SOCIETIES' PROCEEDINGS

ROYAL SOCIETY OF MEDICINE—SECTION OF OTOLOGY.

President—Dr J. KERR LOVE.

June 6, 1925.

DISCUSSION ON ARTIFICIAL AIDS TO HEARING.

Dr J. KERR LOVE (President) said he had written to Dr Jones of Los Angeles, whom he saw two years ago and who was much interested in this subject, asking for a wiring chart of the amplifier set which Dr Jones brought forward chiefly as a test, but also to a large extent as the most advanced form of electrical aid to hearing.* The diagram had come by air mail five minutes before he (the speaker) had left Glasgow to come to this meeting. He would be glad to supply members with a copy in due course.

Mr J. F. O'MALLEY said that aids to hearing were divided into two classes, mechanical and electrical.

Mechanical aids were in the form of tubes, trumpets, auricles, resonators, etc., these being made in various shapes and sizes in order to give the desired help to deaf persons. They were constructed from various materials such as ebonite, non-inflammable "imitation tortoiseshell" and metal, usually brass. Each of these materials had a different effect on the quality of the sound received, ebonite being the least resonant.

The size of the opening which received the sound waves, the length of the conveying medium to the ear and the material of which the instrument was made were important features in obtaining the desired results. If these could be obtained from a mechanical aid it was to be preferred to an electrical aid, as the tone was more natural and the initial cost less; there was no cost of maintenance and the instruments gave no trouble.

Electrical aids always consisted of three parts, a battery, a receiver, and a transmitter, these being connected by a cord or cords in various ways and made up in different forms. The principle on which an electrical instrument acted was as follows: The sound waves struck the transmitter diaphragm where they were converted into electrical waves by the varying pressure of the diaphragm on a number of hollow carbon balls or granules. The electrical waves were transmitted by the wires to the receiver, where they were reconverted into sound waves by means of the current produced by the transmitter varying the magnetism in the pole pieces of a permanent magnet. This was done by winding coils of wire on pole pieces suitably connected. The varying magnetism moved the soft iron diaphragm, thus producing sound waves. The pitch of any sound received by the transmitter might be altered by the relationship between the diameter of the transmitter and the receiver diaphragms, this being an important factor in

* *Monatsc. f. Ohren.*, year 44, No. 5.

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accommodating various types of deafness. The volume of sound produced was varied to suit the case under test by altering the distance between the diaphragm and pole pieces in the receiver, thus making the voice as clear and natural as possible; if this distance was known it could be recorded, and thus the instrument, if damaged, could be readjusted without a personal visit.

The different wave forms given by these instruments were very noticeable. The oscillograph showed that the instruments chiefly used for the very deaf were those which gave a wave form most *unlike* the telephone of commerce or human speech, which probably explained why many patients easily tired of an electrical aid. The oscillograph was a very delicate instrument used to take photographs of the wave form in an electric circuit, and was most useful in studying instruments for the deaf.

Thermionic Valve Instruments were useful in extreme cases of middle ear deafness. It was generally found that the chief objections to them were: the weight, the initial cost, the cost of upkeep and the bulkiness of the instruments. His experience had been that if persons could carry on ordinary conversation with an instrument which could be worn on the clothes, they would decide on the smaller instrument on account of its portability and cost, although the results obtained from a thermionic valve instrument might be decidedly better.

Full details of the person's deafness should be supplied, and preferably by an aural surgeon, before a test. When these details were obtained it was possible to eliminate a number of instruments, thus making the test shorter. This was an important factor, as in some cases the ear tired quickly when tested, and thus gave unreliable results. In some cases, if the person became tired, it was better to defer the test.

It was necessary in fitting aids that the weakest instrument should be tried first and care taken to increase the strength gradually.

A trial of all instruments should be made at home, as it was impossible for a person to decide in a consulting room which kind of aid was most suitable, as the room might not have the same general acoustic properties as the ordinary living room.

Mr W. M. MOLLISON said that he himself made little use of these aids, sending the patients who wanted them to an electrical expert. He had, therefore, only a few words to say about his experience of patients who used them.

Those with high degrees of middle-ear deafness, and those with otosclerosis were almost always helped by some form of electrical instrument. Patients suffering from internal ear deafness, with shortened bone conduction, were occasionally assisted by such instruments. He had found one useful test to guide him roughly, in advising patients, and that was to ascertain by the monochord test the highest pitch which they could hear through the bone. Many patients could not hear the monochord at 30 to 40 cm. through air, but heard it well 16 to 18 cm. through the bone. The little cornets worn under the hair were very useful in these cases.

