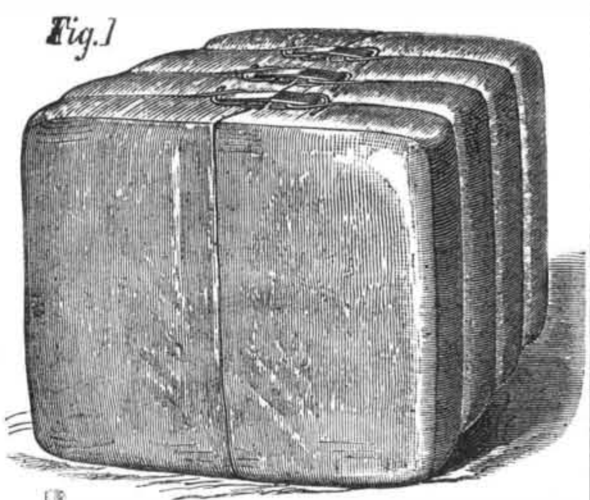
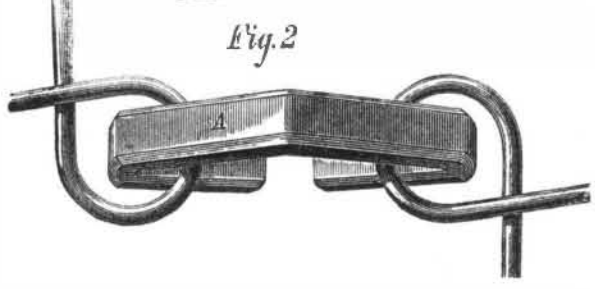
SMITH'S IMPROVED BALE TIE.

The invention illustrated herewith is a new tie designed to secure the wires used for binding hay bales. The usual mode of fastening these wires is wasteful, since about a foot on each end is employed to twist together and tuck under, so that, of the number of bands usual on each bale, fully six feet remain unutilized. Again, considerable wire is lost by cutting the bands rather than wasting the time necessary to untwist them. The present device is intended to prevent this waste, by using no more wire than is just necessary to secure the simple fastening, and, at the same time, to afford the latter of such a form as may be quickly and easily loosened



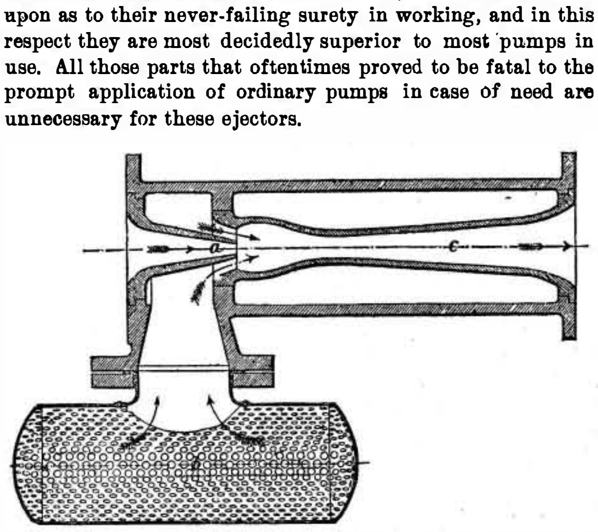


The invention consists of a double hooked piece, A, Fig. 2, having V-shaped jaws, into which the wire (size from 10 to 14) is secured. Small loops are first made on the ends of the wire, and these are slipped over the hooks while the bale is still in the press. The expansion of the bale, on its removal, draws the bands tight, and the jaw of the coupling is so constructed as to prevent the wire slipping. The ends of the wire are turned under the standing part so as to be out of the way, and are not liable to catch in transporting the bale. To unfasten the tie, it is only necessary to seize the ends of the wire with pincers and bend them back, when they will readily slip from the holes. Fig. 1 shows the bands in place on the bale.

For further particulars address the inventor, Mr. Isaac T. Smith, 1,532 Main street, Richmond, Va.

