Life in Japan.

The following are extracts from a volume of "Travels in Japan," from the pen of Bayard Taylor, Esq., just published by Scribner & Co., 654 Broadway, N. Y.

RICE PLANTING IN JAPAN.

"As we advanced through the country, both men and women were busily employed in planting out their rice. This was the first time I had seen any but isolated cases of women being engaged in field labor in Japan; for the Japanese appear to me to be honorably distinguished among nations of a higher civilization, in that they leave their women to the lighter work of the house, and perform themselves the harder out door labor. Indeed, I was at first in some doubt here, for it was by no means easy to distinguish the women from the men at a little distance. To guard the legs, probably from leeches, as they paddled in the mud, they all wore gaiters up to the knees and short cotton trowsers. When the neck was covered, there was no very distinguishing difference between the sexes, as the men never have any hair about the face. The wheat in Japan never appears to be sown broadcast. All that I have seen has been drilled and planted in rows, much as the rice is, a few stalks together. Labor is cheap, and it is to be presumed they find this the more profitable way."

JAPANESE JUGGLERS.

"The jugglers and mountebanks are also distinguished by the variety and originality of their feats. For instance, they perform a series of tricks by means of an enormously long false nose. One will lie down on his back, with a boy balanced on the end of the nose, the boy supporting an open umbrella on the end of his own nose. Another will hold up his foot, upon the sole of which a boy plants his nose, and balances himself in the air. Some of these feats seem impossible, without the aid of some concealed machinery.

"I was witness to some astonishing specimens of illusion. After a variety of tricks with tops, cups of water, and paper butterflies, the juggler exhibited to the spectator a large open fan which he held in his right hand, then threw into air, caught by the handle in his left hand, squatted down, fanned himself, and then turning his head in profile, gave a long sigh, during which the image of a galloping horse issued from his mouth. Still fanning himself, he shook from his right sleeve an army of little men, who presently, bowing and dancing, vanished from sight. Then he bowed, closed the fan, and held it in his two hands, during which time his own head disappeared, then became visible, but of colossal size, and finally reappeared in its natural dimensions, but multiplied four or five times. They set a jar before him, and in a short time he issued from the neck, rose slowly into the air, and vanished in clouds along the ceiling.

"At the fair of Asaksa, in addition to the performances of jugglers of all kinds, there are collections of animals which have been taught to perform tricks—bears of Yeso, spaniels which are valuable in proportion to their ugliness, educated monkeys and goats. Birds and fish are also displayed in great quantities. But the most astonishing patience is manifested by an old Corean boatman, who has trained a dozen tortoises, large and small, employing no other means to direct them than his songs and a small metal drum. They march in line, execute various evolutions, and conclude by climbing upon a low table, the larger ones forming, of their own accord, a bridge for the smaller, to whom the feat would otherwise be impossible. When they have all mounted, they dispose themselves in three or four piles like so many plates.

JAPANESE GYMNASTS.

M. Humbert gives the following description of the performances of this class, both in the streets and booths. "In the public squares, the shouts and the sound of tambourines of two troops of gymnastic mountebanks, installed at opposite corners, are heard above the voices, songs, and clatter of implements of labor in the surrounding workshops. One of these troops performs in the open air, its heroes being the swallower of swords, and the prodigious jumper. The latter leaps with impunity through two hoops crossed at right angles, fixed on the top of a pole, which also supports a jar carefully balanced on the intersecting hoops. But his most remarkable feat consists in leaping, or rather flying, from end to end through a cylinder of bamboo lattice work six feet long and placed on trestles. When he wishes to excite the amazement of the spectators to the highest pitch, the performer lights candles and places them in a line, at regular intervals, in the interior, of the cylinder; after which he passes through like a flash without extinguishing or deranging them.

"His gentle spouse, seated on a box beside the cylinder, accompanies the different stages of the performance with airs on her guitar. To the shrill sounds of the instrument she adds, from time to time, the tones of a voice which is either hoarse and hollow, or piercingly elevated, according as she judges it better to encourage sternly or to celebrate triumphantly the prowess of the astonishing man whose fortunes she is permitted to share."

