The Nature and Origin of Static

What is the Real Remedy for this Radio Trouble ?

By "M. .R.E"

ONE of the most interesting subjects to the set owner is the question of the nature and origin of "static" and the possibility of eliminating it, or, at least, overcoming it to such an extent as to render it less harmless than it is at present, especially to those who have a hankering after distant stations.

The word "static" has now been more or less accepted, but in the days before broadcasting was introduced these parasitic noises were labelled also by the description of "atmospherics" and "X's," and the former of these two words seems to fit the bill more descriptively than "static" or "X's," because "X's" refers to "X," or an unknown quantity, and a good deal is known to-day concerning this type of interference. "Static" is short for "static discharge," and as the electrical discharge in question takes place in the atmosphere mainly, the origin of "atmospherics" is seen also.

However, "static" appears to have come to stay.

WHAT IS STATIC?

Static is as natural as the wind or the clouds. Clouds are formed through the concentration of moisture, due to different temperatures existing in the atmosphere. So are winds.

Whenever different temperatures exist in the atmosphere, or between layers of the atmosphere and the earth, electrical potentials are set up, which are discharging continuously, and serve to disturb the ether, thus setting up ether, or wireless, waves, to be cursed vigorously by all those listeners who are attempting anything in the nature of distant reception. Sometimes the electrical discharges grow so heavy that when they collapse quickly they do so with such visible violence as to be called lightning.

LOCAL DISCHARGES.

Static may appear very definitely when there is a blue sky. Often in the tropics, for instance, on a beautifully clear day, with apparently no wind, and the sea like glass, the aerial starts to rain sparks, and will continue to do so for twenty minutes or more. Sparks up to half an inch or more can be drawn off to earth. A ship running into a sudden squall or into sleet will always experience a long-drawn-out hiss, due to a discharge from the low-hung cloud representing the squall, and the earth. This hiss will invariably paralyse the receiver for several minutes.

Such discharges are local, of course, but they go to show the presence of energy, which, if discharged suddenly, would set up disturbances capable of affecting radio receivers many miles away.

On wavelengths above ten thousand metres static has been studied for years because it had to be overcome in order to carry on successful inter-continental telegraph services. It can be said to have been eliminated for telegraphic (not-telephonic) purposes for wavelengths of this order upwards.

RESULT OF RESEARCH.

As a result of lengthy experiments carried on between England and Australia between 1918 and 1922, the static interference factor was so successfully coped with that it was decided to lay down a direct telegraphic radio service between these two countries on 30,000 metres It was found that on this order of wavelength fading was of little consideration, and providing the static could be held in check the success of the service would be assured. The intense research carried out during these experiments, as well as, of course, the activities of engineers and physicists of other lands at that time, led to much information being made available, and a system of reception developed which was capable of ensuring success. The England-Australia scheme was going into execution in 1923 when the "beam" system was developed, and this service is now operating on 25 metres wavelength.

However, the study of static on long wavelengths has enabled a lot to be learned, and although other factors enter into the problem on the broadcast wave band (220 to 550 metres), many of the effects still apply.

DEFINITE DIRECTION OF ARRIVAL

Static arrives in the form of waves, just as do signals. This means consequently that both have a definite direction of arrival and therein lies the foundation of all successful methods of combat. If an aerial having a very definite directional effect is used and pointed in the direction of arrival of the signal it will respond to it, but will be oblivious to static arriving from a direction to which the aerial is unresponsive.

RESPONSIVE AERIALS.

As has been discussed in the last two issues of this column, aerials will show directional properties if they are of an L type and the flat-top portion is long compared to the down-leads. The Beveridge aerial used in the United States for trans-Atlantic reception is over ten miles long and 30 feet high, and is used on wavelengths of the order of 14,000 metres. Such an aerial is sharply responsive to signals arriving from the ends of the down-leads, and is scarcely responsive at all to signals arriving from elsewhere. Thus signals from Europe come in at the front door and static arriving from the west (which is the direction of prevailing static on the eastern seaboard of the United States) finds the back-door shut. So far as the receiver is concerned, therefore, on an ordinary aerial, the static from the west and the signals from the east would mix, and if of equal strength would leave little chance of steady and reliable reception. By making the aerial, say, ten times more selective towards the east than the west means a ratio of signal to static of ten to one, and therefore an easy proposition to receive the signals

Naturally many means have been developed for taking advantage of this directional effect, and loop-aerials have been principally employed, especially in combination with aerials of orthodox design in order to get signal strengths of reasonable measure. Very definite directional effects are now being obtained for the purpose of navigation, such as steering ships in fogs, and these same principles are being employed by other engineers who are developing systems of concentration of signals to the discomfiture of brother static.

