indicated. The filament should, of course, be lit up from an accumulator battery in the usual way, but this battery is not shown in the diagram. A connection is taken from the negative terminal of the valve filament through the telephones T to the sliding contact on the potentiometer resistance.

The supply of audio-frequency alternating current, which is shown symbolically in the diagram as an alternator A, may be taken from a buzzer circuit, or, better, from a separate valve oscillating at an audible frequency. The latter arrangement gives a purer sound than the buzzer, and consequently a better balance in the telephones. To carry out a measurement the audio-frequency supply to the potentiometer should be switched on and also the filament circuit of the valve. The filament current should be adjusted to its normal value by the resistance shown in series with the filament battery in Fig. 2, or alternatively it should be adjusted to the particular value at which it is desired to make the measurement of the voltage factor of the valve. The H.T. battery should also be adjusted to the particular value at which it is desired to carry out the measurement. When this has been done it will usually be found that there is a loud sound in the telephones T (produced, of course, by the audio-frequency current from the source A). By adjusting the position of the slider of the potentiometer P, a place will be found at which this sound disappears almost completely. This is the balance position, and the distance of the slider from each end of the potentiometer should be noted carefully. Generally it is sufficiently accurate to assume that the resistances of the two parts of the potentiometer will be proportional to these lengths on each side of the slider, so that the voltage factor of the valve is then given by the ratio of the two lengths marked r and l in Fig. 2, *i.e.*, by the ratio r/l.

The reason for this result is evident when we consider that the effect of connecting the grid and anode circuits of the valve to the two terminals of the alternating current supply from A is to apply to those electrodes voltages which are of opposite sign at any given instant, and hence when silence has been secured in the telephone receivers, it means that the plate current does not vary. This condition can only be obtained if, when we apply, say for example, a positive voltage to the grid at the instant considered, we at the same instant apply a negative voltage in the anode circuit of the right value to reduce the effective H.T. battery voltage by an amount just sufficient to compensate for the positive voltage on the grid. The ratio of these two voltages is, by the definition given above, the voltage factor of the valve, and this, as we have seen, is given by the ratio r/l.

Greater accuracy in the measurements can be secured if the potentiometer resistance P is fitted with tapping points and switches for giving more definite resistance ratios, since when an ordinary potentiometer slider is used the actual point of contact on the resistance wire is not usually very well defined. The resistance of P should not be very large, and need only be about 10 to 20 ohms, although if the resistance does not exceed 100 to 250 ohms very little inaccuracy will be caused. The telephones T should also be of the low-resistance type. Alternatively a slide wire resistance can be employed for P, in order to obtain an accurate ratio.

The source A of the alternating current of audible frequency (say, 300 to 1,000 ~ or thereabouts) should be kept some little distance away from the remainder of the apparatus, particularly if an oscillating valve is used for this purpose. Some further details of a convenient way of building up an oscillating valve circuit for this purpose will be described in another article, since the one here described is by no means the only useful measurement which can be carried out by simple apparatus of this type.

The above-described measurement of the voltage factor can be carried out with varying adjustments of the filament, H.T., and steady grid voltage, and the results plotted out in the form of curves; but usually it is found that the value so found differs very slightly with changes in these adjustments, and changes by a few per cent. only over the whole range of working adjustments. At extreme values, however, a larger change may occur, but its magnitude will not even then be very great. The voltage factor is determined almost entirely by the physical structure of the valve, rather than by the circuits to which it is attached.

The Transatlantic Tests

APPARATUS USED

As announced in our last issue we are printing this week a description of the receiving apparatus used by Mr. Godley during his experiments in this country. The apparatus described on page 689 was used by him both in his preliminary experiments at Wembley Park, and also during the actual period of the Tests at Ardrossan. Put as briefly as possible the set is a nine-valve Armstrong super-heterodyne amplifier, in which the first valve acts both as a regenerative high-frequency amplifier (with variometer tuning in its plate circuit), and also as a detector. The earthing inductance of the Beverage antenna was coupled to the tuned grid circuit of this first valve, and the first heterodyne was also coupled to it. The next five valves in order constitute a five-stage resistance-capacity coupled amplifier for magnifying the long wave signals (wavelength = about 3,000 metres) which result from heterodyning the incoming signals by the second valve. The plate circuit of the last valve in this series is tuned to this long wavelength, and is capacity-coupled to the second detector valve, while the last valve (the ninth) is a note-magnifier. The final heterodyning of the long wave signals could be effected either by electrostatic reaction autodyne on the long wave amplifier, or by an entirely separate heterodyne, the last method being the one most favoured.

We are also publishing in this issue (see below) descriptions of the receiving apparatus used by the British Amateurs who achieved the best reception, as announced in our last issue. It is interesting to compare these instruments with the apparatus used by Mr. Godley, especially remembering that the former were used with ordinary aerials of the type and size licensed in this country.

We hope in future issues, as space permits, to describe and illustrate the other apparatus on which American signals were heard. P. R. C.

The First-Prize Set: Description of Apparatus used by W. F. Burne.

IT has always appeared to me that the greatest thing in wireless is the covering of long distances with a minimum of power. Notwithstanding the fact that we have so many high-power transmitting stations, it seems to me yet possible to communicate over great ranges with greatly reduced power. The better way would doubtless be to concentrate on the receiver, making it very selective and at the same time extremely sensitive. Any station may blaze away with its hundreds of kilowatts; yet to my way of thinking this tendency is defeating the best interests of the science. Therefore, amateurs granted only a 10-watt permit have really a great field for research, though they may treat such a permit with disdain. Let us have real experimenting with these transmitters; let a man use his stuff in the interests of science, not for the purpose of amusing the "dabbler" with the latest gramophone "rags."

The experience gained in the recent Transatlantic Test has more than ever enforced this idea. At the time of writing it is too early to offer any hints as to the success of my efforts, yet the origin of some of the signals cannot for a moment be doubted. Very soon it should be possible for amateurs, here and in America, to put up world's records in short wave transatlantic signalling; both by Morse and speech. Experimenters should be urged to build apparatus for short-wave work, trying it out and improving it. It would seem that to listen for a station over 3,000 miles away transmitting on 200 metres, using a power of 1 kW, would be a fool's game. Friends of mine frankly confessed their doubt. "It would be hard enough using at least a dozen valves," they said.

Stations Heard by Mr. W. F. Burne.

FIRST PRIZE WINNER.

2 FP	J. K. Hewitt, 252, Neptune Avenue, Brooklyn, N.Y.
2 BML	R. B. Bourne, P.O. Box 13, Riverhead, Long Island.
2 ZL	J. O. Smith, 3, Corona Road, Valley Stream, Long Island.
1 BCG	Special Station (see last issue of *Wireless World*, p. 647).
1 UN	Joseph B. Dodge, 26, School Street, Manchester, Massachusetts.
1 XM	Massachusetts School of Technology, Cambridge, Mass.
1 ZE	I. Vermilya, 24, Allen Street, Marion, Mass.

The first three receptions included the correct code word as well as the calls, and the last contained one or two errors in the code word which, however, was easily understandable. **1 UN** and **1 XM** were in the "free for all" period."

My aerial is a twin wire inverted L type, supported by a mast on the house and one in the garden; the former being 56 feet high and the latter 45 feet high (Fig. 1). The wires are spaced 10 ft. 6 ins. apart on bamboo spreaders, the lead-in being taken down at the house end. It is held away from the house by insulated cord stays, and even though our Society* is backward in the art of aerial erection, its members at least know how to get the best out of 140 feet slung skywards! The masts are stayed with wire stays, soundly insulated. The aerial is within G.P.O. limits, being 45 feet long and having a down-lead of 50 feet. The connection to the earth is made to the water main, though at present earth plates are being laid under the aerial.

The set used in this great effort was mostly of home construction. Indeed, one cannot call it a set, that designation would be flattering. "It was," as one friend of mine remarked, "a glorified collection of junk!" The set—for we will name it so for brevity's sake—consisted of two, three-valve panels used on the high frequency side, all rheostats, sockets, handles, woodwork, etc., being made at home. The panels in front of the valves are used to "house" the high-frequency transformers and variable condensers. Two or three loose variables were employed, also home-made. The transformer formers were turned from solid 1¾in. ebonite rod, and a groove ⅛ in. deep turned in each former. In this the primary and secondary are wound. The first winding being of 30 turns of No. 38 D.S.C. copper wire. The second winding of 35 turns of the same wire, wound directly over the first winding.

