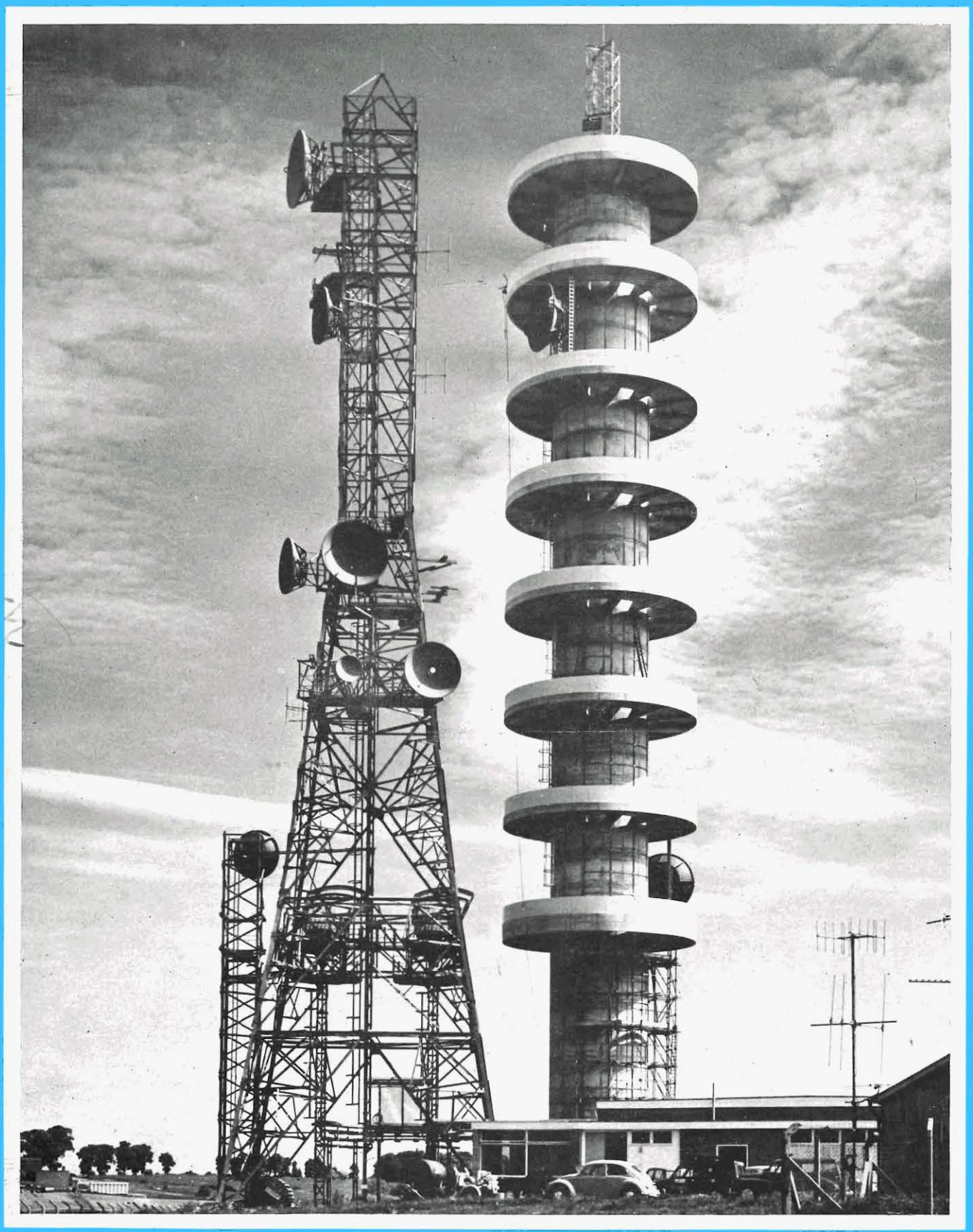
Post Office telecommunications journal

One shilling and ninepence Winter 1970-71 Vol. 22. No. 4



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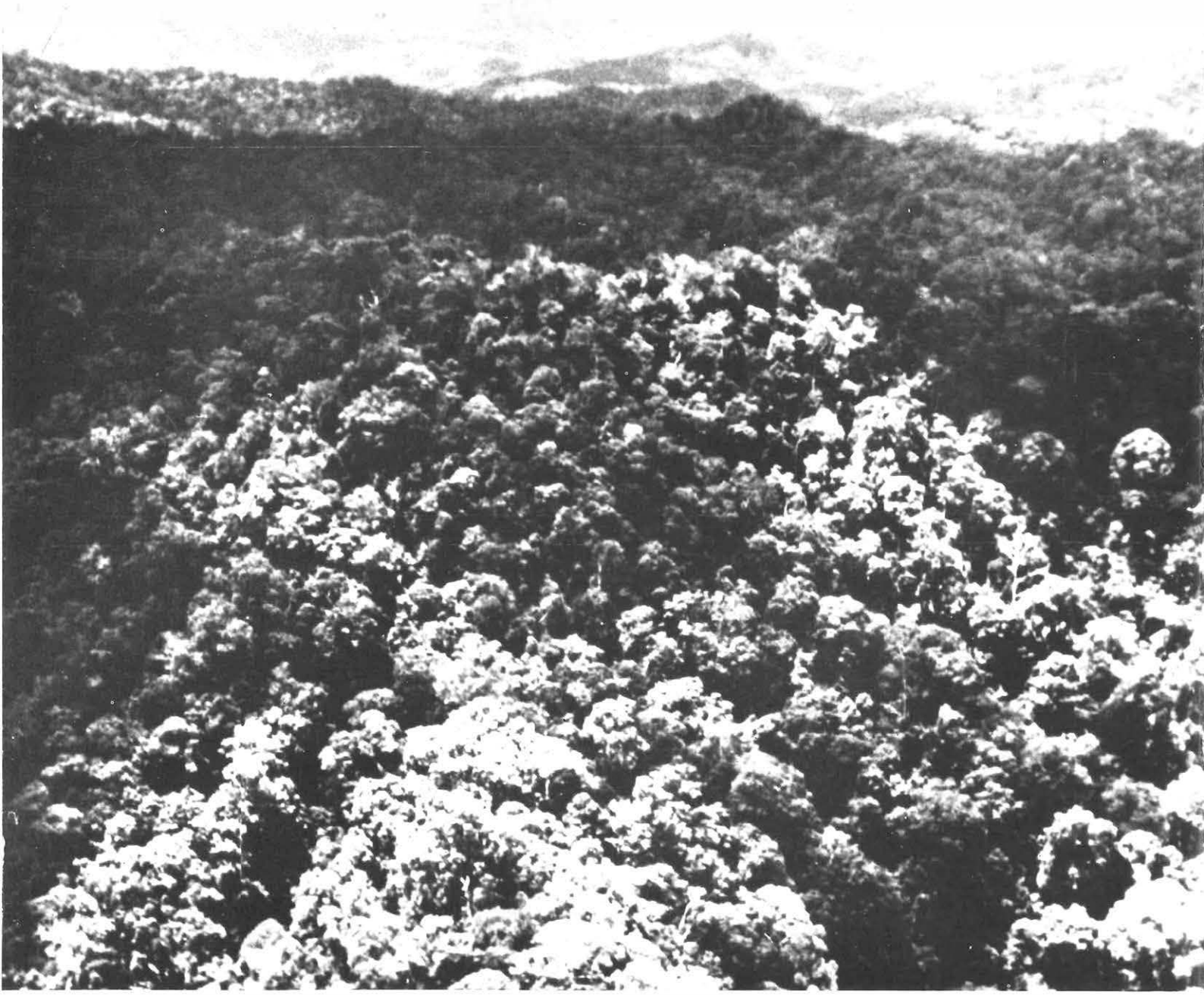

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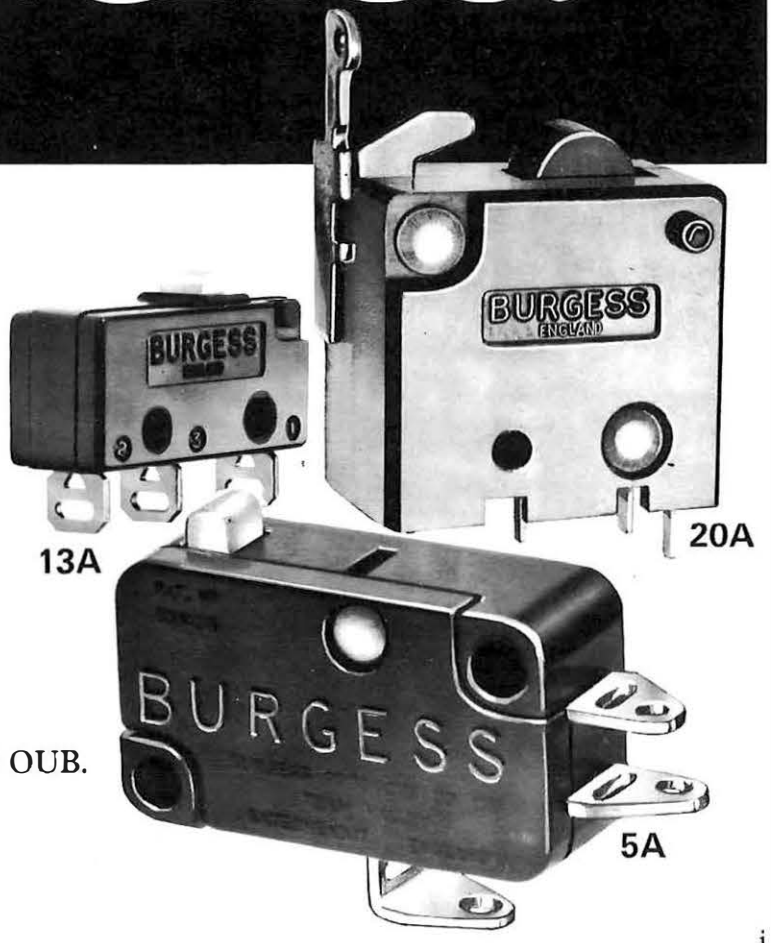

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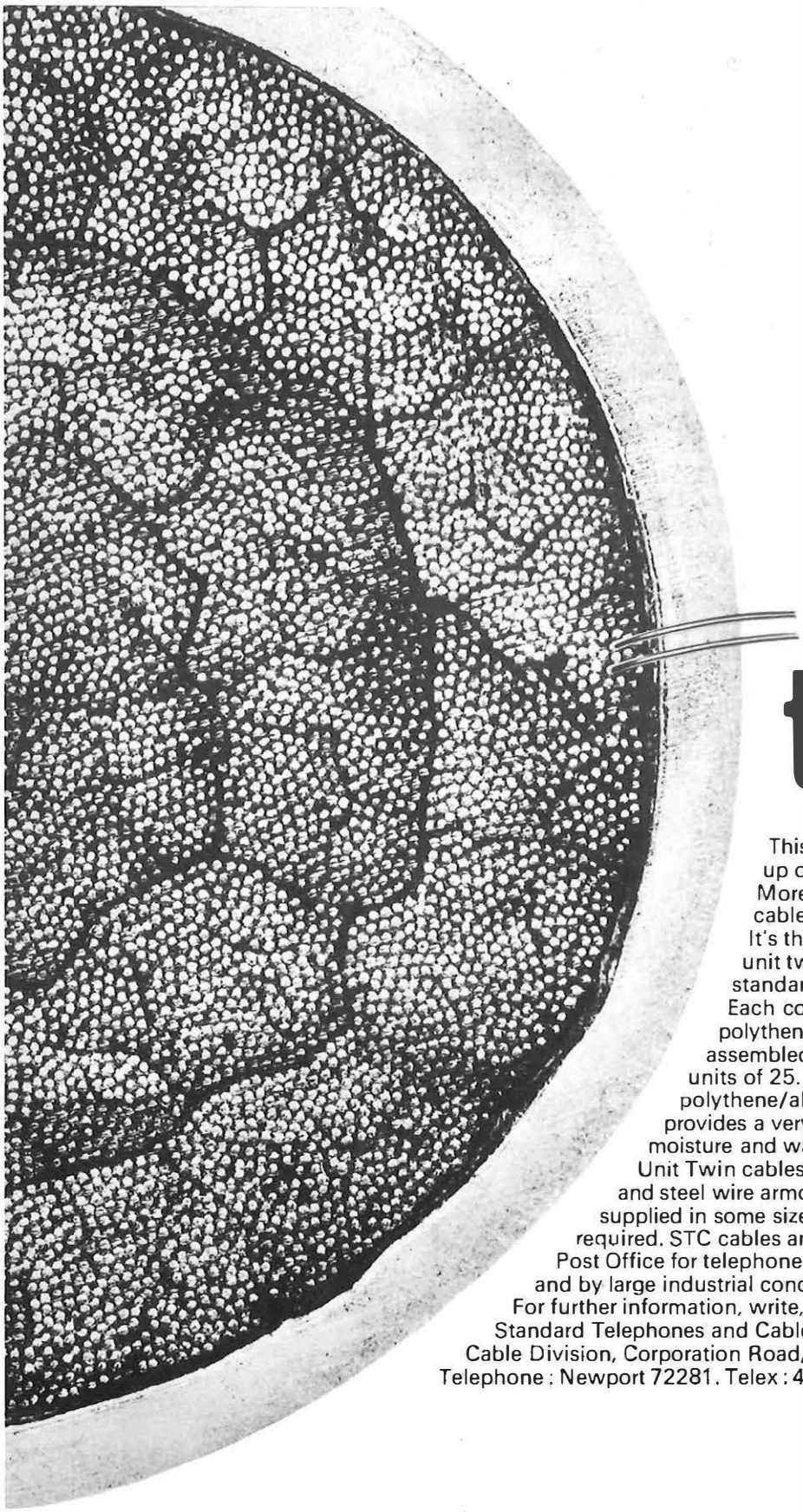

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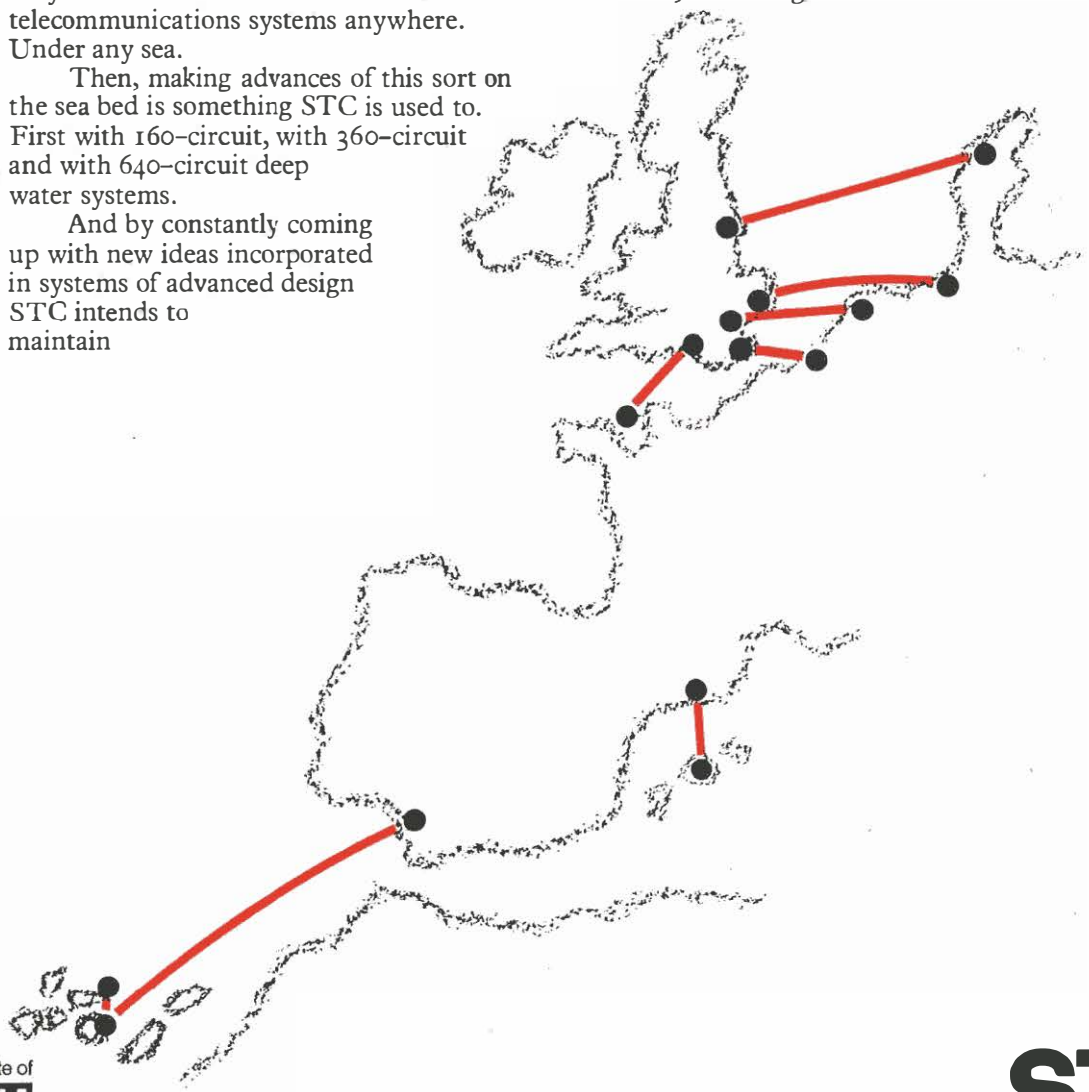

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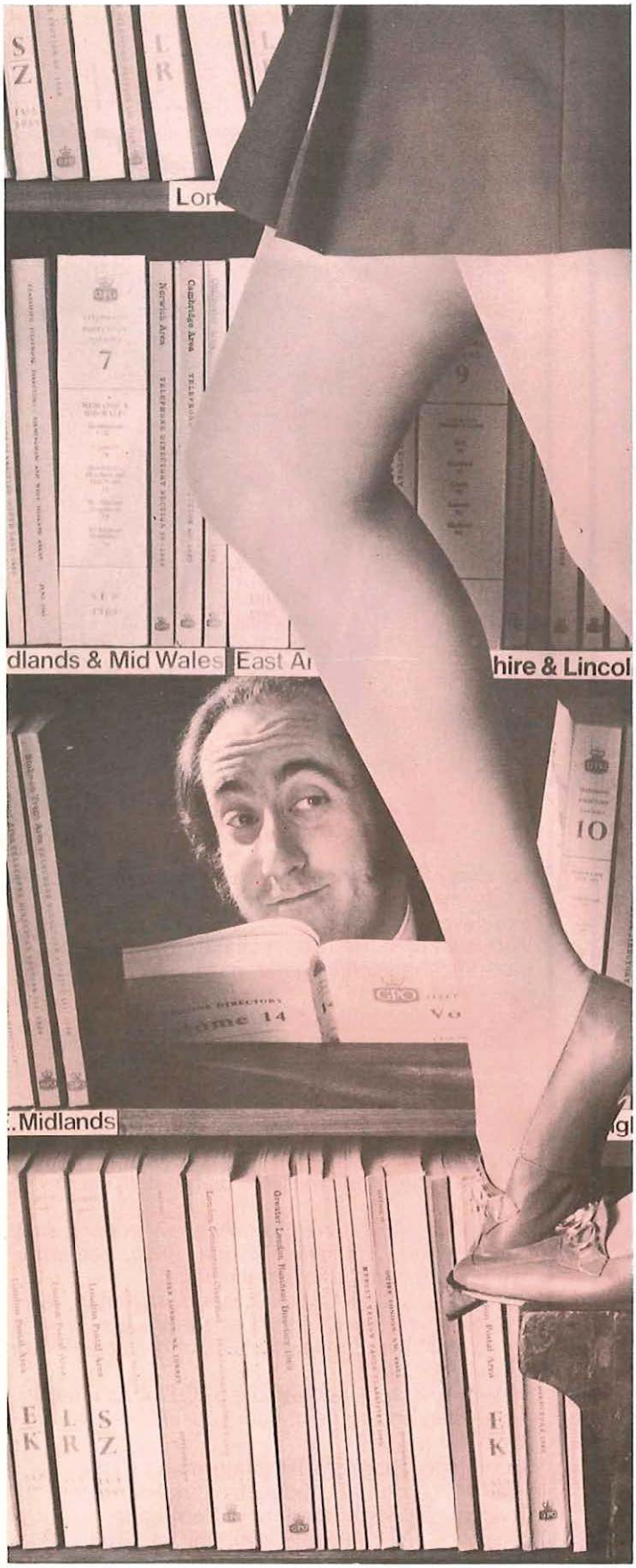

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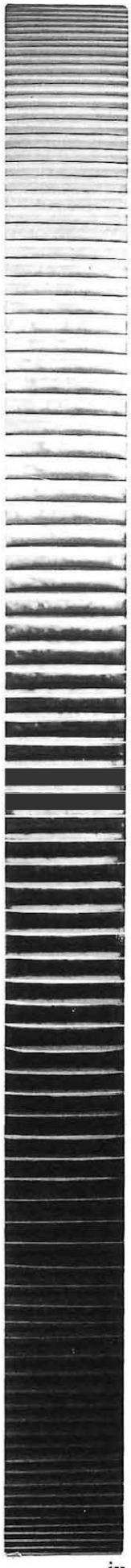
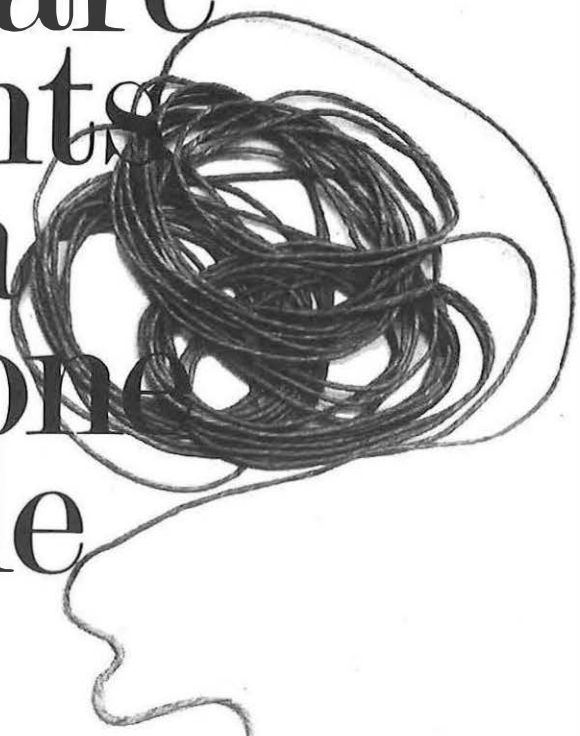


Some rare ingredients go into a telephone cable



The rarest: TCL know-how

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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

Vol. 22 Winter 1970–71 No. 4

'We mean business'

IN its first official report to the nation, the Post Office Board says that it has vigorously attacked the substantial problems with which it was confronted on Vesting Day and has attempted to show that the Post Office "is in business and means business."

The Report and Accounts, published in November, says the Board has been involved in a review of all areas of Post Office activity. The aim was to ensure that the Corporation operated with maximum efficiency and provided the best possible standard of service at the lowest possible cost to the public.

When the Corporation came into existence in October 1969, it had to change the whole atmosphere of the Post Office from that of a Department of State to that of a vigorous business, at the same time building on and improving the good record of the GPO in industrial relations. There was also considerable scope for expanding business and introducing new, profit-making services, says the report.

The first six months—the period covered by the report—were devoted to analysing and evaluating problems and opportunities. Immediate steps were taken to tackle some of the problems, and plans were drawn up to deal with others.

Outlining the telecommunications problems which faced the Board on Vesting Day, the report says the business was facing an unprecedented demand for service. The demand for new telephone connexions was nearly 40 per cent higher than in the previous year. At the same time, the business suffered from shortages of plant and equipment caused in part by under-investment in the past, but also by the persistent inability of manufacturers to meet orders on time. And it was encountering these difficulties at a time of rapid technological change.

