THE SCIENTIFIC USE OF THE PHONOGRAPH.

BY GEO. M. HOPKINS.

One of the uses to which the phonograph is peculiarly adapted is measuring the velocity of sound. From the nature of the instrument it is necessary that the sound be propagated in a confined space, and that this space begin and end at the mouth piece of the phonograph, to allow of making two distinct records on the wax cylinder, one of the sound as it is made directly in the mouth piece, the other of the same sound after it has traveled through the tube and returned to the mouth piece.

The accessories for this experiment are few and simple. The funnel, or auxiliary mouth piece, is in this case connected with the phonograph mouth piece by a flexible tube, and the funnel is suspended so as to cause it to maintain a fixed position, while the phonograph mouth piece and recording stylus traverse the record cylinder.

A forked tube, terminating in the flaring mouth piece, is connected by one of its branches with a long tube which extends away from the phonograph and, returning parallel with itself, enters the suspended funnel. The other branch of the forked tube opens directly into the funnel. The long tube is supported at suitable intervals, and in front of the flaring mouth piece is placed a bell, which is damped so as to produce only a momentary sound.

The phonograph is set in operation in the usual way, with the record cylinder revolving at a speed of say two revolutions per second. Now if a sound of sufficiently short duration is produced by the bell, the two records made, one by the sound entering directly into the phonograph mouth piece, the other by the sound traveling through the long pipe before reaching the mouth piece, will be distinct and separable on reproducing the record with the cylinder revolving at a slower speed, say sixty revolutions per minute. The interval between the records may be accurately measured in the manner described in a previous article.

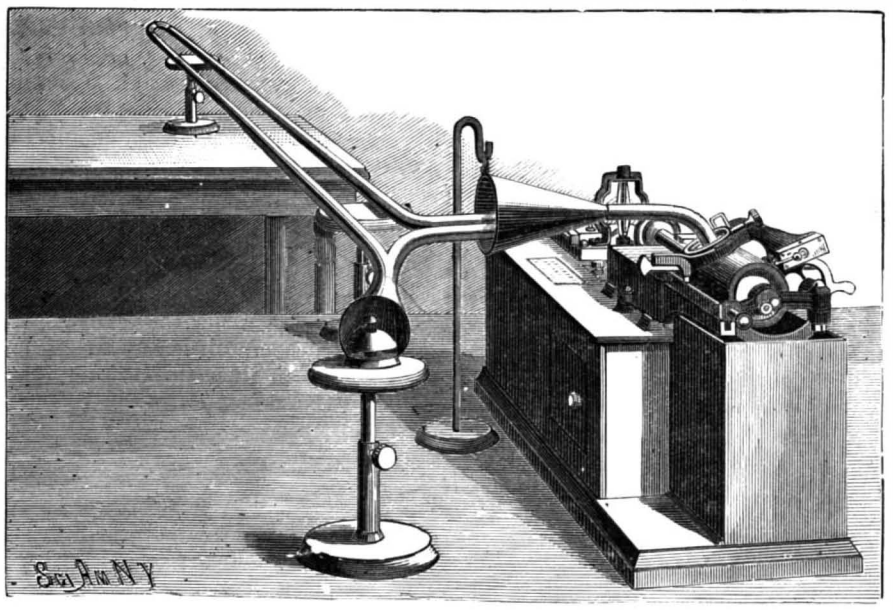

Fig. 1.—MEASURING THE VELOCITY OF SOUND BY THE PHONOGRAPH.

In this way, knowing the length of the tube, the velocity of the sound in the tube is readily ascertained. A tube fifty feet long will show an interval between the records of one twenty-third of a second when the phonograph cylinder makes two revolutions per second. This is an appreciable interval, but when the speed of the cylinder is reduced one-half, the record shows double the interval. The interval may, of course, be increased by lengthening the tube, and it may be made more apparent by increasing the speed of the phonograph cylinder while recording, and greatly reducing the speed while reproducing the record.

The well known experiment in which the interference of sound waves produces silence may be readily adapted to the phonograph. The double tube is connected by one end with the phonograph mouth piece, and by the other with an ear piece. A record of a continuous musical note being in place on the phonograph, and adjusted so as to give a continued sound, the length of the adjustable tube is increased until the waves in that branch travel through half a wave length more than those in the other branch. Under these conditions the waves from the two branches, meeting in opposite phases in the ear tube, neutralize each other, and silence, or a close approximation to it, is the result.

