Station Interference Overcome

ONE of the greatest radio problems at present facing broadcasting authorities in America and on the Continent is that of overcrowding of the ether. In the broadcast band only 90 or 100 channels are available for radio stations, and yet in the United States alone there are over 600 stations operating. The apparent anomaly of the last statement is explained when it is realised that many of these stations—in one case over 50—operate on the same frequency.

These are of course as geographically remote from one another as possible, yet imagine the resulting babel from the speaker of a sensitive set situated in the centre of such a group of transmitters. This, briefly, was the serious problem facing the American Federal Radio Commission a short time ago.

And then preliminary announcements were made in the English daily press concerning a new and sensational invention called the "Stenode Radiostat." Imagine a system of reception which enables over a thousand stations to operate on a band where previously one hundred was the recognised limit. This was the claim made by Dr. James Robinson, M.B.E., Ph.D., a noted English scientist and radio engineer.

Successful Demonstrations.

IF Dr. Robinson's invention would truly allow the multiplication of possible transmissions by even two, then the word "revolutionary" could be applied without exaggeration, and the commercial importance of the invention would be immense. Dr. Robinson and his associates, however, claimed more than this; they said that under their system there was theoretically almost no limit to the multiplication of stations, and a multiplication of ten or even twenty would be comparatively simple.

No wonder the scientific world was full of doubt and was inclined to suspend judgment until a further demonstration and a disclosure of the technique could be given.

Such a disclosure and demonstration have now very effectively been given, both in England and America, and radio engineers are unanimous in their agreement with the somewhat startling claims made.

In the following extract from "Radio News" Dr. Robinson himself explains the working of his invention, and discusses the various difficulties which had to be overcome before success was achieved.

The Inventor Explains.

"IT has often been said that in order to solve a problem the best way is first of all to define that problem clearly. Just what did we want to do? Obviously we had to clear the ether and make room for more stations.

"The main reason why, for example, a minimum space of 10 kilocycles was laid down as the minimum separation between broadcasting stations, was that according to the side-band theory

In a recent number of the "Record" advance particulars of a revolutionary radio invention, the Stenode Radiostat, were given. This set was designed to relieve the serious congestion of the ether in America and Europe—a condition of affairs which happily will not obtain for many years in New Zealand. Nevertheless, we believe the majority of our readers will be interested in the inventor's own explanation of the working of his new apparatus, and in his discussion of the difficulties encountered during its evolution.

a station modulated by frequencies up to 5000 cycles automatically produced wave lengths which had to be received up to 5000 cycles of each side band carrier. It is, of course, essential that the receiver should go as far as possible and faithfully copy all the sounds impressed upon the broadcast transmitter microphone.

In order to get any selectivity, the phenomenon of resonance or tuning had to be recognised. If we made our receivers too sharp then we received the carrier wave and practically nothing on the side waves. At the same time, the quality was thoroughly bad, high notes being cut off and music and speech made unrecognisable. It was considered necessary that the resonance curve of the receiver should be sufficiently wide to embrace all of the side-bands without appreciable loss, and receivers which we made flat enough in tuning to embrace all these side-bands inevitably received some of those of the next channel.

"This was particularly the case when the strength of the station on the next channel was of a high order, or to put it more simply, when we wanted to receive a comparatively weak transmission through the interference of a local station but one channel away, the interference from the local station was then noticeably present.

"The fact that the cutting of the side bands was accompanied by a sacrifice of quality led everyone to believe that this was a case of cause and effect, and one of my first important discoveries was that a loss of quality was due to an entirely different cause.

"A thorough mathematical investigation of the principles of modulation, of the form of the modulated wave transmitted and of its effect on receiving circuits of various degrees of damping, gave me my first clue to the Stenode Radiostat. I soon realised that no matter how selective the receiver may be, it can be made to reproduce faithfully all the modulation frequencies impressed upon the transmitting microphone.

