

SECRET

W. G. RADLEY

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SECRET

SECRET

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Vol. 2 of 2.



NOTE

This Flexible Cover is provided for members of the Post Office Staff who often need to carry official instructions with them. Designed to take loose leaves, it will permit of the contents being varied to suit the work in hand, and thus enable the matter carried to be kept at a minimum.

Issued to Mr.....

.....
(Headquarters Town)

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[Fly-leaf for Cover SS 444A.]

RESEARCH BRANCH SECRET WAR DIARY1st January CONFERENCE AMPLIFIER1943

Arising from difficulties in the manufacture and use of Amplifiers No. 27 (8-way Conference Amplifiers), R. Branch was asked to set up a 32-way conference system at Bomber Command. This was done satisfactorily and is the first instance of the use of outlets in excess of 16. The amplifier is now in course of re-design and facilities for interconnecting up to four amplifiers will be provided. One of the main causes of trouble at Bomber Command was due to speakers retiring from conference without pre-arrangement, thereby leaving their outlets on open-circuit. (Research Case No. 11429 refers.)

23rd January REMOTE CONTROL FOR 7000-TYPE STATIONS1943

The Research Branch equipment referred to in the Diary entry of 22nd September last was tested in conjunction with the Radio Branch equipment today, previous tests having been inconclusive owing to changes which were necessary on the radio equipment. The system is used for effecting a phase correction and the result of the correction is made evident on a cathode ray tube which is adjacent to the controlling key. Thus checking the result of the controlling signals is facilitated. The apparatus operated satisfactorily during the course of the test. No attempt was made, however, to use a second control channel which has been provided to cover further developments. (Research Case No. 11814 refers.)

27th January AUTO-TELLERS1943

Following the decision by the Air Council that all work in fitting up the Inland Reporting System should be suspended while the methods to be used are reconsidered, the Air Ministry's requirements with regard to the two auto-tellers now being constructed at Dollis Hill and the Post Office Factories has become somewhat vague. It has been proposed that a conference should be held at a very early date to examine the position. In the meantime, construction of the two auto-tellers is being proceeded with. The Factories Department now hold all information necessary to proceed with manufacture, except as regards the receiver and sorter panels. As a result, however, of any abandonment or material alteration in the Inland Reporting System, the receiver and sorter panels would have to be substantially modified. If urgently required, the Post Office auto-telling equipment/

RESEARCH BRANCH SECRET WAR DIARY27th JanuaryAUTO-TELLERS (Cont'd)1943

equipment could be put into service with S.T. & C. receiver and sorter panels which already existed. Apart from these panels, it is likely that the auto-tellers will be finished by the dates originally promised, i.e., July and August, 1943.

28th JanuaryMEANS OF EXPEDITING PRODUCTION OF URGENT WAR WORKS1943

If the delivery dates demanded for the completion and delivery to the Fighting Services of communication apparatus developed in the Research Branch laboratories and under construction in the Workshop are to be met, some means of speeding up production must be found. While the present output per man in the Workshop may not be quite as high as during 1940, it is considered to be satisfactory. Any reduction which has taken place could be attributed to four main causes: (a) the staleness which is inevitable after two years with abnormally long periods of overtime, (b) the loss of incentive provided by the patent dangers of the strategical situation in 1940, (c) dissatisfaction natural to very highly skilled workers who see inferior craftsmen earning higher wages in industry generally, (d) increased difficulties of supply owing to pre-war stocks of components, etc. being now completely exhausted, and having to rely on those of war-time manufacture. Causes (a), (b) and (d) are operating similarly in all industries. Cause (c) is peculiar to workshops such as those of the Research Branch where scales of remuneration are invariable. Any substantial improvement in the output per manhour is not considered possible. Neither is it thought likely that any sustained or material increase in the weekly output would result from adding to the hours of overtime already being worked. During recent months it has been found practically impossible to recruit skilled instrument makers and other types of workmen required at the rates of pay offered by the Department.

Much of the work undertaken at Dollis Hill is unsuitable for contractors and they are now so heavily loaded that no advantage would be gained by placing contracts. The possibility of securing further assistance from the P.O. Factories has been discussed with Messrs Faulkner and Hibberd but, owing to the nature of the work, i.e.,

small/

RESEARCH BRANCH SECRET WAR DIARY28th January MEANS OF EXPEDITING PRODUCTION OF URGENT WAR WORKS (Cont'd)

1943 small numbers of many items each requiring skilled men, it is doubtful whether they can assist materially.

Since it is not possible to get additional skilled staff in the workshop owing to the difference between Departmental scales of pay and the rates obtainable outside, the possibility of extending the workshop at the M.S.S. Factory, Colnbrook, is being considered. If this were done, the work could be closely controlled by Research Branch while, since the workmen would be paid by the firm, the rates could be made attractive.

The Priority Section has been asked to investigate the possibility of securing the necessary machine tools and persuading the Ministry of Labour to transfer about four really skilled instrument makers to the firm. So far, the Ministry of Labour has merely emphasized the difficulties of the labour position in the Colnbrook area.

5th February WORK FOR COMBINED SERVICES ORGANISATION1943 Case No. 11824 - Cyphering Machine

A cyphering machine in use is mechanical in construction and manual in operation. The manual operating is slow and laborious. An electro-mechanical equivalent has been built. It comprises contact-operating press-buttons arranged typewriter-keyboard fashion, a jack-field for changing the cypher key, 400 relays for cyphering operations, and a magnet-operated teleprinter for printing. It works at some ten times the speed of the original and with far less fatigue to the operator.

The machine was demonstrated at Dollis Hill yesterday and will be shipped to Bletchley next week.

Case No. 11835 - Provision of W-W. Equipments

Flowers and I visited Commander Travis, Bletchley, today. We had gathered that pressure was being put on the British Tabulating Machine Company (B.T.M.) for the supply of a high-speed testing machine, and that Mawdsley's were still failing to produce the commutators which provide the link between the B.T.M. slow-speed testing machines and our sensing equipments. These were now being delivered from the Post Office Factories at London/

RESEARCH BRANCH SECRET WAR DIARY5th February WORK FOR COMBINED SERVICES ORGANISATION (Cont'd)1943

London and Birmingham to Dollis Hill for assembly of the parts and final testing. Dollis Hill should be able to deliver the completed sensing equipments to Bletchley (or one of the other stations belonging to the same Organisation) at the rate of five per week beginning about February 22nd. We wished Commander Travis to be kept aware that, despite the failure of several manufacturers to supply equipment which he could use, ours would be ready in accordance with our undertaking. Travis said that Mawdsley's failure to supply commutators was the responsibility of the Admiralty. Such work had been given the highest priority by the Cabinet but had been badly handled. He had, however, taken the risk of ordering 12 commutator machines in advance of the completion of the Factory-made prototype. As these 12 machines became available, probably in April, Travis intended to put them into service with slow-speed B.T.M. machines and these would require 12 racks of P.O. sensing equipment. This chain would be put into regular operational service, not only on account of the Service needs, but also to provide experience as to the reliability, etc., of apparatus of a novel type. I pointed out that if the need for more testing equipment was urgent, it was possible that our sensing equipments might be coupled directly to the B.T.M. high-speed machines as a temporary expedient, thus enabling the latter to be turned out without relay sensing attachments. Such a combination had not, however, been put to the test of a practical trial and, until it had, we feel that tests are being made difficult by the lack of knowledge of the relative merits of relay and valve sensing. Travis promised that the second high-speed machine produced by B.T.M. should be put at our disposal for such a trial and that it should be available in about a week's time.

Commander Travis was deeply appreciative of the work done by the Research Branch, both as regards its technical quality and the way in which promises to supply apparatus by given dates had been kept.

RESEARCH BRANCH SECRET WAR DIARY6th February LIFEBOAT BATTERIES FOR RADIO SETS1943

At a meeting between the Ministry of War Transport, the Admiralty and the Post Office, the Research Branch suggested two alternative types of battery and it was agreed that a specification should be written. A demonstration was given of the Research Branch's proposals for a hand-driven generator for charging in a lifeboat.

12th February ELECTRO-ACOUSTICS SUB-COMMITTEE1943

At a meeting of the Committee held today, a suggestion made in the War Office was considered. This was to the effect that amplifiers should be provided in large numbers for "battle" telephones in order to make speech possible for very long point-to-point circuits. A strong recommendation was made by the Sub-Committee that, before such provision of amplifiers is undertaken, full advantage should be taken of the possibilities of improving the overall speech transmission by changes in the telephone instruments. Certain easily made changes suggested by C.I.E.M.E. and the Post Office Research Station have been examined by the Sub-Committee. These include use of balanced armature (DLR.5) telephone receivers, high power microphones with maximum battery feed and suitable transformers. Taken together, these three modifications will enable the speaking range of the line to be about doubled.

Recent Army carbon microphones (Capsule No. 4) have shown a wide variation in, and poor, performance. The control of reference standards is being taken up by C.I.E.M.E.

13th February INVESTIGATIONS IN BRITISH EMBASSIES AND CONSULATES1943

At the request of the Foreign Office, Embassies and Consulates in Portugal, Spain and North Africa were visited between December 1942 and February 1943 by Mr. J.O. Ackroyd, an Assistant Engineer in the Branch. Buildings in Lisbon, Madrid, Barcelona, Seville, Tangier, Algiers, Rabat and Casablanca were examined for concealed microphones or similar apparatus.

In every case the results were negative, although the proximity of enemy controlled premises gave good grounds for suspicion. For example, in Lisbon the German Military Attache's Office is separated from the Embassy by a narrow street and both buildings are fed by open wires and insulated cables from the same D.P., while in Madrid the Ambassador's residence adjoins that of the German Ambassador. It was stressed that the chief defence against the installation of concealed microphones lay in

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(Cont'd)

keeping a close watch on any workmen employed in the building whatever the nature of their activities. It was also pointed out that private houses and particularly flats are vulnerable to such installations and that the discussion of secret matters in them was therefore very undesirable.

Details of the various telephone installations were obtained and in this connection a number of questions were asked as to the ease with which telephone lines could be tapped. There appeared to be considerable evidence that such tapping had been carried out in Lisbon at some time for the benefit of the Germans and it was emphasized most strongly that it was not possible to detect activities of this sort and that no telephone conversation must be regarded as secret.

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[REDACTED]

During the tour a visit was paid to Gibraltar to advise on the installation of overhearing equipment in (a) Detention Barracks, (b) A shop in Irish Town, (c) The Defence Security Office [REDACTED]

[REDACTED] (a) and (c) present little difficulty. (b) can be arranged by commandeering a flat above and installing a microphone behind the already damaged shop ceiling. The Defence Security Officer is considering this.

[REDACTED]

Mr. Ackroyd did practically all his travelling by air, the official arrangements being made by the Foreign Office and, for later stages of the journey by the Consulates, etc. in the towns which he visited. With one exception, assistance was very readily and willingly given at all places, Americans who were responsible for the actual transport arrangements being particularly helpful. Any work done subsequently at Gibraltar, however, should be on condition that M.I.5 make the status of the officers engaged perfectly clear to the local Defence Security Officer. This should avoid the waste of some valuable time experienced by Mr. Ackroyd, even ⁴discourtesies were unavoidable.

20th February1943PROVISION OF LINE COMMUNICATION SYSTEMS FOR THE ARMY

Equipment has been constructed to enable a complete super-group of 60 channels to be transmitted in each direction on each of two submarine cables. The primary super-group 312-552 kc/s is transmitted in one direction and a modulated super-group 24-264 kc/s is formed and transmitted in the other direction. The equipment is now under test in conjunction with the group and channel equipment at Messrs. S.T. & C's Works, N. Woolwich. The "A" terminals, transmitting the 24-264 kc/s bands, will then be installed at *Dover Castle*. System filters are also constructed to enable the band up to 16 kc/s to be operated on a duplex basis with either P.O. or Army 1+4 circuit equipment.

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The maximum range of the system on standard 509/690 lbs/naut paragutta cable is 28 nauts; repeater stations are under construction to be installed at *St Margarets Bay and Asbolscliff* if and when required, the land sections being high frequency balanced pair cable. (Case No. 11699 refers.)

23rd February

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DETECTION OF PETROL FUMES ON AIRCRAFT CARRIERS

D.S.R. Admiralty has asked the Research Branch for assistance in the development of equipment for giving automatic warning of the presence of petrol fumes on aircraft carriers. A scheme for adapting the hot wire detector, which the Research Branch installed in the Holborn Tube to detect inflammable gas, is being drawn up. It is probable that about 20 test points will have to be associated with each installation.

27th February

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MOBILE UNITS FOR M.I.19

Twenty-seven Post Office men who have recently returned to Signals after being out on Class W Reserve have been earmarked for service at the permanent Prisoner of War camps and with the Mobile Units. The first six have arrived and are undergoing training. Some doubt has now arisen as to how and whether Mobile Units should be used in a European campaign. The nomination of a second officer (in addition to Capt. Copping) will not be made unless it is decided to use the Mobile Units.

RESEARCH BRANCH SECRET WAR DIARY19th March MORSE CIPHERING SYSTEM FOR ARMY FORWARD UNITS1943

To-day Capt. Ashbury of H.Q. Signals visited the Research Station and asked whether we could advise him on the development of V.F. telegraph and automatic relay equipment associated with a morse ciphering system he had produced. Later he asked whether we could construct two equipments.

This equipment represents a simple means of rendering Morse code fairly secret (i.e. it is not a high grade secrecy system). Only the 10 morse numerals are used and these are sent in groups of four corresponding to words in a code book. The numbers obtained from the latter are, however, replaced by other numbers according to a substitution cipher before being transmitted by radio, a correcting substitution being applied at the receiving end.

The transmitter consists of a board containing, say, 10 groups having the necessary metal inserts along which a metal pencil is drawn in either (predetermined) direction, one morse character being thereby keyed into the transmitting radio set. The metal inserts are interchangeable in the various grooves. Deciphering at the receiving end is entirely automatic and the result appears on a lamp display.

Some of the experimental apparatus has been constructed and is being tested in the laboratory.

30th March WORK FOR THE WAR OFFICE - W.O. 2263 W/411943

At a meeting between M.I.19, M.I.1, C.S.D.I.C., P.W.I.S. (Prisoners of War Interrogation Section) and the Research Branch on 9th March, the establishment and equipment of small mobile groups of P.W.I.S. to accompany an Expeditionary Force was discussed. These groups would be provided with portable buildings, listening equipment and a few recorders and would be used (a) to obtain information required at G.H.Q. level and (b) to select prisoners likely to possess information useful at War Office level. These would be sent to C.S.D.I.C. at Latimer or Beaconsfield for further treatment.

It was agreed that a draft report should be prepared defining the functions of C.S.D.I.C. and P.W.I.S., and making recommendations as to personnel and equipment. The Research Branch would be responsible for the section dealing with equipment and technical personnel. The report would be submitted to the D.M.I. and others interested in a B.E.F.

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The report was submitted on 19th March. It has been strongly recommended that the accommodation should consist of five portable steel huts built in sections and lined with building board to provide thermal insulation and some acoustic damping. Four huts would be for P/W. and one for listening and recording equipment, the latter being placed 200-300 yards away from the others. Each of these huts should be capable of erection in about ten minutes.

Four listening and two recording sets will be provided. If possible these will be arranged to work from 12-V accumulators in order to dispense with the bulky power equipment necessary to the present larger Mobile Units.

It has also been strongly recommended that ample training under as practical conditions as possible should be given to the sergeant, corporal and signalmen-instrument-mechanics who will form the technical crew, and that adequate training in listening and recording be given to the Intelligence staff.

In consultation with M.I.19, it has been decided that the provision of huts and equipment for at least four such units shall be put in hand immediately and pressed forward with the utmost speed.

A letter from Major McMillan received on 20th March indicated that a C.S.D.I.C. and several Mobile P.W.I.S. Units were being formed in North Africa with H.Q. at Algiers. The letter called for fairly extensive equipment and spares for this purpose and also for further equipment for Australia. The whole of this has been assembled, tested and packed for export and is awaiting further instructions from Movement Control. The weight of stores involved is about eight tons.

31st MarchSCHEME 1451943

The equipment due from Research Branch for a third mobile 12-channel carrier terminal for use with submarine cable has been completed and handed over to Studd Street for installation in the vehicle. The new terminal is a "B" terminal, i.e., it transmits 72-120 kc/s and receives 12-60 kc/s. The final coding of the mobile equipments is:-

Original A terminal	145A	} See Diary entry for 24th October 1942
" B "	145B	
New B "	145C	

4th/

RESEARCH BRANCH SECRET WAR DIARY4th April MATHEMATICAL ASSISTANCE TO R.S.S.1943

On 27th March we were informed that R.S.S. intended to introduce a Quality Control scheme for the S.W., D/F. network and that a request had been made through Mr. Mumford for the instruction of their Mathematician in the technique of the probability significance tests developed in the Research Branch. Consequently their Mathematician, Miss M. Wilson, arrived on 31st March and worked for three days in the Mathematical Group. The problem concerning the R.S.S. will not be easy of solution and, in order to make a rigorous analysis of all the contributory factors affecting the general performance of stations, it will be necessary to design their testing schedules. The R.S.S. will make contact with Research Branch later as specific points arise.

5th April WORK FOR COMBINED SERVICES ORGANISATION1943

On 2nd March I wrote to Commander Travis, putting down on paper some of the things which had been rather troubling one or two of us at Dollis Hill who had had the privilege of knowing the common objective of the work carried out by the B.T.M. Company, Mawdsleys and ourselves.

"We believe that the 4-wheel machine was known to your staff as constituting an imminent and serious problem as long ago as November 1941. Apart, however, from the construction of four analysers for the second stage sifting of data, we were not asked to take part in the direct attack on the problem until 10th August 1942. At that time Wynn-Williams had completed the design of an experimental engine for attaching to your standard slow-speed testing machines. A number of these, together with valve sensing equipments, the design of which had also been worked out in principle by Wynn-Williams, would have provided you with the necessary machinery for operational work.

At your request we took over from Wynn-Williams completion of the design of the sensing equipment and undertook to make 72 of these equipments by April 1943 in the Post Office Factories. Eight of these have been completed and tested at Dollis Hill. More could have been had we continued to press the work to the utmost extent possible as we did in the latter part of 1942.

Construction of the Wynn-Williams engine was placed with Mawdsleys and we have not been concerned. It was clear, however, that no engines would be available until January 1943 at the earliest and completion of the number required for operational work does not now appear likely for some time to come.

By September 1942 the B.T.M. had made considerable progress with a high-speed engine which was to be complete with its own relay sensing attachment. At a meeting at Bletchley Park on 2nd November 1942, development was reported as being complete and we heard that six of these machines could be made for delivery in about six weeks' time. It transpired subsequently that mechanical troubles had held up production of the B.T.M. high-speed engines. We have no precise knowledge of what these troubles were, but we believe that they arose, at least partly, on account of the requirements of the relay sensing attachment. Spasmodic drive was invented to increase the clean contact time available for sensing, but this again caused difficulties and a long delay in their solution.

It appeared to us that the difficulties inherent in the very rapid operation of relay sensing equipment would be avoided by the use of valve

sensing/

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sensing. Although, without a practical trial, it is impossible to say definitely, it seems likely that our valve sensing equipment could have been worked in combination with the straight-forward high-speed B.T.M. engine as envisaged in September 1942. It was agreed at the meeting on 2nd November that such a trial should be made and Flowers continued to advocate this to your staff during November.

In conversation with yourself at Westminster on 16th December 1942, I did the same, pointing out that, although the B.T.M. high-speed engine with our valve sensing might not work, the combination was one which could be produced quickly and, for this reason alone, was worthy of trial. To this you readily agreed and promised that we should have one of the first two or three high-speed engines manufactured by B.T.M. for coupling to one of our valve sensing equipments. This trial has not yet taken place due to the delays the B.T.M. have had in completing their machines, delays which we believe have been partly due to their aiming at a machine suitable for use with relay sensing. Though admittedly the valve sensing equipment has the disadvantages of being more bulky and departing from what has become recognised as standard practice at Bletchley Park, we also believe that it contains possibilities of further development to provide additional facilities to a greater extent than does relay sensing."

On March 16th Commander Travis spoke to me over the telephone, thanking me for the above letter. He said that it had been of considerable assistance to him; it had made him aware of a state of affairs for which he admitted that his own organisation was largely responsible. Later, in an interview with Commander Travis at Bletchley Park on March 23rd, he told me that he was still hopeful of obtaining at an early date sufficient high-speed, 4-wheel, B.T.M. Company's machines to deal with his important traffic. Up to the present an enemy mistake had helped him to keep up-to-date with this traffic but, earlier in the month when he had not been able to profit from this mistake for some days, the results had been more serious.

The first Mawdsley-made commutator had been delivered at Stanmore on March 20th. We obtained access to this a few days later and should have been able to test fully our valve sensing equipment as part of a complete set-up, consisting of a standard bombe, high-speed commutator, and sensing. Up to the present, however, brush bounce has made it impossible to run the commutators at more than half speed, and this was still the position when Sir Stanley Angwin and Commander Travis inspected the equipment at Stanmore and reviewed the position generally today.

As far as it has been possible to test it, the valve sensing equipment functions in a perfectly satisfactory manner and there is no reason for anticipating that it will not do so at the full speed of the machine. Dr. Wynn-Williams and Mawdsleys together are endeavouring to get the mechanical side right. As soon as this has been done, the completion and delivery of other commutators can follow. Commander Travis was reminded that valve sensing equipments sufficient for 12 testing chains had been completed.

RESEARCH BRANCH SECRET WAR DIARY27th April1943DESIGN AND CONSTRUCTION OF PICTURE TELEGRAPH EQUIPMENT

The Ministry of Information is apparently anxious to commence radio transmission of pictures between this country and various centres abroad. Cables & Wireless, Ltd. possess two American equipments and one German (Siemens-Karolus), the latter being loaned from the Post Office. Picture telegraph transmitters and receivers have not hitherto been constructed in this country and Cables & Wireless, Ltd., after failing to interest any of the large telephone manufacturers in such work, had sought the advice and assistance of Sir Stanley Angwin. The three equipments in possession of Cables & Wireless, Ltd. were inspected by the Research Branch and as a result a design has been prepared on the drawing board which is in some sense a compromise between all three, but conforms more closely to that of another, the Belin. This design appears to be one which would be most easily constructed by a normal workshop and has the further advantage of using an enclosed lead screw. It was decided on after full consultation between all the Groups concerned at Dollis Hill, but its suitability will ultimately depend on a satisfactory reply to a letter which was sent to Cables & Wireless, Ltd. today. In this letter they were asked to agree to such features as

- (a) non-detachable drum
- (b) dark room operation
- (c) proposed drum dimensions, and
- (d) machine to function as a trans-receiver

From conversation it is gathered that these will not conflict with their existing practices.

It is proposed to design and construct two complete terminals at Dollis Hill which could serve as prototypes for a large number. The high grade mechanical work required, such as the cutting of the lead screw and the construction of the optical equipment, is not beyond the capabilities of the Dollis Hill Workshops and facilities are also available for passing this work on, if necessary, to the M.S.S. Factory at Colnbrook. Case No. 11997 refers.

29th April19438-WAY CONFERENCE AMPLIFIER

Final details of a redesigned 8-way conference amplifier to replace U.A.27 have been forwarded to S. Branch. U.A.27 uses branching hybrid transformers and two amplifiers with VT.85's (16 volts 0.25 amp heaters, now obsolete). The original request from S. Branch was for a design with modern valves, suitable for A.C. working only; the new amplifier is also greatly reduced in size by the use of resistance bridges and

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RESEARCH BRANCH SECRET WAR DIARY29th April1943

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a single valve (VT.150 with negative feedback). Facilities are also included for the combination of two or four amplifiers to give up to 16 or up to 32 ways; such facilities have been required on several occasions including the provision at Bomber Command covered by the Diary entry of 1st January 1943.

SCHEME 145

Further to last month's Diary entry, group and line equipment for operating 12-circuit systems over each of two submarine cables have been completed by Research Branch and forwarded to for installation in an underground building. These are "static A" terminals on 10' 6" racks, i.e., they transmit 12-60 kc/s and receive 72-120 kc/s. They will operate in conjunction with any "mobile B" terminal, 145B, 145C, 145G and 145H, the "transportable B" terminal 145F or the "static B" terminal 145D. (145B and 145C are covered by Diary entries for 24th October 1942 and 31st March 1943). 12 circuits have been guaranteed over 65 nauts of cable, or otherwise, operation up to the frequency (< 120 kc/s) at which the attenuation is 102 db. It is anticipated that workable circuits will be obtainable over considerably greater lengths and provision is made for operation over cables up to 90 nauts in length; this corresponds to 140 db at 120 kc/s and ensures that circuit noise is the limiting factor in the scheme.

4th May1943DEVELOPMENT OF MINIATURE MICROPHONES AND HEADPHONES

At the meeting of the Communications Committee of the Scientific Advisory Council, Ministry of Supply, on 15th April, the possibility of obtaining wider recognition for the recommendations of the Electro-Acoustics Sub-Committee was discussed. The point was raised at the instance of S.R.D.E. who have apparently been receiving the "backwash" from manufacturers asked to make telephone instruments to slightly differing designs for the three Service Departments and, when the designs agree, to slightly differing testing specifications. It was pointed out that neither the M.A.P. nor the Admiralty had the benefit of access to the accumulated experience of experts through a committee such as the Electro-Acoustics Sub-Committee of the Ministry of Supply. They had, however, liaison representatives on this Committee through whom they should be kept informed of its work. The problem had an
immediate/

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1943

immediate point as the Miniature Components Sub-Committee of the I.S.C.C. had the specification of miniature microphones and headphones within its terms of reference. They were proceeding without contact with the Electro-Acoustics Sub-Committee.

I discussed this problem with Mr. Gray, D.D.S.R.D., at Berkeley Court on the 28th April. We both agreed that any suggestion to either of the other two supply ministries that they should receive advice from a committee set up under the Ministry of Supply would have to be handled very tactfully, Such a suggestion might lead to a re-constitution of the Sub-Committee on an inter-services basis and slowing up of the machinery. Gray stated that, as microphones and telephone receivers largely meeting Army performance requirements were now available following the work of the Electro-Acoustics Sub-Committee, the Ministry of Supply would not welcome any modifications to specifications which would interfere with the full flow of production. A telephone enquiry to D.D.C.D. of the M.A.P. elicited the information that, if the Air Force had been dissatisfied with the performance of telephone instruments in aircraft, their liaison representative would have brought it to the notice of the Electro-Acoustics Sub-Committee. It was known that, apart from sound powered telephones, the Navy was generally satisfied with its instruments. We both agreed, therefore, that any alteration to existing specifications, even in the interests of standardisation between the three Services, would be foolish.

Gray stated, however, that the development of miniature microphones and headphones was an urgent problem. A completely waterproof radio patrol set had been designed and use of standard headgear, etc. with such a set was incongruous. Production of miniature components in large numbers would be required for the campaign in the Far East.

I therefore visited Standard Telephones & Cables at New Southgate on 3rd May with Mr. Barnes in order to discuss the manufacture of instruments with Messrs. Grace and Pocock. I found that S.T. & C. had been asked to develop a miniature helmet microphone for the R.A.E. having the same performance and dimensions as the American MC.253. They had designed a single pole, floating diaphragm unit for this purpose and, on their own initiative, had made up a casing so that the same unit could be used as a receiver replacing the No. 16 R.A.F. receiver.

With regard to a microphone, a small instrument strapped to the wrist had appealed to Gray, and Pocock produced a small carbon microphone which had been developed some years ago as part of an operator's set in which the

microphone/

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4th May microphone was held by an arm from the headband. As compared with an
1943 electro-magnetic unit, the carbon microphone has the disadvantage
(Cont'd) that it is much more difficult, if not impossible, to make waterproof.
It will not operate if held horizontal. It has the advantage, however,
of very much greater sensitivity.

I next made contact with Mr. Mitchell, Chairman of the Miniature Components Sub-Committee of the I.S.C.C. and was invited to attend that Sub-Committee's meeting this morning when miniature telephone instruments were to be discussed. Mitchell stated that the function of his Sub-Committee was the standardisation of miniature equipment generally and that they would be very grateful indeed for any guidance which a more expert body, such as the Electro-Acoustics Sub-Committee, could give them regarding headphones and microphones. It appeared later that a skeleton specification for miniature headgear receivers, based largely on the performance of an Ardente model, had already been drafted by the Admiralty representative, but it was agreed that at the next meeting of the Electro-Acoustics Sub-Committee the Ardente and S.T. & C. designs should be fully discussed. The Electro-Acoustics Sub-Committee should then prepare draft specifications for miniature headphones and also for miniature microphones. At this period the specifications should be confined to (1) physical dimensions (2) impedance and (3) sensitivity. The drafts would be forwarded through the Miniature Components Sub-Committee to the I.S.C. Tech. C. and eventually standardised as inter-service specifications.

Mr. Wigan (S.R.D.E.), who also attended the meeting this morning, said that, after consultation with C.I.E.M.E., he was hopeful of getting the "selected frequency band method", which had been developed at Horsham, adopted for the factory testing of all Ministry of Supply telephone instruments. If the Electro-Acoustics Sub-Committee finally approves this method, it could usefully be introduced more widely by way of the specifications for the miniature microphones and headphones.

