Science Progress.

A FUEL-SAVING HINT.

Leakage of Air Through Unsound Brickwork of Boilers.

It is a matter of common knowledge among steam users, says the Engineering Record, that the resetting of a boiler when the brickwork has become deteriorated is generally attended with a saving of fuel. This is said to occur when nothing more is done than to relay the brickwork in the same shape that it was formerly, no change being made in the style of the setting. The economy thus realized is no doubt attributable to the prevention of the loss which results from an excess of air supplied through the unsound brickwork of the old setting. In some remarks made by Chief Engineer Isherwood, at one of the recent informal meetings of the American Society of Mechanical Engineers, interesting allusions are made to this subject. In Mr. Barrus' book on "Boiler Tests," two references are made to the same matter. In one it is a case where a sectional boiler was in use, and the brickwork of the setting was so arranged that there was unusual opportunity for air leakage on account of the number of exposed surfaces protected by unsound brickwork. The fact of the leakage was determined by comparing the force of draft in the main flue with that in the furnace, at a time when the fire-doors and ash pit doors were tightly closed and the damper set wide open. Had there been no leakage, or if this had been a small amount, the full force of the draft would have been obtained in the furnace. As it was, the draft in the flue amounted to .65 inch water pressure, and in the furnace it was reduced to .34 inch. In the case of another boiler, which was of the water-tube type, the same kind of trial was made to ascertain the effect produced by sealing all the cracks in the brickwork and all the crevices around the cleaning doors. Before this was done the force of the draft was .31 inch in the main flue and .25 inch at the boiler. After the openings were closed the full draft of .31 inch was realized. When the draft was partially cut off by closing the damper it was found that the force realized at the boiler before the openings were sealed was .09 inch. while after they were sealed it rose to .2 inch. The statement is made that the closing of the air leaks was attended by an improvement in the economy of the boiler, though the exact amount is not given.

Rusting of Boiler Shells.

In a paper read in Germany on the rusting of boiler shells, the author concluded that the most serious cause is the introduction of air with the feed-water. If the feed-water enters the boiler near the low-water level he concludes that it will soon be expelled with the steam, unless it has a chance to accumulate in pockets. Such pockets rust rapidly. The feeding, he advises, should be completed before stopping for the day, so that the water standing in the boiler overnight shall be as free from air as practical. Faulty construction, the author believes, is the frequent cause of internal rusting. For preventing rusting he recommends: First, while the boiler is working—(1) Removing air from the feed-water before it enters the boiler. (2) Removing air from the water while in the boiler, and preventing its accumulation in pockets, etc. (3) Addition of chemicals to the feed-water. (4) Protective coatings applied to the inside of a shell. Second, while the boiler is standing idle.—(1) Removing all moisture from the boiler, (a) by blowing it off whilst hot, (b) by producing an air current through it, (c) by placing hygroscopic bodies inside. (2) Direct protection of the shells, (a) by painting with tar, varnish, etc., (b) by covering with protective paints, and such an alkaline coating as milk of lime. (3) Protecting the shells from various temperatures by keeping the draught in the flues constant, and so as to prevent moisture alternately depositing and evaporating on the shell. (4) Protecting the shell by completely filling the boiler with water from which all air has been expelled.

Preserving Railroad Ties.

In this part of the country, where wood is comparatively inexpensive, says the St. Louis Globe-Democrat, the railway companies do not find it necessary to treat all their cross-ties by some process which will lengthen their period of serviceability, but out in the semi-arid and arid regions, where cross-ties are costly, the case is different. Nearly 3,700,000 cross-ties in use on the lines of the Atchison, Union Pacific and Rock Island systems have been treated at a cost of 17 cents to 20 cents each by a process which consists in first injecting chloride of zinc with glue into the timber, and then forcing a solution of tannin into it. The tannin fixes the chloride so that it is not washed away by the rains or removed more slowly by the standing water in damp localities. The distinguished past president of the American Society of Civil Engineers, Octave Chanute, states that on the Atchison system tie renewals have been largely reduced by this treatment. In 1890 it abandoned the process and injected chloride of zinc only, but in 1893 the zinc-tannin treatment was resumed and is now operated. The Union Pacific stopped operating its works in 1887 for financial reasons, and they have not been opened since then. On the Rock Island lines practically no ties treated by the process were renewed until 1892, after six years of service, and at the commencement of the current year over 90 per cent. were still in service.