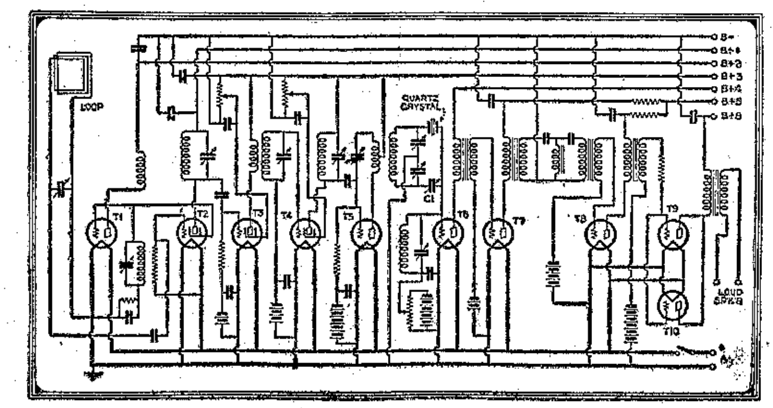
Laboratory Research.

"THE next step was to prepare in the laboratory, experimental apparatus to give a degree of sharpness of tuning hitherto considered useless.

"My theory, at this point, had developed far enough for me to see that we could cut off all the side bands, leaving only the carrier frequency without loss of any modulation frequency. The quartz crystal resonator at once suggested itself as almost the ideal sharply-tuned circuit, for a properly prepared quartz crystal will resonate freely at one frequency, and scarcely at all on the frequencies more than two cycles on either side, even on such high frequencies as are used on the broadcast band.

"A receiver made up in this way with a quartz crystal ground accurately to the frequency of a broadcast transmission gave reproduction so bad that it was useless in any form of reception of speech or music, and the result would appear to confirm the deductions from the side band theory.

"I know, however, that the reason for this bad quality was that the frequencies in the audio spectrum were being disproportionately magnified, and we could say that if all frequencies from 100 to 5000 were impressed at equal strength upon the transmitting microphone, the output from our



highly selective receiver would be expressed as inversely proportional to frequency.

"Thus notes of 100-cycle frequency were twice as strong as those of 200 cycles, those in turn being twice as strong as notes of 400 cycles and so on. It then remained to design a special audio frequency amplifier having a characteristic curve directly proportional to frequency, notes at 200 cycles being magnified twice as much as those of 100, and so on. In this way the overall response curve of the receiver could be made substantially uniform over the whole scale, giving first-class quality without sacrifice of the abnormal selectivity which characterised the radio frequency portion.

Designing the Tuning Circuit.

"EARLY in the article I indicated that according to the theoretical views held by practically all scientists, the resonance curve of a receiver must embrace all of the side-band frequencies if proper quality is to be obtained, also indicating that my own theory had shown this reasoning to be fallacious. Let us now consider for a moment exactly what happens in a circuit of a very low impedance, one that is tuned so sharply that hitherto it has been considered useless for radio telephone communication.

"Let us imagine, for example, that a pure note of 1000 cycles is played in front of a broadcast station microphone. This note causes a rising and falling in amplitude of the carrier wave 1000 times a second, and we say that the carrier is modulated at this frequency. When the signal is picked up in a receiver tuned to the particular transmission, a resonance effect takes place and we have, roughly speaking (considering a carrier frequency of a million) 1000 radio waves to each rise and fall. If we impress upon the microphone a note of 2000, then we have only 500 waves for each rise and fall, similarly a note of 4000 will have 250 waves, and so on.

"Now the intensity of current which the signal will build up in a sharply resonant circuit is a function of the number of waves impressed upon the receiver. You will see that in each pulsation note of 1000 you have twice as many waves for resonance purposes as you have in the note of 2000, therefore, the built-up signal will be roughly twice as strong. Carry this reasoning through all the frequencies in the audio spectrum and you will see very easily that the reproduction of frequencies in a very sharply tuned circuit is, as I have pointed out early in this article, inversely proportional to frequency.

"So far, of course, we have not found the ideal sharply tuned circuit, which would be a circuit that would respond easily to one frequency to the total exclusion of all others. Even the quartz crystal falls considerably short of this ideal. At the same time the commercial application of such a circuit would be impractical because we would pass through the station so easily when tuning as to miss it altogether.

"The present Stenode circuits have been worked out to be a practical com-