MARCONI TIME-SIGNAL RECEIVER R. P. 11. a.

A VALUABLE INSTRUMENT FOR SURVEY WORK.

Information received from MARCONI'S WIRELESS TELEGRAPH COMPANY, LIMITED, Marconi House, Strand, London, W. C. 2.

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The development of wireless telegraphy has greatly simplified the problem of determining longitude in survey work. The Standard Time Signals which are sent out at various times during the day from practically all the important wireless stations throughout the world, provide a convenient and accurate check on the constancy of the chronometers carried by survey parties. When adequate wireless receiving facilities are available, there is no longer the need for a number of delicate chronometers to be carried and, as a rule, a single chronometer will be sufficient for the purpose of checking local time against Standard Greenwich Mean Time. In addition, the time signal of the so-called rhythmic type enables chronometer comparisons of great accuracy to be made, and it is possible and quite simple to calculate the error of a chronometer with an accuracy of one sixty-fifth of a second.

The design of a receiver suitable for the reception of wireless time signals in all parts of the world, has been the subject of a close study by the MARCONI research staff into the requirements of an apparatus of this type.

The MARCONI Time-Signal Receiver, type R. P. 11. a., incorporates the outcome of this work, and is a Time-Signal Receiver which can be be relied upon to provide a dependable instrument for survey parties working in uncharted areas.

The normal standard of efficiency of wireless gear provides no criterion for the successful operation of a Time Signal Receiver and it may be of interest to indicate some of the special features which have necessitated a departure from the more normal construction of receivers used in wireless work.

The first condition to be met in a receiver of the type under review is one of ease of portability. This has been achieved by dividing the equipment into five loads *viz:* (1) the frame aerial, (2) the receiver, (3) the phasing unit, (4) the H. T. battery box, and (5) the L. T. battery box with space for spares. The dimensions and weights of the different units are as follows:

Unit.	*Dimensions.*	*Weight.* lbs.	ozs.
Frame Aerial.............................	3'0 3/4" × 2'4 7/8" high × 3 3/4" deep.	17	—
Receiver with canvas carrying case....	2'0" × 1'2 3/4" × 10 1/4" deep.	51	—
Phasing unit with canvas carrying case	1'2" × 1'2 3/4" × 9 7/8" deep.	25	4
H. T. Battery Box......................	1'7 1/2" × 1'3" × 8" high.	52	—
L. T. Battery and Spares box with 1 pair telephones....................	1'1 1/4" × 1'0 3/4" × 11 1/2" high.	31	12

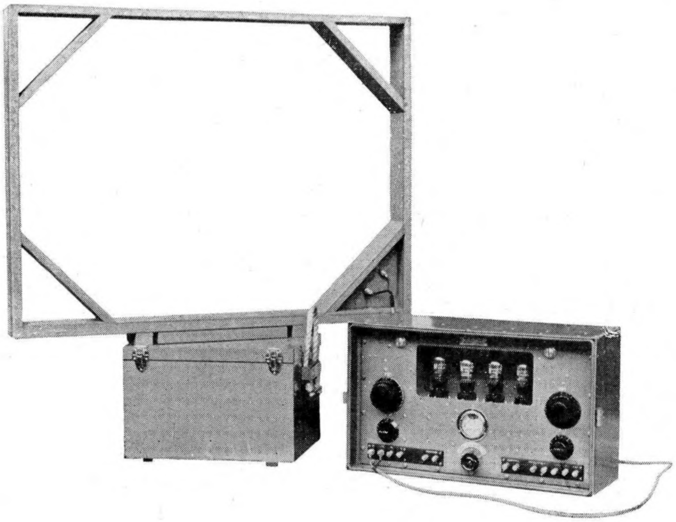
A consideration of these figures shows that the dimensions and weights are such as to allow for transport by carriers whenever necessary.

The constructional features of the receiver are of special interest and enable the R. P. 11. a. to be used under the roughest service conditions and in any climate. The receiver case is made of steel with a removable weather-proof front cover. The case and the steel instrument panel which is disclosed when the front cover is removed, are heavily enamelled in battle-grey. The frame aerial consists of a winding completely enclosed in a frame and fully protected from moisture and the possibility of external damage during transport or whilst in use for reception. The phasing unit is also contained in a steel box similar in construction to the receiver box.

The H. T. and L. T. battery boxes are made of heavy teak, and, like all the other parts of the equipment are built with a margin of safety amply sufficient to withstand the roughest handling likely to be experienced. Dry cell batteries, which can be either of the ordinary or the "Inert" type are provided when the equipment is used in places where there are no facilities available for the charging of accumulators. Where such facilities are available and in cases where the equipment is used in a permanent position, accumulator batteries can be supplied instead of dry cells.

