No. 682,920. Patented Sept. 17, 1901.

E. J. DUFF.

APPARATUS FOR THE TREATMENT OF PRODUCER GASES.

(Application filed Mar. 16, 1901.)

(No Model.) 2 Sheets—Sheet 1.

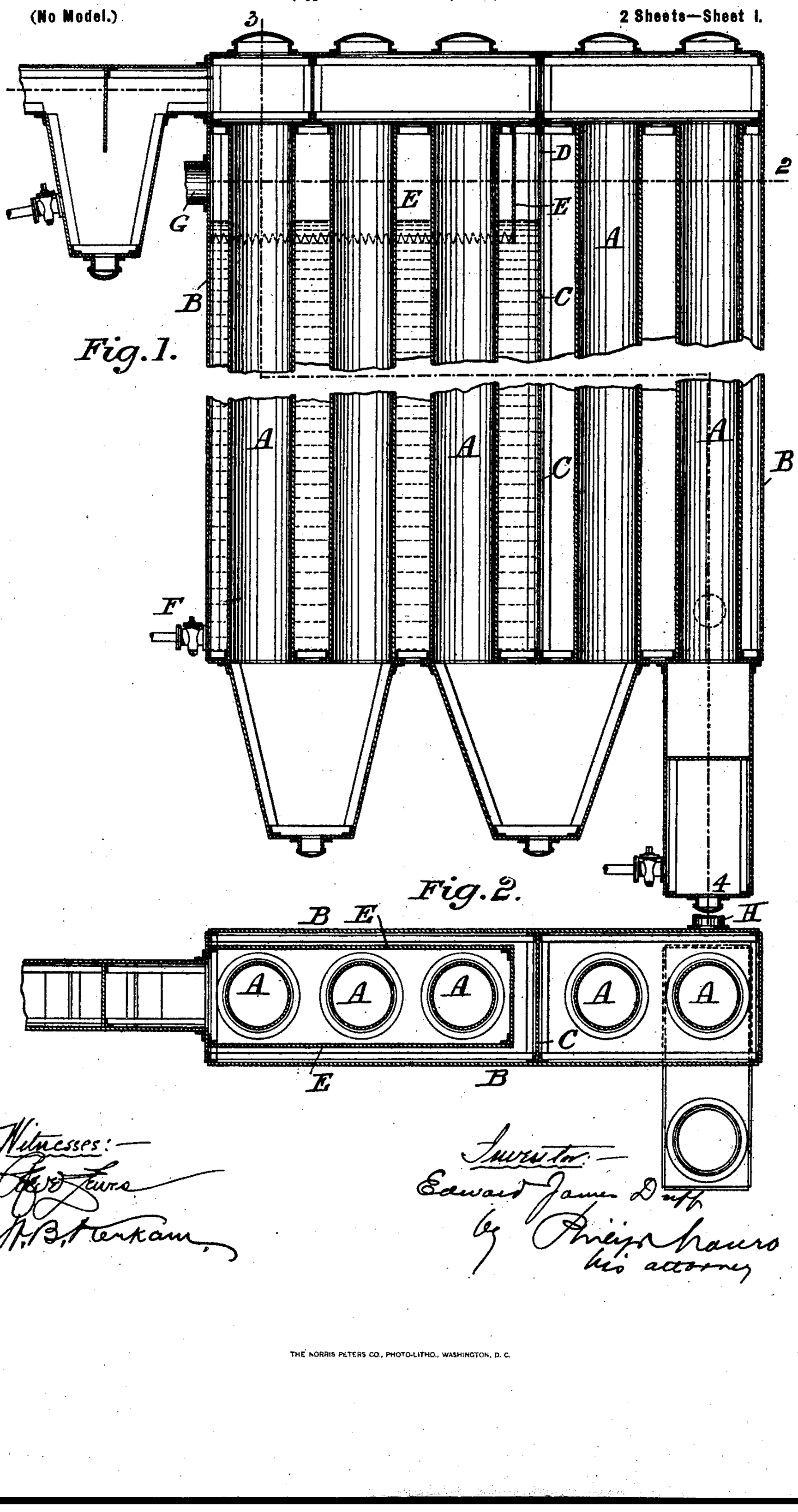

Fig. 1.

Fig. 2.

