W. A. WATTERSON.

APPARATUS FOR ECONOMIZING FUEL.

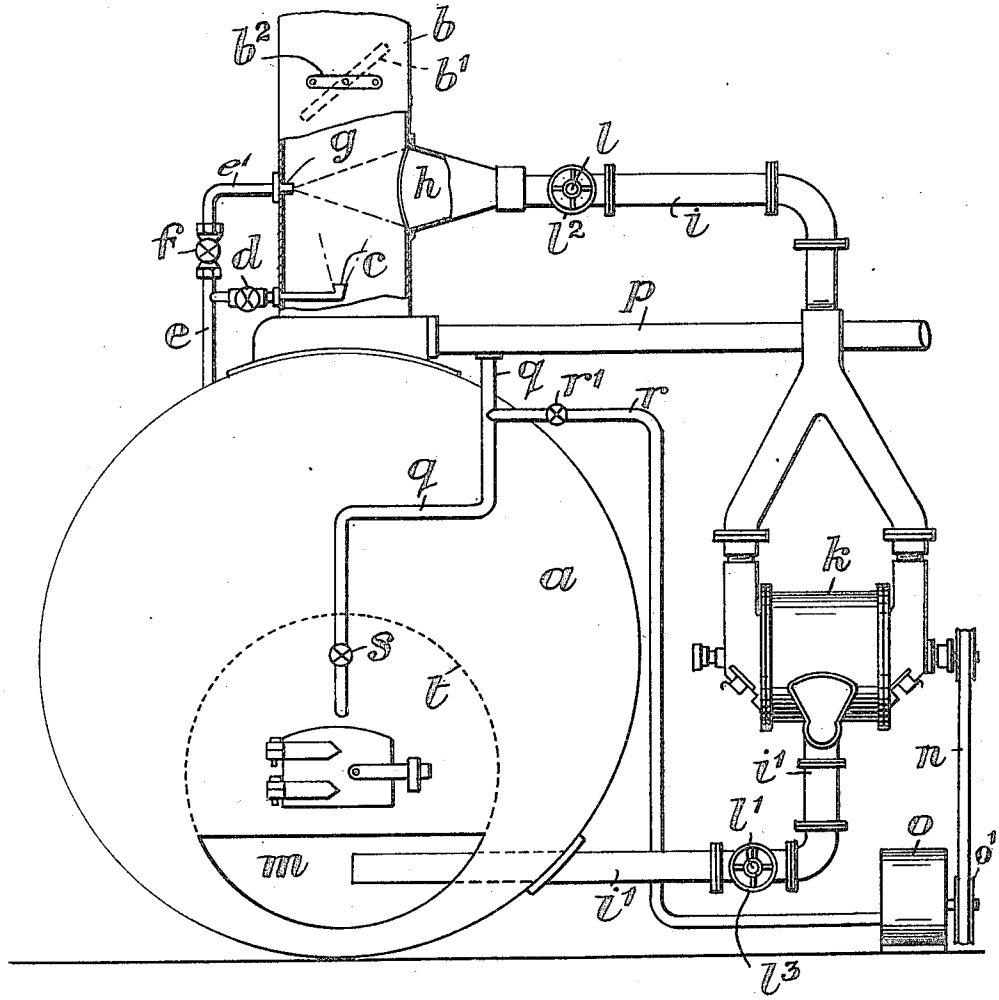
APPLICATION FILED SEPT. 3, 1919.

1,384,223.

Patented July 12, 1921.

2 SHEETS—SHEET 1.

FIG. 1.



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2 SHEETS—SHEET 2.

FIG. 2.

