

*On an Apparatus for the Prevention of Smoke in Steam Boiler and other Furnaces.** By Mr. WILLIAM B. JOHNSON.

Although it is generally admitted by those using steam boilers, that introducing cold air for the prevention of smoke may be made to effect that object, yet there is a general impression that this is effected only at the expense of a loss in the consumption of fuel. The object of the present paper is to show that smoke from steam boiler and other furnaces may be prevented with an economy in fuel, instead of causing a loss; and the experiments made by the writer, described in the present paper, appear to prove satisfactorily that, by judicious arrangement, cold air may be admitted into the furnace, so as effectually to prevent the production of smoke, and at the same time cause the gases given out from the furnace to produce a more intense heat in their combustion, and to that extent economize the consumption of fuel.

The air, to be most effectual for the prevention of smoke, should be admitted in such a position relative to the furnace as to cause the whole of the products of combustion to come under its influence; and it should be admitted also in such increased or diminished quantities as the varying amount of gases produced may require.

The boiler to which the apparatus described in this paper is applied is of the multitubular construction, a form that presents more difficulty to the prevention of smoke than the various kinds of flue boilers. This boiler is of 30 nominal horse power. The shell is 6 feet diameter by 14 feet long; the furnace is 2 feet $10\frac{1}{2}$ inches diameter by 12 feet long, and is attached to the fire chamber, 1 foot 7 inches long; there are 35 tubes, $3\frac{1}{4}$ inches diameter, leading from this chamber. The fire-grate is 7 feet long, and the top of the bridge is 9 inches from the top of the furnace, and is level across the top.

Between the shell of the boiler and the top of the furnace is fixed a vertical wrought iron tube, 7 inches diameter inside; this is placed directly over the furnace bridge, and through it air is admitted to act upon the products of combustion passing from the furnace over the bridge. On this tube is placed a self-acting apparatus, by which the admission of air is regulated. It consists of an outer casing, which surrounds a cylinder containing water, leaving an annular space, down which air passes to the tube. Projecting upwards from the centre of the cylinder is a guide rod, which receives a floating cylindrical chamber, closed at the top by a plate, which forms a valve cover to the annular air spaces. An opening is made in this plate, to receive a regulating valve, by which air is allowed to escape from the floating chamber, and thereby diminish its buoyancy.

The action of the apparatus is as follows:—When the furnace door is opened for firing, a chain, attached to it and passing over pulleys to a bell-crank lever connected to the cover of the valve, lifts it, together with the air chamber, above the surface of the water contained in the cylinder. When the furnace door is shut, the valve cover falls, until the air retained in the air chamber causes it to float upon the water, in

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which position air is allowed to pass down to the furnace. The regulating valve is adjusted by means of a small screw, so that the valve cover may close or rest upon its seat in 5 or 10 minutes time, more or less, as may be required by the mode of firing adopted, and thus stop the supply of air to the furnace.

The advantages of this apparatus are considered to be, that the air, being admitted in a downward direction, does not beat the flame against the furnace plates and injure them, as is the case when it is admitted in an upward direction. The opening for admitting air cannot be choked up with dust or ashes from the furnace. Air is admitted at a part where the whole of the products of combustion are compelled to pass, and where they are most concentrated. The supply of air gradually diminishes from the time of firing, and ceases altogether when the supply obtained through the fire-grate is sufficient to produce complete combustion. The furnace fittings are as simple as those of an ordinary furnace, and therefore are not more liable to get out of order. The self-acting valve for admitting air is simple in construction, no packings or accurate surface fitting being required; and the apparatus is worked by the fireman without any extra duty whatever beyond that required for an ordinary furnace.

The results of the experiments made with this apparatus applied to the boiler described, have proved that smoke was effectually prevented by its use. During the experiments the process of combustion of the gases was observed through an opening made in the back chamber; and it was found that, immediately after firing, a dense black smoke was produced if the valve was closed, which was instantly replaced by a light white flame when the valve was opened, and so continued as long as the valve was opened to its proper extent; but if closed too soon, as was frequently done for experiment, dense black smoke was again produced. Similar results were observed at the chimney top, except that the transition from dense smoke to no smoke was not so instantaneous as in the chamber, on account of the length of flues to be traversed before reaching the chimney top.

A pyrometer has been attached to the boiler, for the purpose of ascertaining whether the use of this smoke-prevention apparatus was attended with an increased production of heat; and numerous experiments made with it confirm the view that a proper supply of cold air is attended with considerable increase of temperature, particularly immediately after the furnace is supplied with fuel.

