Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

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

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included $3 20

One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each: additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, 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, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

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., 37 Park Row, New York.

NEW YORK, SATURDAY, AUGUST 13, 1881.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 293,

For the Week ending August 13, 1881.

Price 10 cents. For sale by all newsdealers.

VENTILATION OF HALLS OF AUDIENCE.

An able and exhaustive paper has lately been presented to the American Society of Civil Engineers, on the ventilation of halls of audience, by Mr. Robert Briggs, C.E. It appears from this paper that a man in health and at rest requires for breathing 480 cubic inches of air per minute. The inhaled air, in American summer condition of 70° Fah. and 70 per cent of hygrometry, or about 1·7 per cent of its volume of aqueous vapor, and 0·04 per cent of carbonic acid, will, when exhaled, be found to contain nearly three times as much vapor and nearly 100 times as much carbonic acid, and to have lost one-fifth of the oxygen inhaled, while the temperature will have risen to 90° Fah. But, contrary to the teaching of some authors, the exhaled air will be about 3 per cent lighter than it was before being breathed. The carbonic acid does not, as some believe, separate and fall to the ground, but it is inseparably mixed with the breath.

Breathing is not the only means through which inhabited air is vitiated; insensible perspiration adds one-fifth or more to the carbonic acid sent out with the breath, while an average of about two pounds of water per day evaporates from an adult man at rest and awake, and both add to the contamination of exhaled air.

Now, if it be accepted that air is unfit for breathing after having once been in the lungs, it seems that about one-third of a cubic foot of air per minute is required by each person. The internal temperature of the body being nearly 100° Fah., it is essential that the surface should radiate heat, and that the air thus heated should pass off. Small portions of ammonia and gases, with floating organic matter, dust, and smoke in the air, with the probability that the origin of disease is only found in the germs of living organisms that subsist on the decomposing organic matter suspended in the atmosphere, are important facts in estimating the quantity of air required for perfect ventilation. It seems, therefore, that at least four cubic feet per minute are required, and that this quantity would amply ventilate a single person if it could all be devoted to his use exclusively.

Passing now to the subject of practical ventilation of halls of audience, it appears that each individual of an audience cannot, by known means, be supplied with his quota of four cubic feet per minute, which would, if made to pass upward along his person while standing, serve to perfectly ventilate him; it further appears that in a room continuously occupied by persons in health, or at least not affected with offensive diseases, as much as 30 cubic feet of air per minute must be properly introduced for each individual. A desirable capacity for the chamber seems to be 1,000 cubic feet of room for each person, but audience halls average no more than 200 to 300 cubic feet to the person, and therefore contain only about six to ten minutes' supply of air. This smaller capacity does not seem to be a very important defect, provided a systematic supply of air, at a proper temperature and in a desirable state of humidity, is properly introduced and distributed. The last part of the problem, as here stated, is the important difficulty to be overcome.

The system of air introduction through perforated floorings is in operation, and has been for twenty-four years, at the Houses of Parliament, London, although it is thought to be "embarrassed in its action by singularly unmechanical and insufficient apparatus for warming and supplying the air."

In other systems the standing difficulty is the establishment of local currents which produce unpleasant sensations in those persons who are exposed to them, and the desideratum has been and still is to supply an effective quantity of agreeably tempered air in such a way as to be imperceptible to the audience.

As regards the comparative effects of gas and electric lighting we are told that "the vitiation of air by electric light, arising from the slow combustion of the carbon, is too insignificant to form any element in considering the ventilation." The ventilation of churches that are heated by furnaces in the cellars beneath the audience can be partially done by removal of air at or near the floor, but no large ventilating shaft from the upper part of the room is admissible as a means of natural ventilation.

Natural processes can be only partially successful in ventilating codience rooms. Success "can only follow the complete adaptation of mechanical appliances and apparatus, as well as of structural arrangements, to the ascertained wants and requirements of the individual composing an audience."

Fans of the disk pattern are recommended as being from 10 to 15 per cent more effective than the common incased fan. The speed of the fan should be such as to impel the air in the ducts at the rate of 600 feet per minute, while the ends of the ducts should be fitted with baffling boxes so that the air may leave the box at a velocity not exceeding 120 feet per minute at a distance of one foot above it.

Box coils, as they are called, consisting of horizontal pipes inclosed in a chamber, are best for indirect heating (ventilation); while vertical coils, though less efficient by 20 per cent, are preferable for office heating.

