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## (54) A furnace burning oil, gas and oil biofuel

(57) The invention relates to a furnace burning oil, gas or oil biofuel, which furnace is encased by a mantle (1), a front end (2) and a black end (3) and comprises a combustion chamber (4) and tubes (5a, 5b) installed outside the combustion chamber, through which tubes the combustion gases generated by the flame of a burner are arranged to flow out of the furnace. The invention is **characterized in that** the burner (6) is of a type which generates in the combustion chamber (4) a fluttering flame, and the combustion chamber (4) ends up in an echo chamber (7) arranged in the back section of the furnace, said echo chamber having a sufficient length for producing a sound when the combustion gases generated by the fluttering flame of the burner (6) impinge on the back end (3) of the furnace, the front wall (9) of said echo chamber (7) being provided with outlets for a first tube set (5a) which ends up in a reversing chamber (10) arranged in front of the front end (2) of the furnace, the back wall (15) of said reversing chamber being provided with outlets for a second tube set (5b) arranged parallelly to the first tube set (5a), said second tube set ending up in a second echo chamber (11) arranged in the back section of the furnace, in which second echo chamber the sound produced by the vibrating combustion gas flow reaches a level capable of loosing and discharging ash and soot from all surfaces of the furnace. (Fig. 3)

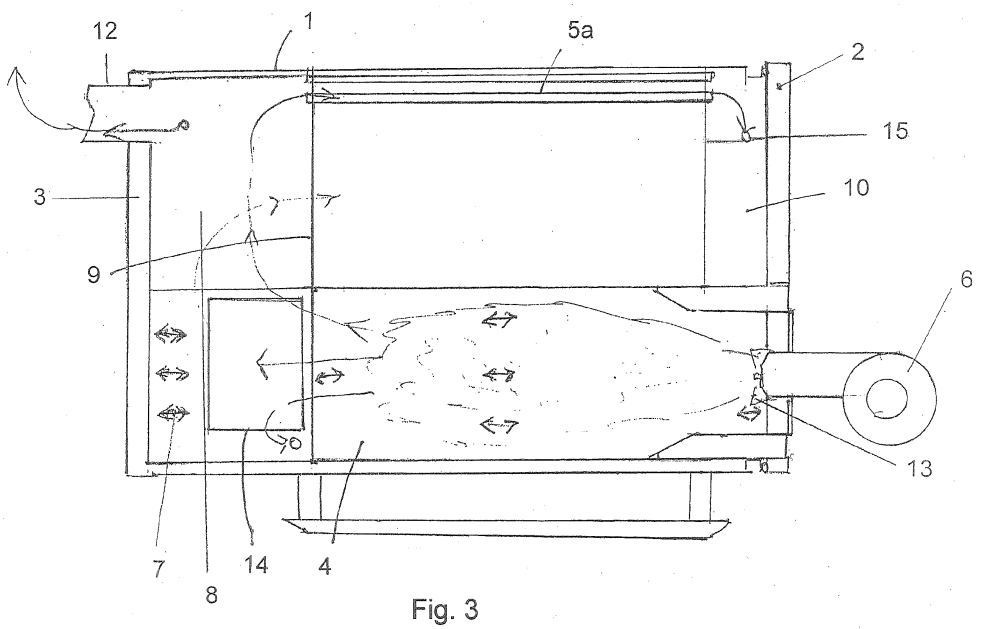


Fig. 3

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## Description

**[0001]** The present invention relates to a furnace burning oil, gas or oil biofuel, which furnace is encased by a mantle, a front end and a black end and comprises a combustion chamber as well as tubes installed outside the combustion chamber, through which tubes the combustion gases generated by the flame of a burner are arranged to flow out of the furnace.

