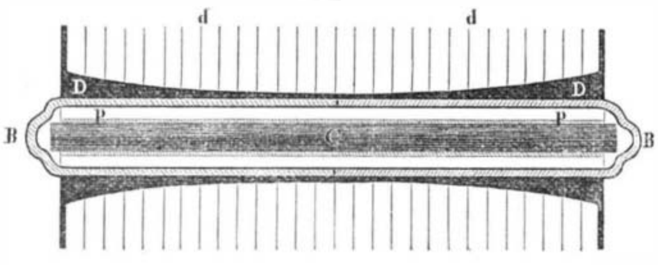
ment. The battery force needed to operate this instrument consists of two or three large-sized Bunsen cells.

Fig. 2 shows the internal construction of one of the large horizontal coils of recent construction, arranged upon Ritchie's plan, which has been adopted with slight modifications by the leading instrument makers of every country. C is the core, consisting of a bundle of soft iron wires. This is separated, by a thin layer of some suitable insulating material, from the primary coil, which usually consists of two or more layers, contained in the space, P P. The two coils are

Fig. 2.




separated by two heavy glass tubes, B B, closed at the outer ends, while their open ends meet in the middle of the coil. D D is a hard rubber bobbin, the tubular portion of which is thinnest in the middle and thickest near the ends, as shown in the figure. A great number of thin insulating disks, *d d*, of which only a few are shown in the figure, divide the bobbin into compartments, the wire being wound up in flat spirals, two or more of these occupying the space between each two adjacent disks. The various compartments communicate with each other, so that the secondary wire is continuous from end to end. The coating of silk and varnish upon the wire affords sufficient insulation between the convolutions in each compartment, and the disks prevent the sparks from striking through between the compartments. The coil may thus be said, as it were, to be insulated wholesale and retail, and the separation from each other of the different parts is complete. In regard to the external insulation, less is required in the compartments in the middle of the coil, where the tension is smallest, and there is the least danger of the electricity breaking through into the primary coil. The greatest tension is found in the compartments nearest the two ends of the coil, which is the reason why the tube is made thinnest in the middle and thickest at the ends. Another reason is that the thickness at the ends lessens the inductive Leyden jar action between the ends of the primary coil.

The largest induction coil yet made is that of the Royal Polytechnic Institute, of London. The length of this coil is 9 feet 10 inches, diameter 2 feet, weight 15 cwt., including 477 lbs. of hard rubber. The core is 5 feet long, and 4 inches in diameter, of No. 16 iron wire. The primary coil consists of 145 lbs. = 3,770 yards, of No. 13 wire. The secondary coil consists of 150 miles of wire, weighing 606 lbs., and having a resistance of 33,560 ohms. The condenser is in six parts, each containing 125 square feet of tin foil. With five large Bunsen cells, the spark is 12 inches in length, and with 50 cells this has been increased to 29 inches.

The induction coil constructed by Ritchie for the Stevens Institute of Technology, at Hoboken, N. J., has a primary coil consisting of 195 feet of No. 6 wire. The secondary coil is over 50 miles in length, of No. 36 wire. The core is composed of a bundle of No. 20 iron wires, wrapped in oil silk and cloth. With three large bichromate cells, this coiled has given sparks 21 inches in length, capable of piercing through solid glass three inches in thickness.

## Correspondence.

### The Colorado Potato Bug.

*To the Editor of the Scientific American:*

In a letter in your paper, on page 52 of your current volume, on the Colorado potato beetle, by Thomas A Cotchett, I discover the writer's want of knowledge of the habits of this insect pest; with which if he were better acquainted, he would readily admit that his plan, so far as driving this pest from our land, would be a perfect failure. The potato beetle does not depend upon the potato or on any one vegetable for its food, but will feed and thrive equally well upon the tomato and the thistle, and on various weeds which are as numerous as the insect pest itself. From the experience of the past three years in the ravages of this beetle, I will say that the following is so far the easiest and most practical way of avoiding injury and saving labor and the potato crops.

1. Let each farmer plant a small patch of potatoes quite early, on which the beetles will readily gather; and let there be vigilance and thoroughness in capturing all of the early or first crop of bugs, either by hand or by the use of Paris green. This done, large fields may be then planted without their being molested by the bugs, to any extent that will injure the crop. This mode is being universally adopted in the West, where we have suffered severely for the past few years.

When our much dreaded pest gets his foot upon England's shore, our friend in London can practice his theory; but we in this land cannot be induced to try it, to the evident detriment of a large portion of planters.

Grand Rapids, Mich. C. J. DIETRICH.

