

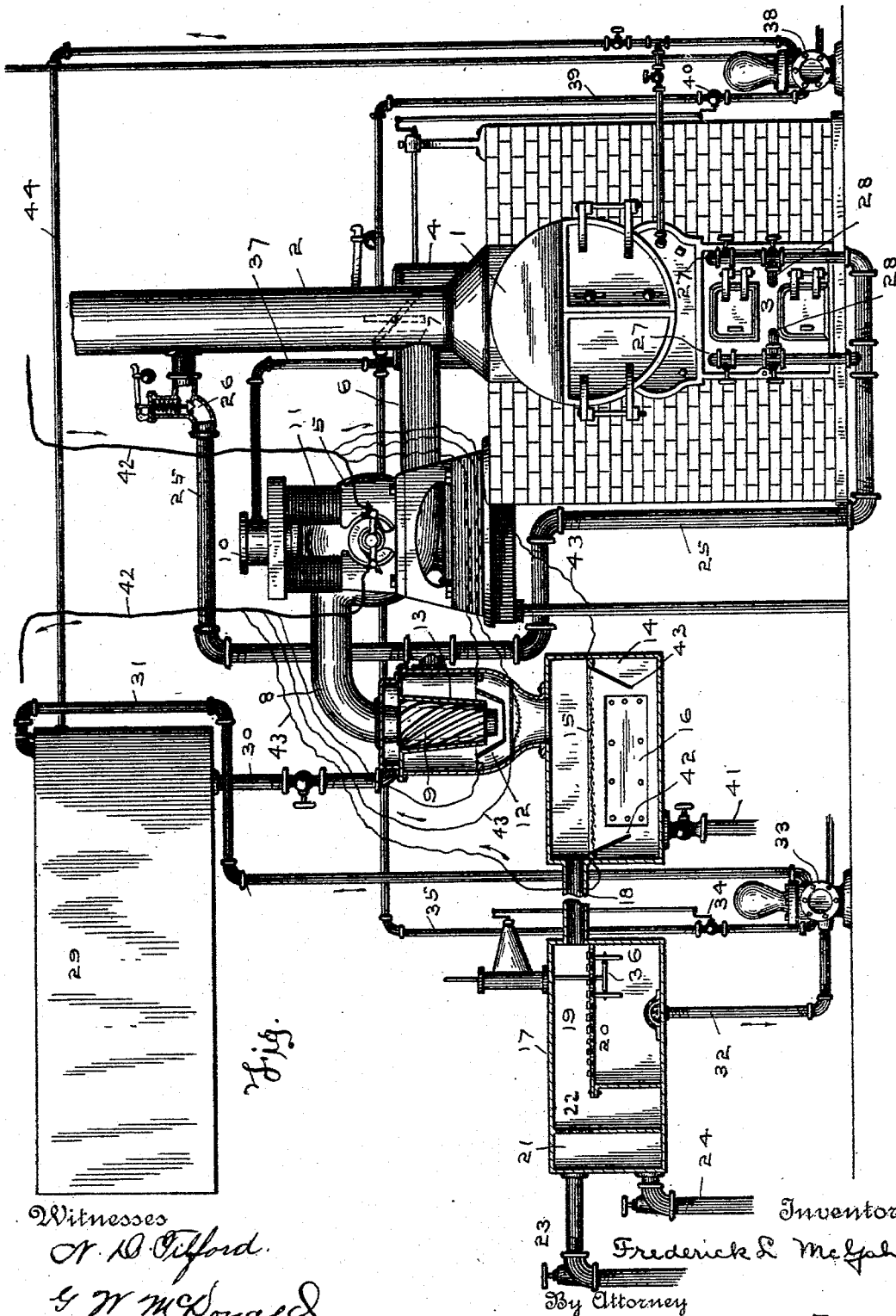
(No Model.)

2 Sheets—Sheet 1.

F. L. McGAHAN.
SMOKE CATCHER AND SEPARATOR.

No. 515,528.

Patented Feb. 27, 1894.



