March 14, 1933. W. A. WOODESON 1,901,791

MEANS FOR REMOVING DUST SUCH AS FROM PLANT FIRED BY PULVERULENT FUEL

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Fig. 2.

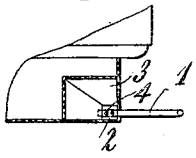


Fig. 1.

Fig. 3.

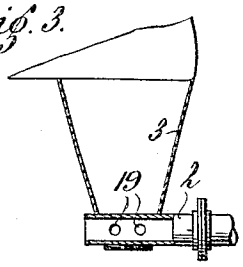


Fig. 4

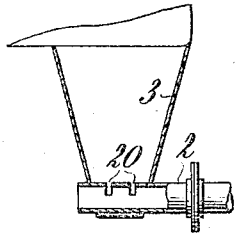


Fig. 5.

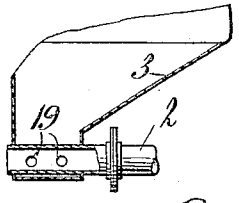


Fig. 6.

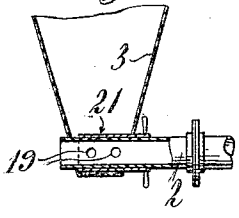


Fig. 7.

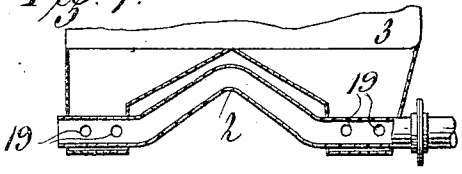
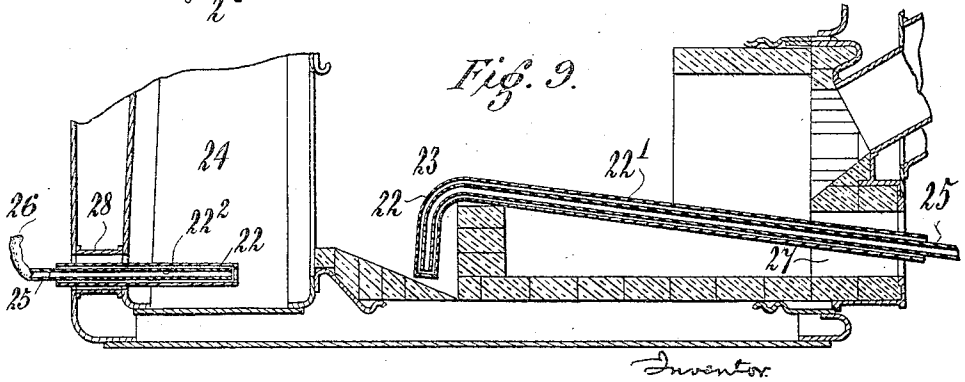


Fig. 9.



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MEANS FOR REMOVING DUST SUCH AS FROM PLANT FIRED BY PULVERULENT FUEL

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Fig. 8.

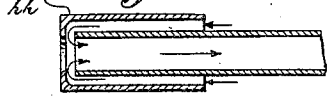


Fig. 10.

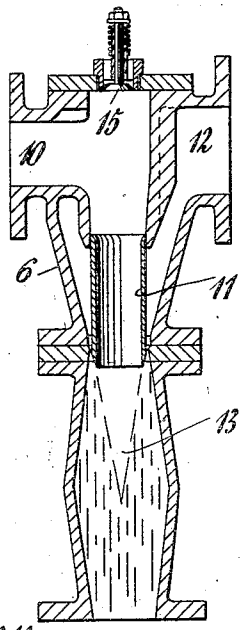


Fig. 11

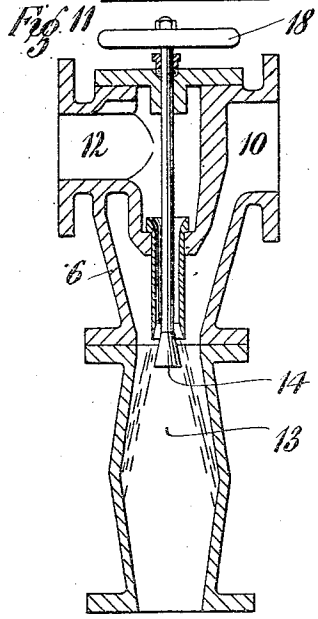


Fig. 13.

