# Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

**TERMS FOR THE SCIENTIFIC AMERICAN.**

One copy, one year, postage included..... $3 00
One copy, six months, postage included..... 1 50

**Clubs.**—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.00 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal or express money order. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

**The Scientific American Supplement**

Is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all newsdealers throughout the country.

**Combined Rates.**—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses as desired.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

**Scientific American Export Edition.**

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies, 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, APRIL 9, 1887.


**Contents.**

(Illustrated articles are marked with an asterisk.)



TABLE OF CONTENTS OF

## SCIENTIFIC AMERICAN SUPPLEMENT

## No. 588,

**For the Week Ending April 9, 1887.**

Price 10 cents. For sale by all newsdealers.



### CAR LIGHTING BY ELECTRICITY.

The regular Boston "special," on the Boston and Albany Railroad, was, last week, lighted by electricity and heated by steam—an arrangement which adds much to the comfort of passengers and removes altogether the danger from fire, always imminent in trains lighted and heated in the old way. The use of incandescence lighting on railway trains is not novel, nor is steam for heating. The Pennsylvania and other railroads long ago used this system of lighting on some of their special trains, and steam has been used for heating cars and other conveyances for years. But, up to the present time, no system of electrically lighting trains has proved satisfactory from a practical standpoint, and if that now adopted on the Boston "special" fulfills its promise, a really important advance will have been made in applied science.

In the system in use, electrical accumulators, commonly called "storage" batteries, are placed under the cars, and these having previously been charged from a dynamo-electric machine, while the train was lying in the depot, give out electrical energy as required. In this particular case, there are sixty cells to each car, and these, it is said, are good for the round trip between Boston and New York, thus necessitating the maintenance of only one electrical station.

In every car there are twenty incandescence lamps, each of sixteen candle power, this being equal in intensity to a five foot gas burner. As these lights glow in a vacuum without combustion, there is no danger of their setting anything afire in case of accident. Indeed, the entrance of oxygen through the breaking of a globe puts an instant end to the life of the lamp.

It is not at all likely that, even should the system now in use on the Boston "special" realize all that is promised for it, it would come to be generally adopted on the railway. It is too expensive. But, if it succeed in this instance, it will, no doubt, be used on many, if not all, similar trains, to wit, special trains on which an extra rate is charged for speedy and comfortable travel.

It should not, however, be forgotten by those who are interested in this subject that other and equally important experiments are now making, looking to the electrical lighting of trains by various and, it is said, cheaper means than that afforded by the movable accumulator. In one of these a small electrical generator is placed under each car, and this, being coupled up with the car axles, continually charges an accumulator, the same performing the two important offices of steadying the lights and furnishing the required energy to keep them aglow when the train stops. In another and still more economical system, a dynamo-electric machine is affixed to the locomotive and driven by a small auxiliary engine, connected by wire with the incandescence lamps in the cars. Then we have the system, now under active experimentation, of making small dynamos, affixed to the axles of each car, supply electrical energy directly to the lamps. This is, undoubtedly, the least costly and troublesome, and, consequently, the most promising system of all, provided, of course, that it can be made to work with certainty. At the first look, the fact that the lights go out whenever the train stops would seem to make the system impracticable. Careful examination, however, gives this defect a less serious aspect. Special trains—and the system is not adapted for any others—stop rarely, and only at principal stations, which are always well lighted, and the promoters of this system say that the reflection of the strong light from the station is quite sufficient for the illumination of the train during the few moments of stoppage. Where the large voltaic arc electric lights are used at the railway stations, as they are at many points on the New York Central, for instance, this assertion is certainly borne out by the fact.

Looking at the various systems of electrically lighting trains which are here enumerated, we should say that that which is most certain in its working is likely to be the most popular, regardless of relative expense. If this can only be said of the system which is now being used on the Boston "special," then the fact that the electrical batteries must be taken out and put back again once a day is of little importance. But if one of these other systems which require no such multiplicity of manipulation should prove to be quite as reliable, the question would resolve itself into one of dollars and cents, and the choice between them would then be clearly in favor of the latter.

