No. 646,530. Patented Apr. 3, 1900.

W. G. STONES.

APPARATUS FOR SUPPLYING AIR, STEAM, OR GASEOUS MATTER TO FURNACES.

(Application filed June 18, 1898.)

(No Model.) 3 Sheets—Sheet 1.

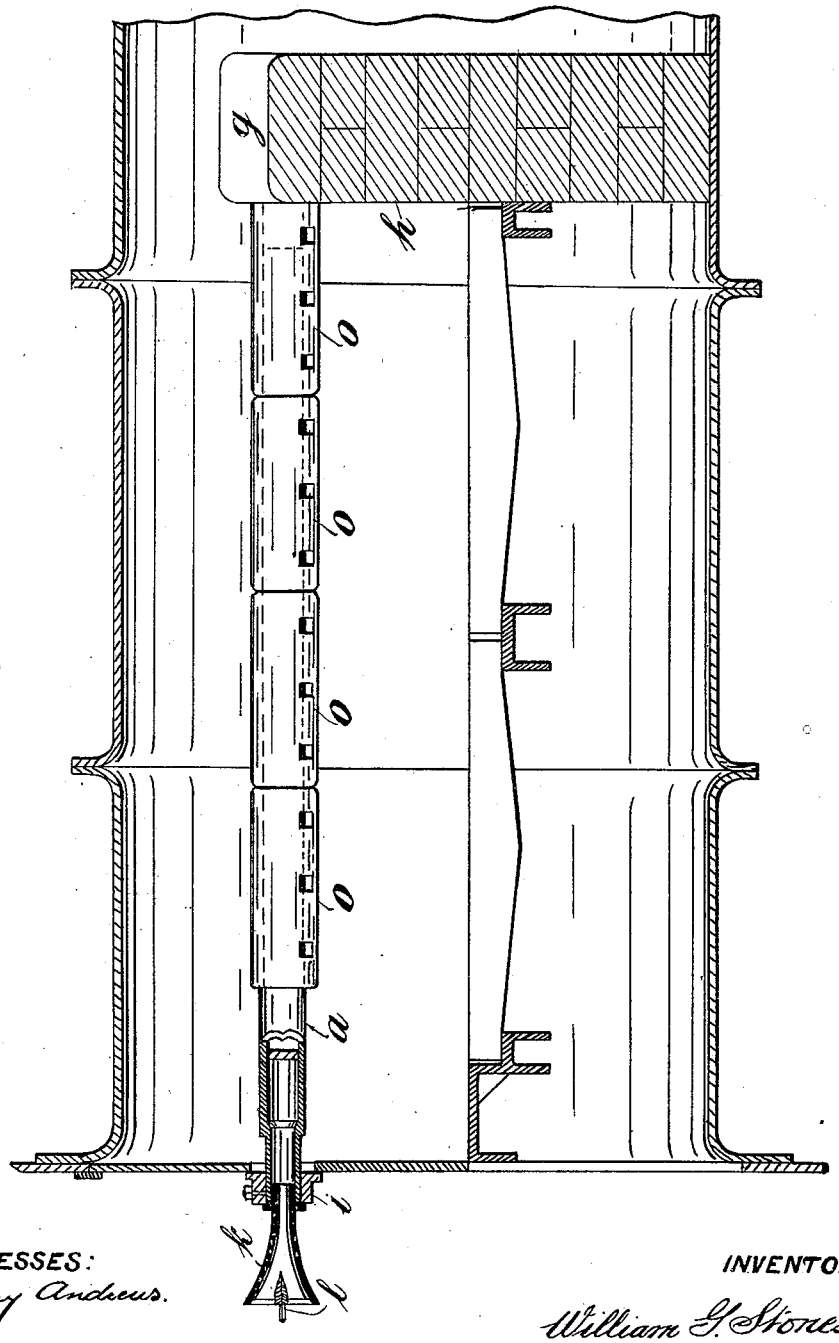

FIG. 1.

