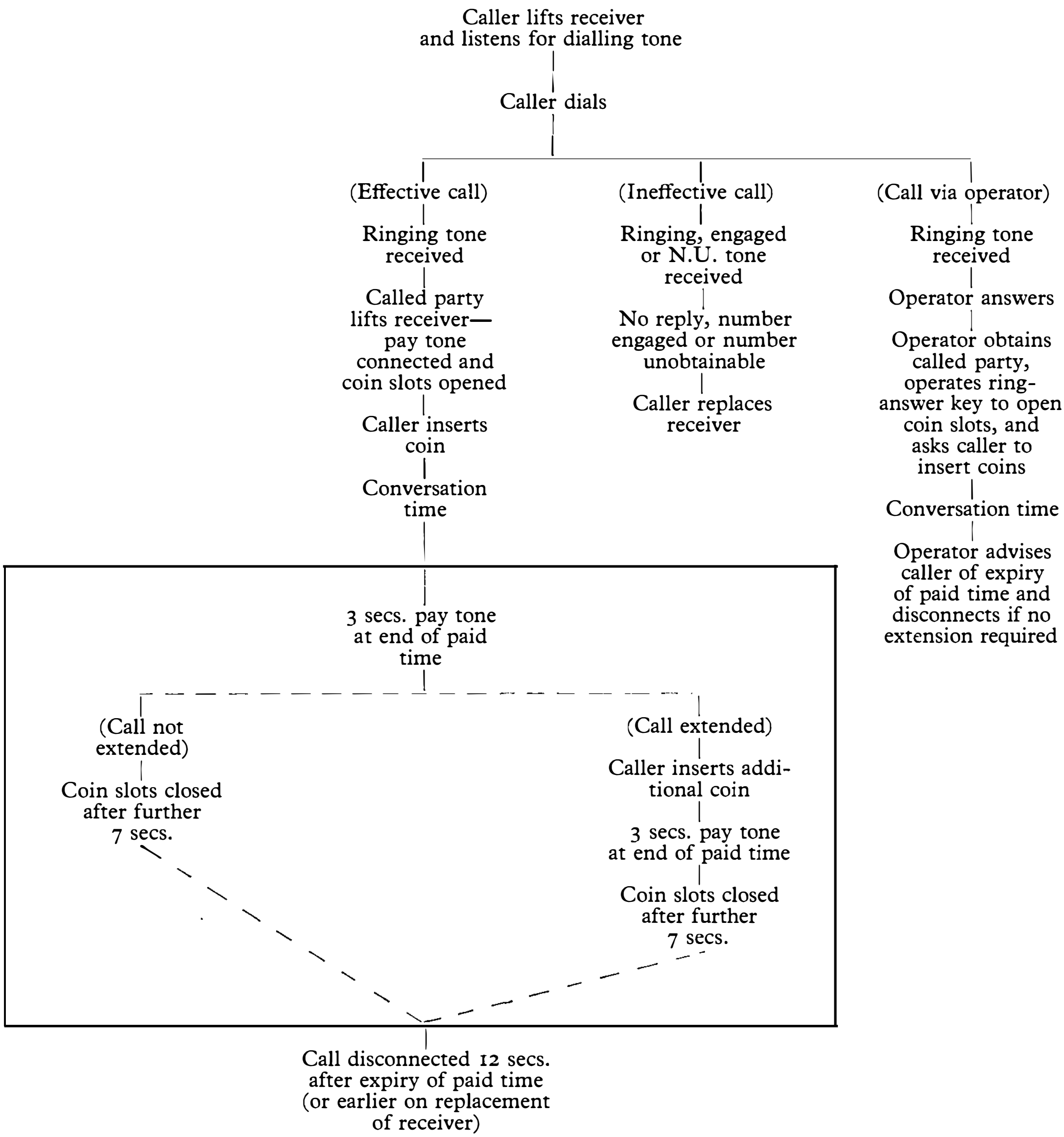
The decision to dispense with buttons did not necessarily involve a departure from the present method of pre-payment working, but it was considered that further simplification in operation and design would result if the method of holding coins in suspense during the setting up of a call could be dispensed with. Accordingly, the arrangement was adopted whereby callers would not be required to insert coins until the called number had answered. In principle, this is similar to the method of working with post-payment boxes in non-central battery manual exchange areas but, to effect a distinction and because the term "post-payment" is not strictly correct, the new box is called the "pay-on-answer" coin-box.

With the "pay-on-answer" system, it is, of course, important to give callers a clear indication when to insert money. With this requirement goes the need to indicate when the time paid for has expired, if callers are to be allowed to extend their calls. All calls under STD conditions, local as well as trunk, will be automatically timed, and it was considered preferable, in particular from the point of view of attracting additional revenue, that callers should be given the facility of extending their calls rather than that they should be cut off or diverted to the manual board at the end of the initial period.

Accordingly, a new type of signal is being introduced with the coin-box, called the "pay-tone". This will be given to the caller, and will also be heard by the called party when he lifts his receiver. The caller will not hear his correspondent answer until he has inserted money. The tone will also be applied to the line after the time paid for has expired.

Various types of signal were considered, such as a verbal announcement, and the possibility of adding a visual signal for the benefit of the caller was also examined. But, following experiments, all of these were rejected in favour of an interrupted tone of 400 cycles frequency, which is universally available, with pulses at the rate of four per second. The effect is a series of rapid pips.

The procedure in making a call will, therefore, be as follows:—



The initial period of pay-tone will continue for about 10 seconds, and if no money is inserted during that time the call will be disconnected. The provision for opening and closing the coin slots is to guard against the insertion of coins at the wrong time.

Two other important changes are the provision of a slot for threepenny pieces (12-sided only) and the method of signalling coins to the exchange. The question was whether a fourth slot should be provided, or whether the threepenny slot should replace the penny slot. A four-slot box for pennies, threepenny pieces, sixpences and shillings would be more complicated and cost more. On the other hand, dispensing with pennies would give real advantages on coin collection and counting, since the bulk of the coins to be handled would be considerably reduced. But the main advantage lay on the technical side and the signalling of coins to the exchange. Since, with the new box, calls may be set up automatically with coins of varying denominations, a simple and rapid system of signalling coins to the exchange was necessary. This had naturally to take the form of electrical pulses, with one pulse for the coin of minimum value and corresponding numbers of pulses for the coins of higher value. If a penny slot had been provided, 12 pulses would have been required to signal a shilling, and this would have slowed down the operation of the box. But, by having a threepenny piece as the lowest-value coin, a pulsing system could be adopted based on threepenny units, with one pulse for a threepenny piece, two for sixpence and four for a shilling.

The system of coin pulsing required for automatic calls naturally influenced the type of coin signals to be given to operators on manually controlled calls. The gongs and bells of the existing box were no longer practicable. Accordingly, the coin pulses to be used for signalling to the automatic equipment will be converted to audible pips of tone on manually controlled calls and all the operator will have to do is to count the number of pips to determine the number of threepenny units which have been paid for. If she wishes to re-check the amount after it has been inserted, she will be able to do so by re-operating her ring-answer key; this will result in the number of pips appropriate to the total amount inserted being repeated to the operator.

The summary below compares the main features of the present box with those of the new pay-on-answer box.

The existing box is black; the pay-on-answer box will be grey.

Present box	*Pay-on-answer box*
Separate hand-micro. telephone	Telephone mounted on coin box
Buttons A and B	No buttons
Coin slots for 1d., 6d. and 1/-	Coin slots for 3d., 6d. and 1/-
Return chute for refunded and rejected coins	Return chute for rejected coins only
Dialling restricted to local calls	Local and trunk calls can be dialled
Money inserted before dialling	Money inserted after called subscriber lifts receiver
Dialling—caller must use four pennies	Dialled calls can be effected with a threepenny piece, a sixpence or a shilling
Dialled calls untimed	All calls timed, but callers can obtain extensions of time by inserting more money
No dialling access to special services, e.g., TIM	Dialling access to be provided to special services
Manually controlled calls—gong for 1d., one bell for 6d. and two bells for 1/-	One pip of tone for 3d., two for 6d. and four for 1/-
Coins in suspense— 11 pennies, 11 sixpences, 11 shillings	Capacity of coin pulse storage equipment— coins to the maximum value of 24 pulses (i.e. 6/-)
Separate manual board calling signals	Tone signal on ordinary subscribers' manual board circuits being developed for coin box discrimination
Specially adapted dial required for manual board and emergency calls	Standard subscribers' dial used
Capacity of coin container— £2 10s. in pennies	600 coins (minimum £7 10s.)
Exchange meter operates on standard meter pulses	Meters associated with call offices will operate on coin pulses where it is economic to provide this facility

Fig. 3: New coin-box with backboard and London Directory holder

Following the public trial at Bristol, the new box will be installed in other STD areas. In the early stages there will inevitably be some lag between the provision of STD in an area and the installation of the pay-on-answer coin-box, but the two will be provided simultaneously for auto-conversions. The installation programme in large towns served by a number of exchanges will also have to be specially considered.

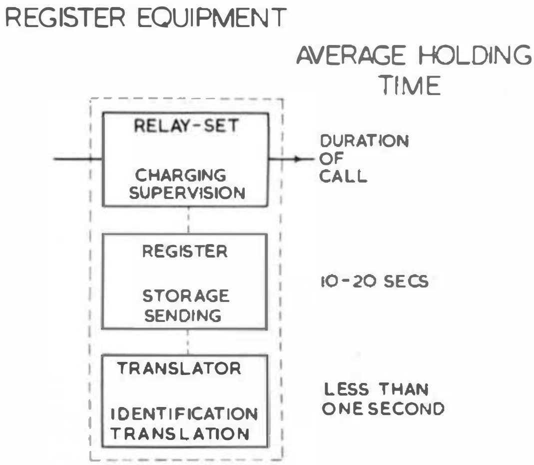
Some changes will have to be made in the call office layout. The lower half of the backboard will be replaced and, to facilitate access for maintenance purposes, the coin-box and its associated telephone will normally be fitted on an angle bracket on the left-hand side, with a combined telephone directory and parcels container on the right. In call offices supplied with the telephone directories covering the London Postal Area, however, a special directory fitting will be provided on the lines of the Swiss model. Fig. 3 shows the new arrangements for these call offices.

Correction

"Register-Translators for S.T.D."

The Editor regrets that several lines were inadvertently omitted from Mr. Francis' article on the above subject in our Summer issue. The paragraph at the top of column 1 on page 118 should have read—the words originally omitted are in italics:

> "It will be apparent from this outline that the time taken to perform each of these functions can differ widely. Charging and supervision may be required during the whole time a call is set up and consequently these functions are performed by *a relay set which is part of a built-up connexion. The functions of storage and sending, however, are required only during the setting up process and are performed by a register associated with a relay set during this period, and then released to deal with other calls. An even shorter time is required for identification and translation, and these functions are performed by* a translator which is common to a number of registers."



We reproduce Fig. 2 from the article; this illustrates the processes outlined.

More Power to your Elbow!

W. C. Ward

In our Spring 1956 *issue we published "Mechanical Aids" by Mr. H. C. S. Hayes which told readers of the equipment the Post Office uses to "assist and increase the effort a man can exert with his own hands". The following article shows further developments in this field.*

IN THE PAST FEW DECADES, THE USE OF MECHANICAL appliances has greatly extended human productivity in many directions, and the Post Office Engineering Department has devoted much effort to exploring the scope for using mechanical aids in the work carried out by its technicians. Included in the advantages of using mechanical aids are the lessening of fatigue to the worker and making his work more congenial. Mechanical aids can reduce the risk of accidents, and make for more uniform work which is also often of a higher quality than that performed by hand.

In a factory where repetition work is performed with flow-line methods the scope for applying mechanical aids is obvious, although much detailed study and observation may be necessary to plan their more effective use. Much of the engineering work in the Post Office cannot, however, be planned in this way, first because no two jobs are exactly the same, and second because it is seldom possible to bring the job to the machine.

To illustrate this difficulty let us take as an example digging a hole for erecting a pole. This is an operation calling for considerable physical effort; it is often a dirty job and it usually takes a man about an hour to perform. A number of motor driven pole hole borers are available, however, which will dig neat holes in a variety of soils at the rate of a few minutes per hole, and it appears at first sight that an ideal application exists here for the substitution of the manual process by a mechanical one.

In practice, however, the scope for mechanization is limited by the situations in which the work has to be performed. Many poles are erected in city streets where there is a danger of meeting other undertakers' plant, while many more are erected in hedgerows in positions which a machine cannot reach. It thus becomes a matter for serious study whether the number of occasions on which a machine can be effectively employed is sufficient to support its standing charges, transport and operating costs. If a machine is provided, continuing detailed planning of the work must be undertaken to ensure that it is used to good advantage.

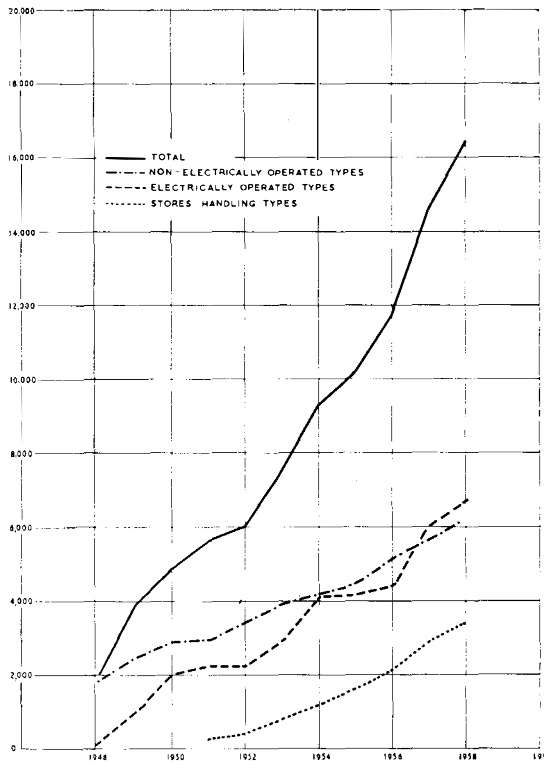


Fig. 1 : Number of mechanical aids in service

Similar considerations apply to many of the mechanical aids in which the Post Office is interested. Nevertheless, by careful organization, the use of mechanical aids for engineering work is increasing very rapidly, and Fig. 1 shows how the number of mechanical aids has increased over the past 10 years. In Fig. 2 the rate of growth in the number of mechanical aids since 1948 is compared with telephone stations and workmen. It will be seen that whereas the stations have increased by about 60 per cent. and staff by about 30 per cent. there has been an eight-fold increase in the number of mechanical aids.

While much has been done, far more is possible even with the financial resources at present available. Regional Directors are provided with details of all mechanical aids which can be supplied but printed information is seldom as inspiring as practical demonstration. With this in mind an exhibition of mechanical aids was held at Watford in the London North West Telephone Area in September, 1958. The exhibition was composed of a number of sections:—

(1) Heavy equipment such as trench excavators, pole hole borers and so on. These were exhibited in the open, and were demonstrated in use on the site.

(2) Lighter equipments which a working party might carry. These were mainly demonstrated in the open, and included a range of 110V electrical equipment at present under trial. Before the exhibition a slab of concrete was laid and some short sections of brick and concrete walls were built for demonstrating the road breaker and drills which are included in this equipment.

(3) A selection of recently developed tools, including gas plumbing equipment, exhibited in the garage building.

(4) A number of handling devices such as fork lift trucks.

(5) Injection moulding and X-ray equipment used in connexion with the jointing of solid dielectric co-axial cables. This part of the exhibition was in a large marquee which also provided a reception centre for the Press and a shelter when the weather proved too uncomfortable outside which, regrettably, it did on many occasions.

The exhibition was visited by more than 1,000 people, including senior officers from Post Office Headquarters and Telephone Areas throughout the country, staff representatives, and members of the Telephone Cable Contractors' Committee. Each visitor was supplied with a catalogue giving a plan of the exhibition and short descriptions of the devices on show.

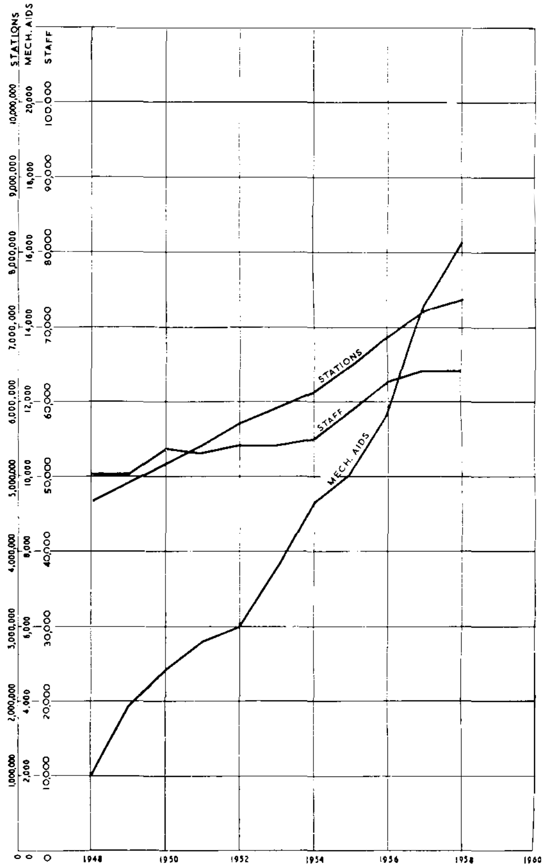


Fig. 2 : Comparison of growth in mechanical aids with telephone stations and workmen

A detailed description of every device exhibited cannot be given in a short article, but the following examples will give some idea of the extent to which the Post Office is applying mechanical aids in its engineering work.

Heavy Equipment

The *Simon Elevating Platform* shown in Fig. 3 is a hydraulically operated knee-shaped arm, mounted on a lorry chassis, carrying a platform which can be elevated to a maximum height of 36 feet above ground. Hydraulic pressure is provided by a pump driven by a separate petrol engine, the elevator and its power unit being mounted on a turntable. The unit has duplicate controls, one set being fitted on the power unit, and the other on the platform so that all movements can be controlled from the working platform.

Fig. 3 : Simon elevating platform

The controls provide for rotating the elevator through a full circle, raising and lowering the platform, and moving it horizontally up to a maximum distance of 23 feet from the centre of the turntable.

The vehicle chassis is provided with jacks to prevent tilting of the chassis when the loaded platform is extended horizontally to the side of the vehicle, but the jacks need not be used when on firm level ground and with a lightly loaded platform. The platform has a safe working load of 275 lb. on hard level ground without jacks and 750 lb. when the jacks are in use.

The machine embodies a number of safety devices; for example, the speed of descent is controlled if the hydraulic system fails; also, the motion of the platform is automatically stopped if it descends on to a solid obstruction.

The machine is very useful for aerial cable work where it can save the considerable time needed to erect ladders and jointing platforms. It is also useful for reaching the faces of buildings in situations where it is difficult or dangerous to erect a ladder.

This machine attracted a great deal of attention at the exhibition, and when the weather was fine trips aloft were very popular.

Gulley Emptier. This equipment—shown in Fig. 4—is similar to that used by local authorities for clearing sludge from roadside drains. In the Post Office it is used for cleansing manholes. It is very useful on cable routes where silt and sludge enter the duct line, and percolate into manholes.

The equipment is mounted on a three-ton chassis, and carries an 800-gallon tank divided into three separate compartments, one a sludge receiver of 400 gallons, a second of 350 gallons capacity which contains clear water for washing down purposes, and a third of 50 gallons containing cooling water for the air pump.

The air pump is driven by its own petrol engine, and applies suction to the sludge tank or pressure to the clean water tank as required for drawing out the manhole contents or providing clean water under pressure.

