Scientific American.

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN, S. H. WALES, A. E. BEACH.

VOL. XX., No. 23...[NEW SERIES.]....*Twenty-fourth Year.*

NEW YORK, SATURDAY JUNE 5, 1869.

Contents:

(Illustrated articles are marked with an asterisk.)

IMPROVEMENTS IN THE STEAM ENGINE.

An immense amount of time and money has been expeuded upon new and ingenious cut-offs for steam engines. Each in its turn, as it was brought before the public, was supposed to excel its predecessors, either in its power of adapting the exact quantity of steam used to the work to be done, or its instantaneous action. The best modern engines show, by the indicator cards, between 60 and 90 per cent of the theoretical effect of the steam; in all cases the figures vary in proportion as care is exercised in keeping the temperature up in the cylinder. All these are improvements, and they tend toward greater economy in the use of steam. Before the steam engine can be called an economical power, our modern system of boilers must be immensely improved, or an entirely new system of applying the heat to the water must be contrived.

We all know that the steam engine is at present a most wasteful source of power, and that we realize only between 15 and 25 per cent of the theoretical amount of power derivable from the coal which is consumed. There is about 75 per cent lost somewhere in the boiler, and it seems as if it would be more important to make the vigorous attempts at improvement upon the boiler rather than upon engine. That which Watt did for the steam engine when he invented the condenser, some engineer of our own time can do by improving the boiler. As it is necessary to apply heat for the generation of steam, and as the boilers of all sea-going steamers must of necessity use salt water, the first improvement should be a better method of abstracting the salt from the water. This is at present performed by the use of surface condensers, but they are large and heavy, and withal do not give perfectly fresh water. This operation should be performed as the water enters the vessel, and before it has passed through the boilers, as in the surface condensation of the present system. As higher pressures and a greater degree of expansion have, so far, proved to be a source of economy, it is probable that we shall see the pressure raised above that which boilers now carry, and as a consequence the steam will be expanded to a greater degree. But before we can arrive at this point, it is necessary that the salt should be extracted from the water before it enters the boiler. What form the boiler may assume is more than any one can say, but so long as the heat is not applied in a better manner, we must lose a large amount. A large quantity of heat is lost by radiation from all parts of the boiler.

It is true we felt the exposed surface, but this is only a method of reducing a loss, which with our present form of boiler we must be subject to. Heat is lost as it travels from the furnace to the uptake, indeed some of the currents of heated gases generated in the furnace scarcely reach any of the surface of the boiler at all, but pass through the center of the tubes out through the smoke pipe, having done no work except to fill up spaces which otherwise would have been left vacant, this loss is greater in proportion as the diameter of the tubes or flues are increased. Where all the losses are, it is impossible to state, for it is most difficult to judge at what point heat is being given off in great quantities; points which we suppose are giving off large amounts may perhaps be wasting but a small percentage of the whole loss.

Watt, when he invented the condenser, made, we might well say, the last great improvement in the steam engine. Since his time the boiler has been changed, tubular boilers have been introduced, and the pressure is far higher than any used in his day. No doubt if Watt had been able to get the pressures in his cylinders as great as we now get them, he would have made use of expansion, fully appreciating its benefits. With the low pressures which prevailed, he carried expansion to its most economical limits. As we look back upon the years past, we see that all the improvements of any magnitude have been made upon the boiler; the improvements in the engine having merely kept up to, and followed closely, the change in the construction of the boiler.

The next great change in the steam engine—the next change that will promote the use of steam and add to its immense utility, will come by improvements in the boiler. We must attack the source of the evil if we wish to overthrow it, and in the faulty construction of the boiler the evil will be found and the difficulty conquered.

WHAT IS PRESSURE? AND WHAT WORK WILL IT ACCOMPLISH?

These are questions suggested by a letter from an esteemed correspondent, who has written us from Australia, in regard to his supposed discovery that pressure will perform work. He describes the method by which he intends to utilize the pressure of the sea upon the bottoms of floating vessels, to propel them without the aid of steam, so indefinitely that we can get no clear idea of the means employed.

