THE
Scientific American.

MUNN & COMPANY, Editors & Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

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VOL. XII. NO. 5....[NEW SERIES.]....*Twentieth Year.*

NEW YORK, SATURDAY, JANUARY 28, 1865.

Contents:

(Illustrations are indicated by an asterisk.)

THE SIZE OF HOLES IN FURNACE DOORS.

Carbon combines with oxygen in two proportions; one atom of carbon combining with one of oxygen to form carbonic oxide, C O, and one atom of carbon combining with two of oxygen to form carbonic acid, $C\ O_2$.

When an abundance of air is passed through a grate into the lower portion of a mass of red hot coal, each atom of the burning carbon combines with two atoms of oxygen to form carbonic acid gas. But if this gas struggles upward through a mass of red hot coal, where it is subjected to the action of an excess of carbon, each of its atoms gives up one atom of oxygen, becoming carbonic oxide, while the atom of oxygen given up combines with an atom of carbon also forming carbonic oxide.

As this carbonic oxide issues from the upper surface of the mass of coal, if it encounters atmospheric air at a red heat, each atom will combine with an atom of oxygen, forming again carbonic acid.

These facts indicate very clearly the proportion of air to be admitted above and below the grate. Each atom of carbon receives one atom of oxygen from below the grate to burn it to carbonic oxide, and one above the grate to complete its combustion to carbonic acid. Therefore one-half the air should be admitted below the grate and the other half above.

This conclusion, however, supposes the depth of coal in the furnace to be sufficient to effect the decomposition of all the carbonic acid formed, and the condition of the fire box such that all of the carbonic oxide issuing from the incandescent coals will be burned, provided air is present. Would it not be well to have these questions determined in the costly government experiments which are in progress?

DISPATCH FROM ASSISTANT SECRETARY FOX.

The following dispatch explains itself:—

WASHINGTON, Jan. 18, 1865.

MESSRS. EDITORS:—Your accurate appreciation of the monitors is finally vindicated off the coast of North Carolina, and I congratulate you upon the results. G. V. FOX, Asst. Sec.

SUGGESTION TO INVENTORS.—During our recent visit to the National currency bureau at Washington, we noticed that all the money packages were bound into packages by hand. It occurred to us at the time that some machine might be devised for this purpose.

A SENSIBLE NEW YEAR'S GIFT.

We have read with much satisfaction that very many employers during the past season improved the opportunity afforded by Thanksgiving to present each of their employees with a fat turkey in honor of the occasion. That this is a wise course none can doubt. So long as the memory of the turkey remains the services of the recipient will be zealous and the cost of the gift made up tenfold in the amount of work performed within a given time.

One instance however has come to our knowledge wherein the feast of fat things given by a manufacturing concern to its workmen was of more value than many turkeys. The Blake & Johnson Manufacturing Company, of Waterbury, Conn., last New Year's day, presented a copy of the SCIENTIFIC AMERICAN for one year to each workman in their employ. As our informant, Mr. William Patten, news-agent, through whom the papers are procured, tersely states, "the paper is furnished to the workmen as an acknowledgement of their faithful and satisfactory services during the past year."

It is very pleasant to record this fact, for it proves two things; that the Blake & Johnson Manufacturing Company are liberal employers and that their artisans are men of standing in their calling. When we hear, as we do, that the workshops in question are models of neatness and system, and that the jewellers' rollers made by them are superior to all others in this country, we feel that we only render simple justice to skilled workmen and business tact in making these facts public. Some steel rollers were once made by Messrs. Blake & Johnson for the English mint from American steel procured at Pompton Plains, N.J., and we have seen notices in a prominent English journal that these were the most serviceable rollers the mint ever possessed. We doubt not that the generosity of the firm in question will be remembered by the workmen, and that the information received through this journal will be worth many times the sum expended.

A GAS EXPLOSION.

An explosion of gas took place at the store of Messrs Lee, Bliss & Co., 314 Broadway, in this city, in the afternoon of January 17th, which may serve as a warning to people in dealing with leakages of gas. For a day or two previous a smell of gas had been noticed in the basement, and it appeared to come from the front wall. A gas fitter was sent for, and he cut through the masonry around the pipe by which gas was introduced into the building. He then directed an assistant to light a match, and try the pipe at a joint within the wall to see if the leak was at that point. On the application of the match, there was a violent explosion which threw the laths and plastering from the wall, and created a commotion throughout the neighborhood.

