Water Wheels---The Turbine---Article 2.

[Continued from page 222.]

Mechanics of Unelastic Fluids.—9. Fluids are bodies so constituted, that their parts are all ready to yield to the action of the smallest force or pressure, in whatever direction it may be exerted. Every particle of fluid presses, and is pressed equally in all directions, whether it be upwards or downwards, laterally or obliquely; and when in a state of rest, the pressure exerted against the surface of the vessel which contains it, is perpendicular to that surface.

10. The particles of a fluid, situated at the same perpendicular depth below the surface, are equally pressed; and the pressure upon any of its constituent elements, wheresoever situated, is equal to the weight of a column of fluid particles, whose length is equal to the perpendicular depth of the particle or element pressed.

Fluids in Motion.—11. Fluids acquire the same velocity by issuing out at an aperture, that heavy bodies do by falling a distance equal to their height of head from under which they issue; consequently, by art. 7, the velocity from under any height of head, will be as the square root of that highth.

12. When fluids in motion impinge perpendicularly on a plain fixed surface, the constant pressure against the obstacle, will equal the weight of water that impinges in the fourth of a second, multiplied by the velocity per eighth of a second. For, by art, 8, the force necessary to give the water velocity, is equal to the momentum; and as the water that strikes in the fourth of a second, must necessarily be the fourth of a second in having its motion arrested, the constant pressure will equal this quantity multiplied by the velocity in feet per eighth of a second

The pressure, will equal the weight of water that impinges during the time necessary for a heavy body to acquire an equal velocity by falling from rest. For the quantity that impinges in that time, must necessarily have its motion arrested, during the same time, and, by art, 3, and 7, the constant force necessary to arrest the motion of a body in the time that it would acquire its motion by falling, is equal to the weight of that body.

Or, the velocity with which the water impinges in feet per second, divided by the velocity acquired by falling one second multiplied into the weight of the quantity that impinges in one second, will equal the constant pressure.

Example.—Let a sluice of water one foot sectional area impinge perpendicularly on a plain fixed surface, at the rate of sixteen feet per second; required the constant pressure in pounds.

By 1st. Here, the velocity per eighth of second is 2, and the quantity dsscharged in the fourth of a second is 4 cubic feet, and $2 \times 4 \times 62{\cdot}5 = 500$ lbs. the constant pressure.

By 2nd. The time necessary to acquire a velocity of 16 feet per second is 0·5 seconds; and $\cdot 5 \times 16 \times 62{\cdot}5 = 500$ lbs. as above.

By 3rd. $1 \div 632 \times 16 \times 62{\cdot}5 = 500$ lbs. the constant pressure.

13. When water is compelled to move in a curve it will resist having its direction changed, and if it be whirled round in a cylindrical vessel of any size, it will rise as high in the vessel as the heighth of head necessary to give it an equal velocity.

14. The tendency of fluid particles towards the orifice occasioned by their sustaining less pressure in that direction gives rise to a contraction in the jet of fluid, which, in issuing from the orifice, assumes the form of a truncated cone, whose greater base corresponds to the orifice. This diminution in the size of the jet is called the contraction of the vein.—When the orifice is pierced through a thin plate, the diameter of the vein is such that only ·62 of the theoretical quantity will be discharged. If a tube equal in length to twice the diameter of the orifice be inserted, the quantity discharged will equal ·80; but if the tube be cone shaped, in form similar to the contraction of the vein, then the theoretical quantity will be discharged very nearly.

15. By art, 2, the re-action against a vessel having an outlet of water, will equal a force necessary to give the issuing water its motion. Sir Isaac Newton supposed it was equal to the weight of a column of water the size of the orifice and twice the highth of the head; which conclusion would have been correct, had the water issued with a velocity equal to that assigned by theory, and in a vein equal to the size of the orifice. But the contraction of the vein (art, 14) causes a diminution in the quantity discharged; unless, however, the smallest part of the vein be taken for the orifice; when Sir Isaac's conclusions will be found very nearly correct

By art, 2, and 12, the re-action will equal the weight of water that issues during the time required for a heavy body to acquire a velocity equal to that of the effluent water by falling from rest.

As fluids press equally in all directions, when a part of the pressure in one direction is taken off by the opening of an orifice, the containing vessel will tend to move, in a contrary direction with a preponderant force equal to that required to give the water motion;—not that the issuing water reacts,—but by art, 2, when a body is found moving in any one direction, it is known that a force equal to that which gave it motion has acted in a contrary direction.