* *The Manchester Wireless Society.*

These formers are mounted on a set of pins, not in the ordinary arrangement of unequally spaced pins, but at the four corners of a square. The two primary ends are then soldered to two *opposite* pins and likewise the secondary. Thus, simply by giving the transformers a ½ turn, the windings can be reversed and a greater range of wavelengths obtained. The loss in efficiency is very small even with a number of valves, as the windings are so nearly the same on a short wavelength. These transformers serve for waves of 180—325 metres with the variable condensers made for the occasion. Another set was wound with 40 and 45 turns which covers a range of 210—360 metres wavelength.

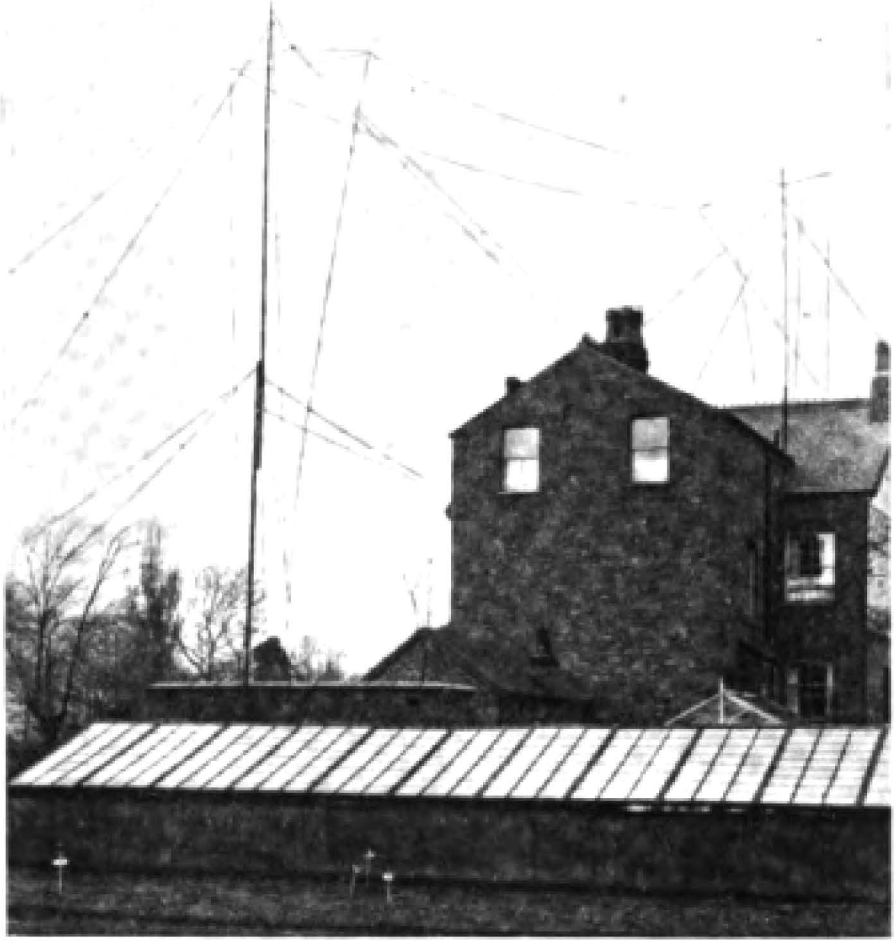

Fig. 1. The Aerials.

Other sets could be made for higher wavelengths if desired. All variable condensers, except those in the Mark III were made by myself, and are of the rotary vane type, air spacing being used. It would not be wise to offer any remarks on the general theory of high-frequency transformers as yet; little seems to be known about them in England and nothing in the States!

The leaky grid condenser was home-made. The condenser has two pairs of tinfoil plates, separated by very thin mica dielectric. The leak was made by drawing a scratch on a piece of ebonite and rubbing a pencil along the scratch. Small washers of tinfoil were cut out and placed under the terminals so as to ensure a good contact between the leak and terminals. A commercial article was tried, but was found inferior to the experimental one, so it was thereupon scrapped. On referring to the diagram of connections, Fig. 3, it will be seen that potentiometer control was used on the amplifying valves, while the connection from the secondary of the last transformer is taken direct to the positive leg of the filament. This tends to stop reaction. The potentiometer, purchased from B. Hesketh & Co., is the key to the successful operation of the set, reaction being either controlled or stopped with this instrument. The valves used were ES4 and ES2 in the H.F. side, whilst an ES4 and French valve were used in the L.F. side.

The tuner used during the greater part of the tests was a Mark III, purchased from Messrs. Halliwell & Good, of Manchester. As this instrument is calibrated it was used, and gave very good results.

Had the wavelength of the transmitting stations been within 20 metres of 200, a home-made affair would have been substituted after tuning the transformers. As it was, two coils of 15 and 26 turns were tried and worked quite as well as the Mark III.

On the first two nights—or rather mornings—four ES4 valves were used, making a total of five with the separate heterodyne, which was a Mullard "Ora." On the third night five valves were used

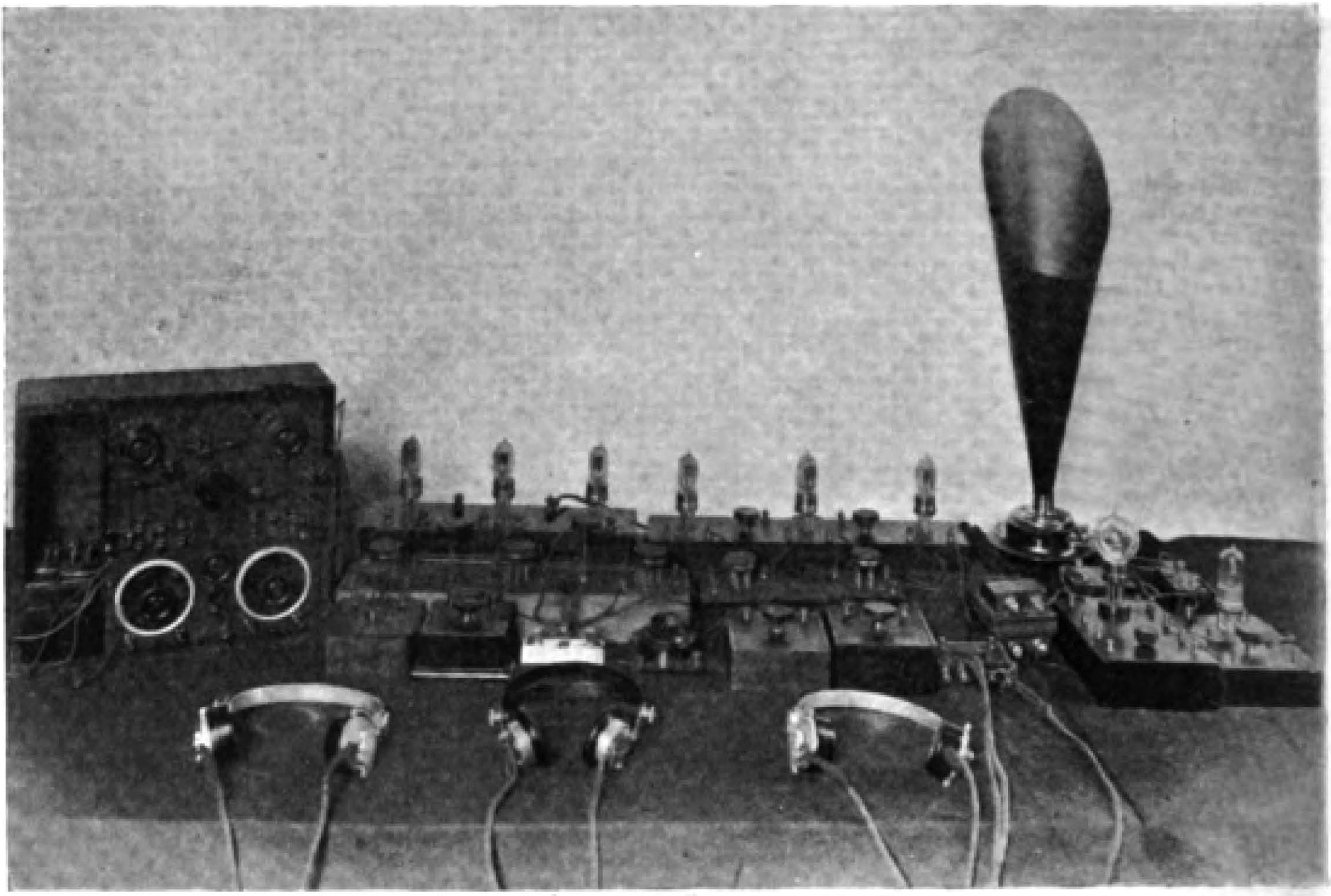

Fig. 2. The Apparatus used by Mr. Burne.