An alternative to the small size headphone fitting in a flat earcap is an insert type receiver such as the HS-30 which it has been suggested may be standardised for all American ground forces. Fifty of these are being obtained for field trial by the War Office, but it is doubtful if they will prove acceptable to troops. Medical advice has further stated that insert receivers would have to be made individual issues.

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(Cont'd)

Some members of the Miniature Components Sub-Committee appear to think that a throat microphone would be more acceptable to their respective Services than such a device as a miniature open microphone strapped to the wrist. A single assembly, comprising headphones and a throat microphone mounted in a skeleton helmet, has been suggested.

I have promised that working from the information and designs available, the Electro-Acoustics Sub-Committee should prepare its draft specifications within the next three weeks; otherwise we may be confronted with an interservice specification prepared by a body without the experience ~~of its members~~ in telephone instrument performance and production.

W.S.R.

RESEARCH BRANCH SECRET WAR DIARY

14th May
1943

PROBABILITY CALCULATIONS FOR THE MINISTRY OF HOME SECURITY

A representative of the Ministry of Home Security called today and brought an interesting new problem. At present air raid warnings are given to areas on the assumption that hostile aircraft will continue flying in a straight line. It is now thought likely that the flight will be of a more random nature and the desirability of modifying the warning system accordingly is being considered. The assumption of random flight appears to be justified except where there are only one or two well-defined target areas in the neighbourhood. From the mathematical theory of random flight an indicator was proposed consisting of a family of probability contours along which the risk of attack is equally likely; the probability of a raid developing outside any of these contours can be determined from tables which are to be used with the indicator. The areas to receive the air raid warning are those lying within a limiting contour which can be selected from considerations of the risk which the Minister of Home Security decides is permissible to take. Details of the proposal are now being discussed with the Operational Research Section of Fighter Command.

31st May
1943

SCHEME 145

Further to the Diary entry of 29th April, group and line equipment for operating a 12-circuit system over a submarine cable from *Southbourne* has been completed by R. Branch and shipped to the station concerned. This equipment can either work directly on to a long submarine cable under the same conditions as the equipments at *Dover Castle*, or it can work via a repeater station at *Swanage* to which it is connected by about 12 nauts of submarine cable; equipment for *Swanage* is not yet completed.

Equipment at *Southbourne* differs from that at *Dover Castle* in that channel equipment is not fitted and the group carrier frequency (132 kc/s) is therefore derived from crystal controlled oscillators, supplied by W. Branch, instead of from the channel carrier frequency generating equipment.

POSSIBLE MANUFACTURE OF CHEAP AND SMALL DIRECT RECORDING DISCS BY M.S.S. CO.

In February the M.S.S. Recording Co. was approached by a Mr. Leslie Cardew who proposed to form a company which would record messages spoken by U.S. and Dominion troops in this country on 5" diameter direct-recording discs and transmit them by post to their relatives. Twelve recording machines and a large number of discs were stated to be on their way from the U.S. Cardew wanted a few discs for demonstration purposes and Watts, having been interested/

RESEARCH BRANCH SECRET WAR DIARY

31st May

1943

interested in such discs in pre-war days, agreed to supply as a favour.

Events moved slowly until Cardew received his calling-up papers. He then got into touch with the Director of Army Welfare (Gen. Jardine, 45, Eaton Square), Brig. O'Donnell and Brig. Morgan and arranged a demonstration. These gentlemen were much impressed and stated that machines and discs should be provided to give the service to all British troops overseas.

As it now appeared that up to 200,000 discs would be required per week, there was a danger that supplies to M.I.19, M.I.5, the B.B.C., etc. might be prejudiced and the matter was taken up with Sir Herbert McCreedy who advised the Adjutant General of the difficulties.

Following this, at a demonstration to Sir James Grigg and the Adjutant General, the requirements had come down to 5,000 discs per week for use in base hospitals only.

Since then Major Eric Maschwitz (late B.B.C. Variety Department, now Army Welfare) has been telling Cardew that the only opponent to the scheme is the Post Office and Cardew has asked Watts to produce 100,000 discs by the end of July. Watts, acting on our instructions, is replying that if Cardew will place an order, quoting Ministry of Supply contracts, the question of priorities for the supply of materials and labour will be "taken up" immediately.

3rd June

1943

WORK FOR THE COMBINED SERVICES ORGANISATION

In February last, Major General Sir Hastings Ismay wrote to Sir Stanley Angwin regarding a new and urgent problem for the solution of which he said there was the greatest need of haste. It will be recollected (see Diary entry for 5th June 1942) that ciphering machines, in which each of the five units in a five unit code is taken separately through a chain of commutating devices, are used on some radio telegraph transmissions. Each of these commutating devices, according to its setting, may or may not reverse the direction of the current. The setting of the commutators changes after each letter. A number of machines operating on this principle were constructed and supplied to Bletchley Park last summer. They have been very successfully used.

Deciphering by means of such a machine is straightforward when the initial setting of the commutators is known, but if this setting is not known a very large number of possible settings must be tried. If carried out by hand the preliminary exploration may occupy a period of

weeks/

RESEARCH BRANCH SECRET WAR DIARY3rd June1943

(Cont'd)

weeks before useful information can be obtained. Mathematical analysis of the principles involved has, however, indicated that the possible initial settings to be investigated can be reduced to a manageable number by the comparison of a "message" tape with a "key" tape. In principle the coincidences between message and key tapes must be counted with the two tapes occupying all possible positions relative to one another. The development of a machine for doing this rapidly was the problem which Sir Hastings Ismay had in mind.

A prototype machine, operating on punched tape, scanned by means of photo-electric cells, has been constructed at Dollis Hill. When running at full speed each scanning head on the equipment will look at 2,000 characters per second so that what, with manual examination would have been a laborious task of weeks, is reduced to a matter of a few hours. The outputs from the photo-electric scanning devices are combined in such a way that coincidences can be counted, but as the position of the holes on the punched tapes may wander slightly and the tapes themselves may not remain absolutely in synchronism, the time at which a test is made for coincidence has to be controlled very closely by a pulse of 50 μ s duration. Dr. Wynn-Williams has developed a valve circuit for the initial counting of the coincidences. Final counts are being made on telephone type relays.

As soon as the prototype machine had reached a stage that it appeared likely to work, we were approached by Commander Travis and our assistance sought with regard to the provision of 24 equipments for operational work at the earliest possible date. After discussion it appeared that the construction of these could be carried out most rapidly through the Engineering and Factories Departments of the Post Office. The Foreign Office wrote to the Director of Telecommunications on 16th May asking if he would give authority for this to be done. The urgency behind the requirement is revealed by a slightly earlier letter from Major General Sir Hastings Ismay to Sir Stanley Angwin in which he states that this requirement has been approved by the Chiefs of Staff as a matter of extreme urgency and secrecy and that the Prime Minister has given a personal instruction that it is to have an "extreme priority". Until these equipments are completed a large part of a programme as approved by the Chief of Staffs Committee and one of its most important sides cannot be proceeded with.

The problem was talked over with Mr. Hibberd of the Factories Department on the 17th May and the experimental prototype exhibited. Mr. Hibberd agreed that/

RESEARCH BRANCH SECRET WAR DIARY3rd June1943

(Cont'd)

that the Factories Department could undertake to construct the photo-electric cell amplifier and power panels, iron frameworks carrying several pulleys and standard 19" transmission type racks, two per equipment carrying panels of valves, transformers, relays, etc. The construction of the optical equipment and the means for driving the tapes, together with the final assembly, would be arranged by the Research Branch. Not all of the constructional work will be possible in the Dollis Hill Workshops, but it is anticipated that considerable assistance can be obtained ~~here~~ by sub-contracting a part of it to the M.S.S. Factory at Colnbrook where modern machine tools have been installed.

A tentative programme was arranged with the Factories Department according to which the Research Branch undertakes to supply drawings and details of specific parts of the equipment by definite dates. If these can be kept, it is hoped that the first six equipments will be made available to Bletchley Park within 12 weeks.

Rate Book components, steel panels and materials for the special racks will be supplied by the Factories Department, but the Research Branch will be responsible for ordering and supplying to the Factories Department all non-Rate Book items. A list of these items was prepared and discussed with Mr. Carter (S. Branch) last week and, although some components may be difficult, it is anticipated that, with the priority carried, the majority will be obtained at I.S.C.C. level within the required period. If difficulty is encountered, Sir Stanley Angwin will give personal assistance at Radio Board level.

The difficulty in engineering a job such as this is evident when it is stated that the components for the 24 equipments had to be requisitioned before the prototype machine was properly working. A somewhat anxious period has been passed when it was found necessary to re-design the photo-cell amplifier circuits on account of their instability and re-arrange the power supplies. There is evidence that these teething troubles have now been passed.

RESEARCH BRANCH SECRET WAR DIARY17th June WORK FOR THE WAR OFFICE - W.O. 2263 W/411943

The report by M.I.19, P.W.I.S. and Research Branch on the formation of P.W.I.S. Units to operate in the field at G.H.Q. (Army Group) or A.F.H.Q. level has been adopted by the War Office. Training, both Intelligence and Technical, is being organised and it is anticipated that one or two units will be formed and equipped in the near future.

22nd June DEVELOPMENT OF MINIATURE MICROPHONES AND HEADPHONES1943

Further to the Diary entry of the 4th May, the Electro-Acoustics Sub-Committee of the Ministry of Supply, in co-operation with the Miniature Components Sub-Committee of the I.S.C.C., has prepared Group Test Specifications for small microphones and telephone receivers in which the electrical performance may have to be sacrificed to considerations of weight and size. These specifications detail the mechanical and electrical tests to which the instruments should be subjected and, as they will become Inter-Service specifications, will result in the Inspectorates of all three Services applying the same kind of test for electro-acoustic performance. The electro-acoustic performance to be expected from miniature microphones and receivers of different types will be determined as samples become available in the next few weeks. It is anticipated that the new miniature telephone instruments will be available in sufficient quantities for field trial with the new radio patrol sets in about six weeks' time.

At the end of May I received a letter from one of the telephone contractors pointing out that, whereas they were developing a moving-iron unit as a miniature telephone receiver with an effective frequency characteristic up to 3000 c/s, they were developing the same unit for the R.A.E. but for a specified frequency range up to 4000 c/s. It seemed desirable in the interests of production that these two versions of the same unit should not be perpetuated. Reports of recent American research have suggested that considerable advantage is gained by extension of the effectively transmitted frequency range up to 4000 c/s. On the other hand, their most recently standardised miniature telephone receiver (the HS-30) cuts off below 3000 c/s. A report was therefore prepared by the Research Branch on the effect of the upper cut-off frequency on the articulation efficiency of a speech transmission system. Upward extension of the frequency range can only be achieved at the expense of loss of

sensitivity/

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22nd June

1943

(Cont'd)

sensitivity of microphones and telephone receivers so that, if the amplification available in the system is limited, an optimum cut-off frequency will exist. This was calculated for a variety of conditions of noise and silence. Previously published methods were used but constants re-determined to accord more closely with experimental results. The conclusions of this work were passed forward by the Electro-Acoustics Sub-Committee to the Advisory Council on Scientific Research and Technical Development in the following words:-

"Even when the amplification available in a speech system is not limited, the improvement in articulation efficiency to be gained by extending the transmitted frequency band considerably above 3000 c/s is small. Since this extension must be accompanied by reduced sensitivity of microphones and telephone receivers, it is recommended that telephone instruments for Army use should be designed to transmit up to 3000 c/s. Above this frequency and below 300 c/s the response of the system should fall, but between these figures it should be as constant as possible without sacrifice of efficiency. Radio sets should be designed accordingly.

This recommendation does not apply to communication systems designed specifically for use between locations where the ambient noise exceeds 100-105 phons. In such cases frequencies up to 4000 c/s should be transmitted and uniformity of response of the system becomes of increasing importance."

W.R.

M.S.S. RECORDING COMPANY - W.O. 2300 W/41

During his tour with the royal party in North Africa, the Secretary of State for War gave details of the proposed scheme for recording messages from troops. It was to be limited to sick and wounded. Mr. Watts feels that if the scheme is to be worked he should be given an opportunity of co-operating providing the normal activities of the firm are not affected. He has been instructed to take no action that would commit the Department or the firm in any way.

24th June/

RESEARCH BRANCH SECRET WAR DIARY24th JuneSUBMERGED REPEATER1943

Laying of the first submerged repeater was completed at 9 p.m. today. The repeater is included in the Anglesey-Isle of Man cable at a point about 18.1 nauts from Port Erin and 25.6 nauts from Cemaes Bay. The laying operation was carried out without difficulty by H.M.T.S. Iris though the weather deteriorated badly during the work and was quite rough when the repeater was lowered. The location is almost certainly within ± 0.5 nauts of the nominal position and probably within ± 0.25 nauts. The output level at the repeater was checked and is about 1 db higher than the estimated level.

After laying, the repeater was checked and found O.K. on all valve combinations. Intermodulation in the repeater can be checked by means of special terminal equipment which sends 360 and 420 kc/s and can measure 300 kc/s (2A-B product) down to 90 db below the signal. The repeater passes the band below 228 kc/s freely without amplification and will not affect the first two groups on the cable, now about to be completed. After being under test in situ for about six months it will be available as a unit in the final 4-group scheme between Holyhead and Belfast; a second similar repeater will be laid between I.O.M. and Ireland. (It is preferred to regard the first unit as experimental, to be replaced in the final scheme, but the difficulties of this are recognised.) In the final arrangement, the band below 228 kc/s will be transmitted without amplification in the submerged repeaters from Belfast to Holyhead and will provide 48 channels in this direction; the return channels are provided through the repeaters in the range 312-504 kc/s. Standard super-group equipment will be used. In the event of a repeater failure, the circuits will automatically change over to the present arrangement, giving two groups in each direction.

Full technical details of the repeater will be given later in Research Report No. 11932. The gain of the 3-stage amplifier is 70 db at 504 kc/s and 57 db at 312 kc/s. Each stage consists of three alternative valves (VT.100) and changeover will be made automatic if a valve fails (as determined by failure of the anode current). Equalization is in the feed back circuit and the output level is about -5 db. Power (200 V, 0.63 amps D.C.) is fed to the repeater from Port Erin; control is from/

RESEARCH BRANCH SECRET WAR DIARY

24th June from the opposite end.

1943
(Cont'd) The amplifier proper is suspended in metalastic supports and the whole equipment is contained in an inner brass cylinder 13 ins. dia. and 4 ft. long; this is filled with nitrogen and is watertight (not under pressure). The outer case is $\frac{5}{8}$ " boiler plate and is pressure tested to 800 lbs/sq. in. corresponding to 270 fathoms; the actual depth is about 35 fathoms. The case is "single-ended", i.e., both cables enter at the same end through an open compartment 3 ft. long in which the final splices are made, the armouring being made off at the entrance to this chamber. The pressure chamber is 5 ft. long.

30th June SCHEME 145

1943 Further to the Diary entry of 31st May 1943, the repeater equipment for *Swanage* has now been completed and will shortly be installed; the terminal equipment at *Southbourne* has now been installed.

1st July WORK FOR COMBINED SERVICES ORGANIZATION (Case No. 11951)

1943 The prototype machine to examine punched telegraph tapes by means of photo-electric cells was set up in a laboratory at Dollis Hill before the end of May. As hinted in the Diary entry of June 3rd some trouble was at first experienced with this machine. This was due to instability of the photo-electric cell stages, but was overcome by alteration to the circuits and power supplies. Trouble was then experienced due to tearing of the tape along the line of the sprocket holes after a very few minutes running at speeds considerably below that desired. After a rather anxious period this was completely overcome by trebling the diameter of the driving sprocket wheel and increasing the number of teeth from 10 to 30.

The prototype machine was transported to Bletchley Park on Whit Monday, June 14th. It was associated with the Wynn-Williams high-speed counting rack and tried out on prepared tapes of known counts. After the usual minor teething troubles had been overcome, it was turned over to the operational staff for their use a few days later.

In the meantime Mr. de Grey (acting for Commander Travis who was then in the U.S.A.) had written on June 8th suggesting that, in view of the difficulties we were experiencing, it might be well to wait a little before embarking on production. The difficulties were cleared, but the operational staff at Bletchley then wished to hold up manufacture

of/

RESEARCH BRANCH SECRET WAR DIARY1st July1943

(Cont'd)

of a large number of equipments until all the desirable facilities to be provided had been determined by operational experience. Together with Mr. Morrell I visited Bletchley on June 25th and discussed the situation with Commander Travis. He stressed the need for a number of equipments as quickly as possible and, in view of this, it was decided that the first six, at least, should be similar to the prototype with such alterations as had already been decided upon, or could be agreed by June 30th.

The experience already gained has indicated that the time taken in running a normal test will not be great compared with that necessary to fit new tapes. The tape traversing and photo-electric part of the equipment will therefore be duplicated with respect to the comparator and counting racks. *W.R.*

M.S.S. RECORDING COMPANY

Serious difficulty is being experienced owing to the serious shortage of office staff at the factory. The priority Section has been very successful in securing labour for production work but unless steps can be taken to obtain at least two trained book-keepers at a very early date costing work will have to be suspended. This is very undesirable on account of the large sums of public money involved.

RESEARCH BRANCH SECRET WAR DIARY13th July EQUIPMENT FOR TRAINING RADIO INTERCEPTION OFFICERS IN THE FAR EAST1943

The training provided by the School of Oriental and African Studies at London University with the aid of recording and reproducing apparatus supplied on loan by the Research Branch has proved so successful that the Air Ministry and Admiralty are pressing for a considerable increase in the number of courses which can be held. It has been arranged that a request for both the existing equipment and the necessary new equipment shall be forwarded by the Air Ministry to the Director General.

23rd July POST OFFICE AND SIGNALS CO-ORDINATION COMMITTEE1943

The Branch continues to be interested from time to time in the testing of various varieties of strip cable designed for one of Colonel Evan's simplified line carrier-telephony systems. Various samples of PVC cable have been tested, but in none of them does the surface retain its water repellent property after exposure to a few weeks of sunshine. Fairly heavy rain then increases the leakance and hence the attenuation to a serious extent. This effect can be reduced somewhat by slotting and ribbing the web, but it is still serious enough to restrict the use of the cable.

23rd July SCHEME 1451943

Further to the diary entry of 30th June 1943, the installation at *Swanage* has now been completed. At *Southbourne* the submarine cable is taken inland for about one mile and there is considerable noise induction from the trolley bus system. As a result, the land section is to be replaced by balanced pair cable; this is determined by the requirements of the 1 + 3 circuit system which constitutes the initial circuit provision; tests with the 12 circuit system indicate that this is unlikely to be seriously affected by the noise, even with the repeater at cut out.

27th July SECURITY MEASURES IN FOREIGN OFFICE PREMISES ABROAD1943

Messrs Saffery and Doust were invited to attend a meeting of the Advisory Committee on Foreign Office accommodation abroad, (Chairman - Mr. de Norman,) on July 15th, to give advice on certain security measures.

As a result of the composition of this Committee Mr. Saffery informed the Chairman that he had not been granted a charter to discuss freely the question of safeguarding Embassies against illicit installation of

microphones/

RESEARCH BRANCH SECRET WAR DIARY

27th July microphones by contractors etc. responsible for erecting and equipping
1943 these buildings.

(Cont'd)

In answer to a question by the Chairman, Mr. Doust agreed that a memorandum of certain building aspects of the case could be prepared by the Post Office for the guidance of architects. It was stated by Mr. Ashton-Gwatkin of the Foreign Office that it was absolutely essential to aim at 100% security.

The meeting considered that plans of new buildings should be sent to the Post Office for examination before finally being agreed, assuming of course, the Post Office would raise no objections.

After the meeting Saffery and Doust had a talk with Brigadier Harker (M.I.5) as it was considered desirable to be in a position to discuss this matter more freely. Brigadier Harker fully agreed and took immediate steps through his liaison officer (Mr. Loxley) at the Foreign Office, to arrange a further meeting, which took place on the 27th instant at the Foreign Office.

The following were present:-

W.I. Mallet, Esq.,	}	Foreign Office
F.T.A. Ashton-Gwatkin, Esq., C.B., C.M.G.,		
F.M. Loxley, Esq.,		
Lt. Col. M.E.D. Cumming, M.I.5.		
Mr. G.F. Saffery,	}	G.P.O.
Mr. J.F. Doust.		

Colonel Cumming opened the discussion by saying that as a result of M.I.5's relations with the Post Office on certain technical matters concerning microphones his Director General (Sir David Petrie) considered that it was highly desirable not to give too much publicity to this subject. At the same time he felt that every assistance possible should be given to the Foreign Office with a view to securing a maximum safety at British Embassies. His Department's principle interest was mainly concerned with the safeguarding of technical details, otherwise the offensive side might be placed in jeopardy.

Mr. Mallet said that the Foreign Office were very perturbed as regards the security of certain Embassies.

Ways/

RESEARCH BRANCH SECRET WAR DIARY.27th July SECURITY MEASURES IN FOREIGN OFFICE PREMISES ABROAD (Cont'd)

1943 Ways and means of guarding against enemy agents installing microphones (Cont'd) in our Embassies were discussed. General conclusions arrived at were as follows:-

1. All telephones should be installed by Post Office staff.
2. Post Office should prepare notes for the guidance of Ministry of Works Architects responsible for designing new Embassies.
3. An officer should be appointed in each Embassy whose duty amongst others would be to safeguard as far as possible against illicit installations of microphones.
4. Notes for the guidance of the officer referred to in item 3 would be prepared by the Post Office technical expert.
5. All Embassies should be visited at regular intervals, say six to twelve months by Post Office technical experts.

Mr. Mallet enquired if the Post Office would be prepared to undertake (a) the installation of the telephones, (b) to provide the necessary technical advisors and (c) supplied the notes referred to in items 2 and 4. Mr. Saffery informed Mr. Mallet that whilst he was certain his Department would assist in every way possible a decision of a matter of this sort would naturally have to be given by his Director General. He suggested the whole case should be put forward through Sir Alexander Cadogan to his Director General. It was agreed that this should be done.

Mr. Saffery was then asked if the Post Office could possibly see their way to send a technical expert at a very early date to Russia, Sweden and Turkey. Mr. Doust said he thought this might be arranged provided very rapid transport were available. He pointed out that the technical officers responsible for this work had very heavy commitments at the present time for the Services. Mr. Saffery suggested it would be very desirable if Sir Alexander Cadogan would raise this question as well as the general one when writing to his Director General.

31st July CONSTRUCTION OF UNITS FOR SIMULTANEOUS SPEECH AND MORSE WORKING OVER CERTAIN1943 CIRCUITS

To assist in the location of enemy radio transmitters R.S.S. operates a chain of widely spread interception stations connected together by a
speech/

RESEARCH BRANCH SECRET WAR DIARY31st July 1943 CONSTRUCTION OF UNITS FOR SIMULTANEOUS SPEECH AND MORSE WORKING OVER CERTAIN CIRCUITS (Cont'd)

(Cont'd) speech conference system. Over these circuits signals picked up by one station are broadcast to some or all of the other stations, the whole system being controlled from a central office in Barnet. With the object of speeding up interception and location still further, a morse telegraph broadcast system is required. Captain Leigh of R.S.S. visited the station early in June to discuss this matter. It is proposed to provide the service on a 1-in-1 basis, using a small part of the speech band of the existing telephone circuits. The design of the equipment is now complete and the construction is in hand. Case No. 12038 refers.

31st July 1943 WORK FOR COMBINED SERVICES ORGANIZATIONS

It will not be inappropriate to review the work that has been done under Case No. 11835. Difficulties which then existed were reviewed in the diary entry for the 5th April. In the meantime four high-speed commutators made by Mawdsleys' have been installed at the station at Stanmore. These have been coupled up in pairs to standard three wheel Bombes and put into operation with Post Office valve-sensing equipment. It has been found that the commutators run in a perfectly satisfactory manner at 2,000 r.p.m. but that the speed desired of 3,000 r.p.m. cannot be readily attained on account of brush bounce. No trouble has been experienced with the sensing equipment.

These arrangements have been put into operational service as testing chains and, in fact, the first "Shark" problem was solved satisfactorily by means of one of them. (This is a four-wheel problem in which none of the settings is known.)

The long awaited test of a high speed four-wheel B.T.M. Company's machine with our valve sensing equipment has at last been made. It was found that, provided the machine was in a satisfactory running condition, no trouble at all arose with the sensing. In the meantime, however, it is understood that the B.T.M. Company have made mechanical alterations to their machine so that it will now operate with relay sensing, although with relay sensing it still requires very careful lining up and timing. The four wheel machine has certain advantages over the three wheel machine plus commutator as it provides greater flexibility.

Time/

RESEARCH BRANCH SECRET WAR DIARY

31st July WORK FOR COMBINED SERVICES ORGANIZATIONS (Cont'd)

1943 Time appears opportune for a round table conference for all parties
(Cont'd) concerned to review the situation and this will be pressed with
Commander Travis

To a certain extent it is sensed that the urge has departed
from this general problem.

RESEARCH BRANCH SECRET WAR DIARY23rd AugustPROVISION OF SPECIAL EQUIPMENT FOR 21ST ARMY GROUP1943

A meeting was held today under the Chairmanship of Colonel Rawlinson of M.I.19 at which representatives of C.S.D.I.C. (U.K.) and the Research Branch were present. It was disclosed that listening and recording equipment would be required for P/W. cages at Army Group Headquarters level for the 21st Army Group now forming for operations in Western Europe. The Unit would be part of a P/W. Interrogation Section (P.W.I.S.). The Research Branch will provide suitable huts, listening and recording equipment, power supply equipment and all camouflage, etc. The War Office will provide transport, and technical personnel will be drawn from those at present under Capt. Copping's command at C.S.D.I.C. Capt. Copping will be responsible for the general layout of equipment and for the training of technical personnel. It was stated that the Unit should be equipped and technical training completed by mid-October and that training of the "I." personnel would then commence.

It was anticipated by M.I.19 that the American Army Group which would be associated with the 21st Army would require similar equipment and it was suggested that steps be taken to complete a similar unit for the United States by the end of October.

28th AugustSTRIP CABLE FOR USE WITH SIMPLIFIED CARRIED TELEPHONE SYSTEM1943

Professor Willis Jackson, at the request of the Communications Committee, Ministry of Supply, has made tests on this cable and has confirmed the adverse reports made in the early stages and throughout its development by the Research Branch. Owing to the deterioration of the surface and the accumulation of dirt and water thereon, the cable is subject to very great changes in attenuation with weather conditions. It is now generally admitted that the wet weather attenuation of strip cable is too high, even at 30 kc/s, for any use except as leading-in cable on airlines. The attenuation can only be stabilised by covering the web with sprayed metal, but it is then high. The original Research Branch suggestion of two covered wires spaced two or three inches apart by separators has been put to the Ministry of Supply and the War Office as the best practical solution to the problem of erecting very rapidly a line suitable for H.F. carrier working.

31st August/

RESEARCH BRANCH SECRET WAR DIARY31st August CONSTRUCTION OF SPECIAL MORSE TRANSMISSION APPARATUS1943

Further to the Diary item of 19th March 1943, two models of a transportable automatic high-grade ciphering machine have been made up and satisfactory preliminary trials have been carried out by the Army. The equipment differs from that originally considered. A message is sent in clear from an alphabetical keyboard and each character is automatically ciphered into a combination of two out of a total of five simple morse characters. Each of these morse characters undergoes three stages of substitution. A change is made in at least one substitution stage after each morse character, the sequence of changes being determined by a separate controlling circuit which ensures a very long substitution cycle. The apparatus automatically transmits the appropriate morse characters after substitution and would normally key a radio transmitter. At the receiving end the operator has a keyboard having five keys, one for each morse character used, which are depressed in turn according to the characters received. These are automatically deciphered and the appropriate alphabetical character displayed on a lamp panel in clear.

The substitution cycle can be altered in several ways of different degrees of complexity, simple changes being made every message, and more elaborate changes at less frequent intervals. Further trials are in progress.

In the early stages, the design of the machine proceeded very slowly as questions affecting the efficiency of the cipher were being dealt with by the War Office security authorities with whom the designers had no direct contact. Later it was discovered that the ultimate authority was in fact the Government Communications Centre at Bletchley Park and an officer of the Research Branch engaged on other work for that body was able to discuss outstanding points with them directly. In consequence several simplifications in design were effected and a great deal of time was saved.

The cipher is now considered to be of very high standard and the machines, which consist mainly of automatic telephone components, should have wide application. Research Case No. 11971 refers.

RESEARCH BRANCH SECRET WAR DIARY1st SeptemberGAIRLOCH-STORNAWAY CARRIER SYSTEM1943

12-carrier circuits have been provided over a standard paragutta cable 37.7 nauts in length and a balanced pair land cable 10.6 miles at the Stornaway end. The equipment is identical with that provided for Scheme 145, i.e., it transmits 12-60 kc/s in the direction Gairloch to Stornaway and 72-120 kc/s in the reverse direction. Case No. 11844 refers.

