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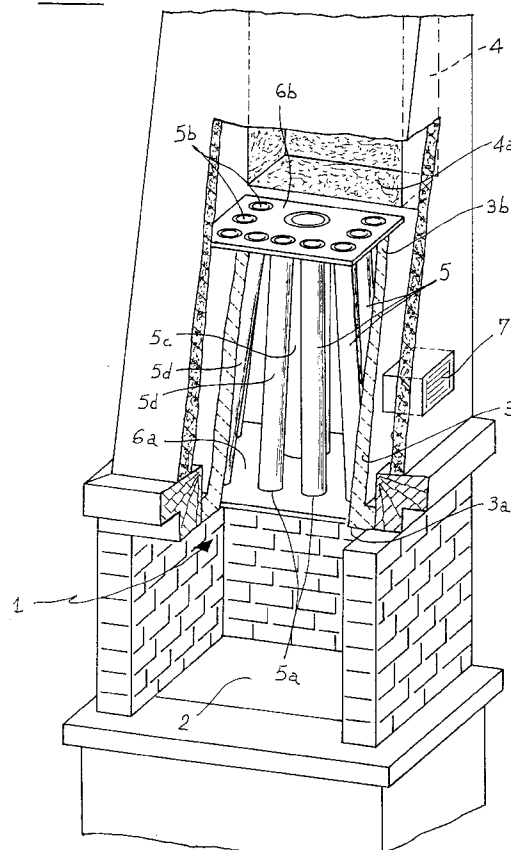
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(54) **Fume exhausting apparatus, in particular for chimneys and fireplaces.**

(57) A fume-exhausting apparatus in particular for chimneys and fireplaces comprises a plurality of fume-conveying channels (5, 105) extending within a hood (3, 103) in a chimney or fireplace and exhibiting lower openings (5a) directed downwardly and disposed close to the lower inlet mouth (3a) of the hood (3, 103) and upper openings (5b) directed upwardly, close to the lower end of the flue (4). In an alternative version, the apparatus comprises at least one main section (102) for recovering heat from the fumes, consisting of a heat-exchange chamber (106) adapted to hold a circulating fluid to be heated, and a plurality of main pipe coils (105) extending within the heat-exchange chamber (106) and adapted to receive and convey the fumes coming from the hood (103).

FIG 1



The present invention relates to a fume-exhausting apparatus, in particular for chimneys and fireplaces, said chimneys and fireplaces comprising a hearth and a hood for collecting said fumes to be sent to a flue.

It is known that chimneys, fireplaces and similar structures do not always have a satisfactory And appropriate draught, that is a capacity of appropriately conveying and drawing fumes into a flue. In fact sometimes fume vortices and refluxes towards the room where a fireplace is located may be created, due either to the presence of excess smoke in the hearth, for example when some foods are being barbecued, or to an imperfect design and construction of the fireplaces themselves.

Under the foregoing and other similar situations, for example when particular weather conditions are present or, above all, at the initial ignition step, when the operating temperatures of the flue do not correspond to those provided for a steady state operation, fumes do not succeed in overcoming the upper hood restriction at the point where said hood is connected to the flue and therefore tend to invade the inner environment or room in which the chimney or fireplace is located.

Under this situation the technical task underlying the present invention is to provide a fume-exhausting apparatus, in particular for chimneys and fireplaces, capable of substantially eliminating the above drawbacks.

Within the scope of this technical task it is an important object of the present invention to devise a fume-exhausting apparatus capable of enabling the natural draught of a chimney or fireplace to be increased to an important amount without resorting to the use of fans or similar power-driven exhausting devices, so that under any circumstances all smoke emissions into the room where the chimney or fireplace is located can be avoided.

The technical task mentioned and the object specified are substantially achieved by a fume-exhausting apparatus, in particular for chimneys and fireplaces, which is characterized in that it comprises a plurality of channels for conveying said fumes, which conveying channels have lower openings directed downwardly close to the lower inlet mouth of said hood and upper openings directed upwardly and communicating with the lower end of the flue.

The description of some preferred embodiments of a fume-exhausting apparatus according to the invention is given hereinafter by way of non-limiting example, with reference to the accompanying drawings, in which:

- Fig. 1 is a perspective view of one embodiment of the apparatus of the invention fitted in a chimney;
- Fig. 2 is a side view partly in section of a second embodiment of the apparatus in question;

- Fig. 3 is a side view partly in section of another embodiment of the apparatus of the invention;
- Fig. 4 is a perspective and partly cut-away view of the apparatus shown in Fig. 3;

- Fig 5 is a diagrammatic front elevation view in split of another alternative embodiment of the apparatus in question.

Referring to the drawings, the fume-exhausting apparatus according to the invention has been generally identified by reference numeral 1.