Tobacco Causes Loss of Memory.

Those annoying and unaccountable lapses of memory experienced when one is unable to recollect some well-known word or the name of some perfectly-familar friend are attributed by a French physiologist to the excessive use of tobacco. This gentleman has observed that aphasia and amnesia are at present almost unknown among the gentler sex. On the other hand, he has nearly invariably found these afflictions common in men who are habitually heavy smokers, while in cases where they are only of rare occurrence he has frequently known the extraordinary lapse to have been preceded by an extra dose of the fragrant weed. It is comforting, however, to be assured by the same authority that a moderate use of pipe or cigar is in no way harmful to the memory.

HEALTH AND HYGIENE.

The Value of Sulphur Di-Oxide in Diphtheria.

Dr. Harvey Gilbert, of Bay City, Mich., contributes the following clinical report to the May, 1894, issue of the New York Medical Times:

Nearly two years ago I commenced the use of sulphur di-oxide in diphtheria, and with such very satisfactory results that the readers of the Times are hereby courteously invited to consider a few thoughts in connection therewith.

Conclusions drawn:

1st.—That the constant, but slow combustion of sulphur in the sick room, or in the several departments of the house where diphtheria prevails, will prevent the second case in the house.

2nd.—That it is an effective and very potent remedy in controlling the disease itself, where it already exists.

3rd.—That it is perfectly safe and harmless.

Substantiating the first proposition, I will state that it is drawn from personal experience in a continuous practice with the remedy, covering a period of two years, during part of the time of which diphtheria has prevailed as an epidemic, and with an average mortality of ninety-eight in 615 cases, in one year reported; only twice in that time, viz., once in August and once in September, when the weather was very warm, so that it was impossible to control the gas, did the second case appear; and they were very light.

Regarding the statement that it is also curative within a short time after commencing the use of the SO2, all noisome and offensive odors subside; even the breath of the patient, in malignant cases, becomes pure.

In one house a boy lay dead upon a couch, and five others were down with the disease in all degrees of severity, atmosphere reeking with bad odors; yet within four hours (time next visit) the air had become purified—amelioration simultaneous; no other remedy used except in one case where malarial symptoms appeared, and all recovered.

There is no question but that the fumes of sulphur in sufficient quantities will cause a dangerous irritation to the air passages; but sulphur is combustible at a much lower temperature (viz., at 180 degrees F.) than is generated when ignited. A plate with sulphur sublimatum sprinkled upon it, and placed over a boiling pot, will check all fermentation in the room, and absolutely render all decomposition with which it comes in contact innocuous, without annoyance to the most delicate.

Of course the theory in this short statement is that diphtheria is caused by a ferment—a microbe—and that the local phenomena are the hydro-carbons in a state of fermentation and decomposition, that the constitutional symptoms are due to the absorption through the blood of the product of this fermentation, and that this may be averted by the use of this oxidizing agent.

Coffee and the Digestion.

To inveterate tea and coffee drinkers, says the London Graphic, we would commend the study of some interesting experiments made recently by an eminent German scientist, Prof. Schutzenstein, who has been investigating the effect on processes of digestion produced by these beverages. For this purpose the professor prepared an artificial gastric juice and mixed it with coagulated egg albumen, with and without additions of tea and coffee infusions. The results obtained are extremely instructive, for while the gastric juice by itself was able to digest 94 per cent. of the egg albumen, in the space of eight hours, when tea was added the proportion digested was reduced to 66 per cent. while when a decoction of coffee was mixed with the albumen, the gastric fluid was only able to digest 61 per cent., or less than two-thirds of the albumen. The digestive power of the gastric juice appeared to vary with the strength of the infusion, the disturbing effect being less when the solutions of tea and coffee were weakened. The professor is of the opinion that the deleterious effect produced is due to the tannin, which is extracted during the process of making, and not to the presence of thein and caffein, and he mentions that tea, which has not been allowed to stand more than two or three minutes is less injurious, because a smaller quantity of this undesirable ingredient, tannin, has been produced than when it is boiled up or left in contact with the leaves for a considerable length of time. But it should be remembered that the weaker infusions, besides containing less tannin, also contain less of all the poisonous properties contained in the tea leaf and coffee berry, and that it is not only the obnoxious tannin which is thus kept in subjection.

