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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 488,

For the Week ending May 24, 1884.

Price 10 cents. For sale by all newsdealers.

STEAM AT A THOUSAND POUNDS PRESSURE.

Jacob Perkins, an American in England, who was the father of the high pressure system of heating by hot water in closed circuits, early gave his attention to the immense power of steam at high pressure for the projection of missiles of war, and so far perfected a steam gun as to exhibit it before the Duke of Wellington in 1824. It was very effective, but the "Iron Duke" considered that a steam boiler that threw away balls as fast as that did would be out of place in an army, and would waste ammunition. From this, steam as a high pressure power has slumbered, with occasional revivals, for more than a half century.

About 1840 a steam rifle made by Perkins was brought to the United States, and exhibited at the southwest corner of Broadway and Chambers Street, New York. It consisted of a steel barrel of medium rifle size, a lever valve, bullet magazine, with a revolving plug arranged for feeding single bullets or a volley. The whole swiveled upon a substantial frame.

The steam generator was of the vertical tubular type, consisting of a strong wrought iron pipe of three inches internal diameter and about eight feet high, with eight internal tubes, each about one-quarter inch in internal diameter. The chamber of the large tube was connected with the valve chamber of the gun by hydraulic pipe with metallic swivel attachment, while the internal tubes were connected with a coil of hydraulic pipe forming the walls of a portable furnace, so that steam used for operating the gun was derived from a secondary generator; the primary circulation being a closed hot water circuit with an air expansion chamber, both divisions having hydraulic or high pressure safety valves.

A small hydraulic pump worked by hand served to feed the generator with the water required for steam; the whole apparatus being very compact, occupying but a few square feet of floor.

A cast iron target a hundred feet away completed the plant.

The closed circulation of hot water from the coil in the furnace through the small tubes in the generator carried the pressure up to a thousand and more pounds to the square inch in a few minutes, and would set the safety valve singing in a tone unknown at ordinary pressures. Under this pressure no water issued from the tiny apertures of the gauge cocks; a blue vapor could be discerned, the tone giving the indication of steam or water.

The safety valve upon the generating or circulating coil was set at three thousand pounds to the square inch, and would sometimes blow off when the gun was not in action, or the water low in the generator.

The heat of the water in the circulating coil was so great as to immediately blue the surface of the pipe when freshly scraped near its entrance to the generator, and would fire pieces of pine instantly.

The heat of the steam in the gun chamber frequently melted the bullets, and rendered volley firing very difficult; for on more than one occasion the whole volley was melted in the chamber by the sticking of the first bullet. The report from the discharge much resembled that of the ordinary rifle, with perhaps less sharpness.

The bullets fell from the iron target in dust, when thrown at the highest pressure; while from lower pressures they were battered into all shapes, from cones to flat, ragged disks.

A peculiar feature of that high pressure steam apparatus with the necessarily high temperature of its active element was the entire absence of any form of packing; every joint was a metallic contact, and the valves of hardened steel with seats of the hardest bronze.

ELASTICITY OF LEATHER BELTS.

One excellent, if not absolutely necessary, quality in a belt is elasticity. Under some circumstances a belt that is non-elastic and only pliable will act, but it is not so useful as a belt that combines elasticity and pliability. A gut string used as a round belt is not elastic—only pliable—and to do effective duty it must be kept very tight, making a strain on the bearings of the spindles it connects. But a belt that is greatly elastic will develop its full driving power, even though it may run quite slack. An amateur foot lathe of considerable capacity can be run by an India rubber thong with so slight a tension as to allow the finger to pass between it and the scored pulley without pain.

Much of the value of leather belts is due to their elasticity; this, as well as their substance, aiding in their adherent contact with the pulley face. By the term elasticity the quality of stretch—permanent stretch—is not intended. An ordinary bullock hide is usually permanently stretched five inches before being cut up, but the elasticity of the belts made from it is not impaired. New belts also have to be "taken up" usually after running a short time. But there is an elastic quality in a well fitted belt that is recuperative; it will return on itself when the temporary strain is removed. It follows, then, that the periodical release of belts from their working strain is a reasonable practice.

A recent experiment appears to prove this. As a test, a mechanic put new leather belts on two iron turning lathes at the same time. The lathes stood side by side, the work on them was similar, and the belts were cut from the same roll. The belt on one lathe was thrown off every night, and that on the other was never released. The latter was shortened four times during its life, while the other was taken up only once, and when the continually strained belt was so nearly worn out as to require repairs, the nightly released belt was in excellent condition.