24th SeptemberSCHEME 145 - MOBILE EQUIPMENT1943

The mobile terminal 145C, referred to in the Diary entry for 31st March 1943 has been completed at Studd Street and fully tested at Dollis Hill.

The group equipment made by the Research Branch for other B terminals (145G and 145H) was handed over to Studd Street for installation in the vehicles during August.

27th SeptemberEQUIPMENT FOR KIRKWALL 2. REPEATER STATION1943

Both the Wick-Kirkwall and the Kirkwall-Lerwick carrier systems were originally operated through a temporary building at Kirkwall. The additional equipment required for the permanent building - Kirkwall 2 - was completed by the Research Branch in September 1941 and has been on site since June 1942. It has now been installed and brought into service.

On the Wick-Kirkwall route, most of the equipment at Kirkwall 1 has been transferred to Kirkwall 2, leaving equipment for one group and the 1 + 2 duplex systems only at Kirkwall 1 to be used in the event of Kirkwall 2 being put out of action. Additional equipment has been provided to equip Kirkwall 2 completely, i.e., three 12-circuit groups and two 1 + 2 circuit duplex systems.

On the Kirkwall-Lerwick route a complete new duplicate terminal has been provided at Kirkwall 2, i.e., one 12-circuit group and one 1 + 2 circuit duplex system. Thus Kirkwall 1 is a complete standby for this route. Case Nos. 11312 and 11313 refer.

2nd October/

2nd OctoberWORK FOR COMBINED SERVICES ORGANISATION1943

An interesting discussion took place to-day with Professor Bayly of Toronto University. We first made contact with him at the Government Communications Centre. Previous diary entries make reference to a considerable amount of work done by the Research Branch and of special equipment supplied to the Centre under headings "work for Combined Services Organization". Professor Bayly is concerned with work being carried out in America for the same purpose and is visiting this country for liaison in connection with this particular work.

He was specially interested in T.H. Flowers' development of the machine for comparing two "messages" in 5-unit code. It will be recalled that in the machines now being constructed for this purpose two paper tapes, one punched in accordance with the intercepted message and the other determined by the "pattern" of the cipher system are passed through machines side-by-side and scanned photo-electrically. Coincidences are counted with the two tapes in various relative positions. With this method the speed of working is limited by the difficulties of running two tapes synchronously at speeds exceeding 16 ft. or 2000 characters per second. With Flowers' development the second tape is dispensed with and the pattern generated by electronic commutators which are kept in synchronism by pulses from a photo-cell illuminated through the sprocket holes in the message tape. Electronic commutators, i.e., a ring of gas-filled relays or hard-valves which become conducting in succession

RESEARCH BRANCH SECRET WAR DIARY2nd OctoberWORK FOR COMBINED SERVICES ORGANISATION1943

(Cont'd)

have been known for some time but there have been difficulties in working rings of more than about 5 or 6. In the new development the valves in any one ring are arranged so that the firing of one valve primes the next. The anodes of alternate valves are commoned, as are the grids of the firing circuits, thus in effect producing two rings of "odds" and "evens" which are interlocked. The firing pulses are directed to the "odds" and "evens" rings alternately. Firing of a valve on either ring causes the anode potential of all the valves on the other ring to be depressed so that no valve in this ring can become conducting prematurely, and all previously conducting valves are extinguished. The whole sequence is thus completely under control. With single tape speeds up to 80 ft/sec., the equipment of which the electronic commutator forms a part is capable of making comparisons at the rate of approximately 10,000/sec. Simultaneous testing is also possible and enables even this speed to be multiplied almost indefinitely.

Professor Baily was complimentary and enthusiastic about the above development. He was also interested in our use of ^{controlled} valve arrangements for phase reversing in combiner units. He said that Dollis Hill technique was in advance of what he knew had been done in America.

Professor Baily holds the view that the development of machine methods for carrying out comparisons or mathematical processes at high speed is of great importance as, only if we lead other nations in such techniques, can we rest assured of the secrecy of our own code and cipher systems.

B.R.
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RESEARCH BRANCH SECRET WAR DIARY

12th October
1943

ELECTRO-ACOUSTICS SUB-COMMITTEE. MINISTRY OF SUPPLY

Following a meeting of the above Sub-Committee early in September I wrote semi-officially to Air Commodore H. Leedham, D.C.D., Ministry of Aircraft Production and to Mr. C.S. Wright, D.S.R.E., Admiralty, telling each that Group Test Specifications for miniature microphones and telephone receivers had been finally agreed between representatives of the three Services. I said that it appeared to the Electro-Acoustics Sub-Committee that the methods of testing proposed for the miniature telephone instruments were suited for wider application. Hitherto control over the quality of supplies of such instruments to the R.A.F., Navy and Army has varied considerably and has often been inadequate. I invited their co-operation in the settlement of the final details of the testing equipment proposed for miniature instruments with a view to its possible future use by all Services. This test equipment had been largely developed by S.R.D.E. and was based on the measurement of the integrated response within a limited number of frequency bands, possibly using a simple photo-electric generator of the testing tones.

The suggestion was warmly received by Air Commodore Leedham and a panel has already been set up representative of the Ministry of Supply and the Ministry of Aircraft Production to decide the final details of equipment to be used for acceptance testing of all Army and Air Force microphones and telephone receivers. Unification of testing methods and of specification requirements for Army and Air Force telephone instruments will simplify the task of manufacturers and facilitate production.

The Admiralty is at present seeking the views of all its own Departments concerned with the acceptance and use of microphones and telephone receivers, but it is hoped that they too will collaborate at a later stage.

Mr. E.J. Barnes of this Branch has been invited to become a member of the panel already set up between the Ministries of Supply and Aircraft Production. He is in a sense helping to co-ordinate the work going on in the two Ministries, but it is felt that it is very desirable for the Post Office to be so represented in these discussions because its own methods of acceptance testing, based on the use of the T.I.E.T., compare unfavourably with those proposed for Service instruments. It is considered that the methods for testing and measuring the electro-acoustic performance of microphones and receivers now being worked out for Service instruments should eventually be applied to those bought by the Post Office.

21st October/

RESEARCH BRANCH SECRET WAR DIARY21st OctoberSCHEME 1461943

Further to the Diary entry for 20th February, 1943, the A terminals have now been installed at Dover Castle and tested out. One B terminal is still held crated by S.T. & C., with the channel and group equipment; the other remains at Dollis Hill.

23rd OctoberARMY LADDER LINE1943

Strip cable for use with carrier systems for long-distance Army communications has been definitely proved unsuitable. Rapid surface deterioration of the dielectric gives rise to excessive attenuation under bad weather conditions.

Ladder line consists of two P.V.C. covered 70 lb. cadmium copper wires, which are erected one above the other on bobbins nailed to poles or trees and bound in after about a four-span length has been tensioned. The wires are kept $2\frac{1}{2}$ " apart by spacers, made from the same wire, which are clipped on at intervals of about 10 feet. The spacers are made to grip the upper wire and to carry the lower one in a one-turn spiral through which it runs freely.

A length of $12\frac{1}{2}$ miles of this type of construction was rapidly erected about the end of September by a G.H.Q. Signal Company. It has given no trouble since and measurements show the attenuation to be roughly 50% more than 70 lb. airline in wet or dry weather. On this particular, heavily-wooded, route airline would have been difficult to erect and almost impossible to maintain. A second ladder line pair has been erected on the same poles so that crosstalk can be studied.

28th OctoberFILTERS FOR SPEECH SECRECY SYSTEM1943

The design of a speech secrecy system based on band scrambling and time delay switching has been divided out between several Service establishments including S.R.D.E., R.A.E. and I.S.R.B., and each of the above establishments has in turn consulted R. Branch in respect of filter, compandor and A.V.C. equipment. Filters have been designed and constructed for S.R.D.E. as follows:-

Band-pass, 5900-6700 c/s	-	7
High-pass, 500 c/s	-	13
Low-pass 3100 c/s	-	13

Case No. 12026 refers.

Construction/

RESEARCH BRANCH SECRET WAR DIARY28th October CONSTRUCTION OF SPECIAL MORSE TRANSMISSION APPARATUS1943

(Cont'd)

Further to the Diary entry of 31st August, two models of the automatic high grade ciphering machine for use on radio by Army Signals were constructed during August and underwent field trials during September and October. It will be recollected that the apparatus employs normal telephone switching components and is readily portable but, although this is so, it gives a total cipher cycle of 25^3 characters and this can be easily increased by alteration to a simple plug field. The equipment has been very well received and the War Office now desire 50 to be constructed for extended field trials. The technical and constructional modifications to be incorporated as a result of the first trial were agreed today. Case No. 11971 refers.

29th OctoberSCHEME 1451943

The transportable (12-circuit) B terminal, 145 F, was completed and tested early in this month. This terminal is to be held crated at Dollis Hill complete with full power plant but will shortly be released to the Army for a period for a training course.

The transportable (12-circuit) A terminals, 145 E and 145 J, have just been completed and tested. These are both arranged to be installed at points remote from the channel equipment and derive the group carrier frequency (132 kc/s) from crystal controlled oscillators. The terminals are, therefore, immediately suitable for use at Dover Castle, Southbourne or Dartmouth, but not at Cuckmere which is not connected to the inland 12-channel cable network. It is so arranged, however, that the 132 kc/s oscillators can be removed and replaced by 132 kc/s crystal filters and amplifiers which enable the group carrier frequency to be derived from the channel frequency generator.

Both of these ^Aterminals will be crated and retained at Dollis Hill together with full power plant and H.F. measuring equipment; one terminal, however, will be released to the Army for a training course.

RESEARCH BRANCH SECRET WAR DIARY

8th November EXAMINATION OF THE BRITISH EMBASSY IN MOSCOW FOR THE PRESENCE OF
1943 ILLICIT OVERHEARING EQUIPMENT

This work was undertaken by Mr. J.F. Doust (Assistant Staff Engineer) assisted by Mr. A.J. Forty (Assistant Engineer) for the Foreign Office as a result of a request which arose out of general discussions on the security of Foreign Office buildings abroad (see entry of 27th July 1943).

The embassy had been unoccupied for some eighteen months and had recently been repaired by Russian workmen following air raid damage. It was considered very desirable to examine the building thoroughly before the Moscow Conference. It was estimated that the work would take about two weeks but, in order to secure the necessary visas, it was necessary for the two officers concerned to travel as members of Mr. Eden's delegation to the Conference. This meant that the time available was not sufficient to allow a clear bill of health to be given to any part of the building before the conference had been sitting for some days.

The party left England on October 9th and travelled via Gibraltar to Cairo where a stay of five days was made while the Secretary of State and General Ismay made last minute studies of problems that would arise. From Cairo it was intended to fly straight to Moscow with a stop for breakfast and refuelling at Habanniyeh. The hours of daylight were too few to permit this and a day was spent at Habanniyeh. A second day was lost owing to a defect in the undercarriage of one of the aircraft, and the party arrived in Moscow on October 18th.

Accommodation for the Post Office engineers had been found in the embassy, which reduced the publicity given to their rather peculiar hours. It also enabled them to study the building and its surroundings without attracting too much attention from the embassy servants.

At first sight it appeared that the embassy was a paradise for anyone who wished to instal a microphone. Most of the walls were covered with tapestry behind which almost anything could have been concealed and the whole building was festooned with wires owing to the Russian preference for running a new circuit to finding a fault on an existing one. As a result of a thirty-five year accumulation of faulty bell, telephone and power wiring, there would have been no need to attempt to conceal microphone wiring. In addition, the house was heated by air which was warmed in calorifiers in the basement and led to the rooms above by innumerable ducts in the walls which were mostly between two and three feet thick. Some rooms were supplied with warm air from four different ducts, the outlets being anything up to twenty feet from the floor. Cool air was removed by up

to/

RESEARCH BRANCH SECRET WAR DIARY

8th November to six ventilators in the floor.

1943

(Cont'd)

The tapestry on the walls, coupled with heavy curtains and thick carpets, gave almost every room the reverberation properties of a broadcast studio, while the thickness of the walls and the double windows rendered background noise negligible. Overhearing conditions were perfect.

The first object was to examine the Smoking Room which adjoined the Secretary of State's bedroom and which would be used by him as a sitting room and for private discussions with his expert advisers. This was started during the night of October 18th and about six hours were spent on it apart from about fifteen minutes chat with the Secretary of State in the small hours before he went to bed. The tapestry, which in this room was mounted away from the wall on battens, the complicated panelling, the huge carved fireplace, the ornate chandelier with its sixty lamps and all the ventilating ducts made it impossible, in the time available, to be sure that no microphone had been installed. Indeed, even after a number of visits it was still impossible to be sure of this room.

The next room to be checked was His Excellency's Study on the ground floor, a room approximately 50 ft. by 30 ft. by 25 ft. high. Here the tapestry was laid flat on the plaster but not fixed to it. This room was not so difficult as there was no panelling, and the skirting board was loose and easily removed - it will be even more easily removed in future. Many holes were found in the plaster, but when the tapestry was removed it was found that they were all due to the shoddy workmanship which was in evidence everywhere. The poor workmanship was really an advantage in that any extra damage caused during the search was likely to pass unnoticed. His Excellency's Study was remarkable in that it was the only room in the building which possessed a key - this lack of keys was occasionally very embarrassing, particularly in the case of bath and other rooms.

It soon became evident that, since detailed searches were impossible owing to the numerous Russian servants (provided by the Government and expected to report unusual occurrences), it would be necessary to adopt different methods. The building was therefore considered from the point of view of anyone wishing to instal microphones. Careful consideration showed that the greatest difficulty would lie, as usual, in getting circuits away from the building and

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RESEARCH BRANCH SECRET WAR DIARY

8th November
1943

(Cont'd)

and it seemed that the best plan would be to try and intercept such circuits.

It was evident from a study of the layout of the buildings and the garden that the telephone cable or the apparently disused overhead pairs were the only reasonably possible channels and these were tested very thoroughly. The need for secrecy made the work slow and difficult but the results were fairly conclusive.

After ten days the conclusion reached was that the balance of probability was against the presence of microphones.

The equipment carried consisted of a miniature superheterodyne receiver for detecting and demodulating carriers up to about 400 kc/s. This could also be used as an audio frequency amplifier for testing telephones. A separate oscillator could be used for testing the sensitivity of telephones (on their cradles) to carrier frequencies or, mounted on a sectioned steel pole, it could be used as a sort of mine detector for locating metal objects concealed behind tapestry. Used in this way it was possible to detect a sixpence at a distance of about two inches or a half-crown at about five inches. The performance of this equipment was very good. In addition special combination tools were made and taken. These included specially strong screwdrivers, fine saws, probes and hooks and a folding jemmy which would have aroused the envy of the most experienced burglar. These tools proved invaluable for dismantling electric fittings, removing skirting boards and searching cracks in panelling for concealed wiring.

During the trip much information was gained which will be useful if such examinations become frequent and which will be helpful in providing the advice on security for which the Foreign Office has asked.

11th November
1943

WORK FOR COMBINED SERVICES ORGANISATION

Case No. 11835 (Previous Diary entry 31st July 1943)

The standard 3-wheel Bombes and associated high-speed commutators and valve sensing equipment are being moved from Stanmore to a new station at Eastcote. This is intended to house all the machines of this type, known as "Cobras". The removal has delayed the installation programme to some extent and some further delay is possible on account of the non-delivery of the 3-wheel Bombes by the British Tabulating Company.

On/

RESEARCH BRANCH SECRET WAR DIARY

11th November

1943

(Cont'd)

On account of its impending removal to Eastcote, the high-speed 4-wheel Bombe, "Freemantle", was shut down on the 8th November, having run since 16th July. This brings to an end the experiment for which we pressed in the summer, and which was to run a hybrid set-up consisting of a B.T.M. 4-wheel machine with Post Office valve sensing. The total time for the test was roughly 2700 hours, of which time the machine was serviceable for 75-80%. The faults experienced were relatively few. Included in the unserviceable time was one period, about half way through, during which a minor overhaul was made. The machine now needs servicing; in particular, a few commutators show enough wear to make changing desirable, so that it might be said that the 2700 hours represent the period between main overhauls.

Case No. 11951 (Previous Diary entry 2nd October, 1943)

The first Factory-made 2-tape machine was delivered on site today. The working of this machine reveals certain technical difficulties, the solution of which held up the dispatch of the second machine for some time, but it is anticipated that installation of the first half dozen machines will be completed fairly rapidly.

16th November

1943

VISIT TO LIEUT-COLONEL D. MCMILLAN AT C.S.D.I.C., ALGIERS

On his way home from Moscow, Mr. Doust left the Foreign Office party at Cairo and travelled home via A.F.H.Q. at Algiers. Five days were spent in Birkadem near Algiers in discussions with Lieut-Colonel McMillan on the equipment required in view of the future policy of C.S.D.I.C. (Mediterranean).

Lieut-Colonel McMillan is second-in-command of Combined Services Detailed Interrogation Centres (Med.) and responsible for all the Military Intelligence obtained, (as distinct from Naval and Air), as well as for the technical equipment and staff. C.S.D.I.C. (Med.) comprises static P/W. camps equipped with listening and recording equipment in Algiers, Cairo and Palestine, one semi-static installation at Bari, and two Mobile Units operating with the/

RESEARCH BRANCH SECRET WAR DIARY16th November1943

(Cont'd)

the Armies in Italy. It also supplies, trains and briefs all Intelligence Officers engaged on interrogations in the field.

It is proposed to instal a large static centre in or near Naples at an early date. The existing centre at Algiers will be maintained but at a somewhat reduced level. The new centre at Naples will be equipped experimentally with binaural listening equipment. Tests made during the stay at Birkadem showed that with the type of listener used in the Mediterranean Area, i.e., Palestinians born and reared in Germany and who were mostly shorthand experts, a great gain in efficiency and reduction of strain on the listening staff was likely to be achieved. If successful, this experiment may show a ready means of improving the efficiency of C.S.D.I.C. (India) and C.S.D.I.C. (S.W.P.A.) where the Japanese language is causing much more difficulty than German or Italian.

Detailed discussion of the equipment supplied by the Research Branch revealed many small improvements, principally in arrangement, mounting and packing, which would be appreciated. The performance of the equipment was summed up in paragraph 12 of the Memorandum on the visit as follows:-

"On the whole, the performance of the equipment supplied has been very satisfactory. No significant intelligence has been found to have been lost through failures, and much has been gained which would not have been obtained without the equipment. From the Intelligence point of view the materials and labour expended in the provision of the equipment have shown a handsome dividend. The troubles that have been experienced have generally been breakages during shipment from U.K. due to the abnormally rough handling of stores which prevails under war conditions. Suggestions in regard to this point and certain others are made by Captain Hayward in Appendix II."

New equipment required were (a) huts, similar to those designed for the Mobile Units which will accompany 21st A.G. in Western Europe, and (b) recording and listening apparatus capable of working from 12 V. batteries. The latter apparatus has been designed and supplied for the 21st Army Group units and found satisfactory.

American officers attached to C.S.D.I.C. are very interested in the British equipment which appears to have advantages over proposed American apparatus/

RESEARCH BRANCH SECRET WAR DIARY

16th November apparatus. Arrangements are being made for comparative tests under
1943 active service conditions and it is hoped that the Research Branch
(Cont'd) will be represented at these tests.

The journey from Algiers to London via Marrakech and Prestwick took four days, three of which were spent at Marrakech owing to unfavourable weather conditions.

30th November USE OF EARTHED RETURN CIRCUITS FOR ARMY COMMUNICATIONS

1943

The use of short wave radio for Army communications is limited in mountainous and hilly country due to the screening effect of intervening hills, etc. This has again turned attention to the possibilities of using earth current signalling and at the request of the Signals Officer-in-Chief, 21st Army Group, a field investigation of the coupling between widely separated short earth return circuits has been undertaken in Richmond Park and North Yorkshire. The results showed that the signal voltage picked up in the receive line could be accurately predicted from theory when terminal effects are fully taken into account and the resistivity of the earth in the locality is known to a considerable depth. The latter information could usually be deduced with sufficient accuracy from geological data. In remote districts where disturbance from power systems does not occur, the practical limitation to the distance over which signalling is possible is set by noise picked up in the receive line and similar in many respects to the atmospheric noise on a radio link. The tests show that with apparatus of reasonable size telegraph communication over distances of a few kilometers should be practical. A detailed report is being submitted to the Signal Officer-in-Chief. Research Case No. 12107 refers.

SCHEME 145

Two additional mobile B terminals, 145G and 145H were completed earlier this month and tested. This completes the mobile equipment provided under this scheme, i.e., 1A terminal and 4B terminals. The vehicles are due to be dispersed but two are still at Dollis Hill.

One repeater station suitable for use at QG Guernsey has been completed, together with testing equipment. This repeater station is suitable for working with a full length of submarine cable, i.e., 80 nauts on each side.

INDIA/

RESEARCH BRANCH SECRET WAR DIARY30th NovemberINDIA-CEYLON CABLE EQUIPMENT1943

(Cont'd)

Submarine cable terminations and line transformers constructed by R. Branch for use on the India-Ceylon cable were lost at sea by enemy action. Replacements are in hand. Group modulating equipment is due to be provided for an extension of the number of circuits on this cable; 3-channel open-wire carrier systems (Hedgerow type) are used. Research Case No. 11990 refers.

RESEARCH BRANCH SECRET WAR DIARY

15th December LIFEBOAT BATTERIES (Previous diary entry 6th February 1943)
1943

Laboratory tests show that 12 Varley cells maintained for nine months according to the procedure recommended by the Research Branch to the Ministry of War Transport are in reasonably good condition, but this finding is not generally supported by examination of ~~the~~ ships' batteries. It is possible however that many of the latter are older, and were neglected during early life. Tests on the Exide "self-priming" battery with the acid stored in compartments separate from those containing the plates confirm that it is satisfactory for ordinary temperature work, but it is found to be useless at -13°C . It is probable that the causes of this failure can be removed.

20th December WORK FOR THE MINISTRY OF SUPPLY IN CONNEXION WITH THE SUPPLY OF MATERIALS
1943

(1) Iron Dusts

A development contract has been placed by the Ministry with the Mond Nickel Co., Ltd. for work on production of new grades of iron alloy dusts by the carbonyl process. The dusts are to be suitable for use at both high and low frequencies. A similar development contract is now under discussion with Messrs. Bradley & Foster, Ltd. and work is being started on low frequency dust. Press equipment for making test toroids at Dollis Hill is now working and the technique suitable for this has been developed.

(2) Plastics for cable sheathing

Work continues to determine most suitable grades of P.V.C. sheathings for Army cables. It now seems certain that good flow resistance at $+70$ or even $+50^{\circ}\text{C}$ cannot be combined with good flexibility at temperatures much below freezing. With the plasticisers now available in this country, good frost resistance cannot be combined with good electrical properties. Samples of cable sheathed in GR-S, synthetic rubber, (Buna) are disappointing, particularly in resistance to tropical conditions.

24th December WORK FOR COMBINED SERVICES ORGANISATION

1943 Case No. 11835 (Previous Diary entry 11th November 1943)

Two machines each comprising standard 3-wheel Bombes, high-speed commutators and valve sensing equipment were brought into service at Eastcote during the month. A third equipment is due for completion by the 1st January 1944.

Case/

RESEARCH BRANCH SECRET WAR DIARY20th DecemberCase No. 11951 (Previous Diary entry 11th November 1943)1943

(Cont'd)

The second Factory-made two-tape machine was delivered on site on the 3rd December 1943. The third and fourth machines were made ready for operational work as single units shortly afterwards, but a request was then received for them to be coupled together. Their availability for operation was thus delayed.

Case No. 11767 (Previous Diary entry 5th June 1942)

Due to circumstances beyond British control, an additional facility on the "Tunney" machine described fully in the Diary entry of the 5th June 1942, became urgently necessary on the 22nd December. This meant the design of several circuit elements, construction of panels and their wiring into the equipment, but the work was completed late Xmas Eve, December 24th, 1943.

28th DecemberLOCATION OF BURIED CABLES1943

The I.S.R.B. has enquired whether it was practicable to locate buried telephone cables with any readily portable mine-detector. Both the Polish type - now in general use by the Army - and a magnetic detector which was developed by the E.R.A. for finding unexploded bombs, were tried on a piece of armoured cable buried 27" down in ordinary ground. The indications of the Polish type vary as the sixth power of the distance. This type depends on eddy currents and is not quite good enough in its present form. The indications of the magnetic type vary as the cube of the distance and depend on distortion of the earth's field. The magnetic type will find a typical armoured cable at 36". It is just going into production.

31st DecemberSCHEME 1451943

All the outstanding equipment required under Scheme 145 was completed during December; this included one static B terminal (145D), a second repeater station for, QG, Guernsey and a group inverter bay to enable the submarine cable system to operate into a No. 5 Carrier System on the English side. Total provision under this scheme has been :-

- 1 mobile A terminal (145A)
- 4 mobile B terminals (145B, C, G and H)
- 5 static A terminals:-
 - 2 installed at Dover Castle
 - 1 installed at Southbourne
 - 2 (145E and J) crated

RESEARCH BRANCH SECRET WAR DIARY

31st December
1943

2 static B terminals (145 D and F) crated
3 intermediate repeater stations:-
1 installed at Swanage
2 held for, QG, Guernsey
1 Group inverter bay (held)
miscellaneous transformers and cable terminating equipment.

One training course on this equipment is now nearly completed. Complete channel and group equipment was erected at Euston Exchange by officers and men provided by the Post Office for the ultimate installation. The system was operated over an artificial network simulating the submarine cable. Complete drill has been worked out and the tests were entirely successful. A second training course with different personnel will start shortly and new terminals will be operated with an intermediate repeater station (QG).

SPLIT BAND EQUIPMENT FOR MUSIC TRANSMISSION

With the extension of B.B.C. propaganda services, the provision of music circuits has been greatly expanded. It is still necessary, however, to provide comparatively high grade circuits over speech channels (audio and carrier) having very restricted frequency bands. Equipment has been designed to provide a music circuit having a band-width 50-4000 c/s over two circuits transmitting 300-2400 c/s. The band 300-2400 c/s is transmitted directly over one circuit and the remaining low and high frequency bands are modulated as follows :-

50-300 c/s	modulated with carrier of 625 c/s	(2 x 312.5 c/s)	to
			575-325 c/s
2400-4000 c/s	" " " "	4687.5 c/s	(15 x 312.5 c/s) to
			2287.5-687.5 c/s

Four such systems (transportable on 6 ft. bays) have been completed without synchronizing equipment, which can be added later if required. Two other systems will be supplied complete with synchronizing equipment, which necessitates the transmission of a 2500 c/s (8 x 312.5 c/s) pilot tone on the 2nd channel. Case No. 11696 refers.

3rd January
1944

WORK OF THE ELECTRO-ACOUSTICS SUB-COMMITTEE

After the last meeting of the Sub-Committee I wrote to Air Commodore H. Leedham, D.C.D., Ministry of Aircraft Production and Mr. J. Gray, D.D.S.R.D., Ministry of Supply, pointing out that one of the Telephone Contractors had complained to me that his firm was being asked to supply identical/

RESEARCH BRANCH SECRET WAR DIARY3rd January1944

(Cont'd)

identical electro-magnetic units to the Army and to the R.A.F., but to different specified impedances. As considerable progress had been made with the standardization of designs between the two Ministries, it seemed a pity that obstacles should be put in the way of production by the same design being requested to an unnecessary number of impedance values.

I had brought the matter up before the Communications Committee where it was decided to be not within their terms of reference. Neither did it interest the Inter-Service Components Committees as it has been ruled that telephone instruments are not components. I therefore proposed to Leedham and Gray an ad hoc meeting between the representatives of the two Ministries and the Post Office in order to see if some agreement could not be reached. This meeting took place today and the following recommendations were agreed :-

1. Notwithstanding the fact that in many cases acceptance tests, being based on the response to an input of constant available power from the source of fixed impedance, do not call directly for the transducer to meet a specified impedance value, impedance figures should be nominated to the manufacturer in order to assist him to design to the maximum efficiency.
2. For all new apparatus the nominated impedance per unit, measured at 1000 c/s, should be either 75 or 300 ohms. It is recommended that equipment should be designed to work with transducers of these impedances, but if a much higher impedance is found to be imperative, it should be 8000 ohms measured at 1000 c/s.
3. The impedances quoted in para. 2 are those which would be obtained with the moving system stationary and in its mean position. In most cases they may be measured with the moving system free but, should resonances near 1000 c/s make such measurements misleading, the desired answer can usually be deduced graphically.
4. The mismatching losses due to quite appreciable departures from the ideal impedance value for any transducer are very small and tolerances of + 20% should be admissible on the figures quoted in para. 2. In any case, with practically all designs, mismatch will inevitably occur at most frequencies within the audio range.

These have been communicated officially to the Ministry of Aircraft Production and to the Ministry of Supply and not very much difficulty is anticipated in making them mandatory.

S.R.

RESEARCH BRANCH SECRET WAR DIARY21st January M.S.S. RECORDING COMPANY, LIMITED1944

A letter from the Ministry of Supply states that a requisition will be placed shortly for 1,320,000 disks and 1,000,000 steel cutters for recording equipment being now supplied for Signals use. A very conservative estimate made after consulting the War Office (Sigs. 4) suggests that these will be required at the rate of at least 6000/week.

