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Principal Contents.

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EXPERIMENTAL WIRELESS

A JOURNAL OF RADIO RESEARCH & PROGRESS

Principal Contents.

AMATEUR TRANSATLANTIC

MIGUEL MOYA, EAR-1 / EA4AA COLLECTION

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EXPERIMENTAL WIRELESS

A JOURNAL OF RADIO RESEARCH & PROGRESS

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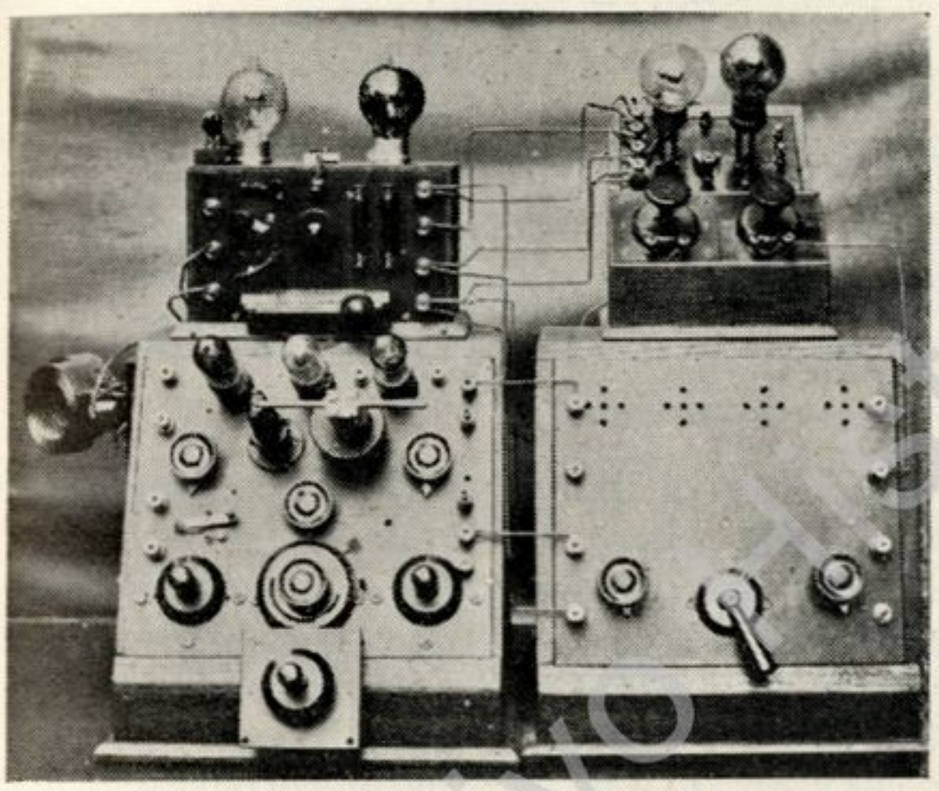
Principal Contents.

An Armstrong Super-Heterodyne Receiver.

By E. J. SIMMONDS.

Super-Sonic amplification is, no doubt, the simplest and most efficient method of short wave reception. Not only does the circuit become easily manageable, but the selectivity of the receiver is increased considerably. In the following article will be found full data for the construction of a super-sonic amplifier.

THE theory of the super-heterodyne is simple, and the operation has many advantages. The principle difficulty in high-frequency amplification at short wave-lengths, namely, valve capacity, is overcome by the simple solution of reducing the frequency to some predetermined fixed value, when a radio-frequency amplifier designed for efficient long-wave working can deal with the signals.



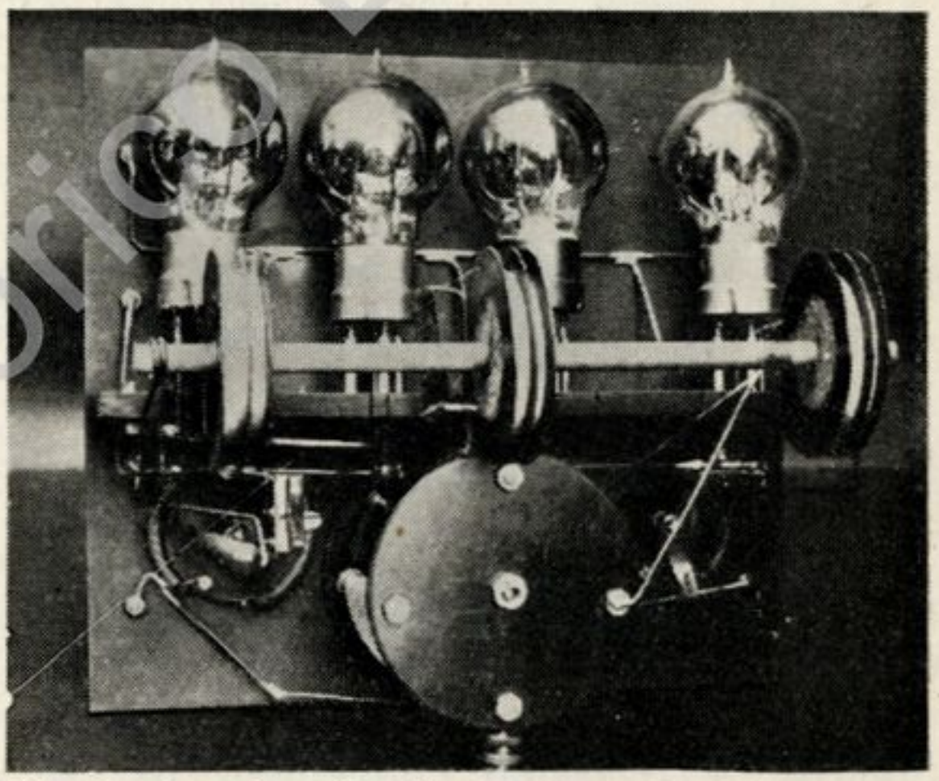


Fig. 1.—The left panel of the complete receiver contains the H.F., detector and oscillator valve and coupling device with the tuned anode coil. The right panel contains the three-stage long wave amplifier and detector. Above these are the H.F. and the detector (tuned anode, resistance or choke capacity) and two note magnifiers. On the right is seen the rear of the super-sonic amplifier.

The original signal is transferred to the closed circuit, and amplified at the original frequency. The local source of oscillations is coupled to the anode coil of the first high-frequency valve, and adjusted to such a value that a suitable beat frequency is formed, and impressed on the grid of the detecting valve. The resulting reduced radio-frequency oscillations are then passed to the long wave amplifier. By this method all the advantages of high frequency amplification at low radio frequency are obtained.

Now that increasing attention is being given to comparatively short-wave working, and in view of the difficulty and instability of ordinary receivers below 200 metres wave-length, it is thought that the description of a receiver embodying high efficiency, sharp tuning, absence of body capacity effect, and ease of adjustment will be particularly useful.

It is proposed to describe a modification of the well-known Armstrong super-heterodyne as made by the writer for the Trans-atlantic tests of 1922, and used continuously since. It is worthy of mention that the instrument was only completed three days before these tests, and that, although unskilled in the adjustments, nearly 100 log entries were made, and 24 different U.S.A. amateurs scheduled complete with code words, in individual periods.

It should also be mentioned that no receptions were possible before 3.15 a.m. owing to "hash" from Northolt Radio, which source of short-wave interference is doubtless too well appreciated to call for more than passing comment.

The amplifier may consist of two units, the first of which is the ordinary one-stage

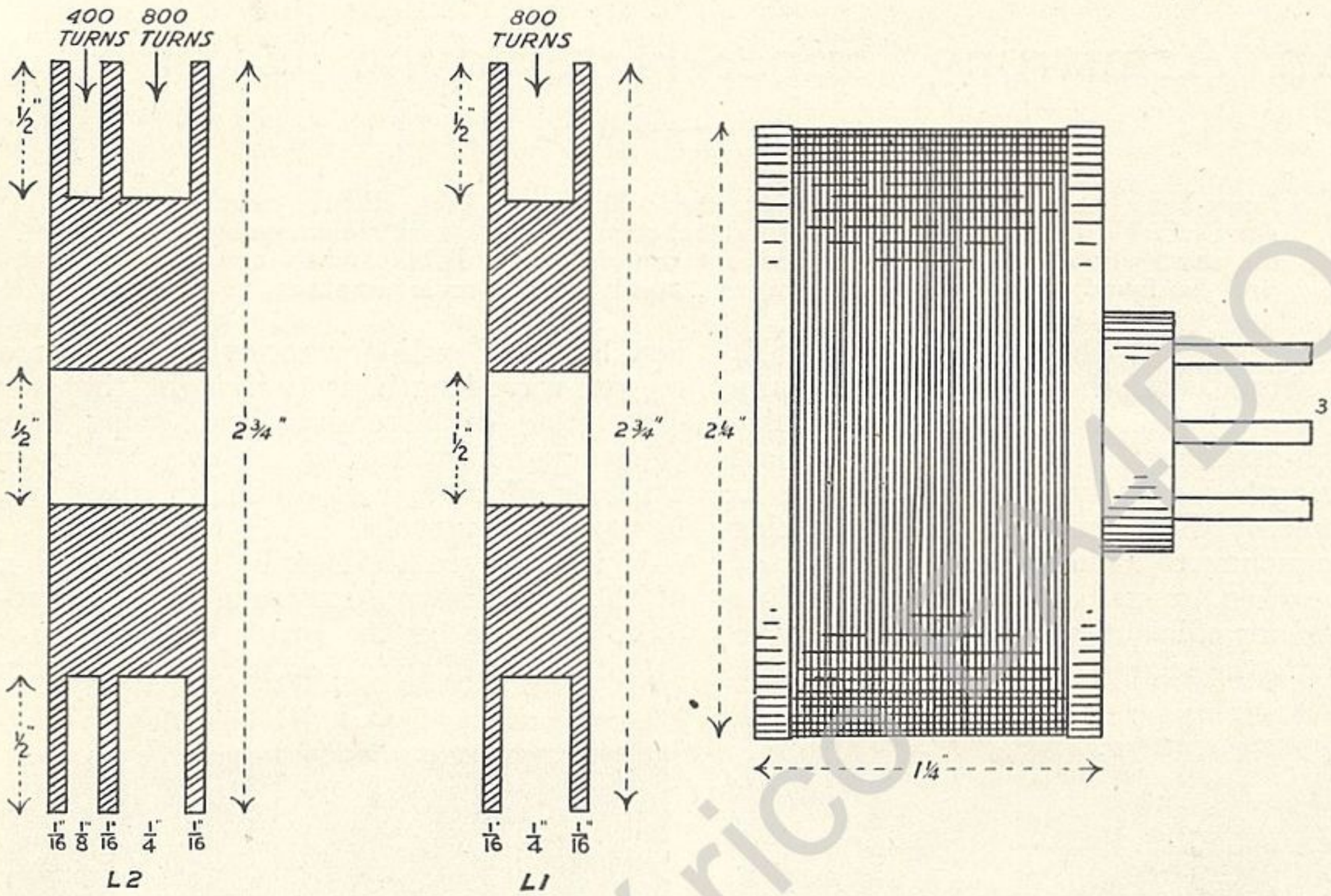


Fig. 2.—On the left are the coupling transformers. Three are required to the dimensions of L_2 and two as L_1, coupled closely together. On the right is the oscillator coil, two being required. One is wound with 30 turns of 24 D.C.C. and works from 140 to 450 metres, and the other is wound with 60 turns, the length being 2½ ins.

H.F. and detector, plus the heterodyning valve and necessary coupling.

It is suggested that the tuned anode coil be of the air-spaced type to reduce self capacity, and for the same reason V.24 or other low-capacity valves may be used. In practice it is found convenient to use a separate H.T. battery of 36 volts with taps for the oscillator valve, and by varying this H.T. voltage it is possible to control the amount of energy transferred to the tuned anode without mechanically altering the coupling; there is also the additional advantage that this method does not affect the tuning. The oscillator coils are of the three-prong plug-in type, with centre tap to negative filament, a variable coupling being arranged between these coils and the tuned anode coil.

Those who have resistance-coupled amplifiers available may use these for the long-wave component with excellent results, but it is strongly advised that the inductively-coupled amplifier be used, as the efficiency of same is so much higher; the resistance-coupled type has also the disadvantage of requiring a higher voltage H.T.

The inductively-coupled type, however, requires more care in adjustment, and, if compressed into too small a cabinet, has the tendency to "couple back."

For those who contemplate making such an amplifier it is suggested that the valve holders be mounted about 6 ins. apart on a board, and then wired up temporarily.

When satisfactory operation is obtained, the question of compression into a cabinet can be taken up. Such step will, undoubtedly, have effects quite unforeseen. All necessary data can be obtained from the diagrams.

The formers for the H.F. transformers may be turned to dimensions out of hard-wood, well dried, and paraffin waxed, or may be built up from waxed cardboard.

They should be mounted on a common shaft of wood, all the coils being wound in the same direction. In connecting up, the two inside leads go to +H.T. and potentiometer slider respectively. Using windings indicated, the amplifier will be resonant at

about 4,000 metres, but the exact wave-length is immaterial so long as the frequency is not too high.

The plate circuits are aperiodic, but it is necessary to tune each grid circuit to the wave-length of the preceding grid circuit. It will be found that if the condensers are adjusted for uniform capacity, and the bobbin turns carefully counted, very little final adjustment will be necessary. This correction should be made after the amplifier is assembled and wired up. Slight changes then necessary may be made by varying the number of turns of the grid circuit transformers. The condenser C_2 is in the grid circuit of second valve, and should have a maximum capacity of ·0005. This condenser controls the regenerative action of the amplifier, and, as this capacity is reduced from maximum, the amplification will be increased up to the point of self-oscillation. This action will be found to be very smooth, with no "overlap," and under perfect control. It is advisable to try the grid leaks connected to +L.T. as well, as shown, as certain valves function better when connected to +L.T.

Any undesirable tendency to self-oscillation can be effectively controlled by the potentiometer, but the writer seldom finds it necessary to damp the grids, although the amplifier cabinet is only 12 ins. long.

This type of amplifier, when once properly adjusted, will continue to function perfectly as long as the H.T. and L.T. batteries are kept in good condition.

For all internal wiring use bare tinned copper wire bent to shape, solder all joints, and consider well the wiring scheme, especially with reference to the relative grid and anode circuits; small changes in wiring have far-reaching effects on all high-frequency amplifiers. Most of the receptions are done on a loop or small indoor aerial. If considered necessary, one or two note magnifiers may be used after the last detecting valve.

After completion the set should be calibrated. Connect up to aerial and earth as usual, and loosely couple a wavemeter to the aerial circuit. Now adjust aerial condenser, closed circuit, and tuned anode condensers, also heterodyne condenser for maximum signals. (Signals will be heard at two different settings of heterodyne condenser.)

Note should be made of the wave-length as indicated on wavemeter, and a chart should be prepared with columns for various condenser adjustments.

