

CHAPTER XIV

The Importance of Good Contact

I AM not sure that amateurs fully realize the importance of perfect metallic connexion in every part of a receiving set. When there is plenty of power, as when one is listening to a station in the neighbourhood, a poor kind of contact may suffice. But to get the benefit of refined and accurate tuning for distant stations, we ought to realize that a tuned response begins with exceedingly small E.M.F.

The whole point of tuning is that response begins with infinitesimal surgings, which, if of the right frequency, will work up by resonance to a substantial magnitude; and that if the initial infinitesimal surgings cannot occur, there is nothing to work up, and there will be no response.

Whenever we are dealing with very small E.M.F.s, as, for instance, in thermo-electric currents, perfect metallic connexion is necessary. An E.M.F. of a volt or two is able to break down a thin insulating film, such as an imperceptible coat of oxide, and establish connexion after the manner of a coherer, just as

an E.M.F. of 100 volts can jump across a microscopic interval ; while 3,000 volts can give a millimetre spark—that is, can jump across a coarse interval of anything short of a millimetre.

But when we are dealing with the hundredth or the thousandth, or even the millionth of a volt, no such facility exists. And yet the initial surgings from a very distant station must begin at even less than the millionth of a volt. The slightest imperfection of contact therefore is sufficient to check the initial response and give tuning no chance. The wonder is that a conductor responds at all to extremely minute force. The fact that it does, shows that some of its electrons must be free from the atoms and able to be directed by the slightest suggestion of a force, as they are no doubt in a vacuum bulb.

Not only in metals, but even in electrolytes, electrons seem free. Special tests have been made to see whether electrolytes accurately obey Ohm's Law ; and they do. But they could not obey Ohm's Law if an infinitesimal E.M.F. did not produce a proportional infinitesimal current. The ratio of E.M.F. to current should be constant ; and as far as experiment has gone, it *is* constant in metals and electrolytes, even for the smallest forces.

But directly we deal with insulators, that is not so. They do not attempt to obey Ohm's Law. They obstruct altogether until they break down. When broken down, they conduct freely. They are said to be ionized—that is, their electrons are set free or liberated internally. But there is a critical force necessary to break them down. This applies not only to recognized insulators but to any kind of a film, a film of oil or grease for instance, or a film of oxide. Such films cannot but exist on anything exposed to the air, where dust is prevalent. They must also exist on any surface touched by the hand, or breathed upon. It is impossible to avoid such films; and if scraped off, they will speedily renew themselves. Loose contacts, therefore, must always be suspect. The scraping action of a sliding contact may usually be trusted to remove the film, and may leave the metals in complete contact. But if cohesion is interrupted by a shake, jar, or tremor, it may not so easily renew itself.

Hence amalgamated or soldered contacts are safer. Sliding contacts are very convenient, and may often be used, but uncertain joints are always liable to give trouble; and some of the stray noises and capriciousness from which amateurs are said to suffer can frequently be traced to this source. It is really easier to

avoid troubles of this kind than to detect them when they occur.

For purposes of sending, there is no trouble of that kind. The E.M.F.s are then big enough to break down obstacles. But for refined tuning, every part of the aerial and every detail of the set should be thoroughly well joined up.

And if sliding contacts are used, the binding or clamping should be firm enough to prevent accidental disarrangement. A gentle tap breaks contact in a coherer, as everyone who used to work with such things was well aware ; and it takes an electric impulse of finite magnitude to restore connexion. No such breaks should be allowed by anyone who desires perfect reception.