A further condition for the successful operation of a Time-Signal Receiver is ease and simplicity of manipulation. This has been achieved by reducing the number of tuning handles to two. The tuning handles are calibrated and by the aid of a calibration chart, supplied with the receiver, these can be set to the wavelength it is desired to receive. This valuable feature assists persons who are little skilled in reading the Morse Code, to identify stations transmitting time signals by reference to the calibration chart, throughout the entire waverange of instrument which extends from 10,000 to 22,000 metres. Special provision has been made to ensure the maximum selectivity and freedom from atmospherical disturbances. Selectivity is obtained by providing high frequency selection and note filtering. The selectivity of the R. P. 11. a receiver, due to the incorporation of these devices, is such that either of two stations of equal signal strength can be separated, provided their frequencies are not less than 200 cycles per second apart.

Additional selectivity is provided by the use of the frame aerial which enables reception to take place on the so-called "figure of eight" polar diagram of reception. Experience has shown that atmospherical disturbances are largely

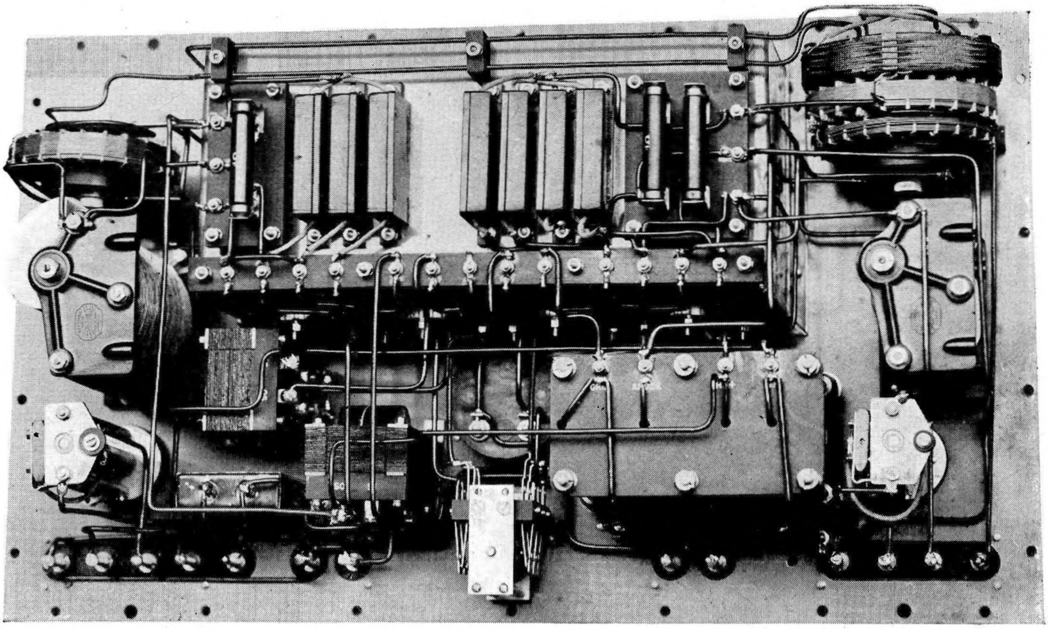


Marconi Time-Signal Receiver
Type R. P. II
with frame aerial and battery box.
The watertight front cover of the receiver has been removed.

Récepteur Marconi R. P. II
pour Signaux Horaires
avec cadre d'antenne et batterie.
Le couvercle étanche du récepteur a été enlevé.

Marconi R. P. II
Time-Signal Receiver.
Phasing Unit.

Récepteur Marconi R. P. II
pour Signaux Horaires
Ensemble de phasage.



Marconi R. P. II
Time-Signal Receiver.
Back of the panel showing method of mounting component parts.

Récepteur Marconi R. P. II.
pour Signaux Horaires
Dos du panneau montrant le montage des divers éléments.

directional in their origin and the "figure of eight" diagram provides a means of eliminating such disturbances over a wide arc of reception. The advantages of this method can be greatly increased by the use of the phasing unit referred to above, which combines the action of a short open aerial with the action of the frame aerial, thus providing reception of the "heart-shape" polar diagram, which still further reduces the arc of reception and gives even greater freedom from atmospherical disturbances.

Four valves of the D. E. 3. *B.* type are used in the receiver and one valve of the same type is fitted in the phasing unit. The total filament consumption of these five valves is 0.3 amperes at 2.8 volts, which is well within the limits of the large dry cells supplied for filament lighting.

TECHNICAL DESCRIPTION OF THE APPARATUS

The dimensions of the standard frame are approximate by 3 feet × 2 feet × 3 inches, but this may be varied to suit special requirements. The frame aerial is wound with N° 26 D. W. S. wire, totally enclosed in a strong teak case and covered with canvas, painted battle-grey. Two terminals connect the windings of the frame aerial to the receiver.

