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NEW YORK, SATURDAY, FEBRUARY 10, 1877. Contents. (Illustrated articles are marked with an asterisk.) Albumen, preserving (28). Alboy for dies (88). Andes and the Amazon, the.... Answers to correspondents. Asparagus in writter Battery for engine (36, 57). Battery for telegraph (79). Bichromate salts in ink (61)... Boller explosions. Locomotive, novel hydraulic* Lubricant-testing apparatus*. Magnets for engines (13)..... Medical progress in 1876 Meerschaum, coloring (20)..... Mildew, preventing (17)..... Mill, grain* ll, gra ners' r (ill, grain* liners' relief fund, coal lirrors, coating backs of (38) loulding machine, upright*. outh, fluids of the Bichromate saits in Ink (61)... Boiler capacity (42)... Boiler, Dower of (71)... Boiler, Bower of (71)... Boiler scale preventive... Boilers, nower of (22). Boilers, sower of (22). Boilers, water in (41). Bones, supe phosphate from (16) Hrass, finishing (36). Bronzing composition... Rusiness and personal. Camellas, training. Carpets, stains on (64). Case-hardening iron (21)... Cement rubber (56). Mouth, fuids of the. Mucilage, transparent Number one, 1877. Oils, treating lubricating. Oxygen not combustible (72)... Parafin paint (66)... Patents, American and foreign. Patents, Official list of. Patents, official list of. Petroleum, refining (63). Petroleum wells in Ohio... Pinks, the²... 79 91 91 91 90 90 90 Petroleum, reflaring (63). Petroleum wells in Ohio. Piston rings (76). Piston rings (76). Planting of an ato by plant. Planting of an ato by plant. Plantator moulds (41). Plantator moulds (41). Pomade, a hint for a new. Postage stamp canceller wanted. Potafo, what came in a. Propelling vescle. Phopelling vescle. Phopelling vescle. Phoses, attar of (35). Raffesia, the⁴. Roses, attar of (35). Roses, clissolving (59). Safe locks, opening (29). Scientific instrument, new. Shipbulding, steel. Silica for frebrick (27). Silk, solvent for. Silate quarry, a visit to a... Smake stack, proportions of a (5). Sugar-evaporating apparatus*. Sugar-evaporating apparatus*. Coment rubber (59)..... Cementing emery wheels (67)... Chloride of calcium (51)... Clock and wind wheel Coal dust, burring (22)... Coccoult, burring (23)... Coccoult, burring (23)... Coal dust, burning (22). Cocalust, burning (22). Coreausy indicus for fish (5).... Cotton picking by machinery... Cotton seed oil, clarifying (49)... Damp-proof walls. Disinfecting agents (39). Edward, Thomas, naturalist. Electricity (22). Engine for flour mills (1)... Engine, power of small (23)... Firebrick (5)... Force analyzed. Forest on windows (12). Glass signs, making. Governors, engine (77)... Grain elevators (78)... Harness blacking... Hat and coat rack* Heating wholesale Houses in London, dwelling... 9799899999

TABLE OF CONTENTS OF THE SCIENTIFIC AMERICAN SUPPLEMENT, **No. 58**.

Injectors (71). Ink. printing (30). Insanity, encouraging.... Leamp for heating (43)... Lead pipe in the ground (52). Lithographic rollers (18).

Locomotive, the first U. S. (11)...

For the Week ending February 10, 1877.

For the Week ending February 10, 1877. I. ENGINEERING AND MECHANICS.—The Brayton Hydrocarbon Engine, with 2 engravings.—Experiments in Blasting Ice.—A water pro-pelled Roasting Jack.—High Pressure Steambollers, by MR. ADAMSOX. —Fracture of Railway Tires. A paper read before the Institution of Civil Engineers, by W. W. BEATMONT Rxpress Passenger Locomotives, Great Western Railway, England, with full particulars, dimensions, and 3 engravings.—Light Weight Freight Cars. The Ordinary Car Load.—Large Rullway Station Roofs, now in process of crection, Glasgow and London, with 3 illustrations.— The New York Central Railway. Roling Stock, Length, Traffic, etc.— The Bhor Incline, India.—The St. Gotherd Tunnel. I. ELECTERICITY, LIGHT HEAT, SOUND ETC.—On the Minute Mess.

