

SPECIFICATION

APPARATUS FOR CLEANING AIR HOLES FOR A COMBUSTION FURNACE

TECHNICAL FIELD

The present invention relates to an apparatus for normally cleaning air holes formed for supplying air for increasing a combustion efficiency of a combustion furnace for the purpose of preventing the air holes from being clogged with foreign material due to generation of combustion gas.

BACKGROUND ART

Conventionally, in the case that air holes formed for increasing a combustion efficiency of a combustion furnace are clogged with foreign material, a measure is taken such that after combustion is completely stopped, the whole combustion furnace is cooled, and an operator enters the combustion chamber of the combustion furnace, the operator actuates a cleaning pin for cleaning the clogged air holes one by one.

However, the aforementioned measure that after combustion is completely stopped and the whole combustion furnace is cooled, the operator enters the combustion chamber of the combustion furnace and the operator inserts the pin into the clogged air hole to remove the clogged foreign material from the air hole takes long cleaning time and requires many

manhours. As is often the case with the operator, since the operator sucks dust generated during cleaning operation, the cleaning operation is not healthy for the operator, For this reason, most of operators refuses such cleaning operation.

DISCLOSURE OF THE INVENTION

Therefore, the present invention provides an apparatus for cleaning air holes in a combustion furnace wherein the apparatus is characterized in that a plurality of cleaning nozzles are fitted to the air holes, and that the cleaning nozzles are driven by a chain extending around a plurality of driving gears so as to clean the air holes.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front view of a cleaning nozzle usable for an apparatus for cleaning air holes in a combustion furnace according to the present invention, Fig. 2 is a side view of the cleaning nozzle usable for a cleaning apparatus for cleaning air holes in a combustion furnace constructed according to the present invention as viewed from left side, Fig. 3 is a side view of the cleaning nozzle usable for an apparatus for cleaning air holes in a combustion furnace according to the present invention as viewed from the right side, Fig. 4 is a vertical sectional view of the cleaning nozzle usable for an apparatus for cleaning air holes in a

combustion furnace according to the present invention, Fig. 5 is a vertical sectional view of an outer sleeve constituting the cleaning nozzle usable for an apparatus for cleaning air holes in a combustion furnace according to the present invention, Fig. 6 is a vertical sectional view of an inner sleeve constituting the cleaning nozzle usable for an apparatus for cleaning air holes in a combustion furnace according to the present invention, Fig. 7 is a front view of a cleaning pin constituting the cleaning nozzle usable for an apparatus for cleaning air holes in a combustion furnace according to the present invention, Fig. 8 is a front view of a retaining member constituting the cleaning nozzle usable for cleaning air holes in a combustion furnace, Fig. 9 is a front view of a set screw constituting a cleaning nozzle usable for an apparatus for cleaning air holes in a combustion furnace, Fig. 10 is a front view of a larger diameter spring constituting the cleaning nozzle usable for an apparatus for cleaning air holes in a combustion furnace according to the present invention, Fig. 11 is a front view of a smaller diameter spring constituting the cleaning nozzle usable for an apparatus for cleaning air holes in a combustion furnace according to the present invention, Fig. 12 is a front view of an auxiliary member constituting a cleaning nozzle usable for an apparatus for cleaning air holes in a combustion furnace according to the present invention, Fig. 13 is a view which

shows the state that the set screw is fitted which constitutes the cleaning nozzle usable for an apparatus for cleaning cooling holes in a combustion apparatus according to the present invention, Fig. 14 is side view of the cleaning nozzle usable for an apparatus for cleaning air holed in a combustion furnace as viewed from the left side, Fig. 15 is a vertical sectional view of the cleaning nozzle usable for an apparatus for cleaning air holes in a combustion furnace according to the present invention, Fig. 16 is a vertical sectional view of an apparatus for cleaning air holes in a combustion furnace according to the present invention, and Fig. 17 is an enlarged sectional view of a driving portion for driving the cleaning nozzle usable for an apparatus for cleaning air holes in a combustion furnace according to the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

The present invention will now be described in detail with reference to the accompanying drawings which illustrate preferred embodiment thereof.

