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IMPROVED BOILER AND FEED WATER HEATER.

We publish herewith illustrations of a boiler designed expressly to economize fuel. We select them from the pages of *Iron*, which journal accompanies them with some sensible remarks, the gist of which is as follows:

If there is one department of engineering receiving more attention than any other at present, it is that of economy of fuel. And this is very justly so, since, like a horse, the expense of boiler or engine power does not lie in its first cost, but in what it afterwards consumes. We take it, as a rough calculation, that an ordinary land boiler will burn its own value in coals about every six or nine months, according to its efficiency and economy.

There is, undoubtedly, very wide margin for improvement in our present construction of boilers and engines. It is well known that only about one tenth of the theoretical value of the motive power of fuel is utilized in ordinary boilers and engines. What a fearful waste this nine tenths of the whole fuel used represents! Money thrown away; our natural resources more rapidly impoverished; the atmosphere laden with carbonic acid and other impurities; and our buildings and edifices disfigured with our wasted coal, or soot.

A considerable portion of this waste of power lies with the mechanical arrangements of the engine. It is comparatively lately that the true principles of obtaining the full work from the steam used has been fully and generally understood. Unrestricted radiation from cylinders, boilers, and pipes, poor expansion, and throttling in the steam pipes are to be thanked for much of this waste. Probably, however, much more is to be attributed to the wasteful use of fuel in boilers. This may be occasioned in many ways, but the sum total of the matter will always amount to the fact that so much of the whole fuel and heat goes out of the chimney unutilized. It is thus that such a very striking saving in fuel may, with the best arrangements, be effected.

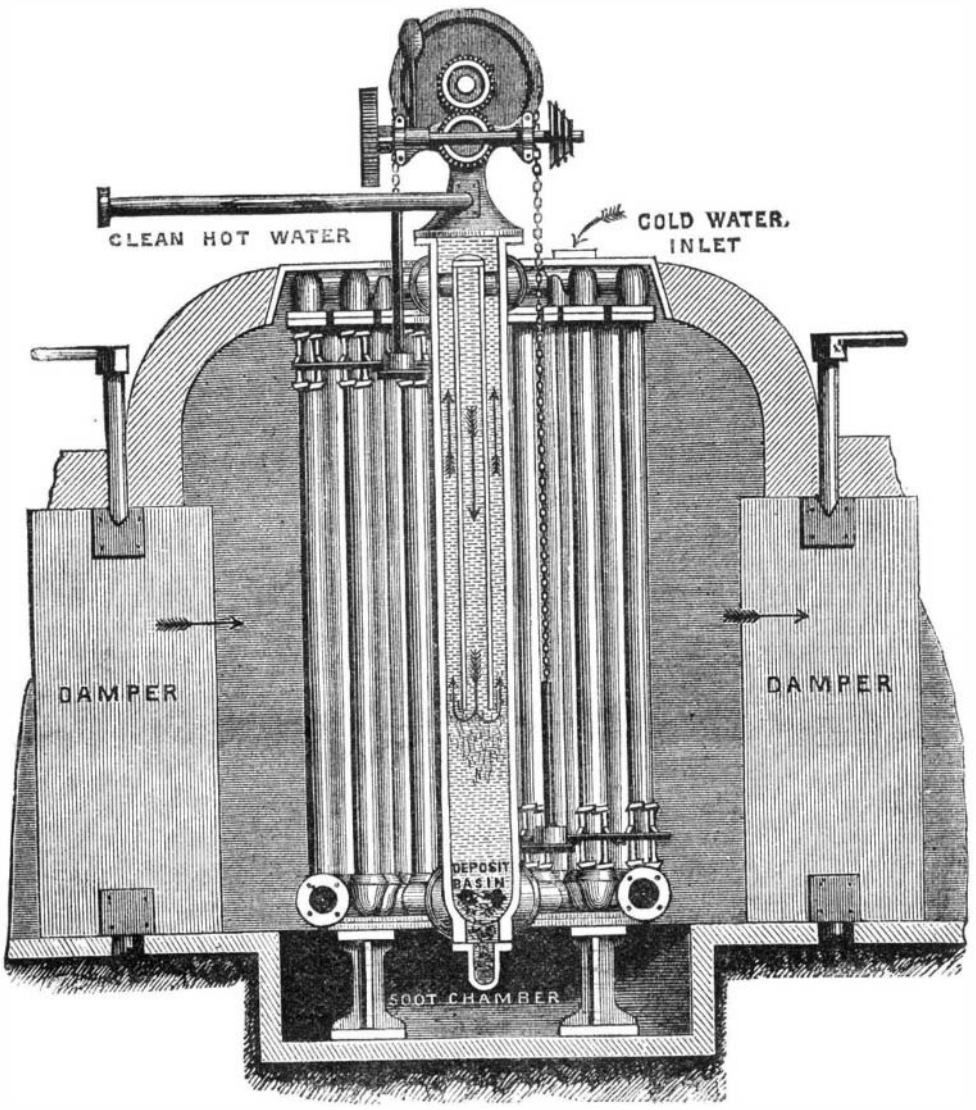
It is a difficult matter to decide immediately what description of boiler should be best for economy, or in what direction the most economy may be effected. If a user of steam power be inclined to invest in the best boiler he can obtain for the highest economy of fuel, he would very soon be bewildered by the very contradictory statements that he might hear on the subject. He will hear, in one direction, that he must use a multitubular boiler for economy, although he sees that it is open to the grave defects of complexity, difficult to clean, liability to wear out in the tubes, and so on. On the other hand, he will hear it stoutly maintained, and very fairly borne out by facts, that the old Cornish boiler, properly used, cannot be beaten for economy of fuel, and gives at the same time the utmost solidity, facility for cleaning, and the greatest durability.

