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Contents:

(Illustrated articles are marked with an asterisk.)

EXHAUST STEAM FOR HEATING PURPOSES.

In a previous article, reference was made to the gain to be derived from the use of a feed water heater, in connection with a non-condensing engine. It must be evident, however, from the figures given in that article, that the heater is far from utilizing all the heat that escapes into the exhaust. When water is converted into steam, a large amount of heat is required, which does not raise its temperature, and, not being shown by the thermometer, is commonly called latent heat. Thus, if a pound of water at the temperature of 60° Fah. is heated until it is evaporated under the pressure of one atmosphere, the temperature of the steam will be 212°; but the heat which has been imparted to it is as much as would have sufficed to raise the temperature of more than 7⅓ pounds of water from 60° to 212°. On the other hand, to convert this steam into water, a similar amount of heat must be abstracted, from which it will be seen that the exhaust steam—which only heats about an equal weight of feed water—parts with but a fraction of its heat. But, as before remarked, if the steam can be cooled sufficiently to convert it into water, or condense it, it gives up to the cooling medium all the heat that became latent when it was changed from water into steam. These facts have suggested to some the idea of turning the exhaust steam into places where it would be cooled and condensed, giving up its heat where it was wanted, as, for instance, in warming a building. The ordinary manner of effecting this is to turn the exhaust steam into heater pipes that are fitted up throughout the building to be warmed, and draw off the water of condensation, to be used for supplying the boiler. Under such circumstances, the exhaust steam encounters an increased resistance, in passing through the heating coils, and this has the effect of increasing the back pressure on the piston. In order to fix some limit to this increase of back pressure, it is usual to attach a loaded valve, opening into the atmosphere, to the pipe leading from the exhaust to the heating coils, so that, when the limit of back pressure is reached, the valve will rise and the exhaust steam will escape into the air. In order to diminish, as much as possible, the back pressure created by the passage of the exhaust steam through the heating coils, they require to be fitted up with the greatest care. Neglect of this precaution has induced many persons to abandon the use of exhaust steam for warming purposes. In the construction of the heating coils, the principal points to be observed are: First, to have sufficient area of pipe to permit the free passage of the exhaust steam; and secondly, to arrange the pipes in such a manner, with suitable traps, that the condensed water or air cannot accumulate in them, but will be continually drawn off. If these provisions are attended to, the heating pipes can be extended over a considerable distance, with but little increase of the back pressure. An example, representing the results of average practice, will illustrate the foregoing remarks more fully:

A non-condensing engine of 60 horse power, exhausting into the atmosphere, had a back pressure on the piston of 1 pound per square inch. The feed water was pumped into the boiler at a temperature of 65°, and the average pressure of steam in the boiler was 75 pounds per square inch. At this pressure, the boiler evaporated 6¾ pounds of water per pound of coal, the price of the coal being $6.50 per tun of 2,000 pounds. The consumption of coal was at the rate of 4,450 pounds per day, costing about $14 46. The factory in which the engine was located was heated with steam supplied by the same boiler, requiring a consumption of 1,000 pounds of coal per day, costing $3 25, so that the total cost of fuel was $17.71 per day. These facts having been ascertained by careful experiment, the heating arrangements were changed, in the manner described below.

A few of the connections about the heater pipes were altered, for the purpose of obtaining more direct circulation, a trap of improved form was attached, a back pressure valve was put on the exhaust pipe, arranged to open at a pressure of 3 pounds per square inch above the atmosphere; and this pipe was connected with the heating apparatus, and a damper regulator was put in. It was found that, on account of the increased back pressure, the cut-off of the engine had to be adjusted so as to admit steam for a greater portion of the stroke, so that the engine required about 12 per cent more steam. If this had been the total result of the change, the effect would have been to increase the coal consumption 12 per cent, in addition to the expense of the alterations. It was found, however, that the exhaust steam from the engine heated the building quite as well as, if not better than, this was formerly effected by live steam from the boiler; and the water of condensation was led into a tank, from which it was used to feed the boiler, being taken by the pump at a temperature of about 200°. The boiler, being no longer required to furnish steam for heating purposes, and being fed with hot water, gave much better results than before, the damper being generally partially closed—so that the consumption of coal was only 4,100 pounds per day, costing $13.33, the saving in the coal bill per day being $4 38.