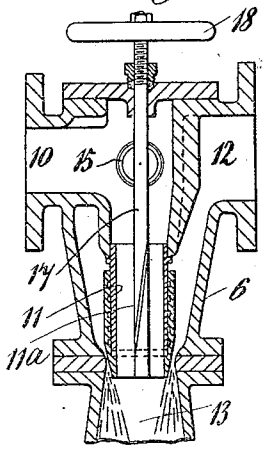


Fig. 12.

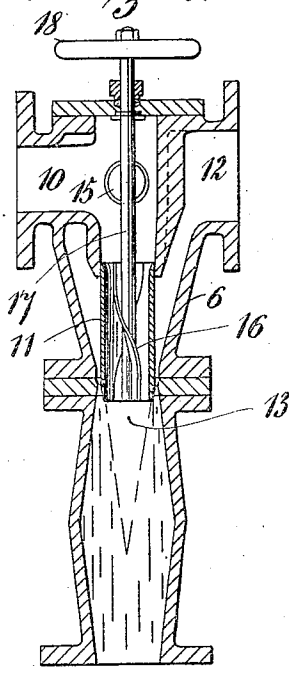
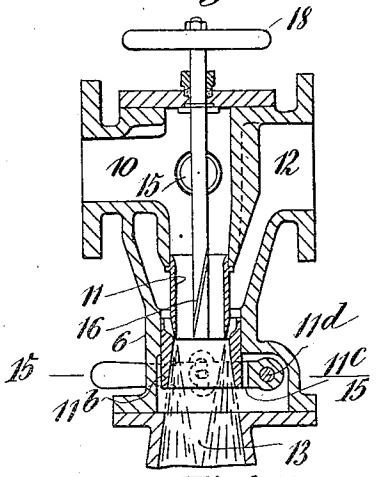
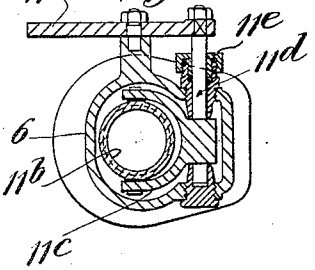


Fig. 14.



11f Fig. 15.



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attys.

Patented Mar. 14, 1933 1,901,791

UNITED STATES PATENT OFFICE

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MEANS FOR REMOVING DUST SUCH AS FROM PLANT FIRED BY PULVERULENT FUEL

Application filed October 17, 1930, Serial No. 489,466, and in Great Britain April 1, 1930.

The object of the present invention is to provide improved means for removing accumulations of dust, such as occur for example in plant fired by pulverulent fuel, in an expeditious manner by means of a simple and effective character.

This I achieve by arranging that the dust shall be entrained in a pipe system in which precaution is taken to ensure a flow therethrough, at high velocity, of air additional to the dust or dust laden air. The subsequently commingled streams are then dealt with so as to produce a precipitation or separation of the dust from the air for example by moistening the same. Advantageously the dust may be allowed to collect in the region of an inlet or inlets in an open ended pipe or pipe system so that the same is drawn in by suction due to the velocity of air flowing through the pipe produced by a water ejector which at the same time acts to flood the dust and prevent its dissemination in an objectionable condition.