WITNESSES:
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Arthur Gresty.

INVENTOR.
William G. Stones.
By his Attorney. Walter Gunn.

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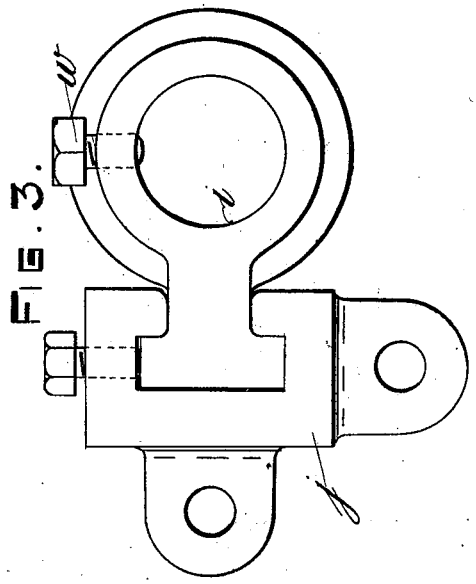

FIG. 3.

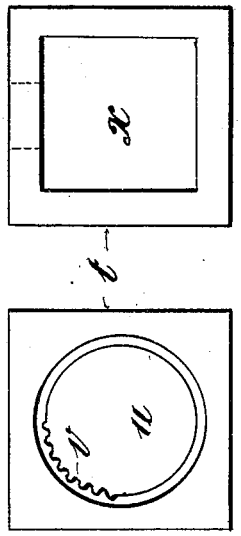

FIG. 5.

FIG. 4.

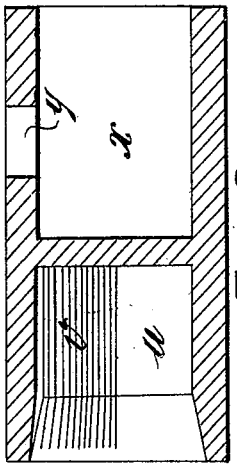

FIG. 6.

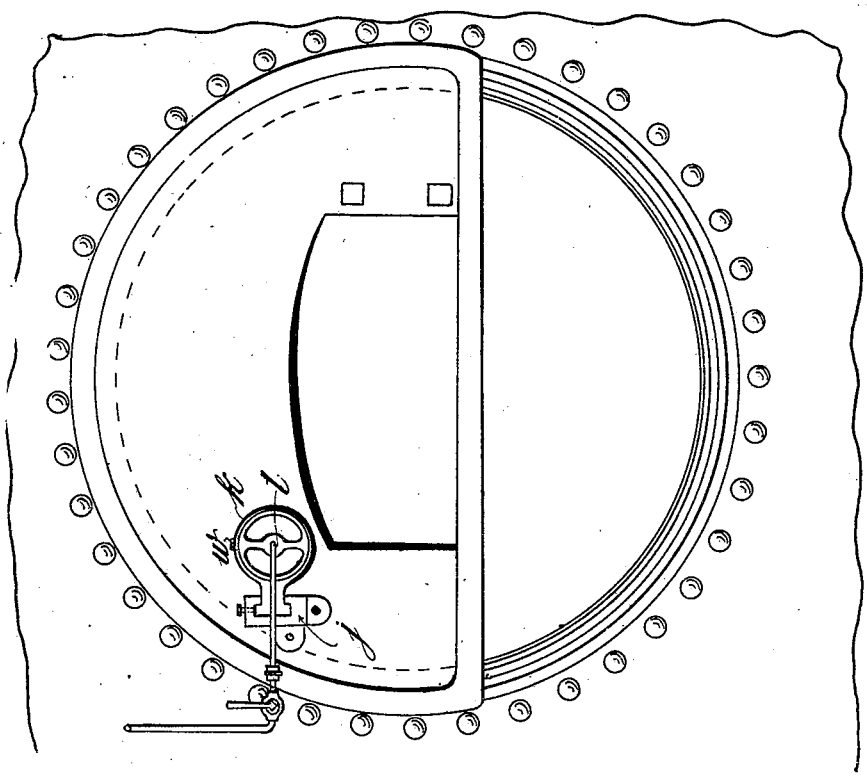

FIG. 2.

