floor, and from the one knob to the other sparks are leaping with increasing rapidity and noise, every one of which would kill twenty men at one blow, if they were linked together hand in hand and the spark sent through the circle. From this conductor wires pass off without the window, and the electric fluid is conducted harmlessly away. Mr. Crosse approached the instrument as boldly as if the flowing stream of fire were a harmless spark. Armed with his insulated rod, he sent it into his batteries; having charged them, he showed how wire was melted, dissipated in a moment, by its passage; how metals—silver, gold, and tin—were inflamed and burnt like paper, only with most brilliant hues. He showed you a mimic aurora and a falling star, and so proved to you the cause of those beautiful phenomena."

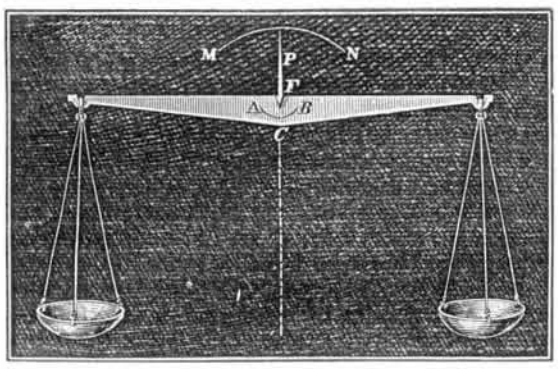
Mr. Crosse appeares to have produced in all "about 200 varieties of minerals, exactly resembling in all respects similar ones found in nature." He tried also a new plan of extracting gold from its ores by an electrical process, which succeeded, but was too expensive for common use. He was in the habit of saying that he could, like Archimedes, move the world "if he were able to construct a battery at once cheap, powerful, and durable." His process of extracting metals from their ores has been patented. Among his other useful applications of electricity are the purifying by its means of brackish or sea water, and the improving bad wine and brandy. He agreed with Mr. Quekett in thinking that it is by electrical action that silica and other mineral substances are carried into and assimilated by plants except fungi; and positive electricity he ascertained to be injurious to fungi, but favorable to everything else.

Mr. Crosse died in 1855. His widow has published a very interesting volume of *Memorials* of the ingenious experimenter.—*Timbs' Curiosities of Science.*

THE BALANCE.

The balance is an instrument so universally used that it seems strange that the principles of its construction should not be generally understood, yet such is the case. To satisfy ourselves that we are correct in this statement, we have conversed with a large number of grocers, druggists, and others, and have only in a very few instances found them posted. Chemists, assayers, and others who have occasion to use very fine balances, are always acquainted with the subject; but we do not write with the view of giving such any information. Our intention is simply to be the means of popular instruction.

The center of gravity in a body is a point so situated that, if the body be suspended from it, the mass may be revolved about this point and will remain at rest wherever it is placed. The balance is a lever having its fulcrum *above* the center of gravity of the beam. When it is balanced the center of gravity lies on a line joining the point of support and the earth's center of attraction. If either end is depressed, the center of gravity describes an arc the radius of which is the distance between the point of support or fulcrum and the center of gravity in the beam. This center of gravity is thus raised or carried away from the earth's center of attraction, and consequently tends to return to it as soon as the weight or other depressing force is removed.



In the engraving, F represents the point of support or fulcrum, C, the center of gravity of the scale beam, and A B, the arc of oscillation. The dotted line represents a line drawn from the fulcrum to the earth's center of attraction, and M N, the arc described by the pointer, P. C, being the lowest point to which the center of gravity can attain, it will remain there unless some force acts upon it. The shorter the distance between F and C, the less will the center of gravity be raised in describing any number of degrees of arc, and the less force will be required to move it. Hence the nearer the center of gravity in the beam lies to the fulcrum, the more delicate will be the action of the balance, all other things being equal. If the beam were suspended from a point coincident with its center of gravity, the latter would not be raised, however much the beam might oscillate; the beam would not then return to its original level, but would remain wherever it was placed. Such a balance would show differences in the weights of bodies, but any difference in weights attached to the ends of the beam, sufficiently great to overcome friction, would continue to move it until it assumed a perpendicular position. The only basis for the estimation of the difference would be the rapidity of this motion, and not the angle which the pointer, P, makes with the perpendicular, as is the case with the properly constructed balance.

If the point of support should be placed below the center, the beam would be reversed by any difference in weight sufficient to overcome friction. Friction is as much as possible avoided by the use of knife edges for supports, and in very delicate balances these edges rest upon pieces of polished agate. A delicate balance with from one to 2,000 grains on each dish should be sensitive to a difference of from .001 to .0005 of a grain.

