carbon and the proper flux) be formed into these ball or masses; or the balls thus formed may be used in combination with ores in puddling, melting, or smelting.

He claims that by thus combining, with the ore, carbon and the proper kind and quantity of flux in the deoxidizing and carbonizing of ores, he overcomes obstacles which have hitherto been considered insuperable.

The balls are composed of seventy-five parts of iron ore: twenty parts carbon; three parts slaked lime; one part nitrate soda; and one part molasses. The ore, carbon, and lime are mixed intimately together, and the molasses and nitrate of soda dissolved in water enough to form the whole into a mass, which is then formed into balls and dried in the sun. This is about an average proportion, which, as before said, varies with different ores. The object is to avoid the melting point in carbonizing, but to go as near it as possible. He thus charges the ore as highly with carbon as possible, before it reaches the melting point. For puddling, he uses say eighty parts burnt iron ore made very fine; sixteen parts carbon; two parts slaked lime; one fourth part nitrate soda; and one and three fourths parts of molasses; mixes the ore, carbon, and lime minutely, dissolves the molasses and nitrate soda in water enough to mix, and then forms the mass into balls and dries them. For melting iron ore, he uses seventy parts ground carbon; three fourths part lime; one fourth part nitrate of soda; twenty-eight parts finely ground ore; and one part molasses. For smelting iron ore, sixty-eight parts ground and burnt iron ore; twenty-five parts carbon; five parts lime; one part nitrate soda; and one part molasses.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Psychic Force.

To the Editor of the Scientific American:

Under this head I will introduce to your notice an experiment, which is akin to or identical with the power possessed by Mr. Home, and which experiment can be tried by any person for himself in less than five minutes.

A slip of thin writing paper, one and a half inches in length and a quarter of an inch broad, is creased in its middle, lengthwise and crosswise. This makes a dipping of the two ends, by which it may be poised on a needle point. The needle is set perpendicularly in a piece of cork, this forming a stand or support.

Now hold the hand, curved to the form of the quarter arc of a circle, near to the outer circle to be described by the paper arrow, and this will move circularly, not always immediately, for sometimes you may have to wait several minutes. For some persons, it will revolve over a hundred times per minute. In most instances it revolves towards the tips of the fingers, but not always. By putting the other hand near, in such manner as to point the fingers in the same circular direction the motion is generally increased. *Voila!* Try it and study its mystery!

"Heat!" is the first exclamation of many; but if it were caused by an upward current of air, the direction of revolution would be determined by the pitch of the ends of the arrow. Experiment has proved that pitching the ends propellerwise has no effect; and reversing the pitch does not change the direction of motion.

Gentlemen of the other side, I charge that if I were to announce that very few persons could do the above, you would cry "deception," "delusion," "weak minded," etc. But, the experiment being within the reach of all, there will be no such rejoinders as Professor Crookes has been annoyed with. In this experiment, the requirements pointed out by the Editors of the SCIENTIFIC AMERICAN are also met, and it may prove to be an anticipation of the delicate apparatus to be devised by Professor Crookes, showing that all persons are more or less possessed of this power.

J. A. SOLLIDAY.

Philadelphia, Pa.

[We tried this experiment, which our correspondent affirms will always succeed, but we had not enough psychic force to make the paper turn, except when we blew it. Perhaps some of our readers are better endowed.—EDS.

Railroad Gages.

To the Editor of the Scientific American:

I have felt for some time that the thanks of the engineering profession are due to the SCIENTIFIC AMERICAN, for the timely and efficient effort it has made to anticipate and prevent the error into which capitalists are likely to be led on the subject of railway gages reduced below the ordinary 4 feet 8½ track. I am glad to see that an engineer of Colonel Seymour's experience has spoken emphatically on this subject.

The necessity of uniformity in such a country as ours ought to supersede any ordinary questions of detail; and it would be a very great advantage to the railway interest of the United States if our engineers would agree, with one consent, to hold to the gage which has come to us from the old country, and which practically meets the problem of railway operation as well as can be desired. In fact, it would be well if this gage question, like that of standard weights and measures, could be made a matter of Congressional law, so as to relieve us from the continued confusions and embarrassments resulting from the want of a common standard. The arguments advanced in favor of a narrower gage are fallacious, as the arguments in favor of an increase have proved to be by much experience and very great outlay; and while there are times when engineers and scientific authorities need to advance far beyond the current of popular sympathy, there are other occasions when a conservative and guarded course is equally essential; and a popular paper deserves commendation and endorsement as much in one case as in the other.

SAMUEL MCELROY

Brooklyn, N. Y.

[For the Scientific American.]

ON SPECIFIC HEAT.

BY P. H. VANDER WEYDE.

