# Scientific American.

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY
At No. 37 Park-row (Park Building), New York.

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TERMS—Two Dollars pe annum.—One Dollar in advance, andthe remainder in six months.
Single copies of the paper are on sale at the office of publication, and at all the periodical stores in the United States and Canada.
SampsonLow, Son & Co., the American Booksellers, No. 47 Ludgate Hill, London, England, are the British Agents to receive subscriptions for the SCIENTIFIC AMERICAN.
☞ See Prospectus on last page. No Traveling Agents employed.

VOL. II., No. 22.....[NEW SERIES. j....*Fifteenth Year.*

NEW YORK, SATURDAY, MAY 26, 1860.


## COLBURN ON BOILER EXPLOSIONS.

BOILERS and bottles have a much closer relationship than most persons would imagine. Of this fact, we have been powerfully convinced by a pamphlet (recently published in London), by Mr. Zerah Colburn, formerly of New York, but now of the London *Engineer*. It seems to have produced something like a bomb-shell explosion among the mechanical periodicals of the British metropolis, on account of a new theory advanced therein. This consists in attributing an explosion to the reduction, at first, of the pressure of ordinary steam in a boiler through a rupture, by means of which some extra escape of steam is effected. This lowering of the pressure, it is held, produces the disastrous result by a secondary effect, namely, the instantaneous flashing of a large quantity of the water into steam, thereby causing it to strike "a violent blow" against the shell. We have stated this theory in as few words as possible. Mr. D. K. Clark, the well-known writer on railroad subjects, has also advanced a theory on this question, which is given in the pamphlet in the form of a letter. It consists in attributing explosions to the sudden projection of water against the bounding surfaces of the boiler, and that the combined momenta of the water and steam act like shot to shatter the metal; simple over-pressure of steam not being sufficient to account for an explosion.

The London *Mechanics' Magazine* has criticized the pamphlet with considerable severity, and Mr. Colburn has replied in two letters, in one of which he takes the familiar example of a bottle of soda-water discharging its gas and fluid contents into the air to illustrate Clark's theory; and he maintains his own with decided ability. We shall give our reasons to show that it is not *altogether* proved, however; and, as for Mr. Clark, he simply mistakes an effect for a cause. All explosions of boilers or bottles are due entirely to the over-pressure of expansive gas or vapor, not the percussion of the fluid.

Mr. Colburn's theory assumes that, when the pressure of steam is suddenly lowered, a *greater quantity* of water in the boiler than that due to supply the reduced pressure caused by the escaped steam, is instantly converted into steam; thus causing a vast and sudden over-pressure, which shatters the metal to fragments. If equal effects are produced from equal causes, we do not see how this can be possible. If steam of 60 lbs. pressure in a boiler is suddenly reduced to 50 lbs. pressure—from a temperature of 294.1° to 281.3°—by escaping through a rupture, the quantity of water converted into steam will neither be more nor less than the amount required to raise the pressure to 60 lbs.; and so on for all other pressures, and the excess will be immediately carried off through the rupture. Safety-valves are applied to steam boilers because this principle is held to be correct; but if Mr. Colburn's theory is true, safety-valves are the most dangerous appliances that have ever been attached to boilers, and the whole engineering profession, from the days of Papin to the present moment, have been wofully blind to their true nature. If, as this theory assumes, an explosion is caused by the sudden escape of steam, a safety-valve is to a boiler what a percussion cap is to a loaded cannon. At the same time, however, this theory affords a very plausible explanation of some apparently mysterious explosions which have taken place. Thus, a boiler exploded, a few years ago, in Philadelphia, at the instant the engineer lifted the safety-valve, by which event he lost his life. A great number of explosions have also occurred just when the engine or pump had been set in motion, whereby the pressure had been first reduced in the boiler.

By this new theory, the incipient cause of every explosion is held to be a rupture in some weak part by over-pressure; and if, as a whole, it cannot be sustained, it can do no harm, but rather good, because it affords a most powerful support to those who attribute all explosions to over-pressure of steam—either gradually or suddenly accumulated. We quote the following extract from this pamphlet, and fully endorse its appropriate soundness:—"All our knowledge of boiler explosions goes to show that, however possible it may be to accumulate an excessive pressure within a boiler, the actual explosion results in the majority of cases from some defect, either visible on concealed, in the materials, workmanship or construction of the boiler. Probably not more than one per cent of all the steam boilers made ever explode at all; but the results of systematic inspection show that a far higher per centage of boilers are constantly in a condition inviting explosion, and from causes which a general examination would not only disclose, but of which it would also insure the removal." This is a strong argument for voluntary Boiler Inspection Associations, which we have recently recommended, and which we hope may soon be formed throughout the various sections of our country.

