Portable Set designed by the Marconi Company.

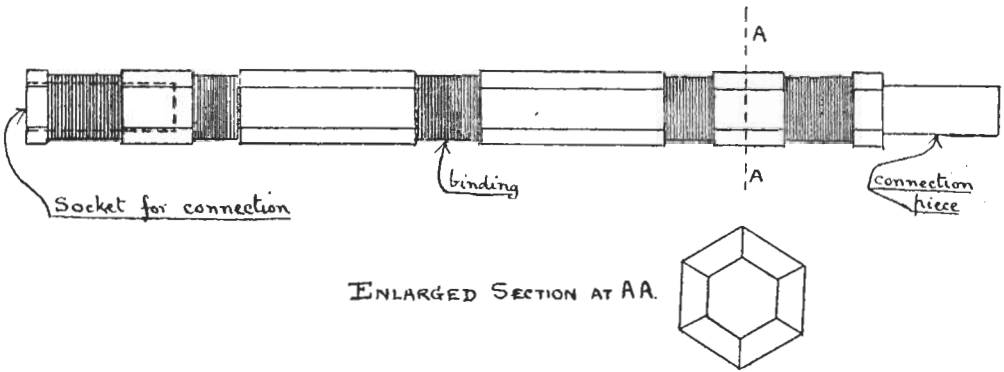
A demonstration was given of two small sets designed by the Marconi Company for military work. They are called the "Infantry type" and the "Cavalry type" sets, and differ from one another only in the details of transport arrangements. The power of these sets is about ·4 K.W. The range guaranteed "over ordinary country" is 40 to 50 kilometres. Three wave-lenghts are arranged for, viz., 500, 600, and 700 metres. Tuning is apparently rather approximate.

The transmitting gear is of the ordinary spark type, using a 10-inch coil as a transformer.

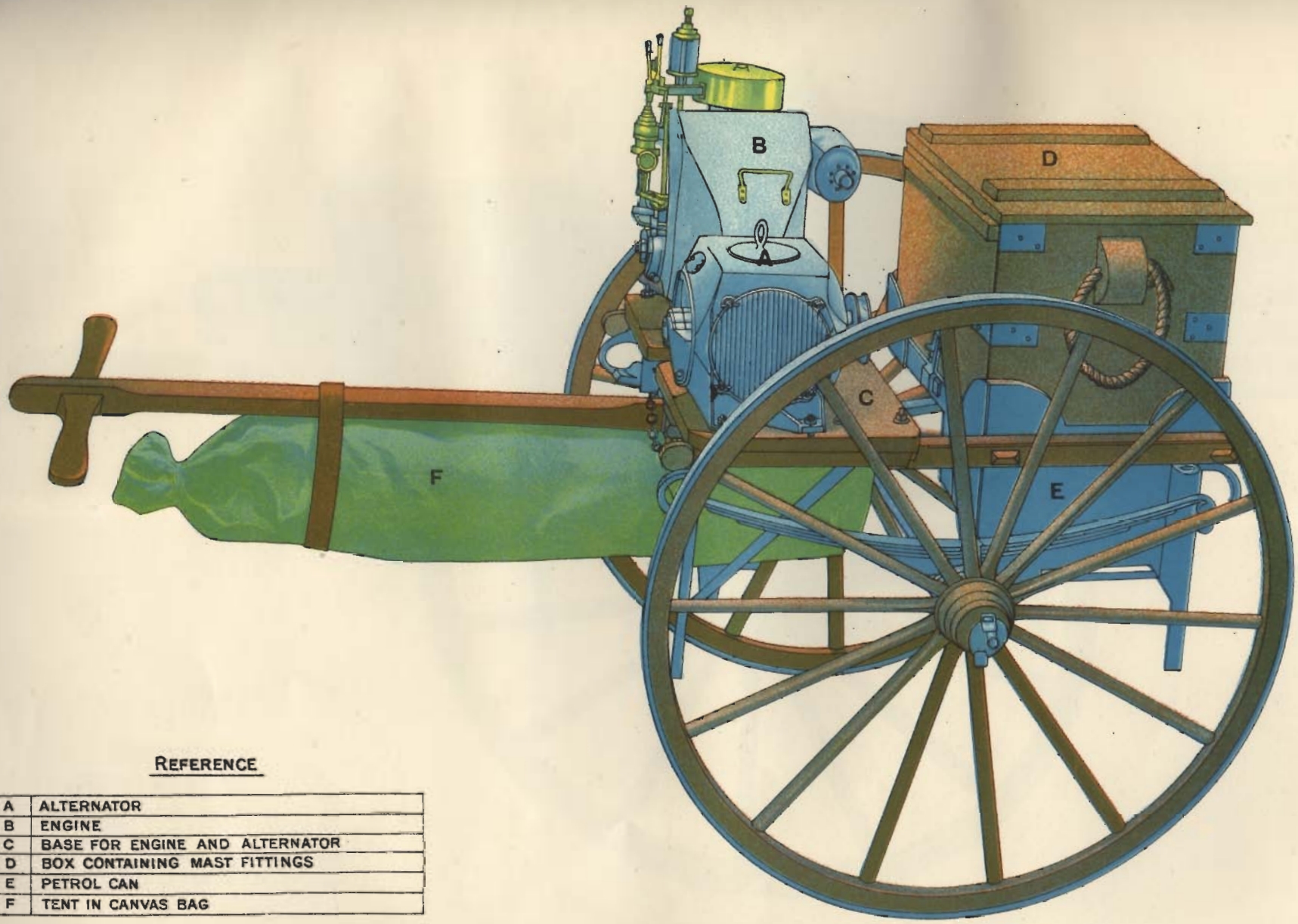
The power is obtained from a small petrol engine similar to the Service engine. This drives the alternator direct through a flexible coupling.

