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(71) Applicant: **Dublix Technology ApS**
2820 Gentofte (DK)

(72) Inventors:
- **Danielsen, Asger**
  2820 Gentofte (DK)
- **Hansen, Kristian**
  2820 Gentofte (DK)

(74) Representative: **Plougmann Vingtoft a/s**
Strandvejen 70
2900 Hellerup (DK)

(54) AN APPARATUS FOR CLEANING BOILER SURFACES

(57) The present invention concerns an apparatus for cleaning open draft boiler surfaces in a combustion or incineration plant in service, said apparatus comprising a cleaning head having a coupling for connecting a cleaning liquid hose to the cleaning head for feeding a cleaning liquid to a rotating nozzle head having a plurality of nozzles from which the cleaning liquid can be sprayed against boiler surfaces during rotation of the nozzle head, wherein the cleaning head is provided with at least one sensor for monitoring the cleaning operation.

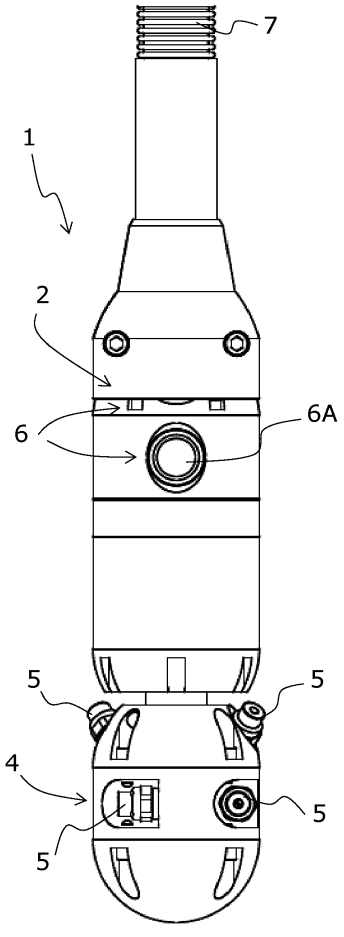

Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to an apparatus for cleaning open draft boiler surfaces in a combustion or incineration plant in service, said apparatus comprising a cleaning head having a coupling for connecting a cleaning liquid hose to the cleaning head for feeding a cleaning liquid to a rotating nozzle head having a plurality of nozzles from which the cleaning liquid can be sprayed against boiler surfaces during rotation of the nozzle head.

BACKGROUND OF THE INVENTION

[0002] An apparatus of such kind is known from WO2021/063465A1 and EP-A-1291598. The cleaning head is provided on the end and connected to a flexible hose, i.e. the liquid cleaning hose, and can simply be lowered through an opening provided in the top of the open draft of the boiler to be cleaned. The cleaning head is moved downwards while cleaning liquid is supplied to the nozzles and thereby sprayed onto the surfaces to be cleaned inside the boiler. Since the apparatus is positioned inside the open draft only during cleaning operations, the apparatus can be relatively simple as the cleaning fluid will keep the apparatus cool during the cleaning operation and the apparatus will not have to suffer the high temperatures inside the open draft of the combustion or incineration plant in service. Furthermore, the flexible hose construction reduces the amount of space required for introducing the cleaning apparatus into the open draft, thereby enabling the use of the apparatus in connection with existing plants substantially without any modifications thereof.

[0003] WO2021/063465A1 and EP-A-1291598 disclose that the nozzle head comprises a turbine and an exchange so as to turn the nozzle head more slowly than the turbine.

[0004] In order to achieve a good cleaning of the inner surfaces, the cleaning heads are produced as with either clockwise (CW) rotation or counter-clockwise (CCW) rotation. for many years it is found useful that the cleaning operation comprises both a cleaning with a CW cleaning head and afterwards a CCW cleaning head or vice versa, so that the inside of the boiler may be exposed to changing angles of the cleaning spray.

[0005] However, although there can be achieved a good cleaning of the boiler by these cleaning heads, it is an object of the present invention to further improve the cleaning operation. In particular the cleaning head is exposed to severe temperatures when it is lowered into the boiler for performing the cleaning operation. It is therefore useful to ensure an efficient cleaning operation and thereby reduce the time of the cleaning operation.

SUMMARY OF THE INVENTION

[0006] This object is achieved in a first aspect of the invention by providing an apparatus of the initially mentioned kind, wherein the cleaning head is provided with at least one sensor for monitoring the cleaning operation.

