

resistance of the conductor be not too great, it may degenerate into a low-toned imitation of speech, or with the smaller conductors which are used for city work the attenuation rapidly lowers the volume of sound until it becomes unrecognisable. Self-induction is the analogue of inertia in mechanics; therefore, if it were possible to endow the circuit in which a wave was in movement with sufficient self-induction to prevent the tailing and consequent distortion of its form, the limit of speech would be materially increased, as the attenuation due to resistance alone would have to be provided for. Now it is possible to achieve this result to a certain extent by adding artificially to the self-induction of telephone cables, technically termed loading. The ideal method would be to increase the self-induction uniformly throughout, and attempts have been made to effect this by lapping a copper conductor with thin iron wire or tape of a high magnetic permeability. Another method consists in distributing magnetic coils at uniform distances of a mile or two apart throughout the length of the line. Under these conditions the distance over which speech is possible has been increased from two and a half to three and a half times.

The British Post Office has recently laid a cable with distributed inductance between England and France which will increase the range of speech about four times as compared with a similar type of unloaded cable.

The rapid and enormous development of the telephone service that has taken place throughout the world within the last few years is a remarkable achievement of the electrical engineer. The principle of the microphone, which converts sound vibrations into electrical vibrations, and of the telephone, which re-converts the electrical into sound vibrations, are so well known that I need not dwell further on the subject than to point out that Graham Bell's telephone, as it left his hands in 1876, is essentially the same instrument, slightly improved in mechanical construction, as he gave it to the world, but all the other adjuncts of a complete telephone service have been profoundly modified, and we are not yet in sight of finality.

In the period during which the ordinary telephone equipment has undergone modifications, inventors have turned their attention to the design and perfection of an automatic telephone in which each subscriber, by a simple method of manipulation, may without the intervention of an operator at the exchange obtain direct access to any other subscriber connected with the service. One of the earliest systems of this type was known as the Strowger. Each subscriber's line terminates on a line switch which forms part of a group of 100 switches. This switch is connected by ten circuits, the equivalent of the plugs and cords in a manual board, with a series of selectors each accommodating 100 junction lines. According to the size of the exchange, there may be two or three sets of selectors connected similarly by means of junction circuits, and, finally, there is a connector, a somewhat similar instrument, which makes the connection between the two subscribers.

Each telephone has a dial with finger holes and numbers. On removing the telephone from the hook the procedure is as follows. If, say, No. 4852 is wanted, the caller inserts his finger in hole 4 and revolves the dial up to the limiting stop. This actuates the line switch, which causes a connecting plug to enter the springs of the first disengaged junction leading to the selector group of 4000. The same action follows in sequence with 8, 5, and 2, the final movement of the connector making the connection if the required subscriber is disengaged. If he be through to another a busy back signal (a vibratory current) is given. When the connection is made and the conversation is complete, the hanging up of the telephones restores the connections to the normal. This method has had considerable development amongst the independent telephone companies in America.

On the subject of the future development of telegraphs and telephones, few of those acquainted with the subject would venture to dogmatise, but certain statistics I have prepared will convey to you possibilities far more pregnant than any amount of speculation. The following figures, for the years 1902 and 1907 respectively, have been gathered from authentic returns, and they embrace information from every country of importance throughout the world:—

#### Telegraph and Telephone Statistics—Wire Mileage.

	1902	1907	Increase
<i>Telegraphs</i>			
Land wires ... ..	3,657,639	5,038,931	1,379,322
Submarine cables ... ..	212,891	239,000	46,105=21.6%
<i>Telephones</i>			
Wire ... ..	7,467,417	12,839,537	5,372,120
Subscribers' stations ... ..	3,534,036	8,406,336	4,873,330

Large figures frequently fail to impress the mind, but when it is stated that this mileage of wire will soon, if it has not by this time, equal one-third the distance from the earth to the sun, the remarkable activity of the modern telegraph and telephone service will perhaps be more forcibly realised.

#### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

**BIRMINGHAM.**—The engineering department is losing the services of Mr. F. H. Hummel, lecturer in civil engineering, who has accepted the chair of engineering at Belfast, and of Dr. J. D. Coales, lecturer in electrical engineering, who has been appointed principal of the Wolverhampton Technical School.

**CAMBRIDGE.**—The observatory syndicate, in a report to the Senate on the Huggins dome and the astrophysical building, state that the buildings now erected may be regarded as consisting of two parts, though for the sake of economy in construction they are structurally blended. The first part consists of a dome 23½ feet in diameter, together with a small room for accessory apparatus and a room for any observer who may be making use of the Huggins instruments installed in the dome. These are to be called the Huggins dome and the Huggins observer's room. The second part—the astrophysical building—comprises a computing room, which also serves as a library, and a small room appropriated to the use of the head of the department. The Huggins instruments are now ready for adjustment and use.