**[0002]** A drawback of the above-mentioned furnaces is gathering of various depositions on the inner surfaces of the furnace during combustion. Various sweeping methods and devices have been developed to eliminate this problem which, however, increase both the manufacture price and maintenance and operating costs. Mechanical sweeping devices using brushes as well as steam and air sweeping devices are known. Likewise, sound sweeping devices have been used, the operation of which is based on the use of waves generated by an infrasound source. All these additional devices increase both the manufacture price and the operating costs of such a furnace.

**[0003]** The purpose of the present invention is to provide such a furnace burning oil, gas and oil biofuel which during normal operation is capable of keeping the walls of the furnace clean automatically without any additional devices or techniques.

**[0004]** This is achieved by a furnace which is **characterized in that** a burner of such a type is used which generates a fluttering flame in the combustion chamber, said combustion chamber ending up in an echo chamber arranged in the back section of the furnace, the echo chamber having a sufficient length for producing a sound when the combustion gases generated by the fluttering flame of the burner impinge on the back end of the furnace, whereby in the front wall of the echo chamber outlets for a first tube set are arranged, the tubes of which ending up in a reversing chamber arranged in the area of the front end of the furnace, the back wall of said reversing chamber being provided with outlets for a second tube set arranged parallelly to the first tube set, said second tube set ending up in a second echo chamber arranged in the area of the back end of the furnace in which second echo chamber the sound produced by the vibrating combustion gas flow reaches a level that is capable of loosing and discharging ash and soot from all inner surfaces of the furnace. A test run of the furnace according to the invention has shown that the cleaning capacity thereof is superior to that of known furnaces operating on a sound sweeping method based on the use of air. The cleaning according to the invention takes place automatically continuously during the operation of the combustion facility without the use of any additional power, so that the efficiency does not decrease but remains constant during the whole time of the operation.

**[0005]** The sound level generated in the echo chambers can be regulated by moving the front plate provided in the front of the nozzle of the burner in one or other direction.

**[0006]** The echo chambers arranged in the back section of the furnace may be separated by a water-cooled partition wall. Also both end walls are water-cooled, whereby at least the front end wall is in the form of an openable door. A length of approximately 1500 mm in the longitudinal direction of the furnace has been proved to be a suitable length of the echo chambers for achieving a sufficient sound level. The sound intensification is based on the resonance phenomenon.

**[0007]** Each of the echo chambers is accessible via its own service hatch arranged on the opposite sides of the back section of the furnace.

**[0008]** The measurements carried out have proved that the efficiency of the furnace according the invention is 5 to 10 % better than that of a conventional furnace.

**[0009]** In the following the invention is described in more detail by referring to an accompanying drawing in which

fig. 1 shows a front view of an example of a furnace according to the invention;

fig. 2 shows the furnace viewed from behind, and

fig. 3 shows a side view of the furnace.

**[0010]** The example of a furnace burning oil, gas or oil biofuel shown in the drawing comprises a cylindrical mantle 1, a water-cooled front end 2, being preferably designed as an openable door, and a water-cooled back end 3, which together encase a combustion chamber 4, as well as tube sets 5a, 5b arranged outside the combustion chamber 4 parallelly to this. In the front end 2 of the furnace, in the area of the combustion chamber 4, a burner 6 of a new type is installed which generates a fluttering flame. The burner may be an oil burner, for instance Oilon Noullox, or a gas burner. The combustion chamber ends up in a first echo chamber 7 arranged in the back section of the furnace, having a length which is sufficient to generate a sound when the combustion gases generated by a fluttering flame of the burner 6 impinge on the back end 3 of the furnace. This first echo chamber 7 is defined by the mantle 1 of the furnace, the back end wall 3, a water-cooled partition wall 8 dividing a cross-sectional surface of the furnace approximately in half, as well as the front wall 9 of the echo chamber. In the front wall 9 of the echo chamber outlets for the first tube set 5a are arranged, the tubes of which ending up in a reversing chamber 10, the back wall 15 of which being provided with outlets for a second tube set 5b arranged parallelly to the first tube set 5a. This second tube set 5b ends up in a second echo chamber 11 arranged in the other half of the back section of the furnace and having a same length as the first echo chamber 7. In this second echo chamber the sound produced by the vibrating combustion gas flow reaches such a level which is capable of loosing and discharging ash and soot from all surfaces

of the furnace. From the second echo chamber 11 the combustion gases are discharged through a flue 12. The regulation of the sound level takes place by moving a front plate 13 provided in the front of the nozzle of the burner 6 in one or other direction.

