VIELTON SYSTEM OF WIRELESS TELEGRAPHY.

The Admiralty recently purchased from the Lorenz Company a W/T Set of the Vielton system.

This Company has bought all the Poulsen and some of the Telefunken patents, and has supplied the German Naval and Military authorities with W/T sets on the Vielton principle. As far as can be ascertained, the sets have been favourably reported on.

Several sets have also been installed in German merchant ships, the ease of variation and range of note rendering them somewhat distinctive.

In the set supplied, the workmanship and finish are very good, but the only safety arrangements to prevent personal injury are provided by the comparative inaccessibility of the greater part of the apparatus. The plant consists of a 7½ h.p. 80-volt motor, driving a 300 volt alternator, giving a normal output of 6 k.w. at a frequency of 50 cycles.

It is claimed, with this set, that it is possible to put from 2½ to 3 k.w. into the aerial, the set being constructed to have a day range of about 600 miles.

The Transformer has a step-up of 20 to 1, supplying, therefore, 6,000 volts at the secondary terminals.

The set is at present designed to transmit three waves, *i.e.*, 2,300, 3,280, and 4,900 feet, but by fitting another variometer, the set can be tuned to transmit any wave-length in the ordinary manner.

The Spark Gaps, which are arranged ten in series, are made of silver and are roughly hemispherical in shape, and so constructed that the spark occurs at the points marked "A" and "B" in the sketch, shown on the right of Plate XIII.; the shape incidentally tends to reduce buckling due to excessive heating.

An "alcohol relay" is operated when the Send-Receive Switch is put to "send," which supplies the arc with methylated spirit. The rate of supply is important, an incorrect adjustment causing the falling off of the normal readings of the instruments when transmitting. Shortage of alcohol generally reduces the efficiency.

The Spark Gap elements are separated by mica washers ·17 to ·15 mm. in thickness; the parting and cleaning of the gap is comparatively a simple process.

The gap is provided with cooling vanes and is prevented from over-heating by a motor driven blower.

The Transmitting Circuit (*see* Plate XIII.) consists of two circuits :—

(*a*) An impulse circuit inductively coupled to the aerial.

(*b*) A Duddell circuit whose inductance is variable by a means of a keyboard, thus giving a change in note.

When transmitting, the Wave Change-over Switch is put to the required wave, thus altering both the inductance of the impulse and aerial circuits.

The Duddell circuit is then closed by pressing one of the 8 tone keys, this action also completes a break "D" in the leads between the Transformer Secondary and Spark Gap.

By putting the Send-Receive Switch to "send," short circuiting the Morse key, and making the 80-volt D.P. switch, the alcohol relay is brought into operation, the blower motor starts up and the magnetic key closes.

The coupling is then adjusted until 20 amperes are shown in the radiation meter, after which the Morse key is broken and the apparatus is then ready for signalling in the ordinary way with the Morse key.

To "Receive," the Morse key must be opened, the 80-volt switch broken, and the Send-Receive Switch put to "Receive," the whole operation taking about five seconds.

When "Sending," the note can be heard in the telephone and the timbre of the note acts as a useful guide to the working of the set. Unless the break in the transformer secondary circuit is deliberately short-circuited it is impossible to transmit on the impulse circuit alone. If, however, this is done, the oscillations will merely be of very high frequency according to the wave-length employed, and similar to those produced by the Poulsen apparatus.

The changes of note caused by alterations of the Duddell circuit do not in any way affect the wave-length or range. An advantage claimed is that an error in tuning the impulse circuit affects only slightly the radiation of the aerial and does not affect the wave-length at all. Experiments recently carried out appear to confirm this.

The receiving circuit is arranged to receive waves from 920 to 17,000 feet. The receiving Change-Over Switch has four positions arranged so as to divide the total range of reception; further adjustment being carried out by a tuning handle which alters simultaneously both inductance and capacity in a certain ratio; a very questionable advantage. The minimum amount of primary used is 30 mics, and the maximum 500 mics, the secondary circuit is aperiodic, and has a value of about 3,000 mics.

The telephones supplied have only one receiver of about 600 ohms. The thermo-detector used is a rectifier of recent invention. It is claimed that this detector does not lose sensitiveness, has no critical adjustment, and is insensible to shock, but these claims have not been substantiated.