### HEATING OF RAILWAY CARS BY STEAM.

An interesting practical article upon "Improved Methods of Heating Railway Trains" will be found in this week's SUPPLEMENT, by Mr. E. Powell Karr, C.E. The writer has reasoned *a posteriori*, *i. e.*, from the record of facts, as shown by the experiments with the Martin system upon the Milwaukee and St. Paul and other roads, rather than from a theory of cause as to what the effect ought to be; and the conclusions reached are, therefore, valuable and available as to the best course to be pursued in designing steam heating apparatus for railway trains.

The ordinary formulas in use for determining the velocity of flow and quantity of discharge of steam are too empirical, and lead generally to results which are absurd in the light of current practice.

The fundamental principle announced in the paper, that the velocity of flow is due to the rapidity of condensation and to no other cause, wonderfully simplifies the entire problem. The late esteemed mechanician, Robert Briggs, seems to have been fully conscious of this principle, but made no use of it in his valuable discussion of the question.

The unmodified formulas of Wiesbach and others refer more particularly to the flow of air and saturated steam, but for dry steam, such as that taken from the dome, the resistances to be overcome, although considerable, are greatly modified and lessened. The paper calls attention indirectly to our lack of knowledge upon the subject of the loss of heat by the impact of cold air upon the surface of a moving object, and the solution of the question offers a wide field of original research to the physicist and the engineer. Its solution is of the widest practical value.

The important practical features of the paper are the tabulated results, the precautions which must be taken to insure success, and the neutral ground pointed out between excessive pressure, with reduction of weight of piping, on the one hand and the minimum of pressure, with excess of weight of piping, on the other.

The condensation called for by the calculations so closely approximates the recorded amount of condensation under circumstances so similar that the result is an invaluable confirmative aid to future investigations.

### Lucky Buyers of Inventions.

The life dream of a Lowell lady has been that the number 272,751 was to be her lucky number. Some years ago she invested a small amount of money in letters patent bearing the favorite number 272,751. She claims the purchase was made to assist the inventor, who lost his health in the late war, rather than for her own speculation, notwithstanding her belief in the number. After years of patient waiting she has been assured by some of the best judges in the State that she had chosen a lucky number, as it appears to-day that the goods which this patent covers are of considerable value. A Pennsylvania manufacturer tells a story of the inventor of a multiple of rolls or trucks used under the bottom of railroad cars between the truck frame and the body of the car. The inventor became pressed for funds and desired a loan of $100, assigning his patent as security. Out of sympathy, the manufacturer gave him the money, never expecting, as he says, to ever get a dime of it back, and threw the patent papers aside in his safe, where they lay undisturbed for ten years. One day a lawyer of his acquaintance called at his office and inquired if he ever bought a patent on friction rolls for a railroad car. After reflecting a moment, he told him that about ten years before he had loaned an inventor some money on a car patent, but he didn't ever expect to hear from it again. The lawyer told him that this patent was being used on almost every car now being built, and a large revenue could be collected. Terms were soon negotiated for collecting evidence of infringement; so that the loaning of $100 to help out the distressed inventor brought him more money than all his other business.—*Boston Journal.*

The money paid for patents which have remained dormant in the hands of the inventor for a long time after their issue is in the aggregate very large. Incidents similar to those related above come to our knowledge very often, where parties have received quite handsome sums for their patents after several years' waiting, when all hope of realizing anything from them had departed.

Upon referring to our file of Patent Office reports we find the patent referred to as the lucky number 272,751 was for a window blind support, a small invention, but seemingly a good contrivance, the merit of which had undoubtedly more to do with the woman's success than her dream.—ED.

### Hindoo's Mode of Reaping and Cleaning Grain.

The *Milling World* tells its readers how the Hindoo reaps with an iron blade, six inches long, an inch wide, and curved like a sickle, costing him four cents. He squats on his heels, cuts a handful, lays it down, and without rising off his heels waddles forward and cuts another. In twelve days he cuts an acre, and receives five cents a day, boarding himself. When he wants to thrash his grain, he drives a stake in the ground, spreads his grain around it, ties a rope to his bull's horns and then to the stake, and drives them around and around till the straw is tramped very fine into what they call "bhoosa." This is fed to the cattle after the wheat is separated. Englishmen have introduced thrashing machines, but the Hindoos will have none of them. They think their cattle would not eat the straw because it breaks it instead of tramping it flat. They clean their wheat by holding it up in the wind in a scoop made of reeds, or, if the wind is not blowing, two Hindoos make wind by waving a blanket, while a third dribbles the grain from the scoop.