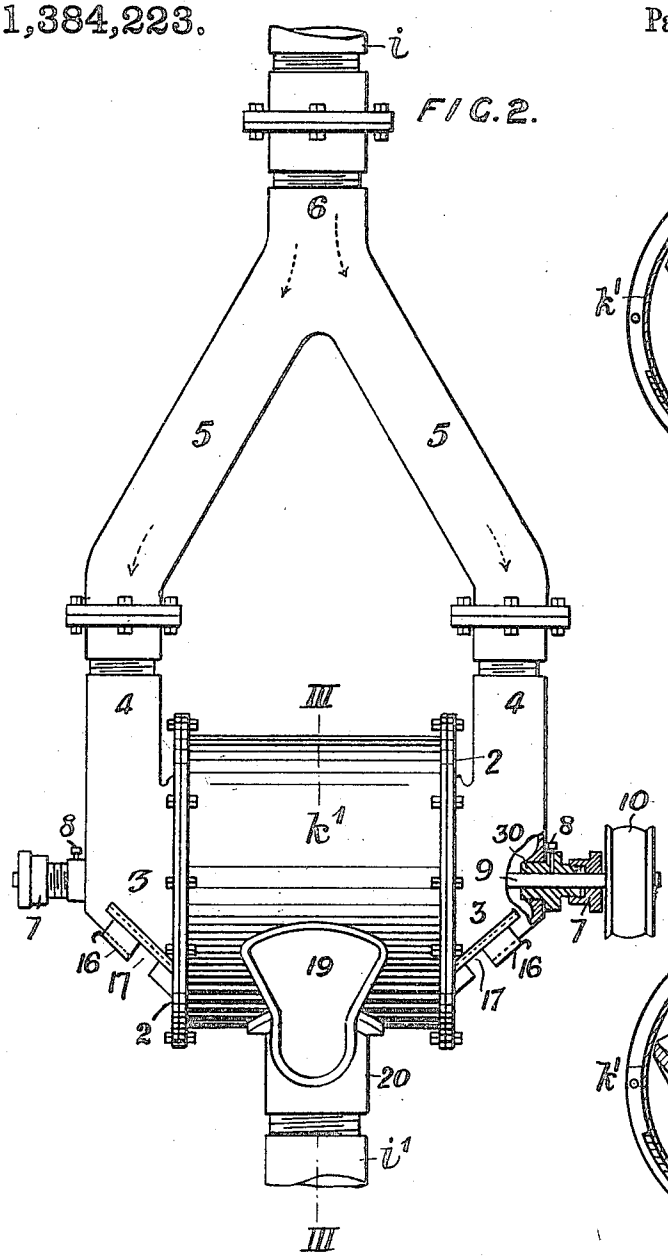


FIG. 3.

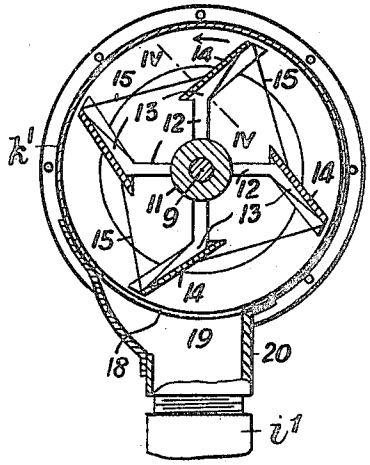


FIG. 4.

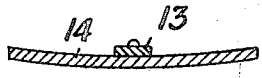
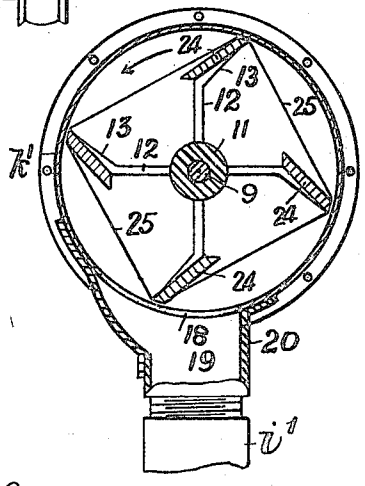


FIG. 5.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR ECONOMIZING FUEL.

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To all whom it may concern:

Be it known that I, WILLIAM ANDREW WATTERSON, a subject of the King of Great Britain, residing at No. 1 Jet and Dredge, Macquarie River, Euchareena, New South Wales, Australia, have invented certain new and useful Improvements in Apparatus for Economizing Fuel, of which the following is a specification.

