THE ACOUSTIC PROPERTIES OF ALUMINUM.*

At the April meeting of the Physical Department of the Brooklyn Institute, Prof. Alfred M. Mayer, of the Stevens Institute of Technology, delivered a very interesting lecture on the acoustic properties of aluminum. From the beginning to the end of the lecture the interest was maintained by the instructive and entertaining manner of the lecturer, no less than by the subject matter of the lecture and the many interesting experiments by which it was illustrated.

The lecturer began by describing the methods of various physicists of obtaining the modulus of elasticity of metals, and told how he, knowing the modulus of elasticity of any metal, could calculate the rate of vibration of a given body of that metal. He then performed several experiments illustrating the elasticity of aluminum, the first being that of vibrating longitudinally a rod of aluminum. The rod was grasped at the middle by one hand while it was rubbed lengthwise by a glove charged with resin and worn upon the other hand. The rod emitted a sound of very high pitch. The exact rate of longitudinal vibration of the

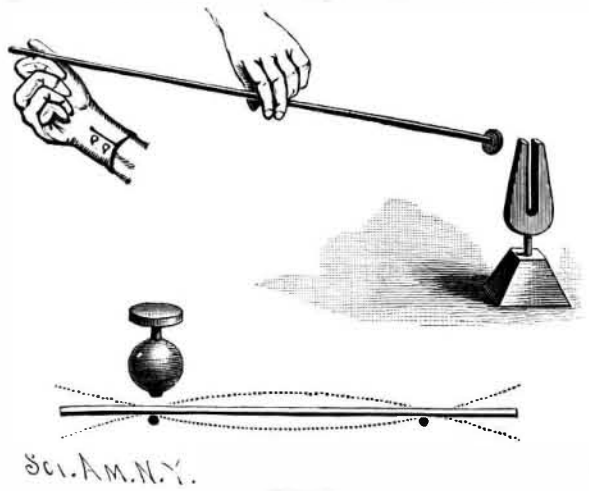


Fig. 1.

rod was ascertained by comparing the sound with that of a tuning fork having a known rate of vibration; then the fork was made to vibrate sympathetically by causing the rod to vibrate in the vicinity of the fork, as shown in Fig. 1. The next experiment was one in which a column of confined air was vibrated in a tube by the longitudinally vibrating rod. Some light dust contained by the tube was heaped up at the nodes, or points of no vibration, and removed from the venters, or region of greatest vibration, thus showing how the air column is divided up into vibrating segments. He said the aluminum rod was divided into two vibrating segments with a node at the middle.

In the next experiment a number of aluminum bars were supported at the nodal point upon a frame elevated a short distance above the table, something after the manner of a metallophone. These bars were tuned to the 1st, 3d, 5th and 8th of the scale, representing the major chord. When these bars were struck with a mallet of suitable weight, beautifully clear notes were emitted, and the sound was prolonged beyond that produced by metallophone bars made of other metals.

To show accurately the location of the nodes, bars were sprinkled with very fine sand and vibrated. The sand was piled up in fine transverse lines at exactly two-ninths of the length of the bar from the ends; a resonator applied at different points along the bar (lower part of Fig. 1) readily located the nodal lines. To re-enforce the sounds and more strikingly exhibit

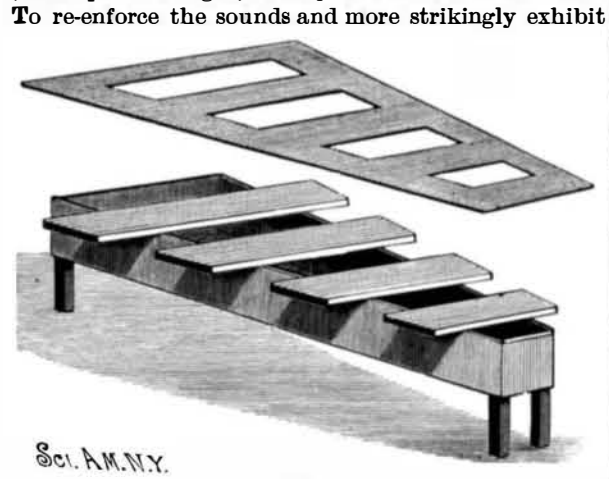


Fig. 2.