## ALUMINUM.

The ore of this valuable metal is scattered in millions of tuns through all sections of the country, being more abundant and more accessible than any other metal. All granite rocks and all beds of clay are partly composed of it. Pure clay, or alumina, is simply the sesqui-oxyd of aluminum ($Al^2 O^3$), containing 24 lbs. of oxygen to 27 lbs. of the metal, and all that is necessary to give us unlimited supplies of this precious substance is a cheap mode of separating it from the oxygen. So rapid have been the improvements in the method of effecting this separation, that within about four years, the price of aluminum has been reduced from $250 to less than $9 per pound. If the price should be reduced sufficiently, this metal is destined to play a great part in the industrial arts, for by its lightness, strength, and incorruptibility in the air, it is admirably adapted to many uses. Even at the present price, it will no doubt replace silver to a considerable extent.

The *Revue Universelle*, from which we translate, describes two processes for the reduction of the sulphuret of aluminum, which have recently been patented in England by J. Johnson. The sulphuret is first obtained from the sesqui-oxyd by one of the known modes; for instance, by passing sulphureted carbon over alumina heated red-hot in a suitable apparatus. This sulphuret is placed in a furnace with such a proportion of the sulphate of alumina that the oxygen which is disengaged by the heat will produce sulphurous acid by combining with the sulphur of the substances employed. The furnace is sealed air-tight and raised to a high temperature, when the whole of the sulphur combines with the oxygen, forming sulphurous acid, and the aluminum is left in the metallic state. In the place of the sulphate of alumina, anhydrous alumina may be employed if care is taken to proportion the alumina to the sulphuret, so that the oxygen of the former may combine with the sulphur of the second, and carry it off in the form of sulphurous acid. It is well to aid the reaction by frequent stirring of the mixture. When the aluminum has been obtained, it may be treated in a manner similar to that in use for puddled iron, and is capable of being either hammered or rolled.

In Mr. Johnson's second process, the sulphuret of aluminum is placed in a melting pot, and sheltered from contact with the air. It is then heated red-hot, and submitted to the action of a current of dry hydrogen, which carries off the sulphur of the sulphuret in the form of sulphureted hydrogen. By adding the sulphuret of another metal, an alloy of the two metals is obtained. The hydrogen employed in this process may be economically obtained by passing the vapor of water over red-hot coke or charcoal.

Some of the alloys of aluminum have very remarkable properties, especially the aluminum bronze, composed of 90 lbs. of copper to 10 of aluminum. This alloy is stronger than the best wrought iron; it may be cast, hammered, or rolled, and it resists the corroding action of the atmosphere, nearly if not quite as well as gold. Besides these properties, it is of a beautiful yellow color, and is susceptible of a very fine polish.

Alloys of aluminum may be obtained by the decomposition of alumina by carbon, in contact with certain metals electro-positive in relation to aluminum—for instance, copper and iron. E. L. Benzon obtains an alloy of aluminum and copper by the following method. Alnmina, animal charcoal and copper (either the simple metal or the protoxyd or peroxyd), all finely pulverized, are thoroughly mixed together in proportion to their atomic weights, and placed in a melting pot similar to the pots in use for cast steel. The mixture, covered with charcoal, is exposed to a strong red heat, nearly sufficient to melt the copper, uutil the aluminum is reduced to the metallic state. The heat is then augmented for half an hour or an hour, until the metals are thoroughly melted together and a perfect alloy obtained.

## THE AGE OF STEAM.

The eras of gold and silver and bronze no longer exist; with the lapse of centuries, and the progress of time, they and their barbarism have passed away, and a new age and period holds sway. *Steam*—the agent and servant of man—represents it; and to its influence and through its might the desert becomes populous, the wilderness smiles and is busy with the hum of a new generation, with new thoughts and strong purposes, who carve its very stones into habitations and shelters, and wrest from the bowels of the earth an abundant and a generous support.