WITNESSES:
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No. 646,530. Patented Apr. 3, 1900.

W. G. STONES.

APPARATUS FOR SUPPLYING AIR, STEAM, OR GASEOUS MATTER TO FURNACES.

(Application filed June 18, 1898.)

(No Model.) 3 Sheets—Sheet 3.

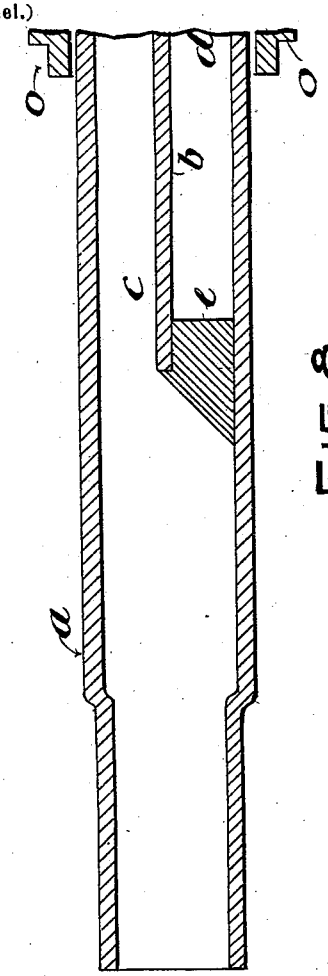

FIG. 8.

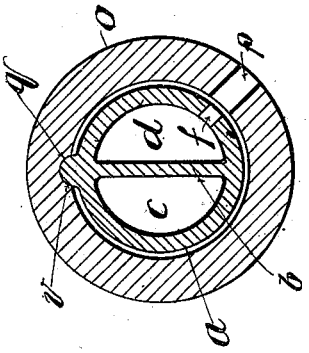

FIG. 7.

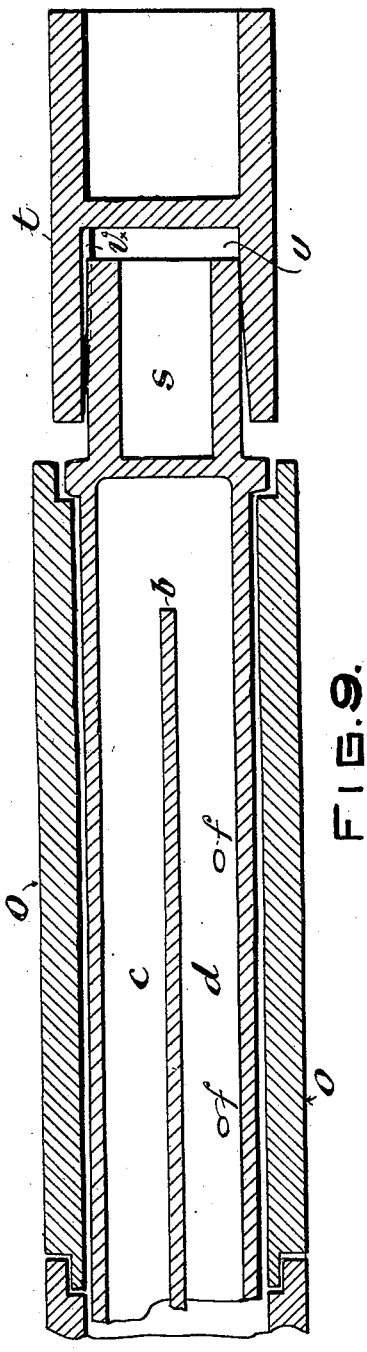

FIG. 9.