Astell-Watts Trench Excavator. As shown in Fig. 5, this is a light excavator capable of digging trenches up to 4 ft. 3 ins. deep and with widths of 9 ins., 14½ ins. or 20 ins. It is thus suitable for laying earthenware ducts used in the cable network.

The excavator is built around a Fordson Major tractor and has a digging chain of the scraper type driven by the tractor engine via the offside half of the back axle. The various digging widths are obtained by fitting appropriate sizes of cutter to the cutting chain. The machine is propelled forward by means of a winch and hawser on the front of the machine. The hawser passes round an anchorage in front of the tractor and the winch is operated automatically by a ratchet mechanism. The spoil is cleared from the trench by a belt driven from a Power Take Off shaft on the tractor.

Cheshire Highway Pole Hole Borer. This is a large machine suitable for digging any type of pole hole in practically any soil other than rock. It is illustrated in Fig. 6, and consists of an auger which is driven either by a separate Fordson Major diesel engine mounted on a vehicle chassis or from a Power Take Off on the vehicle transmission. The borer itself is gear driven and is raised and lowered by a rack bar. Holes are bored in stages and at the end of each stage the borer is raised to the surface and the earth flung off by increasing its speed of rotation. The machine will dig holes from 9 ins. to 36 ins. diameter and to a depth of 10½ feet.

The Post Office does not own any machine of this type but frequently hires one for work where it can be economically employed.

Jumbo 3-Ton Crane. This crane, illustrated in Fig. 7, consists of a jib which can be raised and lowered hydraulically and rotated through an angle of approximately 200°. The cantilevered jib provides the means of raising and lowering the load and because it can be brought to a horizontal position (and beyond down to ground level if necessary) can be used in places where headroom is limited. One feature is a travelling carriage which may be propelled along the jib for a distance of 4 feet, enabling loads to be positioned with great accuracy.

Lighter Equipment

110/55 *Volt Generating Sets.* To provide working parties with a readily available source of power, portable generating sets are being tried in the field. Each set weighs approximately 140 lb. and has an output of 2 kilowatts. In each, the 110 volt A.C. output is centre point earthed to the frame of the set and connected to the frames of the tools in use. The voltage of the supply above earth is therefore limited to 55 volts. Two 20 ampère socket outlets are fitted across the 110 volt output and two across the 55 volt output. These sets are driven by 5½ h.p. petrol engines.

The power output available can be used to operate a variety of electrically driven tools such as road breakers, chain saws and drill hammers.

Electric Road Breaker. This device for use with the generating set described above can do the same work as the familiar pneumatic road drill but is very much quieter in operation. The machine consumes 1½ kilowatts, weighs 77 lb. and has a striking rate of 900 blows a minute. It is supplied with drilling points and chisels, asphalt cutters, and a ramming foot to act as a punner for consolidating soil after an excavation has been back-filled.

Electric Drill Hammer. This tool, which is somewhat similar to the familiar electric drill, has a hammer action in addition to the rotary motion. It

Fig. 4 : Gulley emptier

Fig. 5 : Astell-Watts trench excavator

is very effective for drilling holes in concrete and masonry. Drills of this type are available for a number of voltages and several on field trial are giving encouraging results.

Electric Chain Saw. This device is also for use in conjunction with the generating set described earlier. Its weight is approximately 14½ lb. and its consumption 1 kilowatt. It has a high cutting rate and is useful for cutting up recovered poles and for tree cutting. Spectacular economies can be achieved when this tool is used in conjunction with the Simon Hydraulic Elevating Platform described earlier.

Warsop Rock Drill. This rock drill is a machine driven by a 250 cc two-stroke petrol engine and embodies an air blower for clearing the hole while drilling. It weighs 90 lb. and, with the bits provided, can drill a 1⅜ inch diameter hole to a depth of 4 feet. The machine can be converted to a light road breaker by two adjustments but without changing any parts other than the drilling bit.

The main use of this tool is for drilling holes before using explosives for blasting pole holes or trench excavations in rock.

Tools

Gas Plumbing Equipment. The use of blow lamps for plumbing and other engineering work is being discontinued and propane under pressure in cylinders will in future be used as a fuel instead of petrol. The use of this system enables any working party with a gas cylinder to use a range of small torches, stoves, and so on. The torches are easier to light than petrol blow lamps and less liable to be extinguished in windy conditions. The cost of the gas is less than petrol for the same heat output.

Relay Re-Contacting Tools. Re-contacting relays *in situ* has been performed from time to time for a number of years but the tools hitherto available have lacked the consistency of performance necessary to adopt this system as a standard practice. Recently, however, much attention has been given to this problem and a set of tools has been developed which enables the operations to be reliably performed. Four tools are used, all in the form of specially designed pliers. The first of these punches the old contact from the relay spring, the second locates the new contact in its correct position, and the third and fourth form a contact to its correct shape.

Wire Stapling Tool. This tool, which follows the general form of the stapling machines widely used in offices for fixing papers together, has been developed to a form in which it may be used for stapling small cables in subscribers' premises. The tool has a capacity of approximately 200 staples which can be expelled one at a time by pressing a lever (Fig. 8).

Some of these tools are at present on field trial and, if they are used on surfaces which are not

Fig. 6 above: Cheshire Highway pole hole borer

too hard for the capability of the machine, they give very satisfactory results.

Candy-Striped Tents for Jointers. A jointer's tent was demonstrated which was covered with a translucent material composed of fibre glass impregnated with PVC and coloured with broad red and white stripes.

The object of this design is to render the tents conspicuous when used in the carriageway, particularly at night when the existing type of tent is sometimes difficult to distinguish.

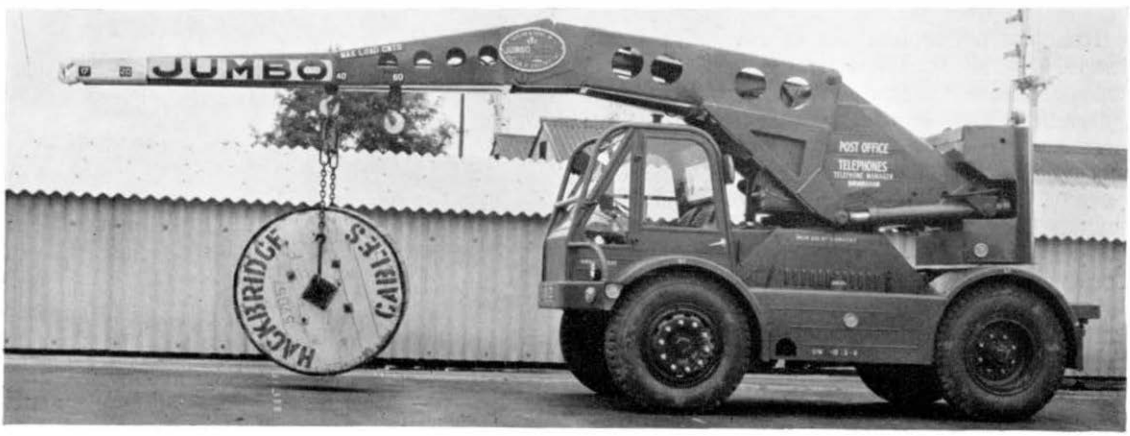
Materials Handling

Conveyancer Reach Truck. This type of truck, illustrated in Fig. 9, is available in two capacities —to lift 2,000 lb. and 3,000 lb. with heights of lift of 9, 10 or 12 feet according to requirements. A special feature is that the fork carriage which carries the load can be retracted over the body of the machine. This so restricts the overall dimensions that a 40 inch square pallet can be handled and placed in position with a working aisle width of only 75 inches. When the truck has been placed opposite the position where the pallet is to be stacked the fork carriage can be extended and the pallet positioned.

The mast and forks are hydraulically-operated, relief valves are fitted to prevent excessive pressures, and the brake is automatically applied when the driver leaves the platform. The truck is driven from a 36 volt battery which is recharged at night. The unladen weights of trucks are 3,650 and 3,800 lb. respectively.

Sherpa (Model 1A) Stacker. This combines the functions of a small fork lift truck with that of an ordinary sack truck. It is sufficiently light to be carried on stores carrying vehicles and can be used during unloading for moving a load from the body of the vehicle to the tailboard, then as a stacker for loading and lowering to and from ground level, and finally for transporting the load to the storage

Fig. 7 below: Jumbo 3-ton crane



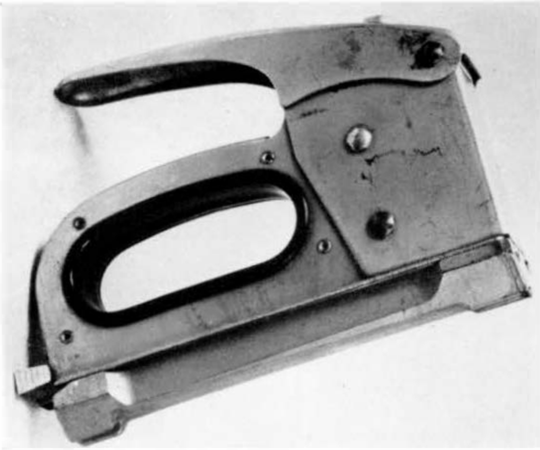


Fig. 8 : Wire stapling tool

position. It can also be used for loading a vehicle if other lifting devices are unavailable.

The height of lift is 44 inches and this caters for the heights of the tailboards on most stores-carrying vehicles. The load is raised by hydraulic ram supplied by a hydraulic hand-operated pump. When used as a sack truck the lifting mechanism can be partly raised so that the load is placed at the point of balance above the wheels, thus reducing the weight on the handles of the truck. The appliance is of great assistance to drivers of stores-carrying vehicles who may have to load and unload the vehicles without assistance as, for example, when carting bulk supply stores from section stocks to outstations.

Jointing and X-ray Equipment for Submarine Coaxial Cables

It is now not unusual for submarine cables to extend several miles over land before entering a repeater station, the land sections differing from the submarine only in the screening and external protection given to the central coaxial pair. In modern cables the basic construction of the coaxial pairs is similar, involving a central conductor surrounded by a solid polythene dielectric with an outer conductor of six preformed return tapes bound by a binder tape.

It is essential that the joints in the cable shall not introduce serious irregularities into its electrical characteristics; the joints must also be capable of withstanding as high an electrical pressure as the rest of the cable, since it has now become regular practice to feed power supplies over the conductors of submarine cables. The joints are made by brazing the centre conductor and injection moulding the polythene core. The machine which is used for moulding the polythene dielectric produces effective fusion between the injected polythene and the polythene core of the cable. When the polythene injection has been made the joint is X-rayed with an X-ray camera and any undesirable dirt, metal particles, or voids in the polythene dielectric are shown on the developed film. If the X-ray examination is satisfactory the return tapes of the outer conductor are brazed and the remaining protection of the joint completed.

The introduction of brazing, moulding and X-ray equipment into jointing chambers calls for effective earthing The earth lead used for this purpose is separate from the power feed, thus enabling the operator to see at a glance that the earth lead is intact and properly connected.

The exhibition stimulated a great deal of interest in the possibilities of using more mechanical aids with advantage, and while it could not produce spectacular results, it was without doubt a very worthwhile step in promoting better quality and economy in engineering work, while making it more congenial to those who perform it.

Fig. 9 : Conveyancer (2,000 lb.) reach truck

VHF Maritime Services

L. T. Arman

IN THE ARTICLE ON MEDIUM FREQUENCY RADIO-telephony services for the Merchant Navy in our Winter (November) 1958 issue, Mr. Bourdeaux drew attention to the inadequacy of the available frequency bands for such services to allow for future requirements for port operations and public radiotelephone services. This article shows how Very High Frequency (VHF) services have been developed to meet these needs.

Very High Frequency services have a comparatively short range but, since requirements for port operations services are of the same order in this respect, the VHF band is ideal for their purpose. For public correspondence, the services additional to those in the Medium Frequency (MF) band that can be provided only in the VHF band should be useful in meeting the increased demand which usually occurs at short range from the coast.

Some ten years ago the frequency band 156.025–165.05 Mc/s was allocated in the United Kingdom to maritime services. Frequencies in these bands have since been assigned to many private services, including harbour and docking schemes, and tug operations. They were also assigned to public services providing access to the inland telephone network. Until fairly recently, however, these services were only national.

An important stage in the development of VHF maritime services was reached when the International Radio Consultative Committee (C.C.I.R.) in August and September 1956 recommended the adoption of frequency modulation for international maritime services and agreed on the minimum standards for certain characteristics of the equipment, notably a frequency channel spacing of 50 kc/s. This made it possible to attack the problem of a frequency plan for international services, and at The Hague Conference in January 1957 such a plan was agreed upon and the C.C.I.R. recommendations on equipment standards were accepted.

A number of harbour boards are now operating VHF schemes on this basis; indeed, Southampton Harbour Board was early in the field with a service inaugurated in January 1957; and the Post Office has started to implement plans to provide VHF public services from a number of points around the coast using the existing medium frequency coast stations wherever possible.

It should be noted that only a portion of the frequency band of 156.025–165.05 Mc/s mentioned earlier is taken up by The Hague plan; allocations within this band to purely private services are being replanned in this country.

The international plan comprises both two-frequency and single-frequency channels. The two-frequency system is preferred for technical reasons, but a number of single-frequency channels have been included for operational reasons. In two-frequency working, a different frequency is used for each direction of transmission, whereas the same frequency is used for both in single-frequency working.

VHF International Maritime Band

The frequency bands, sub-allocations and frequency assignments agreed at The Hague in 1957 are shown in Table I below. The Hague plan recommends that all ships operating in the VHF international maritime band should be equipped for the calling and safety channel on the frequency of 156.8 Mc/s and the first choice inter-ship channel on 156.3 Mc/s, in addition to any other channels to satisfy their particular requirements. For the coast stations frequencies should be assigned first with a view to providing the essential services to ships equipped with the bare minimum of channels. Basically this implies that in general each coast station, either port operation or public correspondence, should in the first instance take up frequencies in the order of choice shown in Table I. The uses to which the various channels are put are referred to in later paragraphs.

Another important point is that where the service areas of different administrations overlap agreement should be reached between those administrations on frequency assignments in order to avoid interference. This is very necessary in the English Channel areas and an agreement was therefore concluded between the French, Belgian,

Table I. Allocations and order of choice

Channel Designators	Ship Frequencies		Intership	Port Operations		Public Radio-telephone
	Transmit Mc/s	Receive Mc/s		Single-Frequency	Two-Frequency	
1	156.05	160.65			10	8
2	156.10	160.70			8	10
3	156.15	160.75			9	9
4	156.20	160.80			11	7
5	156.25	160.85			6	12
6	156.30	156.30	1			
7	156.35	160.95			7	11
8	156.40	156.40	2			
9	156.45	156.45	5	5		
10	156.50	156.50	3			
11	156.55	156.55		3		
12	156.60	156.60		1		
13	156.65	156.65	4	4		
14	156.70	156.70		2		
15	156.75		Guard-band			
16	156.80	156.80	Calling and safety			
17	156.85		Guard-band			
18	156.90	161.50			3	
19	156.95	161.55			4	
20	157.00	161.60			1	
21	157.05	161.65			5	
22	157.10	161.70			2	
23	157.15	161.75				5
24	157.20	161.80				4
25	157.25	161.85				3
26	157.30	161.90				1
27	157.35	161.95				2
28	157.40	162.00				6

Netherlands and British Administrations at Brussels in December 1957 for the first phase in the development of public correspondence services.

Port Control and Navigation Information

Very High Frequency services are already used to a certain extent for controlling shipping in some port areas, but up to 1957 these systems were purely private.

The Mersey Docks and Harbour Board, for instance, have operated VHF service* using amplitude modulation (AM) for port operations since 1950, largely on the basis of the pilot taking portable equipment on board. They also use VHF radio on domestic services such as dredging.

There is a growing need for the development of facilities for port operations and navigation information to enable the ports to be used more efficiently, and these will now be in the international part of the VHF maritime band. Indeed, it can be assumed that all major port services at least will, in time, operate in that band. Adherence to the frequency plan agreed at The Hague in 1957 and uniformity of equipment would ensure that essential services are obtained at all ports by all ships fitted with comparatively simple equipment, capable of being switched over a small number of channels.

As already noted, Southampton Harbour Board is the first United Kingdom authority to operate port operations services in the international

* (See "The Harbour Communications System at Liverpool" by Capt. W. R. Colbeck, RNR, in the May 1952 *Journal*).

VHF band. The scheme consists of a control station at Calshot, a receiving station about half-a-mile away, and a transmitting station another half-a-mile away and about a quarter-of-a-mile from the coast. These geographical separations have been adopted because of the potential interference problems referred to later. Services have been provided initially on the following channels:–

(*a*) The safety and calling channel on 156.8 Mc/s.

(*b*) The port operations first choice single-frequency channel on 156.6 Mc/s.

(*c*) The port operations (navigation information) first and second choice two-frequency channels on 157/161.6 and 157.1/161.7 Mc/s respectively.

Calshot station is also equipped with radar.

In general, ships entering the port area contact the station on 156.8 Mc/s and are directed to one or other of the port operations channels for the receipt of navigational information or docking instructions. Services in the international maritime VHF band are also operated at Southampton Docks (British Transport Commission) and at the Esso Marine Terminal at Fawley. These are provided for certain specialized docking and berthing purposes.

Public Radiotelephone Services

Public services to provide for communication between ships and telephone subscribers are being developed in this country; these will be independent of port operations systems. Service ranges are those obtaining in the ship-shore direction, since the radiated power from the ship is generally lower than that of the coast station; moreover a signal-noise ratio of predetermined minimum is required at the coast station before the radio circuit may be connected to the telephone network. This minimum is not necessarily imposed at the ship station. The range depends upon a number of factors, such as the height of the ship and coast station aerials above sea level and the position of the coast station.

Rough seas can also be responsible for a significant reduction in the range, because of movement of the ship's aerial. In general, a radius of 40 miles can be assumed, but this may sometimes be reduced in certain directions on account of "shadow" arising from topographical features.

All public systems will use two-frequency channels (see Table I), and may be operated on either a full duplex (see later paragraph) or a semi-duplex basis; in semi-duplex the ships will use the "press to talk" system; the coast station will always be duplex.

Calling in both directions, except for the Clyde service, is by voice on the common safety and calling channel on 156.8 Mc/s. Later, when the number of working channels justify it, a common two-frequency channel may be provided (as allowed for in The Hague plan) for calling, and selective calling may be introduced.

So far, international services have been inaugurated at Clyde, North Foreland and Niton, but VHF services should be opened at Mablethorpe (Humber) and Land's End this autumn. These are to be followed by a service to cover the important part of the Thames beyond the range of North Foreland. One working channel in addition to the common calling channel on 156.8 Mc/s has been or will be, provided at each station at the outset, but the plans envisage provision of four working channels ultimately. The frequency of the working channel at Niton and North Foreland is in accordance with the agreement made at Brussels in December 1957.

Table II. Coast Station frequencies

Station	Coast station transmitting frequency (Mc/s)	Ship station transmitting frequency (Mc/s)	Channel number in The Hague Plan
Thames (A.M.)	161.5	157.0	—
Thames (F.M.)	161.95	157.35	27
Clyde	161.9	157.3	26
North Foreland	161.9	157.3	26
Niton	161.85	157.25	25
Land's End	161.95	157.35	27
Humber	161.9	157.3	26

A service for the Clyde was opened in January 1957; it was planned in advance of the international agreement but strictly speaking it is not an international service, as calling is effected on the one working channel provided instead of on 156.8 Mc/s. However, provision of the calling channel only would be necessary to make the Clyde service fully international.

The Thames service† which has been operating since 1949, using a coast station at Shooters Hill, should also be mentioned; this cannot be integrated

† Described in the May 1950 issue.

into the international network as it uses amplitude modulation and eventually its work will be taken over by an FM service.

The frequencies of the channels for the services mentioned above are shown in Table II.