The apparatus 1 is adapted to be fitted in a chimney or fireplace of a conventional type known per se comprising a hearth 2, a hood 3 for collecting the fumes produced on the hearth, and a flue 4. It comprises a plurality of channels 5 for conveying fumes, located above the hearth and therefore extending within the hood 3. The conveying channels 5 exhibit lower openings 5a directed downwardly, disposed close to, or at all events communicating with, the lower inlet mouth 3a of the hood 3, and upper openings 5b directed upwardly and disposed close to a lower end 4a of the flue 4, so that they are affected by a draught effect created thereinto.

As a whole, the transverse section of the conveying channels 5 has an area corresponding at least to the area of the transverse section of the flue and preferably greater than the latter by 50%.

In one embodiment shown in Fig 1, the conveying channels 5, for example defined by lengths of rectilinear pipes having a circular section, are disposed in mutual side by side relation to form a bundle and converge close to the upper portion 3b of the hood 3, so that they substantially occupy, at least close to the upper openings thereof 5b, the whole transverse section of the hood 3, apart from the gaps present between the pipes as a result of their circular section.

In this embodiment preferably one main conveying channel or pipe 5c is provided which is disposed centrally substantially above the flame present in the hearth 2, as well as a plurality of auxiliary conveying channels or pipes 5d disposed perimetrically and each of them having a transverse section the area of which is lower than that of the transverse section of the main pipe 5c.

In the progress of experimental tests the results of which are herein reproduced by way of description only, an excellent draught for a flue of a 25x25 cm square section has been offered by combining together a main pipe with a diameter of 14 cm and nine auxiliary pipes each with a diameter of 10 cm, disposed in groups of three pipes each, in front and laterally of the hearth. The hearth sizes substantially were 70 cm in width, 50 cm in depth and 56 cm in height.

In a 22x22 cm flue use has been made of a main pipe with a diameter of 14 cm and seven auxiliary pipes with a diameter of 10 cm disposed so as to form one three-piece row at the front and two two-piece

rows laterally, for a hearth being 50 cm wide, 40 cm deep and 45 cm high. Excellent results have been achieved as well by the use of nine auxiliary pipes with a diameter of 8 cm, instead of seven auxiliary pipes with a diameter of 10 cm.

Still in accordance with the present invention, provision may be also made for at least one lower plate-like closing element 6a extending close to the lower inlet mouth 3a of the hood 3, exhibiting a perimetric edge shaped such as to mate the inner sizes of the hood 3 and provided with through holes sealingly engaging the respective lower end portions of the conveying channels 5. In the presence of this lower plate-like closing element 6a, all fumes produced in the hearth 3 are forced to go up to the flue 4 exclusively through the conveying channels 5.

If one intends to recover at least part of the fume heat in order to generate hot air, in addition to the lower plate-like closing element 6a an upper plate-like closing element 6b is also provided which is disposed close to the upper portion 3b of the hood 7. The upper plate-like element 6b is also provided with through holes adapted to sealingly engage the upper end portions of the conveying channels 5 and also has a perimetric shaped edge the shape of which is adapted to mate the inner sizes of the hood 3. In this manner the lower and upper plate-like closing elements, 6a and 6b, substantially define, in cooperation with the hood 3, a heat-exchange sealed chamber with respect to the fumes. crossed by the conveying channels 5 themselves. Suitable air intake 7 formed in the hood 3 for admitting cold air from the surrounding atmosphere and emitting hot air thereinto (only one admission intake being shown in Fig. 1) enable a forced air circulation to be created, optionally with the aid of ventilation means, which air passing through the gaps present between the conveying channels 5 can be heated by the heat transmitted from the fumes.

In a further embodiment shown in Figs. 3 and 4, the conveying channels 5 are disposed in mutual side by side relation and in alignment with each other and they occupy the hood volume, and therefore the transverse hood section, only partially. The conveying channels 5 in this embodiment exhibit their lower openings 5a disposed in alignment along the front side of the lower inlet mouth 3a of the hood 3, so as to define a suction area extending along the whole extension of said side.

Preferentially the conveying channels 5 are integral with each other and consist of a unitary body 8, being divided by partitions 8a. Such unitary body 8 can be easily engaged within an already installed hood in order to improve performance of same in drawing fumes. The upper openings 5b of the conveying channels 5 defined by the partitions 8a open into an interconnecting pipeline 9 at differentiated heights in order not to hinder the respective smoke flows. Preferentially, as shown in Fig. 4, the upper ends 5b

of the conveying channels 5 located at the laterally opposite ends of the unitary body 8 communicate with the upper portion of the interconnecting pipeline 9 by two tubular headers 20 exhibiting end portions 20a adapted to be laterally fitted in the interconnecting pipeline as they bend according to the progress direction of the fumes along said pipeline.

