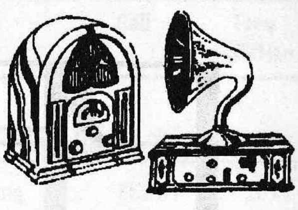
Vintage Radio



by PETER LANKSHEAR

Doctor Robinson's 'Stenode Radiostat'

By 1929, the popularity of radio was already such that in both Europe and the USA, the broadcast band had become very congested. Heterodyne whistles, 'monkey chatter' and general interference were rife. The problem was compounded by the relative lack of selectivity of the majority of domestic receivers, which were typically TRF's with only a few tuned circuits. Dr James Robinson decided to do something about it.

Late in 1929, one of Britain's highly respected radio physicists, Dr James Robinson MBE DSc MIEE FInstP produced a design for a receiver he called the 'Stenode Radiostat', which he claimed would solve the interference problem by receiving AM transmissions without involving sidebands. After a short period of considerable interest, the Stenode (meaning narrow path) was discredited and quietly disappeared, but it did contribute one important development in communications receiver design.

Born in 1884, Dr Robinson had an impressive career. He was appointed lecturer in physics at Durham University 1906-7, Sheffield University, 1910-12 and at East London University, 1912-15.

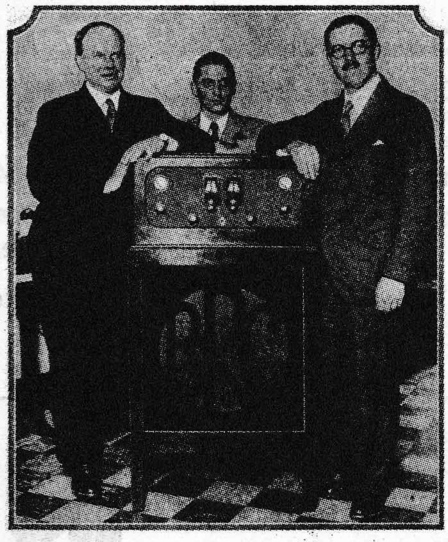
In 1920 he became chief experimental officer at the Instrument Design Establishment, Biggin Hill and then, in 1922 Chief of the Department for Wireless at the Royal Aircraft establishment, Farnborough. He received wide recognition for his invention of the Robinson Direction Finding system, whereby it was possible, by the use of an auxiliary loop, to read a signal when nulling during direction locating. In conventional DF systems the signal disappeared when the null point indicated the exact bearing, an operational inconvenience.

The Stenode

Following an article in the December 1929 edition of Britain's *Wireless World*, a leading American magazine *Radio News* became of aware of Robinson's new receiver theories. If the claims were true, the implications of potential spectrum savings were of enormous significance. *Radio News* therefore commissioned one of Britian's foremost radio writers, W.T. Cocking to investigate the Stenode, and his report was featured in the October 1930 edition.

In his typically lucid style, Cocking covered some basic modulation theory. He explained that with amplitude modulation, a carrier of 1MHz modulated with a note of 1kHz is said to consist of a carrier of constant amplitude with two sideband frequencies, each of constant amplitude, and having frequencies of 1001kHz and 999kHz. Normal receiver design assumes that the presence of these sidebands is needed for proper operation.

There is another way of visualising a modulated carrier, and this is used when visualising the operation of an AM detector. A modulated carrier may be considered as having a constant frequency, the amplitude of which is varying at the modulation frequency.



The Stenode Comes to America

Under the Auspices of RADIO NEWS

THE first demonstration and explanation of the working principle of the Stenode Radiostat, the invention of Dr. James Robinson of England, was given at Washington recently before a distinguished body of the country's leading radio engineers, including those of the Federal Radio Commission, the Army, Navy and private individuals. Above are shown, from left to right: Dr. James Robinson, inventor of the Stenode Radiostat; Arthur H. Lynch, Editor of RADIO NEWS, and Percy Harris, Chief Engineer of the British Radiostat Corporation.