The VHF equipment is being installed and operated from existing MF coast stations wherever possible; otherwise the arrangements may be either the control of a remote VHF station by a coast station, or a telephone exchange operator.

The Thames (amplitude modulation) and Clyde stations are controlled directly by telephone exchange operators. Niton is the only example so far of remote control by a coast station.

The general principles of working are much the same for each station, and it will be enough to describe one; Niton is perhaps the most interesting example to take.

Niton

Niton MF Coast Station is on a comparatively low site and was therefore unsuitable for a VHF radio station required to provide service both out to sea and in the Southampton area. Accordingly, to ensure service in the Southampton waters a high site had to be acquired on the Isle of Wight for the VHF equipment and aerials. A disused Air Ministry site on St. Boniface Downs, about 800 feet above sea level and some six miles from Niton, was convenient and the Post Office took it over. This site had the further advantage that buildings were available and one was adapted to house the radio equipment. For the aerials a mast about 180 feet high was erected; the building and about 120 feet of the mast can be seen in Fig. 1. Control of the VHF equipment is over land lines from the operating position at Niton Coast Station. The VHF station is normally unattended.

Potential interference problems make high masts necessary. The Hague frequency allocation plan in Table I shows that reception on public radio-telephone services at a Coast Station is given very little frequency protection against the transmission from that station on the calling channel on 156.8 Mc/s; indeed, if channel 23 is used (that is, 157.15 Mc/s) the frequency difference is only 0.35 Mc/s. The necessary selectivity cannot be obtained in the receiver at such small frequency differences between the wanted and unwanted signals, having

Fig. 1 : Niton MF Coast Station radio equipment building

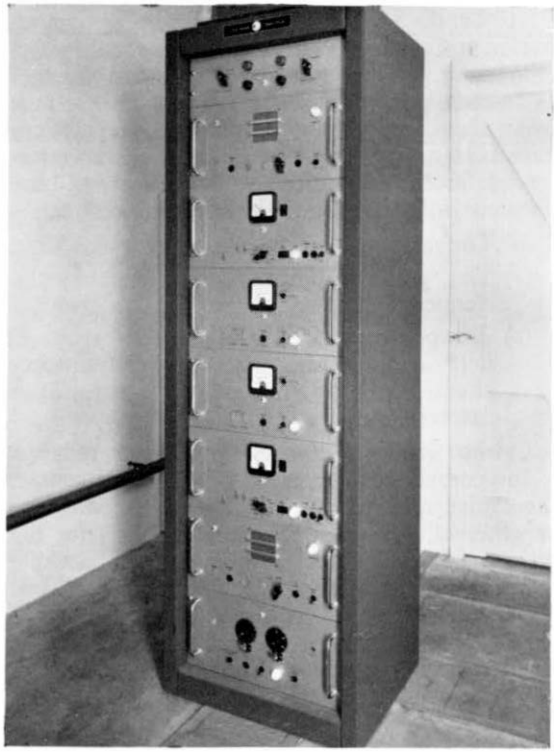


Fig. 2 : Transmitter/receiver

regard to the power of the transmitter compared with the sensitivity of the receiver, and the only recourse is to separate the transmitting and receiving aerials.

This can be done either horizontally or vertically. If horizontally, the distance necessary might be as much as a mile and would involve separating the relevant receiver and transmitter, and there would be an attendant housing problem. Using vertical separation, however, a distance of about 70 feet is enough. With a mast of about 180 feet, therefore, this separation can be achieved while obtaining the required height of at least 100 feet above ground for any aerial.

The receiving aerials for both the calling and working channels are placed at the top to obtain as much range as possible in the ship-shore direction. As mentioned earlier, the range in this direction is generally less than the range for the opposite direction; a higher receiving than transmitting aerial at the coast station will tend to offset this difference.

The working channel transmitting aerials are mounted between the receiving aerials and the calling channel transmitting aerial (the only one in Fig. 1). Spacing is necessary to minimise the radiation of intermodulation products which could result in an interference problem.

One transmitter and one receiver are provided for each channel. These are of conventional design and meet the United Kingdom specification for international services which, in its turn, conforms to the C.C.I.R. recommendations. This equipment is shown in Fig. 2. The transmitters each have a nominal radio frequency (RF) power of 40 watts.

Each transmitter and receiver is connected by land line to combining equipment for connexion to the operator's position at Niton Coast Station. Control circuits are provided which either indicate certain conditions to the operator or include facili-

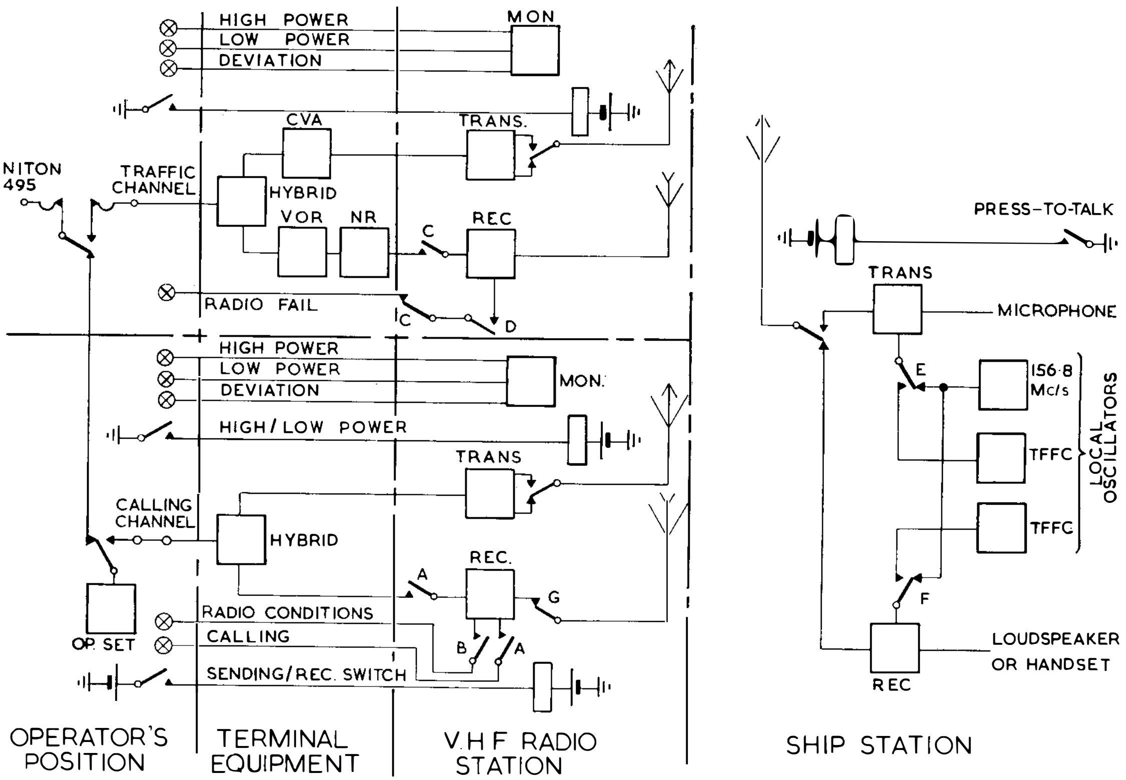


Fig. 3 : Circuit between coast station radio operator and ship

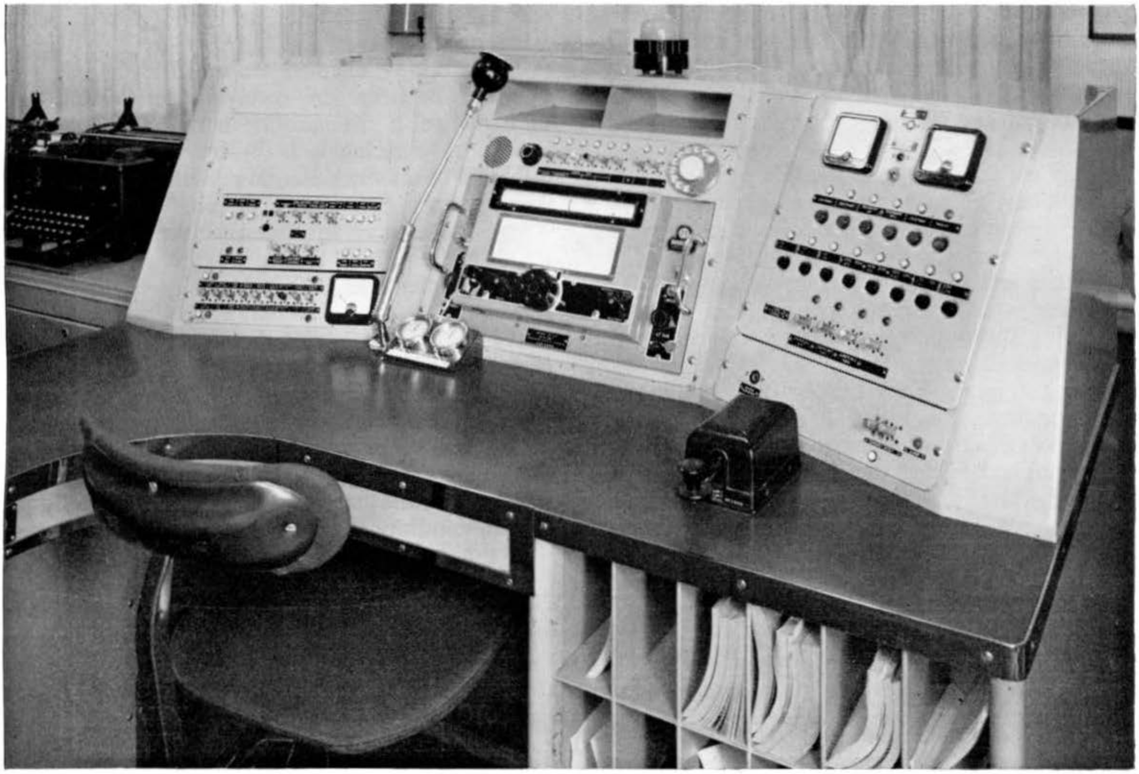


Fig. 4 : Radio operator's console

ties for the operator to set up specific conditions at the radio station.

The circuit between the radio operator at the coast station and a ship is shown in schematic form in Fig. 3. It can best be described by tracing a call in each direction.

Considering a call from the telephone network, the subscriber calls NITON 495 and asks for the ship required; the operator who sits at the Console shown in Fig. 4 calls the ship by voice on the calling channel on 156.8 Mc/s, if within range, and, on receiving a reply, directs the ship to switch to the traffic channel, which will then be connected to the subscriber.

A ship wishing to call a telephone subscriber would call Niton by voice on the calling channel and, on being directed to the traffic channel, would switch his transmitter and receiver by means of switches "E" and "F" to these frequencies; it is assumed that the ship has only one VHF set. That is the simple principle involved; now for an explanation of the means by which it is achieved. The details are shown in Fig. 3.

Considering first the calling channel: the operator connects his operating set to that channel and uses the "send/receive" key to switch the radio equipment to the transmit condition; as the same frequency is used for transmitting and receiving on this channel, the receiver is disconnected at switch "G" while transmitting. Speech incoming to the receiver operates switches "A" if the signal strength is above the minimum required to operate the receiver; these light the calling lamp and connect the receiver to line. If the signal is strong enough to provide a signal-noise ratio of a prescribed minimum switch "B" also operates and indicates to the operator by means of the "Radio Conditions" lamp that the ship can be connected to the telephone network.

It was considered desirable that because of the safety aspect of the calling channel, and because it is not connected to the telephone network, it should be available to the maximum range; thus, no minimum standard of the signal-to-noise ratio is imposed. The operator has the option, by key, of using a high or low power condition on the radio transmitter, but low power is to be preferred whenever possible to minimize interference. A monitoring unit is fitted at the VHF radio station to pass back signals indicating the power condition and whether the transmitter is being modulated (deviation of carrier frequency).

Having completed the calling procedure the operator connects the inland telephone subscriber to the traffic channel, first putting the transmitter in a radiating condition on high or low power. Speech from the telephone subscriber passes via the hybrid network (HYB) to the constant volume amplifier (CVA) where it is amplified to a predetermined level; from there it is passed to the radio transmitter and is received at the ship on either a loudspeaker or a telephone handset, or both. The purpose of the CVA is to ensure that the radio transmitter is fully modulated, irrespective of the wide variations in the level of the speech received from the telephone subscriber.

The ship station is shown in Fig. 3 as using simplex, that is, switching from "send" to "receive" conditions as required; using simplex to communicate with the coast station, the ship's operator connects the aerial to the transmitter by the "press to talk" switch.

The radiated signal operates switch "D" at the coast station, provided that it is above the sensitivity of the receiver, and switches "C" if the radio conditions are sufficiently good for extension of the circuit to the telephone network. Thus the "radio fail" lamp operates if a signal below the prescribed minimum is received, but does not operate in the presence of a good signal, or in the complete absence of a signal; the absence of a signal is particularly important for simplex operation from ships as during reception at this station no signal is radiated.

Switch "C" connects the output of the receiver to the noise reducer (NR) and the speech is passed through this device which reduces the noise in the absence of speech, to a voice operated relay (VOR) and from there to the hybrid network (HYB) and the telephone subscriber. The VOR controls the gain of the CVA so that the received speech which leaks across the hybrid is not amplified in the CVA to the normal level and re-radiated at an excessive level; this precaution is more important if the ship is working duplex, that is, communicating without having to switch from "send" to "receive" as in simplex, for the ship's subscriber would hear his own speech at a distressing level.

A radio operator's console for MF and VHF services is shown in Fig. 4. The keys and signalling lamps for the VHF services are on the upper two panels on the left of the position, while keys, with a dial, for routine testing the radio circuit are fitted at the top of the centre panel.

Equipment Standards

To minimize potential interference and to ensure a certain standard of performance, specifications for both coast and ship station equipments are agreed between manufacturers, the Post Office and other interested parties; these specifications are published by H.M. Stationery Office, and it is a condition of the licence that the equipment used shall conform to the relevant specification.

United Kingdom standards for the International VHF Maritime Band are based on those recommended by the C.C.I.R. at Warsaw in 1956. Private services are not obliged to conform to the International Standards but the standards in specifications now being proposed for these services are not significantly different.

As stated earlier, in The Hague plan ship stations operating in the VHF International Maritime band must be able to transmit and receive on the calling and safety frequency of 156.8 Mc/s, on the first choice inter-ship frequency of 156.3 Mc/s and on any other frequency necessary for their service. Except, perhaps, for public services, simultaneous use of these frequencies will not be required; in general, therefore, ship station equipment can be foreseen as being one set with switching facilities for transmitting and receiving on at least three channels. As public services develop, and particularly if a separate calling channel with selective calling facilities is adopted, a second set purely for these purposes may be installed. Coast stations, however, in general, will need a set of equipment for each channel.

Telephone trunk traffic has increased by 12 per cent. during the past year—the fastest increase since the war; 1.3 million calls are being made each day.

Cheap rate calls have increased by 15 per cent. since the period was extended in July 1958 to cover the whole night from 6 p.m. to 6 a.m., and 2 p.m. to 6 p.m. on Sundays.

Full rate calls have increased by 10 per cent.

External Telecommunications Executive

THE EXTERNAL TELECOMMUNICATIONS Executive is a Department of Post Office Headquarters. It is unique among such departments in that it combines responsibility for administering the policy of overseas communications with the task of operating them.

The Executive was set up in 1952, some two years after the Post Office had taken over, from Cable and Wireless Ltd., the operations of long-distance overseas telegraph services, to add to the overseas telephone service, and the shorter distance telegraph links, already under Post Office control.

The experiment of combining administration with execution, within a single Headquarter Department, has been most successful; the experience of the past seven years has indicated that some readjustments in the organization of the Executive might enable even greater advantage to be taken of the close association of precept and practice—particularly in the very important field of planning.

The Executive is looking forward to a stimulating future of rapid progress. Unlike the majority of other Post Office departments it operates under the salutary influence of effective competition, not only from the foreign telegraph carriers which operate in this country but also from neighbouring European administrations.

Plans for maintaining the United Kingdom's pre-eminent position in this field include the mechanization of the overseas telegraph service, the continued—and accelerated—development of the rapidly growing overseas telex service, the expansion of the leased circuit services and, of course, the construction of more long-distance submarine repeatered cables.

Within Europe two quite large cables will be constructed during 1960 and 1961: a direct cable from the United Kingdom to Sweden and a cable from the United Kingdom, via the Faroe Islands to Iceland. In the wider field, the Executive looks forward to the development of the Commonwealth "round-the-world" cable scheme, starting

(left to right) Mr. H. LEIGH, Staff Engineer; Mr. C. H. G. EBURNE, M.B.E., Staff Controller; Mr. A. G. SUTHERLAND, Telecommunications Controller; Mr. C. J. GILL, Deputy Director; Mr. G. H. COATES, M.B.E., Deputy Director; Col. D. McMILLAN, C.B., O.B.E., Director; Mr. H. G. LILLICRAP, Deputy Director.

Since the photograph was taken Mr. E. F. H. Gould of the Engineering Department, has been nominated to succeed Mr. Gill who will become Controller of the Supplies Department.

with the United Kingdom—Canada cable (CANTAT) in 1961.

The Executive has its Headquarters in Alder House. Field units include the Telegraph Manager's Office in London which is responsible for the operation of the Overseas Telegraph Service and the Overseas Telex Service. The operating centres are in Electra House on the Thames Embankment and in the Central Telegraph Office Building.

There are also the International and Continental telephone exchanges, the former in the Wood Street building and the latter in Faraday Building.

The Radio Telephone Terminal which contains the technical control point for every radio telephone circuit, is at Brent on the northwest outskirts of London and the Executive is also responsible for the development and operation of some 12 radio stations. These last include Rugby, which is by far the largest transmitting station in the British Commonwealth and is certainly one of the largest in the world.

It may be seen therefore that the Executive is very much a self-contained whole. It administers, it plans and it executes, and all of these functions are almost entirely discharged by the staff of the Executive. Exceptions are engineering design and engineering provision which the Post Office Engineering Department undertakes, and the staffing of the Continental and International Telephone Exchanges which is arranged by the London Telecommunications Region.

The photograph shows senior staff of the Executive as it was in July this year. A continuation of the process of the reorganization mentioned above may be expected to bring about a few further changes within the coming months.

More Circuits for TAT

THE DESIGN CAPACITY OF THE TRANSATLANTIC telephone cable between the United Kingdom, Canada and the United States (TAT 1) was 36 4 kc/s spaced circuits, divided 29½ U.K.–U.S.A. and 6½ U.K.–Canada. Since September 1956 when the cable opened various expedients have been adopted to try and keep pace with the ever increasing traffic which still continues to grow at more than 10 per cent. a year. At present 42 circuits are working to the U.S.A. and 13 to Canada. The additional circuits have been obtained by splitting many of the original 4 kc/s spaced circuits into two and by exploiting certain below band capacity.

The quality of the circuits so derived is however somewhat inferior to what is considered a satisfactory standard for long intercontinental systems and development work has been proceeding on both sides of the Atlantic on means for increasing the capacity of the cable without affecting appreciably the quality of the circuits so provided. The American Telephone & Telegraph Company and the Post Office have both developed new terminal equipment which, when used together, will enable the capacity of the U.K.–U.S.A. portion of the cable, for example, to be increased from its design figure of 29½ circuits to 74 or more.

The new British technique uses improved channelling equipment which enables the telephone circuits to be provided in a bandwidth of 3 kc/s per second instead of the 4 kc/s originally occupied. Because of the much improved design of channel filters, the bandwidth is used more effectively, so that circuits of 250 c/s—3050 c/s are obtained compared with 300 c/s—3400 c/s with the original 4 kc/s spaced channels with little reduction in articulation efficiency. The 900 kc/s guard band between channels which applies with 4 kc/s spacing is unnecessarily wasteful for systems where the cost per unit bandwidth is so high and it is expected that 3 kc/s spacing will be accepted as the new international standard on all long submarine cable systems.