Recording and reproducing sets for "Squirt Transmission" now being supplied to I.S.R.B. will consume at least 1000 disks/week.

The Admiralty (D.R.E.16c) propose to order about 200 sets of recording equipment for operational and training purposes in connexion with aircraft carriers and fighter pilots. Their estimated consumption is 10,000 disks/week. Halving this as a result of previous experience, and adding to the other requirements shows that a minimum increase in production of some 12,000 disks/week should be catered for to become effective within six months.

The provision of an additional factory has been considered but it ~~now~~ appears that using both sides of the steel centres which are now coming through and making certain modification in the method of production it will be possible to meet the requirements from the existing factories, providing the necessary labour can be supplied.

The Director General has taken up with the Adjutant General the question of the priority of the War Office requirements above, relative to that of the small "Postal Record" disks.

29th January PROVISION OF FULL DUPLEX FACILITIES AT KIRKWALL AND LERWICK OVER THE SINGLE
CORE SUBMARINE CABLE

1944

Installation of the equipment was made over the period 22nd January to date. Case No. 12127 refers.

LINE TESTING SETS

L. Branch asked R. Branch to construct 17 complete testing sets for use at Hedgerow Stations as a matter of great urgency. The work was divided between the laboratory and the Workshop and 12 of the sets have already been supplied on the due dates. It is understood that the maintenance staffs have found the sets easy to use and effective.

30th JANUARY/

RESEARCH BRANCH SECRET WAR DIARY

30th January

WORK FOR COMBINED SERVICES ORGANISATION

1944

Case No. 11835

The third equipment referred to in the Diary entry of 24th December was brought into service on the 7th January. The fourth equipment is nearly ready for service.

Case No. 11951

The third and fourth machines which were supplied for operational work as single units were coupled together with their associated valve, control and counting racks. This double unit enables comparisons to be made between four tapes. It was brought into operation on the 3rd January and has been working satisfactorily.

The fifth two-tape machine, capable of handling extra long tapes, was delivered to the operational station at Bletchley later in the month and commenced working today.

The equipment of the type described in the Diary entry of 2nd October last was taken to Bletchley on January 18th. It will be recollected that this equipment embodies a major development, the comparison being made between a message tape and a pattern set up by an electronic commutator. The equipment comprises, in addition to the tape scanning apparatus, four racks of thermionic switching equipment and two racks of electro-mechanical recording equipment. Cabling and wiring between the racks is now practically complete and it is hoped that a report on the performance of the equipment will be possible next month. With this equipment, a speed of working approximating to 10,000 characters per second should be possible.

Case No. 11767

The additional facility on the "Tunney" machine referred to in the Diary entry of 20th December has now been fitted to all three existing Tunney machines and a fourth machine, with the additional facility, was supplied on the 21st January.

31st January

LIFEBOAT BATTERIES

1944

As a result of discussions and the work carried out by the Research Branch, it has been recommended that a full-scale trial be given to the Exide self-priming cells.

SCHEME

RESEARCH BRANCH SECRET WAR DIARY31st JanuarySCHEME 1611944

(Cont'd)

This scheme provides for submarine cable terminal equipment similar to that provided under Scheme 145 as follows:-

3 static "A" terminals (161 A, B and C)

~~4~~ static "B" terminals (161 D, E, F and G)

1 intermediate repeater station (161 H)

The first pair of terminals 161 A and 161 D were today completed in accordance with the agreed schedule and await shipment.

CONSTRUCTION OF UNITS FOR SIMULTANEOUS SPEECH AND MORSE WORKING OVER CERTAIN CIRCUITS

Further to the Diary entry of 31st July 1943, one circuit between Barnet and each of the following places has now been supplied with equipment and is working:-

Forfar	-	installed in December 1943
Hanslope	-	" " January 1944
Belfast	-	" " " "

RESEARCH BRANCH SECRET WAR DIARY4th February WORK OF THE ELECTRO-ACOUSTICS SUB-COMMITTEE1944

At the meeting held today the report of the Panel considering the standardization of improved acceptance and maintenance testing methods for telephone instruments was approved. This report deals with the work of the Research Branch on a method of standardizing microphones and receivers by a reciprocity test, in which two similar units are coupled acoustically and the ~~electrical~~ E.M.F. produced in one, measured whilst a known current is passed through the other. The units are of the balanced armature type and the scheme is based on work done by Dr. Sutton of Siemens, C.I.E.M.E. and S.R.D.E. The accuracy and limitation of the method have been determined.

With reference to the Diary entry of 3rd January, it is now understood, in addition to the Ministry of Supply and the Ministry of Aircraft Production, the Admiralty has agreed that they will adopt the recommended values of impedance for new designs. All the modern telephone receivers used by the Post Office have an impedance value close to 300 ohms except one which is slightly below, and this one could be brought into line without harmful effect on its performance. The possibility of the Department coming into line with the three Fighting Services is being explored with S. Branch.

16th February ARMY LINES1944

Ladder line which is thought likely to give a more satisfactory performance than strip cable had not been proved in heavy rain. A day of steady rain, however, enabled valuable data to be obtained on experimental sections of this form of construction. Laboratory results with artificial rain were generally confirmed, and it can be stated that the change of attenuation from dry to very wet weather is about 10 db per 100 miles, compared with 4 or 5 db for air-line. A method of construction which is satisfactory mechanically and electrically has been evolved, and ladder line adopted by the War Office under the title of "70 lbs P.V.C. spaced line". Trial lengths are to be erected in the Tropics by the British and U.S. Armies.

After many faults - one due to an American Army cookhouse chimney being sited exactly between the wires - the 100 mile air-line is now under test for crosstalk and other data.

RESEARCH BRANCH SECRET WAR DIARY

19th February SCHEME 161

1944

The second pair of terminals, 161B and 161E, due for completion by February 29th, were completed and crated today.

(See Diary entry for 31st January, 1944.)

26th February LINE TESTING SETS

1944

All the special testing sets requested by L. Branch for use at Hedgerow Stations and referred to in the Diary entry of 29th January, 1944, have now been installed. Two of the five new lines have been tested and proved for carrier working.

28th February M.S.S. RECORDING COMPANY, LTD. - (W.O. 2300N/41)

1944

The order for 1,320,000 disks and 1,000,000 steel cutters mentioned on 21st January has been received.

A number of experimental steel centres have been received and sprayed. The resulting disks have been very satisfactory and will meet the M. of S. requirements and are suitable for any training work such as that for Fighter Pilots, Armoured Fighting Vehicle crews, Naval Gunnery Schools, etc. It is also probable that the B.B.C. can be persuaded to accept the best of them in place of the 12 ins. zinc centre disks they are now using.

The increased number of disks which will have to be dried at Wraysbury will necessitate alterations to the ventilating system in order to prevent damage to the workers' health due to increased concentration of lacquer solvents in the air they are breathing. The Factory Inspector has been pressing for improvement in this direction for some time. He has also been pressing for the removal of the wooden floors on the grounds of fire risk. The increased risk owing to the larger quantities of inflammable liquids, etc., which will have to be handled make it necessary to lay concrete floors covered with dustless, oil resisting, asphalt as at Colnbrook. Additional buildings will be necessary to accommodate the increased staff and extra stocks of material which will be required. The Personnel Department has been advised of the necessity for the above improvements and has asked the Ministry of Works to take the matter up as one of extreme urgency.

The Priority Section, Stores Department, has been advised that 36 additional hands will be required and has made application for them to the Ministry of Labour. The labour position is so

difficult/

RESEARCH BRANCH SECRET WAR DIARY28th FebruaryM.S.S. RECORDING COMPANY, LTD. (Cont'd)1944

difficult in the Staines and Slough Areas and the wastage of the poor quality labour now available is so high that it has been decided to make every effort to mechanise the disk manufacturing processes as fully as is desirable at the earliest possible moment. It is anticipated that 80% of the highest type of labour could then be dispensed with. A full discussion has been held with Messrs. Watts and Cadman (Sovex, Ltd., who knows most of the special problems and designed the conveyor at Colnbrook) and the latter has been asked to prepare a scheme.

A successful machine would probably save £100,000 on the M. of S. orders alone, and it is thought that reasonable expenditure on experimental and pilot plant is well justified since the saving represents economy in skilled man-hours.

29th FebruaryWORK FOR COMBINED SERVICES ORGANISATION1944Case No. 11951

The equipment of the type described in the Diary entry of 2nd October last and which was taken to Bletchley in the latter part of January was ready for operation on February 5th. This machine has been christened "Colossus"; ~~but~~ it is capable of working at approximately 15 times the speed of the two-tape machines besides having greater flexibility and providing additional facilities. For the first week of its operational life the equipment had to be used to determine the enemy wheel patterns for February. This had presented a far more difficult task than usual owing to the characteristics of the matter available. Since February 22nd Colossus has been in full daily operation for 16 hours per day, and, although the operating staff are not yet sufficiently familiar with it to utilize it to the best advantage, it has dealt with eight messages in eleven hours. For the remaining eight hours of its day, Colossus is turned over for the attention of Research Staff who are endeavouring to graft on to it equipment for providing still further facilities.

2nd MarchRADIO COMPONENTS RESEARCH AND DEVELOPMENT COMMITTEE1944

A new Committee has recently been formed under the Operations and Technical Radio Committee to review and co-ordinate research and development required in connexion with components, particularly miniature components, and to ensure that, in the design of such components, full advantage is

taken/

RESEARCH BRANCH SECRET WAR DIARY2nd March1944RADIO COMPONENTS RESEARCH AND DEVELOPMENT COMMITTEE (Cont'd)

taken of contemporary technical knowledge, particularly in respect of materials. Dr. Radley, who is a member of this Committee, has been charged personally with the task of reviewing outstanding requirements in respect of magnetic materials both for iron dust cores and for cores built up of laminations or strip. The task includes the review of present research and development and the application of the work to specific components and the setting up and maintenance of requisite liaison for this purpose with Government Establishments and the Trade.

As regards iron powder a very considerable amount of work has already been done by the Iron Dust Advisory Committee of the Ministry of Supply. Detailed programmes of research work have been agreed between the Technical Sub-Committee of this Advisory Committee and the Mond Nickel Company and Messrs. Bradley & Foster, Darlaston. This work can usefully continue along the agreed lines. In addition, Dr. Radley and Mr. C.E. Richards, Chairman of the Technical Sub-Committee, have visited the Cavendish Laboratory and discussed perplexing problems concerned with the structure and characteristics of carbonyl powder with Sir Lawrence Bragg. It seems likely that the Cavendish Laboratory could give useful assistance in determining the metallurgical characteristics associated with the desired magnetic properties, which assistance would cut out much "hit and miss" work on the part of the Mond Nickel Company. Arrangements are being made for the Cavendish Laboratory to co-operate. The Iron Dust Advisory Committee consider, however, that much of the development work which is in hand may be wasted unless similar work on the improvement of core making technique can take place. At present very little co-operation is being obtained from the core makers, but a high level meeting is being arranged to put the position and their obligations before them.

An ad hoc meeting was held at the Admiralty on the 21st February 1944 to consider outstanding and future performance requirements for magnetic materials used as transformer core laminations. Representatives of three of the Service Experimental Establishments and of the Post Office attended and stated to what extent the materials now available failed to meet present design requirements for pulse and mains types transformers. The difficulties were discussed with representatives of seven manufacturing firms/

RESEARCH BRANCH SECRET WAR DIARY2nd March1944RADIO COMPONENTS RESEARCH AND DEVELOPMENT COMMITTEE (Cont'd)

firms concerned in the production of magnetic laminations or the building of transformers and decisions were reached as to those directions in which further development or research was required. The Chairman of the Modulation Sub-Committee (C.V.D.) was also present and indicated to the meeting the trends of future design of pulse transformers. These, in general, did not imply much more difficulty as regards the magnetic material.

Following the above meeting, the Research Branch has taken on a certain amount of investigation with regard to the methods of insulating laminations and strip. Mr. Halsey has also visited the B.T.H. Company who have developed a simple form of pulse testing equipment. It has been agreed with representatives of the Experimental Establishments that this equipment (the only one developed) should be standardized and manufactured as quickly as possible. Although the equipment in its present form is restricted to the generation of 1 microsecond pulses with 50 c/s recurrence frequency, it represents a very marked advance on the testing gear at present available. The only test of pulse transformers and material which has been applied to the present is the measurement of the loss at 50 c/s!

RESEARCH BRANCH SECRET WAR DIARY

6th March
1944

SEARCH FOR OVERHEARING EQUIPMENT IN THE BRITISH EMBASSIES AT ANKARA,
ISTANBUL AND ALGIERS

At the request of the Foreign Office the Embassies and associated buildings at Ankara and Istanbul in Turkey and at Algiers in North Africa have been examined for the presence of overhearing equipment. In each case the inspection was restricted to those rooms in which confidential matters were likely to be discussed combined with a general search for possible outlets from the premises.

There are three Embassy buildings at Ankara situated in a compound at some distance from the town, with no near neighbours. Of these, the oldest, the Old Chancery, is built of wood: it now houses the Press Section. The other two buildings, the Embassy and the Ambassador's residence, are of modern stone-faced brick construction, and were finished in 1930 and 1939 respectively. In these, the floors are mostly of parquet wood block and the walls and ceilings of hard plaster. There is little likelihood of the presence of microphones unless they were installed during construction - which is unlikely since the building was built by a British subject under British supervision. The Embassy is provided with a British switchboard installed and maintained by British electricians and operated by three Maltese British subjects. Extension telephones are all of British manufacture.

In addition the U.K.C.C. Commercial Building was visited. This is a block of flats nearer the centre of the town, entirely occupied by British personnel whose activities are not entirely commercial. It, too, is of modern construction with plaster walls and ceilings and concrete floors throughout. It is served by an S.T. & C., 10/50, P.A.B.X. with a cordless manual board operated by a Maltese British subject.

The stay at Ankara was enlivened by an early morning earthquake which emphasised the comfort which can be drawn from the knowledge that a hotel is of steel and concrete construction.

The Embassy at Istanbul is in the centre of the suburb of Pera. The site is contained on three sides by roads and on the fourth by the back of adjoining property. The main building is four stories high and measures approximately 160' x 120' x 60' high. It is built round a central palm court which reaches to the roof, and it contains 97 rooms plus a ball-room two stories high: it was constructed of stone-faced brick and was finished in 1844. It will be appreciated that such a combination of age, size and extent renders a comprehensive search in a short time difficult, if not impossible. However, the more important rooms were thoroughly searched, a lengthy job since the building now houses several distinct departments, the actual Embassy staff being small
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RESEARCH BRANCH SECRET WAR DIARYSEARCH FOR OVERHEARING EQUIPMENT IN THE BRITISH EMBASSIES AT ANKARA,ISTANBUL AND ALGIERS (Cont'd)

in number since the seat of Government has moved to Ankara. About half of the ground floor has been isolated from the remainder of the building and is occupied by the Consulate General.

The principal rooms (including His Excellency's Suite) are on the first floor, and are some 18' high. Beneath this floor there is a space of about 2' 6" high and 8' wide. This runs completely round the building under the corridor surrounding the palm court and connects with similar but lesser spaces under the rooms. This space gives excellent opportunity for the installation of illicit equipment, and therefore required particular attention. It contains many conduits for power wiring and troughing for bell wires and, in the time available, it was impossible to test all these, but nothing of a suspicious nature was seen. There is also a roof space above the attics, with a plank walk over the lath and plaster or ceiling-board ceilings. This, too, was inspected without result.

In general, the task of search was eased considerably by the prevalence of hard plaster walls and ceilings.

After consultation it was agreed that the flats of certain members of the staff, whose activities demanded the utmost privacy, should be inspected. For this purpose, departure was delayed for three days during which time five flats were visited, all with negative results.

The Embassy at Algiers shares with the British Minister one floor of A.F.H.Q. Civilian Building. This is of modern construction and has small rooms with tiled floors and plaster walls throughout. These facts, combined with the almost complete absence of internal fittings made inspection relatively simple, and it is regarded as most unlikely that overhearing equipment is present. The telephone system was installed by the Americans with a common switchboard on the ground floor.

The villas occupied by the Ambassador, the Minister and the Counsellor were also visited, and the principal rooms of each were searched. Of these, His Excellency's villa presented the most difficult problem since it is of Arab design with small double stained glass windows set high in the dividing walls, which are in many cases heavily embossed in ornate plaster work. The search here was distinguished by the masterly repair of a crystal chandelier which was damaged through lack of appreciation that a ladder has two ends!

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RESEARCH BRANCH SECRET WAR DIARY

6th March SEARCH FOR OVERHEARING EQUIPMENT IN THE BRITISH EMBASSIES AT ANKARA,
1944 ISTANBUL AND ALGIERS (Cont'd)

The other two houses are of more conventional modern construction; the chief point worthy of record being the presence in both of them of French telephones and associated wiring no longer in use. These instruments were duly removed and with the aid of American signalmen the obsolete wiring at the Minister's villa was recovered.

No evidence of the installation of illicit equipment was discovered at Ankara, Istanbul or Algiers.

16th March ELECTROLYTIC PAPER STRIP FOR ARMY LIGHTWEIGHT TELEWRITER
1944

Owing to difficulty in obtaining electrolytic paper (potassium iodide-starch-glycerine impregnated) with adequate rapid wetting properties for the Army Lightweight Telewriter, a modified specification designed to select suitable base paper has been prepared.

18th March SCHEME 161
1944

The third pair of terminals 161C and 161F, due for completion on March 31st, were completed today and sent to dispersal sites. The repeater station 161 H was completed on March 4th and forwarded to Swanage for installation.

31st March M.S.S. RECORDING COMPANY LIMITED
1944

Two extension buildings designed by the Ministry of Works for erection at Wraysbury have been approved and final drawings are being prepared. One building will contain zinc and steel stores, zinc turning, buffing, polishing and degreasing departments, and a store for finished circles that are ready for spraying. The other building will house the packing department, which is now necessary as a result of large orders for the Ministry of Supply and Admiralty.

A new building for the assembly of recording equipment for the Admiralty and other customers at Colnbrook is under consideration and sketch plans are being prepared by the Ministry of Works. The estimated cost of these buildings are (a) at Wraysbury - £8,000 and (b) at Colnbrook - £5,000.

RECORDING EQUIPMENT FOR THE ADMIRALTY

At a conference at the Admiralty it was stated that 200 sets of recording and playback equipment including high quality microphones and loudspeakers were being ordered immediately. A preliminary order was also being placed for 150,000 double-sided discs and 200,000 cutters. It will be impossible to assemble this equipment in the Research Branch and the Priority Section have been asked to press the Ministry of Labour for 12 extra hands at the Colnbrook and Wraysbury factories of the M.S.S. Recording Company for this purpose.

RESEARCH BRANCH SECRET WAR DIARY31st March SCHEME 1451944

(Cont'd)

In conjunction with L. Branch, tests have been carried out on the 12-circuit system between Portsmouth A.C.H.Q. (Fort Southwick) and the mobile terminal B1 located on the shore at Swanage. The circuits are in 12-channel cables between Fort Southwick and Southbourne where they enter the submarine cable terminal equipment. They pass via the submarine cable to the repeater station at Swanage (the balanced pair land cable at Southbourne has now been laid, see Diary entry for 23rd July, 1943). A short length of submarine cable exists between Swanage R.S. and the shore; this was supplemented by an artificial cable representing 60 nauts to the B1 vehicle.

No difficulty was experienced in setting up the circuits which was carried out in accordance with the lining up schedules provided by the Research Branch. Noise conditions are satisfactory.

Personnel who will be responsible for the setting up of the submarine cable systems took part in this test.

WORK FOR COMBINED SERVICES ORGANISATIONCase No. 12216

It has already been recorded that the machine known as Colossus, originally described in the Diary entry of 2nd October, 1943, was in part-time operation at Bletchley Park at the end of February. Since then it has been released for full-time operational use and recent developments have, it is understood, made its greater facilities and increased working speed (compared with the two-tape machines) exceedingly valuable. These developments have made the early provision of additional machines of the Colossus type essential if operational requirements are to be met, and the Post Office was asked to give the very highest priority both as regards labour and material to their construction in a letter dated 15th March.

The Research Branch has undertaken to supply a second one of these machines to be in operation by June 1st, a third by July 1st and a fourth in August. In order to do this, it has been necessary to reinforce the Research Group concerned by some 30 Workmen accustomed to exchange maintenance or construction. Six of these, who will eventually be transferred to the Government Communications Centre to maintain the equipments, were selected from the list of those nominated by the Regions for early call-up. Another seven have been obtained on loan from the Circuit Laboratory, Tp. Branch. Some half-dozen have been transferred temporarily from other Research Groups and the

remainder/

RESEARCH BRANCH SECRET WAR DIARY31st March1944

(Cont'd)

WORK FOR COMBINED SERVICES ORGANISATION (Cont'd)

remainder have been obtained on loan from the Regions for a period of two or three months. The Staff Branch has given very considerable assistance in making these arrangements. At the same time, in order to accelerate the circuit design work [necessary to provide the further facilities required from these machines as compared with No. 1] an additional Assistant Engineer and Inspector have been brought into the Group. All arrangements possible have been made to provide for such eventualities as enforced absence of key members of the team due to sickness, etc.

S. Branch has given very considerable assistance with regard to obtaining required components, which include such items as twenty thousand resistors and over 5000 valves, and there is not likely to be much delay in getting components for the equipment due to be in operation by June 1st, although it may be difficult to obtain in time an adequate number of high speed relays for the last two machines.

Provision of these equipments will enable a much higher proportion of the intercepted traffic to be dealt with. The possibility of bottlenecks occurring elsewhere in the Government Communications Centre organisation has been reviewed and has resulted in a request that the Research Branch should construct seven deciphering machines of the Tunney type. The first machine of this type which was constructed very hurriedly and installed at Bletchley Park on June 3rd, 1942 was described in the Diary entry of June 5th, 1942. This construction programme is spread over the next four months and there should be no very great difficulty in meeting the requirements.

The maximum possible assistance in all this work is being obtained from the Factories Department; they ^{factories are} ~~are~~ relieving the Dollis Hill workshops largely of such work as the making and drilling of panels. Because of its nature, however, very much of the ^{later} ~~later~~ work must be done in the laboratories at Dollis Hill where it will necessitate the expenditure of about 25,000 man-hours on Construction and 15,000 on testing.

RESEARCH BRANCH SECRET WAR DIARY3rd AprilSCHEME 1611944

The final B terminal, 161G, was completed and forwarded to a dispersal site. This completes all major commitments under this scheme; only a few spare items are outstanding. None of the Scheme 145 or Scheme 161 equipments now remain at Dollis Hill.

20th April12-CHANNEL CARRIER CABLES IN THE LONDON TUBE TUNNELS1944

The last of these cables has now been tested. Crosstalk and noise are satisfactory despite the unusual conditions of jointing and balancing.

WORK FOR GOVERNMENT COMMUNICATIONS CENTRECase No. 12216

Fair satisfaction can be expressed with the progress of the work although about one half the time which had been allowed for possible contingencies has been used up and the programme is about one week behind the best that was hoped for. All the component parts of one "Colussus" have been constructed and most of the racks have been completed and tested sufficiently to ensure that there has been no error in circuit design. Erection and final wiring of the complete equipment at Bletchley Park should commence during the first week in May. This should be completed in about a fortnight which will leave another fortnight for the final testing out and clearing of incidental faults. There is still every reason to hope that the promise that this machine should be in operation by June 1st will be kept.

The size and complexity of the present machine is indicated by the facts that it extends over seven racks and contains 2,400 valves.

Sixty-eight Workmen are now engaged in the laboratory on the construction of these and the "Tunney" machines. In addition to the staff of the Group concerned and workmen who have been temporarily transferred from other Research Groups, they include men earmarked for transfer at a later date to Bletchley Park where they will assist in the maintenance of some of the equipment constructed at Dollis Hill and men obtained on two or three months' loan from various Regions. The latter are in the 20-25 years age group and nominated for release to the Army. Many of them had entered for City and Guilds examinations and their transfer to Dollis Hill and to work involving considerable overtime and night shifts a few weeks before the examinations caused some dissatisfaction. In order to provide study facilities for those who are poorly accommodated in lodgings, the Lecture Theatre is being made available to them on three nights each week. Typical questions

are/

RESEARCH BRANCH SECRET WAR DIARY20th April1944WORK FOR GOVERNMENT COMMUNICATIONS CENTRE (Cont'd)

Senior

are being given to those men desiring examination practice and officers have volunteered to act as tutors. In addition to helping with individual difficulties, they have undertaken to give more general talks on questions where a number of students is weak.

Although considerable help has been obtained from the Post Office Factory, the main burden of the constructional work in connection with these machines has been thrown on our own workshops. It has been found necessary to circulate all Groups to the effect that no further requisitions involving workshop time could be accepted until at least 15th May and that no work would be done on requisitions outstanding until at least the 1st May. It was realised that this would cause delay to other important work but provision was made for proceeding with this in exceptional circumstances. After consultation with representatives of the P.O.E.U., the working hours in the shop were extended to 8 p.m. on week-nights with the elimination of Sunday work. The men have been asked to make a special effort to enable the Station to meet commitments of the very highest priority which the Branch has felt compelled to undertake. They have been promised a substantial reduction in overtime during June with opportunities for taking ~~ample~~ annual leave.

26th April1944BELFAST-HOLYHEAD CARRIER SYSTEM (SCHEME A)

Two 12-circuit carrier systems have been provided between Belfast and Holyhead using single coaxial submarine cables between Cemaes Bay (Anglesey) and Port Erin (Isle of Man) and between Port Erin and Ballyhornan (Co. Down). This has involved the provision by R. Branch of group equipment at Holyhead, Belfast and Dundonald and repeater equipment at Cemaes Bay, Port Erin and Ballyhornan.

In the direction Holyhead to Belfast, 12-channel groups are transmitted in the ranges 12-60 and 60-108 kc/s; in the direction Belfast to Holyhead the corresponding groups are in the ranges 180-228 and 132-180 kc/s respectively. The cable between Cemaes Bay and Port Erin includes the experimental submerged repeater (see Diary entry for 23rd June 1943), but the whole of the present frequency band is passed by the low-pass filter in the non-amplified path.

The attenuation of the submarine cables is such that the minimum permissible receiving level is twice approached at the highest frequencies;

the/

RESEARCH BRANCH SECRET WAR DIARY26th AprilBELFAST-HOLYHEAD CARRIER SYSTEM (SCHEME A) (Cont'd)1944

the noise level is, however, satisfactory. The groups are terminated with channel equipment at Belfast and Dundonald (alternative terminal) but at Holyhead they are assembled as part of a super-group and transmitted via the coaxial cable system to Liverpool. Case Number 11629 refers.

27th AprilCOMMUNICATION SYSTEMS IN ARMoured FIGHTING VEHICLES1944

At a meeting of the Communications Committee of the Ministry of Supply in January last, Brigadier Schonland, A.O.R.G., drew attention to the fact that in the field A.F.V. crews, especially Tank Commanders, had become fatigued and dazed after a period which might extend to 8-10 hours while the A.F.V. was manoeuvring prior to an action. Fighting efficiency was seriously impaired. During this period the crew wore their headsets continuously and had to listen to very loud radio interference in addition to the noise of their own vehicle when it was in motion. Brigadier Schonland said that it had been suggested that both fatigue and deafening were accelerated by high frequency components in the noise. To some extent this suggestion was confirmed by recent American results obtained at Harvard University where it has been found that test crews subjected for prolonged periods to noise corresponding to that in a bomber airplane became selectively deafened to components of high frequency.

The Electro-Acoustics Sub-Committee of the Communications Committee considered these facts at its meeting early in February last. The Sub-Committee thought it well that experiments should be put in hand to confirm, or otherwise, its previous recommendation which had been based upon subjective test results obtained with fresh crews. This recommendation was that communications systems and telephone instruments designed specifically for use between locations where the ambient noise exceeds 105 phons should transmit frequencies up to 4000 c/s and pointed out that with such systems uniformity of response becomes of increasing importance.

In order to obtain information concerning this question, which is considered to be of grave importance because A.F.V's have been lost due to their crews being in a semi-dazed condition, experimental work is being undertaken by the Research Branch. Two crews each of four youths of ages ranging from 16-18 years were assembled and practised in articulation testing. They were then introduced to conditions roughly corresponding as regards noise

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RESEARCH BRANCH SECRET WAR DIARY27th April COMMUNICATION SYSTEMS IN ARMoured FIGHTING VEHICLES (Cont'd)

1944 to those existing in the field. In order to establish these conditions, use is being made of two of the Station air-raid shelter dugouts, a large loud-speaker and a reproducing system operating from a noise record which when supplemented by a mechanical noise generator gave a fairly accurate reproduction of the noise in a moving A.F.V. The test crews wear head-sets connected to a No. 19 set and listen to typical radio noise for a period of eight hours continuously. At intervals the loudspeaker system and mechanical noise generator are operated to introduce ambient noise corresponding to that inside the A.F.V. when travelling. Articulation tests are made over the system at various times in the eight-hour period. The results so far obtained must be regarded as provisional: they indicate that, although severe deafening does take place and may persist for quite a long time, the hearing of high-level signals is not affected. They do not indicate so far that any advantage is likely to be gained by restricting the response of the speech system at the high frequency end, but they do confirm that a very considerable improvement may be found in practice if the audio gain control on the No. 19 set is used intelligently and always kept at the lowest value possible.