Mr HERBERT TILLEY said that he had been struck by the fact that many patients with large perforations had not been tested by their aural surgeon as to the possibility of relieving the deafness by means of some

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form of "artificial drum." In many of these cases a very marked improvement in hearing could be brought about by this type of "aid."

He (the speaker) was in the habit of employing a small piece of wool soaked in liquid paraffin. The patients were taught how to insert the wool with suitable forceps, and they often learnt to place it in a position which gave the maximum improvement of hearing. He did not advise the use of the gutta-percha disc, because it became foul and septic. Neither did he like the long wick. He assumed the patient to be tolerant, and to have a fairly large perforation. He (the speaker) had even enlarged a perforation so that a more effective application of the "drum" could be ensured.

Mr A. R. TWEEDIE said that Bárány had alluded to this method ten years ago in connection with his theory of the aerial conduction of sound. Bárány considered that the conducting function was independent of the tympanic membrane, and that aerial vibrations reacted to the foramen ovale and by way of the helicotrema to the round window. He regarded this as dependent on incursions of the oval window membrane with corresponding excursions of the round window membrane.

The beneficial effect of the application of liquid paraffin to the middle ear, presupposed a tolerant middle ear. The essential point in its use was the occlusion of the fossula rotunda with a droplet of liquid paraffin (or some other inert fluid, such as mercury) by tilting the head slightly backwards after its instillation. In this position, the paraffin took the place of the droplet of mucus which normally occupied this situation, and tended to protect the round window from the direct action of the aerial vibrations.

Dr KERR LOVE (President) said that the state of our knowledge in regard to chronic non-suppurative diseases of the middle ear was one of the reproaches of otology. During the last thirty years great advances had been made in the surgery of the ear, but little or none could be registered in the treatment of this middle-ear condition.

Electrical aids were very expensive ; eighteen guineas was the amount paid for an instrument which in a few weeks was abandoned. And further, these instruments were very uncertain ; one could not predict that they would certainly be of value in a particular case. Moreover, the patient was ready to accept the fact that the production of increased loudness was a proof that continuous use would make him distinguish sounds better. But there were two reasons why this was not the case. The first was, that the human voice was a compound sound, and no instrument, so far, intensified the voice equally over its whole range. It was in this direction that he (the speaker) thought success would ultimately be reached ; it had already been partially attained by the Western Electrical Company of New York, whose instrument was on the principle of the Audio-amplifier. The men who had done the best work in this sphere were Dr Isaac Jones, of Los Angeles, and Professor Knudsen, a physicist. They had used two valves for the Audio-amplifier, and they were apparently able to amplify high and low tones at will. In the middle-ear type of deafness the difficulty was to increase the value of the low tones without increasing that of the high, and *vice versâ*. Seventy children in the Glasgow school for the partially deaf were subjected to tests with an electrical aid and the teachers were disappointed with the result ; they spent three weeks in carrying out the tests.

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Professor Knudsen had said:—"Our experience with hard-of-hearing patients indicates that selective amplification does not fulfil our initial high anticipations. It is possible that through a process of adaptation, the individual has become accustomed to associating various images of his real world in terms of the distorted sounds he has perceived. Therefore when selective amplification is provided to restore his hearing to the normal or approximately normal condition, these sounds really seem distorted to the individual."

And this brought him (the speaker) to the second reason of failure, a reason differing from that given by Professor Knudsen, viz., that chronic deafness was often of mixed type, the internal ear becoming involved after the middle ear, so that amplification of the part of the scale selected did not always give the expected result.

He (the speaker) agreed with Mr O'Malley that there was no more efficient instrument, to date, than the hearing tube. Otologists should try to protect their patients from having instruments given to them without the chance of trying them to see if they suited their case.

With regard to rubber discs, he (the speaker) had sometimes found them useful, but now and then they were liable to set up discharge in a dry ear.

In all these discussions, the importance of lip-reading must never be forgotten.

Mr SYDNEY SCOTT said that a number of years ago a committee had been appointed to investigate the various projected aids to hearing, and of that body he believed Dr Kelson and the late Mr Hunter Tod were members, while the late Frederick Womack was physicist. They investigated the instruments put forward by Hawksley, including the acousticon. At that time they could not, of course, examine the Marconi instrument, though some members had since done so.

