No. 889,806. PATENTED JUNE 2, 1908.

F. M. REED.

SMOKE CONSUMING APPARATUS.

APPLICATION FILED JUNE 24, 1907.

2 SHEETS—SHEET 1.

Fig 1

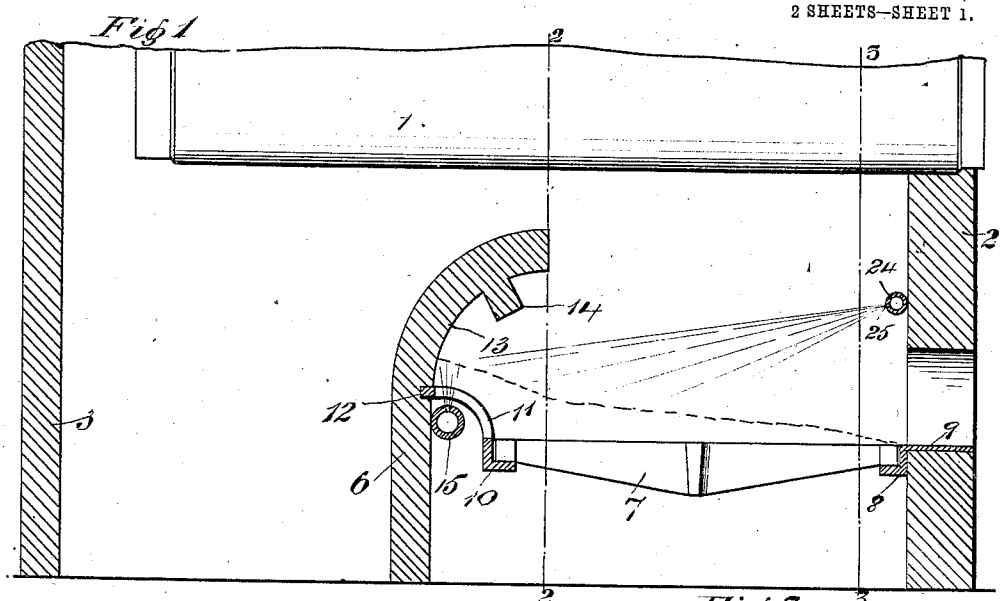


Fig 2.

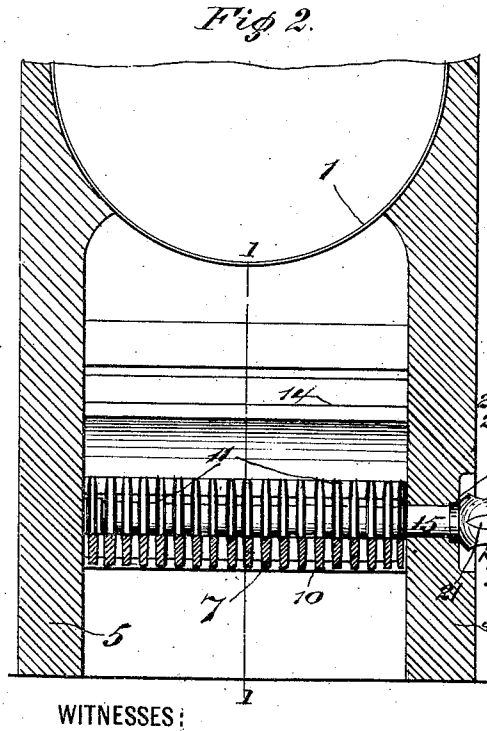
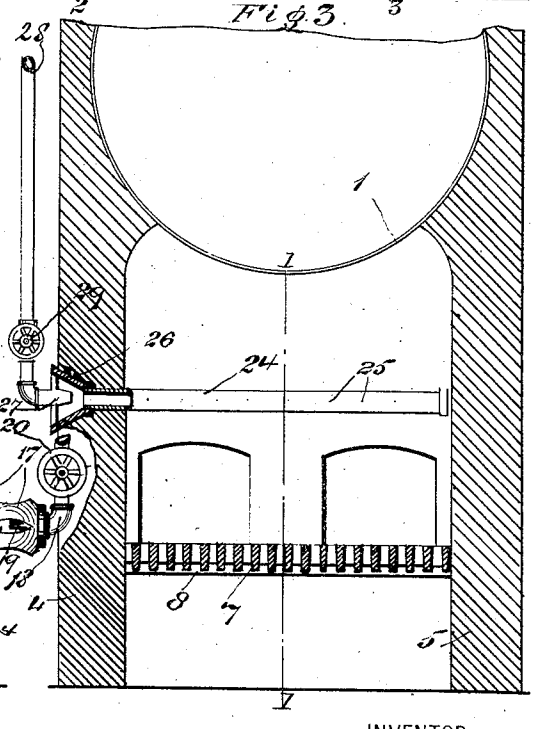


Fig 3.