The adoption of a unit of heat (explained on page 356, of the last number of the SCIENTIFIC AMERICAN), has given occasion to the correct investigation of different classes of phenomena, formerly not well understood; one of these is the peculiar property, of different substances, of requiring different amounts of heat in order to be heated to the same temperature. These amounts differ whether we take the equal quantities of the different substances by weight or by volume. They are of course measured by the accepted standard; the unit and the numbers representing these amounts (accepting that of water as 1) are called the specific heat of the substance, even as the weight of equal volumes of different bodies (accepting water as 1) is called the specific weight. Thus it was found that the amount of heat sufficient to raise the temperature of one pound of water a certain number of degrees was equal to the amount required to raise to the same temperature not less than thirty pounds of mercury, a mass of mercury more than twice the volume of a pound of water, because mercury is only 13·5 times heavier. It was further found that 31 lbs. of gold, 17 of silver, 10·5 of copper, 8·75 of iron, and 5 of sulphur, contained respectively as much heat as 1 lb. of water; or, in other words, required the same amount of heat to raise their temperatures to the same degree. We must, then, necessarily conclude that, at the same temperature, water contains 30 times as much heat as mercury, 31 times as much as gold, 17 times as much as silver, 10·5 times as much as copper, 8·75 times as much as iron, and 5 times as much as sulphur.

Consequently it is easy to deduce from this, when dividing 1,000 by the above numbers, that when water contains 1,000 units, mercury will contain 1,000÷30=33, gold 1,000÷31=32, silver 1,000÷17=57, copper 1,000÷10·5=95, iron 1,000÷8·75=1·14, and sulphur 1,000÷5=200; or, by taking water=1, their numbers become, respectively, for mercury 0·033, gold 0·032, silver 0·057, copper 0·095, iron 0·11, and sulphur 0·2. These numbers, then, are called the specific heat of the substances.

Different methods may be employed to determine this specific heat. One is the melting of ice by a certain amount of the substance (after having heated the latter to a certain definite degree of heat), and to compare the amount of ice thus melted with that melted by an equal weight of water, heated to the same temperature as the substance in question. Of course peculiar precautions are necessary in order to prevent the ice from being melted by exterior causes other than the heat of the heated body under investigation. Another method is that of mixture. It consists in raising the substance to a certain definite temperature, and then throwing it into a vessel containing an equal weight of water at another definite low temperature. The amount of heat communicated to the water will be proportional to the specific heat of the substance. Suppose, for instance, we mix one pound of water at a temperature of 156°, with another pound of water at a temperature of 32°, we shall find that the temperature of the mixture will be the mean, or 94°. But when we mix one lb. of mercury of 156° of temperature with one lb. of water at 32°, the temperature of the mixture will only be 36°. The water, therefore, will have gained only 4 units of heat, in compensation for the 120° lost by the mercury. It is evident from this that the amount of heat required to raise the temperature of one lb. of mercury four degrees, is equal to one thirtieth of that required to effect the same result on water; or, in other words, one thirtieth of the adopted unit of heat. This experiment becomes still more striking if we take equal quantities in bulk of both these substances. Suppose we take a pint of water of 32°, and a pint of mercury of 156°, and mix them; the temperature of the mixture, in place of being the mean or 94°, as is the case when mixing equal volumes of water, will only be 69°. The water has gained only 37°, in compensation for 87° lost by the mercury It is clear from this, that the amount of heat required to raise the temperature of one pint of mercury 37°, is equal to about two and one third of that required to produce the same effect on a pint of water, notwithstanding that the pint of mercury is more than thirteen and one half times heavier than the pint of water; in fact, three pints of water contain as much heat as seven pints of mercury, notwithstanding the latter surpasses the first some thirty times in weight.

The heavier metals have almost all very nearly the same specific heat as mercury. Thus, lead=0·031; iridium, 0·032; osmium, 0·031; platinum and gold, 0·032; thallium, 0·034; bismuth, 0·031; tungsten, 0·033. However, in another class, the specific heats are nearly double the above numbers; thus palladium=0·059; rhodium, 0·053; silver, 0·057; tin, 0·056; cadmium, 0·057. While, again, in another class, they are triple, or more than triple the first. Thus copper=0·095, zinc, 0·096; cobalt, 0·1; nickel, 0·11; iron, 0·114. The light metals have the largest specific heat, but always far inferior to that of water, and most of them nearly equal to that of sulphur. Thus aluminum=0·21; magnesium, 0·25; sodium, 0·20; potassium, 0·16. The two latter are so light that they float on water, while the lightest of all metals, lithium, has the greatest specific heat, namely 0·94, almost that of water. In fact water has a greater specific heat than any other substance, perhaps a few solutions excepted. For instance, a solution of cane sugar has a specific heat of nearly 1·1.