### A Trial of the Pneumatic Dynamite Gun.

On Saturday, March 26, an exhibition and trial firing of the pneumatic dynamite gun, with which Lieut. Zalinski's name is identified, took place at Fort Lafayette, at the entrance of the Narrows in New York Harbor. A numerous company was present, including representatives of the United States army, of its corps of engineers, and artillery, of the Spanish navy, and others. The trial consisted of the discharge of four shells, the range being in the direction of Coney Island Point, giving a clear water space of nearly three miles. The gun used was the large eight inch piece. The shells weighed in the neighborhood of 145 pounds, each containing a charge of upward of 50 pounds of explosive.

The main features of the gun have already been given in this paper. A tabular statement of the full results of these trials is given below. The air is admitted to the gun by a graduated valve, the action of whose cut-off is specified in the table, an arbitrary scale being used for that purpose. The object of varying the cut-off in these experiments was to illustrate how the range can be controlled thereby. The shells used were old ones, that had been in store for many months. The explosive gelatine which formed a principal portion of the charge was composed of 92 per cent of nitro-glycerine and 8 per cent of gun-cotton. Within it a core of dynamite was contained to act as the detonator. The results of the four shots tended to prove the practical success of the gun. A high range, in one case of upward of over two miles, was attained, and the control over the explosion by the delay primer and auxiliaries for deferring the time of explosion was very well exemplified.

While the dynamite gun originally was brought to the attention of the government by another inventor, a Mr. Mefford, and while several have contributed to perfecting its details, the distinctive feature of the shell, its system of priming, was invented and developed by Lieut. Zalinski. The explosion may be brought about by two methods. In using it against ironclads, both methods are combined. Two galvanic batteries are contained in the shell. One is a wet battery, which is kept charged. The other is a dry battery, which is brought to action only by being moistened. These two are arranged in series on one circuit. Part of the circuit is composed of a fine platinum wire, which is surrounded by gunpowder. If the dry battery is moistened, as by immersion in the water, the circuit is completed and the gunpowder explodes. It will be seen that the moistening of the dry battery not only acts to close the circuit, but by throwing this battery into action re-enforces the electromotive force of the other one. Perforations in the head of the shell admit water to the dry battery. These waterways are slightly obstructed by a shield, in order to prevent the inrush of fluid from disturbing the connections. By making them more or less devious, the action of the battery and consequent explosion of the powder can be delayed. Another element of delay can be introduced by modifying the construction of the dry battery. They can be made so that a single drop of water will establish a current, or so that a considerable immersion will be requisite for the same end. This much describes the system of water or immersion discharging. Besides this, a projecting mechanical circuit closer is used which closes the circuit irrespective of the dry battery, and thereby also effects detonation.

The battery, as has been seen, acts by exploding gunpowder. This is contained in a capsule, and the wire which is heated by the current is at one extremity of the capsule. At the other extremity is a charge of fulminate of mercury. This gives another method of delaying the explosion, by varying the length of the column of gunpowder intervening between the wire and the fulminate. The fulminate by its explosion causes the combined charge of gelatine and dynamite to explode.

The next distinctive feature about the shell to be mentioned is the point where the explosion begins. This is in the rear of the charge, the action being the reverse of the needle gun. The object of this is to create a species of gas tamping. The rear portions of the charge exploding first drive the rest of the charge ahead and hold it up to its work.

To determine the efficiency of this method of explosion, shells fired from a four inch dynamite gun have been tried against iron plates. In one case the charge was ignited at its forward end, in the other at its rear end, while in a third a shell charged with sand only was used. The shell charged with sand did considerable injury to the plates. The shell exploded from its forward end did less injury than was effected by the sand-charged shell; while the shell exploded from its rear end pierced a number of plates of iron, aggregating about four inches in thickness.