As a result there were long waiting lists for telephones in some areas. At the same time, congestion of traffic in the system had meant that the quality of service was not always as good as it should be.

"The critical factor remains the supply of exchange equipment," says the report. "When the Board took over, some 1,400—or nearly 80 per cent—of outstanding contracts were in delay, by an average of eight months. Even so the equipment manufacturers have more than doubled their output since 1965–66 and in 1968–69 doubled the number of completed installations to 600."

Early in 1970, the report recalls, the Post Office launched the biggest investment programme in its history, with a total of £2,700 million to be invested over a period of five years. "The Board and the manufacturing industry are determined to ensure that deliveries of equipment are improved since it is on this critical factor that the success of the £2,700 million investment programme largely depends," adds the report.

The Corporation was doing all it could to help the industry meet the heavy future demand by improving and extending its forecasts of equipment needs and systems policies.

Technological change was at the very heart of the telecommunications business, says the report, but modernisation could not be carried out overnight. New equipment had to be compatible with the £2,000 million worth of equipment already in the network, and this created a difficulty experienced by all telecommunications managements. On the one hand, equipment must be compatible and it might be economically wise to standardise. On the other hand, it must be flexible enough to cater for services which it is not yet possible to define.

There was also a serious problem of obsolescence. Most of the exchange equipment now in use was out of date by modern standards, but further large amounts were having to be installed to keep pace with the explosive demand for service in the absence of up to date equipment in the quantities required to fill the gap. As the manufacturing output of modern systems rose, important decisions would have to be taken about the rate at which existing obsolescent equipment should be replaced.

All these problems were being carefully studied.

● Details from the report dealing with the telecommunications business are given on pages 26-27.

IN THIS ISSUE

COVER PICTURE: The new ferro-concrete tower at Purdown (Bristol) radio station is being completed alongside the lattice steel tower which it will replace. It is 220 ft high overall and has eight aerial galleries, each of which can accommodate up to six aerial dishes. When the transfer of services is complete the old tower will be dismantled. An article illustrating the different tower designs used in the microwave radio network begins on page 17. The effect of bad weather on high-frequency radio transmission is described in another article—see page 13.

Ploughing

SUBMARINE cables have always been virtually trouble free in the deep sea. Where they have proved to be vulnerable is at either end of the lines where, lying in the shallower coastal waters, they have been prone to damage by the trawls of fishing boats.

One answer to this problem has been to bury the shore ends of cables under the seabed. While the idea is not new—it was successfully done by the Western Union Telegraph Company as long ago as 1938 when 42 nautical miles of cable was buried off the Irish coast—the cost and the technical difficulties involved have been prohibitive.

In recent years, however, the American Telephone and Telegraph Company developed their own submarine cable burying plough and, up to the end of 1969, had successfully buried nearly 400 miles of cable in the North Atlantic and Mediterranean areas.

The British Post Office has now completed its first operation of this kind by burying nearly 80 miles of the British end of the Widemouth–Tuckerton (New Jersey) transatlantic cable (TAT 3). The operation was carried out in conjunction with the AT & T Company who are joint owners of the cable.

For three months last summer the giant plough developed by the Americans crawled along the Atlantic seabed at depths up to 300 ft. Remotely controlled from the surface by the Canadian Coastguard icebreaker-cableship, John Cabot, the seaplough buried the cable as it inched its way forward. The Canadian ship is the only one in the world with the power and manoeuvrability needed to bury submarine cable in open sea.

The plough, which weighs 15 tons, is 24 ft long, 11 ft wide and nine feet high, can "see", "hear" and execute commands. It carries TV cameras, a hydrophone and instruments to measure the pitch and roll of the plough, speed, distance travelled, ploughshare depth and numerous system-monitoring operations. A control line which is kept above the plough by trawl net floats acts like an umbilical cord in carrying signals and power between the plough and the towing vessel.

The cable is fed through the ploughshare and comes out of the back of the share near the bottom. As the share is pulled through the seabed the cable is buried up to depths of two feet. The depth setting is controlled depending on sea bottom conditions.

Since the towing tensions involved are directly related to the width of the ploughshare it is made just wide enough to permit passage of the cable through it. To accommodate the wider repeaters, a tail gate is provided above and to the rear of the share to allow repeaters to by-pass it. To get some cover over a repeater, auxiliary ploughshares are brought into operation as the tail gate is opened by remote control to widen the path at the time the repeater is laid.

Underwater lights pierce the dark depths as the AT&T Company's plough crawls along the seabed burying a cable as it goes.

RIGHT: Action stations aboard the Canadian Government's icebreaker cableship John Cabot as the crew lower the seaplough to start ploughing operations.

The ploughing operation was preceded in the summer of 1968 by a feasibility study carried out by the Post Office Cableship Monarch. It was first necessary to establish the line of the existing working cable as accurately as possible from off the cable landing at Widemouth Bay to about 100 miles seaward so that subsequent survey work would not interfere with it. To do this the Monarch towed two electrodes through which was fed a 17 Hz current at up to 50 amps output. Without interrupting normal cable traffic Widemouth could easily detect the electrodes as they passed over the cable by means of a narrow band tuned receiver. Maximum readings were reported by Widemouth to the Monarch over a special radio telephone link through Lands End Radio Station. The position of the peak readings were plotted and the exact line of the cable was established.

A sounding survey of the route likeliest to be selected for the ploughing operation was then carried out. Apart from slight undulations this revealed that the sea bottom descended regularly from 25 fathoms to 75 fathoms, a drop of 300 ft along a distance of 82 miles.

Cores and samples of the seabed taken along the route were sent to the National Institute of Oceanography for evaluation and a team from the School of Physics, Bath University of Technology, headed by Professor Deryck Chesterman, used special sonar equipment to provide a map-like picture of the seabed. Towed alongside the ship this equipment produced a 400-metre wide impression of the seabed, showing protruding rocks or obstructions and varying types of seabed. Results showed that the bottom was rocky to about 16 miles west of the cable landing, but further off the seabed was featureless and could probably be ploughed.

the seabed

By Captain O. BATES

Monarch then made a grappling and TV camera run along the proposed burial route towing a 1-ton grapnel, specially made for this purpose, along the bottom while an underwater TV camera and light were suspended from the ship's bow so that the camera could be focused on the seabed to observe the ground conditions. Records were made of the grappling tensions and a continuous TV watch was maintained. A video tape record was made at intervals, or whenever any unusual feature appeared.

After considering the information from the feasibility study it was decided that cable burial was likely to be practicable over the greater part of the route. To make doubly certain, however, John Cabot made a test plough run. This determined that the very abrasive bottom at the inner end of the route would wear out the ploughshare before the operation was completed and the unbedding of large stones which caused the plough to roll could possibly damage the cable while it was being ploughed in. It was decided therefore to plough in armoured cable—usually unprotected lightweight cable is satisfactory. A 25-mile section would be ploughed in after which the ship would return to Southampton to repair the ploughshare before continuing with the remainder of the operation.

After the test plough the John Cabot ploughed in the French shore end of the US–France TAT 4 cable before beginning the TAT 3 operation in early July last year.

When ploughing, the 5,000-ton Canadian ship has two diesel engines of 4,500 hp available for propulsion, a 2,250 hp diesel for operation of the cable engines and side thrusters and a spare engine. The main engine control is so arranged on the bridge that the duty officers can control the engine movements directly—an essential condition for sea ploughing.

The John Cabot was supported by two tugs and a four-man diving team as well as the Post Office Cableship Iris which manned the far end of the cable and assisted with transmission testing.

Ploughing begins by "threading" a half mile ground rope through the plough which is then overboarded and unhooked from its davits by the divers and hung by the towing wire. The bottom end of the rope is secured to the cable and the top end to the ground moorings of a cable buoy. The ship then steers a course over the spot chosen for the buoy anchor and lets it go. From now on the ship needs more than the usual cableship manoeuvring ability. As the buoy clears the ship, the plough is lowered to the ground and the rope pulls through with the ploughshare up. The cable follows, and at the point determined for start of burial the ploughshare and tail gate are lowered and burying begins. The ploughing speed is about 0.8 to 1.0 nautical mile per hour.

The ship is controlled by three

officers on the bridge, two of whom carry out navigation plots every 12 minutes (one fifth of an hour and about every 350 yards of route). The third sits at the engine controls watching indicators of towing tension and plough speed and a TV screen showing the cable entering the plough and the ground for about 10 yards ahead. He can slow the ship or completely stop it if rough ground or obstructions appear. He maintains the engine revs to give a suitable ploughing speed for the ground conditions encountered.

An AT & T engineer team mans the plough control centre. They determine ploughshare depth and settings, make recordings of plough speed, share depth, pitch and roll, tow wire strain, control the TV cameras and maintain hydrophone volume.

During an operation of this nature it is essential to ensure that the cable and repeaters laid are not damaged during the burying operation. To this end the performance of the cable and repeaters is monitored during the whole period of burying so that immediate information will be available should any damage occur.

As the cable and repeaters for the burying of TAT 3 were loaded into John Cabot they were jointed into a continuous length and the cable energised so that the transmission of the cable and repeaters could be checked.

At the commencement of the operation on the cable ground, after John Cabot had passed the initial cable end through the plough, the end was picked up by Iris and the cable and repeaters energised. Transmission tests were then made between the ships through the cable in the tanks of John Cabot. These showed that the end of the cable passed through the plough was undamaged and that the cable and repeaters on John Cabot were in good condition. Cable burying was then commenced.

During the whole of the burying operation the performance of the cable and repeaters was monitored and full transmission tests were made at regular intervals. No changes in performance were observed other than those expected to occur due to changes of temperature and pressure.

On completion of the operation the new buried section was jointed into the TAT 3 cable at each end replacing an exactly similar length of the original cable. Overall transmission tests made after re-energising the TAT 3 cable between Widemouth and Tuckerton showed that there was no significant change in the system performance.

THE AUTHOR

Captain O. Bates, who joined the Post Office in 1939, was Chief Officer of CS Monarch from 1946–59 and served as Captain of the cableship from 1959–70.

Skin divers about to go overboard from their rubber dinghy to disengage the seaplough from its davits. On the left is the vital control cable which carries signals and power between the plough and the towing vessel. The floats attached to the cable keep it above the plough.

DIALLING 'DOWN UNDER'

BRITISH TELEPHONE customers will be able to dial their own calls to the other side of the world within a few years. Following the introduction of customer dialling between London and New York in March of last year, the Post Office plans to introduce in the next two or three years dialled calls to Canada, to the rest of the United States and on to New Zealand and Australia. Already 95 per cent of all telex calls are dialled by the customer.

These plans were described by Mr. James Hodgson, Director of External Telecommunications, addressing the Quinquennial Conference of the Commonwealth Press Union at Gleneagles.

"This is the telephone and telex pattern for the future—Commonwealth and other international services of great flexibility and reliability with, I trust, an ever-improving speed of connexion, especially for the customer who dials his own calls," he added.

International business in this country was growing at over 20 per cent a year in telephone calls, telex calls and leasing of private lines, said Mr. Hodgson. The international telegram service was also growing, though more slowly, and it represented, in absolute terms, a huge volume of communication.

"Between the countries of the Commonwealth the rates of growth are even higher —the inter-continental telephone and telex business of the Post Office grew by over 25 per cent last year and all the evidence suggests that growth on this scale will continue over the next few years at least," he said.

Growth was stimulated not only by the communications appetite of businessmen, including Pressmen, and social users of telephone services, but also by the improved quality of long-distance links by submarine cables, satellites and modern high-frequency radio systems.

Pinpointing cable faults

Pulse echo testers may be used on a much greater scale by the Post Office. By transmitting a pulse over a line under test, the instrument can give in seconds an accurate location of a fault from an oscilloscope trace. Trials are now taking place.

By A. F. G. ALLAN

PULSE echo testing is no longer a novel technique, having been in use for detecting and locating coaxial cable faults for over 20 years. Yet it is comparatively unfamiliar because, until recently, the equipment's bulk and cost have limited its use to the handful of Precision Test Officers working on the location of main coaxial cable faults.

Continuing equipment development has improved the reliability and extended the scope of the instrument and at the same time size, weight and power consumption have been materially reduced.

The present pressing need to improve the overall serviceability of the rapidly growing local cable networks, without increasing maintenance manpower demands, has made it necessary to seek new, quicker, more accurate methods of fault location. This has led to the possibility of adopting the pulse echo testing technique in a part of the network where, to date, very much cruder methods have been traditionally employed.

Towards this end local network trials have already been completed in a few large London exchange areas and results have justified further trials which are now taking place in 18 exchange areas in the London Telecommunications Region.

The principle of all pulse echo testing is simple. Pulses travel along a given type of cable at a known speed. Cable faults produce impedance irregularities that reflect all or part of the energy of a pulse passing along the cable. If the time between a pulse being transmitted down a cable and the reflected pulse being received is known, then the distance to the fault can be calculated. One method of measuring this time gap is to display the transmitted and received pulses on a cathode ray tube on a trace moving across the tube at known speed.

The whole operation is repeated many times per second so that a steady picture is obtained on the tube. The display can be marked out in actual distance, yards or metres to the points of reflection, or simply in time units (microseconds) as on the Testers now in use in the Post Office. As the speed at which the pulses travel along the cable pairs is affected by different cable constructions and the materials used, calibration in yards or metres tends either to restrict use to particular cable types or to the production of errors in assessing distances to faults when used on other types.

Choice of the shape of the transmitted pulse has to be a compromise between the need to "see" to the end of the cable pairs under test and the need to "pinpoint" the fault as accurately as possible. This is a compromise because the sharper the pulse the more accurately it can "pinpoint" the fault but the shorter the distance it will travel without significantly weakening.

On some cables, such as coaxial cables specifically designed for very high frequency working, it has been practicable to use "sharp" high frequency pulses of 0.05, 0.1 and at

Technical Officer Peter Sumner operating the latest model pulse echo test set in a London exchange.

worst 0.2 microseconds duration. On local cables, which attenuate such pulses to a very much greater extent, some extension of the pulse duration is necessary. This makes fault location less accurate but since, in general, the distances over which faulting is carried out are relatively short, sufficient accuracy is obtainable.

Because the total quantity of echo testers required for use in the UK to date has not been sufficiently large to justify special development, commercially available instruments have been bought and evaluated. Two different presentation arrangements are possible. In the first the three-inch tube trace can be made to represent, by altering the time base speed, either the first 100, 200, 500, 1,000, 2,000, 5,000 or 10,000 yards of line. It will be appreciated that when searching for faults at any appreciable distance from the testing point, accuracy becomes progressively worse and at the 10,000 yard setting some 250 yards of line is represented only by a very tiny part of the trace.

Similarly, in the second type the three-inch trace can be made to represent various lengths of line from 100 to 20,000 yards and incorporates the most valuable facility of a delay network. This is switched in 20 steps which enables a long line to be examined in sections with the same accuracy all through. For instance, if the trace range is set to one microsecond with no delay the response of the first 100 yards of the line is displayed. With the same range setting but with the delay switch set to step one it is the second 100 yards (101 to 200 yards) which comes under scrutiny. With the delay set to step two the section 201 to 300 yards may be closely examined and so on.

It is the instrument with the second presentation that has already been supplied to all Telephone Areas for main cable work generally and which is now undergoing field trials in the local networks, even though it is considerably more expensive than the first model mentioned and has to be obtained from an overseas source.

In addition to the accuracy and speed of fault finding which will accrue from the Testers there is also expected to be benefit from the operational viewpoint. Traditional faulting on local lines has always presented some difficulty since this is certainly a business where "practice makes perfect", and where the activities are as much an art as a science. It is difficult, however, to teach the expertise required to a large number of faultsmen of differing capabilities, particularly in the larger urban areas where staff turnover is relatively high. Generally, this leads to the adoption of the very crude methods known as "cut and come again"—opening joints one after the other and gradually approaching the fault point—resulting in a steady deterioration in the state of the network, far too lengthy out-of-service periods for the customers and excessive manhour expenditure.

Pulse echo testing, though employing a relatively expensive instrument, can be operated from the exchange Main Distribution Frame (MDF), a standard point of access to the lines, where testing conditions are convenient and comfortable and where the expertise required need only be taught to a small number of staff, maybe no more than two or three people.

Experiments have been carried out locating the pulse echo test set on the Test Desk itself, obtaining access to lines over the test selectors. But in large exchanges these internal connections between Test Desks and MDF may vary considerably in length and upset the accuracy of fault localisation. In one London exchange it was found that the various routes from Test Desk to Main Distribution Frame ranged from 253 yards to 352 yards. Furthermore, pulse reflections from test selector wipers and bunks are often so great as to mask even major faults further down the line.

Present trials are restricted to the larger urban exchange areas where it is believed the greatest advantage may be obtained. In rural areas, with smaller scattered exchanges, it is unlikely that the cost of the equipment could be justified.

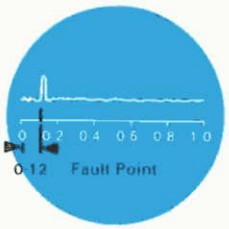
In the preliminary procedures before "live" testing begins, time measurements are made from the MDF, on spare cable pairs, to each of the distribution cabinets in the exchange area. Simulated faults—alternating disconnections with short circuits—are applied at the cabinets to give a clear indication to the operator of the pulse set. This work has two useful aspects. It gives the operator an opportunity to familiarise himself with the instrument; it provides good practice, probably for the first time, in "reading" a cathode ray tube trace rather than a conventional dial and needle instrument; and it gives a reference marker for future work, since the majority of local line faults occur at or beyond the cabinets.

In dealing with day-to-day faults the test clerk, having received a complaint report, carries out a preliminary direct current test on the line and, if satisfied the fault is in the line and not at the customer's instrument, passes the details to the pulse echo tester operator at the MDF. The results are useful since they give the operator a good idea of the type of fault display he should receive.

Without assistance from the field staff, the operator determines the distance to the fault and, from the cable records, "spots" the fault point and inserts the "address" of the fault on the fault docket. When a jointer is available to deal with the fault he is told of the location obtained by pulse echo test. One clear advantage of this arrangement is that each fault does not have to await the attention of a faultsman-jointer before localisation can commence. With, say, a dozen faults reported but only four jointers available, all the dozen faults can be pre-located from the exchange for the field staff to tackle one after the other without lengthy individual field testing.

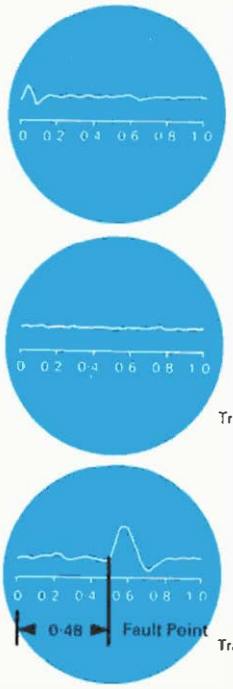
The initial reaction of the staff instructed in the use of the pulse echo tester was not unexpected—a certain reluctance to "play" with an instru-

Preliminary search on 200 microsecond (10 x 20) setting
(full trace represents 22,000 yds approx)



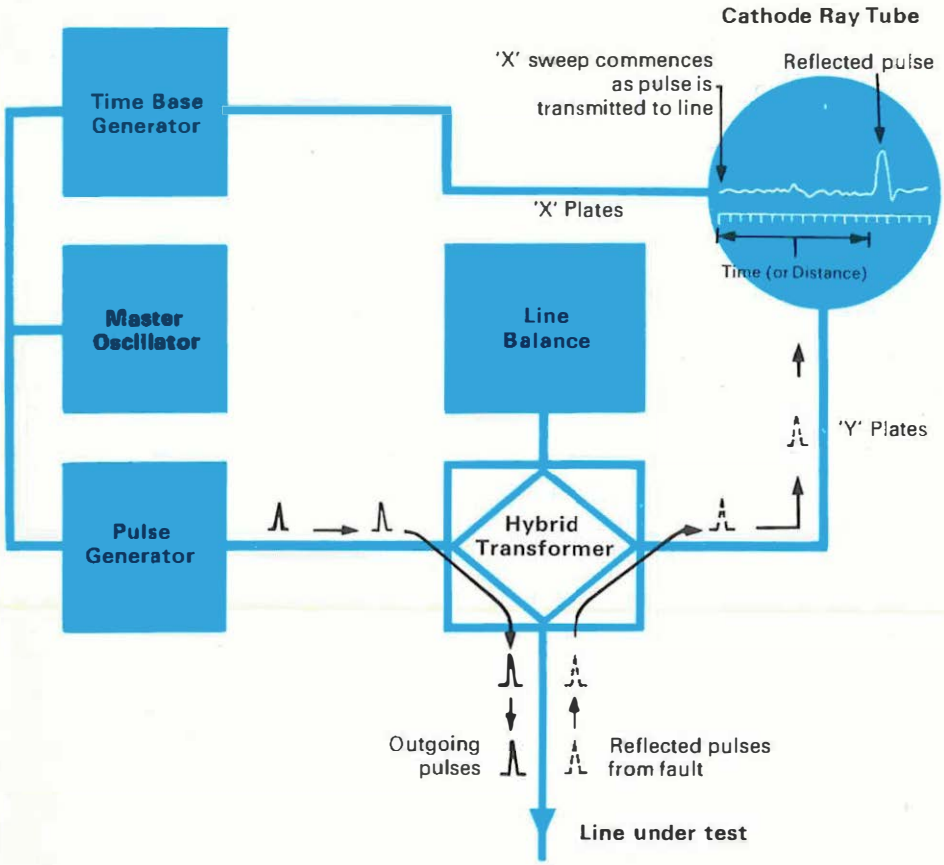
Time to fault = 200 x 0·12 = 24 microseconds
∴ Distance to fault = 24 x 110 = 2640 yds approx.

Secondary search on 10 microsecond (10 x 1) setting
(full scale trace represents 1100 yds approx)



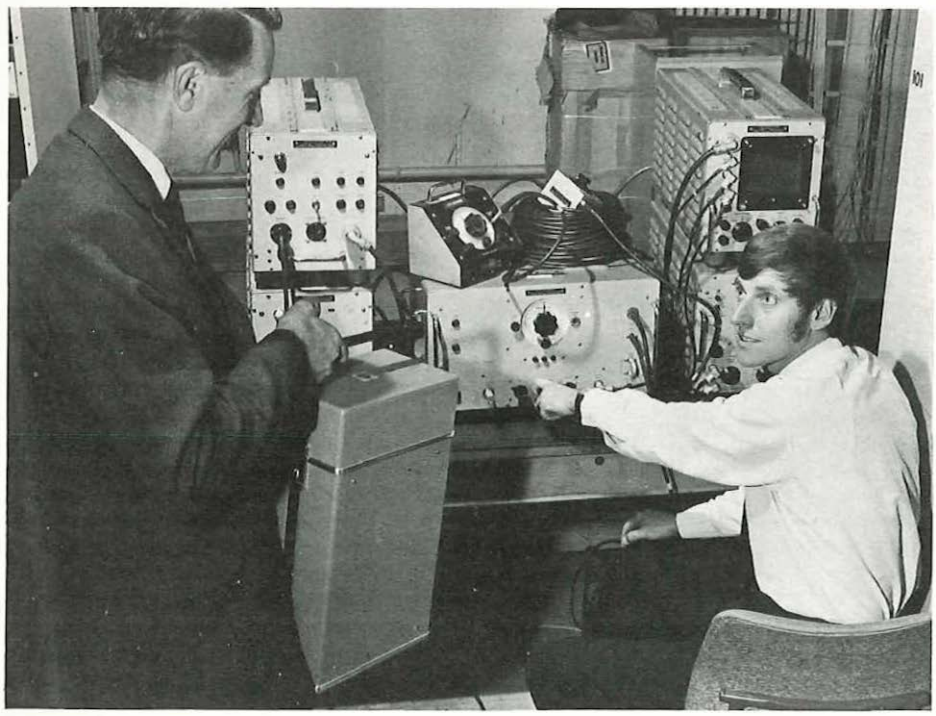
Time to fault
= Delay Switch Reading + reading on trace x time-base setting
= (2 + 0·48) x 10 microseconds
= 24·8 microseconds
∴ Distance to fault = 24·8 x 110 = 2728 yds from test point.

