CHAPTER IX.

The Various Tunes in General Use.

1. There are two methods of getting the energy available into the aerial, and thence into space. These are described in Chapter VI., sections 12 and 1, and are known as the Oscillator and Plain systems.

2. *B* tune, until recently part of the Service apparatus, is still used by the Marconi Co. and the Italian Navy. Its principal wave has a length of from 1,000 to 1,150 feet.

3. Although *B* tune is no longer used in H.M. Service, the method of tuning it is typical and is therefore described.

4. Tuning up a system for *B* necessitates the use of a wavemeter. *B* is an oscillator system.

5. To tune up a system for *B* tune.

(*a*) Tune the aerial and secondary.

The aerial may be of any size or shape, provided the resonance constant of the aerial and secondary combined is 48·5.

The primary leads should be disconnected from the oscillator, and the aerial joined up as in Fig. 55, *i.e.*, with the oscillator on the earth side of the spark-gap. This precaution is necessary to save the insulation of the oscillator. The primary of the oscillator should not be connected up to the jars.

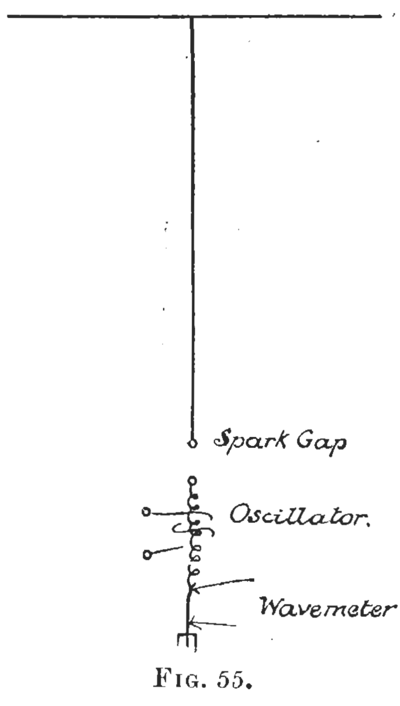

Fig. 55.

(*b*) Tune the primary circuit.

Disconnect the aerial and earth from the **secondary** **Join** up the primary in the usual manner.

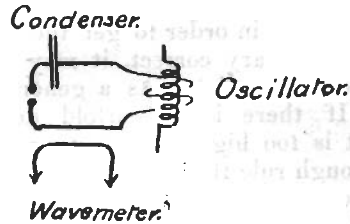

FIG. 56.

Put all 15 jars in the condenser tray, and pack them well. Measure the resonance constant of the primary, and alter the length of leads until it is 32·7 mic-jars.

Unless it is unavoidable, do not take any jars out of the **condenser. If necessary to** reduce the resonance **constant, shorten up the leads, only taking** a jar out when the leads can **be shortened** no further.

(*c*) Measure the waves sent out.

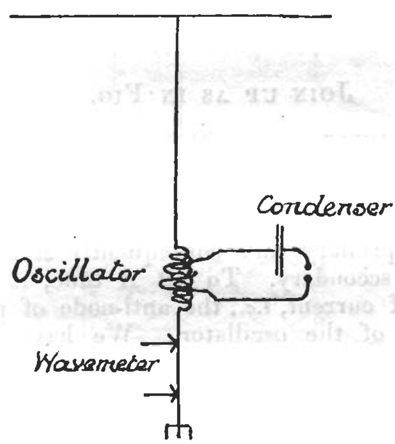

FIG. 57.

Connect up as for sending, and apply the wavemeter as in Fig. 57. If the resonance constant of the aerial and secondary is 48·5, and of the primary 32·7, the waves sent out will have resonance constants 23·5 and about 52, the former being the stronger wave.

Should the shorter not have a resonance constant of **23·5,** one of the measurements made before was incorrect. **The** resonance constant of the longer wave is immaterial, **except** that, when about 52, it shows that both aerial and **primary are** correct.

6. Notes on tuning up *B* tune.

(*a*) When measuring the wave-lengths, a larger swing is sometimes obtained with the long wave than with the short one. This does not mean that the short wave is the weaker.

(*b*) It is possible that, in order to get the resonance constant of the aerial and secondary correct, it may seem necessary to reduce the height of the aerial. As a general rule this should never be done. If there is a fourfold aerial up, and the resonance constant is too high, change to a twofold. Always bear in mind the rough rule that the radiating power of an aerial for a given length of wire varies with the height above earth of the centre of gravity of the wire.

(*c*) The resonance constant of the aerial and secondary at shore stations is nearly always higher than that of a ship with a similar aerial.

This is due, generally, to the length of lead between the earth terminal in the office and the real earth.

This lead should be insulated, for, if it is not, its length will be virtually shortened on a wet day. It should not be armoured, or losses will occur, due to the eddy currents in the armouring.

