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**SMALL BOILERS.**

One of the commonest mistakes committed in engineering practice is to allow too small a proportion of boiler to steam engine. We see evidences of it every day in steam vessels, and more frequently in factories. In ships with limited boiler power a continual struggle is going on between the water tenders, the coal passers, the firemen and the engine. It is a matter of interest which of these machines shall get ahead. The steam gage is anxiously inspected; the pressure is continually falling; a brief "spurt" on the part of the fireman for a time causes the pressure to gain, but when this ceases it falls to the old point again, and no judicious throttling; no loud and imperative commands to carry less water; no skillful slicing of fires; no scientific dilution of the gases with air through the furnace doors; no busy whirling of blowers, can raise the pressure beyond the point at which the capacity of the boiler stops. One may as well attempt to pour five quarts out of a four-quart vessel as to get more steam than it has the capacity to generate. Like spurs applied to a tired horse, the goading is of no avail, and, unless other boilers are put in, no results, except poor ones, are obtained.

A shocking waste of fuel occurs when small boilers are used. The green fuel thrown in is no sooner fairly aglow, and parting with what heat it contains, than fresh charges are put on top of it, the blast is turned on, and that heat which should have been devoted to raising steam is employed to burn the cold fuel, and is soon sent whirling up the smokestack, to be lost in the outer air. If a man fed the hopper of a fanning mill with greenbacks, and blew them out of the dust-opening thereof, he would have a practical exemplification of the waste occurring in boilers too small for their work. Not only is fuel wasted, but the boiler itself rapidly deteriorates, as does every other machine, implement, vessel or apparatus taxed beyond its capacity.

An incessant opening of furnace doors, a continual introduction of fresh fuel, an unremitting torture of said fuel by "slicing," poking, "roasting," and other ingenious devices, to prevent the coal from burning, transpires throughout the day when the boiler is too small. Every cook knows that if she give her range no peace there will be no dinner; the domestic steam will not be raised in a desirable manner, and with a steam boiler continually urged the proprietor suffers daily loss.

A most striking example of the utility of large

boilers and the assertions here made was noticed by us some years ago in a factory. The proprietor of it had a small steam engine driven by a boiler large enough for two such engines. That boiler actually used less coal than one half its size for the same work; the fire once made in the morning burnt slowly through the day. Once or twice firing was all that was necessary, and the doors were continually ajar. The sluggish combustion was accelerated when new fuel was added by closing them for a few minutes. At night the fires were banked, remained so all night, and half an hour before work commenced they were ready for work. No kindlings were used from one week's end to the other, except to start the fire on Monday morning; no coal was burned to heat cold water every morning; no fuel was wasted, for it slowly roasted away to ashes, and the burning gases rising slowly through the flues and heating surfaces remained in contact with them, and gave forth their utmost value.

Half, if not more, of the miraculous economy claimed for cut-offs for engines with peculiar pistons; for valves with crooked openings instead of straight; for valves with three-fourth stems instead of seven-eighths, arises solely from their engines having surplus boiler power, wherein the coal is thoroughly burnt; where every ounce is reduced to ashes—not consolidated to cinder—and where the heat, instead of being discharged at the smokestack as soon as generated, is utilized in turning water into steam.

**EXPIRATION OF THE GOODYEAR PATENT.**

There has never been a more illustrious exhibition of the beneficent operation of the patent laws than in the case of Charles Goodyear's invention of the vulcanization of india-rubber. The unflagging perseverance that carried the inventor through his early struggles was the result of the splendid reward which these laws offered as the crown of his success. For twenty-one years the inventor and his assigns have enjoyed a monopoly of the invention, and a number of magnificent fortunes have been acquired from this monopoly.

But great as have been the profits to the owners of the patent, they are small indeed compared with the advantages which the invention has bestowed upon the community. The properties of vulcanized rubber are so peculiar and so valuable, that the article has come into use in almost every art and every department of life. The infant draws its first drop of nourishment from the tender bosom of its mother through a patent nipple shield of india-rubber, the little girl dances her rubber doll upon her knee, the boy bounds his rubber ball, or claps his hands with delight as his rose balloon of india-rubber floats away into the sky. India-rubber protects the watchman in dryness and comfort through the most violent storm, and it draws together with peculiar elegance and grace the corset of the belle, it keeps the dust from our hands and the water from our feet; we ride in a car which runs smoothly upon india-rubber springs, and is drawn by an engine packed with india-rubber in every joint. In short, all the comforts and conveniences of life are augmented, and all its jolts and jars are softened by this elastic and all-pervading substance.

