

Various Causes of Static

"Anti" Devices in Common Use

No means of overcoming static have yet been discovered, and it apparently is still master of the radio situation, is the opinion of L. W. Austin, of the United States Bureau of Standards, in an article on that subject in the "New York Times." Mr. Austin tells of the difficulty of eliminating this bugbear, gives some of its probable causes, and discusses several of the numerous devices which have been used in an endeavour to cut down interference from this source.

The chief reason why it is so difficult to eliminate static is that it comes from so many different sources of disturbance," he says. "It is as though nature were sending from thousands of radio stations of her own, tuned to all possible wave-lengths and frequently of great power. The result is, since static is coming in on all wave-lengths, that no matter where we tune our receiving apparatus it is impossible to avoid it."

"The only difference between the static waves and the waves from radio stations is that the static is highly damped; that is, very broadly tuned, as compared with the usual ether waves. This enables sharply tuned receivers to discriminate to a certain extent in favour of the radio signals, since the sharper the receiver tuning the narrower the band of static which is being received. But even at best this affords very little help."

PROBABLE CAUSES.

"Perhaps a word or two as to the cause of static may not be amiss. It is, we believe, in general caused by electrical discharges in the atmosphere; much of it undoubtedly comes from lightning and non-luminous discharges in the thunder clouds. But it may also probably originate where any two bodies of air at different electrical potentials come together."

"In regard to non-luminous discharges from thunder clouds, it has been suggested in England that the cloud may discharge quite as readily to the upper conducting atmospheric layers as to the earth. Even though the distance may be no greater, the diminution of air pressure with the height would render the discharge so easy that it is extremely likely that such discharges may take place even without luminous effects."

Mr. Watson Watt, in analysing the records of European radio stations in order to determine the causes of static has concluded that in only about thirty-five per cent. of the cases given could the discharges be identified as the sources of these disturbances, but that in seventy-five per cent. the sources were rain areas of some kind.

Hundreds and perhaps thousands of devices have been produced by various people which, it was hoped, would overcome static. When these have been thoroughly tested, however, while some have been slightly useful, none have proved cure-alls.

ANTI-STATIC DEVICES.

"The fact is, it is rather easy to imagine that static has been eliminated when experiments are being made with weak static and rather strong signals, but it is only necessary to cut down both equally in order to make static disappear. If a record has been kept of the time of year in these inventions it would usually be found that they were developed during the autumn and winter and finally came to grief under the high static of the following summer. Most of these anti-static devices may be divided into the following classes: Directional reception devices, audio frequency tuning devices, signal limiting devices and balanced circuits."

"Directional reception, at least as far as long-wave radio-telegraphy is concerned, is certainly the most effective means of combating static which we

have at present. It is particularly useful where the reception is from overseas, since most of the static comes from the land side and roughly from the opposite direction of the signal."

"Audio frequency tuning is somewhat useful in the reception of code, on account of the difference in tone of the signal and the static, but obviously cannot be used in broadcasting reception, where all the musical tones must be equally received."

"In limiting devices, by means of vacuum tubes or by other means, the maximum strength of signal which can pass through the receiver is limited. This is an idea which has formed the basis for a large number of static-reducing inventions, and it does indeed bring the static down to the strength of the signal. But the unfortunate fact is that when the strong static is coming in, the receiver is practically dead, so that, at that moment, no signal is received, and in the case of code, dots drop out and holes are left in the dashes."

"A number of years ago a rather complicated form of static and interference eliminator was devised which worked somewhat on the principle of the combination lock, in which only the impulses which came in a definite combination could get through the receiver. But in this case, like the limiting devices, static also destroyed the clearness of the signal."

"None of the arrangements thus far mentioned offers any hope for a real cure of static, and unless some brand new idea is developed we cannot see any definite prospect of getting rid of it entirely."