Electromagnetic Burglar Proof Curtain.

This invention consists in the arrangement of a burglar proof curtain to be suspended in front of safes, vaults, behind windows, or in other suitable places, and connected with an electric alarm apparatus in such a manner that it will, when moved or pierced, cause the alarm to be sounded.

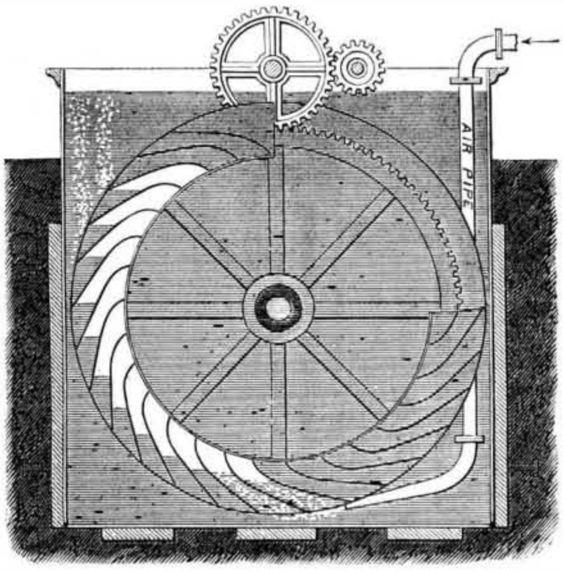
By the use of such curtain a very cheap and, it is claimed, most effective guard is obtained, which can, over night, be suspended in front of the things or openings to be protected, while during day time it can be rolled up out of the way or otherwise do the service of ordinary curtains.

Any attempt to enter by cutting through the curtain will cause an alarm to be sounded by the establishment of a complete circuit, while, on the other hand, any attempt to roll up the curtain or lift the roller from the brackets will, by entirely breaking the circuit, also cause an alarm to be sounded.

Messrs. Edwin Holmes, of Brooklyn, N. Y., and H. C. Roome, of Jersey City, N. J., are the inventors.

CALLES' HYDRO-AERO-DYNAMIC WHEEL.

A mode of transmitting power to great distances, proposed by an exhibitor at the Paris Exposition, from Belgium, Mr. A. Calles, makes use of air under a certain degree of compression as the vehicle of the force to be transmitted, not by accumulating the air thus employed in reservoirs, but by driving it, by the operation of the original motor, directly into a tube extending to the point of final application, where it is to be discharged beneath a wheel submerged in water, which it is to turn by its ascensional force. The mode of application is illustrated in the accompanying engraving, and is described as follows in Dr. A. P. Barnard's report on machinery and processes:



The idea of employing compressed air as a means of transmitting power is not new; but the mode here suggested of using the power so transmitted is sufficiently original. The exhibitor claims originality in another point of view. His application of the power is not only original in form but in principle also. At Mont Cenis, where air is employed as a vehicle of force, it is the elasticity of the compressed air which furnishes the motive power. Consequently, it is there important that the compression should be carried very far. It is carried, in fact, up to six atmospheres. The present apparatus proposes to derive its mechanical advantage not from elasticity, but from volume. It is, therefore, here equally important that there should be as little compression as is compatible with the attainment of the object.

The air being employed to turn a submerged wheel, it will be easily understood that the wheel must have the form of an ordinary overshot water wheel reversed. In the overshot wheel, it is the weight of water, which is in the buckets of the descending side while those of the ascending side are empty, which causes the wheel to turn. The motive power is the difference between the counteracting weights of the two sides. In the submerged wheel driven by air, on the contrary, it is the weight of water which is displaced from the buckets of the ascending side, while those of the descending side are full, which is the measure of the driving power. In the present case, as in the former, this driving power is the difference between the weights of the two sides.