Steel vs. Iron.

One of the most noteworthy features in the industries of the Black Country just now is a steady and continuous substitution of steel for iron. For a long time steel tubes, steel boilers, and steel girders have superseded similar productions in best Staffordshire iron, but the latest and most important development is the manufacture of steel sheets for galvanizing purposes. One of the largest sheet firms in South Staffordshire has recently stopped their puddling furnaces, finding it to their advantage to import steel billets from the North Country and roll them into sheets, rather than rely as formerly upon bar iron of their own puddling.—Hardware Trade Journal.

Fruits to Preserve Health.

Fruit cools the blood, cleans the teeth and aids the digestion. Those who can't eat it miss the benefits of perhaps the most medicinal food on nature's bill of fare. Unripe fruit is sickening, because the pulp, instead of being soft and containing syrup and wine, is tough and filled with acid; the gastric system cannot dissolve the one or absorb the other, the organs become irritated, inflammation sets in and the result is distress, disease and often death. Spoiled fruit is simply so much decay, and the very thought of consuming it makes one shudder. If unripe and decaying fruit be eaten, by all means cook it, so as to soften the pulp and kill the worm.

How Much Food is Needed.

How much should a man eat in a week? Sir Lyon Playfair gives the following as all that is necessary: Three pounds of meat, with one pound of fat, two ordinary loaves of bread, one ounce of salt and five pints of milk; or for the meat five or six pounds of oatmeal may be substituted. This sounds like a starvation diet, but Sir Lyon Playfair generally knows what he is talking about. —Nature.

THE BEST WAY TO REST.

AN OLD-FASHIONED PREJUDICE WHICH SHOULD BE IGNORED.

What Physicians Says of Keeping the Legs on a Level With the Rest of the Body —The Tabouret for "That Tired Feeling."

There is one bit of furniture no bedroom should want for, to-wit, the tabouret—the little foot-stool, indispensible in its way, will not fill the place of this more sufficient "rest" for "bate out underpinnings," to use the "washer-lady's" euphemism.

Amply supporting weary legs, the tabouret, together with an easy chair, furnishes a delightful substitute for the couch when resting and reading are to be combined.

Physicians all agree that a woman should as much as practicable keep her legs on a level with the rest of her body; an occasional indulgence in that mannish trick of placing them even higher would help amazingly toward doing away with those tired feelings and that dragged sensation.

Fashionable women, to whom the necessity of never showing fatigue and of ever looking their "best" has taught the nack of acquiring a maximum of rest in a minimum of time are fast falling into mascu-

USING A TABOURET.

line habits of posture when in the seclusion of bedroom or boudoir. This era of exercise gives them their cue—they learn on the tennis court or in the "swagger" gymnastic class how entirely restorative it is to lounge and loll about.

On the other hand, in the less leisured class, there is a regrettable proportion of women who, soundly intelligent in the main, cling to old-fashioned and mistaken notions of decorum. These estimable women could not, by any inducement, be made to give their aching limbs a little healthful liberty and relaxation. They do not realize, or in their old fogyism they choose to ignore, the fact that the muscular, and, in turn, nervous, system thrives quite as surely on a variety of altitudes and motions as does the stomach on a catholic diet or one's spirits on the spice of life.

Those women who preserve the "bolt-upright" on all occasions when not actually in bed need not hope to retain into middle life youth's most alluring charm—plasticity. Muscles kept ever on the stretch must lose their elasticity ere very long. There is, it is true, a sort of automatic springiness that some ever active women carry with them into extreme—and extremely graceless—old age. These metallic jerks and starts hold about the same relation to the easy bouyancy of youth that the dance of the grasshopper bears to the soft litheness of a pretty Angora.