The Re-action Water Wheel.—16. There are but three modes by which water actuates machines; or, more correctly speaking, there are three ways by which the force of gravity, through the medium of water, will propel machinery, viz., 1st. by inertia, generally termed percussion; 2. By gravity, directly; and 3. By pressure, generally termed re-action.

All water motors, whatever may be their construction, are propelled by the force of gravity, through the medium of water, in one or the other of these modes; or by two or more of them combined.

The class of motors actuated by percussion, termed undershot wheels, have, very properly, gone out of use, and will be passed over without notice.

The class actuated by gravity direct are used to some extent, yet it is deemed unnecessary to treat of them here.

17. The most interesting motor, is that class of water wheels propelled by pressure, usually termed re-action water wheels. It is comparatively speaking, of modern origin, and was not until quite recently very highly esteemed, but will, no doubt, when its principles of action are properly understood, and its advantages duly appreciated, supersede all other motors.

The common re-action wheel, as formerly constructed, can only give an effect, approximately, equal to one half the power. For by art, 15, the pressure, or re-action, can only equal the weight of water that issues at the jets during the time that a heavy body would acquire an equal velocity by falling from rest. And, as the water comes into the wheel without velocity in the direction of the motion of the wheel, when the wheel is moving, the water as it enters the wheel is given a motion similar to that of the wheel by the wheel; which requires such a portion of the force, or pressure, as the velocity of the wheel bears to that of the effluent water. If the wheel move as fast as the water issues, the retarding force will equal the impellant force,—or, the force necessary to give the water a motion as it enters the wheel, equal to that of the wheel, will equal the force of pressure or re-action; (see art. 3 and 15). In which case the machine will produce no effect. But if the wheel move half as fast as the water issues, then the retarding force will equal only half the pressure, and the effect will equal half the power.

18. To establish a rule for estimating the effect produced by re-action wheels: put V= the velocity of the effluent water: v= the velocity of the influent water, and w= the velocity of the wheel,—all in feet per second. Put m= the weight of water that issues per second, and g= the velocity acquired by falling one second. Then, by arts. 12 and 15 $(V \div g)m$= re-action or impellant force; and $(w - v \div g)m$= retarding force, or force necessary to give the water a velocity equal to that of the wheel; which, taken from the impellant force, leaves $(V - w \times v \div g)m$= the preponderant force, which being multiplied by the velocity of the water, is reduced to $m \div g(V - w \times v)w = E$, the effect.

But in the purely re action wheel the water enters the wheel without velocity, and $v = o$, whence $w - v = w$. Therefore the expression takes the form $E = m \div g\,(V - w)w$.

This formula indicates that when $w = \frac{1}{2}V$ the effect is a maximum, and $E = \frac{1}{2}P$; but when $w = v$, or $w = o$, the whole expression vanishes, and $E = o$.

The practical rule deduced from this equation may be expressed in words as follows, viz.,

Rule—To the velocity with which the water enters the wheel, add that of the effluent water, less that of the wheel; multiply this sum by the velocity of the wheel, and by the weight of water that issues in one second; and divide the product by the velocity acquired in falling one second (32) and the quotient will be the effect per second.

It may not be improper to state here that the expression $E = m \div g(V - w \times v)w$, must be affected with the experimental co-efficient n, which varies according to circumstances that will be discussed hereafter.

(To be Continued.)

Interesting News Items.

The subject of penny postage has now been agitated for a number of years, its originator and chief advocate being the learned Blacksmith, Burritt.

It would be a great benefit to our people if such a postage reform were effected, as the price paid for a letter to Europe at present, is 24 cents, and a very large sum is paid by government every year for carrying the ocean mail. If letters can be carried by steamers across the Atlantic for the small sum of two cents, we consider it to be high-handed imposition of any government—American or British, to charge by special law 24 cents for each letter. That letters can be carried for two cents each, across the ocean, and that there are steamship companies ready to engage now in carrying them for that amount, is a fact no longer to be questioned, as the agent of the Glasgow and New York Steamship Company, in this city has come forward and offered to carry full cargoes of mail bags at the rate of two cents per letter, without asking any further grant from our own or the British government. We hope this offer will lead to a decisive reform in ocean postage.

The Pacific Mills. at Lawrence, Mass., have had an addition made to the main building——which is 506 feet long—of 300 feet; thus making the whole length 806 feet long, which makes it a very. long factory indeed. It is to contain 100,000 spindles, 20,000 of which have already been set in operation.