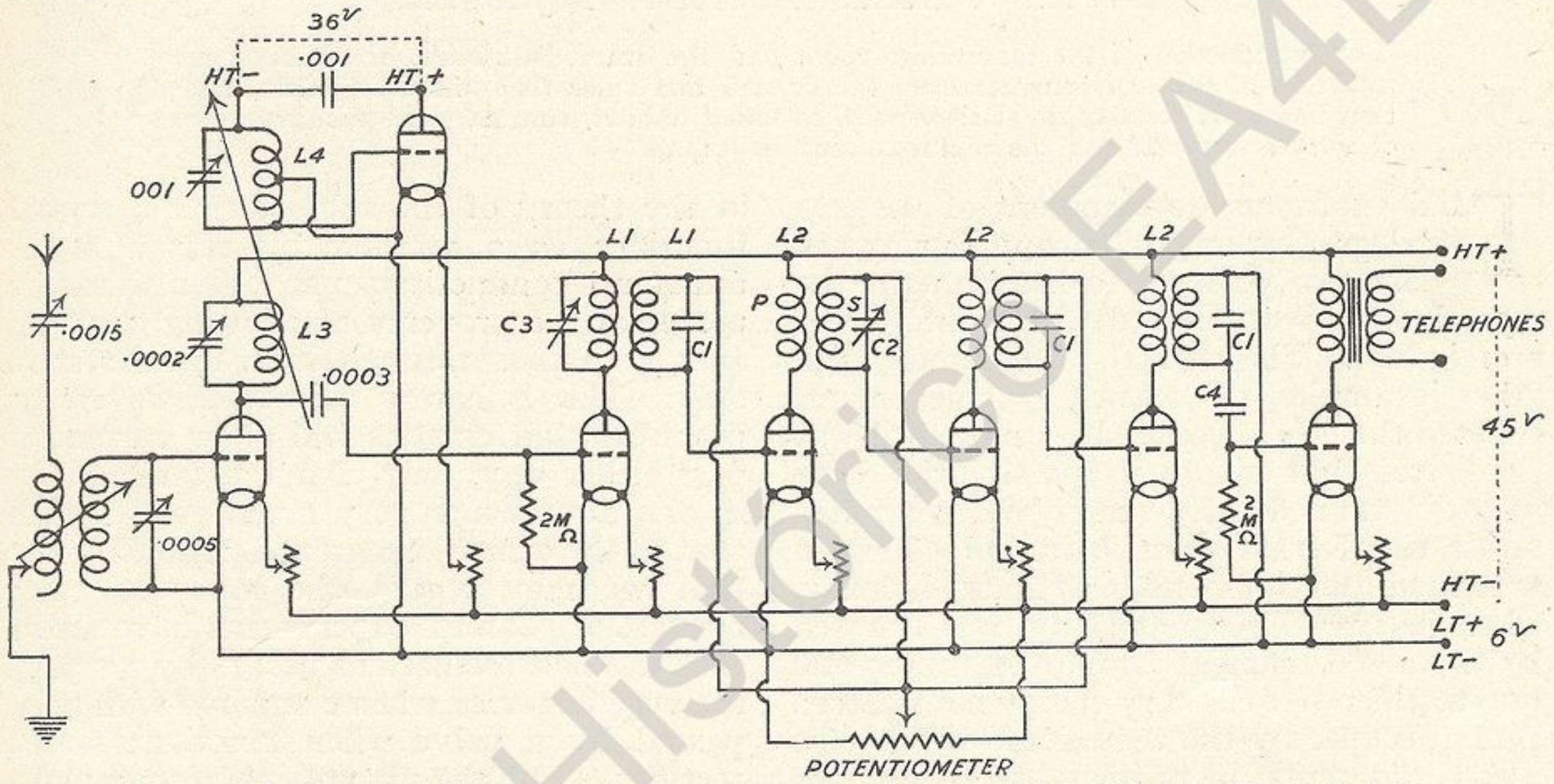


Fig. 3.—The complete circuit of the receiver in which the values are as follows :—C1 0·0001 mfd., C2 0·0005 mfd., C3 0·0002 mfd., C4 0·0003 mfd., L1 800 turns 36 D.S.C., L2 Primary 400 turns, Secondary 800 turns, 36 D.S.C., L3 Tuned anode coil, L4 Threepin plug-in oscillator coil.

This should be tabulated to cover the whole range of the receiver. By this means the maximum results may be obtained on any setting with ease.

It should be noted that the instrument so calibrated may be operated on any aerial suitable for short-wave reception, the only unknown factor being the tuning of the aerial. Although the adjustment appears to be complicated, in practice it is not so, and the writer finds the circuit particularly adapted to quick search.

SPECIAL ARTICLE:—8 DULL EMITTER VALVES

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Experimental Wireless

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The Month's "DX."

Recorded by HUGH N. RYAN (5BV).

The increasing efficiency of amateur transmitters and receivers is resulting in the creation of many new long-distance records which are undoubtedly worthy of mention. It is proposed to record month by month work in this direcion, and the Editor will be pleased to receive details for inclusion in these pages.

MANY of the keenest and most able of our transmitting experimenters devote their efforts entirely to DX work, or the covering of the greatest possible distances with their transmitters. There are many others who, while spending some of their time on shorter-range telephony and kindred work, also carry out DX when they consider conditions to be favourable. It is, I think, generally felt by both classes of experimenter that DX has not received the attention it deserves in radio periodicals. One hears a great deal about the telephony men whose gramophone records are heard in remote parts of our islands. Most of us are kept fully aware of our musical neighbours who strike up with their ± ten watts, without previously listening in, pump out a series of records, and switch off without subsequently listening in for the report we should so much like to give them.

But the DX station does his work chiefly in the small hours, and is generally an obscure sort of individual. The worst of it is that he is generally despised by the lordly telephony men, who regard him as a reactionary who is still dabbling with the departing relics of an obsolete system. Some of our newest telephony stations are even displaying a lamentable difficulty in understanding the "obsolete" code used.

As yet, the DX man has only come into his own for a brief period yearly, when he burns the midnight amps in his efforts to receive Americans on the fewest possible valves, and the gramophone men wonder how he does it.

But the best DX stations are working all the year, and these notes are an attempt to chronicle, month by month, the results they are obtaining.

At present, very little European DX is in progress. Everybody seems to be spending the day-time in building that transmitter which the Yanks simply can't help hearing, and the night in teaching the receiver to catch the Yanks' replies. One or two stations are already making their initial attempts to get across. The best I have heard yet is 2JF, who seems to be in the fore of most good things in DX. 2KW, a confirmed optimist, has been heard to call at least one Yank with 0.1 in the aerial. The London contingent appears to consist, so far, of 5NN, 2SZ, 2SH and 5BV. I am afraid that none of the latter is in form yet, judging from the reports I have received from the North. Quite a number of stations

have started work on the receiving side. The two most striking features of reception so far are the great number of Americans who are received considering the time of year, and the great number of stations who are confining their attentions to single-valve receivers. 5 NN has been doing very well with a Reinartz. 2ZS of Liverpool tells me that he has logged about 70 Americans this month on one valve. By the way, 2ZS's signals come in remarkably well in London considering his aerial current is only 0.12. My own log is about 35 so far this season, on one valve. Our old American friends of last year seem conspicuous by their absence. 2FP and 1BCG are very strong, as usual, and I have had one report of 2EL, but what has happened to all last year's favourites, 1XM, 1BD1, 2BML, and 8AQO? Has anyone heard them? I think that very few of the best Americans are working at present, as although we hear so many American amateurs, we seem to hear a different batch every time. With the exception of 2FP and 4FT, I have never heard any of them on two different nights. Perhaps the best of them are giving their transmitters a rest while they are busy improving their reception. They certainly were not at all pleased with their results last year, and intend doing much better this time. We hear a lot of complaints from our men that we can never get over while the Americans use such inefficient receivers. There is no need to be so pessimistic. I cannot believe that there are really no first-class receivers over there. Our transmission leaves much to be desired at present, and it is up to us to improve it.

You have no doubt noticed how very quiet the French stations are now. It seems likely that they are preparing their transmitters for the winter's work. They are allowed 100 watts in the aerial, and, as very few of them use anything like this power, they have plenty of room for increasing this factor in their transmissions. 8AB will probably use the same power as last year. Certainly he is strong enough to carry anywhere. 8AQ tells me that he is installing a 350 cycle alternator to replace his present 50 cycle supply. He hopes to increase his power considerably, and also to improve his note. Dr. Corret of 8AE and 8AW is using notepaper headed "Comité des essais transatlantiques," which is a good sign, though I do not know quite what he proposes to do. 8BV seems very keen on American work. 2ZS has been heard loudly on one valve by 8BF, when using two watts. There is no doubt about the efficiency of some of the low-power stations in the North.

I do not know what the Dutch stations are doing this year, but the strength of PCII has greatly increased recently; I believe he has about 6 amps. in the aerial.

Those who stay up in the small hours have probably noticed how well the American broadcasting stations are coming in now. WGY and KDKA are exceptionally good, and on a good night WGY is comfortably readable on one valve. 5NN has been getting good loud-speaker results on three valves.

This month's notes have been necessarily confined to a few stations, as only a few are working DX at present. During the coming month, given favourable weather, things should become much more lively. I try to keep in touch with all that is happening in DX, but it is impossible to hear everything. This may perhaps be a blessing in disguise at times, but if any stations get any very good results on DX transmission or reception, we shall be very glad to hear about them. In America they publish a monthly list, known as the "Brass Pounders League," of the stations who have handled the most messages during the month. Fortunately message-passing does not enter our work, but it would be interesting to know who receives the most American stations each month. The best log I have heard of this month is 70 different stations, received by 2ZS. This record will, we hope, be beaten many times in the coming month, and may it be on single valve sets.

SPECIAL ARTICLE :—SIMULTANEOUS BROADCAS

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Experimental Topics.

Wireless Television.

IN the course of an address given before the Royal Society of Arts last month M. Edouard Belin disclosed the fact that he had recently succeeded in transmitting real photographs in half-tones by wireless. M. Belin has been making extended researches in his laboratory at La Malmaison, and he is convinced that the solution of the problem of wireless television is near at hand. The Belin system of telephotography had been developed not only to permit of the transmission of ordinary handwriting and of shorthand, but also to provide absolute secrecy in telegraphic and radiotelegraphic transmissions. Autograph messages have been transmitted by wireless both in France and America. This is a fascinating field of research, and it does not require much imagination to visualise the enormous possibilities of wireless television when achieved on a commercial scale.

The Transatlantic Tests.

This year the Transatlantic Tests organised in conjunction with the American Radio Relay League are due to commence on December 22. Although many experimenters occupy their time with Transatlantic work throughout the greater part of the winter, the official tests always arouse considerable interest amongst amateurs as a whole, and it is anticipated that the number of listeners on this side will be greatly increased by many newcomers in the field of experimental work. To those we make a special appeal. The radiating properties of a receiving aerial on 200 metres are very good, and unless particular care is exercised in the use of oscillating circuits, it is highly probable that the work of an experienced experimenter may be completely spoiled by radiation from a neighbouring aerial. In the subsequent pages of this issue will be found several articles particularly relating to short-wave reception, and it is sincerely to be hoped that many will adopt the suggestions given, to the benefit of all concerned. So far as our own transmission is concerned, the granting of 100 and 1,000-watt licences to certain experimenters certainly increases our chances of "getting across the pond," but the ultimate success of the experiment is, unfortunately, wholly dependant upon the prevailing conditions during the period of the tests.

Radio 2UV A.R.R.A.

By W. E. F. CORSHAM.

Amateur transmission stations usually show a marked dissimilarity in circuits, systems, and apparatus employed. This is due no doubt to the fact that many experimenters build their sets as a result of their own investigations. In order that experimenters may become acquainted with the work of others, details of stations embodying novel methods and circuits would be welcomed in these pages.

EXPERIMENTAL station 2UV, better known as "Two Uncle Vic," the station's 'phone call, is located in the valley at the bottom of Harlesden Gardens, London, N.W.10, and came into action at the beginning of 1920, the twin aerial being hoisted almost immediately after my demobilisation from the R.E.S.S. The first

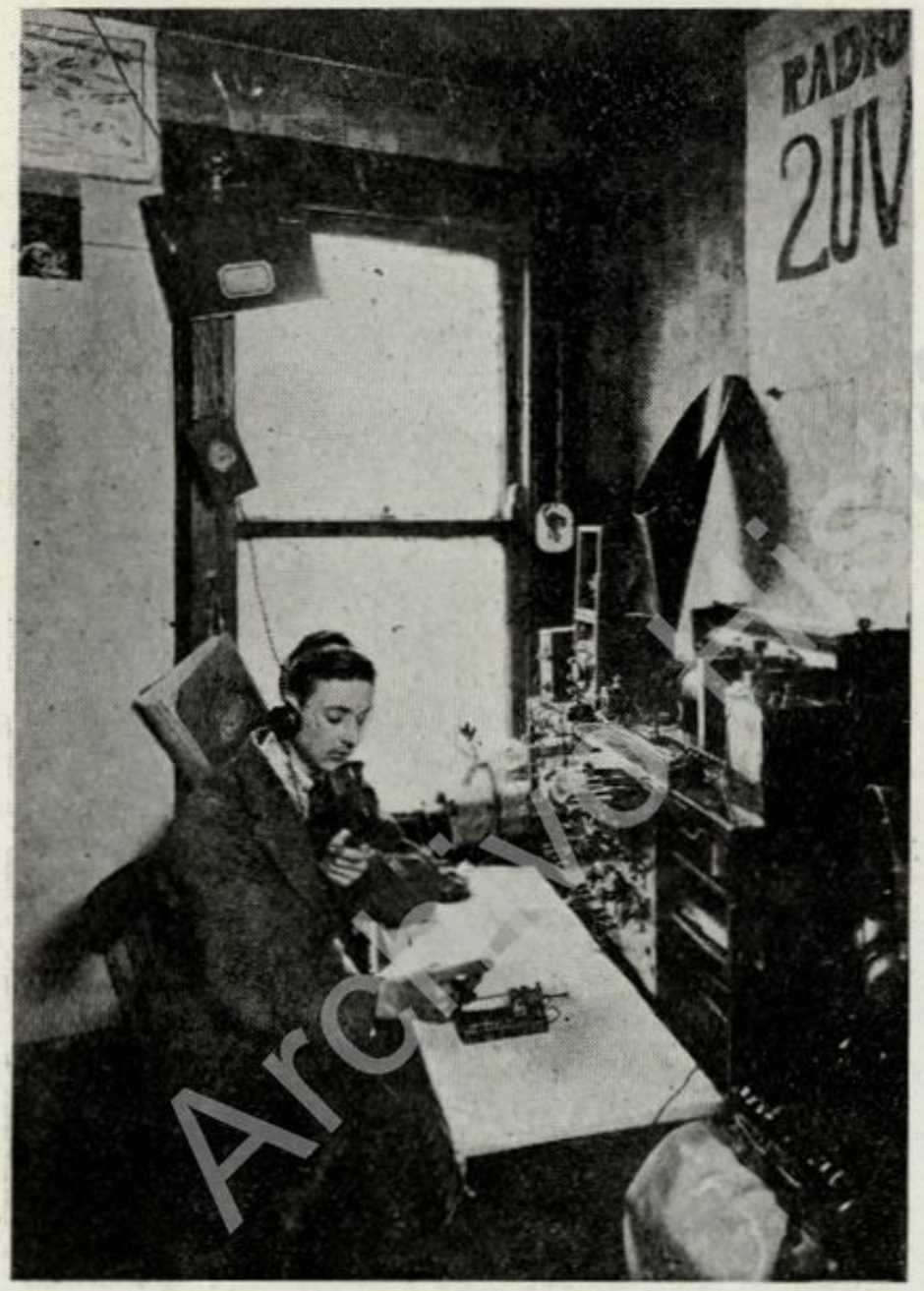

Fig. 1.—Showing the general appearance of 2UV.

difficulty consisted of getting gear together, and, due to this trouble, a crystal set was the first set in use. I wonder if the broadcasting people know what a wonderful amount of interest can be got out of a crystal set? Most of the Mediterranean stations were copied off this set, and it was in use for quite a long period, giving entire satisfaction, and on some nights some remarkable performances.