The New Fold Ceducat Address Housing Souck, head turnel.
The Ref of Incline, India. —The St. Gohead Turnel.
ELECTRICITY, LIGHT, HEAT, SOUND, ETC. —On the Minute Measurements of Modern Science. By ALFRED MYRE, Second paper. —The Micrometer Screw, its scientific and practical applications. With 4 engravings. A most valuable and interesting paper, containing practical instructions and drawings of simPle, easily made instruments, by which any intelligent person may measure the length of rods, thicknesses of plates, and other objects, the range of error being reduced to a range within the one hundred thousandth part of an inch.
Professor Graham Bell's New Speaking Electric Telegraph, by which the sounds of the human voice are transmitted for long distances by electricity. With 2 engravings. Pronounced by Sir William Thompson to be by farthe greatest of all the marvels of the electric telegraph.
Electric Motor Pendulum. for beding seconds. I figure. Electro-Capillary Phenomena, 1 figure. —New Dir Vincertle Battery, of great power. By U. L. VAN ZENAC.—Gravitation and Electric Action. By M. A. FloART.

FORCE ANALYZED.

We have repeatedly taken occasion to point out the ex- to deal with the term "living force." ceedingly loose apprehension which prevails regarding the And here we pass to Newton's third law, namely : To meaning of the word "force." We doubt if there be an- every action, there is always an equal and contrary reaction; other word in the language which is more constantly wrong- ; or, the mutual actions of any two bodies are always equal ly used, or which is dragged in to express a greater variety and oppositely directed. And Newton proceeds further to of more wholly different and entirely indefensible significa- point out-and here is that grand stumbling block of the tions. We are told of "accelerating force," "moving perpetual motionist, no matter what form his mania may asforce," "centrifugal force," "living force," "projectile sume-that if the action of an agent be measured by the force," "centripetal force," in mechanics; imaginative bi- product of its force into its velocity, and if, similarly, the ologists wander into such expressions as "psychic force," reaction of the resistance be measured by the velocities "odic force," and "vital force." We say a force "may be of its several parts into their several forces, whether these generated," and that a moving body has such a "force;" arise from friction, cohesion, weight, or acceleration, action and in brief so generally used is the word, anywhere and and reaction, in all combinations of machines, will be equal everywhere, that we carry its wrong meaning into idioms and opposite. But actions and reactions here dealt with are and colloquialisms, and talk of the "force of habit," "force no longer simple forces, but the products of forces into of circumstances," etc.

term are based on the conception that force is a thing, some thing, for the measurement of which Watt devised the practhing tangible and existent; whereas it is nothing of the sort, as a brief consideration will show. The various arguments on this topic are admirably summed up in Professor Tait's might be employed to do work, but he is by any exertion latest addition to his excellent work on "Recent Advances unable to lift a ton; and after all his labor to do so, the in Physical Science;" and we can do no better than to follow the same course of reasoning and adopt the very clear and it appears that force is a mere name, and that the product of concise definition of the term "force," to which his views a force into the displacement of its point of application has of the subject lead him.

At the outset, we may recall the fact that absolutely nosity, for it shows us that our senses are merely subjective, does work per unit of length. that what we call a sensation of color is but an influence upon the eye due to the extent, form, and rapidity of the vibrations of the luminiferous medium; that our classificaforce.

of the old notion that, in bodies moving in a circle, a centri- would be difficult to conceive." petal force was necessary to balance a so-called centrifugal Particularly blamable, the Lancet thinks, is the President change that direction."

it moves. "Change of motion," therefore, is change of mo- conceits." mentum, or the product of the mass of the moving body into force by the rate at which it produces change of momentum.