Such extensive alterations are not often required as were necessary in this case, where all the arrangements seemed to be made with the intention of wasting fuel. The gain, of course, after making the change, was proportionately large, but the expense incurred was considerable. In many places, the exhaust steam can be used for heating purposes, with very little outlay for alterations. Many heating coils, however, are put up in such a manner as to have very little circulation, and require a high pressure of steam to make them effective. Cases of this kind require extensive alterations before the exhaust steam can be turned into them. But there are numerous owners of small engines and boilers who have small shops which they can easily heat in the manner described. Our hints will probably be sufficient for such ordinary cases, but it is impossible to lay down general rules for every case.

PRISON REFORM.

As evidence of the urgent need of the reform in prison management suggested in our article on "The Scientific Treatment of Criminals," a friend in St. Louis sends us a printed account of recent doings in the State Penitentiary of Missouri, the horrid details of which remind one of certain parts of Charles Reade's "Never Too Late to Mend." For the credit of humanity, we should be glad to believe the story a gross exaggeration. If the half is true, the officers of the institution (and its management as well) would be benefited by a personal experience of the foul food, floggings, blind cells, and other abuses which have driven the convicts into rebellion, to be administered, not vindictively, for that would be contrary to the scientific method, but educatively, so that they might understand what manner of motives they are employing for the discipline of the prisoners and the probable moral effect of them.

Knowing the brutal and brutalizing practices that prevail even in institutions which have the name of being well conducted, we can understand how keepers such as our correspondent describes may, through ignorance, fear, and passion, aided by a thoroughly perverse system of prison employment, gradually convert a penitentiary into a school of vice and vengeance, rather than a place for penitence and reformation. We appreciate, too, the crying need of a radical change in the management of all such institutions: but that the prison system of the country can be made what it should be, by any burst of individual enthusiasm, we very much doubt. It may be true enough that that there is a "noble band of Howards" ready to undertake the reform "at the call of the American people": the hitch lies in the indisposition of the people to make the call. Not until the masses—upper as well as lower—have been educated up to the scientific level, and have learned to consider social problems as scientific problems, to be solved on scientific principles, will they be able to treat this question dispassionately and wisely. When that time comes, there will be little need of Howards to stir the sensibilities of prison keepers.

To the question: "Can you not set some means at work to release these thousands of mismanaged criminals from the pernicious system which thwarts their reformation?" we can only reply that we have already, to the best of our ability, set such a means at work, and that is the SCIENTIFIC AMERICAN. It does not set itself up as a mouthpiece of social or moral reform; yet, by spreading abroad the results of scientific research, by familiarizing the reading public with the spirit and methods of scientific thinking, it is doing its share toward educating the community up to the level required for the scientific consideration of all questions of social policy—the prevention and cure of crime with the rest. The process is necessarily slow; but the appreciative responses that have been made to our bare suggestion of a scientific treatment of criminals—an idea that could not have been entertained a few years ago—are proofs that progress is being made in the right direction.

A POSSIBLE IMPROVEMENT IN HOUSE HEATING.

At this delightful season of genial sunshine and crisp cool air, we have a daily illustration of perfect, because healthful and intensely enjoyable, heating. While the lungs are regaled with an atmosphere which seems to stimulate every pleasurable sense and activity of the body, the sunshine warms without oppressing, and hightens our enjoyment of the sparkling air by force of contrast. If we could imitate—much more if we could reproduce—the same conditions indoors, it is obvious that the perfection of house heating would be attained. Can either be done?

First, let us notice what the conditions are, on a sunshiny day of fall or early winter, that is, the conditions which combine to make such weather so refreshing. Pure air is practically transparent to radiant heat. In summer time, the high temperature of the air comes as an indirect effect of the heat of the sun. The sun rays heat the earth and the objects on its surface, and these, by contact or otherwise, heat the air. In the fall, the period of daily sunshine is briefer and the sun rays fall more obliquely. The ground is heated less, and the nightly periods of radiation are proportionally longer. The air in consequence remains cool throughout the day. Nevertheless, when the sun rays strike our bodies and are absorbed, their heating power is almost as great as in summer, giving us the simultaneous sensation of vivifying warmth, with delicious coolness in the air we breathe. Pass indoors from such an atmosphere to that of a furnace-heated house. How great the change! The air seems stifling, and though the temperature of the room, as recorded by the thermometer, is much higher than that outdoors, the pleasant glow which was felt in the sunshine soon gives place to an extreme sensitiveness to chill. Sit near a wall or a window, and an unpleasant coolness creeps up the back, as though a cold wind were blowing across it, and we look for a draft, though the air is motionless.