This treatment of belts is not always possible; the prime movers and secondary belts can hardly be released every night, unless in such cases as where a long belt is run with an idler pulley or tightener; but the small ultimate belts that drive lathe cones, drills, milling machines, planers, and many other tools and machines could be so treated without trouble and with a resultant economy.

NAILS.

A large dealer in builders' hardware said recently that the demand for clinch or clout nails and for chisel pointed wire nails had largely increased within a year, as compared with that for the ordinary cut nails, and that flooring nails with the wedged-shaped heads were also used in place of the nails with the flat upset heads. His reasons were that better work resulted from the better nails, and there was far less waste. For the coarsest purposes the less first cost of the ordinary cut nails with the flat head induced builders to continue their use; but he believed the improved form and better material of the tough wire and clinch nails would, in time, drive out the inferior material and defective form. The principal advantage of the wedge shaped head, as in floor nails, is that the head never breaks off in driving, as it is only a gradual enlargement of the body of the nail, instead of an upset across the nail. But the chisel point of the wire nail is its especial merit, as it cuts a clean passage through the fibers of the wood for the following of the body of the nail, instead of "stunting" and mutilating the fibers, as the blunt pointed nails do.

The common cut nails will not usually clinch, even when the clinch is turned in the direction of the grain of the wood; but they may be considerably toughened by heating to a red, and gradual cooling. A hardware establishment was burned a few years ago, and among the stores were nearly a hundred kegs of cut nails of various sizes. The remains from the fire were sold to another dealer, and as soon as the value of the burned nails became known he could sell no others until they were gone.

Money in Sunflowers.

Much has been written during the past few years about the value of sunflower seed for feeding to fowls and sheep. The value of the leaves of the plant for feeding to horses has also been favorably noticed. A correspondent of the Toronto *Globe* calls attention to the value of the seed for making oil. In his communication he writes:

Care should be exercised in selecting sunflower seeds, as there is a very great difference in the number of flowers, and consequently in the number of seeds produced, at least so I have proved in my own garden, some varieties ranging from one to three flowers, while others will produce as many as fifty, sixty, and seventy flowers on one stalk. When the object is to provide feed for cattle and fowl, the last variety mentioned will doubtless be found the best paying; when the purpose is to secure oil, only the best oil seed variety should be selected; and, as I have not experimented in this line for oil, I am at a loss which variety to recommend. Experienced farmers and gardeners already know that the plant will readily grow in almost every soil, but prefers light, calcareous land, unshaded in every respect. The quantity of seed required for an acre is from four to six pounds. In some cases the seed is drilled into lines eighteen inches apart, and the plants are subsequently thinned out to thirty inches apart in rows, thus giving about eleven thousand plants to an acre, and each plant produces about one thousand seeds—the better sorts would probably produce many more. In England it is recommended that the sunflower be earthed up when about one foot high, but it will require no further attention. It is said the yield is much increased by the use of a fertilizer, and old mortar is regarded as one of the best. The sunflower has long been grown for its oil seeds in India and Russia, and more recently its cultivation has been taken up in Italy and Germany. In China and Tartary it is produced in immense quantities, and why not equal quantities, as cheap feed for cattle and in henneries, if for nothing else. In Russia, where the production of seed is very large, the oil is expressed on the spot, and is largely employed for adulterating oil, while the purified oil is considered equal to olive and almond oil for table use. In India one acre of land is stated to yield 11½ hundredweight of seed, which in the press gives out forty-five gallons of oil, and is there compared with ground nut and applied to the same uses. I think Canada, including the Northwest, can produce oil in this way quite as well as India or Russia. I also find that experimental culture in France gave 1,778 pounds of seed, yielding 15 per cent of oil (275 pounds) and 80 per cent of cake; but the product (according to the French report) varies considerably according to soil, climate, and cultivation, and that the average may be roundly stated at fifty bushels of seed from an acre, and one gallon of oil from one bushel of seed; also, that the percentage of oil to seed ranges from 16 to 28, and that of husk to kernel from 41 to 60; but this may be in some measure attributable to the varieties used, though none of the reports speak of the varieties grown.

ELECTRIC lights have been introduced into a gunpowder manufactory in England. The buildings are scattered over three miles of territory, and the wires are carried above ground from a dynamo near the center of the inclosure.

Death of Cyrus H. McCormick.

