

A. E. CARR.
 DEVICE FOR DETECTING INCOMPLETE COMBUSTION.
 APPLICATION FILED MAR. 13, 1913.

1,143,889.

Patented June 22, 1915.
 2 SHEETS—SHEET 1.

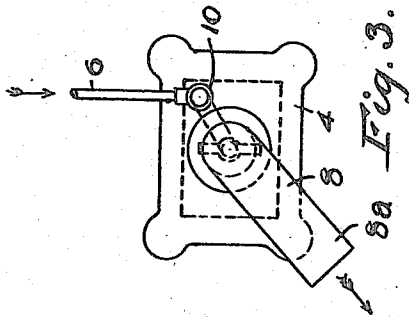


Fig. 3.

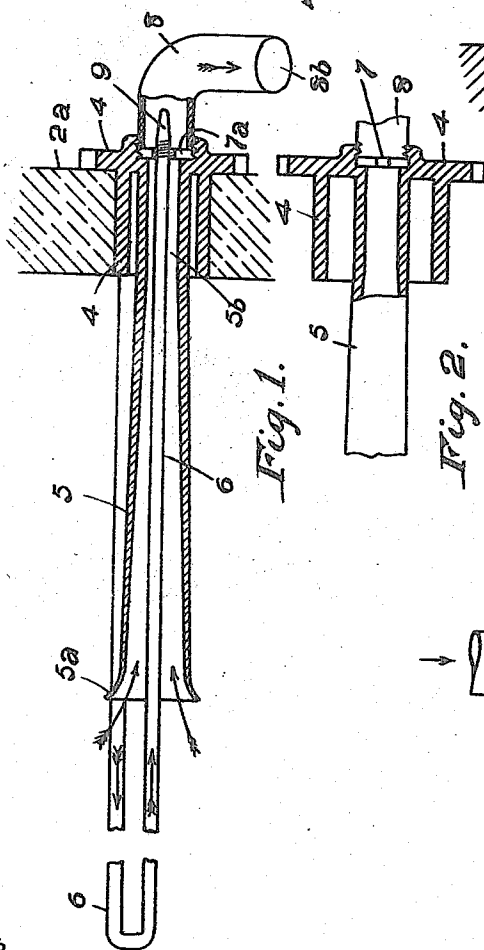


Fig. 1.

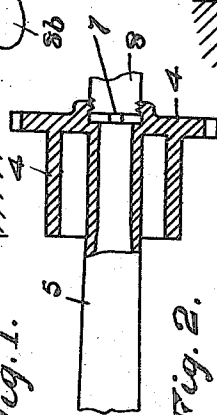


Fig. 2.

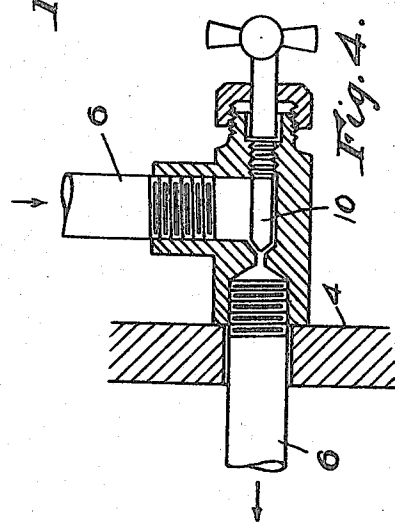


Fig. 4.

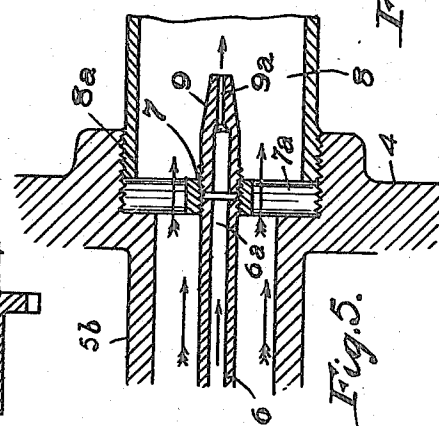


Fig. 5.

Fig. 6.

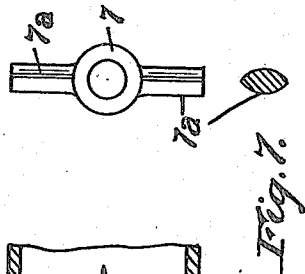


Fig. 7.

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Fig. 10.