Receiving Gear.—The usual commercial Marconi receiving circuit is used with a Fleming oscillation valve detector, and it was stated that designs were complete for a change-over switch-board so that a crystal detector, consisting of a brass plate in contact with a crystal of carborundum could be used as an alternative to the valve.

Fig 3.



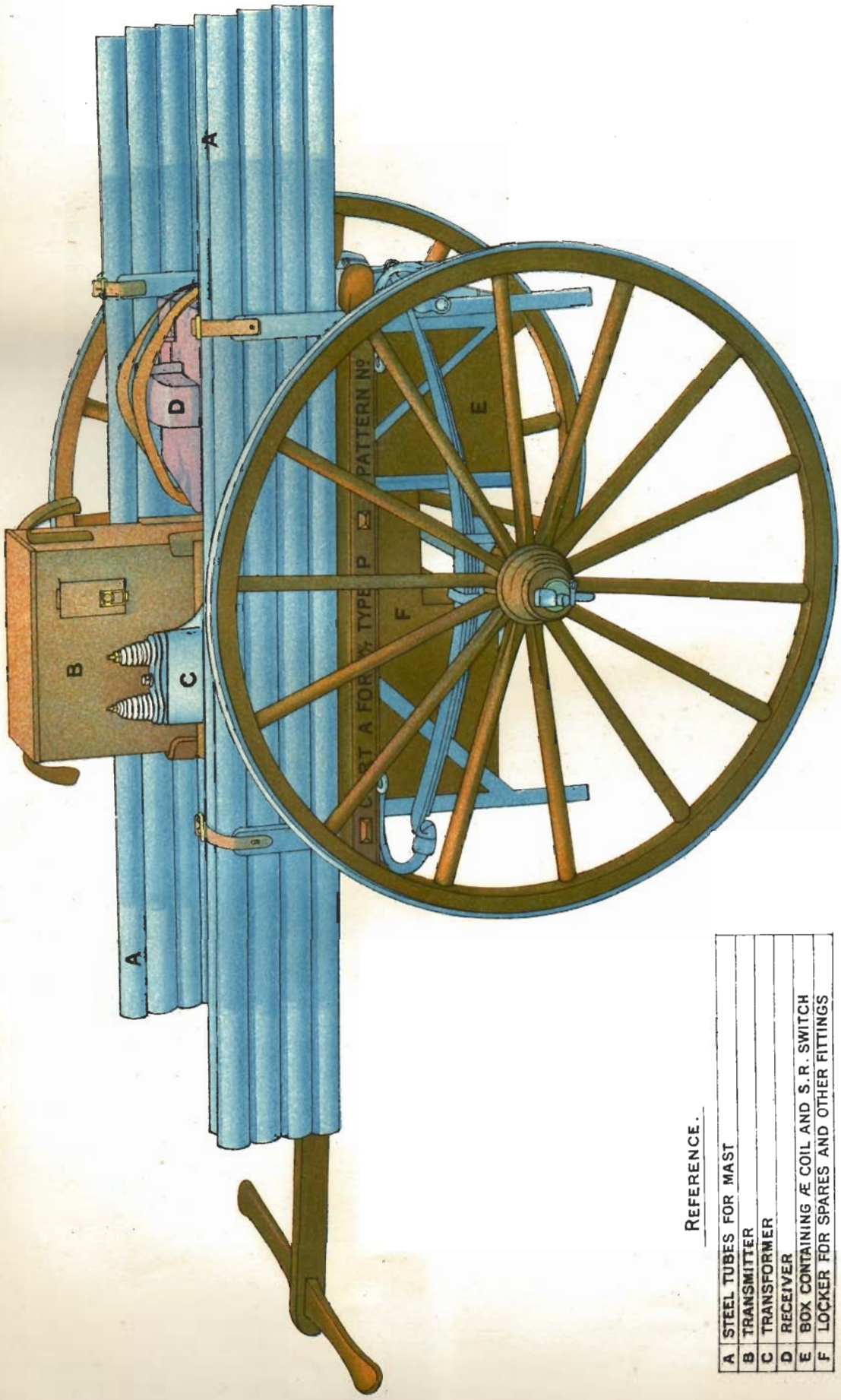
CART "B" FOR PORTABLE SET



REFERENCE

A	ALTERNATOR
B	ENGINE
C	BASE FOR ENGINE AND ALTERNATOR
D	BOX CONTAINING MAST FITTINGS
E	PETROL CAN
F	TENT IN CANVAS BAG

CART "A" FOR PORTABLE SET



REFERENCE.

A	STEEL TUBES FOR MAST
B	TRANSMITTER
C	TRANSFORMER
D	RECEIVER
E	BOX CONTAINING Æ COIL AND S.R. SWITCH
F	LOCKER FOR SPARES AND OTHER FITTINGS

T12. 26474/PINK 118. 700. 4.12.

Malby & Sons, Lith.

Masts, Aerial, &c.—Two masts, 30 feet high, are used, which are placed 350 feet apart. A two-fold aerial is slung between them, and fed from one end. The earth consists of a phosphor-bronze gauze mat about 30 feet long by 5 feet wide, spread on the ground. It was stated that better results were obtained with two such mats placed side by side. Each mast consists of six 5-foot lengths which are connected together as in a fishing rod. The construction of these lengths, which are made of wood, is shown in Fig. 3. Twe sets of stays are used, and there is no canting piece for raising. One of the masts seen was lowered and re-erected in about half a minute.

Landing Set.—It was stated that a set practically identical with that shown had been designed, to be called a "Landing set" for use in ships. It has been specially arranged in small units to facilitate transport by coolie labour.

Visit to Aldershot.

The same set, Marconi's Infantry type,was seen at the military headquarters at Aldershot. It was understood that the set was only moderately satisfactory, and several points were being re-designed with a view to getting better results in the field—notably with the mast, which, it was stated, was continually breaking. The gauze earth mat does not give satisfaction, as, if the ground on which it is laid out is wet it forms an earth, whereas if the ground is dry it forms a counter capacity, and the tuning of the aerial circuit is very different in the two cases.

Telescopic Masts.

Two German firms have produced masts which appeared from the description to be both ingenious and practical.

Fontana Mast.—This consists of a four-sided steel mast. Each side consists of a steel band which is wound on a drum. All the four drums are geared together, and to raise the mast a winch handle is shipped into one of the drums and the band unwound. As these bands unwind they carry with them, at intervals, dises, which form the binding necessary to keep the whole from buckling. The mast is heavy and this is not practicable for Service W.T. purposes.