This well known inventor, whose name will always be associated with improved harvesting machinery, died in Chicago, May 13, 75 years of age. He was born in Virginia, his father being a farmer of mechanical bent, and the inventor of several machines, one of which was a reaper that was not found practicable. Young McCormick experimented on a farm given him by his father, and, after having invented a hand cradle and a hillside plow, experimented on the reaper, for which he obtained patents in 1834. It was first placed upon the market in 1840. In 1845 he moved to Cincinnati, and in the same year secured patents upon several important improvements in the machine. In 1847 he moved to Chicago, where he has since lived, and where he erected large works for the manufacture of his reapers. Up to 1848 he had not made the machines himself, but had had them manufactured by a firm at Brockport, N. Y. In 1848 he began building them himself, and made seven hundred the first year. For some years past now the annual sales of the machines have ranged between forty and fifty thousand. His famous invention brought great wealth to Mr. McCormick, and many honors as well. Gold medals and grand prizes were showered upon him at expositions, and Napoleon III. gave him the Grand Cross of the Legion of Honor. His wealth he used wisely and well. In 1859 he founded and liberally endowed the Theological Seminary of the Northwest, at Chicago. He also endowed a chair in Washington and Lee University, Virginia, and gave to the University of Virginia a fine 26 inch refracting telescope. He was a member of the Presbyterian Church.

Death of Charles O'Conor.

Charles O'Conor was born in this city in 1804, of Irish parents. He received only a common school education and lessons in French and Latin, his father being unable to give him the benefit of an extended course of instruction. He studied law, and was admitted to the bar in 1824. A wonderfully accurate memory, complete fearlessness, and indomitable perseverance enabled him to overcome all difficulties, and, his abilities being recognized, he rose rapidly in his profession, and for half a century ranked among the foremost lawyers at the American bar. He maintained this position because of his strict integrity and impartiality, his vast learning, his knowledge of the law, and his intimate acquaintance with all its intricacies. He was connected with many of the most celebrated cases that have been before the courts during the past fifty years. He was good authority on the interpretation of constitutional law.

Mr. O'Conor died at his home in Nantucket, Mass., on the 12th inst., at the age of 80 years.

The Conductivity of Copper.

The true nature of electrical resistance is by no means well known; and the only light which the induction balance of Professor Hughes has as yet shed upon it has not revealed its true nature. An interesting observation recently made by Mr. W. Groves, the well known practical electrician of Bolsover Street, W., deserves to be more widely known. Mr. Groves took thin disks of brass and coated them by electro deposition with a thick layer of pure crystalline copper. He then cut similar disks of copper from the deposit, and tested them in the induction balance. The scale gave 200 as their induction value. The same disks, after being melted in a founder's furnace, only gave 100 on the scale, and after a second melting their induction value had fallen to nearly that of ordinary sheet copper, namely, from 50° to 80°. If, as many believe, the induction value represents the conductivity of the copper, there is here a great falling off, and it might be valuable, not only in a theoretical but a practical sense, to find out the true cause. Dr. Mathiessen found that copper lost in conductivity by absorption of oxygen, and the pure copper being fused in an ordinary founder's furnace may have lost its electric conducting power by absorption of this impurity. Should that prove to be the case, there is much to be gained by fusing copper in presence of hydrogen, which uniting with the oxygen would form water, and leave the copper in its pure condition.

New Sodium Battery.

The *Bulletin* of the Societe Internationale des Telephones has recently announced the formation in Paris of a syndicate with a capital of 12,000*l*. for working the sodium battery lately invented by M. P. Jablochkoff. Whether such an organization has been, or is to be, established, says *Engineering*, we do not know, but space may well be devoted to a short notice of the battery referred to. In designing it M. Jablochkoff's object was to obtain an element having a much higher electromotive force than any other hitherto devised, and for this purpose he has made use of pure sodium. This metal is used in thin plates, and is coupled with compressed carbon, such as is employed in other batteries, or the plates may be placed in a metal capsule, in the midst of broken carbon. Under such conditions, and subjected only to the humidity of the air, the battery yields the relatively high electromotive force of four volts, which may be raised to six volts by impregnating the carbon with certain metalloid solutions.