"At present the best way of avoiding trouble is to make the signal stronger than the static. Strong signals may be obtained either by using great power or by getting close to the sending station. So the simplest means of avoiding static interference is to make as much use as possible of the local stations. For, except in rare instances, reception over a distance of but a few miles offers the only possibility of perfect enjoyment of a fine musical programme."

"The conquering of static by high power at the sending station is evidently limited by economic considerations, for doubling the power of a sending station only increases the amplitude of the waves by about one and one-half times, since the amplitude increases as the square root of the power. Therefore, at a distance of several hundred miles, any probable increase in station power will not be able to drown out static when it is very severe."

"It must be concluded, therefore, that static seems to have the best of us, except when we are close to the transmitting station, because with all the powers of nature behind it, it will always at times be able to drown out our human efforts."

SHIP INTERFERENCE

WASHINGTON CONFERENCE DECISION

SPARK TRANSMISSION DOOMED.

New Zealand listeners in many parts of the Dominion are subject to a considerable amount of interference from the "spark" transmitters on ships, especially when they are reaching out for long-distance stations. The trouble is due to the fact that the "spark" transmitter causes interference over a wide band of wave-lengths, and cannot be readily tuned out as a valve transmitter.

A very interesting subject discussed at the recent Washington International Radio Conference is the type of transmitting equipment used on wireless installations on ships. It has been reported in the Press that the conference discussed a proposal to force shipping companies to abandon the spark type of transmitters, but after considerable discussion it was agreed to allow the existing spark transmitters to continue until 1940, but no new spark sets could be installed after 1930.

Interference with Broadcasting.

This information is of considerable interest to broadcast listeners. The interference caused by spark transmitters of the type used on ships is well known. The effect is not very noticeable at places well removed from the coast line, but in and near the capital cities and in towns along the coast near capital cities when ships are working to the coast stations in the capital cities, interference is very objectionable.

Claims in Favour of Spark.

It is claimed that there are very sound reasons why spark transmitters should not be summarily abolished from ships. Their replacement by modern equipment would be a very expensive matter, as it is estimated that there are about 12,000 commercial ships using spark transmitters throughout the world to-day. A perhaps more important reason is the technical consideration that it is undesirable, and in some instances unsafe, for a ship to be required to transmit on one wave-length or a very narrow band of wave-lengths. Such a restriction is not serious when it comes to ordinary commercial ship wireless traffic, but when it is necessary to send out the "S.O.S." call it is of the utmost importance that every facility should be available for coast stations and ships to hear the "S.O.S." message.

LOUDSPEAKER HORNS

THE EXPONENTIAL TYPE.

A correctly designed horn makes a very good type of loudspeaker. The best horn is one which radiates most uniformly over the required range of frequency, and it has been proved mathematically that the exponentially-shaped horn conforms closely to this requirement. A horn is of the exponential type when its cross section area doubles at equal intervals along its length. For example, a horn would be of the exponential type if at the orifice it had an area of $\frac{1}{4}$ square inches and an area of $\frac{1}{2}$ square inches, 1 square inch, and 2 square inches, at distances of 1, 2, and 3 feet respectively from the orifice. The rate of expansion determines the lowest frequency of which the horn will be a good sound producer. A horn which doubles in area every foot will reproduce down to about 64 cycles, and a horn which expands twice as rapidly will only reproduce well down to 128 cycles.

Correct Measurements.

A properly designed horn should be free from noticeable resonance, and to prevent this the mouth of the horn should be made large enough to transmit the sounds coming from it without any great amount of back pressure. In the design of loudspeaker horns it has been found that if the mouth is made comparable to $\frac{1}{4}$ of the wave-length corresponding to the low frequency cut-off point of the horn, the resonance in the horn will be negligible. The wave-length in feet is determined by dividing the velocity of sound in feet per second, which is 1120, by the frequency. For example, a horn whose cut-off frequency is to be 32 cycles, corresponding to a wave-length of 35 feet, should have a mouth of 35 divided by 4, or 8 $\frac{1}{2}$ feet. These facts indicate definitely that a horn, to be a good one, must be large. Small horns, whether they are or are not exponential, cannot radiate the low frequencies.