Fig.1: This full page feature photograph appeared in the January 1931 issue of 'Radio News' at the height of the Stenode campaign.

It is obvious that the higher the modulation frequency, the more rapidly is the carrier amplitude varying. Consequently, in order to prevent reduction of high modulation frequencies, it is necessary to design the receiver tuned circuits to allow the current through them to change at least as rapidly as the carrier amplitude is changing. If the circuits do not allow this rapidity of change, the strength of the higher modulation frequencies will be reduced.

The outcome of this is that tuning circuits constants are the same regardless of whichever approach to modulation theory is used. In fact, it can be shown that the two theories are merely alternative ways of looking at the same problem.

With conventional receivers, the bandwidth necessary to respond to AM signals means that transmissions must be separated by 9 or 10 kilohertz to keep mutual interference acceptably low.

Sidebands unnecessary!

Cocking's report described how, at Dr Robinson's British Radiostat Laboratory, he was shown a revolutionary receiver having extremely sharp tuning selectivity. The basic receiver was a state of the art superheterodyne, but with the addition of a quartz crystal filter in the output of the IF amplifier, giving a claimed bandwidth of only 50Hz.

Such extreme selectivity was acknowledged to be unusable with normal AM transmissions as it would, as we have seen, effectively remove all modulation above a few hertz. But this was reported to be compensated for by an audio filter