### A New System of Bridge Building.

*To the Editor of the Scientific American:*

Being a constant reader of your valuable paper, I have noticed occasionally that, in replying to some of your correspondents, you state that it is a great deal more easy to build on paper than to accomplish the practical part. You may think that this project emanates from the mind of a lunatic; however, a great many more absurd propositions have not only been advanced, but have been worked out with material results.

The following is a specification for a bridge that can be constructed for railroad or other purposes, over a body of unfathomable water, from one to five hundred miles in length: The bridge is to consist of a submerged pontoon (made in sections) of sufficient carrying capacity to sustain the weight of the roadway or superstructure, and is to be so constructed that, should one section become damaged, it can be repaired or replaced without in any manner disturbing the other portions or the bridge. The pontoons are to be anchored where possible, and where impossible, steam power is to be used for holding the structure in position and to counteract the force of the wind. The superstructure or roadway is to be made of light but substantial material, and can be elevated from ten to sixty feet above the surface of the water as circumstances may require. It can be made so as to be opened at any navigable point, from one to two miles in length (using steam power), in fifteen minutes, or opened and closed in thirty minutes JOSEPH SLUSSER.

47 West Water street, Cincinnati, Ohio.

### The Tides in the Gulf of Mexico.

*To the Editor of the Scientific American:*

I have noticed in all the Gulf ports of Louisiana, Florida, and Texas, the very small rise and fall of the tide. In some of them there is but one flood and one ebb tide in each 24 hours, the high water occurring when the moon crossed the upper meridian, and the low water 12 hours later. In other parts, a full tide occurred when the moon crossed the upper meridian, falling off to mean low water in six or seven hours, and a half tide occurred when the moon passed the opposite meridian. The influence of the wind very much affects the rise, fall, direction, and velocity of the currents. It would seem that, from the shape and apparent condition of things, there would be a natural current running up the western shore, following the northern shore around and down the eastern shore; yet, according to my little experience, such is not the case. The reasons why, I should think, the currents would run as I mentioned are probable and natural.

The trade winds are the cause. The northeast and southeast trade winds form their average line of contact at about two or three degrees north of the equator, and their united force forms the equatorial current, which is forced along the northern shore of South America, through the Caribbean Sea, until it strikes the western land and is turned northward up into the Gulf of Mexico, carrying a temperature of about 80°, which accounts for the high temperature of the Gulf Stream. After passing the Campeachy banks, the current turns easterly, running between Cuba and the Bahama banks on one side and the Florida reef on the other, forming the starting point of the Gulf Stream which passes out through the Straits of Florida with considerable velocity, and joins again the waters of the Atlantic Ocean, following the line of soundings on our coast and passing along the southern edge of the banks of Newfoundland; whence its course is nearly east, and its velocity and temperature are very much reduced, the latter being 10° or 12° lower. After passing the banks, this stream is joined by a natural current from the north. The two currents join and run in a southeasterly direction, until near the coast of Africa, and are then known as the Guinea current. It draws down towards Cape De Verde, whence the current runs more easterly, and again feels the effect of the northeast trade winds, which again accelerate the motion and keep up the grand circle.

This is my crude idea and opinion in regard to the causes of the Gulf Stream, and these conclusions I have arrived at from my own observations in the premises.

In regard to the Gulf of Mexico, there is a remarkable feature in that gulf, which is worth some study and experiment. It is said to be possible to keep the sea from breaking by pouring on oil. In some parts of the Gulf of Mexico the oil is supplied. From Ship Island westward, I have often sailed through large patches of this oil down to the Campeachy banks, and down the coast of Texas to the Rio Grande river. In passing through these oil spots, the surface is comparatively smooth, and the strong petroleum-like smell will tell you in the night of the presence of the oil, although you cannot see it. Now it seems to me that underlying this part of the Gulf, there must be tremendous oil deposits, which, in some places, have broken through and risen to the surface in quantities for years. For on the coast of Texas, at Brazes, Santiago, Padre Island, and Deckrose Point, there is to be found what the Texans call "sea wax," it washes ashore on the beaches in considerable quantities, and I have picked up large quantities at various times. It resembles pitch, and is found among the sand in pieces, some of them as large as a man's hand. It will float, melt, and burn as well as pitch, and has the same petroleum-like smell as the oil patches. I have no doubt in my own mind about the sea wax being formed by the sun's shining on this vast mirror, extracting the gases and leaving the residue in the condition in which it is found. In the course of time it drifts ashore on the coast of Texas.

Stratford, Conn. TRUMAN HOTCHKISS.

EQUAL parts of American potash and pearlash, 2 ounces each to about 1 quart water, give a good oak stain. Use carefully, as it will blister the hands. Add water if the color be too deep.