Advantageously, connected in succession to the interconnecting pipeline 9 is a draught duct 10 having an extension enabling one upper end thereof 10a to be directly located in the flue 4. In this manner, close to the upper end 10a there is negative pressure created by the quick flowing of the fumes from the hood 3, which negative pressure greatly increases the suction effect of the conveying channels 5.

Finally, in order to be sure that even under a situation of maximum smoke production any smoke admission into the room is prevented, each conveying channel 5 may be divided, as shown in Fig. 2, into a lower movable portion "A" and an upper fixed portion "B", capable of telescopically sliding into each other. Suitable support and movement means for the lower portions enable said portions to be positioned at variable heights above the hearth and in particular by virtue of said means the lower openings 5a of the conveying channels 5 can be lowered directly close to the fume production region.

Said supporting and movement means are not shown as they can be made in any known manner. One embodiment of the same is suggested in an Italian patent application filed on same date in the name of the same applicant. As shown in Fig 2, an auxiliary conveying hood 11 may be associated with the lower portions "A" of the conveying channels 5, at the lower ends 5a thereof.

Operation of a fume-exhausting apparatus, in particular for chimneys and fireplaces, described above mainly as regards structure, is as follows.

The conveying channels 5 enable the whole fume flow to be divided into partial flows, each of which exhibits a reduced vorticity and greater upward kinetic energy. Practically, the apparatus in question enables the so-called draught effect created within the flue to be moved much closer to the flame or, in other words, to the real fume-producing area, thereby enabling said fumes to be drawn upwardly in stronger manner. In the traditional prior art solutions the results of said draught effect have been practically zero at distances ranging between and 20 and 30 cm from the lower end of the flue itself.

In particular, in the third embodiment shown in Figs. 3 and 4 a suction area extending along the front edge of the hearth is created so as to form a barrier against the emission of fumes towards the room where the fireplace is located.

It is pointed out that the last-mentioned embodiment of the apparatus makes it possible to intervene on already installed fireplaces with ease, because the

apparatus can be readily fitted into a hood and engaged to the front wall thereof. Therefore the apparatus of the invention is capable of making a fireplace flue work properly even if it has an inefficient draught as a result of an imperfect design and/or construction, or at all events is capable of improving performance of a fireplace even under the most unfavourable circumstances.

An alternative version of the apparatus in question has been shown in Fig. 5 and identified by reference numeral 100. According to the solution of Fig. 5, the optimal draught achieved by exploiting the innovative technical principles disclosed above and illustrated with reference to Figs. 1 to 4 is herein utilized in order to obtain an important heat recovery from the fumes, without the consequent cooling of said fumes giving rise to operating inconveniences as regards the chimney draught.

The apparatus 100 has a main heat-recovery section 102 disposed uppermost relative to a hood 103, in turn disposed over a hearth 104 in a chimney or fireplace.

The main section 102 internally comprises a plurality of conveying channels or main pipe coils 105 (only two of which are shown) adapted to receive and convey the fumes directed to the hood 103, thereby dividing the overall flow of said fumes into a plurality of partial flows. Optionally, auxiliary straight pipes 105a may be disposed alongside the main pipe coils 105 for the purpose of increasing the overall fume-passage section. The main section 102 further comprises a main heat-exchange chamber 106 adapted to hold a circulating fluid to be heated. Said fluid may advantageously consist of water coming from a heating plant, through an admission duct 115 shown diagrammatically.

The pipe coils 105 and optional auxiliary straight pipes 105a, as well as the main chamber 106, have their major extension running in a substantially vertical direction. All fumes produced by the flame are therefore conveyed vertically upwardly by the pipe coils 105 and auxiliary straight pipes 105a if present.

Preferably, a preheating section 107 for the fluid to be heated is provided upstream of the main section 102, that is close to the hearth 104. Said preheating section 107 is comprised for example of a heat exchanger of the traditional type, capable of directly utilizing heat transmitted from the flame by radiation in order to obtain a preheating of the water introduced therein from the admission duct 115. The preheating section 107, located in the rear wall of the hearth for example, communicates with the main heat-exchange chamber 106 through one tubular connecting length 115a, shown in dotted line.

An additional section 108 for recovery of heat from the fumes advantageously follows the main section 102 and has the same structure as the main section 102. Therefore it comprises a plurality of addition-

al pipe shown), adapted to convey the fumes from the main section 102. The additional pipe coils 109 extend longitudinally within an additional heat-exchange chamber 110 into which the circulating fluid coming from the main chamber 106 and already partly heated due to its passing through said main chamber, is conveyed.

Preferably the additional chamber 110 and additional pipe coils 109, disposed for example close to the ceiling of the room where the fireplace is installed, have their major extension substantially running in a horizontal direction. In other words, the movement direction of the fumes, now already partly cooled, is oriented horizontally.