These diagrams illustrate the instrument with a time-delay facility which enables a line to be examined in sections. The top diagram illustrates a search for an approximate position of fault using the 200 microsecond setting. The three others show the step-by-step close search at the appropriate 10 microsecond settings to "pinpoint" the fault. Previous tests on the cable up to a known distant point (distribution cabinet, pillar, etc.) had established a pulse speed of 110 yards per microsecond for the particular cable under test.



A simplified block schematic diagram of a typical pulse echo test set.

Though not strictly comparable in the facilities offered, the early design valve echo tester on the table, operated by Assistant Executive Engineer Peter Smith of THQ, is contrasted with the modern transistorised tester carried by Executive Engineer Graham Holland.



ment so different from the testing equipment they were accustomed to. But the preliminary exercises of plotting time (and distance) to each distribution cabinet quickly gave them confidence. Within a few days major faults were being localised with a fair degree of success, and confidence grew when it was realised that correct locations were being made in over 90 per cent of attempts made. Identifying minor line faults, for which complaints have been received but where the customer has not lost service completely—noisy lines, overhearing, faintness etc.—is by no means easy but the operators were encouraged to have a go at these also and, surprisingly, were soon achieving nearly 70 per cent success in locations. After a month's experience the pulse echo test operators were prepared to back their locations against those made by any conventional methods. External jointers were also quick to note the trends—much reduced plant disturbance, and the consequent benefit to be derived from this.

Some measure of the possibilities is indicated in the results achieved in the preliminary trials. Of 243 major and minor faults in which fault location was attempted, 199 correct locations were made, and of the remaining 44 in which no satisfactory location could be made by pulse echo tester, 16 were subsequently found to be undetectable by any known method and were recorded as FNF (fault not found). The most remarkable success was the case of a cross-connection wire (jumper) in a distribution cabinet which had been inadvertently cut and made good by twisting the ends of the wires together. In time this twisted joint became corroded and gave intermittent trouble. High-resistance joints of this type are always difficult to pin-point, but the pulse echo operator had no doubt at all where the trouble lay, and was proved correct.

Total times occupied in fault localisation, fault clearance, travelling, etc., were recorded both for field staff working to the pulse echo test operator and those following conventional methods, and it was found that, on average, the overall time per fault was reduced by 35 per cent by pulse echo pre-location techniques.

Visits to cabinets and pillars were halved and joint openings reduced by 25 per cent. Finally, the percentage of all faults which necessitated double visits, i.e. by both customers' apparatus faultsmen and cable repair staffs due to the indeterminate nature of the fault diagnosis, was brought down from 21 per cent to 8 per cent.

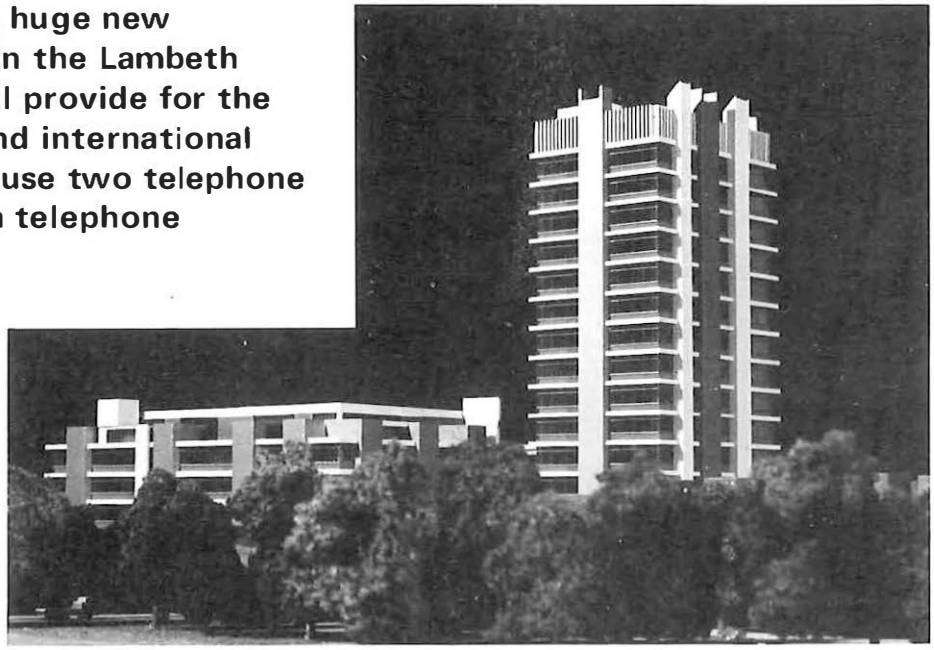
Remarkable improvements are often possible when an enthusiastic team conducts a closely controlled exercise in a restricted locality and it is to ascertain whether similar results can be achieved generally that the more extended trial is being carried out. The outcome is awaited with interest.

THE AUTHOR

Mr. A. F. G. Allan has been associated through most of his career with the THQ organisation, starting as a Youth-in-Training with Training Branch in 1932. He subsequently served in the Research and Lines Branches and spent three years on loan to the Air Ministry. He is now an Assistant Staff Engineer in Service Department with a responsibility for the maintenance of all external plant, Datel and Private Wire Services.

Large multi-purpose centre for London

The Post Office is building a huge new telecommunications centre in the Lambeth district of London which will provide for the growth of both the inland and international telex services. It will also house two telephone automanual exchanges and a telephone service centre.



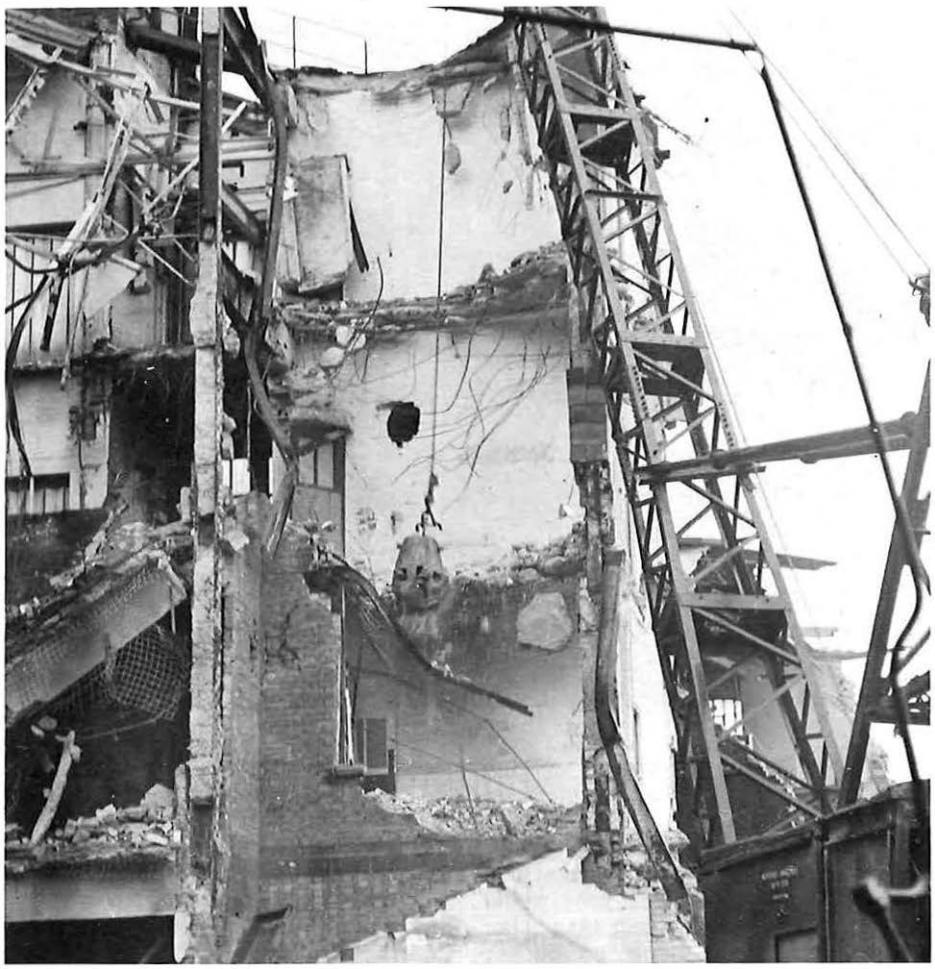
In the picture below the last of the "pickle factory" buildings which occupied the site in South Lambeth Road are being demolished. Above is a model of the imposing new building which will go up in their place. It shows how Keybridge House will look from Vauxhall Park. The trees are part of the landscaping which has been specially designed so that the adjacent St. Anne's Church will not be overpowered by the new building.

By F. W. DAVIES

THE whole telex system in London is being expanded to cater for a big increase in demand. At present all international telex traffic originated in the United Kingdom is handled by the international telex exchanges at Fleet Building and St. Botolph's House, both in the City of London. Due to the rapid growth in traffic, both these exchanges will need relief by late 1974. Inland telex service in the London area is also expected to increase four-fold over the next ten years.

A three-acre site has been acquired in South London for a new building to house both inland and international telex requirements. The site in South Lambeth Road, Vauxhall, was formerly occupied by a well known potted meat and meat essence firm, and demolition of the old buildings—commonly referred to in the area as the "pickle factory"—began in the Autumn of last year. The start of building construction is expected in the Spring of this year.

The international telex equipment to be provided in the new building will cater for about 74 per cent of all outgoing and incoming calls. By 1978 this will represent an annual total of approximately 114 million calls on present forecasts. Facilities will be provided for connexion of international telex calls over long distance submarine cables, HF radio circuits and by satellite communications. A total of about 9,500 international telex circuits will be required at Keybridge House to carry the expected traffic to those countries with which we have a direct service. Automatic accounting equipment will be used for calls beyond Europe. A remote manual telex switchboard at Fleet Building will set up calls on the diminishing number of routes over which the



distant administration cannot accept customer dialling and will also provide for assistance traffic.

The inland telex equipment will cater for 10,000 subscribers initially, but the unit can be expanded as required and will eventually serve 36,000 subscribers. Some 5,000 subscribers' installations on the western side of London which will have been connected to the telex exchange in Fleet Building by 1975 will be transferred to the new exchange. The change has been anticipated for some years and new subscribers who will be affected have been, or will be, given telex numbers beginning with the digit 9 so as to avoid a change of number. The freed capacity at Fleet Building will then be used to meet the growing demands for telex service from Central and North London.

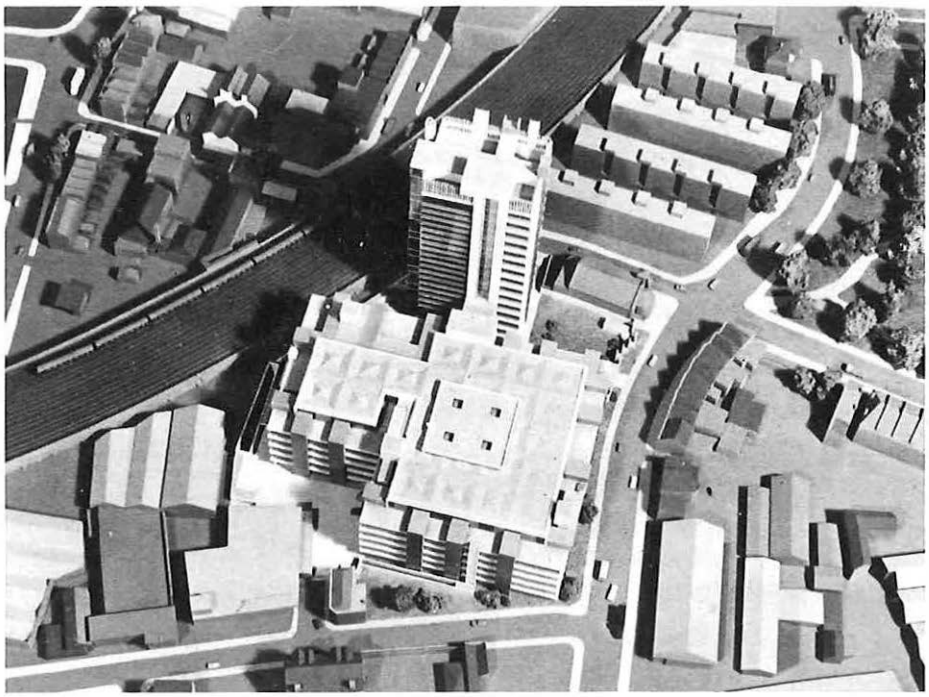
Also to be installed in the new building will be equipment which will serve as a through-routing centre for the interconnexion of calls to and from telex subscribers located in most of South East England, i.e., those connected to Colchester, Norwich, Southend, Tunbridge Wells and Canterbury telex exchanges. Initially this through-routing equipment alone will be capable of handling approximately 15,000 calls per hour, and eventually 40,000 calls per hour.

The two telephone automanual exchanges will handle calls from customers in the Pimlico, Nine Elms, Brixton and Vauxhall districts of London which require the services of a telephone operator. They will be equipped with the latest cordless switchboards. About 450 telephonists will be employed to staff the 144 switchboards on a 24-hour rota basis and more than 30,000 calls per day will be handled when fully operational.

The telephone service centre will be the headquarters for over 200 engineering staff whose job is to lay or repair underground cables, repair faults on customers' telephones or instal telephones, switchboards and other telephone equipment in customers' premises. A garage in the basement will accommodate nearly 100 engineering vehicles together with storage of the heavy hardware of a modern telecommunications business such as drums of cable, ducts, manhole frames and covers. At ground and first floor levels there will be storage facilities for the hundreds of stores items in daily issue to the field staff, and a workshop where up to 10,000 telephones per year can be overhauled and refurbished.

The building, to be known as Keybridge House, will comprise a podium block of five floors and a tower block of 15 floors. The two blocks will be connected by a link five floors high. The building will have a gross area of 770,000 sq. ft.

About three-quarters of the accommodation is contained in the basements and podium block and the remainder in the tower. Each block has been designed to meet its own functional requirements. The five podium floors, which will contain the majority of the inland and international telex equipment, have large areas on each floor to permit flexibility in layout of the equipment and ease of maintenance. The tower block, on the other hand, has floors of very much smaller area and is designed to provide for what is now considered to be the ideal switch room unit, together with lifts, stairs, lavatories, etc., to one side of the tower.



An aerial view of the model looking north.

The basement and sub-basement will accommodate, among other things, the requirements of the telephone service centre. A two-way ramp capable of taking large articulated lorries will connect the ground floor to the basement stores and engineering vehicle parking areas and continues down into the sub-basement to car-parking areas. Diesel generators for standby power, ventilation plant and boiler house make up the remainder of the sub-basement, which is approximately 40 feet below ground level.

Because of the proximity of the building to the River Thames, water will present a problem in the construction of the basements and special precautions will be taken against any flood hazards. The basements will be constructed with a diaphragm wall system, which not only provides the external retaining wall, but acts as a waterproof barrier as well. The wall will be taken down to a depth of 50 feet to reduce the water pressure on the sub-basement floor; this floor acts as a slab foundation to the building. The building will be surrounded by a concrete wall faced in brickwork and about four feet high to protect the building from overflow water should the river flood. Flood gates will be provided at all entrances in the wall.

The total heat emission from the apparatus is such that it will be necessary to ventilate the building mechanically. The ventilation air will be derived from central air handling units on the top floors of the two blocks, and distributed through vertical ducts around the periphery of the building. As some apparatus has excessive heat emission, additional air handling units will be housed in the vertical ducts to provide cooling and increase the ventilation locally. These ducts with their metal cladding, together with the concrete ducts for electrical services, have been used as a dominant external feature, contrasting with the projecting concrete floor slabs.

A corner of the site is adjacent to St. Anne's Church which, it was felt, should not be overpowered by the new building. A large open space, landscaped as a private garden, will therefore be provided between the church and the new building. Other areas around the building will also be grassed and planted.

It is expected that the building will become operational by early 1975 with the completion of the initial equipment installation by the summer of 1976. There can be little doubt that Keybridge House will make a very substantial contribution to Post Office telecommunications business.

THE AUTHOR

Mr. F. W. Davies is a Chief Telecommunications Superintendent in Marketing Services and Tariffs Division of External Telecommunications Headquarters. He is concerned with the general strategy and planning of telex, telegraph and data transmission services.

Oxford Sales Superintendent Mr. James Moore (centre) watches an operator at work in the control room at the Kidlington Headquarters of the Thames Valley Constabulary. Mr. Moore was the local liaison officer for the Advisory Service report to the police force. With him is Chief Inspector Dick Cook, Communications Officer for Thames Valley Constabulary.

Advice for the big spenders

By J. HEADING

BUSINESS organisations are growing larger and more widespread because of the apparently endless mergers and takeovers which are occurring daily, and the natural expansion of companies within their own ranks. The pages of the popular business magazines are filled with the problems of administration encountered by the directors of the expanding companies, and one of the prime difficulties in managing an organisation which is formed of geographically widespread establishments is that of communications.

Factories, offices, depots, service centres—all rely on a communications life line for their efficient existence: a life line which must at all times be fast and reliable, and in which telecommunications plays a vital part.

The telephone system grows more massive and complex every year. Telex is now an international service, its use having become an integral part of the communications set up of most large companies. Fast transmission of data has become necessary with the increase in computer usage—and all these facilities can be very costly. Every company Financial Director worth his salary must justify capital outlay for modern communication services by showing cost savings in other areas and increases in efficiency and productivity.

In comparisons between the available communications services, costs have to be weighed against benefits. It is necessary to decide when telex becomes more expensive than a private teleprinter network; where the provision of facsimile transmission could save a visit by busy executives; when a telephone message is not sufficiently authoritative and an alternative method of transmission is necessary; when the volume of data to be sent to computer centres is great enough to justify providing Datel services.

A Telecommunications Advisory Service (TAS) is organised by the Marketing Department of Telecommunications Headquarters to provide a free service to our larger customers who need advice on reorganising their existing communications. Depending upon the geographical spread of the customer's premises, the study is carried out by telephone manager's area staff or, in the case of a nationwide chain of premises, by Headquarters staff. This article deals with the studies controlled and conducted by Headquarters staff.

Initially, the TAS team meets the customer to determine the terms of reference of the study. These terms are simply an agreement between a customer and the Post Office as to the parameters within which the study team will work. They ensure that the amount of work put into the study is relative to the size of the customer and his current problems. Thus, theoretically, a customer who has an efficient telephone system but who needs advice on teleprinter communications receives a report which shows only recommendations regarding telex and teleprinter working. In practice, however, it is usually necessary to examine all aspects of communications.

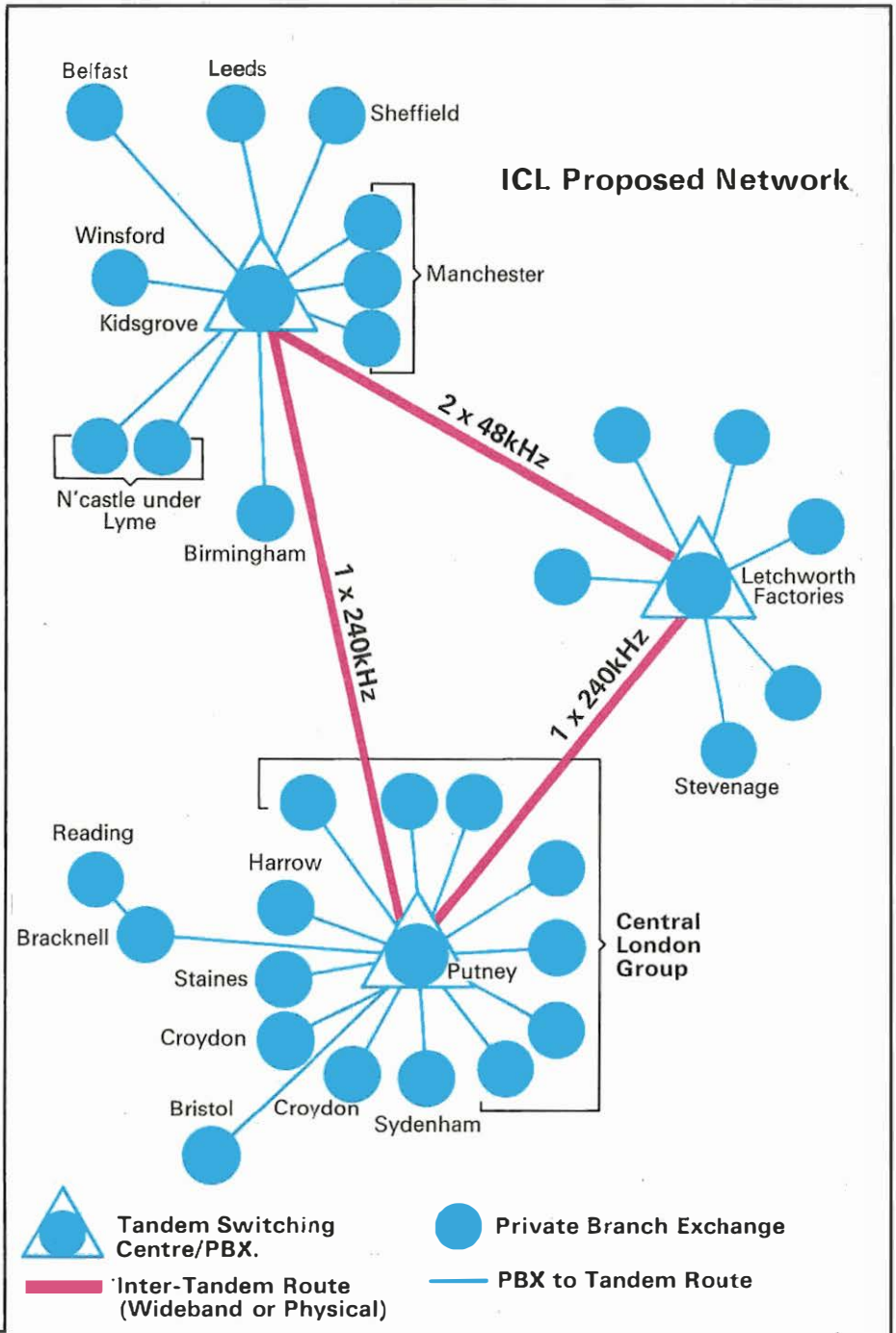
When the terms of reference have been agreed, the investigation of the customer's organisation is conducted in several directions at once. To find the most effective method of passing company information, a traffic record is taken of all telephone calls (and telegraph messages where applicable) between the establishments controlled by the company. From this record, normally processed by computer, the cost comparisons are obtained between calls over the public network or calls over a private network. It may in fact be economical to advise or recommend a controlled combination of both. Since inter-establishment calls in most cases represent a high proportion of call charges, here is one area where costs and congestion may be reduced and efficiency increased.

Where provision of a network of private circuits is indicated by the call record, the Network Planning Department of THQ designs a network showing the grade of circuit required, the alternative methods of switching the circuits and complete costings for the circuits to be provided. At the same time as the traffic record is being taken and processed, visits are made to the larger premises of the company to examine at first hand the require-

ments of all the departments and sections which rely on communications for their work. During these visits the TAS team quiz management and staff on the use made of the telephone, telex or telegraph services, data transmission and postal services: suggests ways in which particular functions could be made easier and generally delve into methods and requirements. This enables an appraisal to be made of the existing telecommunications facilities and their suitability both for the present and for the future.

Some readers may consider that this work is within the normal daily routine of the visiting Sales Representative, and they would be right. What makes the TAS team's visit different is that communications for the whole organisation nationwide are being considered, rather than the purely local situation. The team is looking, therefore, for compatibility of system, as well as efficiency in line with reasonable economy.