### The Phonometer.

A new system of fog signaling at sea has recently been invented in England by Captain W. E. Harris, by which vessels in thick weather are enabled to make known to others their whereabouts, and thus materially to decrease the danger of collision. Although signals from fog horns, bells, or steam whistles may be perfectly audible, the condition of the atmosphere is very frequently such as to render it impossible to determine correctly the quarter whence the sound comes. If, however, the people on the meeting vessels are informed, by the peculiar nature of the signals, of the course each is steering, the question of keeping clear is very greatly simplified. The apparatus, to which the name of phonomoter has been given, consists, says the London *Times*, of the mechanism of a clock placed in a horizontal position under a special dial. The seconds are arranged near the outer circumference of the dial, which is about eight inches in diameter, while the hour and minute dial is about two inches in diameter, and is placed on the lower part, where the seconds dial of a watch is usually sunk. There are four seconds hands placed at right angles to each other and radiating from the center of the main dial. Outside the seconds circle are marked five black segments, with intervals between them. One segment measures ten seconds in length, and the other four five seconds each, with intervals of three seconds. Outside the glass which protects the dial, and pivoted at its center, is a brass segment plate, so arranged as to obscure those segments on the dial not required for immediate use, and thus to prevent error in signaling. Around the dial and outside it is a flat ring of metal about two inches broad, on which all the points of the compass are marked.

The apparatus is placed on a stand with the upper part of the dial toward the head of the ship, the stand being fixed on the bridge just by the steam whistle, so that both are under the direct control of the officer in command. In using the phonometer, the compass ring, or dumb card, as Captain Harris terms it, which is a very important feature of the instrument, is moved round until the true point on which the ship is sailing is in line with the ship's head, all the true points of the horizon being thus indicated. These points being accurately known, it follows that all steamers in each other's vicinity fitted with the phonometer will have the true quadrants of the compass distinctly and concordantly represented. The steam whistle or fog horn is the important adjunct of the phonometer, and it is the duration of each whistle or blast and their number that indicate the course of the ship. The black segment covering ten seconds of space is a measure of ten seconds of time, the other segments indicating periods of different duration; and a whistle of ten seconds' duration indicates that the vessel is steering within the quadrant from north to east quarter north.

Assuming this to be the course of the vessel, the brass covering segment would exclude all the other black segments, and the officer would wait until one of the four seconds hands entered that segment. He would start the whistle and hold it on during the time the hand traversed that segment, and shut off steam the moment the hand reached the end of that segment. This operation must be repeated at intervals during the continuance of the fog.

Another ship coming within sound would at once know the course of the first, and would indicate her tack in like manner. Following out Captain Harris's code, two blasts each of five seconds' duration, with an interval of three seconds, represents from east to south quarter east. Three blasts of similar duration and intervals represent from south to west quarter south, while four blasts of the same length and spaces indicate from west to north quarter west. The special object of the four seconds hands is to enable the operator to reply readily to the signals from other ships, which could not be done if the revolution of a single hand had to be waited for. By the peculiar construction of the dial, the necessity of counting the seconds when signaling is entirely obviated.

### Process of Gilding.

Place in a plate leaf gold, add a little honey, stir the two substances carefully together with a glass stopper, the lower end of which is very flat. Throw the resulting paste into a glass of water mixed with a little alcohol; wash it and leave it to settle. Decant the liquid and wash the deposit again. Repeat the same operation until the result is a fine, pure, and brilliant powder of gold. This powder, mixed with common salt and powdered cream of tartar, and stirred up in water, serves for gilding.

As another method of gilding, Boutet Mouvel gives the following: Dissolve in aqua regia one grain of fine gold, previously rolled out very thin, in a porcelain capsule heated on the sand bath and concentrated till it is the color of ox blood. Add a pint of distilled water, hot, in which have been dissolved 4 grains of white cyanide of potassium. Stir with a glass rod, and filter the liquid through unsized paper. To gild with this liquid, it is heated a little above lukewarmness, and the articles to be gilt are immersed in it and supported upon a piece of very clean zinc.

G. R. McK. says: "I have been a subscriber to the SCIENTIFIC AMERICAN for several years. I take a dozen other papers and periodicals, but derive more pleasure and benefit from the SCIENTIFIC AMERICAN than from all the rest combined."

J. J. H. says: "I owe half my income to the information I obtained from the SCIENTIFIC AMERICAN."

A NEW hygrometer consists of strips of paper dipped in a cobalt salt solution containing common salt and gum arabic In dry weather, it is blue, and in wet, rose red.