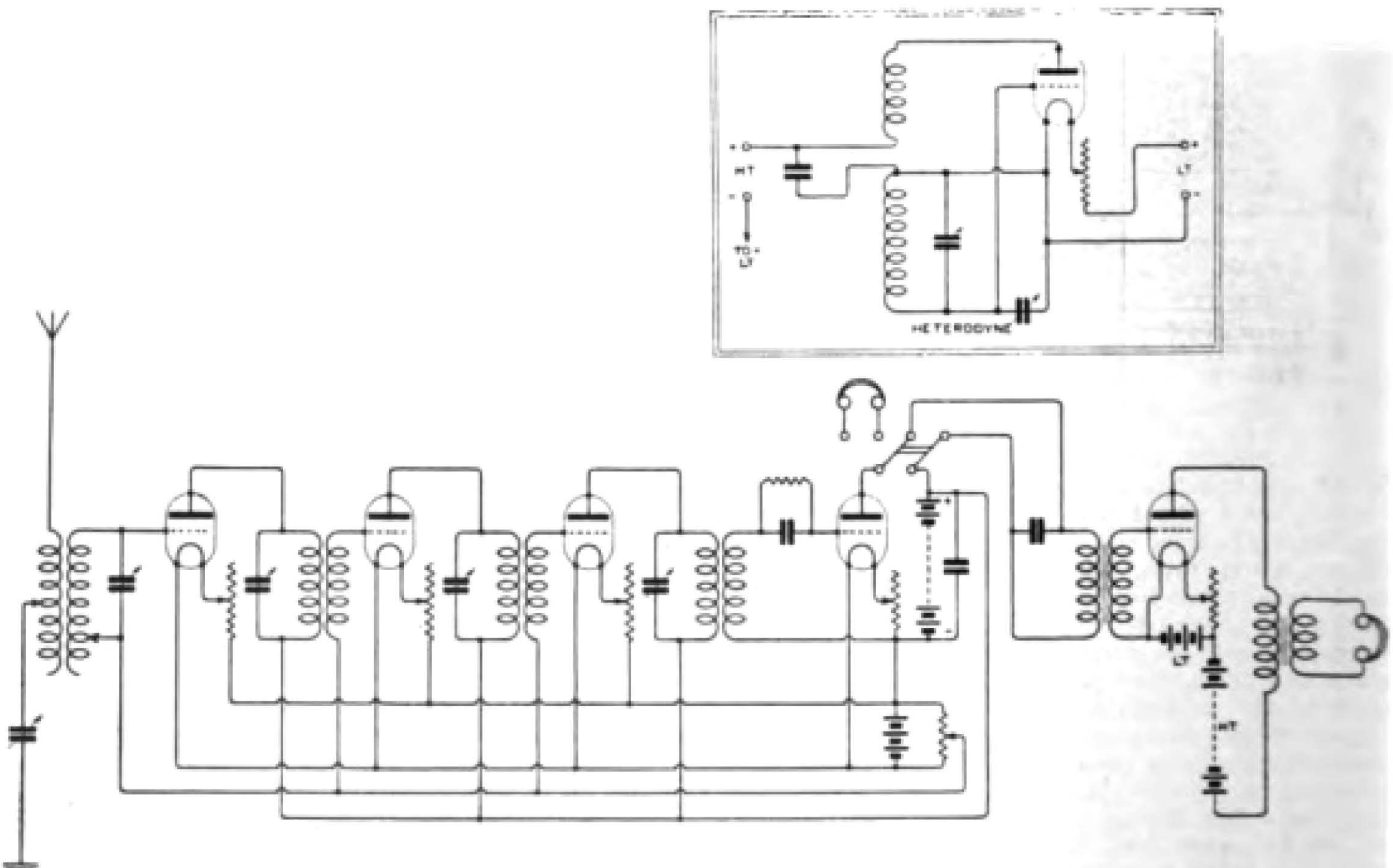

Fig. 3. Circuit Diagram of the Apparatus.

in the H.F. side and the heterodyne. On succeeding nights, six high-frequency valves were used, with the occasional addition of one or two low-frequency valves. The low-frequency side was run together at a moment's notice. A Sullivan L.F. transformer and L.F. transformers purchased from B. Hesketh being used alternately. The panels were of home construction. Brown's and Sullivan's 8,000 ohm telephones were used in the H.F. side and Sullivan's and a Concertone Magnephone in the L.F. side.

For the separate heterodyne (not shown in Fig. 2), a Tingey single valve panel was used. The coils, particulars of which were given in *The Wireless World*, were at first tried, but the instrument would not oscillate; accordingly, two lattice coils were wound with No. 22 D.C.C. copper wire on a 2 in. former, consisting of 25 turns each. It was thought better to wind the plate coil as nearly to the wavelength of the grid coil as possible. With this alteration the heterodyne worked splendidly. Extra high tension was taken from a 30-volt Halliwell & Good high tension unit. The high tension batteries used on the H.F. and L.F., were made up from "Volex" dry Batteries, purchased from the Universal Electric Supply Co., Brown Street, Manchester.

Vernier condensers were used across the secondary terminals on the Mark III and for the heterodyne. It was not found necessary to couple the heterodyne to the grid circuit of the last valve, in fact it was placed at the other end of the room and the condensers only placed on the instrument table.

A considerable quantity of apparatus used has had to be left out of the photograph, Fig. 2, on account of room; this includes accumulators, high tension batteries, vernier condensers, heterodyne, various coils, transformers, variable condensers and switches. The main part of the apparatus is, however, shown.

In conclusion, I would like to add that I am greatly indebted to the members of the Manchester Wireless Society for their splendid assistance in this effort. Especially I would thank Mr. Milner, of this Society, for his very great help and loan of apparatus. May this be only a beginning to a long series of experiments between the American "Bugs" and ourselves, and may Manchester—even if it knows little of aerials—be to the fore in these tests!

The Second Prize Set: Description of Apparatus used by H. H. Whitfield.

FIG. 1 shows a general view of the apparatus, as used for the tests. My wireless den is very small and it is more or less impossible to get a photograph showing all the apparatus at once. On looking at it, one is apt to say, "What a horrible mess!" But the stuff, including the tablecloth, is laid out for use, and not for ornament.

The panel on the wall, left-hand side (Fig. 1), is my ordinary 4-valve receiving apparatus. Three of the valves are fixed along the top, and parts of them only, appear in the picture. The front of the panel is hinged and the connections, chokes, condensers, etc., at the back are easily accessible for alterations when necessary. I might mention here that I have never gone in for receiving sets of the "made-up" variety. My object has been to work out principles, and the panel as constructed is adaptable to many different circuits. The tuning apparatus is, as usual, laid on the table, separate and distinct, and connections between the two are made by means of the terminals along the bottom of the panel. The H.T. and filament batteries are on the floor, out of sight. The battery on the extreme right of the picture is the filament battery for the separate heterodyne.

The box on the table, extreme left, is an old Marconi telephone transformer, pressed into service on this occasion, as I used my own telephone transformer as an inter-valve transformer for my fifth valve (standing on the table alongside). The fifth valve, it will be noticed, is a Cosser "H" transmitting valve, and it may be thought that amplification by means of a telephone transformer and a "B" valve on 60 volts would not be very efficient. It is not, but it was all I had, and although it didn't amplify much, it cleaned things up considerably.

The apparatus is all home-made with exception of condensers, valves, batteries and phones.

Like the majority of wireless strugglers, I am poor, and although one can make do with a lot in the way of makeshifts, there are, of course, certain essentials which one must have. In this behalf I would like to mention my indebtedness to Messrs. Beresford Bros., of Bull Street, Birmingham, for the loan of two small variable condensers, also to Mr. T. Rogers, of Moseley, for the loan of a picked ES2 valve, which I used for the separate heterodyne. (The valve in the picture is a burnt-out "B," put there for the purpose of illustration only).

The small Mark III condenser in the centre of the table is the series aerial condenser and, being more or less at earth potential, did not require a long handle to operate it.

The variometer in the plate circuit of the second valve was fixed to the shelf over the top of the panel and does not appear in the picture.

Stations Heard by Mr. H. H. Whitfield.
SECOND PRIZE WINNER.

1 AFV	F. C. Estey, Salem, Mass.
1 BCG	Special Station (see *Wireless World* last issue, page 647).
2 ZL	J. O. Smith, 3, Corona Road, Valley Stream, Long Island, N.Y.

In the first and third case the special code signals were correctly received as well as the calls.