At the same time, the co-operation of the Medical Research Council and A.O.R.G. has been sought to determine to what extent continuous loud noise may contribute to a man's loss of fighting efficiency other than by his deafening. Field tests in A.F.V's under controlled conditions are difficult to arrange and, although in practice the effect of noise may only be serious when it is added to that of other discomforts, the possibility of obtaining some additional information from the tests now going on at Dollis Hill is being explored.

In view of the possibility of permanent deafening of the testing crews, the Chief Medical Officer, Dr. Scott, was asked to visit the Station and see the work. This he did today and said that he was satisfied that there was no danger if reasonable opportunity for recovery was allowed between tests.

29th April INDIA-CEYLON CABLE EQUIPMENT

1944 Equipment for the transmission of a second 3-circuit carrier system over a single coaxial submarine cable between Talaimannar (Ceylon) and Rameswaram (India), 28.7 nauts in length, has been constructed. In the initial installation (see Diary entry for 30th November 1943) a 1 + 3 circuit/

RESEARCH BRANCH SECRET WAR DIARY29th AprilINDIA-CEYLON CABLE EQUIPMENT (Cont'd)1944

circuit open wire carrier system (S.O.S.) was transmitted over this submarine cable which was a section in an open wire route between Trichinopoly and Colombo. In the present scheme an additional 3 circuits are provided between Erode and Dambulla by means of an S.O.T. system. For transmission over the submarine cable a group carrier frequency of 68 kc/s is used to translate both frequency bands to suitable positions, 51.1-60 kc/s Ceylon to India and 37.7-47.9 kc/s from India to Ceylon.

The equipment has been planned and constructed to match the S.T.C. repeater equipment with which it operates. Owing to the extreme climatic conditions, a fully tropical finish has been applied. Case No. 11990 refers.

GROUP INVERTER PROVIDED UNDER SCHEME 145

In order to meet an urgent requirement, the group inverter equipment provided under Scheme 145 (see Diary entry for 31st December 1943) was installed at Cardiff to enable a No. 5 Carrier terminal to operate in conjunction with a No. 7 terminal. Case Number 12231 refers.

SCHEME 146

The progress of Scheme 146 has not been noted since the Diary entry of 21st October 1943. The B terminal crated by S.T.C. has been sent to a dispersal site, the other remains at Dollis Hill. One repeater station was installed at Abbots Cliff in a buried Nissen hut on 9th February 1944, the other, which is due to be installed in the cable chamber of St. Margaret's Bay Repeater Station was completed today; it will remain at Dollis Hill for the present.

Two new repeater stations, destined for sites on the French coast, are in hand. Case Nos. 11699 and 12109 refer.

EXAMINATION OF SPECIAL PURPOSE LEAD PIPE

A lead pipe, bound with steel tapes and armoured as a submarine cable, is being constructed for conveying petrol across the Channel. Considerable lengths of pipe of this design and 2 ins. in diameter were made and laid experimentally at various points around the British Isles. A 3 ins. diameter pipe then went into manufacture. Lengths up to 35 miles of this pipe have been completed by a number of firms, one of which is Messrs. Callenders Cable & Construction Co. Ltd. The I. Branch has accepted responsibility for acceptance

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RESEARCH BRANCH SECRET WAR DIARY

29th April

EXAMINATION OF SPECIAL PURPOSE LEAD PIPE

1944

of the pipe which was made under carefully controlled conditions, every length being examined for microstructure and bursting strength. Several months after acceptance, however, one length was found to have developed several longitudinal cracks. This length had been stored under pressure during the winter and had been filled one time, it is believed, with hot water.

The pipe is made of Alloy E (0.25% antimony, 0.4% tin) and the firm concerned is still using the old type of press which splits the lead stream, but in view of the great care that had been taken, it did not seem likely that this should have been the cause of weakness.

The assistance of R. Branch was first sought after the failure. Many samples were cut adjacent to the cracks and examined. These showed crescents of small crystals which persist in the structure along the length of the pipe and, although it seems likely that lead free from this structure could be extruded from the presses used, the structure does cause a reduction in the strength of the lead. When subjected to very slow loading, test pieces broke short with all the phenomena of a creep failure.

Conferences took place at Messrs. Callenders factory on the 12th and 24th April and further work was planned to determine the extent to which the faulty structure can be expected to exist in manufactured lengths. As it is not clear whether cracking, which has so far been associated with one length, has been accelerated by the heating of this length or whether this inherent weakness is likely to endanger the security of the pipe in normal service, it has been decided that at present the firm should be allowed to continue production.

4th May

PICTURE TELEGRAPH SERVICES

1944

In 1941 the Imperial Communications Advisory Committee gave consideration to the radio photo-telegraphic services operated by Messrs. Cable & Wireless, Ltd. In view of the great and growing importance of the rapid transmission of pictures, the Committee pointed out the urgent desirability for the Company to establish photo-telegraphic services at principal points throughout the Empire. The Company then had in London two picture transmitting sets, three receiving sets and one combined transmitting and receiving set. All these were of American or German manufacture, one being

RESEARCH BRANCH SECRET WAR DIARY4th May1944PICTURE TELEGRAPH SERVICES (Cont'd)

a Siemens equipment which had been obtained on loan from the Post Office. Cable & Wireless were, however, unable to find any British firm willing to undertake the design and manufacture of equipment to provide the services which the Advisory Committee considered necessary. They, therefore, approached the Post Office in the early summer of 1943. After some discussion, it was agreed that if the Research Branch would design a picture telegraph trans-receiver meeting their requirements, would construct two prototypes and supply manufacturing drawings and details to the General Electric Company, the latter firm would subsequently manufacture 20 equipments.

The design was started in the summer of 1943 after a study of the equipments already being operated by Cable & Wireless but, as the work had not the high priority of much that was being undertaken in the Research laboratories and workshops, the first prototype machine was not ready for assembly until March 1944. In view of the General Electric Co's undertaking to manufacture, an attempt was made to obtain the co-operation of their engineers during the design stage. The results were disappointing.

A working demonstration of the mechanical details of the first of these prototypes was given to representatives of the General Electric Co. and of Cable & Wireless on the 18th March. Some trouble was then being experienced with "patterning" which Cable & Wireless state is a frequent cause of trouble with most picture equipment. Apart from this they were completely satisfied with the machine. The most stringent test for "patterning" consists in traversing an unmodulated spot of light over the whole surface of the photographic paper. After about a fortnight's work during which various changes were made, of which the most useful appeared to be an alteration in the relative position of two 1 : 1 gear wheels, what was considered a satisfactory absence of pattern was obtained and photographic prints were sent to Cable & Wireless today. It is hoped that they will now ask the General Electric Co. to proceed with the manufacture of the 20 equipments in advance of a complete demonstration of the satisfactoriness of the design which can only result from the transmission of pictures between the two prototypes.

Although the design of the electrical part of the apparatus has not been entirely completed, there is no reason why the General Electric Co. should not proceed with the ordering of the component electrical parts concurrently with their commencement of the work on the mechanical details.

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RESEARCH BRANCH SECRET WAR DIARY4th May PICTURE TELEGRAPH SERVICES (Cont'd)1944

There are two systems of picture transmission in use at present. The first is operated by Cable & Wireless, the Radio Corporation of America and most other administrations; the second is operated only by the American Office of War Information. The two systems differ with regard to the drum speed, index of co-operation and the amount of frequency modulation given to the signals. The first system is fundamentally capable of giving twice the definition, i.e. twice the number of picture elements or grains given by the second system. The equipment designed by the Research Branch will, of course, operate in accordance with the principles of the first system. It has been designed to meet the general requirements of Cable & Wireless for fixed stations. The overall dimensions are 3 ft. 2 ins. x 2 ft. 3 ins. x 4 ft. high and the weight about $3\frac{1}{2}$ cwt. It is a high grade, reliable and static equipment and incorporates all normal testing and monitoring facilities required in adjusting and operating a station.

The Commonwealth Communications Council now meeting in London consider that the need for British picture telegraph equipment has increased rather than diminished following the establishment of services by the American Office of War Information. These services, as previously mentioned, use a system fundamentally differing from that employed everywhere else and make use of portable equipment with few facilities, manufactured by the Times Telephoto Company. Although the definition of the picture is poor, it is adequate for most newspaper reproduction and, fearing the position which may result from the too wide use of Times Telephoto equipments, the Commonwealth Communications Council is exploring the possibility of the manufacture by the General Electric Co. of the 20 equipments being expedited if a high priority is given to the work.

RESEARCH BRANCH SECRET WAR DIARY2nd MayLOCATION OF BURIED CABLES1944

A second demonstration of the E.R.A. mine detector was given to the Lines Branch, members of the Inter-Services Research Bureau and officers of the 21~~st~~ Army Group. The demonstration was successful but it was later decided that, in view of the supply difficulty, the scheme should be abandoned.

15th MayWORK FOR THE WAR OFFICE - W.O. 2263 W/411944

A mobile recording and listening unit for use at American P/W cages comprising special portable steel huts, microphones, amplifiers, recording and reproducing machines has been handed over to the United States Army. The general design and layout was decided by Capt. Copping (transferred to M.I.19 from the Research Branch) in discussion with the American officers who would use the unit. A number of preliminary field exercises were held and have enabled a final design which will also meet the requirements of the 21~~st~~ Army Group to be evolved.

25th MayWORK FOR THE WAR OFFICE - W.O. 2263 W/411944

At a meeting at M.I.5 with Brigadier Harker and Major Pinto, Chief Security Officer to the Dutch Government, the latter asked for listening and recording equipment and technical advice on setting up an establishment similar to those of M.I.5 at Ham Common and Nuffield. Brigadier Harker said that he would like us to give the Dutch Government all the assistance in our power. It was agreed that Major Pinto would collect all the information possible regarding the layout and construction of the Concentration Camp at The Hague which would be his Headquarters, and that he would introduce to the Research Branch a technical officer whose integrity and security could be guaranteed. The Research Branch would give advice as to a suitable layout and the equipment required and would make arrangements for production of the latter.

Major Pinto seemed desirous of fitting listening equipment at a large proportion of the 100 Concentration Camps which he would control and arranging to connect this equipment by telephone line to The Hague for recording purposes. He was advised that this would be impossible with an adequate degree of security and no equipment for such transmission over lines will be supplied.

29th MayARMY LINES AND CABLES1944

The faulty batch of P.V.C. covered wire (for ladder line) which was apparently due to variations in material has brought out the necessity

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RESEARCH BRANCH SECRET WAR DIARY30th MayARMY LINES AND CABLES (Cont'd)1944

(Cont'd)

of thorough testing at works. No more P.V.C. will be available for cables, but sufficient has been allotted for ladder line wire.

The War Office asked for advice on a small light type of cable suitable for use in the Far East on the shores of islands and in sea or fresh water. Both quad and coaxial types were considered, and, in connection with the latter, preliminary crosstalk measurements were made in and alongside the Welsh Harp, using small lead covered cables to simulate the proposed coaxial cables. These tests indicated that crosstalk would not be troublesome if the cables were kept a few yards apart on dry land, but there is very little information regarding cross-talk between coaxial cables of the ordinary submarine type in water or on land. With the co-operation of G.H.Q. (Home Forces) Signal Company, two lengths of paragutta submarine cable have been laid in the Welsh Harp so that some reliable measurements, at low and high frequencies, may be obtained.

31st MayEXAMINATION OF SPECIAL PURPOSE LEAD PIPE1944

This pipe is fully described in the Diary entry for the 29th April 1944. At this time a few cracks had been found in the pipe extruded by Messrs. Callender but it had been decided that the firm should be allowed to continue production. Round about the 16th May many more cracks were found in pipe which had been made by Callenders ^{and gave} giving rise to a serious situation, particularly so as most of the American firms, which are about to manufacture lengths of similar cable, are understood to be using verticle presses of the same type. The Petroleum Warfare Department requested that Mr. C.E. Richards should be allowed to visit the States in order that the firms concerned might be made aware of the possible disabilities of pipe extruded in this way. This request was backed by Sir Donald Banks, Controller-General of Petroleum Warfare and consented to by the Engineer-in-Chief. Mr. Richards left by air for the United States on 27th May.

In the meantime production by Messrs. Callender has been stopped, and both Pirelli and Henleys are supplying pipe to them for armouring. The two latter firms appear to be producing satisfactory lead pipe on modern straight-through presses. In addition S.T. & C. and Johnson &

Phillips/

RESEARCH BRANCH SECRET WAR DIARY31st May EXAMINATION OF SPECIAL PURPOSE LEAD PIPE (Cont'd)

1944
(Cont'd) Phillips, who are also using modern straight-through presses, should be in production within a few days. The latest reports from Glovers indicate that experimental lengths which they have extruded are satisfactory and it should be possible for this firm also to go into production within a week.

Extensive laboratory tests have been made on samples cut from pipe manufactured by Henleys. Although these do not show the desired knife-edge break, a long extension has been invariably obtained and there is every indication that the pipe will stand up to Service requirements.

As a target it has been suggested that a slow burst test should be made on every length of pipe made by any manufacturer before acceptance, the conditions being such that bursting occurs in not less than one hour. The slow burst test has not been developed everywhere and it may be some little time before it can be applied. In the meantime a slow tensile test has been developed as an interim safeguard.

1st June WORK FOR GOVERNMENT COMMUNICATIONS CENTRE

1944 Case No. 12216 - Previous Diary entry 20th April, 1944

As a result of high pressure work on the part of staff engaged on the erection and final testing of the second Colossus machine (the first of the improved type), this was able to undertake two operational jobs on the night of May 30/31. An obscure fault then developed as a result of which the machine gave erratic counts when multiple testing. This gave all concerned much anxiety during May 31st, but it was finally cleared at 5 a.m. this morning, when the machine was turned over for operational use. Between this time and 8 p.m. this evening, Colossus II was running continuously and has very successfully dealt with no less than 20 separate tasks. This is roughly equivalent to a full 24-hour output from all the other machines at present operated by the Group concerned, and has given very great satisfaction to Professor Newman and Commander Travis.

The completion of Colossus II on time has been a particularly fine effort on the part of the team concerned and has only been possible because of ~~the~~ *their* unremitting application to the job. Very high praise is due to the Executive and Assistant Engineers, Dr. Coombs and Messrs. Broadhurst, Saville, Chandler and Tissington who have wrestled with difficult technical problems far into and through the night without thinking of going home. They have by their example given much encouragement and inspiration to the more junior staff.

*There are no pages
246-255 inclusive.*

RESEARCH BRANCH SECRET WAR DIARY1st June WORK FOR GOVERNMENT COMMUNICATIONS CENTRE (Cont'd)1944

A further request has now been received from the Foreign Office that the number of these Colossus machines should be increased to a total of 12, in addition to which 24 Tunney machines will be needed to avoid delay in dealing with traffic at a later stage. The assistance of the Factories Department has been enlisted in order to meet this requirement and, with such assistance, it is hoped that the Colossus machines will be supplied to Bletchley Park at the rate of one per month. The magnitude of the work is indicated by the fact that authorisation has been received for the expenditure of £80,000 upon it.

7th June M.S.S. RECORDING COMPANY1944

Very heavy demands for direct-recording equipment and discs have recently been made by the Fighting Services on Messrs. M.S.S. Recording Co. The disc requirements are tabulated below:-

(a) For Director of Military Intelligence

Discs to be used on special secret work 3,000 per wk.

(b) For Inter-Service Research Bureau

Discs to be used for special secret communications systems for which the equipment will be completed within the next eight weeks 2,000 " "

(c) For Ministry of Supply

Discs to be used by Signals Units, mainly for interception of enemy signals. One quarter of the recording equipment has already been delivered and the remainder will be completed during the next two or three months 12,000 " "

(d) For Admiralty

Discs to be used for training Fighter Pilots in the use of Radio Telephony as a means of guiding them back to Aircraft Carriers at sea, for the training of gunnery control officers and for special operational purposes. The supply of equipment will commence in 8 weeks and be completed in 28 weeks 5,000 " "

(e) For B.B.C.

Discs to be used mainly for the preparation of foreign propaganda broadcasts in collaboration with the Ministry of Information 7,000 " "

(f) For Foreign Government Propaganda Services

Discs to be used by the Belgian, French and Polish Governments for propaganda services from this country, and from stations set up in their own countries as soon as practicable 1,000 " "

(g) For United States Signal Corps

Discs to be used for broadcasts and propaganda work among American troops 1,000 " "

(h)/

RESEARCH BRANCH SECRET WAR DIARY7th June M.S.S. RECORDING COMPANY (Cont'd)1944 (h) For War OfficeDiscs to be used for broadcasting and propaganda
work among British troops1,000 per wk.

TOTAL

32,000 per wk.

To meet these requirements an output of between 30,000 and 40,000 discs per week would be required from August 1944 onward. The present maximum output of the two factories is about 11,000 discs per week, but is liable to be seriously reduced under hot weather conditions.

Some delay has been experienced in securing Treasury authority for the erection of buildings costing £6,300 at Wraysbury and also in securing the lifting of the embargo on all buildings work costing more than £5,000. However, these difficulties have now been overcome and it is anticipated that the construction of the new buildings and re-ventilation of the existing building will commence in about five weeks' time. To produce over 30,000 discs per week, however, using present materials would require the erection of buildings costing at least £29,000 and the installation of plant costing about £5,000. About 60 additional factory hands would be necessary and production would cost £320,000 in a full year.

Experimental work with a view to the mechanisation of disc production has therefore been started and has reached a stage at which it is necessary to construct and test a full-scale machine. Discussions have taken place with Messrs. Sovex, Ltd. of Erith and the firm has been asked to proceed with the design work. As many preliminary experiments as necessary on a large scale will be made, but the first machine will be as flexible as possible in order to permit modifications found necessary in use to be applied. The Director of Telecommunications is being asked at the request of the Contracts Department to authorise placing of a non-competitive contract with Messrs. Sovex to this end.

An extensive programme of mechanisation and necessary improvement of this nature is considered to be in accord with the agreement between the Postmaster General and the M.S.S. Recording Co., but, in view of the magnitude of the expenditure, the Director of Telecommunications has been asked to obtain the approval of the Deputy Director General.

RESEARCH BRANCH SECRET WAR DIARY6th JuneWORK FOR THE WAR OFFICE194417th JunePROVISION OF EQUIPMENT FOR S.H.A.E.F.1944

At the request of Brigadier L.H. Harris, equipment to give special ringing facilities has been supplied to S.H.A.E.F. It will mostly be installed in caravans to be occupied by high ranking officers and will enable the equivalent of CB calling and clearing facilities to be provided on magneto signalling lines.

4th JulyDEAFENING AND FATIGUE DUE TO PROLONGED EXPOSURE TO NOISE IN A.F.V'S1944

The tests carried out at Dollis Hill in order to investigate deafening due to prolonged exposure to loud noise in A.F.V's were described in the Diary entry for the 27th April. These tests have now been concluded and a draft report on them was considered by the Electro-Acoustics Sub-Committee on June 23rd. This report was agreed and presented to the Communications Committee today. It will be recollected that in the tests selected crews wore headgear receivers connected to No. 19 wireless sets for periods of up to eight hours during which time they had to listen to "radio" noise and, at intervals, to ambient "room" noise corresponding to that in a moving A.F.V. ^{Conditions} These have been arbitrary but fairly representative of those in practice. At intervals articulation tests were made over the system to which the wireless set was connected and the hearing loss of each member of the crew was measured after each exposure. Deafening, corresponding to a rise in the threshold level, occurred but did not interfere with the reception of loud signals. The use of a filter to reduce the magnitude of the

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RESEARCH BRANCH SECRET WAR DIARYDEAFENING AND FATIGUE DUE TO PROLONGED EXPOSURE TO NOISE IN A.F.V'S

(Cont'd)

high frequency components in the radio noise and signals was tried and is not recommended, but a simple limiter may be useful. Very considerable reduction of the harmful effects can be obtained by a proper use of the audio gain control. These laboratory tests have not yielded any information regarding fatigue and general loss of fighting efficiency resulting from exposure to the noise.

The work forming the subject of this report was welcomed by the Communications Committee as providing information which had long been desired concerning the optimum level of signals in headgear receivers. Early steps will be taken to implement the recommendations. In order to round off the work, the Research Branch has been asked to provide information indicating the optimum setting of the audio gain control for various noise levels covering all types of A.F.V. moving at different speeds. It has also been asked to provide, for record and test purposes, disc records of the noise in various types of A.F.V.

RESEARCH BRANCH SECRET WAR DIARY8th JulyH.A.I.S. CABLE1944

Mr. C.E. Richards returned today after a six-weeks visit to America. This visit had been undertaken at the request of the Petroleum Warfare Department in order to advise the United States Corps of Engineers and American firms concerning the trouble that had been experienced in this country in connection with the manufacture of H.A.I.S. cable. (This, it will be recollected, is the name for a special pipe made for conveying petrol across the Channel.) Some notes made by Mr. Richards regarding American technique follow as being of interest.

There are four firms at present engaged in this manufacture in the United States:-

General Electric at Schenactady

General Cables at Bayonne, New Jersey

Okonite-Callender at Paterson

Phelps Dodge at Yonkers

The two first named are using 1.5 to 2% tin alloy, and the other the American equivalent to E alloy. The first 20 miles, or so, made by General Cables is in a very dilute tin alloy which they use for normal cable work, which contains approximately 0.07% copper and 0.05 to 0.1% tin. The production of this was stopped as it was considered unlikely that it would withstand the transport and handling. The techniques adopted in the various firms differ quite appreciably and briefly are as follows.

General Electric use a three-part gas sealed kettle and bottom pouring through a Piercy standpipe, which is apparently an improvement on the Hill standpipe introduced by Callenders. During the filling of the press the cylinder is sealed with inert gas and the top is surrounded by a ring burner burning producer gas. This is believed to give an effective curtain and prevent access of oxygen to the lead surface. It is claimed that approximately two inches of the old slug is melted during pouring. The small amount of dross which is formed is skimmed off and there is a dross ring at the top of the press. Although using normal pressures and temperatures, General Electric achieve a very high extrusion rate which is between 20 and 40 ft. a minute for this cable.

General Cables use a sealed kettle and a vacuum press which draws the lead from the bottom of the kettle through a heated duct which passes down through the middle of the ram. This firm believes that the vacuum press

lead/

RESEARCH BRANCH SECRET WAR DIARY8th July H.A.I.S. CABLE (Cont'd)

1944
(Cont'd) lead is an improvement on anything else on the market, but had some trouble with the production of faulty welds when changing over from their original alloy to the 2% tin. By careful control of the process this was subsequently avoided.

Okonite-Callender use standard Callender technique of bottom pouring with a Hill standpipe; their own particular variation is to use sodium refined lead to which they attribute their freedom from serious trouble. One faulty length was inspected and the trouble was found to have been due to the inclusion of a small chip of wood in the metal. Although it cannot be said for certain, it is probable that this was introduced on the end of the standpipe which is passed from one to another and between times was rested for a moment on a wooden stool. The top of this stool was found to be badly worn and splintered. It has now been replaced by a lead-topped stool containing a small steel cup to hold the end of the standpipe.

Phelps Dodge use more or less standard technique with bottom pouring employing a modification of the Hill standpipe. This firm do not seem to use any particular stunts and produce quite good lead without them.

All the lead in use in America contains about 0.04 to 0.07% copper. The standard St. Joe brand contains this naturally, but it is usual, if there is deficiency of copper, to add some and there are frequently disputes between the Cable Companies and the lead suppliers, because the so-called synthetic copper lead is considered less useful than the natural material. The copper makers would like the suppliers to give them a guarantee of the natural copper lead and to mark in some way ingots of synthetic material. The lead suppliers have resisted this. A great deal of the lead in use also contains a fairly high proportion of silver, such as 0.004%. If the silver is not up to this figure Okonite-Callender are in the habit of adding enough to bring it up.

In general rather more care is taken in the American factories to secure clean working conditions and to handle the metal carefully in the presses, than is customary in this country. More labour is available and the ancillary equipment, such as quenching gear, is usually more robustly made than that over here. Very little trouble was encountered in obtaining lead sheathing of an appropriate standard and the tests suggested were well received.

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RESEARCH BRANCH SECRET WAR DIARY8th July H.A.I.S. CABLE1944
(Cont'd)

It was pointed out in one or two instances that they could, with advantage, be made more severe, but this was not practicable as increasing the severity would have increased the time necessary for testing and would have resulted in a big hold up in the Test Department. An incidental point is that the steel tape available in America does not appear to be as good as British tape. In order to meet the British Specification figures, American Steel and ~~Wool~~ Wire Company found it necessary to add 0.7% carbon, whereas British steel is quite satisfactory at 0.35. The high carbon content leads to trouble in spot welding and gives a very springy material which is difficult to lay on snugly. Sharon Steel Corporation have produced an alternative material which contains about 1% ^{Carbon} in order to give it the necessary tensile properties. This seems to lie down rather better than the high carbon steel and it does not cause trouble during spot welding; it is very liable to tear on the taping head and to prevent this, instead of using fully annealed strip, it was necessary to give one pass through the cold rollers.

12th July REDESIGN OF THE "COMPUTER"

1944

The Branch has been asked to investigate the principles to be adopted for a timing control device termed a "computer" for use in 9000 type A.M.E. stations. The function of a 9000 type station is to give direction to path finder aircraft in the vicinity of a target. Two stations are involved in an operation. They are known as "cat" and "mouse" stations. The cat keeps the aircraft on a specified approach course; the mouse gives instruction as to when the target indicators should be released. At both stations the position of the aircraft is indicated as an echo on the trace of a cathode ray tube. The computer takes note of the time when the aircraft passes two points on the line of approach to the target and from the interval between the two inst^{ants}~~ances~~ counts the time at which the signal should be transmitted to the aircraft to release its markers or bombs.

The design of the computer was, it is believed, commenced some two years ago and T.R.E. produced an equipment known as the 52 type. Later S.T. & C. were asked to convert the idea into an all-relay model with certain additional facilities. This they did and 15 were produced and were known as type 53. These computers proved unsatisfactory in service and the Post Office were asked in May last to produce 12 type 52 equipments in a few days. They accomplished this without alteration to the design in any respect. The type 52 computer has, however, proved faulty in service and the Post Office has now been asked to investigate, as a matter of urgency, the whole problem and to suggest the best/

RESEARCH BRANCH SECRET WAR DIARY12th July REDESIGN OF THE "COMPUTER"

1944 best means of providing the necessary signals.

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Preliminary examination by S/AD and the Circuit Laboratory has shown that the T.R.E. design is not based on good engineering practice. A new design has therefore been constructed and is now in the testing stage. On its completion it will represent the best that can be done with an electromechanical timing device. A sufficient number of these is to be constructed to replace the existing computers at a very early date. The Research Branch has also been asked to develop a computer using another technique. An all-valve device is being developed experimentally.

22nd July POST OFFICE AND SIGNALS CO-OPERATION

1944 A German loading pot and short lengths of armoured cable with 1.2 mm aluminium conductors, captured in Normandy, have been examined. Signals needed advice as to jointing these wires, and various methods, depending on what special tools are available, have been recommended. The Germans use Oxy-Propane welding, and when joining aluminium to copper they use a copper-plated aluminium wire, which can be soldered. A reasonably good twisted joint can be made if the aluminium is cleaned with vaseline (or the grease impregnating the paper of the Germany cable) and emery paper.

Failing this a "Nicopress" tool, used by American Signal Units, makes a good joint. Best of all, though rather bulky, is the S.T. & C. electric welder. This welds aluminium to aluminium or copper, which the German method evidently does not.

27th July 12-CHANNEL CARRIER ON 14/40 CABLE

1944 There is a large stock of this lead covered star quad cable and an enquiry has been received from the Engineering War Group as to whether it was suitable for use with mobile 12-channel equipment. The matter has been discussed with L. Branch and has further appeared on the agenda of the Post Office and Signals Co-Ordination Committee. The only difficulty appears to be crosstalk. Measurements at Dollis Hill indicate that far-end crosstalk can be balanced by means of condensers (with perhaps a few resistances) sufficiently to allow of working a 12-channel system on each quad over eight repeater sections averaging 16 miles. Field tests are to be carried ^{cut} on a spare Army cable near Luton. The main difficulty is non-uniformity as cable is made by several firms.

RESEARCH BRANCH SECRET WAR DIARY31st July SELF-PRIMING SECONDARY BATTERIES FOR LIFE BOATS1944

Tests have been completed of the type samples of the batteries Exide referred to in the Diary entry of 31st January, 1944. They have satisfactorily passed the specification tests and give about 60 two-minute discharges of about 8 A at normal temperatures and about 55 similar discharges at -5°C . The batteries show considerable improvement over earlier samples from the same firm. There are signs, however, of some anomalous behaviour under tropical conditions.