Witnesses:
Geoffrey Andrews.
Arthur Gresty

Inventor.
William Grimshaw Stones
By his Attorney Walter Lucas.

UNITED STATES PATENT OFFICE.

WILLIAM GRIMSHAW STONES, OF BLACKBURN, ENGLAND.

APPARATUS FOR SUPPLYING AIR, STEAM, OR GASEOUS MATTER TO FURNACES.

SPECIFICATION forming part of Letters Patent No. 646,530, dated April 3, 1900.

Application filed June 18, 1898. Serial No. 683,844. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM GRIMSHAW STONES, a subject of the Queen of Great Britain and Ireland, residing at Blackburn, in the county of Lancaster, England, have invented certain new and useful Improvements in or Relating to Apparatus for Supplying Air, Steam, or Gaseous Matter to Furnaces, (for which I made application for British patent on the 17th day of November, 1897,) of which the following is a specification.

My invention relates to means for admitting air, steam, or gaseous matter into steam-boiler and other furnaces for consuming smoke or economizing fuel; and my said invention has for one object to so introduce air into a furnace as to considerably raise its temperature before it is projected onto the live or burning fuel, and thus effect the more perfect combustion of the inflammable gases arising from the fuel instead of such air being admitted and projected, as heretofore, onto the fuel in a cold state.

A further object of my invention is to effect the aforesaid heating of the air in a manner which serves to preserve the life of the apparatus which conveys the air and which in the absence of the cold air passing through it and the protective devices hereinafter described, also its proximity to the burning fuel, is liable to rapidly burn out.

A further object is to allow for the distribution of the air in different directions, according to the condition of the fire.

The accompanying sheets of drawings illustrate the manner in which the foregoing objects are attained, and the description of the several views is as follows:

Figure 1 represents a longitudinal section of one of the furnaces of a Lancashire boiler with my invention applied thereto; but it will be understood that my invention is equally applicable to the furnaces of other types of boilers or steam-generators which require to be supplied with heated air or gaseous matter. Fig. 2 represents a front elevation of the same furnace. Figs. 3 to 9 represent the essential parts of my improved apparatus in detail on a larger scale.

In accordance with my invention I employ a pipe or tube *a*, having its core divided by longitudinal mid-feather *b* into two passages *c* and *d*, respectively, as shown more clearly in Figs. 7, 8, and 9. This tube is closed at one end and open at the other end, and the passages *c* and *d* only communicate with each other at the closed end of the tube by an opening in the mid-feather or by such mid-feather stopping short of such closed end, as shown in Fig. 9. The other end of passage *d* is closed by a plug or block *e*. In the outer wall of the passage *d* is a series of holes *f* (see Figs. 7 and 9) in a row, parallel and radial or otherwise, to suit requirements. This peculiar construction of pipe constitutes a flow and return tube and is fixed, by preference, at one side and near the crown of the furnace, as shown more clearly in Fig. 2, with the open end at the fire-door end and the closed end at the bridge end. At the closed end it is supported in a refractory (fire-resisting) block *g*, built into the usual fire-bridge *h*, and at the open end it is supported in a collar *i*, (see Fig. 3,) mounted removably in bracket *j* on the boiler-front or like part, as shown in Fig. 2.

The extreme front end of the tube is by preference slightly narrower than the other parts and is furnished with a bell or trumpet mouth *k*, as shown in Fig. 1. Opposite and projecting into such bell-mouth is a steam-injector nozzle *l*, supplied with steam from the steam-space of the boiler or other source of supply and designed to impel a continuous jet of steam into the tube *a*. Such steam in passing into the tube induces a current of air to pass into the tube and, mingling with it, to travel along passage *c* until it reaches the opening *m* at the far end and then flow through such opening into passage *d*, from which both air and steam then escape through the holes *f* into the furnace. In operation, therefore, my improved apparatus compels the air to travel to the rear end of the furnace before coming into contact with the fuel, and the pipe *a* being in close proximity to the fire it will at once be seen that the temperature of the air will be considerably raised by such traverse, and therefore rendered eminently fit to mingle with the unconsumed gases of the furnace. At the same time it will be seen that another advantage arises from the use of pipe *a* in that in consequence of passing the air through the full length of

