Freezing in winter is avoided by the automatic draining off of the water in the filter as soon as the supply from the roof ceases; but it is closed again, so as to cause the water to pass through the filtering material, as soon as water is supplied from the roof.

### Interesting Electrical and Magnetic Experiments.

At a recent evening lecture at the Royal Institution, London, a discourse was delivered by Sir William Thomson, Dr. Siemens being in the chair. The subject was "The Effects of Stress on the Magnetization of Iron, Cobalt, and Nickel." Sir William first pointed out that certain magnetic bodies possessed the power of retaining magnetism in a greater degree than others, iron possessing this force in a high, and nickel and cobalt in a lesser degree; paramagnetic bodies do not possess this power.

The magnetic property in bodies might be different in different directions; that is, it varied according to the structure of the body. Some bodies could be isotropic; that is, their magnetic properties might be the same in all parts of their mass; thus, a lump of dough, when uniformly kneaded and placed between the poles of a powerful magnet, was unaffected; but when compressed in one direction, became influenced by the magnetism.

The influence of the magnetism of the earth on a bar of soft iron was next pointed out, the bar becoming magnetic when held in the line of the dipping needle, the upper end of the bar always taking the same magnetism, even when the ends were reversed, after the bar had been held in one direction.

One interesting experiment consisted in inverting a bar of iron, part of the weathercock of Oxford Cathedral, which had stood upright in the steeple for over 300 years, and had been carefully treasured by Faraday in the same position, with the same end up, ever since. It would have been a scientific sacrilege to have done so idly, but the object was to see whether, after three centuries of fixity in position, it had acquired a fixity of magnetization. No one had a better right to perform the act than the philosopher to whom Faraday has handed on the lamp, and no one could have done it with more reverence. The result could not be predicted, and it was awaited with considerable interest. Before inversion, the upper end of the bar was a true north pole by virtue of its position, and the lower end a true south pole. After inversion, the latter became a true north pole, and the former upper end a true south pole, showing that the magnetic induction of 300 years had not taken a permanent hold upon the iron.

The effect of striking a bar of iron, cobalt, or nickel, held in the line of the dipping needle, was shown to give a very perceptible amount of magnetism to them, even when the blows were very slight.

It was pointed out that this effect was very much more considerable in long than in short bars, and that therefore it was advisable to avoid the use of such bars, long in proportion to their breadth, for stanchions in ships, as compass errors might become considerable from the magnetism which such bars might acquire.

Villari's discovery was next alluded to, namely, that the effect of stretching a magnetized wire was to increase its magnetism, this increase reaching a maximum at a certain point, and then decreasing as the strain was still further increased. On the relaxation of the strain the magnetic condition of the wire was nearly, but not quite, restored to its normal power.

Sir William had extended these experiments by determining the effect of transverse strains such as is produced by applying hydraulic pressure in an iron tube; this transverse strain was found to decrease the magnetic force in the tube when the magnetic power was feeble, a maximum being reached at a certain strain; when the magnetism was strong the opposite effect was produced, a transverse strain producing an increased effect, rising to a maximum at a certain strain.

The effect of torsion on a wire was found to be to decrease the magnetic power in a wire, no matter which way the twist was made; but on the relaxation of the twist, the magnetic power remaining in the wire was less than it was at first.

In conclusion, says the *Telegraphic Journal*, Sir William said that the values of the discoveries did not necessarily lie in their immediate practical application, but in the fact that every new law brought to light added a link to the chain of human knowledge, and must be a gain to mankind.

The Annual Soirée of the Royal Society was held at the society's rooms in Burlington House on the 1st of May. A large and distinguished company was present. Among the objects exhibited, those of an electrical nature came in for a fair share of notice. The Telephone Company exhibited various forms of apparatus; the "telephone harp," of Mr. F. A. Gower, being the most prominent instrument. This invention enables some of the sonorous properties of the telephone to be rendered perfectly audible to a large audience. The telephone being a most unsatisfactory instrument for audible demonstration to a large audience, the harp of Mr. Gower will prove very useful for keeping up the interest of lectures on the subject.

Mr. Henry Edmunds exhibited his method of showing variations in the pitch of sonorous vibrations by means of a revolving vacuum tube.

Mr. Robert Sabine exhibited his discovery of the effect of light on selenium in generating an electro-motive force.

Mr. Ladd exhibited a large Holtz electrical machine, and specimens of Byrne's American pneumatic battery, lately illustrated in the SCIENTIFIC AMERICAN.

