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

Ofen zum Verbrennen von Öl, Gas und Biobrennstoff

Four pour brûler du fioul, du gaz et du bio-combustible

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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 back 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] US 3,190,340 discloses a furnace according to the preamble of claim 1.

[0003] 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.

[0004] 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.

[0005] 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 loosening 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.

[0006] The sound level generated in the echo cham-

bers can be regulated by moving the front plate provided in the front of the nozzle of the burner in one or other direction.

[0007] 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.

[0008] Each of the echo chambers is accessible via its own service hatch arranged on the opposite sides of the back section of the furnace.

[0009] The measurements carried out have proved that the efficiency of the furnace according to the invention is 5 to 10 % better than that of a conventional furnace.

[0010] 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.

[0011] 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 Noulloux, 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 com-

bustion gas flow reaches such a level which is capable of loosening 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.

[0012] 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.

[0013] On the opposite sides of the back section of the furnace service hatches (14) 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 enclosed by a mantle (1), a front end (2) and a back end (3) and comprises a combustion chamber (4) and a tube (5a, 5b) installed outside the combustion chamber, through which tube the combustion gases generated by a flame of a burner (6) are arranged to flow out of the furnace, wherein the burner (6) is of a type which generates a fluttering flame in the combustion chamber (4), and the combustion chamber (4) 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, **characterized in that** 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 parallelly 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 loosening 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 (14) is arranged for the echo chamber (7, 11) of the respective side.

Patentansprüche

1. Ofen zum Verbrennen von Öl, Gas oder Biobrennstoff, der von einem Mantel (1), einem Vorderende (2) und einem Hinterende (3) umhüllt ist und eine Verbrennungskammer (4) und ein Rohr (5a, 5b) aufweist, das außerhalb der Verbrennungskammer installiert ist, wobei die Verbrennungsgase, die durch eine Flamme eines Brenners (6) erzeugt werden, durch das Rohr aus dem Ofen strömen, wobei der Brenner (6) von einer Art ist, die eine flackernde Flamme in der Verbrennungskammer (4) erzeugt, und die Verbrennungskammer (4) in einem Hallraum (7) endet, der in dem hinteren Abschnitt des Ofens angeordnet ist, der eine ausreichende Länge hat, um einen Schall zu erzeugen, wenn die Verbrennungsgase, die durch die flackernde Flamme des Brenners (6) erzeugt werden, auf das Hinterende (3) des Ofens aufprallen, **dadurch gekennzeichnet, dass** die Vorderwand (9) des Hallraums (7) mit Auslässen für einen ersten Rohrsatz (5a) versehen ist, wobei der Rohrsatz (5a) in einer Umkehrkammer (10) endet, die an der Vorderseite des Vorderendes (2) des Ofens angeordnet ist, wobei die Rückwand (15) der Umkehrkammer (10) mit Auslässen für einen zweiten Rohrsatz (5b) versehen ist, der parallel zu dem ersten Rohrsatz (5a) angeordnet ist, wobei der zweite Rohrsatz (5b) in einem zweiten Hallraum (11) endet, der in dem hinteren Abschnitt des Ofens angeordnet ist, wobei der Schall, der durch die

schwingende Verbrennungsgasströmung erzeugt wird, in dem zweiten Hallraum (11) einen Pegel erreicht, der fähig ist, Asche und Ruß von allen Oberflächen des Ofens zu lösen und abzuführen.

2. Ofen nach Anspruch 1, **dadurch gekennzeichnet, dass** der in den Hallräumen (7, 11) erzeugte Schallpegel durch Bewegen einer Frontplatte (13), die an der Vorderseite der Düse des Brenners (6) bereitgestellt ist, reguliert werden kann.
3. Ofen nach Anspruch 1, **dadurch gekennzeichnet, dass** eine wassergekühlte Trennwand (8) zwischen beiden Hallräumen (7, 11) angeordnet ist.
4. Ofen nach Anspruch 1, **dadurch gekennzeichnet, dass** die Hallräume (7, 11) eine Länge von ungefähr 1500 mm in der Längsrichtung des Ofens haben.
5. Ofen nach Anspruch 1, **dadurch gekennzeichnet, dass** beide Endwände (2, 3) des Ofens wassergekühlt sind.
6. Ofen nach Anspruch 5, **dadurch gekennzeichnet, dass** die vordere Endwand (2) die Form einer zu öffnenden Klappe hat.
7. Ofen nach Anspruch 1, **dadurch gekennzeichnet, dass** auf den entgegengesetzten Seiten des hinteren Abschnitts des Ofens eine Wartungsluke (14) für den Hallraum (7, 11) der jeweiligen Seite angeordnet ist.

