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

[Continued from page 230.]

EARLY HISTORY OF TURBINE WATER WHEELS. —19. By the term "turbine," is understood, that class of re-action wheels which receive the water with a whirling motion.

Some short time previous to 1830, it was discovered that, by giving the water a motion with that of the wheel previous to its acting on a re-action wheel, the effect would be greater than when the water came into it without motion in that direction.

Z. and A. Parker obtained a patent, October the 19th, 1829, embracing this principle in the specification. Mr. Parker says he discovered the principle, accidentally, in 1827.

In 1823, M. Fourneron of France, commenced an investigation of the action of water on wheels, which terminated in the discovery of the celebrated wheel which bears his name.— He wrote an essay, which was published in a Journal in France, in 1834, giving a full description of the invention, and several machines which he had erected; and was awarded a prize of six thousand francs for the successful introduction of his wheels into use.

It is somewhat singular, that the discovery should have been made on both continents at the same time. Fourneron says he established his first turbine at Pont sur l'Ognon, in France, in the year 1827: the same date of Mr. Parkers discovery in the United States.

The original discoverers, not understanding the principles of action, did not make their claims, when applying for a patent, broad enough to cover the whole grounds; and in consequence, since 1830, a number of patents have been issued to persons of the United States, embracing their principle to a greater or less extent. While all who observe the operation of these wheels see their superior action, few, or none appear to understand their principles of action. And most writers on the subject, appear to mistify, rather than elucidate the action of water on this class of wheels.— Some seem to think the water acts by impulse, some by re-action and re action and percussion combined; while many bring in centrifugal and other unknown forces as auxiliary. Experimenters differ so widely in their reports,—some who are interested giving such extravagant results—that the studying of the elements of mechanics, and becoming familiar with the few principles of nature which originate, carry on and terminate all mechanical movements, are the only means by which millwrights can gain a correct knowledge of the action of the machine. They will then perceive that there is no great mystery about the action of water.

PRINCIPLE OF ACTION.—20. The principle by which the turbine water wheel is made to be more efficient than the common re-action wheel, is very simple, and well known to all mechanicians. It is that principle (see art, 5) which causes a bullet dropped from the ceiling of a steam boat to strike the same point on the floor, as if the vessel were still; that which enables passengers or a car moving 40 miles per hour, to walk forward with as much ease as aft; and the satelites to respect their secondaries as their center of motion, as they would do if the primary was removed and they at rest.

That principle which causes two bodies moving in the same direction, with equal velocity, to act on each other as if at rest.

21. Notwithstanding the earth and moon act on each other while moving around the sun precisely as they would do if the sun were removed and they moving in a right line or were not progressing at all; yet, as some suppose that centrifugal force varies the action of bodies on each other on the earth, it may be necessary, before proceeding to discuss the above principle, to illustrate that principle of inertia by which a body in motion opposes being compelled to describe a curve, called centrifugal force. On investigation it will appear, that, notwithstanding the high authoritiy to the contrary, that there is no such force as centrifugal, and that the very term (centreflying) is erroneous. For bodies moving in a circle have no tendancy, whatever, to fly from their circle of motion; but merely oppose being compelled to move in a curve; (art 3) and are continually making an effort to move in a direct line, not from the centre, but perpendicularly to a line drawn from the centre through the body. If "centrifugal force," be a correct term, then is "vis inertia," equally so; for they are both the same; viz: That principle impressed on on all ponderable matter by which it tends to remain in that state in which it is placed.

FIG. 1.

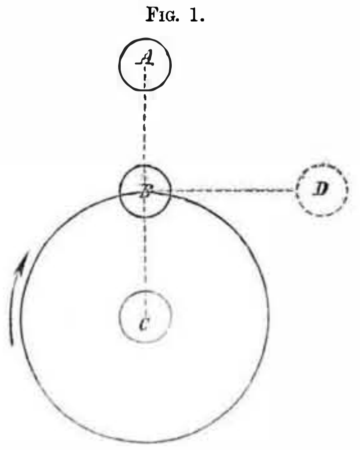

FIGURE 1.—if, while the body B, fig. 1, is moving around C, as its center, on arriving at the point B, in the circle, it should have its connection with C, destroyed, it would not approach A, on the opposite side from the centre C, but would move towards D, perpendicular to a line drawn from C, through B to A; and would have just as great a tendancy to fly from A, as from C. And moreover, its velocity will be no greater after its connection with C, is broken, than when moving in the circle; which would be the case if it tended to fly from C.— See "Scientific American," vol. 7, page 363, for a further illustration of this principle.