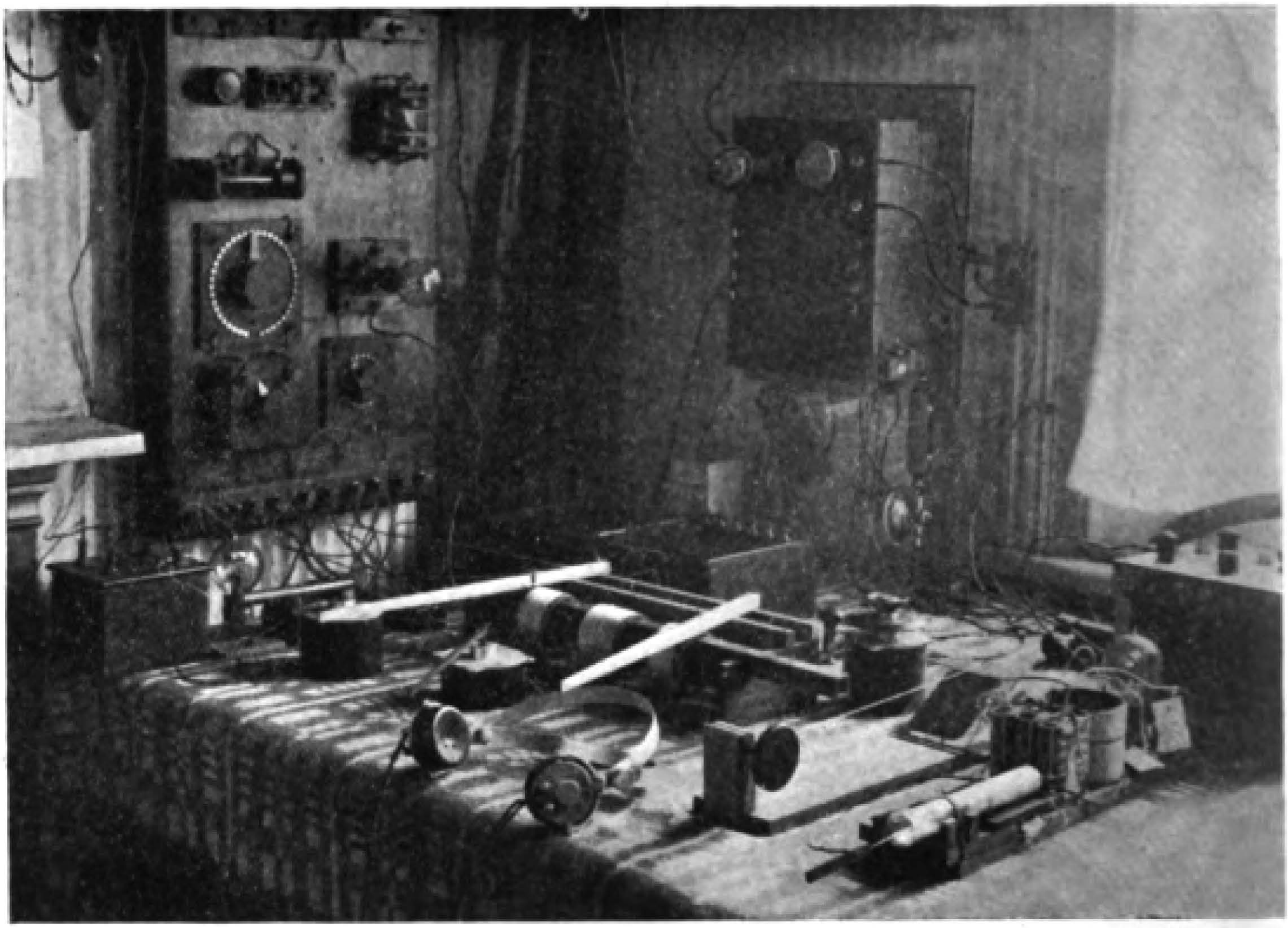

Fig. 1. General view of the Apparatus used by Mr. Whitfield.

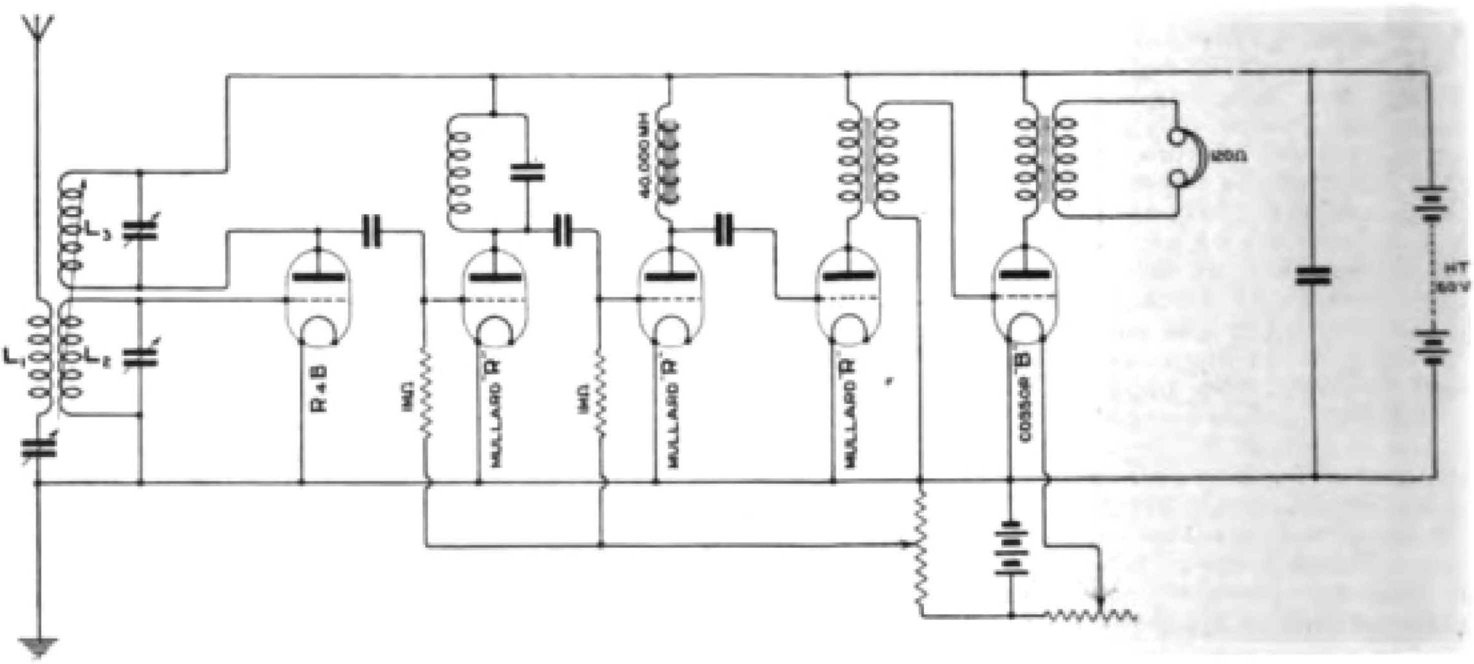

Fig. 2. Circuit Diagram of the Apparatus.

The tuning apparatus shown in plan, Fig. 3, consists of three coils wound on 2¼ in. diameter ebonite tube. Their method of mounting is, I think, novel. They are simply hung on a piece of square ebonite tube, and the coupling between them is adjusted by means of the levers as shown, connected to the two outside coils (similar to the tool-feeding arrangement on a capstan lathe). This arrangement has the advantage of giving easy critical adjustment, and at the same time the long handles minimise capacity-to-earth effects, always very troublesome on short wavelengths.

The six terminals are at the back and therefore out of the way.

The coil on the right is the aerial coil of 27 turns. The middle one is the secondary and has 44 turns, and the one on the left of 34 turns is the anode coil of the first valve. The three coils are wound with No. 32 silk-covered enamelled wire, the turns being spaced with white silk thread equal to about twice the diameter of the wire. The object of this spacing is too well known to need comment.

Referring to the diagram of connections, Fig. 2, it will be seen that the bottom end of the secondary coil is connected to filament negative instead of potentiometer, and self-oscillation of this valve is prevented by a reverse coupling of the anode and secondary coils. I have used this method for the past eighteen months or so and find it a much better method of stopping self-oscillation, for, although grid-damping by positive volts will stop self-oscillation, it at the same time introduces undesirable noises into an otherwise quiet circuit, and therefore, should, I think, be avoided wherever possible.