According to this invention the apparatus comprises a plurality of nozzles in the chimney, uptake or funnel for supplying a jet or jets of steam at a low pressure and producing a flow of steam and products of combustion in a pipe or conduit leading from the chimney and opposite to the place where the jet or jets is or are projected to the ashpit. The said pipe has mounted therein a rotary fan or blower having the two-fold function of mixing and forcing the unburnt gases, hot air, sparks, flame, smoke and the like into the ashpit where they pass into the fire so that complete combustion is insured and no sparks are given off.

This rotary fan or blower comprises a casing, which is suitably made cylindrical and provided with a cover at each end and a central coned extension, furnished with a branch pipe or conduit on each end cover in communication with the suction pipe. The shaft is rotatable in air-tight bearings in the said coned extensions and has a number of arms, each of which carries an inclined concave blade, the outer edge of which is shaped or fashioned so as to be concentric with the wall of the casing. The latter is provided with an approximately tangential delivery duct to which the discharge pipe is connected. The branch pipes on the end covers are conveniently connected to the suction pipe by means of a breeches pipe or bifurcated conduit. One or both of the central coned extensions on the end covers is furnished with a valve to admit air from the atmosphere, if desired, and thus control the suction pressure in the chimney or uptake.

In order that the invention may be more readily understood, reference will be made to the accompanying drawings, illustrating one suitable construction and in which—

Figure 1 is an end elevation with portions broken away of a boiler provided with the spark arresting and fuel economizing apparatus.

Fig. 2 is a side elevation, to a larger scale, of a blower constructed according to this invention.

Fig. 3 is a transverse sectional elevation on the line III—III Fig. 2.

Fig. 4 is a sectional view on the line IV—IV Fig. 3 and

Fig. 5 is a view, similar to Fig. 3, showing another arrangement of rotary fan blades.

As shown in Fig. 1, the boiler *a* has a flue or chimney *b* provided, at a short distance above the boiler or smoke box with a hole through which is introduced a small nozzle *c* projecting into the middle of the chimney and turned upward at the end which terminates in a bell mouth. This nozzle *c* is connected by a valve *d* to a steam pipe *e*, the other end of which is connected to the boiler *a*. This nozzle *c* serves to assist and steady the upward movement of the products of combustion, sparks and so on up the flue or chimney. The steam pipe *e* is continued upward, is similarly provided with a valve *f* and furnished with a bend e^1 having a nozzle *g* at its extremity and projecting through a hole into the flue for the purpose of discharging the main jet of steam. Opposite to this nozzle *g*, the flue is provided with a hole which may be of about half the diameter of the chimney, and riveted or fixed thereto is a tapered or funnel-shaped pipe *h*, the smaller end of which is connected to a pipe *i* provided with a rotary suction fan or blower *k*, and there is a valve *l* in the pipe leading to the fan, while the pipe or conduit i^1 beyond the fan *k* is provided with a valve l^1, the opposite end of the pipe i^1 projecting into the ashpit *m*. The valves *l* and l^1 preferably are mounted on spindles of the throttle type, and each spindle is provided with a handle or wheel marked l^2 and l^3, respectively, for controlling or setting the valve in position. The chimney or flue damper b^1 is provided with a double armed lever b^2 at one end of its spindle, projecting outside of the flue. The rotary blower or fan *k* is driven by a belt *n* from an engine or steam turbine *o* or other source of power, or the rotary blower may be coupled direct thereto. In the construction shown the engine *o* is supplied with steam through the main steam pipe *p* branch pipe *q*, valve r^1 and branch pipe *r*. The branch pipe *q* is also furnished with a valve *s* and leads into the furnace or firebox *t* above the grate.

The fan, as shown in Figs. 2, 3 and 4, comprises a cylindrical casing k^1 and each end cover 2 is furnished with a central conical extension or chamber 3 provided with a branch pipe 4. The branch pipes 4 are connected by flanges and bolts or otherwise to a bifurcated conduit or breeches pipe 5, 5, the other portion 6 of which is similarly connected by flanges and bolts or otherwise to one end of the suction pipe i. Each conical extension 3 is provided with a stuffing box 7, and a lubricator 8 for the shaft or spindle 9 of the fan. If desired, the bearings 30 may be extended or lengthened inward or each end cover 2 may also have a bearing to adequately support the shaft 9 within or nearer to the casing. The shaft has mounted thereon a pulley 10 and a boss 11 (Fig. 3) with a number of radial arms 12, each of which has a bent or angular extension 13 at its outer end. Each bent portion has suitably riveted thereto a curved or concavo-convex plate 14.