Illuminating gas, when unmixed with air or oxygen, is no more explosive than iron or dirt. A flaming torch might be thrust into one of the large receivers at the city gas works with perfect impunity; it would be extinguished as quickly as if it were immersed in water. The gas is combustible, but no combustible will burn unless brought into contact with oxygen. Burning is the combination of fuel with oxygen, and the presence of the oxygen is just as important as that of the fuel. When a jet of gas is burned the combustion goes on only at the outer surface of the volume of escaping gas, where the oxygen of the atmosphere can come in contact with it. Professor Doremus, at one of his lectures this winter at the Cooper Institute, showed that there is no fire in the middle of a gas jet, by introducing a thimble full of gunpowder into the centre of the flame and holding it there several seconds without burning it.

But if illuminating gas is mixed throughout with atmospheric air, and a spark is applied to it, the whole mass burns instantaneously, producing an explosion. The products of combustion are water and carbonic acid, and both are raised to a high temperature by the heat generated by the combustion. This elevation of the temperature causes great expansion of the volume, which may burst open the rooms or vessels in which the gas is confined.

In all cases of the explosion of illuminating gas it will be found that the gas had previously become mingled with atmospheric air. This almost necessarily occurs when gas leaks in a confined room. The proper precaution to be adopted is the thorough ventilation of the room before a light or flame is brought into it.

ADULTERATING LARD WITH WATER.

Lard is now worth from 20 to 24½ cts. per pound, and this high price is stimulating the practice of adulterations. We learn that the old plan of mixing water with lard is being extensively practiced. By pouring water into the lard and keeping it constantly agitated till it cools, some 20 or 25 per cent of water can be mixed with the lard.

Of all substances there is none in which adulterations can be more easily detected than in lard. It is only necessary to melt it at a temperature of 212°; if it melts without ebullition or bubbling it contains no water; and if it deposits no sediment it is probably pure. Sometimes lard is adulterated with starch; this may be detected by the addition of a solution of iodine, which will turn the starch first violet and then black.

Water is used to increase the weight of butter as well as that of lard By making the butter very salt its capacity for containing water is greatly increased. Hassall examined 48 samples of London butter and found water in all of them. The salt butters contained from 8.48 to 28.60 per cent of water, and the fresh butters from 4.18 to 15.43 per cent. The salt in the salt butters ranged from 1.53 to 8.24 per cent, and in the fresh butters from 0.30 to 2.91 per cent. The butter in the several samples was from 67.72 to 96.93 per cent, showing a proportion of combined salt and water from 3.07 to 32.28 per cent.

BEAM ENGINES.

The tenacity with which mankind cling to their opinions is proverbial. The prejudices of English Engineers against beam engines is remarkable. A late writer in the *London Mechanics' Magazine*, in an article on the Steam Engine says:—

"The beam engine is undoubtedly the most practical for slow motion, hence its universal adoption for pumping and blowing. The valves of these engines when of a large size, or above fifty horse power, nominal, are generally of the double beat kind. This valve is not perfect in its action, as practice proves that the expansion of the valves and the casing are unequal. The position of, or distance between, the seatings is not even, or the same when heated as when cool. It should be a rule to grind the double beat valve in its seats when hot, the top and bottom diameters being unequal, that is, the latter sufficiently small to pass through the former. In small valves this is not of much practical importance, but in those of the large kind, the evil is painfully perceptible. The defect is seen and felt in the opening and closing. The steam, acting on the top or larger surface, has more power over it when the valve is stationary than when in motion. The area of the opening in the center part should equal half the top seat."

Beam Engines for slow motion, indeed! The fastest steamers we have afloat and the quickest working engines in factories are beam engines, and when we want a high piston velocity we put up a beam engine because we get more "turns" out of them than any other kind for paddle vessels. The *Stockton*, a passenger boat between this city and Philadelphia, makes regularly 650 and 700 feet per minute piston speed; she has a beam engine rising 50 inches diameter and 12 feet stroke. The *Jesse Hoyt*, another fast bay steamer, 480 tuns burden, has a beam engine 48 inch cylinder and 12 feet stroke, and makes regularly on an average 576 feet per minute, burning 12 tuns of coal per 24 hours in so doing. The average boiler pressure is 30 pounds, and the trips are intermittent, or short, only 22 miles in length. Several are made in a day, and the average time for this distance is 65 and 70 minutes; it has been made in one hour with ease. The steam is worked expansively, cutting off at 8 feet, or three-fourths of the stroke; formerly the influx was stopped at one-fourth the stroke, but by altering the cut so as to follow 8 feet, 15 minutes better time was made, while the coal consumed was only one-half a tun greater.

It should be stated that the fires are kept banked all night on the fuel mentioned, and that the net consumption for 24 hours is 12 tuns.

The trouble in regard to double beat valves is overstated. Such difficulties formerly existed, but are measurably overcome. Of course if the metals composing the valves and chest are alike the expansion will be the same. For running in fresh water the valves and chest are generally made of cast iron, for little or no corrosion takes place; but for marine engines the case is different, and brass must be used for the valves and seats. It was formerly customary to use disks wholly of brass for the valves, which were bolted to columns in form like spools. This practice is now obsolete in the best shops, and the "spool" is very greatly enlarged, so that it is nearly the size of the valve itself.

