from five to twelve; and on this variation specific distinctions are founded. The smallest sponge of this kind thus far found is three inches in diameter, and the largest twelve inches. Frequently the fingers were found detached from the body; and in one case two large ones were found near each other, having so grotesque a resemblance to a pair of diminutive feet that for a time my assistants positively refused to aid me further!

The exterior of the *brachiospongia* is silicified, while through the interior characteristic silicious spicules are distributed. Near the center of the base, and opposite the mouth of the cup, is a small papilliform cone, which others have regarded as the point by which the sponge was attached to its support. But, in my opinion, this is a hasty conclusion; and I think it can be shown that this basal protuberance is the remnant of a partially absorbed arm. In a specimen of *b. Hoveyii* (Marsh), having twelve arms, only six of which appear in the illustration (see Fig. 2), there is evidence that the sponge arms, though constant in their specific numbers, were at intervals liable to alternate absorption and reproduction. The arm, A, seems to be the youngest in a series of which the basal cone, B, is the retiring member. A more careful study of these curious and highly interesting fossils may serve to throw light upon the mysterious laws of spongoidal growth."—*Rev. Horace C. Hovey, M. A.*

Correspondence.

The Blair Direct Process.

To the Editor of the Scientific American:

From a proof copy of the very interesting paper read on the 6th of May last before the British Iron and Steel Institute by their distinguished late President, Mr. Isaac Lowthian Bell, upon his visit to the mines and iron works of the United States in the fall of 1874, I make the following extract. Mr. Bell says, on page 47:

"My friend Mr. T. S. Blair, in company with other gentlemen, has erected a work near Pittsburgh for carrying his mode of making steel into practice. * * Mr. Blair's method consists in deoxidizing iron ore and melting the iron sponge so obtained in an open hearth with pig iron." On page 48: "Mr. Blair claims great advantages for his apparatus in saving of fuel. * The difficulty which besets this and all other modifications of dealing with iron in so fine a state of division as it exists in the sponge is its proneness to oxidation. Hitherto, it seems to me, the direct process, as it is termed, has met with the most success at Landore. The pig iron, after being melted, has blocks of ore thrown in; the carbon and silicon of the bath reduce the oxide, and the metallic iron is instantly taken up by the bath of liquid metal. Very different must be the action on sponge, which, when thrown into the furnace, will float on the melted pig, and, being exposed to carbonic acid at a very high temperature, will to some extent infallibly be re-converted into oxide. So far as I was able to learn, 2 parts of pig iron and 1 of sponge lost about 20 per cent in the furnace. Now if it be true, as I have heard it stated, that a mixture of wrought and pig iron can be fused in an open hearth with a loss of 6 per cent, it follows that a considerable portion of the sponge used in Mr. Blair's process must be re-oxidized. The specimens of steel I had the opportunity of examining indicate entire success so far as a mere question of quality in the product is concerned. There seems to be no doubt that, in obtaining the sponge iron, Mr. Blair has made a notable step in advance of M. Chenot; and I am far from wishing to be understood as expressing an unfavorable opinion on the future commercial merits of the scheme."

As one interested with Mr. Blair from the beginning in the carrying out of the mode of making iron and steel by the direct process, I would respectfully ask that you publish this communication, which seems necessary as an explanatory appendix to that portion of Mr. Bell's paper which relates to the Blair process. We had the pleasure of a long visit from Mr. Bell in October last, nearly all of his time, during his three days in Pittsburgh, having been spent with us. Our books, showing the exact amount in pounds of every component of each charge, and the resulting product in pounds of every cast of steel made by us from the beginning, were thrown open to him and were freely and fully inspected, as well by himself as by his son, Mr. Charles Bell, who assisted him in his observations. Every facility which any of ourselves enjoyed for seeing or knowing what was being done in and about every department of the works was cheerfully given him, our object (aside from showing deserved courtesy to so distinguished a stranger) being to enable him to criticize our operations with full knowledge of their details. While Mr. Bell says "so far as I was able to learn," his means of knowing the exact facts were as ample as Mr. Blair's or my own. He saw that, never at any time, even for experimental purposes, had we made a cast of "2 parts pig and 1 part sponge." In point of fact, as we never did use pig in anything approaching the above proportions, neither Mr. Bell or any of ourselves know what the loss would be.

For the week in which Mr. Bell's visit took place, the average quantity of pig metal used (in 11 casts) was $25\frac{17}{100}$ per cent of the total weight of material charged into the furnace; and the last cast inspected by Mr. Bell, and made on the Saturday, was composed of $19\frac{3}{10}$ per cent pig, $53\frac{4}{10}$ per cent sponge, $18\frac{3}{10}$ per cent scrap steel from our own steel, and 9 per cent spiegeleisen. A tabular statement was taken off from the books, which Mr. Bell took with him, of casts made from the beginning (inclusive of the time when we were battling with the difficulties incident to working a new and different melting furnace from that of Mr. Siemens, Mr. S. having at that time refused to allow us to use his furnace unless we abandoned iron sponge, which he himself was then trying to make). This statement shows that, of 691,883 lbs. of the different metals charged into the furnace, $33\frac{32}{100}$ per cent consisted of pig metal; and the amount of steel made was 589,070 lbs., showing a loss of $14\frac{86}{100}$ per cent.

