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The Radio Interference Service

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Engineer-in-Chief's Office

The Early Days

A PART FROM "JAMMING" BY UNWANTED transmissions or "atmospherics", interference with broadcast reception was at first rare, though some trouble was experienced from ordinary receivers used in a radiating condition either unwittingly or in an effort to obtain the maximum amplification. Such misuse was in fact an infringement of the conditions of the licence and when complaint was made, the Post Office had to investigate and educate and/or admonish offenders. This type of interference later became less frequent with the introduction of sets of improved performance. Up to this time, the work devolving on the Post Office in keeping interference under control was negligible and field investigations were carried out in the evening, after normal hours of duty.

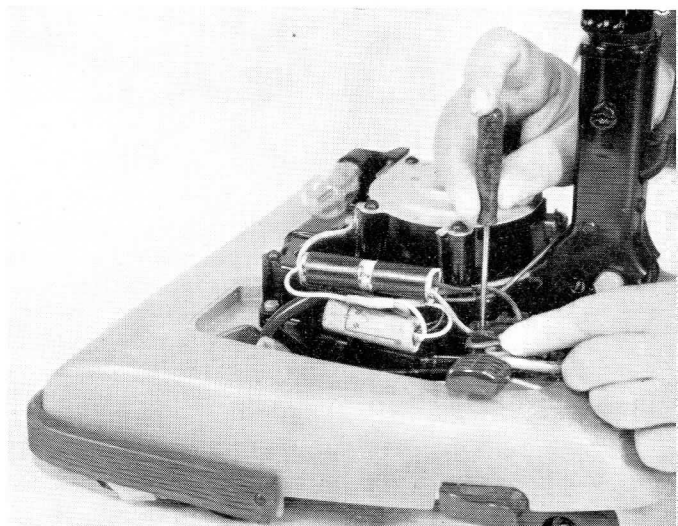
Then came the great growth in popularity of broadcast entertainment and the general expansion of electricity supplies. Mains-operated radio sets rapidly came to the fore, as well as the multitude of electrically-operated industrial, commercial and domestic appliances and machinery, which help to speed up production in industry, reduce drudgery in the home and add generally to the amenities of modern life. Nearly all this apparatus is a potential source of interference if used in the vicinity of a broadcast set. The complaints reaching the Post Office increased steadily and the work of investigating interference complaints could no longer be properly and economically carried out by telephone and telegraph staff in their "spare time".

The Organisation Takes Shape

Gradually staff became employed for an appreciable part of their normal hours of duty on radio-interference work. Many weary miles were covered, on foot and by public transport, by men

loaded down with a portable receiver in one hand and a bag of tools in the other. In 1932, it was decided that the work should be done by full-time radio-interference investigation officers (I.O.'s) in the field, who should have the rank of Skilled Workmen, Class I. The first major steps towards efficient organisation were taken in 1933-1935, when the Engineer-in-Chief arranged the provision of special motor-vehicles, apparatus and training courses. The vehicles, which had non-metallic bodies to permit the use of aerials contained within the vans, carried not only the portable receivers used for tracing interference to its source, but also an extensive range of standard suppressors, which were used primarily for demonstrating but upon request were also sold to owners of apparatus causing interference. All staff employed regularly on the work were required to obtain special qualification by means of courses in R.I. run by the Training School and Radio Branch in collaboration. For many years the Radio Branch decided the syllabus and provided the lecturer for R.I. courses, as well as much of the equipment, the School pro-

FIG. 1
SUPPRESSOR BEING FITTED TO A VACUUM CLEANER.



viding basic instruction, facilities and accommodation. The I.O.'s had assistants where warranted and were attached to the Sectional Engineer, usually under the supervision of an Inspector on a maintenance or power duty. It was recognised that the latter could not be expected to be a radio expert, and technical supervision was vested in the Superintending Engineer, whose office, in most cases, had one or more Inspectors who were R.I. specialists, and who made frequent visits to Sections to co-operate with the local field staff.

In addition, a "Broadcast Interference Group" was established within the Radio Branch of the Engineer-in-Chief's Office. Its main responsibilities were training, provision of apparatus and transport, dealing with radio exhibitions, technical advice to district staff, and frequent visits to them. In fact, at one time the endeavour was made to visit each I.O. once a year.

The Coming of Television

An experimental low-definition television service opened in 1929. Pictures were crude and small, transmission times very limited and programmes unambitious, so it is not surprising that they had little public appeal. The real public service at high definition began in November, 1936. Right up to the war, receivers were not exceptionally sensitive and they were used only at short distances from the transmitter. Few complaints of interference (T.V.I.) were received. Over 40,000 complaints of R.I. and over 100 of T.V.I. were received per annum in the years just before the war. During the war, the R.I. service was kept going in skeleton form. Bad R.I. cases were dealt with, the aim being to enable listeners to receive the B.B.C. "Home" programme reasonably satisfactorily, and much work was done for the Services and Government Departments, whose many radio and radar installations in this country were, on occasions, subject to interference.