On wave-lengths above 10,000 metres the direction of static can be measured and its intensity recorded according to the hour of the day and the season of the year.

STATIC AT ITS WORST.

Static is at its worst at 3 p.m. and is at its worst when 3 p.m. is occurring over high land such as mountains. It will be appreciated that 3 p.m. is revolving round the earth. When 3 p.m. is over the sea, static is at its minimum. The worst time for static is when 3 p.m. is over the Andes mountains in South America. Naturally, the waves due to these static discharges travel strongest through the darkness following the 3 p.m. position, so that static is invariably from the west for twelve hours of the day, while at the position corresponding to 3 a.m. (i.e. at the Antipodes of 3 p.m.). The static will be coming round the earth both ways and will be east and west, but strongest towards the dark side of the globe, as the waves naturally travel with less resistance this way.

This effect can be checked up on a long wave direction finder at any time, and it will be found uncanny to note that it will infallably point via the route of maximum darkness to 3 p.m., when the direction of maximum noise is arrived at. Actually 3 p.m. might be occurring 10,000 miles away!

Something of this nature occurs on short-waves of the order employed for broadcast purposes, but it is certain that the waves do not travel from such long distances, although static generated in mid-Atlantic on 600 metres has been recorded simultaneously in England and Canada. The reason that static becomes so much more troublesome at night than day is because, like man-made wireless waves, the distance traversed by waves is much greater due to absence of the sun. The static has less definitely defined directions of arrival with shorter waves, but will invariably be found to come off high land or else from the direction of the tropics.

RE-RADIATION FACTOR.

As the wavelengths become shorter also, the re-radiation factor becomes very apparent. Thus signals from the east and static from the west cannot be efficiently separated because trees or buildings to the east of the receiver pick up the static energy and re-radiate it, thus causing re-radiated waves to come back from the east and mix with the signals.

On very short wavelengths (20 to 100 metres) such as are being used for long-distance signalling at present, it is practically impossible to get directional effects except when the receiver and aerial system are erected in an absolutely bare, open space many acres in extent, and quite devoid of mineral deposits or even stunted vegetation. This is all due to this re-radiation effect.

THE REAL CURE.

It will thus be seen that for broadcast purposes it is desirable to have a directional receiving effect and a loop is the simplest design, but it can only be used effectively where there are no surrounding objects to allow it to pick up re-radiated effects.

The real cure which is employed to an extreme degree in England is the laying down of many medium-sized broadcast stations in order to so flood the ether with signals that the signals always predominate, or in other words, the signal to static ratio is well in favour of the signal. Naturally, the running of many stations means high costs and the income to run such a system is available in England owing to the population. Undoubtedly the broadcasting service in New Zealand will include the running of relay stations just as soon as funds permit.

People coming from England to New Zealand are frequently heard to remark that there is no static in England. If English listeners listened to Moscow or Rome like New Zealanders do to Sydney and Melbourne they would have to put in multi-valve receivers and discover that brother static is just as full of pep there as here. Listeners with small sets close-by our New Zealand stations have probably never heard static! Sounds incredible but it is a fact. The signals from the near-by stations flood the receivers and any static interference would be negligible and probably unrecognised by the uninitiated.

MORE NEW VALVES

FURTHER DISCOVERIES.

One of the interesting features of recent wireless development is the manner in which apparatus first designed for wireless reception or transmission has been transformed and adapted to other purposes. One of the most familiar of such cases is the development of the public address system from the wireless amplifier and loudspeaker. Two most valuable new instruments have recently been perfected by a big American company, as a result of investigations to improve wireless valves. Both have been the result of an accidental discovery that the electrical characteristics of certain valves under test varied from day to day. Further observations showed that the behaviour of the valves varied according to whether the weather was bright or dull.

AN INTERESTING DEVICE.

The outcome was the production of an interesting electrical device, which will allow a current to pass through it only if it is exposed to light. This device has many applications in general electrical engineering, and it is likely, moreover, to be of considerable value in television. From the development of this device arose another of equal importance. This is an instrument resembling a wireless valve in appearance, but lacking the heated filament. It is used as a control unit for many kinds of electrical equipment, and its most interesting feature is the fact that it can be controlled by an amount of energy equal to only one one hundred millionth part of the energy that is subject to the control; that is to say, one unit of energy impressed on it will cause it to start or stop the flow of an electric current equal to 100,000,000 similar energy units.