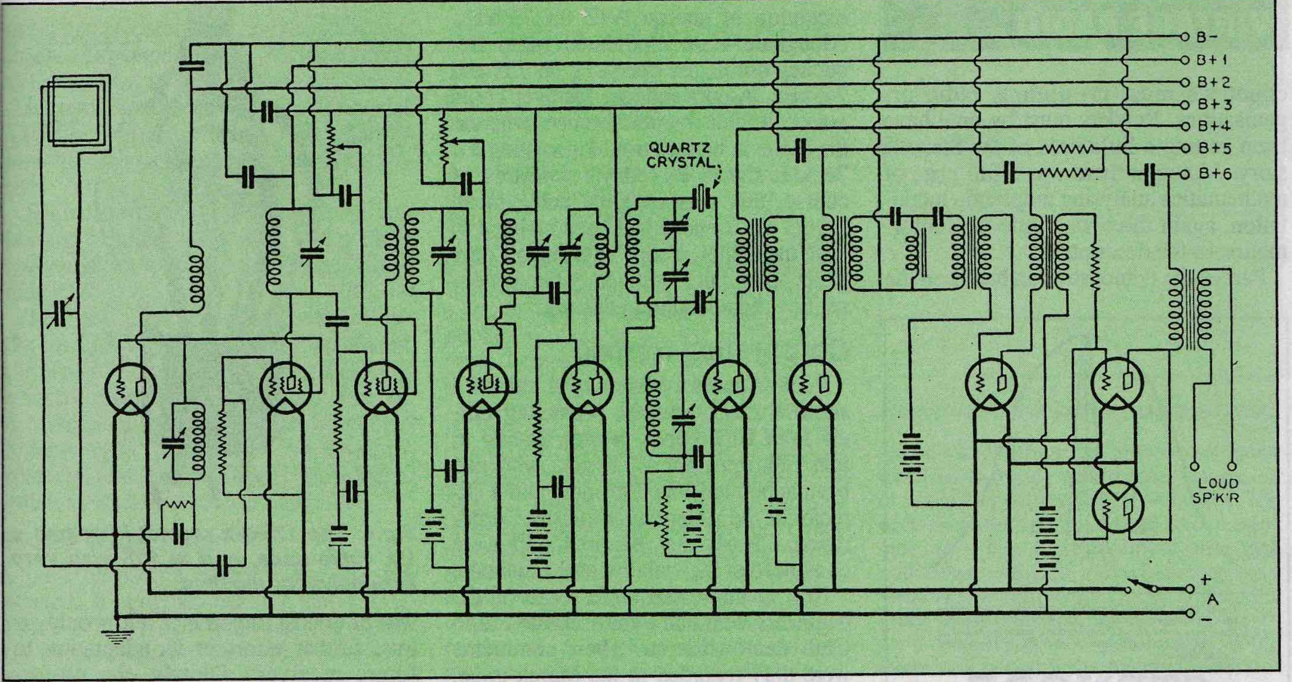


Fig.2: Although clearly simplified, this diagram shows that the prototype Stenode was based on a typical late-1920's superhet. The triode at far left is the local oscillator, whose output is fed to the adjacent tetrode mixer along with the signal from the loop aerial. Then follow three IF stages, with the innovative crystal filter just before the detector.

with a sharply rising audio response. By having an inverse of the IF response, this filter should restore normal fidelity.

Dr Robinson maintained that his 'super selective' receiver would respond only to carrier amplitude variations and that interference from adjacent transmissions would be eliminated. In fact, he claimed that the Stenode system would permit carrier spacings as close as 1kHz. The benefits in a crowded spectrum were obvious.

The Cocking article concluded by reporting that demonstrations had confirmed the prototype receiver was extremely selective, to the extent that tuning was critical, but that more development was required.

Million dollar idea

The editorial staff of *Radio News* were clearly impressed. Although the November 1930 issue had a major event in the release announcement of the landmark RCA model 80 superheterodyne, the editorial, entitled 'A Million Dollar Idea' gave enthusiastic support to the Stenode. Events had moved quickly, and a team from the British Radiostat Company was preparing to travel to America to demonstrate the Stenode.

The leading article was also about the Stenode. This time A. Dinsdale, the editor of the magazine *Science and Invention*, described at considerable length the Stenode theory, but introduced little that had not been covered previously by Cocking. Boundless possibilities for the future development of television were foreseen, but significantly, his assessment did not coincide exactly with the editorial opinion. His concluding paragraph was significant:

There is no hope of the Stenode coming on to the market for broadcasting purposes in the immediate future, however. Radio broadcasting is only one of the many users to which the ether is put; the entire field of radio communication is very much broader, and to begin with, Dr Robinson is concentrating on the adaptation of his receiver for commercial point-to-point services in order to speed up communication. The British Radiostat Corporation does not intend to manufacture or sell apparatus itself, but will license others to do so. Meanwhile, research work is being continued with a view to simplifying the receiver.

Engineering reaction

Radio News for December 1930 confined its Stenode material to comment from several leading American authorities. McMurdo Silver was cautious. In his opinion, Cocking's article did nothing to discredit current sideband theory, and he ascribed the acceptable fidelity of the Stenode to listener tolerance, pointing out that good adjacent channel selectivity could be achieved by conventional circuit design at much lower cost.

Howard Rhodes of Electron Research Laboratories was rightly sceptical of the ability of the audio filter to restore audio fidelity with 60dB of sideband attenuation, while Hammarlund's chief designer D.K. Oram made the valid criticisms that the Stenode was vulnerable to cross modulation and that it was impracticable to revise the frequency allocations of the broadcast frequency band, because they had still to cater for the millions of conventional receivers already in use. National's James Millen looked forward to a demonstration, while L.M. Hull of Radio Frequency Laboratories was critical of the lack of any quantitative data, essential for any real evaluation.

In the January 1931 *Radio News* editorial, Arthur H. Lynch was ecstatic. 'Venit, Vidit, Vicit' were the exultant headlines. Dr Robinson had arrived in America. Demonstrations to industry and government leaders and scientists in Washington and Chicago were reported to be a triumph. Lynch went so far as to state that the Stenode was the most important single communications invention since Morse invented the telegraph!

A feature article provided yet another description of the Stenode receiver, this time by Dr Robinson himself but again with little new information.

