

SIXPENNY PHONOGRAPHS.

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When a great scientific discovery or invention is announced to the world, such, for example, as the telephone of Professor Graham Bell, the microphone of Professor Hughes, or the phonograph of Mr. Edison, it is pretty certain in a short time to be followed first by spurious and unauthorised imitations, which, if the invention be protected, are nothing more or less than direct infringements of the patent, and after that by highly interesting modifications of the apparatus either for the extension of the principle, developing further physical facts, or to analyse those already discovered; or else for the reduction of the instrument to its simplest possible form, so as to place in the hands of the teacher as well as in those of the million a scientific toy which can illustrate and render familiar the principle which lies at the base of the more important and typical apparatus.

There are few who can have failed to see that both the telephone and the microphone have gone through both these stages; and the phonograph, after having been imitated by amateurs and copied by unlicensed manufacturers, has led to the very beautiful analytical and synthetical apparatus of Mr. Stroh, and has quite recently reappeared as a curious and most interesting scientific toy, and one which we would hesitate to say could not be made applicable to some useful purposes.

The very simple apparatus which we illustrate below is a speaking phonograph that can be made and sold for sixpence or even less, and yet leave a profit to the manufacturer. It is the invention of M. Lambrigt, an inspector of telegraphs at Albi, in the Department of Tarn, in the south of France, and has been brought to this country by M. Hospitalier, whose name is well known in connection with physical and electrical science.

The whole apparatus which is represented in Fig. 1, consists, first, of a hollow cone of pasteboard about $\frac{1}{2}$ in. in diameter, whose apex is connected to the centre of a similar sized pasteboard disc by means of a lead wire about 16 in. long; and, second, of a small board or tablet, on which is fixed one, or a larger number of short lengths of lead wire, each of which bears upon its upper surface a phonographic embossed record corresponding to a certain word or sentence, by which it was originally produced by a process to be described further on.

To those who are familiar with the construction of the phonograph in the form in which it was first shown in this country, it would appear necessary in order to reproduce the sounds recorded on the tablet, for the edge of the disc to be held in an annular frame so as to convert it into a diaphragm, and for its centre to be thrown into vibration by means of a point or style projecting from it and drawn over the undulatory surface of the record. But the method of using the apparatus is far simpler than that; all that is necessary is to hold the paper cone against the ear with one hand and with the other to take hold of the cardboard disc, drawing its edge along the record with a steady scraping motion, and the mechanical vibrations thus set up in the disc being communicated by the wire to the conical ear-piece which serves as a resonator and concentrator, produce in the organs of hearing the sensation of the articulate sound by which the markings on the leaden record were originally produced. We should have thought that a stout thread or a lighter wire would have formed a more efficient as well as a cheaper connection for the purpose than the lead wire, but we are informed that M. Lambrigt has found the lead to answer the purpose better than anything else; it does not require to be kept stretched between the cone and the disc, and being of a very inelastic nature it does not spring about and produce disturbing sounds by clashing against itself or against neighbouring objects. Again, it would naturally be expected that the ear-piece would be more perfectly adapted to its purpose if it were in the form of that used in the ordinary thread telephone, that is to say if it consisted of a cylindrical cardboard box closed at one end with a stretched paper diaphragm, to the centre of which the connecting wire were attached, but simple as it is, this would undoubtedly be a more complex form of construction than the cardboard cones, and would be far more liable to be destroyed by the weight of the connecting wire. The employment of cardboard as the material of which the principal parts of the apparatus are constructed is, in the case of the cone, for cheapness, and in that of the disc partly for cheapness, but chiefly to protect the markings on the lead record from being destroyed, as they soon would be if a harder material than card were employed.