Provided between the main section 102 and additional section 108 is an interconnection chamber 111 towards which all fumes from the main pipe coils 105 and auxiliary pipes 105a of the main section itself are directed. Said fumes are then admitted to the additional pipe coils 109 of the additional section 108. The interconnection chamber 111 may be provided to advantage with an inspection door 111a for cleaning pipes 105, 105a, 109.

The additional section 108 is followed by a further heat-recovery structure. Said structure comprises a duct 112 for collecting and conveying the fumes from the additional section 108 itself and a pipe coil 113 into which the water coming out of the additional heat-exchange chamber 110 flows. Also the pipe coil 113 and duct 112 preferably have their major extension running in a substantially horizontal direction.

Extending from the pipe coil 113 is a delivery pipe length 115c through which the water heated to a high temperature is admitted again into the heating plant or other appliance for use. In turn, the fume collecting and conveying duct 112 may communicate with the external atmosphere via a subsequent flue.

Experiments carried out have proved the achievement of excellent results in heating important water amounts by means of a fireplace the hearth of which was 40 cm high, wide and deep, through the use of an apparatus in accordance with the invention exhibiting the following features as regards structure and size. The main chamber 106 is 120 cm high and has a 40x30 cm rectangular section. Located inside said main chamber are four main pipe coils 105 with a diameter of 9 cm, said coils exhibiting each five 180° bends and two 90° half-bends at the ends, as well as four auxiliary straight pipes 105a with a diameter of 3.5 cm.

The additional section 108 extends over a length of 65 cm and has 30x25 cm rectangular section. Located inside said additional section are four pipe coils 109 with a diameter of 6 cm, said pipe coils exhibiting each three 180° bends and two 90° half-bends at the ends, as well as three auxiliary straight pipes 105a with a diameter of 3.5 cm.

The final duct 112 is 1 m long and has a diameter

of 22 cm, whereas the pipe coil 113 has an inner diameter of 2.5 cm and has a rectilinear extension of 20 m.

The final duct 112 communicates with the external atmosphere through a flue extending in a substantially horizontal direction.

Operation of the alternative version shown in Fig. 5 is as follows.

The presence of the main pipe coils 105 and optional auxiliary straight pipes 105a enables the overall flow of the fumes to be divided into partial flows which are less subjected to vorticity so that the fume drawing action at the fireplace hood 103 can be increased to a great extent.

Practically, the assembly consisting of the main pipe coils 105 and optional auxiliary pipes 105a puts into effect the same effects as described with reference to the conveying channels 5 in the embodiments illustrated in Figs. 1 to 4, greatly increasing the so-called natural "draught" of the chimney.

By virtue of the increased draught thus achieved, the fume conveying pipes 105, 105a, 109 can have an important extension and therefore offer a large heat-exchange surface enabling an important amount of heat to be transmitted from the fumes to the fluid to be heated.

Practically, the increased draught effect offered by the inventive apparatus enables lowering in the fume temperature to be compensated for, so that the heat produced by said fumes can be widely recovered for heating forced-circulation water or air.

In addition, the movement of the fumes in a horizontal direction beyond the main heat-recovery section 102 eliminates the risk that the cooled fumes, due to the fact that they are thicker than the new coming fumes, may descend along the hood, thereby impairing a good chimney draught.

It will be also recognized that conveying the fumes in a horizontal direction enables the heat exchange between said fumes and the water surrounding the additional pipe coils 109 to be further increased.

In addition, the unexpected achievement of a good draught also through a horizontal movement of the fumes makes the presence of the flue practically unnecessary. It becomes therefore possible to easily install heating chimneys or fireplaces even in dwelling houses where no flue is provided.