the quality of the tone emitted by the vibrating bars, a Helmholtz resonator was placed under each bar, when the sound was very loud and rich. The bar when struck bends downward at the center and upward at the ends, then by its own resiliency bows upward at the center and bends downward at the ends, thus producing opposite effects which partly neutralize each other. The lecturer said that the end portions of the bars outside of the nodes seriously diminished the total sound emitted by the bar. He therefore produced a piece of cardboard (Fig. 2) having apertures in it corresponding in width, length and position with the several segments of the bars, and placing this over the series of bars so as to cover the portions lying outside of the nodal lines, the effect was like that of a resonator, the sound having much more volume.

Another interesting experiment consisted in placing one of the bars on cords stretched across a frame and supporting it a quarter of a wave length from the table, as shown in Fig. 3, noting the intensity of the sound as the bar was struck, then lifting the frame and bar from the table through a distance equal to several wave lengths. At certain intervals the sound was quenched, showing interference at those points. The same thing occurred on lowering the bar to its original resting place.

Prof Mayer tried a large aluminum Chladni plate, producing several intricate sand figures showing the nodes and venters. The plate was explored with a resonator which re-enforced the sound at the venters, while at the nodes the effect was practically nothing.

The experiment with the longitudinally vibrating aluminum rod was designed to show one method of getting the velocity of sound in a solid. The number of longitudinal vibrations per second of the rod, multiplied by twice its length, gives a velocity of sound in it; similarly the length between two adjoining nodes in the tube experiment is a half wave length, and the length of the rod (which gives the half wave lengths) divided by the half wave length (as shown by the dust in the tube) shows how much faster is the propagation of sound in the rod than in the air column.

The lecturer performed numerous other experiments, showing the superior resonant qualities of aluminum, and stated that all he had shown was merely preliminary to a further study of the subject. He intends to make a further investigation in Paris, with Koenig, during the coming summer, and will be able, when the investigations are completed, to publish the results.

* Abstract of a lecture delivered by Prof. A. M. Mayer before the Physical Department of the Brooklyn Institute, April 22, 1892.

Tannin in Tea.

"Some examples which have been forwarded to us," says the *British Medical Journal*, "of the results of analyses for tannin and theine in tea indicate considerable variation in the amount of tannin, according to the quality of the tea and the state of growth at which it is picked. In some blends of China teas the percentage of tannin extracted by infusion for thirty minutes was 7·44; theine, 3·11; and a similar result was given in the examination of the finest Moning; while, on the other hand, with fine Assam tea a percentage of 17·73 of tannin by weight was extracted after infusion for fifteen minutes, and two blends of Assam and Ceylon tea gave, respectively, 8·91 and 10·26 of tannin. On the whole, it is probable that the Indian teas are much more heavily loaded with tannin than the China or Japan teas. Moreover, the common method of prolonged infusion in boiling water is well calculated to extract all the tannin, while it dissipates the flavor of the tea. To be drunk reasonably, tea should not be infused for more than a minute, and with water of which the temperature does not exceed 170° F. It should be taken without sugar or milk, which would drown the flavor of the delicate and aromatic infusion thus obtained. This at least is how tea is drunk both in China and Japan, whence we have borrowed the use of it. With our European method of prolonged infusion in boiling water we destroy all the best flavor of the tea, and we extract such heavy proportions of tannin as to cultivate indigestion as the result of tea drinking. Indigestion is unknown among tea drinkers in the East, and it is in all probability only the result of our defective use of the leaf."

Parcels Post Extension.

A postal treaty has been concluded between the United States and Great Britain, by which parcels may be sent by post to and from this country and the Windward Islands. These embrace the colonies of St. Lucia, St. Vincent, Barbados, Grenada, Tobago. No parcel can exceed eleven pounds weight, or five kilogrammes. Greatest length, 3 feet 6 inches. Greatest combined length and girth, 6 feet. Postage, 12 cents per pound.

Photographing Bullets.