22. It was demonstrated, art, 18, that the simple re-action wheel could only approximate to an effect equal to half the power.— On an inspection of its principle of action, it will readily be perceived that the machine is defective; for the water has an actual velocity after leaving the wheel equal to one half that with which it issues; Therefore, one half the power is, necessarily lost. Now if the actual velocity which the water has after acting on the machine, can be consumed in, or prevented by giving the water a motion previous to acting on the wheel; if a machine can be so constructed that it will move as fast as the water issues, and the pressure, or re-action independent of a retarding force will equal that due half the head, we should have a machine realizing the power. If one half the head can be used to give to the water a motion in unison with that of the wheel before acting, and the other half used to impell the wheel by pressure, by art, 20, this may be effected.

FIG. 2.

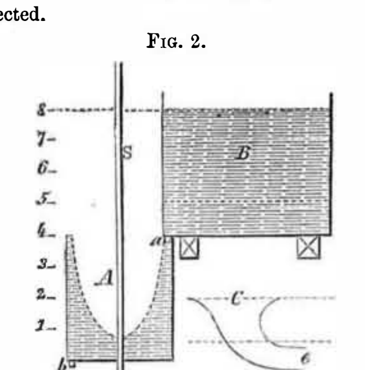

FIG. 2.—Let A, represent a cylindrical vessel on a shaft, or spindle stopped at t; whose depth is four feet. Let B, be a cistern placed over the brim of A, and filled with water to the highth of four feet above the surface of the water in A. a is a bent tube, (see it enlarged at C) inserted at the bottom of B, conducting the water into A, at a tangent to its inner surface; b is a similar tube to a, at which the water issues from A, horizontally, at a tangent to its inner surface, in a direction contrary to the movement of A. c represents a section of the tubes a, and b, on a larger scale, and in another position; e, being the orifice at which the water escapes, and is directed towards the front at a, and b, in the figure. The scale at the right of the figure shows the highth in feet.

When a, and b, are both open, and B, kept full of water; the vessel A, will revolve in a direction contrary to that with which the water issues at b, and in the direction of that at a; and the water in A, will revolve with the vessel. If by any means the velocity of the periphery of the vessel A, should be so retarded that it revolves just as fast as the water issues at the jets; by art 20, the water will re-act at b, and tend to impell the vessel A, as it would do if A was at rest and the water came in at a, perpendicularly. Here we have $v=w=V$, hence, $E=m\div g(V-w\times v)w=P$, the power.

If a friction brake be applied to the shaft s, so adjusted that the periphery of the vessel revolves with a velocity of 16 feet per second, and twenty pounds of water escape per second at b, then the pressure at b, (and consequently its equivalent on the brake) will equal the weight of water that escapes during the time that a body would acquire an equal velocity by falling from rest, and by art 7, as heavy bodies will by falling from rest acquire a velocity of 16 feet per second in half a second of time, the constant pressure at b, and on the brake, will equal one half the weight of the water that issues at b, per second; or, 10lbs. Which being multiplied by the velocity of the wheel per second, 16 feet, will give the effect; equal to 160 And the weight of water issuing, per second, 20lbs. multiplied by the whole highth, 8 feet, will equal the power, 160. Hence the effect is equal to the power. $E=20\div32(16-16+16)$ $16=160$. And, $P=20\times8=160$.

To demonstrate that the effect is doubled by applying one half the head to giving the water a motion before acting, and using the other half to propell the vessel A. Suppose the water at a, to come into the vessel A, perpendicularly, and A to revolve as fast as the water issues at b, equal to 16 feet per second. Then the whole of the force at b, will be expended in giving the water as it enters the vessel A, a velocity equal to that of the vessel. The retarding force will equal the impellent force, and the effect will be nothing. $w-v=v$, consequently the expression, $m\div g(v-w\times v)\,w$, vanishes. But if the vessel A, move half as fast as the water issues at b, equal to 8 feet per second; then the retarding force will equal half the impelling force, and the effect will equal half the power. $E,=20\div32(16-8+0)\ 8=40$, and, as in this case the head is the highth of the vessel A, $P=20\times4=80$, or the effect equals half the power. Hence, the effect of the machine is double by using one half the head to give the water a whirling motion before acting.