I have in mind, says Mrs. Mariette F. McCann, one young matron and mother—an acknowledged beauty—whose health keeps pace with her looks. Not so long ago a careless maiden literally on the eve of her marriage, she scandalized the proper folks of a certain village by kicking football on the green lawns of her future country home. Sensible girl, she is now happy in the possession of a physical foundation equal to the social and domestic burdens that send half our society women to untimely graves. Women may or may not—about as they choose—keep at bay the dreaded heart failure.

To go back to the innocent cause of this plea, for more limb room, I want to say of the tabouret that it may become a most picturesque and important part of the mise en scene of those hours of studied deshabille, when a pretty woman, prettier than ever in a flowing tea gown, receives, half reclining, her intimates only.

In a winter room, furnished in mahogany and tapestry-like portieres, the tabouret is effectively upholstered in old-fashioned worsted-filled canvas, which seems, if not in reality, to owe its gay pattern to the patient fingers of some passed-away kinswoman. Something cool in texture should cushion the tabouret for summer. India silk, linen or denim, or, best of all, a matting—a combination of cotton and swamp grass, deliciously dyed, is finely woven and reversible, and, therefore, extremely durable.

To Foot Stockings.

Here is a good way to foot stockings. Taking the wornout sock, fold it on the seam, and where the heel merges into the leg, begin to cut, and keeping half way between the two edges cut off the under part; then cut open the heel seam, and spreading out the part cut away from the stocking, make a paper pattern from which to cut out a new bottom of cloth. Fold this together in the middle and stitch together the rounded edges for a new heel: then, unfolding, stitch the new bottom into the stocking, holding the former toward you, as on account of the room for seam and shrinkage, which of course was allowed in cutting the pattern, it will be larger than the stockings. Woolen or cotton stockings past wearing should not be thrown away, as often one pair is useful in mending another.

Testing an Oven.

The French method of testing the heat of an oven is a very simple one. It is done with a piece of white paper. If the oven is too hot the paper will blacken or blaze up; if it becomes a light brown, the oven is right for pastry; if it turns a dark yellow, the temperature is proper for baking bread and the heavier kind of cake; if light yellow, it is just fit for sponge cakes and the lighter desserts.

THE BAREFOOT BOY.

The City and Country Sides to a Well Discussed Question.

Whether children should go barefooted in the warm season is a disputed question. To most little folk the sensation is delightful, and were parents not opposed few children would wear shoes in warm weather. That in towns and cities such exposure may easily be dangerous is sadly apparent. The following quotation is from a celebrated doctor, whose specialty lay along these lines:

"Going barefoot, a very common practice among the children of the indigent in cities and those of all classes in the country, is a common cause of blood diseases. In large towns the streets and gutters are receptacle of filth of every description, a partial specification of which would embrace the diseased expectorations of men and animals; dead carcases of flies, cockroaches, rats and mice, killed by poison; also poisonous chemicals and acids, swept from drug stores and medical labratories; filthy rags which have been used in dressing foul ulcers, mucus from sores, etc., the bare touch of which is polluting. But when, as is almost daily the case, the barefooted urchin 'stubs his toes' against a projecting stone, rupturing the skin, and then brings his feet in contact with this heterogeneous compound of mineral, vegetable and animal poisons, the blood is sure to receive an impure inoculation, which, unless eradicated by vegetable medication, clings to the individual through life, rendering him ever succepticle to epidemics, colds and chronic diseases."

Right here the natural question arises, What about ladies' trailing gowns, which carry their nasty burden homeward? And what about the carelessness which allows men to indulge openly in well-known filthy street habits? When men cease to be expectorating machines, women can go about with considerably less danger to themselves and their families.

"In villages, although less exposed to corrupt animal inoculation," continues the doctor, "children are liable to come in contact with poisonous plants, which abound in country places, and merely a thoughtless gallop through stubble fields may impart a humor which is sooner or later to cause death. Because serious effects do not manifest themselves immediately, many parents flatter themselves that the practice is not attended with bad results. But blood impurities are generally insidious, and produce disease when least expected."