In Fig. 2 is shown a simple device, by means of which the conductivity of gases for sound may be tested. A flexible gas-tight tube is connected by one end with the phonographic diaphragm cell, while the opposite end of the tube is attached to an ear piece consisting of a diaphragm cell provided with a very thin rubber diaphragm. In the side of the flexible tube, at opposite ends, are inserted smaller rubber tubes for changing the gas in the flexible tube. Each of the small tubes is provided with a pinch cock for shutting off the gas in the larger tube.

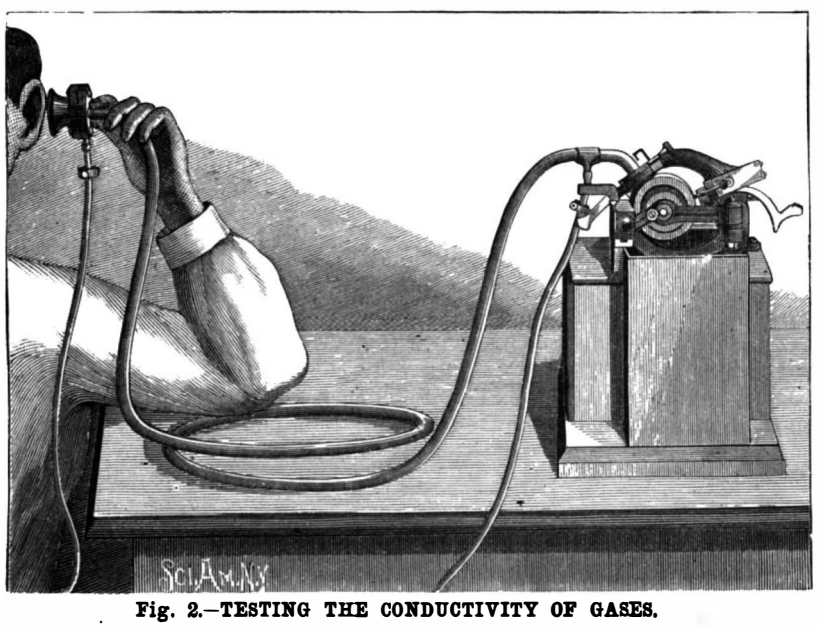

Fig. 2.—TESTING THE CONDUCTIVITY OF GASES.

When the tube is filled with air the sound is conveyed with perceptible diminution. When hydrogen is substituted for the air, the sound is diminished so as to be scarcely audible. Other gases produce different results.

THE application of the Broadway Railway Company, New York, for leave to substitute cable propulsion for horses has been granted, and the cable machinery and appurtenances will soon be inaugurated. The works will be put in as fast as possible. The great thoroughfare is to be attacked in three sections at a time, the street to be closed while the slotted tube and rails are being laid.

Photographing Flowers.

There are certainly difficulties to be met with in photographing flowers which do not often assail those who are engaged in the more ordinary paths of work. One of the chief of these is the necessary nearness of the objects to the camera—a difficulty which will be at once appreciated by any one who endeavors to focus upon his ground glass screen the image of a flower-spangled hedgerow. It is at once seen that, owing to the various planes of the different petals, only a few can be brought to a sharp focus at one time. It is, of course, the same if we attempt to photograph a single flower or a mass of flowers in a greenhouse, but here we are relieved of one great difficulty in having a perfectly still atmosphere to work in. But whereas in the open air it is next to impossible to reduce the growth to one plane, unless, indeed, we clip away half its beauty with a pair of shears, in the greenhouse we are able to mitigate the evils to a very great extent by adopting certain precautions. The flowers, being in pots, can be moved about and grouped as we may think best, and any petal-bearing stems which are obtrusively prominent — and therefore out of focus—can be held back by the temporary expedient of attaching to them gray lines of the thinnest binding wire. We have tried this plan many times with great success, but care must be taken in adopting this method of pulling the stems out of their natural position that they are not so awkwardly placed that the dodge is likely to be detected. Care must also be taken that the wires used are properly concealed.