The Post-War Years

As the country readjusted itself to conditions of peace, broadcast reception of sound resumed its normal position in daily life, and the television service restarted. The latter at once made rapid progress, and it has made even more rapid progress since. With the opening of the Sutton Coldfield station, the B.B.C. began the extension of service

to the provinces. We now have to deal with 77,000 sound and 28,000 television interference complaints a year. The possibility of eliminating unnecessary complaints, which are an appreciable proportion of the total, and of increasing the efficiency of the service is being investigated very carefully.

The original single training course given to I.O.'s has now been replaced by separate courses in basic radio theory, radio (i.e. sound broadcasting) interference and television interference. All are now run wholly by the Training Branch at the Central Engineering Training School at Stone. Under full regionalisation, the visits from the Engineering Department to Technical Officers have been discontinued, though the Engineering Department continues to collaborate with them in the more difficult field investigations. Regular conferences between the Engineering Department and radio staff at Regional Headquarters are now held. The introduction of standard suppressors for television began several years ago and the whole range is now available to the I.O.

The vast majority of owners of interfering apparatus has always co-operated willingly with the Post Office and had suppressors fitted at its own expense. There has however always been the unco-operative minority, and to deal with such people the Wireless Telegraphy Act 1949 now gives the Postmaster General power to make and enforce regulations which prescribe what have been regarded by an impartial committee as reasonable arrangements for countering interference.

Some Data and Technicalities

For several years, detailed records of the types of apparatus causing interference have been kept by Telephone Managers and summarised by the Engineering Department. The present period is one of change and development, which is reflected in the annual analyses of returns. The principal causes of complaint in the 12 months ended 31st December, 1950, are given in the Table. The most striking feature in each case is the large number of fruitless complaints, i.e. those in which the interference is intermittent and never occurs during the I.O.'s visits; or it is of such short duration as to defeat all efforts to track it to its source. In some of these cases, the interference is undoubtedly due to impending breakdown of an electrical appliance or



FIG. 2—IGNITION INTERFERENCE WITH TELEVISION RECEPTION.

machine; no doubt the actual breakdown occurs, skilled maintenance is given and both fault and interference are eliminated before the Post Office investigator comes near.

Interference Suppressors

Except in a few special cases, practically all interference results from sudden changes or discontinuities in electrical circuits, such as may be caused by the operation of commutator-type motors, the making and breaking of contacts, and the discontinuities inherent in operating gaseous discharge devices such as fluorescent lamps. The circuit-changes impress on the electricity supply mains sudden changes of potential or current, which contain components at even very high radio frequencies; in addition, radio-frequency energy is radiated into space. These components are known as "radio noise" voltages, currents and fields. Practically all electrical apparatus contains the

elements essential to generating interference. In fact, the most severe and widespread interference is caused by the noise voltages and currents fed back into the electricity mains by low-power apparatus. The problem of suppression, once the source has been located, is therefore generally one of attenuating the noise voltages and currents and restricting the circulation of the latter to the immediate vicinity of their source. This can be done by inserting in series, between the apparatus and the mains, impedances (or suppressors) which are negligible in their effect on the power-current driving the apparatus, but have a value as high as possible at the radio-frequencies concerned; also by shunting between the mains and the framework of the apparatus, impedances as low as possible at the radio-frequencies but extremely high at the frequency of the power-current (in the United Kingdom, usually 50 c/s).

Figure 1 shows suppressors being connected to a

**THE MOST FREQUENT SOURCES OF INTERFERENCE WITH RECEPTION OF
SOUND BROADCASTING, EXPRESSED AS A PERCENTAGE OF CASES CLOSED.**