The direct process at Landore, to which Mr. Bell refers, is that of Dr. C. W. Siemens. Dr. Siemens uses the ordinary open hearth furnace (not the rotator), and the steel is good enough for railway rails, and is used for that purpose, 1,000 tons of rails per week being about the average product.

The materials consumed in making 2,240 lbs. of steel in the ingot amount to 2,961 lbs. on the average, and consist of 1,517 lbs. Bessemer pig, 197 lbs. spiegeleisen, 706 lbs. scrap steel, 541 lbs. ore (60 per cent). Mr. Bell correctly describes the operation thus: "The pig iron, after being melted, has blocks of ore thrown in. The carbon and silicon of the bath reduce the oxide, and the metallic iron is instantly taken up by the bath of liquid metal." He, however, adds: Very different must be "the action on sponge, which, when thrown into the furnace, will float on the melted pig; and, being exposed to carbonic acid at a very high temperature, will, to some extent, infallibly be re-converted into oxide."

When Mr. Bell was at our works he witnessed the fact that the iron sponge, when thrown into the furnace, did not float on the melted pig; and as it plunged and remained under the surface protected by the covering of the slag, it was not exposed to the highly heated carbonic acid, and was therefore not oxidized to an undue extent. This remarkable and interesting fact was noticed and commented on with much pleasure by Mr. Bell at that time, as it had previously been a source of satisfaction to ourselves, controverting, as it did, the theory of all and the experience of most parties.

If you will permit me, I will remark that, if Mr. Siemens would first convert his 60 per cent ore into iron sponge, and make it the principal ingredient of his charge (instead of the highly priced and more deleterious pig metal), his ingots would cost him less per tun; and instead of being useful only for rails, it would command $25 per tun more and could be used (as the Blair steel is) for all purposes, from homogeneous metal up to tool steel.

My object being, however, to make some necessary corrections of errors in the document of Mr. Bell, I ask you to give this communication the same publicity you do that paper.

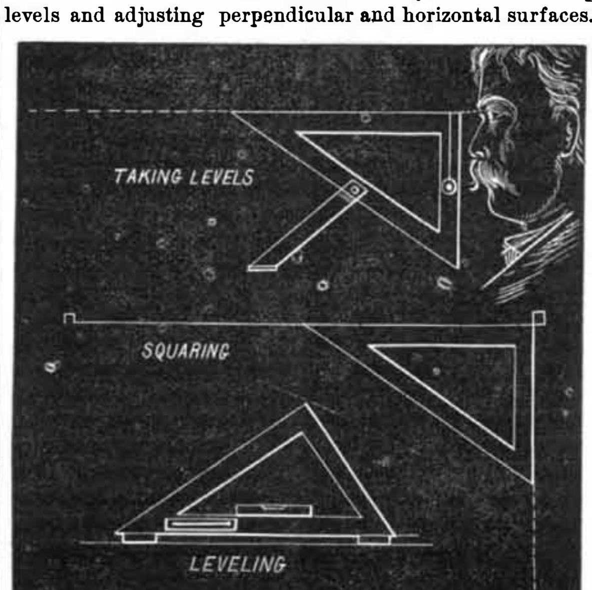
MORRISON FOSTER, Vice President.

Blair Iron and Steel Company, Pittsburgh, Pa.

A Simple Surveyor's Instrument.

To the Editor of the Scientific American:

I send you a diagram of a cheap and useful instrument, for the use of those who have ditching and leveling to do. Farmers and builders often need a ready means of taking levels and adjusting perpendicular and horizontal surfaces.



The hypothenuse of the triangle is conveniently made $7\frac{1}{2}$ inches long, the other sides being $4\frac{1}{2}$ and 6 inches, respectively. A plummet indicates the correct position of the instrument. It can readily be adapted for leveling horizontal surfaces, by adding a spirit level, as shown in the engraving.

H. C. NAYLOR.

Indianapolis, Ind.

Parasites in Wasp Stings.

To the Editor of the Scientific American:

The other day while I was dissecting a wasp, I took out his sting and found upon it a parasite. It was oval in shape. Its legs had hairs around the joints and around the feet. Its head was small compared with the body. Its *antennæ*, two in number, consisted of two joints; from the end projected two hairs as long as the other part of the antennæ. Its color was white. If among your readers there is any one who can inform me concerning this parasite, I would be very glad to hear from him.

Plainfield, N. J. W. D. M.

The Miner's Respirator.