In an 18 or 20 inch poppet valve, for we have some of this size, the brass seat is not more than an inch thick in the average, considered through the diameter of the valve. The difference in the rates of expansion is therefore very little. It may be here remarked that most of the complaints from poppet valves arise from defective workmanship. Most engineers and lathemen fancy it is an easy thing to make a pair of poppet valves, whereas there is no detail that requires nicer adjustment and closer attention. In shops where beam engines are built one man is kept on this work continually, and he soon acquires great proficiency in it.

Where the valves are taken apart in order to get them out of the chest, the exhaust valve for instance, it very often happens that the engineer is at fault and not the valves; for it is an easy matter to throw one of the disks out of line with the other by screwing up the bolts unequally, or allowing dust or dirt to fill in.

The writer quoted at the commencement of this article says in relation to beams:—

"Beams of cast iron are generally adopted for two reasons: first, simplicity of manufacture, and secondly, symmetry and cost, all of which are certainly matters of great consideration to the contractor. The chief object to be sought after in the manufacture of cast iron beams is an even diffusion of the material, so that, in cooling, the fiber of the metal can contract equally. In order to maintain lightness combined with strength, in large engines beams are in halves or sides, connected by distance pins. It is a rare occurrence for beams so constructed to fracture. The gudgeon bosses of cast iron beams would, if embraced with wrought iron bands shrunk on, be greatly strengthened. Beams of wrought iron plates and angle iron are coming much into use; but the cost is the greatest barrier to their general adoption. The presumed unsightly appearance of the rivet heads, angle iron, and laps of plates—each of these eyesores—is soon healed by the conviction that safety is guaranteed."

Beams to our engines are known as skeleton beams. The form is that of a diamond; the breadth being equal to half the length. The strap is wrought iron. and the center or skeleton cast. The two parts are firmly keyed together. Accidents have happened from breaking the strap; when this occurs a general smash up is the result. Ten years ago these occurrences were frequent, but they are now rare, for the dimensions of the straps have been much increased.

Ideas vary with localities. Our engineers think there is nothing more uncouth and lubberly than the solid cast iron beam, and they are termed by the irreverent "grate bars," from a remote resemblance to that useful appendage to a boiler. The cost of construction is certainly in favor of the solid beam; it has no advantage in weight, is unquestionably weaker, weight for weight, than the composite beam, and in point of appearance there is no comparison. The Stevens beam was complete from the hands of its designer and no material improvement has been made in our day.

A Mechanical Problem.

Make two broad-faced wheels of precisely the same size, weight and form. Let them be composed of wood and iron, but have the iron in one disposed around the perephery, and in the other at the center. Allow the wheels to start together and roll down an inclined plane; what will be their relative velocelies? If on coming to the bottom of the plane they roll along a level floor or track, what will be their relative movements throughout their course?

PROFESSOR GROVE ON LIGHT.

In our last number we made a brief statement of Professor Grove's views of heat, as set forth in his treatise on the Correlation of Forces. The principal point of difference between him and some other writers on this subject, is in relation to the nature of the all-pervading ethereal fluid which fills the vast spaces between the planets and the stars, and which by its undulations, vibrations, or motions, conveys the forces of light and heat across these spaces. In his chapter on light, Professor Grove sets forth his views of this fluid more fully, and it seems that the point on which he insists is, that it is ponderable, or subject to the attraction of gravitation. He argues the point at great length, but the following paragraphs contain the substance of his conclusions:

"An objection to which the view I have been advocating is open, and a formidable one, is, the necessity involved in it of an universal plenum; for if light, heat, electricity, &c., be affections of ordinary matter, then matter must be supposed to be everywhere where these phenomena are apparent, and consequently there can be no vacuum.

"These forces are transmitted through what are called vacua, or through the interplanetary spaces, where matter, if it exist, must be in a highly attenuated state."

"The difference between the view which I am advocating and that of the ethereal theory as generally enunciated is, that the matter which in the interplanetary spaces serves as the means of transmitting by its undulations light and heat, I should regard as possessing the qualities of ordinary, or as it has sometimes been called gross, matter, and particularly weight; though, from its extreme rarefaction, it would manifest these properties in an indefinitely small degree; whilst, on the surface of the earth, that matter attains a density cognizable by our means of experiment, and the dense matter is itself, in great part, the conveyer of the undulations in which these agents consist. Doubtless, in very many of the forms which matter assumes, it is porous, and pervaded by more volatile essences, which may differ as much in kind as matter does. In these cases a composite medium, such as that indicated by Dr. Young, would result; but even on such a supposition, the denser matter would probably exercise the more important influence on the undulations. Returning to the somewhat strained hypothesis, that the particles of dense matter in a so-called solid are as distant as the stars in heaven, still a certain depth or thickness of such solid would present at every point of space a particle or rock in the successive progress of a wave, which particles, to carry on the movement, must vibrate in unison with it.