The conditions of perfect heating have been reversed. The air is at dog days heat. The walls and furniture are cold. The bodily heat is depressed by breathing the hot air, yet streams of heat must flow out from us in all directions to make up the deficiencies of surrounding objects. The thermometer may declare that such a room is warm, but every nerve declares that it is not comfortable. Substitute for the furnace an open fireplace with a blazing fire. An approach is made toward perfect heating. The radiant heat passes like sunshine through the air without heating it; and if the fire is so placed that its radiations impinge on a considerable area of the enclosing walls, the walls will be warmed as they cannot be by hot air; the furniture will be warmed in like manner, and the occupants of the room will enjoy the cheerful influence of live heat while having sufficiently cool air to breathe. The great expense and inconvenience attending open fires must ever greatly restrict their general use. Only about one tenth of the heating power of fuel is developed by its combustion in an ordinary fireplace, and much of that escapes unused. Besides, to heat a room of considerable size uniformly, it would be necessary to have an open fire at each side, or better, at each corner; an arrangement not to be tolerated as a matter of economy.

To burn fuel economically, it is necessary to burn it centrally and in mass. The coal that would supply a number of separate fires would furnish an immensely greater amount of heat if burned in a single furnace, a fact more or less recognized in every contrivance for heating houses by hot air, hot water, or steam. But in all such arrangements it is deemed essential to distribute, not heat directly, but matter more or less highly heated. In other words, we first heat our air or water, and trust to the cooling of that to furnish the heat required, overlooking the well known fact that heat will travel alone quite as well as in company, and that it can be much more easily controlled than air or water.

Radiant heat, the sort required for perfect heating, obeys the same laws as light. By proper arrangements of reflectors and lenses, heat radiations can be massed into beams of parallel rays and sent where we will, with little or no wasting. It is not until the radiations are arrested that they become manifest as heat; a fact put to practical use two thousand years ago, when Archimedes burnt the fleet off Syracuse with mirrors. A stream of heat vibrations, intense enough to fuse gold, would pass through a tube of ice without affecting it, provided the air in the tube be sufficiently pure and dry. There appears to be no good reason, therefore, why we should not warm our houses by the direct distribution of pure heat, and so gain all the benefits of an open fire in each room, with none of its disadvantages.

Briefly described, the plan would involve (1) a central furnace, constructed of course with a view to the development of the greatest amount of heat from a given amount of fuel. (2) A system of tubes leading to the different rooms, terminated by radiators in each room. (3) A system of reflectors to throw the heat of the furnace into the conducting tubes in beams of parallel rays, with other reflectors at the bends and angles of the tubes to direct the course of the radiations properly. The radiators in the rooms might be placed so that every portion of the room would be flooded with heat rays, yet no part be heated beyond what would be enjoyable. As nothing would enter the rooms from the furnace save pure heat, the effect would be like that of a room warmed by direct sunshine. The surplus heat of the furnace might be utilized in warming, say to 50° or 60° Fah., and an abundant supply of fresh air led in from out-doors; a steady circulation being kept up, from the ventilating chamber, through the rooms, by the draft of the furnace. We should have then (theoretically) perfect heating combined with perfect ventilation, and at the same time the most economical combustion of our fuel.

Possibly there may be mechanical difficulties to prevent the successful carrying out of a plan of house heating of this sort. We do not anticipate any, and the advantages it promises, on the score of health, comfort, and economy, certainly justify its trial by any one possessing the requisite means. The plan could be easily tested in the laboratory of any institution having a few lenses and reflectors.

MECHANICAL AESTHETICS AND PRACTICAL MEN.

