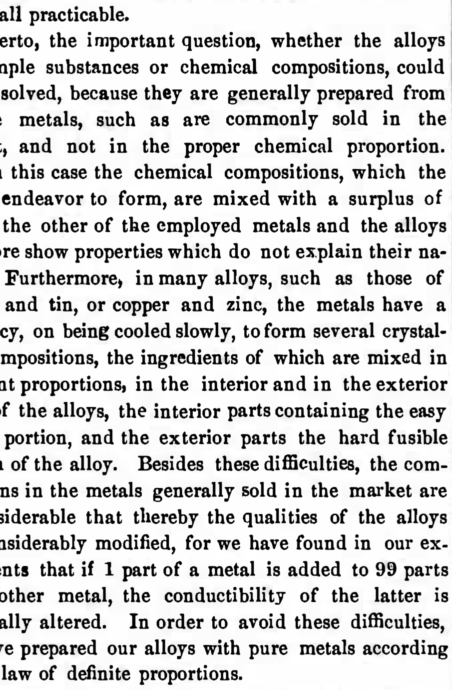
THE CONDUCTIBILITY OF METALS AND THEIR ALLOYS FOR HEAT.

Translated from Dingler's Polytechnic Journal, expressly for the Scientific American.

In order to be able to determine with exactness the conductibility of all common metals and of 70 of their alloys and 30 amalgams, it was necessary to fix upon a new method. The old method of Depretz could give authentic results only for a few of the very best conductors of heat, such as silver, gold and copper. With his method a long and thick bar of the metal is required in order to be able to drill holes in the same, large enough to receive some mercury and the globe of a thermometer, and it would have been necessary to procure a large quantity of each metal perfectly pure, which cannot easily be accomplished. Furthermore the fact that with his process mercury is used, makes it impossible to determine the conductibility of such important alloys as brass and bronze, and for the amalgams his method is not at all practicable.

Hitherto, the important question, whether the alloys are simple substances or chemical compositions, could not be solved, because they are generally prepared from impure metals, such as are commonly sold in the market, and not in the proper chemical proportion. And in this case the chemical compositions, which the metals endeavor to form, are mixed with a surplus of one or the other of the employed metals and the alloys therefore show properties which do not explain their nature. Furthermore, in many alloys, such as those of copper and tin, or copper and zinc, the metals have a tendency, on being cooled slowly, to form several crystalline compositions, the ingredients of which are mixed in different proportions, in the interior and in the exterior parts of the alloys, the interior parts containing the easy fusible portion, and the exterior parts the hard fusible portion of the alloy. Besides these difficulties, the compositions in the metals generally sold in the market are so considerable that thereby the qualities of the alloys are considerably modified, for we have found in our experiments that if 1 part of a metal is added to 99 parts of another metal, the conductibility of the latter is essentially altered. In order to avoid these difficulties, we have prepared our alloys with pure metals according to the law of definite proportions.

The apparatus which we used for determining the conductibility of the metals is represented in the accompanying engraving, and it consists of a box of pinewood, A, about 4⅛ inches wide, 6½ inches long, and 8⅝



inches high. It is furnished with a cover, and painted white inside and outside. In this box are contained two square cases of vulcanized india-rubber, the sides of which are ½ an inch thick. The largest of the two cases has a length of 2 inches at each side, it is 5½ inches high, and capable of containing 20 cubic inches of water. The smallest case has a length of one inch on each side, and a hight of five inches, and it is capable of containing 5 cubic inches.

These cases are painted white and surrounded by wadding in order to avoid all and every communication of heat from one case to the other, a pine board, is placed between them. The quantity of heat radiated from the largest case, B, is so small, that if the same contains 12 cubic inches of water, at 195° Fah., and the smallest case, C, 3 cubic inches at 60°, the temperature of the water in the last-named case does not rise 1-20th of a degree during the time required for our experiment. By these means all sensible radiation and transmission of heat is avoided, and the rise of the temperature taking place in the smallest case during the experiment is caused altogether by the heat transmitted through the prismatic metal bar, G, which forms the communication between the two cases. This bar is 3 inches long, and ½ an inch wide, and it is so arranged during the experiment, that ½ an inch of its length is contained in the case, B, and ½ an inch in the case, C, one inch is surrounded by the side walls of the cases, through which it passes, and the remaining portion, marked H, in the engraving, is inclosed in a tube of vulcanized india-rubber; the whole is made water-tight by covering the sides of the holes through which the metal bar passes, with a varnish of india-rubber dissolved in benzine. The bar is at a distance of two inches from the bottom of the case, B, and ½ an inch from the bottom of the case, C.

If an experiment is to be made, the cases are placed in water, in order to equalize their temperature; after having been cleaned off carefully, they are placed into the wooden box and surrounded by wadding, and 2 cubic inches of water having the temperature of the room, are poured into the smallest case, C. Both cases are now covered up by covers of vulcanized india-rubber, and after the cases have been covered all over with wadding, the lid of the box is closed down. Through a hole in the case, C, a very sensible thermometer is introduced, and in another hole a rod, E, of whalebone is placed, furnished at is lower end with a small disk of vulcanized india-rubber for the purpose of stirring-up the water in the case during the experiment, whereby its temperature is equalized throughout. After the water in the case, C, has obtained a settled temperature (generally within one degree of the room), a thermometer is introduced into the case, B, and 12 cubic inches of boiling water are now poured into this case through the tube, F, and this quantity of water is kept at the boiling point, during the whole time of the experiment, by means of a small jet of steam which is introduced through the tube, F.