This doctor gives illustrations to prove his theory, which is plainly against the "barefoot boy."

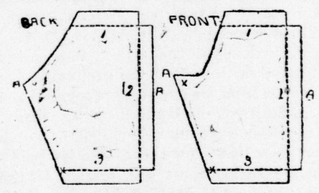
In direct opposition to this theory it is strongly urged that the custom is so healthful as to render the well-shod child an object of commiseration because he has not its blessings. Some produce statistics to prove that cold and contagious diseases avoid the "barefoot boy," and some London experiments have been made to prove the great desirability of letting all children go barefooted.

It is undeniable that country children often get wet feet in attending the usually distant school in bad weather. Here the barefoot boy rises superior. By evaporation his feet are soon dry and warm, whereas the feet incased in leather remain wet, and colds or sore throat often result. No one will deny that the ordinary shoe distorts the foot, and anybody who has ever gone barefooted can testify to the delightful sensation of freedom which the custom inspires.

Each one, then, it appears, must decide personally. It may be well to add that very little harm can result from allowing country children to walk over the warm country roads free from shoe leather, as children love to be.—Jenness Miller Monthly.

Patching on the Machine.

If any one has ever tried to patch the underware of father or brothers, they have doubtless found it a hard task to avoid



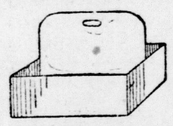
MACHINE PATCHING.

using patches of all shapes—oblong, round, triangular, etc.,—in order to fill up a glaring deficiency. To such the mode of patching here presented may not come amiss.

First rip the inside leg of the drawers as far down as the patch is required, and down the back to the seat. Get the width of the torn parts from A to A. Cut them out, lay them on a piece of paper and block out two patches, in shape like the diagram given. Let the dotted lines suggest the torn piece. Make cloth patch one inch larger on the sides marked 1, 2 and 3, never enlarge on the curved sides. Stitch the patches neatly on the outside of the drawers; hem the inside, and close all up with over and under stitch on the machine. Such patching is a delight to both wearer and repairer.—Orange Judd Farmer.

A Handy Box.

Such a box as illustrated herewith should have a place in every home as it will save many trips after articles to be used in making repairs and also save many vexatious delays in searches for tools, etc.



A HANDY BOX.

A convenient size is 12x16 inches deep. Make of half inch lumber and divide through the centre lengthwise by a board extending six inches above the top of the box with a hand hole cut in by which to carry the box. Narrow pieces, say two inches wide, should be set in to divide the sides making four compartments in all, to contain nails and screws of different sizes and such things. The larger tools can lay on top. This tray or box should always contain hatchet, pinchers, screw driver, monkey wrench, wire cutter and brace and bits besides gimlets, files, etc. The saw and augers should hang beside it so as always to be convenient. One who has not used some such a time saver will be surprised at its general utility and will wonder why one was not thought of and made long ago.

OVER THREE HUNDRED FEET HIGH.

The Magnificent Waterfall in Labrador First Described a Short Time Ago.

For many years vague reports of a great waterfall in Labrador near the headwaters of the Grand River had led men to explore the interior plateau of that region, but no satisfactory account has been given of the appearance of the falls until the recent publication of the results of an exploration undertaken by Henry G. Bryant, of Philadelphia. The object of this expedition, says the New York Evening Sun, was expressly to verify the reports as to the height and location of this natural wonder. On Sept. 2 last year Mr. Bryant's party reached the cataract. "Standing at the rocky brink of the chasm," he has written, "a wild and tumultuous scene lay before us, a scene possessing elements of sublimity and with details not to be apprehended in the first moments of wondering contemplation. Far up streams one beheld the surging, fleecy waters and tempestuous billows dashing high their crests of foam, forced onward toward the steep rock whence they took their wild leap into the pond below." Conversation amid the road and reverberations was impossible. It seems that a mile above the falls the river is a noble stream, 400 yards wide, already sweeping along with accelerated velocity. The walls draw nearer to one another as three successive rapids are passed, down which the volume of water rushes, now gathering in great billows, till, with an arrowy flight, the whole vast volume shoots out into the air.