If we take a stand in a mental point of view, and look backward upon the years which are irrecoverably gone; if we reflect through what convulsions and changes the political and social world has passed, from a state of ignorance and commercial stagnation to one of the most prosperous and peaceful, we must see among the most prominent and efficient causes of this reformation—steam. Without it, at this present day, if it were abolished and utterly unknown, on the face of the earth, darkness would reign again as it formerly did. The development of the arts and sciences in their highest perfection tend inevitably to moral and social advantage, if it be only in the insignificant cause of lessening the severity of labor through the use of a powerful motor; leaving more leisure for the workman and the operative to search out the causes which produce certain effects, and which lead him, as stated before, insensibly to the cultivation of a thoughtful mind; and the improvement and stimulation of the brain, within proper bounds, is the very base and foundation of a national and commercial greatness.

The rudest minds and the most unreflecting persons who are, by chance or necessarily, brought up to its use, cannot fail to wonder and feel awe-stricken, at times, in the presence of this awful force. Escaping from its bonds, and rending all before it, as it does sometimes through carelessness or mismanagement, it exemplifies in a literal sense, and demonstrates in a most practical manner, the strength of its sinews and the illimitable range of them. Who can form any accurate estimation of what power is exerted against the pistons and cranks of a steamer moving so majestically and surely in the teeth and front of the hurricane and tides, until, some parts having given out, it lays bent and twisted into a hundred fantastic shapes? Rods and links, six or eight inches in diameter, of the best wrought iron, bent at right angles as a boy would bend a wire; and iron castings, ribbed and strengthened with braces and radii, snapped into fragments as if they were but the frailest glass. When he sees all this, then may he form some conception of that noble servant who, at this moment as we write, is driving a thousand busy wheels and whirling heavy masses in mid-air, to the increase of wealth and the general prosperity. There is not a mechanical force in operation at the present day, nor a machine turning out work by the 100 per cent better and faster than by manual labor, but what owes its origin, in some form or other, to the power of steam. If we take the pick of the miner (who plies his calling in subterranean darkness, and who burrows like a mole), even so small

a tool as that is the son and offspring of steam, either in smelting the ore from which it was made or in forging it. Upon the banks of busy streams, and in the solitudes of the primeval forests, the song and chirp of this agent, steam, is loudly heard. Even the water wheel, which disputes a little part in the list of motors, owes its increased efficiency and its greater power to the better facilities for manufacturing through the employment of steam.

There is no corner or quarter of the globe, known to man, where it has not penetrated. The icebergs of the Pole have overlooked its toil, and cast their shadows athwart its funnel, whitened by the salt air and furnace heat; the waters of the northern seas have lent their drops and globules to be evaporated and aid man in penetrating into unknown solitudes; and the fierce heat of the tropics has heated the bearings and dried out the oil from the steam engine until they have screamed again. Everywhere—in all lands and habitable places—its wreaths are seen twining and coiling in the air, and finally disappearing entirely; and lately, in Japan, through the exertions of Commodore Perry, a little locomotive carried upon a circular railroad a throng of wondering and pleased Japanese. It is an assertion that cannot be disputed, to say that it is the very emblem and symbol of peace and prosperity. When the steam engines are the most rapid in their revolutions, and when their number and sum increase in quick succession, then do the papers teem with joyous accounts of prosperous harvests, groaning warehouses, and full freights; then are all men busy, and the voice of complaint and the piteous cry of want are unknown in the land. In all its various operations, whether in swinging the ponderous beam of the steamer slowly and steadily to-and-fro, whether heaving the piston regularly up-and-down through all the wrath and tumult of the elements, urging the vessel on, and trampling even the might of the seas beneath its resolute beat and stroke, it is still the object of unflagging and never-ceasing interest. In careful and experienced hands—careful, beyond every other consideration—there is no limit nor bound to its range, and man need not enumerate the catalogue of its operations to praise it; the *results* are enough. The fires of sacrifice that burned of old on altars and hill tops no longer gleam and startle the terrified people with the victims' shrieks and cries; but, through all the night, and through the summer's heat and winter's cold, the genial furnace-fires flame and burn, and render good return to man.

## DEFALCATION OF THE POSTMASTER OF NEW YORK.

On Saturday, May 12th, it was discovered that Isaac V. Fowler, Postmaster of New York, was in arrears in his payments to the department to a large amount, variously stated at from $155,000 to $176,000. This is particularly startling as being the first considerable defalcation (except one or two in California during the confusion of its early settlement) which has occurred among the officers of the United States government since the passage of the Sub-treasury Bill. Previously to the adoption of that measure it was customary for these officers to use the government moneys in their hands temporarily for their own benefit, paying them over punctually at the stated periods of settlement. But numerous defalcations having occured in consequence of the government funds having been invested in enterprises which proved unprofitable, a provision was embraced in the sub-treasury law making it felony for any custodian of the public money to use it for any period, however short, for his own benefit. The wisdom of that enactment, so manifest in itself, has been abundantly proved by its operation in practice, having almost wholly prevented the occurrence of defalcations. It seems even that Mr. Fowler's would not have taken place, had he not been allowed to violate this provision of the law. It is said that most of the large sums which he has used and is unable to repay have been lost in unprofitable speculations. The *Tribune* says—"The following appear to be some of the speculations in which he has failed: real estate operations; shares in Pennsylvania coal companies; shares in the Empire City Bank, by which he lost $20,000. The only profitable investment seems to have been in a patent right for manufacturing wire sofa and other springs."

