

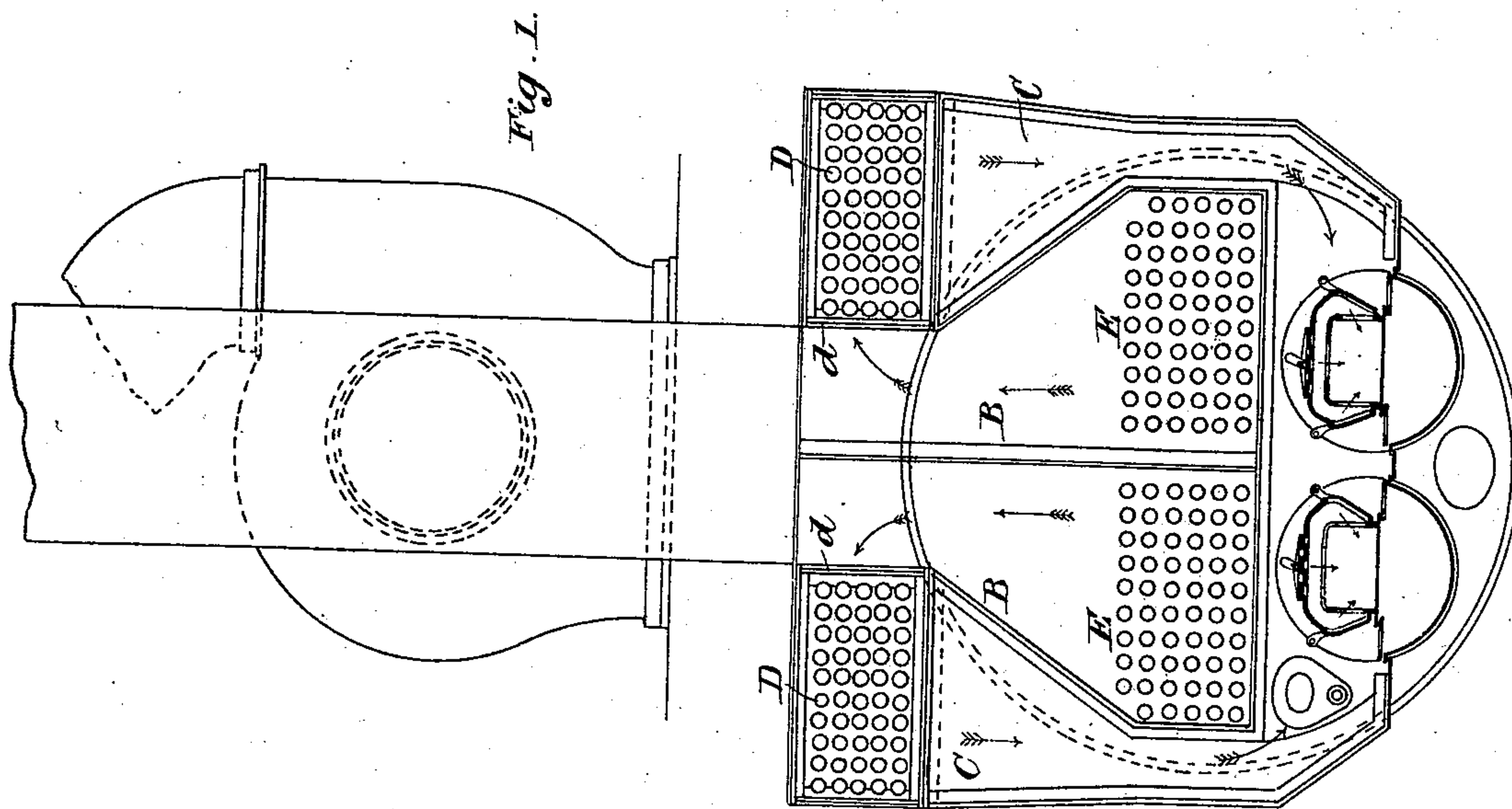
(No Model.)

2 Sheets—Sheet 1.

J. D. ELLIS.  
BOILER FURNACE.

No. 501,709.

Patented July 18, 1893.