The committee had found that, as a rule, certain cases of middle-ear deafness of the form classed "otosclerosis" were benefited by electrical aids; but patients with senile deafness, who could hear low tones, but could not clearly analyse voice sounds, and had lost high tone perception, heard better with a plain speaking tube. Mr Cheatle had pointed out that it was the person who heard best in a noise who was benefited by the acousticon. He (the speaker) had never met with a case of a child whose hearing had been improved by the use of the acousticon; it had never seemed worth while to buy an instrument for a child suffering from middle-ear deafness.

With regard to Mr Tilley's suggestion relating to the insertion of paraffin-soaked wool into a perforation in a middle ear case, he (the speaker) had been struck by the frequency with which suppuration was thus set up. There was some danger of active suppuration being caused by the foreign body when the ear had become dry. Wool, as an aid to hearing, could be used when there was no perforation at all, namely, when there was a relaxed drumhead, especially if the right quantity of wool was used. Patients came once a fortnight to have the drum inflated and, after inserting such a plug, they had not needed advice or help for three or four months, while their friends had noticed remarkable improvement in their hearing. In some cases pressure had to be applied to the

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stapedial region, in others to the region of the fenestra rotunda, and in one case a false drum had to be inserted in front of the malleus.

Sir JAMES DUNDAS-GRANT said that, if possible, in the first instance one should try mechanical rather than electrical apparatus, though from the point of view of elegance the electrical devices were to be preferred, and it was to be hoped there would be still greater improvements in them. Many patients derived much satisfaction from wearing small electrical apparatus, but many came back to the mechanical forms. He had found the "banjo-shaped" instrument the most acceptable; it was flat, and its tube could be shortened, while it could be carried easily in the pocket.

Tubes for conversation varied enormously. Some were made of flexible material and of almost uniform bore; but they should be gently tapering, and the more distinct and uniform the tapering, the better the result. He (the speaker) endorsed Mr Mollison's remarks about artificial auricles and quoted the case of a teacher who, more than twenty years ago, had had these auricles supplied and since then had been able to maintain herself by her profession; whereas without them she could not have done so.

He (the speaker) referred to a Scandinavian report of 368 patients on whom apparatuses for improving the hearing were tested. Of those with middle-ear deafness a small number derived no benefit, but 5 per cent. obtained most help from hearing tubes, 44 per cent. received most assistance from trumpets, and 45 per cent. from electrical apparatus. Of otosclerosis cases, 4 per cent. had most help from hearing tubes, 46 per cent. preferred trumpets, 40 per cent. electrical apparatus, and 10 per cent. were unbenefited. Of those with internal ear deafness, 15 per cent. received most help from hearing tubes, 52 from trumpets, and 19 per cent. from electrical apparatus. For old age deafness, trumpets and tubes were found most effective. Therefore the Scandinavian figures went to confirm our experience in England.

He (the speaker) thought the cotton-wool plug had deserved its name of "artificial drum." He believed its use originated with the late James Yearsley. It was an invaluable aid, and he (Sir James) had been taught to use it by Laidlaw Purves, who strongly recommended it both for cases of perforation and relaxed membrane. He (the speaker) found it very satisfactory when moistened with parolein containing a little menthol. When it was applied in suitable cases, he had not seen suppuration restarted by it, but he told patients to apply, in the intervals between wearing it, a little dilute alcohol, as that seemed to be a safeguard against inflammation. A case was sent to him from the North with the strictest injunctions not to use a drum, as one which had been applied had been lost in the ear, and there had been great difficulty in removing it. He (the speaker) did use a drum in that case, but he secured it with a thread, as indicated in his description of the "captive artificial drum." The improvement in hearing had been so great that the patient was able to move from the front to the far end of the church which he attended.

Mr F. J. CLEMINSON said that some deaf persons found a difficulty in differentiating the words in a conversation; such patients were particularly those suffering from senile deafness. He was shown by one instrument

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maker the Meyrovicz apparatus, which tended to bring about this separation of words without greatly magnifying their intensity. It was a very small box, containing a diaphragm, attached by a small portion of its circumference, the remainder being free. The instrument could be held in the hand, and was said to have the effect of clarifying the sound by aiding the user to separate the words.

He (the speaker) had used an artificial drum for one patient only, and it had been a great success. The patient had worn it daily for five years, and so far as he knew—he saw her six months ago—she had had no suppuration. The addition of a grain of menthol, or two grains of carbolic acid to the ounce of liquid paraffin, as the medium in which the cotton-wool was soaked, had seemingly prevented it.

Mr J. S. FRASER said his experience had been that long black tubes were the best for cases of nerve deafness, though it was doubtful if they gave much better hearing than was obtained by placing the curved hand behind the ear. Auricles were good in cases of otosclerosis and of cicatrised tympanum.