Witnesses:—
Geo. H. Graves
H. B. Wenham

Inventor:—
Edward James Duff
by Briesen & Knauth
his attorneys

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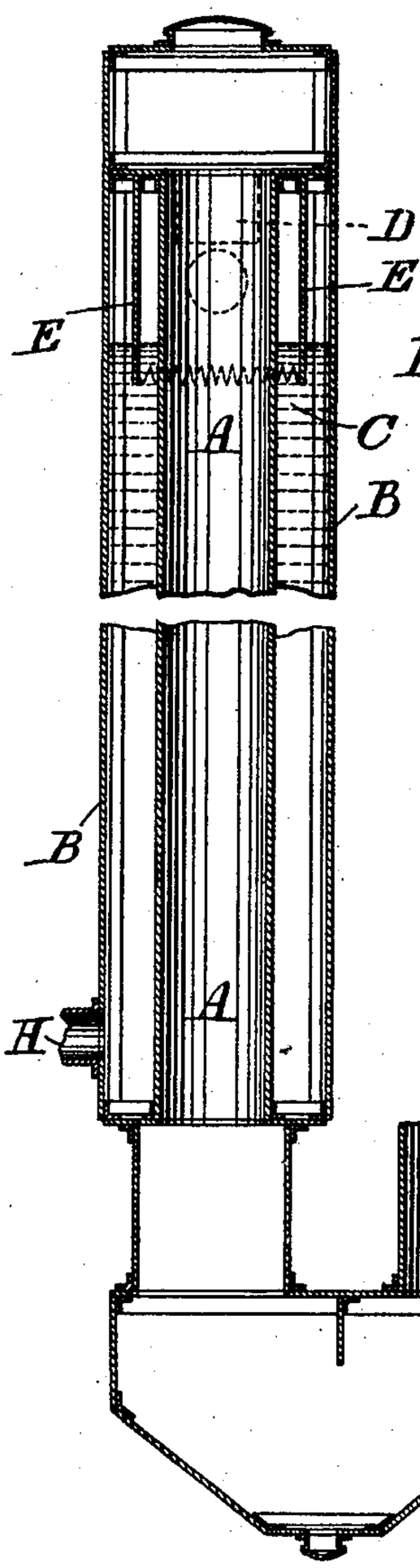

Fig. 3.

Witnesses: —
F. W. Lewis
H. B. Herkamer.

Inventor:
Edward James Duff
by Pierce Bowers
his attorney

UNITED STATES PATENT OFFICE.

EDWARD JAMES DUFF, OF LIVERPOOL, ENGLAND, ASSIGNOR TO THE UNITED ALKALI COMPANY LIMITED, OF SAME PLACE.

APPARATUS FOR THE TREATMENT OF PRODUCER-GASES.

SPECIFICATION forming part of Letters Patent No. 682,920, dated September 17, 1901.

Application filed March 16, 1901. Serial No. 51,547. (No model.)

To all whom it may concern:

Be it known that I, EDWARD JAMES DUFF, engineer, a subject of the King of Great Britain and Ireland, residing at 30 James street, Liverpool, in the county of Lancaster, England, have invented certain new and useful Improvements in Means to be Employed in the Treatment of Producer-Gases; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In a gas-producer plant arranged for the recovery of ammonia from the gases the gases are usually passed from the producer through a temperature-interchanger before being washed by a water-spray. The said interchanger is usually constructed of pipes through which the gases issuing from the producer pass, which pipes are surrounded by other pipes or casings, through the space between which and the first-named pipes the air and steam pass on their way to the producer. This method, owing to the slow rate at which moist air absorbs heat, does not admit of the reduction of the temperature of the gases below about 300° centigrade, and when the gases at this temperature strike the water-spray in the washer or scrubber there is a great absorption of heat by the water, and a large amount of water-vapor is added to the gases. This large addition of water-vapor necessitates the employment of ammonia-recovery and gas-cooling towers of considerably greater size than would otherwise be necessary.

My invention has for its object to reduce the size and cost of the said towers and also to reduce the cost of the operation by absorbing the heat of the gases more effectively before they meet the water-spray in the washer or scrubber and utilizing this heat directly for the production of steam in the interchanger.

According to my invention I surround a portion of the pipes of the interchanger by water instead of by air and steam, the portion so surrounded being preferably that through which the gases last pass—that is, the portion nearest to the washer or scrubber. By this means the spare heat is absorbed and the temperature of the gases reduced to nearly the temperature required to maintain the water in the washer or scrubber just below boiling-point and to reduce the gas to a temperature at which very little heat will be given to the water in the washer or scrubber. The heat which previously evaporated water in the washer or scrubber will in the arrangement according to my invention be absorbed in the interchanger to raise steam, which will become absorbed in or mixed with the moist air passing through the interchanger, and thus be restored to the producer as heat.

In the accompanying drawings I have illustrated the application of my invention to a temperature-interchanger such as is described in the specification of United States Letters Patent No. 662,062, granted to me November 20, 1900; but my invention is not limited to application to this particular form of temperature-interchanger.