To the Editor of the Scientific American:

As a respirator for miners, I propose a thin rubber mask, which would cover the nose and mouth, fitting so as to exclude all external gases. I further propose to have on the mask, in place of a nose, a rubber tube which would communicate with a leathern vessel, resembling in appearance a knapsack, to be strapped to the shoulders. This leather vessel should contain a mixture of the gases oxygen and nitrogen, which would be conducted to the nostrils by the tube. The mask should contain a second tube, to let the exhalation from the lungs escape; and this second tube should have a valve, so that vapors could escape, but nothing enter. In a short time, these gases would be consumed by the miner; and to remedy this, I propose to have large receivers in the vicinity of the workmen, so that the leathern vessels might be replenished with air. ANNA BLUNT.

58 East 9th street, New York city.

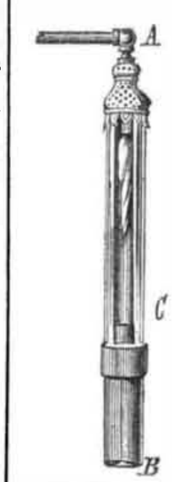
How to Take Observations at Sea during a Fog.

To the Editor of the Scientific American:

Referring to the Schiller disaster, it strikes me that observations could readily be taken from a captive balloon allowed to ascend above the strata of a dense fog. SUBSCRIBER.

NOVEL GAS APPARATUS AT THE PARIS GRAND OPERA

The magnificent opera house lately completed in Paris, probably the finest structure of its class in the world, contains a number of ingenious and novel improvements in the stage mechanism. The usual mode of illumination by gas in theaters is attended with many disadvantages and considerable danger, from the light scenery catching fire from the exposed flames. The foot lights also are a constant source of peril to ballet dancers wearing inflammable gauzy dresses, while the current of heated air which they generate is especially distressing both to vocal organs and to the eyes. The gas flames in the French opera house are so arranged that the heat is entirely conducted away, while the flames themselves are inclosed in a glass chimney so constructed that, should it break, the gas to the burner is immediately shut off. We give herewith an engraving showing the construction of the burner, in which it will be remarked that the flame burns downward. A is the supply pipe, and B a supporting tube beneath for the chimney, C. Through the tube, B, there is a blast of air driven, which draws down the flame, and, at the same time, effectually prevents the heating of the glass. Should the latter break, the end section of the tube, A, which is hinged, falls, thereby closing a valve and shutting off the supply.



The footlights thus arranged are formed in sets of twelve, and number in all one hundred and twenty. Apparatus is provided whereby any one set or all may be lifted to the level of the stage or lowered beneath.

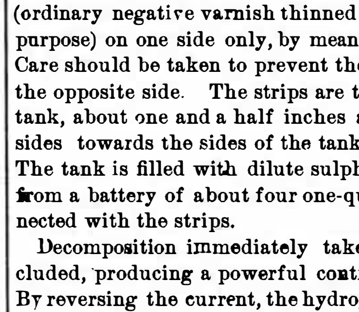
The Occlusion of Hydrogen by Palladium.

"The well known result of Graham's experiments on palladium, and the large volume of gas absorbed when thin strips of this metal are made the terminals of a rather strong current of electricity, are familiar to all. To demonstrate this fact to an audience or class has only lately been attempted, and I have devised a simple piece of apparatus, which I have used many times and have found to be correct and reliable, if the following directions are carefully carried out: Pure palladium foils, measuring about one eighth of an inch in width and three inches long, are attached to stout pieces of copper wire with hard solder; these are passed through pieces of cork cut square, according to size of tank used.

The strips are first heated in a Bunsen burner and allowed to cool. They are then coated with a thin shellac varnish (ordinary negative varnish thinned with alcohol answers the purpose) on one side only, by means of a camel's hair brush. Care should be taken to prevent the varnish from flowing on the opposite side. The strips are then placed in the lantern tank, about one and a half inches apart, with the varnished sides towards the sides of the tank and parallel to the light. The tank is filled with dilute sulphuric acid, and the wires from a battery of about four one-quart Bunsen cells are connected with the strips.

Decomposition immediately takes place; hydrogen is occluded, producing a powerful contraction in the palladium. By reversing the current, the hydrogen is discharged, and the phenomenon is repeated in the other strip. By these means the strips undergo wonderful contortions. This simple experiment demonstrates the peculiar properties of this metal." —*L. H. Laudy, in the American Chemist.*

IMPROVEMENT IN THE CONSTRUCTION OF PRISONS.



Mr. Alfred B. Mullett, late government architect, has patented an improvement in the construction of prisons, shown herewith, which consists in combining two ranges of cells, C C, with a partitioned or double corridor, G. The heating apparatus is below, and the arrows show the courses of the air, which passes through each cell, and out through the ventilators, over the corridors, as shown. The arrangement appears to be an excellent one.

ALUM and plaster of Paris, well mixed in water and used in the liquid state, forms a hard composition and is a useful cement.