It is assumed by the inventor that air immerged in water ascends to the surface with a velocity of one meter per second. In point of fact, the rapidity of ascent of air in water will depend very much upon the volume ascending, and will be, on an average, materially greater than is here stated. But assuming the statement to be correct, it would furnish a limit to the velocity which can be given to the circumference of the wheel; and a given wheel will perform its maximum of work when the supply of air is sufficient to keep its ascending buckets full at half this velocity. Considering, however, that the motive power in the case is gravity, the most advantageous velocity must be necessarily not greatly different from that which experience has shown to be best with the ordinary overshot wheel working in the air—that is to say, must not exceed one meter per second at the circumference.

The compression of the air must evidently be sufficient to overcome the pressure of the water at the point of efflux beneath the wheel. This point may be taken at three or four meters of depth, and the corresponding pressure will amount to three or four tenths of an atmosphere. As the air ascends, it resumes by degrees the bulk which belonged to it before compression. In order to take advantage of this circumstance, the velocity of discharge must be so adjusted to that of the wheel that the buckets may not be entirely filled at the bottom. Otherwise there will be an overflow from the rising buckets, and to that extent a loss of motive power.

The inventor takes no account of the resistance of tubes to the flow of air through them. He supposes that at low pressures and low velocities this resistance will be insensible, so that the power received from the source may be almost wholly re-established by the wheel. He has erected a wheel in the park of the Exposition, which is designed to demonstrate the truth of this proposition, and to illustrate his system generally. It is driven by air compressed by an engine in the palace, and transmitted through a tube nine and a half centimeters ($3\frac{3}{4}$ inches) in diameter, and one hundred and fifty-seven meters (more than 500 feet) in length. This tube makes in its course fourteen right angles in order to avoid the constructions which it encounters on its way. It is computed that a force of nine and a half horse power is expended in compressing the air, and that the velocity of efflux is thirty-two meters (more than 100 feet) per second. On the other hand, the power of the wheel turned by the escaping air is stated at nine horse power. From these figures it would result that the loss in the present instance is but about five per cent. That there is a fallacy in the calculation is evident from the consideration that the loss of a submerged wheel, driven in this way by air, cannot be less than that of an ordinary overshot water wheel of the same dimensions; and that this loss is at least one fifth, and is often more than one third. And it results from the experiments of the Italian engineers at Coscia, on the resistance of tubes to columns of air driven through them, that to maintain such a velocity as is stated to be given to the air in this experiment, and to the distance named of one hundred and fifty-seven meters, there would be required an expenditure of force without return, sufficient to produce a compression of nearly an atmosphere and a half.

Locomotive and Traction Engines.

Thomas Aveling, of Rochester, England, well known in connection with the celebrated Aveling & Porter's steam road rollers and traction engines, has just patented, through the Scientific American Patent Agency, an improvement the object of which is to construct agricultural, road, traction, and portable steam engines, and tramway locomotives, in a simpler and more economical manner than heretofore, and at the same time to render them stronger and more durable.

At each side of the fire box end of the boiler is fixed a strong wrought iron horn plate. These horn plates are riveted to the boiler and firebox. They project beyond the end of the fire box, and above the top of the boiler. The projecting portions of the horn plates are connected to the crown of the boiler by curved or bent plates, between which and the horn plates are secured the bearings for the crank-shaft. The axle of the traveling wheels works in bushes secured in screw bolts to the rear ends of the horn plates. Above this axle is a shaft, also working in bushes and carried by the horn plates. To this shaft is keyed the gearing for transmitting the rotary motion of the crank shaft to the axle of the traveling wheels. The crank shaft receives rotary motion in the usual manner from the cross head and connecting rod of the engine, and is fitted at one end with a spur pinion which drives intermediate gearing; and, through the spur wheel, gives rotary motion to the axle of the traveling wheels. A fly wheel, on the opposite end of the shaft, is employed to carry the crank shaft over its dead points. The engine is fitted, as usual, with a tank, and it is provided with any approved steering apparatus for guiding the front wheels.

From the above description, it will be understood that as the wrought iron horn plates will take all the thrust from the piston acting on the crank shaft the boiler and fire box will not be so liable as heretofore to be damaged or strained by the working of the machinery.