Revendications

1. Four destiné à brûler du pétrole, du gaz ou un biocarburant, qui est délimité par un manchon (1), une extrémité avant (2) et une extrémité arrière (3), et comprend une chambre de combustion (4) et un tube (5a, 5b) installé à l'extérieur de la chambre de combustion, tube par lequel les gaz de combustion produits par une flamme d'un brûleur (6) sont amenés à s'écouler hors du four, dans lequel le brûleur (6) est d'un type qui produit une flamme oscillante dans la chambre de combustion (4), et la chambre de combustion (4) aboutit dans une chambre d'écho (7) agencée dans la section arrière du four, qui présentent une longueur suffisante afin de produire un son lorsque les gaz de combustion produits par la flamme oscillante du brûleur (6) frappent sur l'extrémité arrière (3) du four, **caractérisé en ce que** la paroi avant (9) de ladite chambre d'écho (7) comporte des sorties pour un premier ensemble de tube (5a), ledit ensemble de tube (5a) s'achevant dans une chambre d'inversion (10) agencée sur l'avant de l'extrémité avant (2) du four, la paroi arrière (15) de ladite chambre d'inversion (10) comportant des sorties

pour un second ensemble de tube (5b) agencé parallèlement au premier ensemble de tube (5a), ledit second ensemble de tube (5b) s'achevant dans une seconde chambre d'écho (11) agencée sur la section arrière du four, seconde chambre d'écho (11) dans laquelle le son produit par l'écoulement de gaz de combustion vibrant atteint un niveau capable de libérer et d'évacuer les cendres et la suie de toutes les surfaces du four.

2. Four selon la revendication 1, **caractérisé en ce que** le niveau sonore produit dans les chambres d'écho (7, 11) peut être régulé en déplaçant une plaque avant (13) agencée sur l'avant de l'injecteur du brûleur (6).
3. Four selon la revendication 1, **caractérisé en ce qu'une** paroi de séparation refroidie à l'eau (8) est agencée entre les deux chambres d'écho (7, 11).
4. Four selon la revendication 1, **caractérisé en ce que** les chambres d'écho (7, 11) présentent une longueur approximative de 1500 mm suivant la direction longitudinale du four.
5. Four selon la revendication 1, **caractérisé en ce que** les deux parois d'extrémité (2, 3) du four sont refroidies à l'eau.
6. Four selon la revendication 5, **caractérisé en ce que** la paroi d'extrémité avant (2) est sous la forme d'une trappe pouvant être ouverte.
7. Four selon la revendication 1, **caractérisé en ce que**, sur les côtés opposés de la section arrière du four, une trappe de visite (14) est agencée pour la chambre d'écho (7, 11) du côté correspondant.