We met our practical man, him of the street car, who "never learned nuthin' from books", at the American Institute Fair the other night. He was slowly trudging through the machinery department, apparently devoting his attention to the steam engines. We noticed that, as he scrutinized the large driving engine, his brow clouded: by the time he had reached the nickel-plated Baxter, the cloud deepened into a frown; and when he arrived opposite the Myers rotary a fierce scowl overspread his features. Suddenly turning on his heel, he recognized us, and, without further preamble, burst out with: "Now, look here, boss, I wanter know if this is'nt cussed nonsense, all this 'ere frippery, nickel plate and red paint, and gildin', and stuff, about a masheen! What for, anyhow? Do'nt make the thing run no better, does it? What's the use er shinin' that Baxter like a lookin' glass? I do'nt fuss over my engine that way; much as I can do to keep the green off the brass. Have'nt had no paint near it for ten years. Do'nt see that it works any wuss, either."

We remarked that we supposed the exhibitors desired to attract public attention by uniting artistic beauty with mechanical excellence, and that the certainly augmenting tendency toward æsthetic refinement was— "Which? Oh, keep them big words for yer paper; I never was no shakes on the dictionary. Just you tell me what's got inter people, that they waste stamps on what ai'nt no use? Look at this, now." And here he fished from his overcoat pocket a dilapidated copy of the SCIENTIFIC AMERICAN of a few weeks back, containing the engraving of the new mold-ramming machine on the front page. "What's that feller in that picter for? Or that heap er dirt and the shovel? Could'nt any practical man understand that masheen without that chap a pullin' the handle? S'pose a mee-chanic wants all that shadin' and prospectiv' and figgers? When I see a masheen, I wanter see drawins', nice plans and things drawed out. Why do'nt yer print them, not picters, only fit ter hang in the parlor?"

"Advantageous advertisement," we insinuated. "No t'aint, nuther," he rejoined; "no more than these ere circulars and books with fancy covers that these fellers is givin' away so loose for nuthin.' Nor them blue signs, nor that shiny engine. I do'nt do no advertisin'. Do'nt believe in it. Did'nt I try it? Did'nt I pay a dollar for puttin' my name in a pious paper printed out in Milwaukee, or Oregon, or somewheres? The chap that wheedled me in said he'd throw in a ten dollar chromo and a book about saint's rest by a man named Baxter (that engine feller', I s'pose). Did'nt get nary an answer. Catch me gettin' fooled by any noozepaper agin!"

"No, I ai'nt got nuthin showin' in this Fair. Anybody that wants ter see my work can come to my shop. There aint no gold and silver and red paint there, nor patent invenshuns, nuther. Feller wanted me to buy one er them new fangled emery wheels t'other day. But I said: 'No, sonny, I used this old grindston' and others like it goin' on thirty year; and I guess I can make it do a little longer. No sir, when I git any money to waste on advertisin' or fancy paint or blamed invenshuns, then I'll shut up shop. Good night. Come see us, sometime. Aint got no cards; shop's in the alley, fourth door back on —— street. There aint no sign. Just stand in the entry and yell; and if one of the boys hears yer, he'll let yer in."

Our meditations, as we watched our friend elbow his way out of the crowd, took about the following shape: Anything akin to beauty or taste, when brought in connection with the mechanical, is, by the self-called practical individual, resented as an unwarrantable encroachment. When the purpose of ornamentation is (besides gratifying the eye) thus to draw attention to the merits of an object, both end and means meet his wholesale condemnation. Strictly and purely utilitarian, he fails to see any benefit in a measure which does not instantly bring in pecuniary returns, or to perceive that increased gains are or can be due to the keeping of certain facts constantly before the world, or to presenting the same in some manner so unique as at once to attract the popular gaze. Since he cannot appreciate matters so clear to every rightly thinking observer, it is manifestly impossible for others more refined to impress him. He and his kind see nothing to praise in the fact that our American mechanics and manufacturers (though the country is destitute of museums of industrial art, those great educators of the Old World) nevertheless contrive to mingle the beautiful with the useful, with a delicacy and true art feeling elsewhere almost unrivaled. The visitor at any of our great fairs will find this æsthetic selfculture making itself everywhere felt. It appears in the graceful figures and neat proportioning of the ordinary implements of labor, in the exquisite finish of the metal and wood work, in the thousand tasty forms of the commonest minor appliances, in the dainty traceries which embellish the safes, the carriages, and the massive portions of the engines, in a bit of carving here, a dot of bright color there: and thus through all the different productions, gathered as representatives of the varied industries.