Claims

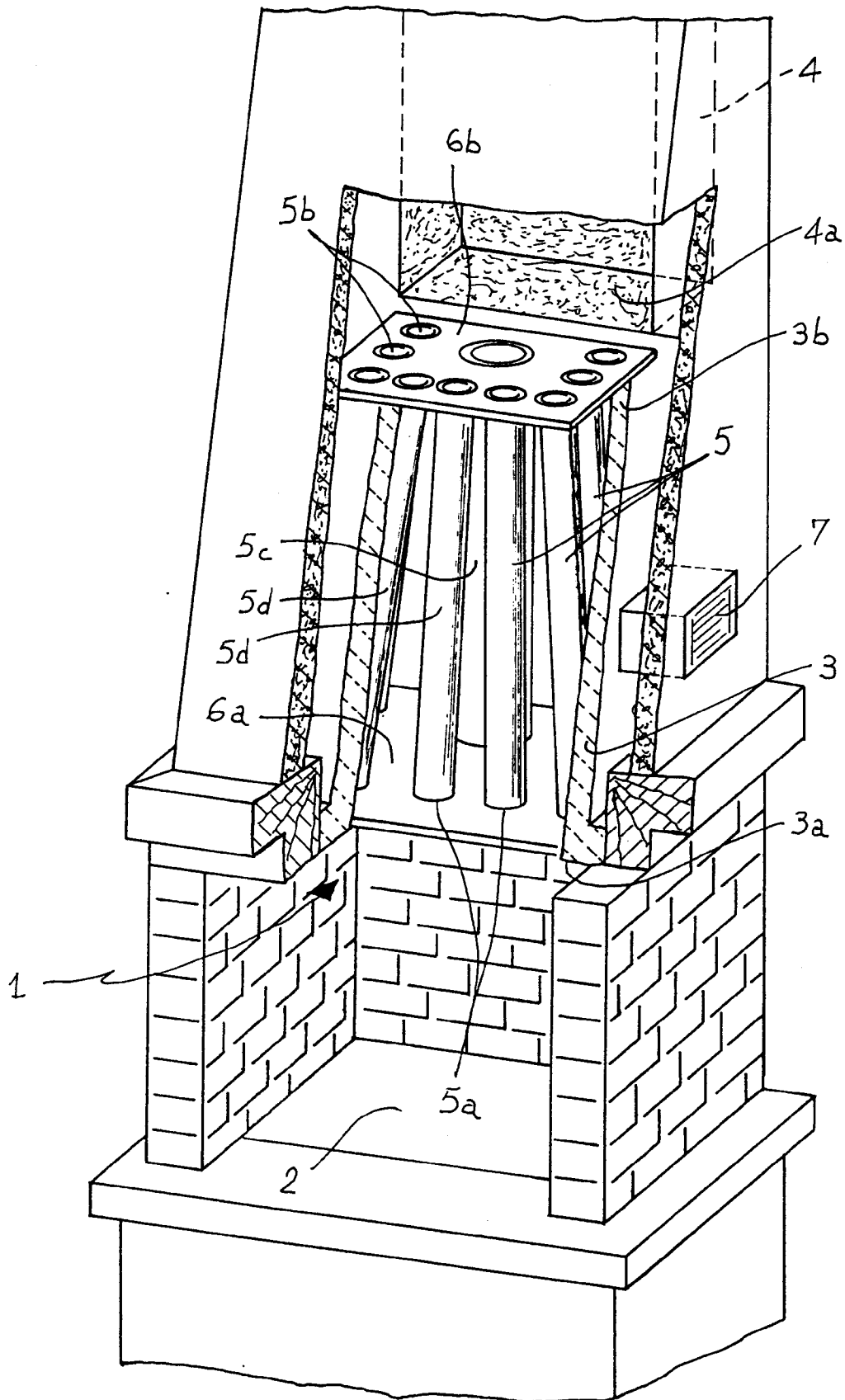
1. A fume-exhausting apparatus, in particular for chimneys and fireplaces, said chimneys and fireplaces comprising a hearth (2, 104) and a hood (3, 103) for collecting said fumes to be sent to a flue (4), characterized in that it comprises a plurality of