Mr. JOHNSON showed the pyrometer that had been used in the experiments, with the regulating cylinder at work, and explained their action. He observed, that the general fear of proprietors of steam boilers that smoke prevention involved a waste of fuel caused a great impediment to the carrying out of smoke burning; and the present apparatus had been devised to meet this difficulty, since waste of fuel was not a necessary accompaniment of the principle, but simply showed a defect in the mode of carrying it out. The object of the pyrometer was to test more fully the result of the apparatus in economizing fuel. The alter-

nate experiments of opening and shutting the air valve always showed a rise of temperature after firing whilst the valve was open, which appeared conclusive evidence of improvement in the employment of the fuel, more heat being generated by the consumption of the same fuel, in consequence of its more perfect combustion.

The CHAIRMAN said, he believed it was generally admitted that the additional supply of air to consume the smoke could be introduced without loss of temperature if properly regulated; but the difficulty was to make the apparatus self-acting, and to insure it from getting out of order. The object might be effected without apparatus, by sufficient care in firing; but it was impracticable to obtain the constant care requisite on the part of the men. The plan described appeared to be well contrived for the purpose, from its simplicity of construction and working, and the principle of action was certainly a good one; it was similar to that of a plan described at a former meeting by one of their members, in which the air was admitted through a regulating apparatus in the fire-door.

Proc. Inst. Mech. Engineers, London.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED FROM APRIL 27 TO MAY 25, 1858,
(INCLUSIVE,) WITH EXEMPLIFICATIONS.

APRIL 27.

258. MACHINE FOR WETTING PAPER; John A. Lynch, Boston, Massachusetts.

Claim—The combination of the wetting cylinder, handle, and roller, the whole constituting a new implement or machine by which the sheet on which the impression is to be taken can be dampened, and its superfluous moisture absorbed by passing the apparatus once over the sheet.

259. HARVESTERS; J. B. McCormick, Versailles, Kentucky.

Claim—The separator formed of the bar and rods, in combination with the adjustable rod, bars, one or more seat and reel, provided with concave beaters when the several parts are constructed.

260. PREPARING STEREOTYPE PLATES; John McElheran, Brooklyn, New York.

Claim—Producing a plate of fixed metallic types for printing from, by stamping letter dies in succession to each other into a plate made of, or coated with, such a substance as will readily take and preserve their impressions, and allow a stereotype or electrotpe to be made thereof, either directly or by means of an intermediate plaster cast, whereby the ordinary process of setting and distributing the type is dispensed with, and but one set of types is used.

261. METALLIC SHOE FOR TRUSS BRIDGES; David H. Morrison, Dayton, Ohio.

Claim—The combination of metallic shoes or angle pieces with several parts of wooden trusses, in such manner that the cuts or gains made in the timbers of the trusses, against which the bearing surfaces on the shoe rest, are at right angles, or nearly so, to the fibres of the timbers, for the purpose of preventing the injurious effects of shrinkage, there being on every shoe at least three such bearing surfaces, one each for the chord, post, and brace.

262. MILL-STONE DRESS; Gabriel Natcher, Indianapolis, Indiana.

Claim—1st, The lines upon the upper portion of the inclined plane of the furrow. 2d, The curved or retarding lines upon the breast circle. 3d, The parallel or uniform lines upon the whole surface, running straight or at any desired curve. 4th, The combination and arrangement of the various parts making up the complete dress of the mill-stone.

263. MILL-STONE DRESS; Gabriel Natcher, Indianapolis, Indiana.

Claim—The application of the diamond in the production of the small lines in any required form upon the face of mill-stones for dressing the same.

264. METAL AWNING; Wm. C. Parison, City of New York.

Claim—The metal plates or strips, so arranged that one may overlap the other, and be kept in proper position by guides, when said plates are used in connexion with toggles and arms, and a windlass, arranged so as to raise and lower, or fold and unfold the plates.

265. COTTON GINS; S. R. Parkhurst, City of New York.

Claim—The manner of connecting a ginning or card cylinder with a stripper, by combining with said cylinder and stripper the internal gear and pinion.

266. ENVELOPES FOR LETTERS, &c.; Charles Phelps, Salem, Massachusetts.

Claim—The application to a letter envelope of an opener therefor, said opener to be attached to, and part of, said envelope.