The questions, which his letter has suggested as a subject for the present article, are not new; they have been long the subject of thought and discussion, and have been definitely answered. But though it is known to physicists,that pressure, merely, can never perform work, there are many men like our correspondent whose minds are not clear upon the subject,and errors in their views, and mistakes in invention, frequently arise from this cause.

First,what is pressure? A ball of rubber rests upon a table. It does not, regarded as a mass, move relatively to the point of support. If we examine this ball minutely, we shall find that its shape—supposed to be perfectly spherical when no pressure is sustained—is no longer a sphere, but has become a spheroid, whose shorter axis lies on a line drawn through its center and the center of the earth's attraction. If now the support be suddenly lowered away from the ball, pressure either is lessened or annihilated, and the ball considered as a mass, begins to move; and we find by further experiment, that so long as the conditions of pressure are not altered, no relative motion will take place between the mass and the supporting body; and still further,that when the pressure is lessened, the ball approaches the spherical form, finally attaining that form when all pressure has been removed.

Now, if we approach this subject free from preconceived notions, to observe what has taken place, we find that when mass motion begins to diminish, what we call pressure begins to increase, and when mass motion begins to increase, pressure diminishes. All we have to show for this so-called pressure is change of form. Change of form implies molecular displacement, and molecular displacement implies increased molecular motion; so that, in this case, we have the simple conversion of mass motion into molecular motion. In this view, pressure is simply increased molecular motion, and is synonymous with tension.

Let us now try our experiment with a liquid inclosed in a vertical pipe, with a pressure gage inserted at the bottom. Let the pipe have a funnel at the top, into which water may flow to maintain a given head while the water is flowing through the tube, and an escape pipe to keep it down to the same head when the bottom of the tube is closed. If now the bottom be closed, the pressure gage will show an amount of pressure upon the sides of the pipe corresponding to the hight of the water column. And if the tube be composed of elastic rubber, we shall find that it expands until its resisting force is equal to the pressure upon its walls. If, now, the water be permitted to flow through a tap at the bottom, we shall find the pressure, indicated by the pressure gage. to decrease,while the elastic walls of the tube contract. We have here the same phenomena of diminished pressure,increased motion and change of form, we had in the first experiment.

With gases we also find pressure diminishing in the tubes through which they are conveyed, as motion of the column increased.

So after having examined the three states of matter, solid, liquid, and gaseous, we find that in all observed cases, diminution of mass motion, and increase of pressure are connected, and *vice versa;* while at the same time we find that all we can discover of pressure is a change of form in masses, greater or less as the so-called pressure is greater or less.

Now, whether we regard this change of form as the result of an occult force styled pressure, "*vis mortua,*" or anything else we please to call it; or whether we reject the hypothesis of an occult force, and consent to consider pressure and tension as identical, and the representative of molecular motion, does not affect the fundamental truth that pressure, as pressure, never performs work, and that only when it partially or wholly ceases, mass motion, which is capable of being directly applied to work, supervenes. So that if it were possible for our Australian inventor to convert all the pressure which now sustains his vessel upon the surface into mass motion or direct power to perform work, the supporting power would be gone with the pressure, and though his vessel might go ahead, it would also go—to the bottom. Any portion of this pressure converted into motion, is so much subtraction from its supporting power, which is pressure.

The necessity for a more perfect understanding of the fundamental laws of physics on the part of inventors cannot be too strongly urged. The ground upon which nuggets of discovery, so to speak, could be picked up at random, by any one who had eyes, has been mostly explored. There are now no more nuggets. Those who get gold hereafter must mine scientifically, or return with empty pockets.

THE NEW YORK "TIMES" ON NITRO-GLYCERIN.

In the case of Widow Cuff against the Newark and New York Railroad Company, the evidence, given in the Hudson County Supreme Court, shows with what desperate recklessness the nitro-glycerin explosion at Bergen, in 1867, was brought about. Burns, the man in charge of the oil, was drunk and drowsy. Wishing to melt the glycerin, he dipped the can into a vessel of water, and then put a red-hot poker into the water. When he found this had no effect, he took an iron spike and hammered it into one of the cans to break up the frozen mass! Then came the explosion, at last. With proper care nitro-glycerin is as safe as gunpowder, though greatly more powerful.