The temperature of the water in the case, B, is transmitted through the metal bar, G, to the water in the case, C, and the rise of the temperature of the water during 15 minutes, and the time in which the rise takes place, are now carefully marked, from 5 to 5 minutes. During this time the water in the case, C, is kept constantly in motion, and the temperature of the water in the case, B, is kept up to the same point by the small jet of steam.

The metal bars used for the purpose are obtained by casting, and they are filed down to the required dimensions. For mercury and natrium we could not use the same proceeding, and we used a thin case of sheet iron, the cross-section of which is exactly ½ square inch, the same as that of the metal bars which are employed. This case is filled with mercury, and perfectly closed, and the conductibility of the case thus filled is determined in the manner above described. The conductibility of the case previous to its being filled with mercury was also determined, and by subtracting the latter from the conductibility of the case, when filled the conductibility of the mercury has been obtained.

[To be continued.]

OIL—FAT—WAX.

[Communicated to the Scientific American.]

Oils, fats, wax, all belong to the animal and vegetable kingdoms. Fats proper form about the twentieth of the weight of a healthy animal. Oil, fat, and wax are of analogous composition, though they differ in texture. Oils and fats are easily separated into two greasy bodies, one very liquid, the other quite solid; the liquid is termed *oleine*, the solid is called *stearine*. In winter olive oil partially congeals; the solid is the stearine, and the fluid is the oleine. The art of making hard candles consists in separating the solid stearine from the liquid oleine of fats. Castor oil contains little or no stearine, but palm oil is nearly all stearine; hence the former is useless to the candle maker, but the latter very valuable. Butter contains sixty parts of oleine and forty of stearine, in every hundred parts by weight; hence it is a good representative of what is denominated fat—that is a body of a texture between oleine (oil) and stearine (wax).

Nearly every kind of oil and every sort of animal fat differs in the relative proportion of stearine and oleine which they contain. The most beautiful specimen of stearine is spermaceti—the solid fat of the whale; and the most perfect example of oleine is that expressed from the pestachio nut.

The chemistry of oils, fats and waxes is of extraordinary interest; hence they have been subjects of special study by several philosophers. Cheveural, a French chemist, has distinguished himself in this particular, and it is all in consequence of his discoveries that we now have such excellent hard candles at a moderate price; and the day is not far distant when tallow will be as little known and remembered as its old companion, the tinder-box, is at present.

The making of fats and oils into soap is purely a chemical operation, but of immense domestic value. It is difficult to mention the chemistry of fats and oils without becoming involved in a discussion that would fill volumes; we cannot, however, pass unnoticed one of the proximate elements of fat and oil, called *glycerine*, a peculiar sweet principle—a sort of white sirup, which can be separated from oil and fat. No cosmetic has perhaps been so justly and generally employed as glycerine, which is obtained by steam distillation from fat or oil.

Oil has been used as food from the most remote period, as is evident by its frequent mention in the Scriptures:—"Cakes and oil—unleavened bread and oil—meat and oil—wine and oil—nothing in the house save a pot of oil." In Italy, the land of the olive tree, oil is there consumed as food even more extensively than butter is in this country. The Africans use the palm oil and various other kinds now first made known to us through Dr. Krapf's travels in the same manner. Plato, Fernelius, Dioscorides, and nearly all the ancient writers speak favorably of oil in a medicinal sense, observing that it renders the body "prompt and agile." Every kind of fat of animals bears with it the peculiar odor of the creature from whence it its derived; so also every kind of oil (and oils are as numerous as the plants of the earth) bears with it some peculiar characteristic smell or quality. Oil is justly considered as one of the most universally useful things in the whole world. How beautifully was this typified, when the dove, after the Deluge, returned to the ark, bearing in its beak an olive leaf!

SEPTIMUS PIESSE.

COMPENSATING PENDULUMS.

MESSRS. EDITORS:—Your illustration of a newly invented "compensating pendulum," published on page 96, Vol. II., of the SCIENTIFIC AMERICAN, reminded me of the circumstance that, many years ago, in England, my grandfather constructed a clock, the pendulum of which was rendered compensative by a very simple and ingenious contrivance, a description of which I will subjoin; merely premising that the clock to which I refer was one of the old-fashioned make—an eight-day clock, with a case some six or seven feet in hight, and a pendulum proportionably long.

"The pendulum rod consists of a strong brass bar, to the bottom of which the bob is secured in the usual way; another bar of the same metal, and of exactly the same dimensions, is secured to the back part of the clock case, and kept in a perpendicular position by one or more grooves, the bottom resting upon an immovable base. At the top of this bar is a projection, to which the pendulum is attached by two pieces of watch-spring which pass through a slit of brass just below, fastened to the back part of the case. There is an adjusting screw at the top of the pendulum, by which it can be regulated without stopping the clock. Now, it is evident, from the construction, that the expansion and contraction of this fixed bar and of the pendulum rod must be equal, and in contrary directions; for whatever be the expansion of the pendulum by heat, as the lower end of the bar rests upon a fixed point, it must necessarily expand upwards and raise the upper end of the pendulum in the same proportion that its length is increased, so that the distance of the point of suspension from the center of oscillation will always remain invariable."

The above description is transcribed from a brief memoir (in manuscript) of my grandfather, written by my father, who was much devoted to scientific and mechanical pursuits, and the originator of an invention which, should the Atlantic telegraph ever come into successful operation, may prove of much practical utility.

HENRY GILES.

Fonthill, C. W., June 30, 1860.