Principle of the Working of the Vielton System.

When considering the arc method of obtaining oscillations, with a supply voltage of Alternating Current, it is very difficult, on account of the many complications thereby entailed, to put forward a simple and comprehensive explanation of the theory of the system. The matter is simplified, and for all practical purposes the explanation is correct if the arc is considered as a Direct Current Arc during each half cycle of the alternator with the voltage of the Transformer at that particular instant applied across it; and it is on this basis that the following exposition is discussed:—

Referring to Plate XIII., "A" is the Duddell Circuit, and "B" the Impulse Circuit. Assume the arc to be burning steadily, then if the oscillating circuit is shunted across it, some of the arc current will immediately be taken to charge S^1 this fall of current in the arc (which is burning in a hydrocarbon vapour) will cause a large rise in the D.P. of the arc; with a further charging of the condenser.

As soon as the condenser is fully charged, the current of the arc rises, and therefore lowers the D.P. of the arc; the condenser now discharges through the arc, thereby increasing the current through the arc and lowering the D.P. yet more; and the condenser becomes fully discharged. The D.P. across the arc again charges the condenser as before, and hence a series of intermittent condenser discharges is produced.

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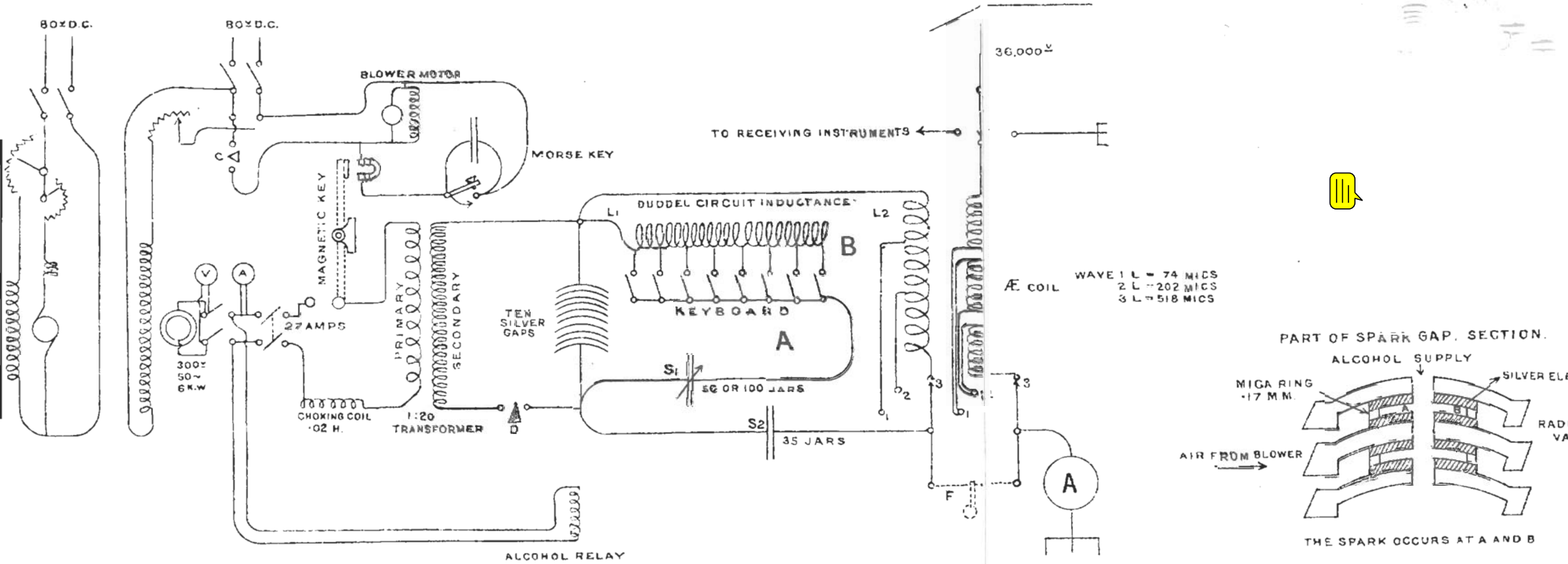
TRANSMITTING CIRCUIT.