The American technique, known as Time Assignment Speech Interpolation (TASI) is much more intricate and is based on the fact that, on any group of circuits comprising separate "go" and "return" channels, at least half the channels are idle at any instant while speech passes in the opposite direction; the TASI equipment has been developed to use these idle channels to carry additional conversations.

The principle on which the system operates is as follows. When any talker starts to talk the speech detector associated with his circuit signals this information to the control circuit which records the fact in its memory store and allocates a free cable channel, connexion being made via an electronic switch.

At the same time the number of the talker channel in use is signalled in code form to the distant end of the cable channel where the receiver associated with the cable channel arranges for the incoming electronic switch to connect to the appropriate listener. The total time of operation of the speech detector plus receiver and electronic switches is of the order of 10-15 milliseconds and a speech burst is clipped by this amount.

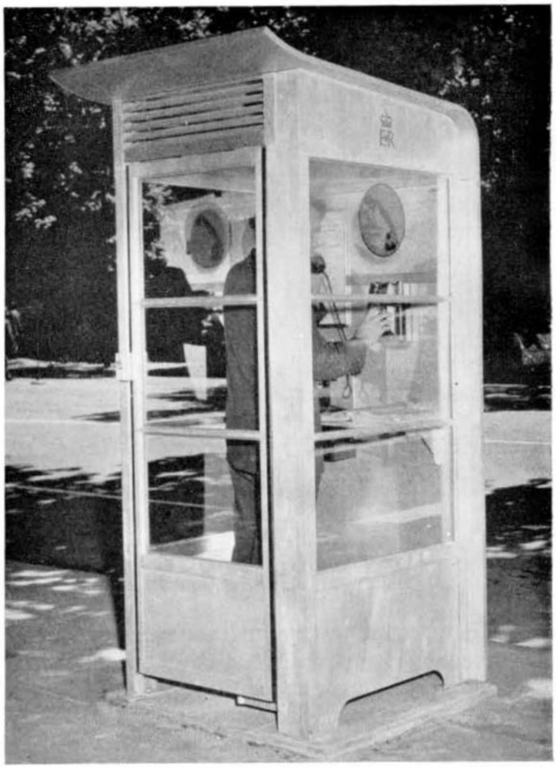
The connexion once established is left through until nearly all the cable channels are in use, when a forced release is transmitted to the distant end over a separate signalling channel which is also used to check that the right connexion has been made. Checking is done by transmitting in repeated cycles the stored information from the memory at the transmitting end regarding the talker channels in use and the cable channels to which they are connected. This information is checked at the incoming end and the connexions to the listener channels corrected if necessary. As the checking information is repeated several times a second any incorrect set up will quickly be rectified.

It is proposed to equip the U.K.-U.S.A. circuits on TAT 1 with both the British and American devices during 1960 thereby providing at least 2½ times the number of circuits available in an unmodified system. As at present designed each TASI unit can deal with up to 36 cable channels. The greatest increase in capacity is obtained with a full unit; the multiplying factor drops off as the number of channels connected decreases.

One drawback of the TASI equipment is that it is unsuitable for circuits carrying data or telegraph channels; other than this, however, it can be applied to any 3 kc/s spaced speech channels.

Because of the intricate engineering and the considerable development effort which has been involved in its production, TASI equipment is expensive, the estimated combined cost of the units to be fitted in London and White Plains on the TAT 1 cable being over £1 million. However, having regard to the fact that the original cost of the 36-channel cables was some £15 million the £1 million is a relatively small price to pay for the additional capacity so obtained.

The new techniques are not being applied at present to the U.K.-Canada circuits, because little advantage would be obtained by so doing; in any event a new large capacity CANTAT cable (sixty 4 kc/s spaced circuits or eight 3 kc/s spaced circuits) to Canada is to be laid in 1961.



Australia Plans a new Kiosk

The Australian Telephone Administration, like the Post Office in the United Kingdom, has recently developed a new kiosk design and has installed one in Melbourne.

This cabinet has been developed to reduce painting and maintenance costs and to improve ventilation, transport and usage under Australian climatic conditions.

Observed results and public reaction have been most favourable and a further field trial is now being arranged by installing two of these cabinets in each State in the Commonwealth.

The roof and back are of aluminium coated plywood and the sides and doors are of aluminium sections and sheet material screwed together. The sides and door are fully glazed to provide a good natural lighting and a view into the cabinet. The back is solid, to facilitate instrument mounting and with the inward opening door this allows free orientation to provide protection against the sun during the hottest hours.

The International Frequency Registration Board (I.F.R.B.)

J. A. Gracie

The International Telecommunication Union, now meeting in Geneva, is reviewing the work of the International Frequency Registration Board. In this article Mr. Gracie, who is Vice-Chairman of the Board, outlines the organization and some of its problems.

To appreciate the functions of the International Frequency Registration Board, let us consider, for a moment, some simple aspects of radio frequency assignment and radio spectrum utilization.

If we switch on a broadcasting receiver and tune it to the frequency (wave-length) of the local transmitting station, we normally get good clear reception. But if we turn the dial and listen to a more distant station, we shall often find that good quality reception is impossible because of interference from another station which appears also to be using the same frequency.

We may even tend to sympathize with the regular listeners to the interfering stations on the score of the poor service they would seem to be obtaining. However, if we could transport the receiver to their neighbourhood we should find that clear reception is obtained because the strength of the signal from the new "local" station is now so much greater than that of the other station which is sharing the frequency, that interference from the latter station has dropped to negligible proportions.

Also, if we now tune in, at the new receiver location, to the frequency of the first station we listened to, we may find that signals from this station are now subject to interference from yet another station operating on the same frequency, the presence of which was undetectable at the original point of reception. Hence, all the stations, although sharing frequencies with other stations, may in practice be giving a service of good quality to "local" listeners; and it is only when a listener is so situated between two stations that the signals from both are of comparable strength, that reception of either of the two stations becomes poor.

Thus, if a new radio station has to be brought into operation, two basic criteria must be satisfied in assigning a frequency to it: (a) the frequency must be so chosen that its propagational characteristics will enable it to produce an adequate signal in the area of intended reception (this may involve, for long-distance services, the choice of several frequencies for use during different times of the day and during different seasons of the year); (b) the geographical separation between this area of reception and other stations already using the same (or a closely adjacent) frequency must be sufficiently great to make the signals from the existing stations so weak in relation to that of the new station that interference to the latter will not arise or, at least, will be tolerable.

These two requirements must be met if the new station is to provide a satisfactory grade of service, and the Administration or Agency which has jurisdiction over the new station always endeavours to ensure that these criteria are satisfied.

There is yet a further condition, however, that should be fulfilled: (c) if the selected frequency or a closely adjacent frequency is already in use by another radio station, the area (or points) of reception of the latter station must be sufficiently far removed from the new station so that interference is not caused to the already-existing service. Very often this last requirement receives insufficient consideration.

When radio was in its relative infancy, radio frequency assignment presented no problems—a different frequency was selected for each radiocommunication station when it came into being, as there were plenty of frequencies to go round. As radiocommunication services expanded, however, the problem of finding frequencies on which new stations could operate without causing interference to already-established services became more and more acute. Fortunately, technical progress in the design of radio equipments tended to reduce this difficulty; transmitting stations were designed to maintain their frequency to a higher degree of accuracy—and not drift about as with earlier equipments—and radio receivers were designed to be more highly selective, that is, more effective, when tuned to the desired station, in suppressing interference from stations working on neighbouring frequencies.

Further Advances Possible

This technical progress has continued and intelligence can now be transmitted by radio, whether in telegraphic or spoken form, in a much narrower section of the frequency spectrum than in earlier days, but while the possibilities of still further advances in such techniques are by no means exhausted, there are limits to what may be accomplished without greatly increasing the costs of both sending and receiving equipments.

Radio, to many people, means "broadcasting", but although this type of radiocommunication service has a great impact on every day life, there are, of course, other very important types of radio service. For example, efficient and interference-free radiocommunications are absolutely vital to the safety and regularity of air transport services—the pilot of an aircraft must be able immediately to receive weather reports, landing instructions, and so on which can be transmitted to him only by radio, and he has to rely on radio-navigational aids (signals transmitted from special types of radio station) for determining the position of his aircraft in bad visibility. Ships, also, are dependent on radiocommunications for weather reports and instructions from their owners, and they, too, rely in bad weather on bearings which are derived from radio signals, and they navigate through ice fields or crowded estuaries, in fog, by means of radar.

There are still other types of radiocommunication service, such as the so-called "fixed services", which are often the means of conveying public service messages—for example a telegram to India or a telephone call to Australia; and the subscriber who pays for the facility of speaking to a friend in, say, Australia, is justifiably annoyed if his conversation is seriously impaired by interference from another radio service. Such "fixed service" communications may, in some countries and in some areas, provide the only link with the rest of the world and are essential to the wellbeing of the community concerned.

The various types of service cannot in general be mixed up together. Some types—broadcasting and television services, for example—use transmitting stations of great power which send out very strong signals designed to give high-grade reception in urban areas where interference generated by industrial machinery would otherwise impair the quality of the service. Others, such as stations on board aircraft, must be of small dimensions, using very low-power and hence sending out weak signals, which would be blotted out by a broadcasting station if this were transmitting in the same neighbourhood on the same frequency.

Also, for some types of service, communication is required only over fairly short distances and, for this purpose, "medium" frequencies (between about 150 kc/s and about 4 Mc/s) are most suitable. Other services have to provide communications over very great distances, for which purpose "low" frequencies (below about 150 kc/s) or "high" frequencies (between about 4 Mc/s and 30 Mc/s) alone are suitable. "Very high" frequencies (above 30 Mc/s) are, in general, only useful for very short-range communications.

Accommodating Services

The International Telecommunication Union (I.T.U.), formerly in Berne but now with headquarters in Geneva, has sought during past decades to ease the problem of accommodating the ever-growing number of radio services through the allocation, by agreement among the countries which are members of the Union, of specific blocks or "bands" of frequencies to the various types of service; but after that, with a few exceptions—notably in short-range and medium-range broadcasting services where the planning was carried down on a regional basis to the assignment of specific frequencies to specific stations—it was left to the individual Administrations to select the frequencies, from the appropriate bands, for any radio service which they desired to bring into use.

Until 1948, therefore, any country which wished to open a new radiocommunication service selected the required frequencies, usually after listening tests to ascertain whether they appeared to be clear of interference from existing services, and merely notified the Bureau of the I.T.U. (then in Berne), for the information of other countries, that they were using these frequencies. This system, however, completely broke down during the Second World War because of the enormous expansion of radio services for the Armed Forces, services for political warfare, and the rapid development of entirely new services, coupled with the urgency with which, irrespective of other considerations, these services had to be brought into use. After the war, the situation was quite chaotic and interference between radio services was widespread, so much so that some of the services which must use low-power equipments—for example aeronautical and aircraft services—could not obtain interference-free communications, which were necessary for the safety of aircraft and hence of human life.

Atlantic City Conference

A Conference of the International Telecommunication Union held at Atlantic City in U.S.A. in 1947 took two important steps.

First, it drew up a new "Table of Frequency Allocations" which divided up the usable radio spectrum into bands of frequencies which were re-allocated among the various types of radio service in a manner commensurate with the anticipated relative needs of each type of service. Secondly, it decided to establish an international body, to be called the "International Frequency Registration Board" (I.F.R.B.), to which all countries which desired to use a new frequency for either a new or an existing service had to notify full particulars of the proposed use of this new frequency. The I.F.R.B. was charged to examine this proposed use, to ascertain whether it conformed with all relevant I.T.U. Regulations in regard to the type of service and so on concerned, and to examine whether the use of the frequency would be liable to create interference to already-established services. If the Board found that such interference was liable to be caused or that, in other respects, the proposed use of the frequency was not in accordance with I.T.U. Regulations, the Board was empowered to reject the proposal and to refer the matter back to the notifying Administration.

Because this meant that the Board would have some element of supra-national powers the Conference decided, after long discussion, that the I.F.R.B. should consist of 11 members, all experienced in radio frequency assignment questions, drawn from representative areas throughout the world. Thus, of the 11 members of the present Board, there are three members from the Americas (Argentine, Cuba and United States); three from Western Europe and Africa (France, South Africa and the United Kingdom); two from the Eastern Europe states (Czechoslovakia and the U.S.S.R.) and three from Southern Asia and Australasia (Australia, China and India). According to the I.T.U. Convention, these members serve "not as representatives of their respective countries or of a region, but as custodians of an international public trust"; and they must not request or receive instructions relating to the exercise of their duties from any Government, or from any public or private organization or person.

The Board was given other duties. One was to compile, and maintain up-to-date, a "Master Radio Frequency Record" of the frequencies assigned to all radio stations throughout the world, with other pertinent particulars such as the geographical location and call-sign of the station using each frequency, the type of service, the emitted bandwidth, the power of the transmitter and the hours of daily use; and to arrange, in co-operation with the Secretary-General of the I.T.U., for copies of this Record to be published periodically for the information of all countries.

Because of the very frequent changes and additions to this Record—there are frequently more than 2,000 amended or new entries during a single month—and the need to be able rapidly to tabulate sections of the list, on a day to day basis, for the purpose of conducting interference studies, the Master Record is kept in the form of punched cards on which the various particulars are recorded in code. The latest edition of the published Record, which is now in preparation and which will be reproduced by the offset process from photographs of the tabulations of the punched cards, will be an imposing affair consisting of three volumes having a total of about 6,000 pages and containing particulars of more than 350,000 frequency assignments.

As far as the Board's main task is concerned, it is not possible within the scope of this short article to go deeply into the highly complex question of the propagation of radio signals and the assessment of the possibility of mutual interference between radio services which either share the same frequency or operate on closely adjacent frequencies. It will perhaps suffice to say that, for short-range services using fairly low or very high frequencies, where the signals are propagated along the surface of the earth and remain substantially constant in strength, the calculation of potential interference is a relatively simple matter. For long-range services using high frequencies, however, the question becomes very involved because the signals are propagated by reflections from ionised layers of the upper atmosphere and vary in strength from hour to hour, from season to season, and from year to year throughout an 11-year cycle of solar activity. Curves have therefore to be established, in relation to each frequency for a new service, which show (a) the probable variation of the strength of the signal of an existing service which might be affected, after making any necessary adjustments for the amount of power radiated and the gain of the directional transmitting aerial, and (b) the likely variation of the strength of the interfering signal from the new service, after making any necessary adjustments for the radiated power and the effect of the directional transmitting aerial, and for the discrimination against interference which may result from the selectivity of the receiver and the directional characteristics of the receiving aerial used by the existing service.

Comparison of these curves, and of similar curves in respect of other existing services which may also be affected, shows the periods during which the services can probably work together without interference and the periods, which may be limited to only a few hours per day or during certain seasons, when serious interference seems likely to occur. Where the curves show that serious interference appears inevitable during prolonged periods, the Board makes an unfavourable "Finding" and the application to use the frequency is returned to the notifying Administration. Where the risk of interference does not appear to be great or the periods of likely interference are of short duration, the Board accepts the frequency—sometimes on a provisional basis—for inclusion in the Master Radio Frequency Record.

One of the main tasks which has fallen on the I.F.R.B. has been to persuade Administrations to bring the operations of their radio services into conformity with the new Table of Frequency Allocations which was established by the Atlantic City Conference. As previously mentioned, conditions in the radio spectrum after the end of the Second World War were deplorable, with high-power fixed or broadcasting stations working cheek by jowl with low-power aeronautical and maritime stations and causing intolerable interference to the latter.

The first step to restore some semblance of order obviously consisted in segregating the various types of radio service and in trying to shepherd these into the appropriate frequency bands allocated to the type of service concerned. The situation in this connexion was further complicated by the introduction of the new Table of Frequency Allocations which, to provide for the expansion of some types of service, necessarily had to deprive other types of service of blocks of frequencies which they had previously been entitled to use—with the result that the stations of that service had to seek alternative frequencies.

Finding New Frequencies

The magnitude of the problem can be judged by the fact that, in 1953, there were about 30,000 stations operating on "out-of-band" frequencies. The finding of new frequencies for this great number of stations has imposed a very heavy burden on Administrations, in both staff time and the cost of modifications of the equipments; but the Administrations almost without exception, have made tremendous efforts to this end in the common interest. At present the total number of stations which still appear in the records of the I.F.R.B. as operating on out-of-band frequencies is little more than 1,000 and even a fair number of these are believed to be no longer in active use.

In no field has the problem of frequency assignment become more acute than in long-distance broadcasting services. Such services—which, to be effective, must be transmitted on high frequencies ("shortwaves")—were originally limited to broadcasts, in the national language of the country concerned, destined for reception by nationals of that country in colonial or other oversea territories (as from the United Kingdom) or in remotely situated areas (in the case of large countries such as the U.S.S.R. or Brazil). During the Second World War, however, long distance broadcasting, particularly in "foreign" languages, became a powerful instrument of propaganda and counter-propaganda and such use has intensified enormously during recent years. In consequence, the bands of frequencies reserved for long-distance broadcasting services are extremely congested and mutual interference occurs.

Attempts were made at International Conferences held under the aegis of the I.T.U. in 1948 and 1950, to establish world-wide plans for short wave broadcasting services, but these Conferences unfortunately failed to reach their objective. Many countries of the I.T.U., however, still held the view that the only method of securing order in the high frequency broadcasting spectrum is for all stations which participate in these services to adopt internationally agreed plans for the assignment of frequencies and programme periods, and the I.F.R.B. was given the task of preparing such plans. The Board, in consultation with the Administrations of all countries, has produced nine plans, one for each season (winter, equinox and summer) of the year and for the main phases (low, medium and high) of sunspot activity and has circulated them to all countries of the Union for their consideration and comments. The Board found, in preparing these plans, that it was quite impossible to satisfy in full the requirements of all countries during certain periods of the day and during certain seasons, and has endeavoured to make the most equitable distribution of the available frequencies among the countries concerned during such periods. The I.T.U. Administrative Radio Conference, which started in Geneva in August has the task of reviewing these plans and deciding whether they offer the possibility of a solution to the present unsatisfactory situation.

Leaving aside a number of other duties of the Board of a less important character, it might be asked whether the I.F.R.B. is succeeding in its primary task of bringing better order into the radio spectrum. It would be idle to pretend that things are satisfactory as regards fixed services—it might perhaps be fair to say, however, in view of the continual expansion of such services, that had it not been for the I.F.R.B., matters might have been a good deal worse. As far as long-distance broadcasting services are concerned a solution to the present problems has still to be found. On the credit side, however, there is no doubt that the aeronautical and the maritime services are, in general, enjoying greatly improved communications, sometimes involving the safety of human life, than were available to them some years ago.

The conference now being held in Geneva may decide to alter both its composition and its functions; but it would appear that many Administrations hold the view that some form, or degree, of international management of the radio spectrum will have to continue. Radio frequencies are very valuable commodities and, as with most other commodities, there is a limit to the available supplies—a limit imposed, at least at present, by certain natural phenomena. Hence it is possible that some form of rationing—which already has had to be introduced in the case of regional and national broadcasting services—may ultimately have to be more generally applied if only to satisfy the hunger for frequencies of some of the rapidly growing children of the telecommunications world, namely, the hitherto under-developed countries for whom the absence of good communications has, in the past, seriously impaired their economies and standard of living.

C.T.B. Report

During the seven years to March 31, 1957, national bodies of the Commonwealth Telecommunication Board spent more than £30 million on developing and expanding their oversea systems, says the Board's report for the calendar year 1958.

The Report summarizes traffic for the financial year ending March 31, 1958. During that year telegraph traffic at 742 million paid words was 7.4 per cent. lower than in the previous 12 months; telex traffic rose by 21.65 per cent; telephone traffic increased by 8.1 per cent; and the number of phototelegrams forwarded by national bodies to Commonwealth and foreign destinations fell by 34 per cent. to 9,820.