[0007] By the invention it is realised that the cleaning operation can be monitored during the operation, i.e. while the cleaning head is lowered into action inside the boiler by providing a sensor recording and/or transmitting selected data about the cleaning operation and/or the environment in which the cleaning head is being operated. By receiving live data of the environment that the cleaning head is exposed to the operator can adjust the cleaning operation in order to optimise the cleaning and/or avoid unnecessary deterioration of the condition of the cleaning head.

[0008] In one embodiment, the at least one sensor may comprise a temperature sensor monitoring the temperature inside the boiler during the cleaning operation. Hereby, it can be ensured that the cleaning head is not heated excessively during the cleaning operation.

[0009] In another embodiment, the at least one sensor is a camera for transmitting and/or recording an image or a video of the cleaning effect in the boiler. The deposits that are to be removed by the cleaning can be recognised and localised by the camera so that the cleaning operation can be adapted by the operator so that the cleaning can be intensified in identified areas inside the boiler. In a particular embodiment, the camera is an infrared (IR) camera, whereby heat build-up areas can be detected and thereby areas that may require extra cleaning can be identified, for instance due to soot deposits or the like.

[0010] The at least one sensor may preferably be an external sensor provided on the outside of the cleaning head in order to ensure accurate sensor data, such as images of the environment in which the cleaning head is being operated. The sensor, such as the camera, may advantageously be provided flush with the exterior surface of the cleaning head, for instance with a protective transparent lens behind which the camera is mounted.

[0011] In some embodiments, the sensor may be air-cooled. Alternatively, the sensor can be liquid cooled, preferably by using the cleaning liquid supplied to the cleaning head as sensor cooling liquid as the liquid passes through the cleaning head.

[0012] In some embodiments of the invention, the coupling includes a connector for establishing a communication connection between the at least one sensor and an associated communication line accompanying the cleaning liquid hose. As an alternative or as a supplement to this wired sensor data communication, the at least one sensor may be adapted for wireless communication of sensor data.

[0013] In some embodiments of the invention, the at least one sensor may include monitoring the rotation speed and/or other parameters for the monitoring the operation of the nozzle head.

[0014] By the invention it is realised that a plurality of sensors may be provided. In particular the two or more sensors may include different types of sensors monitoring different parameters of the cleaning operation. This may be advantageous in order to achieve an extensive set of data during the cleaning operation so that the cleaning operation may be performed more efficiently.

[0015] Furthermore, a sensor data receiving system may be provided remote from the cleaning head for collecting sensor data from the cleaning head mounted sensor or sensors. Such receiver may be connected to the sensor via a data communication connection line accompanying the cleaning liquid hose and/or by wireless communication. The receiver may be provided with a display or the like for presenting the data to the operator.

DETAILED DESCRIPTION

[0016] In the following, the invention is described in more detail with reference to the embodiments shown in the accompanying drawings, in which:

Fig. 1 is a schematic side view of a cleaning head according to a first embodiment of the invention;
Fig. 2 is another schematic side view of same; and
Fig. 3 is a schematic view of a cleaning head inserted into a boiler.

[0017] With reference to the figures, a cleaning head 1 for cleaning open draft boiler surfaces in a combustion or incineration plant in service will be described. The cleaning head 1 comprises a main body 2 with a coupling 7 in the form of a threated portion for connecting a cleaning liquid hose 8 to the cleaning head 1 for feeding a cleaning liquid 9 to a rotating nozzle head 4. The rotating nozzle head 4 comprises a plurality of nozzles 5. The cleaning liquid 9 is sprayed through said nozzles 5 against boiler surfaces during rotation of the nozzle head 4, when the cleaning head 1 is lowered down into the boiler 10. The cleaning head 1 is provided with one or more sensors 6 for monitoring the cleaning operation. In the embodiment shown in figures 1 and 2, one of the sensors 6 is a camera 6A for transmitting 11 and/or recording an image or a video of the cleaning effect in the boiler 10.

[0018] The camera 6A may be provided with a lens, which is substantially flush with the surface of the main body 2 of the cleaning head 1 so that the camera 6A is protected by the lens. The camera 6A records image data either as still pictures or as a video and transmits 11 the image data to a data receiving system 12, which is provided remotely from the cleaning head 1 outside the boiler 10. The data receiving system 12 collects sensor data from the cleaning head mounted sensor or sensors 6, such as the camera 6A. In the embodiment shown, the receiver 12 is communicating with the camera 6A and any other sensors 6 via wireless data transmission 11. The receiver 12 may be provided with a display 13 or the like for presenting the image data to the operator who can then control the cleaning operation, e.g. by lifting or lowering the cleaning head 1 as indicated by the arrow 14 (see fig. 3). As an alternative, it is realised that the coupling 7 may include a connector (not shown) for establishing a wired communication connection between the sensors 6 and the receiver via an associated communication line (not shown) accompanying the cleaning liquid hose 8.