7. Tuning up *A* tune. *A* tune sending apparatus is used by the Marconi Co. and in the Italian Navy. *A* tune should be adjusted in the following manner. (*See* page 119.)

JOIN UP AS IN FIG. 58.

The sliding tuner consists of two parallel copper wire rods, joined by a slider, *P*, of copper. This provides an easy method of altering the length of leads in the primary circuit. An alteration in the length of leads means an alteration in the wave-length of the primary and consequently a redistribution of current in the secondary. To get *A* tune, it is necessary to have the node of current, *i.e.*, the anti-node of potential at the aerial terminal of the oscillator. We have, then, to move the slider about until we get a wave-length that brings the anti-node of potential at the aerial terminal. To find out when this is the case, a "testing spark-gap" is used, which must be made in the ship. It consists of a well-insulated needle-point opposed to a plane, the distance between them being adjustable.

A capacity—3 or 4 feet of wire will do—is joined to the needle-point. The plane is connected to the aerial terminal of the oscillator. Plug the oscillator to the aerial, fix a spark length at the ordinary spark-gap, and press the key. Adjust the length of the testing spark-gap until a spark, not a brush discharge, sometimes passes and sometimes does not. Move the slider about until this length is greatest. The testing spark-gap is a measure of the potential at the aerial terminal, so when it is longest we have the anti-node of potential there. A tune is then ready for sending. It will be found that the total lead

Tuning up "A" Tune.

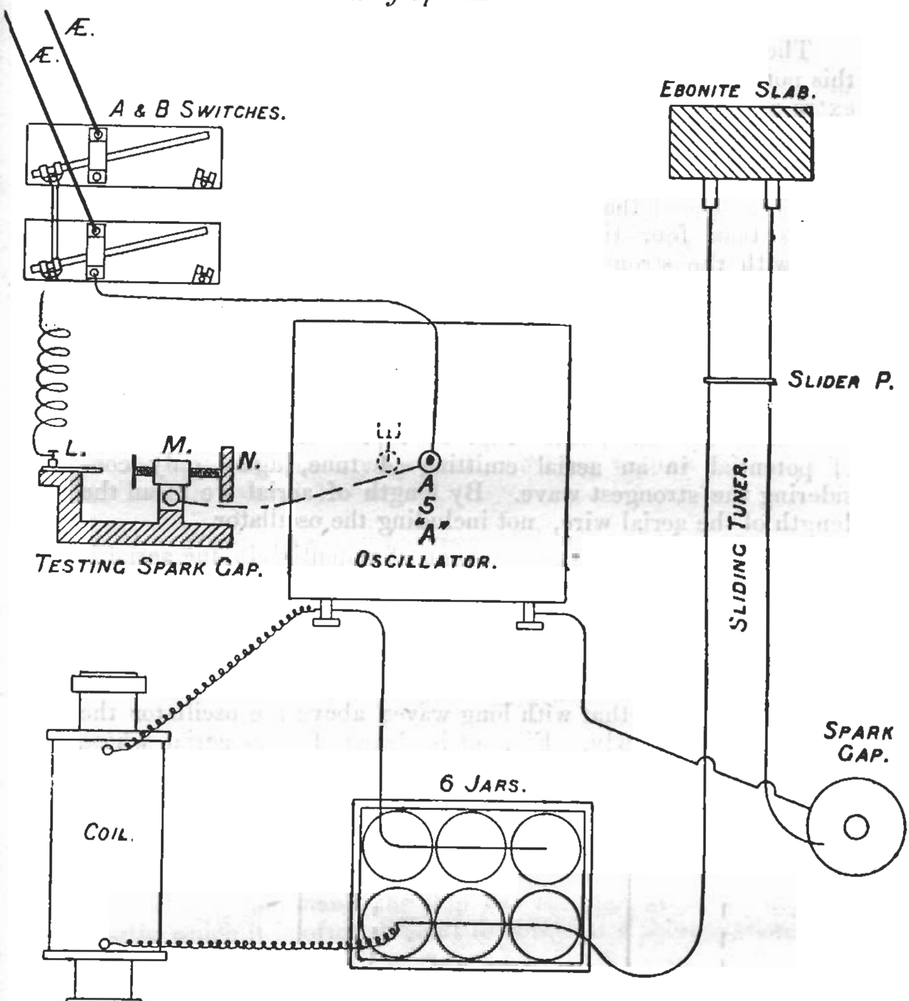

FIG. 58.

from spark-ball to spark-ball in the primary circuit is between 3 and 6 feet, exclusive of the primary of the oscillator and the jars.

POINTS TO BE OBSERVED IN TUNING UP *A* TUNE.

1. Great care must be taken not to alter the length of spark at the ordinary spark-gap.

2. The operator's hand should not be touching the insulated part of the testing spark-gap while the key is pressed. His body, giving an easier passage to earth, may cause leakage, and results will then be rendered inaccurate.

3. The spark at the ordinary spark-gap should not be less than 1 cm.

Spark for Tune *A*.

