Steam Boilers and Furnaces.

ARTICLE 3.

INCRUSTATIONS.—By the use of hard water for steam boilers, an incrustation or scale is liable to be formed on their interior surfaces which materially injures their efficiency in evaporating steam, and also destroys the metal. So much has been said on this subject, however, in former volumes and in preceding numbers of this volume of the SCIENTIFIC AMERICAN, that we have but little to add new, yet that which we now present will be found very useful and generally new.

In hard water, the *sulphate* and the *carbonate* of lime are the principal matters held in solution that cause incrustations in steam boilers, but the sulphate is the prime scale-former. The reason of this is, that when the water in the boiler becomes saturated with the lime in consequence of the evaporation of pure water which passes off as steam, the sulphate of lime then separates from the water in which it was formerly held in solution, and attaches itself to the whole surface of the metal. The carbonate of lime, on the contrary, although it separates from the saturated water, does not attach itself to the whole surface of the boiler; it is precipitated, but while the water is hot, it has little or no disposition to adhere to the metal unless by cementation with the sulphate. Mr. J. Graham, whose experiments we have described in a former article, was able to prevent the formation of incrustations in boilers when using hard fresh water, by blowing off the saturated water regularly when it has attained to the "salting point," in the same manner that the concentrated brine is run off in the boilers of ocean steamships. In doing this about four per cent of the amount of water fed in is sacrificed, but this is a very small loss in comparison with the good results thereby obtained.

In boilers using sea water, the sulphate of lime is really the only scale which is formed; in those using hard fresh water the scale is chiefly composed of carbonate of lime. Recent experiments regarding both kinds of these boiler incrustations have been described by James Napier, of Glasgow, an excellent practical chemist, in the London *Engineer*. The following is his analysis of scale taken from a boiler in which river water had been used:—

Carbonate of lime	79.0
Sulphate of lime	6.3
Peroxyd of iron	3.5
Silica	2.2
Carbonaceous matter	4.0
Water	5.0
	100.

The next analysis is that of scale taken from the boiler of a steamer running between Glasgow and Liverpool, in which no attention was paid to "blowing off." This scale was composed of two layers; the one (that next the metal) was hard and crystalline, the other (or outer coat) was softer and granular. The thickness of the whole crust was about three-eighths of an inch:—

Sulphate of lime	81.6
Magnesia	4.2
Silica	2.8
Peroxyd of iron	2.4
Salt	0.7
Water of crystallization	7.7
Carbonic acid	0.6
	100.

The next analysis was that of scale taken from the same boiler, which was worked for the same length of time, as in the former experiment, but care was taken to "blow off" regularly. The scale in this case was only one-sixteenth of an inch thick—only one-sixth the thickness of that formed when "blowing off" was neglected:—

Sulphate of lime	94.5
Magnesia	1.5
Peroxyd of iron	0.5
Salt	1.1
Water	2.4
	100.

These analysis show that the sulphate of lime is the main ingredient of the scale deposited by sea water. They also afford very satisfactory evidence regarding the way to prevent incrustations by care in blowing off the saturated water regularly.

The following is the method proposed by Mr. Napier for the prevention of incrustations in all boilers. He analyzes the water to be used, and if found to contain only the bi-carbonate of lime in suspension, there is no difficulty in preventing it from forming scale. The carbonate of lime separates from the water at a high heat, and is kept suspended in the boiler while the water is hot, but when the boiler is stopped, it falls to the bottom in cooling, and when cold it hardens, adheres to the metal, and forms a crust. A boiler using hard fresh water containing carbonate of lime has thus a thin layer of scale formed every night, and at last it accumulates to a thick stony crust, which almost prevents the passage of the heat from the fire to the water. To prevent such scale, the plan to be adopted is simple. In about an hour after the engine is stopped every evening, and when the fire is cooled down, the engineer should blow off the water freely. This will discharge all the sediment which has been precipitated, and prevent it hardening and adhering to the metal.