The February issue carried the text and a report of Dr Robinson's lecture and demonstration at Columbia University to the Radio Club of America, one of the country's most prestigious radio organisations. Readers must by now have been getting a little tired of the Stenode story. Although there was a full page of mathematics analysing amplitude modulation, again there was little new information in the description.

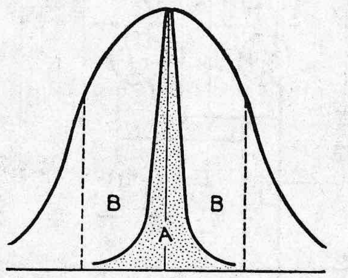
Part of the demonstration had been the reception of station WJZ on 760kHz. Alongside were modulated radio frequency oscillators operating on 755 and 765kHz. A conventional receiver could not cope with the interference, whereas the Stenode had no trouble isolating the 760kHz signal. By today's standards, of course, this was no great achievment. Earlier the Stenode had been claimed to have the ability to cope with signals only 1kHz apart, but significantly the demonstration did not attempt this test.

Corporation formed

Radio News for March 1931 carried a surprise announcement. Managing Editor John B. Brennan Jr was leaving to join Editor Arthur H. Lynch, who had been appointed Vice President and a Director of the American Radiostat Corporation. Clearly the editorial staff were convinced of the viability of the Stenode.

Not so impressed were some of the engineers who had witnessed the Radio Club demonstration. Their comments were duly recorded in the March issue. J.G. Aceves pointed out with suitable mathematical analysis that a simple electrical network could not compensate for the extreme high note attenuation of a crystal filter. He went on to say that he was a trained organist and his ears told him that the reproduction of the Stenode receiver was severely attenuated below 200Hz and above 2kHz.

An interesting and lengthy contribution came from the chairman of the Radio Club debate. L.C.F. Horle regretted his inability to comment at the time of the demonstration, but he confessed that he had difficulty in following Dr Robinson's explanation and that the demonstration did not convince him of the validity of the claims. Prophetically, he considered that the crystal IF filter was of utmost importance and would attract further effort in its adaptation to future receivers. Clearly, the professional engineers were not as wholeheartedly convinced as had been the *Radio News* editorial staff.



Inner curve shows Stenode's selectivity, outer curve that of ordinary receiver. Lines BB are 5 k. c. distant from Line A. All background noise included in the light portion between A and BB is eliminated by the Stenode.

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Fig.3 (left): One of Arthur Lynch's initial advertisements in the July 1931 issue of 'Radio News'. Fig.5 above shows samples of the much smaller ads that ran from August to October.

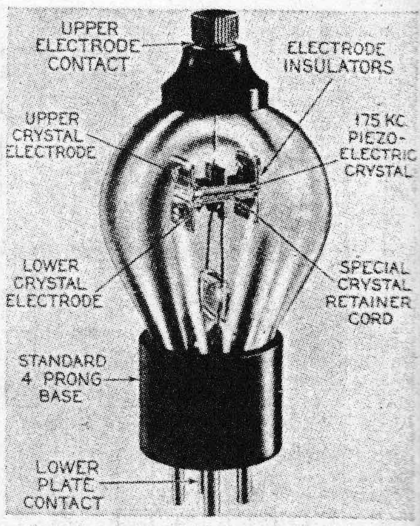


Fig.4: The 175kHz crystal filter had a UX valve base, and at $15 was very expensive for the time.

Amateur version

For the seventh successive month, *Radio News* for April 1931 featured the Stenode. In a short and final article by a member of British Radiostat, Humfrey Andrewes considered the use of the Stenode on the amateur and shortwave bands. He described how in one case reception was possible sandwiched between transmissions only 3kHz apart. Significantly there was no longer any claim to complete elimination of interference - only a considerable reduction. His emphasis was on the value of the crystal filter.