But even yet there are some nooks and corners of the arts from which india-rubber has been excluded by the operation of the Goodyear patent. Many valuable inventions which depend upon the use of vulcanized rubber are lying dormant till this material can be had at a more moderate price. On the 15th of next June the patent will expire, and this great invention—one of the most valuable that has ever been made—will become the property of the public. Then will its innumerable applications be still further multiplied, and new devices for its use will come forth in endless succession from the inexhaustible brains of our inventors.

**Reflecting Magic Lantern.**

Mr. Chadburn, of Liverpool, has patented in England a magic lantern, by which engravings upon paper, photographs and all kinds of pictures are readily produced upon the wall by reflection. The principle upon which this instrument operates is the same as that patented in this country on the 19th of April, 1864, by Geo. Siebold, of Philadelphia, Pa.

**CHEAP SOAP.**

Soap for family use can be made very cheap and of excellent quality with little trouble by the use of a common article sold in all drug stores. This is lye put up in a concentrated form in small iron boxes holding one pound. These boxes cost twenty-five cents in ordinary times, now we believe they retail at forty or fifty cents, and will make twenty-five pounds of green or new soap. The plan of procedure is merely to take a box of this substance, knock off the lid and throw it into a gallon of boiling water. After standing ten hours the lye will be clear, and must be thrown into a wash boiler with another gallon of boiling water; when the contents of the vessel boil, four pounds of any grease must be added slowly, poured in in a thin stream and stirred well. When intimately mixed the boiler should simmer slowly for four or six hours, and half an hour before taking off another gallon of hot water may be added together with half a teacupful of salt. The latter is not necessary, however, and if too much is thrown in the soap is curdled or made short so that it breaks and wastes. When the soap is thought to be done plunge a case knife in, if the mass drops clear and rosy and chills quickly it is soap and will be firm and hard when cold. Have ready a wash tub well wet on the bottom and sides; pour the soap in and let it set; in a few hours it will be hard enough to cut out and as white as snow. This process makes twenty-five pounds of soap, or, by the aid of grease, four pounds, lye, one pound, twenty-four pounds of water, less two quarts driven off in boiling, (one gallon weighs eight pounds nearly,) are converted into soap of excellent detergent properties. Since the grease is saved from the family waste the soap has only cost what the lye has come to, and, as the loss by drying is only 25 per cent, eighteen pounds of soap can be made for fifty cents, a little over three cents per pound. We have made hundreds of pounds of this soap in all varieties and use it constantly for domestic purposes.

**A SIGNIFICANT FACT.**

We have frequently called public attention to the fact that, notwithstanding the existence of war and the consequent disturbance of business, the arts do not languish nor does trade stagnate to the degree that might have been expected. Repeated calls for men to fight the battles of the nation have drained the North of large numbers of its most skillful craftsmen. Eager to uphold the national credit and honor under all circumstances, machinists, carpenters, engineers, farmers, masons, indeed, members of every calling, have laid down their several implements and hurried to the field. Nay, more, they have also unloosed their purse strings, and while they have shed their blood in their country's defense, they have loaned to the Government the wages received for this very service.

In consequence of the absence of manual labor, machinery has been, and still is largely in demand to supply the demands of trade, and we call attention to the unprecedentedly large list of patent claims in this number as the fullest evidence that inventors are awake and equal to the emergency. Machines, plans, processes, designs and apparatuses are all recorded there, and it would be difficult to find a branch of manufacturing not represented.

The present list is the largest ever issued from the United States Patent Office, and numbers no less than one hundred and fifty-one cases.

Our friends and patrons will be pleased to learn that the SCIENTIFIC AMERICAN PATENT AGENCY is, as usual, largely represented here, and may fairly claim the lion's share in the number of patents procured. Out of the whole number SEVENTY-THREE were obtained through this office, and we present this naked fact as the best evidence of the confidence of the inventive portion of the community in our efforts to serve them.

**NOTICE TO SUBSCRIBERS.**

The first five numbers of the present volume of the SCIENTIFIC AMERICAN being out of print, we shall commence the time of each new subscriber from the date of receipt of the order, unless the writer states specifically that he wishes such back numbers as can be furnished.