*Witnesses:*

*Geo. T. Smallwood.*  
*Rever Lewis.*

*Inventor:*  
*John D. Ellis.*  
*by Jacob Manno.*  
*his attorney.*

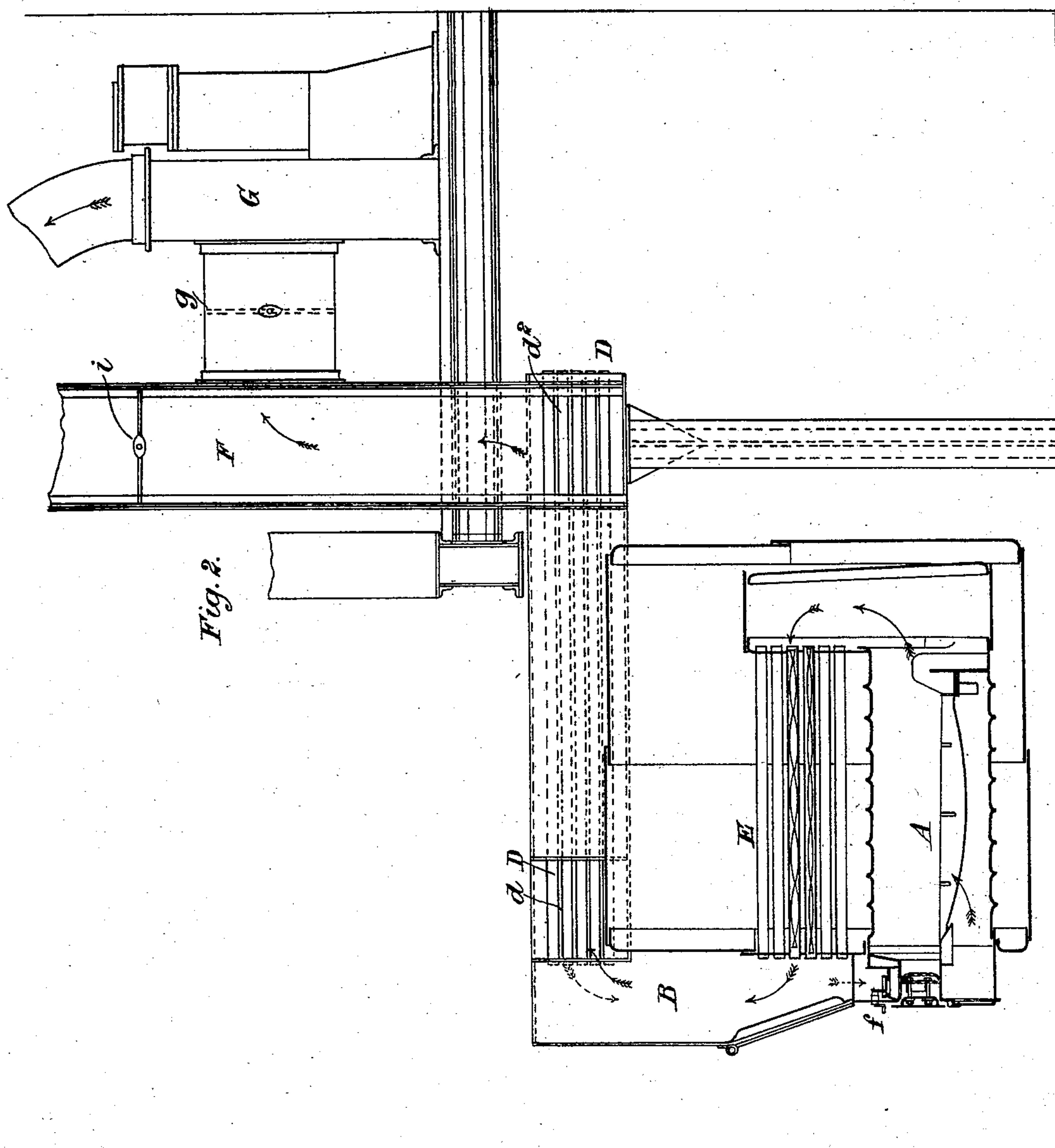
(No Model.)

2 Sheets—Sheet 2.

J. D. ELLIS.  
BOILER FURNACE.

No. 501,709.

Patented July 18, 1893.



Witnesses:  
 Geo. T. Smallwood  
 Rev. Lewis.

Inventor:  
John D. Ellis  
by Wm. H. H. H. H.  
his attorney.



# UNITED STATES PATENT OFFICE.

JOHN DEVONSHIRE ELLIS, OF SHEFFIELD, ENGLAND.

## BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 501,709, dated July 18, 1893.

Application filed January 17, 1893. Serial No. 458,692. (No model.) Patented in England May 11, 1891, No. 8,078.

*To all whom it may concern:*

Be it known that I, JOHN DEVONSHIRE ELLIS, managing director of John Brown & Company, Limited, Atlas Steel and Iron Works, Sheffield, in the county of York, England, a subject of the Queen of Great Britain and Ireland, have invented certain Improvements in Boiler Furnaces, (which has been in part patented in Great Britain by Patent No. 8,078, of May 11, 1891,) of which the following is a specification.

My invention consists in a new combination of devices or arrangements connected with tubular steam boilers and their furnaces whereby the heating effect and economy and facility of working of such boilers and furnaces are improved so that the efficiency of a given boiler when working with natural draft may be greatly increased and even multiplied several times without loss of economy and without difficulties in working.