"The year 1958", says the Report, "may well take its place as the beginning of a new chapter in the history of Commonwealth telecommunications". Since 1948, post-war difficulties have been "tackled with vigour and successfully overcome. In the course of their subsequent development and operation of the system the national bodies have adopted new techniques in both the radio and cable sections of their network and have consolidated and much improved the already strong position of the Commonwealth world-wide system of telecommunications . . ." The Commonwealth Telecommunications Conference of 1958, whose first business was to discuss the Board's proposals for development, adopted in principle the proposal to lay a "round-the-world" system of large capacity cables.

A summary of the "round-the-world" plan was published in the Winter, 1958 *Journal*.

Jubilee of the Ship-Shore Radio Services

G. F. Wilson

THIS IS THE JUBILEE YEAR OF THE POST Office Ship-Shore radio services. Night and day for fifty years, since September 29, 1909 the coast radio stations have kept watch and ward for the safety of life at sea, and they have kept pace with an ever-growing demand for maritime radio-communication facilities.

The service came into being when the Post Office purchased from the Marconi International Marine Communication Company and Lloyds eight coast stations which they had previously used for communication with ships.

Earlier, in November 1908, the Post Office had taken its first exploratory step in this direction by building a station at Bolt Head in South Devon. It is appropriate that fifty years later the latest and probably the most up-to-date coast station of its kind should also be in Devon—at Ilfracombe—brought into service early this year. Another station will be opened at Anglesey early in 1960.

During its first years the service provided radio-telegraph communication with about 300 British ships over ranges reaching to a few hundred miles. The staff, which consisted of 20 operators who had come over from the Marconi Company and a similar number recruited from Post Office Telegraphs, handled about 50,000 messages a year. The maritime service owes a great deal to the work of these early pioneers, operating as they often did in most trying conditions at stations more isolated than any we have today. Few of them would have imagined that 50 years later the service would have grown to provide a worldwide radiotelegraph service in which over 6,000 British and half as many foreign ships send their messages to United Kingdom coast stations from positions on all the oceans of the world.

Today the coast station staff, now 225, handle 850,000 radiotelegrams a year.

But development has not been limited to radiotelegraphy; "You May Telephone from Here" is true of nearly 5,000 British and numerous foreign vessels when they are within about 250 miles of our coasts. These ships can be connected with telephone subscribers on shore with the same ease as a trunk call is made between subscribers in, say, Glasgow and Bristol.

Some of the larger liners are equipped to keep their passengers in telephone communication with the United Kingdom throughout their long distance voyages. In addition to this "commercial" development the well co-ordinated safety services, including free medical advice, have been built up.

The growth of the services in both volume and scope has been steady, and developments which have appeared to be "the last word" have repeatedly proved to be but landmarks on an ever-widening vista.

What will the next 25 years bring? Will morse and the highly skilled operator give way to automatic telegraphy and unskilled operators? Will ships have circuits for telex connection and data processing? Will selective calling enable the telephone subscriber on shore to "dial" a ship without the intervention of a coast operator?

It is certain that these and similar questions will have to be answered and equally certain that many other aspects, as yet unforeseen, will have been dealt with before the next Jubilee.

Moon as Reflector?

Radio Studies of the Universe by R. D. Davies and H. P. Palmer (Routledge, 25s.) is a relatively simple outline of radio astronomy for the layman. Readers will remember that Dr. H. P. Palmer wrote on "The New Science of Radio Astronomy" in our Spring issue.

The authors point out that the sun, which war-time radar proved to be a powerful radio transmitter, serves as a continuous index of solar activity used when predicting radiocommunication conditions in the ionosphere.

They also suggest that "the discovery that to radio waves the moon is only five miles deep suggests interesting possibilities for high frequency radio communication, which means that in terms of the type of message that can be transmitted, modulation frequencies up to at least 10 kc/s can be reflected from the moon with very little distortion.

"High modulation frequencies interfere with themselves, i.e., the waves reflected from the back and front of the moon will blur together. It will be possible for the people on opposite sides of the Earth to communicate with one another at high frequencies at any time provided the moon is visible to both of them."

How the Piece Part Depot serves the Telephone Network

Miss H. V. Hughes and C. E. A. Orridge

ONE OF THE PRIME FUNCTIONS OF THE PIECE Part Depot of the Factories Department is to maintain a regular supply of all piece parts required to keep the automatic telephone network in efficient working order. Full control of stocks is vested in the Factories Depot at Sherlock Street, Birmingham and, with the exception of London Telecommunications Region, whose needs are met from subsidiary stock held at the Marshalsea Road Depot, London, all demands are met from Birmingham.

The organization has many unique features, and it is the proud boast of the Piece Part Depot that it meets the bulk of Maintenance Exchange requisitions (that is, replacements of "old" by new equipment) within 24 hours of receiving them. Behind this statement lies a story which is part of the romantic growth of the telephone service itself.

Some readers are all too familiar with the term "piece part"; for others we had better clarify it from the start.

A piece part is any part or sub-assembly required for automatic exchange equipment. It may belong to the group known as pre- or non-standard and relates to the original exchanges installed and equipped by the Big Five telephone contractors to the Post Office (Siemens, Ericssons, Standard Telephones and Cables, Automatic Telephone and Electric, and General Electric) all of whom had their own proprietary equipment. On the other hand it is more likely to belong to the standard group, which refers to the newer and more up-to-date exchanges installed and equipped to Post Office standard drawings and specifications.

The present Birmingham Depot opened in 1951 with a nucleus of Factories' staff already handling standard piece parts. It was proposed to add to this depot by stages non-standard piece parts then under the control of the Engineering Department. The amalgamation was finally brought about by June, 1953.

The first automatic exchanges installed in this country were in the nature of experiments to decide whether a full policy of automation could be embarked on. Because many changes were likely to arise in the type of equipment no general provision was made of piece parts for maintenance purposes. Such requirements as did arise were met by local order purchase on the manufacturer by the exchange needing them. Parts were identified by reference to Spare Parts Folders supplied by the manufacturer.

With the expansion and development of the automatic system it became obvious that this method of obtaining piece parts was inadequate. Consequently, in 1929 stocks were concentrated in a central depot under the control of the Engineer-in-Chief and issues were made to exchanges as required. Arrangements were also made at the same time for exchanges to retain small stocks of those parts most frequently required, to be replenished periodically from the central depot. This practice is still retained.

By this time five manufacturers were installing exchanges for the Post Office; although the exchanges were all of the Strowger type each manufacturer had his own design and the parts were not interchangeable. This meant that stocks of 14,000 items had to be kept to meet the needs of all exchanges. Efforts to reduce this enormous figure resulted in the appearance of the first standard parts which could be used on equipment produced by any of the manufacturers. These standard parts were allocated Post Office codes, listed in the Rate Book and stocked by the (then) Stores Department.

By 1933 central stores depots had been set up in London, Birmingham and Manchester to replace the 1929 scheme. In addition, work was being carried out in associated replacement depots on refurbishing faulty parts.

The Post Office had now gained considerable experience in working automatic exchange equipment and as a result standard designs were drawn up which all the telephone manufacturers agreed to produce in future. Piece parts for this equipment were also given Post Office codes and, at first obtained by engineers direct from contractors.

The increasing use of Post Office standard equipment and the necessity to replace parts more quickly brought about the introduction in 1937, in the London and Birmingham Factories, of the Urgent Maintenance Service. Its aim and purpose was to supply any standard piece part within 24 hours of receiving a requisition. In conjunction with this scheme it was arranged to provide, by assembly within the factory workshops, both Rate Book and Non-Rate Book 3000 type relays. For this purpose quantities of old relays were obtained for dismantling and recovery of parts. The parts recovered, with quantities of new parts, formed the original stock from which relays were assembled as required. At the beginning of the Second World War all standard coded piece parts were stocked by the Factories, all non-standard piece parts were stocked by the Engineering Department and standard parts for non-standard equipment were stocked by the Stores Department.

During the war piece parts generally were difficult to obtain. To increase supply old racks of equipment, recovered by the Supplies Department, were broken down to obtain the parts which the Factories refurbished and made good for reissue.

After the war the Engineer-in-Chief decided that all piece parts for telephone exchanges should be stocked and repaired by the Factories Department. For a time this decision could not be carried out, but the complete merger of standard and non-

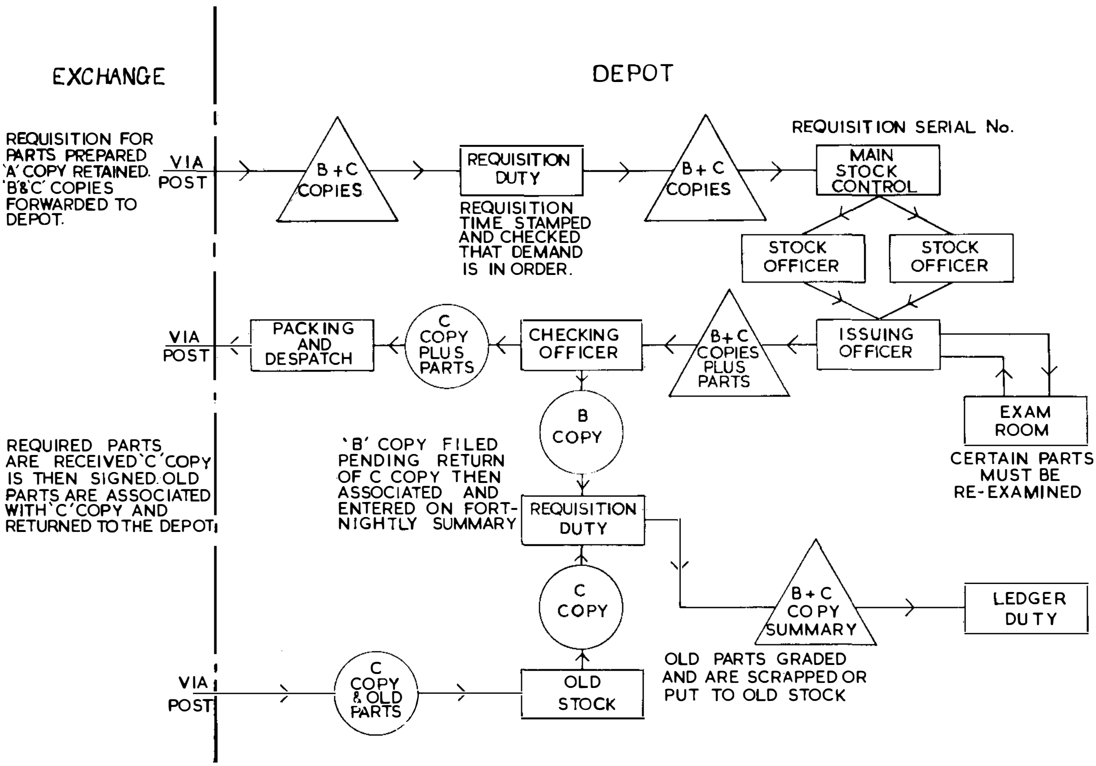


Fig. 1 : Circulation of maintenance exchange requisitions

standard piece parts was accomplished by 1953.

A further development in the rapid extension of the trunk network after the war made it necessary for parts for line transmission equipment to be available from a central point instead of by direct purchase from the manufacturer. To meet this need the Transmission Section of the Depot was set up in 1953, recovered apparatus again forming the source of the original stock of parts. The range of items has increased as a result of expansion and introduction of new types of equipment and is providing service to an ever-widening field as it becomes known. It is quite commonplace to get an urgent call for a part to be sent by the next passenger train as far north as Elgin in Scotland or by passenger train and boat as far south as the Channel Isles.

Range and Method of Stock Provisioning

Having looked backward let us now look at the day to day working of the Depot and see what goes on to provide this all important service.

Stocks are held of approximately 13,200 items. Of this total about 3,500 are stocked for standard exchanges, 8,500 for non-standard, and the remainder for line transmission equipment.

The range of items comprises piece parts for the following groups of equipment:—

(*a*) Relays (500, 600, 3000 and high speed types).
(*b*) Selectors, 2000 type.
(*c*) Uniselectors, types 1, 2 and 3 and Motor Drive No. 2.
(*d*) Meters 100 type.
(*e*) Coaxial, carrier and submarine terminal equipment.
(*f*) Non-standard automatic exchange equipment.
(*g*) Carbon brushes.
(*h*) Ringing, pulsing and announcing machines.

Provisioning of stock is the responsibility of the Depot clerical group. Close liaison exists between the Telephone Maintenance and Lines Maintenance branches of the Engineering Department and the Piece Part Depot on the stocking of piece parts and the settlement of technical difficulties which may arise, particularly on the non-standard side. This liaison is sound and ensures good service all round.

Stocks of items in group (*e*) are ordered individually as the need for replenishment arises. Those in all other groups are reviewed annually and the aim is to maintain a working stock sufficient to meet six months' issues at all times. A stock, equivalent to three months' issues, is taped off as a "danger" level so that if the tape has to be broken urgent provisioning action can be taken. In addition an emergency stock of three months is held for all "live" non-standard parts at a storage place near the Cwmcarn Factory, South Wales, in view of the difficulties of replacing this out of date equipment in the event of fire or damage at the main storage depot in Birmingham.

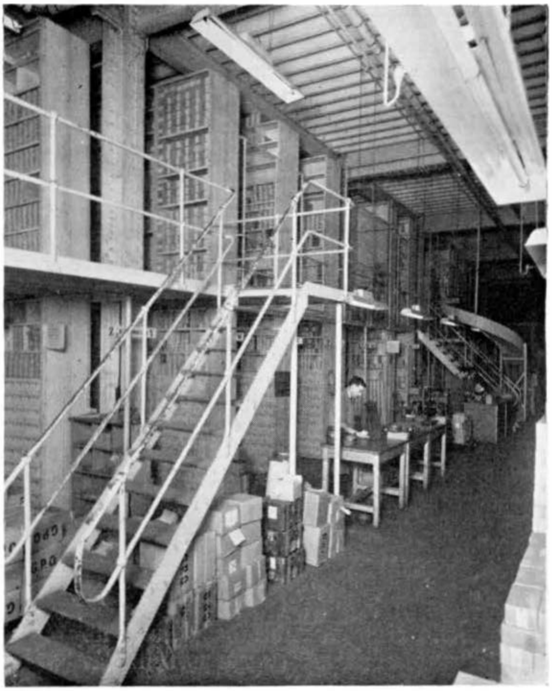


Fig. 2 : Two tier storage racks

Use of Old Equipment

The unique feature of provisioning for both standard and non-standard parts is the tremendous use made of "old" equipment.

For instance large quantities of 3000 type relays are returned to the Supplies Department annually and passed in a regular flow throughout the year to the Factories Department for break up and ultimate stocking as parts. These old parts are repaired or refurbished in the factory workshops and eventually go to stock as good, ready for re-assembly to produce the various types of relays required by the exchanges. In this way dismantling of old relays provides the main source of supply for replenishment of the new stocks.

Another important aspect is the elasticity in the stock provided by stocking basic parts such as spring blanks in much larger quantities than the part assembly, such as springs. Thus, sufficient spring blanks are held from which any type of spring or springset can be assembled. This enables the stocks of the more expensive items to be kept at an economical level. This principle applies to relay coils also.

It will be seen from this that the Piece Part Depot is well equipped to meet any exceptional requirement for standard coils or spring sets at short notice. This year, for example, as a result of a works specification which affected exchanges up and down the country call was made for two special new coils of which 30,000 have already been issued.

Non-standard equipment is similarly returned to the Supplies Department and offered to the Piece Part Depot for recovery of piece parts. If required these parts are taken into old stock for repair and re-issue. The oldest automatic equipment for which piece-parts are still required was installed in 1915. It will be appreciated therefore that the re-use of old equipment is of great advantage and is, in fact, the only source of supply of certain parts for the maintenance of the early and experimental systems which have long been out of production.

Fig. 3: Typical stock drawer

Finally, of course, a proportion of new parts of both standard and non-standard equipment has to be bought. This is done by normal stores provisioning procedure—by placing indents on the Contracts Department for all requirements over a limit of £250 or by local order purchase below this limit.

In addition to provision cards which record the history of provisioning for each individual item, daily transactions are recorded on "Bizada" ledger cards. Special tables were designed by the Ministry of Works to support the ledgers at an angle to facilitate posting. The ledger record provides a vital link in the provisioning chain and great care is exercised in its compilation.

Accounting

Two systems of accounting are in operation. As non-standard piece parts fall almost solely under the heading of maintenance, all purchases are debited to the appropriate maintenance sub-head (FIA) by the Factories Department in their Cost Statement at the time of purchase. Issues to engineers in the field, therefore, are made on unpriced Delivery Notes. When it becomes necessary to allocate to a special Works Order, other than maintenance, a corresponding credit to Maintenance sub-head FIA is made by the Factories Department in their Cost Statement and a priced Delivery Note is issued transferring the charge to the appropriate heading in Telephone Area Cost Statements. The Factory is the main user of standard piece parts and all stocks are held "on charge". Issues of these items to engineers are made on priced Delivery Notes transferring the charge through Telephone Area Cost Statements.

The value of stock holdings of both new and old piece parts in the standard range at the end of the financial year ended March 31, 1958 was approximately £1,150,000.

Requisitions

On the average, 1,370 requisitions are received weekly, covering 3,500 items. Of this quantity 80 per cent. are demands under maintenance exchange procedure. Requisitions are scrutinized to verify details, particular care being taken to ensure that the description is correct. The staff uses a great deal of time in coding such items as coils and spring sets, of which there are many hundreds of different types. Speed and accuracy are prime factors in maintaining the 24-hour service and every effort is made towards this end. Despite the existence of comprehensive Engineering Instructions covering identification and requisition procedure of piece parts, many requisitions have either to be corrected in the Depot, returned to the Telephone Manager for additional information, or forwarded to the Engineering Department for advice, because unidentified descriptions are given, or incorrect items have been demanded. Such errors cause unnecessary delay in the supply of the parts.