During the visit it is also necessary to consider telephone and telegraph contact to and from the company's premises with outside suppliers and customers. It is naturally more difficult to rationalise this traffic since it is of a more random nature, but the image projected by switchboard staff and the way in which extension users deal with incoming calls is very important to the company. Modern facilities can help the sales office to improve by an appreciable percentage the numbers of orders dealt with per day, as well as reducing the working noise in the office. Telex is often not used for calls to other firms because no one has bothered to find out if the other firms have telex installed. And so the TAS team digs into every facet of communications, weighing operational requirements against costs and benefits—checking the suitability of



THESE COMPANIES BENEFIT FROM ADVISORY SERVICE

WELL KNOWN organisations which have benefited from an advisory study include The Plessey Organisation, British Oxygen Company, National Westminster Bank, Hawker Siddeley Ltd, Rolls Royce, Marley Tile Co. and the John Brown Partnership. Studies made for two other organisations are described briefly below as an example of the benefits that can be obtained.

Implementation of the proposals outlined in a report presented to the Thames Valley Constabulary are well in hand. The main recommendations were for private speech and telegraph networks. The savings in telephone charges amount to over £10,000 a year.

Improvements in the telegraph system are designed to reduce operating manpower and speed up transmission times—of vital importance to a Police Force.

In a recent study conducted for International Computers Limited, the record of inter-establishment traffic formed a pattern for a Tandem Switched Network allowing interdialling of calls between the main premises of ICL. Three switching centres at Letchworth, Kidsgrove and London, with a total of 31 Private Branch Exchanges parented on them, are proposed. By using wideband circuits between the tandem centres, the annual charges for telephone traffic may be reduced by as much as 50 per cent. (See diagram above).

From the visits made to the larger factories and offices in the ICL group, it was possible to recommend operational and organisational improvements which would complement the operation of the new network and increase the savings as well as improve efficiency.

The Telecommunications Adviser for International Computers Ltd was provided with circuit estimates to cope with an increase in traffic flow of 50 per cent to 75 per cent over the next five years. This information enabled him to take essential capital requirements figures to his Board of Directors for approval.

existing systems and forming opinions about possible improvements.

It is necessary to take into account the growth factors which are forecast by the company, and normally this information is readily available from the Accountant's office. Other important factors are the forecast increase in trading, the current cost or rate of capital, the period over which capital schemes are normally calculated and the plans for buildings on which a lease is shortly due to expire. When the TAS team is satisfied that all relevant information has been collected, its report may then be prepared. The report normally includes details of existing systems and installations, followed by the recommendations for improvements and added facilities.

Customers have a habit of wanting to have proved to them the logic of spending money on improvements. Ask any salesman. The report must include detailed costings for the recommended improvements with annual charges listed for existing and proposed systems. Operational recommendations are also included, these being more difficult to justify on cost savings alone. But since capital outlay is not normally involved in operational improvements, the benefits are normally sufficient to justify their implementation. Where private networks are justified the network design is shown in the text and often more than one proposal is offered.

A teleprinter operator at the Thames Valley police headquarters reports on the private telegraph network which the Advisory Service recommended to give the police speedier transmission times.

Business organisations today are faced with a wealth of alternative communications systems, numerous operational considerations and an endless supply of free literature. Understandably, companies find it difficult to decide what is best for their particular needs.

The personal service which the Telecommunications Advisory Service is providing is helping businessmen to make a judicious choice while at the same time improving the Post Office's national service by reducing congestion on the public network.

THE AUTHOR

Mr. J. Heading is a Senior Sales Superintendent in Marketing Department who has carried out a number of advisory reports, including the recent report for ICL.

International Teletraffic Congress in Munich

THE SIXTH International Teletraffic Congress was held at Munich from 8 to 15 September 1970, and was attended by 283 delegates from 29 countries.

The first Congress in Copenhagen in 1955 had the title "Congress on the application of the theory of probability in telephone engineering and administration." The present title was adopted for the second Congress at the Hague in 1958. The word "teletraffic" is surely unique, being an excellent English word, coined abroad, which has not found its way into an English dictionary, nor yet acquired great currency in England.

International Teletraffic Congresses are held every three years and are occasions when telecommunications traffic experts meet to disclose their discoveries; to have their theories tested in the crucible of criticism by professional colleagues; to discuss methods and processes for solving problems both theoretical and practical; to pose new problems that call for attention; and finally to arrange for the next Congress.

The Munich ITC, sponsored by the Deutsche Bundespost in co-operation with the German telecommunications industry, was a worthy successor to previous events, including Paris in 1961, London in 1964 and New York in 1967, and was characterised by impeccable organisation and generous hospitality. The proceedings, covering no less than 108 papers from the delegates, contained many valuable contributions and represented a notable step forward on many fronts. The delegates and their parent organisations remain deeply indebted to Dr. K. Rhode (Bundespost) and Dr. A. Lotze (Stuttgart University), who chaired respectively the Organising and Papers Committees, for the fruitful results achieved by the Congress.

Technical progress in recent years has greatly increased the scope, complexity and urgency of problems in the telecommunications traffic field. Thus one finds that two sessions of the Congress were devoted to solution of traffic simulation problems by computer; three sessions dealt with queueing problems; common control switching systems, including PCM switching, required three sessions.

There were papers on such diverse topics as the traffic problems that will arise in due course with the new CCITT No. 6 signalling system; the dimensioning of a satellite network; the traffic problems arising with information services using the telephone as a data terminal on-line to computers. A session was given over to discussion of the relationship between the ITC and CCITT.

Although theoretical considerations continue to predominate, increasing attention is being directed, under the influence of the International Advisory Council of the ITC, presided over by Dr. Arne Jensen (Denmark), to practical aspects, and several papers reflected this trend, including, for example, studies of subscriber behaviour, comparison of theoretical and practical traffic, new parameters for traffic measurement, and dimensioning difficulties under conditions of rapid growth.

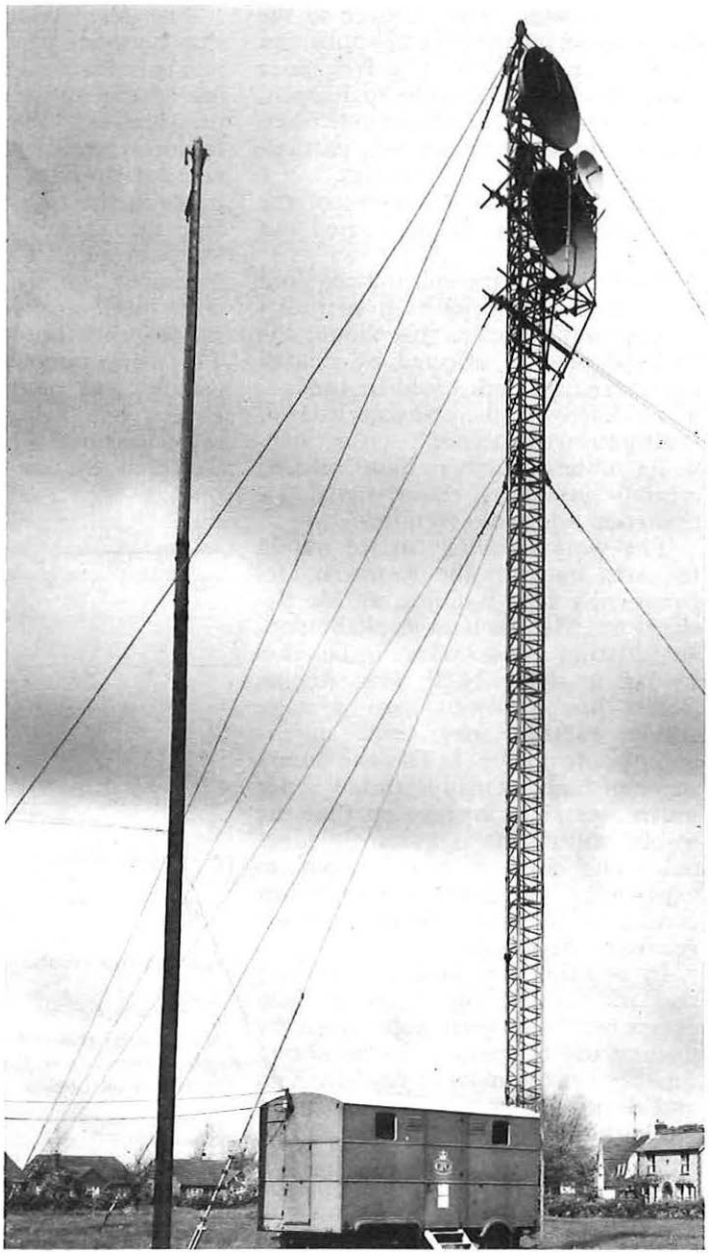
While Erlang remains the father and perpetual mentor of all activity in this field, it was gratifying to UK delegates at least, to note that the authority of British Post Office pioneers such as O'dell and Berkeley is still quoted occasionally at the present day. It could be invidious to name particular individuals from among the delegates, but there is no risk in giving mention to such famous names as R. I. Wilkinson (USA) whose method of dimensioning alternate routes now has world-wide acceptance, C. Jacobaeus (Sweden), originator of dimensioning principles for common-control link systems, and L. Kosten (Netherlands) whose many discoveries in traffic theory find everyday application.

H.A.L.

High frequency radio and the weather

By D. TURNER

Britain's trunk telephone and television traffic is growing so fast that the microwave radio relay systems which carry a good deal of it are becoming congested. As a result the Post Office is studying the possibility of exploiting frequency bands up to nearly 40,000 MHz. To find out how much influence the weather is likely to have on the performance of these radio relay systems of the future the Post Office is conducting experiments in collaboration with the Science Research Council. This article describes Research Department's part in these investigations.



This experimental transmitter station is typical of the installations being used for tests at frequencies of 11, 20 and 37 GHz.

RADIO propagation even at the present microwave network frequencies between 2,000 and 6,000 MHz is affected to some extent by the weather. Variations of a property of the atmosphere (its refractive index) bend the radio waves and cause fading of the received signals. At the higher frequencies now being considered, up to 40,000 MHz, the effect of the weather may be much more drastic.

When rainfall is present in the radio path there may be substantial attenuation of the signal in addition to fading caused by refraction. The wavelength at the higher frequencies is no longer very large compared with the diameter of raindrops which both scatter and absorb the energy of the radio wave.

Snowfall, we know, has little effect —except when melting—and the size of droplets in clouds and fog are relatively small so that the effect of these is minimal.

To plan radio relay systems which may be affected by weather it is necessary to know how frequently rainfall of a given intensity is likely to occur in a particular area, how far it extends and how long it will last. Intensity is important because the heavier the rain the larger the raindrops and the greater the amount of radio energy scattered and absorbed.

Current investigation also includes consideration of the introduction of route diversity techniques. Because of the cell-like structure of areas of rainfall—this has been known for many years and has become more generally appreciated with the increasing use of radar weather displays —it may be that if one radio path was severely affected by a rainstorm an alternative route could be found which avoided the rain cell causing the trouble.

Attempts are also being made to determine the characteristics of multipath transmission. As already mentioned, variations of atmospheric refractive index may cause fading of the received signal. Under stable weather conditions, and particularly during nights with little cloud, the atmosphere may become stratified so that at a particular altitude a rapid change of refractive index may occur. Some of the energy from the transmitting aerial travelling at an angle from the direct path to the receiving aerial may arrive by reflection from regions of rapidly changing refractive index so that two or more signals may be received. The reflected signals will have travelled by longer paths and so

will be delayed with respect to the direct signal and may be in opposition to it causing a fade. The frequency with which this is likely to happen, and its severity and persistence when it does are largely unknown, particularly at the higher frequencies.

The three main objectives of the experiments now being carried out are:

- To determine the spacing required between the radio paths from transmitters to receivers so that should one path be severely affected by rainfall the alternative path could be used.
- To determine the characteristics of multipath transmission.
- To obtain further data relating rainfall intensity, radio signal attenuation and radio frequency.

The work is being carried out in the area between the Research Department's new building at Martlesham and Mendlesham Radio Station, an existing radio relay installation 23 km to the N.N.W. East Anglia, which has a lower than average annual rainfall, may seem an inappropriate choice. In fact the occurrence of high intensity rainfall is not much less than average so that the results will not be significantly affected. The area is also known to experience tropospheric conditions conducive to multipath transmission relatively frequently.

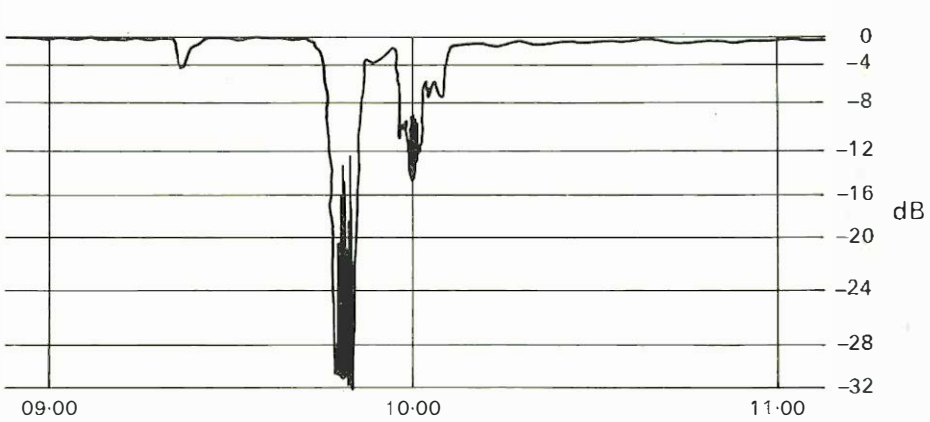
In addition, the cost of installing and maintaining an extensive field experiment has been kept down by making use of spare aerial mounting capacity on the mast at Mendlesham and all installations in the experiment are within easy travelling distance of Martlesham.

To determine the best separation between radio paths, two sets of parallel paths at spacings of 4 km and 8 km have been arranged with one set perpendicular to the other. This has been done to establish the existence, if any, of asymmetry in the distribution and shape of raincells in an area of rainfall. One set of paths lies approximately in a S.W. to N.E. direction, the direction of the prevailing wind. Single frequency transmission at 20 GHz and 37 GHz are used since rainfall is not expected to produce any significant change in performance with frequency over a typical radio frequency channel bandwidth. Data collected at each receiving station is transmitted to Mendlesham Radio Station over a radio telemetry system working at 460 MHz.

To keep costs down the multipath transmission experiment makes use, as far as possible, of the same stations and only those combinations of frequencies and path lengths likely to yield the most significant information. Multipath transmission is sensitive to quite small changes of frequency so that instead of a single frequency, as used in the path diversity case, the transmitter frequency is stepped over a 500 MHz bandwidth in each case.

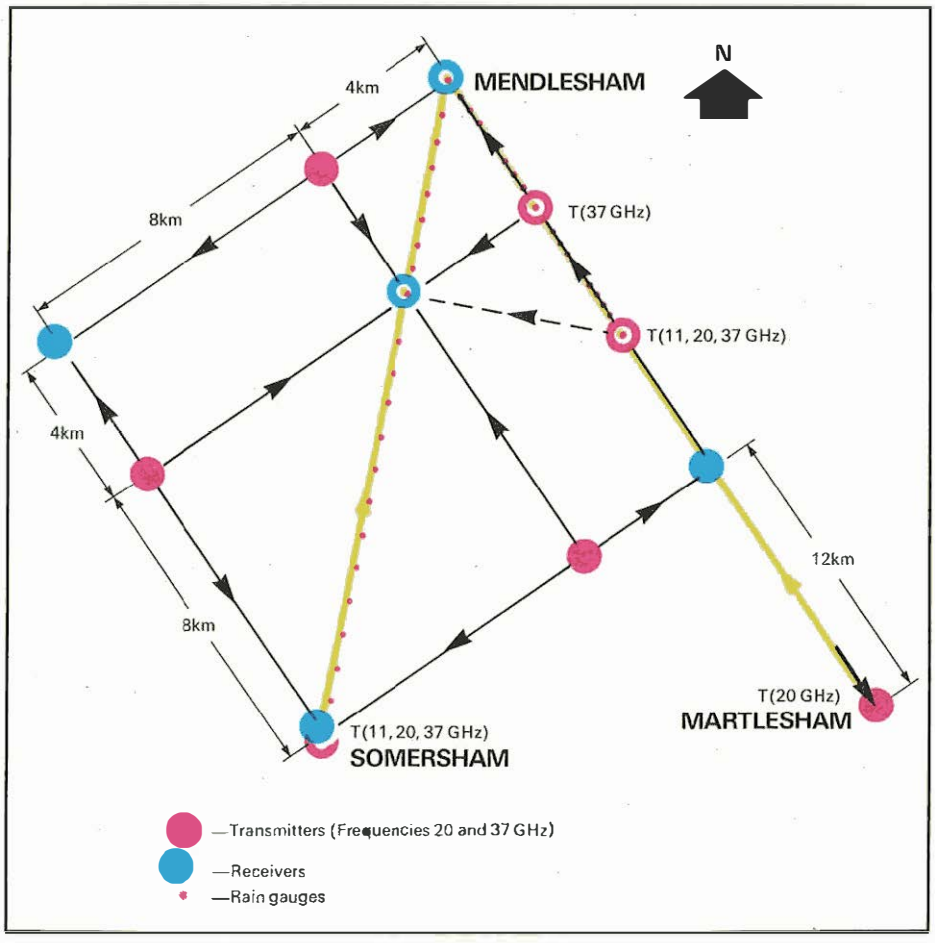
The determination of the relationship between attenuation and rainfall rate is fundamental to an understanding of the effect of rainfall in radio propagation. Ideally, to do this requires measurement of the instantaneous profiles of rainfall intensity between the transmitter and receiver and the signal attenuations at the same instant. The latter is readily measured but the former requires a large number of rapid-response raingauges distributed along the path. The measurements done so far have usually had neither sufficient raingauges nor raingauges of adequate response time. The Radio and Space Research Station have developed a gauge from which rainfall rates averaged over successive 10 second intervals is expected to give a good approximation to instantaneous rates. This represents a substantial improvement on results from raingauges used previously.

The gauge is of the standard drop type i.e. the rain collected by the funnel is formed into drops of constant size, the rainfall rate being determined by counting, by optical means, the number of drops falling through a light beam in a fixed period. Particular care has had to be taken to prevent obstruction of the waterways by debris. Twenty-two of these gauges are being installed at 0.8 km



A chart record showing the variation of signal received during a rainstorm.

A layout of the radio paths and the raingauges being used for rainfall intensity measurements in the current experiments. The yellow line indicates multipath transmission tests.



spacing and a further 19 between Crowfield and Mendlesham at 0.4 km to evaluate the significance of spacing in determining the quasi-instantaneous profile and to examine any irregularity in the rainfall distribution.

The raingauge has been designed to function unattended for several months, the data collected by the gauge being transmitted to Mendlesham on command over a radio telemetry system. Each gauge contains a test and calibration system which can be operated from Mendlesham for periodic checks. It was decided that it would be an advantage to mount the raingauge logic circuitry and radio telemetry equipment at the tops of 20 ft. high telegraph poles. This reduces the chance of vandalism, requires a minimum of ground area because no fencing is required and, since the location is often constrained to the edge of fields, keeps the rainfall collector clear of debris and avoids any distortion of rainfall catch due to the presence of a hedge.

Mendlesham Radio Station will be used as the data control, logging and analysis centre for data from the three parts of the investigation. In addition to radio signals affected by multipath transmission and rainfall, rainfall intensities, atmospheric temperatures and wind velocities will also be recorded on magnetic tape. Daily weather reports will be separately logged. A search is also being made for a site suitable for weather radars to scan the area. This will enable measured radio propagation results to be related to the general weather pattern and will assist in extending the conclusions from the investigation to other parts of the United Kingdom.

THE AUTHOR

Mr. D. Turner is an Assistant Staff Engineer in charge of the Aerials and Propagation Section of the Microwave Radio Relay and Satellite Systems Branch of Research Department.

PROGRESS IN THE NORTH WEST

It has been a busy autumn in the North West. In one week three major buildings were opened. Stores distribution has been streamlined with a new £1 million supplies depot at Preston; a £1¾ million telephone exchange at Salford will help cope with the Region's rising trunk call traffic and at Skelmersdale new town a £1½ million telephone development has been completed.

A section of the huge interior of the new Supplies Depot.

PRESTON

PRESTON'S new 160,000 square feet supplies depot is part of the Post Office's new national supplies system which is designed to improve the availability of telecommunications stores. It is one of the territorial depots which are located within easy reach of all parts of the area they serve to supply equipment most frequently used by Telephone Managers' Offices. Preston will serve the North Western Region which was previously serviced from Birmingham and Scotland.

Under the old system a depot served a specified part of the country and acted as a national supplier for certain ranges of equipment. As more depots were set up demarcation lines between service areas became unclear; TMOs had to requisition from different depots to obtain stores for one job; there were delivery delays and this led to field users requisitioning enough equipment to cover the longest delay. The territorial depots handle a relatively small number of items, but they are the ones most frequently used. Items in smaller demand are stocked in central depots but are normally supplied through the appropriate territorial depot and all requisitions are dealt with by a single processing point.

The new system offers faster delivery times, so helping to ensure that stores are on hand to enable Telephone Managers to meet customers' orders promptly. It has also lowered costs by allowing a reduction in the level of stocks, minimising the amount of capital tied up in equipment which does not earn revenue until it is eventually brought into service.

The Preston depot, which occupies a 16-acre site in the town, will employ a staff of 70 and will issue 6,000 tons of stores a year. Opening the depot Mr. K. H. Cadbury, Senior Director, Telecommunications Planning and Purchasing, said that Preston had been chosen as the site because of its first class road communications. It was ideally placed to serve the whole of the region quickly and efficiently.

The depot is close to the M6 and within the area of the proposed new town for Central Lancashire so that it will also benefit from the excellent road communications which the new town will have with other parts of the North West.

SALFORD

PRESSURE on existing trunk exchanges in the North West where traffic is currently running at 150 million calls a year will be eased and callers will get a better service through reduced congestion with the opening of the Turret automatic trunk dialling exchange at Salford.

The new exchange is expected to deal with 15 million trunk calls a year dialled by subscribers from 19 exchanges in towns to the west of Manchester. Its 2,700 trunk circuits will rise to 4,000 by the mid-1970s. To reduce faults, the electronic equip-

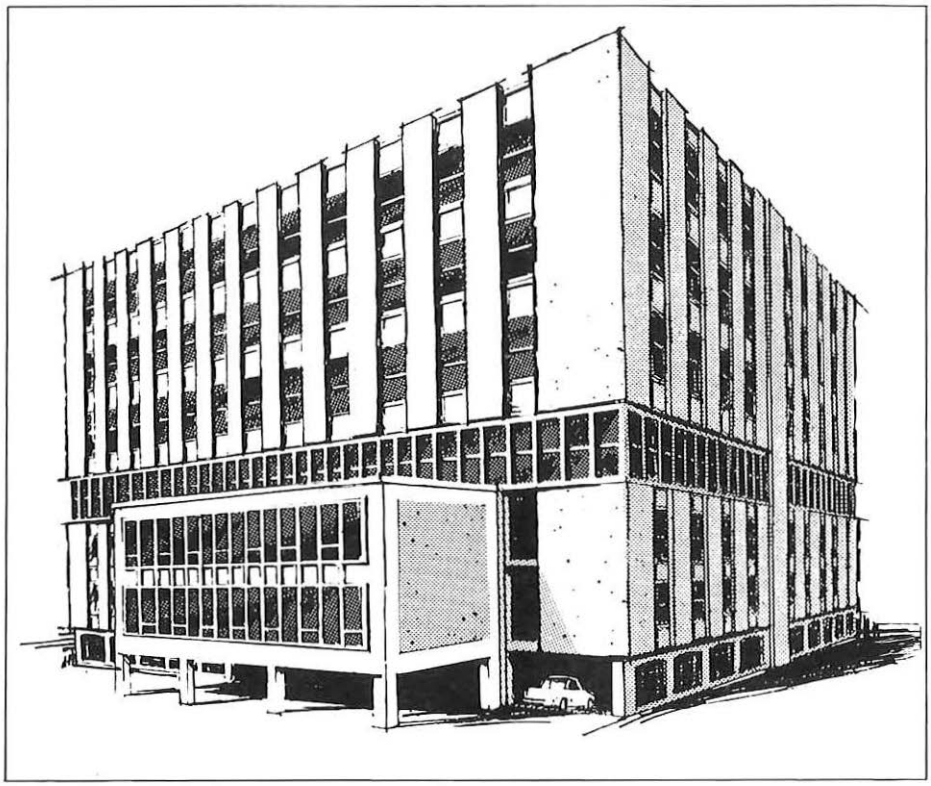
ment in the exchange, which includes 120 miles of cabling and 200,000 relays, is safeguarded by a clean air system. Five tons of clean electrostatically filtered air can be blown through the building each minute at higher than atmospheric pressure to exclude dusty air from outside.