Messrs. Siemens Bros. exhibited one of their dynamo-electric machines capable of giving an electric light equal to 1,200 normal sperm candles; an electric lamp was also shown by the same firm.

Among the other scientific apparatus, the Edison "phonograph" was shown in action by Mr. Stroh, and explained in a short lecture by Mr. W. H. Preece.

The "mechanical chameleon," the invention of Mr. A. B. Kempe, excited much interest among the more scientific portion of the visitors. This ingenious apparatus, by mechanical means, enables all the gradations of tint of any two colors to be obtained and to be varied at will, the one tint dissolving gradually or suddenly into any other, or remaining stationary if required.

Mr. Francis Galton, F.R.S., exhibited a curious optical instrument, by which portraits of different persons could be combined so as to form a new face possessing the characteristics of each individual portrait.

Mr. Nathaniel Holmes showed in action his flashing light signal apparatus, in which a brilliant "flare" is produced by the action of water dropping on phosphuret of lime.

## Communications.

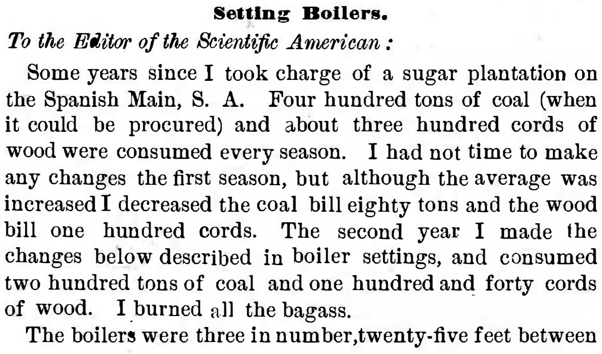
### Setting Boilers.

*To the Editor of the Scientific American:*

Some years since I took charge of a sugar plantation on the Spanish Main, S. A. Four hundred tons of coal (when it could be procured) and about three hundred cords of wood were consumed every season. I had not time to make any changes the first season, but although the average was increased I decreased the coal bill eighty tons and the wood bill one hundred cords. The second year I made the changes below described in boiler settings, and consumed two hundred tons of coal and one hundred and forty cords of wood. I burned all the bagass.

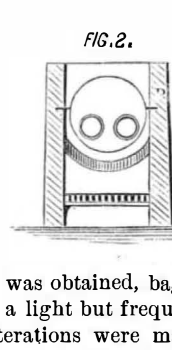
The boilers were three in number, twenty-five feet between

FIG. 1.




heads, four feet diameter, each containing two twelve-inch flues. The old settings were of tiles and stone, sixteen square feet of grate surface for each one, and were in independent settings. There were two bridge walls straight across, one at the back end of the grates, the other at the back end of the boiler. The boiler was eighteen inches above the bridge walls. The space between the bridge walls was about four feet deep and vacant. The alteration consisted in making a bridge wall twelve feet wide on a circle with the boiler, the front end fifteen inches therefrom, and the back end eight inches below the boiler, like part of a conical tube, shown at D, Fig. 1. Back of this wall a straight wall was placed, between which and the former was left a space 12 inches wide, and on each side of which was placed a door with a register, A, of four square inches, for the admission of air. Back of the last wall was constructed the combustion chamber, C. B is a bonnet of boiler iron; P, Fig. 2, cast iron plates. The masonry was not in contact with the boilers.

FIG. 2.



The grate surface was increased for each boiler from sixteen to 20·5 square feet by putting in bars five feet long in place of four foot bars taken out. My method of firing was as follows: Our coal was usually about one third slack. Coarse coal sufficient to make a good fire was separated from the dust with rakes, and after a good fire was obtained, bagass or wood was thrown on, followed by a light but frequent firing of slack coal. Before the alterations were made we made a great quantity of ashes, lodging under the boilers and in the flues and front bonnet. After this no ashes of any account were made, but a small amount of fine whitish dust collected in the combustion chamber. The heat in the combustion chamber was intense. No blower was used at any time. The fires were run down and hauled every run and new fires made. Everything which came from the furnaces and ash pits was screened, and whatever passed through a No. 8 screen was thrown away. No coal dust of any account passed through the grates. This method of boiler setting is not patented, as far as I know.

Bangor, Me. FRANK B. CORT.

### Driving Piles in Sand.

*To the Editor of the Scientific American:*

Referring to the communication of F. L. James, M.D., in the SCIENTIFIC AMERICAN of June 1, 1878, page 340, permit me to give my experience.

Some 30 years ago I made a contract with the United States Government to build a granite basin at the Pensacola navy yard, which required the driving of about 3,000 piles, to the depth of from 30 to 40 feet, in the hard, sharp sand at that yard.