The separate heterodyne (Fig. 4), although built

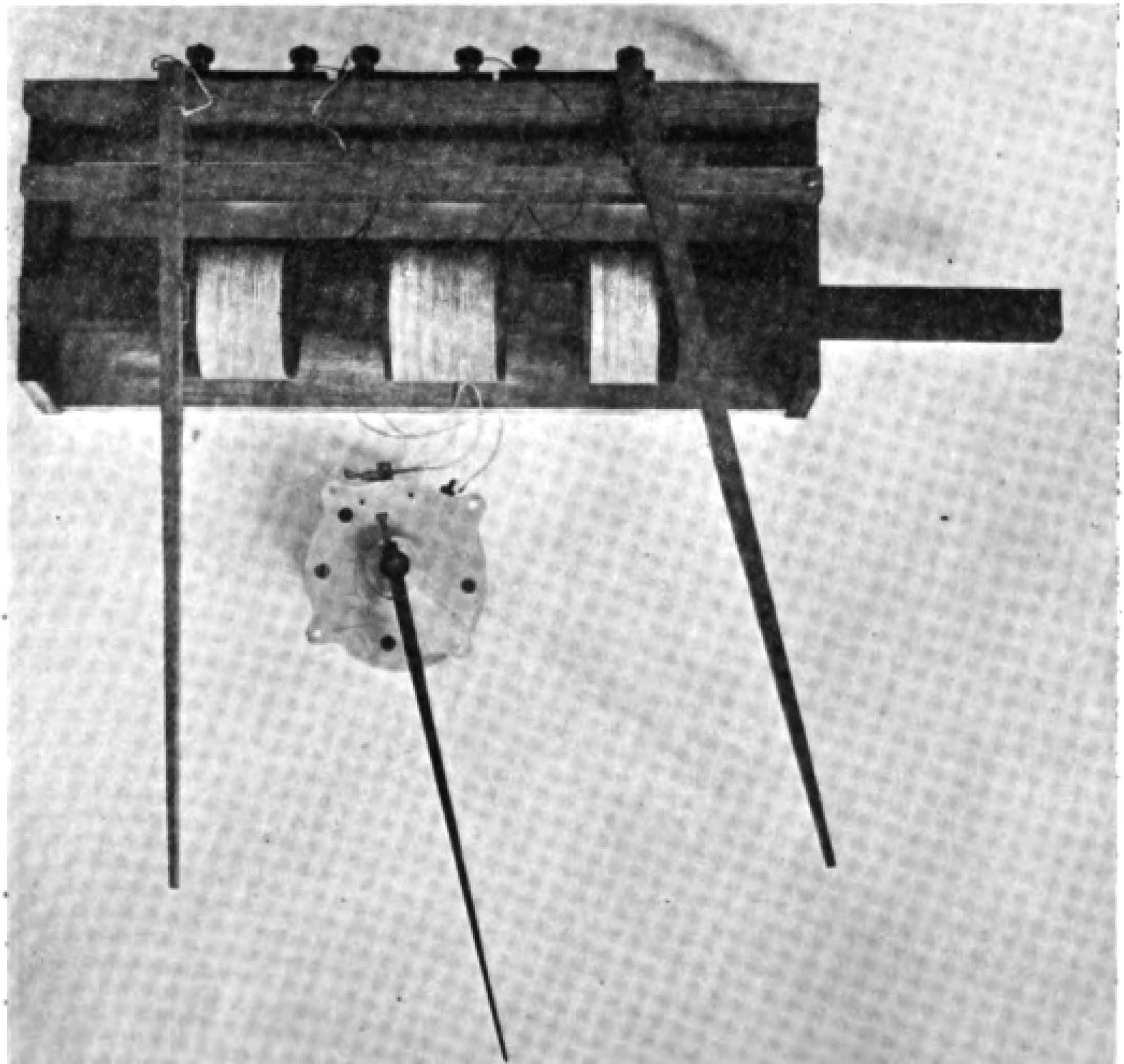

Fig. 3. Tuning Apparatus.

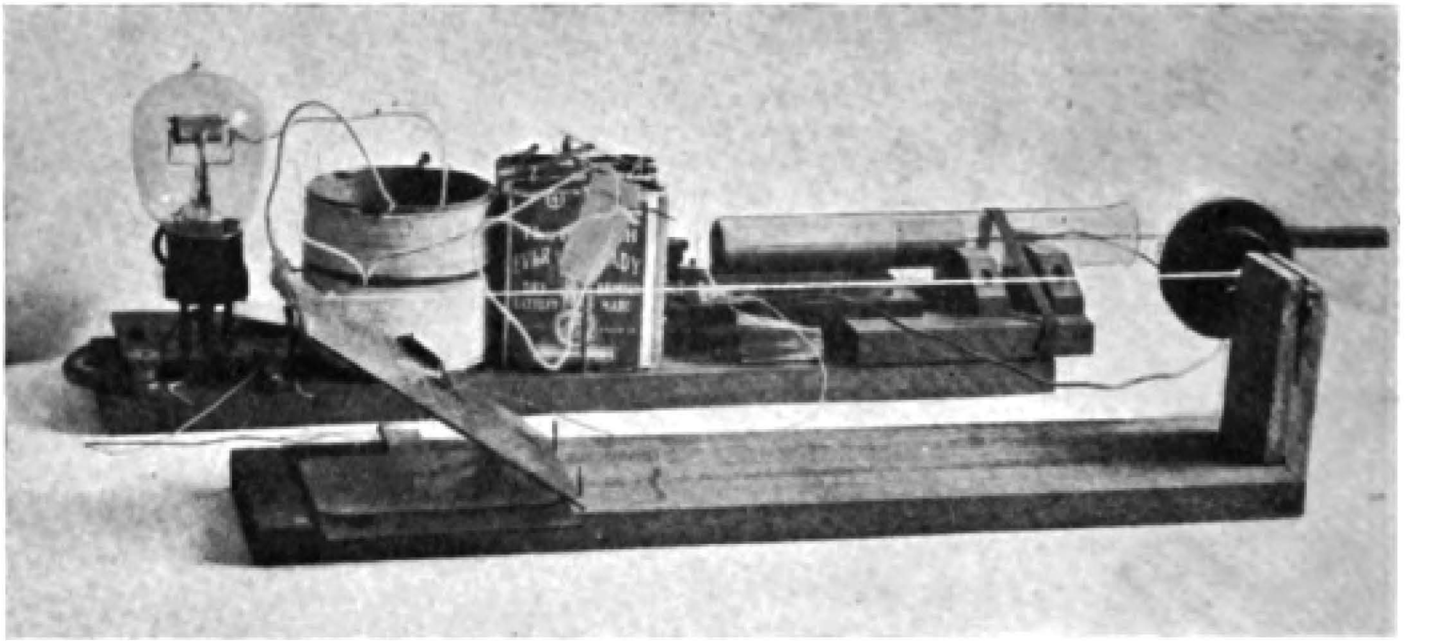

Fig. 4. The Separate Heterodyne.

on the principle of that as described in recent editions of *The Wireless World*, differs very much, as will be seen in its appearance. The time at my disposal only permitted of a temporary affair, but it worked very well. Its main variable condenser is one I made about twelve months ago, and consists of a test tube coated for part of its length on the outside with tinfoil, the inside movable portion being a short piece of brass tube, which happened to fit. Incidentally this type of condenser, although easily made, appears to be a horrible energy waster. The billi-condenser for fine adjustments is shown in front, and here again the arrangement is, I think, a novel one. Two quarter-plate negative glasses, with pieces of tinfoil stuck on with shellac, form the two halves of the condenser, connection being made by a flexible tab left on one side of each. The fixed plate is laid on its back on the baseboard and the movable one is hinged against two pins. It is raised or lowered by means of a silk cord wound round and fastened to the spindle of the operating handle, sprung in an upright at the other end of the baseboard. The weight of the glass plate keeps the cord taut. Here, again, we have distant control, and the big air space separating the two capacities allows of very fine and easy adjustment for heterodyning signals of such short wavelength. The heterodyne being unscreened, I did not need to use any coupling coils between it and any particular part of the receiving apparatus, as I got sufficient strength of heterodyne without. An ES2 valve was used, with 8 volts on plate. I am of opinion that the billi-condenser to some extent acted as a radiator in the manner of the well-known Hertz oscillator. During use it was 18 inches away from the other apparatus. The tuning generally was exceedingly critical, and yet the set seemed to be very sensitive to any and every harmonic that came along.

The aerial is standard G.P.O., 140-feet, 2 wire, 40 feet high, due east and west. Lead-in from east end. 500 feet above sea-level. No screening. Clay subsoil. Wire 7/24, enamelled. Earth to water pipe.

The box-like affair, just visible on the wall at the back (Fig. 1) is part of my transmitter, and, of course, took no part in the test.

The Third Prize Winners : Description of the Apparatus used by W. E. F. Corsham, of London, and R. D. Spence, of Aberdeenshire.

As announced in our previous issue, Mr. W. E. F. Corsham, of Harlesden Gardens, Willesden, London, N.W.10, and Mr. R. D. Spence, of Craighead House, Huntly, Aberdeenshire, each heard signals from one station, with correct code words. Mr. Corsham used three valves and Mr. Spence used six, and for this reason the judges have decided that Mr. Corsham is deserving of the more valuable of the two third prizes that have been offered.