According to my invention I employ the combination of first induced draft, secondly the heating of the air supply for the furnace or furnaces by the otherwise waste heat of the said furnace or furnaces and thirdly tubes (preferably internally ribbed tubes commonly known as "serve tubes") having in them spiral plates or equivalent retarding devices by which the hot gases from the furnace or furnaces drawn through the tubes by induced draft are deflected and caused to come into contact most efficiently with the very extended heat absorbing surfaces in the said tubes. In the said combination the hot gases from the furnace or furnaces are drawn through the said tubes by a fan or other exhausting device so that after leaving the boiler they are caused to come into contact with tubes or passages through or around which the air to supply the furnace or furnaces passes so that the said air which is drawn in by induced draft becomes heated by the waste gases before passing into the furnace or furnaces. In addition cold air in any amount required may when desired be drawn through openings for instance in the ash pit door.

The accompanying drawings represent in Figures 1 and 2 in sections at right angles to each other a marine boiler provided with an arrangement according to my invention.

In this arrangement the hot gases come into contact with the exterior of the tubes and

the incoming air passes into the tubes but the reverse of this may be employed if desired.

A are the furnaces having separate compartments in front those marked B for the products of combustion from the tubes E and those marked C for the air supply to the furnaces. Above the boiler are nests of tubes D situated in casings into which the products of combustion (which have passed into the compartments B from the boiler tubes E) pass by openings  $d$  and leave by the openings  $d^2$  passing thence into an uptake F from which they pass into a fan G which causes the passage of the heated gases as aforesaid from the furnaces then through the tubes E then through the casings B and by the openings  $d$  through the casings containing the tubes D and through the openings  $d^2$  to the uptake F and thence to the fan G.

Although I have shown the tubes D as being in a horizontal position and that position may probably be most efficient I do not limit myself to that position as they may be placed at any angle which circumstances may render desirable and the said tubes may be arranged in other than the direction longitudinally of the boiler as shown if desired.

The air for supplying the furnaces by the same fan G is drawn through the tubes D and thus becomes heated by the hot gases passing around them and the air so heated then passes through the compartments C and by openings regulated by valves  $f$  into casings around the furnace doors and thence into the furnaces. The draft for the furnaces is thus an induced draft and the air is moreover heated by the escaping hot gases before the said air passes to the furnaces which together with the tubes containing retarders gives a very efficient and economical combination. In the drawings I have shown two of the tubes in section illustrating in the one case a plain tube with a retarder in it and in the other case an internally ribbed or "serve tube" with a retarder in its central space. These tubes with retarders are shown as being used as the boiler tubes E but they may also be used for the nests of tubes D if desired. If it be desired that the hot gases shall pass through the tubes and the air around them then in place of the openings as described the casings B will have an opening into the end chambers above the compartments C into



which chambers one end of each of the tubes will open the other ends of the tubes opening into the uptake and the casings in which the tubes are contained will have at the uptake  
5 end an opening for the inlet of air and at the other end an opening into the casings C.

The uptake F is provided so that it can be used when desired with natural draft only when the valve *g* is closed and the valve *i* is  
10 opened. In normal working with the induced draft the valve *i* is of course closed and the valve *g* opened.

Although I have shown two furnaces in the drawings the invention may be applied also  
15 to single furnaces or furnaces in other number.

I do not limit myself to the particular form of retarders shown, for instance they may be in the form of a tube with the fire box end  
20 thereof closed.

I claim—

1. The combination with a tubular steam boiler and its furnace, having a space or chamber in front of the boiler, a partition dividing  
25 said space into two contiguous compartments, one of which communicates with the boiler tubes, and conducts the hot gases upward, the other communicating with the fire chamber and conveying air downward, a cluster of  
30 flues or tubes forming two series of passages communicating with the two compartments respectively, and through which the incoming air and outgoing products of combustion pass in opposite directions, and means for creat-  
35 ing an induced draft, substantially as described.

2. The combination with a furnace and tubular boiler, of retarders in the tubes of

said boiler a partition dividing the space in front of said boiler into two contiguous com- 40  
partments, one of which receives and conveys upward the products of combustion from said tubes, the other compartment serving to convey air downward to the furnace, and a fan or device for creating a forced draft through 45  
the boiler tubes, substantially as described.

3. The combination with a double tubular boiler whose outer shell is contracted toward the top, two clusters of tubes with interven- 50  
ing passages arranged one on each side of the contracted part of said boiler, and a partition in front of each boiler dividing the space into two contiguous compartments, one of which communicates with the tubes and the other with the intervening spaces, so that the air 55  
and products of combustion pass to and from the furnace in opposite directions through adjacent passages, substantially as described.

4. In a steam boiler furnace the combination of the contiguous passages for the incom- 60  
ing air, and the products of combustion respectively, boiler tubes provided with retarders and communicating with the passages for the products of combustion, and a device connected with said passages for creating an in- 65  
duced draft, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN DEVONSHIRE ELLIS.

Witnesses:

BENJ. BURDEKIN,  
*Solr., Notary Public, Sheffield.*  
JOSEPH BINNER,  
*Coachman to Mr. Ellis, Thurnscoe.*