The Receiver.

The four valves mounted in the receiver fulfil the following functions. The first is the detector, the second a note filter amplifying stage, the third a plain note magnifier and the fourth a local oscillator.

The aerial tuning inductance is contained partly in the frame aerial and partly in a coil in the receiver, the latter being provided for the purpose of inducing the reaction into the aerial circuit and also the signal of the local oscillator. Both the reaction coil and the coupling coil from the local oscillator are rigidly fixed in relation to the aerial coil. The degree of reaction is controlled by a non-inductive variable resistance in series with the frame. This method of reaction gives a very fine control and it therefore enables reaction to be used to the utmost advantage. Although grid leak rectification is employed, there is no danger of "wipe-out" effect since the E. M. F. induced in a small aerial is minute. The aerial circuit is tuned by a variable condenser and a fixed condenser is switched in parallel with the variable condenser for wavelengths above 19000 metres.

The note filter stage consists of fixed coils and condensers arranged to give an optimum frequency of 1200 cycles.

The note magnification stage is quite normal and the coupling from the filter stage is by means of an iron core low frequency inter-valve transformer.

The local oscillator consists of a simple self-oscillating circuit and its constants are so arranged that the condenser adjustment keeps roughly in step with the aerial tuning condenser when giving a beat note of 1200 cycles, *i. e.* the optimum of the note filter stage. The coil coupling the local oscillator to the aerial circuit consists of a few turns only and the circuit is arranged so as to ensure an equal strength of local oscillator signal through the whole wave-range. By means of a switch, a fixed condenser is switched in for wavelengths above 19000 metres. The same switch also controls the aerial circuit.

The Phasing Unit.

This unit is provided with one valve of the D. E. 3 *B* type, with a three-position switch. When the switch is in the first position, the phasing unit is in operation. In position 2, the phasing unit is switched off but a resistance is inserted to compensate for the load taken by the valve. If the filament resistance in the receiver is adjusted to the correct value when both the receiver and phasing unit are in use, the phasing unit can be switched on and off without the necessity for re-adjustment of the receiver filament resistance. If, however, the phasing unit is definitely not required, the switch may be put in position 3, which switches off the valve and compensating resistance. The filament resistance of the receiver can then be re-adjusted. The open aerial used for phasing is carried in a small compartment of the unit.

Batteries.

The normal high tension necessary to work the receiver is 100 volts. The total feed at 100 volts is 2 ½ milliamps. In order to avoid variations of the local oscillator calibration, it is necessary to work the receiver as near as possible to the high tension voltage of 100 volts. The low tension battery consists of three large cells in series and the voltage across the filaments is adjusted to 2.8 volts, by means of a filament resistance. A voltmeter on the instrument panel reads the exact voltage indicated by a red line on the dial.

Operating the Receiver.

When operating the receiver, the frame aerial is set in such a manner that its plane is pointing in approximately the direction of the station from which it is desired to receive. The range switch is set to the range indicated in the chart and the calibrated dials of the receiver are placed in the position given in the waverange chart corresponding to the wave it is decided to receive. The filaments are turned on until the required filament adjustment of 2.8 volts has been obtained. By turning the reaction handle, the signals increase in strength until a fairly loud and sustained note or howl is produced in the telephones. In this position, the receiver is oscillating. To obtain the most efficient reception, the reaction adjustment must be turned in the opposite direction until the howl just stops. This brings the receiver to its most sensitive point. A final adjustment can be made on the tuning dials and by slightly swinging the frame. When the phasing unit is used for the purpose of getting reception on the "heart-shape" polar diagram of reception, an open aerial supported at the free end at a height of not less than 30 ft. is used. With the receiver adjusted for reception on the frame, the phasing unit switch is put into position number one, and the variable coupling of the phasing unit is adjusted to minimum signal strength. The frame is slightly swung to and fro through a small angle, until it is finally in a position where the signal strength is at minimum. A final re-adjustment of the variable coupling of the phasing unit leaves this also at the position of minimum strength, and the signal from the open aerial and the frame will now be correctly balanced to give reception on the "heart-shape" polar diagram of reception, with the point of zero receptivity of the diagram pointing at the station to which the receiver is tuned. If the frame is turned 180°, the signal will be at maximum strength. It is sometimes of advantage to shift the frame slightly so that the maximum of the "heart-shape" diagram is not pointing directly at the station it is required to receive, so that the minimum "heart-shape" points at a station which is interfering or at a source of strong atmospherics. By shifting the frame slightly, the best position can be quickly discovered.

See also leaflet No 1071 published by the MARCONI'S WIRELESS TELEGRAPH COMPANY, LIMITED.