"At the utmost, our assumption, on the one hand, is, that wherever light, heat, &c., exist, ordinary matter exists, though it may be so attenuated that we can not recognize it by the tests of other forces, such as gravitation, and that to the expansibility of matter no limit can be assigned. On the other hand, a specific matter without weight must be assumed, of the existence of which there is no evidence, but in the phenomena for the explanation of which its existence is supposed."

PAPER FROM CANE.

Our old subscribers will remember that a good deal was said a few years ago about Lyman's process of preparing wood fiber for paper making. A long cannon was fitted with a steam-tight valve over the muzzle, the valve swinging on hinges and being closed with a latch. The cannon was filled with logs or sticks of wood, and steam was forced in under a very high pressure till all the pores of the wood were filled with it. The latch was then struck up, when the valve flew open, and the wood was shot out by the force of the steam. The pressure of the steam being removed from the outside of the wood, that within the pores expanded, and split the wood to shivers. The labor of cutting and trimming the sticks to prepare them for entering the cannon prevented the process from being economical, but it was thought that the cane of the southern cane brakes, being straight and free from limbs, might be worked with advantage. The following letter gives the result of the trial with cane.

Messrs. Editors:—My father, believing that in the great cane brakes of the south-west there was an inexhaustible source of supply for paper—provided the cane could be disintegrated, and the fibrous portions of the plant so cleaned as to leave it a pure cellulin, without too great an expenditure of fuel or chemicals—about three years since turned his attention to that subject. He thought that Lyman's steam explosive process was a step in the right direction for the preparation of the material for chemical treatment.

With this belief he leased of the owners of Lyman's patent the exclusive right to its use in the western and south-western states. To fully test its value—previous to erecting more extensive works—we had two of the Lyman disintegrating guns made at the Novelty works, New York, and put them in operation at this place in July, 1863. We continued to operate with them on cane until reluctantly convinced that the process was not only extravagantly wasteful of fuel, but dangerous to operate, and uncertain in results; the disintegration was not into ultimate fibers, but into long bundles of fibers, which to separate had to be treated with caustic alkali under pressure, precisely as straw is treated, and then again blown through a small opening by steam power. We did not abandon the use of the guns on hasty trial, but used them until we had expended many tons of coal and cane, keeping account of the cost. We then threw them out as utterly worthless in a commercial point of view; we, however, never abandoned the hopes of so freeing cane fiber as to make a good quality of paper.

My father went through an elaborate and analytical series of experiments which have resulted in perfect success. We are regularly producing paper like the enclosed which is three-fifths cane.

The process of disintegration and cleansing is effected without the use of alkali or any other chemicals, but by a system of sap volatilization which by active passing steam prepares the cane for any simple and cheap mechanical treatment which is certain in its results.

The steam that is used in volatilizing the sap and cementing principle of the plant is utilized in heating wash-water and the condensed steam is evaporated leaving a residue resembling burnt sugar (caromel), but more bitter, which when used for coloring liquors gives to them a delightful aroma; but we are now preparing to use it for a more utilitarian purpose.

By my father's process there is little of the plant wasted. By a simple machine of his invention we strip the leaves from the cane, which, when cured, make a most excellent food for cattle; our stock are kept on it and eat it with a relish. The non-fibrous portions of the plant are separated by washing and are also utilized. F. H. Sellers.

Sellers' Landing, Hardin Co., Ill.

[The sample sent us is a very fair article of wrapping paper, smooth and strong enough for most purposes for which wrapping paper is employed.—Eds.

SPECIAL NOTICE.

Silas S. Putnam, of Dorchester, Mass., has petitioned for the extension of a patent granted to him on April 15, 1851, for an improvement in window-curtain fixtures.

It is ordered that the said petition be heard at the Patent Office, Washington, on Monday, March 27, 1865, at 12 o'clock, M., and all persons are notified to appear and show cause, if any they have, why said petition ought not to be granted.

Vehicle for Medicine.—According to the *Chemical Gazette*, wafer paper is much used in France as a vehicle for powders. It may be made by heating two common smoothing irons and touching their surfaces with butter, and then pouring on one of them a small quantity of thin paste, made of rice or wheat flour, the other iron being instantly applied so as to press the water between the two faces and cook it sufficiently. The iron must not be hot enough to scorch it. In using the wafer cut it of the proper size and dip it in water; place the powder on it and wrap or roll it up. It is said to go down like an oyster.

Bones are brittle in cold weather; a slight misstep may cripple a person for life.