This latter fact, however, has no practical value, because the price of such solutions, and the difficulty of using them, make the arrangement quite impracticable. With a couple of sodium and copper, the electromotive force falls to three volts. Such a battery, which may be of value in some cases, is made up of a thin plate of sodium, and a piece of red copper gauze. It will be seen that the force of this battery is considerably in excess of others now in use. So far as we know, there is not yet sufficient information as to the durability and the internal resistance of the sodium battery, to establish any useful comparisons with ordinary types. On account of the avidity with which sodium decomposes water, and absorbs oxygen, it is necessary to shield the battery from exposure when it is not in use, and for this reason it should be kept, except when active, in a bath of naphtha, or at all events in a hermetically sealed vessel. M. Jablochkoff asserts that the waste of the sodium, that is to say, its combustion, beyond what is converted into useful energy, is extremely small. One of the objections, which naturally present themselves to this battery, is the great precaution which must be taken in using it, on account of the explosions which occur when sodium is brought into contact with water. With proper precautions, however, such a danger is not great, although more than one serious accident has happened from this cause.

The Liquefaction of Hydrogen.

M. Olszewski recently stated, in the *Comptes Rendus*, that he has liquefied hydrogen by the aid of liquid nitrogen; his previous use of liquid oxygen being unsatisfactory. The nitrogen was compressed to 60 atmospheres, and cooled in a glass tube to —142° C., for a considerable time, by the aid of ethylene evaporating in a vacuum; and in this way was liquefied. The pressure being diminished to 35 atmospheres, the nitrogen began to boil with such rapidity that it seemed white and opaque in the upper portions of the tube containing it. If the pressure was maintained at this point, the nitrogen ceased to boil; wholly clarified itself; and showed a very pronounced meniscus. The liquid nitrogen, amounting to from 3 to 4 cubic centimeters in volume, preserved this condition for a considerable time, slowly evaporating, and producing an increase of pressure in the apparatus. At length its meniscus became less and less distinct; and it finished by completely vanishing when the pressure gauge stood at 39·2 atmospheres; which is, therefore, the critical pressure of nitrogen. When the liquid nitrogen was reduced to the pressure of one atmosphere, it at first rapidly evaporated; but afterward, when scarcely half of it was left, the evaporation slackened, but the liquid itself remained completely transparent, without freezing. The nitrogen did not freeze, even when evaporated under a vacuum; but it was very different when hydrogen contained in a glass tube of about 4·5 millimeters internal diameter was plunged in the liquid. While the nitrogen evaporated in the vacuum, and the pressure of the hydrogen fell from 160 to 40 atmospheres, the hydrogen was observed to condense into a colorless transparent liquid, running down the sides of the tube. A moment later, the exterior surface of the tube was covered with an opaque white coating of the portion surrounded by the gaseous nitrogen, and with a semi-transparent ice on the portion dipping in the liquid nitrogen. This ice and the white coating were evidently due to the nitrogen, which thus solidified upon the sides of the tube, prodigiously cooled by the ebullition of the contained hydrogen. The insufficient quantity of liquid nitrogen has not hitherto permitted M. Olszewski to observe the meniscus and critical pressure of liquid hydrogen; but he is convinced that nitrogen, in considerable quantity, boiling in a vacuum, will furnish the only means of liquefying hydrogen to its static condition.

Petroleum as Fuel in Rolling Mills.

Among the many ways in which efforts are being made to economically employ petroleum as a fuel, one lately tried at the Union Rolling Mill at Cleveland, Ohio, is said to have been a pronounced success. The apparatus is described as quite simple, and easily attached to an ordinary puddling furnace. What may be styled shallow pans, or receivers, are set upon the floor of the furnace, and in these pans are heavy, closely fitting perforated cast iron plates, lying upon shelves but half an inch raised from the bottom; leading to the centers of these receivers, from beneath, are oil pipes connecting without with a tank or barrel sufficiently elevated to give the oil a good head; intercepting the oil pipes near the furnace is a small cylinder in which is an automatic valve, which can be set at any position to automatically regulate the flow of oil. Auxiliary, are pipes for carrying exhaust steam for blast, a bridge wall back of the receivers to detain the flame, and a water-lined arch to protect the burners.

In operation, the automatic valve being set, the oil is allowed to flow into the receivers; a handful of cotton waste, ignited, starts the fire; the plates become heated, and the oil, forcing its way up under the plates, is instantly atomized, and rushes up through all the perforations—gases, hydrocarbons, and all—into a brilliant flame, leaving no residuum whatever beneath. The first fire was lighted about 9:30 A.M., but the full heat was not let on until about 11. At 12:10 P.M. the furnace was charged, and at 1:22 P.M.—exactly one hour and twelve minutes—the first heat was concluded. The pig iron melted rapidly, the balling was performed without difficulty, and the ball went through the squeezer in excellent shape. Necessarily there were some drawbacks. The steam used for blast was scarcely dry enough, the pressure being only 70 pounds at most; there was a slight escape of smoke from the rear of the furnace when the draught was open, and a high wind at the time did not conduce to the most favorable test; nevertheless the results made a favorable impression on practical men who witnessed this trial.