As shown, the blades 14 are far enough apart to allow space between them to permit a better mixing of the products of combustion while being conveyed to the ash-pit m.

The outer ends of the blades of the fan are adapted to rotate in proximity to the inner periphery of the casing or drum k^1 and the inner ends of the blades are adapted to rotate in the neighborhood of the central openings in the end covers for admission of the mixed steam and products of combustion to the casing from the conical chambers 3. As shown in Figs. 3 and 4, the blades 14 are convex toward or in the direction of rotation and correspondingly concave behind. If desired the blades 14 may be connected and stayed or braced together by a wire or wires 15 at or near their outer ends. Each wire 15, for example, is connected at one end to the outer end of a blade 14 and at the other end to the angular extension 13 of an adjacent radial arm 12. Each conical chamber 3 is, moreover, provided with an opening 17, which may be about opposite to the branch pipe and is furnished with a slide or flap 16, adapted to control the area of the aperture 17 to the atmosphere and regulate, according to the amount of opening, the suction pressure in the uptake or chimney b.

The casing k^1 is also provided with a discharge opening 18 (Fig. 3) extending around about a sixth of the circumference of the casing and the latter has fixed thereto a smaller casing forming a tangential duct 19 leading to the discharge pipe i^1. This aperture 18 is conveniently made fan-shaped and the duct 19 is shallow at the wide and entering end of the aperture 18 and tapers gradually with increasing width and increasing depth toward the small or narrow end where it merges into the tubular extension 20 to which the discharge pipe i^1 is connected. This discharge duct 19 may be integral with the casing k^1 or it may be screwed or bolted thereto, as shown.

As shown in Fig. 5, the fan blades 24 are mounted in such a manner that their concave or hollow surfaces are toward or in the direction of rotation and are correspondingly convex behind. In this example, the blades are tied or stayed together by wire 25 extending all around from the outer periphery of one blade to the next.

In operation, and if the pressure of the steam issuing from the jets c and g and the amount of the opening of the damper b^1 and the valves l l^1 be properly adjusted, only carbonic acid gas is discharged, and neither smoke nor sparks can escape into the atmosphere no matter how dirty or damp the fuel may be. The imperfectly consumed products of combustion being returned to the ashpit m under pressure produced by the action of the jet or jets c g and assisted by the fan or blower k, cause a gentle or forced draught and are again heated before passing into the fire where they are practically consumed, thereby effecting substantially complete combustion and consequently great economy of fuel. If the steam jet q be turned on at high pressure this forms a very effectual method of damping or extinguishing the fire and thus consequently saves drawing the fire in case of emergency, or at the end of the day's work. There are also numerous other advantages inherent to this invention which need not be specifically enumerated because they result from the freedom from sparks, smoke, perfect combustion and facility with which the fire may be controlled.

I claim—

1. In an apparatus of the character described, the combination with a furnace, of a main steam jet entering the flue of the furnace and directed across the direction of flow, an auxiliary steam jet entering the flue below the main jet and directed in the direction of flow, an exhaust conduit communicating with the flue opposite the main jet, and communicating with the ash-pit of the furnace.

2. In an apparatus of the character described, the combination with a furnace, of a main steam jet entering the flue of the furnace and directed across the direction of flow, an auxiliary steam jet entering the flue below the main jet and directed in the direction of flow, exhaust conduit communicating with the flue opposite the main jet and communicating with the ash-pit of the furnace, and a rotary fan communicating with the conduit between the flue and ash-pit.

3. In an apparatus of the character described, the combination with a furnace, of

a main steam jet for discharging into the furnace flue transversely to the axis of the flue, an auxiliary steam jet for discharging into and axially of the flue, an exhaust conduit communicating with the flue opposite the main jet and communicating with the ash-pit of the furnace, and a steam jet for discharging into the furnace above the fuel.