If the vessel A, be suffered to revolve with a greater or less velocity than that with which the water issues at b, and comes in at a,; the effect will be diminished. But a slight variation will not alter the effect perceptibly; for if A move one eighth slower or faster than the water at the jets, the effect will be reduced only one sixty fourth (1-64) of the whole amount. But if its motion should be increased, or reduced one half, (to 24, or 8 feet per second) the effect will be reduced one fourth.

And if the issues a, and b, be dissimilar in size, the effect will be less; though not appreciable, when the difference is small; for when the orifice at a, is twice that at b, the diminution in effect will only be one tenth. This may be demonstrated by lowering the water in the cistern B, down to the dotted line one foot above a, and enlarging the orifice at a, to double that at b, and letting A revolve at a mean rate between that of the water at a, and b,—equal 12 feet per second, when the effect will be 9, and the power 10.

Here we have a machine that will realize as great a percentage of the power as it is possible to obtain; the principle of action of which is embraced, to a greater or less extent, in all turbines. And the efficiency of the different varieties of this class of motors, depends entirely on how far this principle is carried out in their operation.

Danger of Painted Pails.

"I would desire to direct the attention of the readers of the "Scientific American," to the danger of using pails which are painted inside, for containing water, for domestic purposes.— The oxyd of lead with which they are painted, is a dangerous poison, and I know that it is productive of evil in many cases. Last week, having occasion to take a drink of water from a painted pail, which had been in use for some months, I was convinced from the taste of the water, that it had taken up a portion of the paint, and having analysed the water I found it to contain a very minute quantity of it, sufficient, however, if a large quantity of the water were taken, to produce those fearful diseases peculiar to lead poisonings."

JAMES MANLEY.

New York.

[We advise all persons to avoid using painted wooden pails. A coat of varnish, on the outside is all the embellishment we ever desire to see on a water pail.

Observation and Inquiry.

Sir Edward Bulwer Lytton recently delivered an address before the five Societies of Edinburgh College, on the occasion of his inauguration as Honorary President of these Associated Societies. In the course of his address he made some remarks on the habits of observation and inquiry, which we commend to the attention of all our young men. They are as follows:—

"Nature indicates to the infant the two main elements of wisdom; nature herself teaches the infant to observe and to inquire. You will have noticed how every new object catches the eye of a young child, how intuitively he begins to question you upon all he surveys,—what it is? what it is for? how it came there? and how it is made? who made it? Gradually, as he becomes older, his observation is less eager. In fact, both faculties are often troublesome and puzzleing to those about him. He is told to attend to his lessons and not ask questions to which he cannot yet understand the replies. This reckless vivacity is drilled into mechanical forms, so that often when we leave school we observe less and inquire less than when we stood at the knee of our mother in the nursery. But our first object on entering upon youth, and surveying the great world that spreads before us, should be to regain the earliest attributes of the child. What were the instincts of the infant are the primary duties of the student. His ideas become rich and various in proportion as he observes,—accurate and practical in proportion as he inquires.

The old story of Newton observing the fall of the apple, and so arriving by inquiry, at the laws of gravity, will occur to you all. But this is the ordinary process in every department of intelligence. A man who observes more attentively than others had done, is something in itself very simple. He reflects, tests his observations by inquiry, and becomes the discoverer, the inventor, enriches a science, improves a manufacture, adds a new beauty to the arts, or, if engaged in professional active life, detects, as a physician, the secret cause of disease, extracts truth, as a lawyer, from contradictory evidence—or grapples as a statesman, with the complicated principles by which nations flourish or decay. In short, take with you into all your studies this leading proposition, that, whether in active life, or in letters and research, a man will always be eminent according to the vigilance with which he observes, and the acuteness with which he inquires. But this is not enough—something more is wanted—it is that resolute effort of the will which we call perseverance. I am no believer in genius without labor; but I do believe that labor, judiciously applied, becomes genius itself.

Success in removing obstacles, as in conquering armies, depends on this law of mechanics,— the greatest amount of force at your command concentrated on a given point. If your constitutional force be less than another man's you equal him if you continue it longer and concentrate it more. The old saying of the Spartan parent to the son who complained that his sword was too short is applicable to everything in life,—"if your weapon is too short, add a step to it." Dr. Arnold, the famous Rugby schoolmaster, said the difference between one boy and another was not so much in talent as in energy. It is with boys as with men: and perseverance is energy made habitual."

One of the Aldermen of our City while recently discussing one of the regulations of our City Railroads, said "the carelessness of the Managers of the Hudson River Railroad was unexampled in the annals of *navigation*!"