**[0011]** The furnace, having a power of 4,5 MW, may have a length of approximately 5000 mm and a diameter of 2300 mm, the echo chambers provided in the back section of the furnace having a length of 1500 mm as already stated, whereby the tube sets have a length of 2800 mm, the reversing chamber 10 arranged in the front end of the furnace having a length of 350 mm. The water-cooled walls of the echo chambers are preferably manufactured of boiler steel by dowelling technique, whereby a water chamber of about 120 mm has been provided in the plane back end wall 3 and the partition wall 8 of the furnace by sufficiently densely dowelling. The water-cooled front end 2 of the furnace designed as an openable door is preferably also manufactured by dowelling technique to provide a water chamber of 10 mm.

**[0012]** On the opposite sides of the back section of the furnace service hatches are arranged to allow an access to the echo chamber 7, 11 of the respective side.

## Claims

1. A furnace burning oil, gas or oil biofuel which is encased by a mantle (1), a front end (2) and a back end (3) and comprises a combustion chamber (4) and tubes (5a, 5b) installed outside the combustion chamber, through which tubes the combustion gases generated by a flame of a burner (6) are arranged to flow out of the furnace, **characterized in that** the burner (6) is of a type which generates a fluttering flame in the combustion chamber (4), and the combustion chamber (6) ends up in an echo chamber (7) arranged in the back section of the furnace which have a sufficient length for producing a sound when the combustion gases generated by the fluttering flame of the burner (6) impinge on the back end (3) of the furnace, the front wall (9) of said echo chamber (7) being provided with outlets for a first tube set (5a), said tube set (5a) ending up in a reversing chamber (10) arranged in the front of the front end (2) of the furnace, the back wall (15) of said reversing chamber (10) being provided with outlets for a second tube set (5b) arranged parellelly to the first tube set (5a), said second tube set (5b) ending up in a second echo chamber (11) arranged in the back section of the furnace, in which second echo chamber (11) the sound produced by the vibrating combustion gas flow reaches a level capable of loosing and discharging ash and soot from all surfaces of the furnace.

2. The furnace according to claim 1, **characterized in that** the sound level produced in the echo chambers (7, 11) can be regulated by moving a front plate (13) provided in the front of the nozzle of the burner (6).

3. The furnace according to claim 1, **characterized in that** a water-cooled partition wall (8) is arranged between both echo chambers (7, 11).

4. The furnace according to claim 1, **characterized in that** the echo chambers (7, 11) have a length of approximately 1500 mm in the longitudinal direction of the furnace.

5. The furnace according to claim 1, **characterized in that** both end walls (2, 3) of the furnace are water-cooled.

6. The furnace according to claim 5, **characterized in that** the front end wall (2) is in the form of an openable door.

7. The furnace according to claim 1, **characterized in that** on the opposite sides of the back section of the furnace a service hatch is arranged for the echo chamber (7, 11) of the respective side.

