July 11, 1939. J. ARKIN ET AL 2,165,880

APPARATUS FOR CREATING A LAYER OF SECONDARY AIR AND STEAM ABOVE A HEARTH

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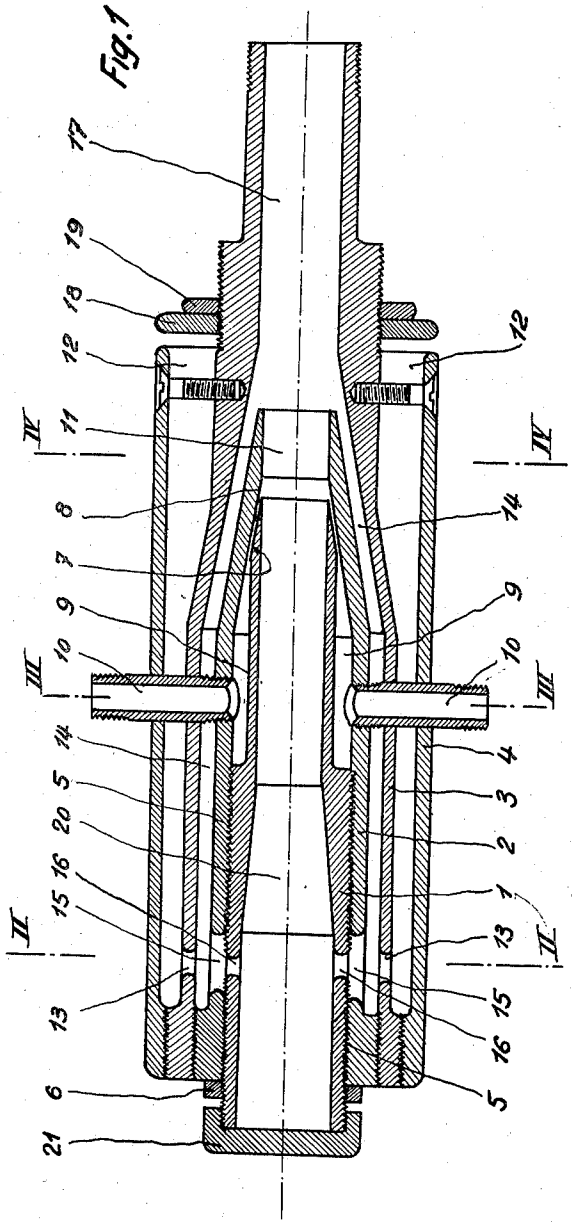


Fig. 1

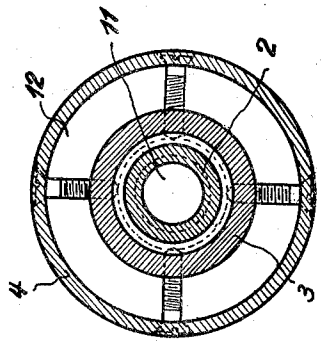


Fig. 4

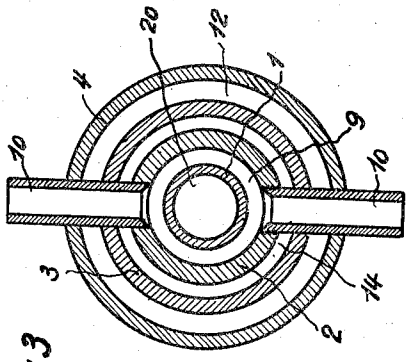


Fig. 3

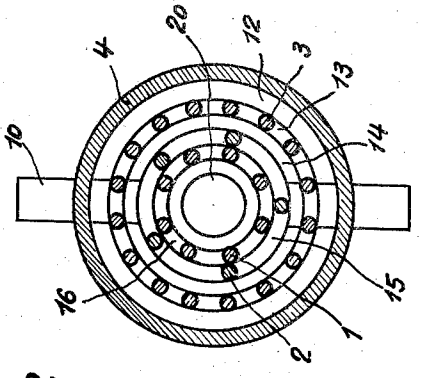


Fig. 2

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APPARATUS FOR CREATING A LAYER OF SECONDARY AIR AND STEAM ABOVE A HEARTH

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Application November 30, 1936, Serial No. 113,520
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4 Claims. (Cl. 110—60)

This invention relates to an apparatus for creating a layer of secondary air and steam above the fire bed of a steam boiler and like installations. It differs from other apparatus of this type by a particular system of regulating the proportion of air and steam and, in addition, by the particular combination of the steam supply with a double supply of air, which permits a preheating of the air and better mixing of the air and steam and, consequently, ensures a better combustion and satisfactory smoke-consumption.

