Science and Art.

Measuring Falling Water.—No. 1.

In the article on page 208—on the power of falling water—it was stated, that the power which propels machinery is estimated by multiplying the weight into the velocity of the moving body, such as the weight of the water into its speed. Examples showing how the amount of power was calculated, were also presented. The object of this article is to point out the means of estimating the amount of water which will pass through a certain opening of sluice, or through a certain open space in a given amount of time.

The quantity of water which flows in a stream in a given time, is generally ascertained by the open area of a sluice, or else by a rectangular notch cut in a board, in the edge of the dam, at the surface of the water; so that the section of the passing stream may be measured as it flows through the notch. If water flows through an opening regulated by a sluice in the flume of a dam, and the discharge is constant—the dam maintaining a uniform level above the opening—how can the quantity of water which flows through the opening of the sluice be ascertained? If the laws of gravitation (without correction,) governed the flow, it would only be necessary to measure the area of the opening and calculate the velocity as that of a body falling from the surface of a dam through the centre of the orifice, and the area multiplied by that velocity would give the quantity of water passing through it in a certain time. In the same manner, if no correction were required to find the quantity flowing through a rectangular notch in the plank or weir on the edge of the dam, it would only be requisite to measure the hight from the surface of the dam to the bottom of the notch, in order to find the velocity of the water, as by the law of falling bodies, and then take two-thirds of the quantity which would flow at that velocity through the area of the notch, for the area of the parabola described by the notch—it being two-thirds of its circumscribed rectangle. Such were the rules given at one time by the best authorities, but experiments proved that the actual quantity of effluent water was less than the theoretic quantity. George Rennie, the celebrated civil engineer, made a great number of experiments on flowing water, and his reports were published in the transactions of the Royal Society. The French government at one time appointed a commission of engineers, who made elaborate experiments on a large scale, on falling water, and various experiments were made by other persons—the latest, most elaborate, and accurate, being those made under the direction of Mr. Francis, at Lowell. The conclusions arrived at by Rennie, were: 1st, That the quantities discharged in equal times are as the areas of the orifices. 2nd, That the quantities discharged in equal times under different hights, are as the square roots of the corresponding hights. 3rd, That the quantities discharged in equal times under different hights, are to each other in the compound ratio of the areas of the apertures and of the square roots of the hights, *nearly*—the hights being measured from the center of the apertures. The co-efficient or number expressing the proportion between the theoretic discharge of the water calculated as a falling body, and the actual discharge as measured, was ·600, (or ·6) for rectangular openings, or four-tenths less than the theoretic discharge. The following is Rennie's formula:—

Letter A=the area of the orifice, in square feet.

H=the head or hight of water, in feet.

T=the time in seconds.

g=the action of gravity, in one second.

Q=the quantity of water discharged, in cubic feet.

Suppose the orifice to be 2 feet long and 6 inches deep, (one square foot,) having the long side parallel with the water's surface, and head 4 feet above the center of the opening. Then will Q=·6 A T V *g* H. Then multiply 64 —the effect of gravity, by 4 feet, the hight of the head—and extract the square root for the theoretic velocity in feet per second, and as the area of opening is one square foot, the quotient will be the quantity discharged in cubic feet per second. Multiply this by the co-efficient ·6, or deduct four-tenths, and we have the actual discharge. Thus, 64·3×4=257·2—the square root of which is 16·037, the theoretic discharge:—16·037×.6=9·6222 cubic feet actual discharge per second—577·33 cubic feet per minute. If this amount be multiplied by 62·5 and 4 then divided by 33,000, the horse-power of it will be ascertained.

The result here obtained is the same as that by the old rule, viz.: "multiply the square root of the hight of the head by 8·02, for the velocity." The ·6 is the co-efficient of correction. An explanation of the data for such calculations will be useful to many persons.