When the first amateur transmitters began to get into operation on 1,000 metres did anyone ever hear such a large amount of Q.R.M. that immediately began to spring up on that wave-length; BYK and other Navy sparks using about 2 to 5 kw. seemed to work most of the day and nearly all night, and the "Sorry, O.M., Q.R.M.!" got so frequent that it was obvious that a new wave-length would have to be found, especially as Croydon was occasionally being Q.R.M. by a slight miscalculation of

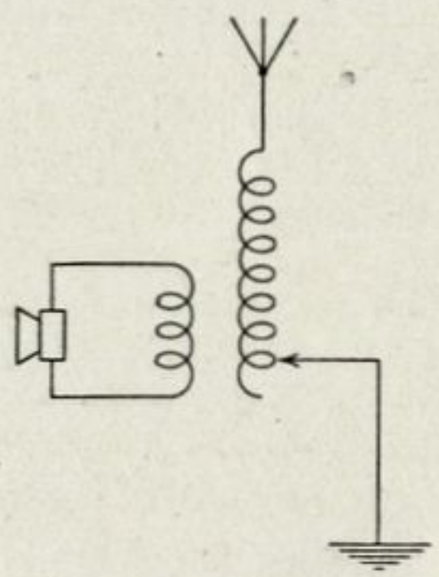

Fig. 2.—The simple modulation system consists of an absorption coil coupled to the aerial circuit.

wave-length, and PCGG had commenced music tests. The non-transmitting amateurs began to voice their disapproval of the heterodyning effect of carrier waves on this station, so that the poor transmitting amateur, already well bound up by restrictions, began to look for some other wave to release his experiments on, and the first stragglers began to appear on 360 metres, where, in course of time, new emigrants from 1,000 appeared every evening, until in time 360 began to get as bad as 1,000 metres for congestion. Then the Cross Channel commercial sets began to get busy, and shipping

to increase their use of the 300-metre wave. D.F. stations on 400 to 440 also got busy, and down we went again to 200. Finally the Post Office authorities sanctioned the use

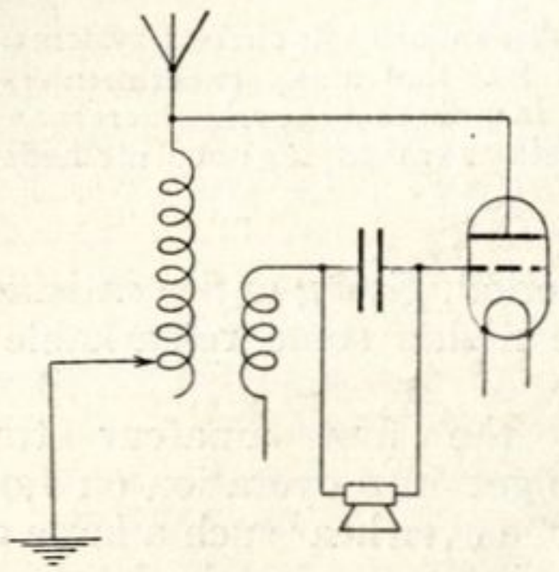

Fig. 3.—Here the microphone replaces the normal grid leak.

of 200 and 440 metres and the 1,000-metre wave-length was closed for amateur work.

The first transmitter at 2UV consisted of a tonic train set, radiating ·06 on 1,000 metres, 0·1 on 360 metres, and 0·13 on 200 metres. This was, I believe, the first tonic train set of its kind to be used in London after the war, the feed consisting of 4 volts on a ¼" spark coil, taking about 2 amps. in primary coil, and supplying heavens knows how many volts on the plate, but very few milliamps., hence the low radiation. Very successful results were obtained with this set, quite good distances being worked, an example being the tests worked with 2JZ of Huntly, Aberdeenshire, in February, 1922, when he received my signals and replied to me on a set whose input was less than 50 watts. I got his speech very well on a three-valve L.F. set. That's 500 miles on a set radiating 0·1 amps., whose actual wattage must have been in the region of 2 to 3 watts output, and good clear speech on 50 watts.

The set used can be seen in Fig. 1. A small power 'phone set, also radiating 0·1, came into being at this time, with about 120 volts on plate ; good speech at 20 to 30 miles was obtained on this input, and on some very special tests arranged with 2OD and 2SX, they received my speech Q.R.Z., but clearly when my input consisted of the six-volt

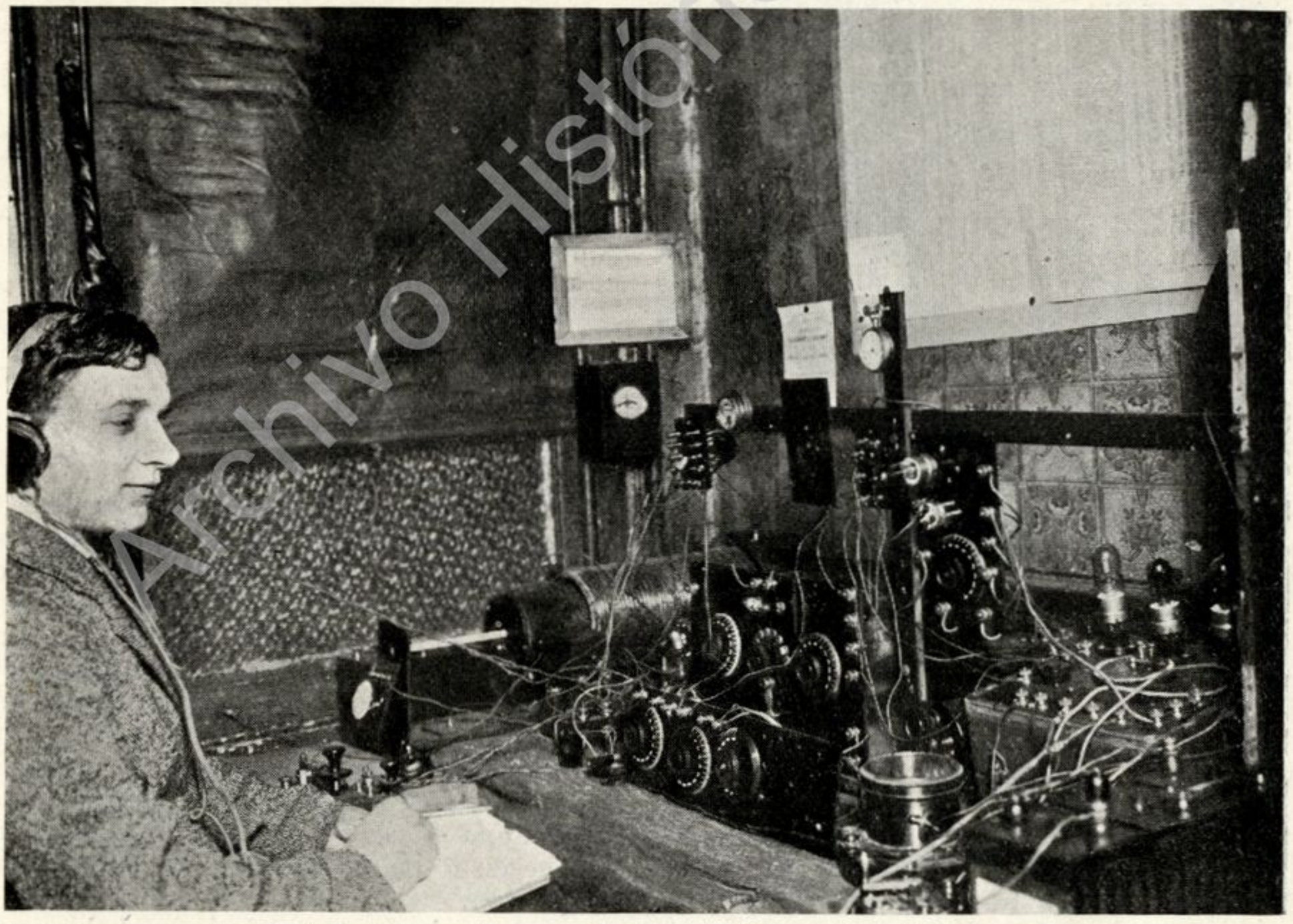

Fig. 4.—The apparatus employed by 2UV during the last Transatlantic Tests.

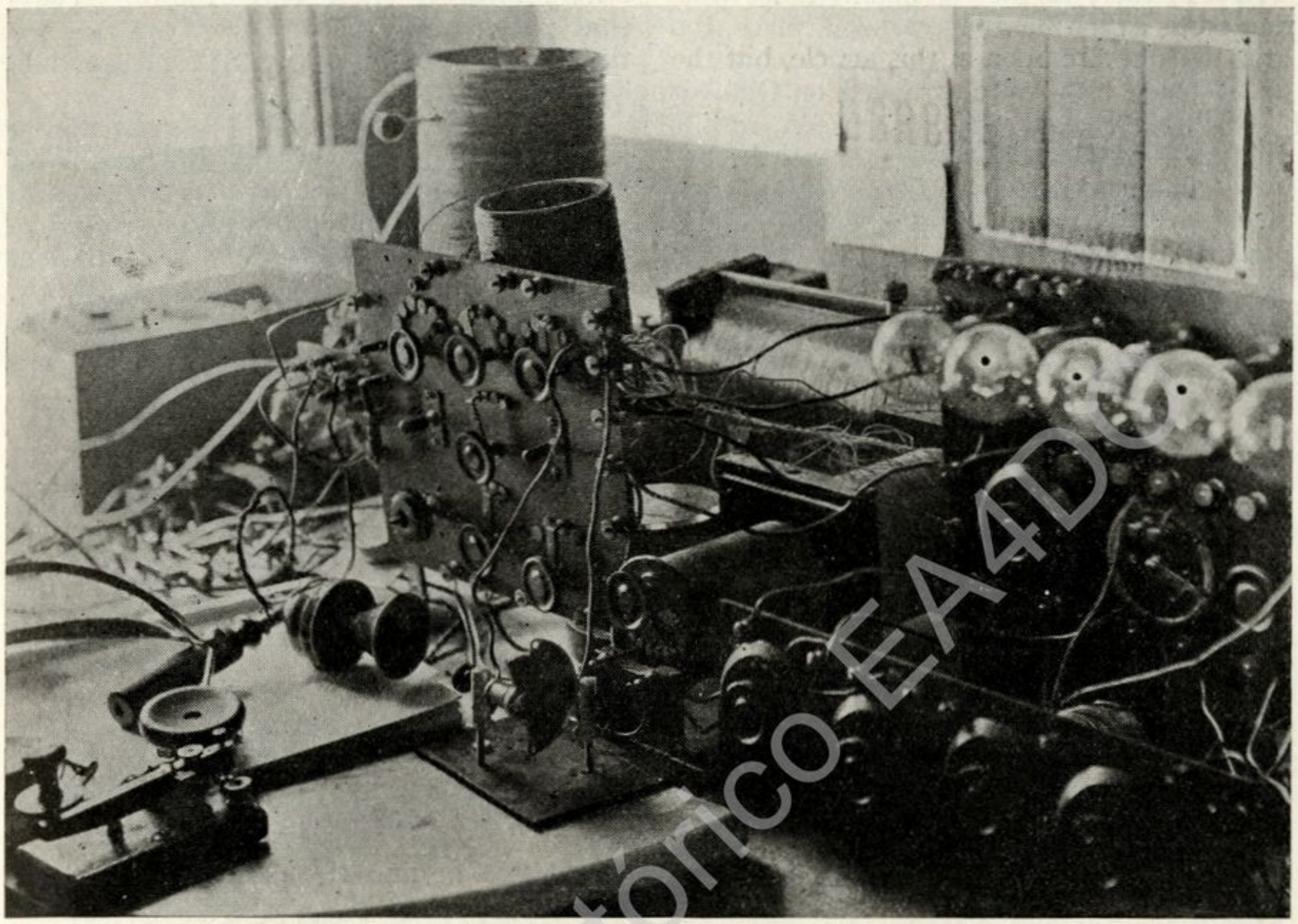

Fig. 5.—A near view of the apparatus now in use at 2UV.

accumulator supplying the valve filaments, and a four-volt dry cell from the H.T., very much the worse for wear ; in other words, a doubtful ten volts. How did I modulate it ? Perfectly simple—a coil coupled to the aerial circuit on the earth side will do this very well, but a better and much easier system is as in Fig. 3, where the microphone, shunted by a condenser, takes the place of the grid leak. This system works excellently on radiations up to 0·2, but heavy saturation begins to set in here, and ordinary grid control is far more reliable then, but wonderfully clear results are obtainable on these systems at low inputs, and a good deal of unnecessary trouble and fuss can be saved. So much for the transmitter.