One constructional form of the apparatus according to the invention is illustrated by way of example, in the accompanying drawing, wherein:

Fig. 1 is a longitudinal axial section thereof; and Figs. 2–4 are sections taken on the lines II—II, III—III and IV—IV, respectively of Fig. 1.

The apparatus comprises four principal parts 1, 2, 3, and 4 having a common axis. When the apparatus is assembled, only the innermost tube 1 can be displaced and change its position relatively to the other parts. The displacement of the tube 1 is effected by means of the thread 5 formed externally of the tube 1 and internally of the tube 2, a locknut 6 being provided for locking same in position.

This displacement of the tube 1 regulates the annular opening between the cone 7 of the tube 1 and the tapered end or cone 8 of the tube 2.

This annular opening permits the passage of a thin jet of steam from the chamber 9 through the nozzle formed by the forward ends of tubes 1 and 2. This steam, which serves for heating the tubes, is supplied through the conduit or conduits 10.

Air enters into the apparatus through the passage 12 between the casing or jacket 4 and the regulating valve 18, which is displaceable longitudinally of the thread formed on the forwardly extending portion of tube 3 and is retained in position by a locknut 19. This air, after passing through the apertures 13 in the tube 3, separates into two currents, one of which passes by way of the passage 14 between the tube 3 and the tube 2, and the other by way of the apertures 15 and 16 into the chamber 20 of the nozzle 1.

Thus, the steam emerging from the annular opening between the cone 8 and the cone 7 of tubes 2 and 1 respectively passes into the cylindrical end portion 11 of the tube 2, entraining air from the chamber 20 of the tube 1, and then passes into the cylindrical end portion 17 of the tube 3, entraining the air supplied to the passage 14 between the tube 2 and the tube 3. The end portion 17 extends into the fire box or is connected thereto by an extension tube, so as to deliver the mixture into contact with the combustion products in the fire box over the fire.

The rear opening of the tube 1, to which may be connected apparatus for controlling the supply of steam, is closed by a cap 21.

Due to the fact that the steam passes between the two layers of air 14 and 20 which have already been heated by absorption of heat from the walls of tubes 1 and 2, which are heated by the steam, an energetic mixing of air and steam in the apparatus is produced immediately upon coming into contact with one another. The temperature at which they come into contact is kept as high as possible, which causes the formation above the grate of a water gas upon the water steam mixture becoming admixed with the carbon of the smoke of the fire, whereby the smoke disappears.

We claim:

1. Apparatus for supplying a mixture of preheated air and steam above the fire beds of boilers comprising a steam tube having an open forward end, a small air tube within the steam tube forming with the steam tube a steam chamber and steam nozzle, the forward end of the small air tube being open and adjacent the said nozzle so that air in said small air tube is influenced by steam issuing from said nozzle, a large air tube surrounding the steam tube and extending forwardly beyond the steam tube so that the steam tube and small air tube discharge into the large air tube, an air jacket surrounding the large air tube and open to the atmosphere at its forward end, a steam conduit connected to the steam tube, and the rear portions of said small and large air tubes having openings whereby communication with said air jacket is effected, the rear ends of said air tubes being otherwise closed to the atmosphere, whereby in operation steam issuing from the steam nozzle draws air forwardly in the small and large air tubes in heat exchange relationship with the steam in the steam chamber and nozzle and the air is thus preheated before mixture with the steam in the forwardly extending portion of the large air tube.

2. Apparatus according to claim 1 and in which the forward end portion of the steam tube is forwardly tapering internally and the small air tube and steam tube are adjustably connected together by screw threads so as to be relatively adjustable longitudinally to regulate the steam outlet opening of the nozzle.

3. Apparatus according to claim 1 and in which the large air tube has a reduced portion extending forwardly beyond the air jacket tube,

and a valve adjustably mounted on said forwardly extending portion adjacent the forward end of the jacket tube to regulate the admission of air to the apparatus.

4. Apparatus for supplying a mixture of steam and preheated air to a fire box comprising a mixture tube the rear portion of which serves as an air tube, a steam tube within said air portion of the mixture tube, a small air tube within the steam tube and forming with its outer wall and with the inner wall of the steam tube a steam chamber and a steam nozzle, a jacket surrounding said mixture tube and being open at its forward end for admission of air, a steam conduit supplying steam to the steam tube, the small air tube and air portion of the mixture tube having openings rearwardly of the steam chamber whereby communication with the air jacket is effected, and having their rear ends closed whereby air induced through the small air tube and air portion of the mixture tube is required to pass in contact with the walls of the chamber formed by the steam tube and small air tube and be preheated before intermixture with the steam.

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