RESEARCH BRANCH SECRET WAR DIARY5th AugustSUBMARINE CABLE CIRCUITS TO FRANCE - SCHEMES 145 and 1611944

The first two 12-circuit carrier systems to Northern France have been completed satisfactorily and made available for service. Two submarine cable terminal equipments had been installed at Southbourne (the original installation of 31st May 1943 and terminal 161A) and one repeater station at Swanage, together with the necessary submarine cables between these two points. Field trials on this route, to the mobile B terminal B₁ on the shore at Swanage are referred to in the Diary entry for 31st March 1944. The repeater station 161H, previously stored at Swanage, was subsequently installed at this station.

As soon as essential clearance work had been completed in the vicinity of Cherbourg, two submarine cables were laid between Swanage and Querqueville, a point about 10 miles to the west of Cherbourg. These cables, each about 63 n.m. in length were completed on July 31st; they are known as the Swanage-Querqueville No. 1 and No. 2 (1944) or Anglo-French No. 3 and No. 4 (1944) cables respectively. Meanwhile it had been decided to utilize transportable B terminals 145F and 161D on the French side and these were set up in a building at Querqueville by Messrs. Scowen and Dormer who had been released from R. and L. Branches respectively for this purpose.

The cable attenuation was very close to the expected value and the systems were lined up without difficulty. On the English side the groups were connected directly to the 12-channel network; System No. 1 was terminated at Portsmouth (Fort Southwick QQCD.) and System No. 2 at Whitehall Repeater Station QWHI. On the French side the channel equipment was installed with the submarine cable terminal equipment at Querqueville and the audio circuits were extended 4-wire to Bayeux via Carentan. These extensions were initially very poor and unreliable; their improvement, however, is entirely the concern of L. of C. Signals.

Between the English terminals and Querqueville the systems were entirely satisfactory; the channels were lined up to +4 db (4-wire) and the noise level is very low.

22nd AugustASSISTANCE FROM THE LIBRARY TO THE WAR OFFICE1944

For a long time the Library at Dollis Hill has been giving considerable assistance to the Military Intelligence Section of the War Office responsible for collecting information on telecommunications systems in occupied countries. Mr. Wright, the Librarian, has rendered much useful personal service in this respect.

RESEARCH BRANCH SECRET WAR DIARY22nd AugustASSISTANCE FROM THE LIBRARY TO THE WAR OFFICE (Cont'd)1944

(Cont'd)

A letter has today been received from the Director of Military Intelligence, the War Office, expressing warm appreciation of these services and assuring us that they have been of considerable value to the general war effort.

23rd AugustDEAFENING AND FATIGUE DUE TO PROLONGED EXPOSURE TO NOISE IN A.F.V'S1944

Subsequent to the report by the Electro-Acoustics Sub-Committee of the Communications Committee, referred to in the Diary entry of the 4th July, it was suggested that it would be helpful if some indications could be given of the optimum setting of the audio gain control of the A channel of the No. 19 Wireless Set under various practical conditions. There is some difficulty in doing this, as the level and character of both the ambient air-borne noise and of the electrical interference will vary from vehicle to vehicle and from time to time. Tests have, however, been carried out at Dollis Hill under a wide range of conditions and the results of these, indicating optimum settings, are being presented to the Committees concerned in the form of curves.

28th AugustWICK-KIRKWALL, GROUP 41944

A fourth 12-circuit group has been installed on the two submarine cables between Wick and Kirkwall. These cables previously carried circuits as follows:-

12-circuit Group 1	-	12-60 kc/s (Wick-Kirkwall)
" " 2	-	64-112 kc/s (Aberdeen-Kirkwall)
" " 3	-	112-160 kc/s (Wick-Kirkwall)

1 + 2 circuit systems (duplex) on each cable

The addition of the fourth group completes the circuit carrying capacity of the cables with the present arrangements; the noise level at the highest frequency slightly exceeds the usual Post Office limit for carrier circuits.

Owing to unexpected difficulty with the frequency generating equipment, only six circuits (alternate channels) are available for traffic; the others will become available after some modified equipment has been installed. Case No. 11901 refers.

30th AugustTRAINING OF C.C.M.S. OFFICERS1944

Following contact between the Postmaster General and an officer concerned with the organisation of the Control Commission, Military Section, the Department was asked to give special training to two parties of selected/

RESEARCH BRANCH SECRET WAR DIARY30th August1944

(Cont'd)

TRAINING OF C.C.M.S. OFFICERS (Cont'd)

selected officers from the Royal Corps of Signals. These officers will go into Germany and Austria at an early stage of the military occupation of these countries. Their duties will be to take charge of the civil telecommunication system. After discussion with Colonel R. Rayner, a three-weeks course was arranged for these officers. The course was designed to give them a comprehensive picture of the capabilities and the main characteristics of modern telecommunication plant without going into great technical detail. The first of these courses started on August 21st, but R. Branch is somewhat concerned that, with three or four exceptions, the engineering knowledge of these officers, who are of field rank, and their previous experience with modern telecommunication plant are so slight that they cannot be expected to exercise efficient engineering control over communications plant in a large area. This would be true with the full and willing co-operation of the local technical staffs concerned. The officers are not entitled to expect such co-operation. The attention of the War Office (C.C.M.S.) has been drawn to this with our appreciation that many considerations other than their qualifications as telecommunication engineers will have restricted the selection of the officers.

31st August1944WORK FOR GOVERNMENT COMMUNICATIONS CENTRECase No. 12216 (Previous Diary entry of 1st June 1944)

The third and fourth Colossus machines were handed over for operational work on the 18th July and 20th August respectively. They have since been running satisfactorily. These two machines, together with Nos. 1 and 2, were constructed by the Research Branch. The first of the Factory-made machines, Colossus No. 5, is now being installed in a recently completed building and it is anticipated that it will be ready for use before the middle of September.

Colossus No. 5 was brought to Dollis Hill from the Factory. This was done in order that some initial testing might be carried out at Dollis Hill and in order that it might be brought a stage nearer completion by the addition of wiring and components which could not be undertaken by the Factory staff for security reasons. In view of the possibility of production in the London area being interfered with by some new form of aerial bombardment, it has been decided that subsequent machines should be transported directly from the Factory at Birmingham to Bletchley Park.

The/

RESEARCH BRANCH SECRET WAR DIARY

31st August

WORK FOR GOVERNMENT COMMUNICATIONS CENTRE (Cont'd)

1944
(Cont'd)

The last part of the work at Birmingham will be undertaken by Research staff and the Factories Department has made facilities and working space available for this purpose.

Maintenance staff

A number of young skilled mechanics have been loaned from the Department to the Government Communications Centre to undertake the maintenance of special equipment developed and constructed by the Research Branch. The transfer of these men commenced in April 1942 and, since then, we have released about 36 as apparatus of different types has been developed and installed at the Centre. The first of the men concerned were enlisted in the R.A.F: the others have remained civilians. Of the eight enlisted men, four have been working for some time as part of a much larger team of which all the remainder are still civilians. The team is concerned with the maintenance of equipment which is under civilian control and the technical maintenance is itself supervised by officers of the Research Branch. The position has been very carefully considered between Bletchley Park and Dollis Hill and it has been agreed that it would improve the efficiency of the work if these four men could revert to civilian rank. The Department would then assume full responsibility for their supervision. The Director of Telecommunications at the Air Ministry has been asked if he could make arrangements accordingly.

The maintenance of 5-unit equipment at the ends of the lines between Knockholt and Bletchley has been giving some concern to the Centre. This has resulted in the Department being asked if it could supply 12 trained Teleprinter Mechanics to ensure satisfactory operation of the 5-unit apparatus. This includes an assortment of 5-unit transmitters, distributors, and reperforators of various types both British and American. It has not been possible to make 12 experienced men available but three are being transferred to the Foreign Office immediately and another nine, liable for military service and with good technical qualifications, are being given a Teleprinter course at the Central Training School prior to being transferred.

31st/

RESEARCH BRANCH SECRET WAR DIARY31st August DESIGN OF COMPANDORS FOR S.R.D.E.1944

S.R.D.E. have in hand the design of compandors for radio equipment in tropical climates and the copper oxide rectifiers normally used by the Post Office are unsuitable at high temperatures. R. Branch was requested to make recommendations as to the type of variable impedance elements which should be employed. A considerable amount of work at the basic circuits has been carried out in this connexion and a memorandum has been forwarded to S.R.D.E. Alternative proposals for the use of selenium rectifiers and diodes are put forward together with details of the principles which should be observed in the design of the circuits if optimum stability of performance is to be obtained. Case No. 12179 refers.

RESEARCH BRANCH SECRET WAR DIARY1st September1944USE OF ARMY 14/40 CABLE FOR 12-CHANNEL CARRIER WORKING

Tests on the cable near Luton have been completed. They show that five pairs can be balanced, with condensers only, to the necessary D.E. crosstalk figure for eight repeater sections, but in order to balance seven pairs (one per quad) three element networks are required, necessitating a good deal more work. It appears, however, that this cable could be used for patching a high grade cable and satisfactory crosstalk figures could easily be obtained, though they might fall below the high standard of permanent 12-channel cables.

15th September1944ARMY SELECTIVE CARRIER SYSTEM

Some measurements made at the request of S.R.D.E. have shown this system to have one rather serious defect. Radiation cannot be picked up at distances greater than a mile or so at rightangles to the line but, at the ends, the line acts as a very directional aerial and signals in the 60-400 kc/s range can be picked up at considerable distances.

17th September1944WORK FOR GOVERNMENT COMMUNICATIONS CENTRECase No. 12216

The first Factory-made machine, Colossus No. 5, was brought into service today (see Diary entry for 31st August, 1944).

19th September1944SUBMARINE CABLE CIRCUITS TO FRANCE - SCHEMES 145 AND 161

A third 12-circuit carrier system to Northern France was brought into service by L. Branch over a new polythene cable laid between Cuckmere (Sussex) and a point near Dieppe. This cable is 69.2 n.m. in length with 3000 yds. of H.F. balanced pair cable at Cuckmere. The Static 'A' terminal 161B was used at Cuckmere and the mobile equipment B4 on the French side; the circuits are satisfactory.

20th September1944SECRATYPE

This device is a telegraph cyphering machine which is being designed for S.R.D.E. It uses a photo-electric record on film. Experiments have been completed for the preliminary design and drawings are in hand.

30th September1944FIELD TRIAL OF LADDER LINE

The 30 miles of ladder line erected on the South coast in May

has/

RESEARCH BRANCH SECRET WAR DIARY

30th September FIELD TRIAL OF LADDER LINE (Cont'd)

1944

has remained entirely free of faults (other than downfall due to tanks, etc.). It has been used for some weeks for the carrier system while the open wires were being overhauled.

SCHEME 164

Scheme 164 involves the provision of additional terminal equipments for submarine cables similar to those provided under Schemes 145 and 161 (see Diary entries for 31st December 1943 and 31st January 1944). The requirements are as follows:-

- 1 Static 'A' terminal (164A)
- 2 Static 'B' terminals (164 B and C)
- 2 Intermediate repeater stations (164D and E)
- Miscellaneous equipment (164F)

The first B terminal 164B was completed today and crated prior to dispersal. The A terminal had been completed earlier in the month but was robbed to replace a faulty item at Cuckmere (see Diary entry for 19th September 1944). Case No. 12293 refers.

RADIO COMPONENTS RESEARCH AND DEVELOPMENT COMMITTEE

In the last paragraph in the Diary entry under this heading for 2nd March, 1944, reference is made to the development by the B.T.H. Company of a simple form of pulse testing equipment. This equipment was of a kind likely to meet a very real and urgent requirement in connexion with the development of pulse transformer designs and the investigation of core materials. The Company, however, reported that they were unable to carry the development beyond a bench "lash-up" stage. The Post Office representatives on the Committee therefore undertook the engineering of the development and to arrange for the construction of six equipments with such re-design ^{as} ~~that~~ may be necessary to overcome any difficulties encountered. Completion of these six equipments has been delayed slightly due to firms failing to meet delivery dates for the pulse forming networks but the first three are now under final test in the laboratory and the remainder will be completed shortly. Apart from a prototype which will be retained at Dollis Hill for our own experimental work, the other six equipments will be distributed one each as under:-

T.R.E./

RESEARCH BRANCH SECRET WAR DIARY30th September RADIO COMPONENTS RESEARCH AND DEVELOPMENT COMMITTEE (Cont'd)1944

T.R.E.

T.C.M. Co., Ltd.

A.S.E.

B.T.H. Co., Ltd.

S.T. & C., Ltd.

Magnetic and Electrical Alloys, Ltd.

30th September. CO-ORDINATION OF TECHNICAL SERVICES IN THE TELECOMMUNICATIONS FIELD1944

On the 10th May last the Director of Communications Development, Ministry of Aircraft Production, wrote to the Engineer-in-Chief, stating that "Scientific or instrumental devices to assist in traffic handling have for the past 25 years been dealt with in a somewhat haphazard manner by the Directorate of Signals, Air Ministry, and no technical authority has been requested to watch the interests of the Signals Directorate and to co-ordinate all technical activities in this regard. The Director of Telecommunications felt that this state of affairs should no longer continue, and he proposed that in future the responsibility and all work resulting from it should be entrusted to the D.C.D., M.A.P."

D.C.D. readily concurred in the necessity to entrust direction and co-ordination to a central technical authority, but suggested that such enquiry, investigation and work were primarily the function of the Engineering Department of the G.P.O. Such a proposition was discussed at a meeting between the Engineer-in-Chief and the Deputy Engineer-in-Chief of the G.P.O., the Director of Communications and Development, M.A.P., and the Director of Telecommunications, Air Ministry, together with their technical advisors, on the 1st August, 1944. At this meeting the general proposal was agreed and machinery set up to enable the Post Office to work under the most favourable conditions. The meeting gave further consideration to a programme of work proposed by D.C.D. in connexion with the development of main channel equipment. Certain items, i.e.,

1. Converter from 5-unit teleprinter slip to Wheatstone slip and vice versa
2. Signal shape indicators
 - (a) Warning of an approach of faulty conditions
 - (b) Fault analyser

were selected as subjects for immediate experimental work. The first-mentioned problem has already been tackled by the Research Branch and considerable progress has been made utilising machines at present in production with the minimum of modification and additional apparatus.

Such/

RESEARCH BRANCH SECRET WAR DIARY

30th September

1944CO-ORDINATION OF TECHNICAL SERVICES IN THE TELECOMMUNICATIONS FIELD (Cont'd)

Such additional apparatus as has been required has been made the easier by the experience gained in connexion with the message recorder project.

It was agreed that further items for research, i.e.,

1. High speed terminal equipment
2. Slips twice system
3. Very high speed receivers and terminal apparatus
4. New signalling code
5. Single sideband operation

should be re-considered and examined in greater detail. For this purpose a Technical Initiation Committee was set up and first met on the 9th August. This Committee reported particularly with reference to the specific suggestion from D. of Tels. that the ultimate objective was a very high speed Morse system capable of operating at speeds of from 10 to a theoretical limit of 1000 w.p.m. Admiralty equipment already exists for transmitting short messages from naval craft at very high speeds and in order that the transmission time might not exceed a second or so for security reasons. If this security aspect is not of importance to the Air Ministry, it was pointed out that their requirements could perhaps be more efficiently met by the use of a multi-channel slow speed system. This would avoid difficulties due to distortion of signals when transmitted over a path involving a varying number of reflections, and also eliminate the difficulties of building up the traffic from a number of slow speed operators at the sending end and of breaking it down so that it could be handled at the receiving end. The D. of Tels. has, however, requested the continued investigation of the high speed single channel system and this will be pursued. Some members of the Initiation Committee have also started detailed investigation of the application of the Verdan system to radio teleprinter circuits. The necessity for applying safeguards such as this arises on account of the fact that mutilation of the signals on the radio links is liable to produce an undetectable substitution of one letter for another when teleprinter code is used.

SEARCH/

RESEARCH BRANCH SECRET WAR DIARY30th SeptemberSEARCH FOR OVERHEARING EQUIPMENT IN THE BRITISH EMBASSY AT PARIS1944

Following a request from the Foreign Office an Assistant Engineer has gone to Paris to examine the British Embassy and other premises in Paris to discover whether any overhearing equipment has been installed by the Germans before their departure. He is accompanied by an S.W.I from the L.T.R. who will endeavour to get telephone services restored to the Embassy. The S.W.I. has been engaged on the provision of special facilities for Mr. Saffery and will be able to give any assistance required in the search.

PROVISION OF OVERHEARING EQUIPMENT IN GERMANY DURING MILITARY OCCUPATION

At a meeting at Beaconsfield on the 21st September with Colonel Rawlinson of M.I.19, it was learned that the provision of overhearing equipment to assist in the examination of prisoners during the military occupation of Germany was under consideration. No definite plans have been formed but it appears likely that part of the present organisations at Cockfosters, Latimer and Beaconsfield will be moved into Germany at an early stage of the military occupation. An endeavour will be made to combine military activities with those of the Control Commission and the Secret Service under a central body. The initial purely military installations will be planned as far as possible so that they will serve the other two organisations when the military occupation has been terminated. It is understood that officers from M.I.5 will be responsible for counter espionage work under the Control Commission and an endeavour will be made to co-ordinate their requirements with those of M.I.19 if the single control is not set up by the time that equipment is required for installation. As far as possible equipment will be supplied from existing installations in this country, but this will probably not be possible to a very large extent as questions of transport and security may demand modifications which cannot easily be made.

M.S.S. RECORDING COMPANY - W.O. 2300 W/41

The proposed dipping and drying plant for the manufacture of direct-recording discs appears likely to meet requirements and Messrs. Sovex who are responsible for the design of the equipment have been asked to proceed immediately with construction of the apparatus. The Personnel Department will be asked to provide a suitable building with such air-conditioning/

RESEARCH BRANCH SECRET WAR DIARY

30th September

M.S.S. RECORDING COMPANY - W.O. 2300 W/41

1944

conditioning and ventilating plant as may be necessary to
suit the new equipment. (See Diary entry for 7th June 1944).

RESEARCH BRANCH SECRET WAR DIARY

17th October
1944

SEARCH FOR OVERHEARING EQUIPMENT IN H.M. EMBASSIES AND ASSOCIATED BUILDINGS
AT PARIS AND BRUSSELS

Mr. Forty, Assistant Engineer, returned today from a visit to Paris and Brussels undertaken at the request of the Telecommunications Department (see Diary entry for 30th September). Both of the cities visited had recently been liberated after four years of German occupation and it was possible that the enemy had installed ^{secret} ~~suitable~~ apparatus to be used if and when he should be compelled to evacuate. When the buildings concerned were actually visited, this appeared to be unlikely for the following reasons:-

(a) There is evidence that right to the last the Germans expected to hold France and Belgium. Consequently installations would have been made only for use by the Gestapo in their normal course of duty. Such equipment might have been installed in the outside offices visited, all of which had housed German departments during the occupation. If such were the case it is probable that the apparatus was recovered upon leaving, in common with most of the telephone instruments. Repeated instances of traces of hurried departure argue against the installation of new equipment at so late a stage.

(b) The French and Belgian Embassies were both tended during the occupation by former servants who stayed behind to act as caretakers. According to their statements the Germans did not enter the premises except in each case for a brief tour of inspection. Furthermore, many of the rooms were filled to the ceiling with stored furniture, which would make unobstrusive installation a most difficult operation.

The visits drew attention once again to the difficulties of searching for concealed overhearing equipment in rooms which are highly ornamented, having tapestry covered walls and a miscellaneous assortment of bell and other wiring, much of which is no longer in use.

The Embassy at Paris is an 18th Century building in the Rue Faubourg St. Honore. Several of the main rooms, including H.E's study, are tapestried, while all have high and ornate ceilings. Certainty of search cannot be claimed under such conditions, but no signs of interference have been detected. The telephone service is supplied from two Post Office switchboards installed shortly before the war and connected by ten exchange lines to the town system. This apparatus was restored to service with the co-operation of the P.T.T. There is, in addition, a Siemens Halske

automatic/

RESEARCH BRANCH SECRET WAR DIARY

17th October
1944

SEARCH FOR OVERHEARING EQUIPMENT IN H.M. EMBASSIES AND ASSOCIATED BUILDINGS AT PARIS AND BRUSSELS (Cont'd)

automatic house telephone system with extensions in all the important rooms. This needs detailed examination before it can be regarded as "safe".

The Embassy in Brussels occupies a 19th Century house on a corner site in Rue de Spa. The building is smaller than that in Paris, and the decoration plain in all but three or four rooms. The telephone service is provided by a small switchboard of Belgian manufacture with 13 extensions and originally four exchange lines. At present all fitting and maintenance work is performed by Belgian nationals who are not supervised at their work.

Both in Paris and in Brussels other buildings were examined besides the Embassies. No sign of the presence of overhearing equipment ~~was~~ was detected in any of these.

It may be mentioned that contact was made with the Army Unit responsible for the detection of overhearing equipment in military buildings. As far as could be ascertained, no such apparatus has yet been discovered in France or Belgium.

18th October
1944

CO-ORDINATION OF TECHNICAL SERVICES IN THE TELECOMMUNICATIONS FIELD

Continuing the Diary entry of 30th September, a laboratory model of equipment for converting from teleprinter to Wheatstone slip has been constructed and demonstrated to various officers in the Air Ministry (D. of Tels.), M.A.P. (D.C.D.) and 26 Group. Use is made of an automatic transmitter, P.O. code 1B, Creed code 65, and a morse keyboard perforator, P.O. code 40, Creed code 9. The automatic transmitter accepts teleprinter slip and transmits teleprinter signals at 50 bauds or 66 w.p.m. The translation of the signals indicating any particular letter causes operation of the appropriate one of approximately 40 electro magnets positioned above the keybars of the morse perforator. This is accomplished by means of a circuit containing 45 relays. Relay maintenance is a matter of some difficulty with the R.A.F. and another version is, therefore, being developed using a single relay only but a large number of valves. Two interim models of the equipment using relay conversion are however to be built for field trials and the Air Ministry has undertaken to make the necessary components available to the G.P.O.

Conversion/

RESEARCH BRANCH SECRET WAR DIARY

18th October
1944

CO-ORDINATION OF TECHNICAL SERVICES IN THE TELECOMMUNICATIONS FIELD (Cont'd)

Conversion in the opposite direction, i.e., from Wheatstone to teleprinter slip is more straightforward in that use can be made of a morse printer (P.O. description Printer Creed No. 3, Creed description Model IT Morse Printer) which accepts Wheatstone slip and types the message in alphabetical characters on tape. This involves, however, the development of mechanisms operated from the type head of the printer so that, instead of, or in addition to, the character being printed a pair of contacts is closed. The closing of these contacts controls the operation of one or more of five electro-magnets corresponding to the elements in the five-unit code to be operated. These electro-magnets control directly the five punches of a Teleprinter Keyboard Perforator No. 44 (made in the P.O. Factory). Minor difficulties were encountered due to the necessity for dealing with figure and letter shift signals but these have been overcome. The equipment is still in embryo form, but it should be ready for demonstration by the end of November.

28th October
1944

WORK FOR GOVERNMENT COMMUNICATIONS CENTRECase No. 12216

The second Factory-made machine, Colossus No. 6, was brought into service today.

Case No. 12358

It appears that the type of traffic now being dealt with by the Colossus machines can sometimes be effectively attacked by the application of what is known as a dragging technique. Two machines to be known as "Dragons" have been requested for applying this test. They are wanted very early in the new year in order that the Centre may be in a position to give the maximum assistance possible in the event of a major Spring offensive. It is thought that two such machines constructed at Dollis Hill can be ready respectively in January and February. The amount of circuit development required is comparatively small and the machines themselves are not large. Authority has been obtained for carrying out the work.

It will be necessary to have the telephone relays required (approximately 1000) made in the Post Office Factory, as contractors are unable to supply them in time.

28th October
1944

POST OFFICE AND ARMY SIGNALS CO-ORDINATION COMMITTEE

Disconnection locators have now been turned ^{out} in quantity by the Post Office Factory and a few are being sent to Italy at once in order to locate breaks in American spiral 4 cables. For Post Office ^{use} this instrument will be known under the title Tester SA.9070.

Air/

RESEARCH BRANCH SECRET WAR DIARY28th OctoberPOST OFFICE AND ARMY SIGNALS CO-ORDINATION COMMITTEE (Cont'd)1944

Air-line, with four wires, has been found unsatisfactory in France and Belgium and methods of improving it are being discussed with the War Office. One suggestion is to run two ladder-line pairs on the insulators of a two-wire arm. Ladder line has been used to some extent in France, apparently with success.

30th OctoberDEVELOPMENT OF A PETROL VAPOUR DETECTOR FOR AIRCRAFT CARRIERS1944

At the request of the Admiralty the Research Branch has developed equipment suitable for detecting dangerous concentrations of petrol vapour in aircraft carriers. The general principles of the equipment conform to those of the coal gas detectors developed and installed in the Holborn tube and, in the development of the equipment for the Admiralty, the Research Branch has made use of previous experience. An experimental model has been developed, constructed and recently installed in one of H.M. aircraft carriers.

The apparatus automatically explores 20 separate locations for dangerous amounts of petrol vapour. The detecting elements consist of hot platinum wires on the surface of which petrol air mixtures burn catalytically, thus raising the temperature of the wire and hence its resistance; this change in resistance is utilised to disturb the balance of a Wheatstone bridge and hence operate an alarm. The 20 locations are connected in continuous sequence to the common alarm apparatus by a stepping chain of relays and facilities for the application of a periodical routine test are provided.

In a preliminary sea trial the apparatus has functioned satisfactorily and dangerous local concentrations of vapour were detected on two occasions whilst aircraft were being fuelled.

The life of the best detecting wires so far found (commercial platinum) is 50 - 100 hours and efforts are being made to improve this.

The official views of the Admiralty from the standpoint of maintenance and the provision of further installations are not yet known, but it is already clear that certain modifications of detail are desirable with a view to facilitating maintenance. It is considered by the Research Branch that certain facilities provided should be sacrificed in the interests of simplification.

RESEARCH BRANCH SECRET WAR DIARY10th NovemberIRON DUST ADVISORY COMMITTEE - DEVELOPMENT WORK WITH THE MOND NICKEL CO.1944

A meeting was held today between representatives of the Mond Nickel Company, Ministry of Supply and G.P.O. to discuss the patent terms which would be relevant to the development contract with Mond Nickel Co. for the development of iron and nickel-iron magnetic powders.

With regard to the study of nickel-iron powders, the company thought that application of the Ministry of Supply standard "Free User" clauses might hamper the future development of these powders by the firm, even though they were not in the habit of collecting royalties on their own patents. It was pointed out to the firm that they were engaged in a joint research programme shared at present by the G.P.O. and possibly later by the Cavendish Laboratories, so it would be reasonable to consider any patents which might be taken out as joint property of the Government representatives concerned and the firm's nominees.

Later in the discussion it was confirmed that the firm's main objection was the provision in Clause I of the "Conditions" that the Department could claim that certain inventions possibly arising from this collaboration might be deemed the property of the Department.

It was agreed that the Ministry of Supply would prepare a modified draft of the standard conditions providing for joint patent applications in appropriate cases. The Department would retain "Free User" rights in any patents arising from the collaboration. This draft was to be submitted to the Ministry of Supply, Contracts Branch and the Mond Nickel Co., Ltd.

26th NovemberSCHEMES 145 AND 1611944

Since the Diary entry for 19th September, additional equipment has been brought into service by L. Branch as follows:-

1. From Whitehall (QWHI) via Dover (QDOV)

Abbott's Cliff and Audresselles to Boulogne.

This system operates over 23.5 n.m. of polythene cable with 4.5 miles of balanced pair cable between QDOV and Abbot's Cliff. The 12-channel terminal on the French side is located at Audresselles and is the mobile B2 (145C). Put into service on October 26th, 1944.

2. From Dover (QDOV) via St. Margarets Bay and Sangatte to Calais.

This system operates over 19.5 n.m. of polythene cable with 3.5 miles of balanced pair cable between Dover and St. Margarets Bay. The 12-channel terminal on the French side is located at Sangatte and is the

mobile/

RESEARCH BRANCH SECRET WAR DIARY

26th November

SCHEME 145 AND 161

1944

mobile B.3 (145G). Put into service on November 4th, 1944.

RADIO COMPONENTS RESEARCH AND DEVELOPMENT COMMITTEE

Three sets of pulse testing equipment referred to in the Diary entry for 30th September 1944 were despatched during the month to Messrs. T.C.M., B.T.H. and S.T. & C. The remaining sets are complete but are being held pending the receipt of certain operational instructions from B.T.H. Six additional sets are in hand.

SCHEME 164

The static "A" terminal and the second static "B" terminal are complete at Dollis Hill and await packing.

27th November

EARLY UTILIZATION OF SUBMERGED REPEATERS

1944

The possible early requirements for the provision of circuits to Europe by means of Anglo-Dutch submarine cables have been discussed with the L. Branch. In order to meet these requirements, it is probable that it would be necessary to include a submerged repeater in each of two cables and the Research Branch is proceeding with the experimental development of a two-way repeater to give up to 70 db amplification. With 100 watt transmitting amplifiers, these would give 24 circuits over the probable length of the cable, utilising the frequency bands 12-108 kc/s for transmission in one direction and 132-228 kc/s for transmission in the other.