He agreed with the President as to the enormous prices charged by makers of electrical instruments, and in the North the makers had ceased to allow patients to take an instrument on a fortnight's trial before purchase. He spoke of this to one maker, and the reply was that "cases of deafness were very infectious" and one patient passed it on to another; so he (the speaker) ordered him out of the room. Noises of a secondary character must, he thought, interfere with the comfort of the patient.

The best instrument was one with thermionic valves, especially with the bone-conduction attachment, but it weighed 16 lbs.

Mr H. J. BANKS-DAVIS said that, a few years ago, a novel form of artificial drum had come under his notice. The patient was a University Professor and Lecturer in Law, suffering from tinnitus and Ménière's symptoms. The tympanic membrane had been destroyed and the foramen ovale was visible. When asked how he was able to carry on his coaching duties, he replied that he always wore an artificial drum, and as cotton-wool produced a discharge, he now used a conical plug of bacon-rind. On this being supplied, he quickly cut out a tapering piece about half an inch long, and adjusted it to his meatus saying, "I now hear quite well."

Mr R. GRAHAM BROWN said that in Australia there was a greater tendency to keep in touch with patients than appeared to be the case in this country. When he, as a younger man, saw these patients, he advised them to go and buy an acousticon; but he found that this procedure was bringing him a bad name. Inquiry showed that patients paid twelve to eighteen guineas for the instrument, and, failing to get satisfaction, threw it away. He presented one to a student who had a distinguished career, and after a week he came and threw it at him (the speaker). He now advised patients to go to the instrument-maker and try an instrument for a week or a fortnight, and, if it was satisfactory, to buy it. To young people his advice was definite; they should avoid aids to hearing as long as possible, because, later on, especially in the case of electrical instruments, they found they could not do without them.

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Mr LAWSON WHALE said that he had on several occasions found that persons who were deaf were made worse by electrical aids ; these patients were always suffering from tinnitus. The additional sounds perceived by the use of the machine aggravated the original tinnitus.

Mr SCOTT STEVENSON said he did not think members went far enough back in regard to electrical aids. Half a century ago, Bell discovered that the vibrating diaphragm was a good means of conveying the human voice, but he (the speaker) thought there must be a better means of conveying sound than in the microphone now employed. That was a very primitive instrument, considering how physics had advanced in the last fifty years. Instead of sending patients to those who made these things and relying on their doing the experimental work, otologists should make an attempt to re-examine the microphone as a means of conveying sound and see whether it could not be improved. He told patients that they were not likely to get more good from anything else than a hearing trumpet or a speaking tube.

Mr R. T. WORTHINGTON said the problem was not only one of the transmitter, but also of the receiver. Mechanical aids, all were agreed, were the most effective when patients could use them. He believed that, finally, there would be produced an electrical instrument which would beat all mechanical aids.

He had been using a wireless apparatus and he had occasion to test a considerable number of different kinds of loud speakers. He had a deaf patient who was anxious to use the wireless apparatus and she had about ten different loud speakers on trial ; she said there was one which surpassed all the others, the Brown, which was the most expensive kind, costing fifteen guineas. He obtained one and found that it was easily superior to two or three loud speakers which he had. He was told that it was worked with a reed, the effect of which seemed to be to raise the tone. It was not really that the pitch was raised, but there was less distortion of the upper notes. Therefore, if receivers were so improved as to secure a more natural tone, and perhaps, too, by replacing the disc with a reed, electrical apparatus might become much more efficient.

Casts of Labyrinths—ARTHUR H. CHEATLE, F.R.C.S., and V. E. NEGUS, F.R.C.S.—The casts represent the semicircular canals and cochlea in correct orientation. A frame was fixed on the skull, with two lateral pieces so placed that the lower edges corresponded to the Frankfort plane, *i.e.* the upper margin of the bony auditory meatus and the lowest point of the orbit. From uprights a cross-bar was carried, and from this a vertical support carried a small tube, the ends of which fit into each internal auditory meatus. After opening up the middle-ear spaces, including the tympanic antrum and cells, and having cemented the cross-tube in position, the frame was detached from the tube and the latter left *in situ*. Metal was then run in through the foramen ovale and foramen rotundum of one side in such a way that it ran along the small tube and into the semicircular canals and cochlea of both sides.

Mr Shaw, of the Royal Dental Hospital, did the actual casting.