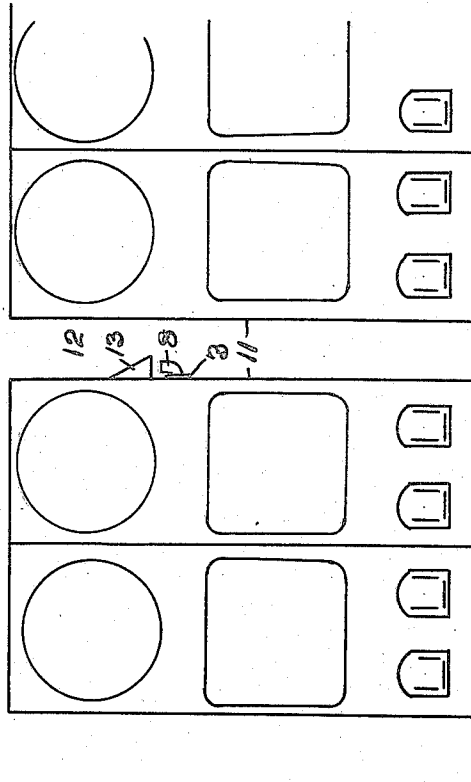


Fig. 9.

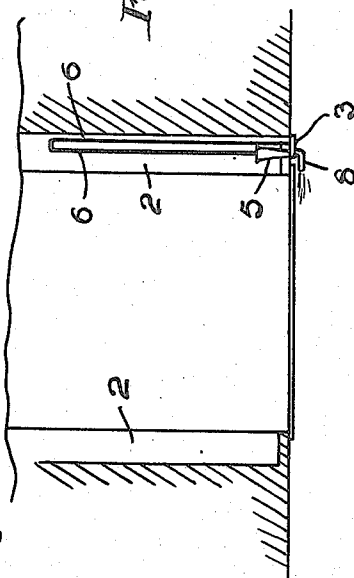
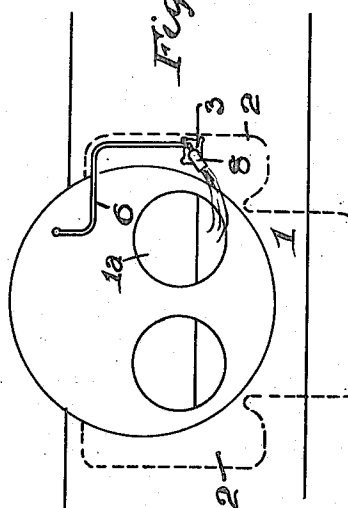


Fig. 8.



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UNITED STATES PATENT OFFICE.

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DEVICE FOR DETECTING INCOMPLETE COMBUSTION.

1,143,889.

Specification of Letters Patent. Patented June 22, 1915.

Application filed March 13, 1913. Serial No. 753,928.

To all whom it may concern:

Be it known that I, ALFRED EDWARD CARR, a subject of the King of Great Britain, and a resident of Formby, near Liverpool, England, have invented certain new and useful Improvements in Devices for Detecting Incomplete Combustion, of which the following is a specification.

This invention relates to a device or attachment for fitting to the flues of boiler or other furnaces whereby it may be immediately discovered whether or not the boilers are producing black smoke, and in the flues of which particular one of a bank of boilers such smoke is being produced. Where a number of boilers are arranged in a series all connected up to a common stack, there may be only one boiler which is producing black smoke, it being difficult to detect under ordinary circumstances which one it is, and the furnaces of all the boilers may be opened up to admit air with a view to abating the smoke, thus unnecessarily reducing the steam pressure throughout the series of boilers.

The feature of the present invention consists in providing a device which can be fitted to the flue of each particular boiler in a series, such device being so constructed as to immediately betray the character of the flue gases of that boiler, though if desired one such device may be fitted in a flue common to a series of boilers to indicate the character of the flue gases.

According to this invention a device is fitted to the flues of the boiler consisting of a tube open to the boiler house and communicating with the flue, a small nozzle to which is led a supply of steam being disposed in the interior of the flue tube, the ejector action of the steam through the nozzle serving to draw a portion of the flue gases through the tube into the boiler house, the color of the issuing flue gases being thus readily seen, and incomplete combustion at once detected.

The invention is illustrated in the accompanying drawings, in which, Figure 1. is a longitudinal vertical section through a smoke detecting device constructed in accordance with this invention. Fig. 2. is a fragmentary sectional plan view of Fig. 1. Fig. 3 is a front elevation of the device. Fig. 4. is a detail view in section to an enlarged scale of the steam regulating valve. Fig. 5 is a vertical section, also to an enlarged scale, of

the steam nozzle showing its method of attachment in the apparatus, Fig. 6. being an end view of the spider for supporting the nozzle, and Fig. 7. a section showing the preferred shape of the spider arms. Fig. 8. is an elevation, and Fig. 9. a plan in section, showing the method of fitting the device to the flues of a Lancashire type of boiler, Fig. 10. showing a suitable position for the device when fitted to a water tube boiler.