Witnesses

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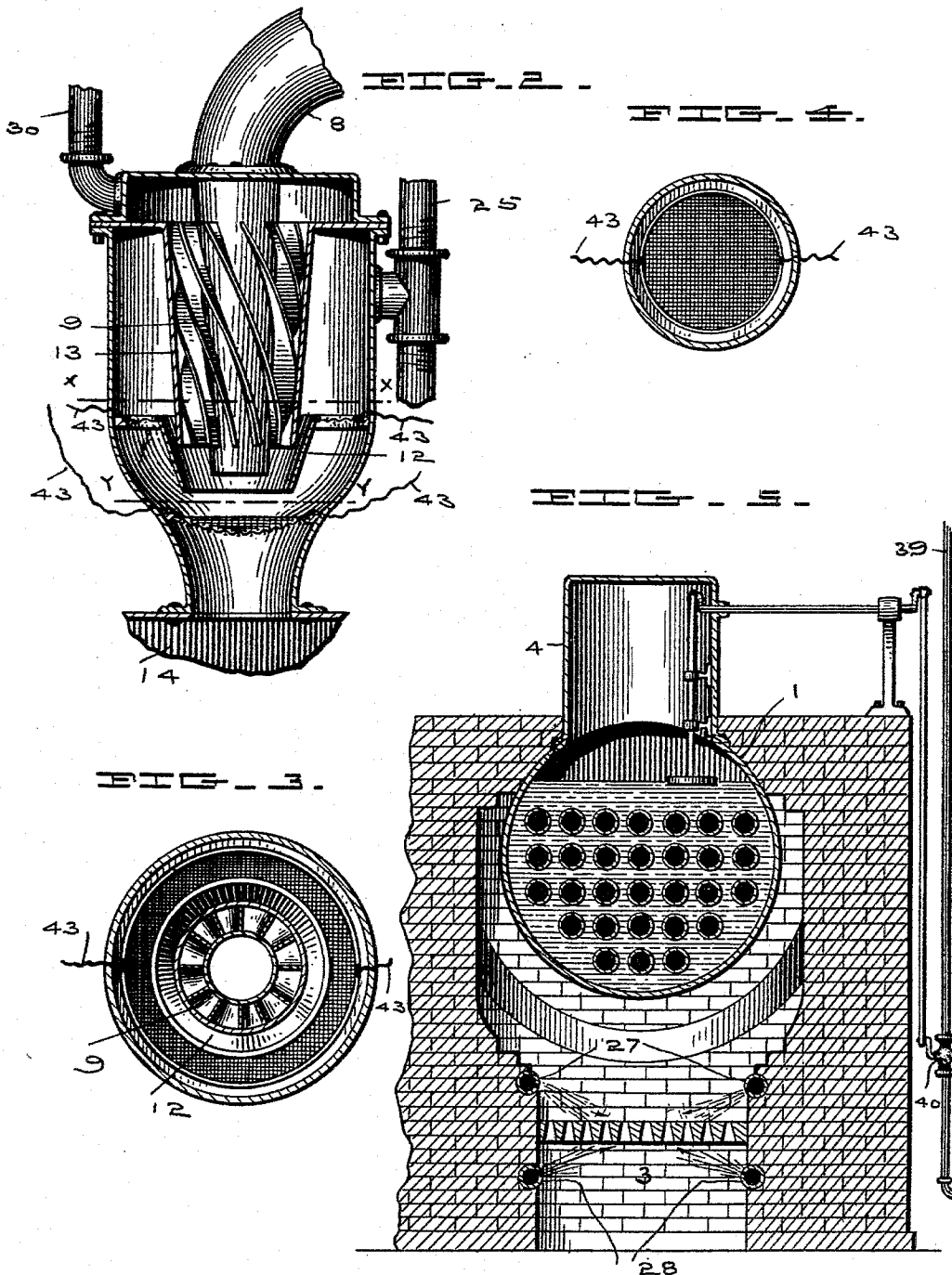
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UNITED STATES PATENT OFFICE

FREDERICK L. MCGAHAN, OF ST. LOUIS, MISSOURI.

SMOKE CATCHER AND SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 515,528, dated February 27, 1894.

Application filed July 13, 1893. Serial No. 480,350. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK L. MCGAHAN, a citizen of the United States, residing in the city of St. Louis and State of Missouri, have
5 invented certain new and useful Improvements in Smoke Catchers and Separators; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to
10 which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

15 My invention relates to new and useful improvements in an apparatus for catching the smoke from boiler furnaces and separating and saving the products therefrom which are chiefly composed of sulphate of ammonia,
20 which is a most valuable fertilizing agent, and other valuable elements which through the construction of my apparatus can be saved, and a new hydrogen gas formed which is returned to the furnace from the water trap,
25 having there supplied itself with oxygen taken from the water, makes almost complete combustion when mingled with the other gases in the furnace and what little is not given to complete combustion is again returned to the
30 water trap and given new life, thus using these gases over and over, it is possible to reach the very closest per cent. of economy in all classes of fuel. While nearly all kinds of coal contain large quantities of an aqueous
35 fluid, essential oil and various ammoniacal salts that can be converted after being saved into a considerable revenue, by the return of the gases to the furnace creating more complete combustion therein and the fertilizer
40 salts which are the most easily saved will more than pay the first cost of the fuel used, besides netting a nice interest on the cost of the plant. If desired by adding an exhaust steam drier and separating pan system, a fine
45 quality of coal tar, lamp black and parting powder for use in foundries may be obtained.