After signing my contract, I was informed by the then Chief Engineer of the Navy Department that a corps of engineers had tried the experiment of driving piles at that yard, and that the maximum depth to which they could possibly be driven was 15 feet; at that depth the heads of the piles were boomed up, though banded with iron hoops, and that the hammer rebounded without moving the pile.

I inquired how heavy a hammer had been used, and was informed that it weighed 1 ton; it struck me at once that it was like trying to drive a 6 inch spike with a tack hammer instead of using an 8 lb. maul.

I obtained hammers weighing two tons and a half, and allowed them to fall but 12 feet: the result was that I drove my 3,000 piles without banding the heads, the effect of the blow being to polish the heads of the piles.

If you will publish the above it will be of more benefit to the practical mechanic than the long article on the same subject illustrated by letters, figures, and hieroglyphics which I recently saw in a scientific magazine.

New York, May 23. JOHN S. GILBERT.

### HUGHES' MICROPHONE AN ALLEGED PIRACY.

Mr. Thomas A. Edison sends us a communication in which he points out in some detail that Professor Hughes' microphone is a piracy on his carbon telephone, which, it will be remembered, is based on the great changes of resistance to the electrical current which occur in carbon under minute pressures. We illustrated both of these inventions in our issue of June 8, 1878, and at the same time pointed out the close similarity between them. Mr. Edison states that Hughes' discovery is not merely identical with his, but that the correspondence continues down to the minutiæ which many who concede the similarity of the investigations in other respects believe to constitute a distinctive feature in favor of Hughes. Mr. Edison says that "the subdivision of carbon has been repeatedly tested by me in my experiments on the telephone," and that he has employed the metallization of the carbon by plunging it in mercury for many years past. The change of electrical resistance with enormous rapidity by plumbago under pressure was published, as we have previously stated, in this journal on July 28, 1877, and we have already pointed out a fact dwelt upon by Mr. Edison in his present letter, namely, that Edison some time since abolished the vibrating plate in the carbon telephone, substituting a solid plate, and thus removing the last possible distinctive difference between the completed form of his device and the same form of the pirated microphone of Hughes.

It is not necessary to dwell on these points, because they are very few and simple, and the reader can review them by turning back to the illustrated description, above referred to, of the devices of both Hughes and Edison. The more interesting part of Mr. Edison's letter is its conclusion, wherein he implicates Mr. William H. Preece, the coadjutor of Professor Hughes, in introducing the microphone.

Mr. Preece is electrician to the London Post Office, the author of several works on electrical subjects, and an expert of considerable ability in that line. In the early part of last year, Mr. Edison states in the letter before us, he came to this country and visited Mr. Edison at his laboratory. With that freedom which is characteristic of the man, Edison exhibited to him the experiments which he had under way, including those involving the carbon telephone. At Preece's expressed desire Edison made him his agent for the presentation of this telephone in England. Subsequently Preece was also charged with the introduction of the phonograph in that country, and thereafter Edison kept him fully advised of his advances, both by private letter and by mailing him published accounts. Among other journals sent to Preece was a copy of the Washington *Star*, of April 19 last, containing an account of Edison's modification of the carbon for measuring minute degrees of heat; and that this was received by Preece before the presentation of the microphone to the Royal Society is amply proved by the fact that that gentleman embodied an extract from the account in an address delivered, in May, before the London Society of Arts. This extreme sensitiveness to heat, it will be remembered, is claimed to be a special discovery of Hughes in relation to the microphone. It is somewhat remarkable besides, in view of the above, that the announcement of Hughes' observation of the capabilities of the microphone as a thermometer appears as an addendum to the *Engineer's* publication of the paper, read by Huxley, announcing the invention of the microphone to the Royal Society, and that our cotemporary stated that the discovery had been made by Hughes since the presentation of the communication by Huxley.

Mr. Edison says, in conclusion, that he considers the conduct of Mr. Preece, in this matter, "as not merely a violation of my own rights as an inventor, but as a gross infringement of the confidence obtained under the guise of friendship." Mr. Hughes' part, under this aspect of affairs, is inexplicable, and responses from both him and Mr. Preece, to answer to these charges, will be awaited with interest.

THE DIRECT CABLE DUPLEXED.—Dr. Muirhead has just successfully applied the duplex system to the direct cable between Torbay and Ireland, the longest line yet duplexed. Trial tests show an actual speed in working commercial messages of from seventeen to twenty words a minute, thereby doubling the capacity of the cable.