The efficiency of well exposed steam pipes with steam at 36 to 40 pounds pressure is given as 3 cubic feet of air heated from zero to 100° Fah. per square foot of surface, or 5 cubic feet from 50° to 70° or 80°

For direct heating by coils placed in the rooms to be heated one square foot for each 80 cubic feet of space within the walls of an exposed room, but special provision must be made for doorways and open passages.

The cross section of steam supply pipes should have one circular inch area for every 500 feet of effective heating surface, enlarged $\frac{1}{100}$ for each foot from the point of first distribution or branch from the main. The condense water or return requires one half as much. Flow mains should rise vertically to some point where they can be drained or trapped, and then descend half an inch in 10 feet to the end.

Boilers of the common tubular form require one square foot of heating surface to each 9 square feet of coil surface or radiators, or one square foot of grate surface to 270 of radiating surface, the grate and heating surface of the boiler being as 1 to 30.

Chimney flues 50 feet high should have an area one-tenth of the grate surface, and 100 feet high one-twelfth. The maximum quantity of coal consumed will not exceed 8 pounds per square foot per hour, while for six months in the year 20 to 30 pounds per 24 hours per square foot will suffice.

A fan delivering 20,000 to 40,000 cubic feet of air per minute will require from 20 to 60 pounds of coal per hour. No allowance need be made for steam to drive the fan where buildings are warmed and ventilated, as the exhaust steam will be utilized for heating purposes.

The author says, "steam heating apparatus in all its details, as used in America, is peculiarly American," and "as practiced here, is not fully known or used in England or France, and but little more known in Germany."

BUTTON-SET RIVETING FOR BOILERS.

"Button-set riveting," which means forming the zone of a globe on the rivet by means of a concave "set" and a sledge, has been generally regarded with disfavor by boiler makers, but it has been long used by oil tank builders, enabling them to erect large tanks with astonishing rapidity and at correspondingly low cost for labor. The fine appearance and general good character of this work led enterprising boiler makers, who were not in condition to warrant the expense of steam riveting machines, to clandestinely try this method on steam boiler shells, and it has at last found favor among reputable makers, who now employ it openly, and they are supported in it by most people who understand the difference, except perhaps professional hand riveters, whose occupation is injured by its adoption.

We take the following from an interesting report by Mr. Wells to the recent convention of Railroad Master Mechanics at Providence, on the subject of "set riveting," as compared with "steam" and "hand riveting" of locomotive boilers. The plan of "set" riveting consists in placing upon the inserted hot rivet a set, mounted upon a handle, as smiths' sets, flatters, and hot chisels are, and having a cavity of the shape and dimensions of the desired head in its lower end, and "driving" the rivet by strokes from one or more sledges upon the other end of the set, a heavy holding iron being used to meet by its inertia the force of the sledges. The weight of the set described is 2½ to 3 pounds, of the sledges 9 to 10 pounds, while the holder or anvil placed upon the other end or head of the rivet is about 60 pounds, and held firmly against the work by the short arm of a stiff lever of the first order.

The skill required for this work is readily acquired by laborers of ordinary intelligence, and consists merely in properly placing the holder, holding the set squarely on the rivet, and delivering fair blows upon its upper end. The first blows serve to upset the body of the rivet in the hole more effectually than blows struck with light hammers directly on the rivet point, and 24 blows in all, at the rate of about 80 per minute, finish the "setting" of the rivet, and half a dozen blows upon a "flatter" placed on the lap near the rivet completes one rivet, except a few blows more on the set to give the head a nice finish according to the taste of the workman.

Thus are driven on the shell of a boiler 30 rivets per hour, or an average of 22 on all parts, including changing bolts, drifting holes, and adjusting the work. Hand riveters average about 125 rivets per day of twelve hours and a half, or 10 per hour, under similar conditions. The report shows that the riveting of a locomotive boiler containing 1,722 rivets will occupy 65·85 hours, at a total cost for labor of $44.77, or an average of 2·64 cents each rivet, against which stands 5·84 cents each for rivets driven by hand at the rate of 10 per hour. The difference in favor of set riveting is shown to be 54 per cent in cost and 51 per cent in time. From the drawings exhibited, showing sections of laps riveted by the two methods as well as by steam riveter, it appears that "set" riveting is the most perfect in the matter of the rivet filling the hole. The remarks by members that followed the report indicated that no discussion was possible, since all seemed to think favorably of this method, and the president of the convention thought, that being the case, it ought to be adopted at once.

THE TORPEDO STEAM ALARM.

For several days the torpedo steamer Alarm has been stationed at Yonkers, on the Hudson, where trial has been made of the new propelling and steering machinery with which she has been fitted.