The velocities of falling bodies are as the times of descent, and the spaces fallen through are as the squares of the times; consequently the velocities are as the square roots of the hights—therefore, as gravitation produces the velocity of 2 in descending through the space of 1, the hight in feet through which a body falls being multiplied by 64·3 will give the square of its velocity in feet per second. So if the height fallen be 1 foot, the square root of 64·3—8·02 (nearly) is the velocity with which a heavy body falls through the space of one foot. In the above example the square root of the hight 4 feet, 2×8·02=16·04. The same method of calculation will answer for any hight and any area of opening, to ascertain the amount of effluent water passing through a rectangular orifice in a given time.

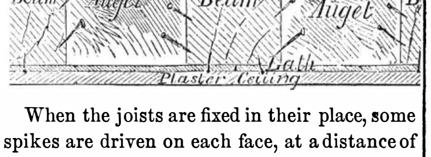
[For the Scientific American.]

French Method of Building Houses.

In relation to an article in a late number of the Sci. Am., on fires, allow me to give you a few details about the construction of floors in the houses of Paris, which you mention. In this city [New York] all the floors are formed simply by nailing boards on the upper face of the joists, and laths on the under part, to hold the ceiling. No provision is made to prevent fire from destroying such floors. When a fire makes an opening through the ceiling, the joists and boards of the floor above are soon burned, and the opening which is thus made, causes an increase of the flames, by forming a draft. And as the same effect is produced on each floor, the whole building soon becomes an immense furnace.

I think, then, that in the construction of the floors alone, consists the whole secret of incombustible houses; the conflagration being limited between two floors, gives time to bring an efficient remedy before it can communicate to the whole building.

The floors of French houses are constructed as shown in the annexed diagram.



When the joists are fixed in their place, some spikes are driven on each face, at a distance of about two inches from each other, and in a slanting position, at the same time the under part, which forms the ceiling is covered with laths. The masons then form between the joists what is called *les augets* (because it has the shape of an *auge*, or trough.) The spikes and fibers of the timber give a good hold to the plaster, which is also supported by the laths of the ceiling on which it is pressed and worked down to the said shape, leaving only about three or four inches thickness in the middle, and rising against the sides nearly to the top of the joists.

On the upper face of the joists there is another layer of laths, and on these a coat of old plaster from demolitions, laid on with mortar or plaster, and on this are laid the baked hexagonal bricks, which are very generally used. When wooden floors are required, some strips of oak are spiked on the coat of plaster above mentioned, so as to take hold in the joists, and on these strips the *parquet* is nailed.

The timbers of the floors are thus confined between two coats of plaster, and each joist is itself coated with it on its four faces. It is thus that the houses of Paris are secured against fires. No conflagrations like those in New York ever take place in Paris, and when a fire does break out in an apartment, the firemen have only to provide ladders for the windows, through which they can generally soon master the fire—the flames most generally coming out through the windows, having no escape through the floors.

As the French people turn everything into songs, even the most serious calamities, there is one told as being sung by a fireman making a comparison of his *belle* to a house on fire, and he speaks of her sparkling eyes as an expression of her passionate feelings. E. B.

Increasing the Speed of Steamboats.

At a meeting of the Royal Scottish Society of Arts, held in Edinburgh on the 14th of January, a paper was read on the subject embraced in the above caption, by Robert Aytoun, which caused some discussion, of which the following is the substance, taken from the London *Artizan*:—