The receiver at 2UV is possibly one of the most efficient of its kind in London. The first record put up was the first reception of the American amateurs in Great Britain, when 2UV successfully logged 1AFV of Salem, Mass., on a three-valve set (L.F.), a most astounding piece of work, considering that it was the first time the receiver had

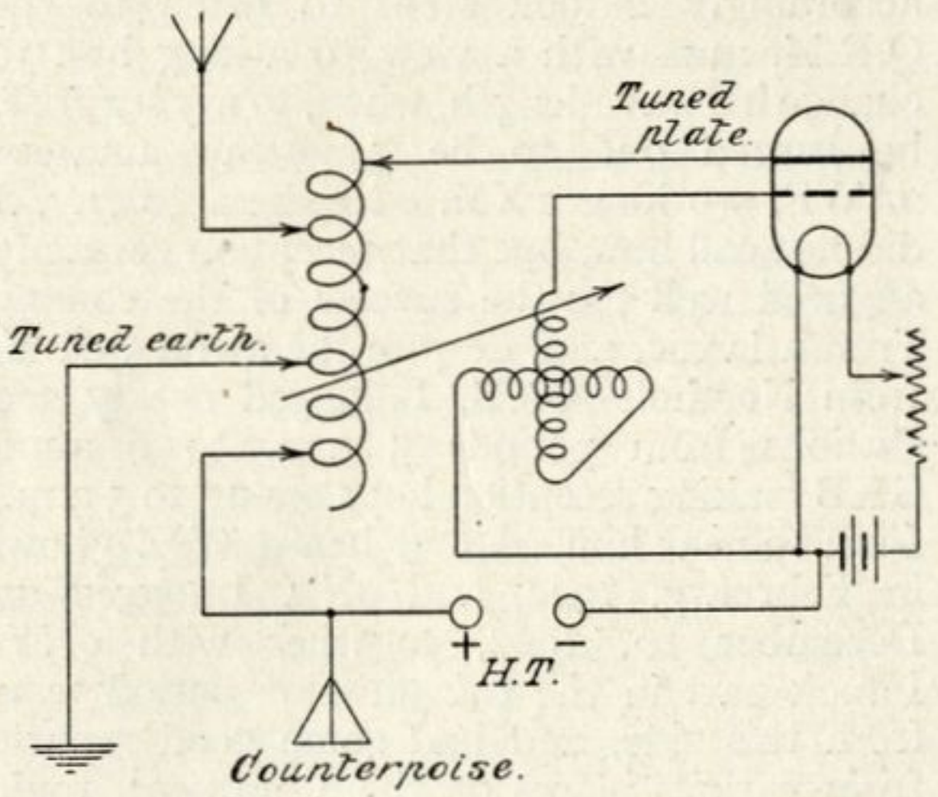

Fig. 6.—Illustrating the circuit employed for transmission.

got down to 200 metres, and that the first three hours it was at work saw the code word

YLPMF safely in the log book. Since then numerous experiments have taken place, too long to elaborate upon in this article, but the first French tests were arranged on October 31 with 8LBC, and very good Q.S.A. results obtained. Before the 1922 transatlantics were commenced a rather interesting incident, worthy of mention here, occurred, and possibly the first of its kind in this country. On November 26, 1922, at 11.59 p.m., when testing out the set I was going to use for the

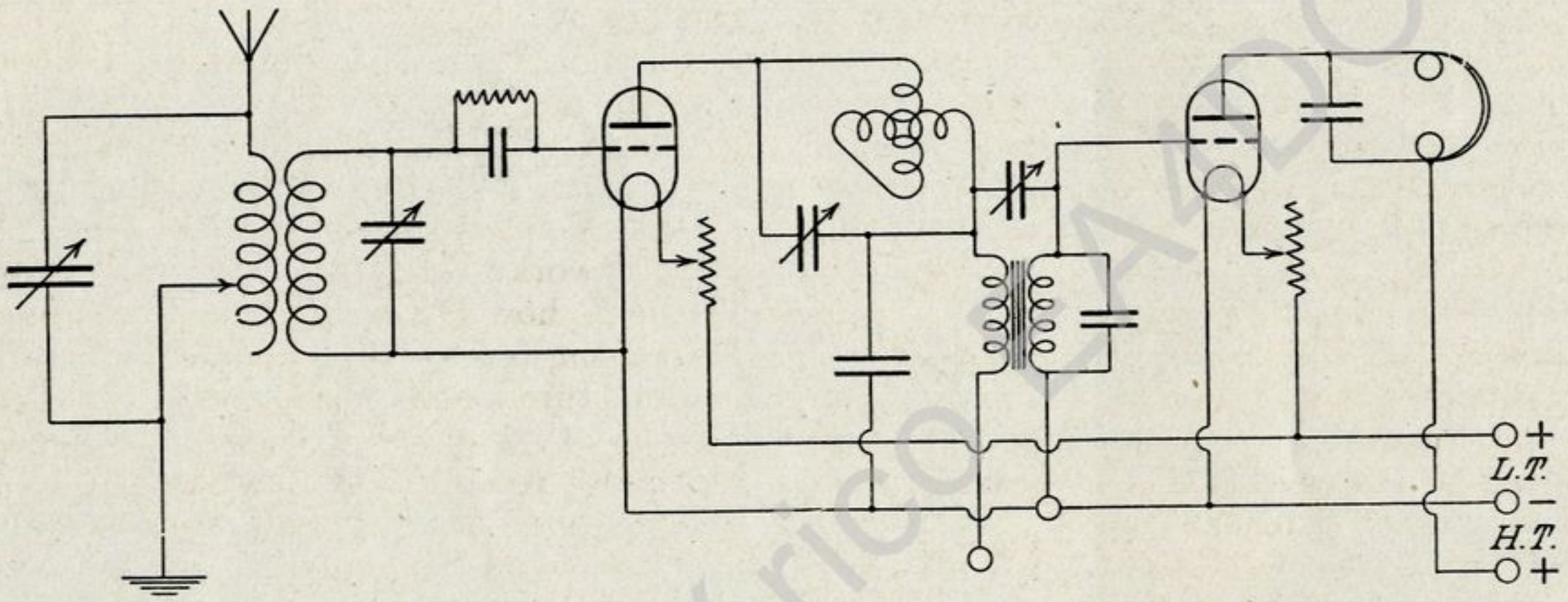

Fig. 7.—The receiver employs a single valve regenerative circuit with tuned plate coil, followed by a special note magnifier.

coming tests, and working with 2OD, of Gerrard's Cross, to my annoyance a C.W. station came dead on top of him, making reception exceedingly hard. I couldn't get one tuned out without getting the other, and accordingly I took steps to listen to the Q.R.M. man with a view to asking him to change his wave-length, when, to my surprise, he turned out to be American amateur 2AWF, working 1XM. Needless to say, I did not call him, but that reception certainly augured well for the success of the coming Transatlantic, and, despite the awful Q.R.M. from Northolt GKB, I logged nearly 200 stations from periods 3 a.m. to 6 a.m., GKB making reception hopeless up to 3 a.m., I am so near him. I first heard WJZ's howl in February, 1922, and oNX I logged on December 10, 1922, together with oNY. I took part in the transmission period tests from this side, and had some good reports from various places on the Continent, tonic train being used. No doubt 2KF, 2OM, and 2SH remember those early morning chats that passed away the hours of waiting for the period, the station at 2UV in use then being pictured in Fig. 4.

The present station will be seen in Fig. 5, and consists of a tonic train set capable of radiating 1 to 2 amps.; a C.W. and 'phone set capable of radiating 0·7, and a five-valve receiver one to five valves at will. The usual number in use being two. Most of the U.S.A. broadcasters have been logged on this, together with a good number of American amateurs.

The circuit of the transmitter is shown in Fig. 6, and that of the receiver in Fig. 7. I always use L.F. because it is my practical experience that much better results are obtainable on distance work if great care is exercised to clear distortion for speech, and it is quite possible to get rid of that bugbear to the low-frequency worker. The only good word I have for H.F., and I have at times used it fairly extensively, is for its better selectivity, and I use it occasionally when GKB is Q.R.M., but a good tuned circuit is just as good.

This concludes a rough outline of 2UV, and the work accomplished since its inauguration. A 1-kw. license has been granted to the station by the P.M.G., and if all goes well, I hope for good DX work with the U.S. amateurs in the near future, together with my brother amateurs of the A.R.R.A. "Best 73's C.Q.!"

The Month's "DX."

Recorded by HUGH N. RYAN (5BV).

The increasing efficiency of amateur transmitters and receivers is resulting in the creation of many new long-distance records which are undoubtedly worthy of mention. It is proposed to record month by month work in this direction, and the Editor will be pleased to receive details for inclusion in these pages.

THE outstanding feature of the past month has, of course, been the extraordinary spell of bad conditions, lasting about five weeks, and including the whole of October, during which reception of American amateurs was practically impossible. The conditions on the early morning of September 23 were perfect, and Americans were coming in nearly as fast as they could be logged. It was a few days after this that last month's notes were written. Apparently I was crowing about the splendid conditions a little too soon, as I heard not a single American between that date and November 10, neither have I heard a report of any other listener doing so. 2JF, 2ZS, 2KF and other well-known men all report to the same effect.

The Transatlantic aspect of these notes was in imminent danger of disappearing this month when quite suddenly normal conditions returned. They may or may not last, but at the time of writing all is well. Now for the actual results obtained. Reports from the North are not yet to hand, but certainly London has been getting some excellent logs.

On the morning of October 11 5NN logged twelve Americans on one valve. 2WY received the very fine total of twenty-three on the same morning, using three valves. About twelve Americans were received on one valve by 2AAH (British, not American !), who has one of our latest series of call-signs, but is nevertheless an "old-timer" in DX work. I only kept a short watch that night and received ten Americans on one valve.

I heard 2JF and 5KO calling 1CMP several times, so it may be assumed that they were also on the war-path.

The two strongest Americans were 1CMP and 2BY, both of whom produced very loud signals indeed. An interesting item was an A.R.R.L. broadcast message from 1FD. This was rather badly jammed in London, but parts were quite readable, including a report of a cable just received from England in connection with Transatlantic work. The message was signed "Schnell," the A.R.R.L. traffic manager. That practically concludes the American news, since the bad weather spell only broke a few days before writing.

Canadian 1AR has written asking for the co-operation of British amateurs in Transatlantic work to show our American "Radio-Cousins" how DX really can be conducted. He is using transmitting apparatus of British manufacture, and works with an aerial current of $7\frac{1}{2}$ amps. He would appreciate reports of reception in this country, having been received here a record number of times in August and September.

A curious feature of the spell of bad conditions was that it only seemed seriously to affect Transatlantic work. European DX has not been seriously hindered by it. The Dutch stations have been coming Transatlantic well, but nothing of great interest has occurred in connection with any of them except PCII of Leiden, who reports having effected two-way working with 7ACM on the morning of Sunday, October 4, between 3 and 4 a.m., Amsterdam time. The whole of the working was overheard and confirmed by oMX of Amsterdam.

The Dutch "Radio-Expres" states that PCII was using 100 watts, and radiating 3 ampères, using a Mullard valve with 1,500–2,000 volts on the plate. The working remains to be confirmed, but if it turns out to be authentic it is a very fine piece of work, as the seventh district is the one most remote from Europe, and 7ACM is at Cambridge, in Washington State, right over on the Northern Pacific coast of America ! We will leave our congratulations until it is confirmed.

The only other notable feature of Dutch work this month is the sudden and considerable increase in the strength of oDV.

The French stations are now awaking from their summer sleep, and have been very much in evidence during the last month. I suggested in last month's notes that 8AQ's silence was due to the non-arrival of his new alternator. It appears that the reverse is the case. The alternator turned up, full of beans, and 8AQ is now having his valves repaired! 8BF, of Orleans, has just installed a new transmitter, using 25 cycles A.C. The signals from this set are extremely strong, and the note is exactly like the once-familiar note of 8AB. 8BF tells me that the power of this set is one kilowatt, and that during the Transatlantic tests he is going to use it alternately with his old 100-watt pure C.W. set. In spite of the power of the 25-cycle set, I think I would put my money on the pure C.W.

There are now several more British stations "on the air" with their potential Transatlantic transmitters. 5NN has been suffering from valve trouble, but is now working again. 2SH is again using big power, under a special licence for 100 watts. He is putting about 4 amps. into the aerial. Several other stations have been granted these temporary licences for increased power during the Transatlantic season, and may soon be expected to establish some interesting records. An important point in connection with these licences is that, under their terms a British station calling an American should prefix the American call sign with the letter "n" and his own call sign with the letter "g," *e.g.*, "n 1CMP de g 2JF." This will help to avoid confusion between British call signs and their American duplicates. It is to be hoped that all British transmitters using sufficient power to render distant reception possible will, in future, use this prefix. It is much less clumsy than the present "British" or "Brit." prefixes.

In connection with the issuing of special licences for Transatlantic work, it is interesting to note that the Dutch authorities have sanctioned the erection of a station for this purpose, the licence allowing the station to operate until May, 1924.

The station is to use C.W., power 500 watts, and wave-length 200 metres. It is to be situated at Delft, and its call sign is PA9.

It will be remembered that last month I suggested that the fault of the non-reception of our signals in America did not, perhaps, lie entirely with the receivers on the other side, as is rather commonly supposed by our men. I think that my view is confirmed by the results obtained by several American amateurs in *working* with the Macmillan Expedition Station WNP. The Macmillan ship is at present frozen in the Arctic at a nearer point to England than to an average point in the States, but yet he has carried out two-way working with several American amateurs, while he has never yet been received in England, neither has he received any British signals. That, I think, should dispel the idea that American amateurs cannot receive. This should give us more hope of getting over so long as we send out good stuff, and it should also encourage us to try to receive WNP. I know that many of our stations are trying to do so, and it is difficult to explain their lack of success.

With regard to the well-known Americans of last year upon whose absence this year I commented in the last notes, the list still holds good with the exception of 1BDI, who has now been logged this year by 5NN (November 11).

Apart from the chronicling of DX, I should like this month to put forward a suggestion for the better reporting of signal strength in DX and other work. The present "R" code of signal strengths has become useless, firstly because it has far too many different degrees of audibility, and secondly because everybody applies a different meaning to it. Nobody can really say what is the difference, for instance, between R5 and R6, nor is that difference of sufficient importance to be worth worrying about.

I suggest a new code, which should be called by a different letter to distinguish it from the old "R" code, which should have only four degrees of audibility, and which should take into account the receiver used. Let us call it the "A" code, then "A21" would mean strength 2 on one valve.

The figures for strength would be—

1—just readable (with difficulty).
2—comfortably readable, but not very strong.
3—good strong signals (the best strength for good consistent work).
4—very strong.

The second figure should indicate the

Experimental Wireless

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Experimental Topics.

Trans-Atlantic Telegraphy.

DECEMBER, 1923, will always stand out as one of the stepping stones in the history not only of amateur experimental work, but of wireless progress in general. During the latter weeks some of the most remarkable transmissions ever recorded have been conducted, fuller details of which will be found elsewhere in these pages. It is only within the last few years that the problem of long-distance transmission has been approached from an entirely different view-point. Formerly, the tendency has been to erect gigantic stations using power of the order of some 50 kilowatts or more, and to operate these stations on extremely long wave-lengths. Recent events, however, seem to indicate that this system is now open to considerable rivalry, and its continuance will probably be a matter of some debate. Progress in short-wave transmission during the last few years has led up to a number of experiments on trans-Atlantic telegraphy using a directed beam with an input power of the order of one kilowatt. The success of these experiments has created considerable interest, but this accomplishment seems almost insignificant in light of the recent amateur performances. Mr. E. J. Simmonds, a regular contributor to EXPERIMENTAL WIRELESS, and one of the leading private experimenters in the country, has created what is surely a world's record in establishing two-way communication with a Mr. Dodman, of Summit, U.S.A., using a power of approximately 30 watts. The communication was conducted without the slightest difficulty, and it is not regarded in any sense as a freak performance. Previous to this accomplishment, we have news of Mr. Partridge and Mr. Hogg getting in touch with several American and Canadian stations on powers of approximately 100 watts. The workings were not confined to one or two short periods on one particular day, but were repeated on several occasions. There are two important deductions to be drawn from these events. It is clearly evident that the possibilities of short-wave low-power transmission are not yet fully realised, and are not likely to be so until further investigation has taken place, and, perhaps, it is not rash to suggest in the very near future, the shorter waves will be of greater use than the longer waves. What is more important, however, from the amateur point of view, is that these remarkable transmissions are primâ facie evidence of the value of private experimental work, and should serve to strengthen materially the amateur's position and his relationship with the authorities. While we are strictly opposed to the issue of transmitting licences to all who may care to apply for them, it is sincerely to be hoped that the genuine experimenter will be given greater facilities for further investigations. It is very gratifying to learn that many transmitting licensees are more than justifying their claims for a permit by doing such excellent work, and the fact that each year's performance excels that of the previous year is a clear proof, not only of their capabilities, but of the value of their investigations.

The Month's "DX."

Recorded by HUGH N. RYAN (5BV).