Comet Mast.—This is a telescopic mast with a steel band which fits inside the tubes. This band is exactly the same width as the inside diameter of the tubes. The band is wound on a drum, and as it is unwound it forces the tubes out. This seems a very much better arrangement than the Fontana mast, but it is not a practicable instrument on account of its great weight.

Both these masts were seen at Aldershot, and the latter was erected. It was stated that the Fontana mast was very unpractical, and was continually giving trouble in small details.

Abstract of Report from "Actæon" on Harbour Defence Sets.

The wave-length of these sets has been altered to 850 feet, as the maximum range required cannot be obtained with the 500-foot wave. Experiments are, however, being continued with the latter wave to try and overcome the difficulty. It is probable that the range will be increased when the alternators become available.

Extemporised sets for use in T.B's and T.B.D's, as mentioned in last Annual Report, are in use in the Nore Destroyer Division, and give satisfactory results.

A new harbour defence set is under trial. The transmitter and receiver are contained in separate boxes, but both boxes are made to fit together for transportation. The upper box contains the receiving gear, buzzer, battery, log, pads, and telephones. The lower box contains the transmitter, signalling keys, send and receive switch, and coil contacts. The lower box is used as the operator's seat, and the other is fitted as a desk. A switch is fitted across the detector to short circuit it when sending. The primary is made up of three turns of $\frac{3}{8}$-inch copper tubing wound to a pitch of 3 inches. The condenser is made up of three sections of glass plates, which makes this set rather heavy, but experiments will be tried with ebonite plates, and it is hoped to thereby reduce the weight by about 15 lbs. The buzzer is of the ordinary terminal type, with four dry cells. The weight could be considerably reduced by substituting a one-cell buzzer. The total weight of the set is at present 94 lbs. The maximum spark obtainable is $3\frac{1}{2}$ mms., and the best working spark is 2 mms. The spark plugs are of cadmium, and they have been turned down to a diameter of $\frac{1}{2}$ an inch, which appears to concentrate the spark and keep it regular. No heat regulating device has been fitted and no loss of range is detected, but after the set has been working for some time the spark gap gets very hot. This set has been tried in T.B. No. 6, which has no rigging insulators, using an aerial without insulators. A strength of 7–8 was obtained at No. 1 buoy, Felixstowe, which is considered good under the circumstances. The receiving gear was made up in "Actæon," and consists of a primary and secondary winding on a much smaller scale than the Service H.D. set. No condenser is used across the secondary, and the detector used is the same as that used in the Type C receiving sets.

RECEIVING CIRCUITS AND DETECTORS.

Experimental Receiving Circuit.

"Vernon" has been experimenting with a new receiving circuit, which is shown in Fig. 1, with a view to obtaining greater selectivity without unduly weakening signals. The standard unit consists of two inductances, whose coupling can be varied by revolving one inside the other. One or more of these may be used as found necessary.

The shock absorber consists of a number of acceptors in parallel, one to each Service wave-length; the acceptor of the wave-length being received has to be disconnected.