We may here be pardoned the apparent egotism of a word as to the artistic merit of the pages now under the reader's eye, and this with reference to the "pretty picters" objected to by our practical friend: not merely as to their intrinsic beauty, but to suggest the influence which they must exert in elevating the standard of popular taste. A diagram of mere lines may be intelligible to the professional engineer; but the man who proposes to buy a machine asks and needs a representation, showing it as it will appear when set up in the shop. True, a rough sketch would convey an idea, but we prefer to call in the aid of artists (to whom in their specialty there are no superiors), to employ the highest skill attainable in the engraving of their works, and thus to maintain a standard of artistic excellence, of the public appreciation of which we have abundant evidence.

If a little nickel plating or a neat coat of paint will render a machine (without detriment) more pleasing to the eye, it is not false economy to add such embellishment. A bright bit of glass will take the attention when a rough diamond may be a hundred times passed unnoticed; and even if ornamentation be deemed unnecessary for its attractive power, let the beautiful, where possible, be cultivated for itself alone. True art is both refining and ennobling; and it may be found in the harmony of tints in the decoration of an engine, as well as on the canvas colored by a master hand: in the molding of a tool, as well as in the forms which assume all but life under the sculptor's chisel.

SCIENTIFIC AND PRACTICAL INFORMATION.

PAINTING ON ZINC WITHOUT PAINT.

M. Puscher, of Nuremberg, has lately invented a simple process for coloring sheet zinc, based on the employment of acetate of lead. On applying this substance, mixed with a minium preparation, a reddish brown tinge is obtained. The cupola of the synagogue at Nuremberg was thus colored as an experiment over a year ago, and, to all appearance, is yet unaffected by the weather. By adding other bases, lighter or darker tints of gray and yellow may be obtained, giving the zinc work the appearance of carved stone. With a solution of chlorate of copper, the preparation turns the sheets of zinc black.

FISH BONES AS FERTILIZERS.

The *Moniteur Industriel Belge* states that German manufacturers are purchasing the fish bones gathered along the Norwegian shores, which result from the extensive fish-curing stations there located. These bones make a fine fertilizer, and, when pulverized by suitable machinery at the points of collection, are readily transported. The same journal suggests the more extended utilization of the bones from the establishments in Newfoundland, and estimates the product from American fisheries at twenty million pounds a year.

THE HOURLY DEATH RATE.

Dr. Lawson, an English physician, has recently published some curious observations regarding the time of the day when the greatest and least number of deaths occur. He finds, from the study of the statistics of several hospitals, asylums, and other institutions that deaths from chronic diseases are most numerous between the hours of eight and ten in the morning, and fewest between like hours in the evening. Acute deaths from continued fevers and pneumonia take place in the greatest ratio either in the early morning, when the powers of life are at their lowest, or in the afternoon, when acute disease is most active. The occurrence of these definite daily variations in the hourly death rate is shown, in the case of chronic diseases, to be dependent on recurring variations in the energies of organic life; and in the case of acute diseases, the cause is ascribed either to the existence of a well marked daily extreme of bodily depression, or a daily maximum of intensity of acute disease.

PEAT PAPER.

M. Bertmeyer has recently exhibited, in the Polytechnic Society of Berlin, specimens of paper and pasteboard obtained from the products of the peat beds about Königsberg, the quality of which is said to be excellent. The pasteboard was 2·4 inches thick, and sufficiently hard and solid to admit of planing and polishing. The paper made from peat alone was brittle, like that manufactured from straw; but the addition of fifteen per cent of rags produced the requisite toughness.

ARTIFICIAL EBONY.

This material is made of sawdust mixed with other substances and powerfully compressed in molds. The following is the process of manufacture, as now largely carried on by Messrs. Latry & Co., of Paris: The sawdust, reduced to a fine powder, is mingled with a suitable quantity of water and blood, and dried at about 112° Fah. The albumen of the blood is thus agglomerated with the powder. The compound is then packed in heated molds, into all the crevices of which it is forced by strong hydraulic pressure.

A NEW RUSSIAN CANAL.