CAPEWELL'S REVOLVING CARRIAGE WHEEL FENDER AND STEP.

In turning an ordinary carriage short, the wheel is liable to cramp against the body of the wagon, endangering its overturn and wearing and defacing the vehicle. To prevent this is the design of the device exhibited in the engravings. It is a roller, A, turning in projections under one edge of an open work triangular frame, B, of metal which is secured to the under side of the carriage rail. The sides of the frame are of such an angle that the wheel, when backed toward the wagon for turning around, shall engage the face of its tire squarely with the roller, thus effectually preventing cramping or friction. The construction of the roller is seen in Fig. 2, which is a longitudinal vertical section. It consists of alter-

Fig. 1

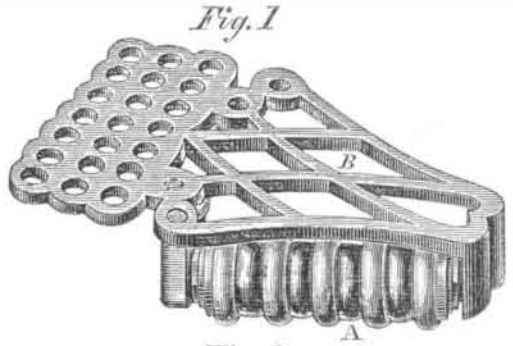
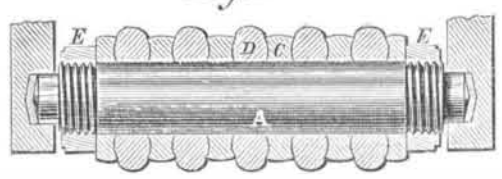


Fig. 2



nate disks of iron, C, and rubber, D, the latter cushioned or compressed by nuts, E, at either end. As the rubber stands above the iron washer rims, it receives the pressure of the wheel and renders the action noiseless. The roller may be placed on either side of the frame, B, to suit either the right or left side of the carriage. Besides its use as a fender, it makes an elegant and handy step to the carriage.

Patented through the Scientific American Patent Agency, September 17, 1867, by Geo J. Capewell, whom address, at West Cheshire, Conn.

Correspondence.

The Editors are not responsible for the opinions expressed by their correspondents

Provincial Protection to Inventors.

MESSRS. EDITORS:—A question which interests many persons in this Province, is the manner in which the Dominion will treat the Patent question. A Government measure was introduced at the recent session, passed the Commons, was amended in the Senate in an important feature, and was consequently withdrawn by the Government. The matter, therefore, stands open to the next session, some eight months hence; and meanwhile it is important that correct notions on the subject should be sent abroad.

Each Province has, at present, a different system. That of the late Province of Canada is, as you know, exclusive—giving no right to a Canadian, the assignee of a foreign inventor, to obtain a patent in Canada. In New Brunswick, on the contrary, our system is most liberal. Here, any assignee of a foreign inventor can obtain a patent for the invention, subject to precisely the same regulations and under the same conditions which are applied in the case of New Brunswickers patenting their own inventions. The fees, too, are moderate, and the mode of application simple. Now, what we desire in respect to a patent law for the whole Dominion is, that it should copy the liberality and simplicity of our local Act. The present law of the Dominion should give its protection to the *creations* of genius, skill, and application, whether the possessor of these qualities lived on one side of the line or the other. We have always found fault with the United States Congress for not passing a copyright law, by which the intellect and the labors of British writers would be protected in the Republic. Not that it would have been of much service to us, for New Brunswick literature is not very extensive; but because we consider it right, just, and politic. What applies to literary creations, applies equally to inventions and discoveries in the arts and sciences.

But beyond this, we think that the Dominion Patent Act should make patents already existing in each Province, patents for and throughout the whole Dominion. Objections to this there may be, but we conceive that the reasons in its favor are overwhelming. It would make what is property in one Province, property throughout the Confederacy; it would simplify the settlement of the patent law question; and it would prevent conflicts of jurisdiction, of local patent laws with the Dominion patent law, of local patents with Dominion patents—which must otherwise arise. We cannot see that it would work injustice to any person, because, of course, all existing rights would be protected in any legislation for the purpose.

Your experience in the matter of patents and patent laws, will enable you to give us advice and assistance in this matter. Although of very great importance, the subject of patent laws is little understood in New Brunswick. J. E.

Woodstock, N. B.

Water Test for Boilers.