The increasing efficiency of amateur transmitters and receivers is resulting in the creation of many new long-distance records which are undoubtedly worthy of mention. It is proposed to record month by month work in this direction, and the Editor will be pleased to receive details for inclusion in these pages.

SINCE last month's notes the DX world has awakened well and truly. Last month the all-night listener for Americans heard nothing but Americans and a few hetrodynes (the number of Americans logged varying inversely as the umpteenth power of the number of hetrodynes.)

Now, however, most of the long-awaited high-power transmitters are in action, and, judging by the awful row that goes on in the small hours, the power really is high.

The time for producing long lists of "Yanks heard" is past, and everyone is striving to be the first to "get over" or, better still, accomplish two-way working with the States.

Since there are few very good logs this month, I will deal with the few first. The fact that anyone can get so many Yanks through the QRM shows that conditions are splendid. The small number of logs is due entirely to the fact that most of the best men are engaged chiefly in transmitting. By far the best night yet was that of December 1-2. Conditions on that night were not very good until about 6.50 a.m. on the 2nd, when Americans started to come in as fast as they could be logged, and were still coming in at 8 a.m. in broad daylight!

Between 7 a.m and 8 a.m. 2AAH logged twenty-six complete calls (*i.e.*, call-sign of both calling and called stations), as well as many other single call-signs logged, on one valve—a very fine performance. On the same morning, between 6 a.m. and 8 a.m., 6LJ, another London man, logged thirty-seven Americans, calls being received from every district except the seventh—another excellent piece of work.

Mr. Rogers, a receiving man at Ashford, has logged some fifty Americans on one and two valves.

No reports from the north are to hand.

The excellent conditions indicated by these results give us great hopes for the official tests in the near future.

On that splendid morning, December 2, I answered a CQ from 8AJW, and received a reply asking for a repetition of call-sign and more power. Unfortunately, the rest of the working was spoilt by a humorist with a hetrodyne who appeared to think that his call-sign was 8AJW!

The reception of PCII by 7ACM, reported in last month's notes, was, unfortunately, not true, being due to a similar hetrodyne masquerading as 7ACM. It is most unsporting behaviour on the part of the stations who do this sort of thing with their hetrodynes, and it is to be hoped that they will have the decency to refrain from it in future. In this case, PCII has our entire sympathy, and we wish him all the better luck in the near future.

8AB, of Nice, whose 25-cycle note was so familiar last year, has been in America ever since the end of last year's tests, and has only just returned. Not many people have noticed his return, however, as he now works on 130 metres! He has already worked with two American amateurs, who appear to get him very well on that short wave-length.

Many of the Americans are also down on that wave, and come in very loudly indeed. The great advantage of going down there is that horrible fading which characterises all 200 metre work is almost entirely absent. After being used to the effect, it sounds quite uncanny to hear a weak distant station staying at a constant strength. Low power signals also seem to carry very well indeed on this wave-length. I think that by the time we are working regularly with the States (and may it be soon), it will be on about 150 metres. It promises to be the

wave-length for DX as soon as the majority of stations can receive it efficiently.

That practically completes the American news.

The R.S.G.B. station, 5AT, is now going strong. It has sent out some very useful calibration waves, for the benefit of the many who do not quite know where 200 metres is, and the knowledge of the exact position of this and the other waves sent will be of great benefit to many who do not possess wave meters.

Also 5AT has recently been working in the small hours trying, like the rest of us, to "get over the Pond." He has also been calling the elusive WNP, but with, unfortunately, no more success than we have had.

We have this month had the unusual experience of hearing our friends the broadcasters engaged in perfectly good DX. The tests have been so widely reported in the technical press, that no more than a passing mention is necessary here. Nevertheless, we congratulate them upon their temporary entry into our nocturnal activities. (By the way, we know now what Uncle Arthur means by "The night shall be filled with music!")

The tests showed, at any rate, that the B.B.C. are no more immune than we are from the spells of bad conditions which always come when they are least wanted.

European DX has rather been overshadowed by the American work, but several interesting results have been obtained.

On December 4 signals from 6DW of London were received at good strength by 5US of Yorkshire, on a 4-foot frame and single-valve super. The input at 6DW was about 2 watts, and aerial current ·13 amps. The distance between 6DW and 5US is approximately 190 miles.

5DN of Sheffield, whose call-sign is familiar to many London amateurs, has been heard in Switzerland. He was using 10 watts, and his aerial current was ·42 amps. This is an interesting example of what can be done with a small aerial current, as even though ·45 is not a good aerial current for 10 watts, it travels as well as the ampere obtained by some stations more technically "efficient."

Mr. F. R. Neill, of Belfast, has contributed greatly to the interest of DX recently by his excellent reception of many English stations. His usual receiver comprises $_2$HF and $_1$LF stages, and on that, for example, he can read my own signals all over the room.

I believe he has received very good telephony from 2OD. It would be interesting to know if there is a place where 2OD's telephony cannot be heard. His transmission is extraordinarily good, and seems to carry everywhere.

On December 9, between 2 a.m. and 3 a.m., 2AAH and myself received KDKA (Pittsburg Broadcast) very loudly indeed on approximately 100 metres. It seems impossible that this could have been a harmonic, especially as the fundamental was very weak indeed that night. It also appears impossible that it could have been a retransmission from a station in this country, as the music and speech was absolutely pure, and seemed quite evidently a first-hand transmission. Also, it was not fading in the least, as was the fundamental, so it could not have been picked up on a super-receiver and retransmitted.

KDKA was probably experimenting with transmission on two wave-lengths simultaneously, as I believe several American stations have been doing recently. Single-valve receivers were used in both cases.

The new "A" code of signal strengths published in these notes last month has "caught on" to some extent already. I have heard it used several times by DX stations, and at least one station has had the code incorporated in his printed report cards.

A number of experimenters have approved of the code, and asked me to "boost" it further, so let's hear it used more!

Just before going to press comes the great news that 2KF has, on several consecutive nights, worked with American 1MO. The results are fully authenticated, and 2KF has our heartiest congratulations. The wave-length used by 2KF was very low, as was his power (aerial current being under 2 amps.)

This achievement has just been followed up by some excellent work by 2SH who has for several hours established two-way communication with 1MO, 2AGB and Canadian 3BP, which it is understood is located in Ontario. 2SH has also been reported by 5XD of New Mexico, about 600 miles from the Pacific.

SPECIAL ARTICLE :—VALVE MANUFACTURE

EXPERIMENTAL WIRELESS

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Experimental Topics.

An Amateurs' Radio Research Fund.

IT is a pleasing thing to find the attention of a wireless club being occasionally devoted to the general advancement of radio science as a change from the individual problems and requirements of their own members. The Derby Wireless Club, at their annual general meeting—their thirteenth A.G.M. by the way—discussed the possibility of forming an Amateurs' Radio Research Fund. The proposal made was that all holders of wireless licences should be invited to contribute to such a fund, a minimum subscription of one shilling being suggested, and that the revenue be devoted to research. Radio television was advocated as being a suitable line of investigation, but it was thought that the nomination of the precise subject and of an expert investigator might be left in the hands of the President and Vice-Presidents of the Radio Society of Great Britain. Here is the germ of a good idea. It is very appropriate that those who benefit by the wireless facilities now available should do something practical to advance further discovery. Donors to the fund would get a direct return in the greater service which improved wireless could render them, and incidentally they would have the satisfaction of knowing that they were contributing to the advancement of a branch of science in which they were personally interested. The precise method by which such a fund might be most usefully employed needs, we think, fuller consideration and discussion. A great deal of research work is already being conducted in university and college laboratories, as well as by private workers, and possibly some portion of the amount subscribed might be employed with advantage in founding research scholarships, or in some other way subsidising the work of qualified student or staff workers in those institutions. The founding of an annual prize for the best piece of private research work might be another useful means of encouragement of effort. It is not always the professional investigator who makes the most important discoveries in science, and the possibility of securing some adequate recognition of their work might encourage amateur experimenters not only to greater effort, but to conduct and record their experiments in a more systematic way. In any case, the Derby proposal is an interesting one, and we shall be glad to open our columns to any of our readers who would like to express their views.

The Transatlantic Tests.

The annual Transatlantic tests have always been regarded as one of the most important events in the life of the amateur transmitting enthusiast, or "ham," as he is familiarly termed in the States. Perhaps it is safe to suggest that in the light of the success of this year's performance, low-power Transatlantic communication will be so commonplace that in the very near future any organised tests will cease to exist.

The Month's "DX."

Recorded by HUGH N. RYAN (5BV).

The increasing efficiency of amateur transmitters and receivers is resulting in the creation of many new long-distance records which are undoubtedly worthy of mention. It is proposed to record month by month work in this direction, and the Editor will be pleased to receive details for inclusion in these pages.

THE latter half of December and the first half of January is always the most interesting part of the year from the "DX" point of view, and this year has been no exception. At the beginning of December no British station had succeeded in sending signals across the Atlantic. We all hoped that the coming trans-Atlantic tests would result, at any rate, in a few of our best stations "getting over," and the more sanguine among us hoped that two-way working on fairly high power might be accomplished before the winter was over. But few even considered the possibility of two-way working before the tests commenced.

Events have moved very fast since the beginning of December, and it is now ancient history that 2KF established two-way working with 1MO on December 8, though the news only got into the tail end of these notes. This success was quickly followed by those of 2SH, 2OD and 5BV, all of whom established two-way communication across the Atlantic before the end of 1923.

The total numbers of American and Canadian stations worked by these four stations, and the approximate powers used, are as follows :—2KF, five Americans, one Canadian, 90 watts ; 2SH, two Americans, one Canadian ; 2OD, one American, one Canadian, 40 watts ; 5BV, two Americans, two Canadians, 45 watts.

The most remarkable performances are those of 2KF and 2OD, the former because of the large number of stations worked, the latter because of the low power and also because 2OD has worked Canadian 1BQ so very often and consistently.

Since the end of 1923 we understand that a number of other British stations have established communication with America, but full details are not yet available. These stations include 2SZ, 2NM and 2FU.

That is a fairly complete account of the results obtained apart from the official trans-Atlantic tests. These tests extended from December 22, 1923, to January 10, 1924, and during that time the stations who had entered for the tests sent ten-minute schedule transmission every night, and each station had a different five-letter code word for each night. This code word he sent with the schedule transmission each night, and reception on the other side could thus be verified.

At midnight every night during the tests American 1XW (Hartford, Conn.) sent, on 100 metres, a report of the previous day's reception results in America and Canada. These transmissions were received in Europe by 8AB, PCII, 2KF, 5KO, 2KW, 5BV and others during the first part of the tests, but towards the latter part it is to be feared that most of these stations found that keeping up during the test periods of each night was quite a sufficient tax on the constitution, without listening for American reports as well!

At 12.45 each night R.S.G.B. station, 6XX, broadcast the results of the tests up to date. Up to the time of writing the following stations have been recognised by the R.S.G.B. as having been received, with code words verified, in America :—2FQ, 2KF, 2SZ, 5LC, 5PU, 6NI, 5BV, 2KW, 2NM and 2OD.

These are all ordinary amateur stations, and in addition to these 6XX, the special R.S.G.B. station, and 6YA, which, we understand, is being run by the members of a radio society, have been successful.

5KO does not yet appear in the R.S.G.B. lists, but 1XW has reported this station as having been received, with code word, and 1BQ gave me a message for him recently, giving his code word, which has been verified.

In addition to these British stations, six French stations (8AB, 8AE, 8BF, 8CT and 8LD) and three Dutch (PA9, PCII, oDV) have been received in the United States.

The tests have been very interesting from

several points of view. Firstly, they have shown very clearly the differences between the two classes of transmitting men. We have those who are keen experimenters, who design and make their own apparatus, and who operate it themselves. Also we have those who never perform any experimental work, who buy their sets ready made, who usually know no Morse whatever, and who are usually best known for the great number of gramophone records which they send.

Both classes of station took part in the tests (the latter employing operators), and success was, fortunately, almost entirely with the experimenters.

It was to be noticed, however, that while the stations of the former type transmitted only during their schedule periods, as was requested, and gave other people a clear field at other times, those of the latter type transmitted nearly the whole of every night, with a fine disregard for anybody else. But for this it is probable that more of the better type of stations would have been successful and none of the others.

Now that the tests are over we hear of an extraordinary trans-Atlantic success obtained by a station whom we usually associated with excellent short-distance telephony in and around London rather than with DX.

On the evening of December 27 2XZ was working on his usual 10-watt set, with another station only about 1½ miles away, and experimenting with pianoforte transmission. His transmission was received, on a nine-valve super-hetrodyne set, at Kansas City, Mo., 5,000 miles away. The speech and music are accurately reported, and there appears to be no doubt about the authenticity of the reception. There is no doubt that that night was an exceptionally fine one for long-distance work, and this result is in the nature of a "freak reception." But, nevertheless, it speaks highly of the transmission, and we congratulate 2XZ.

It was on this night that I first worked Canadian 1BQ, and his signals were of such great strength on one valve that, bearing in mind having been "had" on previous occasions by humorists with hetrodynes, I did not believe that he was a Canadian, much to his amusement, and that, I believe, of several British stations also! Later the same night 2OD worked him, and his signals were reported to be very strong, so it seems that it was a very fine night.

The best night since the tests so far was that of January 12—13, when some thirty Americans were heard in England on 100 metres alone.

By this time everybody knows that the 100-metre transmission of KDKA, mentioned in last month's notes, is a separate transmission and not a harmonic, as many thought at first. It is a very good transmission and will often work a loud speaker on two or three valves.

Some confusion was bound to arise in trans-Atlantic work owing to the fact that British and French call signs have their duplicates both in America and Canada. During the tests, of course, where only single-way work was involved, British stations prefixed their call signs with the letter G and French stations with F. This becomes very clumsy in two-way working, and the Americans have adopted the practice of using a distinguishing "break" sign instead of the usual "de." The sign is composed of the letter corresponding to the "called" station's country, followed by that corresponding to the "calling" station's country. The letters used are:—Britain, G; France, F; Holland, N; U.S.A., U; and Canada, C. Thus, American 2AGB calling Dutch PCII would call PCII nu 2AGB, and PCII would reply 2AGB un PCII. This is the most convenient way of avoiding confusion.

European "DX" is now in evidence again, though it was less interesting after the American work. However, much remains to be done in European work, chiefly in designing receivers which are selective enough to receive through the terrible QRM which we get nowadays, and sensitive enough to enable less power to be used by the transmitter, thereby lessening the QRM.

Nearly a year ago we used to read in French radio papers of a Swiss amateur transmitter, known as XY, but I do not think that he was ever heard in this country. He has apparently increased his power recently, as he is now quite strong. He first came in on January 6 at about 4 p.m., and at 5 p.m. 5DN called him, was heard, and worked him for some time. Another record for 5DN. This station seems to favour

Switzerland as the recipient of his record transmissions. He was using 10 watts, but his aerial current is now up to ·5, instead of the ·4 reported last month. No doubt he will reach the desirable ampère before long. May it travel in proportion to its size!

Mr. Neill, of Belfast, whose work I mentioned last month, has been doing well again this month, chiefly in reception of telephony from England. His best stations are 2ON and 2NM, both of whom he receives very well on telephony, the latter sometimes on one valve. He also receives speech from 2ZK, 2VF and 2IN, all of Liverpool district, the first of whom sometimes only uses 110 volts H.T.