The horn makes it possible for a comparatively small diaphragm to get a good grip on the air and thereby produce a large volume of sound. The small diaphragm and the large horn may be replaced by a large diaphragm, as is done in a cone type loudspeaker.

The material of which the horn is made is important. Although a horn may be well designed, and constructed to the correct size, total length and expansion per unit length, it may still fail to give really good results because of resonant effects in the material used in the construction. The material used should have no marked resonant frequency unless it is very low, where it might help to increase the low note radiation.

RADIO TIME SIGNALS

FROM VLW AND 2YA.

Radio time signals have been sent out from the Dominion Observatory, VLW, Wellington, for over seven years. The service was started in a small way first by sending time signals at 9 hours G.M.T. (-8.30 p.m. N.Z.T.) on Tuesday and Friday evenings. This service began on October 1, 1920, and is still continued.

A considerable addition to the radio time signals was started on May 1, 1922, when a daylight signal was sent at 23 hours G.M.T. (-10.30 a.m. N.Z.T.). The daylight signal is now sent every day of the year, including Sundays and holidays.

All these signals are sent automatically from the standard clock at the Dominion Observatory through the Wellington radio station "VLW," and are sent on a wave-length of 600 metres. Some of these signals have been heard at considerable distances from Wellington—as far away as 4320 miles. The automatic time signal consists of a dash beginning exactly at the hour and continuing for about three seconds. The signal is repeated at the first, second, fourth and fifth minutes. In addition to the automatic signals, a number of signals are sent by hand; these enable the listener to tune-in and identify the particular minute observed.

It is now proposed to broadcast the Observatory time signals by the Wellington broadcasting station 2YA on a wave-length of 420 metres. The signal to be sent will be a 1000 cycle note, and it will be superimposed on any programme at the time. Each signal will last for about three seconds; the beginning of the signal will indicate the beginning of the minute.

It is proposed to broadcast these signals at 3.30 p.m., 4.30 p.m., 7.30 p.m., and 8.30 p.m., and they should be of very considerable use to listeners in general, particularly all those who have to deal with accurate time, such as astronomers, all transport services, watchmakers, engineers, surveyors, etc.

The Death Sentence.

These claims are not completely convincing to the broadcast listeners, for the efficiency, over great ranges, of the valve transmitter, should justify the expenditure of converting the spark transmitting ship equipments into valve transmitters. The "S.O.S." call, therefore, should be heard at a greater distance. However, the Washington Conference has decided that the spark transmitters are not to be used after thirteen more years have elapsed. This death sentence is welcome news to broadcast listeners.

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ABOUT VALVES

USEFUL ADVICE.

Radio valves, like living things, grow old, and finally come to the end of their existence. Formerly, when valves had solid tungsten filaments, a valve was useful until the filaments would no longer light. To-day, however, economical valves employ special filaments which continue to light even after the valve has become practically useless. So a lighted valve is no proof that the valve is still good.

Progressive radio dealers have valve testers with which to determine the characteristics of valves. When possible the radio enthusiast should have doubtful valves tested by his radio dealer and, as often as not, those same valves, provided they have X-L or thoriated-tungsten filament, can be rejuvenated or reactivated as it is called, so as to deliver several hundred hours of additional service.

AN EASY TEST.

To the radio listener in rural parts where a local radio dealer is a rarity, there is a simple home-made means for testing the efficiency of valves. This involves nothing more than mere comparison between a valve of highest efficiency and the valve in the receiving set. First of all, the radio enthusiast should secure a new valve from a reliable dealer. This valve is now substituted for one valve after the other in the receiving set, noting the difference in signal strength and tonal quality. In this manner the radio enthusiast or listener can tell which valves are getting weak, causing a loss in signal strength and even impairing the tonal quality, by direct comparison.

Reliable valves have a life well in excess of a thousand service hours. Furthermore, while efficient valves should be employed for the audio amplifier sockets, the older valves can be used with good results for the radio frequency and detector sockets.