The three-storey exchange building will be extended to seven floors to meet future long term growth.

Speaking at the opening ceremony, Mr. Edward Fennessy, Managing Director Telecommunications, said that while Britain might not have the best telephone service in the world it was still a good one. Critics of the telephone system forgot that every time they dialled a number they were seeking a unique connexion with one out of the other nine million subscribers in the country.

"We cannot meet the demands of such a vast range of customers and satisfy everyone all the time," Mr. Fennessy added. "Ours is certainly not the worst service in the world. We intend in this decade to make it the best."

The exchange was opened by the Mayor of Salford. His inaugural call was answered automatically by a Post Office computer at the Computer '70 Exhibition at Olympia in London which sent information about the exchange through the telephone network to a teletype machine at the opening ceremony. The message was relayed to guests by closed circuit television.



This artist's impression of the new Turret exchange at Salford shows the building as it will finally appear after further extension to meet long term growth of the trunk service.

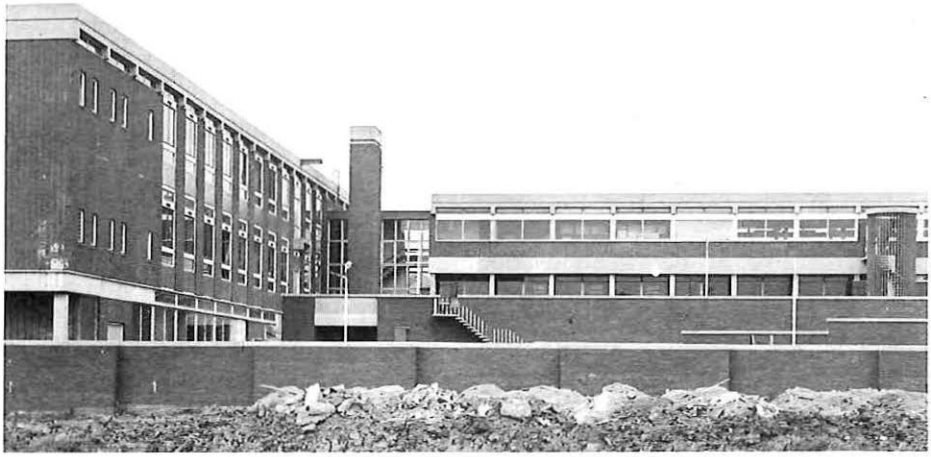
SKELMERSDALE

SKELMERSDALE'S new exchange is the first in the North West to have the latest "office desk" type cordless switchboards. Eighteen have been installed and a maximum of 66 can be provided to meet future growth. They make use of the keysender push-button dialling and allow an open office type layout giving more pleasant working conditions for the staff. A queuing system ensures that calls are dealt with in the order in which they have been dialled by subscribers.

Equipment has been provided for 5,800 subscribers and can be extended to cater for a total of 20,000 lines.

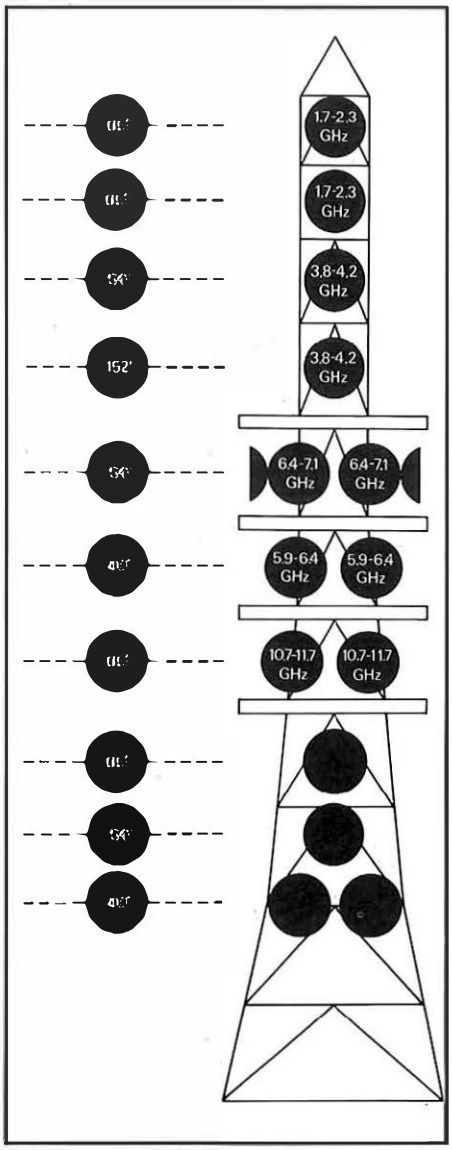
The new exchange replaces a three-position manual exchange and a temporary automatic exchange.

The opening was a milestone for Liverpool Telephone Area. The manual exchange was the last on Merseyside and all 285,000 subscribers on the 78 exchanges in the Telephone Area now have automatic service.



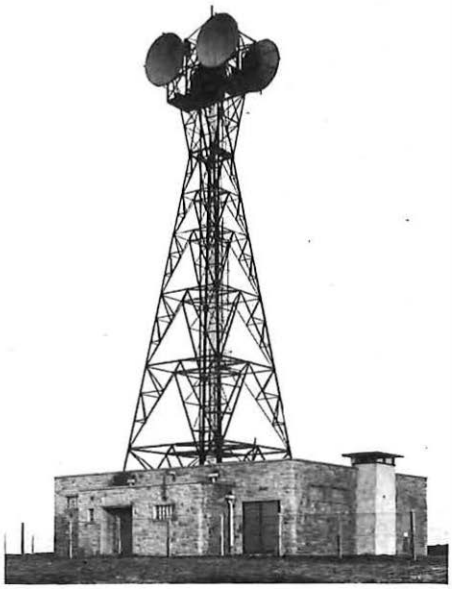
ABOVE RIGHT: The interior of the old manual exchange at Skelmersdale which, since 1927, had been housed in the downstairs front room of a semi-detached house. It closed down with the opening of the modern automatic exchange pictured right.

LEFT: The ferro-concrete tower at Wotton-under-Edge. There are several of this type in the network and their shape is well suited to carrying horn aerials though dishes can also be fitted. A limitation of the taller towers of this type is a need to cluster all the aerials at the top which results in excessive aerial height and waveguide attenuation for some directions of shoot.



CENTRE: An outline design for a new type of lattice steel tower which is being considered by the Post Office for towers with ultimate capacities of 10 to 40 dish aerials. The galleries, an innovation for steel towers, would provide simple mountings for the aerials and give very good access for installation and maintenance. They would also help to maintain a symmetrical appearance as additional aerials were added to meet rising traffic capacity.

BELOW: Windy Hill Relay Station, which is on the 4 GHz system, was installed in 1952 between Manchester and Kirk o' Shotts primarily to extend television service to Scotland. This route, now recovered, was distinguished by towers of symmetrical and elegant design but their aerial carrying capacity was inadequate to cater for long term growth in the demand for circuits.



Problems of tower design

By R. L. MOXON

THERE are well over 100 Post Office radio towers and masts scattered throughout the country, each a vital part of the microwave radio relay network which interconnects most of our large centres of population, carrying mainly trunk telephone and TV-distribution circuits.

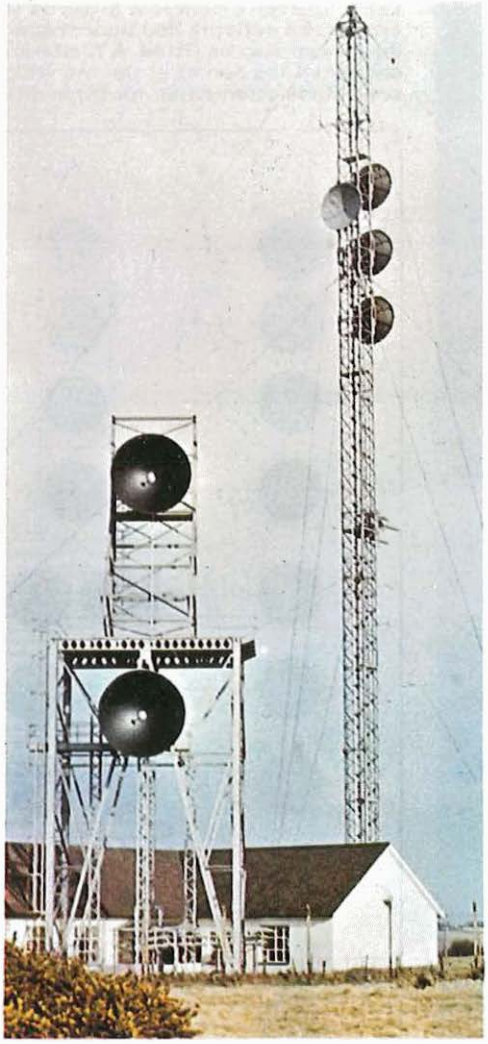
These towers support dish or horn aerials at heights sufficient to give unobstructed radio paths between the inter-working terminal and relay stations, and many have become local landmarks. Yet such has been the variety of tower structures put up over the years that the differences in shape, size, height and general appearance has been a continual puzzle to many people. Why does design vary so much? Why are some made of concrete and others of latticed steel work?

The simple answer is that consideration has to be given to a variety of technical, economic, topographical and aesthetic factors, which can vary so much from area to area, that the general adoption of a standardised design has not been possible.

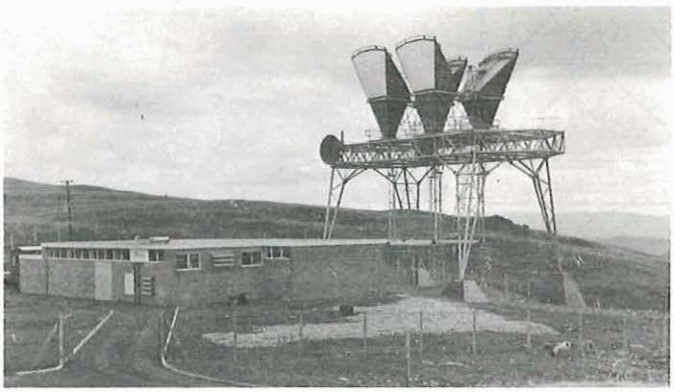
It takes a great deal of work and thought before the form that any particular radio tower will take can be determined. The radio frequencies employed on the microwave radio relay network range from two to 11 GHz and are similar in many ways to lightwaves, the aerials beaming signals in the required directions like radio searchlights. The spacing between the stations in the network—usually about 25 miles and rarely more than 30 miles because the received signals are weakened as range increases and there is a greater chance of severe fading during certain meteorological conditions.

With stations this far apart, and in the absence of hills, aerial heights of some 200 ft above ground level would be required for a path to be unobstructed by the earth's curvature. But by siting the relay stations on hills and by selecting paths clear of intervening high ground, aerials may be mounted economically at lower heights, though a minimum of 50 ft is

ABOVE: The new Craiglockhart Radio Station, Edinburgh, is the first to be equipped with the Tower No. 5A, developed by Post Office engineers. These towers are made from a small number of interchangeable piece parts which are assembled in a variety of configurations to form structures suited to the differing requirements at each station.



RIGHT: This 205 ft high stayed mast at Tolsford Hill Station which carries telephony and the Eurovision circuit to France is to be replaced with a ferro-concrete structure which will incorporate the inland-facing aerials at present mounted on the small gantry to the left.



This tower at Whinfell Common Radio Station in Westmorland is unique in that it takes the form of a platform on four tubular steel legs. Although it caters primarily for large horn aerials, the platform can also carry dish aerials mounted along its sides. Only local ground clearance height was needed for the aerials at this station and the design has been successful to the extent that the structure is not visible from most of the surrounding countryside.

usual to clear local obstructions such as trees and houses.

The number of aerials needed at any particular station is related to the number of directions served and the number of broadband channels required in each direction to carry the traffic, though the ultimate capacity in any one direction is limited by the frequency spectrum reserved for Post Office microwave radio systems.

Because of this, on busy routes such as London–Birmingham and Birmingham–Manchester, towers have been provided on the basis of eventual full use of the available spectrum—five frequency bands between 2 and 11 GHz, each band utilizing two dish aerials making a total of 10 dish aerials (or horn aerials equivalent) in each direction. Some relay stations on the North–South routes also serve East–West crossing routes and the towers at these stations may eventually carry 40 or more dish aerials, each about 12 ft in diameter. At other stations, such as those on spur links to television broadcast stations, a tower with capacity for only one or two dishes may suffice indefinitely.

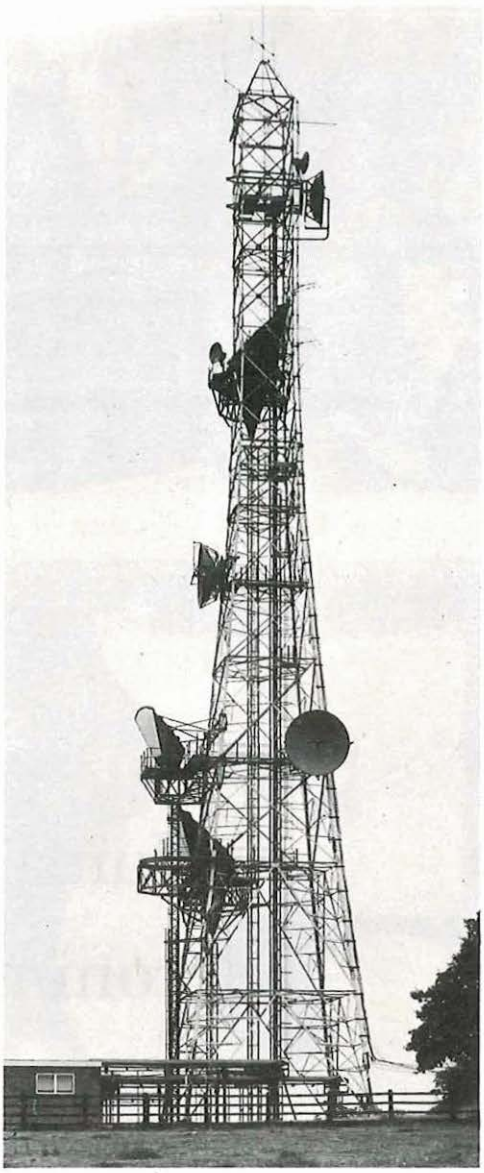
Not until the ultimate number of aerials to be carried, their height range above ground and their directions of shoot have been decided can the type of tower or mast be chosen.

For example, should only two or three aerials be required at heights between 100 and 300 ft, a stayed mast would be the economic choice. On the other hand, for the same number of aerials at about 50 ft a small self-supporting tower would be of reasonable cost and would be preferred on account of maintenance expense associated with stayed structures.

Another example is where an existing tower has reached the limit of its capacity and is to be replaced by a new one with room for full spectrum development on several lines of shoot. Here a multi-galleried, ferro-concrete tower would be appropriate—like the one recently completed at Purdown.

It is the usual practice to house the radio transmitting and receiving equipment in a standard, extendable building adjacent to the tower. The aerials are connected to the equipment by waveguides which must be kept as short as possible since signals are

Post Office Microwave Radio Relay Network



ABOVE, LEFT: This lattice steel tower at Copt Oak Radio Station near Leicester is built in the so-called Eiffel form though its outline is unavoidably marred by the substructures needed to carry the dish and horn aerials. Forecast traffic growth indicates that this tower will eventually be inadequate and its replacement will provide an opportunity to replace it with a tower of more pleasing shape.

ABOVE, RIGHT: The tower at Riddingshill Radio Station is a standardised type which has been widely used in the network. It was designed primarily to accommodate horn aerials with a circular waveguide running vertically down towards the ground from the base of each aerial. The dish aerial has now superseded the horn for new links, largely for economic reasons. While this type of tower is satisfactory for mounting dishes, its shape does not enhance the overall aesthetic qualities of the design.

attenuated in passing through the guides, with adverse effect on circuit performance.

The Post Office Tower in London is a special case where aerials had to be mounted at a height sufficient to ensure that the radio paths would not become obstructed by surrounding tall building development. Excessive waveguide loss was avoided by providing rooms for the radio equipment high up in the tower, an arrangement that would be uneconomic for general use.

Whatever type of structure is chosen, it must be strong enough to withstand safely the highest forecast wind loading and at the same time be sufficiently rigid, under this condition, to hold the aerials within less than a degree of their normal orientation. To give an idea of the magnitude of the forces involved, the loading on one 12-ft diameter dish aerial from a wind gust of 140 mph can exceed three tons. Fortunately, such wind speeds are not common, though they are statistically likely to occur at many exposed radio stations as gusts of three seconds duration once in 50 years.

Some of the accompanying pictures show towers which will need—or have needed—to be replaced after 10 to 20 years service because of traffic growth. It would have been uneconomic in these cases to provide larger towers from the beginning. One merit of steel towers in these circumstances is that they are easily dismantled and may possibly be re-used elsewhere. On the other hand, ferro-concrete towers are well suited to large stations where growth to the full gamut of microwave channels may be foreseen with reasonable confidence. Their low maintenance cost is also a point in their favour.

THE AUTHOR

Mr. R. L. Moxon is a Senior Executive Engineer in Network Planning Department and has been responsible for the provision of towers for radio links since 1966. He was formerly concerned with the provision of transmitters for Post Office HF, MF and LF services.

LEFT: The world's leading experts on human factors engineering listen intently at one of the sessions of the Symposium.

RIGHT: Chairman of the Symposium, Mr. F. E. Williams, introduces at the opening session Mr. W. J. Bray, Director of Research for the Post Office (right), and Mr. B. Copping of Dollis Hill, the Organising Secretary.

5TH International Symposium on Human Factors in Telecommunications 1970

By F. E. WILLIAMS

IN the early days of the telephone, when the user had access only to a few thousand other subscribers, the problem of connecting him to the correct one was not very difficult. The number of other telephone users with whom connexion can be made has now grown to an international total of hundreds of millions, and the process of setting up a connexion has inevitably become more complex. Other services and facilities have become available and in addition to merely talking over the circuit the user can also send data and printed information, and before long he may have the option of a vision link as well.

The big question now facing telecommunications engineers all over the world is: with the growth of all these facilities, how can the operation of the system be kept simple enough for the ordinary user to be able to cope with it? For example, can an infrequent user of the telephone be expected to establish a connexion with a friend in a distant country, involving dialling or perhaps keying as many as 16 digits, and correctly interpreting unfamiliar tones sent back to him from the distant country —tones which may tell him that the number is engaged, or that he has dialled incorrectly, or which may be an instruction to him to proceed with the next stage of his dialling?

This kind of question assumes importance from the economic aspect as well as from the purely human factors angle. If the user cannot cope with the complexities of the system, he will be unable to make full use of new services and facilities which become available. Also, his mistakes and hesitations may result in tying-up expensive equipment and circuits which could otherwise be earning revenue. On all counts, the aim should obviously be to make the system as simple, foolproof and easy to operate as possible.

Problems such as these were discussed in London in the autumn when experts in human factors engineering met to pool their knowledge and experience at the International Symposium on Human Factors in Telecommunications. This was the fifth and largest such Symposium to be held, and it was sponsored by the British Post Office with the support of the Telecommunication Engineering and Manufacturing Association and the Medical Research Council's Applied Psychology Unit.

Some 80 research engineers and psychologists, drawn from the major telephone administrations and operating companies of the world, gathered at the Institution of Electrical Engineers for the 5-day Symposium. The first four days were devoted to technical papers on various aspects of human factors research, the papers being contributed mainly by Britain, the United States, Western Germany, the Netherlands, and Sweden. Delegates also attended from Finland, Denmark, Canada, Australia, Norway, France, Belgium, Italy, Switzerland, and Japan. On the fifth day the delegates visited Cambridge, where they were taken on a brief tour of the Colleges, followed by a technical visit to the Medical Research Council's Applied Psychology Unit.

In his opening speech to the Symposium Mr. W. J. Bray, Director of Research in the Post Office, stressed the special value of bringing together experts from telecommunications administrations throughout the world —not only because they were all facing similar problems, but also because of the paramount importance in international telecommunications of ensuring compatibility between the operating procedures and standards of transmission used in the various countries. As the world-wide telecommunications network grew even larger, and the range of services became ever wider, so the problems facing the ordinary user become more complex.

We had to live now with mistakes we had made in the past, said Mr. Bray. Each nation had at present on its own telephone dial its own particular arrangement of letters and

Research engineers and psychologists specialising in human factor studies in many parts of the world met in London recently for a five-day Symposium sponsored by the British Post Office.

numbers, and its own unique set of tones to indicate "ringing" or "busy" conditions. These led to customer difficulties and misunderstandings, especially on international calls and when complicated by language differences. The achievement of internationally recognised standards in telecommunications was primarily the role of the International Telephone and Telegraph Consultative Committee (CCITT), but the International Symposium on Human Factors in Telecommunications could make an important contribution to the achievement of such standards, by making available the results of human factors studies.

The first technical session of the Symposium was devoted to a general review and discussion of Human Factors Research and future problems to be faced. Mr. Bray surveyed British work, Dr. Ivan Brown of the Medical Research Council's Applied Psychology Unit discussed the role of the applied psychologist in Communications Research, and Dr. John Karlin of the Bell Telephone Laboratories surveyed the American field. An interesting point that emerged was the universal difficulty encountered by all the experimenters in finding a large pool of volunteer subjects, representative of the ordinary user, to take part in subjective tests. Many organisations (including the British Post Office Research Department) draw volunteers from the staff of their own research organisations; the Applied Psychology Unit at Cambridge is able to call upon a panel of housewives, and other organisations have attempted to bring in the general public at exhibitions. The question always remains, however: are these subjects typical of the average user?

The second session dealt with Transmission, and in particular with the effects of PCM on the quality of transmission, and the effects on users of very long-distance telephone connexions of the appreciable fraction of a second taken for the speech signal to pass from one end of the circuit to the other.

The third session dealt with Data-sending and Keying. The papers included studies of customers' dialling errors, questions on the best arrangement of keys for push-button telephones, and the most suitable choice of symbols for additional keys used for data-sending.

The fourth session, on Human Engineering, covered the operational procedure involved in the introduction of new services, and some papers on coin-box telephones. This was followed by a session on Users' Behaviour which produced a useful pooling of information on customers' international dialling habits, and data on errors and ineffective calls.

The sixth session, on Subjective Testing, included studies of the problems involved in the recognition of unfamiliar foreign signal tones in international dialling, and interesting new studies designed to evaluate the part played by vision in normal person-to-person conversation. For example, a study of the working day of employees at the Bell Telephone Laboratories in the USA has shown that the technical staff spend on average 35 per cent of the day in talking face-to-face, and 7 per cent of the day on the telephone. Why do sophisticated telephone users choose to spend five times as much time communicating face-to-face as in telephoning? And would a vision link supply what is lacking in the telephone conversation, or would a high-quality audio channel do just as well?