This shows what an immense store of heat may be contained in the waters of our planet, especially the ocean, which covers about three fourths of its surface. If, then, we take into account that, for equal weights, the specific heat of air and gases is about one fourth that of water, and that our atmosphere has only the weight of a layer of water, at most, of 34 feet, it is clear that its heat is only equivalent to that of a layer of water of 34÷4, or 8½ feet high. This depth of water, therefore, is capable of storing up as much heat as the whole atmosphere; and, in giving off its heat, is able to communicate half its excess of temperature to the air, retaining the other half. Suppose, for instance, a certain portion of the Atlantic ocean to have a temperature of 80°, while the atmosphere over it is 20°; eight and one half feet depth of water will then be capable of heating the air 30°, bringing it to 50°, while the water itself descends 30°, also reaching 50°. No wonder, therefore, that the Gulf Stream, which continually is pouring the warm water from the tropics against the northwestern coast of Europe and its islands, modifies the climate of this part of the world to such a degree as to make it much warmer than the regions in the same latitude on the continent of eastern Europe, Asia, or America. When we fully consider that water is about 800 times heavier than air at the ordinary pressure, it is clear that one cubic foot of water contains as much heat as 800×4, or 3,200 cubic feet of air, or one cubic inch of water nearly as much as two cubic feet of air.

In applying these facts to the heating of buildings, we must not, however, forget that the cold walls and objects in buildings require much more heat than the air (they have a greater specific heat), and therefore we cannot succeed in heating a room before we have brought all the objects in contact with the air to the same temperature. Applying this on a large scale again to the Gulf Stream, it is clear that west winds blowing over the same are heated to a moderate temperature, and will very soon lose this heat when passing, in winter, over the cold or perhaps frozen ground of the British Islands, France, Belgium, Holland, and the western parts of Germany In giving them a portion of their heat they will have lost most of it before reaching Russia; wherefore the influence of the Gulf Stream does not extend beyond the lands of western Europe, which enjoy the sole benefit of the same.

New York.

SYRACUSE---ITS MECHANICAL INDUSTRIES.

A correspondent, in the New York *Daily Times*, gives a lengthy account of the mercantile and manufacturing industries of Syracuse, N. Y., from which we make the following extracts. In describing John Greenway's brewery, the writer says:

In this Syracuse brewery, looking, as it does, like some great orphan asylum or other State institution, the manufacture of beer is carried on, on so large a scale and with such mechanical precision as in itself to create more than a gastronomical interest. The first point is the wing of the building used for malting purposes. No less than twelve floors, each ninety-one by sixty-five feet, are used for the laying out of the malt for sprouting, after it has remained for forty-eight hours in the thirty-one steeping tubs, which hold 225 bushels apiece. The malt is in every stage of progress—some just taken from the water, some again almost ready for the drying kilns, where it is taken seven days after it leaves the tubs. There are two kilns to each floor. The kilns are heated by enormous furnaces, with twenty-four flues, in the basement. The flooring of the kiln is of iron, and the temperature, even on the top floor, is kept up to 90° Fahrenheit.

Malt is only made during eight months of the year, but in that time Mr. Greenway generally makes from 225,000 to 250,000 bushels. When the malt is properly dried it is transferred on a "carrier" to the storing bins below which hold about 45,000 bushels. These "carriers" are very ingenious contrivances. They run the whole length of the malt house and granaries, 335 feet, and communicate with the elevators and hoppers.

A "carrier" is a narrow endless sheet of cloth, about two feet in width and bagging slightly on the middle, which runs backward and forward on rollers moving on a staging four feet from the ground, and either discharges the malt into the hoppers, or carries the raw barley from the elevators to the malting rooms. It will carry 1,000 bushels an hour. The granaries consist of three floors, 162 feet long and 65 feet wide; two of them being 14 feet, and the third 11 feet high. They have a storage capacity of 175,000 bushels of barley. The hop room is 65 by 40 feet. Its contents vary in quantity, according to requirements and market values; but 350,000 pounds is about the average annual consumption.

"The two huge vats, in which the malt, hops and water are converted into beer, hold 300 barrels each. The fluid in them is boiled by a steam worm which covers the bottom and is fed from the boilers in the basement. All the beer is boiled by steam. One engine of forty-five horse power suffices for boiling the beer and heating the building in winter time. It consumes 700 tuns of bituminous coal in the course of the year. The coal bunkers of the establishment hold 300 tuns.

"An admirable contrivance, the patent of a Frenchman named Baudelot, is used for cooling the beer before it is run into the fermenting vats. The boiling beer is forced up to the floor above into a horizontal pipe seven feet from the ground. From this pipe it issues with great force from innumerable little jets, and dashes down on a succession of highly polished wooden bars about an inch in thickness and four inches across, placed like the laths of sun shutters when they are turned so as to admit the light. These bars are hollow, and are filled with constantly flowing iced water.