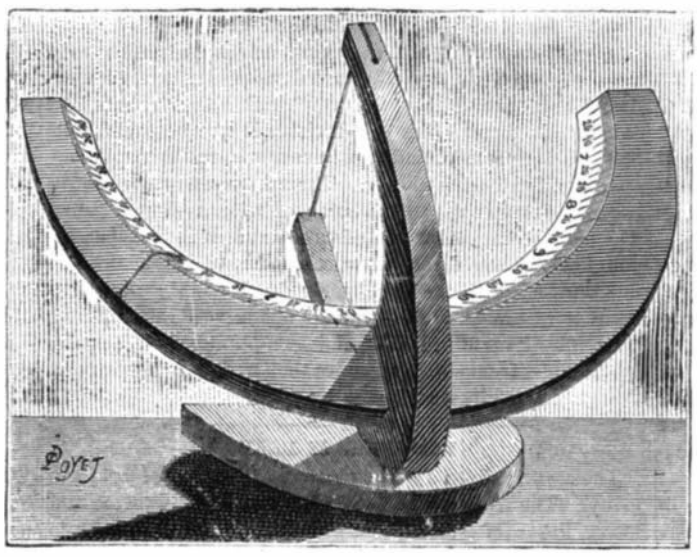
### A NEW SUN DIAL.

A correspondent of *La Nature* communicates to that journal the following description of a sun dial to be used as a regulator in the house, the instrument being placed in the window when it is desired to ascertain the time.

It consists of three parts, which may be easily disconnected by the removal of screws from two of them. The form, which is purely geometrical, comprehends the right line, the circle, and the ellipse. It is of the equatorial kind —the only one that is capable of giving exactness. In spite of its small size, the hour may be read on it from minute to minute as on a watch. The dividing lines indicate the even minutes, while the odd minute is given when the shadow falls between two divisions, its passage through the interval having an appreciable duration of only fifteen seconds. In selecting this form it has been the author's object to obtain sensitiveness. The stability of the style prevents all danger of the instrument getting out of order. The instrument represented in the accompanying engraving was tried and found to be exact to a quarter of a minute, from seven o'clock in the morning to noon. The error, if there was any, diminished on approaching noon, when it became nil.



PERAUX'S SUN DIAL.

To make use of the apparatus, a window is selected which receives the sun. Then the exact hour is obtained from a watch, or by other means, and marked on the dial, account being taken of the difference between the true hour and the mean hour; this being indicated in a table glued under the base. Then the position is regulated by means of leveling screws. It is requisite (1) that the midday line, the style, and a leaden wire shall be in the same plane, and that (2) the style be parallel with the axis of the earth, or make with the horizon an angle equal to the latitude of the place. When the dial has been regulated at the place selected a datum point is made there. It is more convenient to fix a very horizontal shelf on three screws, or to cause the dial to abut against a piece of wood worked into the form of a square, which shall mark the angle that the apparatus makes with the line of the window. We shall always be certain then to put the dial in the same place. By this regulator watches may then be set with all security. Since the invention of clockwork solar instruments have possessed no utility, except as regulators, on condition that they were instruments of precision. The exact hour, since the existence of railways, has become a social necessity.

This system of sun dial, when made of iron, is especially adapted for public uses in temperate regions. For such purposes it is only necessary to fix the base of the dial against a wall, point downward, and turn up the figures. Thus, a sun dial of 1·3 meters diameter, fixed at 3 or 4 meters above the ground, would carry divisions spaced 6 millimeters apart, which would make them perfectly visible. It would present every guarantee of precision, solidity, and durability. If the principal divisions were either hollowed out or formed in relief it would be easy to repaint the instrument. At the side of it there might be placed a table of corrections.