* * * Thus the measure of a force is the product of the mass of the body moved into the acceleration which the force In accordance with its custom, the Lancet begins the new produces on it." Unit force is, therefore, that force which, ear with an extended review of the notable events of the whatever be its source, produces unit momentum in unit of past twelvemonth in the world of medicine and its allied time. The earth's attraction for a body in our latitudes pro-sciences. From the thirty-six columns devoted to this valuduces in that body, if let fall, in one second a velocity of able summary of progress, the following items are especially about 32.2 feet per second. Hence, if we take 1 lb. as the worthy of remembrance.

accelerating force is not a physical idea at all, we have yet

velocities; they are rates of work, the time rate of increase, It will be observed that all these erroneous notions of the or the increase per second, of a very tangible and real sometical unit of a "horse power." Now with a moderate exertion a man may raise a hundredweight, which in its descent weight will not do any work by descending again. Hence an objective existence. And a simple mathematical operation shows us that it is precisely the same thing to say: the thing can be learned as to the physical world save by observations power or amount of work done by an agent in each tion or experiment, or by mathematical deductions from data second is the product of the force into the average velocity so obtained. The exercise of reason is an unavoidable neces- of the agent, and to say: force is the rate at which an agent

THE ENCOURAGEMENT OF INSANITY.

A good many honest but misguided people have expressed tion of sounds, as to loudness, pitch, and quality, is merely the belief that the SCIENTIFIC AMERICAN has been too severe the subjective correlative of what in the air particles is ob- in its remarks about spiritualistic frauds, delusions, and jectively the amount of compression, the rapidity of its alter- the like. Particularly disagreeable to such people has been nations, and the greater or less complexity of the alternating our characterization of spiritualism as a mixture of self-demotion. And thus we may know that light and sound no ception, knavery, and craze. We are pleased therefore to more exist outside ourselves than does the pain, which a find our diagnosis sustained by so excellent a medical swiftly moving stick is capable of producing on our bodies, authority as the London Lancet, which goes even further reside in the stick itself. Heat, though not material, has than we have presumed to, and raises a warning voice against objective existence in as complete a sense as matter has. It those who are in any way party to such spurious manifestais merely a form of energy, which, in all its constant muta- tions of the psychological instinct. The Lancet does not tions, satisfies the test which we adopt as conclusive of the hesitate to say that the practice of gathering neurotic people, reality of matter, that we cannot in the slightest degree at what are politely called seances, for the purpose of holding alter its quantity. This test fails altogether when applied to converse with denizens of the spirit world, is so debilitating to the mind and so debauching to the moral sense that it In his endeavor to reach an idea of the meaning of force, needs to be stigmatized in terms at once trenchant and de-Professor Tait first brings forward Newton's laws of motion. cisive. "To speak plainly, while strong-brained beings Of these the first is: Every body continues in its state of rest may indulge in this form of dissipation without more serious or of uniform motion in a straight line, except in so far as it consequences than perhaps a trifling weakness of memory, is compelled by forces to change that state. That is, any minds of less robust mould may suffer severely. Anything change whatever in the direction or the rate of motion of a more perilous than the custom of permitting young persons body is attributed to force. This carries with it the upsetting of either sex to participate in this abuse of mind power it

force, it being imagined that a body moving in a circle had of the "Psychological Society" and other patrons and leaders a tendency to fly outward from the center. "If," says our of "the last new craze." They ought to know better than author, "a body is to be made to move in a curved line in- to give their countenance and support to a pursuit in which stead of its natural straight path, you must apply force to weaker heads are in danger of being turned, to their perma. compel it to do so; certainly not to prevent it from flying nent injury. Already mischief, perhaps irreparable misoutwards from the center about which it is for the moment chief, has been wrought. "Minds that have hitherto done revolving. In fact, just as you must apply force in the di-wonderfully well in the world are showing signs of weakness. rection of motion to change the rate of motion, so must you. The worry of trying to be quite sure whether there is a force apply force perpendicular to the direction of motion to outside the material world, which will bridge over the gulf between the present and the past-those who now tread the Newton's second law is: Change of motion is proportional earth, and those who have passed out of normal sight and to the moving force and takes place in the direction of the hearing-is beginning to tell on the mental strength of some straight line in which the force acts. Motion is here used as who have been lured into the toils of a psychology, which is a technical scientific term for what we now call momentum, no longer a science, because it has cast adrift the principles the product of the moving mass into the velocity with which of Nature and elects to run riot in vain imaginings and idle

These are hard words, but they certainly are neither unjust its change of velocity. "Of course," says Professor Tait, nor unnecessary. As symptoms of mental degradation, the "the longer a given force acts, the greater will be the change recent actions and utterances of several once straightforof momentum which it produces; so that, to compare forces, ward and sensible English scholars are surely painful which is the essence of the process of measuring them, we enough to warrant any protest, however forcible, against the must give them equal times to act, or we must measure a encouragement of such unsanitary pursuits and speculations.

