

Scientific American,

MUNN & COMPANY, Editors and Proprietors.

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

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

Agents: "The American News Company," Agents, 121 Nassau street, New York.  
"The New York News Company," 8 Spruce street.  
Messrs. Sampson, Low, Son & Marston, Crown Building 138 Fleet st.,  
Trabner & Co., 60 Paternoster Row, and Gordon & Gotch, 121 Holborn Hill,  
London, are the Agents to receive European subscriptions. Orders sent to  
them will be promptly attended to.

VOL. XXII., No. 10. . . [NEW SERIES.] . . Twenty-fifth Year.

NEW YORK, SATURDAY, MARCH 5, 1870.

Contents:

(Illustrated articles are marked with an asterisk.)

*Improved Machine for the Manu- facture of Spoked Wheels.....151	The China Trade on the Pacific Railroad.....158
Polishing Granite.....151	*Universal Balance for Mill- stones.....158
The Growth of Tree Trunks.....151	The New Explosive Dualin.....159
Cobalt—its Properties and Uses.....152	The Law of Vis Viva.....159
An Invention Wanted.....152	What Oysters Eat.....159
Platinized Looking-glasses.....153	A Plea for the Society for the Pre- vention of Cruelty to Ani- mals.....159
A Plea for our Dumb Slaves.....153	Systematic Thinking.....160
Something about Gold.....153	Concerning Patent Office matters.....160
*Extracting Juice from Sugar cane, Beet root, etc.....153	The Lightest Machine.....160
Size of Mortar Twists in Brick- works.....154	*Mr. Rutherford's Star Photo- graphs.....160
*Mind Collectors for Boilers.....154	Materials for Telegraphic Insula- tors.....160
*The Pneumatic Tunnel under Broadway.....154	The Mormon Tabernacle.....160
Editorial Summary.....155	Tyndall on Haze and Dust.....161
Opening of the Broadway Tunnel to the Public.....155	Fecundity of Fishes.....161
The Louisville Railroad Bridge.....156	Preservation of the Body of Mr. Peabody.....161
*Hubbell & Capron's Improved Turbine Wheel.....156	The Zircon Light.....161
How Wall Paper is Made.....156	Action of Magnetism on Various Cases.....163
Asphalt Roads.....157	Answers to Correspondents.....163
Crystallization of Boiler Rivets.....157	List of Patents.....163
The Foot-pound.....157	Recent American and Foreign Pa- tents.....163
The Length of Belt, Distance Be- tween the Centers of two Pul- leys and the Diameter of one Pulley being given to find the Diameter of the other.....157	Applications for the Extension of Patents Patented in England by Americans.....164
Prize Engravings.....157	New Books and Publications.....164
*Improved Clay Crusher.....158	
The Fear of Men in Animals.....158	

THE NEW EXPLOSIVE DUALIN.

Beyond a brief notice of the new explosive, dualin, as it is called, we have purposely said nothing about it, preferring to wait and see whether it possessed enough merit to warrant much attention, rather than cumber our space with an account of what might prove, after all, but another example of a long list of compounds which have never attained any practical importance.

If, however, the accounts that reach us are to be relied upon, this compound bids fair to prove of some value. It is claimed for it that it possesses the slow combustibility of gunpowder with the intense rupturing force of nitro-glycerin, that it may be handled with safety, and that it is not liable to spontaneous combustion.

This explosive is the invention of Carl Dittmar, of Charlottenberg, Prussia, who thus describes it.

"Dualin is a yellowish-brown powder, resembling, in appearance, Virginia smoking tobacco. It will, if lighted in the open air, burn without exploding; but, if confined, it may be made to explode in the same manner as common powder. It is not sensitive to concussion; will not decompose by itself, nor cake or pack together; may be readily filled into cartridges; and it matters not whether the place where it is stored be warm or cold, dry or damp. It has from four to ten times the strength of common powder, and is stronger than dynamite. \* \* \*

"Dualin consists of cellulose, nitro-cellulose, nitro-starch, nitro-mannite, and nitro-glycerin, mixed in different combinations, depending on the degree of strength which it is desired the powder should possess in adapting its use to various purposes."

The preparation of cellulose, nitro-starch, nitro-mannite, and nitro-cellulose, involves distinct processes, which will be found described in another column.

How future trials may affect the popularity of dualin, if it can at present be said to have acquired popularity, we can not undertake to say. It is only fair to say that in the opinion of some good judges, it is decidedly inferior in power to dynamite, though it is said to be cheaper. It will explode in contact with flame which does not ignite dynamite. On the contrary, it may be used in temperatures which freeze dynamite and render the latter incapable of being directly exploded. But dynamite may be used when wet and may even be exploded under water in drill-holes, while dualin, like gunpowder, is, we are informed, useless when wet. This fact gives dynamite an immense advantage over dualin for mining and engineering purposes.