Resistance of Nickel to the Action of Water.

A small square bar of steel coated with nickel has been repeatedly immersed in water for hours together without showing any signs of rusting, and Mr. John Spiller states, in the *Photographic News*, that he finds it possible to bury it in flowers of sulphur for several days without tarnishing the lustre of the nickel surface. Neither has this latter severe test any effect upon the copper and brass bars upon which the nickel coating has been applied, and these metals may even be immersed in aqueous solution of nitrate of silver without effecting the reduction of that metal. In one of the angles only, where the coating seemed to be imperfect, was there any indication of silver reduction in the case of the brass tube, the steel bar being perfectly protected over the whole surface against the action of silver and copper solutions.

Here, then, is a most valuable property in electro-deposited nickel. A metal of the zinc and iron group is proof against the action of nitrate of silver; the experiment proves it to be so, and we must regard pure nickel as belonging (from this point of view) to the class of noble metals, resisting, like gold and platinum, the attacks of sulphur and of highly corrosive metallic solutions. The nickel facing, when burnished, has a whiter color than polished steel, although not equal to silver itself, its aspect being rather that of rolled platinum. It withstands the action of heat also remarkably well, for the fusion point is very high, and oxidation occurs only at elevated temperatures. For fine balance beams and weights, lens mountings, reflectors, laboratory microscopes, Sykes' hydrometers, still worms, egg beaters, camera fittings, and a variety of apparatus used by the chemist and photographer, the nickel coating will, probably, find extensive application.

THE steamer *New London*, recently burnt in Long Island Sound, is reported to have been scandalously ill furnished with appliances for subduing fire and for saving life. "The life preservers and the boats were inaccessible, and the people on board the steamer had to make their escape as best they could, throwing planks and state room doors into the water, and then leaping after them in hopes of reaching shore by their friendly aid. The fire extinguishing apparatus, too, could not be promptly and effectually used." The *Commercial Advertiser* thus accounts for a calamity in which at least twenty persons lost ther lives.

Improved Safety Water Gage.

It is needless for us to say anything in regard to the value of a reliable water gage as an adjunct to steam boilers. The gage shown in our engraving, however, has certain peculiarities of construction not to be found on ordinary water gages, which improvements render it perhaps better adapted to general use than any hitherto brought before the public.

It is called the "Safety Water Gage" from the fact that if, as frequently occurs, the glass tube should be broken, the escape of water and steam is prevented by the action of valves which automatically close the communication between the boiler and the tube.

