On Water Wheels.

MESSRS. EDITORS—Permit me to make a few remarks in relation to the communication of Messrs. Collins & Gilbert, on page 251. You were surprised at their statement, that a wheel "would pass 150 per cent. of its area." But in the "Essay on Turbine Water Wheels," page 246 Vol. 9, SCIENTIFIC AMERICAN, article 28, headed, "The Velocity of the Wheel," an explanation of the cause is given. In fig. 6, accompanying that essay, however, a large C near the arrow in the flume, is omitted by the engraver, but it is referred to in the first line below it.

At the close of a long sentence, which is somewhat ambiguous, Messrs. Collins & Gilbert say, "the results as given in the article, will, in all ordinary cases, be found to be altogether too high, for though we are aware that an aperture may be constructed which will pass 100 per cent. of its area, we know that one of the same size may be constructed which, from its form and location, will not pass more than 50 per cent. of its area." This, strictly speaking, is incorrect. Any aperture, properly so called, will pass at least 62 per cent. of the theoretical discharge. Nevertheless, by appendages, we may reduce the discharge to 50, 20, or even 10 per cent.; or, by plugging it up, reduce it to nothing. Why was the passage of the water through the guides and issues of a turbine water wheel dragged into the discussion of the quantity of water that passes through an aperture, or over a notch board? Was it to let your readers know that Messrs. Collins & Gilbert make turbines with polished guides? I understood your object to be to give rules by which the quantity of water flowing over a notch board or through an aperture, could be measured; and that you had no reference at all to its passage through a wheel. For the information of the gentlemen, I will state that no well constructed turbine will pass quite 100 per cent. of the theoretical discharge, when running at a speed to produce a maximum effect. But to return.

Most attempts to give rules for determining the quantity of water flowing down a stream in a given time, leave their data quite inexplicable to common millwrights; and the results are not to be relied on under all circumstances. The quantity of water is generally greater than that indicated by the rule. All rules for determining the quantity of water that flows over a notch board, in a given time, are based on the known velocity acquired by bodies falling through a certain space in vacuo near the surface of the earth, which, in the latitude of New York, is 8·04 feet per second, acquired by falling 1·005 feet. But 8 feet per second acquired by falling 1 foot, is near enough the truth for all practical purposes. Now, if the actual discharge of water from under a head, equalled the theoretical, as the velocity is as the square root of the head, by multiplying the square root of the head by 8, and into the area of the aperture, we would have the quantity discharged per second. But it is known that when the orifice is pierced through a thin plate, the actual discharge is only 0·625 of the theoretical. Hence, as 1 is to 0·625, so is 8 to 5, 5 is the co-efficient that is commonly used. And, as the velocity is double when issuing from under four times the head, it follows, that if the aperture reach to the top of the head, forming a notch, that the average velocity will be two-thirds of that at the bottom of the notch. Hence, two-thirds of the quantity must be taken when water flows over a notch board. And as there are 60 seconds in a minute, which, multiplied by 5, is 300,—two-thirds of which is 200,—if the area of the notch be multiplied by the square root of its depth in feet, and by 200, it will give the cubic feet of water discharged per minute.

Many circumstances, however, may tend to cause the actual quantity passing over a notch to be greater that obtained by calculation. If the board be of considerable thickness, if the inner corners of the notch be rounded off, or if the notch bear considerable proportion in size to the canal in which it is placed, so that the flow of the water in the canal gives it a motion before passing over the notch, which is usually the case when it is placed in the tail race, the actual quantity passing over the notch will be greater than the calculated quantity.

Owners of water power should attend to these things when having the power of their wheels tested, or they may be deceived; their wheels may consume much more water than interested wheel builders may lead them to believe. J. B. CONGER.

Jackson, Tenn., August, 1856.

[We stated in the remarks referred to by Mr. Conger, that we did not suppose, with the *same area* of openings, there could be a difference of discharge, varying from 150, 125, 90, 80, 73, and 50 per cent. in different wheels. The experiments of Rennie, published in the Philosophical Transactions of the Royal Society, with an opening in a brass plate 1-20th of an inch thick, gave a co-efficient of 0·600 for rectangular openings, 0·633 for round openings, and 0·594 for triangular openings. The rules given on pages 216 and 224, for measuring the quantity and velocity of falling water, have received the approbation of our millwrights generally for simplicity and clearness of description.

Faraday on Silvering Glass.

