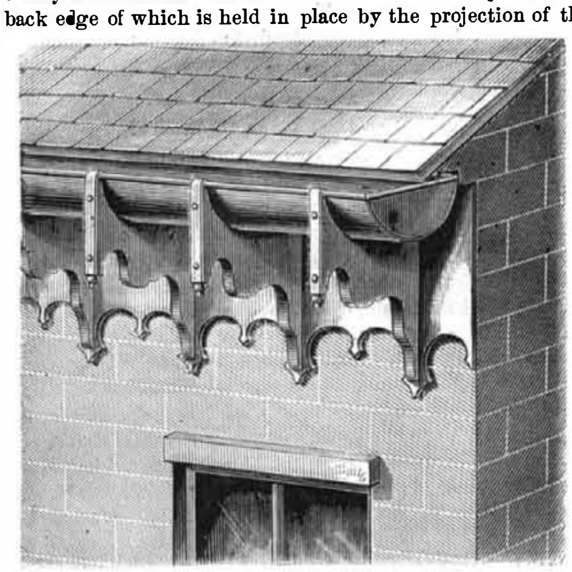
ROHRER'S IMPROVED GUTTER BRACKET AND SUPPORT.

The engraving represents a method of securing eaves gutters to buildings whereby beauty and usefulness are both secured. The brackets, now usually merely ornamental appendages, are, in this device, made of use in supporting the gutter, while that service does not detract from their office as ornaments. The tops of the brackets—which may be made of any form desired—are hollowed to receive the gutter, the back edge of which is held in place by the projection of the



eaves, and the front by strips of metal secured to the front edges of the brackets, and provided with a hooked end to embrace the edge of the gutter. The result is a neat and secure device for supporting eaves gutters. The attention of builders and others is directed to this economical and efficient device. Territorial and manufacturing rights are for sale by the patentee.

Patented through the Scientific American Patent Agency, Feb. 4, 1868, by Jeremiah E. Rohrer, Rohrersville, Md.

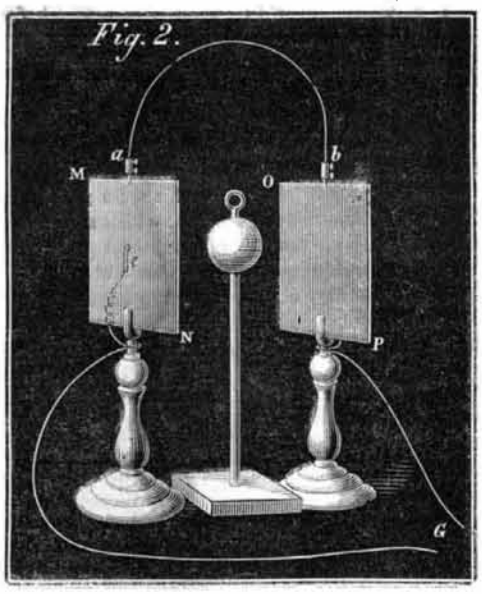
Science Familiarly Illustrated.

HEAT AND COLD.

BY JOHN TYNDALL, ESQ., LL. D, F.R.S.

Lecture V.--Continued.

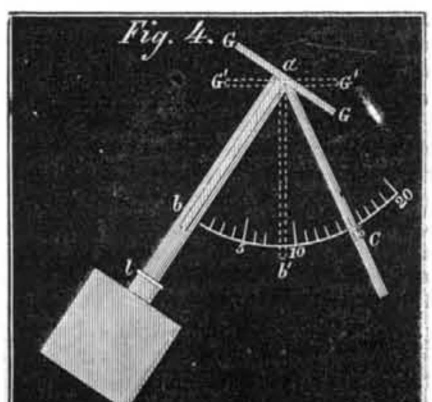
You see I have here two sheets of tin, M N and O P, one covered with lampblack, and the other uncovered. I place them facing each other, and I put this stand exactly midway between them. Now, I have a little device here—a telltale—