The seventh session was devoted to Directories, and particularly to retrieval systems for directory assistance, and there was a final session for general discussion and summing up.

A constantly recurring question throughout the Symposium, and one of economic importance to all administrations and operating companies, is that of how much a customer would be prepared to pay for a proposed new service. Technical developments were making possible the provision of an almost unlimited range of facilities—Viewphone, data transmission, access to computer stores, etc.—at a cost; but it was generally agreed that simply asking prospective customers by questionnaire how much they would be prepared to pay for each such service produces extremely misleading answers. Delegates were inclined to the view that the only practical way of finding out was to give a new service for a time to certain selected users, and then, after they had become accustomed to it, ask them how much they would pay not to have it taken away.

The fact that this Symposium was a unique gathering of telecommunications experts from most of the Western world, and that many of them had brought their wives to London with them, was not overlooked on the social side. The ladies enjoyed shopping and sight-seeing expeditions in London, Windsor and at Cambridge, where they took to the punts on the River Cam while the delegates were discussing styles of print and the effects of noise in telephone conversations at the Applied Psychology Unit.

At the end of the week delegates were unanimous that the Symposium was an invaluable forum for the presentation of human factors research. At the invitation of the Swedish Administration, the next Symposium will be held in Stockholm in June 1972.

THE AUTHOR

Mr. F. E. Williams is a Staff Engineer at the Dollis Hill Research Station in charge of the department dealing with subscriber apparatus and human factors in telephony. He was Organising Chairman of the Symposium.

Celebrating a centenary

In 1870 the public telegraph system became, by Act of Parliament, the responsibility of the Post Office. It was the beginning of a century of dramatic growth in telecommunications. The affairs of the telecommunications business of the Post Office have always been directed from offices within the boundaries of the City of London and it was apt that in the centenary year the Lord Mayor should choose "Communications" as the theme of his period of office. Post Office floats took part in the Lord Mayor's Show. As Telecommunications Journal was going to press, a centenary lunch was held in the Mansion House. Representatives of the City, Government, Universities and other bodies were guests of the Post Office and the telecommunications industry.

THREE Post Office floats illustrating "The story of the telephone" got big cheers from the crowds who watched the 1970 Lord Mayor's Show in London.

Sixteen staff from the City and Central Areas of London Telecommunications Region were dressed in period uniforms and costumes to add an authentic touch to the displays. Two of the girls wore 1920 "flapper" girl dresses and danced the Charleston to amplified music while on another float a male colleague played a "man of the future" dressed in a tight-fitting silver-lame suit. They deserved the cheers. Rain fell throughout the procession and staff were soaked.

The first float covered the period 1875 to 1910. It included a Brighton Pavilion style canopy beneath which stood a lady and gentleman of the period using a 1909 telephone; a large-scale replica of Graham Bell's first telephone; and a drum and cable used in the period flanked by a linesman wearing the uniform of the time, including a stovepipe hat.

The second float depicted the period 1920 to 1970 and featured a replica of a 1920 telephone kiosk, the "flapper" girls and a 9 ft. high model of the Post Office Tower. Trimphone bleeps and telephone bells mingled with the Charleston music.

The third float, which looked at the future telephone service, was dominated by a huge dome under which was seated the "man of the future" using a viewphone. Monitors displayed viewphone pictures and, between banks of microwave aerials, electronic equipment and oscilloscopes and flashing lights were tended by two scientists in protective clothing. Amplified telemetry noises could be heard by the watching crowds.

A visitor to the telegraph exhibition tries the piano-like keyboard of the Hughe's printer, in use from 1867 until as late as 1939.

THE CENTENARY of the inland telegraph service was celebrated by an exhibition which covered the development of telegraph equipment from its very beginning. The exhibition, at the Post Office Telecommunications Museum in London, was opened by Sir Richard Hayward, Board Member for Industrial Relations, who once worked at the Central Telegraph Office.

Sir Richard emphasised the *esprit de corps* which had always existed in the telegraph service—it was demonstrated by the large number of former staff who attended the exhibition. "People have always mattered in the telegraph service," said Sir Richard.

Mr. E. J. Harman, Chief Superintendent of London Inland Telegraphs, said the service had produced some prodigious feats of telecommunications and morale had always been high. They were at their best in periods of disaster and crisis, providing a fast service to many destinations 24 hours a day.

The week-long exhibition ended with a dance and social for past and present members of the telegraph staff.

A policy for quality

By R. G. W. NUNN

The Test and Inspection Branch of Purchasing and Supply Department has changed its name to Quality Assurance Branch. The new title reflects a change of policy by the Post Office which is having far-reaching effects on the quality of the items it buys.

GRADUALLY, and without too much ado, a new philosophy is being evolved and put into practice by the Post Office which is ensuring the supply of higher quality goods and materials from outside contractors. It is this "silent revolution" which lies behind the change of title of Purchasing and Supply Department's Test and Inspection Branch—now known as Quality Assurance (QA) Branch.

It really started five years ago with a basic change of policy for inspection and quality assurance which resulted in a new condition concerning "Standards of Acceptability" being included in new contracts. Today, this condition applies to the purchase of almost the whole range of engineering stores and equipment. Changes, however, are still going on and the effects are becoming more and more widespread.

Essentially, the job of the Purchasing and Supply Department is to ensure that equipment, materials and services of the required quality are supplied in the right quantities at the right time at the most economical price to meet the demands of the day-to-day running of the Post Office and its growth and development.

For practically all the engineering supplies which it buys in quantity, the Post Office specifies acceptable quality levels (AQLs), generally in terms of the maximum permissible percentage of non-conforming items in deliveries. Suppliers of telephones, for example, must ensure that no more than a half per cent of the instruments they deliver have any major defect.

Acceptable quality levels are a practical compromise between the cost of avoiding defects during manufacture and the operating costs and difficulties which defects would produce during installation and service. They are specified by QA Branch—after consultation with branches responsible for design and use.

For a long time now "acceptance inspection" techniques have been used to ensure that the contractors comply with the AQLs. In other words, QA Branch staff have themselves inspected samples of a product, either during or after manufacture, and depending on the results have accepted or rejected batches.

The Post Office has been one of the pioneers of direct inspection by batch sampling in this country. It is a valuable tool for consumer quality assurance and has enabled us to improve the quality of supplies and to reduce inspection costs very significantly over the past 20 years.

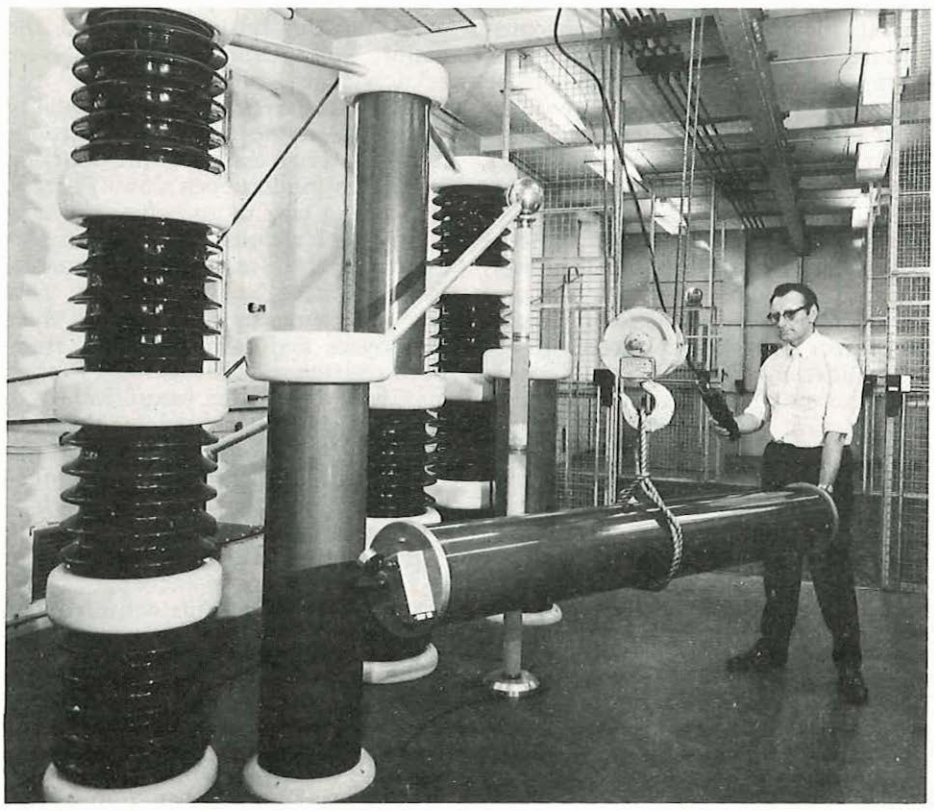
Nevertheless, the system has its limitations, one of which is that the onus for determining quality and for taking corrective action where necessary, lies with the consumer rather than with the supplier. Although the latter are bound by contract to conform to the specified standards, they tend under this system to rely on the consumer to tell them when their quality has gone outside the limits and only then to take "crash" action which usually does no more than put it right temporarily. Under these conditions quality is likely to be variable and at times even poor, unless the consumer is prepared to devote the effort necessary to keep a tighter control on it by the frequent examination of large samples.

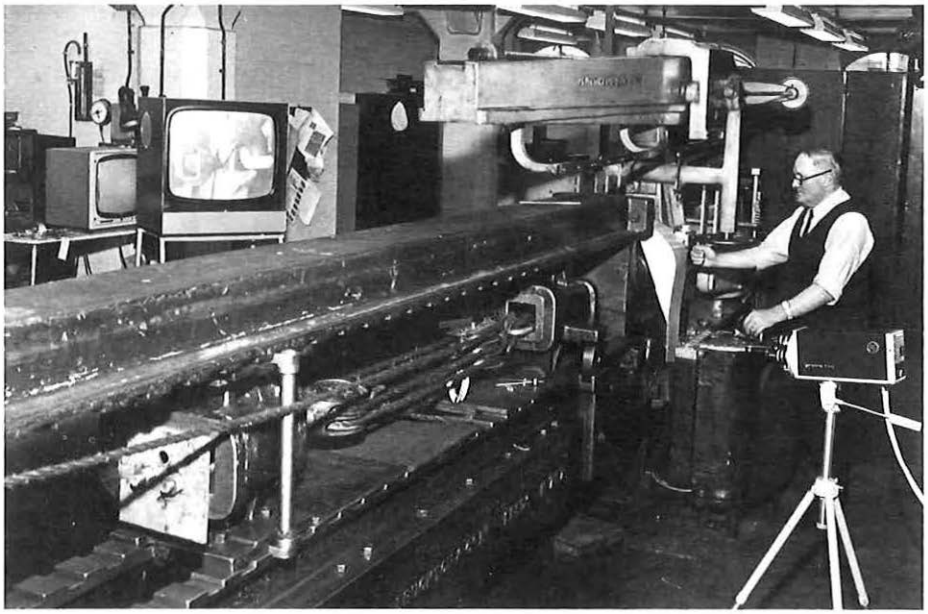
It is the steps which are being taken to overcome this problem that form the basis of the new thinking on quality assurance. What is happening now is that the onus for ensuring quality is being shifted from the Post Office to the suppliers.

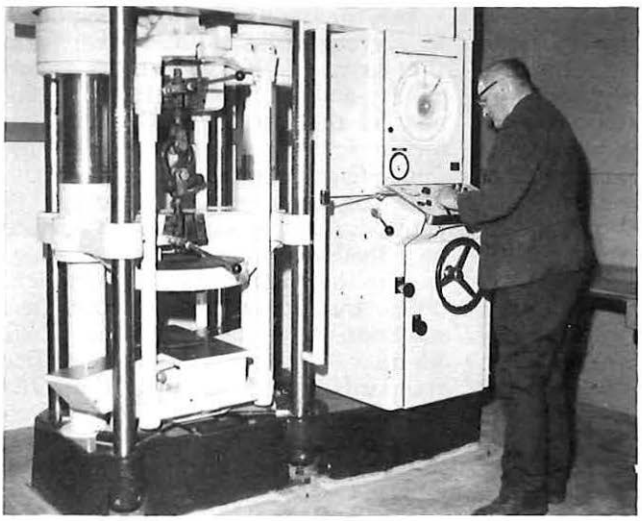
It has been made a condition of contract that suppliers should operate an effective system of quality assurance to the satisfaction of QA Branch. They are required to disclose their methods for ensuring that their product conforms to Post Office standards, to make all relevant records available, and to satisfy QA Branch that these are adequate and reliable.

When the Branch is satisfied that a

A section of equipment is hoisted into place in the London Test Centre's new High Voltage Laboratory (up to 200,000 volts) which will be used for the testing of cables and high voltage insulators for telephone wires.







ABOVE: This tensile tester at Fordrough Lane, Birmingham, is 60 years old but modern closed-circuit TV equipment has been adopted to help the operator keep an eye on what is happening as pulleys and crane hook are tested.

LEFT: Testing a shackle to destruction on a modern 50-ton tensile testing machine at Fordrough Lane. It operates to the highest grade of accuracy laid down by the British Standards Institute.

TESTS COVER

Quality Assurance Branch has a total staff of just under 900, about 600 of whom are involved with quality assurance work and the rest on other tasks which it is convenient and economic for the Branch to carry out so as to make full use of its resources and expertise and to avoid unnecessary duplication of expensive facilities elsewhere in the Post Office.

The Branch comprises a small headquarters unit in London and four operational sections in London and Birmingham—two Test Sections staffed by engineering grades and two Materials Sections staffed by scientific/experimental grades.

HQ unit is responsible for the formulation of policy, the administration and direction of the Branch, co-ordination of the work of the sections and liaison with other bodies inside and outside the Post Office. A special group is responsible for the quality assurance of undersea cable systems.

The London Test and Materials Sections are at Studd Street, Islington, the former being responsible for engineering supplies manufactured in London and Southern England. Small groups of staff are outstationed in the south and south-west to deal with work in these areas. Laboratories provide a support service for field staff, enabling tests to be performed in greater depth

system is working effectively the supplier is permitted to deliver items under the Authorised Release procedure. He is given a special approval stamp and allowed to despatch these items from his works without direct Post Office inspection. His system is constantly supervised by QA Branch and its effectiveness checked regularly —a process known as "Validation". If these checks indicate that a system has become ineffective, the Authorised Release privilege is withdrawn and QA Branch takes any action necessary to protect Post Office interests. Regular validation checks not only ensure that the supplier is conforming with the system but also provide an independent assessment of the quality of the product because they involve, among other things, the examination of large samples of the product to verify the result of the manufacturer's own quality assurance activities.

To be effective QA Branch needs a wide range of facilities and resources, including laboratories equipped for many kinds of electrical, mechanical, physical and chemical tests; and staff with specialised knowledge of testing techniques, the properties and behaviour of materials, industrial quality control and manufacturing processes in so far as they affect quality.

As for the future, whilst all the major Post Office suppliers have acknowledged the need for, and indeed the desirability of, quality assurance in the telecommunications industry, progress in its introduction and extension has been slow. There is still a long way to go before the new contractual requirements are implemented fully. In some cases manufacturers have had to negotiate new pay and productivity deals with their employees and to overcome a stubborn resistance to change. QA Branch staff have responded magnificently to the challenge presented by the new policy which could not have been implemented without their full co-operation.

It has recently been decided to extend the quality assurance concept to the installation of exchange equipment by contract. This will involve a great deal of re-thinking and re-training of both Post Office staff, including those employed on Clerk of Works' activities in the Regions, and contractors' installation staff. When this has been fully implemented Post Office costs of inspection and testing of exchange installation will be reduced significantly.

Modernising and upgrading of Branch laboratories is progressing. Projects include the provision of a new high voltage laboratory (up to 200,000 volts), a new acoustics laboratory and anechoic (echo-free) chamber and a "clean air" laboratory for the repair of filters. In the longer term, a specially designed laboratory building to house the Birmingham Materials Section and part of the Test Section at Fordrough Lane is on the drawing board and will be to the same standards as the new Post Office Research Centre at Martlesham.

The ultimate objective is to make the Post Office quality assurance system and supporting facilities comparable with the best in the country.

THE AUTHOR

Mr. R. G. W. Nunn is an Assistant Staff Engineer who has been in QA Branch (formerly I Branch) for just over eight years during which time he has seen and helped to bring about many radical changes in the work and role of the Branch. He spent the earlier part of his career in LTR areas.

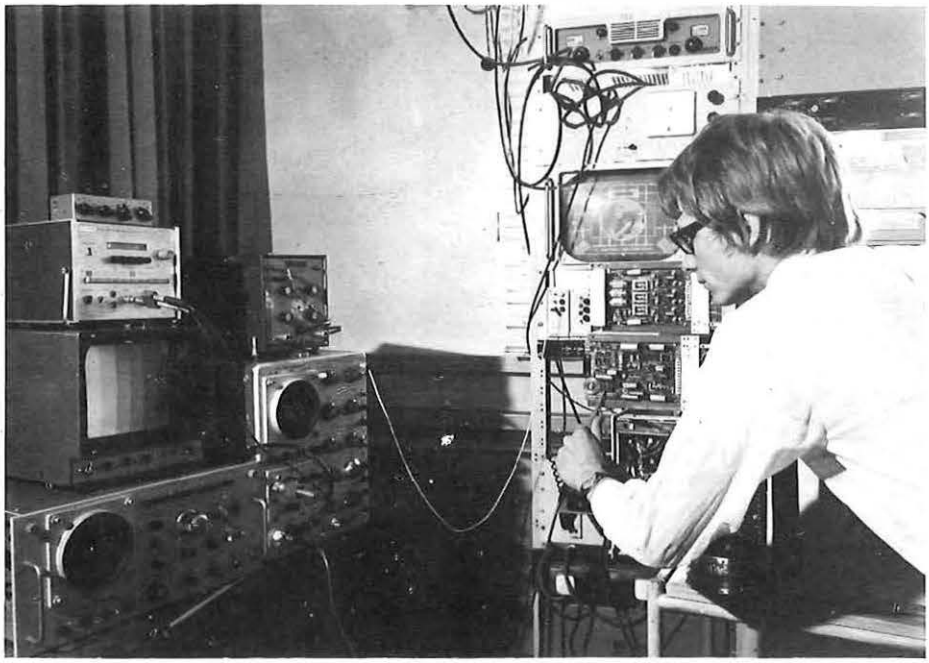
A WIDE RANGE

than would be possible at contractors' works. In other laboratories the repair and calibration of oscilloscopes, TV monitors, pulse and datel test equipment and specialised equipment for testing television and microwave radio links is carried out.

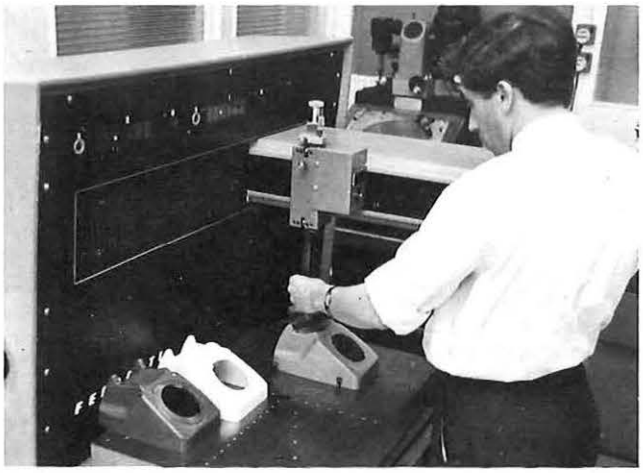
The Birmingham Test and Materials Sections are at Fordrough Lane. The Test Section deals with work in factories in the Midlands, Northern England, Wales, Scotland and Northern Ireland. Many staff are outstationed in main manufacturing centres like Coventry, Beeston, Liverpool, Manchester, Hartlepools, Sunderland, Edinburgh, Belfast and Newport (Mon.). The Birmingham laboratories also support field staff and provide a repair and calibration service for repeater station test gear, line filters and radio equipment (not microwave).

The London and Birmingham Materials Sections are responsible for the quality assurance of materials and for other development, analytical and advisory work such as evaluation studies of new materials, devising new uses for existing materials and establishing the causes of failure of materials in service.

Organic materials (plastics, textiles, wood, etc.) are dealt with by London, and inorganic materials (metals etc) at Birmingham.

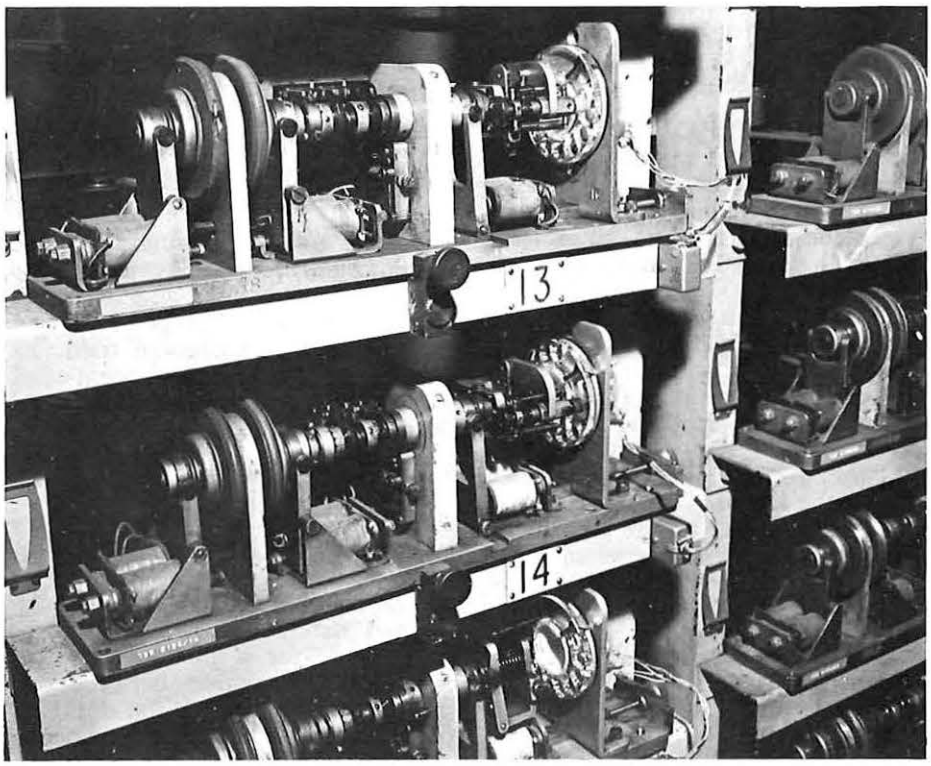


ABOVE: Colour television monitors used in TV switching centres are serviced in a laboratory at Studd Street, London.



RIGHT: Checking the dimensions of a telephone case on a Ferranti Co-ordinate Measuring machine at Fordrough Lane, Birmingham. The machine can measure any part of a case and displays each measurement on eye-level glass panels, enabling the operator to see results at a glance.

In the Birmingham Materials Section laboratory a projection microscope is used to examine metals.



This bank of automatic "fingers" at the Birmingham Test Section laboratories is used to test telephone dialling mechanism. In only four weeks each "finger" dials the figure nine 500,000 times to give a full-life test to the mechanism.

Yet another

The telecommunications business met record demands for service and capital expenditure was higher than ever before during the financial year 1969-70. There was also a significant improvement in productivity, and the business's financial performance was closely in line with its target.

The first Report and Accounts presented by the Post Office Corporation covers the first six months after Vesting Day. However, the report also gives details of the full financial year 1969-70 so that comparisons can be made with previous annual reports of the GPO.

Main details from the telecommunications report are given on these pages.

A technical officer tests one of the supervisory relay sets at the TXE 2 electronic exchange at Odiham Hants. This system is being used for almost all new small-to-medium exchanges.