On page 363 we published the receipt of J. Fitzpatrick describing a simple method of silvering glass, but every new improvement relating to this beautiful art is of general interest. We therefore give below an extract from a lecture of Prof. Faraday, recently delivered before the Royal Society, in which he explained with experiments, Mons. Petitjean's silvering process. The extract is taken from a brief report of the lecture in the *London Mechanic's Magazine*:—

"M. Petitjean's process consists essentially in the preparation of a solution containing oxyd of silver, ammonia, nitric, and tartaric acids, able to deposit metallic silver either at common or somewhat elevated temperatures. 1540 grains of nitrate of silver being treated with 955 grains of strong solution of ammonia, and afterwards with 7,700 grains of water, yields a solution to which, when clear, 170 grains of tartaric acid dissolved in 680 grains of water is to be added, and then 152 cubic inches more of water, with good agitation. When the liquid has settled, the clear part is to be poured off; 152 cubic inches of water to be added to the remaining solid matter, that as much may be dissolved as possible, and the clear fluids to be put together and increased by the further addition of 61 cubic inches of water. This is the silvering solution No. 1. A second fluid, No. 2, is to be prepared in like manner, with this difference, that the tartaric acid is to be doubled in quantity.

"The apparatus employed for the silvering of glass plate consists of a cast-iron table box, containing water within, and a set of gas burners beneath to heat it. The upper surface of the table is planed and set truly horizontal by a level. Heat is applied until the temperature is 140° Fah. The glass is well cleaned, first with a cloth, after which a plug of cotton, dipped in the silvering fluid and a little polishing powder, is carefully passed over the surface to be silvered, and when this application is dry it is removed by another plug of cotton, and the plate obtained is perfectly clean. The glass is then laid on the table, a portion of the silvering fluid poured on to the surface, and this spread carefully over every part by a cylinder of india rubber stretched upon wood, which has previously been cleaned and wetted with the solution. In this manner a perfect wetting of the surface is obtained, and all air bubbles, &c., are removed. Then more fluid is poured on to the glass until it is covered with a layer about 1-10 of an inch in depth, which easily stands upon it, and in that state its temperature is allowed to rise. In about ten minutes, by the heat of warm water the hollow box of the table, silver begins to deposit on the glass, and in fifteen or twenty minutes a uniform opaque coat, having a greyish tint on the upper surface, is deposited. After a certain time, the glass employed in the illustration was pushed to the edge of the table, was tilted that the fluid might be poured off, then washed with water and examined. The under surface presented a perfectly brilliant metallic plate of high reflective power, as high as any that silver can attain to; and the coat of silver, though thin, was so strong as to sustain handling, and so firm as to bear polishing on the back to any degree, by rubbing with the hand and polishing powder.

"The usual course in practice, however, is when the first stratum of fluid is exhausted, to remove it, and apply a layer of No. 2 solution, and when that has been removed and the glass washed and dried, to cover the back surface with a protective coat of black varnish.—When the form of the glass varies, simple expedients are employed, and either concave, convex, or corrugated surfaces are silvered, and bottles and vases are coated internally. It is easy to mend an injury in the silvering of a plate, and two or three cases of repair were performed on the table."

Spontaneous Ignition of Sawdust.

The number for August of the *Journal of the Franklin Institute*, contains a report on the spontaneous ignition of a wooden box containing sawdust.

It occurred in the factory of Joseph S. Elkington & Sons, Philadelphia. A mass of sawdust which had been confined for nine months in a wooden box around a tank for rendering grease, was observed to be heated like a mass of live coal, ready to burst into flames, although it was 40 feet from any fire. The tank which it surrounded was of boiler iron, heated by steam at 50 lbs. pressure, and was 280° Fah. The heat was applied from 6 to 9 hours in succession, and the apparatus was used two or three times per week. When the fire was first discovered, an inch board forming part of the box was burned through. In 1853, the factory of Mr. Elkington was burned down, and this discovery has led to the inference that the cause of that fire was the spontaneous combustion of such a box.

The Committee of the Franklin Institute, in their report on this case, mention several well-known instances of spontaneous combustion of wood, kept in long contact with surfaces heated by hot water.

In 1848, Day & Martin's Blacking Factory in London came near being burned down by the spontaneous ignition of a wooden casing surrounding tubes containing hot water; and it was also found, on examination, that wherever these tubes touched the flooring the latter was charred.

The following extract from the report we recommend to the general attention of all concerned; it deserves a wide circulation:—

"There can be but little doubt that the sawdust in the case before the Committee, exposed at intervals for nine months to a temperature of about 280 Fah., became charred by the gradual distillation of the water and volatile matters of the wood. Charcoal thus formed at a low temperature is much more inflammable and hygrometric than that made at higher temperatures.