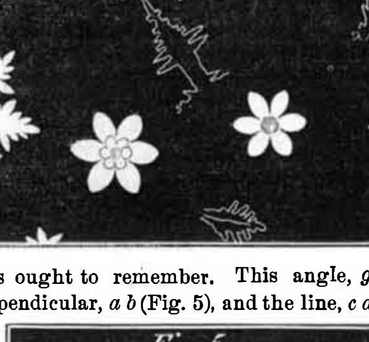
which will inform me which of these plates is heated. Suppose I heat this plate. Observe what occurs at the magnetic needle. I simply warm that plate by putting my finger upon it. The red end of the needle moves towards me. I cannot explain the wonderful power which moves the needle. It is what we call an electric current, and is produced by the union the two metals of the thermo-electric pile. When the plate is heated you see that a deflection of the needle is produced. The needle will return to zero when I withdraw my hand. I want you now to judge which of these two surfaces absorbs radiant heat most freely. The needle will not rest at zero unless these two plates are exactly at the same temperature. If one becomes warmer than the other the needle will deviate from zero. Thus we have it in our power to determine which plate absorbs heat most greedily. Now Mr. Cottrell will give me a ball of copper which is heated to redness. You observe it is radiating its heat as a luminous body radiates light [The red hot copper ball was placed equidistant between the two plates of tin, one of which was coated with lampblack. In a few seconds the needle of the pole began to travel from the zero.] Thus we prove that this surface coated with lampblack, which is the best radiator, is also the best absorber We might experiment with a variety of substances in this way, and prove that great differences exist as regards their absorptive powers.

It is very wonderful what a slight and trivial thing will be sufficient to prevent the absorption of radiant heat. I have here an exceedingly instructive substance. It is a piece of paint given me by Mr. Hills, of the firm of Bell and Co. A portion of this paint is coated with gold leaf, and though the gold leaf is infinitesimally thin, it has been competent to protect the surface of the paint from the action of radient heat to which the whole thing was exposed, while the other part of the surface, which was not covered with gold leaf, has become blistered. Where the gold leaf was present it prevented the rapid absorption of the heat.

I have here a sheet of paper covered on one side with iodide of mercury, a substance which has its color discharged by heat. On the other side of the paper there are certain figures represented by a thin coating of metal. I place the paper with the iodide of mercury side downwards; and over the other side I will hold a hot spatula which will radiate heat to the surface of the paper. Where the thin coating of metal is, the heat will be rejected, but where the paper is not coated the heat will be absorbed, and then it will reach the iodide of mercury on the other side and destroy its color. You will find that in this way we shall produce on the underside of the paper a perfect picture of the figures on the upper side, for you will find that the red color of the iodide of mercury will remain underneath the metal coating, for that coating has the power of rejecting the heat as the gold leaf rejected the heat in the other case, and so protected the paint and prevented its blistering. [The experiment was performed with a successful result.]



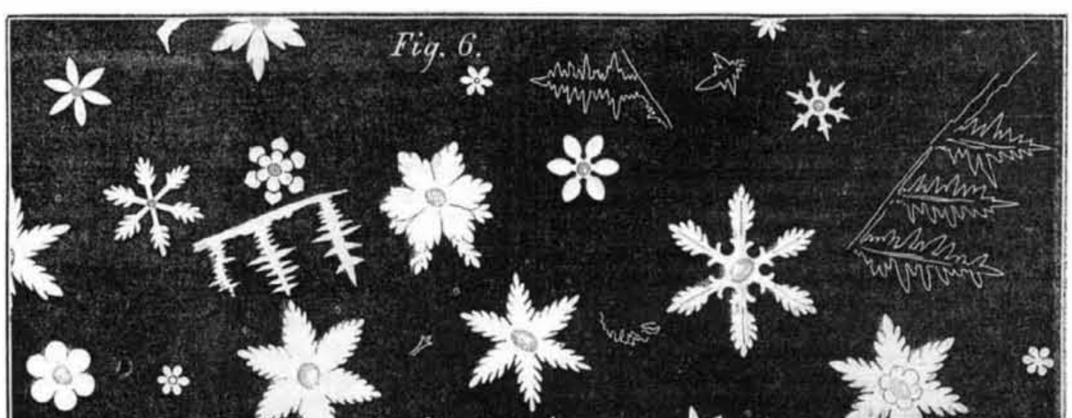
The radiation of heat obeys the same laws as the radiation of light, and it obeys the law of reflection due to light. This we can illustrate by means of our beautiful thermo-electric pile; but I will first of all make a single experiment that shall impress upon our minds the law according to which light is reflected. It is a very simple experiment, but I trust it will be very effective as far as regards the proof of the law. Mr. Cottrell, who knows my requirements very well, is now placing there in front a little looking-glass, G G. I intend to send a beam of light, *a b*, from the electric lamp, *l*, towards the mirror G G. The beam will strike upon the mirror, and be reflected. How? So that the reflected beam will lie as much on the left of this index, *a b*, which is perpendicular to the mirror, as the direct beam lies upon the right side of it. There are two terms employed in connection with this subject which the elder boys ought to remember. This angle, *g*, made between the perpendicular, *a b* (Fig. 5), and the line, *c a*, along which the direct ray goes to the mirror, is called the *angle of incidence*.—The angle, *h*, between the perpendicular *a b*, and the resected ray, *a f*, is called the *angle of reflection*: and the