The paragraph we have quoted is from the New York *Times*, of May 14th. The daily press of this city evidently thinks itself competent to discuss any and all questions, whether of political economy, science, or transcendentalism. But assuming as it does to be the universal instructor of the public, it ought on a subject involving great hazard of human life to speak at least intelligibly, if not intelligently.

What does the last sentence of the above paragraph mean? There is a substance known to chemists called chloride of nitrogen. It is formed by inverting a jar of chlorine gas in a solution of sal-ammoniac, and it floats upon the surface of the solution in oily drops. The circumstances under which this substance is likely to explode are so numerous, and the certainty that they can all be eliminated from an experiment is so difficult of attainment, that the most skillful experimenters hesitate to exhibit even the smallest quantities of it to a class. Even when experimenting with very small quantities, Sir Humphry Davy was wounded in the face by an explosion of this substance, and the celebrated chemist, Dulong, lost an eye, and had a hand maimed for life in an experiment with the same explosive. Yet it is just as true of this substance as of nitro-glycerin, that, with proper care, it is as safe as gunpowder; meaning by proper care, the certain and absolute removal of all circumstances under which an explosion is possible. The explosive itself is perfectly harmless without the circumstances, and the circumstances will never blow people into fragments without the explosive.

The great difficulty with nitro-glycerin is, that sometimes, through ignorance, and at others through heedlessness, proper care is not taken. Even the enforcement of proper care is a matter of difficulty. Leakages occur during transportation, when everything was supposed at the outset to be sound; and divers other accidental circumstances are liable to explode this substance which could not by any possibility render gunpowder unsafe.

That explosive is the safest which will explode under fewest conditions, provided the conditions are such as may be controlled by ordinary means.

The paragraph we have cited seems to convey the impression that in the Bergen disaster the means employed would have exploded almost anything but nitro-glycerin. The man was drunk. Surely, this of itself would have ignited gunpowder. He was drowsy. This would set fire to gun-cotton. He put the can into water. Everybody knows the wonderful igniting power of water upon combustibles. He stuck a hot poker into the water, utterly careless of the extreme inflammability of that liquid. Having failed to ignite this "safe," but powerful explosive, by any of the ordinary means enumerated, never known to fail with any other, this monster of recklessness had resort to an iron spike, an object of such deadly potency, that it can only be obtained by surreptitious means in any civilized country; and with this fell implement he *at last* effected an explosion.

The real facts in the case cited are that the very first agent employed by the unfortunate, and perhaps careless man, who ignited the nitro-glycerin, capable, in the manner he employed it, of producing ignition, did produce it with its awful results; and yet the *Times* makes this absurd attempt to torture the facts into a demonstration that it as "safe as gunpowder." Fie! Fie!

It is just because men do get drunk and drowsy and careless, and that many other unavoidable contingencies are liable to arise, which will explode nitro-glycerin more readily than dynamite and other less powerful explosions, that we deprecate the indiscriminate use of that terrible explosive compound.

A NOBLE INVENTOR.

Invention is confined to no rank or condition of life. The names of statesmen, warriors, divines, authors, merchants, bankers, manufacturers, and mechanics, are to be found enrolled among the benefactors of the race, as inventors and discoverers of new and useful improvements in the arts.

In the course of our professional experience we have frequently been called upon to take out patents for men distinguished for their labors in other departments of life. We were forcibly reminded a few days since of the ubiquitous character of inventors by a visit to our office of a venerable British Peer, the Earl of Mount Cashell, of Moore Park, a gentleman eighty years of age, who, a short time previous to his departure from his home, had employed our services to obtain for him a patent for an improvement in windows. Having a son residing near London, Canada West, his Lordship came over to pay him a visit, and on his return he called on us to inquire about his business. He mentioned the fact that he was a kinsman of the celebrated Lord Rosse, so well known for his scientific attainments and astronomical discoveries, and said that a vein of ingenuity runs through the family; and, furthermore, that he had a number of useful improvements