This vessel, and the novel system of torpedo warfare provided for in her construction and equipment, were described and illustrated in detail in the SCIENTIFIC AMERICAN of March 17, 1877. The Fowler wheel, which had been adopted to fill the double office of propelling and steering, did not prove entirely satisfactory. It enabled the boat to turn quickly in small space, but it did not give speed enough.

© 1881 SCIENTIFIC AMERICAN, INC

Accordingly an appropriation was made by Congress to change the driving machinery, and the Mallory propeller was substituted. The tests now being made are chiefly to determine the efficiency of the new system. With the Fowler wheel but seven knots were made. With the Mallory propeller a speed of eleven knots has been attained, two of the four boilers being used, and her commander, Lieut. R. M. G. Brown, expresses the opinion that twelve knots can easily be accomplished—in plain English, about two thirds the speed a vessel of this character ought to have to make her effective against modern war vessels.

As a steering apparatus the propeller is evidently a success. The vessel can be stopped without reversing the engine, and can be made to spin as upon a pivot. Whether the lack of speed is due to the plan of the vessel or to lack of power in the propeller does not appear.

The Alarm is 172 feet long, including a 32 foot ram. Her beam is 26 feet 6 inches, and drawing 11 feet of water she displaces about 700 tons. She is intended to fight bows on, and in addition to her ram and torpedo equipment she carries one large gun in the bow. It is an ordinary 22 ton smooth-bore. The Alarm is intended chiefly for coast defense, and if her speed were increased fifty per cent., and her cannon changed to a heavy breach-loading rifle, she would be really formidable. Her torpedo equipment appears to be entirely satisfactory.

MR. LAWSON'S BOILER EXPLOSION.

BY S. N. HARTWELL.

In the year 1835, at the request of the Secretary of the United States Treasury, a series of experiments was undertaken by a committee of the Franklin Institute to ascertain causes of unexplained boiler explosions. A small plain cylinder boiler, set in brick, having in each of its flat cast iron heads a small glass window supported by a metal grating, through which to observe the effect of certain manipulations that were supposed to contribute to destructive boiler explosions.

The first experiment was "*to ascertain whether, on relieving water heated to or above the boiling point from pressure any commotion is produced in the fluid.*" In the report of the committee on this experiment is the following:

Experiments were made which showed that on making an opening, even when the pressure did not exceed two atmospheres, a local foaming commenced at the point of escape, followed soon by a general foaming throughout the boiler, the more violent in proportion as the opening was increased. This small boiler (12 inches diameter by 34 inches long, half full of water) "was completely filled with foam by opening the safety valve, which was placed in the middle of the top, and the water violently discharged through the opening of the valve." In regard to the effect on the gauge, they say "the gauge fell always on making the opening."

The committee used also fusible disks of much larger area than the safety valve, by which, on fusing, an aperture 0·95 inch in diameter was suddenly opened. The effect even at low temperatures was the violent discharge of the scalding contents against roof of the boiler house.

A number of experiments followed until the water was entirely exhausted, and the boiler was allowed to attain a red heat, and trials were repeated by injecting water directly upon the hot surface. They say "the result was uniformly a diminished elasticity of the steam."

The interesting and valuable experiments of Mr. Daniel T. Lawson, of Wellsville, recently made and described in vol. xlv., No. 2 (July 9), of the SCIENTIFIC AMERICAN, seem to be a supplement to those of the Franklin Institute made 46 years before, and they add one more to the practical demonstrations of theory.

Probably no well-informed engineer who has given the subject proper attention doubts that Mr. Lawson's experimental boiler would explode as described on suddenly letting out the steam through a two-inch pipe, when the pressure had risen to 380 pounds per square inch. The questions that arise in this connection Mr. Lawson may not be able to answer until more experiments are made. The estimated strength of his boiler being, as he says, about 600 pounds to the square inch, at what steadily increasing pressure under his practical conditions would it have exploded had no shock been produced by the artificial means applied to liberate the steam? And at what pressure would it have given way under conditions of the cold hydrostatic test? At 350 pounds pressure his first experiment failed to explode the boiler, while it did explode at 380 pounds on a second trial. How many shocks equal to the one produced in the first trial would have sufficed to explode the boiler? And how many would have destroyed the boiler? And with what proportional results at lower pressures, say down to practical every-day examples of boilers supposed to be working under one-fifth their breaking load? The term superheated, used by Mr. Lawson in describing his experiment, is, however, calculated to mislead those who are not familiar with boiler temperatures. Water that discharges steam from its surface, or boils under a pressure of 380 pounds per square inch, has a temperature not far from 440° Fah., about the melting point of tin. But according to the accepted meaning of the term this water is not superheated. Its temperature is normal to the conditions, the same as 212° is to conditions of atmospheric boiling.