.... MEDICAL PROGRESS OF THE PAST YEAR.

PicAhr.
I. CHEMISTRY AND METALLURGY.—Preparation of Cinnabar.— New Method of Separating Nickel and Cobait.—Laboratory Notes.— Sulphurous Acid Gas as a Disinfectant.—New and Simple Method of Geuerating the Gas in Apartments.—Still's Gas Purifer, 2 figures.— Sensitive Forme Apparatus for Ordinary Gas Pressure, 2 figures.—The Chemistry of Coal.—Carbonic Acid Gas.—Decoloration of Indigo.— Waterproofing for Woollen Materials.—New Test Paper. Proceedlugs of the Chemical Society, London.—Fluid Cavities in Minerals.—High Melting Points. Color and Color Changes, by Professor J. WALZ.—An interesting taper, showing that when a series of color changes is initiated by chemi-cal acid, the colors are formed in the order of the spectrum. Prepara-tion of Thallum.—Ammoniacal Saits.—Synthesis of Pheuri.
W._TECHNOLOGY.—History of the Art of Coach Fuidling, by G. A

- Cal action, the colors are formed in the order of the spectrum Applied to of Thallium.-Ammoniacal Salts.-Synthesis of Phenyl. 7. TECHNOLOGY.-History of the Art of Coach Building, by G. A. THRUPP. An interesting paper.-Construction and Preservation of Plate Holders.-New Process for Silvering Glass.-Fireproof Concrete. Sulphur Concrete.-How Black Bricks are Made.-Improved Erated Bread.-The Otto of Roses, how prepared.-The Table as an Oblect of Art, with 12 figures.-New Discoveries at Pompei.-Aztee Ruins in Arizona.
- V. LESSONS IN MECHANICAL DRAWING. New Series. By Professor MACCORD, with 6 figures
- VI. AGRICULTURE, HORTICULTURE, EIC.-Movements of the Leaves of Dionaea.-The Brighton Grape.-Dried Potatoes.-Apricot Pulp.-Indian Oil Seeds and Oil.
- MULLING ON SPECIAL ONLY OF THE PROSPHERE OF A CONTRACT OF THE CONTRACT OF T

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standard of mass, the weight of a pound of matter is rather In the department of anatomy and physiology, several immore than 32.2 units of force, so that the unit of force is portant advances may be noted. M. Malasses has continued his researches in connection with the blood, and has introrather less than half an ounce.

Unit momentum is that of 1 lb. of matter moving with a duced the new term blood-corpuscle capacity, to designate the velocity of 1 foot per second. Unit force is that force which, quotient obtained on dividing the number of blood corpuscles acting for one second, produces in unit of mass a velocity of in an animal by the weight of the animal in grammes. Thus 1 foot per second. Momentum, then, is obviously not force. • a rabbit, weighing 2,450 grammes and having 919,450 millions We may substitute ton for pound, or mile for foot, and the of blood corpuscles, has a blood corpuscle capacity of 375 relative values will remain unaltered; but if we take minute millions. It is worthy of notice that the blood corpuscle instead of second, then the time unit increases sixty fold the capacity of carnivora, in consonance with their more active nominal value of the momentum considered; while that metamorphosis of tissue and manifestations of life, is much representing the force is increased three thousand six hun- greater than that of herbivora. Heretofore the pressure of dred fold. Hence the two cannot possibly be equated. Now the blood has always been estimated by manometers inas we have shown that there is no such thing as centrifugal troduced into the larger blood vessels. Dr. Kries has force, and as from the above it follows that the so-called ingeniously shown that the pressure in the capillaries may