As maintenance exchange covers the bulk of

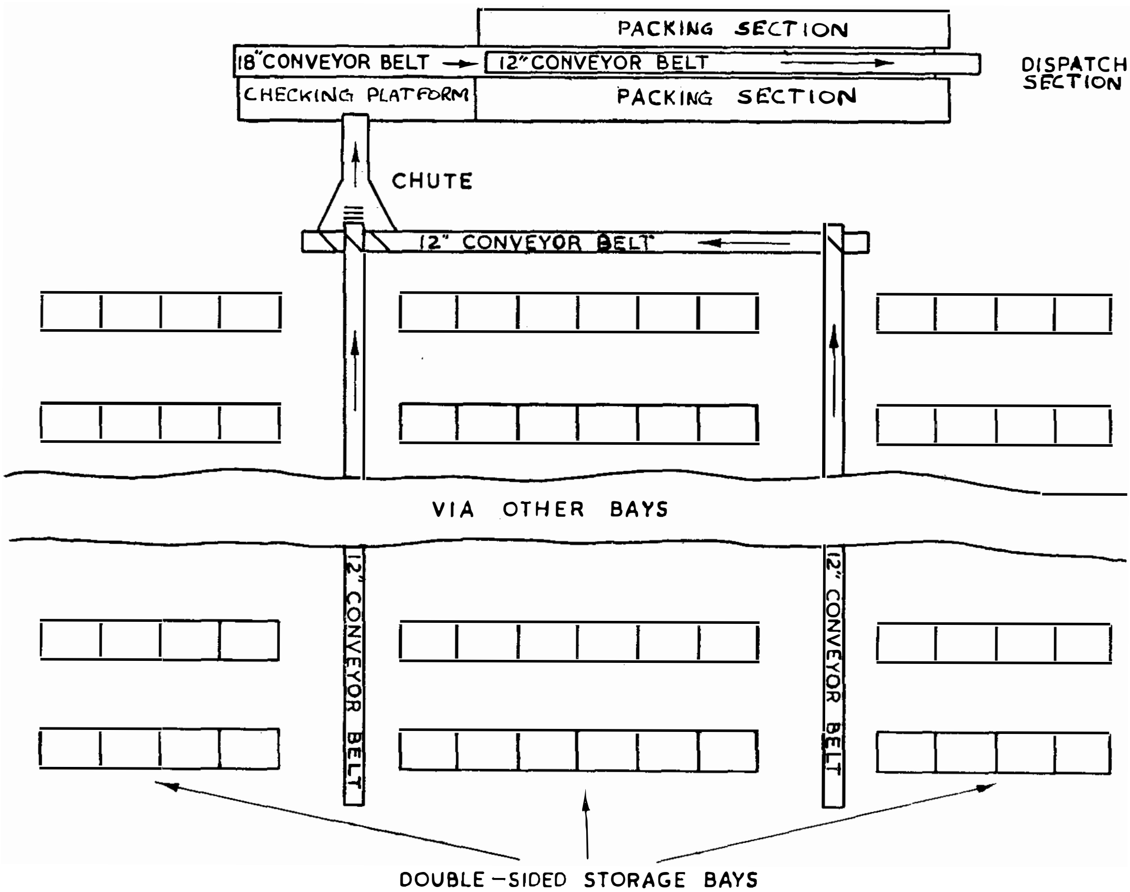


Fig. 4 : Conveyor Belt System

transactions with engineers the diagram (Fig. 1) is drawn to illustrate the progression of a requisition form from the time it is received in the Depot until the transaction is finally complete. (The procedure for dealing with maintenance exchanges for non-standard parts differs slightly from that for standard parts at the ledger and accounting stages in view of the fact that "old" parts are not ledgered, neither have they any "accountable" value). The diagram, therefore, refers in total to standard transactions and in part to non-standard.

Under maintenance exchange procedure on receipt of the new part, the engineer sends in the old in exchange. This is graded as either suitable for repair, in which case it is put into stock, or if beyond economic repair or of an obsolete type, scrapped. Maintenance exchange transactions are incomplete until the old parts are returned; entries are made daily on a summary which provides for the recording of issue of new, recovery of old, and writing off to Worn Out and Obsolete Plant and Stores (W.O.O.P.S.) if appropriate. The summary is closed fortnightly and total issues and recoveries are then ledgered. The summary thus considerably reduces the amount of ledger posting and covers also at the same time the necessary accounting.

Non-Standard Requirements

The use of recovered apparatus of non-standard design has already been mentioned. In this connexion special reference must be made to the facilities provided by the Piece Part Depot in meeting exceptional demands for works specifications and overhauls. On receipt of advance notice steps are taken to provide the necessary parts or sub-assemblies by using old "made good" parts

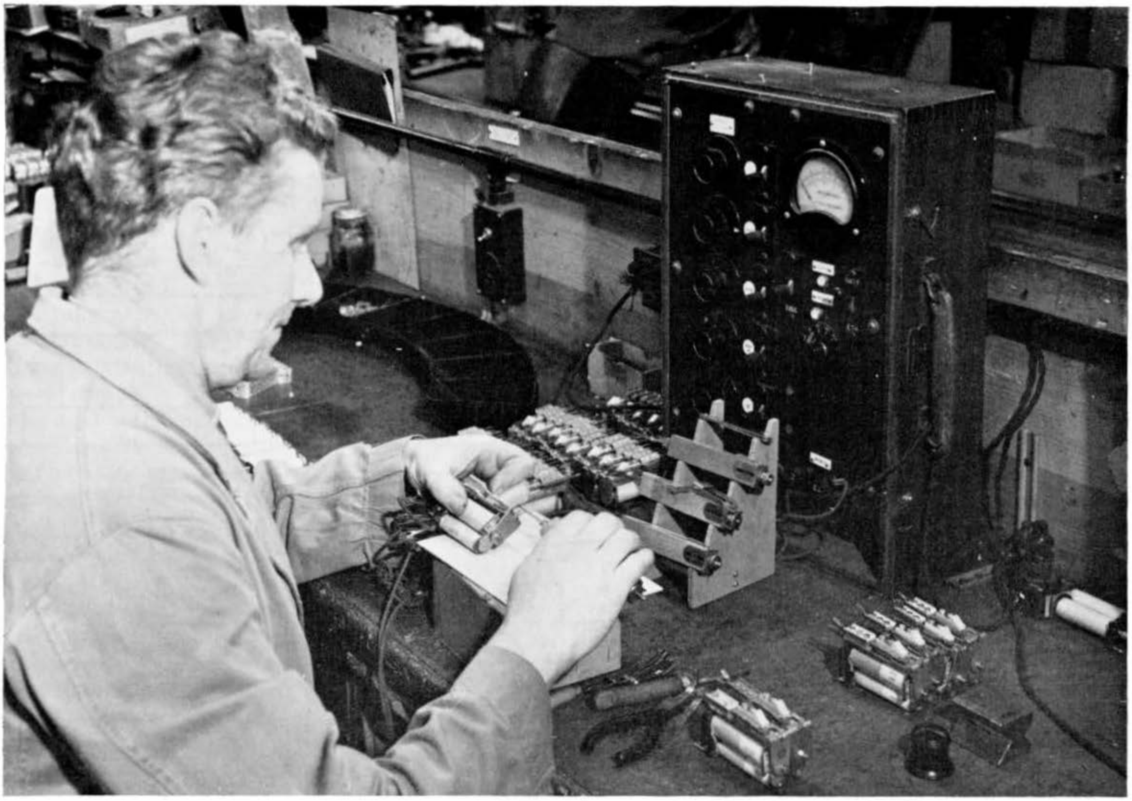


Fig. 5: Testing and adjusting relay for correct operation

or/and by purchasing new parts if necessary. An estimate of the value involved and the time to be allowed is furnished to the engineer. The items as they become available are then set aside for subsequent issue as called for.

All relay and spring set requirements of non-standard design are built up within 14 days' notice. There are occasions when the part called for is so antiquated that the Piece Part treasure trove cannot produce a counterpart; in these circumstances the patient is sent in for repair and return.

Stocking

Stocking this large range of small parts called for a bold and imaginative approach. The accommodation taken over for the Depot had been built for manufacturing car bodies and though a number of structural modifications were necessary for effective office, storage and workshop layout, full advantage was taken of a ceiling height of 20 feet to house the piece part main stock. Storage racks with adjustable shelves which accommodate steel drawers of various sizes occupy the main floor to ceiling space.

Access to the higher shelves of these racks, using ladders, would have been slow and hazardous and could not be entertained; consequently an upper deck was fitted whereby the racks were transformed into a two-tier arrangement. Visually this structure appears similar to an ancient Man o' War, and is locally-named the "battleship". A general view of the arrangement is shown in Fig. 2, while Fig. 3 shows a close-up view of a typical stock drawer, each drawer being labelled with the code number of its contents.

As with all such structures, little use can be made of the available natural light, and special attention has been necessary to obtain a satisfactory artificial lighting arrangement whereby stock drawer designations and requisitions are easily read without shadows, while troublesome glare is avoided when a man has to look towards the upper shelves. This has been achieved by using ordinary filament lamps in special shades incorporating reflectors suspended just below the bulb. Requisitions for piece parts generally call for only small quantities of perhaps one or two items which are, in the main, small in size, and light in weight.

To maintain the speed essential to an efficient spare parts organization, the stock is so arranged that although the floor space is limited, a working stock of every item is held on the lower deck (the balance being stored in the corresponding position on the upper deck). To ease handling within the Depot, several mechanical handling devices are employed. As such devices have become so commonplace that their application arouses little interest today, perhaps we need look only at the conveyor belt system.

This system consists of a number of separate conveyor belts laid out as shown in Fig. 4. The belts serving the storage bays pass down the two main isles, lower deck, of the stock room at a feeding height of 6 feet 3 inches. A stock officer, when making an issue, places the required parts in a special circular pan; he then places the pan on the nearest conveyor belt, which is at the most no further than six paces from the most distant stock drawer. The pan containing the parts is carried by the belt and deposited, by way of a chute and gravity rollers, on to the checking platform. After check the pan is placed on the second belt, to be carried to the packing section. Here, the parts are removed from the pan, wrapped, packed, labelled and placed on the third belt which deposits them directly into a mail-bag in the despatch section.

We began with a backward look, so it is right to end with a forward one. What of the future?

Recent new developments have been the provision of parts for the recording machines used for the Weather and Cricket Score Service, Line Connectors No. 1, 4000 type Selectors (now being installed at Coventry) and more topical still Subscriber Trunk Dialling equipment. In all these and for any new calls it is the aim and purpose of the Piece Part Depot to help maintain at full efficiency the vital telephone network of this country.

Fig. 6: Assembly of Strowger type spring sets

Colour Television

T. Kilvington, B.Sc. (*Eng.*), M.I.E.E., F.T.S.

FROM THE EARLIEST TIMES OF PRE-HISTORY man has felt the urge to make pictures of the things he could see. Probably at first, he used a stick to make pictures in the sand, as children do today. Then, later, he used sharper tools and harder surfaces of wood or stone so that some of his work endures to this day. As time went on, natural pigments and dyes were discovered and man's pictures changed from monochrome to colour—a limited range of colours at first, as may be seen still in certain cave paintings. But the range of available colours widened until the artists of the Middle Ages were able to record on canvas almost the whole gamut of colour that their eyes could see.

Printing, and in time photography, both started as monochrome methods of recording the visual scene. Colour printing and colour photography came later and much more slowly. In the same way man's latest picture-making medium, television, began as a means of transmitting images over a distance and of reproducing them in monochrome but it was natural that, as with the other methods of reproduction, attention should soon be turned to the problem of producing television pictures in colour.

The Science of Colour

Before we can begin to understand the processes of colour television we must touch briefly on colorimetry—the science of colour. It is generally well known that light is the sensation produced by electro-magnetic waves of extremely short wavelengths and that the colour produced depends on the wavelength. A source of light which produces equal energy over the whole visible spectrum appears as white; coloured sources lack energy in certain parts of the spectrum, that remaining in other parts giving rise to the sensation of coloured light.

It might be thought then, that to define a given colour it is necessary to have a complete knowledge of the spectral distribution of the energy in the light. This is certainly one way but fortunately there is a much simpler one. It is found that the sensation produced by most colours can be matched by a mixture of three primary colours only, in suitable proportions. This is the principle of the paint box. Most of us learned when young that we could produce many different colours by mixtures of blue, yellow and red paints.

Similarly, in colour printing and colour photography the coloured images are built up by superimposing three images, one corresponding to each of three colours. In each, the final coloured image is produced by subtracting unwanted colours from the white light by which the image is viewed—hence they are called subtractive processes.

With colour television, however, as it is at present conceived, the coloured image is produced by adding together three images each produced in colour—an additive process. For this reason the three primary colours used are red, green and blue, a mixture of which in suitable proportions will produce white light.

An ordinary monochrome television system comprises, broadly speaking, three component parts: a transducer (the television camera) to convert the visual image into an electric signal; a transmission system to convey the electric signal to its destination; and a reverse transducer (the cathode ray tube) to convert the electric signal back into a visual image.

Clearly such a system could be adapted for colour simply by using three complete systems, one for the red image, one for the green and one for the blue. The original image would be optically split into three and viewed by three cameras taking through red, green and blue filters respectively. At the receiver the images produced on three cathode ray tubes would be viewed through appropriate red, green and blue filters, the three images being optically superimposed. Such systems have been tested; they give good coloured pictures, but require some three times as much equipment as a monochrome system. In addition, one colour transmission would occupy about three of the broadcasting channels at present used for the monochrome service and there are already scarcely enough channels available.

What then are the requirements for an ideal colour television system?

One of the greatest problems is the very large number of monochrome receivers already in use. Ideally therefore the system should be such that if the colour signal is received on a monochrome receiver, a monochrome image is produced—in other words the colour system should be "compatible" with the existing monochrome system. Similarly, the owner of a colour receiver should be able to receive monochrome transmissions (in monochrome of course) without requiring a separate monochrome receiver—a property known as "reverse compatibility". Furthermore, and probably most important of all, the colour signal should require as little channel space as possible. These requirements have been met in most ingenious fashion in the system now adopted as the standard for colour television in America—known throughout the world as the N.T.S.C. system, the letters referring to the National Television Standards Committee.

The principle of the system is illustrated in Fig. 1. A three-colour camera produces three electric signals (R, G and B) corresponding to the red, green and blue components of the image to be

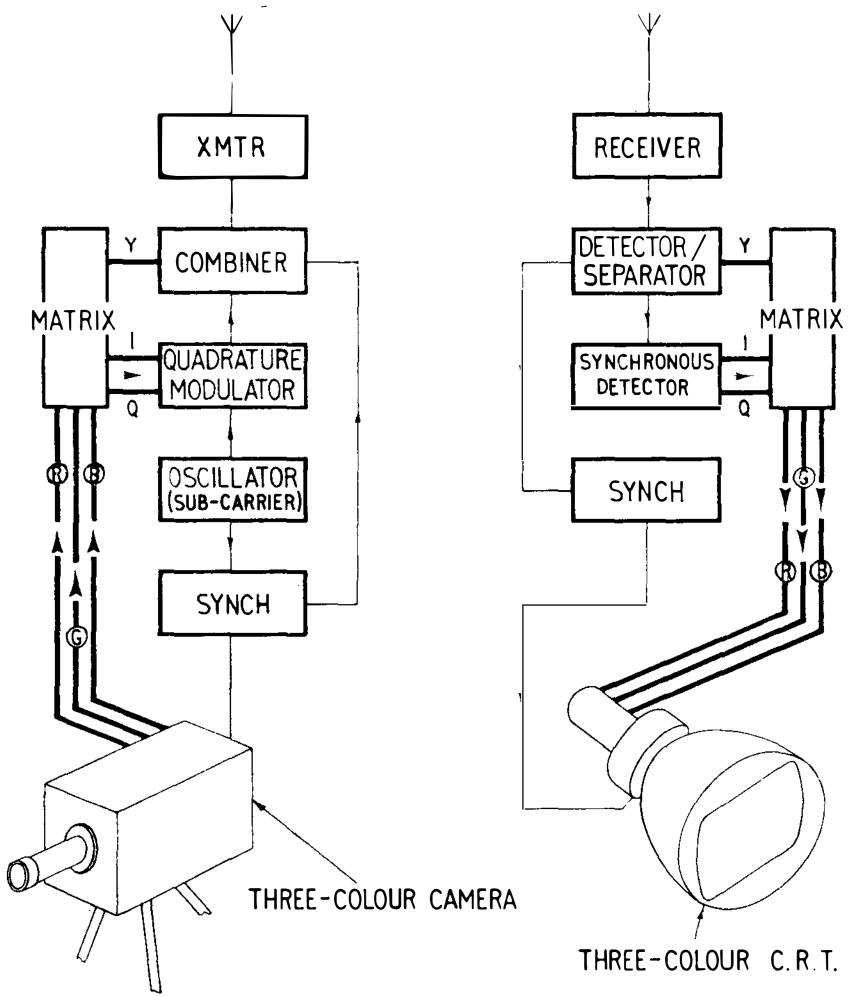


Fig. 1 : Schematic diagram of the N.T.C. colour television system

transmitted. These are not transmitted directly but are first operated on in the matrix unit which produces three different electric signals known as the Y, I and Q signals.

The Y signal is simply an addition of the R, G and B signals in the correct proportions to produce the "luminance" signal. This is a signal indicating the brightness of the image, irrespective of colour, and corresponds to the signal normally produced by a monochrome television camera.

The I and Q signals are also derived from the R, G and B signals by a series of additions and subtractions and together determine the chrominance or colour of the image.

Since the three signals Y, I and Q are produced by a series of simple operations on the R, G and B signals, it follows that at the receiving end, by an analogous process in reverse, it is possible to reconvert the Y, I and Q signals into R, G and B signals.

What are the reasons for this seemingly complicated transformation? First of all, the Y signal representing luminance, as already mentioned, is of the same form as the signal that would be transmitted in a monochrome system. It can therefore immediately be used in monochrome receivers to produce an image in black and white and gives to the colour system the desired feature of compatibility. Second, it has been found that it is not necessary to transmit the chrominance signal with the same degree of precision as the luminance—a certain blurring of the colour edges is permissible provided the luminance transitions are sharp. This enables channel space to be saved and in fact the whole colour signal, luminance and chrominance is squeezed into the same bandwidth as a monochrome signal.

This is possible by making use of the fact that the luminance signal does not comprise a continuous spectrum of energy throughout the video (vision) frequency band, but a series of bundles of energy spaced at intervals through the band. The

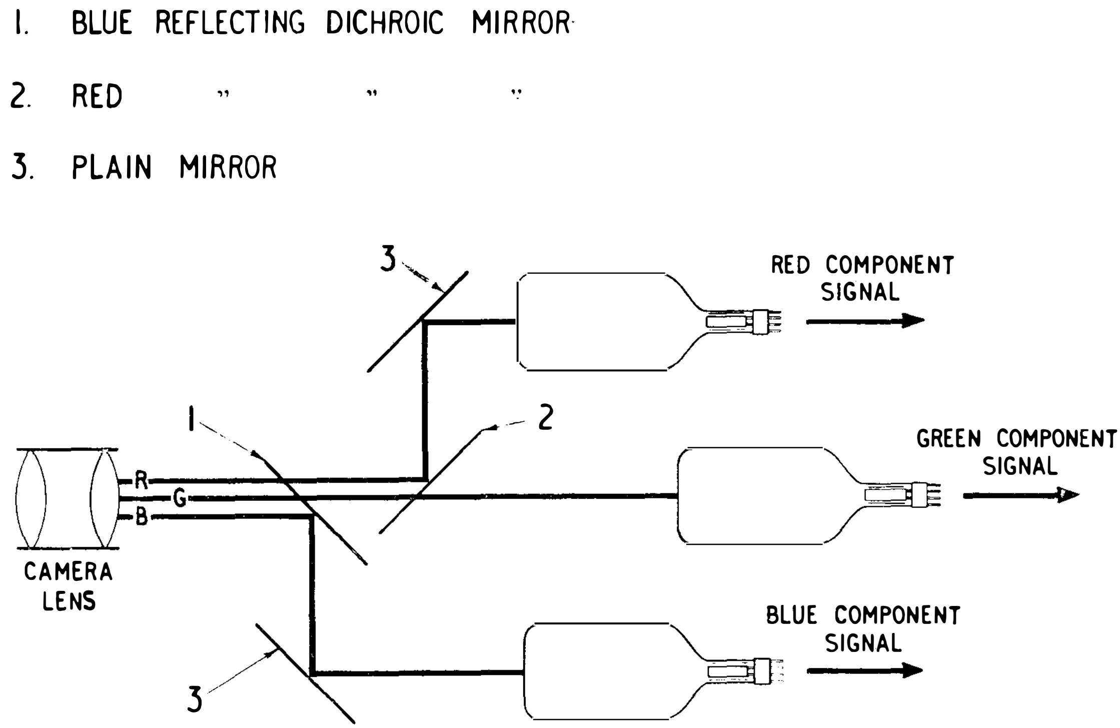


Fig. 2 : Principle of a three tube colour television camera

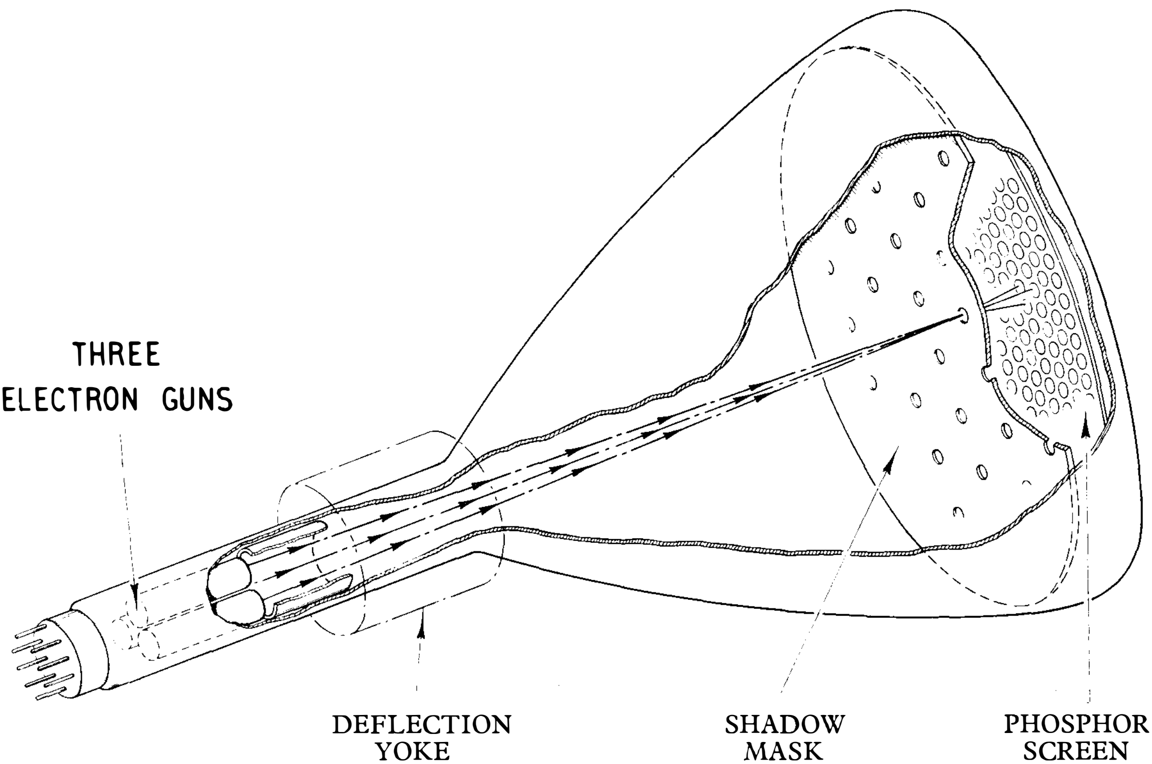


Fig. 3 : Principle of the R.C.A. shadow mask colour tube

chrominance signal is put on to a sub-carrier which falls in one of the gaps between bundles of luminance energy towards the top end of the video band. Since the chrominance signal also comprises a series of bundles of energy rather than a continuous spectrum, the two signals, luminance and chrominance, interleave with one another and cause a minimum of mutual interference.