The sending spark should never exceed 14 mm., as beyond this point the strength of signals diminishes. This is due to the extra resistance introduced by the longer spark-gap.

8. *A* tune differs from the rest in that it is not more than four times the length of the aerial. To be accurate, it should be said that the strongest wave of the three sent out is less than four times the length of the aerial. As it is only with the strongest waves we are immediately concerned, it is not necessary to go into the complicated distributions of potential in an aerial emitting the usual three waves.

Suffice it to say that the distribution of potential in an aerial where the wave-length is more than four times the length of the aerial is represented in Fig. 59 as far only as that wave-length is concerned. Fig. 60 represents the distribution of potential in an aerial emitting *A* tune, again only considering the strongest wave. By length of aerial we mean the length of the aerial wire, not including the oscillator.

In Figs. 59 and 60 the amount of potential in the aerial is indicated by the length of the perpendicular from the dotted line to the aerial.

This potential is oscillating and is considered as relative to the potential of the earth.

It will be seen that with long waves above the oscillator the potential rises slowly. Fig. 59 is drawn for an aerial whose inductance is small when compared with that of the secondary of the oscillator. In both figures *A* represents the aerial terminal of the oscillator.

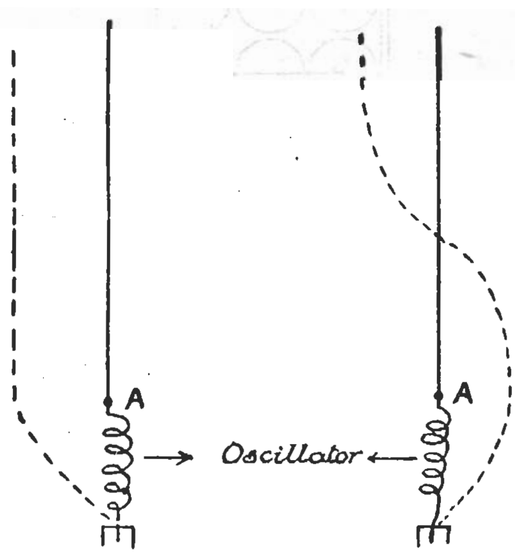

Fig. 59. Fig. 60.

With long waves, then, the only node of potential is at the earth, while with short there is a second node, sometimes a little more than halfway up and sometimes a little less.

9. When tuned up in the manner described in section 10, the wave-length of *A* will be approximately 400 feet. A wave of this length is useless over land, but is very selective. That is to say, it is not greatly interfered with by other systems and by atmospherics. It is consequently most useful where no land intervenes.

10. *A* tune is always used wherever possible by the Marconi Company. It is also used in the Italian Navy. Its working distance is 60 miles, but it is often useful up to 120 and even further. There is a case on record, well substantiated, where an *A* tune message was received 1,200 miles, but no reason can be assigned to this phenomenon.

The power used is very small, working with a 14-mm. spark it does not exceed 300 watts.

11. *C* tune has a more powerful apparatus than either *A* or *B*.

It consists of a 2½ k.w. set, and has a working range of 250 miles.

At present it is fitted only in the *Vernon*, but sets have been ordered for Scilly Islands, *Defiance*, and *Actæon*.

12. It is easier to fit *C* tune to a shore station than to a ship. In the first place the aerial in a ship is strictly limited, which is not the case ashore. Secondly, the space in a ship does not allow of very convenient arrangement. The condensers must be self-contained, and no leakage in a heavy sea must be allowed.

On the other hand, the ship has the benefit of a very good earth, which it is often difficult to obtain at a shore station.

13. The capacity in the primary of *C* tune is roughly 160 jars, and the resonance constant 200. The condensers must be arranged so as to stand a spark of 1 centimetre. The Poldhu jar, used extensively at shore stations, cannot be guaranteed to stand more than 5 mm. and then only when the oil is absolutely clean, and the leads to it short.

When arranging condensers to form the capacity of a shore station or ship, it must be carefully borne in mind that the greatest strain comes on the condenser the leads to which have the greatest inductance. Every possible device should be taken to equalize the inductance of the leads to the various condensers. When using Poldhu jars, then, they must be arranged two in series and eight in parallel. This will approximate closely to the correct capacity, each jar having nearly 40 jars capacity. *C* tune Mark I. is designed to work at 15 words per minute when using maximum power, and 25 words at half-power.

14. In order to equalize the energy expended to each wave, the aerial and secondary of the oscillator should have the same resonance constant as the primary. When this is the case the strength of the long wave is not far short of the strength of the short one. But if circumstances are such that this cannot be done, the aerial and secondary must be so arranged that the strongest wave sent out is 3,000 feet long and has a working distance of 250 miles. That is to say, the resonance constant of aerial and secondary must err on the side of greatness. In all cases the secondary wave should be sacrified to the primary one if necessity arises.