This mode of burning petroleum is the plan of a Cleveland lady, and seems not unlike, in principle, the proposed way of burning petroleum in locomotives contemplated under the Holland patents.

DECISIONS RELATING TO PATENTS.

United States Circuit Court.—Southern District of New York.

MUNDY *vs.* LIDGERWOOD MANUFACTURING COMPANY.

When an inventor merely brings an old element into his machine, he makes no invention; but where he does more—dispenses with certain parts, duplicates others, rearranges and simplifies the machine—he must be held to have made an invention.

When a patent is for a combination, one element of which is a gear wheel with a cone supported in a peculiar manner, and the defendant uses the gear wheel with the cone, but the latter is supported differently, though the elements employed by the defendant are the equivalents of those of the complainant in the patented combination, *Held* that the defendant takes the complainant's combination and infringes his patent.

The New York Produce Exchange.

The dimensions of this great building, which was illustrated in the SCIENTIFIC AMERICAN for May 10, are as follows: Length on Broadway and Whitehall Street, 307½ feet; on Beaver Street, 150 feet; and on Stone Street, 149 feet; the tower being 40 by 70 feet, and 200 feet high. The aggregate floor surface in the building is 7½ acres, and the Board Room proper is 220 by 140 feet, 60 feet high in the center, and lighted by 23 windows, each 31 feet high, and a skylight over the center. The cost of the site and the pile foundations was $1,000,000, and the total cost of building and site about $3,000,000.

In this great building, by the aid of the cable, the telegraph, and the telephone, the principal commercial emporiums of two continents are brought into instantaneous commercial intercourse. Substantially all the agricultural productions exported from New York are bought and sold on the floor of the Exchange, and how large this business is may be estimated from the fact that in 1880 there was received at New York 59,000,000 bushels of wheat, 61,000,000 bushels of corn, and 5,000,000 barrels of flour; and in addition to these articles the transactions in beef and pork and their related products are always on an immense scale.

New Stone Saw.

A new sort of saw for cutting stone is described in *La Semaine des Constructeurs*, which seems to have advantages over those now commonly in use, and is easily and cheaply made and operated. In place of the ordinary long steel blades, supplied with sand to enable them to grind their way into the stone, the new machine presents only a slender endless cord, composed of three steel wires twisted together, which is stretched over pulleys in such a way as to bring the lower portion horizontally over the stone to be cut. The frame carrying the pulleys is movable, so that the cord can be brought into contact with the stone, or lifted away from it, at pleasure, and the whole is kept in rapid motion, while water falling in drops from a reservoir above serves to moisten the stone. The three wires which form the saw differ from the ordinary kind in being square in section, and by twisting into a cord they are so turned as to present a succession of oblique cutting edges, which act, when set in motion, in nearly the same way as so many small chisels, while the rapidity with which the blows follow each other probably adds to the effect.

American Institute of Electrical Engineers.

At the call of a number of prominent electricians a meeting was held on the 13th of May, in the rooms of American Society of Civil Engineers, New York, and the organization of the above named society was effected.

The first of its kind in this country, it bids fair to have a prosperous career, and will undoubtedly tend to promote the interests of all those engaged in electrical pursuits. That the society is a representative one, will be seen by the list of officers elected which is as follows:

President: Dr. Norvin Green.

Vice-Presidents: A. Graham Bell, Charles T. Cross, Thomas A. Edison, George A. Hamilton, Charles H. Haskins, Frank L. Pope.

Managers: Charles F. Brush, William H. Eckert, Stephen D. Field, Elisha Gray, Edwin J. Houston, C. L. Hillings, Frank W. Jones, George B. Prescott, W. W. Smith, W. P. Trowbridge, Theodore N. Vail, Edward Weston.

Treasurer: Rowland R. Hazard; Secretary: Nathaniel S. Keith.

Incorporation of a Bridge Building Company.

The firm of Clarke, Reeves & Co., proprietors of the Phœnixville (Pa.) Bridge Works, has been merged in a corporation under the style of the Phœnixville Bridge Company. The works of the company have a capacity of thirty to thirty-five thousand tons a year, and among their productions have been the Kinzua Viaduct, numerous new bridges for the West Shore Railway, and the structures of the Second and Ninth Avenue elevated railways of New York city. Mr. David Reeves is president of the company, and Mr. Adolphus Bonzano is vice-president and chief engineer.