KORTING'S STEAM JET BILGE PUMP.

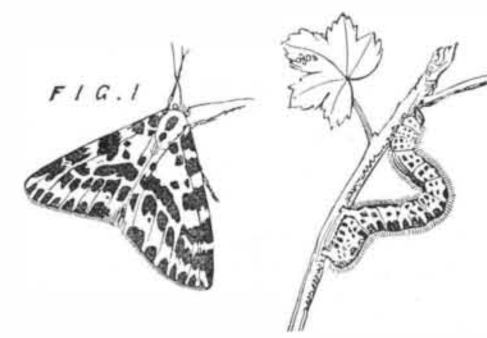
The application of an ejector to throw the water out of a ship's hold is an expensive way to attain this purpose. For the amount of steam necessary for working an ejector is found to be ten to fifteen times the amount used to do the same work by a donkey pump, or by the ordinary bilge pump in connection with the large engines. But on the other hand, it is an ascertained fact that such ejectors may be relied upon as to their never-failing surety in working, and in this respect they are most decidedly superior to most pumps in use. All those parts that oftentimes proved to be fatal to the prompt application of ordinary pumps in case of need are unnecessary for these ejectors.



In the annexed engraving a section of Körting's steam jet bilge pump is shown, the arrangement being so very simple that it hardly requires any explanation. The steam coming from the boiler enters through a nozzle, *a*, and forces the bilge water, after having passed the suction filter, *b*, through the diverging tube, *c*, whence it is discharged into the sea by means of a pipe through an opening in the ship's side. The arrows indicate the directions of steam and water.

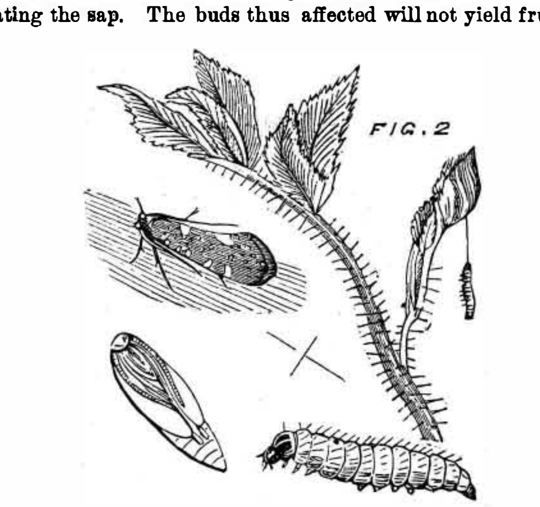
The Currant and Raspberry Moths.

A correspondent of the *English Mechanic* writes as follows: " A destructive pest among the fruit bushes is the *abraxis grossulariata*, known under the name of the gooseberry caterpillar, the magpie, or the currant moth. This moth and its caterpillar are shown in Fig. 1, and will, doubtless, be easily recognized when it is mentioned that the wings are whitish with black markings, and a few yellow blotches or stripes here and there; the caterpillar is yellow and black. The larvæ of this moth spin the leaves together in the autumn and winter, in position ready to devour the leaves as soon as they appear in spring. The remedy for this is to remove all the dead leaves from the bush in winter and burn them, or else dig, close handy, a hole at least two feet deep, into which you may rake the fallen leaves, and then remove



from underneath the bush about two inches of the top soil, putting it on the leaves in the hole, and then filling up with the soil previously removed. Tan and decayed manure, with a dusting of lime, may then be put under the bush, and the result will be found satisfactory, in freedom from early attacks of the pest, and a good crop of fruit. If, however, the bush should become infested with larvæ hatched from eggs deposited by the moth which has arrived at the perfect stage on some neighbor's domain, the best remedy is a dusting with powder of white hellebore, which is easily laid on and under the leaves by means of a muslin bag. Like most of the other garden pirates, this insect can be exterminated, as far as one's garden is concerned, by a little energy at the proper time.