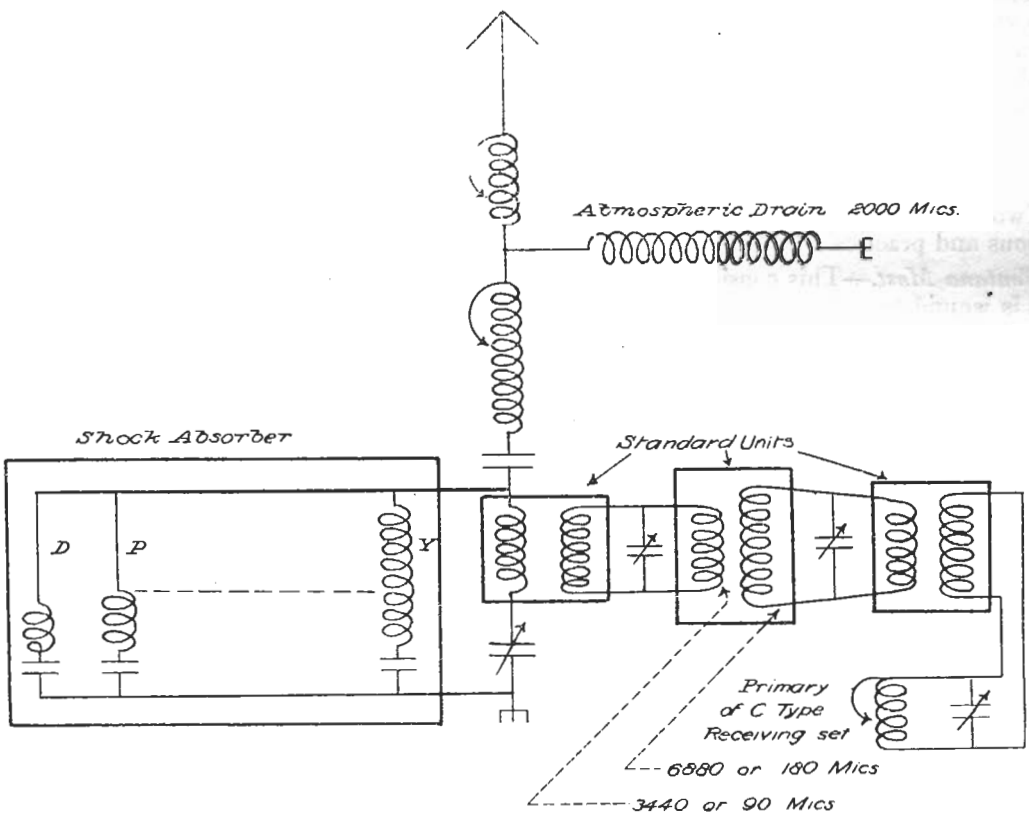
An atmospheric drain, consisting of an inductance of 2,000 mics, is fitted at the foot of the aerial tuner.

Little experience has been gained with this circuit, but with one standard unit the same selectivity as rejector with maximum capacity can be obtained on T tune, together with a substantial increase in strength of signals.

Experiments are being carried out in "Vernon" with the object of designing a receiving circuit more sensitive and selective than the Service tuned shunts circuits so that full advantage may be taken of the sensitive receivers now used, and of the comparatively undamped single wave received from a quenched spark transmitter.

The type of circuit under trial is shown in Fig. 1. It consists of a C Type receiver coupled to the aerial by intermediate circuits made up of "standard units" and condensers. Interference

FIG. 1.



is cut out by loosening the coupling of the "standard units," and by means of the "shock-absorber" circuit. This latter consists of acceptors for all the Service waves connected by plug connections between aerial and earth. The acceptor for the wave length of the signal being read is left unplugged. An acceptor in the aerial, and an "atmospheric drain" from aerial to earth, are used to increase the selectivity of the circuit.

For the purpose of carrying out these experiments a quenched spark transmitter has been fitted in a screened cabinet, and is connected to the receiving silent cabinet by lead-cased wires, so that continuous signals can be received and easily controlled. Considerable difficulty has, however, been experienced in confining the wave to the wire entering the receiving cabinet, but as this difficulty has now been overcome, the experiments can be pushed on, and reliable data obtained.

Little practical experience has as yet been obtained with this new receiving circuit, but even with one standard unit the circuit is more efficient and simpler to work than the tuned shunts circuit. A number of standard units would of course increase the selectivity of the circuit, but at the expense of simplicity, which, it is recognised, is of very great importance.

The final designs of the instruments, &c. have not yet been fixed.

EXPERIMENTS WITH RECEIVING DEVICES.

Tellurium.—Referring to page 26 of last year's Annual Report, during the past year trials have been carried out with the following forms of tellurium ore in conjunction with zincite, in the hope that even better results than with the tellurium could be obtained with one of these couples:—

Zincite and Nagyate.
Zincite and Sylvanite.
Zincite and Calvanite.
Zincite and Selneide Ore.
Zincite and Kalgoorlite.