Fig. 1 is a front view of a nozzle usable for an apparatus for cleaning air holes in a combustion furnace according to the present invention, Fig. 2 is a side view of the nozzle as viewed from the left side, Fig. 3 is a side view of the cleaning nozzle as viewed from the right side, and Fig. 4 is a vertical sectional view of the cleaning nozzle.

As shown in Fig. 4, the cleaning nozzle 1 includes as essential components an outer sleeve 2 having a plurality of female threads adapted to be threadably engaged with a plurality of male threads formed on the outer surface of an inner sleeve 10 shown in Fig. 5, an inner sleeve 10 shown in Fig. 6, a cleaning pin shown in Fig. 7, a retaining member 11 shown in Fig. 8, a set screw shown in Fig. 9, a larger diameter spring shown in Fig. 10, a small diameter spring 7 shown in Fig. 11 and an auxiliary member 3 shown in Fig. 12, and these components are assembled together to constitute the cooling nozzle.

In Fig. 12, reference numeral 3a denotes a projection portion, and reference numeral 3b denotes an insert hole for allowing a rear end 8b of a cleaning pin 8 to be inserted therethrough.

Fig. 4 is a vertical sectional view of the cleaning nozzle 1 after the respective components are assembled.

As shown in Fig. 4, a pin insert hole 10d is formed at the fore end of the hollow inner sleeve 10d and through holes 10f and 10d are formed at the rear end of the inner hollow sleeve 10. After the inner sleeve 10 is threadably engaged with the outer sleeve 2, the cleaning pin 8 is attached to the rear end of the inner sleeve 10, and the retaining member 11 is fitted to the rear end of the inner sleeve 10 together with the auxiliary member 3.

The rear end 8b of the cleaning pin 8 is received in the projection portion 3a having the small diameter spring 7 received therein, and the larger diameter spring 4 is fitted around the outer surface of the projection portion 3a of the auxiliary member 3. A first groove 10b and a second groove 10c are formed at the foremost end of the inner sleeve 10.

The larger diameter spring 4 has a function for returning the cleaning pin 8, and the small diameter spring 7 has a function for preventing the cleaning pin 8 from being broken when it is forcibly displaced when a foreign material adhering to a pin inserting hole 10d is solidified due to cooling of the cleaning nozzle 1, resulting in the cleaning pin 8 failing to be inserted through an insert hole 19a.

Fig. 13 is a view which shows the state that there is fitted a set screw for a cleaning nozzle constituting the cleaning nozzle employable for the apparatus for cleaning air holes for a combustion furnace according to the present invention.

Fig. 14 is a side view of a cleaning nozzle employable for the apparatus for cleaning air holes for a combustion furnace according to the present invention, and Fig. 15 is vertical sectional view of a cleaning nozzle employable for the apparatus for cleaning air holes for a combustion furnace according to the present invention.

In this case, the nozzle 1 is such that a caster 10a is

arranged at the fore end of the inner sleeve 10 in such a manner as to cover the first groove 10b and the second groove 10c therewith. Deterioration of the fore part of the nozzle can be prevented by arranging the caster 10h at the foremost end of the inner sleeve in the above-described manner.

Fig. 16 is a vertical sectional view of the apparatus for cleaning air holes in a combustion furnace according to the present invention. The combustion furnace consists of an inner wall 16 having a plurality of air holes 16a, 16a, 16a, 16a, --- formed therein while forming a combustion chamber 19 for burning materials to be burnt, an air chamber 15 for blowing air in the combustion chamber 19 so as to increase a combustion efficiency, and an outer wall 14.

According to the present invention, the cleaning nozzles 1 are fixed to a number of air holes 16a, 16a, 16a, 16a ---- formed in the inner wall 16, and the air holes 16a, 16a, 16a, 16a ---- each clogged with foreign materials are cleaned by reciprocally actuating the cleaning pin 8 for each of the cleaning nozzles 1. In the drawing, reference numeral 18 denoted a nozzle driving portion having the cleaning nozzle secured thereto.