It is very desirable that, if possible, the new design should get away from the principle of switch valves used in the repeater at present laid in the Irish Sea. Although the development of a long-life valve is being pursued with the General Electric Company, no valve with a guaranteed long life is yet available, nor does it appear that such a valve would be available in this country within the near future. It has been known for some time, however, that the Americans were developing a long-life valve for submerged repeater work and details of this valve have recently been made public by the publication of British Patent Specification No. 564494 granted to the Western Electric Company. As it is probable that quite a number of these valves have by now been manufactured in America, an attempt is being made to obtain a small quantity, and the assistance of the co-ordinating authority in this country, C.V.D., Admiralty, has been sought in this respect.

29th November/

RESEARCH BRANCH SECRET WAR DIARY29th NovemberM.S.S. RECORDING CO., LTD.1944

Sufficient progress has been made by Messrs. Sovex with the design of the disc-dipping plant to enable the main outlines of the necessary building to be decided. Treasury authority for the erection of the building has been sought and the Ministry of Works is preparing plans.

The buildings at Wraysbury have now been completed after a delay of two months owing to the prior labour claims of London bomb damage.

30th NovemberWORK FOR GOVERNMENT COMMUNICATIONS CENTRE1944Case No. 11951

The first of a Mk.II version of a Robinson machine was delivered on November 9th. The Robinson is the two-tape machine which was first described in the Diary entry for the 3rd June 1943. The Mk. II has involved a great deal of entirely new development and a few difficulties have been encountered. The machine is expected to go into operational service by December 6th.

Case No. 11757

A fire occurred in the workshop and spare-parts store at the Government Communications Centre on November 15th. It was started by the accidental breaking of a large bottle of benzene used for cleaning purposes. Prompt action by the Post Office staff saved a considerable amount of portable stores and equipment and limited the fire to the workshop and the end of the machine room adjacent to the workshop. Three, relay, Tunney machines were damaged by heat and water, but these were the only operational machines involved. Service was restored in two hours by adapting spare, uniselectors, Tunney machines to do the work. No. 3 relay Tunney machine which had only been delivered two days earlier was least damaged and was brought into service on the 18th November. Nos. 1 and 2 relay Tunney machines have been re-conditioned, including the replacement of some panels and are now almost ready for service.

INTERCEPTION OF BERLIN-TOKIO PICTURE TRANSMISSIONS

A letter has been received from the Foreign Office appreciative of the assistance given by the Research and Radio Branches in the interception of the Berlin-Tokio picture transmissions. This assistance has included help on the operational side and technical advice regarding the adaptation of available equipment for the task in hand. The position has now been

reached/

RESEARCH BRANCH SECRET WAR DIARY

30th November

INTERCEPTION OF BERLIN-TOKIO PICTURE TRANSMISSIONS

1944

reached when the Foreign Office are able to undertake the work themselves.

The first of a series of 12.11.44 version of a German machine was received on November 28th. The machine is the first of a series of machines which are described in the diary entry for the 28th June 1944. The machine is a 12.11.44 version of a machine which is described in the diary entry for the 28th June 1944. The machine is a 12.11.44 version of a machine which is described in the diary entry for the 28th June 1944.

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(continued)

RESEARCH BRANCH SECRET WAR DIARY13th DecemberAUTOMATIC RECORDING AND ANALYSIS OF RADAR DATA1944

Following an unofficial contact between an officer in the Ministry of Supply (who before the war had been in the Engineering Department and, early in his career, a member of the Research Branch) and Dollis Hill, the General Post Office was approached officially by the Director General of Artillery in May last with a request for assistance in the development of a high-speed data recorder and analyser for use in the perfection of anti-aircraft weapons. The development was not an immediate operational requirement but a recorder and analyser of the nature envisaged was considered by the Ministry of Supply to be essential before any further development in Radar tracking devices could take place. The Ministry pointed out that the most successful Radar equipment used for gunnery direction was of American origin ^{and} ~~which~~ owed much of its development to assistance which the American Army had had from the Bell Telephone Laboratories. They therefore especially wish to undertake this development in co-operation with the Post Office Research Station.

In principle the equipment consists of two cine-theodolites by means of which the target aircraft is located correctly in space, the departure of the photograph of the aircraft from the central position in the field of the cine pictures enabling corrections to be made for error in training of the theodolite telescopes. The location of the aircraft as determined from the corrected angular bearings and elevation of the theodolites is compared continuously with that indicated by the Radar equipment under test. This comparison enables both constant and periodic errors of the Radar equipment to be determined. In course of making these comparisons the equipment should, preferably, be capable of translating the location of the aircraft into rectangular space co-ordinates.

It was pointed out in May last to the Ministry of Supply that the Groups which would be concerned with this development were then so heavily loaded with work of immediate operational importance (the work of the Signalling Group for the Foreign Office) that it was impossible for them to undertake any experimental work until the late Autumn. The position shows prospects of easing slightly and the whole project was reviewed

today/

RESEARCH BRANCH SECRET WAR DIARY

13th December

AUTOMATIC RECORDING AND ANALYSIS OF RADAR DATA (Cont'd)

1944

today with the Ministry of Supply at R.R.D.E., Malvern. It is thought that automatic data recording and analysing equipment having the required degree of accuracy could be fairly readily constructed making use of techniques which have been developed by the Signalling Groups during the past two years.

The estimated cost to the Department of the development and construction of a prototype is of the order of £10,000, and it is anticipated that this prototype will be ready by about the end of 1945. Although the equipment cannot be ready before the date at which it is hoped the European war will end, the Ministry of Supply are still extremely anxious that its development should be carried as far as possible before that time.

19th December

M.S.S. RECORDING COMPANY, LIMITED

1944

A meeting was held at Abell House, Ministry of Works, in order to discuss the final form and lay-out of the proposed building for housing the disc dipping plant which is at present being constructed. Details of finish and ventilation were also settled and it is thought that suitable accommodation for a solvent recovery plant has been provided. Recovery of solvents becomes very important when production of discs on a large scale is undertaken. On the assumption that solvent recovery equipment will cost approximately £5,000 and have a life of 5 years, it is estimated that it will effect a saving of at least £4,000 per annum with only one dipping machine in use. The building for the solvent recovery plant will be designed to house two machines. If these are brought into use the saving will be more than double.

29th December

CO-ORDINATION OF TECHNICAL SERVICES IN THE TELECOMMUNICATIONS FIELD

1944

The two models of the equipment for converting from teleprinter to Wheatstone slip, using relays for the identification of the letters, as described in the Diary entry of the 18th October were installed in the Air Ministry building, Whitehall, on the 14th December. After experimental working during which a few minor difficulties emerged and modifications were made, they were put into traffic today.

31st December

WORK FOR GOVERNMENT COMMUNICATIONS CENTRE

1944

Case No. 12216

A "converging" unit has been added to the third Factory-made machine,
Colossus/

RESEARCH BRANCH SECRET WAR DIARY

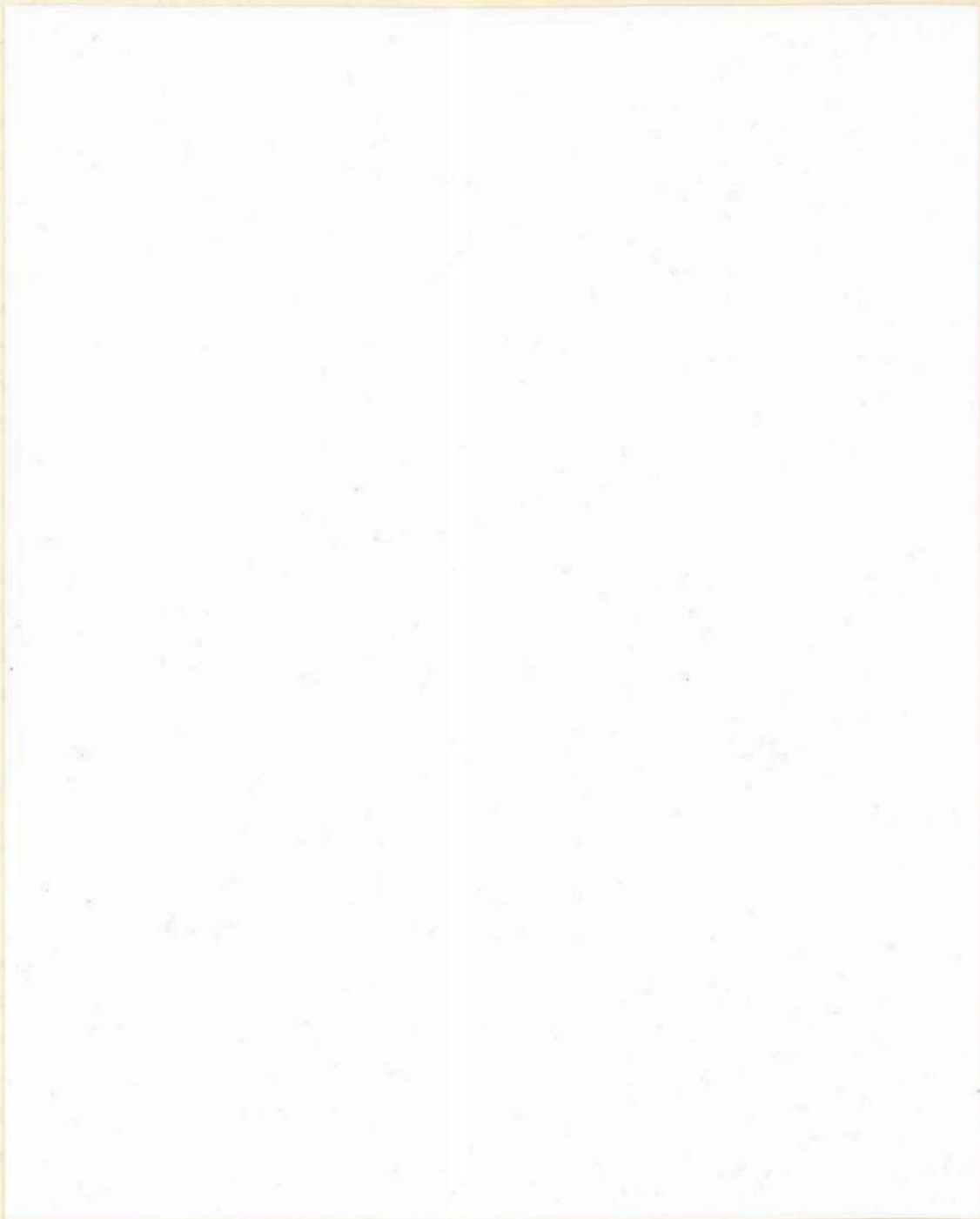
31st December WORK FOR GOVERNMENT COMMUNICATIONS CENTRE (Cont'd)

1944

Colossus No. 7, which has been in service for some time. The fourth and fifth Factory-made machines, Colossus Nos. 8 and 9, are installed, but are not yet in service.

RESEARCH BRANCH SECRET WAR DIARY10th January1945CO-ORDINATION OF TECHNICAL SERVICES IN THE TELECOMMUNICATIONS FIELD

The two models of the equipment for conversion of teleprinter to Wheatstone slip were worked in traffic for about a week and gave satisfactory service. They were withdrawn from service because of difficulties of a purely operational nature concerned with the use of different symbols for the same purpose in the two codes. The Air Ministry is now trying to resolve these difficulties.

15th January1945

RESEARCH BRANCH SECRET WAR DIARY

15th January

1945

RESEARCH BRANCH SECRET WAR DIARY

15th January

1945

RESEARCH BRANCH SECRET WAR DIARY

15th January

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RESEARCH BRANCH SECRET WAR DIARY

15th January

1945

RESEARCH BRANCH SECRET WAR DIARY15th January194519th JanuaryFORTHCOMING MEETING OF THE "BIG THREE"1945

The Research Branch was called in to advise Colonel [redacted] of M.I.5, who is responsible for security at meetings attended by the Prime Minister, regarding the possibility of the use by the Russians of overhearing equipment. Colonel [redacted] had asked whether an officer from the Research Branch would be able to visit the premises which would be placed

at the disposal of the British Delegation and examine them for microphone installations of various kinds. While it was agreed that this could easily be arranged as an officer was already engaged on similar work in Palestine, it was thought that further information regarding the circumstances of the Conference was necessary before a decision could be reached. A discussion was, therefore, arranged by Colonel [redacted] with Major General Sir Hastings Ismay. It was learned that the premises would be handed over by the Russians only a few days before the Conference commenced and that they would be completely staffed by Russian servants. It was obvious, therefore, that not only would the purpose of the search be very difficult to conceal, but also that we could give only a very limited guarantee that the premises were "clean". So many methods would be available, i.e., long or short wave radio transmitters concealed in furniture or behind panelling, ordinary wired systems with amplifiers in servants' quarters, etc., that it would be an impossible task to guarantee complete freedom. Major General Ismay appreciated this point and agreed with the view put forward by the Research Branch that any search which, although it did not disclose any concealed equipment, still left us unable to give an absolute guarantee of the non-existence of such equipment, might lead to a false sense of security. It was, therefore, decided that all officers taking part in discussions should be warned that they must expect their conversation to be overheard at all times and that all discussions of any importance should be held on the British battleship in attendance.

WORK/

RESEARCH BRANCH SECRET WAR DIARY21st January WORK FOR GOVERNMENT COMMUNICATIONS CENTRE1945Case No. 12216

The fourth Factory-made machine, Colossus No. 8, was brought into service during the first few days of this month. A converging unit was added two weeks later. Colossus No. 9 is nearly ready for service: No. 10 is on site.

Case No. 12358

The first of the machines constructed at Dollis Hill for applying the new type of test referred to in the Diary entry of 28th October 1944 was, it will be recollected, promised for January. It was actually accepted for traffic on the 7th. The machine is known as a "Dragon". It had a few teething troubles but is now satisfactory. Its use has led to new facilities being requested, some of which can be incorporated in the existing machine. Others will be introduced with the second of these machines, when they will be provided by auxiliary equipment now being designed.

Case No. 11951

The type of machine known as "Robinson" was first described in the Diary entry for the 3rd June 1943. This equipment has now had a long period of investigation and testing and a good deal of experience has been gained, especially in respect of avoiding interference between relay and valve circuits. A super Robinson machine, embodying all the improvements which have resulted from experience, was put into traffic today and is working satisfactorily. It is a four-tape machine. In contrast to the original type, in which the tapes have to be started and stopped many times in the course of one test, the tapes on the super Robinson run without a stop from start to finish. This has been found to increase the life of the tapes very considerably.

24th JanuaryRADIO COMPONENTS RESEARCH AND DEVELOPMENT COMMITTEE1945

Further to the Diary entry for 26th November, the last of the first batch of six pulse-testing equipments was today handed over to Messrs. M. & E.A. Nos. 4 and 5 were despatched to T.R.E. and A.S. E. at earlier dates.

27th JanuaryEXAMINATION OF GOVERNMENT HOUSE AND OTHER BUILDINGS IN PALESTINE1945

An Assistant Engineer, Mr. Forty, from the Research Branch has visited Palestine to examine various Government buildings for the presence of illicit microphones or overhearing equipment. In Jerusalem, Government

House/

RESEARCH BRANCH SECRET WAR DIARY

27th January EXAMINATION OF GOVERNMENT HOUSE AND OTHER BUILDINGS IN PALESTINE (Cont'd)

1945

House and the offices of the G.O.C., the A.O.C., the Inspector General of Police, the General Secretary and the Defence Security Officer were examined. Defence Security outstations at Haifa and Tel Aviv were also visited.

The security difficulties were greater in Palestine than any that have been encountered, and in order to keep operations completely secret, it was necessary to confine the search to the premises of the most senior officers only. The nature of most of the buildings, i.e., local stone with thick walls and very little ornament, made the search easier and a fair degree of certainty exists that no illicit overhearing equipment was in use.

The High Commissioner (Lord Gort) has requested that overhearing equipment be provided for the use of his staff. After some discussion it was agreed that the only installation which would be satisfactory from the security point of view would be in Government House. The microphones will be installed in H.E.'s study and an adjoining room which is used as a waiting room for visitors. The type of equipment has been decided and will be despatched shortly.

It is essential that the installation be carried out and approved by a man with experience of the work and the High Commissioner will be recommended to secure for this purpose the services of a Research Branch man who is, at present, working on similar equipment as a ^{Signalman} ~~Engineer~~ in the Royal Corps of Signals at Cairo. He is considered fully qualified to carry out the installation.

31st January POST OFFICE AND SIGNALS CO-OPERATION

1945

A further study has been made of the radiation from a selective carrier system using one wire and earth. It is indicated that speech might be picked up at a considerable distance and can give information even when it is several db. less loud than the noise. The selective carrier system can, however, be safely used on a pair of wires which is in good order.

An improved search coil method of finding buried cables has been developed for use, with tone applied to the sheath or wires and the War Office has asked for two sets of apparatus to be used abroad.

The/

RESEARCH BRANCH SECRET WAR DIARY31st January POST OFFICE AND SIGNALS CO-OPERATION (Cont'd)1945

The erection of aerial cable with a lashing wire spiralled on by a machine to secure it to the suspension wire was demonstrated to Army representatives at Denham on the 19th. For small cables, this method certainly appears better than pulling through rings.

RESEARCH BRANCH SECRET WAR DIARYWORK FOR GOVERNMENT COMMUNICATIONS CENTRECase No. 12450Feb 15th
1945

In the diary entry for 5th April 1943 reference is made to a 4-wheel cyphering machine used by the enemy and the means taken to extract from intercepted messages sufficient information to enable the wheels to be set and the messages de-cyphered. The "bombs", high-speed commutators and valve and relay driving gear used in the testing process have already been described in this diary. The technique and apparatus have proved adequate until recently when the enemy introduced a new complication in some services.

It will be recollected that the Cyphering machine comprises 3 or 4 drums, a "stecker" field and a reflector such that, for given positions of the drums, the 26 letters of the alphabet are arranged in 13 pairs. The pairing changes for every character of the message. Hitherto all the possible pairs provided by the drums and reflectors have been known. It has therefore been possible to try all the known pairs in combination with all the possible "steckers" until a fit has been registered with a "menu". The bomb does this, the moving wheels and known reflectors providing the pairs in all possible arrangements, and the diagonal board providing an instantaneous list of all possible "steckers". The scale of the work hitherto undertaken is, say, 100 bombs, 1000 operators and 200 maintenance mechanics.

RESEARCH BRANCH SECRET WAR DIARYWORK FOR GOVERNMENT COMMUNICATIONS CENTRE (Continued)Case No. 12450Feb 15th

1945

Recently the reflector has been made pluggable, thus instead of 2 or 3 standard reflectors there are now millions, actually $(25 \times 23 \times 21 \times \dots \times 3 \times 1)$. The bomb technique fails because it is now impracticable to provide enough plant and staff or to increase the speed of the machine sufficiently.

The experts at Bletchley Park think that the new problem may be tackled by what they term a "scratching" technique. This technique is workable with a plugged reflector, provided that certain conditions are imposed. One of the conditions is a very favourable "menu" demanding at least 50 letters in the crib. The assumption is made that drum 3 does not move during the crib. This drum can then be compounded with the reflector to form a new or equivalent reflector, unknown of course but invariable throughout the menu. The procedure is then to assume the stecker of two letters in the menu and work out the equivalent reflector pairs implied by the assumption. Next, the second letter of the menu is taken, an assumption made regarding the stecker, the equivalent reflector pairs worked out and so on. It is clear that there are only thirteen pairs in the equivalent reflector and as each link in the menu implies one pair, the chance of building up an equivalent reflector without contradictions is small if the assumptions made are wrong and a large number of links is tested. When a contradiction is found new assumptions are made, and so on until all possible drum orders and positions and stecker assumptions have been exhausted or the answer found. The number of such tests

RESEARCH BRANCH SECRET WAR DIARYWORK FOR GOVERNMENT COMMUNICATIONS CENTRE

Case No. 12450 (Continued)

Feb 15th
1945

reaches astronomical figures but by sundry artifices the number can be reduced and, in combination with high speed Kermionic Testing Circuits a workable technique is possible.

I saw Sir Edward Travis at Bletchley Park today when he asked me if the Research Branch could devise and construct the necessary equipment to carry out the testing. In view of the fact that it would take from 14 to 16 months to complete the equipment, by which time the European War might be over, and that it would tie up a number of Engineers in addition to workshop and laboratory constructional staff, I asked Sir Edward to obtain from the Chief of Staff's Committee a decision as to whether we should proceed with a machine of this nature. If it is developed it will be known as an "AUTOSCRITCHER".

W.S.R.

15th February EXAMINATION OF SPECIAL PURPOSE LEAD PIPE (H.A.I.S. Cable)1945

Trouble was experienced by the Navy in laying, during cold weather, one of the short lengths. Cable manufactured by Phelps Dodge was involved, the outer lapping stripped and jammed the paying out gear. As the American makers had all used their own compounds instead of those recommended by the British P.W.D., the whole American production was suspect (except that from Okonite-Callender which had already been rejected owing to splitting on the journey across).

The assistance of the Research Branch was sought and examination of cable from Phelps Dodge, General Electric Co. and General Cables showed that their resistance to low temperature handling was in the order shown, the

/last

RESEARCH BRANCH SECRET WAR DIARY15th February EXAMINATION OF SPECIAL PURPOSE LEAD PIPE (H.A.I.S. CABLE) (Cont'd)1945

last being best. The opinion was expressed that General Cables could be handled down to 0°C, General Electric to 5°C., but Phelps Dodge remained brittle at much higher temperatures. Cable contractors in this country agreed generally this verdict and it has now been proved that General Cables product could be handled as a length was laid during some of the coldest weather. The compound used by Phelps Dodge appears to have been good when applied but to have been damaged by weathering. Compound recovered from the inner lappings is still good but that from the outer serving is brittle.

American H.A.I.S. cable was mostly made during the very best weather and exposed on the dock to full sunshine for several weeks before shipment.

24th February RECEPTION OF ARMY 14/40 AS AERIAL CABLE1945

The "Neale Spinner", a machine which binds an aerial cable to the suspension wire by putting on a helix of galvanised steel wire, was again demonstrated to the War Office and engineers of the Home Counties Region. It was found that the binding wire could be put on by a man riding in a bosun's chair, though not so easily as with the machine. It was agreed that the binding method is as quick as pulling through rings, makes a better job and enables two cables to be erected on one suspension wire. For the 14/40 cable, protected or armoured, it is the only convenient method.

By a coincidence, some miles of this cable have to be erected by 21 Army Group in Holland, where flooded roads make buried cable impossible, and the machine (the only one in the country) is being flown over. If armoured cable has to be used, it will require a suspension wire because the tape armouring has no great strength in tension.

26th February CO-ORDINATION OF TECHNICAL SERVICES IN THE TELECOMMUNICATIONS FIELD1945

The Air Ministry has now settled the question of symbols and operational procedure. The two 5-unit to Morse conversion units were withdrawn from Whitehall, modified in accordance with Air Ministry decisions, and shipped to Station X on 20th February. They were put into operational traffic today.

/WORK

RESEARCH BRANCH SECRET WAR DIARY

1st March
1945

WORK FOR GOVERNMENT COMMUNICATIONS CENTRECase No. 12216

The fifth Factory-made machine, Colossus No. 9, was brought into full operational service yesterday after a trial period during which the last installation faults were cleared up. Converging units, together with a new facility, known as "multiple test doubting", designed to speed up converging operations, were put into service on No. 5 machine on the same day. A converging unit had already been added to No. 8 machine.

Case 12358

An attachment has now been completed to the first "Dragon" machine. It is designed to provide additional facilities.

Case No. 12450

A letter has now been received asking this Branch to proceed with the construction of an "Autoscritcher" as an urgent matter.

1st March
1945

SCHEMES 145 and 161

Since the Diary entry for 26th November 1944, the No. 1 System via Dover has been transferred to a transportable B terminal, 161E, at Audresselles (8th January); the No. 2 System still utilizes a mobile B terminal. No. 3 System was brought into service by L. Branch on this route, between Whitehall and Calais on 12th January. It operates over a third polythene cable and utilizes a mobile B terminal at Calais.

RESEARCH BRANCH SECRET WAR DIARY

March 5th
1945.

PICTURE TELEGRAPH SERVICES

An entry in this Diary of the 4th May 1944 makes reference to the development by the Research Branch of picture telegraph apparatus for Messrs. Cable & Wireless, Ltd. Two prototypes were to be constructed in the Research Branch workshops and, after these had been demonstrated to work to the satisfaction of Messrs. Cable & Wireless, the General Electric Co. were to manufacture 20 equipments. One of the prototypes was to be passed to the General Electric Co., together with full working drawings of the equipment and all the necessary manufacturing details.

The main drawings showing the mechanical construction of the actual picture transmitting and receiving drum with its drive, mounting, etc., fully detailed, were supplied to the General Electric Co. in July and August last. Practically all the other drawings were sent to the firm very early in the autumn, the final ones being despatched on 2nd November. These last referred to the cabinet and framework to which we had been requested to make some last-minute modifications in the way of carrying handles. Provisional components schedules were given to the General Electric Co. on August 19th. Some slight circuit modifications have necessitated changes in one or two of the components, but final components schedules were in the possession of the firm during the first week in November. One or two items were omitted in these, but we have no reason to believe that this has delayed progress by the General Electric Co.

Items were omitted from the components schedules given to the General Electric Co. in November because pictures being received then were not entirely satisfactory due to the occasional occurrence of faint longitudinal stripes. These stripes were eventually traced to an alteration in frequency of the F/M oscillator in the transmitter circuit. After a good deal of experimental work, it was found that the inductance of the tuning coils altered in small discreet steps as the equipment warmed up but this was entirely cured by removing the central tuning sticks from the cores. Later the ventilation of the cabinet was improved resulting in a lower maximum temperature for any component and a more uniform temperature distribution.

Cable & Wireless asked the General Electric Co. to go ahead with the manufacture in the late summer in advance of a complete back-to-back demonstration by the Research Branch. This demonstration was, however,
/given

RESEARCH BRANCH SECRET WAR DIARYMarch 5thPICTURE TELEGRAPH SERVICES (Cont'd)1945.

given on February 12th and was attended by Mr. W.G.R. Jacob, Chief Engineer, and other representatives of Cable & Wireless and representatives of the General Electric Co. Pictures transmitted between the two prototype equipments were inspected and approved, although the Research Branch promised to undertake further experimental work to clear up one or two minor points not sufficient to hold up production.

March 8th.INDIA CEYLON CABLE EQUIPMENT.1945.

Information was received from the War Office that the equipment made by R. Branch for the above submarine cable (see Diary entry for 29th April, 1944), has been satisfactorily installed and was handed over for traffic on 26th December, 1944.

March 24th.ERECTION OF ARMY 14/40 AS AERIAL CABLE.1945.

Further information has been received that the "Neale Spinner" has proved very successful in Holland (see Diary entry for 24th February, 1945). Another machine, similar in principle but of much better design, has now arrived from Canada. It is used by the Bell Telephone Companies and a demonstration has been arranged for the information of Cn. Branch and the Home Counties Region.

RESEARCH BRANCH SECRET WAR DIARYMarch 31st WORK OF THE ELECTRO-ACOUSTIC SUB-COMMITTEE, MINISTRY OF SUPPLY1945 *

It is of interest to record a comprehensive review of the work done by the Electro-Acoustic Sub-Committee of the Communications Committee, Ministry of Supply, during 1944, as much of the experimental work has been carried out at Dollis Hill.

Although acceptance tests do not normally require that a microphone or telephone receiver should meet a specified impedance value, it is desirable that a specified impedance should be adhered to, in order to assist the designer. The Sub-Committee has recommended that all new apparatus should have a nominal impedance of 75 or 300 ohms, measured at 1000 c/s. In cases where a higher impedance is required, 8000 ohms was recommended. The figures apply for the condition in which the moving element is stationary, and in its mean position. Since mismatch losses due to departure from the specified impedance are small, an impedance tolerance of 20% is admissible. The recommendation has also been adopted by the Ministry of Aircraft Production and the Admiralty for new designs and has been implemented by action on the part of the Inter-Services Component Technical Committee.

Tests were made on German Throat Microphones of the sealed carbon granule inset type and the associated telephone receivers. The tests showed that the apparatus was inferior to the equivalent British installation used in A.F.V's and that the carbon throat microphone was practically useless in the higher noise levels.

A method of using a balanced armature microphone as a means of factory testing telephone receivers and microphones was developed on behalf of C.I.E.M.E. The balanced armature microphone is used as an artificial ear being driven by the transducer under test through a small coupler. The accuracy of the reciprocity method of calibration of microphones was investigated and the errors likely to arise described in a report.

A/

RESEARCH BRANCH SECRET WAR DIARY31st MarchWORK OF THE ELECTRO-ACOUSTIC SUB-COMMITTEE, MINISTRY OF SUPPLY (Cont'd)1945

A report was produced relating to the standardisation of methods for testing and assessing the quality of telephone communication circuits. The report shows that sound, syllable, word and sentence articulation tests inter co-relate, and that any one of these tests serves to measure transmission performance. Emphasis was placed on the need for standard conditions for such tests so that the comparison of results obtained in different laboratories can have some meaning.