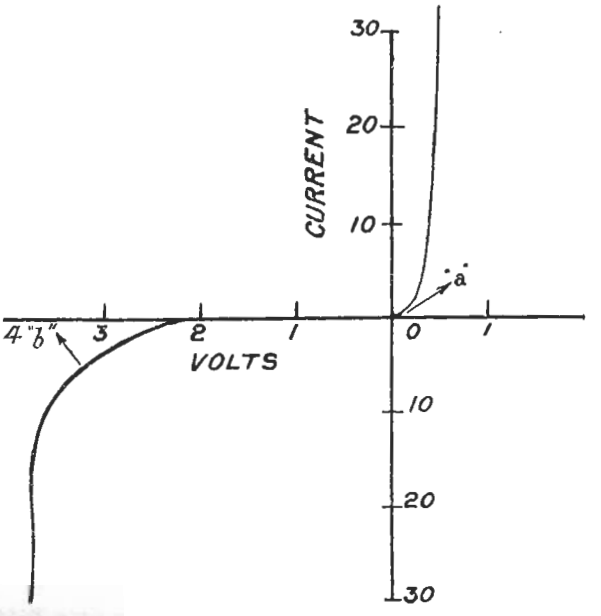
In no case was it found that a satisfactory couple was produced.

The couples were tested—

(1) By obtaining the characteristic curve.

(2) The detector was placed in a receiving set "Type B," and connected to "Vernon's" aerial.

FIG. 2.



Such a characteristic curve for zincite and tellurium is shown in Fig. 2, and only those rectifiers which show a small radius of curvature, as at "a," are suitable for detectors. The explanation of this will be readily understood from the following.

The least radius of curvature occurs when about ·1 volt is being applied to the rectifier (though this varies slightly in the different zincite tellurium detectors), and it is desirable with this detector to use a potentiometer to supply this initial voltage, in order to bring the detector to its maximum state of sensitiveness. On a wireless impulse of, say, ·2 volt being received, the E.M.F. applied to the rectifier is increased by that amount to ·3 volt in one half oscillation, and reduced to —·1 volt in the other half, giving intermittent D.C. impulses of 15 divisions and 0 divisions (divisions $\times \frac{3}{10}^{6}$ = ampères). It follows that, without a potentiometer, only currents of 4 divisions and 0 divisions would have been passed by the rectifier, with a consequent weakening of the signals.

It will be observed in the curve for the zincite tellurium detector that the current voltage curve bends in two places, as shown at "a" and "b." These points are comparatively near together. In general, a sensitive contact detector is very liable to be rendered insensitive by strong signals, probably owing to the high voltage due to these signals causing heat at the point of contact of the two substances; and, as this heating effect increases, the points in contact burn away and the detector becomes insensitive.

With such substances as tellurium and zincite the action is different. In this case, when a potentiometer is applied in such a direction as to make the tellurium the positive member, a current is caused to flow, and this current increases with the voltage applied, and at ·4 volt flows comparatively freely; if the potentiometer be now reversed so that the tellurium is the negative member, and if this potential be kept below a value of about 3·5 volts, no appreciable current will flow; but on the pressure of about 3·5 volts being attained, the current is permitted to pass, and, as the voltage is raised, the current flowing increases in value. It is owing to the fact that the current is allowed to flow comparatively freely when or after a certain voltage is attained, that the detector remains stable.

The following couples have also been tried, but these have no rectifying effects within working voltage limits:—

Smalltite and Tellurium.
Stream Tin and Tellurium.
Stream Tin and Zincite.

Dennis Detector.—A very handy form of the "Dennis Detector," designed and constructed by Major Dennis, is shown on Plate V. It consists of three zincite tellurium couples arranged on a circular ebonite base which, in its turn, is secured on another base on which it is free to revolve. Six studs protrude from the periphery of the base, and are in electrical connection with the six members forming the three couples. Two brushes bear on the periphery, and are so arranged that they will make connection with the studs alternately as the base is revolved. By this means it is easy to utilise any one of the three couples at will. The base also carries a small milled-headed key with which the pressure of contact between the two members of each couple can be adjusted.