The Goldsmiths' Company have given 700*l.* for the equipment of the metallurgical department of the chemical laboratory.

The prize of 50*l.* out of the Gordon Wigan fund for a research in chemistry has been awarded to Mr. J. Thomas, Trinity, for experimental investigations on "The Isolation of the Aromatic Sulphinic Acids" and "The Resolution of Externally Compensated Quinoline Derivatives containing Two Asymmetric Carbon Atoms."

Mr. W. F. Penée, of the Indian Forestry Service, will deliver a course of lectures on Indian forestry during the Michaelmas term of 1910.

**OXFORD.**—The next award for the Radcliffe prize will be made in March, 1911. The prize, which is of the value of 50*l.*, is awarded by the master and fellows of University College every second year for research in any branch of medical science comprised under the following heads:—human anatomy, physiology, pharmacology, pathology, medicine, surgery, obstetrics, gynaecology, forensic medicine, hygiene. The prize is open to all graduates of the University who shall have proceeded or shall be proceeding to a medical degree in the University. Candidates must not have exceeded twelve years from the date of passing the last examination for the degree of B.A., and must not, at the date of application, be fellows on the foundation of Dr. John Radcliffe. The memoirs must be sent to the University Registry on or before December 1.

The Rolleston memorial prize, the value of which is 60*l.*, will be awarded in Easter or Trinity term, 1912. The prize is open to such members of the Universities of Oxford and Cambridge as will not have exceeded ten years from the date of their matriculation on March 31, 1912, and is to be awarded for original research in any subject comprised under the following heads:—animal and vegetable morphology, physiology and pathology, and anthropology, to be selected by the candidates themselves. Candidates wishing to compete should forward their memoirs to the registrar of the University before March 31, 1912. The memoirs should be inscribed "Rolleston Memorial Essay," and should each bear the name and address of the author. They may be printed or in manuscript, memoirs already published being admitted to the competition.

The electors have appointed Mr. Raphael Meldola, F.R.S., professor of chemistry in Finsbury Technical College, City and Guilds of London Institute, to deliver the Herbert Spencer lecture in the course of next Michaelmas term. No more appropriate selection could have been made than that of Prof. Meldola, whose wide range of scientific knowledge and interest, extending far beyond the bounds of his special subject, and whose well-known sympathy with everything which can tend to further the progress and popularise the results of physical and biological research, justify the expectation that his lecture will be of exceptional interest and value. The subject and date of the lecture will be announced later.

Mr. Selwyn Image, who has recently been elected to the Slade professorship of fine art, is well known to naturalists as a keen student and collector of the British Lepidoptera. He is a Fellow of the Entomological Society of London, and is at present serving on the council of that society.

The delegates of the common university fund propose shortly to appoint a reader in social anthropology.

At the tercentenary festival of Wadham College, held on June 23, allusion was made both by Lord Curzon and by Sir Archibald Geikie to the connection of the college with the early history of the Royal Society. The latter speaker gave it as his opinion that but for Dr. John Wilkins, the warden of Wadham, under whose auspices the Oxford meetings of "the association of certain worthy persons inquisitive in Natural Philosophy" (Walter) began about 1648 or 1649, the Royal Society might never have come into existence.

**SHEFFIELD.**—Dr. J. Robinson has been appointed junior lecturer and demonstrator in physics, and Mr. J. Miller assistant in the architectural department.

**MR. H. S. JACKSON**, research assistant in plant pathology at the Oregon Agricultural Experiment Station, has been appointed professor of botany and plant pathology in the Oregon Agricultural College.

The Speech Day of the Merchant Venturers' Technical College, Bristol, will be Friday, July 22, when Colonel F. C. Ord, C.B., the master of the Society of Merchant Venturers, will distribute the prizes.

**DR. H. S. JENNINGS**, hitherto professor of experimental zoology at the Johns Hopkins University, has been appointed professor of zoology and director of the biological laboratory of the same University, in succession to the late Prof. W. K. Brooks.

The Cleveland College of Physicians, now the medical department of Ohio Wesleyan University, is to be consolidated with the medical department of Western Reserve University at the close of the present college year. Mr. H. M. Hanna has given the sum of 50,000*l.* as an additional endowment fund for the medical department.

It is announced in *Science* that two more industrial fellowships for the investigation of the diseases of plants (making four in all) have been established in the New York State College of Agriculture. They are to be known respectively as the Herman Frasch fellowship and the John Davey fellowship. The first-named provides for the investigation of the use of dry sulphur as a fungicide both to the plants and in the soil, and the second provides for the investigation of heart-rot of trees.