B *Completed by Send Receive Switch.*
C " " " " "
D " *when Duddell Circuit is closed.*
F *Change over switch for the three waves.*
L_2 *Impulse Circuit Inductance. Total 50 Mics.*

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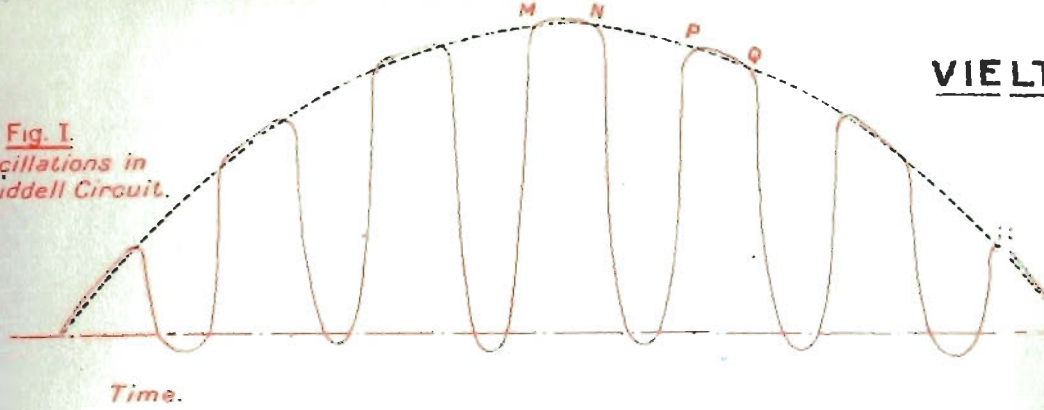
Charge in S1.

Fig. I.
Oscillations in Duddell Circuit.



The Red Curve shews the discharge of the Condenser only.

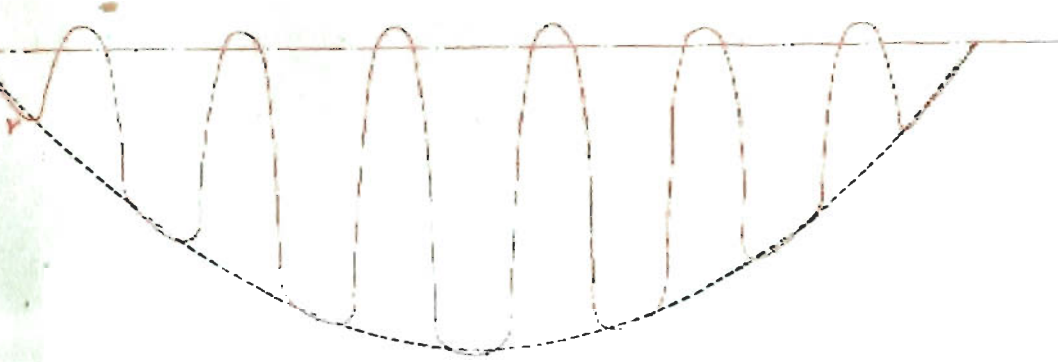


Fig. II.
Oscillations in Impulse Circuit.

Note: AB is small compared with B.C., in "Poulsen" these times are equal.

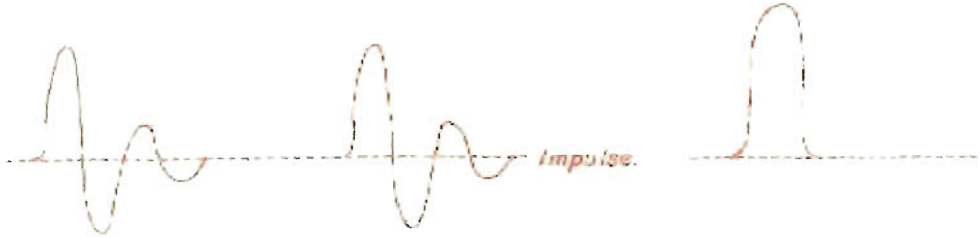


Fig. III.
Oscillations produced in Aerial of Normal Damping.