RADIO TELEPHONY

AIRWAYS EXPERIMENT.

An experiment is at present being tried out at the London Terminal Aerodrome, Croydon, by which the Air Superintendent of Imperial Airways is enabled to listen to the radio-telephone conversations taking place between the Croydon wireless station and aircraft operating on the air routes.

Hitherto information of the arrivals and departures of aircraft, and of their progress along the routes, has been obtained by the Air Superintendent, as a matter of common routine, from the Control Tower at Croydon, where all messages to and from aircraft and other air ports are dealt with. Though this service was a reliable one and gave the operating companies the information they required concerning their particular machines, it was thought that quicker notice would be received of incidents, and routine reports would take less time to reach the company if a loudspeaker were connected by a direct line to the Croydon receiver and transmitter circuits, so that everything received by that station and transmitted by it would be heard in the office where the loudspeaker was situated. As the Air Superintendent was the official most concerned, the loudspeaker was duly installed in his office.

This arrangement means, of course, that either he or someone representing him must always be in the office to note what is said, an arrangement which is obviously not so good as a written message in black and white which can be filed for reference and produced as evidence subsequently in case of dispute.

AMERICAN LISTENERS

ELEVEN DIFFERENT TYPES.

(By Arthur Tucker, President of the American Radio Foundation.)

The Earnest Listener.—He uses radio to obtain useful information, crop reports, news items, baseball scores, and police reports. He patronises few stations, usually those near at hand.

The Entertainment Seeker.—He wants lively music, jokes, "gags," the wise cracks of announcers and of those in charge of programmes at cabarets, banquets, and entertainments. He will roam the whole field to get what he wants, and complains if the programmes he must take are "high-brow." (This type is well established in New Zealand.)

The Music Lover.—He scans the programme to find the highest class instrumental and vocal music, and revels in it, hanging on each note and criticising more severely than a reviewer at a first-night. He complains if the broadcasters do not invest heavily in high-priced artists. (Another New Zealand type.)

The Hero Worshipper.—He wants to hear his favourites. It may be a favourite President, clog dancer, congressman, singer, announcer, or entertainer. This listener will follow his favourites from station to station, and will roam the country to catch them, watching the calendar and the clock closely so as to miss not a syllable.

The Dance Hound.—He must have jazz, hour after hour of it. When one station shuts it off he switches to another. (Found also in New Zealand.)

The Static Dodger.—He hasn't a very good set, and is continually twirling the dials to see if he can light somewhere that will produce a fairly clear sound, regardless of what it may be. (We have him in every corner of New Zealand.)

The DX Seeker.—Programmes mean nothing to him. Anything that comes from far off is good enough for him, so long as he can identify it, and brag about it. (Whisper! There are one or two of this type in New Zealand.)

The Permanent Listener.—He adjusts his machine to the first station that comes to hand, settles down in his easy chair, with paper and pipe, and sticks to that station until it blows up or runs out on him, regardless of what is bouncing across the ether. (Well distributed New Zealand type.)

The Casual Dial Twirler.—He doesn't know exactly what he wants, and shifts a dozen times in the course of an evening, sampling this and that. Not a bad sort of devotee of radio. (Not so bad if he kept his valve from howling.)

The Henpecked Listener.—He buys the set, then listens to what his daughter, son, wife, and aunt want to hear, in the way of programmes, renewing the batteries occasionally, and tightening the aerial.

The "Nut" or "Fan."—He builds sets, tears them apart, builds them over again, then builds more. Occasionally he stops long enough to tune in a station or two, most of them distant. What comes over the ether bothers him very little. It's how it comes that he cares about. (Not unknown in New Zealand.)

If this experiment is unsuccessful, as there is rather a probability that it will be, compared to the normal method, it will be removed in due course. In the meanwhile it is an interesting test and may show the way to a more suitable means of rapidly disseminating advice and reports of aircraft movements to the various offices concerned.

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