A new University for Natal is, says the *Westminster Gazette*, to be opened formally in August next. It is anticipated that a large number of students will be enrolled at once. Under the South Africa Act of Union the University will come under the jurisdiction of the Union Government, while education, other than higher education, will be vested in the Provincial Council for a period of at least five years. The Act establishing the University provides that instruction shall be given in classics, literature, law, science and art, and other studies. Designs for a handsome building have been approved by the Natal Government. Already Mr. W. N. Roseveare has been appointed professor of mathematics and Mr. Bews professor of botany and geology.

The Rural Education Conference, which has been constituted by the Presidents of the Board of Agriculture and

Fisheries and the Board of Education, for the discussion of all questions connected with education in rural districts, and for the periodical exchange of views between representative agriculturists and the two departments, will be composed as follows:—Lord Moreton, Lord Barnard, the Right Hon. Lord Belper, the Right Hon. Lord Reay, G.C.S.I., G.C.I.E., the Right Hon. A. H. Dyke Acland, the Right Hon. H. Hobhouse, Sir Francis A. Channing, Bart., M.P., Sir A. K. Rollit, Major P. G. Craigie, C.B., Mr. Graham Balfour, Mr. C. Bathurst, M.P., Mr. G. A. Bellwood, Mr. J. F. Blackshaw, Mr. W. F. Brockholes, Mr. G. G. Butler, Mr. A. W. Chapman, Mr. F. J. Chittenden, Mr. S. H. Cowper-Coles, Mr. D. Davies, M.P., Major J. W. Dent, Mr. H. J. Elwes, F.R.S., Prof. W. R. Fisher, Mr. P. Hedworth Foulkes, Mr. W. J. Grant, Mr. A. D. Hall, F.R.S., Mr. W. A. Haviland, Prof. C. Bryner Jones, Mr. T. Latham, Mr. J. L. Luddington, Mr. H. Martin, Mr. E. Mathews, Rev. R. Meyer, Mr. W. Parlour, Mr. C. N. P. Phipps, Mr. J. H. Sabin, Mr. A. F. Somerville, Prof. W. Somerville, Mr. A. E. Bromehead-Soulby, Mr. C. Turnor, Mr. F. Verney, M.P., Prof. T. Winter, and Prof. T. B. Wood. The Right Hon. H. Hobhouse will act as chairman of the conference, and Mr. E. G. Howarth, of the Board of Education, and Mr. H. L. French, of the Board of Agriculture and Fisheries, will act as joint secretaries.

On May 28, at the Regent Street Polytechnic, London, Mr. Blair (education officer to the London County Council) gave an address on "The Newer Education" to the members of the Federated Associations of London Non-primary Teachers. Mr. Blair said that the adverse criticisms sometimes passed on the results of modern elementary education arise from ignorance of the progress that has really been made in this direction during the last fifty years. There is now hardly an illiterate person in the country, and, moreover, the facts that crime has decreased, that sanitary conditions have improved, that the death-rate has fallen, and that the funds of savings banks and provident societies show a steady increase, must all be attributed indirectly to the work done in elementary schools. We were in this respect far ahead of Germany. An important part of the recent work of the London County Council has been the institution of its scheme of scholarships for children fit to pass from the elementary to the secondary schools. The full development of this scheme is yet to come, for there is a distinct need that the child, leaving the secondary school at the age of sixteen and not wishing to take up elementary-school teaching, shall have some course of definite technical training. So far as wage-earning capacity is concerned, boys and girls leaving secondary schools at this age are in no better position than children leaving the elementary schools at the age of fourteen. After reading certain examiners' reports referring to the unsatisfactory work in some secondary schools, Mr. Blair stated that there is still a tendency for this work to be too academic in character, and he urged that secondary-school teachers must strive to correlate their teaching with the facts of life, and remember that upon them falls a large part of the responsibility for training the child for its future duties as a citizen of the Empire. Some statesmen consider that before long we may be called upon to meet a serious national emergency, and the way in which we shall do this will depend on the work of the teachers both in the elementary and in the secondary schools.

## SOCIETIES AND ACADEMIES.

LONDON.

**Royal Society, June 27.**—Mr. A. B. Kempe, vice-president and treasurer, in the chair.—**A. Mallock:** Damping of sound by frothy liquids. The object of the note is (1) to explain the well-known fact that a vessel which, when empty or filled with a homogeneous liquid, gives a musical note when struck, ceases to do so when the liquid contains bubbles of gas; (2) to direct attention to the fundamental difference between the damping of waves propagated through a gas containing spheres of liquid (e.g. rain or fog), and that which occurs in a liquid containing bubbles of gas. The damping of sound waves by fog has received considerable attention, and it has been shown that although