MESSRS. EDITORS.—I have a second-hand steam boiler and am desirous of knowing whether it will stand inspection or not, and I have no way of ascertaining except by sending to Chicago, a distance of one hundred miles, which would be an unnecessary expense in case of its not being strong enough to stand the test.

I propose to fill the boiler full of cold water, and then heat, it until it expands sufficient to produce the desired pressure which I think will take place before the water becomes very warm and before any steam has generated. I conversed with several machinists and engineers in regard to this way of testing, all of whom seemed to think it would not answer, but they could not give any reasons for thinking so. I cannot consistently place much reliance on such groundless opinions, and therefore would like to get your opinion and advice on the matter before trying the experiment.

De Pue, Ill. J. H. HASSLER

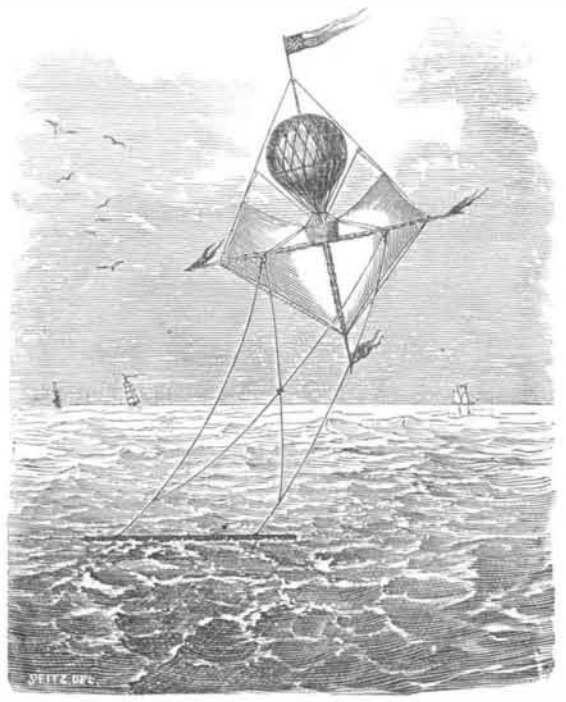
[We cannot advise the plan proposed; we do not think it would work. Dalton says that 1,000,000 parts of water at 32° Fah., becomes 1,046,600 at 212° Fah.; 1 in 23.3. Will not the shell of the boiler expand as much as the water and render nugatory the attempt to determine pressure? The boiler must be fitted with a force pump for feed, and it would be very easy to rig a contrivance to work it by hand so that you could apply the usual hydraulic test. If there is no steam gage to indicate pressure, the weight of the safety valve can be set to the point to which the boiler is to be tested and then the pump used until it rises.—EDS.

Marine Aeronautics.

MESSRS. EDITORS:—In your last number I notice an article entitled "The Great Aeronautical Exhibition." One paragraph particularly attracted my attention, and I quote it:

"In this class we notice only the following, chiefly on account of its absurdity. The expectation that a body floating in a current of air, and propelled by no other force, could be guided by sails, is a folly which our readers will appreciate without further remark."

Probably the most of your readers concur in your opinion, that it is folly to suppose that a body floating along in a current of air or water, propelled only by the force of the current itself, would exert any resisting force upon the fluid by which its direction could be changed. It is a fundamental principle of mechanics, that a body, moved by a single force in a given direction, requires a second force, acting in another direction, to produce any change in its course. A ship propelled through the water by means of sails, can be guided by her sails alone, to some extent. The second force in this case is the resistance upon her keel. If the keel were movable upon a central pivot—proper strength and other difficulties not being considered—the ship might be guided by its keel so as to sail as close to the wind as it now does by the use of the rudder. Many of your readers are acquainted with the old method of utilizing the force of river currents to propel ferry-boats across streams; the ends of the boat being connected by ropes to grooved pulleys running upon a rope stretched from one bank to the other. The end



of the boat lying in the direction the boat is required to move, is hauled up stream by shortening the rope at that end, so that the boat makes an oblique angle with the direction of the current. The force of the current upon the side of the boat propels it across.

So far no means have been discovered of guiding vessels—not locomotive—except by the resistance of one medium to the force of propulsion afforded by another. The difficulties of effecting locomotion in air-navigation are very great, for reasons which I need not here mention.

It occurred to me, some years since, that an application of the principles to which I have alluded, might be made to the guidance of balloons over large bodies of water. Since I first conceived the idea, I have made some experiments which have confirmed my first opinion, and as the subject of aeronautics is now attracting much attention, I have ventured to send you a drawing and a description of the apparatus which I have been experimenting with, representing it, however, as I should suppose it would appear when made upon a suitable scale for actual use. The sails are, however, probably too