FINANCE

The business made a profit of £61.3 million over the whole year, an increase of £11.2 million over the previous year. Income rose by £84 million, of which £60 million was due to increased business and the rest to changes in tariffs. The rise of £73 million in expenditure included £20 million for pay awards and £4 million for higher prices. The major factor in the remaining expenditure was the increasing level of capital charges—reflecting the high level of investment.

TELEPHONES

Growth was the highest ever. The number of connexions in use rose by 400,000 to 8.6 million and telephones by 600,000 to 14 million—an increase over the year of 8.7 and 8.1 per cent respectively.

Demand for new connexions was 38 per cent higher in the full year than in 1968–69. As a result, and also because of delays in the supply of equipment, the waiting list rose in the second half of the year to 108,000 but, the average time orders were held on the list was reduced from 4.5 to 3.8 months and by the end of the year plant was available to meet 83 per cent of orders on demand.

Calls: Many more calls were made than in the previous year. Local calls increased by 11.4 per cent over the full year to 8,270 million; trunk calls by 11.3 per cent to 1,333 million; continental calls by 21.1 per cent to 29 million and inter-continental calls by 20.6 per cent to 3.5 million. The proportion of trunk calls obtained by STD went up from 70 to 75 per cent during the year and continental calls dialled by the customer from 57 to 63 per cent.

Automation: STD was made available to another 470,000 customers in the six months making more than 7.25 million in all—about 86 per cent of the total. By March, 1970 only 105 exchanges had still to be converted from manual to automatic working.

TELEX

Some 1,600 new connexions were installed during the six months to bring the total to about 29,000. Inland traffic went up by 5.1 per cent over the year and international traffic by 19.2 per cent. About 94 per cent of all international calls are now dialled direct by customers.

DATA TRANSMISSION

Britain now has 9,500 data terminals, more than any other country except the United States. The Corporation was also commissioning for 60 of its customers, individually-tailored nationwide networks. Plans were made for a new service that transmits information between distant computers at 48,000 bits per second and to open an experimental public switched network for transmitting data at the same rate between London, Birmingham and Manchester —one of the first services of its kind in the world. Data control equipment that will enable customers' computers to set up datel calls automatically over the public telephone and telex network was also in an advanced stage of planning.

INTERNATIONAL

The first intercontinental telephone subscriber dialling service from Britain was opened on 1 March 1970 and enables London subscribers to dial New York and make their calls at a much cheaper rate than by the operator-controlled system. The service will be extended to other parts of Britain and the United States as equipment becomes available.

Ships at sea: Business in the long-distance maritime radio service increased, in spite of a reduction in the number of deep sea ships and the size of crews who use the service. The Lincompex system, a Post Office invention which improves the speech quality of high-frequency radio circuits, was used successfully on a number of fixed service links. It is now being extended to the radio-telephone service for ships.

New exchanges: A new international telex exchange was opened at St Botolph's in the City of London which is designed to handle about 12 million dialled continental calls a year

record year

and building began on another exchange, Mondial House, which will handle dialled calls from and to the United Kingdom and between other countries and also deal with operator-controlled traffic.

Satellites: During the year new satellite services were opened to overseas countries including Japan and Australia, and by the end of March 1970 14 countries were linked to Britain by satellite via the Goonhilly Earth Station, Cornwall.

COMPUTERS

The Telecommunications business is making extensive use of computers. More time-sharing terminals are being provided for scientists and engineers engaged in research and development and the application of on-line systems to local exchange plant network utilisation and equipment maintenance is being developed. Computers are being used to develop and implement programmes for telephone exchange design and specification while computerisation of telephone billing and stores control work has advanced rapidly. Telephone directories are now being compiled by computer and printed by the most advanced linked techniques.

CAPITAL INVESTMENT

Completion delays by contractors, particularly of electronic and crossbar equipment, remain a serious problem, affecting growth of the system and quality of service.

The business pushed ahead as quickly as possible to introduce more electronic switching systems into the network. At present it is ordering almost all new small-to-medium exchanges in the TXE 2 electronic system which has a capacity of up to 2,000 lines. It is also negotiating the purchase of the TXE 4 electronic exchange which can handle up to about 40,000 lines and is planning to introduce electronic stored programme controlled register translators into existing exchanges in London and other large cities.

Buildings: Slightly more buildings and extensions were completed than in the previous year, mainly for telephone exchanges. A major problem continued to be the scarcity of suitable sites, which increasingly delays the provision of buildings. Efforts to overcome this problem were intensified. A new range of standard single-storey exchange buildings was introduced during the year. These new buildings, which are cheaper and quicker to erect, will replace some of the present range of standard buildings. About 180 of them will be provided within the next two years.

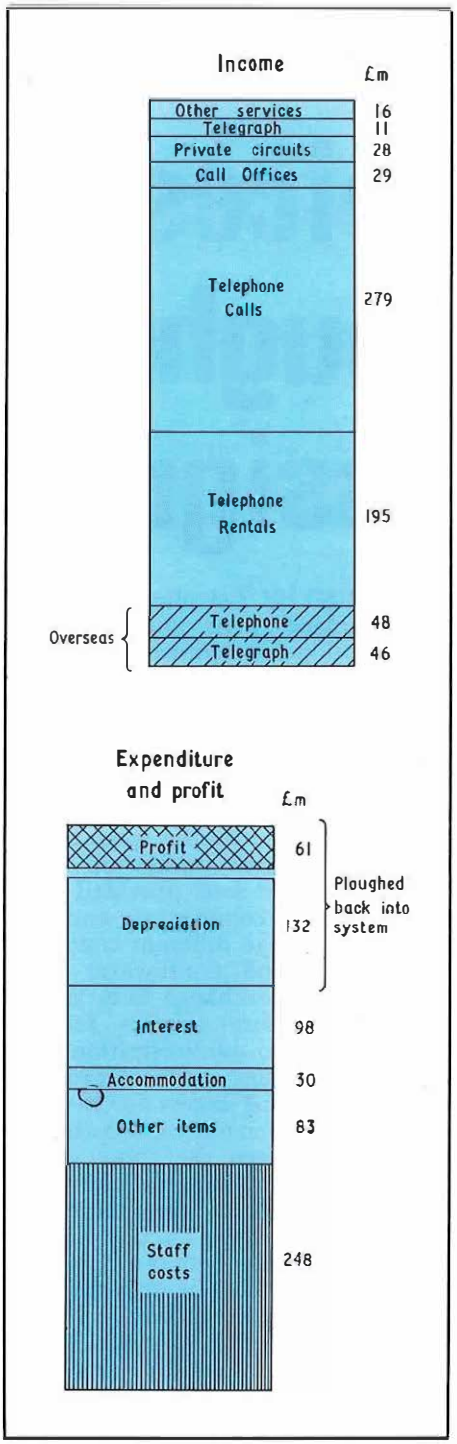
Local Lines and trunk network: During the year the local networks connecting customers' premises with telephone exchanges were increased by nine per cent. In the trunk network the number of long-distance circuits was increased by 14 per cent and shorter-distance circuits by 10 per cent. As a result, the number of long-distance routes suffering from severe congestion was almost halved.

Plans were made to bring into service by 1975 a new 60 MHz coaxial cable system that will enable about 100,000 telephone conversations to be carried over a single cable.

IMPROVING EFFICIENCY

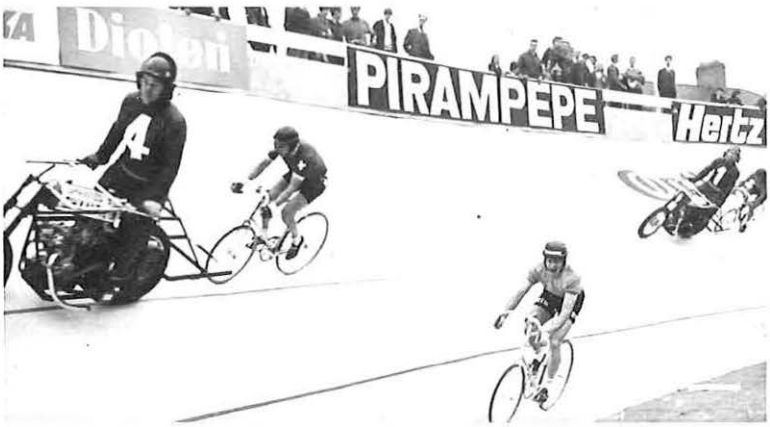
The drive to increase efficiency and raise the level of productivity continued. More clerical work has been mechanised or handed over to computers and new work procedures introduced. The Unions have played a big part in this effort, not least through the joint committee set up to consider the monitoring and implementation of productivity projects. Management-by-objective procedures which set targets and progress their achievement have been strengthened and extended. A measure of the success of this drive is that although the telecommunications system grew by more than 8 per cent during the the year, the staff increased by only one per cent.

In the engineering field maintenance productivity rose by 6.6 per cent. Installation staff provided more than two million new telephones, an increase of 16 per cent over the previous year with an increase in staff of only five per cent.



The aerial control tower at the satellite earth station at Goonhilly Downs, Cornwall.

Leicester's toughest assignment



One of the events in progress at Leicester's Velodrome.

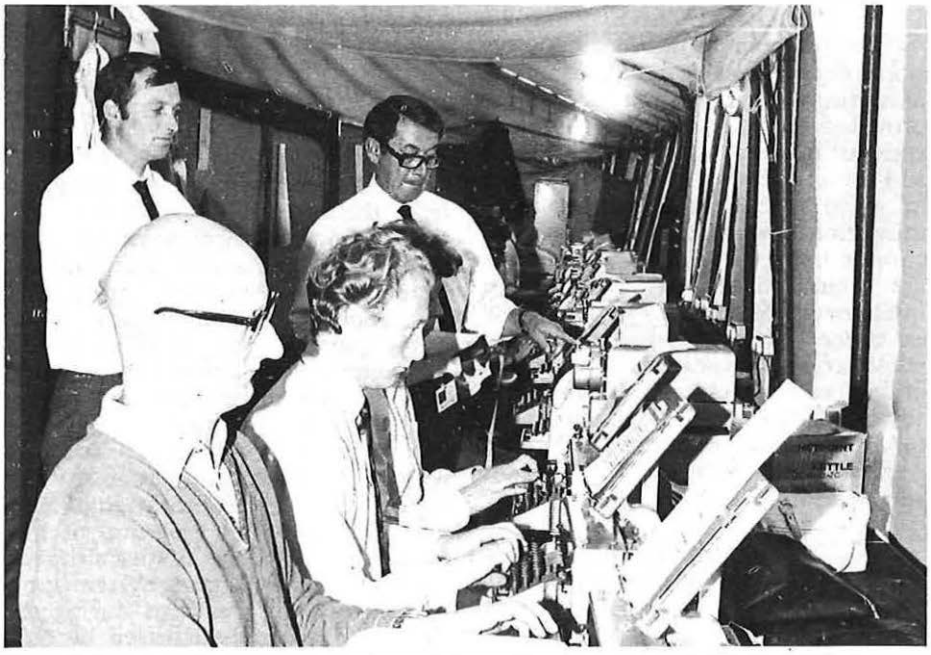
LEICESTER Telephone Area staff tackled their biggest international assignment when they provided the communications network for world-wide coverage of the World Cycling Championships. The 10-day event attracted competitors from 34 countries.

Providing communications links was complicated by the spreading of events over three venues up to 10 miles apart but staff provided more than 250 BBC commentary and control circuits to 38 different countries; 100 inland and continental telex, telegraph and exchange lines and 10 four-wire picture circuits for the Press; and 100 administration lines and 80 special circuits for continental and international access for overseas Press. In addition 650 cable pairs were provided between the three venues and Leicester exchanges—equivalent to about 10,000 cable conductor miles—and another 2,500 circuits to carry additional traffic between Leicester and other switching centres throughout the United Kingdom.

Midlands Region Outside Broadcast Groups, helped by staff from other Regions, provided numerous colour TV links over microwave systems for the Eurovision network.

To ensure adequate coverage of the road race, continental TV cameramen rode pillion on motor cycles using hand-held cameras which relayed a video signal to a helicopter above. Hovering in a line-of-sight path between the motor cycles and the BBC receiving station, the helicopter acted as a mobile repeater to flash pictures into the main TV network.

The efficiency of the Leicester staff was highlighted by two unexpected events. In one case the Colombian National Radio commentator arrived without arranging a link back to his station in Bogota. Colombia had only one competitor and it was essential that the commentator should be able to broadcast when this man was on the track. Staff set to work to arrange a telephone link from the Colombian's commentary position via New York to the South American station and completed the link just two minutes before the start of the race.



Post Office teleprinter operators "wire" journalists' copy to newspaper offices all over the world from the Press marquee.

There were more problems at the road-race circuit where 40 Post Office staff with telex and telephone equipment were housed with the Press in a large marquee. When the marquee was blasted by gale force winds two large rips appeared in the canvas, main support stays listed dangerously and three-hundredweight cross members swung over the heads of staff. The marquee was evacuated for 40 minutes while temporary repairs were made. Additional engineers and vehicles were called in on standby to recover the valuable telex equipment immediately the final press call was made. Within an hour of the call 26 call offices, 14 fully equipped telex and telegraph positions and 50 telephones had been removed. Ninety minutes later the marquee collapsed.

A unique system was devised for the making of overseas calls. Journalists made bookings at a Post Office reception desk set up in the Press Tent at the Saffron Lane Velodrome, the main centre of events. The desk was staffed by five telephonists and a linguist and five booking operators seated at the same suite with access booking circuits to continental linguist; non-linguist and international exchanges. When London had established a call they rang back over a special level access route to a 4-position PMBX 4 housed in a portable cabin at the Velodrome. The wanted journalist, who had been given an identification ticket by the booking operators, was then paged in English and French by the incoming operator over a public address system audible in both the Press Tent and bar. He was then directed to one of the 20 telephone booths in the tent which had been allocated for this purpose.

Journalists described the communications facilities and organisation as among the best provided for international sports coverage during the whole of 1970.

Miscellany

TELETOURIST

CALLS TO the Teletourist service totalled 318,000 in the quarter ended 30 September, an increase of more than 11,000 over the previous year. Calls to the London service rose to just over 291,000. It provides in five languages information on major events of the day in and around the Capital. The Edinburgh service, which gives information on city events in English only, attracted 17,418 calls in the same period, an increase of over 5,000.

DIAL-A-DISC

DIAL-A-DISC opened in Glasgow Telephone Area in November to take the total number of centres getting the service to 42. By dialling a short code and for the price of a local telephone call Dial-a-Disc users can hear a different "top of the pops" record every week night and all day Sunday.

What is the best way for people to communicate?

DEVELOPMENTS IN communications —particularly with a growing use of visual services—could result in radical changes in the way people conduct their business affairs and private life. Travel habits and the choice of places for living and working may be affected.

To learn as much as possible about the effectiveness of sound and visual telecommunications between people—compared with communication by personal encounter—the Post Office and the Civil Service Department are jointly sponsoring a three-year research project at University College, London, at a total cost of £70,000.

For the first time laboratory research is attempting to compare in a wide-ranging and systematic way the relative effectiveness of telecommunications media. The work has implications for the location of commercial and residential development, business organisation and people's travel needs. The research is part of the wide range of communication problems involving human factors being studied by the Post Office. It is also of direct concern to the Civil Service Department, where the responsibilities for efficient governmental administration depend on effective communications.

The research team will include specialists in urban planning, experimental social psychology, operational research, and electronic and telecommunications engineering. The six-man team will be led by Mr. Alex Reid, a 29-year old architect, who has already carried out some studies relating communications with travel between home and workplace. Following a pilot study begun last year, the new project is to be carried out in a communications laboratory at Sunningdale, Berkshire.

Laboratory studies are appropriate for measuring effectiveness, but the acceptability of a service cannot be satisfactorily judged in an artificial environment. For this reason the Civil Service Department has been conducting field trials using, initially, telephone conference facilities, facsimile document transmitters and pantographs in a widely dispersed Government department to determine how extensively people would use such equipment as an alternative to face-to-face meetings.

Visual telecommunication in this country has so far been confined to specialist fields, such as public television broadcasting, and closed-circuit television for hospitals and schools. However, the Post Office has started trials with a telephone that will enable the users to see each other; and it recently announced plans to introduce to a number of major cities next year a "conference by television" service.

RESEARCH DEPARTMENT PRIZES

Left to right: Craftsmanship winners Mr. Winchester, Mr. Papworth and Mr. Hines discuss their prizewinning work with Sir Gordon Radley and Mr. W. J. Bray, Director of Research.

WINNERS of the 1970 Christopher Columbus Prize Fund premiums are—Scientific, Dr. M. R. Miller and Dr. D. H. Newman; Craftsmanship, H. E. Hines, J. P. Papworth, V. A. Winchester. The Fund set up by Sir Gordon Radley, a former Director General of the Post Office, awards annual premiums to Research Department staff for published scientific or engineering papers by officers under 30 and for examples of high quality craftsmanship.

Dr. Miller, a Senior Executive Engineer in Electronic Switching Systems Branch (R8), submitted a paper which resulted from work he carried out at the University of Warwick. It is a considerable contribution to the Department's studies of electronic telephone switching networks employing pulse code modulation transmission.

Dr. Newman, a Senior Scientific Officer in Materials Branch (R3), described work which is being adapted to the Department's study of the ageing of Gallium Arsenide lasers—expected to be key components in future optical transmission systems of very large capacity.

Mr. Hines, a Trainee Technician (apprentice) in Training Branch (R10), got a Craftsmanship premium for a set of tools; Mr. Papworth, a Technical Officer in the Mechanical Engineering Production Group of the External Plant and Research Services Branch (R1), for machining and fitting work required for the production of a new linear submarine cable laying engine designed by Submarine Cable Systems Branch; and Mr. Winchester, also a Technical Officer from the same Branch, for a water-cooled mould for the jointing of the polythene sheaths of large lightweight submarine cables.

● The death of Sir Gordon Radley was announced as the Journal went to press.

BIG BUSINESS

A NEW field of big business is to be opened up by the Post Office. In keeping with its new commercial outlook, the Corporation is to look at the possible commercial exploitation of the freehold properties it owns in town and city centres throughout the country. A property development adviser is to be appointed and the commercial potential of all property investigated.

There will be three main categories of exploitation—new sites where the site or building or both exceeds initial Post Office requirements (this is already being done by renting out excess space); existing sites with a reduced operational function, particularly where a sorting office is moved but counter facilities remain; and existing sites no longer required.

It could mean extending buildings upwards or outwards to provide extra office or other commercial accommodation, or the hiving-off of parts of Post Offices and retaining counter services alongside shops or showrooms.

MORE CALLS

TELEPHONE users in Britain made 910 million calls in October—10.3 per cent more than in the same month the previous year. Of the total, 783 million were local calls and 127 million trunk calls.

Data – an exchange of views

THE POST OFFICE has completed a series of one-day seminars which have helped to stimulate the flow of ideas on data communication between the telecommunications business and its customers. Represented at the seminars were computer equipment manufacturers, computer bureaux, Government departments and local authorities, universities and other organisations making extensive use of computers and data transmission.

The discussions followed papers presented by Post Office experts on the likely future demand for data communication services, and on transmission methods and control procedures that could help to meet future requirements for data users. Views and suggestions put forward at the seminars will help the Post Office in planning technical development and market research. The seminars were also planned to help those attending to assess the impact on their systems or equipment of the possible services which could be offered.

Chairman for the series of seminars was Mr. H. Barker, Director of Network Planning. Papers were presented by Mr. G. Dale of Telecommunications Marketing Department and by Mr. N. G. Smith and Mr. K. J. Chapman of Telecommunications Development Department.

Mr. Dale examined the current situation in data communications, the growth in the number of terminals and how the Post Office is shaping its development programme to meet future needs. (Post Office data terminals are doubling in number each year and there are now over 12,000 in operation. By 1973 there could be 50,000 terminals in use in Britain and by 1983 half-a-million.)

Mr. Chapman and Mr. Smith spoke on data users' future requirements and the possibility of the Post Office setting up a data-transmission system using switching techniques separate from the telephone network. Such a system would mean new interfaces and call-control procedures to bring maximum benefit to users, and these aspects were open to full discussion.

SILENT 'PHONE'

DEAF AND DUMB people will be able to converse over the public telephone network with a new system developed by Modern Telephones Ltd. The system, which the company claim to be the first of its kind in the world, has received Post Office approval.

By means of a device which changes audible signals such as "dial", "ringing", "engaged" and "unobtainable" tones into visual lamp signals, deaf people can establish their own connexions. An Electrowriter (being used above), which transmits and receives handwritten messages instantly over any distance, allows communication to take place.

BOOK REVIEWS

Circuit Consultants Casebook by T. K. Hemingway, 220 pages, 120 illustrations, 75s. (£3.75)

Electronic Designers Handbook (2nd Edition) by T. K. Hemingway, 304 pages, 196 illustrations, 68s. (£3.40)

Business Books Ltd. Mercury House, Waterloo Road, London S.E.1.

The author of these two books is head of Electronic Technology at the Guided Weapons Division, British Aircraft Corporation, Stevenage. He has clearly had considerable experience in the design of transistor and diode circuits using discrete components. He shows the careful thought and analysis (using common sense rather than mathematics) that has to go into the engineering for reliable production and service of apparently simple and straightforward circuit concepts, and demonstrates the truth of the adage "development is more important than design."

Part 1 of "Electronic Designers Handbook" deals with some basic diode and transistor properties and circuit design principles. Part 2 takes for analysis some particular circuit techniques including complementary pairs, cascodes and bootstrapping. Part 3 is a particularly useful section entitled "Prototype Testing" but in fact describing practical difficulties encountered in circuit design.

"Circuit Consultants Casebook" may be regarded as a complement to or an expansion of Part 3 of the Handbook. Part 1 of the Casebook considers basic design problems and errors while Part 2 deals with ways of meeting specification requirements not readily achieved by standard circuits such as multi-vibrators, Schmitt triggers, timing circuits etc.

Both books will appeal to the junior designer or advanced student of electronics but, being based on evidently hard-won experience, will be a useful stimulus and standby to design or inspection authorities. The writer of specifications will find in the Casebook many examples of circuit failure mechanisms that should be anticipated when the operating requirements of a new equipment item are being set down.

MBW

Structure and Performance of the US Communications Industry by Kurt Borchardt (Harvard Business School and Bailey Bros. and Swinfon Ltd.) 60s.

In Europe telecommunications services are run as monopolies more or less directly under government control. The fact that in the United States telecommunications services are operated by private companies under a complex system of State and Federal regulation was, until recently, a situation that other countries noted with interest but without much concern. But the last decade or so of unprecedented expansion in world telecommunications, the introduction of communications satellites, the development of data transmission and the consequent involvement of telecommunications with new industry, has required the telecommunications authorities in all countries handling international services to have a clear understanding of United States practices and constraints.

Furthermore, the existence of the regulatory bodies has brought out into the open for public debate some very fundamental problems on the relationships between telecommunications and the computer industry, the broadcasting industry and the electronic manufacturing industry which in other countries are perhaps not fully appreciated or certainly not fully discussed.

The author of this book, lecturer on business administration in Harvard University, is credited with 20 years in handling communications legislation as Counsel for the Inter-State and Foreign Commerce Committee of the United States House of Representatives, and he is clearly well qualified for the study that he has undertaken. In Part I he defines his study as "the question of what constitutes workable regulation of the structure of the electronic communication industry".

In the second chapter, he gives a concise review of the historical background leading up to the present position in which the dominant companies, AT & T, Western Union and GT & E, are placed at the present time, including the famous Consent Decree of 1949, the Carterphone case of 1968 and the MCI decision of 1969. This chapter reviews also the oversea communications situation including the TAT 4 decision and the background to the establishment of COMSAT. Chapter 3 deals with broadcasting, pay television and CATV (i.c. cable distribution).

Part 2 of the book, chapters 4 to 6, analyses the implications and consequences of the regulatory process as it has evolved in the United States and looks forward to future developments.