[0019] By the camera 6A, the deposits that are to be removed by the cleaning can be recognised and localised so that the cleaning operation can be adapted by the operator so that the cleaning can be intensified in these identified areas inside the boiler 10. Preferably, the camera 6A is an infrared (IR) camera, which is particularly heat sensitive so that heat build-up areas can be detected and thereby areas that may require extra cleaning can be identified.

[0020] Besides a camera 6A, the sensors 6 may include a temperature sensor monitoring the temperature inside the boiler during the cleaning operation and/or a sensor includes monitoring the rotation speed and/or other parameters for the monitoring the operation of the nozzle head.

[0021] As mentioned earlier, the sensors may be air-cooled or liquid cooled for instance by the cleaning liquid supplied to the cleaning head.

[0022] In the embodiment shown, the sensor 6 is located on the main body 4 of the cleaning head 1. For such a placement of the sensor 6, the sensor 6 may not participate in the rotating movement of the rotating nozzle head 4. This may be useful to achieve a stable or stationary capture of the environment by the sensor 6 and/or a stable communication to the receiver via e. g. the wired communication line. As an alternative, the sensor 6 may be located on the rotating nozzle head 4. This embodiment allows for the sensor 6 to also perform the rotating movement of the rotating nozzle head 4, thus being able to perform a more comprehensive capture of the environment. For this embodiment the wireless communication line may be advantageous, but a wired communication line may also be considered.

[0023] In embodiments of the cleaning head 1 with a plurality of sensors 6, one or more sensors may be located on the main body 2 and/or one or more sensors 6 may be located on the rotating nozzle head 4.

[0024] Above, the invention is described with reference to some currently preferred embodiments. However, by the invention it is realised that other embodiments and variants may be provided without departing from the scope of the invention as defined in the accompanying claims.

Claims

1. An apparatus for cleaning open draft boiler surfaces in a combustion or incineration plant in service, said apparatus comprising a cleaning head having a cou-

pling for connecting a cleaning liquid hose to the cleaning head for feeding a cleaning liquid to a rotating nozzle head having a plurality of nozzles from which the cleaning liquid can be sprayed against boiler surfaces during rotation of the nozzle head,

characterised in that

the cleaning head is provided with at least one sensor for monitoring the cleaning operation.

2. An apparatus according to claim 1, wherein the at least one sensor includes a temperature sensor monitoring the temperature inside the boiler during the cleaning operation.

3. An apparatus according to claim 1 or 2, wherein the at least one sensor is a camera for transmitting and/or recording an image or a video of the cleaning effect in the boiler.

4. An apparatus according to claim 3, wherein the camera is an infrared (IR) camera.

5. An apparatus according to any one of the preceding claims, wherein the sensor is an external sensor provided on the outside of the cleaning head.

6. An apparatus according to any one of the preceding claims, wherein the sensor is air-cooled.

7. An apparatus according to any one claims 1 to 5, wherein the sensor is liquid cooled, preferably by the cleaning liquid supplied to the cleaning head.

8. An apparatus according to any one of the preceding claims, wherein the coupling includes a connector for establishing a communication connection between the at least one sensor and an associated communication line accompanying the cleaning liquid hose.

9. An apparatus according to any one of the preceding claims, wherein the at least one sensor is adapted for wireless communication of sensor data.

10. An apparatus according to any one of the preceding claims, wherein the at least one sensor includes monitoring the rotation speed and/or other parameters for the monitoring the operation of the nozzle head.

11. An apparatus according to any one of the preceding claims, wherein a plurality of sensors are provided.

12. An apparatus according to claim 11, wherein the plurality of sensors are monitoring different parameters of the cleaning operation.

13. An apparatus according to any one of the preceding claims, wherein a sensor data receiving system is provided remote from the cleaning head for collecting sensor data from the cleaning head mounted sensor or sensors.