Some engineers will be found to rely most for economy on special grate arrangements—patent fire doors, automatic stokers, fire bars, etc. Others will laugh these to scorn, and say that they are useless new-fangled notions, and simply are a further expense and trouble. It is probable that there is some truth in all the various opinions, and the varying practical results are achieved according to the special circumstaces of each case.

We only propose to consider the action and waste of the hot gases of combustion in being allowed to pass freely into the open air. It is at once seen that the comparison between the temperature in the fire box and in the chimney will give us one of the best tests as to the economy with which the boiler is working, and that for perfect economy the escaping heat should not be greater than that of the steam. The question is, how is this effect to be obtained? And, if obtained, will it answer, practically?

To reply to the last query first: It would not answer, practically, to reduce the temperature of the escaping hot gases to that of steam, for, in that case, the draft would be too materially checked, and the fire would only smolder, and might even be put out. For whatever causes would tend to reduce the temperature of the escaping gases so low must be a constant cause always in operation. We therefore see that it can only be permitted to reduce the temperature of the escaping products to a degree which shall not interfere with the draft or the brightness of the fire.

In a very large proportion of boilers at present in use, the temperature of the escaping gases is probably very much higher than is compatible with economical working. To render useful this hitherto large proportion of wasted heat is the object of the feed water heater which we herewith illustrate.



TWIBILL'S FUEL ECONOMIZER.