Detailed measurements of noise were carried out in a German Pz Kw 111 tank. In general, the noise level closely approximated to that in the British counterpart, the Cruiser Mk.VI. The main causes of the noise were the gear box and transmission with track noise as a secondary source.

Tests carried out on the American Army Lip Microphone show that it is inferior to the Goodmanslow level moving coil type normally used by the British Army; but that it is superior to other types of carbon microphones, either of the throat or mouth variety. Since the T.45 is more sensitive than the moving coil unit, it could be recommended if a high level microphone was required under conditions of loud noise.

Information has been received by A.O.R.G. that crews in Armoured Fighting Vehicles, particularly Tank Commanders, become partially deafened and dazed after prolonged listening to noise and signals in their headphones. Tests were therefore carried out at Dollis Hill in order to investigate this deafening. In these tests selected crews wore headgear receivers connected to No.19 Wireless Sets for periods of up to eight hours during which time they had to listen to "radio" noise and, at intervals, to ambient "room" noise, corresponding to that in a moving A.F.V. The conditions have been arbitrary but fairly representative of those in practice. At intervals articulation tests were made over the system to which the wireless set was connected and the hearing loss of each member of the crew was measured after each exposure. Deafening corresponding to a rise in the threshold level occurred but did not interfere with the reception of loud signals. The use of a filter to reduce the magnitude of the high frequency components in the radio noise and signals was tried and is not recommended, but a simple

limiter/

RESEARCH BRANCH SECRET WAR DIARY31st March WORK OF THE ELECTRO-ACOUSTIC SUB-COMMITTEE, MINISTRY OF SUPPLY (Cont'd)1945

limiter may be useful. Very considerable reduction of the harmful effects can be obtained by a proper use of the audio gain control and a set of "popular" notes to help users to get the most efficient working of the set has been prepared with the assistance of A.O.R.G. These notes have been sent to the War Office (M.T.12) in order that they might be given publicity among armoured formations. (These tests were referred to in the Diary entry of 4th July, 1944).

The Sub-Committee has continued to review information from the U.S.A. and other sources concerning developments in telephone instruments and apparatus. It has also sought to maintain contact with work of a similar nature to its ^{own} going on abroad, particularly at the Cruft Laboratories at Harvard University. In addition to its value for the development of Army equipment this contact has been useful to the Research Branch generally.

14th April AUTOMATIC RECORDING AND ANALYSIS OF RADAR DATA1945

The way in the Research Branch came to be associated with this work for the Ministry of Supply is referred to in the Diary entry for the 14th December, 1944. It was originally intended that, following a study of the problems involved, proposals for meeting the requirements should be made, new apparatus which would be required being designed in outline, and an estimate of the cost prepared, all by the middle of March. A decision would then be made whether all or part of the work should be undertaken, and whether a visit should be made to the U.S.A. to study the similar work which has been in progress there. It has not proved possible to make the progress expected, but the point has been reached where it is thought that a summary of the position to date would be useful to all concerned. This summary first outlines the nature of the problem involved. It then describes, with a little technical detail, the manner in which it is proposed to meet the requirements. One of the objects of this description is to exhibit the operating procedure. The proposals are the result of co-operation with the Ministry of Supply and R.R.D.E. with whom close contact is maintained. The summary represents the Post Office understanding of the operational requirements, and it is particularly desirable that this aspect of the problem should

RESEARCH BRANCH SECRET WAR DIARY

14th April AUTOMATIC RECORDING AND ANALYSIS OF RADAR DATA (Cont'd)

1945

be agreed at this stage, in order to avoid abortive design work. A further point brought out in the summary is the amount of work which the plant can be expected to handle. The summary also includes an estimate of cost based on the operating procedure set forth. It will be appreciated that this can only be a guide at the moment. The summary which has been prepared is to be sent to the Ministry of Supply and R.R.D.E. as a basis of discussion regarding future procedure.

15th April SCHEME 146

1945

As explained in Diary entries for 20th February, 1943 and 21st October, 1943, equipment was constructed by R. Branch to enable five carrier groups, i.e., 60 circuits, to be set up on each of two cables across the Straits of Dover. In its final arrangement, the supergroup translating equipment was installed at Dover Castle and Calais, with repeater stations for both systems at St. Margarets' Bay. These installations had been carried out and modified to meet changing conditions as required.

The first system was brought into service fully on April 5th, the first group having been taken up on 28th March, 1945. The Dover-Calais system is included in 12-circuit systems between London (Whitehall) and Paris. Four groups are through-connected in this way, the fifth group being terminated at Dover Castle on the English side.

The cables between St. Margarets Bay and Sangatte are polythene, approximately 20 nauts in length; lengths of balanced pair cable are included on the French side between Sangatte and Calais. The system operates satisfactorily and lining up of the second system is now progressing.

16th April WORK FOR GOVERNMENT COMMUNICATIONS CENTRE

1945

Case No.11951

Super-Robinson No.2 was in full service on 1st April.

Case No.12216

Colossus No.10 went into service on 6th April.

Case No.12450

In view of the rapid development of the European war a letter has
been/

RESEARCH BRANCH SECRET WAR DIARY16th April WORK FOR GOVERNMENT COMMUNICATIONS CENTRE (Cont'd)1945 Case No.12450 (Cont'd)

been written to Sir Edward Travis asking him if he still wishes us to proceed with the development and construction of an autoscritcher as described in the diary entry of February 15th. No reply has yet been received to this letter.

29th April CO-ORDINATION OF TECHNICAL SERVICES IN THE TELECOMMUNICATION FIELD

1945 The first thermionic slip conversion unit, 5 unit to Morse, was installed at Whitehall on 20th April. It was put into training service on the 23rd and into full operational service to-day. (Previous diary entries 30th September, 1944, 18th October 1944, 10th January 1945 and 26th February 1945).

30th April WORK FOR M.A.P.1945

Three requests have been received for the construction of sound reproduction machines for use by the R.A.F. and Admiralty.

1. A machine to reproduce verbal announcements of the bearing of a rotating radio beacon. This is urgently required in connexion with operations in the Far East. Two prototypes for trial will be made immediately.
2. A machine to reproduce the sounds heard from hydrophones incorporated in buoys and transmitted by radio to patrolling aircraft. These are for use in training personnel. Existing machines will be adapted and special glass disc records made.
3. The development of a machine which will record and reproduce speech with medium quality and run continuously with attenuation at not more frequent intervals than once in about 6 hours. This is required for general service use for monitoring. A prototype is expected to be completed by about August 1946. This work follows discussions between the Post Office and M.A.P. which resulted in an undertaking that the Post Office would help in the development of direct recording and reproducing equipment for Air Ministry purposes. The discussion took place at the same time as a demonstration staged at R.A.E. Farnborough of all available types of speech recording and reproducing equipment.

1st May/

RESEARCH BRANCH SECRET WAR DIARY1st May SPEECH SECURITY SYSTEM1945

On the 17th March last the Deputy Engineer-in-Chief received a letter from the War Office stating that Treasury sanction had been obtained for the provision of secret speech equipment for twenty stations, and that a formal requisition on the G.P.O. was in process of going through. The letter stated that, apart from its use by the Foreign Office for diplomatic conversations, there is pressing need for a secret speech apparatus. On line it might be used between London and Berlin when the Control Commission is installed there. On radio it will be used on the Single Side Band Transmitters which will link Theatres and Commands overseas to this country.

Thanks to the experimental work that has been done on the Vocoder in the Research Branch during the last two years it has been possible to tell the War Office that it is hoped to complete its development and the development of the associated equipment necessary to apply the Vocoder signals to a line or radio link this summer so that the supply of Vocoder terminals and associated transmission apparatus to them can start early in 1946. In order to do this staff has had to be earmarked to the extent of interfering very seriously with the prospect of the Branch undertaking any extensive transmission research for the Post Office during the next twelve months.

When this has been done, however, we shall only be part way towards meeting the War Office requirements. There must be associated with each Vocoder terminal equipment ensuring absolute secrecy. The principles of this equipment are as yet undecided, but it is certain that it will be of an elaborate nature, and that a great deal of experimental work will be necessary in its development. The matter has been talked over with Mumford

as/

RESEARCH BRANCH SECRET WAR DIARY1st May SPEECH SECURITY SYSTEM (Cont'd)

1945 as W(D) Branch have been interested in speech secrecy systems for radio work, but he has no-one and it has been decided that the work should be undertaken by R. Branch. It cannot be done with the staff available nor is there any Assistant Engineer in the Department or on loan from the Department to a Service Establishment, whose recruitment would immediately improve the position. In order that this development should be completed with despatch, it is essential that the engineers undertaking it should have experience of transmission research and be men of more than average ability.

It has been suggested, therefore, to the Engineer-in-Chief that he should ask the War Office to release Majors J. Lawton and F. Scowen for the purpose. Lawton and Scowen were commissioned in the Army at the Department's suggestion in order that they might be available to go to France, supervise the installation of the special carrier telephone equipment constructed in the Research Branch, and ensure its satisfactory operation at the earliest possible date. This purpose has now been fulfilled, and the maximum number of circuits provided over the cables laid.

RESEARCH BRANCH SECRET WAR DIARY10th MaySCHEME 1461945

The second system between Dover and Calais (see Diary entry for 15th April 1945) was completed during the first few days of May and nearly all the new groups are now in service. The repeater stations being constructed for use on the French side, if required, are not yet completed and their use is not foreseen in the near future.

14th MayEXAMINATION OF FOREIGN OFFICE BUILDINGS ABROAD FOR THE PRESENCE OF ILLICIT OVERHEARING EQUIPMENT1945

The Foreign Office proposes to add a Maintenance Electrical Engineer to the staff of all important Embassies. This engineer will be responsible for the maintenance of all telephone and electrical equipment in the buildings and no foreign workers will be permitted to enter for this purpose. He will also be responsible for the continued security of the premises as regards the presence of illicit overhearing equipment after a thorough examination has been made by a Research Branch officer in the first instance.

Five men of high calibre are at present being trained for telephone maintenance and before taking up duties will be given all the information available at the present time on methods of overhearing which might be employed. Additional men will be trained as required. Steps will be taken to keep them informed of new developments which they might be called upon to combat.

19th MayH.A.I.S. CABLE1945

Work on this is now thought to have been completed and it is understood that all the lines have been laid. The last fault examined was on cable manufactured by Messrs. Glover which is extruded in a vertical press. The cause of breakdown was overheating whilst waiting for the charge to cool; a circumferential tear resulted.

Summarizing the position on the lead sheath, no trouble has been experienced with the Pirelli continuous press lead except that when using E alloy the impeller became coated with a low melting antimonial alloy which reduced the rate of extrusion considerably. No service failures have been recorded. Henley "straight-through" press sheathing is liable to have blow-holes which go right through the sheath but they are infrequent. Of the vertical press sheaths used, cable made by Glovers, General Cables and Phelps-Dodge was free from weld faults; General Electric (U.S.A.) produced a short length of faulty cable. The cable made by Okonite-Callender (U.S.A.) as well as that made by Callenders Cable Co. in the U.K. was all scrapped, the weld faults being too numerous to permit of cutting out.

RESEARCH BRANCH SECRET WAR DIARY25th May WORK FOR GOVERNMENT COMMUNICATIONS CENTRE1946

The requirements of the Centre and the position with regard to the equipment with which it had been provided by the Research Branch was discussed by Dr. Radley and Mr. Flowers with Sir Edward Travis and Professor Newman at Bletchley Park today. The end of the war in Europe has caused by far the greater part of the traffic carried by Dollis Hill equipment to cease. The future programme is in three parts:-

(a) The maintenance of certain equipments for the Japanese war. These equipments include the four Super-Robinsons, No. 3 of which was ready for service on the 7th May, and the fourth is being installed, together with necessary 5-unit tape punching machinery.

(b) The continuance of work on European traffic not "broken" before VE. day, which work has an historical and research value. It is anticipated that this phase will last two to three months. For this purpose, the equipments known as Dragon No. 2, Aquarius and Proteus will be required. Aquarius was completed and handed over on the 24th May. The other two are nearly complete. The equipments called Auto-Scratcher and Salamander are not required and work on them has stopped.

(c) The dismantling and disposal of such apparatus as will not be required, and the dispersal of the maintenance staff. Security considerations demand that the break-up and disposal of equipment shall be done by the Research Branch. Some parts will be useful to the Branch for other projects that are in mind.

(It has been agreed with the Staff Branch that the Post Office Workmen now on loan to the Foreign Office and engaged on maintenance duties at the Government Communications Centre should be retained until the equipment has been broken up and that, if before this occurs full employment cannot be found for them at the Centre, they should be held at Dollis Hill temporarily.)

MULTI-POINT PETROL DETECTOR

The simplification of the equipment last referred to in the Diary entry of 30th October, 1944, has now been agreed with the Admiralty. The facilities provided have been reduced and cam operated stepping substituted for relay stepping. The life of the hot wire elements can now be increased to 200 or 400 hours by more uniform construction. It has not yet been decided by the Admiralty whether these detectors will be installed on a large scale or not.

FAILURE/

RESEARCH BRANCH SECRET WAR DIARY26th May FAILURE OF TELEPHONE EQUIPMENT UNDER TROPICAL CONDITIONS1945

It having been found that the tests previous applied were not stringent enough to safeguard the performance of equipment in the Pacific theatre, the matter has been investigated by S.R.D.E. and C.I.E.M.E. and specifications issued covering all aspects of the durability of Army telecommunication equipment. Microphones and receivers of the types now in service have been subjected to these tests by C.I.E.M.E. and the failure of some types of which very large numbers are in service is giving rise to concern. The Research Branch has been co-operating to the extent of investigating the expansion and distortion of phenolic mouldings under the test conditions. It undertook this work as it was better fitted than the Service Establishments to do so.

26th May CABLE COMMITTEE INVESTIGATIONS (MINISTRY OF SUPPLY)1945

Several of these have been in hand and are now well on the way to completion. They are concerned mainly with plastic covered wires and cables with Polythene and various grades of P.V.C. coatings. No satisfactory abrasion test for these coatings has yet been agreed.

SPEECH RECORDING ON DISCS

In addition to the work involving recording of speech for the M.I. services, a large quantity of equipment has been designed and supplied for training and welfare purposes for the three Fighting Services. Some of the work was carried out via third parties, such as items for E.N.S.A. and the Royal Ordnance Factories, but all eventually had a direct bearing on the war effort.

Apart from a few large commitments, such as the sets of equipment for the Ministry of Supply (60 sets), the Inter-Services Research Bureau (60 sets), the Admiralty (200 sets) and the Armoured Fighting Vehicle Training Regiments (15 sets), most of the work has consisted of about a hundred small installations. To avoid giving a catalogue of all these installations, a summary is given below of the quantities of the main items of equipment used and still to be supplied against outstanding orders.

Recording Machines	670	Power Units	366
Recording Amplifiers	604	Microphones	320
Microphone Amplifiers	527	Playbacks	286

The development of this equipment, the supply of all the components, and the development of apparatus to test completed items have been carried out by Group R2/1 of the Research Branch. The M.S.S. Recording Co. assisted with the recording machines. Much of this equipment has been built under R. Branch

staff/

RESEARCH BRANCH SECRET WAR DIARY

26th May SPEECH RECORDING ON DISCS (Cont'd)

1945 staff supervision by outside contractors. Nearly all the assembly of individual units into sets, with the associated wiring and testing, as well as installations on site, where necessary, has been done by R2/1 Group. It may be of interest to record that two officers from this Group recently spent several months in Italy in connexion with A.F.V. Training Equipment.

In addition the Branch has undertaken the supply of consumable stores to various Government or Government-controlled Departments, the maintenance of 19 sets of Armoured Fighting Vehicle Training Equipment, 35 R.A.F. Special Training Recording units and other recording equipment; also the operating of two high quality recording studios for language training under the direction of London University.

28th May MATHEMATICAL WORK FOR OTHER DEPARTMENTS

1945 The Mathematical Investigations Group (R5/2) has been called upon to solve various theoretical problems arising in the conduct of the war. Mathematical problems have come from the War Office, The Royal Corps of Signals, The Admiralty, The Air Ministry, The Ministry of Supply, The Radio Security Service, the Ministry of Home Security, The Ministry of Aircraft Production, S.H.A.E.F. and other sources. Most of these problems, with the exception of the electro-magnetic field type arising from the Royal Corps of Signals, involve the application of the mathematical theory of probabilities to special cases. The problems from S.H.A.E.F. were concerned with the types of probability distributions encountered in the design of military operations.

29th May WORK FOR THE WAR OFFICE

1945 As it is intended that this should be the last Diary entry, the position of various projects which have been undertaken for the Directorate of Military Intelligence is briefly reviewed below:-

(1) Overhearing device with associated radio transmitter

At a meeting at M.I.5 Brigadier Harker enquired regarding the prospects of developing a short wave radio overhearing device using a very small transmitter which could be easily concealed on suspect premises and which would work for say 6, 12, 24 hours or longer. W. Branch has developed a F.M. transmitter which looks very promising. It was agreed that officers from M.I.5 should take an experimental model and test it to see whether it would prove a useful tool. For the tests they would use a standard communications receiver. If the tests

were/

RESEARCH BRANCH SECRET WAR DIARY

29th May WORK FOR THE WAR OFFICE (Cont'd)

1945
(Cont'd) were satisfactory, the question of the design of a more portable receiver, specially adapted for the work, would be considered.

(2) Mobile Units supplied to U.S. Forces

Five complete mobile overhearing and recording units have been supplied to the U.S. Forces and are actively employed on the Continent. Each can deal with four overhearing points simultaneously. Equipment for a further two units is urgently required and will be supplied during the next two weeks.

(3) Fixed Stations in U.K.

The three large fixed M.I.19 installations in this country are still working at high pressure but it is anticipated that the one at Latimer will now be closed down gradually, work ceasing there during August. The installation at Beaconsfield will then be closed down over the following three or four months. No closing date for the Cockfosters camp has yet been suggested. The installations belonging to M.I.5 at Ham Common and Nuffield are understood to be closing down shortly and the equipment will be recovered.

(4) Interrogation centres in Germany and Austria

A large camp for the direct interrogation of prisoners-of-war and later of political prisoners is being arranged near Hanover. Overhearing equipment in about forty rooms will be provided. The quantity of recording equipment required will not, however, be very large. Twelve positions will probably suffice. The necessary equipment has been assembled by Capt. Copping (transferred to M.I.19 from R. Branch) and will be installed and maintained by his staff.

Under the direction of Col. McMillan comparatively large quantities of overhearing equipment are being assembled and prepared for the use of the British & American Authorities in Austria and several consignments have still to be forwarded.

RESEARCH BRANCH SECRET WAR DIARY30th MayM.S.S. RECORDING COMPANY1945

By the adoption of hand operated dipping processes, the output of the 17½" and 13" discs at the Colnbrook factory has been increased by nearly 200% with consequent reductions in cost. The dipping machine for 12" discs which is expected to give an output of at least 12,000 discs per week is well in hand at Messrs. Sovex's Works but the building to house it has not yet been commenced.

As a result of the success in hand dipping at Colnbrook, similar methods are to be adopted at the Wraysbury factory.

The Board of Trade has enquired as to how far the M.S.S. factories will be able to meet peace-time direct-recording requirements in this country and whether the Post Office is prepared to help to establish the industry. Such an industry would save the expenditure of very large sums in the U.S. every year. The Deputy Director General is considering this question and the legal aspect in connexion with the agreement with M.S.S. and the Post Office's relation to industry.

The demands by the Services and the B.B.C. continue to be heavy and the Deputy Director General will be advised by the Contracts Department and the Research Branch that if commitments are to be met some measure of control will have to be maintained until August 1946.

SCHEME 164

Further to Diary entries of 19th September 1944 and 26th November, 1944, the outstanding equipments 164D and 164E are complete at Dollis Hill but have not yet been tested. These are repeater stations, primarily intended as reserves for Guernsey; the original provision was made under Scheme 145 and no installation has yet been carried out. The miscellaneous items known as 164F having been provided as required, the Scheme is otherwise complete.

DEVELOPMENT OF SOUND REPRODUCTION EQUIPMENT FOR M.A.P. AND THE ADMIRALTY

Construction of the first two of the three items referred to in the Diary entry of the 30th April is now well in hand.

SECRATYPE

Construction of the photo-electric equipment for reproducing signals from a multi-track film is now well in hand. The apparatus for making the film is not so far advanced but its design is complete.

31st/

RESEARCH BRANCH SECRET WAR DIARY

31st May
1945

CO-ORDINATION OF TECHNICAL SERVICES IN THE TELECOMMUNICATIONS FIELD(1) Slip Conversion Equipment

Equipment for the conversion of Morse to 5-unit slip is being made. The first solution comprises a modified Morse printer, relays and a magnet-operated Perforator No. 44. The request has been made that we should also develop an electronic version working from a Wheatstone transmitter to a Perforator No. 44. This is partly designed. The relay and thermionic equipments for conversion from 5-unit to Morse slip are still in traffic. It is anticipated that the Post Office Factory will be asked to make a number of these equipments, probably the thermionic type. Monitoring equipment for 2-tone multi-channel telegraph equipments is being made. This equipment provides a continuous check on the distortion on up to four channels and gives warning of the deterioration of the transmission beyond a certain point. Four terminals are being constructed, for each end of the England-Cairo, and England-Delhi circuits.

(2) Development of high-speed radio telegraph equipment

The Air Ministry requirements for high-speed terminal apparatus for radio telegraph links covers the development of an electronic transmitting and recording equipment to replace the existing equipment and capable of working at much higher speeds up to, say, 500 words per minute. These requirements have been fully discussed between the Post Office and representatives of D.C.D., M.A.P. and D. of Tels., Air Ministry, and the difficulty of developing a printing device capable of working up to 500 words per minute emphasised. It has now been left that the Post Office should prepare an appreciation of the problems involved after consideration of which the Air Ministry may re-state their requirements.

AUTOMATIC RECORDING AND ANALYSIS OF RADAR DATA

The study of the problems involved in this project has been progressing steadily. It has involved not only the application of techniques known to the Post Office but also the study of techniques such as Servo-mechanisms. A summary of the proposals and an estimate of the cost was circulated by R. Branch early in May and a meeting was held at R.R.D.E., Malvern, on 23rd May to decide the future action. The Ministry of Supply (Directorate of Artillery) and R.R.D.E. are anxious to press on with the scheme and have requested the construction of recording apparatus without delay. The proposals already made by the Research Branch as regards the design principles of the computer are acceptable/

RESEARCH BRANCH SECRET WAR DIARY

31st May AUTOMATIC RECORDING AND ANALYSIS OF RADAR DATA (Cont'd)

1945
(Cont'd) acceptable but it has been agreed that before the design is finalised the work done in the U.S.A., at the Bell Telephone Laboratories and M.I.T., should be studied. The Ministry of Supply has undertaken to make arrangements for the Research Branch to send a representative or representatives to the U.S.A. It would arrange for their access to the Bell Telephone Laboratories and the M.I.T. and for them to be made fully acquainted with all that has been done in these two laboratories. Arrangements are being made for Messrs. Flowers and Chandler to visit America and it is hoped that they will be able to take advantage of this visit to discuss possible developments of automatisisation of telephone switching and other peace-time problems.

APPRECIATION OF WARTIME WORK OF THE RESEARCH BRANCH STAFF

It will perhaps be appropriate to conclude this Diary by the quotation of part of an Instruction circulated yesterday to all members of the Research Branch staff in the laboratories, workshop and offices.

"During the past 5½ years the work of most of you has had very different objectives from those of our pre-war research investigations. Those objectives have, in some cases, been known to you: in others they have been unknown or only partially known. Owing to the secrecy which has had to surround many of the more important projects with which we have been concerned, I alone have had the satisfaction of knowing fully the extent to which our work has contributed to the war effort. I wish that I could share my knowledge with every member of the staff for the record is one of which we could all be justly proud, but the defence of the country in the event of future war entirely prohibits publicity. It may be sufficient to say that, not only have we assisted the Research and Development Branches of the three Fighting Services, but much of our work has been even more immediately concerned with military operations. Rapid accomplishment of some of this work was stated by the War Cabinet to be of overriding importance but, faced with tasks which involved not only research but production programmes which were big undertakings, you carried them through to the full satisfaction of our "customers".

It is unlikely that the war against Japan will make so many direct demands on the Branch. On the other hand, it is no time for relaxation of effort for we have had during the past five years to neglect much of our normal work/

RESEARCH BRANCH SECRET WAR DIARY

31st May APPRECIATION OF WARTIME WORK OF THE RESEARCH BRANCH STAFF (Cont'd)

1945
(Cont'd) work and have, therefore, much leeway to make up. Other Branches of the Engineer-in-Chief's Office are looking to us for the speedy solution of problems which are of considerable importance to the reconstruction and post-war development of the Post Office system."

B. S. Radley

B. S. Radley

WORK BEING UNDERTAKEN BY THE RESEARCH BRANCH DIRECTLY FOR
OTHER DEPARTMENTS. FEBRUARY 1943

Department	Nature of Work	Staff Engaged	Time to complete	Remarks
1 War Office (Director of Military Intelligence)	Development of special equipment using telephone apparatus, also speech recording and reproducing gear.	13	months	Equipment being supplied both on account of stations in the U.K. and of armies overseas and demands unlikely to change materially in 1943.
2 War Office	Mobile and fixed terminals for multi channel telephone circuits over submarine cables.	9	6	
3 War Office (A.P.V. School)	Speech training equipment.	1	4	
4 Ministry of Supply (D.S.R.)	Experimental work in connection with the development of micro-phones and telephone receivers for use with radio, intercommunication or line telephony.	3	-	Continuous programme.
5 Ministry of Supply	Experimental work in connection with the provision of suitable materials for dust core inductors etc.	2	12	
6 Ministry of Supply (D.S.R.)	Experimental work in connection with the development of field cables.	3	-	Continuous programme.
7 Ministry of Supply (S.R.D.E.)	Companders for Field Radio Sets.	$\frac{1}{2}$	2	
8 Foreign Office	Development and provision of testing equipment utilising automatic telephone mechanisms.	6	4	Further similar work anticipated.
9 Foreign Office	Development of special equipment using teleprinter mechanisms and photo-electric cells.	1	4	A very recent project and work involved still somewhat indefinite.
10 Air Ministry	Speech training equipment.	1	1	
11 Ministry of Aircraft Production	Experimental development and provision of two Auto-tellers (teleprinter-speech conversion equipment).	2	6	In connection with Inland Reporting Scheme.

WORK BEING UNDERTAKEN BY THE RESEARCH BRANCH DIRECTLY FOR

OTHER DEPARTMENTS, FEBRUARY 1942

Remarks	Department	Nature of Work	Staff engaged	Time to complete	Remarks
12	Ministry of Aircraft Production	Development, provision and installation of line synchronizing equipment for C.H. stations.	1½	6 months	1
13	Ministry of Aircraft Production	Monitoring equipment for C.H. stations.	½	4	In conjunction with the B.B.C.
14	Ministry of Aircraft Production	Development and provision of remote control line equipment for 7000 type stations.	1	1	2
15	U.S. Army	Development and provision of high speed V.F. telegraph radio control.	2	1½	3
16	Ministry of War Transport	Experimental work in connection with hand generators and batteries for lifeboat radio transmitters.	2	1½	4
17	Ministry of Home Security	Development and provision of listening equipment for locating buried Air Raid casualties.	½	2	5
Continued.	-	Experimental work in connection with the development of field cables.	2	1	6
Further studies anticipated.	2	Commanders for field radio sets.	½	1	7
A very recent project and work involved still somewhat indefinite.	4	Development and provision of testing equipment utilizing automatic telephone mechanisms.	8	1	8
	1	Development of special equipment using teleprinter mechanisms and photo-electric cells.	1	1	9
	1	Speech training equipment.	1	1	10
In connection with inland reporting Scheme.	6	Experimental development and provision of two auto-callers (teleprinter-appeal) conversion equipment.	2	1	11

WORK BEING CARRIED OUT FOR THE POST OFFICE IN ORDER TO
ENABLE CIRCUITS TO BE PROVIDED FOR SERVICE OPERATIONAL REQUIREMENTS

Nature of Work	Staff Engaged	Time to complete	Remarks
Development and installation of special carrier telephone equipment where standard systems cannot be used or are insufficient.	7	months 12	The completion date relates only to schemes already in hand. Anticipated circuit provision requirements will constitute a fairly continuous load for this group.
Experimental work in connection with speech secrecy.	3	-	
Development and testing of equipment for music circuits.	1	2	P.O. provision for B.B.C. propaganda services.
Development and testing of line amplifiers and conference amplifiers.	1½	continuous	P.O. provision largely for Service P.W.S.
Multi-channel telegraph systems for radio application.	1	3	

GENERAL NOTE: Only officers of the rank of Inspector and above engaged for substantially the whole of their time on the particular project have been counted. About 25 per cent should be added to allow for time of (i) senior engineering officers, (ii) officers engaged in the investigation and development of materials, components etc. and on whose work the project depends, (iii) senior officers in the Group controlling the experimental workshops.

