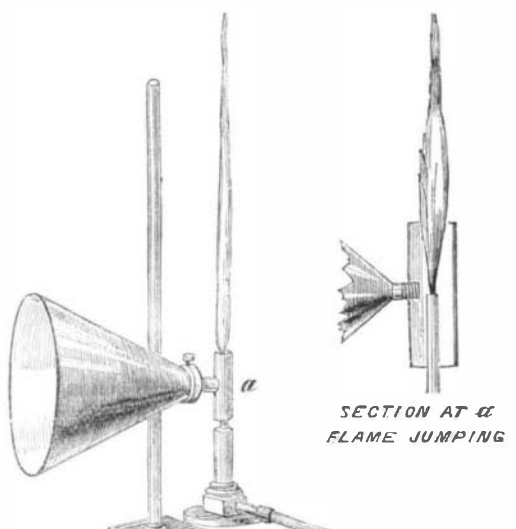
make. The current of air in the room, owing to our care for your comfort in the matter of fresh air, prevents these phenomena showing themselves as well as they do when the theater is empty; but they are perfectly manifest. No one in this room can hear my watch ticking; but if I hold it near the flame you can distinctly hear the flame give a little roar, and see it suddenly shorten for each tick of the watch. The regularity with which it jumps indicates the regularity with which my watch is ticking.

Fig. 4.



And now observe the action of a tube in preventing the dissipation of sound. Using a less sensitive flame as the sound test, I take off the india rubber ends from our 11 foot tube, and place the flame at the end furthest from myself. The tapping of these two keys together does not affect the flame; but now, my distance from the flame being as great as before, I tap them opposite the open end of the tube, and each tap is rendered, by means of the flame, as visible to your eyes as it is audible to your ears.

Through the unconfined air this small bell does not affect the flame when set ringing; but when I place it at the extremity of the tube, the flame dances to each stroke. Speaking pipes possess their value solely from their preventing the dissipation of the sound pulses; they act precisely as this tube does.

As you know, light cannot well get round a corner; neither can sound, though it does so more easily than light. This little bell acts automatically. I wind it up and start it. At a few feet distance the flame answers to each stroke. Placed behind a board, the flame becomes tranquil. I again bring it out from behind the board, and the flame jumps to each movement of the hammer. (For this experiment the sensitive flame was arranged as in Fig. 4, with a large glass funnel having its tubular end opposite the root of the flame; the board was held about 10 feet distant from the mouth of the funnel.) Sound therefore can be shaded off in the same way that light can be.

In this box, which is well padded, is a bell which I can set ringing at pleasure. The only way by which the sound can get out is this small square opening at one side of it. The bell is now ringing without affecting the sensitive flame (arranged as in Fig. 4); but when this box is turned round, so that its opening faces the quiet flame, we have it dancing and jumping as before.

In other respects also there is a similarity between the mode of action of sound and light.

When a beam from the electric lamp is allowed to fall upon the glass mirror in my hand, it is reflected from the mirror, and, the track of the beam being marked by the dust floating in the room, you can see the direction which it takes. This is in accordance with a well known law, namely, that the angle of incidence is equal to the angle of reflection. It is perfectly plain to you that a line drawn so as to fall at right angles upon this mirror would divide that large angle formed by the two beams of light into two equal angles.

I hope now to make visible to your eyes the reflection of sound in obedience to the same law.

At one corner of the lecture table I place our sensitive flame b, at the opposite corner the padded box containing the electric bell, a, with its opening directed in the path taken a moment ago by the beam of light, and I will hold this board, when everything is ready, where I before held the glass mirror. My assistant will now set the bell ringing. You observe that the flame is uninfluenced by it; but when I bring the board forward, the shortening of the flame at each stroke of the bell proves that the law of the reflection of sound is the same as the law of the reflection of light; the angle of incidence is equal to the angle of reflection. In this case the flame is knocked down by an echo.

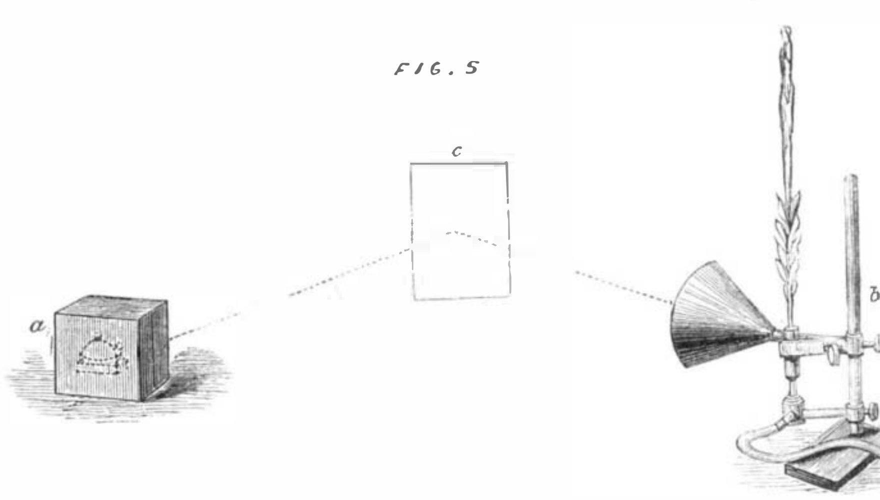
We have thus considered the reflection of sound from a plane surface; let us now see if it behaves like light when reflected from plane surfaces.