Radio News did not again feature the Stenode. The advertisement in Fig.3 appeared in July's edition. Perhaps Mr Lynch did not control American rights to a million dollar industry after all.

For the next three months, the final *Radio News* advertisements were the modest little notices in Fig.5. Gernsback's *Official Radio Sevice Manual*, published at the end of 1931, has the circuit of the American version and a full page Stenode advertisement offering nine blueprints, data and direction books for only $5. Previous purchasers who had paid $10 were offered a refund! It was pointed out that profits relied solely on royalties paid by licensees. One doubts if in fact there were any, and the Stenode Corporation seems to have disappeared after this.

Recalling his comments made in the

previous December. It is worth noting that, in September 1931, McMurdo Silver produced a design for a very selective superheterodyne receiver, the model 716-683, incorporating two sharply tuned IF stages, but without a crystal filter.

Significantly, this receiver incorporated a tuned audio filter and peaked loudspeaker response to restore tonal balance.

The last references that I can find to the Stenode appeared three years later, in the British *Wireless Magazine*, featuring constructional articles for a pair of receivers called the 'Wireless Magazine Stenode Sets', using selective IF transformers and peaked audio amplifiers, much as McMurdo Silver had done.

Not a total loss

Dr Robinson's efforts were not all wasted. It will be recalled that L.C.F. Horle of the Radio Club had suggested the incorporation of the crystal filter into selective IF systems.

The following year, James Lamb, technical editor of *QST*, pioneered the use of the crystal filter in communications receivers. Practically unchanged from Dr Robinson's design, it has remained a feature of communications receivers ever since. ■

Meyer's HD1 Monitor

(Continued from page 24)

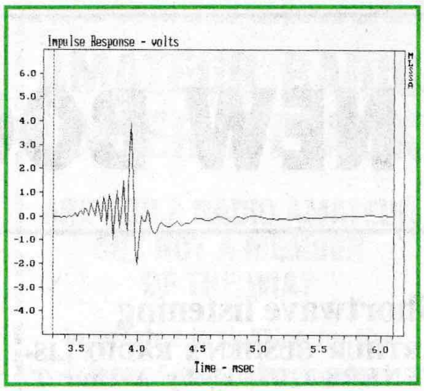
music, and few are able to cope with the lowest notes in the dynamic register of a large pipe organ like that in the Sydney Town Hall. I was pleasantly surprised by the quality and volume of sound which the HDI's produced and noted that my current monitor speakers could not better them in this regard. I did note however, that with the sustained continuous sinusoidal inputs, the cheeky little red light on the front panel tended to illuminate more frequently with the organ music than with the other music I played.

The last set of discs that I played were the first discs which I purchased from the 'Philips Complete Mozart Edition' (Volume 3, Serenades for Orchestra, Phillips 422 503-2). The music on these particular discs is played by the Academy of St Martin in the Fields, conducted by Sir Neville Marriner. Although I'm a lover of Mozart's music, much of the music is new to me.

The Meyer HD1's, reproduced this music with a delightful delicacy, even at listening levels in excess of 100dB(A). I will have more to say about Mozart's music in future reviews, but suffice it to say that the HD1's provided a superior level of classical reproduction than I would have expected, based solely on my objective laboratory assessments.

The Meyer HD1's are not everyone's cup of tea. Although visually suited for a sound monitoring suite, or a control room, I believe that they would tend to look out of place in most residential situations. The only exceptions to this would be in a book case, or if they were mounted on a wall with other hardware with which they were visually compatible. In a recording studio, I have no doubt that they would ably perform their task, and potentially would even look better, if the nagging questions in my mind relating to monitoring equalisation distance can be resolved.

The HD1's measure 415 x 305 x 423mm, and each weigh 23.5kg. Recommended price is $5898 per pair, plus tax if applicable. Further information is available from Audio & Recording, 36 Daphne St, Botany 2019; phone (02) 666 9935. ■



Results of the impulse response test.