## LATENT HEAT.

MESSRS. EDITORS:—I have observed in the SCIENTIFIC AMERICAN, at different times, various paragraphs in which latent heat is mentioned as existing in all substances; and from certain answers to questions put to you on this subject by your correspondents, and from my own observations, I am inclined to think it is but imperfectly understood, and those who recognize the truth of the phenomenon are unable to give any solution of the fact. It appears to be one of the mysteries of nature unrevealed to the majority of your readers. All they know is that latent heat does exist, and it has been proved by the fact that a gallon of water, converted to steam at 212°, will heat 5½ gallons of water to 212°; thus affording evidence of latent or concealed heat. Now it appears to me that by giving latent or hidden heat a more appropriate name by a little effort of our reasoning faculties, this hidden heat can be made intelligible to all. I would call this concealed heat *expanded* or *diluted* heat. All bodies absorb heat more or less in proportion to their affinity or attraction for it and their capacity for holding or retaining it; this capacity varies according to the volume or space the body occupies. Steam being more bulky at a high temperature than at a low one, in the form of water, it is capable of retaining more heat in its expanded form than if condensed. By reducing the volume of steam, air, or any other substance capable of compression, to one-half its bulk, the temperature will be increased to double its original heat; if we compress it to one-tenth its volume, the temperature would be in the same ratio, as all the heat is still there, but concentrated, and therefore more intense. If we compress two volumes of air of a given temperature into one volume, we have the same quantity of heat in the one that the two contained before compression. This has been verified by a well known apparatus for producing fire before the discovery of lucifer matches; it consisted of a small brass or iron tube or cylinder, 4 inches long by about ¼-inch bore, fitted with a piston. By placing a piece of tinder or punk in a cavity at the end of the piston, and suddenly forcing the piston to the bottom of the cylinder, the air being compressed and the heat also which the air in the tube contains being concentrated to about one-tenth its original space, it is sufficient to ignite the tinder or punk. There is no heat added by this compression, but what was already there is concentrated. A similar illustration may be made by dissolving salt in water. If we put an ounce of salt in a quart of water, the salt disappears or is absorbed by the water, and is but slightly perceptible to the taste. Now by reducing this volume or taking half the water away by evaporation, what remains will be twice as salt as it was before; if we reduce it enough, we come down to the pure ounce of salt again, except what little may escape with the evaporation. Solids possess this latent heat as well as gases, air, steam, &c., but we cannot make them give it out for want of sufficient power to compress or condense them.

A. F. W.

Philadelphia, Pa., Feb. 18, 1860.

[As our correspondent says, this is a mysterious subject. Many of the manifestations of latent heat are perfectly analogous to the squeezing of water from a sponge by compressing it, but this is not the case with all the phenomena. For instance, water changing into ice converts 140 degrees of sensible into latent heat, though its bulk is increased by the change.—EDS.

## BELTS FOR DRIVING MACHINERY.

MESSRS. EDITORS:—I noticed an article on page 84, present volume of the SCIENTIFIC AMERICAN, on the above subject, and I made up my mind to give you some of my practical experience with belts and pulleys for transmitting power. I have found that it makes a considerable difference in the power transmitted, according to which side of a belt is placed next to the pulleys. I was one of those who once did as my father did before me; and so I run belts with the rougher side next to the pulleys, thinking they would "hug" tighter, to use a common phrase. A few years ago, having occasion to put in a lot of new belting, I proposed to try the *smooth* side next to the pulleys, most of which were of iron, turned and filed smooth. To my surprise I found that the belts did not require to be so tight, that they did not slip so easily, and were not so liable to crack.

An error is made by many persons in using pulleys, namely, they make the driven pulley too small, thereby getting speed before power. My first experience for myself was running a gang of twelve 7-inch saws and a trimmer 8½-inch with a 4½-inch pulley. I had too much speed and my saws did not run with power to do the work. I then tried a 6-inch pulley, which did better; but still not being satisfied, I had a 7-inch iron one put on, which drove the saws with sufficient power to do all the work.

In regard to purchasing belting, I believe that the best white oak tanned leather will be found 50 per cent the cheapest in the end, and my mode of preparing a new belt is to soak it for about ten minutes in water; then let it dry 15 minutes; then brush it over two or three times with neatsfoot oil. When it is well dried, I put on the belt, and oil it once in two months in cold weather, and once a month in warm.

P.

Troy, N. Y., Feb. 16, 1860.