The Russian Government, says the *Revue Industrielle*, has recently completed negotiations with a Russo-English company for the construction of a canal from Cronstadt to St. Petersburg. The work is to occupy six years in accomplishment and will cost $5,530,000. This will render St. Petersburg the finest port on the Baltic, and besides greatly benefit the city as a commercial center, since the railways to Moscow, Warsaw, and all parts of Russia will be in direct communication with the docks.

A CURIOUS PROPERTY OF SAND AND ITS APPLICATIONS.

If a quantity of dry silicious sand be placed in a bag of canvas or thin box of sheet iron, the mass, after slight compression, forms a conglomerate, capable of resisting pressures of over 60 tuns. So far as the envelope is concerned, the sand within acts as if it were an enclosed solid, producing no effect on the covering except a trivial amount where the contact occurs with the load. The sand, however, remains perfectly divisible, and, no matter what may be the superincumbent weight, escapes freely though slowly out of a small aperture made in the bag or box. A simple piece of paper, however, placed over the orifice, is sufficient to stop the flow, even under the load above noted.

M. Beaudemoulin, who discovered this peculiar property several years ago, has lately published in France a work suggesting various modes of its application. For building walls it is well adapted, since the filled bags or boxes need merely be held in place by a framework; while, being very thick, they would form a protection, in case of being used for dwellings, against variations of temperature. Such walls, beside, would be fireproof. It is also suggested that for lowering heavy weights or even entire buildings, which, by a change of street level, have become located too high above the roadway, the sand bags could be placed beneath, and their contents allowed gradually to escape, thus letting the load slowly settle down.

NATURAL ANTISCORBUTICS.

General Sherman says that the *agava Americana*, or Spanish bayonet, the fruit of the common prickly pear, and the succulent leaves of some of the varieties of the cactus that abounds on the deserts of Texas, New Mexico, and Arizona, furnish excellent specifics for that horrible disease, the scurvy.

BROMHYDRIC ACID.

M. Melliés states that a much simpler way of making this acid than that now employed, and which besides ensures a more copious supply, consists in passing a current of sulphydric acid into a small flask containing bromine. Bromide of sulphur is formed and bromhydric acid disengaged.

Intercolonial Exhibition at Sydney, New South Wales.

We have received from M. Jules Joubert, Secretary of the Agricultural Society of New South Wales, the first number of the society's *Journal*, in which are published full particulars of an exhibition to be held at Sydney in April, 1875. There is a long list of premiums, to be awarded for merit in all branches of agriculture and manufactures, the prizes for wines, sugar, and silk indicating the growth of three important industries in the Australian colonies. Agricultural implements are much required in Australia, and competition by American manufacturers is especially invited, communication *via* San Francisco being rapid and convenient.

The Secretary writes us that the Agricultural Society and the Chamber of Commerce of Sydney are, together, making liberal arrangements for an adequate representation of Australian products at our Centennial Exhibition of 1876.

An Early Opinion of Railroads.

An old copy of the English *Quarterly Review* of the year 1819 contains an account of a scheme for a railroad, on which it is proposed to make carriages run twice as fast as stage coaches. The editor evidently failed to appreciate the idea, or to believe in its possibility, for he comments upon it thus wise:

"We are not partisans of the fantastic projects relative to established institutions, and we cannot but laugh at an idea so impracticable as that of a road of iron upon which travel may be conducted by steam. Can anything be more utterly absurd or more laughable than a steam-propelled wagon moving twice as fast as our mail coaches? It is much more possible to travel from Woolwich to the arsenal by the aid of a Congreve rocket."

M. De Lesseps' plan of changing the Algerian shotts or lakes into an inland sea is shown, by a French engineer, to be little value. He has recently visited the country, and reports that the lakes are higher than the Mediterranean, and that a canal would merely drain them. Beside, the project would cost $60,000,000, and it is difficult to see, even were the scheme feasible, any prospect of substantial returns.

PROFESSOR PURSER believes that the moon, in revolving around the earth and drawing the tides behind her, causes the latter to act as a brake on the revolution of the globe, and he considers that it may be mathematically shown that this action is slowly but surely checking the earth's speed of rotation, so that the days and nights are gradually lengthening. In a thousand million years or so, they may become each a month long.