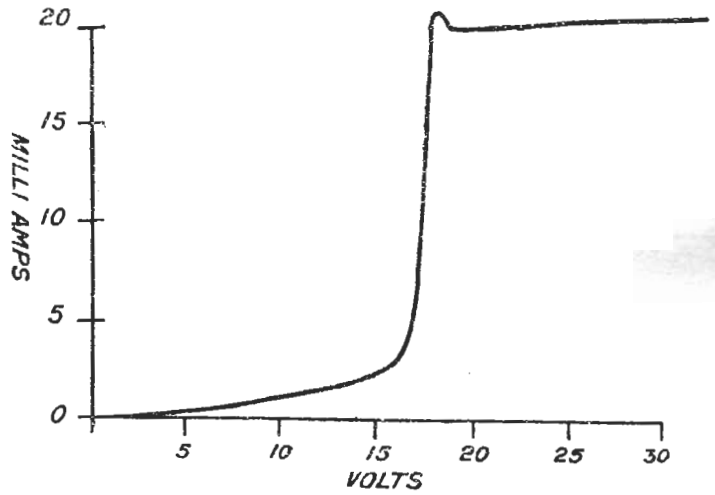
Carkeet Detector.—P.O. Telegraphist Carkeet stated that, when water was dripped on the point of contact of a rectifying couple formed by silicon and a steel point, the result was to render this detector of a very stable nature and to also increase the strength of signals. It was

endeavoured to reproduce these results in "Vernon," and also in "Defiance," where P.O. Carkeet was able to be present; but, after many attempts, the trials were given up as not bearing out the claims stated.

Silicon Detector.—Silicon has also been further tried, using copper as the other member of the couple; the best results having being obtained when the copper is fitted with a point of about the same degree of sharpness as a copper tack. The result gives good signals, about one or two strengths better than the magnetic detector, but inferior to the Perikon or Dennis, both as regards strength of signals and stability.

Oscillation Valves.—With reference to page 47 of the 1910 Annual Report, trials have also been carried out with Fleming's oscillation valves in conjunction with Marconi valve receiver circuits, but the results have not compared favourably with either the Perikon or Dennis detectors in the "C" type receiving circuit.

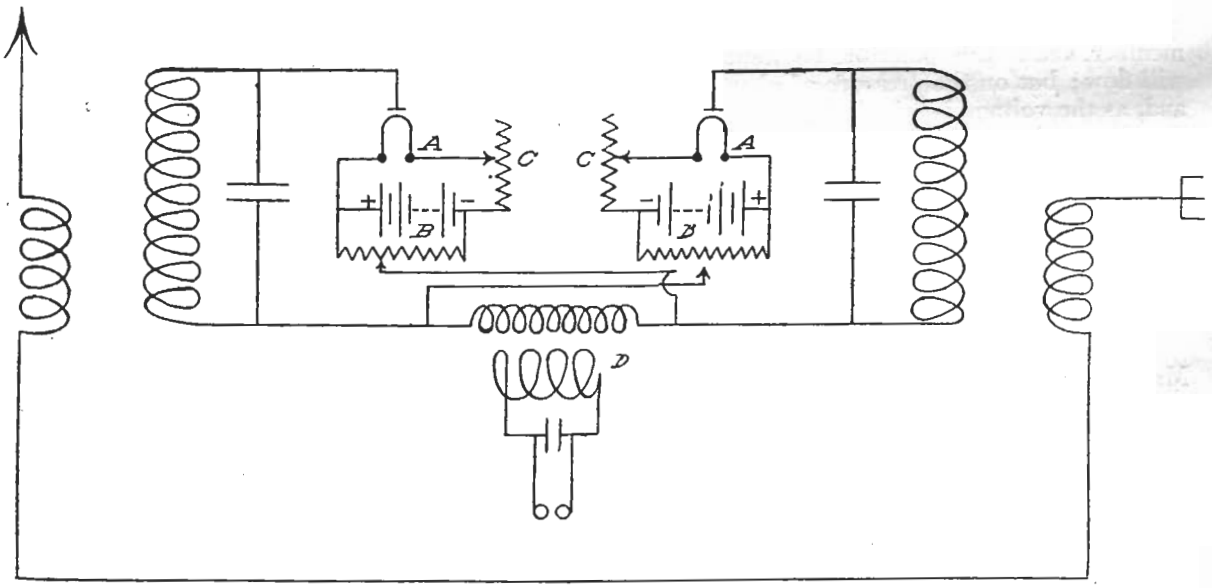
FIG. 3.