In the West of England 5KO is going strong, having been heard in Algiers. 6RY is a fairly recent station, at Bath, but has already worked 8CT of Bordeaux.

I have just received from 7QF some particulars of amateur work in Denmark. He has sent me an enormous list of British, French, Dutch and Italian amateurs whom he has received. The very size of the list testifies to the excellent reception conditions in Denmark.

There are three active Danish transmitters at present:—7ZM, 200-220 metres, D.C. C.W.; 7EC, 190-210 metres, A.C. C.W.; 7QF, 180-210 metres, rectified A.C. All are near Copenhagen, and all have been heard in England on one valve. 7ZM and 7QF work on Saturday evenings, 7EC nearly every evening.

Yet another European country has entered the field of amateur transmitting work. Italy now has one transmitter—1MT, situated at Venice. He has already made a good start in "DX" work. 7QF has heard him often, and he has worked two British stations—2HF, near Birmingham, on December 9, and 5DN, of Sheffield, on January 13. 5DN was again using an aerial current of only ·5 amp. Some of the London stations must look to their laurels. They almost monopolised the success in trans-Atlantic work, but the North look like beating them in European "DX."

By the way, what extraordinary call signs we hear nowadays! PA9 sounded curious at first, but what about PAR14, who is often to be heard now? I believe he is somewhere in Holland. ACD is another mystery station, who often works 1MT (Venice).

TRANS-ATLANTIC TELEGRAPHY.

In view of the recent trans-Atlantic amateur transmissions it ts thought that details of the apparatus used by some of the most successful participants will be of value to many experimenters.

British 2OD.

By E. J. SIMMONDS.

THE object of this article is to give the outline of a special transmitter, the construction of which was commenced late in November to participate in the recently closed trans-Atlantic tests. Owing to various delays, however, which will be discussed later, this set was not finished, and ready for test until December 21.

In view of this fact, and also because of the astounding success of 2KF in effecting two-way communication with U.S.A., it was decided to make an initial test with the same object, using the standard transmitter at the writer's station. From the diagram it will be seen that the circuit is one much used in U.S.A., being the well-known Hartley, employing as oscillator, Marconi AT.40X valve, H.T. from stepped-up A.C., 50 cycles, full wave rectification, and filament lighting from A.C. mains.

At 0315 G.M.T. Sunday, December 16, calls ARRL, etc., were transmitted for fifteen minutes with an input of 900 volts and 35 milli-amperes. At the termination of this

transmission, and on switching over to the receiver, a reply was immediately heard from American 2AGB, of Summit, New Jersey, who gave QSA. Two-way communication was at once established, and tests proceeded, until 0430 G.M.T., when 2AGB closed down.

The writer is bound to admit that his hand was distinctly shaky when recording the first reply from 2AGB, as it seemed so absurd and improbable, in view of the small power and valve in use.

It should be mentioned that through the kindness of Mr. Davis, of the G.E.C. Technical Department, Magnet House, Kingsway, a M.O. 250-watt valve was available, but the great difficulty was to obtain the necessary supply of H.T. to feed such a large valve, expense being, of course, a serious item. This difficulty was partially solved by the following method.

The H.T. for the small set is obtained from a step-up transformer, which has the usual centre tap on the secondary, and the approximate voltage between this tap and the outers, when on load, is 600 to 800 volts, depending, of course, on the main supply voltage, and the load on the secondary. It was, therefore, decided to use the two outers of the transformer, and rectify by a synchronous rectifier, and by this means double the H.T. voltage and also avoid the voltage losses so apparent when rectifying valves are used, and, of course, obtaining full wave rectification.

In practice, however, it was found that with a load of 70 to 80 milli-amperes the

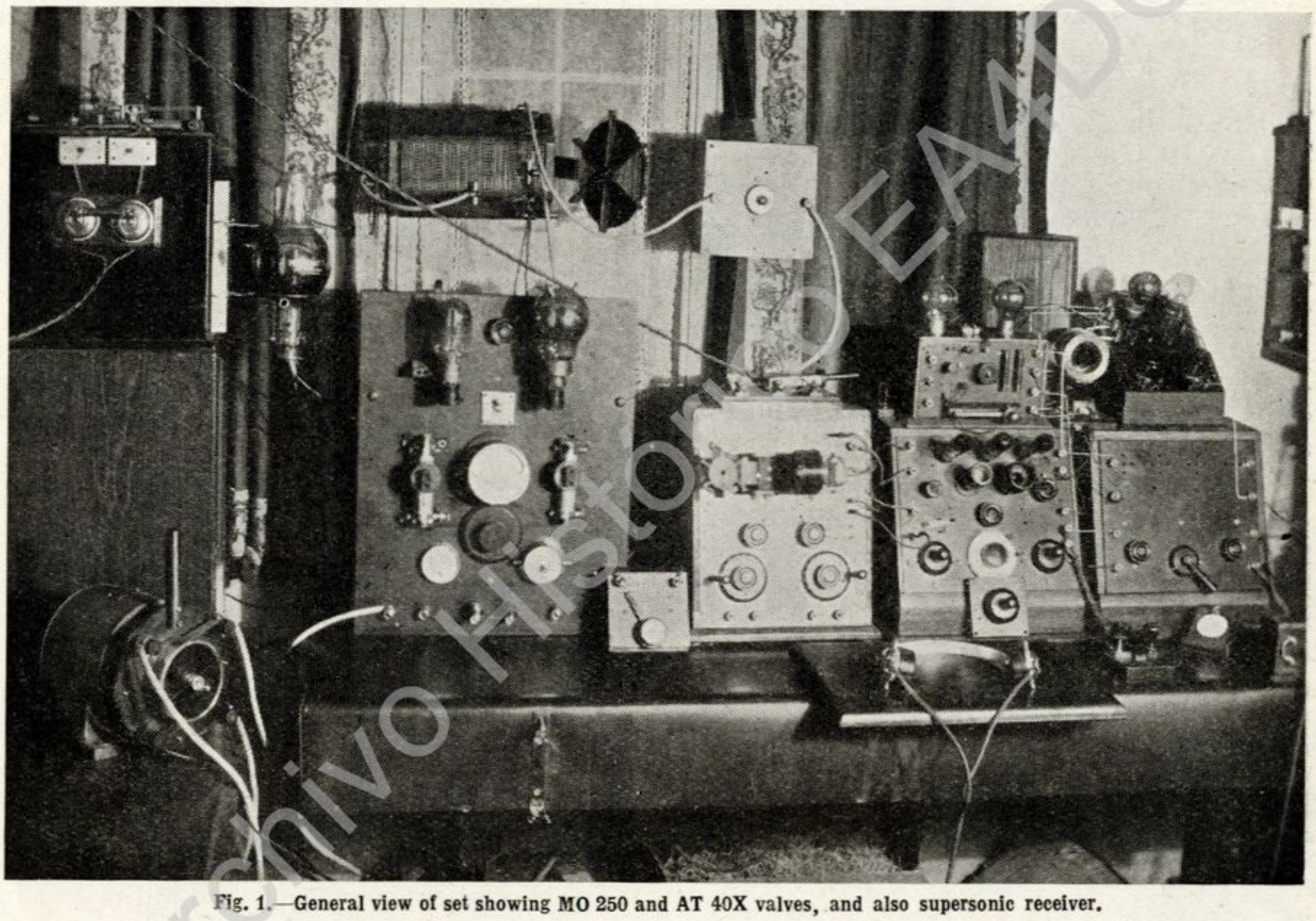

Fig. 1.—General view of set showing MO 250 and AT 40X valves, and also supersonic receiver.

Surely this is a world's record for two-way trans-Atlantic working, as at no time did 2AGB have any difficulty in reading signals from the British station, which were readable through QRN and QRM.

Confirmation has been duly received from 2AGB regarding the strength of signals.

Incidentally, the American reception must have been of high efficiency, and it is understood that a super heterodyne receiver was used. In view of this result it was decided to push forward the completion of the larger set with all speed.

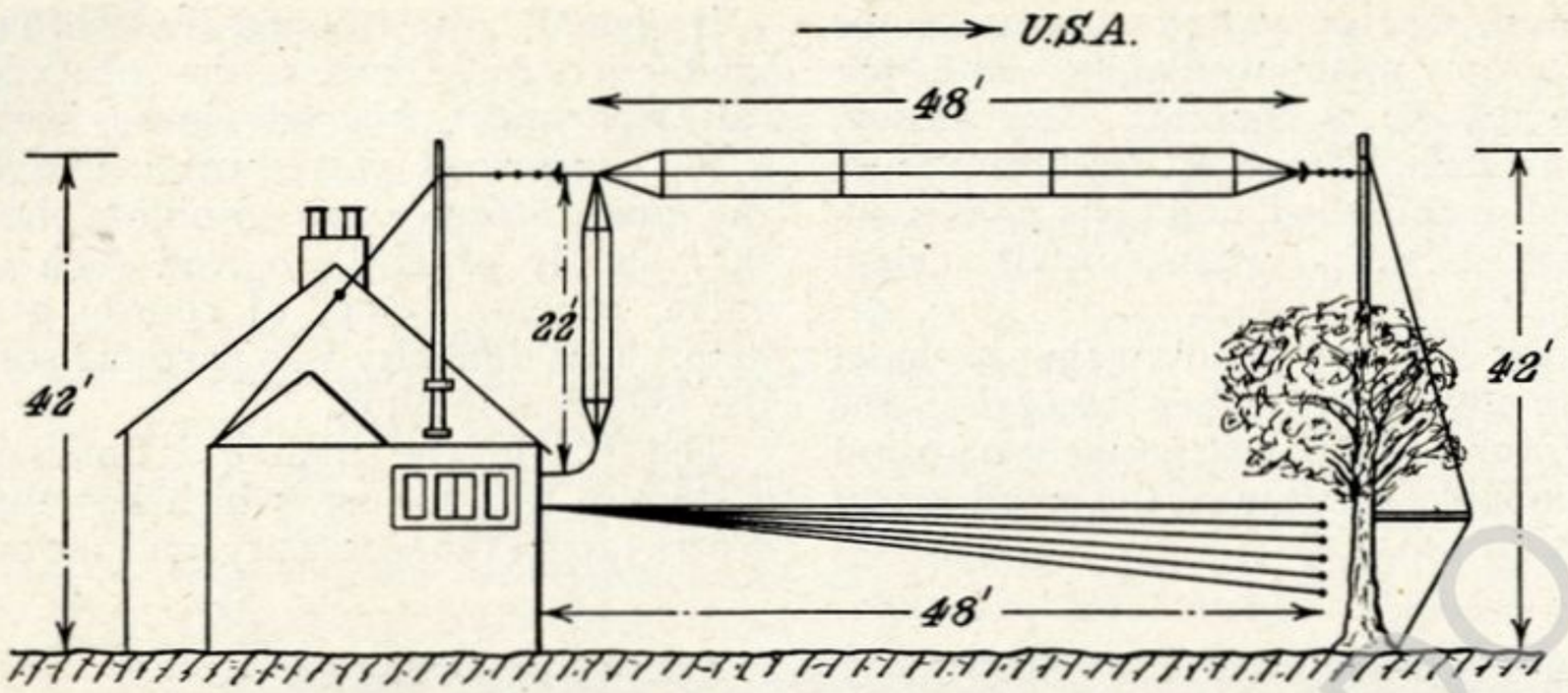

Fig. 2.—Arrangement of aerial and counterpcise systems.

voltage of the transformer secondary dropped to 1,200 to 1,300 volts.

This was, however, better than 600 volts, and the actual input to the 250-watt valve was 1,200 volts, at 75 milli-amperes, which, of course, is much under the rating of the valve.

Protecting fuses were inserted in the H.T. leads from the transformer to the rectifier disc, to obviate any chance of breakdown; as a matter of fact, in the initial tests, a short

Fig. 3.—Aerial and surroundings at 2OD.

did take place in the transmitter, and these fuses undoubtedly saved the H.T. winding from being burnt out. The fuses were of platinum-silver wire, ·0015 diameter, and blow at about 250 milli-amperes.

The oscillating circuit used was the reversed feed back, with the addition of a tuned circuit in the plate lead to power valve. This tuned circuit sharpens up the wave considerably and effects a desirable decrease in plate current.

The main inductance consists of a skeleton hexagonal former, 6″ in diameter, wound with 28 turns of 12 S.W.G. bare copper wire, spaced one diameter, and the reaction is a pancake skeleton former, wound with 18 S.W.G., bare copper wire; this is tuned with a variable condenser, maximum capacity ·0003. The grid condenser and plate stopping condenser are each ·002, and made of mica from a smoothing condenser of a B.T.H. generator.

The R.F. choke coil consists of 300 turns of 24 S.W.G., space wound on 4″ former. The A.T.I. is fixed well away from all earthed bodies to avoid capacity losses, which at the high radio frequencies used become of great importance.

The shortening condenser used in the aerial calls for some comment. In constructing a condenser for this purpose the following points should be observed. Solder all the plates (which should be of copper or brass) into the supports, and pig-tail the shaft by a flexible connection, also the supporting insulation should be kept as far as possible outside the field.

Attention is here directed to the Cardwell condensers (see Q.S.T.), which are designed especially for transmitting circuits.

The remarks regarding the fixing of A.T.I., apply equally to the aerial condenser.

The grid leak is wound to a maximum

resistance of 15,000 ohms, tapped every 1,500 ohms, and is the vitreous type, supplied by the Zenith Co.

Much valuable time was lost in efforts to obtain a suitable synchronous motor to operate the rectifier disc, but the machine was ultimately furnished by the Crypto Co., and has proved most satisfactory in every respect.

The writer wishes to record his appreciation of the valuable assistance afforded to him by Mr. Sharp, of the designers' department of that company.

The speed of the motor is 1,500 r.p.m., when run from 50-cycle supply. It is self-starting, and synchronises in a few seconds of starting up.

The construction of the two-part commutator for the rectifier was a difficult task, in view of the fact that the lathe available had only 3″ centres and no back-gear.