But in order that the invention may be more readily understood and easily carried into effect it will be further described with the aid of the accompanying drawings wherein Fig. 1 is a diagrammatic elevation of part of a boiler ash ejector equipment more particularly for use in ships, Fig. 2 being a plan view of a portion thereof. Figs. 3, 4, 5, 6 and 7 are part sectional diagrammatic views of alternative forms of suction nozzles. Fig. 8 is a sectional and diagrammatic view of a modified form of nozzle and Fig. 9 is a view illustrating the application of two such nozzles to a boiler. Figs. 10, 11, 12, 13 and 14 are sectional and diagrammatic views of various types of ejector apparatus which may be used in the equipment. Fig. 15 is a cross section taken on the line 15—15 of Fig. 14.

As shown in Figs. 1 and 2 an ash suction pipe 1 has an open ended nozzle 2 which extends through a hopper 3 or pocket formed in the smoke box, such pipe having two lateral ash inlet holes 4 and being extended upwardly for connection to the suction branch 5 of a water ejector 6 adapted to discharge through a pipe 7 led overboard. The inlet 8 to the ejector is connected by a pipe 9 to any suitable water pump.

Although the ejector 6 is shown as associated with a single ash suction nozzle 2, it will be obvious that the pipe 1 may have various branches leading to any desired portions of the uptake or smoke box in which dust may collect, the pipe system in other words being so arranged that air moving at high velocity will carry ash or dust from any desired part of the system by means of suitable branches up to the jet where the dust is caught by the water jet, thoroughly wetted and carried by the water to any desired point of discharge, which may be the ash shoot of a ship as instanced.

The ejector apparatus employed may take various forms. In the case of that shown in Fig. 10 arrangement of the water jet chest is such that the dust entering at 10 passes through an internal pipe 11. This allows the water entering at 12 to surround the dust and carry it well forward away from the jet chest before mixing takes place in chamber 13. By this means no dust can lodge in the jet chest due to being moistened by spray from the jet or desertion of the water owing to the release of pressure.

An alternative form of jet chamber is shown in Fig. 11 where the water jet is central, and the ash stream outside, both mixing in chamber 13. The quantity of water passing through the jet tube 12 can be regulated by altering the position of a central axially adjustable obturator 14.

If for any reason such as closing all the air inlets to the system a high vacuum tends to be formed in the jet tube 11 or around the jet tube 12 and in the system, the effect of this would be to cause spraying in the jet chest, which might cause choking owing to the dust having to pass over damp surfaces. Should the water supply be shut off at the same time as the air inlets are closed a high vacuum existing around the jet would be liable to draw the water, already in the pipes back into the ash pipes. To prevent both of these occurrences an automatic air valve such as that shown at 15 in Fig. 10 may be employed, loaded either by a spring or a weight or a

combination of springs and levers so arranged that the actual vacuum produced may be regulated to any desired degree. The valve is set to support a vacuum slightly in excess of that existing under the conditions when air is entering the nozzles and carrying the dust. Any higher vacuum than is actually required will open the valve and allow air to enter and pass through the ash pipe thus preventing water from entering it.

If in the case of the ejector of Fig. 10 it should be desired to provide for clearing the ash tube 11 should it become choked the construction may be modified as shown in Fig. 12 where the air valve 15 is located at the side of the chest and a clearing device 16 is employed.

This is shown as forming part of a spindle 17 and comprises two or any suitable number of scraper blades which can be rotated by the wheel or handle 18.

The ash scraped off by the blades falls into the water jet below and is carried away.

The ash ejectors furthermore may be of such a form as to render it possible to vary the quantity of water used for ejection purposes as well as making it possible to remove any foreign body which may become lodged in the water orifice and thereby breaking the water jet and causing loss of vacuum.

Thus, as shown in Fig. 13, the ash laden air admitted at 10 passes through a tube 11 over the outside of which is fitted a nozzle sleeve 11^a secured to the end of a clearer spindle 17 such as that of Fig. 12.

The opening of the water nozzle can be varied and adjusted by operating the spindle 17.

Should a foreign body become lodged between the end of the adjustable nozzle sleeve 11^a and the casing 6 the nozzle sleeve can be lifted high enough, by operating the spindle 17 to allow the water stream to flush it clear of the nozzle opening into the discharge pipe.