### A Natural Copper Plating Bath.

Two years ago, at a mine operated by Wm. Utter, at Campo Seco, near Milton, water came in and work stopped. To keep the large iron-bound and iron-bailed bucket used to hoist rock from drying up and falling to pieces it was let down into the water. Next season when it was drawn up, lo, a miracle! It was copper-bound and copper-bailed. From this has sprung quite an industry, and the mine has been sustaining itself from ore water ever since. The water contains an acid which has the property of taking into solution the particles of iron thrust into it, and it has also copper in solution which is let go, particle by particle, as the iron is picked up. It is a simple chemical exchange, and this mine may make another profit still if it will get another chemical into the water which will make the acid lay down the iron which, as a black flood, the water carries down into the Stanislaus River. The copper industry consists in taking bundles of scrap iron and old tin to the mine, where it is thrust into vats of water caught up, in which the metals are soon changed to copper, the residue of the iron taking the form of a black stream and flowing away. To make sure of making the water swap all its copper for iron, which it is glad to do without boot, one vat is placed below another down the bank to the river, and when the water escapes it has eaten its fill of iron and left pay for its meal in genuine copper.—*Stockton (Cal.) Mail.*

### Telephonic Sounds.

The *Operator* says: "Mr. Nat. G. Warth, manager of the Midland Telephone Company, at Gallipolis, O., writes: 'Please give some one the chance of explaining this phenomenon. This morning early, while in temporary communication over a Western Union wire with Major R. B. Hoover, at Pomeroy, Ohio, twenty miles away, I could distinctly hear the croaking of frogs and the singing of birds. The wire passes through dense woods, and along large streams between the two points. There were only the two sets of instruments in circuit. The sounds certainly were taken up and transmitted from some point between us. Now, by what law could this occur? Could the sound have been induced by a damp atmosphere?'"

### The Arlberg Tunnel.

The length of the Arlberg Tunnel will be 6·382 miles. The culminating point will be 2·611 miles from the eastern extremity, at an altitude of 1,332·63 yards above the Adriatic. The work was begun in June, 1880. Two perforators are used; at the eastern end the Ferroux machine, which was employed in the St. Gothard Tunnel, acting by percussion and moved by compressed air; at the west end is the Brandt machine, which is moved by water under pressure, and drills by boring. It had given excellent results at Pfoffensprung, upon the Swiss side of the St. Gothard, and the inventor guaranteed an advance of at least 6 feet 4 inches per day, a guarantee which has been largely exceeded. The simultaneous employment of the two engines is especially interesting, since it will allow a comparison under identical conditions, and will have a great influence upon the choice of methods in the piercing of future tunnels. The ventilation will be effected by a separate apparatus, distributing air under a low pressure, through pipes carried into the neighborhood of the workmen.

### DETACHABLE UMBRELLA AND PARASOL COVERS.

The engraving shows an improvement which permits a quick, ready change of the cover of a parasol or umbrella, so that with a single frame a number of covers of different materials and variety of colors may be used. It has the special advantages not only of economy, by enabling a worn-out cover to be readily replaced, but of enabling ladies to provide themselves with parasol covers corresponding with each change of suit. The interchangeable covers adapted to fit a single frame are slipped over the top of the stick of the frame, the aperture in the cover passing over the end of the stick being re-enforced with a ring of leather. This ring fits down upon the notch-plate and is held in place by means of a rubber ring, which is sprung into place and confined under a metallic collar upon the stick, so as to bear firmly upon the ring of the cover, as shown in Fig. 3 in the accompanying engraving. The ring of the cover is kept from turning upon the handle by means of short shank points projecting up from the runner. When the cover is thus secured upon the stick, it is secured to the ribs either by means of cad strings or of split rings sewed to its under side to spring into eyes or loops upon the ribs, about midway of their length and at the ends thereof. Fig. 1 shows the invention complete; Fig. 2 shows the method of fastening the cover to the ribs; and Fig. 3 shows the attachment of the cover to the stick; Fig. 4 shows the fastening clips, and Fig. 5 the ties. This neat and useful invention was recently patented by Mr. T. D. Lockling, Panama, United States of Colombia.


LOCKLING'S IMPROVED UMBRELLA.