The sheer fall is 316 feet, at the head of which inclines a chute with a further vertical height of 32 feet, making the total descent from the head of the chute to the surface of the water in the chasm 348 feet. The Grand Falls are thus nearly twice as high as Niagara and are inferior to that cataract only in volume of water. In respect of its power to awaken human emotion, however, it may well be questioned whether the Grand Falls is not the greater of the two. At least there can be little doubt that such is the case where the Grand Falls are seen amid the wild nakedness of nature, as Niagara itself was seen by its earlier white visitors. In approaching the scene Mr. Bryant's party were able to hear the roar at a distance of twenty miles.

The Bryant party set out for Rigolet, in Hamilton inlet, July 23, and, as we have seen, arrived at the falls after an arduous journey, not wholly free from perils, on Sept. 2. A scientific question of some interest presents itself in connection with the present aspect of the cataract. The appearance of the sides of the gorge below the falls and the zigzag line of the river suggest that the falls have receded from the edge of the plateau to their present position, a distance of twenty-five miles. What length of time has been required for the process of cutting out this gorge? A similar question for Niagara has engaged the serious attention of competent observers. For the greater part of the distance channeled by Niagara the material has been a comparatively soft shale rock, supporting a stratum of limestone. The escarpment of the Grand River Falls is of gneissic rock. If its canon also has been cut out, conjecture is lost in the immensity of time that should have been required.

TRADE UNIONS IN GREAT BRITAIN.

Over a Million Members in 599 Bodies—Their Incomes and Expenditures.

One of the leading features of the Labor Gazette of London for May is a brief summary of the statistics of trade unions for the year 1892, given pending the issue of fuller details in the report of the chief labor correspondent, now in the press. The reports of 599 separate unions have been dealt with, 482 of which are registered and 117 not registered, while 105 have branches numbering in all 7,308, making up an aggregate of 1,237,367 members. The total income of all these societies dealt with was about $8,900,000, and the expenditure about $75,000 less; 298 societies, with a membership of 745,648, paid unemployed benefit to the amount of nearly $2,000,000; 308 societies, with 1,103,641 members, paid in dispute benefit $2,300,000; 193 unions, with 585,389 members, paid in sick allowances over $1,000,000, and 88 unions paid as accident benefit to disabled members $89,000. For the purpose of comparing 1892 with the previous year only 381 unions are available, that being the number supplying returns for both years. The increase of membership on these 381 unions during 1892 was 32,161, or a little over 3 per cent upon the membership of 1891. The total income of the 381 societies showed, however, an increase of 21.8 per cent. There was also a very considerable rise in expenditure, amounting, in fact, to nearly 44 per cent upon the outlay of 1891. The chief share of this increase was due to heavy demands upon the unemployed and dispute benefits, which in 1892 absorbed $1,900,000 more than in 1891.

Particulars are also given with regard to co-operative farming in England and Scotland in 1893 and 1892. Forty-seven societies have made returns, showing that a total of 4,692 acres was being farmed in 1893, an increase of 121½ over 1892. The capital employed in 1893 was $450,000, an increase of $29,000 over 1892; and the net loss sustained amounted to $2,190, as compared with $3,410 in 1892.

An Egyptian Custom.

More than 1,000 years ago Herodotus observed a remarkable custom in Egypt, says Prof. Drummond. At a certain season of the year the Egyptians went into the desert, cut off branches from the wild palm, and, bringing them back to their gardens, waved them over the flowers of the date palm. Why they performed this ceremony they did not know, but they knew that if they neglected it the date crop would be poor or wholly lost.

Herodotus offers the quaint explanation that along with these branches there came from the desert certain flies possessed of a "vivific virtue," which somehow lent an exuberant fertility to the dates. But the true rationale to the incantation is now explained. Palm trees, like human beings, are male and female. The garden plants, the date bearers, were females, the desert plants were males, and the waving of the branches over the females meant the transference of the fertilizing pollen from the one to the other.