The beam of the electric lamp is now directed upon the concave mirror. You can see the band of light marked in the fine dust floating in the air; as soon as it strikes the polished surface it is thrown back, but the rays no longer pursue parallel paths, they are converged, thrown together into one spot. By holding a piece of tracing paper at the point where they meet, termed the focus, the brilliant little star of light caused by their convergence is made visible.

Substitute for the lamp a small bell, and for the tracing paper at the focus of the mirror our sensitive flame, and the conditions are the same as in the previous experiment, sound waves taking the place of the waves of light. You cannot see the track of these aerial pulses as you could the luminous ones, but their obedience to the same law of reflection is very manifest by the shortening of the sensitive flame as each sound wave reaches it. The flame, when out of the focus of the mirror, is unaffected: replace it in the spot when the sound waves are crowded together, and it responds to each stroke. Move the bell so that the sound pulses, though only having the same distance to travel to the flame, no longer fall on the mirror; the flame remains perfectly quiet.

We may go further still. Here are a pair of mirrors, the curvature and size of which is the same. They are arranged so as to face one another. A light is placed in the focus of one, that its rays which fall divergent upon the curved surface are reflected from it parallel; they travel to the opposite mirror, and are again converged; a piece of tracing paper held at the focus of the further mirror shows the spot of light as before (Fig. 6).

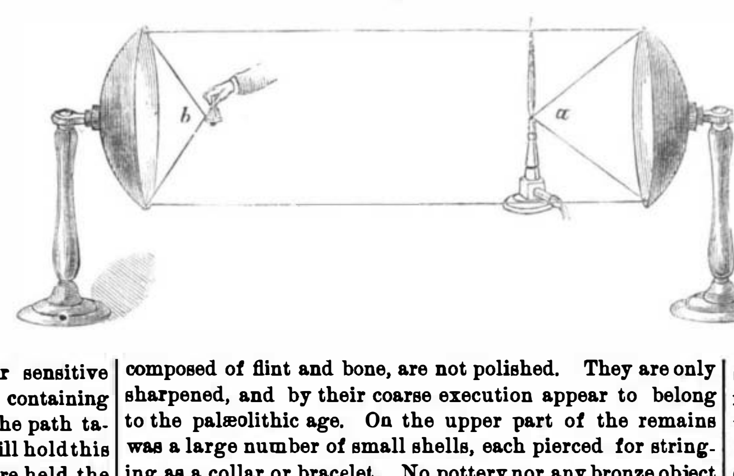
Sound is reflected in precisely the same way, and the sensitive flame, when carefully manipulated, can be used as a means of proving this fact. For these experiments it is essentially necessary that the flame be reduced to the proper pitch of sensitiveness. By reducing the pressure of the gas we can regulate the flame so that it will not respond unless strongly agitated. The flame is placed in the focus of the mirror, a, and when the bell is rung, not being in the focus of the conjugate mirror, there is no action. I now bring it into the focus, b, and the flame shows a very strong action. By other modes of experimenting it has long been ascertained that sound was thus reflected from plane and curved surfaces; but never before have these phenomena been made visible. Hitherto these effects have been investigated by the sense of hearing; I have now been able to prove them by appealing to your eyes.



New Fossil Man.

In the *Revue Scientifique* for December, it is stated that a third skeleton of a troglodyte has been discovered by M. Rivière in the caves of Mentone. This new skeleton, judging from the various and numerous implements by which it was surrounded, lived at an epoch far more remote than that assigned to the skeleton now in the Museum of Paris. The warlike instruments and objects found with them, though composed of flint and bone, are not polished. They are only sharpened, and by their coarse execution appear to belong to the palæolithic age. On the upper part of the remains was a large number of small shells, each pierced for stringing as a collar or bracelet. No pottery nor any bronze object was found. Our readers may recollect that the first skeleton found in the same neighborhood, on the bank of a railway cutting on the sea margin, appeared to have been crushed by a fall of rock. It was figured in several English journals last year.