When the nozzle opening has been cleared of the foreign body the nozzle sleeve can again be adjusted into its correct working position.

Figs. 14 and 15 show another form of this nozzle, where the ash laden air enters at 10 as in Fig. 11 and passes through the centre of tube 11 while the water passes between the tube 11 and an adjustable nozzle piece 11^b.

The adjustable Venturi nozzle 11^b is guided in the casing 6 and is held in position by a forked lever 11^c the spindle 11^d of which passes through a stuffing box 11^e and is fitted with an operating lever 11^f.

In the centre of tube 11 is fitted the ash scraper 16 which is operated from the outside by means of its spindle, the operation of the scraper 16 and nozzle piece 11^b being independent.

The quantity of water passing through the nozzle is regulated by adjusting the Venturi nozzle 11^b by means of the lever 11^f.

The nozzles through which the dust enters the suction pipe and pipe system may be variously constituted. In each of Figs. 3, 4, 5, 6 and 7 it is in the form of a pipe passing through the chamber to be emptied as in Figs. 1 and 2, the pipe being provided with openings along its length for the entry of the dust, the end of the pipe being open to allow atmospheric air to enter and carry forward the ash. These openings take the form of circular side holes 19 Figs. 3, 5, 6 and 7 or top 20 Fig. 4. The nozzles may also be provided with controlling means. For example as shown in Fig. 6 the pipe may be equipped with a sliding sleeve 21, provided with holes, slots or openings so arranged that by moving the sleeve the openings for the dust may be covered or uncovered. In the event of a lump or other obstruction tending to choke the dust openings this sleeve would assist in removing the obstruction by being given a few rapid sliding motions over the holes.

In Fig. 8 a sleeve 22 is arranged adjacent the inlet end of the suction pipe so that air may always enter regardless of the depth of dust in the container to be emptied. This sleeve allows air to be carried to the end of the nozzle, and air and dust enter the nozzles together. This arrangement can be used with a flexible pipe for insertion into heaps of dust or taking away accumulation of dust for which permanent connections are not provided.

Fig. 9 illustrates how nozzles according to Fig. 8 may be adapted for extracting ash from the furnace 23 and combustion chamber 24 of a boiler, 25 being the main air pipe or branch to which a flexible connection 26 is made.

The suction nozzle 22^1 is passed into the furnace 23 through the ash door at 27 and may be of straight or curved form to suit the type of brickwork employed.

The suction nozzle 22^2 is applied through the back of the boiler passing through a specially provided tube 28 or a number of tubes large enough to allow the nozzle to be angled down and thereby suck all the ash lying on the combustion chamber bottom.

What I claim is:—

1. In a dust removing apparatus, an ejector comprising a housing having a passage therein receiving dust laden air and a passage therein receiving water under pressure, a venturi in said water passageway, the air passageway provided with a tubular extending portion having an end of a diameter less than the smallest diameter of said venturi extending into said venturi a distance sufficient to assure that the dust laden air is discharged into the water passageway at a point beyond the greatest constriction of the venturi, for the purpose described.

2. In a dust removing apparatus, an ejector comprising a housing having a passageway therein receiving dust laden air and a passageway therein receiving water under pressure, a venturi in said water passageway, the air passageway provided with a tubular extending portion having an end of a diameter less than the smallest diameter of said venturi extending into the constricted portion of said venturi, and means for reducing or increasing the size of the Venturi passageway around the end of the air passageway extension tube, for the purpose described.

3. In a dust removing apparatus an ejector comprising a housing having a passageway therein receiving dust laden air and a passageway therein receiving water under pressure, a venturi in said water passageway, the air passageway provided with a tubular extending portion having an end with a diameter less than the smallest diameter of the venturi extending into and terminating at a point slightly beyond the point of greatest restriction of the Venturi passageway, the outer end of said tube having its walls reduced in thickness, and means for reducing or increasing the size of the Venturi passageway around the reduced end of the air passageway extension tube, for the purpose described.