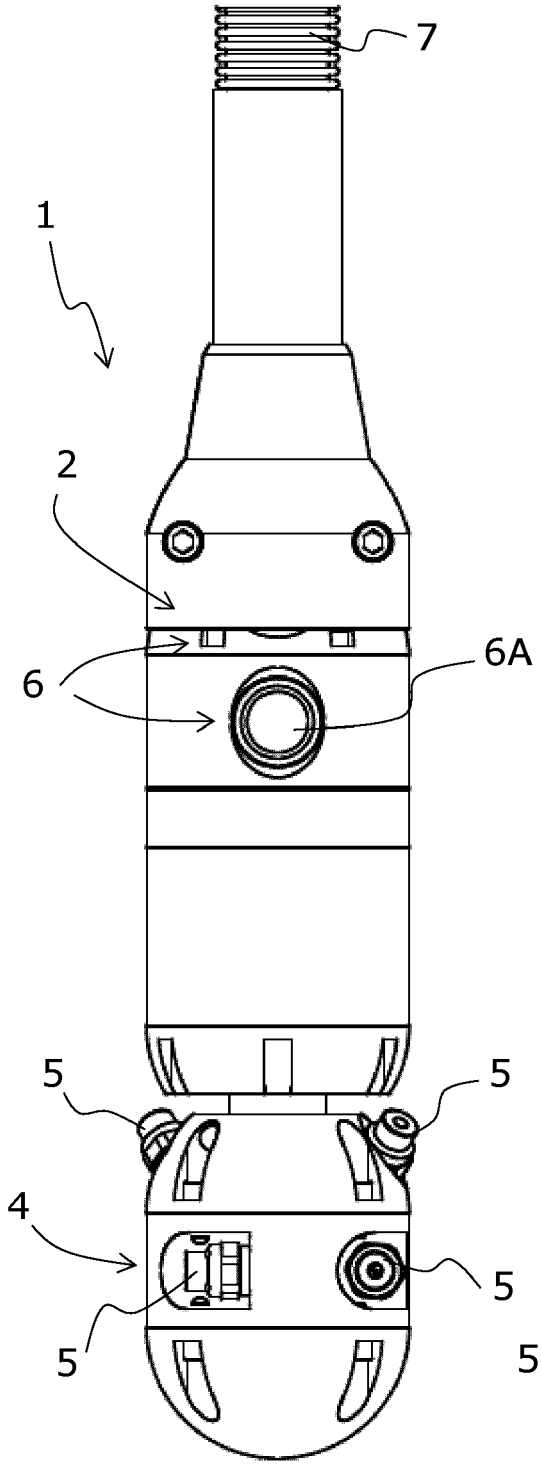

Fig. 1

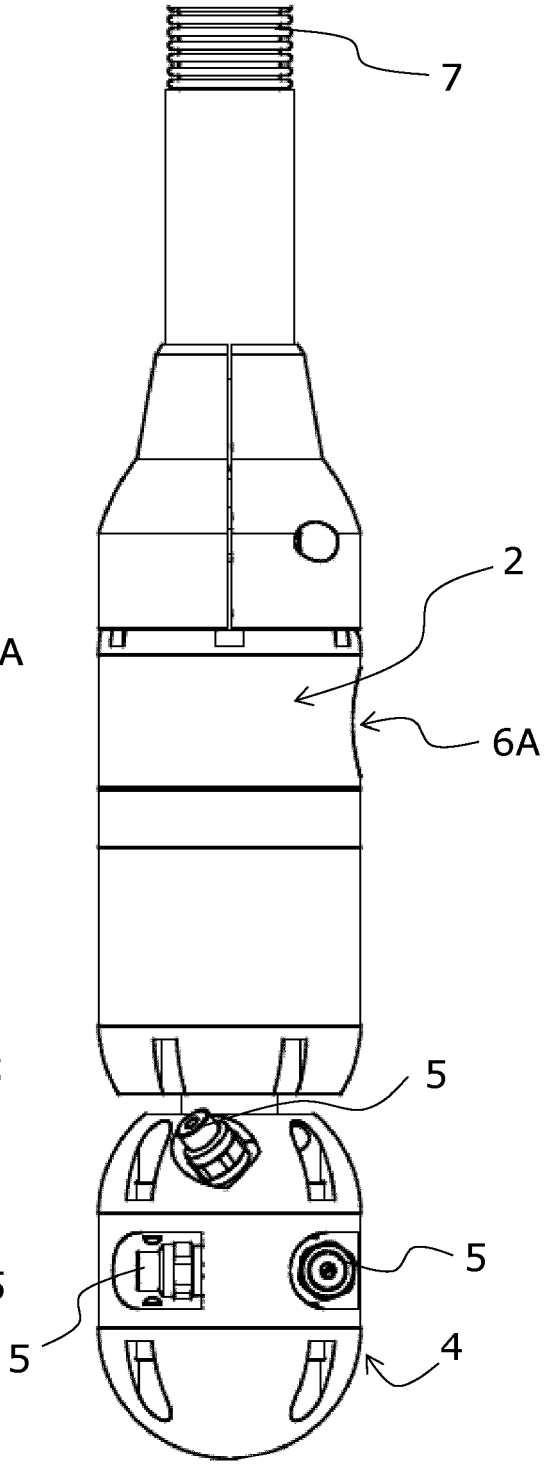

Fig. 2

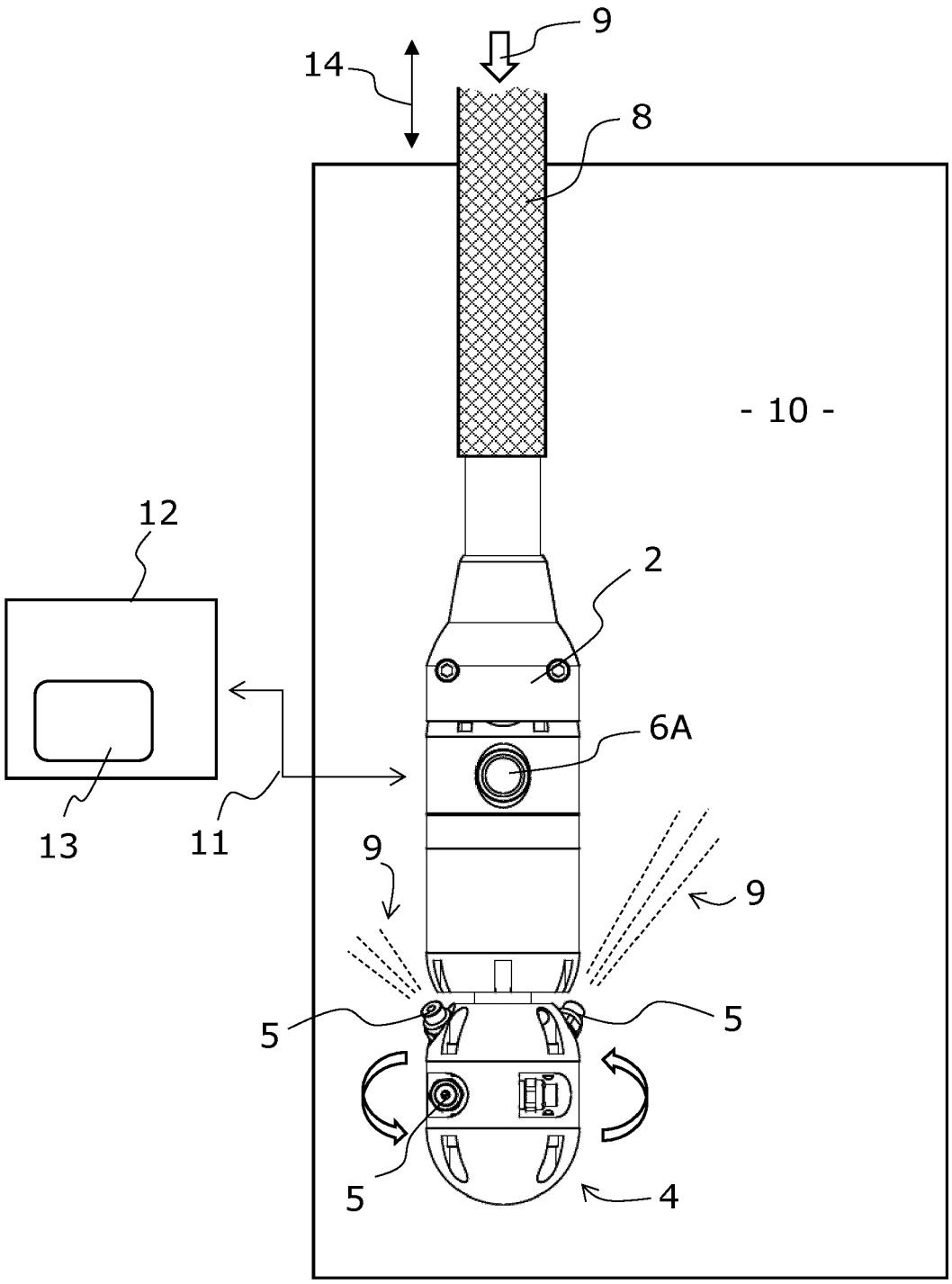

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 23 20 2601

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	US 8 770 155 B2 (TANDRA DANNY S [US]; CLYDE BERGEMANN POWER GROUP AMERICAS INC [US]) 8 July 2014 (2014-07-08) * the whole document *	1-13	

TECHNICAL FIELDS SEARCHED (IPC)

F28G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 March 2024	Bloch, Gregor

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 20 2601

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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