In photographing flowers in a greenhouse it will generally be necessary to provide some kind of background. The entire beauty of the picture will be sacrificed if the straight lines of the beading between the glass panes come into view, and more especially if the bright sky is seen through them. A square yard of some good tinted material—such as is used for ordinary studio backgrounds—will answer the purpose better than anything else, but it should, if possible, be stretched on a frame, so as to present one even, unwrinkled surface. In the absence of a greenhouse, and when we wish to photograph flowers in the form of a bouquet, we shall do well to conduct operations in the studio or in an ordinary room. In the first case no difficulty should present itself with regard to lighting, for curtains, screens, and blinds are under ready control, but in an ordinary room, as in the case of portraiture, special arrangements have to be made.

The flowers must first of all be grouped as artistically as possible, and may by preference be held in some kind of ornamental vase. This should be of glass or of some light colored material—such as alabaster—in order that there may be contrast between it and the flowers which it holds. This vase should be placed near a window where there is a good diffused light—not actual sunlight—with a looking glass or white screen at the other side, so as to reflect light on its shady parts. The background should not be too dark, nor should it be of a pronounced pattern of any kind. All must be as light and airy in design as possible. The flowers themselves must not be matted together, and it will be found that a few—say some choice roses or lilies relieved by springs of maidenhair or feathery grasses — will be far more effective than a great number. We have occasionally seen flower photographs—generally roughly colored—exposed for sale in some of the shops, and they are useful as a guide to show what to avoid. These flowers appear to have been grouped and supported on a sheet of white cardboard, with the result that a heavy black shadow—a kind of mourning band—borders them on all sides, for the light in which they have been photographed appears to have come from the front, that is, behind the camera. Strong contrasts are most easy to obtain in photographing flowers, and they should be carefully avoided, first by suitably lighting the object and providing a proper background, and secondly by giving a prolonged exposure with a small stop, so that development may proceed without the least forcing and blocking up of the high lights.

The lens which is kept to use for flower work is one of the rectilinear type. Almost any lens except a portrait lens will do for photographing flowers, provided it can be well stopped down. To get the best results, it is as well to use isochromatic plates, and many published pictures have shown us all what good service such color sensitive plates will do in this particular field of work. But ordinary plates, if used with a yellow screen behind the lens, and with the protracted exposure which that course entails, will give results which are difficult, if not impossible, to distinguish from those obtained by the use of isochromatic plates. —*Photo. News.*

Rolling Cold Steel.

The particles of any metal in cooling are supposed to make a definite crystallized arrangement. Heat, in a certain sense at least, is as to the atoms a disintegrating or repellent power, and, under great force or pressure, crystallizations may be compelled to rearrange themselves on new lines or submit to a change in form. In drawing wire, for example, the force applied is in the direction assumed by the fiber, as softened by heat, and its strength is supposed to depend upon this arrangement of particles, compacted more or less by the die through which it was drawn. Now rolled wire is a reversed process, as the compression of molecules both changes their form of arrangement and form of crystallization. Up to a recent period heat was always supposed to be a prime factor in the process, and that without it no alteration in what may be styled granulation was possible. Now a Chicago paper announces a change in manipulation that completely explodes the old theory. Bars of cold steel are as easily rolled into wire as if the metal were hot, and not only that, but the process nearly doubles the tensile strength. That of hot-drawn steel wire is 56,460 pounds to the square inch, while cold-rolled is 105,800 pounds.

What is the nature of the changed arrangement of particles that produces such results? It must be compression that forces the atoms into new forms, or compacts them more closely together, and yet one effect of compression is to evolve heat. The fact of added strength is abundantly vouched for, but the reason of it remains to be explained. Manifestly if wire can be rolled from cold bars with such results, why may not steel plates for ships or other purposes; yea, why not even railroad bars? If these things are possible, with strength doubled and cost diminished, this manufacturing industry is certainly on the eve of a total revolution. Science, too, has added to its domain the wealth of a new discovery whose value is beyond estimate. Gains on any line of advancement, as all experience proves, are but a prelude to greater gains on other or similar lines. The ending of a beginning in what is new now is beyond the ken of the wisest.—*Iron Trade Review.*

A PATENTEE is protected from the use of all plans or devices which, however seemingly different from the patented invention, are the same in principle and operation.