A curve for a 12-volt carbon filament valve is shown in Fig. 3. It will be noticed that, unlike the contact detectors, the valve only allows negative electricity to flow from the incandescent filament to the grid, and will not allow it to flow in the other direction however much the voltage be raised within working limits. Also that, at about 18 volts, the rectified current has reached a maximum, and any further large rise in voltage only causes a small increase in the current caused to flow from the filament to the grid. It is claimed that this form of curve prevents strong signals or atmospherics exceeding a certain intensity, but it is found that this maximum intensity of sound is quite sufficient to drown any signals below strength 7, so that no real advantage is obtained. A potentiometer of about 16 volts is required to bring this detector to its maximum sensitiveness.

It was found that 12-volt carbon lamps gave the best results, though both 4-volt tantalum and carbon filament lamps as well as 12-volt tantalum filament were tried.

FIG. 4.



A.=Oscillation valves, joined in opposition.
B.=Potentiometers, raising voltage between grid and filament in each valve to a critical value.
C.=Series resistances, for burning filaments at correct voltage.
D.=Step-down transformer for low resistance telephones.

When tried in Marconi's receiver valve circuit, a diagram of which is shown in Fig. 4, the strength of signals did not compare at all favourably with the Perikon or Dennis detectors in the "C" type circuit, and though the result was more favourable when the valve was tried in the latter circuit, the strength of signals was still not up to the Service standard. These valves are more stable than the contact detectors, but they varied so much in sensitiveness, and also in the length of time for which they remained efficient, that this advantage was nullified.

A similar valve detector, called the Audion bulb, introduced by the De Forest Radio-telegraph Company (now the North American Wireless Corporation), has also been undergoing trial in "Vernon." It appears to have about the same degree of efficiency as the oscillation valve, and, like the latter, to be a complete rectifier, but also to be subject to the same defects and drawbacks as that valve. It differs from the oscillation valve in that it is provided with two grids which, in working, are connected to the receiving circuit into which the incandescent filament does not come directly. The bulbs under trial required 20 volts to burn at their full brilliancy, and an available potentiometer voltage of about 30.

The characteristic curve for the bulb is of a more gradual nature than that for the valve, and when a voltage of between 30 and 40 is applied between the grids, a blue luminosity suddenly appears in the bulb, under which treatment the bulb rapidly deteriorates in efficiency.

In view of these results it is not proposed to proceed further with the incandescent lamp type of detector, the advantages of the contact type of detector being manifold.

Cerrusite Ore, Patent No. 22164/10 (Smith), claims that great stability and sensitiveness are obtained when the rectifying couple is composed of cerrusite ore, which is a carbonate of lead ore, and a platinum point.

Samples of this mineral were obtained from Mr. Lyon, one of the patentees, and tried in "Vernon."

The couples experimented with were—

Cerrusite Ore and Platinum Spring.
Cerrusite Ore and Bornite.
Cerrusite Ore and Zincite.

The first did not give a promising characteristic curve of rectification, the curve being very gradual, and showing only very slight rectification; when compared practically with the Perikon detector the signals were two strengths weaker than with the latter, and it was found difficult to obtain an adjustment which gave the maximum intensity of sound.

The second couple tried gave no results whatsoever.

The third couple gave good results, being about one strength weaker than the Perikon, and having about the same stability.

In view of the above results it was decided not to continue further experiments with cerrusite ore, and the sample crystals were returned to the patentee.

Zincite and Platinum Spring.—Trials were carried out with this couple, and the characteristic curve obtained gave promise of a very efficient detector, but, when tried practically, although the signals obtained with it were one to two strengths stronger than with the Perikon, yet this detector proved so unstable (the slightest shock proving sufficient to render it entirely insensitive until readjusted) that it was considered useless for Service purposes.