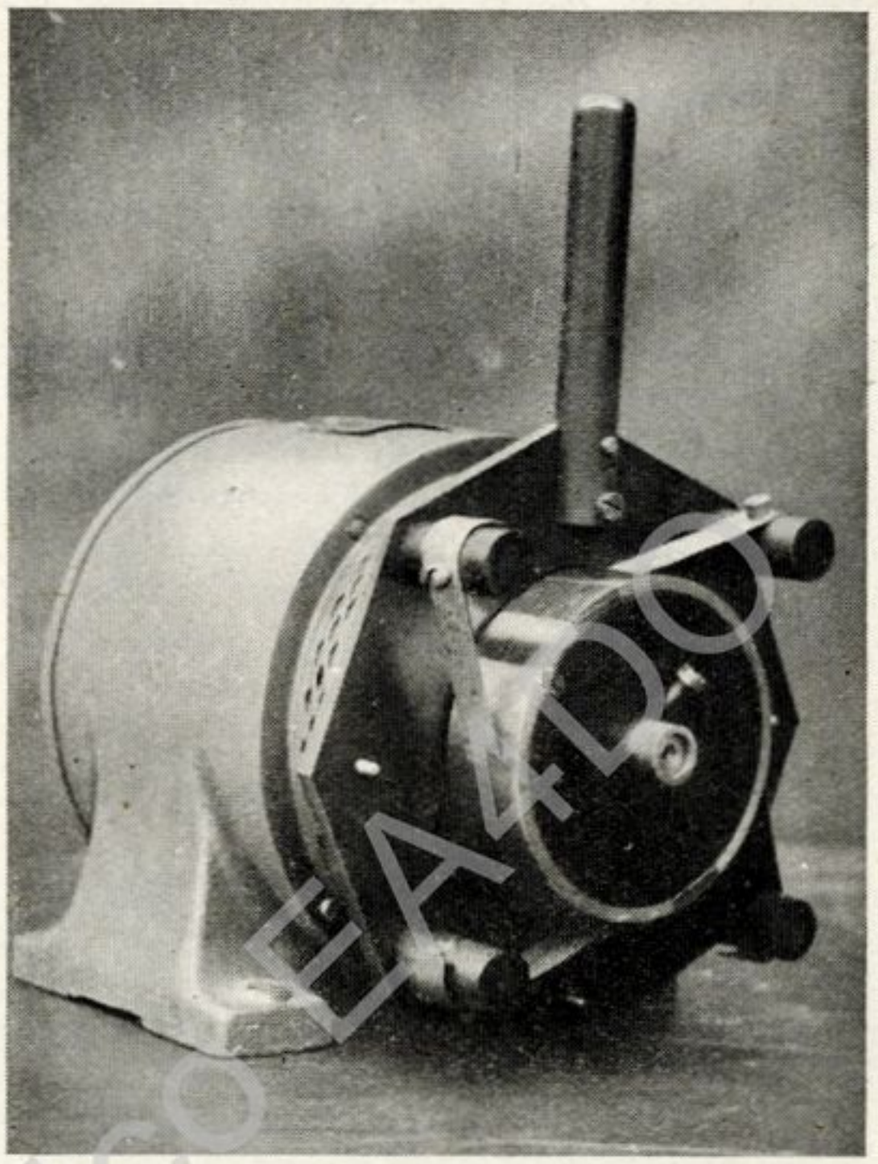

Fig. 5.—Rectifier and brushgear on synchronous motor.

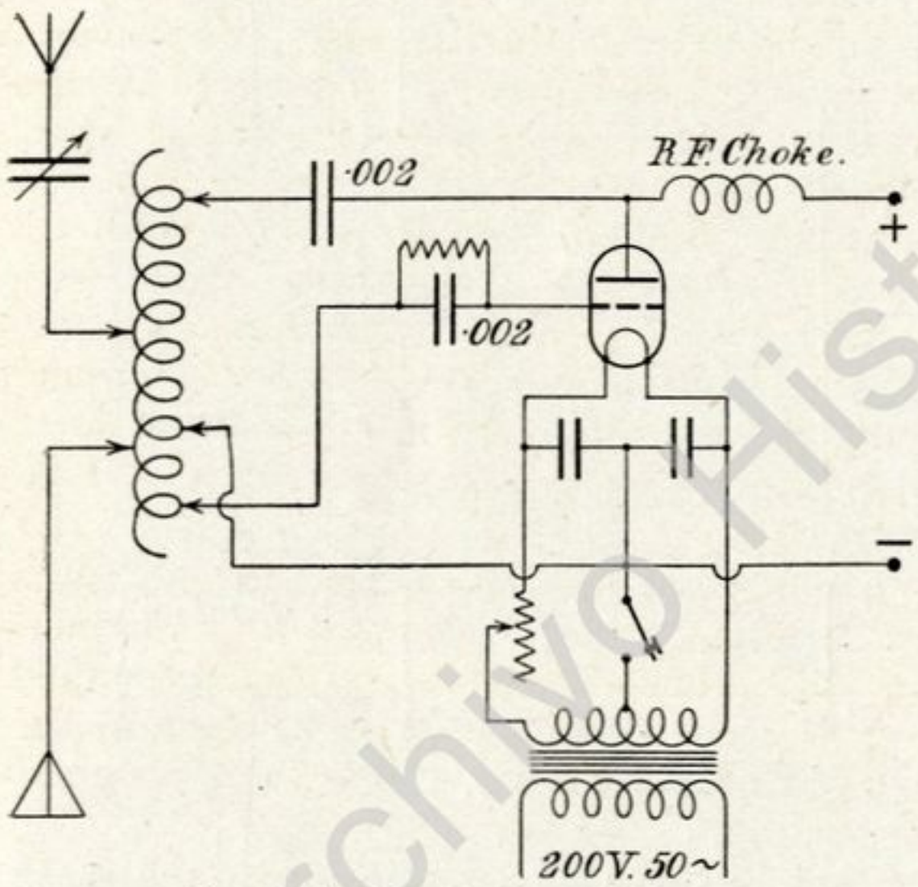

Fig. 4.—Circuit used with AT 40X valve.

As the diameter of the disc is 5″ there was insufficient room to use a slide-rest, and in consequence all the turning had to be done by hand tool with a hand-rest.

The insulating core was turned from a slab of ebonite 1″ thick, and on this was mounted a piece of 5″ outside diameter solid-drawn brass tube, $\frac{1}{4}$″ thick (obtained from Messrs. Smith & Son, clockmakers, Clerkenwell), and the tube is screwed to the insulating disc by 12 studs, screwed 3 B.A., the method employed being to tap the hole both in brass tube and ebonite, and cut off level with surface.

The brass tube is split as shown, and insets of ebonite, or, better, mica on edge, fixed, the whole then being carefully trued up in the lathe. There is also a brass bush with $\frac{1}{2}$″ diameter centre hole and grub screw to clamp the screw to motor shaft.

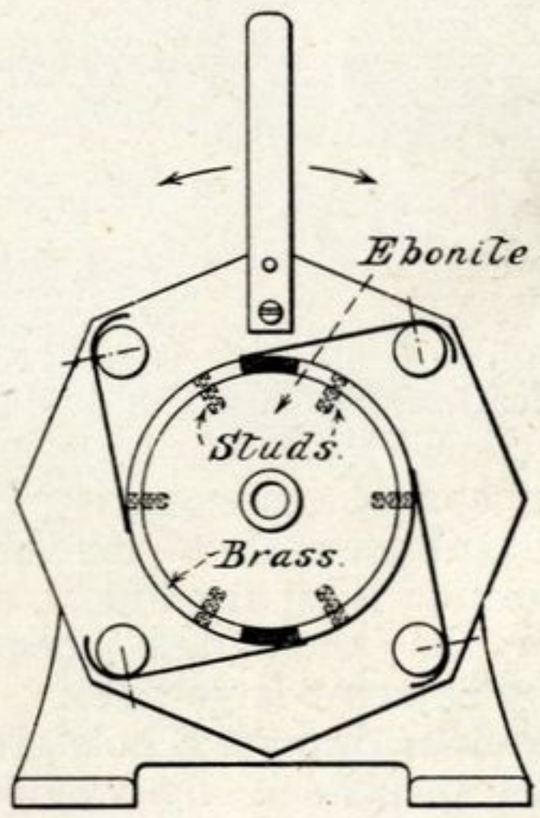

Fig. 6.—Showing arrangement of rectifier disc and brushes.

The insulation between the two sections

must be very good, in order to stand up against the voltage of the transformer.

The brush rocker carries four brush supports 90° apart, and is capable of being rotated by the insulated handle to the position of sparkless commutation.

Brushes are of copper gauze, with the usual supporting strips, and the leads to the four brush holders are of good quality H.T. cable; a short here would be a disastrous thing.

The aerial, built of 12/25 enamelled H.D. copper wire, is a six-wire cage, 70 ft. long, including lead-in, and runs due east and west, being directional for Holland.

The diameter of the cages is 30" for the horizontal portion, and 18" for the lead-in, and the position is far from ideal, as can be seen from the photograph, being much screened by adjacent large trees.

The lead-in is through a hole ground out of one pane of glass in the window of the operating room.

As the garden is a very small one the earth screen had to be designed to meet the existing conditions and is a 6" wire fan, 48 ft. long, average height 10 ft., also of 12/25 enamelled H.D. copper wire; great care was taken to make each wire, both in aerial and earth screen, of equal length. The earth screen terminates immediately under the free end of aerial, although, of course, it is preferable to extend it beyond the garden mast, but there was no available ground to permit of this.

The average experimenter always works under adverse conditions, especially as regards suitable space for an adequate aerial and earth screen, and has to make the best of local conditions.

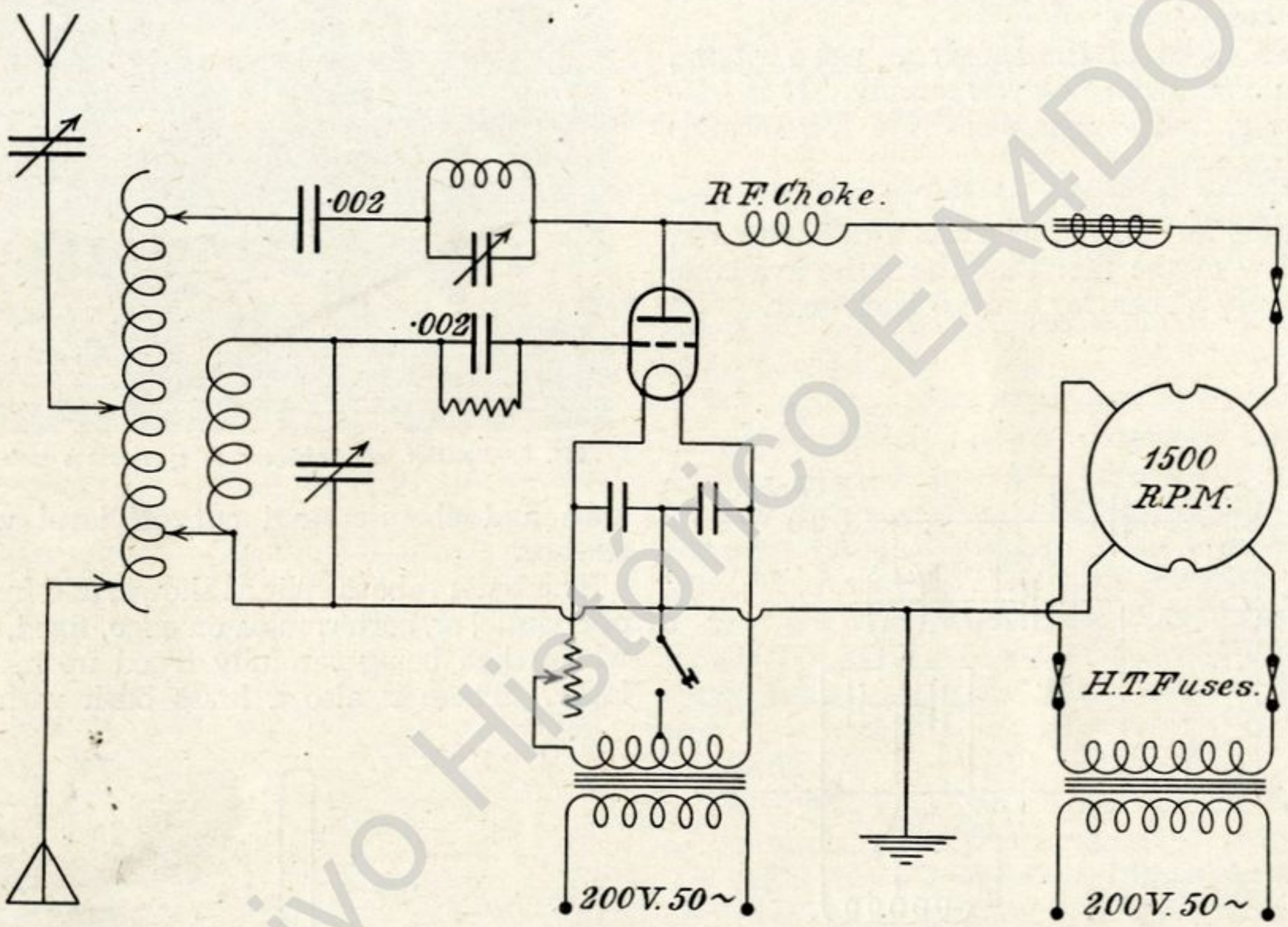

Fig. 7.—Circuit used for 200 metres test, using synchronous rectifier.

This station was duly reported in the trans-Atlantic tests, and code verified, but at the time of going to press full details of receptions are not to hand. Apart from that, a long series of regular and consistent two-way tests were carried out with Canadian 1BQ, and shorter tests with U2ACB, also U1CMP, and it is of interest to quote from one of 1BQ's reports: "You are now best European station heard here," and in a later report, "If you want me, just call, as you always come through when any get through."

French 8AB.

By LEON DELOY.

I HAVE always been very keenly interested in the study of short-wave wireless. My transmitting licence gives me the right to use many waves up to 1,500 metres, and the first transmitter I built worked on that wave. The next one worked on a shorter wave, and so forth until I came down to 100 metres. Every time I decreased the wave-length I increased the range of my station, which was quite contrary to everybody's expectations a few years ago.

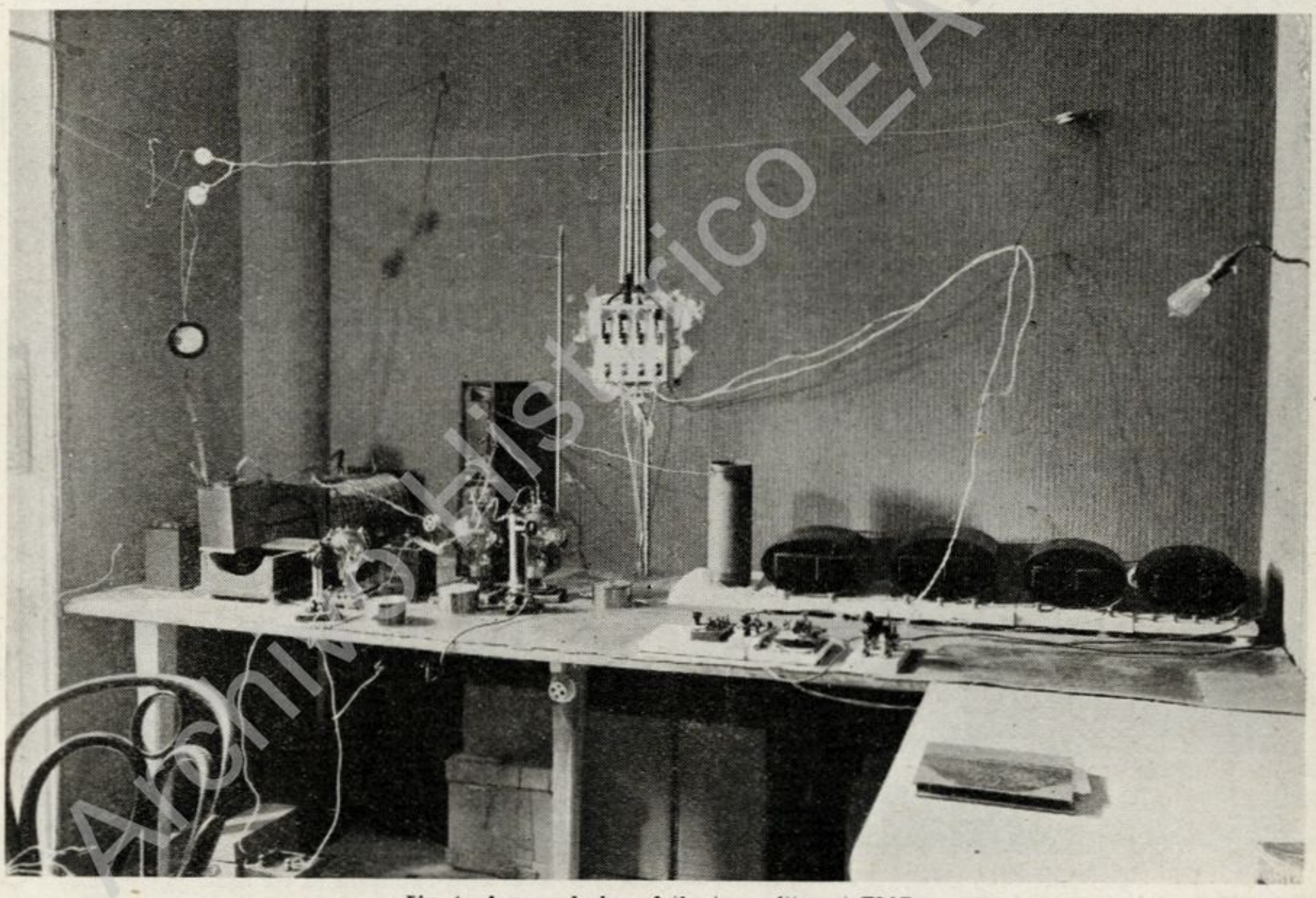

Fig. 1—A general view of the transmitter at F8AB.