In carrying out the invention, and in the case of a land boiler, say, of the Lancashire type as shown in Figs. 8. and 9., having a central main flue return 1 and two side flues 2, the smoke detecting device 3 is placed preferably in the front wall 2^a of one of the side flues 2, where the side flues adjoin the central main flue. The fitting of the apparatus is preferably effected in an orifice made in the front wall by removing a brick, a rectangular spigoted flanged casing 4 being provided adapted to fit the opening left by the removal of the brick. This flanged casing may be of cast iron, and is fitted with a bell mouthed tube or passage 5, either integral as shown or attached to the casing, which, when the flanged casing is in position, projects into the flue so as to be in communication with the flue gases. The bell mouth 5^a of the tube extends into the flue, the other end 5^b of the tube of restricted bore being connected to the flanged casing. A small bore steam pipe 6, say a quarter of an inch diameter, is led, preferably from the steam space of the boiler, through the front plate of the flanged casing, and carried some distance into the flue along the exterior of the bell mouth tube 5 and returned axially along the bore of the same, the ends 6^a of the steam pipe being entered into the eye 7 of a spider piece Figs. 5. and 6. disposed across the front end of the flared tube 5. This spider may be held in position across the front of the tube in any suitable manner, say, by means of a delivery pipe or elbow 8 which may be screwed at 8^a or otherwise detachably secured into the face plate of the flanged casing, so as to form a continuation for the flared tube 5, the action of attaching the delivery elbow to the flanged casing serving to grip the spider in position. The front end 6^a of the steam pipe where it enters the spider boss 7, is provided with a detachable nozzle 9, preferably screwed, the jet bore 9^a of the nozzle being made very small say, about one sixteenth of an inch.

diameter or less. The outer end 8^b of the delivery elbow is left open, and may be deflected as shown in Figs. 3 and 8, so that its open end points to the boiler furnaces 1^a.
 5 A regulating valve 10, Figs. 3. and 4., tap, or other analogous device, is fitted to the steam pipe 6 where it enters the flanged casing 4 in order that the passage of steam may be adjusted to any nicety as required.
 10 The action of the apparatus is as follows: Supposing a series of boilers in a bank to be each fitted with a smoke detecting appliance, the steam pipe tap 10 of each detector is turned on a sufficient amount such
 15 that the jet of steam issuing from the nozzle 9 just produces an ejector action within the delivery elbow 8 thus causing a suction or exhaustion of part of the flue gases into the flared mouth of the tube 5, these gases
 20 being delivered together with the steam which has been superheated in its passage through the small bore pipe loop 6 exposed to the direct action of the hot flue gases—through the open end 8^a of the elbow 8. The
 25 draft of the furnaces will be sufficient to cause these ejected flue gases and superheated steam to be drawn back into the furnace mouth, as indicated in Fig. 8, so that no ill effects will be felt in the atmosphere of
 30 the stoke hold or boiler house. Owing to the fact that the steam is superheated and colorless on issuing from the elbow, if complete combustion is taking place in the boiler furnace the combined superheated steam and
 35 completely consumed flue gases will also show colorless when they issue from the elbow, but if any one or more boilers of the series is making black smoke, the ejected flue gases issuing
 40 from the elbow of that particular boiler or boilers will immediately betray the fact by their color, the engineer needing only to attend to that particular boiler with a view to obviating the smoke. A very small quantity of superheated steam only is required to
 45 cause an ejection of the flue gases, namely, so much that its ejector action will be just sufficient to overcome the normal suction of the flue draft.

It is desirable to provide a detachable cap
 50 to fit the open end of the elbow 8, and the spider arms 7^a are preferably brought to a point fore and aft Fig. 7., to obviate liability of soot depositing thereon and clogging the

tube 5. By making the elbow in the way described access may be readily given to the
 55 fine bore nozzle 9 on the steam pipe, and in this way provision made for ready renewal or cleansing of the nozzle. The whole apparatus is arranged to be carried from the flanged casing fitting into the recess left by
 60 the removed brick, the apparatus being thus self-contained and extremely simple to fit.

In applying the invention to a water-tube type of boiler, the smoke detector device 3
 65 would be fitted into the side wall 11 of one of the alley-ways 12 left between adjoining pairs of boilers, a small hood 13 communicating with the flue of the boiler being fixed above the upturned elbow 8, so that the flue
 70 gases would be directed into the hood and drawn back into the flue, the color of the issuing gases being seen as they pass from the elbow into the hood.

While the invention has been described with particular reference to its application
 75 to a land boiler of the side flue type, and to a water tube boiler, it is readily applicable to other classes of boilers or furnaces in general, the device only requiring to be inserted
 80 into the flue of the boiler or furnace in such manner that the flared tube 5 is in communication with the flue gases, and with a steam
 85 pipe connected up to the flared tube in such manner that superheating of the steam may be obtained and an ejector action on the flue
 90 gases caused in the elbow or analogous fitting, or the ejector action could be set up by a jet of compressed air.

I claim:—

A smoke testing apparatus comprising
 90 means connected with the source of smoke supply for conveying a sample of the smoke from said source, means for withdrawing the smoke and discharging it into the atmosphere, means for removing the sample
 95 abstracted arranged adjacent the outlet of the abstracting means thereby providing an open air space for the passage of the smoke to be tested.

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

ALFRED EDWARD CARR.

Witnesses:

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 B. E. KNIGHT.