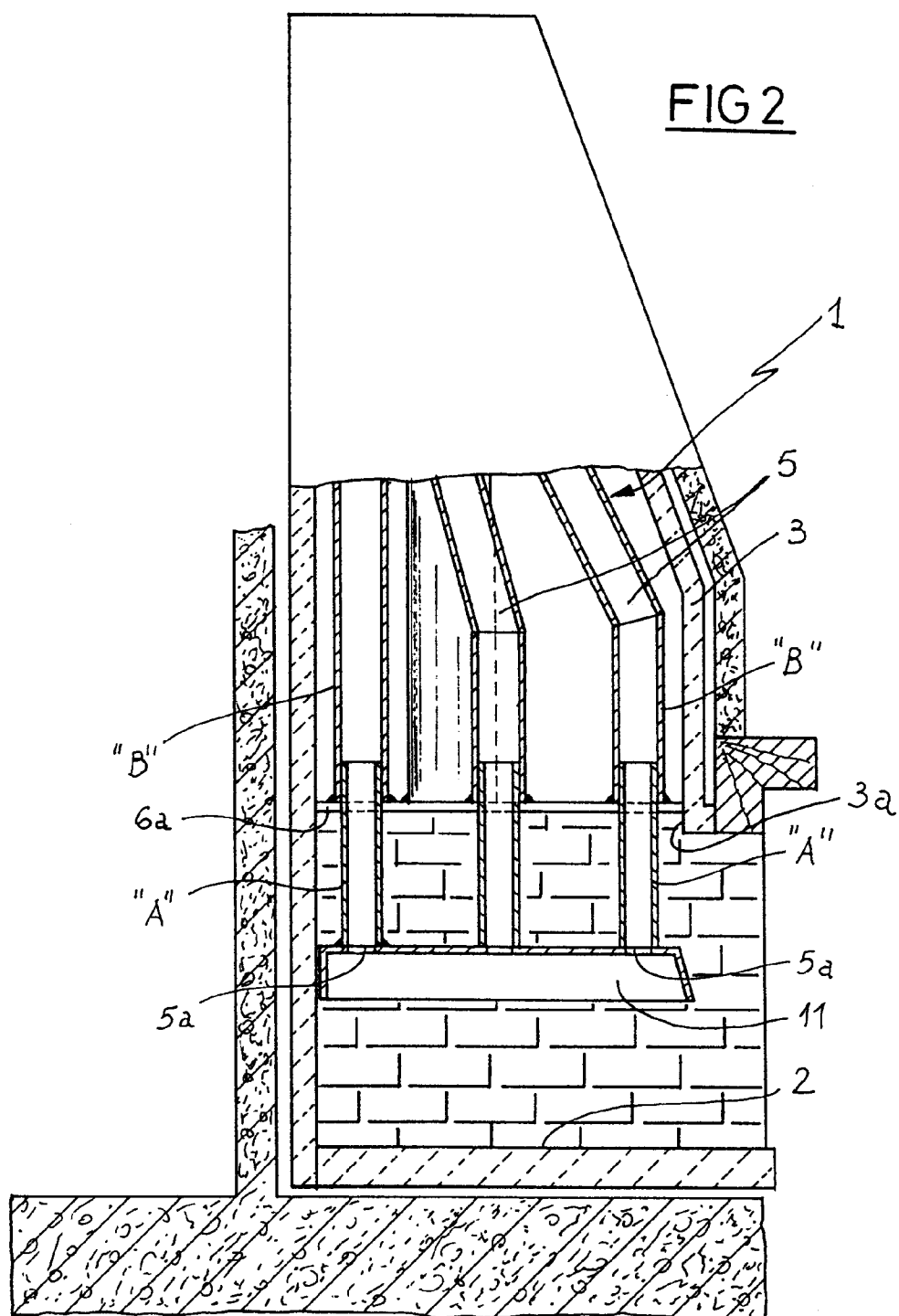
channels (5, 105) for conveying said fumes, which conveying channels (5, 105) have lower openings (5a) directed downwardly close to the lower inlet mouth of said hood (3, 103), and upper openings (5b) directed upwardly and communicating with the lower end of the flue.