Several classes of duty can be performed by this gun. Its most obvious is the attack on a vessel. In this case a quick action primer is used, one which will explode the shell the instant it touches the vessel, or when the circuit is closed. The dry battery will afford sufficient delay, if the shell enters the water in the neighborhood of the vessel, to allow it to reach a good depth before exploding. Its other range of work may be termed sub-aqueous, where it is to be used for countermining torpedoes or for attacking vessels well beneath the water line. For this method of attack, delay primers are used, allowing it to penetrate to any given depth of water or to the bottom before exploding.

As an additional measure of precaution, spring circuit breakers are used, which, when the shell is within the gun, are held inward by contact with the walls of the bore, and are only released after the shell leaves the same. Hence, when the shell is within the gun, even if water were poured down the mouth, it would not explode, as the electric circuit would be mechanically broken.

As at present constructed, a composite shell is used, the head containing the explosive being of metal, attached to a wooden tail or guide piece. It is proposed in the future to make it entirely of metal, having a metallic tail piece with wings to cause a slight rotation or rifling motion to be imparted to the projectile.

The gun is loaded through its breech. Immediately back of it is placed a wooden sabot and a felt wad to prevent windage. The breech block is then closed, and all is ready for firing.

A cruiser is now under contract for the United States navy to be armed with these guns. On her it is designed to place three pieces, two of 10½ inches and one of 12½ inches caliber, the latter to discharge a shell carrying 200 pounds of explosive. The air is to be compressed to 2,000 pounds to the square inch, and an air reservoir is to be supplied so large that, when once charged, the ship will be able to go through a long action without any pumping. In the gun exhibited at Fort Lafayette, the gun reservoir was 137 cubic feet capacity, while a second or storage reservoir of but 100 cubic feet capacity was contained in the casemate of the fort.

An interesting feature of the practice is the perfect immobility of the gun. Attached to it was a sighting instrument, with delicate spirit level. After the discharge, the bubble in the level was quite undisturbed, and maintained its central position. The second shell fired, which attained an extreme range of 2,492 yards, ricocheted at the end of its course, clearing 436 yards in so doing. This contained a delay action primer, and exploded at the end of the ricochets. The third one parted from its tail piece, and hence had a greatly restricted range. It exploded with extreme violence on striking the water. On account of this, the fourth was tried, and attained a range of nearly 4,000 yards, but did not explode. It probably struck the bottom before the delay primer worked, owing to the shallowness of the water, and there broke to pieces. With regard to accuracy, it is evident that it could attain a very high degree of precision. We give in the second table results attained in firing, not at a specified mark, but under circumstances which enabled the place of fall to be accurately noted. These show how closely it can adhere to a given point of impact. Its deviations to the right or left and the amount by which it overshot a base mark are given.

I.—RESULTS OF EXPERIMENTS OF MARCH 26, 1887.

| No. of fire. | Weight of shell. | Weight of charge (explosive gelatine and dynamite). | Initial pressure. | Final pressure. | Loss of pressure. | Setting of cut-off. | Elevation. | Time of flight—in seconds. | Range—yards. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | lb. | | | | | | | |
| 1 | 146 | 50¾ | 1002 | 955 | 47 | 1·5 | 14° | 9·6 | 1816 | Quick action primer. Exploded. |
| 2 | 144 | 50½ | 1001 | 933 | 68 | 1·0 | 14° | 11 8 | 2492 | Delay action primer. Exploded at end of ricochets. |
| 3 | 143 | 50½ | 1005 | 905 | 100 | 0·8 | 33° 30′ | 20·8 | 2456 | Tail broke. Exploded on striking. |
| 4 | 139¼ | 50½ | 1005 | 905 | 100 | 0·8 | 33° 30′ | 25·4 | 3868 | Did not explode. |

II.—TRIALS BEFORE A NAVAL BOARD, JUNE 25, 1886.

| | Deviation to right. | To left. | Overshot in yds. |
|---|---|---|---|
| 1 | 16 feet. | — | 417 |
| 2 | — | 8 feet. | 438 |
| 3 | — | 9 " | 417 |
| 4 | — | 22 " | 417 |
| 5 | — | 16 " | 417 |

Wind from right, 15 to 18 miles. After first shot, gun was moved to left. No other change was made. Range of buoy, 4,421 ft. Total range, 4,838 ft. These five rounds were fired in 9 m. 40 sec. No haste was made, and work of loading was done by untrained men.