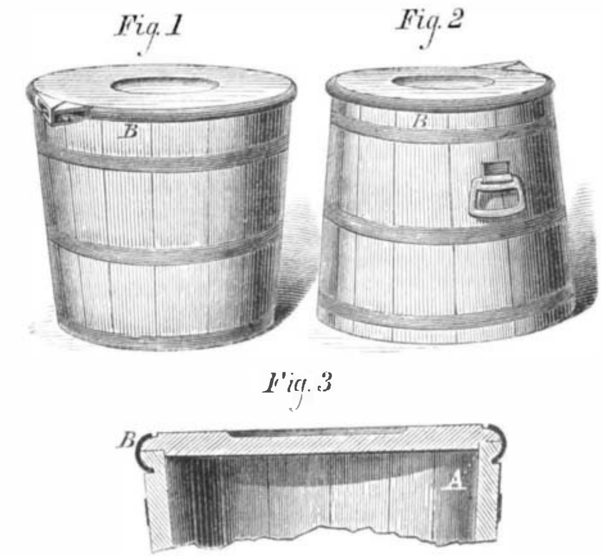
Fig. 6.



IN a French industrial establishment, employing 630 men, chiefly vegetarians, the sick fund was constantly in debt. By the introduction of meat into the food of the men, the average loss of time per man, on account of illness or fatigue, was reduced from 15 to 3 days per annum.

GILBERDS & HARRIS' RETURN BUTTER AND OYSTER PAIL.

Fresh, sweet butter is appreciated by every one; but however good its quality in the beginning, it will not retain its original flavor unless properly packed in suitable receptacles. Where the butter is exposed to the bad air of damp cellars and dust, it is very liable to become deteriorated, and hence lessened in value while in transit; while butter, packed in good pails, brings from 1 to 5 cents more per pound than when in the common tub or firkin. Similarly good return oyster pails, that hold from 5 to 25 gallons, are found much the



cheapest and most convenient way of sending oysters over the country; but these have ordinarily to be locked to preserve their contents from being taken while in transit, and even then the purchaser frequently receives his gallons short because the pails in common use are not tight enough to keep the liquid from slopping over. The pails shown in our engravings are, it is claimed, stronger, tighter, and better adapted to preserve their contents, and stand the rough handling of transportation, than any now in the market. They are made from white oak staves, and are held together by heavy galvanized iron hoops. The covers are of sufficient thickness to allow a flange, A, to extend over the top of the package, while the under side of the cover projects into the pail, as shown in sectional view, Fig. 3. The cover is rounded on its upper corner in form of a quarter circle, and a corresponding quarter circle is cut on the outer edge of the package, the two forming a rib, B, of semicircular or semi-elliptical cross section, with the cover joint along its medial line. A hoop is then swedged in form to fit this rib, except that its edges are a little shorter, while it has strong malleable flanges, shown on the left, in Fig. 1, at each end. A screw passing through one flange into the other is turned by a common screwdriver or key. It will be readily seen that the hoop, when tightened by its clamping device, operates in both vertical and lateral directions, and not only draws the cover down on the package, but strengthens it around the top.

On the oyster pail (Fig. 2) the screw, instead of being slotted, is made and turned by a key; this saves all expense and trouble of locks.

This method of holding the cover is equally adapted for fruit jars or any article having a movable cover. These pails were awarded three first premiums at the New York State Fair, in September last, and also at the Provincial Fair, Canada, and are, we are informed, readily endorsed by all butter and oyster dealers. They are now manufactured by the Jamestown Butter and Oyster Pail Company, at Jamestown, N. Y., to whom all orders should be addressed.

Trout in an Artesian Well.

The *American Journal of Science and Arts* presents the following curious statement: Mr. Bard, the agent of the California Petroleum Company, at San Buenaventura, was lately engaged in constructing a wharf at a point southeast of that place. Wanting water to supply this wharf, he commenced sinking an artesian well on the sea beach, not 5 feet from high water mark. At the depth of 143 feet a strong flow of water was obtained, which spouted forth to a hight of 30 feet. It was controlled with a "goose neck," and utilized. One day, while the agent was absent, the men round the well noticed fish in the waste water. On his return they called his attention to the fact, and on examination the well was found to be filled with young trout, thousands of them being thrown out at every jet. These trout were all the same size (about two inches long) and perfectly developed. The eyes were found perfect. Now there is no stream nearer than the Santa Clara river, several miles distant. Could these fish then, it is asked, have come from its head waters by some subterranean outlet? There are no trout in the lower portions of the stream. The temperature of the well water is 64° Fah

© 1874 SCIENTIFIC AMERICAN, INC