Our correspondent is perfectly correct in regard to the superior results obtained from driving pulleys with the grain instead of the flesh side of the belt next to the pulley. It would naturally be supposed that the rough side would be the best to apply to the pulley; but experiment has adduced the fact that when the grain side of a belt is placed next to a pulley, it will drive about 34 per cent more than when the flesh side is placed next to it. In connection with this subject we may state that Mr. William Barbour, superintendent of the mechanical department of the Pacific Mills, at Lawrence, Mass., has sent us the following communication, which will undoubtedly be deemed valuable by many of our readers:—

MESSRS. EDITORS:—Herewith I send a table of the power, width and velocity of belts for driving any kind of machinery where applicable. Knowing there is, among machinists who have the charge and arrangement of machinery, a want of information on this subject, and having seen nothing in print for general information of this character, I present this; having made practical use of it several years with perfect satisfaction, I cheerfully recommend it to all who may at times be in want of reliable information with regard to belts, their width and power, &c. You will observe that the table takes in belts from one to six inches in width, and running up to a velocity of 4,000 feet per minute. I will, at another time, continue the table in four parts more, running up to a width of 30 inches with the above velocity; this width and speed being minimum and maximum of all belts worth of notice.

| Velocity in feet per minute. | 1 Inch. | 2 Inches. | 3 Inches. | 4 Inches. | 5 Inches. | 6 Inches. |
|---|---|---|---|---|---|---|
| 5 | .4 | .8 | .13 | .17 | .22 | .26 |
| 10 | .8 | .17 | .37 | .36 | .45 | .55 |
| 15 | .13 | .27 | .41 | .55 | .68 | .83 |
| 20 | .17 | .36 | .55 | .73 | .92 | .111 |
| 25 | .22 | .45 | .68 | .93 | .115 | .138 |
| 30 | .27 | .55 | .83 | .111 | .138 | .166 |
| 35 | .32 | .64 | .96 | .128 | .163 | .194 |
| 40 | .36 | .73 | .111 | .147 | .184 | .322 |
| 45 | .41 | .83 | .128 | .166 | .208 | .250 |
| 50 | .45 | .92 | .139 | .184 | .231 | .277 |
| 75 | .68 | ·138 | .208 | .277 | .347 | .417 |
| 100 | .92 | .185 | .277 | .371 | .463 | .561 |
| 200 | .184 | .371 | .556 | .742 | 1.031 | 1.113 |
| 300 | .277 | .556 | .835 | 1.113 | 1.392 | 1.671 |
| 400 | .371 | .742 | 1.113 | 1.485 | 1.896 | 2.227 |
| 500 | .463 | .927 | 1.392 | 1.856 | 2.321 | 2.795 |
| 600 | .556 | 1.113 | 1.671 | 2.227 | 2.795 | 3.345 |
| 700 | .649 | 1.298 | 1.948 | 2.598 | 3.248 | 3.898 |
| 800 | .742 | 1.485 | 2.227 | 2.971 | 3.713 | 4.456 |
| 900 | .835 | 1.671 | 2.506 | 3.332 | 4.177 | 5.013 |
| 1,000 | .927 | 1.856 | 2.785 | 3.711 | 4.642 | 5.581 |
| 1,100 | 1.081 | 2.042 | 3.123 | 4.085 | 5.106 | 6.127 |
| 1,200 | 1.113 | 2.227 | 3.332 | 4.456 | 5.581 | 6.665 |
| 1,300 | 1.206 | 2.412 | 3.621 | 4.849 | 6.035 | 7.242 |
| 1,400 | 1.298 | 2.598 | 3.898 | 5.198 | 6.498 | 7.798 |
| 1,500 | 1.392 | 2.785 | 4.177 | 5.571 | 6.963 | 8.356 |
| 1,600 | 1.486 | 2.971 | 4.456 | 5.942 | 7.427 | 8.913 |
| 1,700 | 1.577 | 3.156 | 4.735 | 6.313 | 7.892 | 9.471 |
| 1,800 | 1.671 | 3.332 | 5.013 | 6.685 | 8,356 | 10.027 |
| 1,900 | 1.763 | 3.527 | 5.292 | 7.056 | 8.821 | 10.570 |
| 2,000 | 1.856 | 3.713 | 5.571 | 7.427 | 9.285 | 11.130 |
| 2,100 | 1.948 | 3.898 | 5.848 | 7.998 | 9.748 | 11.680 |
| 2,200 | 2.042 | 4.085 | 6.127 | 8.171 | 10.213 | 12.250 |
| 2,300 | 2.135 | 4.271 | 6.402 | 8.542 | 10.670 | 12.810 |
| 2,400 | 2.227 | 4.456 | 6.685 | 8.913 | 11.130 | 13.160 |
| 2,500 | 2.321 | 4.642 | 6.963 | 9.285 | 11.600 | 13,940 |
| 2,600 | 2.412 | 4.807 | 7.242 | 9,656 | 12,060 | 14.470 |
| 2,700 | 2.506 | 5.013 | 7.521 | 10.027 | 12.530 | 15.030 |
| 2,800 | 2.598 | 5.198 | 7.798 | 10.398 | 12.980 | 15.580 |
| 2,900 | 2.642 | 5.385 | 8.077 | 10.760 | 13.450 | 16,150 |
| 3,000 | 2.785 | 5.571 | 8.356 | 11.130 | 13.920 | 16.710 |
| 3,200 | 3.172 | 6.372 | 9.544 | 12.744 | 15.916 | 19.110 |
| 3,400 | 3.264 | 6.528 | 9.892 | 13.056 | 16.120 | 19.780 |
| 3,600 | 3.394 | 6.988 | 10.382 | 13.976 | 17.370 | 20.760 |
| 3,800 | 3.648 | 7.448 | 11.096 | 14.896 | 18.544 | 22.190 |
| 4,000 | 3.840 | 7,840 | 11.680 | 15.680 | 19.620 | 23.360 |