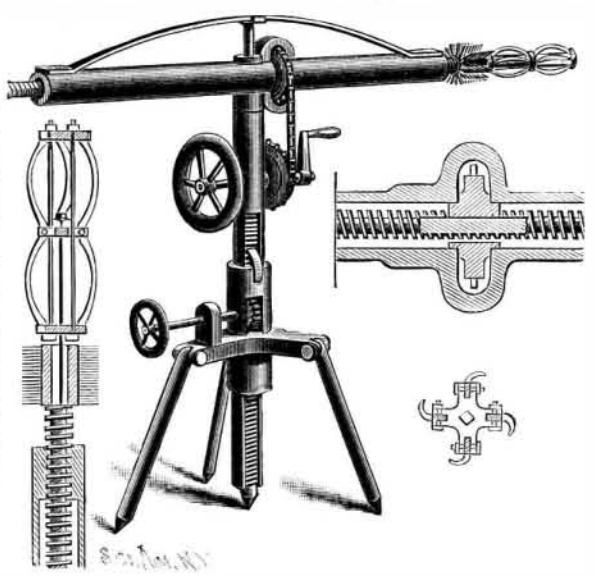
In a lecture on this subject, delivered recently at the South Kensington Museum, Professor C. V. Boys explained his apparatus for the purpose. It consists of box lined with black cloth, in which the photographic plate is exposed, of a condenser formed of a plate of glass about a foot square; of a smaller condenser in the form of a bottle, to act as a starter of the spark; and of a system of wire circuits and knobs to give the spark which throws the shadow of the bullet on the plate, and thus takes the photograph. The bullet enters and leaves the box by two holes, covered with paper to exclude the light, and in passing the plate the bullet touches the terminals of two wires, composed of thin lead wire, thus partly completing the circuit; a small flash passes from the smaller condenser, causing a larger flash to pass between the knobs of the plate condenser inside the box, and this flash, lasting less than one millionth of a second, takes the photograph of the bullet, no lens being employed. A wet string in the circuit of the small condenser is used to damp the electrical oscillations. Mr. Boys was able to infer from his experiments with a rifle that the bullet must have

Fig. 3.

received some three per cent of its velocity after leaving the muzzle, at which point the turning effort of the rifling must have necessarily ceased.

AN IMPROVED FLUE CLEANER.

The boiler tube cleaner shown in the illustration, which has been patented by Mr. Michael J. Carbis, of Bingham, Utah Ter., is designed to be quickly set up and readily operated to clean the tubes of scale, sediment, or any obstructions, being especially adapted for cleaning the tubes of the Babcock & Wilcox and similar styles of boilers, the machine being for this purpose set on a platform having the same inclination as the tubes, or extension tripod legs may be arranged for the purpose. In a suitable tripod stand is a vertical sleeve, in which slides a post having in one side gear teeth in mesh with a pinion actuated by a hand wheel, as shown in the principal view, whereby the post is raised and lowered. On the upper end of the post a pivot engages a socket on the under side of a horizontal casing, in which screws the feed screw rod, having on its outer end a scraper and brush, as shown likewise in the sectional view. The feed screw rod has a keyway engaged by a key on a sprocket wheel on the casing, as shown in one of the views, the sprocket wheel being rotated by means of a crank on a shaft in bearings lower down on the post, whereby the feed screw rod is moved inward or outward. The scraping plates are



CARBIS' FLUE CLEANER.

preferably made of thin steel, spirally curved, the small figure showing an end view of the scraper.

The plates are sufficiently elastic to conform to the inner surface of the tube, and in a normal position are preferably somewhat in excess of the diameter of the tube. The brush is located directly in the rear of the scraper, is preferably circular in form, and has a diameter somewhat greater than that of the scraper, so that it will readily remove all the particles loosened by the latter. The feed screw rod is made in sections, readily connected together, whereby the scraper may be passed through tubes of any length. If desired, the cleaner may be geared to run as high as two and a half or three revolutions on the driven sprocket wheel to one revolution of the driving wheel, thus doing the work very rapidly. Where tubes are badly incrusted, the cleaner and brush may be taken off and a suitable cutting tool attached to the outer end of the slotted shank of the feed screw rod by means of a set screw or a key, and in this way the worst cases of choked-up tubes can be efficiently dealt with.