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2 SHEETS—SHEET 2.

Fig 4

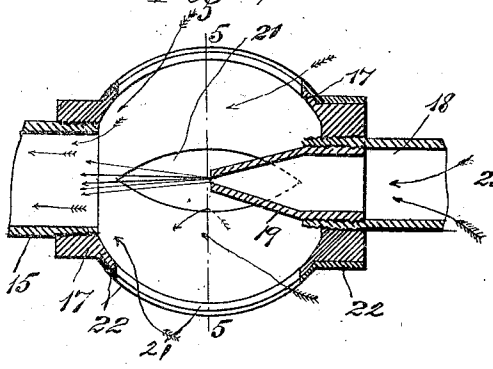


Fig 5

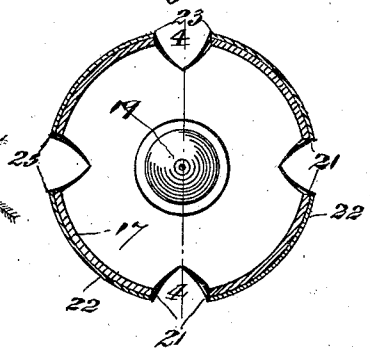


Fig 6

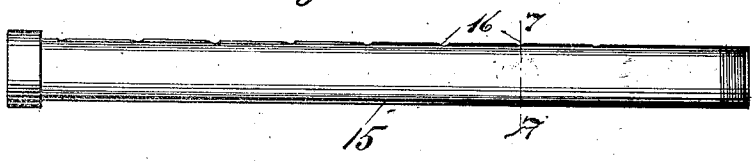


Fig 7

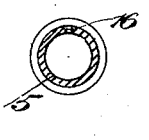


Fig 8

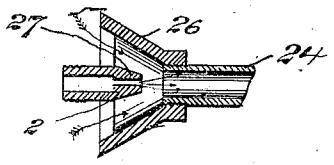
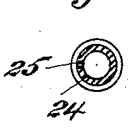


Fig 9

Fig 10



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UNITED STATES PATENT OFFICE.

FRANKLIN M. REED, OF INDIANAPOLIS, INDIANA, ASSIGNOR OF ONE-THIRD TO GEORGE K. SCHOFIELD AND ONE-THIRD TO ROBERT H. COKEFAIR, OF INDIANAPOLIS, INDIANA.

SMOKE-CONSUMING APPARATUS.

No. 889,806. Specification of Letters Patent. Patented June 2, 1908.

Application filed June 24, 1907. Serial No. 380,559.

To all whom it may concern:

Be it known that I, FRANKLIN M. REED, citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Smoke-Consuming Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to new and useful improvements in an apparatus for reducing the generation or formation of smoke in furnaces to a minimum and for consuming that smoke or unconsumed gases that is or may be generated in a furnace.

Various devices whereby air under pressure, steam, or other fluid blasts have been applied and used in connection with boilers and other furnaces of various constructions with a view of creating a perfect and fierce combustion of the fuel in the furnace to either prevent a formation of the smoke or a consumption of the latter after being formed. None of the appliances heretofore in use have satisfactorily performed the function required of them to that degree as to render them useful and practical and a valuable adjunct to a furnace of a steam boiler or other furnace in which soft or bituminous coal is used as a fuel.

The object of this invention is to provide an apparatus, that, by the coöperation of the parts thereof, a zone of intense heat is created and maintained at a certain fixed portion of the furnace and whereby the unconsumed gases are directed toward and into said zone and retarded in their onward course at this point to be consumed; also, to provide means coöperating with the above means whereby a whirling motion or eddy of the retarded gases is created at said zone of intense heat whereby the partially consumed gases are thoroughly mixed with the oxygen of the air to support their combustion to contribute to the maintenance of the high temperature at this portion of the fire or zone of heat. I attain these objects by means of the apparatus illustrated in the accompanying drawings in which like numerals of reference designate like parts throughout the several views.