Referring to the drawings Figure 1 represents a general view of my improved apparatus partly in elevation and partly in section. Fig. 2 is an enlarged sectional view of
50 the water trap with the insulated wire screens therein. Fig. 3 is a cross sectional view through

the same on the line $x-x$. Fig. 4 is a similar view on the line $y-y$. Fig. 5 is an enlarged sectional view through the fire box of the furnace and also through the boiler.

1 represents a steam boiler which supplies steam to power.

2 is the stack and 3 the furnace, 4 being the steam dome.

5 is an exhaust fan which may be supported at any suitable point near the boiler, its exhaust pipe 6 connected to the breeching or smoke stack 2 as at 7 and its discharge pipe 8 entering into the top of the centrifugal water spreader 9 hereinafter described, and extending entirely through such water spreader, the pipe 8 ending at a point a little below the lower end of the spreader. A damper may also be placed in the stack 2 as shown in dotted lines in Fig. 1 to regulate the amount of smoke, &c., that is to pass into the exhaust pipe of the fan, but this is hardly necessary as the suction from the fan being greater than the natural draft through the stack, it will draw to its capacity and the remainder will necessarily pass up the stack.

For running the exhaust fan 5, a small vertical engine 10 is connected with the fan shaft by a sliding clutch pulley so it may be thrown in and out of gear. This engine is used to run the exhaust fan when steam is not allowed to go down in the boiler at night, but when steam is kept up only during the day, I have connected on the opposite side of the fan from the engine a direct contact electric motor which may be connected directly to the shaft of the fan by a clutch or by a belt as desired, the engine and motor being so geared and regulated as to give the desired speed to the fan so that the desired amount of draft will be obtained regardless of stack draft or atmospherical changes.

The centrifugal water spreader 9 may be of any well known form and its lower end opens through a contracted nozzle around the end of the smoke discharge pipe 8 into the water trap 12 which is a cylindrical casing having a contracted base and its upper part is divided into an inner and outer chamber by the depending wall 13 inside of which is the centrifugal water spreader 9. In the water trap 12 are suitably supported from its walls, and insulated therefrom in any suit-

able manner the copper wire screens which are so placed as to be readily removed the object of this insulation being, to allow the electric current which passes through the screens no escape from them except over the wires 42. The water trap opens at the bottom into a water basin 14 in which is a copper wire screen 15 supported on angle irons, and insulated therefrom the object of this screen being to form a break or separator between the heavy and flaky particles that are discharged into the basin from above. The basin has a removable door 16 in its side so that the screen can be cleaned at any time, this screen being removable.

17 is a second water basin separated from the first by the pipe 18 near the top, this latter basin being divided into three chambers or compartments, 19, 20 and 21, the first 19 being under the top of the basin and extending down between the chambers 20 and 21, the dividing plate between the top of the chamber 20 and the chamber 19 being finely perforated, such perforations being counter-sunk from the under side and the holes then outverted by a small punch.

In the wall or plate which forms the partition between the chambers 19 and 21 near the top are perforations 22 and opening from the chamber 21 are the pipes 23 and 24 with valves therein, the former pipe being a surface drain for skimming all oils and light materials into a receptacle not here shown, and which is the subject matter for another application, the latter pipe being a drain to draw from the chamber 21 the heavy solids deposited therein and drain them into a reservoir not hereshown, and from which it can be taken, and any valuable substances distilled therefrom and saved, this also being the subject of another application.

25 is an escape pipe leading from the water trap 12 near its top, one branch entering the stack 2 and having a safety or pressure valve 26 therein near such stack, the other branch extending around to the front of the furnace 3 where it has two sets of branches 27 and 28, these having regulating valves therein, the pipes 27 entering the fire box and extend one brick deep inside the furnace walls and just the length of the furnace grates and have slotted openings therein, these slots being directed downward toward the center of the grate on an angle of about forty-five degrees, the pipes 28 extending in the ash pit of the furnace just within its walls and have slotted openings therein which are directed upward toward the grates at about an angle of seventy degrees.