Although this method of working boilers will prevent scale, if the water only contains carbonate of lime, it will not entirely suffice to prevent incrustations when the sulphate of lime is the principal ingredient in the water, because it does not precipitate like the carbonate. Having by analysis discovered the quantity of the sulphate of lime in each gallon of the water to be used as feed, a sufficient quantity of the carbonate of soda is to be employed to neutralize the sulphate and convert it into the carbonate. The carbonate of soda dissolved is to be fed regularly into the boiler by a pipe connected with the water feed pipe. On land boilers, the carbonate of lime thus formed should be blown off every evening when the water has cooled down; in marine boilers, the carbonate will float near the surface when the boiler is working, and it can be blown off by the surface water cock. Any alkali will neutralize the sulphate of lime in a steam boiler, but the common carbonate of soda is the cheapest which can be used. Care, however, must be exercised not to employ it or any other alkali in excess for such a purpose, as it has a tendency to volatilize with the steam.

Razor Paper.

This article supersedes the use of the ordinary strop; by merely wiping the razor on the paper, to remove the lather after shaving, a keen edge is always maintained without further trouble; only one caution is necessary, that is, to begin with a sharp razor, and then the paper will keep it in that state for years. It may be prepared thus:—

First procure oxyd of iron, (by the addition of carbonate of soda to a solution of persulphate of iron,) well wash the precipitate, and finally leave it of the consistency of cream. Secondly, procure some good paper, soft, and a little thinner than what this journal is printed on; then with a soft brush spread over the paper (on one side only) very thinly the moist oxyd of iron; dry it, and cut into pieces two inches square. It is then fit for use.

SEPTIMUS PIESSE.

Recent Patented Improvements.

The following notices of inventions patented last week were unavoidably crowded out:—

PROPELLER ENGINE.—The several direct-acting screw propeller engines hitherto constructed are objectionable in the following particulars, viz.:—The horizontal engines occupy too much space transversely in the vessel to admit of being placed in the run. The vertical engines pass through the decks and project so far above the water line as to be useless for war purposes; and all approved double engines operate on cranks placed at right angles to each other, which involves a series of bearings, much friction, and liability to derangement from the shafts getting out of line. In addition to these imperfections the extreme shortness of the cranks with the attendant great friction on the crank pins and journals, to say nothing of the heavy diagonal thrust of the connecting rods, are serious defects in the direct-acting screw propeller engines now in common use.

To obviate these difficulties, that well-known able, and veteran inventor, John Ericsson, of hot air celebrity, has invented a useful improvement in steam engines for working propellers, which consists in the arrangement of the two cylinders of a double engine in such a manner that their base or bottom ranges with a plane passing through the axis of the propeller shaft or nearly so, in combination with a certain arrangement of rock shafts, crank pins, and connecting rods for imparting motion from the pistons to the shaft, whereby the inventor is enabled, firstly, to bring the cylinders nearer to the propeller shaft, and hence to economize space and construct the frame of the engine of great strength and compactness. Secondly, to avoid the diagonal thrust and friction of the slides, unavoidable when the connecting rod is attached directly to the cross head. Thirdly, to operate the two connecting rods nearly at right angles to each other, which enables the inventor to produce a continuous motion with a single crank on the propeller shaft and a single crank pin in common. Fourthly, to employ a crank on the propeller shaft much longer than half the length of the stroke of the piston, thereby diminishing the heavy pressure on crank pins and journals which has heretofore caused so much trouble by the overheating of the bearings and at the same time diminishing the strain on the engine frame. The inventor resides in New York.

SCREW MACHINE.—Ira Griggs, of Utica, N. Y., has invented a machine for turning the heads of screws and cutting the notches in them, and he has assigned the invention to the Utica Screw Cutting Machine Company. The invention consists in a certain mode of applying and operating a series of screw blank holders in a machine, in combination with a suitable arrangement of the feeding apparatus to supply the blanks to the holders; the turning cutters for cutting the heads and the saw for cutting the notches therein; so that a greater number of blanks can be operated upon in a given time and in a more perfect manner than is ordinarily done. There is also a certain relative arrangement of the driving shaft of the machine, the blank holders, and the rotating stock which contains them, the turning cutters and saw for cutting the notches whereby the driving belt which rotates the blank holders or their axes to turn and finish the heads, is rendered inoperative during the cutting of the notches in the heads. It also consists in a series of rests to support the necks of the screws for the purpose of keeping the heads steady during the action of the turning cutters and saw. There is likewise a peculiar method of applying and adjusting the dies or jaws of the blank holders to make them gripe the blanks and to adapt them to various sizes. An improved method of applying a spring punch in combination with the plunger which operates the jaws or dies of the holder, is employed for the purpose of discharging the screw blanks from the holders by the movement of the said plunger.