Mr. Aytoun stated that the proposition in hydraulics, that the power required to impel a boat increases as the square of the velocity, has exercised a pernicious influence over the minds of shipbuilders, in making them look upon it as hopeless to attempt any great increase of speed, which was to be attended by such enormous increase of power. This proposition, by showing the impossibility of greatly increasing speed with any of the known forms of boats, by giving them increased power, clearly indicated that the path of improvement, if any, must lie in new forms, calculated to take advantage of the new power of the marine steam engine. It at once occurred to him that, by elongating the bow of the vessel, that water which our present steamboats dash aside from their path with great force and velocity, and the rapid removal of which absorbs the whole power of the engine, might be laid aside comparatively slowly and gently, like the sod from a plow, however great the speed of the vessel. A diagram was shown, exhibiting three steamboats, whose midship sections were all equal, but the length of whose bows were, respectively, 1, 2, 3. It was pointed out that when No. 2 had twice the speed of No. 1, it dashed aside the water in its path with no greater velocity than did No. 1, and therefore did not require more steam power, though proceeding at double speed. That when No. 3 had thrice the speed of No. 1, it dashed aside the water in its path with no greater velocity than No. 1, and therefore did not require more steam-power, though proceeding at three times the speed. It thus appeared that the well-known proposition above referred to, which has so long paralyzed the efforts of shipbuilders, must now give place to the more hopeful one—namely, that the resistance to the motion of boats may be made the same for all velocities, by suiting the form of the boat to the velocity required of it. A similar proposition, in regard to railways, was early made by Mr. Maclaren, with the happiest results, at a time when eight or ten miles an hour was the greatest speed they were thought capable of achieving. The author stated that it was to be hoped that enterprising shipbuilders would not be slow in realizing the same speed in steamboats which the railway engineers have done in the rail, and that, by the elaboration of the self-same proposition—namely, that the resistance to motion may be made the same for all velocities. A considerable advance in speed has been attained of late years by fining the lines of steamboats, by cutting them in two, and inserting an addition to their length amidships, or by increasing their original length, though this last is often marred by a proportionately increased breadth of beam. That these were all steps in the right direction, and tend to support the principle just stated; but nothing short of an attempt to reach thirty or forty miles an hour will satisfy the occasion. Mr. Sang, Mr. Elliot, and Mr. Swan, discussed the subject of the paper at some length; and while they admitted, as mathematicians, the correctness of the principle advanced by Mr. Aytoun, considered that that gentleman had not given sufficient weight to other sources of resistance to the motion of boats, such as friction, which would become very formidable when boats of the great length which he advocated, were urged to great speed.

The Pitch Lake of Trinidad.

The Earl of Dundonald has purchased estates surrounding the above-named lake, and he has obtained a grant of about one-third the surface of it. A company has recently been formed in London, for the purpose of manufacturing a "patent fuel" of this pitch, mixed with other substances, to be used as a substitute for coal, by the West Indian steamers.

Wheat, Flour, Bakers and Millers.

The signature printed to the article on the above-named subject in the last No. of the Scientific American, was T. Royal, Bridgeton, Pa. It should have been J. Royal, Bridgeton, N. J.

Literary Notices.

Haslett's Engineer's Book of Reference.—It might be supposed that the engineering world was satiated with books for reference in the every-day life of engineers; but this is not the case, judging from the number of pocket books on engineering which have issued from the press during the past few years. We must say that each of the books of this character recently published has peculiar qualities of its own entitling it to patronage, and this is peculiarly the case with the above-named work, just published by Stringer & Townsend, this city, and edited by C. W. Hackley, Prof. of Mathematics in Columbia College. This book contains over 500 pages of closely printed matter, embracing "Haslett's Field Book" for engineers, and much general information very valuable to machinists and carpenters as well as civil engineers. Its general information is more varied and extensive than any other work of the kind with which we are acquainted. The author, Mr. Haslett, is a civil engineer of much experience, and this is not his first literary appearance before the public. The editor, Prof. Hackley. is one of the most distinguished mathematicians in our country, and unitedly they have made a most valuable and reliable book.

Knickerbocker Magazine—The March number is out and for sale at the publishing office, and at all the periodical stores. Price 25 cents per copy, $3 per annum. S. Huestis, publisher, 348 Broadway.

Putnam's Magazine for March, is an excellent number. Dix & Edwards, publishers, 321 Broadway.

Frank Leslie's Journal, for March, is received. It is full of interesting reading,

Westminster Review—The number for this quarter of this Review, commences a new volume. It contains seven long and able essays, besides the usual able criticisms on contemporary literature. The first article is on "German Wit," and is a literary treat. There is one on "The House of Savoy," which is well worthy of universal perusal. This Review is called "Liberal in sentiments." and is conducted by Chapman, the American publisher in London. It is re-published by L. Scott and Co., No. 54 Gold st., this city. This is an excellent time to subscribe.