Figure 1 is a longitudinal sectional elevational view of a boiler furnace taken along the line 1—1 in Figs. 2 and 3; Fig. 2 is a transverse sectional elevational view of the same taken along the line 2—2 in Fig. 1; Fig. 3 is a similar sectional view taken along the line 3—3 in Fig. 1; Fig. 4 is an enlarged detail sectional view the air-collecting chamber of the twyer taken along the line 4—4 in Fig. 5; Fig. 5 is a transverse detail sectional view of the same taken along the line 5—5 in Fig. 4; Fig. 6 is an enlarged detail view of the twyer pipe; Fig. 7 is a transverse sectional view of the same taken along the line 7—7 in Fig. 6; Fig. 8 is an enlarged detail sectional view of the air-collecting chamber of the forward jet-pipe; Fig. 9 is an enlarged detail view of the forward jet-pipe; and, Fig. 10 is a detail end sectional view of the same taken along the line 10—10, in Fig. 9.

The following is a description of my invention in such full, clear, concise and exact terms as to enable others skilled in the art to which it appertains to construct, operate and use the same.

Figs. 1, 2, and 3 are illustrations of a boiler furnace in which 1 designates a broken portion of a boiler, 2 the front wall of the boiler setting, 3 the rear wall, 4 and 5 the side walls, 6 the bridge-wall of the furnace and 7 the grates thereof. The grates 7 are supported at their forward ends by the cross-beam 8 formed integral on the dead plates 9, and the rear ends of said grates are supported by the cross-beam 10 and both of which beams are built into said side walls which support them. The twyer protecting grate 11 is formed integral on the grate supporting beam 10 and curves upwardly above the level of the grates 7 and backwardly to the bridge-wall 6 terminating in the cross-bar 12 with which it is formed integral. The cross-bar 12 is built into the bridge-wall 6 of the furnace to protect it from the intense heat of the furnace at this portion of the fire to prevent it warping or twisting by an unequal or irregular heating to maintain the bars of the grate 11 in their relative positions.

That portion of the bridge-wall 6 situated above the approximate level of the fire is arched or curved, and said arched surface is so disposed that its concave surface 13 is directed toward the fire of the furnace so that the gases generated from the fire in the furnace in their passage over said fire will be intercepted by it and a circular or whirling motion or eddy at the zone of intense heat of the furnace will be imparted to them to thoroughly mix said gases with the oxygen

of the air admitted into the furnace through the furnace-doors and the jet and twyer pipes, hereinafter described, to retard their movement at this point in order to the more completely consume the unconsumed products of combustion and to prevent the formation of smoke.

A baffle 14 extends directly across and projects from the concave surface 13 of the bridge-wall 6 which is provided to intercept and operate to deflect the gases downwardly toward and upon the surface of the rear hot portion of the fire. The deflector 14 is constructed of fire-brick or other brick of a refractory material built into the bridge-wall 6 so as to project the required distance beyond the concave surface 13 thereof, as shown in Fig. 1.

The twyer or rear-blast-pipe 15 is situated at the rear of the furnace and extends horizontally under the protecting grate 11 and said twyer or rear blast-pipe 15 is provided with a series of blast or jet openings 16 arranged at suitable intervals apart along said twyer or blast-pipe and so situated relative to the fire over the grate 11 as to impinge directly up and against it so as to maintain an intense combustion at this portion of the furnace.

The twyer pipe 15 projects through the side wall 4 and on this projecting end situated exteriorly of said side wall is mounted an air-collecting-chamber 17 whereby the air is collected to be forced into the said twyer-pipe 15 to supply the necessary volume of air to the jet openings 16 thereof to form air-jets or blasts of the required pressure. A steam pipe 18 is connected to the steam nozzle 19 of the air collecting chamber 17 and said pipe is provided with a suitable valve 20 whereby the supply of steam to said nozzle is controlled. Air-inlet openings 21 are provided for the supply of air to said collecting chamber 17 and a registering valve 22, provided with valve openings 23, surrounds and fits over the surface of said chamber to be turned thereon so as to control the admission of the air into said air-collecting chamber 17. The construction and operation of the said air collecting chamber being for the most part, similar to other air-collecting and mixing chambers which are of common use and well known a further detailed description of the same is unnecessary.