Mr. Corsham's aerial was 100 ft. single wire (7/20 enamelled) in the form of an inverted L. Two masts were used, one 20 ft. high, in the garden, and the other secured to the chimney pot in such a way that the height from the ground to the top of this second mast was 46 ft. The receiving apparatus was situated in a room 15 or 20 ft. from the ground and the 25 feet down lead was taken from the highest point of the aerial. The arrangement was thus non-symmetrical, the free end of the aerial being practically no higher than the receiving instruments and the maximum height above the receiving instruments being 25 ft. A double earth connection was used, one consisting of a wire to the water tap and the other of a single wire running immediately beneath the aerial and earthed at the far end. Mr. Corsham informs us that the situation of his house is at the bottom of a hill with practically no screening.

It was intended to use two receivers, one a five-valve low-frequency amplifier detector and the other a three-valve experimental receiver. The first caused trouble in the early part of the Tests and was therefore scrapped, attention being concentrated on the second circuit for the remainder of the Tests. A separate oscillator was, of course, used, similar in construction to the Marconi Independent Oscillator. Owing to the fact that it was Mr. Corsham's first attempt at using a separate oscillator on 200 metres, he had a certain amount of trouble with it and further, conditions did not permit of his listening in for the calibration waves. His calibrations were, therefore, made on harmonics from FFU, GFA and GKU. Time signals were checked from a Nauen harmonic.

The five-valve set, although silent in action most of the time, had an irritating habit of howling when least expected and was therefore discarded. The circuit of the three-valve set is shown in Fig. 6. According to Mr. Corsham, this set occasionally works better on short waves when the earth is disconnected.

We notice upon examination of Mr. Corsham's log that he reports "amâteur interference heavy" about the time he received the signals from 1AFV (morning of December 12th). The signals from 1AFV are given by Mr. Corsham as of sufficient strength to be nicely readable and he thinks that if he had had more time to experiment with and adjust his apparatus, he would have received many more stations. The set is shown in the photograph, Fig. 5, and in the diagram of connections in Fig. 6. It is of interest to note that Mr. Corsham is Chairman of the Willesden Wireless Society.

Station Heard by Mr. W. E. F. Corsham.

(JOINT THIRD PRIZE WINNER) WITH THREE VALVE SET.

1 AFV F. C. Estey, Salem, Mass. With code group correctly received.

Station Received by Mr. R. D. Spence.

(JOINT THIRD PRIZE WINNER) WITH SIX VALVE SET.

2 ZL J. O. Smith, 3, Corona Road, Valley Stream, Long Island, N.Y. With code group correctly received.

The other recipient of the third prize, Mr. R. D. Spence, of Huntly, Aberdeenshire, used the apparatus which is shown in the accompanying photographs and diagram (Figs. 7 to 10). The first photograph (Fig. 7) is a general view of the receiving gear. On the extreme left is seen the high tension unit containing tapped-off resistance and two microfarad condensers. Next to it is the amplifier, then the Mark III tuner and on the right, a converted Marconi No. 16 receiver, used for long waves. On the right, in front, are the Townsend wavemeter and the heterodyne unit.

In the second photograph (Fig. 8) is a close-up view of the amplifier, removed from its case. Fig. 9 is a side-view of the amplifier, valves, inter-valve transformers, grid leak, four or six-valves switch and reactance switch. The aerial consisted of a single wire "T" of 7/24 copper, average height 45 ft., length of horizontal wire 80 ft., with down-lead 20 ft. to instrument room situated 25 ft. from the ground. Earth connection was made to the water pipes and also to a wire running out under the aerial and buried about three inches in the ground. The Mark III tuner calls for no comment, being standard in its connections, with the detector switch kept on to the valve position so that the first valve amplifier is connected directly to the closed circuit of the tuner.

The amplifier is of Mr. Spence's own design and

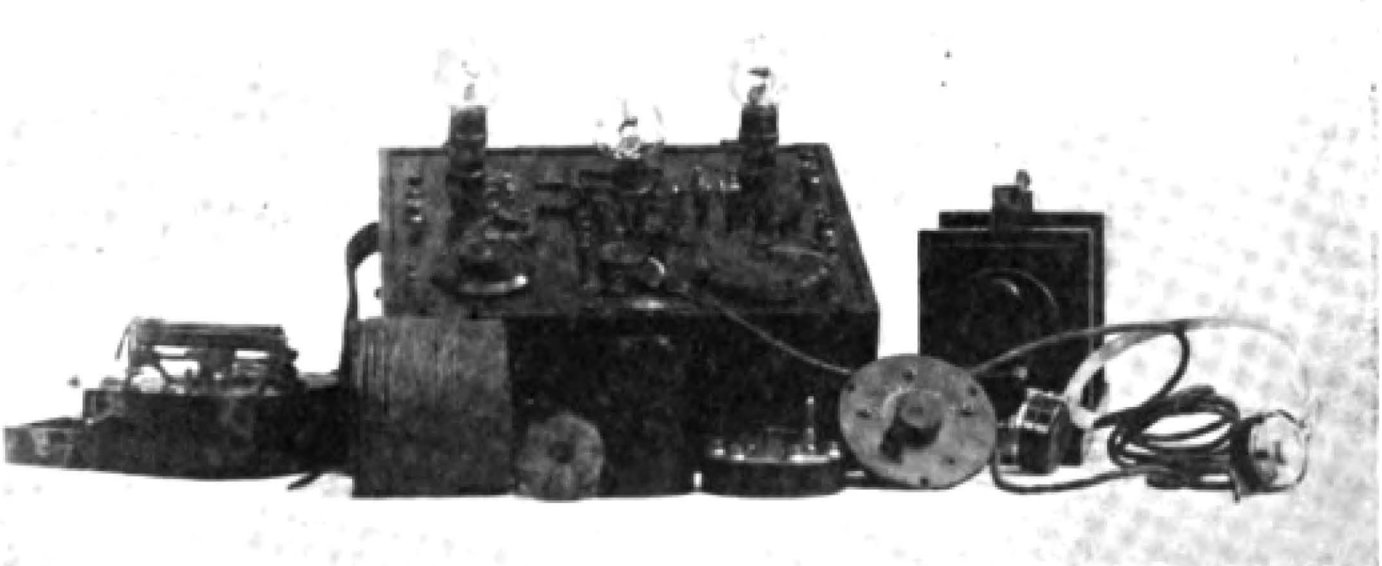

Fig. 5. Mr. Corsham's Apparatus.

constructed by his brother, Mr. H. R. Spence. Six R type valves are used, three as H.F. amplifiers, one as rectifier, and two as L.F. magnifiers. The details of the H.F. transformers are as follows :—

Dimensions of wooden bobbins :—

Mean diameter, $\frac{7}{8}$ in.

Axial length, $\frac{1}{2}$ in.

Width of groove, $\frac{3}{16}$ in.

Depth of groove, $\frac{1}{8}$ in.

Windings :—

Primary (tuned), 45 turns 42 S.W.G. D.S.C.

Secondary, 50 turns 42 S.W.G. D.S.C.

The secondary is wound on first with the primary over it, separated from the secondary by a few turns of oiled silk cloth. The starting end of the secondary (*i.e.*, the inside end of the inner winding) is connected to the grid, which is thus kept free as far as possible from undesirable capacity effects, while at the same time the primary or tuned winding is outside and easily accessible, if it is desirable, to remove a turn or two to adjust the tuning of the three transformers to correspond. The tuning condensers for the primary windings of these transformers are closed circuit condensers from the earlier pattern of Mark III short wave tuners made by Mr. Robert Paul.

It will be noticed that there are two terminals connected by a strap in the plate circuit of the first valve. This enables inductive reaction or variometer reaction to be used if desired. The remaining points of the amplifier are dealt with below. The letters refer to the letters on the diagram (Fig. 10).

T_1, T_2 = *L.F. Transformers.* These are Disposal Board goods and are the ordinary small Army pattern of transformer wound with 47 S.W.G. S.S.C. Ratio 4-1.

R_1, R_2, R_3 = *Filament Rheostats.* These are home-made, of platinoid wire wound on slate, with sliders.

P = *Grid Potentiometer.* This is an old crystal potentiometer removed from a Marconi No. 16 "balanced crystal" set.

r = *Grid Leak.* Mullard 1 megohm.

Grid Condenser. Mica and tinfoil, 0.0003 microfarad. Disposal Board. Bought from Mr. Tingey.

Valves. "R" type, supplied by General Electric Co., Ltd.

Valve Holders. Two sets of three mounted in ebonite, bought from Mr. L. McMichael.