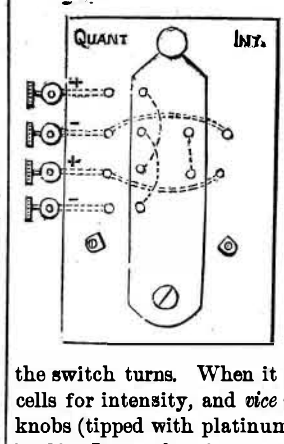
Another insect, *lampronia capitella*, also attacks currants. This moth is the raspberry grub, and is shown in various stages in Fig. 2. It is a pretty little moth, and its larva is unmistakable, being a bright red. If, on examining the young buds or shoots of the raspberry canes, we find a larva of *l. rubiella* on slitting open a bud or shoot, it will be tolerably correct to conclude that all the buds which appear to be in a similar condition are occupied by one of these destructive little pests. It will be sufficient if a sharp pinch is administered to the bud between finger and thumb, because that method has the merit of leaving the shoot to assist in elaborating the sap. The buds thus affected will not yield fruit:



but by carefully destroying all the larvæ, we take a good many steps towards obtaining a crop in the next season. Like the rose fly and the sesia on the currants, it is impossible to detect the presence of the enemy till the mischief has been done—the egg being placed in position during the preceding autumn, its presence becoming manifest only by the effects. A very good way of forestalling these and similar pests is to top dress the ground in early autumn with soot, and to dust that pungent substance freely about the fruit quarters, over leaves and everything. It is unsightly and unpleasant, but it seems to keep off a host of insects, and it is valuable as manure."

JOINING UP CELLS OF BATTERIES.

The little instrument, of which the following is a description, may be useful to some of our amateur electricians. It is a switch for joining-up cells for quantity or intensity by one movement. The engraving shows one for two cells, but it could be made for any limited number.



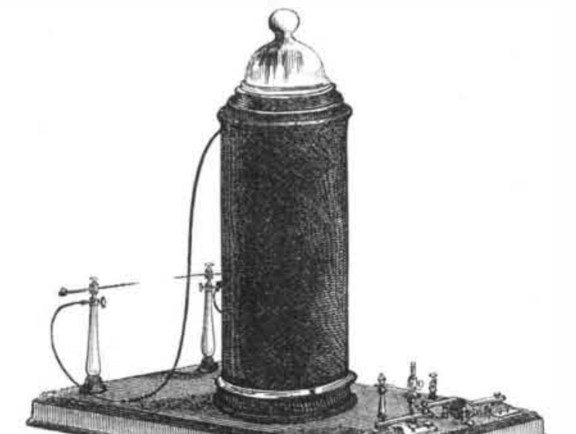
To the four binding screws are attached the wires from the cells, the line wires being fastened to the outer screws. The connections on the switch are marked in single dotted lines: the double lines represent those under the wooden slab on which the switch turns. When it is moved to the right, it joins the cells for intensity, and *vice versâ*. The small circles are brass knobs (tipped with platinum, if preferred). The rest explains itself. It may be of use on the lecture table.—*A. Trotter.*

PICRIC ACID dyes leather a good yellow without any mordant; it must be used in very dilute solution and not warmer than 70° Fah. Anilin blue modifies this color to a fine green.

THE ELECTROSTATIC OR INDUCTION COIL.

It has been proved by experiments that the quantity of electricity traversing the secondary wire of an induction coil is the same whether the current is produced by the closing or by the opening of the primary circuit. The difference between the two currents, in respect to their electromotive force, is, however, very marked, that of the opening current being far greater than that of the closing one, although, as above stated, the actual quantity of electricity is the same in both cases. The reason of this is that, when the primary or battery circuit is closed, it is opposed by the extra or self-induced current, and hence the former requires a certain length of time to attain its full force. When, however, the primary circuit is broken, the extra current is in the same direction, and therefore does not delay the action to the same extent as in the first instance. The primary current disappears almost instantaneously, or at all events in much less time than is required for it to attain its full strength. The duration of the induced or secondary current corresponds with the time occupied in the charging or discharging of the primary wire by the battery current. As the same quantity of electricity is produced in the secondary wire in each case, it is obvious that it must necessarily pass through the circuit in a shorter time at the breaking than at the closing of the primary circuit, and thus its potential or electro-motive force must be correspondingly greater.

