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