"Whether such charcoal will absolutely inflame under 300°, the Committee is not able to say; it is possible that the rapid absorption of large quantities of oxygen by it would produce sufficient elevation of temperature to cause actual combustion. The fact, however, is established, that such combustion will occur under the circumstances indicated, and is of importance, from the liability to recurrence of the accident under like circumstances, as in the cases of joists running near flues or through hot air chambers, wood-work on steamboats near the boiler, steam drum, or smoke stack, jacketing of boilers in ordinary situations, &c.

The Committee believe that the attention of builders and others should be called to the fact, with the object of avoiding the risk, and thus diminishing the causes of fire, already too numerous."

Sawdust boiled for 15 minutes in a liquor containing one pound of plaster of paris to the bushel, then dried in the sun, will be rendered perfectly proof against spontaneous combustion, like the above cited case. This would be a cheap and simple method of treating all sawdust designed for non-conducting packing around hot water or steam pipes.

It is less tiresome to walk than to stand still a given length of time, for in walking, each set of muscles is resting half of the time, but when standing still all the muscles are continually exerted.

Recent Foreign Inventions.

Precipitating Salts from Solution.—L. J. F Margueritte, of Paris, has taken out a patent for precipitating salts from their solutions by sending a current of chlorohydric acid into the solution. If, for instance, it is stated, a current of this gas is let on to a saturated solution of chlorides, such as potassium or sodium (common salt,) these two salts will be almost entirely eliminated from the liquid.—The chlorohydric acid gas will settle the salt in the solid state, thus dispensing with vaporizing of salt water, &c., to obtain the salts.

This invention will be efficient in substituting a more expensive for a less expensive method of obtaining salts from water either by artificial heat or that of the sun. Water, no doubt, has a great affinity for chlorohydric acid gas, and will unite with it rapidly, thus allowing the salt (chloride of sodium) to separate and crystalize; but then it is more expensive to make and use hydrochloric acid for this purpose than to use fuel for vaporization.

Manure from Scrap Leather.—G. Chisholm, of London, manufactures artificial manure from scrap leather, by first submitting the scraps to the action of hydrochloric acid gas at a high temperature, until they are saturated with it, then subjecting them to the action of carbonate of ammonia, also in a state of gas. This latter alkaline gas neutralizes the acid gas, the leather then crumbles to powder and makes an excellent manure. Sole leather scraps are steamed after they are acted upon by the two gases. Such manure will contain but little, if any, phosphate of lime, but will be rich in nitrogen. It cannot, however, be manufactured cheaply.

Smoke Consumer for Steam Boilers.—J. L. Jeffree, of Blackwall, London, has secured a patent for placing at the back of the fire-box of tubular marine boilers hollow flattened pipes, which communicate, through air flues, with the atmosphere. These tubes become hot and heat the air which flows in to mix with the smoke from the fires, thus supplying it with sufficient oxygen to promote perfect combustion and consume the smoke. It is applicable only to steamers using bituminous coal.

Manufacturing Iron.—C. J. Hampton, England, patentee. The improvement claimed by this inventor is the use of soda or other alkaline salt in combination with lime in the puddling furnace. The alkaline salt is dissolved in water, and the solution is then mixed with quick-lime, to slack it, and in this state it is introduced into the puddling furnace. It is stated that it greatly improves the quality of the iron.

C. Sanderson, of York, Eng., has also obtained a patent for improving iron. It consists in the use of the sulphate of iron (copperas) by adding it to cast-iron when in a molten state, which, he states, causes the discharge of earthy matters from the iron, thereby purifying it of deleterious substances, which impairs its strength. The sulphate of iron in a pulverized condition, is added in small quantities—about a pound to 500 lbs. of iron, and stirred. It re-acts upon the silicon, phosphorus, and arsenic that may be in the iron, and cause them to separate from it, in scum. Castings of iron treated in this manner are stated to be superior in strength. Any of our iron molders can try an experiment with the copperas, and satisfy themselves of its merit.

New Old Paddle Wheels.

The last number of the London *Mechanic's Magazine* contains an illustration of an improvement in paddle wheels, for which a patent has recently been obtained in England, and we recognize it as one of the oldest plans tried. The object is to keep the paddles vertical, by having them swinging on axes, with their lower halves made heavier than their upper parts.

New Kind of Bread.

At a late meeting of agriculturists at Tiptree Hall, England, a quantity of bread was handed round which was made of wheat flour and Mangel Wurzel, (white beet) mixed in equal proportions. The bread is spoken of as a very palatable article of its kind, while it has the great merit of being less expensive by half than the ordinary bread, and quite as nutritious.