29 is a water tank supported at a sufficient height and 30 is an outlet pipe with a valve therein leading into a water basin in the top of the water spreader 13, the spiral gutters of the spreader opening into this basin, 31 being the return pipe to the tank 29 from the chamber 20, the suction pipe 32 of a pump 33 entering the bottom of such chamber and pump-

ing the water back to the tank 29, the pumping being regulated by a valve 34 in its steam pipe 35, the valve in turn controlled by a float 36 in the chamber 20. Steam is supplied the pump 33 through the pipe 35 from the dome 4 of the boiler as is also the engine 10 through the pipe 37, and the pump 38 through the pipe 39, this latter being the boiler feed pump and its valve 40 is regulated through a float in the boiler, these floats being of any ordinary or well known form.

41 is a pipe with a valve therein through which any deposits in the water basin 14 may be drawn off for distillation and separation.

42 are the main circuit branch wires for supplying a current to the motor and 43 are wires for passing an electric current through the screens in the water trap and the screen 15 in the first water basin.

Having mentioned the several parts of my improved apparatus, I will now describe its operation, which is as follows: The tank 29 being filled with a water supply and the furnace having the necessary fuel therein, upon being lighted, the electric motor is started and the fan set in motion, the engine being disconnected. A regular and steady draft will be established by the fan and a quick ready fire started, all smoke and unconsumed particles are discharged by the fan into the water trap through the centrifugal water spreader, this having been started at this time by the water supply being turned on through the pipe 30 from the tank 29, the water passing through the spreader tending to partly cool the smoke, &c., passing through the end of the pipe 8, the water being showered in a circular sheet through the nozzle at the end of the centrifugal water spreader, and around the end of the outlet pipe 8 absorbs instantly the smoke and these being dashed by the water and the blast from the fan into the funnel shaped nozzle which supports the upper screen in the water trap and against the lower screens in such water trap thus become integral and the effect of the heat and cold coming in contact with each other so forcibly, is that a certain part of the oxygen is liberated and rises with other hot gases from the funnel below the water spreader to the top of the water trap, the electric current passing through the screens or not as desired, its effect being beneficial however, as it facilitates the separation of the hydrogen and oxygen from the water as it is dashed through the screens, a positive and negative pole 42 and 43 being established in the first water basin 14 by extending suitable iron bars from the screen wires 15 to near the bottom of the basin. The electricity with the hot blast from the fan acts fully upon the large body of water and liberates the hydrogen and oxygen which from its lightness quickly finds its way up to the top of the water basin formed into a hydrogen and oxygen gas of great heat making properties. As the water passes through the basin 14 and into the chamber

20 of the second water basin, all small particles are prevented from entering such chamber by the raised edges of the perforations. Through the movement of the float 36 the pump 37 is set in motion and the water is pumped out of the bottom of the chamber 20 by the pump and up into the tank 29 thus keeping the same in constant circulation, using it over and over again until it is loaded with the gases and other substances from the furnace, when it is drained off through pipes 24 and 41 and the supply kept up through the boiler feed pump through pipe 44, this pump also being controlled by a float in the boiler as before mentioned. The hydrogen and oxygen gases formed as before mentioned by the hot blast from the fan coming in contact with the water from the centrifugal water spreader being held in a constant spray between the screens in the water trap 12, form a hydrogen and oxygen gas, these with any others from below finding their way up as they are formed as before mentioned into the upper part of the water trap and as the heat and pressure increase in the water trap the gases are carried through the pipe 25 and through the branches 27 and 28 and discharged into the furnace, those from the upper branches being discharged down into the fire and those from below upward so that the most perfect result is obtained. The gases so formed are found to be highly inflammable and when used in this manner are a great producer of heat and with this new method of applying, almost complete combustion is obtained. The discharge of this gas into the furnace is regulated by valves and should the pressure be greater than required a part will escape through the safety valve 26 into the stack 2, but as soon as the pressure diminishes the valve would be closed by its spring or weight which would be set to allow an escape at a given pressure and yet prevent any further waste than is necessary. When, however, the furnace is under full operation and the valves into the furnace are open there will be no pressure at all.

In the apparatus herein shown, as soon as sufficient steam was raised in the boiler, the motor for running the fan could be disconnected and the fan run by the engine 10 but if desired it might be run altogether by either the motor or the engine.

While the best results are obtained by passing an electric current through the screens in the water trap and the first water basin, a good result may be obtained without this.

The screens are thoroughly insulated when a current is passed through them as care must be taken to prevent short circuiting.