4. In a dust removing apparatus, an ejector comprising a housing having therein a passageway receiving dust laden air and a passageway therein receiving water under pressure, a venturi in said water passageway, the air passageway including a tubular extending portion having an end of a diameter less than the smallest diameter of the venturi, the outer end of said tube having its walls reduced in thickness, and means to move said tube backwardly and forwardly in said venturi at the point of its greatest constriction, for the purpose described.

5. In a dust removing apparatus, an ejector comprising a housing having a passageway therein receiving dust laden air and a passageway therein receiving water under pressure, a venturi in said water passageway the air passageway provided with a tubular extending portion having a surrounding sleeve forming an elongation thereof, said sleeve having an end of a diameter less than the smallest diameter of said venturi and means exterior of said housing having operative connection with said sleeve for moving the reduced end of the same backwardly and forwardly in the venturi for reducing and increasing the size of the Venturi passageway around the end of the sleeve, for the purpose described.

6. A device as defined in claim 5, wherein the sleeve operating means includes blades rotatable within the tubular air passageway extension portion as the position of the sleeve is altered, for the purpose described.

7. A device as defined in claim 1, wherein an automatic air valve is positioned in the air passageway and is adapted to open to atmospheric pressure when a vacuum within the ejector reaches a predetermined amount.

8. In a dust removing apparatus, an ejector comprising a housing having a passageway therein receiving dust laden air and a passageway therein receiving water under pressure, a venturi in said passageway, the air passageway provided with a tubular extending portion discharging into said venturi, a sleeve rotatable externally upon said tubular portion, a stem threadedly mounted in said housing and supporting said sleeve, and means to rotate said stem in said housing for moving said sleeve backwardly and forwardly on said tubular air passageway extension, for the purpose described.

9. A device such as defined in claim 8, wherein the rotatable stem passes through the tubular air passageway extension and is provided with outwardly extending scraper blades rotatable in said sleeve, for the purpose described.

10. In a dust removing apparatus, an ejector comprising a housing having a passageway therein receiving dust laden air and a passageway therein receiving water under pressure, a venturi in said water passageway, the air passageway provided with a tubular extending portion having an end of a diameter less than the smallest diameter of said venturi extending into the venturi a distance sufficient to insure that the dust laden air is discharged into the water passageway at a point beyond the greatest restriction of the venturi, and scraper means movably mounted within said air passageway tubular extending portion, the parts arranged for the purpose described.

11. In a dust removing apparatus, an ejector comprising a housing having a passageway therein receiving dust laden air and a passageway therein receiving water under pressure, a venturi movably mounted in said water passageway, the air passageway provided with a tubular extending portion having an end of a diameter less than the smallest diameter of said venturi extending into the restricted portion of said venturi, and means to move said venturi in respect to the tubular extending portion of the air passageway for reducing or increasing the size of the Venturi passageway around the end of the air passageway extension tube, for the purpose described.

12. A device as defined in claim 1, wherein means is provided for reducing or increasing the size of the Venturi passageway around the end of the air passageway extension tube.

13. In a dust removing apparatus, an ejector comprising a housing having therein a passageway receiving dust laden air and

a passageway therein receiving water under pressure, a venturi in said water passageway, the air passageway including a tubular extending portion having an end of a diameter less than the smallest diameter of the venturi, means to move said tubular extension backwardly and forwardly in said venturi to adjust the size of the Venturi passageway around the end of said tubular extension, for the purpose described.

14. In a dust removing apparatus, an ejector comprising a housing having a passageway therein receiving dust laden air, and a passageway therein receiving water under pressure, a venturi in said passageway, the air passageway provided with a tubular extending portion discharging into said venturi, a sleeve movably mounted upon said tubular portion, and means to move said sleeve backwardly and forwardly on said tubular air passageway extending portion, for the purpose described.

Signed at Gateshead in the county of Durham, England, this twenty-ninth day of September, 1930.

WILLIAM ARMSTRONG WOODESON.