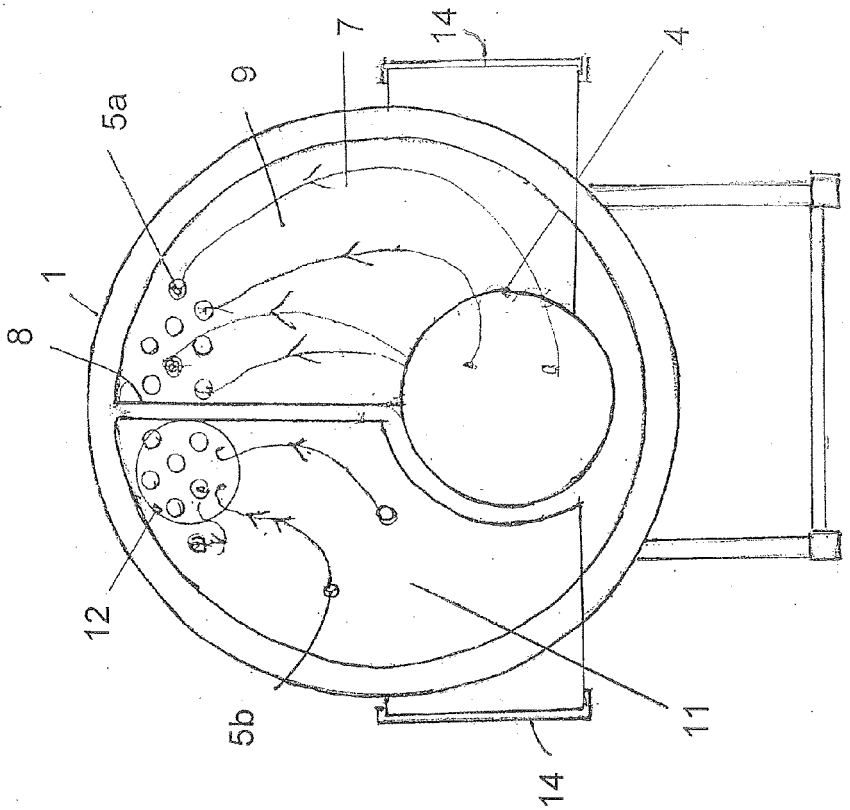


Fig. 2

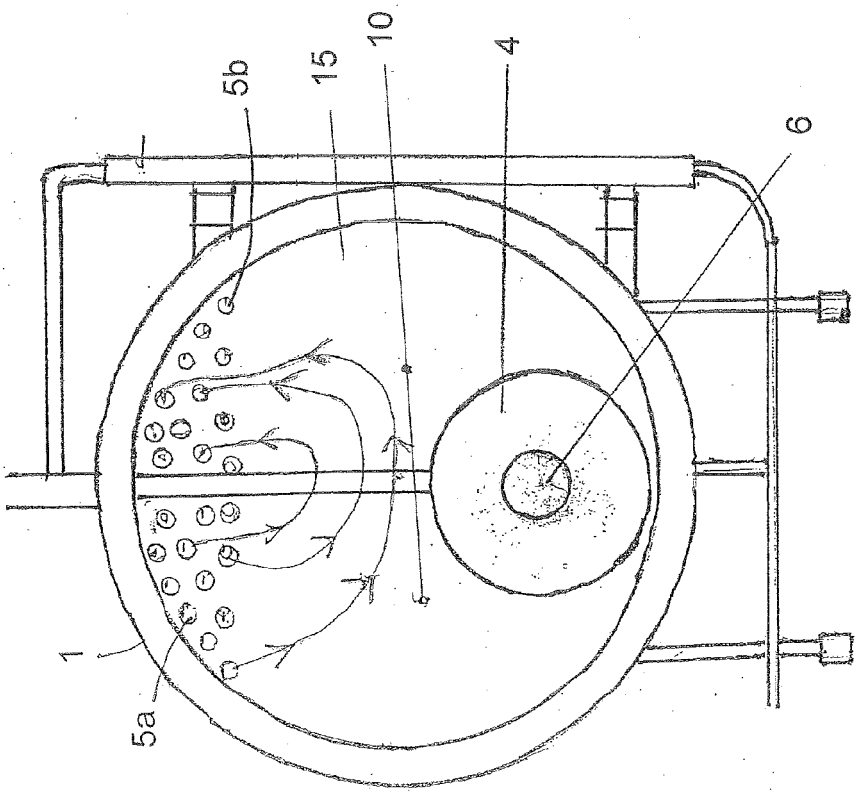