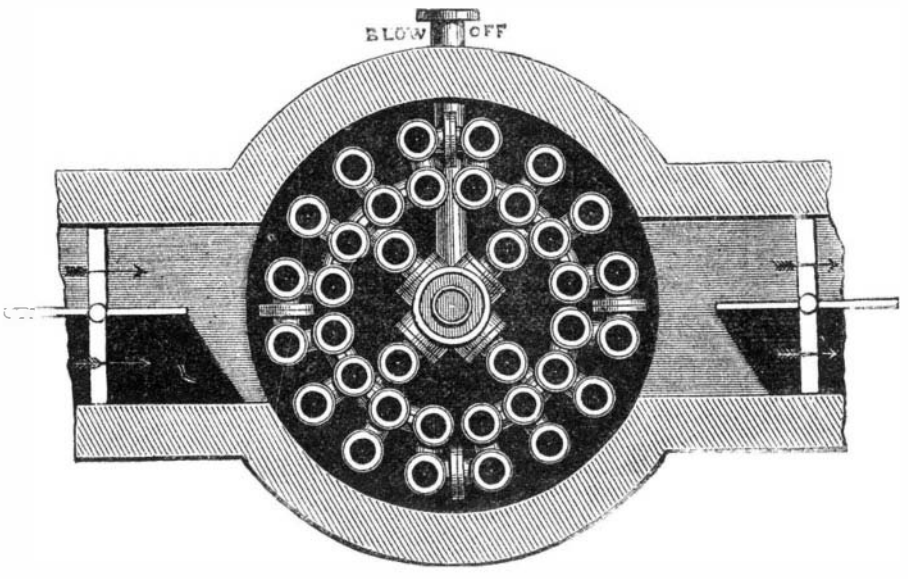


FIG. 2.

A very large additional heating surface is thus added to the boiler, which materially aids in absorbing the heat from the gases of combustion. The absorbed heat, which would otherwise have passed up the chimney and have been wasted, is thus utilized in heating the feed water to about 250° or 300° Fah. This is sufficient to effect a gain of from 15 per cent to 30 per cent on the former consumption of fuel, depending upon the amount of heat formerly going to waste in the different instances. The broad principle on which such considerable economy may be effected is easily seen when we consider that, if the whole of the water evaporated is raised from 60° to 300° before going into the boiler, this represents some 20 or 25 per cent of the whole heat required to vaporize the water into steam.

Referring to our illustration, we see a circular arrangement of the pipes of the economizer, which admits of a very convenient attachment in the center of his latest patented improvement, namely, the feed water filter. The sectional view, Fig. 1, shows this useful addition to the feed water heater. The hot water, after having ascended to the top of the outside set of pipes, and having been thus raised to its highest temperature, is then ready to precipitate and part with its suspended matter. This is effected by diverting the stream downwards through a central pipe in the filter into the deposit basin below, the clean feed water ascending again around the descending tube, and being thence taken to the boiler. The suspended sediment becomes separated from the water by the abrupt reversal of the current, and thus collects in the basin provided for that purpose at the bottom of the filter. This deposit basin is fitted with a door or cover, from which the sediment can be removed as it collects.

The importance that should be always attached to the prevention of incrustation upon the heating surfaces of boilers is now becoming more thoroughly appreciated. The advantages derived from keeping boilers clean are threefold; first, greater safety against explosion, since the failing of plates is frequently due to their overheating or burning from deposit; second, much greater economy in the evaporation of water, as calcareous sediment is a very bad conductor of heat; third, considerable economy in the cost of boiler repairs, as the plates, being always exposed to the water, are less likely to become leaky. The inventor uses quadruple scrapers, which insure perfect cleanness of his tubes from soot. The raising and lowering action in our illustration is very simple and compact, and a considerable improvement over former arrangements. An advantage in the way in which the tubes are connected at the top and bottom consists in their connections being separate circular pipes—the best form to resist pressure—rather than a flat-sided box. The arrangement also admits of very easy withdrawal and replacing of any one of the tubes when required, the bottom joint being made on a slightly tapered face. The joints are all made metal to metal, and will, therefore, stand any amount of heat. This boiler and heater is the invention of Mr. Joseph Twibill, of Hulme, near Manchester, England.

New Electro-Magnetic Clock.

Messrs. T. Cooke and Sons, of York, England, have completed the erection of an electric motor and clock dial in the telegraph gallery of the new buildings of the General Post Office, London, which, in some points, is novel and interesting. The hands of the large dial, which are driven by the motor, are at a distance of about forty-five feet from it, and are connected to it by means of iron rods and several pair of bevel wheels for turning the bends. The dial itself is six feet in diameter, and such is the sensitiveness and power of the motor that the connecting rods, bevel-wheel work, and hands, are driven by a single Lelanché cell of small size, the current from which is transmitted by the standard clock in the gallery. The motor consists simply of a polarized pendulum vibrating between two pairs of electro-magnets, carrying a double ratchet at the upper end, the pointer of which is worked by a vane at the top of the buildings.