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He used an alloy which consists of tin two parts, lead one part, and cadmium one part. The molten metal was run in by gravity and was assisted in its passage into the semicircular canals by exhaustion of air by means of a pump. A second frame has been constructed with pointers to correspond with the Frankfort plane on either side, and when these have been placed in position, the model of the labyrinths is held on the top of the frame on the patient's head. The model is then in the exact orientation which it occupies in the skull. The utility of the method, in the first place, shows the exact position of the internal ear for operative purposes; secondly, for demonstration purposes; and thirdly, in testing the patient's vestibular reactions. The frames used in casting and fitting on the patient's head have been made by Messrs Mayer & Phelps. Enlarged models, twice the natural size, have been made by Mr Thomas, seal engraver and medallist, 1 Great Pulteney Street, London, W. 1, and from these, casts of strong material can be made in any quantity required.

Mr NEGUS said it was difficult to get labyrinth casts together in one piece, but this had been done. It might be thought, as the cochlea was pointing inwards, the specimens were distorted, but they were correct and exactly as they came out of the skull. There would be found a different orientation of the canals in different subjects. The lateral canal in the present specimen was more horizontal than was usually imagined. The Frankfort plane was used as it was the most fixed. Sir Arthur Keith tried to use the lateral canal as a fixed plane in gibbons, but he found that the individual differences amounted to as much as 20 degrees. It was hoped to supply enlargements for teaching purposes. The models would be useful in testing the rotation and caloric reactions.

Sarcoma of Left Occipital Region simulating Mastoid Disease—W. S. SYME, M.D.—Female, aged 50, was first seen in April 1924, when she complained of deafness in left ear and dull pain behind ear, passing upwards, and down towards shoulder. There was an eczematous condition of the external auditory meatus and thickening of the tympanic membrane, with other signs of chronic adhesive processes in the middle ear. There was some tenderness over the mastoid area and over the adjacent part of the occipital bone, but no definite swelling. The temperature was normal. The tenderness was thought to be due to a subacute, superficial, inflammatory condition associated with the eczematous condition of the auditory meatus. Her tonsils were very septic and she was advised to have them removed.

She was not seen again till January 1925. She had lost weight considerably. She still complained of the dull pain behind the ear, the tenderness was more marked, and there was a definite swelling. Though the swelling was firm, it appeared softer in one part, but not

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actually fluctuating. One of three conditions seemed to be indicated: (1) chronic suppuration in mastoid cells abnormally far back, with superficial destruction of bone; (2) a gumma; and (3) new growth. The length of time was against mastoid disease, and the Wassermann reaction was negative. A general surgeon who saw the case with me inclined towards a diagnosis of mastoid disease. It was decided to explore. An incision was made over the swelling, somewhat further back than the usual mastoid incision. No pus escaped, but a mass of what appeared to be granulation tissue undergoing organisation was found. Further exposure, however, showed that we were dealing with a new growth which had extensively invaded the bone and spread to the dura mater. It was considered that further operative procedures were out of the question.

Histological examination of the mass removed proved it to be mixed-cell sarcoma.

BRITISH MEDICAL ASSOCIATION, BATH, 1925.

(*Contributed by Dr R. Scott Stevenson.*)

THE Ninety-third Annual Meeting of the British Medical Association was held at Bath, on 22nd, 23rd, and 24th July, and was attended by considerably over one thousand members of the Association. Along with their relatives and friends, they severely taxed the accommodation available in Bath and neighbourhood. The Association was unfortunate in that the President-Elect, Dr F. G. Thomson, Senior Physician to the Royal United Hospital, Bath, was laid aside by illness; his duties, however, were ably undertaken by the Honorary Local Secretary, Mr W. G. Mumford.

The Section of Laryngology and Otology, under the Presidency of Mr Arthur H. Cheatle, C.B.E., attained a notable success. For the first time it became a "three day Section," thus standing on an equality with the Sections of Medicine, Surgery, and Midwifery; while the attendance on the first day of the session eclipsed that of each of the other Sections during the Meeting.

The first session was made memorable by the brilliant address on "Overlooked Cases of Foreign Body in the Air and Food Passages," delivered by Professor Chevalier Jackson, of Philadelphia. For two hours he fascinated, by his exposition of the subject, a crowded audience numbering over two hundred. Professor Jackson said, that of the 1485 cases of foreign body that had come to his bronchoscopic clinic in the past twenty years, there were over 200 in which foreign bodies had been overlooked, for periods varying from one month to thirty-six years. A broad review of the histories of these cases revealed the outstanding fact that the non-recognition of the presence of a

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