The claims of dualin to take front rank as an explosive can not yet be conceded, but there is little doubt that it is far better than many other compounds which the last few years have brought forth. Before it can gain the full confidence of miners and engineers, it must undergo many more trials than have yet been made. It is, however, only just to say that reports from the Hoosac tunnel, where it has been successfully tried, are highly favorable.

We learn that experiments were made in the United States, January 5th, 1870, in a quarry near Washington City, belonging to the Messrs. Lewis & Hall; January 18th and 19th, at Hoosac Tunnel; and January 22d, at Roxbury, near Boston, Mass.

The attested results of these trials leave no doubt in our minds that dualin is much safer than nitro-glycerin. It is also stated that such experiments as have been performed with this explosive in Europe have given the most satisfactory results.

THE CULTIVATION OF TIMBER.

"When you have nothing else to do plant a tree; it will grow when you are sleeping." This advice we think may be extended to times when people are not at leisure, and to the United States Government as well as private individuals. Why not make a business of planting trees? We are well aware that in many cases trees have been planted and grown with success, by private individuals and on private estates, but the fact remains that large areas of public domain are to-day entirely without timber, and the sources from which lumber can be derived to supply the needs of this territory upon its future settlement, are undergoing a drain which will ultimately exhaust them.

If there exist reasons why the agricultural department of our Government could not, if disposed, greatly increase the value of the public lands by rendering nude portions tree-bearing, they are not now obvious to us.

Our continent possesses a variety of forest trees of industrial value, exceeded by no area of similar extent. Certainly in all this variety there may be found some adapted to vigorous growth in almost any climate, or any soil capable of sustaining vegetation.

THE LAW OF "VIS VIVA."

One of the best definitions we have seen of the term *vis viva* is that it is "the measure of mechanical work developed by motive forces or inertia, in variable motion." When the full import of all its terms is comprehended, this definition will be found to accord with the notion of force as precedent to motion. So long as this notion of force prevails, so long must the term *vis viva* or its equivalent be a necessity in the intelligent conception of the laws of motion.

Let us briefly examine this definition with a view to clear away some of the vagueness with which this subject is attended in the popular mind.

What is meant by mechanical work? Certainly, this can be expressed in terms of its accepted unit the foot-pound. A foot-pound is a pound raised one foot without regard to time. This is the *unit of work*. It is not a unit of force, as it is sometimes erroneously considered. More or less force will be required to perform it, according as the time in which it is done is shorter or longer. Power is force in relation to time. The mightiest force requires time to produce an effect. The most infinitesimal force will produce an effect in time.

All this is inseparable from the idea of force as existing independently of matter and antecedent to motion. A mechanical effect is *motion produced*; motion involves the idea of distance traversed, distance traversed involves the idea of time in which it is traversed. But distance traversed does not necessarily imply mechanical work performed. It is only when a resistance is overcome that work is accomplished. A body moving in absolute space performs no mechanical work, though it move with a constant velocity forever. Let it, however, encounter some other body having less motion and it performs work. It increases the motion of the mass which it strikes against, or some of its particles, or it may produce both these effects. The mass-motion produced is mechanical work. The effect upon the striking body is no less work. Its motion is decreased by the impact.

Increase or decrease of mass-motion is, properly speaking, *mechanical work*, and we shall find upon strict examination that this is all implied by the term. But as no increase or diminution of motion can take place in a body without its receiving or imparting motion from or to another imparting or receiving body, it follows that *vis viva* practically relates only to transmission of motion from one body to another, in *space and time*.

It will be seen that the idea of *vis viva* is, therefore, essentially different from the term momentum, which is simply the amount of motion a body possesses, considered with relation to definite periods of time and definite distances, and which is expressed by mass or weight multiplied by the time it traverses a definite distance. Momentum has no reference to the amount of motion a body can impart or receive in time and space.

The terms "motive forces" and "inertia" convey the idea of material forces or matter in motion. The expression, "in variable motion," seems unnecessary, since the very idea of imparting or receiving motion implies variable motion. The expression  $MV^2$  (mass or weight multiplied into the square of velocity) is the mathematical symbol of *vis viva*; that is the measure of the mechanical work developed by a moving body—or in other words the change of motion produced by it on another body in space and time—is measured by its mass multiplied into the square of its velocity.

It must be further observed that *vis viva* is not a measure of force, but of the mechanical work performed, or the change of mass motion produced.

Whether we accept the notion of the existence of occult force which acts upon matter, or accept the doctrine that there is no force which the human mind can recognize other than moving matter, there still remains the necessity for an expression of the law of the transmission of motion. One thing is certain, a body cannot transmit motion it does not possess, and if momentum expressed by  $MV$  (mass multiplied into velocity) be the absolute amount of motion a body possesses, it certainly cannot impart the motion expressed by  $MV^2$  or its mass multiplied into the square of its velocity. Evidently there must be some limitation to the interpretation of one or both of these expressions, which will reconcile their apparent conflict. This limitation is, we think, to be found in the fact that in momentum definite spaces and times are considered with uniform motion, while in *vis viva* the motion considered is a variable one, or one in which motion is constantly received or imparted; and that  $MV^2$  determines the

space through which a body will move before it comes to rest, when opposed by a resistance capable of absorbing all its motion.  $MV$ , or momentum, is the expression of the motion of a body neither imparting or receiving motion, and therefore performing no work. Momentum is an absolute expression when the factor of time in the velocity is constant. *Vis viva* is a proportional or relative term only.