S_2 = *Switch.* This allows four or six valves to be used at will, as shown in diagram. It is of the "barrel" type and was removed from an old Disposal Board transmitter.

S_1 = *Switch.* Telephone switchboard type (Mr. McMichael).

Switches. These are small miniature tumblers.

C_2 = *Blocking Condenser.* Mica and tinfoil,

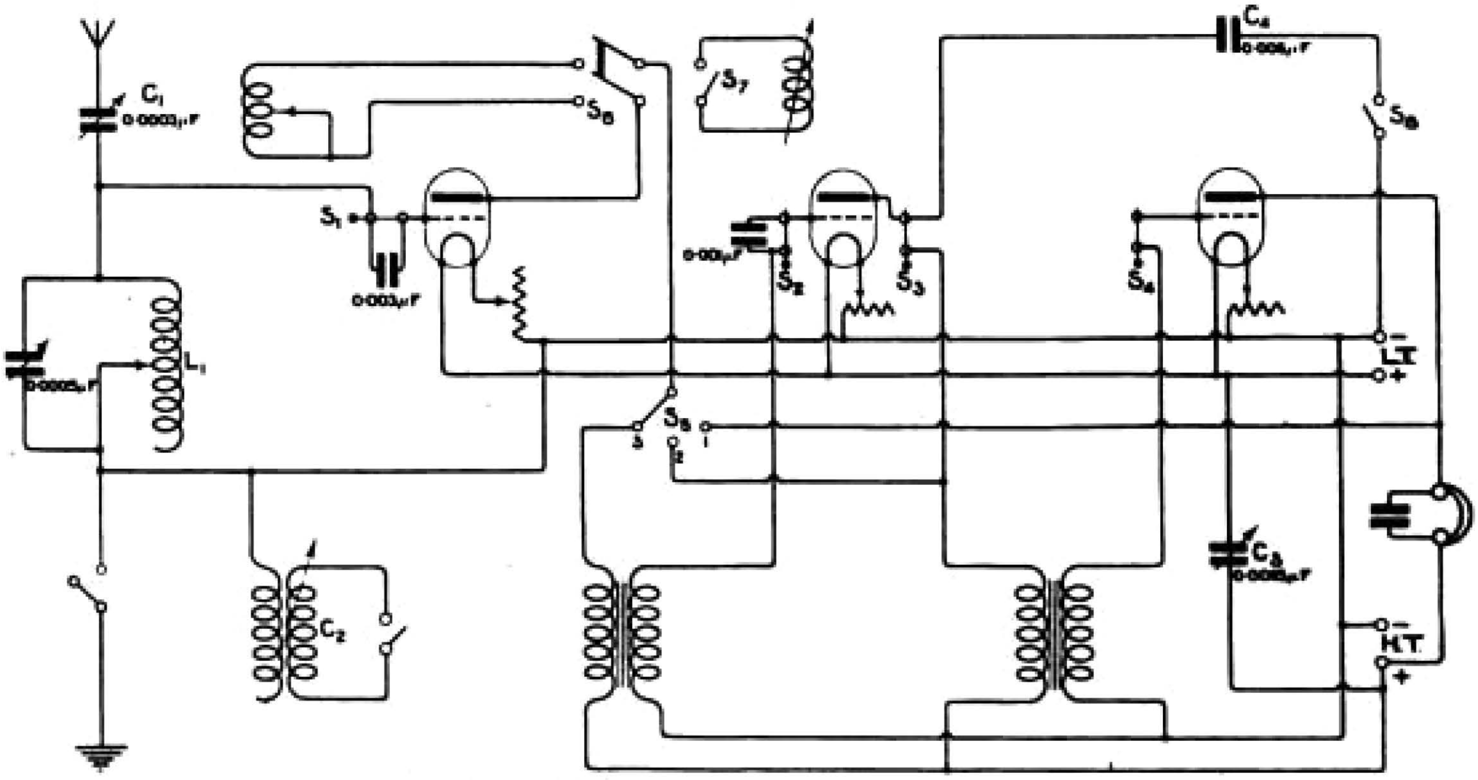

Fig. 6. Circuit Diagram of Mr. Corsham's Apparatus.

The switch in the aerial circuit is for the purpose of disconnecting the earth, as the set sometimes works better without the earth. C_2 is a loose-coupled tuner. The switches S_1, S_2, S_3, S_4, consist of two terminals and a pin for shorting or breaking the circuits. S_5 allows one, two or three valves to be used. S_6 and S_7 bring in either reaction or a coil for tuned plate circuit. S_1 and S_2, although shorted in the diagram, were not so in the test. Apparently the loose-coupled tuner is used merely as a substitute for a fine tuning condenser, as slight alterations of the sliding coil give very fine tuning to the aerial. Condenser C_3 gives even finer tuning.

0.002 microfarad. This is the telephone condenser from a Marconi "Type 16" set.

C_1 = *Reactance Condenser.* This is home-made and has one moving and two fixed vanes of sheet zinc. Moving vane, quadrant shaped, 4 ins. radius.

T_3 = *Valve-phone Transformer.* Army pattern. Disposals Board.

Phones. Brown, 120 ohms. "A" type.

L.T. Battery. "Exide" type, six volts 50 amp.-hour, bought from Chloride Electrical Storage Co., Ltd.

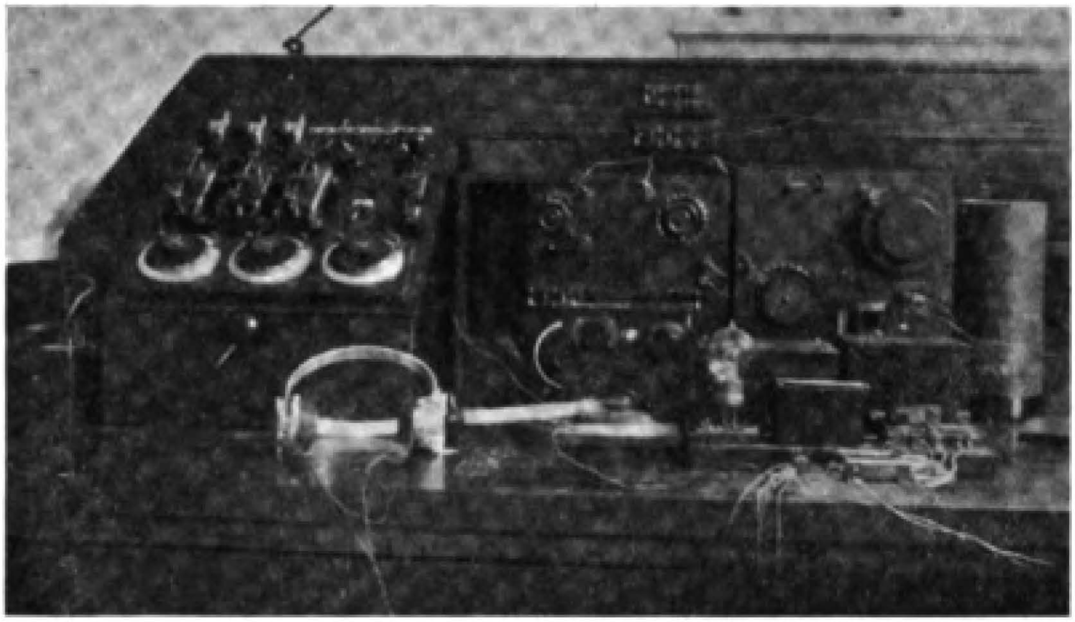

Fig. 7. General view of Receiving Gear.

H.T. Supply. This is obtained from the lighting circuit which is supplied from 32 chloride cells, giving 64 volts. The mains are connected across a resistance of 100 ohms, tapped off to six points. By connecting the H.T. terminals of the amplifier to two of these points, shunted by a two-microfarad Mansbridge condenser (O), I am able to get any desired portion of the total voltage.