The most interesting point connected with this very simple apparatus is the method by which the leaden records are produced, which is as follows:—The upper surface of a rectangular prism of glass, or other hard and rigid material, is thickly coated with stearine wax, which is then scraped into a convex form, as

shown in the diagram Fig. 2, in which a represents the glass bar and b the convex coating of stearine. This bar is then fixed into a simple phonographic instrument, which, by means of a screw or other mechanical contrivance, traverses it at a suitable speed below a diaphragm. This diaphragm is rigidly held around its circumference by an annular framework (not shown in the diagram), and is in every respect exactly similar to the diaphragm of an ordinary phonograph. To the centre of this diaphragm is attached a thin flat plate, whose lower end is cut out to a concave curve to fit the convex surface of the stearine b . When all is properly adjusted, and the temperature is so arranged as to give to the stearine surface the proper degree of hardness to insure the best results, the handle of the instrument is turned, and at the same time words are spoken against the diaphragm, which immediately set up in it vibrations, which are communicated to the plate or style. While this is moving up and down, following the vibrations of the diaphragm caused by the voice, the stearine coating of the bar a is steadily drawn in the direction of the arrow below the vibrating bar, receiving from it a phonogram similar to that produced on the tinfoil of an ordinary phonograph.

The stearine bar is then coated with a fine surface of plumbago so as to give to it an electrically conducting surface, and it is then electro-plated with copper by the ordinary process. Out of the copper coating so formed the stearine is removed, and a rigid backing of lead or other metal having been run over the outside convex surface of the copper, a firm copper-lined matrix or mould is formed, the whole presenting the appearance shown in Fig. 3, and consisting of a rectangular block having along the centre of one of its sides a semi-cylindrical groove c of copper which bears upon its surface certain raised striations corresponding to the depressions which were made by the diaphragm on the surface of the stearine. Into this groove is laid a piece of lead wire of about 3 or 4 millimetres in diameter, and the two being put into a press and squeezed together the surface of the lead wire receives a permanent impression which is an exact reproduction of the original impression made upon the stearine bar. From one copper matrix a very large number of lead impressions may be made, and we are told that the whole process can be gone through and lead wires, each containing the record of a short sentence, can be made and sold with a profit for one halfpenny each.

It is an interesting fact that if a small stick of wood, such as the stem of a common match, be substituted for the disc shown in Fig. 1, and its end be drawn along the copper groove of one of the matrix moulds shown in Fig. 3, articulate speech is communicated equally well to the ear-piece, although the motion of the point is the reverse of that of the disc; and this bears a very close analogy to the fact that in the ordinary Bell telephone a message is transmitted with equal distinctness whether the poles of the receiving instrument be reversed or not.

We have had an opportunity of testing this simple little instrument, and the words come out of it with remarkable distinctness, though of course with but feeble power; and among the following words, all of which we have heard it utter, some were unmistakably clear: "Mon cher ami," "Louis Quatorze," "Victor Hugo," "La République," "Octavie," "Bonjour," "Lambrigt," "Miserable," and "Miracle," and it is a curious fact that while in the phonograph the words "Phonograph" and "How do you do?" come out with exceptional distinctness, so in this instrument the words "Bonjour," and the name of the inventor, "Lambrigt," are the clearest of those we have heard.

It is only fair to Mr. Edison, the inventor of the phonograph itself, to point out that the plan of producing a phonogram on a stearine surface, and afterwards reproducing it in copper by the process of electrolysis, was suggested by him long ago, but we do not understand that M. Lambrigt claims any novelty for that portion of the invention, but more especially for having produced a little instrument at the cost of a few pence, which can demonstrate the action of the phonograph and illustrate some of the most beautiful phenomena connected with the science of acoustics. We must congratulate M. Lambrigt on his success, and upon the very beautiful methods by which he has brought it about, and we hope before long his very interesting little instruments may find their way in large numbers to this country, for it is by the cheapest and simplest apparatus that some of the greatest discoveries of science are made, not on account of any intrinsic merit in cheapness, but because popular instruments, accessible to thousands, often give to individuals a first taste for scientific investigation, starting them on a research which may lead to great things, and out of the multitude of workers which such inventions instigate, some discoveries are well-nigh certain to be made.