Figure 1 is a vertical section. Fig. 2 is a horizontal section on the line 1 2, Fig. 1, and Fig. 3 is a vertical section on the line 3 4, Fig. 1.

The temperature-interchanger illustrated is constructed of a number of vertical tubes A, through which the gas passes, such tubes being inclosed in a rectangular chamber B. Any suitable number of these tubes A, preferably those nearest the gas-outlet, are surrounded by water to within a short distance of their upper ends, the space inclosing the tubes which are so surrounded with water being separated from the rest of the space by a diaphragm C, with an opening D at the upper part above the water-level. Between the gas-pipes A and the outer shell B are depending partitions E, constituting a bottomless chamber, with its serrated lower part dipping into the water, which is admitted by a cock F or in other convenient way. The air from the blowers enters at G into the space between the plates E and the upper parts of the gas-pipes surrounded by it and is forced through the water and issues under the serrated edges of the said plates E into the space between the said plates E and the outer casing B, absorbing in its passage both heat and moisture from the water made hot by contact with the gas-pipes A, which pass through it. The air thereby carries off with it a large amount of water-va-

por, and this saturated hot air then passes through the opening D into the space around the remaining gas-pipes A, which are not surrounded by water, and as these gas-pipes are nearest to the gas-producer and convey the hottest gas the air and water-vapor passing in contact with them become superheated on their way to the outlet H at the lower end of the chamber, from which they pass direct to the gas-producer.

In existing processes a large amount of steam has to be raised in steam-boilers (or to be obtained from extraneous sources) to supply to the producer along with the air the amount of steam required. Also in the existing gas-cooling towers the cooling depends upon the amount of heat absorbed as steam by the air in the water-cooling tower through which the air passes on its way to the producer. This amount of heat absorbed is limited by the limited supply of air required. The heat absorbed in existing processes is not sufficient to cool the gases sufficiently, and a large amount of water-vapor passes away with the cooled gases to the furnaces or gas-engines. This large amount of water-vapor reduces the temperature of the gas-flames and causes loss of efficiency and is very objectionable. My invention by reducing the amount of cooling to be done in the cooling-tower enables the restricted amount of air hereinbefore referred to to cool the gases to a lower temperature than heretofore and to increase the efficiency of the gases.

Having now particularly described and ascertained the nature of this invention and in what manner the same is to be performed, I declare that what I claim is—

1. In a temperature-interchanger, a gas-passage, a chamber adapted to contain a body of water penetrated by the gas-passage, an air-passage adapted to be closed between its inlet and outlet ends by the body of water through which the air is blown in its passage through the apparatus.

2. In a temperature-interchanger for use in connection with gas-producing apparatus, a gas-passage, a chamber adapted to contain a body of water in contact with the outer surface of the wall of said passage, an air-passage penetrated by the gas-passage, and a partition dipping into the body of water and closing the air-passage.

3. In a temperature-interchanger for use in connection with gas-producing apparatus, a chamber adapted to contain a body of water, an air-passage, a partition dipping into the body of water and closing the air-passage between its inlet and outlet ends, and a gas-passage leading through the air-passage between its inlet end and the partition and through the body of water.

4. In a temperature-interchanger for use in connection with gas-producing apparatus, a chamber adapted to contain a body of water, an air-passage, a partition having a serrated lower edge dipping into the body of water and closing the air-passage between its inlet and outlet ends, and a gas-passage leading through the air-passage between its inlet end and the partition and through the body of water.

5. In a temperature-interchanger for use in connection with gas-producing apparatus, a gas-passage, a chamber adapted to contain a body of water surrounding said passage at or near its outlet end but not at its inlet end, an air-passage part of which surrounds the inlet end of the gas-passage and another part of which is penetrated by the gas-passage at its outlet end, and a partition dipping into the body of water and separating the two parts of the air-passage.

6. In a temperature-interchanger for use in connection with gas-producing apparatus, a series of upright pipes suitably connected at top and bottom to form a continuous gas-passage, an inclosing casing about said pipes, a partition across the interior of the casing dividing the same into two communicating chambers one having an air-inlet and the other an air-outlet, a chamber adapted to contain a body of water below the air-inlet and about the gas-pipes therein, and a depending partition in said chamber dipping into the body of water and dividing the air-space in the chamber above the water into two parts into one of which the air-inlet opens and the other of which communicates with the air-space in the other chamber.

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

EDWARD JAMES DUFF.

Witnesses:

EDWARD SCOTLAND,

RALPH GIBBS.