Superheated water is that having a temperature higher than the boiling point at the given pressure; but to bring it into this very unstable condition experimentally requires very delicate manipulation. Professor Douny, of Ghent, many years ago succeeded in doing so, but it is probable that nine out of ten of his imitators have utterly failed in their attempts to prevent circulation of the water and to exclude air and other impurities. Heat applied to a limited surface of a steam boiler invariably induces circulation, a condition destructive of the desired effect. Perfectly still and perfectly pure water, perfectly deaerated, may be superheated so that a slight disturbance will cause explosive ebullition. But pure deaerated water in motion is not explosive unless the pressure is suddenly removed from its surface, when a sudden escape of contained heat, causing violent action, is the result of the lowering of the boiling temperature. Thus water at 212°, if suddenly introduced into a vacuum, will practically explode, and for an instant fill the vessel with a heavy foam, which will again mostly become "solid water" as soon as its temperature falls to the boiling point under the new condition of pressure. The greater the change of pressure suddenly effected the greater, of course, will be the shock of the disintegration or explosion of the water. Probably a correct estimate of the velocity of the flight of the water at 440° Fah., every particle of which is, in regard to the new condition, surcharged with heat, and springs with lightning speed, would show that the explosive action very nearly resembles that of a fair quality of gunpowder.

In regard to one of the questions suggested above the late experiment in the boiler yard of Sidebotham & Powell, in Philadelphia, an account of which was published in the SCIENTIFIC AMERICAN of July 23, 1881, may be considered another of those valuable practical things that form a common-sense basis for determining the strength of modern structural material, and it throws light on the subject of boiler explosions, which will no doubt dispel some of the vapors that have been raised around the late occurrence at Gaffney's dyehouse. We need more of this sort of thing and less theoretical prediction.

PIONEER CANNING.

BY H. C. HOVEY.

The first successful attempts at canning fish, fruit, and vegetables were made at Eastport, Me., about the year 1840. The honor of this pioneer work (as I am informed by Mr. D. I. Odell, British Vice Consul, Eastport, Me.), is to be shared between Mr. Charles Mitchell, who brought the idea with him from Scotland, and Mr. U. S. Treat, who employed him and furnished the requisite capital to carry on experiments. After working for Treat four or five years, Mitchell was associated with a Mr. Underwood for thirty-six years in canning lobsters at various points from Portland to the Gulf of St. Lawrence, and finally settled down at the Grand Manan.

The original Eastport firm, formed in 1841, was "Treat, Noble & Haliday." At first they canned salmon, clams, and lobsters. Then they put up, in a similar manner, beef, mutton, fowl, corn, etc. At one time large quantities of ox-tail soup were thus hermetically sealed and sent to market. To supply the material ox-tails in great numbers were brought on from Boston to Eastport in crates.

When the firm broke up, which it did in 1844, Noble went to St. John, N. B., and Haliday to Halifax, N. S., each to engage in the fish business. But Treat kept on canning. He bought an island, that bears his name, in Passamaquoddy Bay, where, besides the business already mentioned, he established a large trade in smoked herring, fish oil, and fertilizers, having a steam mill for the purpose. He made heavy shipments, principally to ports in Connecticut. It is satisfactory to our sense of justice to know that each member of this enterprising firm amassed a competent fortune, and enjoyed a fair share of public recognition.

Mr. Treat's superior knowledge and experience becoming known to Hon. S. F. Baird, of the Smithsonian Institution, the latter secured for him an appointment in Japan, at a salary of $5,000 a year, to develop the fishing and canning enterprises of that empire. There he remained for three years, at the expiration of which period he removed to California; where, at the advanced age of seventy-five years, he is associated with his two sons in his old business of canning salmon.

When Mr. Winslow Jones, of Portland, had his celebrated law suit, some years ago, with certain parties in Chicago, who, as he claimed, had infringed on his patent process of canning corn, the defense summoned Mr. Treat as a witness to prove that the process had been in use long before the Winslow patent had been procured.

It is also claimed for Mr. Treat that he originated the canning of oysters at Norfolk, Va., being employed by dealers for that express purpose.

The canning of various products, chiefly marine, is still extensively carried on at Eastport. What is known as "The Eastport Packing Company" is mainly engaged in putting up lobsters, which are caught in immense quantities from Cutter to Point Lepreau. They pack only the claws and tails, grinding up the bodies and shells for use as a fertilizer; thus wasting nothing. One hundredweight of live lobsters, costing the company but one dollar, will make eighteen one pound cans, selling in New York at one dollar and a half per dozen.