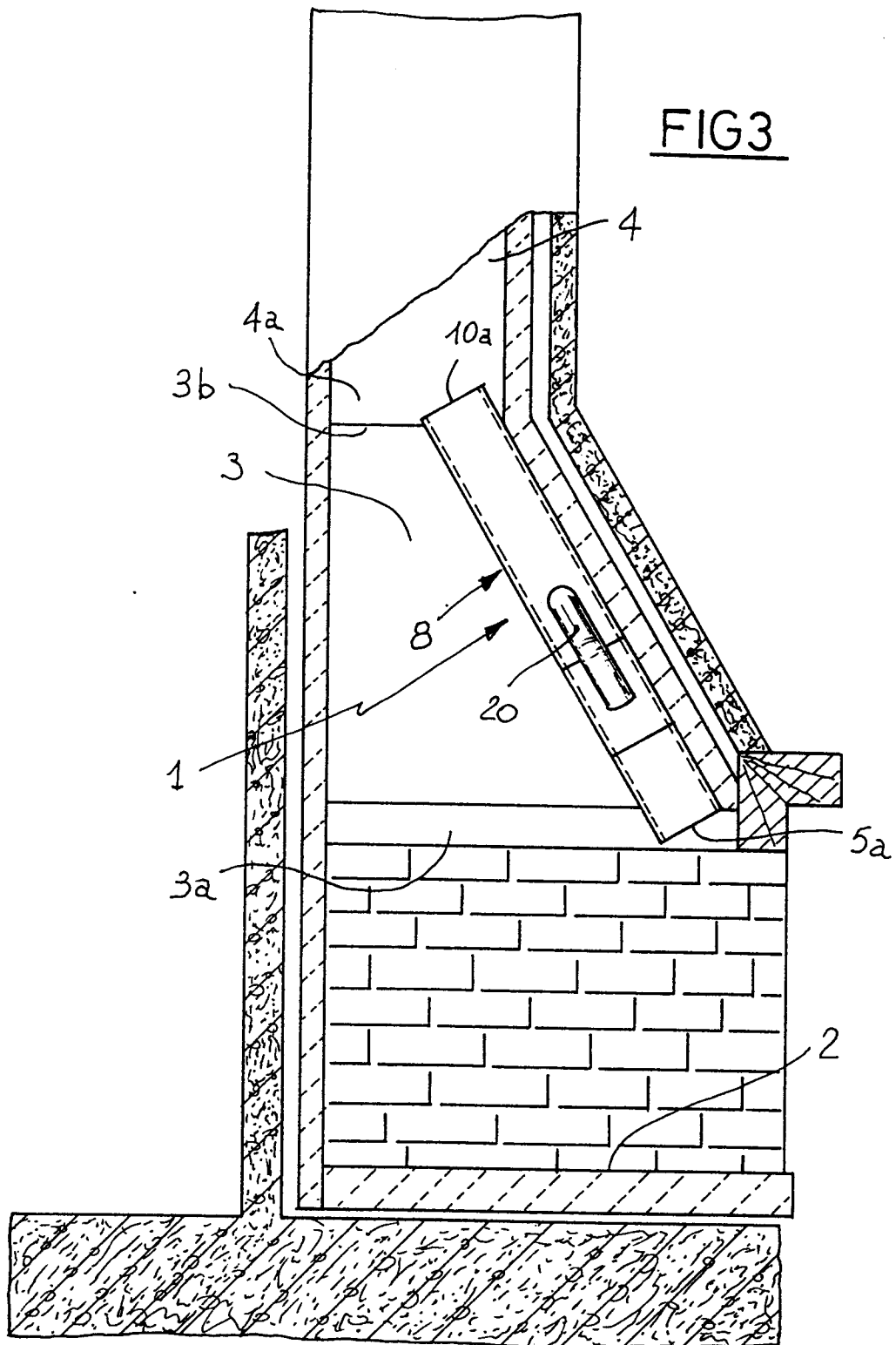
2. An apparatus according to claim 1, characterized in that said conveying channels (5) are defined by lengths of rectilinear pipes disposed in mutual side by side relation and converging close to an upper portion of said hood (3).
3. An apparatus according to claim 1, characterized in that said conveying channels (5) comprise a main conveying channel (5c) disposed centrally substantially above the flame in said hearth (2) and a plurality of auxiliary conveying channels (5d) disposed perimetrically and each of them having a transverse section the area of which is lower than that of a transverse section of the main conveying channel (5c).
4. An apparatus according to claim 1, characterized in that said conveying channels (5) altogether exhibit a transverse section the area of which corresponds at least to the area of the transverse section of said flue (4).
5. An apparatus according to claim 1, characterized in that provision is made for at least one lower plate-like closing element (6a) extending close to said lower inlet mouth (3a) of the hood (3) and exhibiting through holes adapted to engage the lower end portions of said conveying channels (5).
6. An apparatus according to claim 5, characterized in that it further comprises an upper plate-like closing element (6b) disposed close to an upper portion (3b) of said hood (3) and exhibiting through holes adapted to engage the upper and portions of said conveying channels (5), said lower (6a) and upper (6b) plate-like closing elements defining, in cooperation with said hood (3), a chamber for producing hot air.
7. An apparatus according to claim 1, characterized in that said conveying channels (5) occupy the volume of said hood (3) partially and exhibit their respective lower openings (5a) consecutively aligned along the front side of the lower inlet mouth (3a) of said hood (3).
8. An apparatus according to claim 7, characterized in that said conveying channels (5) are aligned and in side-by-side relation and integrally embodied by a unitary body (8) capable of being engaged to an already installed hood (3).