Heterodyne Unit. The inductance and reaction coil are wound side by side on a cardboard tube (P), 4½ ins. in diameter and consists of 10 and 12

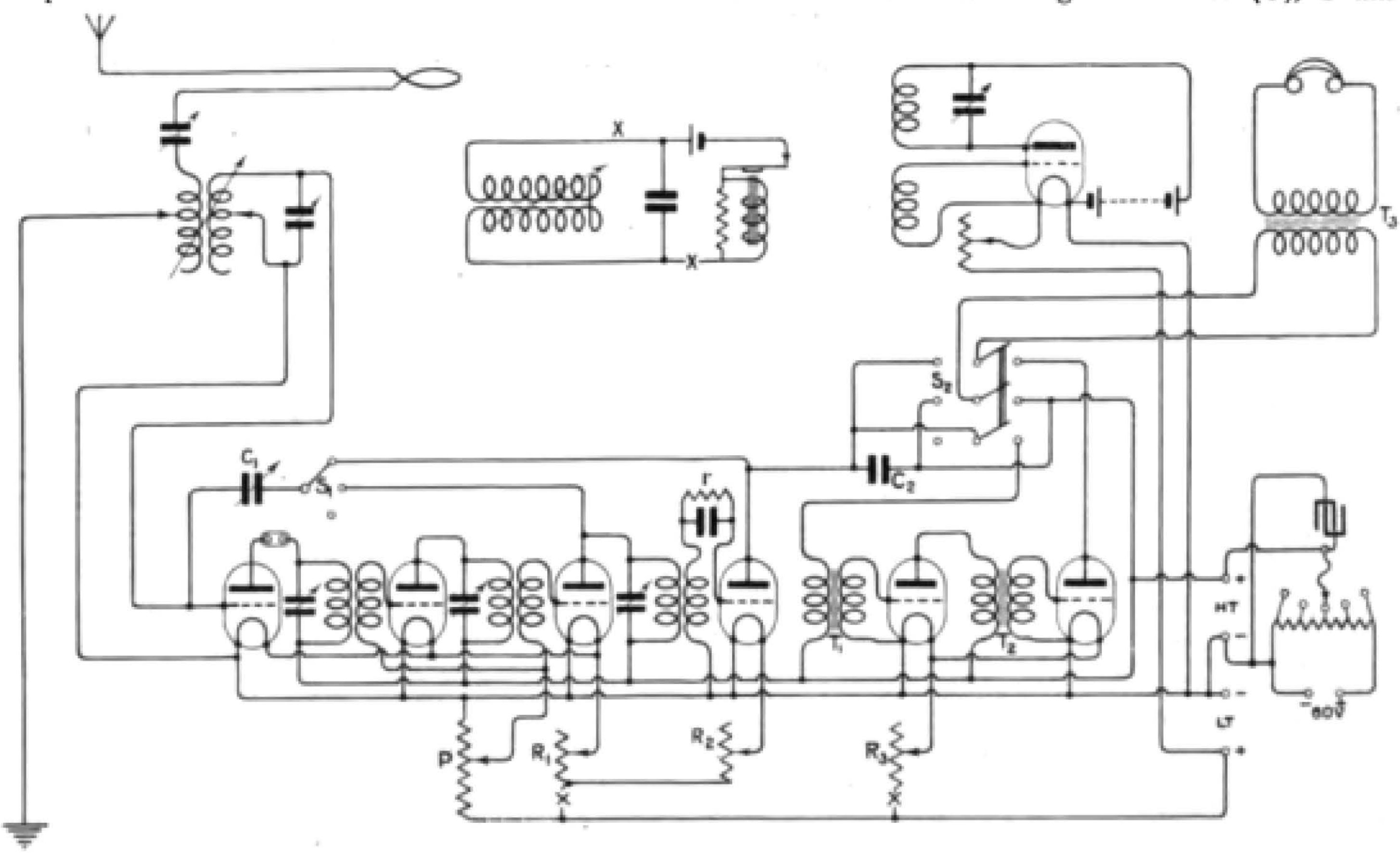

Fig. 10. Circuit Diagram of Mr. Spence's Apparatus.

turns of 22 S.W.G. enamelled copper wire respectively. The condenser is a Mark III tuner, closed circuit condenser (R), as used in the amplifier. The range of wavelengths covered is about 170-390.

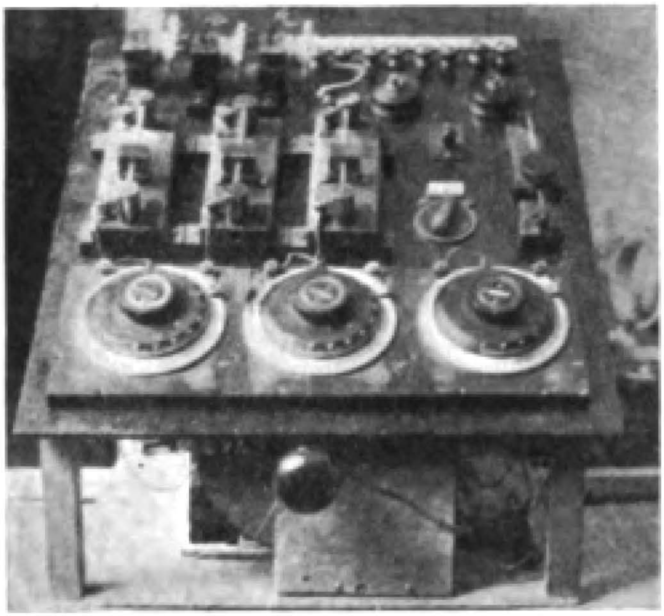

Fig. 8. A near view of the Amplifier.

A wooden "pot-handle" is fitted to the knob of this condenser to minimise the capacity effect of the operator's hand.

The H.T. for heterodyne valve consists of six "Ever-ready" cells (S).

×1 = *Wavemeter.* This is a Townsend wavemeter, 120-1,600 metres, specially calibrated from N.P.L. standard meter, and was given to me by Prof. Townsend.

Remarks. The chief difficulty encountered with a set of this type is in searching for a station if the wavelength is not exactly known. Owing to the tuning of the H.F. transformers, the tuning is very sharp indeed, and any alteration of wavelength means making five or six adjustments. I have tried gearing the condensers together, but have not found it satisfactory. If the wavelengths of the American stations had been known exactly, *i.e.*, within 5 per cent., I am confident I should have heard more of them.

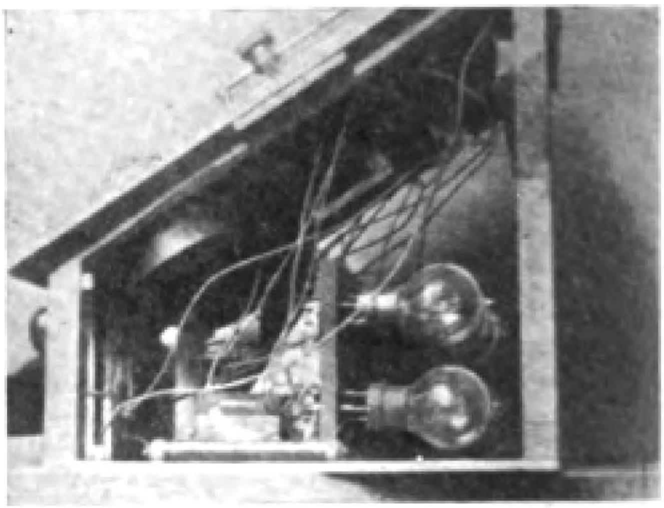

Fig. 9. Side view of the Amplifier.

My station is situated in the middle of a wood and is particularly badly screened towards the west by trees, which are higher than the aerial, and by sharply rising ground.

1 BCG.
Some Notes on the Station.

THE distinction of having transmitted the first transatlantic signals from an amateur station, conforming in every way with the radio laws and regulations of the United States belongs to Mr. Minton Cronkhite, of Greenwich Connecticut, whose call "1BCG" was heard with considerable strength not only by Mr. Godley, but by British and Continental amateurs. His transmissions, however, were not strictly connected with the prize tests, as he transmitted over considerable periods during the whole time.

1BCG station, of which we shall publish further particulars in a later issue, was erected by Mr. Cronkhite in association with E. H. Armstrong (the well-known inventor), George Burghard, John Grinan, Walter Inman, and Ernest Amy. The set uses four Radiotrons* UV 204, one as a master oscillator, and three as power amplifiers. The plate potential is 2,000 volts, supplied from a motor generator. The total input of the set was 989 watts, and 558 watts were delivered to the aerial. The latter was of the T type, the horizontal part being 100 feet long. Both the flat top and the leads were eight-wire cages. The effective height of the aerial above the radial counterpoise was 75 feet. The counterpoise was 120 feet in diameter, supported on poles eight feet from the ground. There was no direct earth connection. The aerial resistance was 15·5 ohms, and all transmission took place on a wavelength of 200 metres.

The station was first heard on the morning of December 10th, by Mr. Paul Godley at Ardrossan. Godley immediately telegraphed to Mr. Cronkhite that his signals were "wonderful," and requested that he would transmit a complete message. This was done on the morning of the 12th, and receipt was duly cabled by Mr. Godley.

The best reception of 1BCG by an English amateur was undoubtedly that by Mr. Greenslade at the British School of Telegraphy. On one occasion Mr. Greenslade copied the signals from that station for nearly two hours, although he was not fortunate enough to receive the message referred to above, or any code signals.

* Transmitting valves made by the Radio Corporation of America.