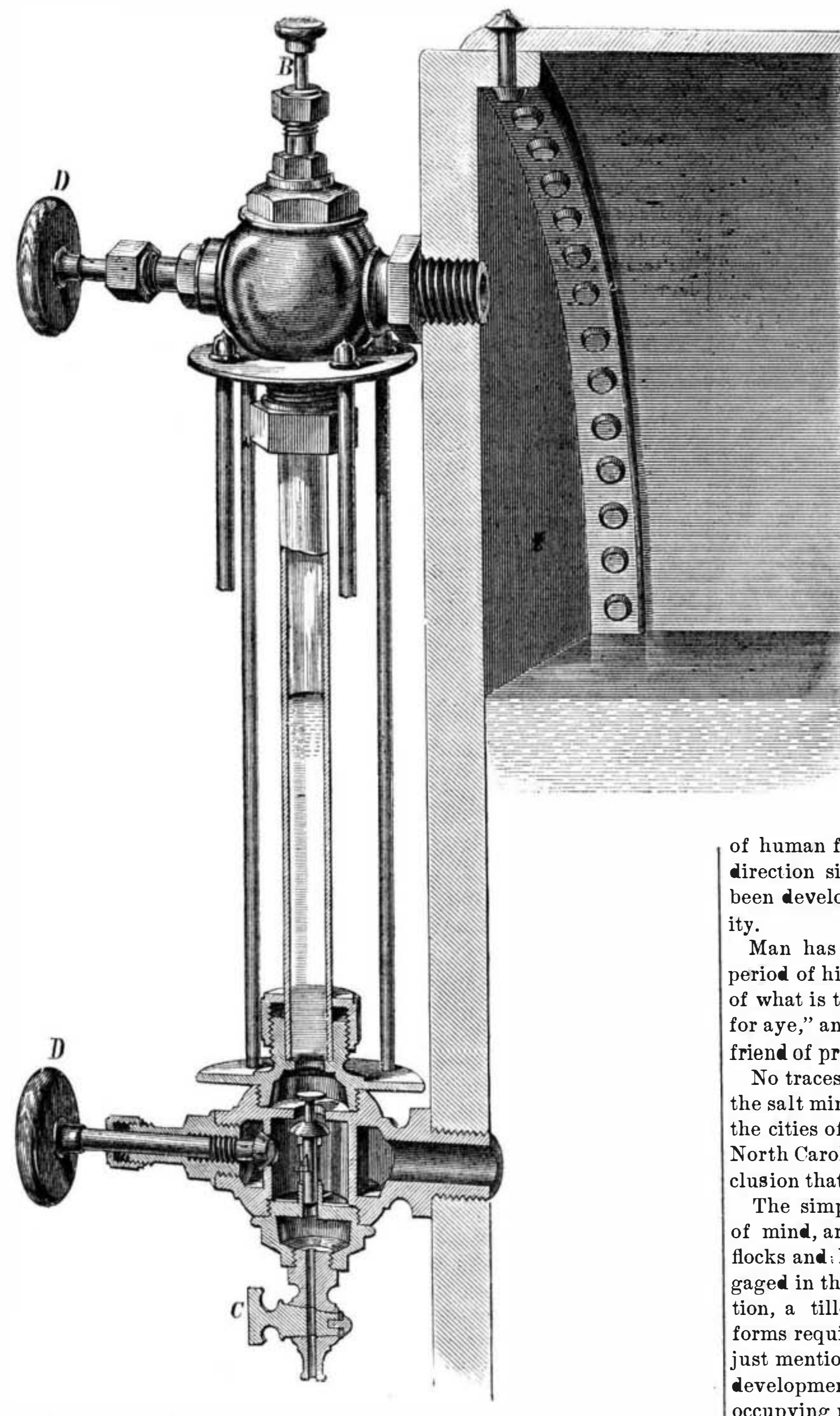
The method by which this is accomplished is indicated in the engraving, where A represents the lower valve, B the knob on the stem of the upper valve, C a pet cock for keeping the gage free from sediment, and D hand knobs on the stems of valves which control the passage of steam and water from the boiler, but do not act automatically.

As will be seen, the lower valve, A, receives the pressure of water upon its under side, so that if the pressure upon its upper surface be removed by breaking the tube, the valve is immediately forced up to its seat, thus preventing the outflow.

The upper valve attached to the stem, B, is of the same form, and prevents the efflux of steam in the same manner, the passage of the steam being out, through the upper cock which connects boiler and gage, into a chamber, thence up through the valve attached to B, and down through an annular passage to the glass tube. It is evident that the moment the pressure in the glass ceases, these valves will immediately close.

A very great advantage is obtained by this construction, namely, that the cocks connecting the gage and boiler may be made so large as to obviate all danger of clogging, without the danger of any one getting scalded or burnt, should the glass tube break. The gage is therefore not only safe in its action, but much more reliable in its indications than the old form of gage.

When it becomes necessary to put in a new tube, all that is required to set the gage in operation after its attachment is to press down the knob, B. This first lets steam into the tube; the pressure then being equalized on the top and bottom of the valve, A, the latter drops and allows the water to rise to its proper level. In order that the valve areas above and below, which receive the pressure, shall be equal, the valves are given conical faces, which meet the sharp edges of the port, as shown in the lower valve, at A. Several hundred of these gages are in use and giving great satisfaction. Patented June 11, 1867. For further information address the manufacturer, Augustus P. Brown, 57 Lewis street, New York.



BROWN'S PATENT SAFETY WATER GAGE.

Cook's Evaporating Apparatus.