Fig. 1.



The most striking example of this action is afforded by th electro-magnetic induction coils of Ritchie, Ruhmkorff, Ladd, and others, which are now made to produce the most powerful electrostatic effects, far surpassing those of the frictional electric machine.

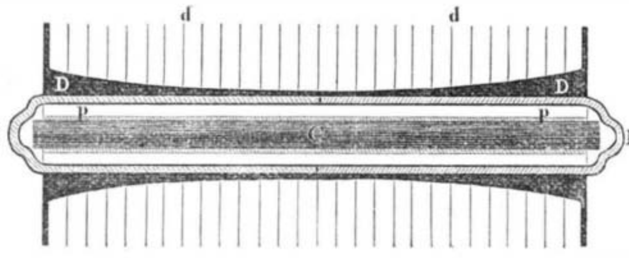
The discovery of the electrostatic properties of the induced or secondary current was made by Professor C. G. Page, of Salem, Mass., who (in 1836) published the first account of an induction apparatus, consisting of a primary coil with a secondary coil wound upon it, of many times its own length. Professor Page was also the originator of the automatic circuit breaker, and of the devices for rendering the same adjustable. Ruhmkorff, of Paris, constructed in 1851 the coils which bear his name. By careful insulation of the secondary wire, he succeeded in producing sparks of nearly one inch in length, capable of charging a Leyden jar with great rapidity. Ritchie, of Boston, in 1857, vastly improved the induction coil, and in successive instruments obtained sparks of 6, 10½, and 12½ inches. The cause of the superiority in Ritchie's coils is due chiefly to an improved method of winding the fine wire coil, by which it has been found possible to use with success a wire of several hundred thousand feet in length, while the limit in the instruments as constructed by Ruhmkorff was about ten thousand feet. Fig. 1 shows the external appearance of one of Ritchie's medium sized coils, giving a spark of nine or ten inches in length.

The chief parts of this apparatus are the primary and secondary coils, an interrupter to the primary circuit, and the condenser. In the instrument shown in Fig. 1, about 68,000 feet of silk-covered wire, 0 012 of an inch in diameter, is wound upon the exterior coil. The primary or inducing coil consists of about two hundred feet of copper wire, one seventh of an inch in diameter (No. 9), the ends of which terminate in binding screws upon the base. A heavy glass bell, seen at the top of the coil, insulates the primary from the secondary circuit, its foot being turned outwards by a flange as wide as the thickness of the coil. The induction coil, for more perfect insulation, is also encased in thick gutta percha. The ends of this coil are carried by gutta-percha-covered conductors to the two glass insulating stands, seen at the rear of the instrument, where they end in sliding rods, pointed with platinum at one end, and having balls of brass at the other. The interrupter devised by Mr. Ritchie consists of a toothed wheel, which raises a spring hammer, the blows of which fall upon an anvil, breaking contact between two heavy pieces of platinum. The European induction coils are usually provided with an automatic circuit breaker, but comparative trials have shown that there is an advantage in varying the rapidity of the interruptions, according to the class of effects to be produced, and that a certain time is requisite, for the complete charge and discharge of the soft iron wires which form the core, longer than the automatic circuit breaker allows.

The object of the condenser is to destroy by induction the greater part of the force of the extra current, which would otherwise materially diminish the power of the apparatus. In the instrument shown in the figures, the condenser consists of 144 square feet of tin foil, divided into three sections (two of 50 and one of 40 feet), carefully insulated by triple folds of oiled silk and placed within the base of the instrument. 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.