This is an interesting and thoughtful book which will be useful on at least two levels; on the one hand to those engaged in the planning and operation of international services who need a guide to the United States' regulatory situation and on the other hand to those concerned with planning and policy affecting the inter-relation of telecommunications, broadcasting and data processing who may like to see set out some of the problems and arguments that United States experience has recognised.

The book has useful footnote references but no index.

MBW

First direct cable between Britain and Spain

SIGHTSEERS watch laying operations for the British shore end of the first direct submarine cable link between Britain and Spain. The cable was floated in at Kennack Sands, Cornwall, from the Post Office Cableship Ariel, and was connected to an underground cable running to Goonhilly Downs four miles away. The offshore end was later picked up by the Cableship Alert and spliced to the rest of the cable which she had laid from Bilbao, Spain. When it goes into public service early this year the cable will be capable of carrying 640 simultaneous telephone calls. It will also connect the Transatlantic TAT 5 cable between Spain and the USA.

ALL AUTOMATIC

LONDON and the Midlands, the regions with the highest concentration of telephones in Britain, now have 100 per cent automatic telephone service. Their last manually operated exchanges, at Upminster, Essex (London) and Sleaford, Lincolnshire, have been converted to automatic working.

At Upminster a new crossbar exchange, the first of its kind in the London area, has a capacity of 11,500 lines and the crossbar installation at Sleaford an initial capacity of 1,500 lines.

London now has 392 automatic exchanges serving 2.5 million lines and the Sleaford exchange is one of 700 in the Midlands serving one million connexions.

The North Eastern Region became the first to have an all-automatic service in February of last year.

Nearly 99 per cent of the country's 8.7 million exchange connexions are now on automatic service and the Post Office expects to convert the remaining one per cent within four years.

RAPID LINK

THE FIRST Datel link in Britain which can transmit at a rate of up to 48,000 bits a second over leased circuits has been commissioned by the Post Office for the Midland Bank Ltd. The link will be used to send standing order details between the bank's northern computer centres at Bootle and Leeds.

The 48 kHz wideband circuit and specially developed Post Office Modems 8 and 9 link ICL System 4/50 computers at the two centres. The service will provide serial binary data facilities at a fixed rate of 48,000 bits a second in both directions simultaneously, as well as a both-way speech circuit for use either separately or at the same time as data is being transmitted.

Special cable has been provided between the Modems 8 in the computer centres and the Modems 9 in the local high-frequency repeater stations.

Three more Datel 48K links to the Midland Bank's other computer centres will be provided next year.

● The Post Office has already set up a Datel 48K manually switched network between London, Birmingham and Manchester. In this trial, customers are able to book time as they need it.

New signalling system on trial

THE POSSIBILITY of bringing a new long-distance signalling system into international use, giving telephone users improved international dialling, was brought a step nearer by a recent conference in London.

Meeting under the auspices of the International Telegraphs and Telephones Consultative Committee (CCITT), a technical organ of the International Telecommunications Union, telecommunications engineers from 12 countries planned international trials of the CCITT No. 6 separate channel signalling system which, they hope, will prove more flexible, reliable and economical than systems now in use.

Following previous meetings in Geneva, the conference met for two weeks in Fleet Building, one of the Post Office's headquarters, with Mr. J. J. Bernard of the Netherlands in the Chair. Leader of the UK delegation was Mr. D. J. Harding, a Staff Engineer with the Post Office in Telecommunications Development Department.

The new signalling system's specification was drawn up after four years' joint study preceding the 1968 plenary meeting, when a working party to organise field trials was set up. Systems 4 and 5, already in use on international circuits, transmit control information over the circuit to be used for speech, whereas System 6 employs a separate data link which has a processor at each end and can control up to about 1,000 speech circuits on each route. An advantage is the elimination of individual signalling equipments: the greater the number of circuits controlled the greater the economy.

The programme of tests being organised includes both submarine cable and satellite circuits to establish the practical feasibility of the system. Tests have already started between London, Munich and Antwerp and will shortly take place in co-operation with partners in Australia and Japan. Field trials are expected to be concluded during 1973 and, subject to satisfactory results, the system could be in operational use by 1975.

The data link itself is provided with at least one standby link with controlled changeover arrangements, so that traffic is not lost. An error-detecting code, with provision for acknowledgement and retransmission when required, ensures a high degree of accuracy in the transmission of the data messages.

IPOEE WINNERS

THE Institution of Post Office Electrical Engineers has announced the results of the 1969-70 Session's Associate Section Papers Awards.

The first prize of seven guineas has been won by Technical Officer R. Milton of Brighton Centre. Prizes of four guineas each have been awarded to Technical Officers H. C. Hawkins (Stoke-on-Trent), R. Mathewson (Aberdeen) and A. W. Smart (Dundee).

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Spring 1970 to Winter 1970

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GROUP INDEX

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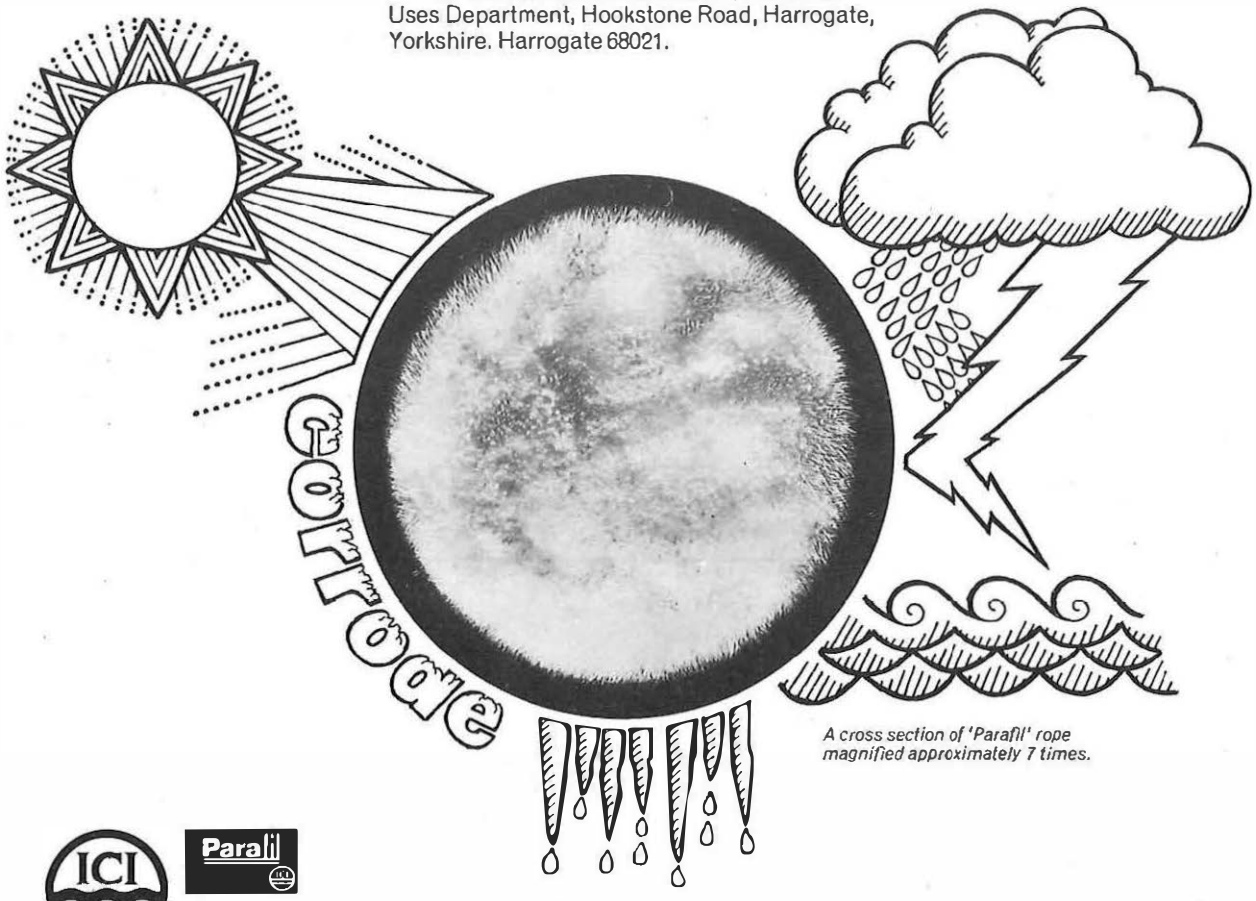
●r contact ICI Fibres Limited, Industrial Uses Department, Hookstone Road, Harrogate, Yorkshire. Harrogate 68021.



A cross section of 'Parafil' rope magnified approximately 7 times.

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Telecommunications Statistics

(Figures rounded to nearest thousand)

	Quarter ended June 1970	Quarter ended March 1970	Quarter ended June 1969
TELEGRAPH SERVICE			
Inland telegrams (incl. Press, Service and Irish Republic)	2,015,000	1,836,000	2,088,000
Greetings telegrams	606,000	481,000	584,000
External telegrams:			
Originating U.K. messages	1,887,000	1,788,000	1,834,000
Terminating U.K. messages	1,765,000	1,693,000	1,709,000
Transit messages	1,636,000	1,577,000	1,604,000
TELEPHONE SERVICE			
Inland			
Net demand	265,000	337,000	236,000
Connexions supplied	279,000	293,000	235,000
Outstanding applications	278,000	293,000	229,000*
Total working connexions	8,723,000	8,551,000	8,017,000
Shared service connexions (Bus. and Res.)	1,612,000	1,564,000	1,461,000
Total effective inland trunk calls	359,617,000	342,974,000	320,354,000
Effective cheap rate trunk calls	88,175,000	81,216,000	77,021,000
External			
Continental: Outward	3,978,000	3,090,000	3,315,000*
Inter-Continental: Outward	517,000	437,000	366,000*
TELEX SERVICE			
Inland			
Total working lines	30,000	29,000	27,000
Metered units (incl. Service)	88,882,000	76,598,000	65,727,000*
Manual calls from automatic exchanges (incl. Service and Irish Republic)	48,000	44,000*	35,000
External			
Originating (U.K. and Irish Republic)	5,838,000	5,475,000	4,659,000

**Figures amended.*

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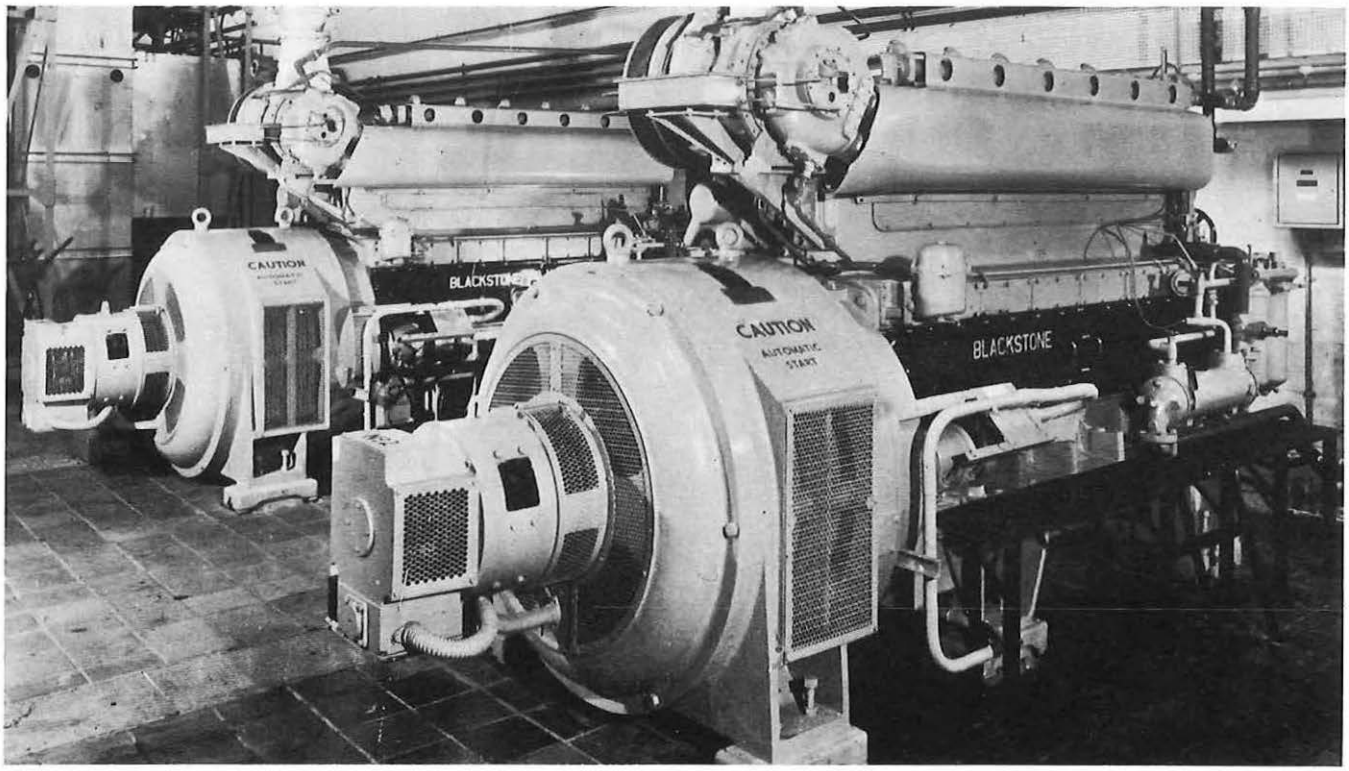
Advertisements. Communications, advertisement copy, etc., should be addressed to Sawell & Sons Ltd., 4 Ludgate Circus, LONDON, E.C.4. (Telephone: 01–353 4353). No official responsibility is accepted for any of the private or trade advertisements included in this publication.

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

Correspondence. Communications should be addressed to the Editor, Post Office Telecommunications Journal, Public Relations Department, Post Office Central Headquarters, 23 Howland St., LONDON, W1P 6HQ. Telephone: 01–631 2191 (editorial), 2193 (sales). Remittances should be made payable to "The Post Office" and should be crossed "& Co.". The Giro account number is 535–1006.

Power Generation



Photograph by courtesy of the Post Office

For dependable communication

Two type ERS6 diesel engines driving 337 kW alternators provide emergency standby power for the Post Office telecommunications centre at Temple Bar, London.

Since the introduction of the first organised postal service in this country the Post Office has gained a reputation for speedy and reliable communication. Following the mail came Telegraph, Telephone, Telex, Micro Wave Radio and Satellite Communication.

Telecommunications have become a vital part of international relations, and business and domestic life. To eliminate the possibility of breakdown in the system due to mains power failure, the Post Office have installed Mirrlees Blackstone standby sets in many telecommunication centres throughout the country.

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The equipment meets all relevant specifications, including P.O. specification W6770, and is in use in many P.O. radiotelephone systems throughout the U.K. Rugged all-weatherproof universal versions are also available.

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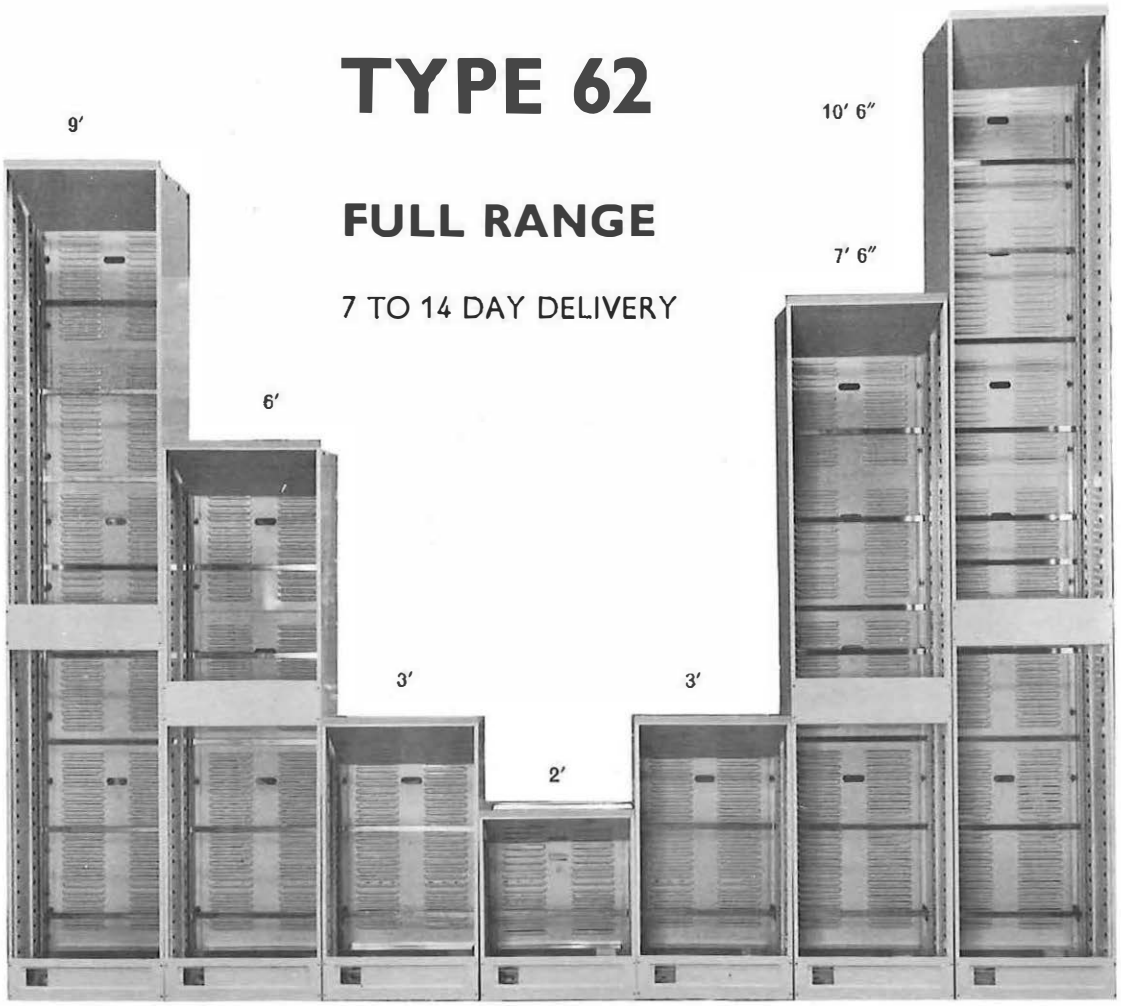

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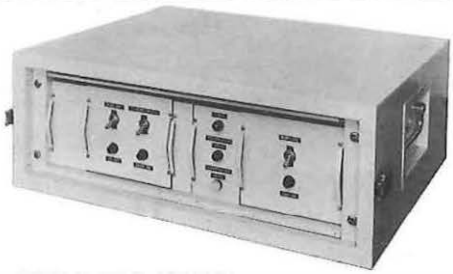

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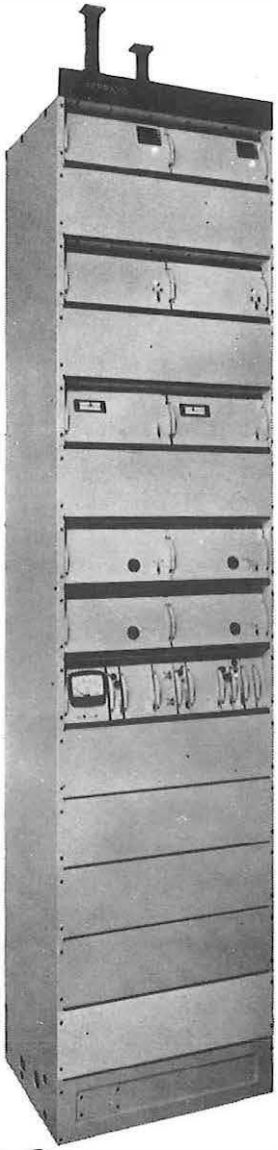

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System Options	
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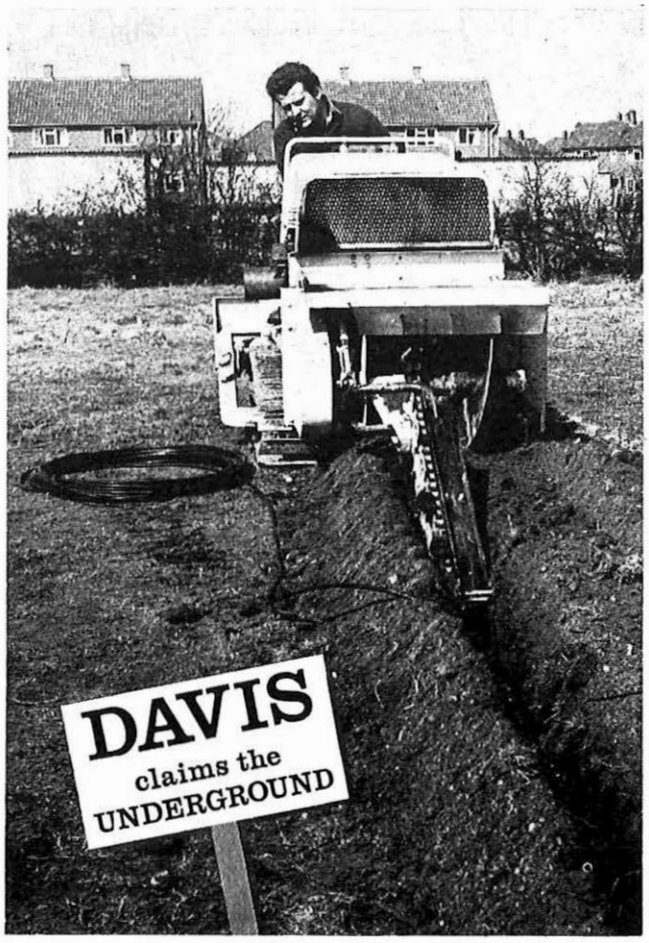

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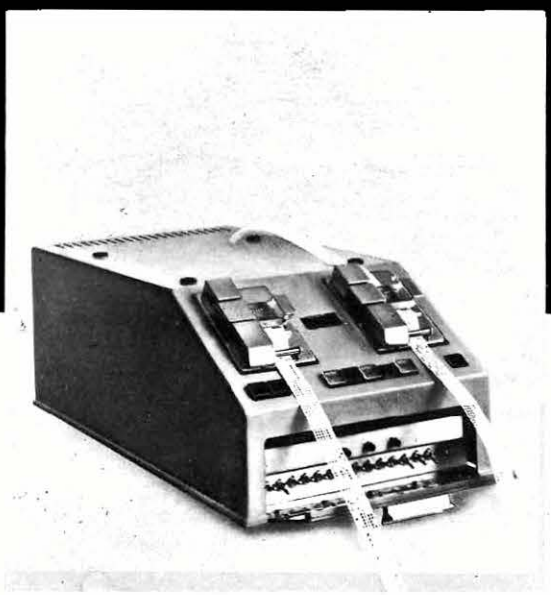
Telegraph Tape Transmitting Equipment



The Plessey Tape Transmitter Type TAA 70 is designed for desk mounting. It provides facilities for reading punched paper tape and for generating automatically a series of characters to precede (Start of Message) and to follow (End of Message) the actual tape transmission. In addition it automatically inserts the Transmission Identification.

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When the unit is switched on following the loading of punched paper tape into either of the readers, a series of telegraph signals is transmitted to line, comprising a start signal, a number of preset characters, (SOM) circuit or channel identity and transmission serial number followed by the characters on the tape and an optional further set of characters (EOM).

The two readers operate independently or alternately. If tape is loaded into the second reader, transmission from it automatically follows the first and the message is preceded by the Start signal and SOM format as outlined above.

An electronically generated "Cancel Transmission" text is provided under operator control. This function is inhibited during the transmission of the Start signal and SOM format, so that a message can only be cancelled during the actual transmission of a message tape.

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