Changes may be made in my apparatus without departing from the spirit of my invention and without changing the results, but

What I claim as new, and desire to secure by Letters Patent, is—

1. In a smoke catcher and separator means for exhausting the smoke as it enters the stack from the furnace and discharging it into a

stream of water which surrounds the smoke discharge whereby the gases and the unconsumed products of combustion are supplied with sufficient oxygen and returned to the furnace, substantially as shown and described.

2. In a smoke catcher and separator means for conveying the smoke and unconsumed products of combustion from a furnace and discharging them into a stream of water against suitable screens whereby the gases in such smoke and products take up sufficient oxygen and are returned to the furnace, substantially as shown and described.

3. In a smoke catcher and separator means for conveying the smoke and unconsumed products of combustion from a furnace and discharging them through a suitable nozzle into a stream of water, such water stream discharged through a nozzle surrounding the smoke nozzle, whereby the gases are charged with sufficient oxygen and returned to the furnace and the heavy products are carried off by the water stream and separated therefrom, substantially as shown and described.

4. In a smoke catcher and separator means for conveying the smoke and unconsumed products of combustion from a furnace and discharging the same into a water stream against suitable screens whereby the gases are charged with sufficient oxygen from the water and returned to the furnace and the heavy products carried away by the water and afterward separated therefrom, substantially as shown and described.

5. In a smoke catcher and separator means for conveying the smoke and unconsumed products of combustion from a furnace and discharging the same against one or more electrically charged screens through or with a stream of water whereby the gases of such products take in sufficient oxygen and are returned to the furnace, substantially as shown and described.

6. In a smoke catcher and separator an exhaust fan adapted to convey the smoke and unconsumed products of combustion from a furnace and discharge the same through a centrifugal water spreader connected with a water supply and having a discharge below into a water trap, screens in such trap against which the water and products of combustion are discharged, whereby the gases in such products are supplied with sufficient oxygen and means for returning the same to the furnace, substantially as set forth.

7. In a smoke catcher and separator an exhaust fan adapted to convey the smoke and unconsumed products of combustion from a furnace and discharge the same into a water trap, such trap having a water spreader therein, connected with a water supply and having a discharge below into such water trap, electrically charged screens in such trap against which the water and products are discharged, whereby the gases in such products are supplied with sufficient oxygen and returned to the furnace, the heavier products

carried by the water into one or more water basins where they are separated from each other and means for returning such water to the spreader, substantially as set forth.

5 8. In a smoke catcher and separator an exhaust fan adapted to convey the smoke and unconsumed products of combustion from a furnace and discharge the same into a water trap, a water spreader in such trap, connected
10 with a water supply and having a discharge below into such water trap, screens in such trap against which the water and products are discharged whereby the gases are separated and supplied with sufficient oxygen to burn
15 and are returned and discharged into the furnace above and below the grates, substantially as set forth.

9. In a smoke catcher and separator means for conveying the smoke and unconsumed
20 products of combustion from a furnace and discharging the same against one or more screens, together with a stream or spray of water whereby the gases and heavy particles are separated, the latter carried by the water
25 into one or more water basins where the particles are separated from the water and deposited in suitable chambers, substantially as set forth.

10. In a smoke catcher and separator means
30 for conveying the smoke and unconsumed products of combustion from a furnace and discharging the same against one or more screens, with a stream or spray of water whereby the gases and heavy particles are separated, the latter being carried by the water
35 into a water basin and passed over a screen and into a second basin whereby the particles are separated from the water, substantially as set forth.

40 11. In a smoke catcher and separator means for conveying the smoke and unconsumed

products of combustion from a furnace, and discharging the same against one or more screens, into a water trap, in connection with a stream or spray of water whereby the gases
45 and heavy particles are separated the latter being carried by the water into a water basin and passed over a screen whereby the larger particles are removed therefrom, the water passing into a second basin over a perforated
50 plate removing the smaller particles and a drain for removing the lighter impurities, substantially as set forth.

12. In a smoke catcher and separator an exhaust fan for establishing a draft and draw-
55 ing the smoke from a furnace and discharging the same into a water trap where it is completely absorbed by the water therein, the gases generated from the heat, smoke and water coming in contact with each other, being
60 returned to the furnace and assisting in complete combustion therein, substantially as set forth.

13. In a smoke catcher and separator, an exhaust fan for exhausting the smoke as it enters the stack from the furnace and discharging the same into a water trap and into a stream of running water therein, the smoke and water discharges being simultaneous, whereby the two thoroughly commingle, the gas from
65 the smoke taking up sufficient oxygen, and suitable connections between such water trap and furnace where the unconsumed gases are returned to the furnace, substantially as set forth.

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

FREDERICK L. MCGAHAN.

Witnesses:

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