## LITERARY AND SCIENTIFIC NOTICES.

### NEW AMERICAN CYCLOPÆDIA, VOL. IX.

It has been well said that the possession of a good cyclopædia has more influence in elevating the social position of a man and his family than the investment of an equal amount in any other form of property. And it may be added that there is no other portion of a man's possessions from which he can derive so large a measure of the noblest and most durable enjoyment and satisfaction. Next to our schools and newspapers, we believe that the old "Encyclopædia Americana" has been the most valuable boon that has yet been bestowed upon the mind of this country. But in the swift progress of science, arts and events, that publication has nearly lost its value, and the Messrs. Appleton judged rightly that there was a demand in the community for another work of a similar character. We rejoice that the enterprise of supplying this demand has been undertaken by such competent hands, and we congratulate the editors on the ability, the learning and the capacity for the kind of writing required, which they have been able to marshal for the composition of this great work.

The new cyclopædia is to consist of 15 or 16 volumes, each containing 700 or 800 pages, and costing three dollars. It will thus be a very cheap work in proportion to the amount of matter which it contains, and will constitute a complete library in itself, with the several subjects arranged in alphabetical order, so as to he readily found as attention is called to them by either reading, conversation or reflection. The ninth volume contains more than 1,300 articles, and the following list will give an idea of the immense variety of the subjects:—Heart, Heat, Herod, Hessian Fly, Henbane, Hippopotamus, Holy Alliance, Holy Water, Holy Week, Homer, Homestead, Honey, Robin Hood, Hop, Horse-breaking, Horse-power, Hot-bed, Hour Circles, Henry Hudson, Howitzer, Alexander Humboldt, David Hume, Husband and Wife, Hustings, Hydraulic Ram, Hydrogen, Hydrophobia, Hymen, Immaculate Conception, Inquisition, Language of Ireland, Itch, Andrew Jackson, Japan, Language of Japan, Japanning, Jaundice, Jersey City, Jelly and Sir Jamsetjee Jejeebhoy.

All of these articles are written by persons familiar with the subjects of which they treat, and some single articles are really worth the cost of the whole volume. For instance, the plain treatise on the legal relations of husband and wife, by the learned Professor Parsons, not only gives the common law principles which govern these relations, but adds a summary of the modifications of the common law on the subject which have been made by the statutes of the several States; showing, in the briefest space, the rights of women in regard to person and property in the several parts of the country. We have examined several of the articles in this volume on subjects with which we are familiar, and find them, like those in previous volumes, admirably written. The "New American Cyclopædia" is exactly adapted to the perpetually recurring intellectual needs of the great mass of educated families throughout the country.

THE EDINBURGH REVIEW. Re-published by Leonard Scott & Co., this city.
The number of this periodical for the present quarter contains several very able essays, among which the best is, perhaps, one on "Education in England," and the other a scientific criticism of Professor Darwin's work on "The Origin of Species." This periodical is the oldest of its cl s in Great Britain; but although many of its old contributors are dead, they are well represented by the vigor, ability and independence of their succesors.

THE MATHEMATICAL MONTHLY. Published by Ivison, Phinney & Co., this city.
The May number of this magazine continues the discussion of the problem of probabilities. There is occasionally something in this purely intellectual periodical which is applicable to real life; for instance, the note on co-factors, by Pliny Earle Chase, of Philadelphia, in this number, might be sometimes used for reckoning dollars and cents.

THE WESTMINSTER REVIEW. Re-published by Leonard Scott & Co., this city.
The April number of the Westminster has a timely article on Japan, which moves through the subject in the methodical, clear, thorough and able manner characteristic of the great English reviews.

DINSMORE'S RAILROAD AND STEAM NAVIGATION GUIDE. Published by Dinsmore & Co., No. 9 Spruce-street, this city.
This old, useful and reliable publication is out in a new dress, and is the neatest and cheapest work of the kind published. It contains tables of the distance between the stations of all our railroads, the time of starting the trains, fares, &c.; also the time of sailing and routes of steamboats. It is a necessary hand-book to every traveler.