On the other hand, I noticed that when the British amateurs were working on 1,000 metres I never heard any of them. When they came down to 440 metres I heard very few of them, but when they were on 360 I started hearing and working them regularly. Now that they send on 200 metres they are very easy to receive, and some of them have been heard at my station in Nice, when they were using exceedingly little power.

During last year's trans-Atlantic tests I used a wave of 190 metres, and I was heard in America "one hour steadily," also several times after the tests, and all the way to Texas. That 190-metre wave was, as far as I know, the shortest one that had ever spanned the Atlantic.

All these and other remarks made me decide to attempt two-way communication with the American amateurs on a wave of 100 metres. During a short trip I took to America this summer I convinced some of them of the interest of the experiment, and Mr. Fred H. Schnell, among others, built a special station to try and communicate with me on that wave. On my return home I dismantled immediately my old station, however good it had proved to be, and re-

built it for 100-metre work. It immediately proved to be a great improvement. For a couple of weeks I conducted nightly tests on schedule, and all reports showed that my signals were much louder than on my old set, in spite of the fact that I was using only half power. I am especially indebted for very regular and accurate reports to Mr. E. J. Simmonds, British 2OD, whose co-operation was very useful in getting the best efficiency out of my set. The reports were so encouraging that I decided to attempt to reach America even before I had re-installed my transmitter for full power. A first attempt was a failure because my correspondent could not believe I had rebuilt my set in so short a time, and he listened for me on my old wave of 190 metres. When this was cleared we tried it again.

I called for one hour on the morning of November 26, calling ARRL, signing F8AB, and sending a code group of five letters to avoid any error in reports of reception. When I woke up late that morning, after a few hours sleep, I found a cable had arrived saying: "COPIED SOLID CONGRATULATIONS." That was quite good news, and I considered it so encouraging that next night I sent a message of greetings in the name of the French amateurs to the American amateurs, and another message about a change of schedule. I asked my correspondent if the new schedule suited him, to "cable agreement." A few hours later a cable was here saying "AGREEMENT!"

In the course of the same day I had another cable from Mr. Schnell saying he would be ready to transmit on 100 metres the next night, and so it happened that November 28 was to be the long-looked-forward-to day when two-way communication between Europe and America was to be established by amateur stations.

Fig. 2.—Receiver, showing "Grebe" on the left, and home-made super-heterodyne on the right.

On the morning of the 28th I transmitted as agreed, from 0230 to 0330, and then switched over to reception. A few seconds passed, which seemed very long indeed, then came the strong whistling of an A.C.C.W.

signal, and sure enough it called 8AB and signed 1MO! 1MO had again received all I had sent. His signals were readable 6 ft. from the 'phones on two valves, one radio-frequency and one detector. When I said so to him, he came back with: "U ALSO VY QSA TWENTY FEET!! FB!" He has told me since that his receiver uses one detector with tuned plate circuit and one step of low-frequency amplification. We went on talking for a little while as easily as if we were in the same town, although we are about 4,000 miles from each other. Then Mr. Warner took the key at 1MO. His first remark was: "HR WARNER GE OM A PROUD MOMENT OF MY LIFE TO TALK TO U FM MY OWN HOME OM SINCERE CONGRATS ON WONDERFUL ACHIEVEMENT"; and a little later: "MAKING HISTORY TONITE OM." I surely was as glad as they were over there, as this was the reward of three years' work! Then Mr. Schnell took the key again, and said: "SA OM PSE GIVE ME MEG FOR WNP FOR OUR RELAY TEST TOMORROW"; and I sent a message of greetings of the French amateurs to the amateur on board the *Bowdoin*, somewhere near the North Pole. How the world looked small, and how wonderful it is to see far-distant friends become so near just because one has a few feet of wire on one's roof and a couple of glowing valves on one's table!

For the last eleven days I have been in daily two-way communication with American amateurs. About 2,000 words have been exchanged and six stations worked. They are 1MO, 1XAM, 1XAQ, 2CQZ, 2CFB and 1CMP.

A few words about my transmitter may be of interest. I am using two 250-watt (input) S.I.F. French tubes in parallel in a Hartly circuit, with some modifications suggested by Mr. John Reinartz. As will be seen from the accompanying simplified diagram of connections, these modifications are the use of a variable condenser both in the aerial and counterpoise. These two condensers should always be on the same reading, and the counterpoise should be so built that the current in it is the same as in the aerial. The wave-length can then be adjusted simply by adjusting the condensers. The aerial and counterpoise current is between 2·5 and 3 ampères, but I have tried to decrease it, and down to 2 ampères 1MO did not report any appreciable change. When I made it 1 ampère, though, he said it was enough reduction as it became weak. On full power I have been received in America "on 20-ft. indoor aerial," and even "without aerial." My longest range so far reported is Kitchener, Ontario.

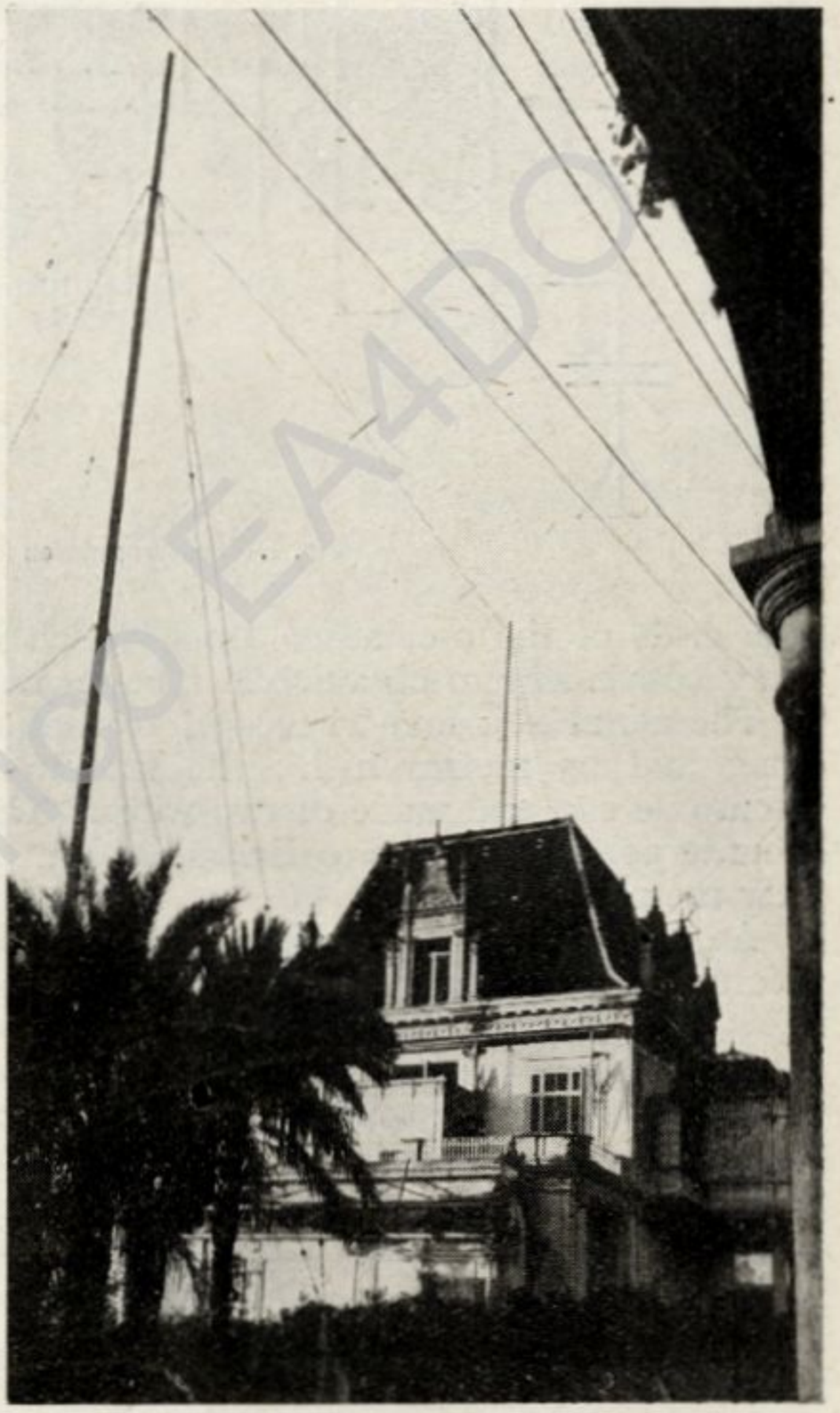

Fig. 3.—Aerial and counterpoise, the far end spreader of the latter being to the right of the palm tree leaves.

The plate high tension is simply furnished from the 25-cycle town supply by a step-up transformer. The filaments had to be heated by batteries instead of A.C. on account of the changes of tension of the supply here. These changes of tension are responsible for the only fading ever noticed during these experiments.

For a grid-leak I am using the plate-filament space of a 50-watt (input) S.I.F. tube. By controlling the filament temperature of this tube one controls the tension on

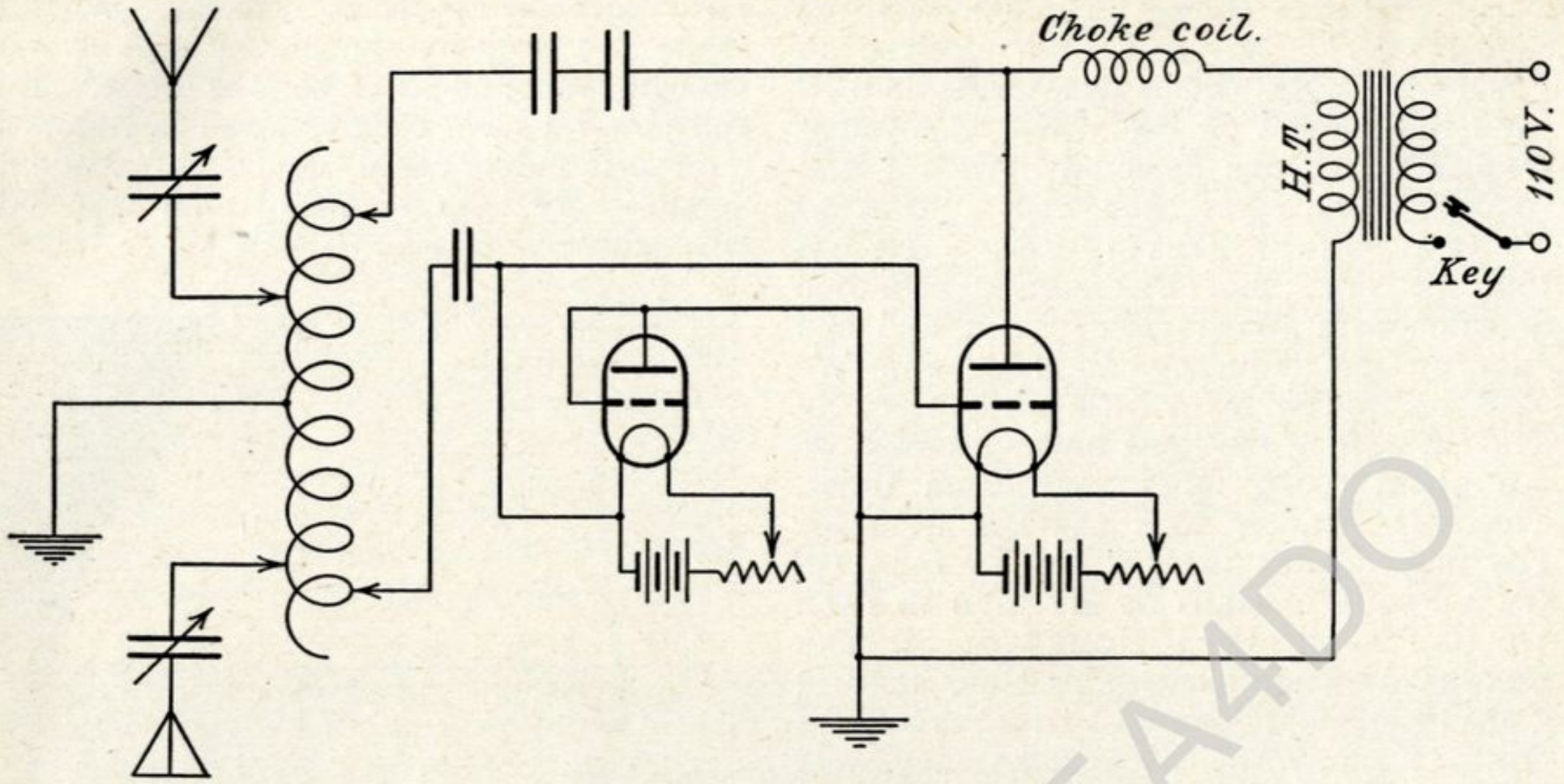

Fig. 4.—The transmission circuit using a valve as a grid leak.

the grids of the oscillating tubes, which is very convenient to obtain best efficiency.

The aerial is a four-wire cage, 10 metres long and 25 metres high; the lead-in is from one end and made of two wires. The counterpoise is similar to the aerial, but a few metres longer.

As will be seen from the accompanying pictures, this set is yet in an experimental stage, and such ranges were certainly not contemplated at such an early date.

The most remarkable point about these tests is that they have shown that waves of the order of 100 metres have wonderful possibilities which were until now almost unsuspected. There seems to be no fading on those waves, and interference, especially from arc harmonics, is very reduced.