Fig. 17 is an enlarged sectional view which shows a driving portion for driving the cleaning nozzle usable for the apparatus for cleaning holes for a combustion furnace. The cleaning nozzle driving portion 18 is composed of a cleaning

nozzle 1, a securing frame 18a, a rotational gear 18c and an eccentric cam 18d. A securing frame 18a is fixed to the inner wall 16 while coming in contact with the inner wall 16, and a rotational gear 18c and an eccentric cam 18d are arranged behind the cleaning nozzle 1.

Reference numeral 20 denoted a driving motor for rotating a chain 17. A driving gear 21 is rotatably mounted on a rotational shaft of the driving motor 20, and the chain 17 is placed on the driving gear 1. The chain 17 extends around the gears 18c, 18c, 18c, 18c ---- for the cleaning nozzle fitting frame 18, 18, 18, 18 ---- so that as the chain 17 recirculates, gears 18c, 18c, 18c, 18c ---- are rotated in operative association with eccentric cams 18d, 18d, 18d, 18d ----.

The reason why a shaft 18e having the eccentric cam 18d mounted thereon exhibits a hexagonal sectional shape consists in that the cleaning nozzle can spirally be opened and closed, and moreover, air can freely be rotated. For example, similar to a washing machine, an air swirl for rightward rotation or leftward rotation can freely be generated.

Next, a series of steps for cleaning air holes 16a, 16a, 16a, 16a ---- formed on the inner wall 16 will be described below with reference to Fig. 15.

When the gear 18c having the chain 16 placed thereon is rotated in the b arrow-marked direction as the chain 17 moves

in the a arrow-marked direction, the eccentric cam 18d, 18d, 18d, 18d, 18d ---- fixed to the gear 18c by a fixing bolt 18d to be rotated in operative association with the gear 18c serve to displace the auxiliary member 3 in the upward/downward direction, and at the same time, displace the foremost end 8a, 8a, 8a, 8a --- of the cleaning pin 8, 8, 8, 8, 8 ---- through an air hole 16a, 16a, 16a, 16a, 16a formed through the inner wall 16 in the upward/downward direction so as to remove the clogged foreign material from the air hole 16a, 16a, 16a, 16a, 16a ---- .

It is possible to generate a swirl flow in the combustion chamber 19 by regulating a quantity of air to be fed through the air hole 16a, 16a, 16a, 16a, 16a ----formed through the inner wall 16. Namely, as shown in Fig, 14, it is possible that a swirl flow is generated in the combustion chamber 19 in the form of a convectional flow by regulating a quantity of air to be supplied to the combustion chamber via the air hole 16a, 16a, 16a, 16a, 16a --- formed through the combustion chamber 19.

INDUSTRIAL APPLICABILITY

Since the present invention is constructed in the above-described manner, the following advantageous effects are obtainable.

Firstly, since the clogged material in each air hole

formed through the inner wall can automatically removably cleaned, there does not arise a necessity for stopping an operation of the combustion furnace.

Secondly, since each air hole can normally be cleaned, a sufficiently quantity of oxygen can normally be supplied to the combustion chamber, and a quantity of air to be supplied to the combustion chamber can adequately be regulated, a convectional flow can be generated in the combustion chamber, resulting in complete combustion being achieved. This is very favorable for an environment.



CLAIMS

1. An apparatus for cleaning air holes in a combustion furnace characterized in that a plurality of cleaning nozzles are fitted to said air holes, and that said cleaning nozzles are driven by a chain extending around a plurality of driving gears of driving motors so as to clean said air holes.
2. An apparatus for cleaning air holes in a combustion furnace, characterized in that each cleaning nozzle comprises a hollow outer sleeve, a hollow inner sleeve, a cleaning pin, a retaining member, a set screw, a larger diameter spring, a small diameter spring, and an auxiliary member.
3. An apparatus for cleaning air holes in a combustion chamber, characterized in that a caster is arranged at the fore end part of said inner sleeve.