THE Geo. F. Blake Manufacturing Co., of Boston, stands among the most prominent of New England concerns, and the pumps for every kind of use made at their works are found all over the world. Owing to increasing business, the company have just removed to more spacious quarters, at No. 113 Federal St. The new store is 60×110 feet, and the company will have some 13,000 square feet of space, including a well lighted basement, which will allow them to carry a larger assortment of finished pumps than ever before. The elevator will be run by electricity.

### Work to be Pursued at the Naval Observatory, Washington, during the Year 1887.

CAPTAIN R. L. PHYTHIAN, U.S.N., SUPERINTENDENT.

*With the Great Equatorial.*—Observations of double stars will be continued. Observations of previous years will be discussed, if time and force will permit.

Continuation of measurements of the fainter stars in the Pleiades. Completion of these observations if possible.

Observations of the conjunction of the five inner satellites of Saturn with the minor axis of the ring, and the angles of position and the distances of the faint satellite Hyperion.

Reduction and discussion of the observations of former years, as time and force will permit.

*With the Small Equatorial.*—Observations of comets, whenever possible.

Observations of stars that need to be identified for the preparation of the third edition of Yarnall's catalogue, now in progress.

Observations of stars and asteroids for identification for the transit circle, and of such asteroids as cannot be observed with that instrument.

Observations of occultations of stars by the moon, whenever practicable.

*With the Transit Circle.*—Completion of the observations of miscellaneous stars for the proposed Transit Circle catalogue. Concurrently with these, observations of the sun, moon, and planets.

After the completion of the above observations (which, it is hoped, will be accomplished by the 1st of March), the instrument will be dismounted for repairs, and will thereafter be used in observations of:

The sun daily.

The moon throughout the whole lunation.

The planets, major and minor.

Stars of the American Ephemeris required for the determination of instrumental and clock corrections.

Miscellaneous stars, as may be deemed advisable.

The observations of preceding years will be reduced as rapidly as possible.

*With the Transit Instrument.*—Observations for the correction of the standard mean time clock daily.

*The Repsold Circle (at Annapolis).*—Observations of the 303 southern stars.

The 59 refraction stars of the Leiden observatory.

Auxiliary stars of the Berlin Jahrbuch.

*Time Service and Chronometers.*—Daily comparison of all chronometers on hand.

Daily noon signals over the wires of the Western Union and Baltimore and Ohio Telegraph Companies (Sundays excepted).

Correction, daily, of the clocks upon the Observatory Department time lines in the city of Washington.

Dropping, daily (Sundays excepted), of time balls at noon of the 75th meridian at the following points:

Wood's Holl, Mass., under the auspices of the Fish Commission.

Newport, R. I., under the auspices of the Torpedo Station.

New York city, under the auspices of the Western Union Telegraph Company.

Philadelphia, Baltimore, New Orleans, } Under the auspices of the Hydrographic Office.

Washington, Hampton Roads, Savannah, } Under the auspices of the Observatory.

Time balls will also be dropped from the Branch Observatory at the Navy Yard, Mare Island, on Telegraph Hill, San Francisco, through the Branch Hydrographic Office, and at the Navy Yard, at noon of the 120th meridian, daily (Sundays excepted).

The time service will be extended to such other points as may be deemed best, as funds will permit.

Test in the temperature room of such chronometers as have been repaired during the past year, including the plotting of their rate curves, with the necessary computations therefor.

The examination of nautical instruments will continue.

Photographs of the sun will be taken daily, when practicable, with the photo-heliograph of Transit of Venus Commission pattern.

Meteorological observations will be made as usual.

### Danger in the Bottle.

Mr. G. W. Fitton writes to the *Chemist and Druggist* that he has narrowly escaped what might have been a serious affair. "Not having the blind down in front of the window as usual," he writes, "and the sun being very strong, the rays, after passing through a large carboy filled with the usual solution of bichromate of potash, were thrown on to the woodwork of the window inclosure, soon burning a piece nearly ¼ inch thick and 4 inches long; more would have followed had I not discovered it in time. Should like to know," he adds, "if you have heard of a case like this occurring before?"

There have been a number of similar incidents recorded, and it stands druggists in hand to be careful about displaying globular shaped jars in their windows where the sun's rays can be refracted by them.