The two components, I and Q, of the chrominance signal, are both impressed upon the same sub-carrier by "quadrature" modulation. They can be separately detected at the receiver by what is known as "synchronous detection" which requires a sample of sub-carrier at some standard phase to be transmitted with the signal. Such a sample or "burst", consisting of a few cycles of colour-sub-carrier frequency, is combined with the normal television synchronizing signal, and added to the luminance and chrominance signals, the latter on its sub-carrier; the composite colour television signal is fed to a transmitter and radiated in the normal way.

At the receiver the Y signal is obtained by normal detection, and the I and Q signals by synchronous detection. These three signals are now operated upon in the matrix to obtain the R, G and B signals for application to the colour reproducing device. Synchronization of the reproduced image is obtained in the normal way.

The third desirable feature of a colour system, reverse compatibility, is inherent in the colour *receiver*, since if only a Y signal is fed into the matrix, R, G and B signals are produced in the correct proportions to produce a black and white image. As a precaution, if the incoming signal contains no colour-sub-carrier burst, a "colour killer" comes into operation to prevent any spurious I and Q signals from being generated and fed into the matrix.

The colour camera and the reproducing device are not in themselves a part of the N.T.S.C. system. Any suitable devices could be used. One possible arrangement of a colour camera is shown in Fig. 2. Light from the scene to be televised is focused by a single lens and a system of mirrors on to the sensitive plates of three separate camera tubes. Some of the mirrors are "dichroic" as indicated, that is, they reflect light of one of the primary colours but transmit light of the other two colours.

Probably the most complex part of the colour system is the colour reproducing device. The simplest system to visualize is one in which the red, green and blue images are reproduced separately on three small cathode-ray tubes and projected on to a screen with superposition by some means similar to that used in the camera, but in reverse. However, such a device involves an extremely high order of precision both mechanically and electrically to obtain satisfactory registration between the three images. Consequently many attempts have been made to produce a single cathode-ray tube which will display colour pictures directly. The most successful of these is perhaps the R.C.A. shadow-mask tube the principle of which is illustrated in Fig. 3.

The screen is composed of a very large number of phosphor dots—about one million—arranged in triads or groups of three. In each triad one dot emits red light, one green and one blue light when bombarded with electrons (in contrast to the white light emitted by the phosphor of a conventional cathode-ray tube used in monochrome television). The tube contains three electron guns, each similar to that in a monochrome tube and each producing a beam of electrons.

By means of the shadow mask it is arranged that one of the beams strikes only the red phosphor spots, another the green and the third the blue. To achieve this there is only one hole in the shadow mask for each group of three dots on the screen and the mask is so placed relative to the screen that the electron beams which pass through the holes at different angles strike only the appropriate points on the screen. In the actual tube the phosphor dots and the holes are minute and the spacing between the shadow mask and the screen is about three-eighths of an inch. It will be appreciated that the manufacture of these tubes on a mass production basis is no mean achievement. Unfortunately it is also costly and at the present time the tubes are very expensive.

The introduction of a colour television service in this country will depend on many factors, both economic and technical. In the cinema, where colour has been available for well over twenty years, many of the films made today are still black and white. So with television it may be many years before colour is established as the normal service. In the meantime many technical problems have to be solved to enable colour receivers at a reasonable price to be placed in the hands of the public with confidence that they will perform as reliably and last as long as the black and white receivers of today.

Calls on Credit

Numbered credit cards enabling telephone subscribers to make calls from any telephone and, on giving their card number, to have the charge debited to their account will be available late this year or early in 1960.

No extra charge will be made for the calls but a small charge will be made for the card to cover extra operating and accounting costs.

Essay Competition Results.—S. J. Spicer, Technical Officer, Engineering Department (W.1), has won the 6-guinea prize and an Institution Certificate in the Essay Competition, 1958–59, held by the Institution of Post Office Electrical Engineers.

The following (with the titles of their essays) have won prizes of 3 guineas each, and Institution Certificates:—

W. M. Milne, Technical Officer, Aberdeen (Scotland), *Visual Training Aids*.
A. K. Hill, Technician IIA, East Area (London Telecommunications Region), *Public Relations*.
P. B. Lock, Technical Officer, London Postal Region, *Automatic Boiler Control Systems*.
V. D. Ede, Technical Officer, Stoke-on-Trent (Midland Region), *Tracing Noise on Programme Circuits*.

Institution Certificates of Merit have been awarded to :—

J. Williams, Technical Officer, Rotherham (North East Region), *Basic Routines by Comparison*.
J. G. A. Wallace, Technical Officer, Southport (North West Region), *An Infra-Red Electrical Heating System in Practice*.
G. R. Southall, Technician IIA, Birmingham (Midland Region), *The First Two Years*.
A. Forte, Technician I, Gateshead (North East Region), *Creepage in Underground Cables*.
W. Morrison, Technical Officer, Edinburgh (Scotland), *Printed Circuits and their Potentialities*.

The essays were judged by J. Stratton, G. Spears and A. J. Leckenby.

Selected Telecommunications Statistics

Beginning with this issue—in which, instead of the usual quarterly returns, we present some figures for the complete financial year to March 31, 1959—we shall exclude the figures of staff operating the inland services, and shall include some statistics of the overseas telecommunication services.

	March 31st 1957	*March 31st* 1958	*March 31st* 1959
The Telephone Service at the end of the year			
Total telephones in service	7,225,900	7,361,200	7,532,500
Exclusive exchange connexions	3,286,100	3,345,700	3,464,500
Shared service connexions	1,187,700	1,153,900	1,141,600
Total exchange connexions	4,473,800	4,499,600	4,606,100
Call offices	70,400	72,100	73,300
Automatic exchanges	4,784	4,897	4,982
Manual exchanges	1,196	1,099	1,027
Orders on hand for exchange connexions	246,100	171,400	145,000
Work completed during the year			
Net increase in telephones	338,500	135,300	206,400
Net exchange connexions provided...	417,700	350,800	368,900
Net increase in exchange connexions	208,600	25,900	106,500
Traffic	Millions	Millions	Millions
Inland telephone trunk calls	321	327	340
Cheap rate telephone trunk calls	78	74	79
Oversea telephone calls:			
Outward	2,239,000	2,422,000	2,678,000
Inward	2,183,000	2,388,000	2,596,000
Transit	148,000	250,000	290,000
Inland telegrams (excluding Press and Railway) ...	16m	14m	13m
Greetings telegrams	3m	3m	3m
Oversea telegrams:			
Originating U.K. messages	7,080,493	6,652,671	6,251,162
Terminating U.K. messages	6,838,911	6,523,879	6,292,001
Transit messages	5,745,655	6,130,544	5,607,945
Inland telex calls	2m	3m	* 3m. calls from manual and automatic exchanges. 2m. metered units from automatic exchanges.
Oversea telex calls:			
Originating (U.K. and Irish Republic) ...	1,359,432	1,641,351	1,944,335
Terminating (U.K. and Irish Republic) ...	1,306,029	1,594,283	1,886,869
Transit	9,367	14,603	41,398

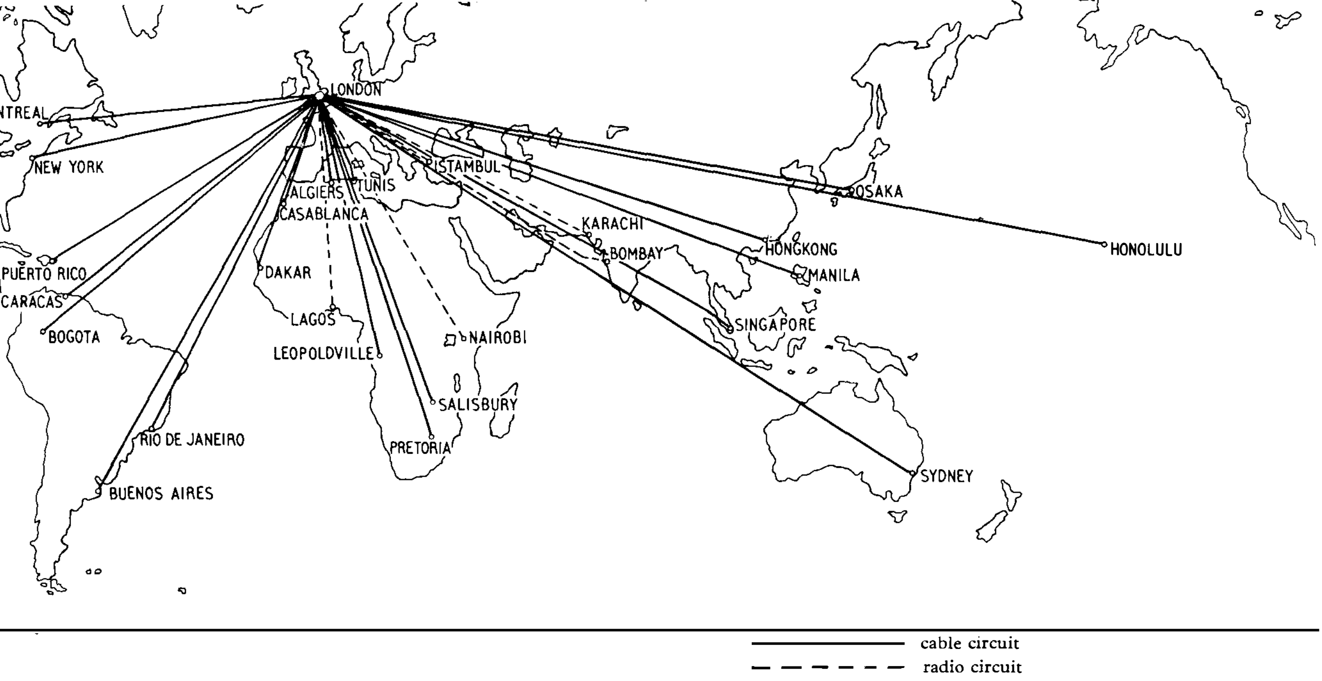
NOTES

During the year the telephone order list was reduced by 26,400, *from* 171,400 *to* 145,000. *At the end of the year* 84,800 *applications for service were in process of being met and* 60,200 *were awaiting cables or exchange equipment. Subscriber Trunk Dialling was inaugurated at Bristol on December* 5 *and plans were made to extend the system over most of the country by* 1970.

The oversea telephone system was extended by opening service with three Commonwealth and foreign countries. Traffic on the first Transatlantic Telephone Cable—opened for service in September, 1956—*increased by* 16 *per cent. with Canada and by* 17.5 *per cent. with the United States in the year ended March* 31, 1959. *The total number of calls over the cable was* 538,255 *(including* 160,858 *on leased circuits between U.S.A. and Continental countries).*

The number of subscribers lines on the inland telex system increased from 4,308 *to* 5,027. **Automatic telex was introduced in London and Leeds on August* 31, 1958.

The oversea telex service was extended to three more countries, making a total of 36 *oversea services.*



International Telex Expansion

The Post Office International Telex Service, which started from scratch after the war, is now carrying more than 16,695,000 paid minutes a year and earning revenue at the rate of £1,165,000 annually. This phenomenal growth indicates the value to the commercial world of this new means of business communication.

By 1954 telex service had been provided between the United Kingdom and most European countries, including several "behind the Curtain". Beyond Europe, though, service was then available only to specially equipped users in New York and Washington and in Leopoldville.

But since 1954 many extra-European countries have developed internal telex networks, the value of International Telex for business communication has been demonstrated; and technical developments (such as the TAT cable circuits to Canada and error-corrected radio systems) have provided long distance international circuits for telex use. Moreover, all users of the large internal telex system in the United States can now be reached internationally.

Today, direct services with practically all European countries are available between the 5,180 telex customers in the United Kingdom and about 47,000 subscribers in 20 countries outside Europe—and subscribers in India, Pakistan, Nigeria, Kenya and Turkey will be added to the number this year. Service by relay at points overseas, made possible by technical developments, also enables our customers to reach subscribers in other countries. Calls to extra-European countries have risen from 5,500 a year in 1954 to 56,000 a year, and are still rising.

Revising Post Office Forms

Special Public Relations Department committees, set up by the Postmaster General and including representatives from the telecommunication services, are revising many of the forms and form letters the Post Office sends to customers in connexion with these services. This is part of a plan to revise all forms sent to the public.

The main purpose is to rewrite communications with a more friendly approach and in simpler, more direct English. The typography also is being improved and the forms will be printed on white instead of buff paper.

International standard sizes of paper will be used where there is no operational objection and no undue waste.

The AX forms (for Telephone Managers' correspondence with customers) are among the first to be revised. New designs have also been produced for application for service forms and for acknowledgment postcards.

The new forms will be brought into use as existing stocks are used up.

Post Office Starts "Bell" Training Experiments

THE POST OFFICE HAS STARTED EXPERIMENTS towards adapting the American Bell system of supervising and training telephone operating staff, as the "Ray" group recommended in their report on their visit to the United States, which we published in our Summer number. The experiments are being carried out at Holborn, Mayfair and Victoria exchanges in London, and at Chester, Manchester (Peterloo) and Stoke-on-Trent. The staff associations are giving full and ready co-operation.

The standard method of Post Office training for telephonists at present is an initial period of four to five weeks on elementary operating at a centralized Regional training school, followed by two to three weeks post-school training at the exchange at which the telephonist will be employed. The training in this post-school period is largely aimed at increasing manipulative skill.

Refresher Training

To keep experienced telephonists up to date with new practices and to remind them of important procedures, they are given regular refresher training at all exchanges, each having an hour a week at zone and group centres, and one hour every four weeks elsewhere. Specialist staff organize the initial training at the centralized school, and post school and refresher training at most exchanges.

The Ray Report showed that all training in the Bell System is done locally and that beginners are allocated to particular first-line supervisors from the first day of their employment. Each first-line supervisor has a group of operators in her special care, and she is responsible for their training at all stages throughout their career, as well as for their general wellbeing.

The essence of Bell practice is the emphasis, throughout training and subsequent service, on the personal relationship between operator and supervisor, and on the status of an operator as an individual; the aim is to give her confidence, to encourage her to be self reliant in her day-to-day work and to regard her Service Assistant as someone she can consult about any problem, official or personal, rather than merely as a supervisor in the British sense.

The Bell system training plan provides for four main types of training: Initial, for 12 to 15 days after recruitment; Continuation, at intervals during the next three to six months; Day to Day, at the switchboard, as required, to cover new and revised operating procedure; and Progress, once a quarter in the first year of service and then once in six months.

To gain experience of training on Bell lines and to see if such a scheme could work in this country, two sets of experiments have been put in train. At Chester, Holborn and Mayfair exchanges, a group of telephonists has been assigned to each Assistant Supervisor who will be responsible for training them after the initial training, which they will continue later centrally. In the experiments at Victoria, Peterloo and Stoke-on-Trent exchanges, the group leader Assistant Supervisor will also carry out initial training. At all six centres there will be some differences, depending on local conditions, as well as any need to make some adjustments in the light of experience.

Service Soon Restored

Service was interrupted on the Transatlantic Telephone Cable (TAT 1) between the United Kingdom and North America in the early hours of July 24 by a fault in one of the two cables between Oban and Clarenville at a point off the coast of Scotland. Emergency radio facilities were brought into use to maintain services to North America.

Full service by cable was quickly restored—thanks to the ready co-operation of the French and German Postal, Telegraph and Telephone Authorities and the American Telephone and Telegraph Company. A section of their partially completed new Transatlantic Cable system between France and the U.S.A. (TAT 2) was used temporarily to replace the damaged part of TAT 1.

H.M.T.S. *Iris* repaired TAT 1 by midnight on July 26.

Converting to Automatic Telex in the North-West

NORTH-WESTERN REGION TOOK A STEP FORward in converting the telex service to automatic working on September 26. All the telex installations served by Manchester and Liverpool exchanges, which include all to the west of the Pennines from Pwllheli to Gretna Green, will join those in London, Leeds and Sheffield already connected to automatic exchanges.

The telex system in the North-West has grown from 60 lines served by 13 positions to 570 lines and 34 positions during the past four years. Traffic has increased by nearly 1,000 per cent. from 1,330 to 12,660 calls weekly. The oversea component is particularly big, 25 per cent. of the traffic at Liverpool being routed through Intelex. Calling rates have remained pretty steady at around 5.6 a day. As in the postal service, the peak comes in the late afternoon from 4.30—5.30 p.m. The mid-day peak, 11.30—12.00, comes a close second.

Already, at only an eighth of its extended optimum, telex is producing as much oversea traffic as the telephone service. There have been very few complaints, the odd ones usually being made about poor time to answer. The reason for occasional falling in speed of switchboard service is the comparatively long time taken to set up a call, and the fact that operators cannot deal with more than one call at a time in an overlapping operation. Quite small rushes of traffic often necessitate swift transfer of staff from other telegraph jobs.

The versatility and willing co-operation of the telegraphists at Manchester and Liverpool deserve the highest commendation. The high standard of maintenance also merits special mention. There is no doubt that speedy attention to faults has helped to create a favourable attitude by customers.

The few number changes necessary were made last year. Preston installations will be served by the Manchester exchange until the new Preston automatic exchange is ready in 1963.