We learn by the "Philadelphia Ledger," that a Mr. McGinnes, of Schuylkill Co., in that State, some two or three years ago, suggested the idea of facilitating coal mining operations by sinking perpendicular shafts, and opening the vein for working operations at several points. For two years he has been constructing the works, at an outlay of over $100,000, and has succeeded in demonstrating the feasibility of his plan. In the borough of St. Clair, he has leased 440 acres of land, under which tract lies a vein of coal thirty feet in thickness. This vein is open at two points, one by a slope or road passing down through and with the coal, a distance of three hundred yards, at an angle of fifteen degrees. At the bottom of this slope, gangways extend through the coal in various directions. At the head of the slope are two engines of twenty horse-power, to hoist the coal from the bottom. The capacity of the opening, therefore, is only limited by the power of the machinery to raise the coal, and the ability to prepare it for market. We hope that the introduction of this old and excellent system of mining into Pennsylvania will lead to a reduction in the price of coal in this quarter of the Republic.

To a number of correspondents we have merely to say that their communications have been received and are undergoing investigation.

What has become of Prof. Porter's "Æroport?" We have not heard of it for a long time. It is about time that we should hear something of it again. Surely the varnish of the oil-cloth case is now dry.

(For the Scientific American.)

The India Rubber Question.

I have been a reader of your journal from its first number. I have watched your progress from your smallest beginning, and am by no means surprised that your success has continued till the "Scientific American," if not the first journal of its kind on this continent, it, at least, occupies a place of which the mechanic and manufacturing age of the country may be proud. I do not address you now in a spirit of fault-finding in reference to your article of last week touching my relation to the Chaffee patent, for I have noticed in all your criticisms upon patent matters, a manly, elevated, impartial, and just tone, always looking for right and the greatest good to the greatest number, and always in the protection and defence of any man of genius, whether rich or poor, and always raising your voice against oppression and wrong, whether in legislation or administration, hence I do not find fault. But your article does me injustice, through applying my acts with respect to a fraudulently re-issued patent, as having had reference to this one.

When the Chaffee patent was about to be extended, I did oppose it, and one of the grounds assumed in that opposition was so unanswerable that an intelligent administration of the Patent Office would have refused the extension. 'Tis true that I denounced the Commissioner of Patents for the outrage upon the Laws, rules and practice of the Office in relation thereto, and I have nothing to take back or qualify in that respect. But you are under a misapprehension when you say that "after it was granted that I published a circular with the opinions of a number of lawyers attached, asserting that it was granted illegally," and hence your criticism upon my present relation to it, should look for other premises for its justification.

The acts of a Commissioner of Patents, however arbitrary, however unjust, in the matter of extensions of patents, you well know, are binding upon third parties, and though he may, under the act of Congress—making him sole judge of the facts and merits in all cases of extension by his acts, take millions of dollars from the public as in this case, and put it in the pocket of an individual or a company of speculators, yet such is the law, and its danger to the ends of strict justice, none will deny, and though under the mysterious ways of Providence, I am greatly profited by the result of that great outrage, yet I do not hesitate to condemn now, as I always, have, a Law which lodges such a dangerous power in one man. I do not care who is the Commissioner of Patents, the principle is wrong, dangerous, and should be changed. Will then the danger be less a danger should the law remain unchanged? The poor mechanics and inventors look to your journal as the leading representative of your honest wishes. Continue then to expose the wrong and encourage the right, and continue to do it fearlessly, regardless of who or where it hits; under our free institutions you have nothing to fear. You may rejoice to know that the good will remain a blessing to the country, and to a class of men who have done and are doing so much to advance the nation in greatness, power, and glory. Yours, Horace H. Day.

New York, March 16, 1854.

American Ships for England.

Mr. Donald McKay, of East Boston, has now on the stocks, nearly ready for launching, a beautiful clipper ship of 3,000 tons, having three decks, and being diagonally cross-braced with iron. He has also in frame a clipper ship of 4,000 tuns, which will store more cargo than the "Great Republic" would have done. Both these vessels are for Messrs. James Baines & Co., of Liverpool, and are intended for their line of Australian packets. Mr. McKay has also on the stocks a packet ship of 1,500 tons, and is making preparations to build four packet ships of 2,200 tons each, all of which are to be finished in ten months. The aggregate size of all these ships will be 17,300 tuns.

The British Government have rewarded Mr. Low, the inventor of the screw-propeller in use in the naval service of that power, with the sum of $50,000.