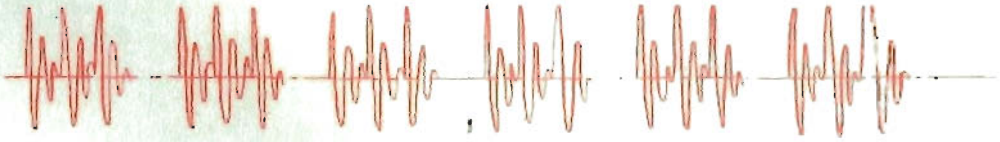


Fig. IV. *Telefunken.*

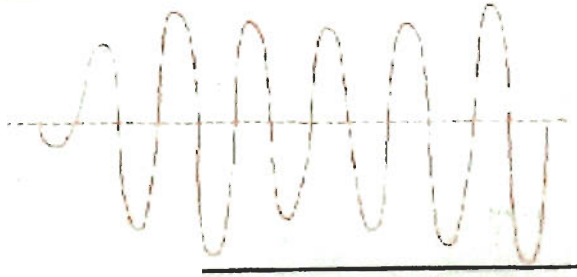
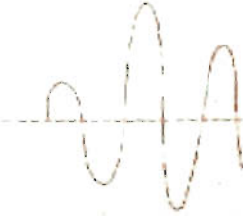


Fig. V. *Vielton*

Aerial.



Let us assume that the Alternator is running at 50 cycles, the current curve across the arc due to the alternator will be as shown in Plate XIV., Fig. 1 (red curve), and it is evident that when the voltage of the alternator reaches a maximum that the oscillation of the Duddell Circuit will be of maximum amplitude, and that they will be superimposed on the Current Curve of the Alternator, which they will use as their zero line, the discharges being in character similar to those shown in black, Plate XIV., Fig. 1. Although the set is designed for a tone range of one octave, from 750 cycles to 1,500 cycles, for the sake of clearness in the illustration the Duddell oscillations have been shown in Plate XIV., Fig. 1, as possessing an impracticably low frequency. It should be noticed that actually in practice the discharges would momentarily cease between X and Y as the arc is there extinguished.

Now, L^2S^2 are of comparatively small values, and if they be shunted across the arc instead of L^1S^1 we shall have a similar state of affairs to that explained above, but in this case the frequency will be very high. These impulses will be nearly identical with such as are used by Poulsen in his set, and cannot be heard in the telephones. In order to make the oscillations audible when radiated by the Aerial to which the circuit is coupled, it is needless to say that Poulsen splits them up into periods of an audible frequency, either by means of a Tone Sender at the Transmitting end or a Tikker at the Receiving end.

One of the chief features of the Vielton system—though perhaps hardly a novel one—is the method whereby these high frequency oscillations are controlled and given a musical quality.

It will be convenient to discuss the operations taking place in one half cycle of the alternator.

Suppose the Impulse Circuit is closed when the current in the Duddell Circuit is zero, as at point "M"; the large condenser in the Duddell Circuit is discharged, and consequently the main part of the energy from the transformer is being taken to recharge it, leaving insufficient to charge the condenser in the Impulse Circuit; this condition prevails until point "N" is reached, when the Impulse Circuit is caused to oscillate, which it continues to do at constant maximum amplitude until the current in the Duddell Circuit is again zero, viz., at "P," when its oscillations once more cease.

Thus from "M" to "N" and from "P" to "Q," the Impulse Circuit is inactive, so trains of oscillations take place as in Plate XIV., Fig. 2, where a low frequency is shown for clearness.

These oscillations in point of fact are superimposed on the current curve of the Duddell Circuit, which they in turn use as their zero line, and have the effect of giving a sort of shivering character to the otherwise regular slope of that curve. The effect of these trains of impulse discharges on the aerial to which that circuit is inductively coupled, is to produce trains of damped oscillations in it (*see* Plate XIV., Fig. 3) of a frequency determined by the frequency of the Duddell Circuit, hence causing a musical note in the Receiving Circuit.

It may be thought that although the Vielton System is stated to be essentially an arc system, nevertheless it is really the Telefunken principle in another form; so a comparison of the oscillations set up in the two systems may be of interest.

In the Telefunken system, the oscillations in the Impulse Circuit have the character shown in Plate XIV., Fig. 4, and these produce in the aerial undamped oscillations as shown.

Whereas in the Vielton system the corresponding oscillations in the Impulse and Aerial circuits are as indicated in Plate XIV., Fig. 5.