Chester Area customers were recently transferred from Liverpool to Manchester exchange. The Voice Frequency systems carrying these lines also served the Teleprinter Automatic Switching offices in Chester and North Wales and therefore they also had to be reterminated on Manchester telegraph switching centre. Although only a small amount of traffic was carried on the network, the changeover was a complicated job involving liaison between two regions and three areas. That it was effected smoothly without any interruption of service reflects great credit on the staffs.

Liverpool automatic exchange is in the same building as the existing manual exchange. Owing to the contraction of telegraphs, there is ample room in this building for the new exchange and for almost unlimited development.

There were difficulties in the way of installing the new exchange in the same building in Manchester and it had to be put in a building which is already nearly full. The "new look" development forecast, which estimates that the service will double in size between 1970 and 1980, has made the problem more acute but with the co-operation of other users, the extra space for the ultimate requirements will probably be found.

One way a telex conversion differs from its telephone counterpart is the amount of work necessary on customers premises. Supplies of conversion kits came through rather slowly at the outset and involved careful planning. Many of the old type telex teleprinters cannot be converted to work to automatic exchanges and until we knew when we were to have supplies, we had to be ready to exchange the old type with convertible type machines from telegraph private wires. Fortunately we received enough new type teleprinters in time to convert all installations for automatic working with new or modified telex machines.

Eight positions will be retained at the Manchester manual exchange after conversion to deal with assistance traffic and control of calls to London customers still connected to London manual exchange. All fault reporting and enquiries for the zone will also be temporarily centred at Manchester. The exact procedure has not yet been decided but it will have regard to the responsibility of Telephone Managers for the service given to customers.

Bristol Prefers STD

An overwhelming majority of 1,700 Bristol telephone subscribers, asked their opinion on subscriber trunk dialling, expressed a preference for the system because it is quicker and cheaper.

Analysis of the 1,700 replies received showed that 90 per cent. are taking advantage of the new tariff for short calls, 30 per cent. are making more calls, and more than 70 per cent. approve the timing of local calls in conjunction with the decrease in the unit charge from 3d. to 2d.

New Definition of Investment

The Government has agreed that the Post Office investment allocation for 1960–61 will be increased by £6m. Investment totalling £1.2 million has been transferred from 1958–59 to 1959–60.

A new definition of the scope of Post Office investment for control purposes has also been agreed. Under this certain items will be excluded and the figures will be:—

		£m
1958-59 (*redefined for comparison*)	-	88.3
1959-60 - - - -	-	89.0
1960-61 - - - -	-	90.6

The proportion for telecommunications will be about 92 per cent. for each year.

Examples of the items which will in future be excluded from the definition of capital investment are:

Rearranging existing plant without actually adding to fixed assets; for example, moving telephones or other apparatus from one point to another within a customer's premises.

The Post Office undertakes various engineering works of a capital nature (for example, relaying underground cables in connexion with street works), the cost of which is met from the capital resources of the promoting authority. To avoid double counting the cost of these works to the authorities concerned will be excluded.

* * *

Post Office Honours—Mr. W. R. Tyson, Telephone Manager, Bournemouth, and Mr. W. S. Procter, Chief Engineer in London Telecommunications Region, were honoured with the O.B.E. in the Queen's Birthday List.

Two of the Post Office telecommunications staff received the M.B.E.: Mr. F. J. H. Clarke, Senior Telecommunications Superintendent of of the Long Distance Area, and Mr. C. H. Lewis, Area Engineer, Bristol.

Among recipients of the B.E.M. were: Miss C. M. Patmore, Exchange Supervisor, Bishops Stortford; Mr. F. G. Walton, Leading Technical Officer, City Telephone Area; Mr. H. Horwood, Chief Supervisor, Exeter; Mr. H. Bennett, Overseer (Telegraphs), Cardiff; Mr. J. H. Evans, Postal and Telegraph Officer, Cable and Wireless Services, Electra House, London; Miss E. N. Maker, Chief Supervisor, Directory Enquiry Bureau, Terminus (London) Exchange; Mr. A. E. Smith, Technical Officer, Cambridge; Miss M. E. Moreland, Assistant Supervisor, Coleraine; Mr. W. H. Ward, Technical Officer, Liverpool; Mr. A. C. Butcher, Inspector, North Area, London Telecommunications Region; Mr. E. Hunt, Technical Officer, Engineering Department.

* * *

Cost Reduction.—By next year the average cost of the telephone exchange apparatus needed for each subscriber will be reduced by a total of one quarter, said the Postmaster General on July 25.

In 1954–55, on an average, apparatus costing nearly £35 was needed in every new telephone exchange for each subscriber connected. This year the corresponding cost is just under £32; next year it will be £27.

Simplification of the call charge tariff has eliminated the need for much equipment previously used to discriminate between calls of 5, 7½, 12½ and 15 miles distance. Substantial economies have been secured by technical changes such as the use of line finders by closely tailoring the provision of switching equipment to tariff requirements and by putting in apparatus only as the number of lines connected to an exchange, and the traffic, increases.

OUR CONTRIBUTORS

L. T. ARMAN ("V.H.F. Maritime Services") entered the Post Office by way of the old Stores Department and subsequently worked in the Factory and Inspection departments. He was transferred to the Radio Branch of the Engineer-in-Chief's Office and was engaged there on the trans-oceanic radiotelephone services, notably on the automatization of those services. He was commissioned in the Army in 1944 and was engaged mainly on Reichpost telecommunication in Münster. On demobilisation in 1946 he went to the North West Area of London Telecommunications Region and worked on telephone installations. About one year later he was seconded to the Foreign Office until 1954. Since then he has been in charge of a group in the Radio Branch of the Engineering Department dealing with V.H.F. radio services of all categories.

J. A. GRACIE ("The International Frequency Registration Board"), Vice-Chairman of the I.F.R.B., entered the Post Office in 1924 as a Probationary Assistant Engineer, and before going to Geneva in 1948 was an Assistant Secretary at Post Office Headquarters.

(*Continued overleaf*)

MISS H. V. HUGHES ("How the Factories' Piece Parts Depot serves the Telephone Network") is an Executive Officer in the Factories Department. She joined the Post Office as a Writing Assistant in 1931, serving in the Stores Department at Birmingham. Six years later she was promoted to the grade of Clerical Officer. In 1942 Miss Hughes was transferred to the Headquarters of the Factories Department, then in Birmingham. She became an Executive Officer in the Birmingham Factory in June 1948. Since 1955 she has been vice-Chairman of the Factories Department non-Engineering Whitley Committee. Miss Hughes is one of only six women officers who have written for the *Journal*.

T. KILVINGTON ("Colour Television") contributed an article ("The Post Office Research Station holds an 'Open Day' ") to the Autumn 1957 issue and his career was outlined in that issue. Since then he has been to Moscow as a member of the United Kingdom Delegation to a Study Group of the International Radio Consultative Committee May-June 1958.

A. V. LEAVER ("Subscriber Trunk Dialling and the New Coin-Box") who is a Principal in the Subscribers' Services Branch, Inland Telecommunications Department, has been engaged from the outset in the development of the new STD coin-box. He has had experience on both the telegraph and telephone sides and his 20 years in the traffic grades in the old London Telephone Service and at Headquarters have provided a useful background for his present duties. During the Second World War he was in the War Group at Dollis Hill organizing the Post Office activities in connexion with the operation of the air raid warning system.

C. E. A. ORRIDGE (joint author, "How the Factories' Piece Parts Depot serves the Telephone Network") is an Assistant Engineer in the Telephone Maintenance and Standards Branch of the Engineering Department. Entering the Post Office in 1941 as a Youth-in-Training, he worked in London Telecommunications Region successively as Unskilled Workman, Technical Officer and Assistant Engineer until 1946 when he served as a Royal Signals Instructor at the School of Signals, Catterick, for two years. In 1956 he was transferred to the Engineering Department and worked on matters relating to the rationalization of piece parts. He is now engaged on problems relating to maintenance of automatic exchanges.

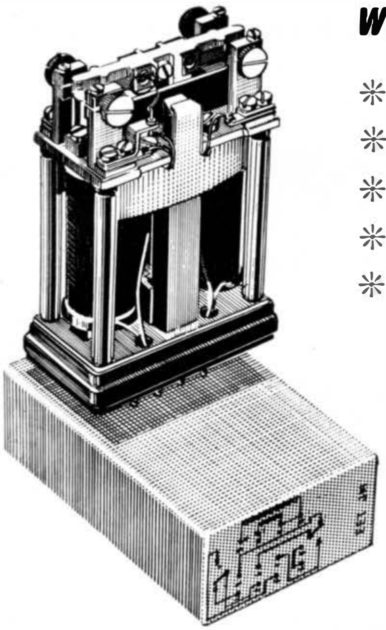
W. C. WARD ("More Power to your Elbow") is an Assistant Staff Engineer in the External Plant and Protection Branch of the Engineer-in-Chief's office. He joined the Post Office as a Youth-in-Training in the then London Engineering District in 1924, and subsequently became first Probationary Inspector and then Probationary Assistant Engineer (old style). He served for five years as old style Assistant Engineer in the Sectional Engineer's office at Blackburn and for eleven years as Area Engineer in Nottingham Telephone Area. He came to the Engineer-in-Chief's office in February 1950.

Publication and Price. The *Journal* is published in November, February, May and August, price 1/6. The annual postal subscription rate is 6/6 to any address at home or overseas.

Contributions. The Editorial Board will be glad to consider articles of general interest within the telecommunication field. No guarantee of publication can be given. The ideal length of such articles would be 750, 1,500 or 2,000 words. The views of contributors are not necessarily those of the Board or of the Department.

Communications. Communications should be addressed to the Editor, Post Office Telecommunications Journal, Public Relations Department, Headquarters G.P.O., London, E.C.1. Telephone: HEAdquarters 4345. Remittances should be made payable to "The Postmaster General" and should be crossed "& Co."

GPO



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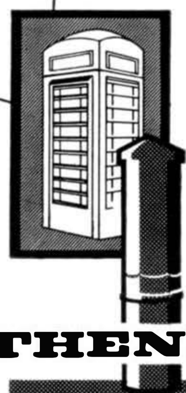

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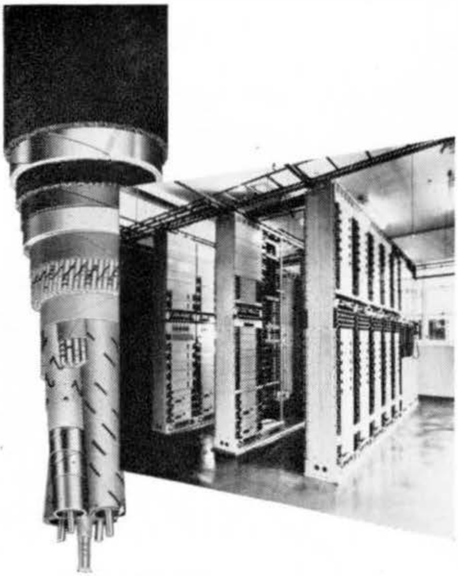

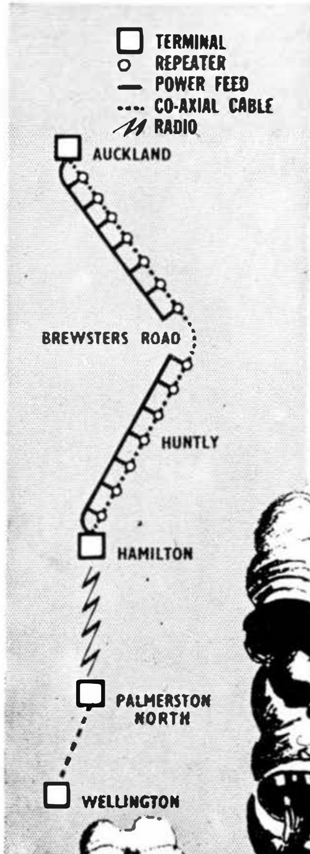

On the second cable link between Wellington and Palmerston North BICC have supplied the Co-axial Cable and ATE are supplying the Transmission equipment.

FIRST CO-AXIAL CABLE SYSTEM IN NEW ZEALAND

The first section of the new Trunk Telephone link in the North Island of New Zealand is now in service with the commissioning of the multi-channel carrier telephone system operating over co-axial cable between Auckland and Hamilton. On this section 240 circuits are to be provided initially; the system is extensible to 960 circuits. A. T. & E. Co. Ltd. were entrusted by the New Zealand Post Office with the supply of all the line transmission and terminal channelling equipment. BICC were responsible for the design, manufacture and installation of the co-axial cable in conjunction with the New Zealand Post Office. This is another example of a joint enterprise by two specialist organisations who undertake complete communication systems anywhere in the World.

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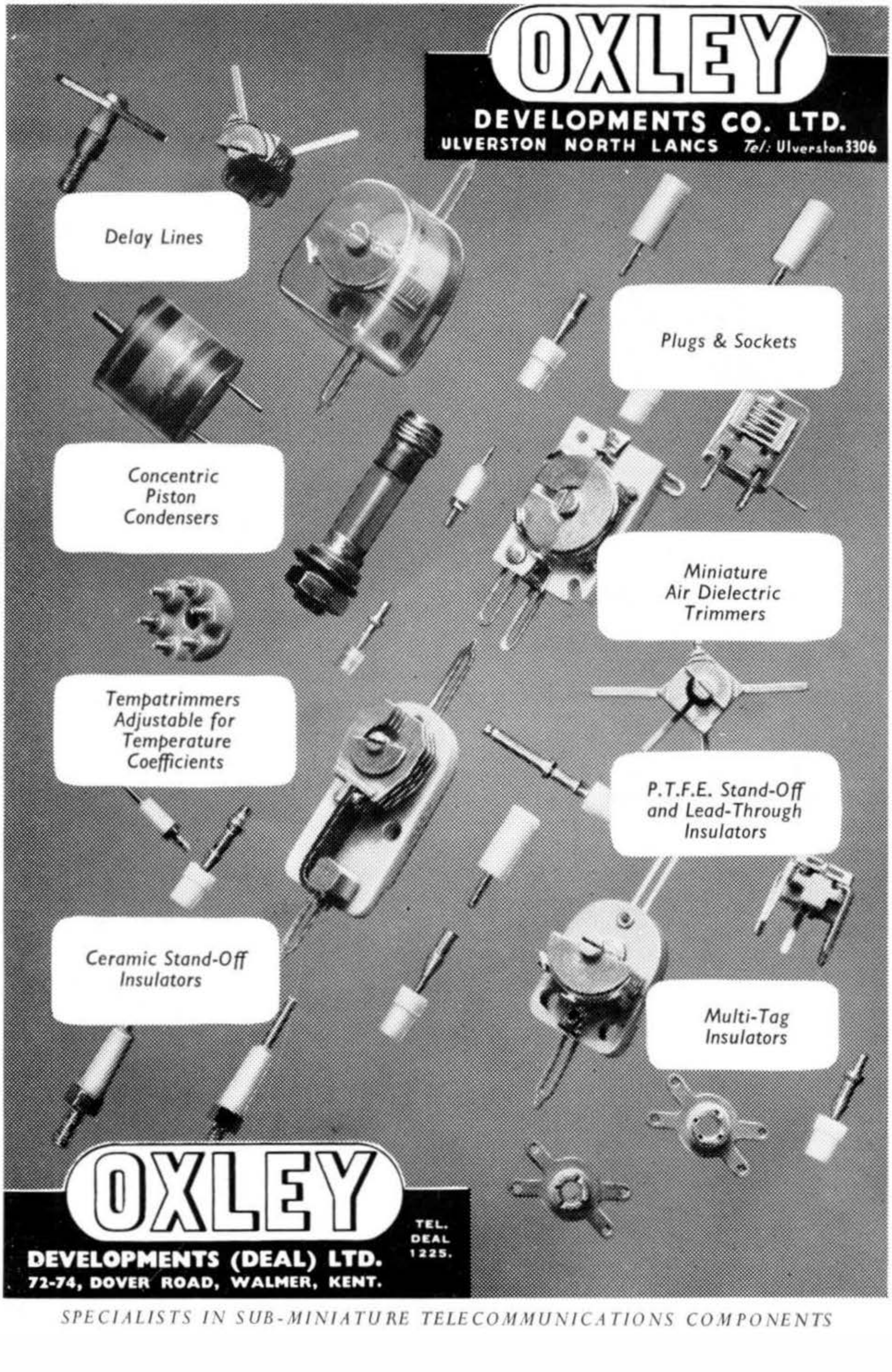

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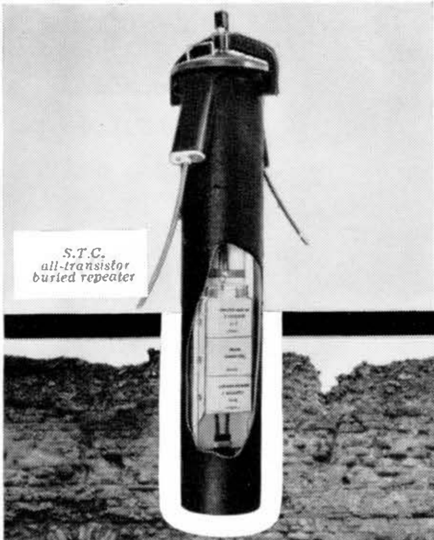

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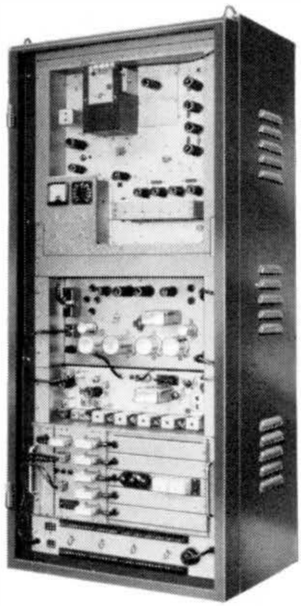

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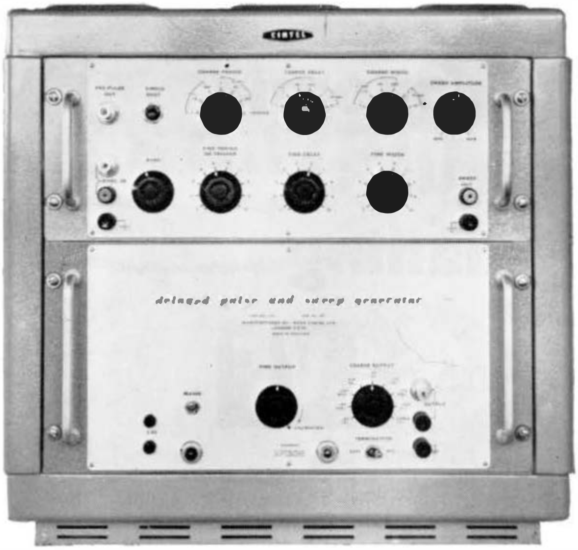

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Width: Variable from 0·09μsec to 105msec ±5%.

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5V max	in 75Ω	rise time	10mμsec
10V max	in 150Ω	rise time	<20mμsec
25V max	in 600Ω	rise time	<40mμsec
50V max	in 1000Ω	rise time	50mμsec

Polarity: Positive or negative going.

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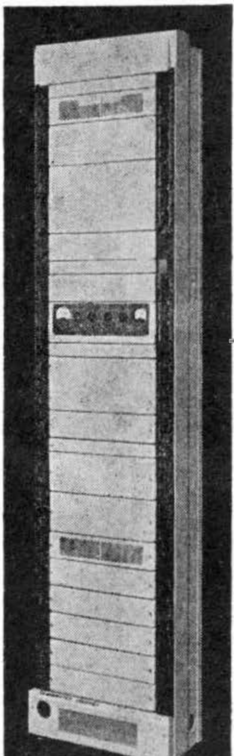

240 circuit terminal rack

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