Fig. 1

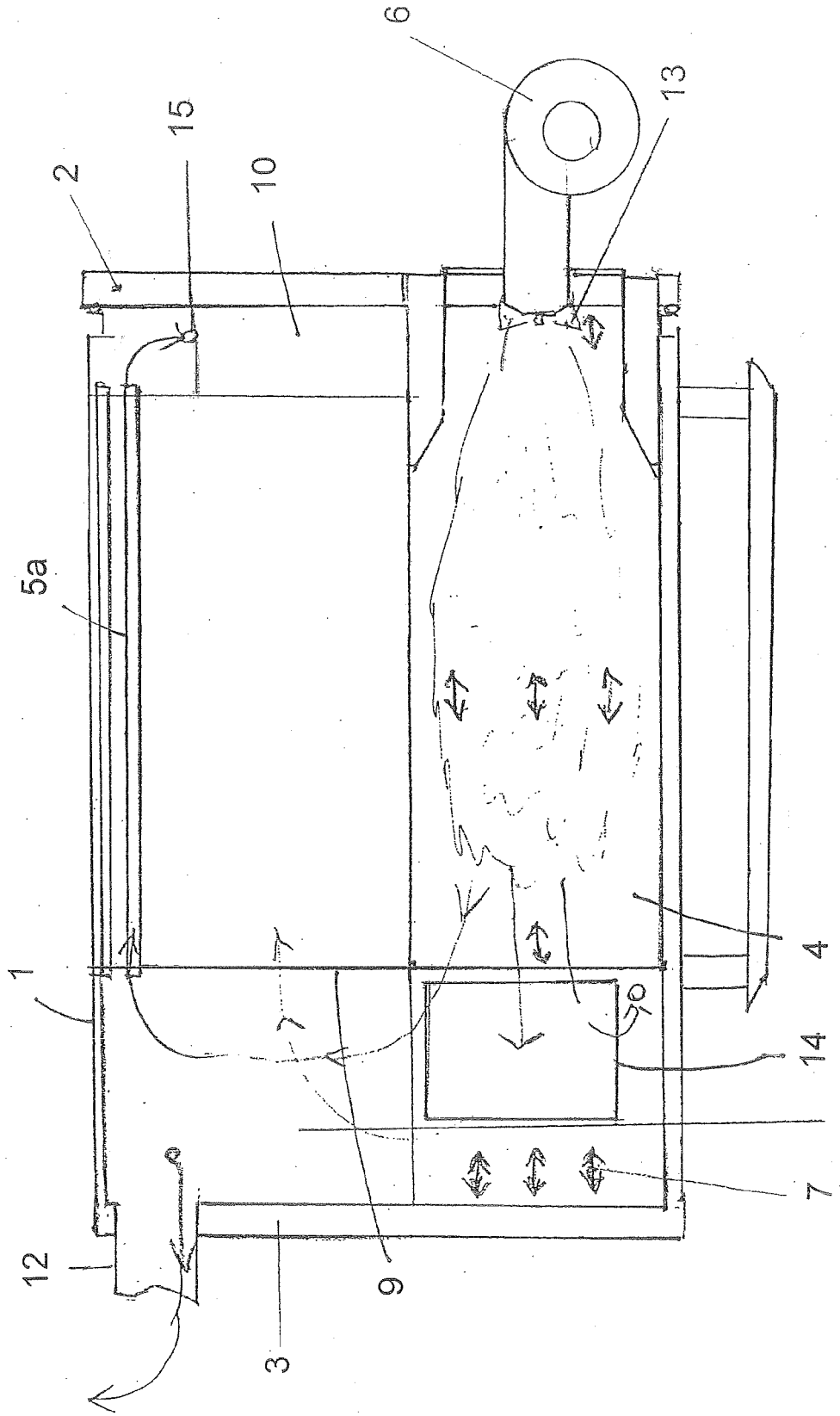


Fig. 3