The next important element in this invention is the forward jet-pipe 24 whereby the products of incomplete combustion of the fuel situated at the forward portion of the fire or that portion of the fire situated toward or near the fire-doors of the furnace and said jet-pipe is arranged to coöperate with the twyer-pipe 17, previously described, to completely consume the unconsumed smoke and gases generated in the furnace.

The forward jet-pipe 24 is situated in the interior front portion of the furnace to extend over the fire-door openings thereof or a suitable distance over the top of the front portion of the fire and said jet-pipe is provided with a series of jet-openings 25 which are arranged at suitable intervals apart along said pipe and are proportioned in number and size to provide a sufficient volume of fluid to force the products of incomplete combustion of the fuel downwardly upon the surface of the fire and direct them toward the heat zone of the furnace.

The forward jet-pipe 24 projects through and beyond the outer side of the side wall 4 and on the projecting end is secured an air collecting chamber 26 which is flared outwardly towards its air-inlet end to provide air-inlet passages of suitable area around the nozzle 27, formed integral with said chamber, for the admission of the requisite amount of air to supply said jet-pipe 24. A steam supply pipe 28 is connected to the boiler 1 or other suitable source of supply and to the nozzle 27 and said steam pipe 28 is provided with a valve 29 whereby the supply of the steam to said nozzle is controlled.

The operation of this invention is as follows:—The fire having been started in the furnace, the air blast of the twyer-pipe 15 is first put into operation by turning the valve 20 to supply steam under pressure to the nozzle 19 to create an intense combustion of the fuel in the vicinity of and above the twyer-pipe 15. I next put the air-blasts from the pipe 23 in operation by means of the valve 29. These air-jets, as previously explained, are directed toward the bridge-wall 6 and that portion of the fire situated over the protecting grate 11 of the twyer-pipe 15 carry and direct the unconsumed products of combustion toward and into the heat zone to be consumed. The concave side 13 of the bridge-wall 6 being situated toward the fire and a deflector 14 being situated in the surface of said concavity, as shown and previously described, operate to produce a whirling downwardly motion to the unconsumed products of combustion and the gases generated in the furnace to direct them to and into the heat zone of the fire to be completely consumed thereby preventing a formation of smoke.

I claim:—

1. In a smoke consuming apparatus, the combination with a furnace, a bridge wall having a concaved front side, said concaved side being directed toward and over the rear portion of the fire of the furnace, and a blast pipe situated in the front of the concaved side of said bridge wall and having a series of blast openings arranged at intervals apart along said pipe, said pipe situated on a level with the top of said grate of the furnace and coöperating with said bridge wall, of a steam jet-pipe coöperating with said bridge

wall and said blast pipe to concentrate the unconsumed products of combustion and having a series of jet openings arranged at intervals apart along said pipe and directed toward said rear blast pipe.

2. In a smoke consuming apparatus, the combination with a furnace, a blast pipe situated at the rear of said furnace on a level with the grate thereof having a series of blast openings distributed at intervals apart, and a rear arched grate projecting over said blast pipe to protect the latter from the fire, of a steam jet pipe having jet openings arranged at intervals apart, said jet pipe cooperating with said blast pipe and situated at the front interior portion of said furnace above the level of the fire thereof.

3. In a smoke consuming apparatus, the combination with a furnace, a bridge-wall having its top side portion concaved, said concaved side portion being directed toward and over the rear portion of the fire, a baffle extending across and projecting from the face of said concaved surface and situated above the level of the rear portion of the fire of the furnace, and a twyer situated in front of said concaved surface of said bridge-wall and on a level with the top of the grate of the furnace, of a steam jet-pipe coöperating with said twyer and said concaved bridge-wall situated at the front interior portion of said furnace above the level of the fire thereof.

In testimony whereof I affix my signature in presence of two witnesses.

FRANKLIN M. REED.

Witnesses:

THOMPSON R. BELL,

ROBERT H. COKEFAIR.