The sums in the columns beneath the figure 1, 2, 3, 4, 5, 6, (in the first horizontal line) indicate the horse-powers (in decimals) of belts of those widths, when running at the respective velocities stated in the first column. *Example.*—A 6-inch belt, running 2,200 revolutions per minute, gives 12¼ horse-power.

I would strongly recommend all belts above 12 inches in width to be made double, as they will carry 50 per cent more power, with less decay, if properly made.

W. B.

Lawrence, Mass., Feb. 20, 1860.

## BURNING FLUID AND TENEMENT HOUSES.

MESSRS. EDITORS:—I have read your remarks on page 121 of the present volume of the SCIENTIFIC AMERICAN, about the destruction of the tenement house in Elm-street, also your recommendation of iron staircases for such houses. Now, considering the means by which the house was set on fire, namely, burning fluid, would it not be as well to insist on the houses being so well and strongly built that gunpowder might be exploded in the cellar without injury to the house; that being quite as innocent as burning fluid. Two gallons of burning fluid spilled on a staircase would burn any wooden tenement, however well constructed, and two kegs of powder exploded in the same place would not destroy the building more effectually.

I think that the coroner's jury should have censured the fluid first, and the builder of such houses second.

M. P.

New York, Feb. 22, 1860.

## SAVING LIFE IN SHIPWRECK.

MESSRS. EDITORS:—In the case of apparatus for casting a line between a wrecked vessel and the shore, why is not the mortar placed upon the ship, instead of on shore? In nine cases in ten the ball with the rope attached may be cast upon the shore, while in nineteen cases out of twenty, the rope will not strike the ship, when cast from the shore. Anchor claws might be attached to the ball to facilitate its catching hold upon the shore. Ships ought to carry, each, a small mortar, with a supply of rope and ball.

A CAREFUL READER.

Fishkill Landing, N. Y., Feb. 14, 1860.

[It is customary for British vessels to carry the apparatus spoken of.—EDS.

## FRANCE ON AMERICAN ASTRONOMERS.

A late number of the *Revue des Deux Mondes* contains a review from the pen of Mr. Auguste Laugel, on the Observatory of Cambridge, Mass., and the labors of the Professors Bond—father and son. The reviewer speaks in terms of unqualified praise of the labors of these *savans*, of the great extension which the science of astronomy has acquired in the United States, and of the tendency of the people to the support and encouragement of this particular field of science. He contradicts the generally received opinion in Europe that the people of the United States are only ambitious in the direction of material progress, and points with conclusiveness to the fact that we have more observatories already than France. The writer speaks in the highest terms of the works of Lieut. Maury, and then utters the fear that the vogue which this writer's popular writings on meteorology have attained may lead the people of the United States, naturally of a practical turn of mind, too much after meteorology, to the neglect of astronomy. The writer then mentions in the most honorable terms the labors of the other astronomers of the United States, and in speaking of the late work of Professor Pierce, of Harvard University, "Physical and Celestial Magnetism," characterizes it as a veritable astronomical encyclopædia, but regrets that he has mingled theological ideas with scientific calculations.

TRANSPARENT IVORY.—The process for making ivory transparent and flexible is simply an immersion in liquid phosphoric acid, and the change which it undergoes is owing to a partial neutralization of the basic phosphate of lime of which it principally consists. The ivory is cut in pieces not thicker than the twentieth part of an inch, and placed in phosphoric acid of a specific gravity of 1·131, until it has become transparent, when it is taken from the bath, washed in water and dried with a clean linen cloth. It becomes dry in the air without the application of heat, and softens again under warm water.—*Druggists' Circular.*

THE sea serpent has been caught at Bermuda in the form of a huge gymetrus, 30 feet long. The haunts and habits of this tribe of fishes are but imperfectly known to marine geologists.