REVUE UNIVERSELLE. E. Noblet, editeur, Paris et Liege.
We have received the first number of the four h volume of this work. It is devoted to mines, metallurgy, public works, sciences and arts applied to industry, and appears to be very ably edited. We shall transfer to our columns such of its articles as we think will interest our readers.

THE QUARTERLY JOURNAL OF AGRICULTURE. Published by the United States Agricultural Society, at Washington, D. C.; edited by Benj. Perley Poore, secretary of the society.
The first number of the eighth volume of this standard work is almost entirely filled with lectures and articles by men eminent in agricultural science.

## AMERICAN INVENTIONS IN EUROPE.

The following useful inventions made by our countrymen have recently been introduced in England and patented through the foreign office connected with the Scientific American Patent Agency:—

*American Steam-heating Apparatus.*—The *Rhadamanthus* steam frigate has been ordered by the British Admiralty to be fitted with the Wethered steam arrangement for her engines. This consists in using combined saturated and superheated steam. The system in this case is an experimental one; £900 being appropriated for the purpose. Before receiving the apparatus, she is to be fairly tested as to speed and consumption of fuel by her present arrangements, so as to judge fairly of the gain which may be secured under the use of the improvement. An increase of speed, with a saving of 40 per cent of fuel, is promised.

*Sewing Machine.*—Invented by H. W. Hayden, of Waterbury, Conn. It relates to the formation of the lock stitch, an improved device for taking up the slack of the thread, and a new contrivance for feeding the cloth.

*Weighing Machine.*—Patented by John Howe, Jr. and Frank E. Howe, both of this city. The invention relates to improvements in the supports, joists and levers of platform balances. This is a very excellent scale and it is having an extensive sale in this country.

*Fire-arm.*—Patented by Charles T. Pierson, of this city. This invention consists in encompassing the cone or nipple of the fire-arm with a cup, and attaching a collar packed with india-rubber to the hammer, to protect the percussion powder from moisture and prevent accidental discharge of the gun.

*Apparatus for Blowing-off Water from Steam Boilers.*—Patented by James H. Washington, of Baltimore, Md. The blow-off pipe has a hinged joint and float so as to keep the opening in the same position in relation to the surface.

*Tailors' and other Shears.*—Patented by James H. Roome, of this city. This invention consists in combining one limb of a pair of shears with a handle forming part of a separate lever, and of combining the said limb and handle with the other limb of the shears, whereby the leverage exerted by the thumb or hand, in cutting, is gradually increased as the shears close, and a drawing cut is produced.

*Variable Cut-off Gear for Producing Expansion in Steam and other Motive Engines.*—Patented by Foster, Sutton and Stephens, of Harlem, N. Y. A compound cam, composed of two parts yoked together, is applied to the main shaft and controlled either by a governor or by the engineer.

*Machinery for Cutting Corks.*—Patented by Edward Conroy, of Boston, Mass. This machine was described and illustrated on page 345, Vol. I. (new series) of the SCIENTIFIC AMERICAN, and was alluded-to, favorably, in an extract from a British cotemporary, published on page 250 of the present volume.

*Revolvers and Bullets for the same.*—Patented by John Walch, of this city. Two charges are placed in each chamber, one forward of the other; both being fired before the breech revolves.

*Salinometer Case for Steam Boilers.*—Patented by Joseph Grice, of this city. A vessel is interposed between the boiler and the salinometer case, for the passage of the steam, to prevent ebullition in the salinometer case.

## FOREIGN NEWS AND MARKETS.

*Steam Frigates.*—Steam was introduced into the Royal Navy of England in 1822, and now two-thirds of all the war ships are steamers. The screw was introduced as the propelling agent in place of paddle wheels, in 1842; now there are 345 screw sloops and frigates, and 48 line-of-battle ships, having a power capable of moving them in a calm at the rate of from 10 to 15 knots an hour. The activity lately displayed in the British dockyards has led to such an increase of war steamers that the fleet is now equal to the fleets of France and Russia combined.

*Miscellaneous Matters.*—The wages of the operatives in the cotton factories of Bolton have been advanced 5 per cent, which brings them up to the Manchester standard. The steamship *Great Britain* (once wrecked in Dundrum Bay) made a recent voyage from Liverpool to Melbourne in 55 days and 16 hours—the quickest time on record between the two places; the total length of