Men who learned the art of canning in what is geographically, but not otherwise, "the last town in the United States," conveyed the mysteries of the business to the remotest portions of the land; until now the trade in canned goods has become one of the most lucrative and important branches of industry in America, furnishing employment for thousands of people.

GALVANIZATION OF AN ENGINE PISTON.

Mr. P. Paul, an engineer, makes known through the columns of our French contemporary, *Le Genie Civil*, a curious accident which happened in 1880 in the shops of Fleury's Boiler Works at Cette. The feed water of the steam generator depositing a large amount of incrustation, Mr. Fleury was advised to throw into the boiler fragments of zinc, the disincrusting property of which is well known. After a few days the motor, notwithstanding its frequent lubrication, began to work with difficulty. The iron piston griped strongly, and before long it became almost impossible for the engine to work at all. On taking the mechanism apart to examine into the cause of the trouble the piston was found to be coated with a heavy layer of copper, which, upon turning the piston in a lathe, was found to be thickest in those parts that had been submitted to friction.

The explanation offered by Mr. Fleury is quite plausible. The boiler was connected with the engine by copper pipes. The particles of zinc carried along by the steam constituted, then, with the metal of the pipes, an infinite number of small galvanic couples; hence the transportation of the copper by the piping to the piston, which principally attracted it because of its continual motion exerting an attraction as a mass upon the molecules, the fixation of the latter being facilitated by the heating produced by friction.

Mechanics' Fair in Boston.

From the statement of Mr. Charles Slack, at a recent meeting of the Massachusetts Charitable Mechanics' Association, it appears that its various enterprises are getting on well, and that the mason work on the new exhibition building, which was begun on March 1, is now completed, and goods will be received as per programme. It is arranged that among the other interesting exhibits there will be one of special interest by "the Boston Manufacturers' Mutual Fire Insurance Company. They will exhibit a large collection of apparatus for saving and protecting property at fires, and of articles which have been through fire. Small brick structures will be erected outside the building for the practical trial of some fire-proof materials. Altogether, the managers of the exhibition are well satisfied with the prospect."

William S. Hudson.

William S. Hudson, locomotive engineer and inventor, died at his residence near Paterson, N. J., July 20. Mr. Hudson was born in Derbyshire, England, and served his apprenticeship with Robert Stephenson, builder of the "Rocket." Soon after coming to this country he was employed to begin the manufacture of locomotives at the Auburn State Prison, but the project failed for lack of competent workmen. Mr. Hudson then became master mechanic of the Attica and Buffalo Railroad, afterwards merged in the New York Central.

In 1852 he removed to Paterson, to take charge of the Rogers Locomotive Works. Very many important improvements in locomotive construction are due to Mr. Hudson's skill and inventive faculty.

The Need of a Hand Reel for Silk.

Some months since the attention of inventors was called in this paper to the growing need of a light hand reel for unwinding silk cocoons. The president of the Women's Silk Culture Association (1328 Chestnut street, Philadelphia) informs us that the demand is still unsupplied and urgent. A rough model of a reel is now at the rooms of the association, and inventors are desired to develop the idea of it into a satisfactory machine. A large number of persons have taken up the work of raising worms, and a proper reel for unwinding the cocoons would meet with a ready and growing sale. The reel should have a wheel 72 inches in circumference, and should be compactly built. It must also be inexpensive to meet with favor from the class now becoming interested in the culture of silk.

The association has established a school for teaching the art of raising and feeding silk worms, and they believe that if the industry were properly introduced silk culture would not only prove of great importance to our manufacturing interests but would furnish remunerative employment to thousands of poor families, particularly women. The demand is chiefly for reeled silk, and the lack of a suitable hand reel is the only drawback to the good work.

Italian Poison Antidote.

M. Bellini, of Florence, advocates the use of iodide of starch as an antidote for poisons in general, and, as it has no disagreeable taste and is free from the irritant properties of iodine, it can be administered in large doses; also, without fear in all cases where the poison is unknown. It will be found very efficacious in poisoning by sulphureted hydrogen gas, the alkaloids and alkaline sulphides, ammonia, and especially by alkalies, with which iodine forms insoluble compounds; and it aids in the elimination of salts of lead and mercury. In cases of acute poisoning an emetic is to be given before the antidote is administered.

IT is reported that a considerable deposit of specular iron ore has lately been discovered near Acworth, Ga. It is said that scientific men pronounce it to be of high grade, free from phosphorus and sulphur, and strongly magnetic, while the bed is well located for treatment of the ore on the premises, as well as convenient for shipment to market.

© 1881 SCIENTIFIC AMERICAN, INC