	* SOUND %	* TELEVISION %		
Unknown ; interference not observed by P.O. staff ...	(18,018 complaints)	23.8	(7,068 complaints)	29.2
Inefficient aerial/earth systems	15,246	20.1	947	3.9
Faulty receivers	9,507	12.5	1,972	8.2
Faulty wiring of buildings	5,029	6.6	234	0.9
Refrigerators	2,255	3.0	331	1.4
Fluorescent tubes	1,787	2.4	—	—
Radiation from T.V. receiver time base ccts.	1,725	2.3	—	—
Radio transmitters	1,469	2.0	1,007	4.2
Bedwarmers	1,423	1.9	—	—
Motors, misc.	1,334	1.8	315	1.3
Sewing machines	1,162	1.5	2,374	9.8
Overhead power lines	900	1.2	632	2.6
Drills	791	1.0	221	0.8
Radiation from I.F. oscillators of radio receivers	622	0.8	156	0.6
Misoperation of receivers	539	0.7	204	0.8
Thermostats misc.	539	0.7	184	0.7
Smoothing irons	528	0.7	—	—
Vacuum cleaners	527	0.7	257	0.9
Neon sign tubes	503	0.7	192	0.8
Underground mains	492	0.6	—	—
External cross modulation	414	0.5	—	—
Fans	391	0.5	521	2.1
Calculating machines	353	0.5	150	0.6
Hairdryers	292	0.4	697	2.9
Motor car ignition	—	—	1,096	4.5
Medical apparatus (valve-operated)	—	—	306	1.2
Filament-type lamps	—	—	305	1.2

* The figures in the first and third columns do not necessarily represent the number of complaints received. For example, the fourth item from the end means that of the complainants whose sound-reception problems were solved, 0.4% had been collectively troubled by interference from 292 hairdryers.

domestic vacuum cleaner. In this particular instance, it has been necessary to use one unit to be effectual at the low frequencies used for sound broadcasting and another for the higher television frequencies.

The electrical ignition system of a motor car has the characteristic of producing interference which

is negligible at low frequencies and does not become severe until the television frequency band is reached (Figure 2). The interference is produced solely by radiation, there being no electric mains to convey the interference energy away from its source. Suppression is obtained, without adverse effect on the performance of the car engine, by