### Peculiarities of the Great Michigan Fire.

A correspondent of the *Fireman's Journal*, who has lately gone over the territory devastated by the great fire in the forests of Michigan last fall, says his observations are conclusive that phenomena aside from the ordinary conditions of combustion were developed. In the first place the fire created at least two veritable storm centers which had the essential features of storms, and especially the spiral winds. The evidences are confirmatory of the belief that this storm center, after it became fully developed, consisted of a heated body of air or gas in a state of combustion, which was constantly fed by the smoke and vapor driven to the center by the whirling winds and the gases generated in the combustion of the pines and other resinous woods. This body of air, or burning gas, if it may be so called, by its heat acquired an ascensive force, but by the rapid forward motion of the fire was sucked forward and devoured, actually preceding the fire proper. It is evident that this body was of intense heat, possibly as great as 400° Fahr., at which point oxygen and carbon unite. That such a body of luminous vapor existed, detached from the fire, is asserted by many who saw it from a distance, and by those who were under it, but who escaped from the fact that it passed above their places.

The idea is further sustained by the fact that the fire jumped whole patches of inflammable slashings, and alighted beyond, lifting and falling in its forward motion like a balloon touching the earth. Fences in the center of broad fields burst into a blaze as if by explosion, and others nearer the fire escaped. A man in fighting the fire took off his trowsers, fearing they would catch fire and burn him up, and left them in a furrow in the middle of a field remote from any combustible material. When he went to get them he found them burned, and six quarter-dollars that were in the pocket melted together. A set of spoons were served the same way at another place.

Mrs. Lock and five children were burned to ashes, nothing but their bones remaining in the middle of the road, one hundred feet from any heavy timber. Green timber was dried and burned, and perhaps the most conclusive evidence was the apparently spontaneous appearance of fire in stumps and fences when no sparks were falling. These blazes appeared of white light and indicated a chemical union of carbon and oxygen. Another general feature is the fact that the fire appeared to move forward in parallel lines of varying width, and that in these lines everything was burned, and frequently to ashes. At the edge of the track a fence would be burned square off, just as though it had been cut or sawed perpendicularly; a house would be taken and the barn left; a wagon and a fanning mill were within five feet of each other, and the wagon was burned to ashes and the fanning mill not charred. It would be impossible, under ordinary circumstances, to burn a wagon without piling combustible material over it, but of this nothing but the iron was left.

Finally, the storm and fire disappeared simultaneously; that is to say, the fire was dependent upon the storm, or secondary to it—that it was prevented from lingering in the track or from burning sideways. In from two to three hours the fire was practically out where it had passed, indicating that the prime cause of the rapid combustion was in the storm which had passed, and which passing, perhaps, carried in its wake a condition of atmosphere opposed to combustion. This hypothesis explains pretty much all the phenomena except the balls of fire, which exactly correspond with what is known as "ball lightning," but which is a form of electricity wholly disputed by some, but recognized by Professor Loomis.

The statements of Ballentine and Kabocké are confirmatory of this ball lightning idea, and contradictory of the idea that these lights arose from the intense heat, or they themselves could not have survived it. Other statements are to the effect that this ball of fire fell on the ground and exploded, running in all directions. This is explained by some who were not present, who say that it was but the resinous cones of the pine ignited, carried by the wind, falling, scattering the burning pitch about them; but it should be remembered that those people who saw this phenomenon are men who have lived amid forest fires all their lives and have seen all the ordinary phenomena, and are not of a class exactly visionary or imaginative. It is fair to assume the possibility of electrical phenomena incidental to this fire storm, both from the fact that it was a great commotion in the elements and because it differed from a storm only in the facts of the absence of rain and presence of fire.

### Detection of Fusel Oil in Distilled Liquors.

Fusel oil consists chiefly of amylic alcohol, and although the latter differs very much in taste, smell, and physiological properties from ordinary alcohol, its presence in small quantities in brandy, whisky, etc., is not easily detected. The estimation of the quantity present was scarcely possible. L. Marquardt, of Hamburg, believes that he has solved this problem. Without entering into the details of the quantitative analysis, which is exceedingly tedious, we will only say that his process consists in first extracting the fusel oil with chloroform, washing thoroughly, and then oxidizing the amylic alcohol to valerianic acid by means of bichromate of potash and strong sulphuric acid at 85° C. The odor of the acid is easily recognized.—*B. B.*