the pipe it tends to keep the pipe cool, which, owing to its close proximity to the burning fuel, is liable to burn out. This burning out of the pipe, however, is specially guarded against and prevented by a covering of fire-clay or refractory (fireproof) material *o*, made up, by preference, in sections with spigot and socket or like joints, as shown more clearly in Figs. 1, 7, 8, and 9. Each section is formed with openings *p*, in exact register with holes *f* in tube *a*, and to retain such sections in their proper relative positions I provide the pipe *a* with a ridge *q* and the interior of each section with a groove *r*. (See Fig. 7.) They may, if necessary, be held by two or more ridges and grooves.

The position of holes *f* and *p* in relation to the furnace-grate is such as to direct the air and steam onto the burning fuel and for all practical purposes may lie at an angle of about forty-five degrees to the horizontal, as shown in Fig. 7. To permit, however, of the holes being arranged at varying angles to suit the fire or to direct the air and steam on the fuel at varying points, I provide the closed end of the tube with an extension *s* and support such extension in a metal bearing-piece *t* of, by preference, rectangular formation and designed to fit the fire-brick block, which in turn is built into the fire-bridge or other support. Upon the said extension of tube *a* I form one or more ridges or flutes, (see Fig. 9,) and in one end of bearing-piece *t*, which is formed with a circular opening *u*, I form a series of corresponding flutes or ridges *v*, (see Fig. 4,) with one or other of which the said ridges or flutes on the pipe extension is designed to take at a definite angle and so enable the holes *f* and *p* to lie in the desired position relatively to the furnace-grate. The adjustment of the front end of the tube *a* is permitted by set-screw *w*; but the arrangement of flutes and ridges might be applied to both ends of the tube.

To effectually secure the bearing-piece *t*, I form the rear end with an opening *x* and in the wall of such opening a hole *y* for the passage of a bolt which serves to secure the bearing-piece to the fire-brick block and bridge. The position of tube *a* or its extension in relation to bearing-piece *t* is such as to allow of contraction and expansion. It is also obvious that the tube may be supported from one end only or its closed end be supported from the crown of the furnace; also, that two or more pipes may be arranged in one furnace, with holes *f* and *p* set as desired.

Having thus particularly described my invention, I declare that what I claim is—

1. In combination, a tube with holes or perforations for delivering air or gaseous matter, a mid-plate within the tube for producing two passages, flow and return, communicating with each other, and a plug for closing one end of the return-passage, as set forth.

2. In combination, a tube with holes or perforations for delivering air or gaseous matter, a mid-plate within the tube for producing flow and return passages communicating with each other, a plug for closing one end of the return-passage, a collar with T extension and adapted to fit over one end of the tube, a bracket with T-slot adjacent to said collar and adapted to receive the T extension of the collar, an extension on the tube, and a bearing-piece adjacent to such extension and adapted to receive the extension, as set forth.

3. In combination, a tube with holes or perforations for delivering air or gaseous matter, a mid-plate within the tube for producing flow and return passages communicating with each other, a plug for closing one end of the return-passage, a rib on said tube, a series of fireproof sections adapted to cover the tube and each of such sections having perforations or holes corresponding to those in the pipe, and a longitudinal recess on its interior face adapted to engage the rib upon the tube, as set forth.

4. A tube end bearing-piece consisting of a short tube of metal, a division-plate dividing such tube transversely, a hole in the wall of the rear part, and flutes in the wall of the fore part, as set forth.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

WILLIAM GRIMSHAW STONES.

Witnesses:

ARTHUR GRESTY,

WALTER LUNN.