la was regards both light and heat is this—that "the angle of incidence is equal to the angle of reflection." If I am right in what I have stated you will find the reflected beam as far from the perpendicular on one side as the direct beam is from the perpendicular on the other side. I want now to prove the same with regard to radiant heat by a very rough experiment, and show you that it obeys the same law as light. I take this piece of tin, which will reflect heat, and hold it so that the radiant heat from this fire will fall upon it, and then be reflected, according to the law I have just mentioned, on to the face of the pile. I have no doubt that reflected heat will warm the face of the pile, and cause the needle to move towards me. We thus see that heat exhibits the same law in this respect as light.

I wanted to make one or two experiments more, and I wished to do so, as before, by means of our thermo-electric pile; but I find that the needle does not act freely although the pile does its duty. Hence I think I must tell you by my tongue what that needle, if it were in a proper condition, would have told you by its motion. I intended to make the needle my voice but it has become dumb. I wanted to show you that this thing we call radiant heat passes in very different degrees through different bodies. I wanted first to compare the passage of heat through glass with its passage through other bodies. I have here a piece of rough glass, and I have also a beautiful substance—a very common one, but to me more precious than the diamond, though the diamond is a beautiful thing. This substance is rock salt. This would allow heat to pass through it with perfect freedom, while the glass would cut it off. So with different liquids. I have here a liquid called bisulphide of carbon, and here I have some of the well known liquid called water. If I filled one cell with water and another with bisulphide of carbon, I should find that the bisulphide of carbon would transmit heat with great freedom, while the water would not transmit it at all. Water is, indeed, as regards heat, one of the most opaque bodies in nature to all but incandescent or luminous heat. It is a perfectly opaque body to all rays emitted, say from the surface of a boiling kettle, or from the heated cube, or from the cheek of the young philosopher who helped me in an experiment in the early part of this lecture. During the burning of Her Majesty's Theater the heat struck upon the windows of a club house opposite, and as the glass would not allow the heat to pass through, the windows became hot, and thus the glass was broken. Had those windows been composed of rock salt the heat would have passed through them, and they would have remained perfectly cool, although there might have been an efflux of the most powerful radiant heat. If time allows, I will show you in the next lecture that we can boil water by radiant heat passing through bisulphide of carbon, though the same heat does not boil the bisulphide of carbon through which it is transmitted, notwithstanding that bisulphide of carbon boils at a lower temperature than water.

I have told you that different bodies, both solid and liquid, possess the power of transmitting heat in different degrees. Now, the body which absorbs the radiant heat, instead of transmitting it, becomes warm by the absorption. Ice is a body which is exceedingly opaque to the rays of heat, but allows light to pass through with freedom. I intend to place a piece of ice in the path of a beam from the electric lamp, and which will be a mixed ray of heat and light. The ice will stop by far the greater portion of the radiant heat, and the heat will be lodged within the ice. But the temperature of ice cannot be raised beyond 32° Fahrenheit without the ice beginning to melt, so that the portion of the beam arrested by the ice will occupy itself in liquefying the interior of the



ice. It will liquefy the ice internally, and I want you to see the wonder and the beauty involved in this beautiful substance which you skate over every winter, but, perhaps, never think of. This beam of light and heat passing into the ice will dissect the ice and separate the crystals, and you will see the beautiful figures into which the ice resolves itself. The ice will break up internally into most beautiful flowers consisting of six petals. In order to enable you to see these figures I must magnify them very much, and for that purpose I shall cause an image of them to be thrown on this large white screen. The lamp is placed in the gallery to increase the distance from the screen, and so make the figures appear larger. Mr. Cottrell has a lens there, and he will now take a piece of ice, and make the surface smooth by putting it on a warm body, and then place it in the path of the