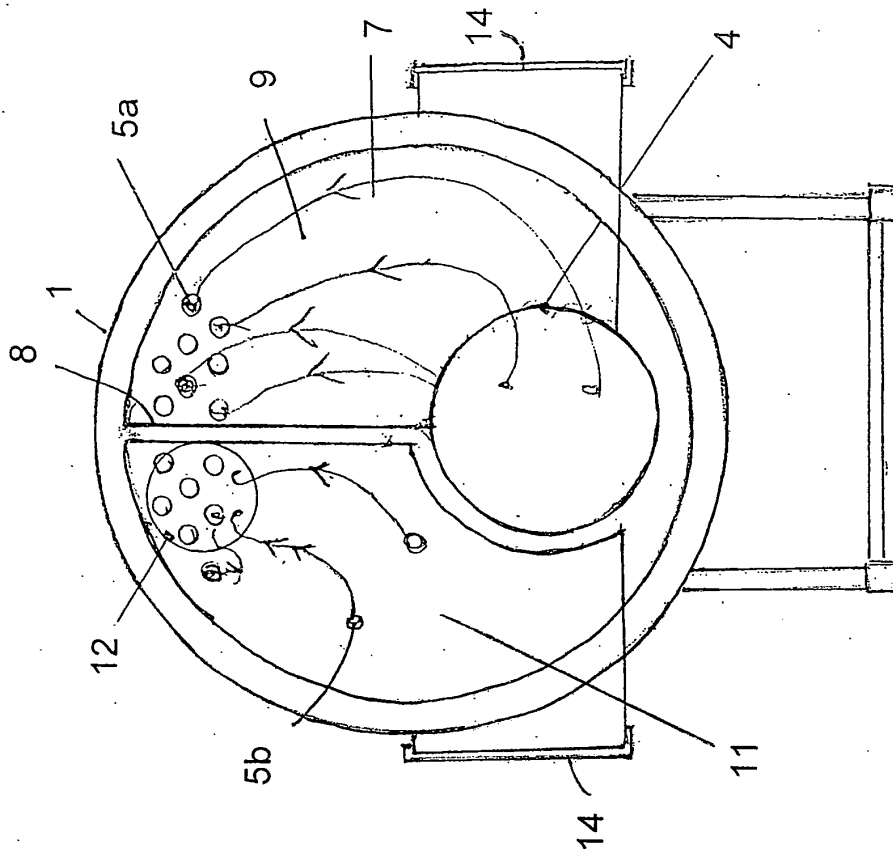


Fig. 2

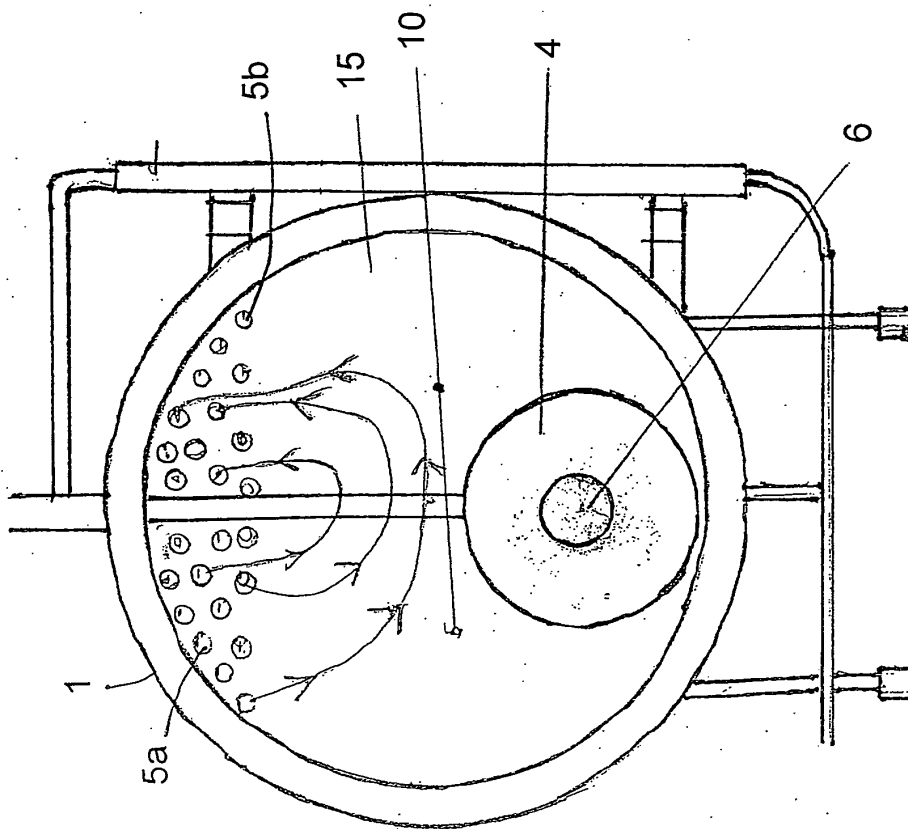


Fig. 1

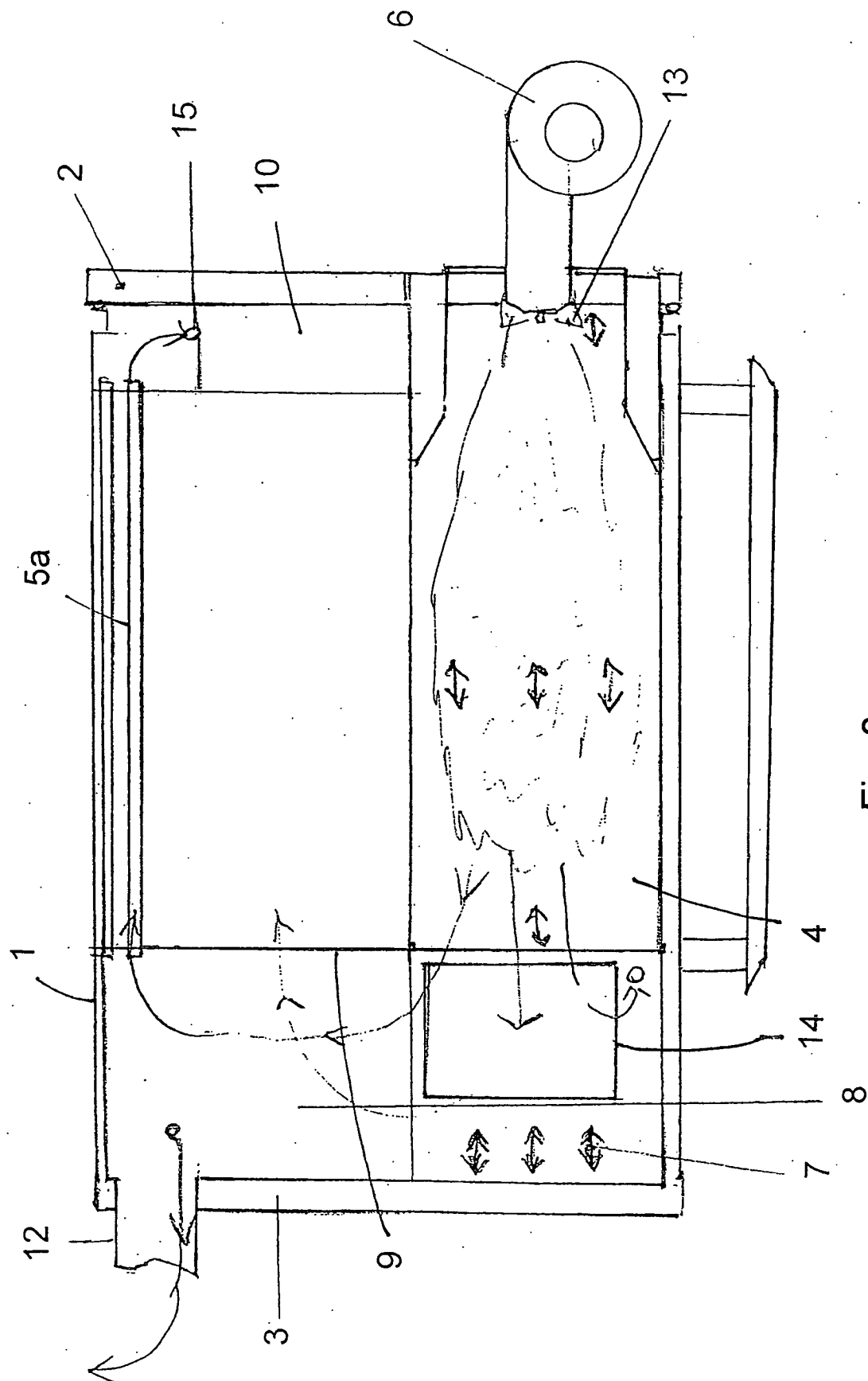


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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