Mr. Justus Cook, of Wellsville, N. Y., has nvented a new evaporating apparatus for the convenient and economical heating and evaporating of liquids in the process of extracting the juices of plants, roots, barks, etc., as well as in the manufacture of sirups and sugar. It consists in an evaporating vessel with a flat bottom and circular or square ends, and with a false flat bottom so placed as to leave a steam space between the true and false bottoms, and in one or more rotating agitators or stirrers.

Between the true bottom and the false bottom, the steam is introduced, and made to pass back and forth beneath the liquid in the vessel. Timbers beneath the vessel, on each side, are made adjustable by means of a joint connection and a screw for each pair of timbers, by means of which the vessel may be brought to a true level, and the liquid properly distributed or discharged. The agitators or stirrers are attached to vertical shafts, and suspended from transverse trusses. The latter are supported by the sides of the vessel.

When the evaporating vessel is full or nearly full, the stirrers will revolve beneath the surface of the liquid and keep the liquid in a constant state of agitation. Sweep plates, attached to the vertical shafts, stand edgewise above the heads of the agitators. These plates are designed to fan the surface of the liquid and blow off the steam to increase the evaporation.

As the heating agent employed for this evaporation is steam, the vessel may be made of wood, and also the lower or true bottom. The false bottom is made of metal, on account of its being a better conductor of heat.

Pierson's Frames for Diking Sheets.

This invention furnishes an improved frame for diking sheets, which enables them to be handled, transported, and placed or driven without danger of breakage, thus removing one great source of expense in using diking sheets.

The diking sheet may be made of metal, cement, or other suitable material or combination of materials. These sheets are designed to be driven into the ground where the dike is to be formed, and should extend from about six inches below the low water line to about six inches above the high water line, to prevent rats, crawfish, etc., from working through the dike.

As heretofore made, many of the sheets, even when made of metal, are broken in the operation of driving, and very many, especially when made of composition, are broken by handling and transportation, thus entailing great loss. To prevent this loss, a frame is put upon the sheets, the bottom bar of which is preferably made wedge shaped upon its lower edge, so that it may more readily be forced into the ground. The top bar of the frame rests upon the top edge of the sheet, and should be sufficiently strong and heavy to allow the sheet to be driven without being broken. The side bars of the frame cover the sides of the edges of the sheets, and the ends of these side bars are attached to the opposite sides of the ends of the top and bottom bars, so that the edges of the sheet may be flush with the outer edges of the side bar. This construction allows the adjacent edges of the sheets, when arranged in place, to be in contact with each other, so that there may be no space between the sheets when the frames may decay or be removed. The frames may be made of wood or metal, and permanently attached to the sheets. Or, if desired, the frames may be so made and attached to the sheets that they may be detached and removed, in whole or in part, after the sheets have been driven to their places.

Mr. James S. Pierson, of New York city, is the patentee of this improvement.

Indian Cotton Cloth.

The marvelous delicacy of touch possessed by the Indian women (says an English writer) counterbalances the inferiority of Indian cotton in weaving the fine and delicate muslins to which the names of "webs of woven air," "dew of night," "running waters," etc., are given by the natives. They now use the spinning wheel generally for the ordinary fabrics, but "the spindle still holds its place in the hands of the Hindoo woman when employed in spinning thread for the finer muslins. For these the Hindoo woman first cards her cotton with the jawbone of the *boalee* fish; she then separates the seeds by means of a small iron roller, worked backwards and forwards upon a flat board. An equally small bow is used for bringing it to the state of a downy fleece, which is made up into small rolls, to be held in the hand during the process of spinning. The apparatus required for this consists of a delicate iron spindle, having a small ball of clay attached to it in order to give it sufficient weight in turning, and imbedded in a little clay there is a piece of hard shell, on which the spindle turns with the least degree of friction."