4. In an apparatus of the character described, the combination with a furnace, of a main steam jet for discharging into the furnace flue transversely to the axis of the flue, an auxiliary steam jet for discharging into and axially of the flue below the main jet, an exhaust conduit communicating with the flue opposite the main jet and communicating with the ash-pit of the furnace, a steam jet for discharging into the furnace above the fuel, and a rotary fan communicating with the conduit between the flue and ash-pit.

5. Apparatus for treating products of furnace combustion and for economizing fuel comprising, in combination, a main steam jet device, entering the flue for carrying off the products of combustion and directed across the direction of flow, an auxiliary steam jet device also entering the said flue below the main steam jet device and adapted to discharge a jet in the direction of flow, a conical mouthpiece connected by its wide end with the side of the flue opposite to the main jet device, a pipe connected at one end with the small end of the mouthpiece, a rotary fan casing, both ends of which are connected to the said pipe, a peripheral, approximately, tangential discharge duct in the said casing and connected to one end of a delivery pipe, the said delivery pipe adapted at its other end to enter the ashpit of the furnace, a rotary fan, revolubly mounted in the said casing and means for driving the said fan.

6. Apparatus for treating products of furnace combustion and for economizing fuel comprising in combination, a main steam jet device, entering the flue for carrying off the products of combustion and directed across the direction of flow, an auxiliary steam jet device also entering the said flue, below the main steam jet device, and adapted to discharge a jet in the direction of flow, a conical mouthpiece connected by its wide end with the side of the flue opposite to the main jet device, a pipe connected at one end with the small end of the mouthpiece, a rotary fan casing, both ends of which are connected to the said pipe, a peripheral, approximately, tangential discharge duct in the said casing and connected to one end of a delivery pipe, the said delivery pipe adapted, at its other end to enter the ashpit of the furnace, a rotary fan, revolubly mounted in the said casing, means for driving the said fan and a pipe adapted to discharge live steam into the furnace above the fuel.

7. Apparatus for treating products of furnace combustion and economizing fuel, comprising in combination, a main steam jet device, entering the flue for carrying off the products of combustion and directed across the direction of flow, an auxiliary steam jet device entering the said flue, below the main steam jet device, and adapted to discharge a spreading jet, approximately in the direction of flow, a conical mouthpiece connected by its wide end with the side of the flue opposite to the main jet device, a pipe connected at one end with the small end of the mouthpiece, a rotary fan casing, both ends of which are connected to the said pipe, a peripheral, approximately, tangential discharge duct in the said casing and connected to one end of a delivery pipe, the said delivery pipe adapted, at its other end to enter the ashpit of the furnace, bearings in the coned connection, a rotary fan spindle mounted in the said bearings, a boss on the said spindle having arms with radial extensions, curved fan blades mounted on the said extensions and means for driving the said spindle.

8. Apparatus for treating products of furnace combustion and economizing fuel comprising, in combination, a main steam jet device entering the flue for carrying off the products of combustion and directed across the direction of flow, an auxiliary steam pipe entering the said flue below the main steam jet device, a bell-mouthed nozzle for the said auxiliary steam pipe and adapted to discharge a spreading jet approximately in the direction of flow, a conical mouthpiece connected by its wide end with the side of the flue opposite to the main jet device, a pipe connected at one end with the small end of the mouthpiece, a breeches pipe connected to the other end of the said pipe, a rotary fan casing, a central coned connection at each end of the said casing, each of said connections being joined to one of the bifurcations of the said breeches pipe, a peripheral, approximately, tangential discharge duct in the said casing connected to one end of a delivery pipe, the said delivery pipe adapted, at its other end, to enter the ashpit of the furnace, a rotary fan spindle mounted in bearings in the said casing, the said bearings, a boss on the said spindle having arms with radial extensions, curved fan blades mounted on the said extensions, means for driving the said spindle and a pipe adapted to discharge live steam into the furnace above the fuel.

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