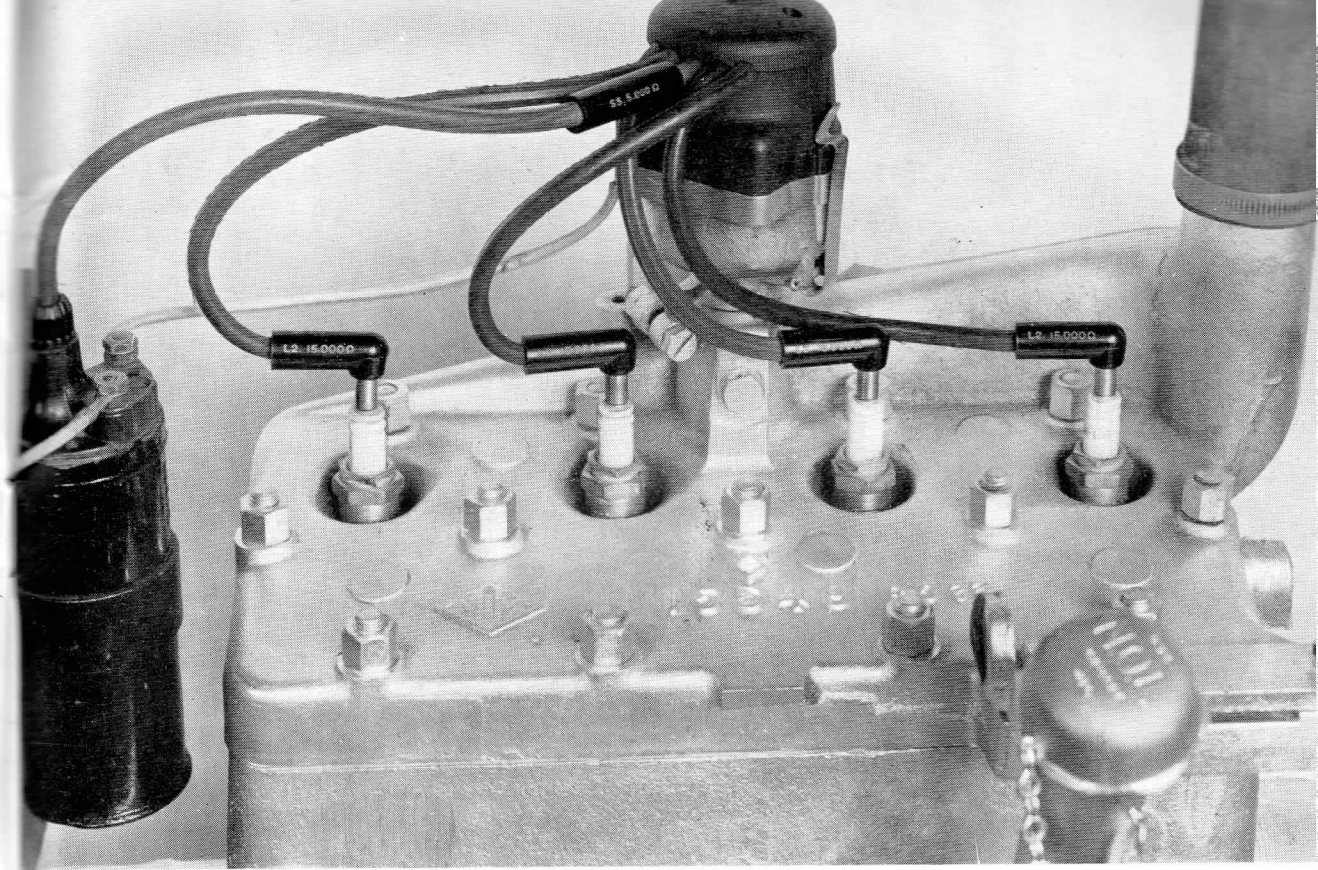


FIG. 3—MOTOR CAR ENGINE WITH SUPPRESSORS FITTED.

connecting one or more resistors in the high-voltage ignition leads, to “damp out” oscillation. In many cases, one resistor is adequate, though some vehicles require more. Five are shown fitted to the engine in Figure 3.

Personal Matters

The radio interference I.O. is something of a “lone wolf” among the staff, practically all of his work being carried out away from Post Office premises, in the open air and in premises of complainants and owners of “suspected” apparatus. Technically also, the I.O. is comparatively isolated; he may be the only Post Office man in his headquarters town to be employed on radio duties. His work brings him into intimate daily contact with the public and he has to be at one and the same time a technician, sleuth and diplomat. The qualities required of a good I.O. are therefore somewhat different from those required of the majority of engineering staff. The main requirements are that the I.O. should be self-reliant and

able to “get on well” with complainants and plant-owners, and that he should have an adequate technical knowledge and “flair” for locating sources of interference.

Interference of considerable duration, which is sufficiently obliging to be present during the I.O.’s visit, is not particularly difficult to localise and suppression is usually straightforward. Interference of intermittent occurrence and short duration is another matter entirely, and it is here that the “natural” investigator, whose instinct and past experience are used to reinforce the process of observation and deduction, has a chance to excel: does the interference occur only after dark?—on early-closing days?—when the weather is wet—or dry—or hot—or cold?—when there is a strong wind? All such factors not only can and do come into play, but to the knowledgeable I.O. they may give a valuable clue to the probable nature of the source of the interference, and hence to the type of premises on which it is most likely to be found. Not all intermittent interference is accompanied by



FIG. 4—INVESTIGATION OFFICERS TRACING INTERFERENCE WITH DIRECTION-FINDING EQUIPMENT.

such pointers, however: imagine, for example, the feeling of hopelessness which must pervade the I.O. shown in Figure 5, who is seeking, among a large collection of high voltage electrical plant, for one loose connection or corroded joint which he believes to be the cause of widespread interference with television reception. The work undoubtedly has its attractions, though, and few members of the radio interference staff would willingly change to other duties. The extreme variety of work encountered is alone a constant source of interest; the man who is dealing one day with interference at a power station may encounter, in consecutive jobs, interference from a small electric shaver in a home, the lift in a block of flats, the neon signs outside the local cinema, and so on.

Nor are pathos and humour entirely absent. Dealing with the lighter side, the listener who

thinks the soil in the flower-pot indoors to be a satisfactory earth for the radio set exists not merely in the imagination of a music-hall artist: he is encountered in real life from time to time.

Perhaps the most curious incident the writer has heard of recently is the "barking-dog" case, for details of which he is indebted to the Coventry radio staff.

As the story runs, several residents in a village near Coventry were troubled by dog-barks, which were heard via the loud-speakers of their radio sets, and one of the affected residents registered a complaint with the G.P.O. The experiences of the local radio staff were decidedly out of the ordinary. One listener visited asserted that she heard the dog-barks on her radio set. No set was visible and it transpired that the loud-speaker was embedded in a wall that had just been re-papered. It was also learnt that when a certain handbell was rung, the

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ringing could be heard in radio sets nearby. The local electricity distribution is overhead, and the radio staff found that crackling noises could be heard in a portable receiver in the vicinity of the power line. This suggested a defect in the line or in a consumer's installation connected to it. While tracing along the line, the I.O. heard barking on his portable receiver and traced it to a shed at the side of a house, where the dog was barking furiously. Investigations in the immediate vicinity led to an electric pump-motor, the earth wire of which had broken away from the frame of the motor and lay loosely across it. Evidently the loose contact functioned as a microphone and sound occurring in the vicinity modulated the radio-frequency currents induced in the overhead wiring by the local broadcast transmission. Subsequent re-radiation could account for the usual type of interference. The trouble disappeared when the earth wire was properly connected.

FIG. 5—SEEKING THE SOURCE OF INTERFERENCE IN AN E.H.T. SUB-STATION.

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