Very great attention is paid to the temperature of the air during the process of spinning, and the spinners in the dry climate of the Northwest of India work underground to secure a moist and uniform atmosphere. The cheapness of English manufactured goods seems to have greatly depressed the cotton fabrics of India, but the fine muslins of the latter country yet maintain undisputed celebrity, and are valued as highly as ever. The Dacca muslins are the very finest of all. One of the best pieces which found its way to England was ten yards long by one yard wide, weighed only three ounces two pennyweights, and could be passed through a very small ring.

Improvement in Architecture.

The earliest periods were characterized by the utmost simplicity of invention and construction. Later, the efforts for defence from enemies and for architectural display, which have always employed so much time and power, began to be made. The megalithic period has left traces over much of the earth. The great masses of stone piled on each other in the simplest form in Southern India, and the circles of stones planted on end in England at Stonehenge and Abury, and in Peru at Sillustani, are relics of that period. More complex are the great Himyaritic walls of Arabia, the works of the ancestors of the Phœnicians in Asia Minor, and the Titanic workmanship of the Pelasgi in Greece and Italy. In the iron age, we find granitic hills shaped or excavated into temples; as, for example, everywhere in Southern India. Near Madura the circumference of an acropolis like hill is cut into a series of statues in high relief, of sixty feet in elevation.

Easter Island, composed of two volcanic cones one thousand miles from the west coast of South America, in the bosom of the Pacific, possesses several colossi cut from the intrusive basalt, some in high relief on the face of the rock, others in detached blocks removed by human art from their original positions and brought nearer the sea shore.

Finally, at a more advanced stage, the more ornate and complex structures of Central America, of Cambodia, Nineveh, and Egypt, represent the period of greatest display of architectural expenditure. The same amount of human force has perhaps never been expended in this direction since, though higher conceptions of beauty have been developed in architecture with increasing intellectuality.

Man has passed through the block and brick building period of his boyhood, and should rise to higher conceptions of what is the true disposition of power for "him who builds for aye," and learn that "spectacle" is often the unwilling friend of progress.

No traces of metallic implements have ever been found in the salt mines of Armenia, the turquoise quarries in Arabia, the cities of Central America, or the excavations for mica in North Carolina, while the direct evidence points to the conclusion that in those places flint was exclusively used.

The simplest occupations, as requiring the least exercise of mind, are the pursuit of the chase and the tending of flocks and herds. Accordingly, we find our first parents engaged in these occupations. Cain, we are told, was in addition, a tiller of the ground. Agriculture in its simplest forms requires but little more intelligence than the pursuits just mentioned, though no employment is capable of higher development. If we look at the savage nations at present occupying nearly half the land surface of the earth, we shall find many examples of the former industrial condition of our race preserved to the present day. Many of them had no knowledge of the use of metals until they obtained it from civilized men who visited them, while their pursuits were and are those of the chase, tending domestic animals, and rudimental agriculture.—*Professor E. D. Cope, in Half Hours with Modern Scientists.*

Goodrich's Improvement in the Manufacture of Iron.

This improvement in the process of puddling and boiling and smelting iron ores, and melting iron, is especially adapted to the manufacture of wrought iron from the ore in the processes of puddling and boiling. It consists in the use of agglomerate balls or masses, composed of ingredients hereinafter described, and used in combination with the iron or iron ore; the temperature of the furnace and the circulation of the blast being, in a great measure, controlled by the size and quantity of the agglomerate balls; and the effect produced upon the ores and iron treated being, in a great measure, dependent upon the proportions of the ingredients of which the balls or masses are formed.

The chemical character of the different iron ores varies so much that the true proportions of the ingredients of which the agglomerate balls are formed can be ascertained only by experiment. This the metallurgist can readily ascertain in working the ore or smelting and melting iron. Different ores melt at different degrees of heat and require different quantities and kinds of flux. The flux being one of the ingredients of the agglomerate balls, the quantity and kind of flux must be varied to properly flux each particular kind of ore.

The invention combines, into hard balls or masses of any desired form and size, iron ore reduced to a granulated state or to a sufficient degree of fineness, pulverized coal or carbon, and lime or other flux. Gum or gluten of any kind may be added to produce sufficient cohesion in the mass. The entire quantity of ore used in the furnace may (in combination with 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.