WATER GAGE ALARM.— S. W. Warren, of Brooklyn, N. Y., has invented an improved means of operating the valves of alarm water gages, safety valves, and feeders for steam boilers. The improvement consists in a certain method of applying a spring in combination with a valve and with a tube, one end of which is connected with the upper part, constituting the steam space of a boiler, and the other with the lower part of the water space thereof; the said tube being arranged just below the proper water level of the boiler so that it will remain full of water, till the water in the boiler sets below the proper level but at such a distance from the boiler that the water supplied to it by the boiler will never be at as high a temperature as that in the boiler itself, when steam is up in the boiler. When the water gets below the proper level in the boiler, the water leaves the tube and steam fills it and thereby causes an increase in its temperature, by which it is caused to expand longitudinally, and by its expansion made to act upon the spring to move the valve and permit the escape of steam to sound an alarm whistle or to open a feed pipe.

UPSETTING TIRES AND AXLES.—This machine is designed for reducing the diameter of tires without the necessity of cutting out a portion of the same. It is also designed for increasing the diameter of the arms or journals of axles. To accomplish the first result a portion of the tire is compressed or bulged out between two jaws, by means of long levers and the bulged portion then hammered down on an anvil. And to accomplish the second object, the journals of the axles are placed in hollow metal sockets and then crowded by the jaws and eccentric levers until the journals are shortened and increased in diameter. This appears to be quite a useful invention as it places in the hands of every country blacksmith a cheap, simple implement with which he can upset tires and axle journals in a very short time. Zena Doolittle, of Perry, Ga., is the inventor.

CANAL BOATS.—This invention which is clearly defined by the claim is designed for avoiding a serious inconvenience experienced in running canal boats from the stern being sunk down below the bow by the weight of the engine, &c., when the bow portion is not loaded and of the boat being thrown off an even keel, said inconvenience being the blowing round by the wind of the bow portion of the boat and the consequent impossibility, very often, of keeping the boat in a direct course. We regard this as a good contrivance. It was patented by Jas. E. Gibson, of Port Carbon, Pa.

BORING MACHINE-—This invention provides a drill stock which will receive two sizes of augers and drive a large auger with a slow speed and a small auger with a fast speed. The arrangement is very compact, and with it the expense of having two separate boring machines, one to bore light and the other heavy work, is avoided. We view the invention as one of merit and utility. It is the invention of L. A. Dole, of Salem, Ohio.

SLEEPING CAR.—Zenas Cobb, of Chicago, Ill., has invented an improved sleeping car in which four persons can comfortably sleep in the same space that they occupy when sitting in the car by day. This is effected by having the seats and backs to slide on ways until they meet, thus forming a bed for two, and also having two shelves to be capable of adjusting so as to form a bed for two more. In the day time the shelves form extra backs to the seat. There is also provided a table which will fold up out of the way, or on which, when brought down betwen the seats, bundles may be placed or meals served.

STONE GATHERING MACHINE.—This invention consists in having a receptacle or box mounted on wheels and having an inclined plane at its front end; the wheels of the box have rods attached, which are also connected to a scraper that works over the inclined plane and which scraper, by means of spring or drop guides in connection with the rods, is made, as the machine is drawn along, to draw up stones into the receptacle or box. This most useful machine is the invention of G. W. Bishup, of Brooklyn, N. Y.

MEASURING FAUCET.—This invention consists in the employment of rotating cylinders provided with followers arranged in such relation with the tube of the faucet, and connected with suitable mechanism, with an index, springs and cut-off, so that liquids may be drawn from a vessel in measured quantities. Gilbert Hubbard of Montville. Mass., is the inventor.