Thus a body moving uniformly through a definite space in a definite time, has a momentum expressed by its mass or weight multiplied into its velocity. While passing through the space, or when it has passed over the space, it has the power to overcome a certain constant resistance, and to move a certain distance before it imparts all of its motion to a resisting medium. Its relative or proportional power to move through such a resisting medium or to overcome an attractive force is its *vis viva* ( $MV^2$ ) as compared with other bodies moving through similar media or opposing an equal attractive force. It is not an absolute expression of the quantity of motion in a body, like momentum. It has reference only to space traversed, while motion is being absorbed by resistance.

WHAT OYSTERS EAT.

Not long since a journal which claims to instruct the public in regard to the preservation of health, came out with a sweeping denunciation of oysters as an article of diet. What little of argument could be gleaned from the whirlwind of denunciation with which the use of oysters as an edible was assailed amounted to this. Oysters are nasty. Whatever is nasty is injurious to health. Ergo, oysters are unwholesome diet.

In whatever particular oysters are generally nasty, or whether they are particularly nasty in general was not, to our thinking, made out very clearly; but the subject has since received more scientific treatment at the hands of the Rev. J. B. Reade, F.R.S., who has been investigating into the private, domestic, and personal habits of these delicious "sea violets." The Rev. J. B. Reade, F.R.S., has been interviewing a large number of oysters, and has read a paper before the Microscopical Society giving the result of his researches. Oysters are proverbially reticent, but they have at last been made to reveal the secrets of their prison houses.

It may not be generally known that the question of what constitutes the food of marine animals which exist at great depths, is at the present time much mooted among naturalists. We do not take it upon us to say whether the discoveries of Mr. Reade are calculated to add to the zest with which most people swallow this prince of bivalves; but he found in the stomach of every oyster he examined "myriads of living monads, vibrios in great abundance and activity, and swarms of a conglomerate and ciliated living organism, which may be named *Volvox ostrearius*, somewhat resembling the *V. globator*, but of so extremely delicate a structure that it must be slightly charred to be rendered permanently visible."

The oyster is not therefore a vegetarian; he doubtless swallows his *Volvox ostrearius*, his vibrio, or his monad, with as great satisfaction as we humans swallow him when he lies delicately quivering on the half-shell, with the added savor of a drop or two of lemon juice. But he does not confine himself to the few plain dishes we have mentioned. Mr. Reade has been able to make out the following bill of fare:

"*Actinocyclus senarius*, *Ceratoneis fasciola*, *Coscinodiscus minor*, *C. patina*, *C. radiatus*, *Dictyocha aculeata*, *D. fibula*, *D. speculum*, *Gallionella sulcata*, *Navicula entomon*, *Tripodiscus Argus*, *Xanthidium furcatum*, *X. hirsutum*, *Zygoceros-rhombus*, *Z. Surirella*, and two new species of this genus."

Mr. Reade does not add to this attractive list that "all other delicacies will be served in their season;" but he does say, that the oyster, like creatures of a larger growth, lives on the food which is successively in season; and he finds that even a different shore is marked by a decided difference in the infusorial contents of the stomach. The "Scotch Natives" are characterized at the present time by innumerable circular forms, resembling the *Coscinodiscus*. Others are nearly destitute of these living rotatory disks, but they are much richer in more interesting species; and in addition to the silicious shelled infusoria which are received into their stomachs, they also occasionally furnish examples of calcareous *Polythalamia* adhering to the inner surface of their shells.

Who knows but that as science advances oysters may be fattened on selected food, as pork designed to be extra fine is fed on corn. Who knows but that the coming oyster may be recommended to the palates of gourmands as prime *Coscinodiscus* or New Jersey *Volvox*?

A PLEA FOR THE SOCIETY FOR THE PREVENTION OF CRUELTY TO ANIMALS.

The man who professes Christianity and belies his profession by a total want of sympathy for the mute and patient servants who, for small reward, minister to his daily wants; who can stand unmoved by compassion and see animals maimed and tortured at the caprice of wanton cruelty; who can witness such acts without his breast swelling with righteous indignation—is either a self-deluded formalist, or a consummate hypocrite.

There are many who profess Christianity in the State of New York; yet how many of these will feel a blush of shame or hurl a word of protest, at the despicable movement now on foot against the Society for the Prevention of Cruelty to Animals.

The attempt to repeal or limit the wholesome laws under which this society has been able to do so much good, is made in the interest of brutal men by brutal men representing the brutish element of our metropolitan population.

It is a burning disgrace to the State and a blot upon our