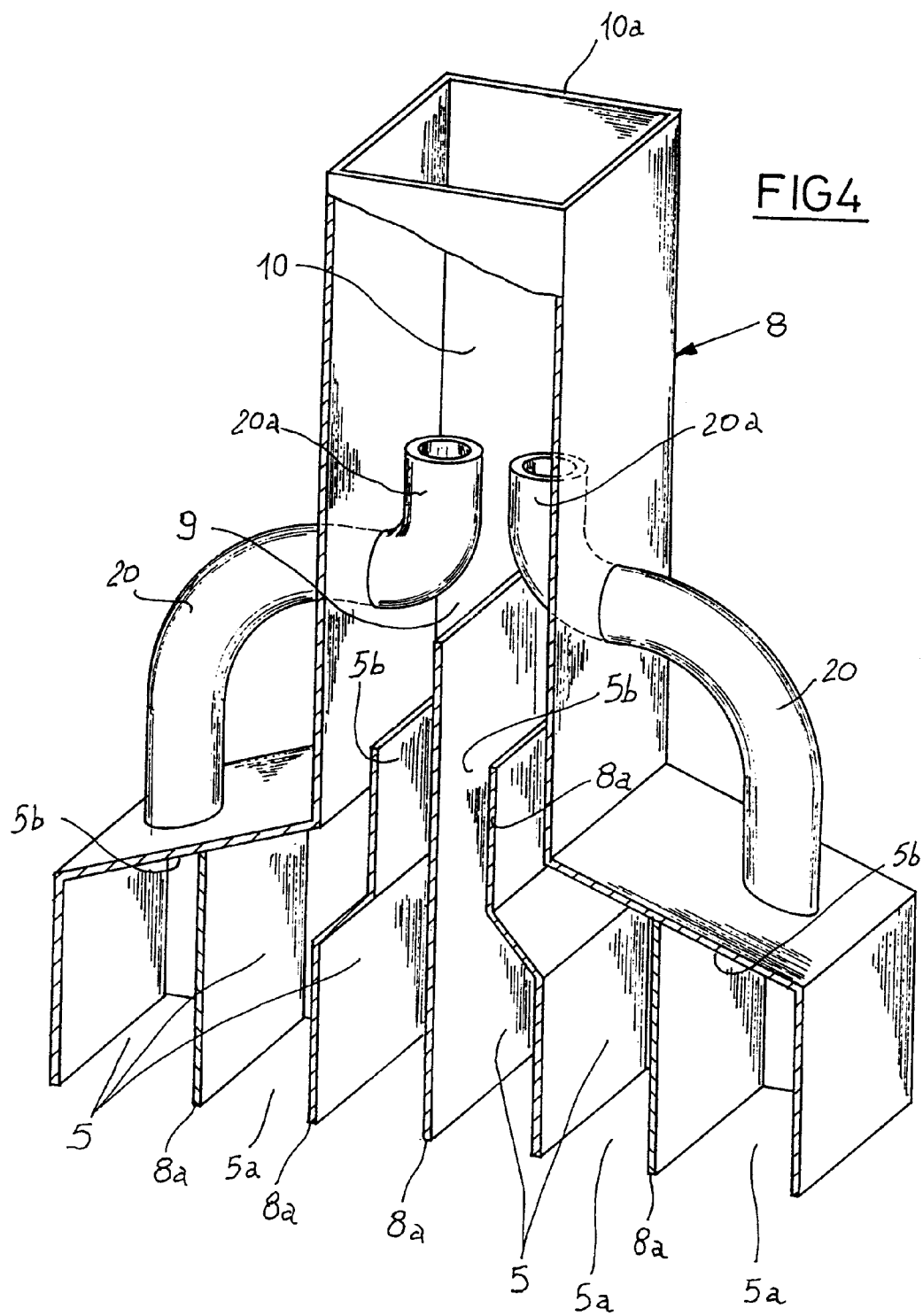
9. An apparatus according to claim 8, characterized in that said unitary body (8) comprises an interconnecting pipeline (9) into which said upper openings (5b) of said conveying channels (5) open, at heights differentiated from each other. 5
10. An apparatus according to claim 9, characterized in that a draught duct (10) having its upper end (10a) disposed in said flue (4) is connected in succession to said interconnecting pipeline. 10
11. An apparatus according to claim 1, characterized in that said conveying channels (5) are each comprised of at least one lower movable portion ("A") and one upper fixed portion ("B") telescopically sliding into each other, and in that support and movement means for said movable lower portions are provided for positioning them at a desired height above said hearth (2). 15
12. An apparatus according to claim 11, characterized in that it further comprises an auxiliary hood (11) connected to the lower ends (5a) of said lower movable portions ("A") of the conveying channels (5). 20
13. An apparatus according to claim 1, characterized in that it comprises at least one main heat-recovery section (102) for recovering heat from said fumes, disposed uppermost relative to said hood (103), said main heat-recovery section (102) being comprised of a plurality of main pipe coils (105) constituting said conveying channels, for receiving and conveying the fumes coming from said hood (103), and a main heat-exchange chamber (106) adapted to hold a circulating fluid to be heated, said main pipe coils (105) being such disposed within said heat-exchange chamber (106) that their major extension runs in a substantially vertical direction. 25
14. An apparatus according to claim 13, characterized in that the circulating fluid to be heated in said main heat-exchange chamber (106) is water. 30
15. An apparatus according to claim 13, characterized in that a preheating section (107) for said fluid is provided which is connected to said main heat-exchange chamber (106) and arranged close to said hearth (104). 35
16. An apparatus according to claim 14, characterized in that an additional heat-recovery section (108) is provided after main heat-recovery section (102), said additional section (108) comprising a plurality of additional pipe coils (109) for conveying fumes and an additional heat-exchange chamber (110) adapted to hold said circulating fluid to be heated, said additional additional heat-exchange chamber (110) that their major extension substantially runs in a horizontal direction. 40
17. An apparatus according to claim 16, characterized in that an interconnection chamber (111) is defined between said main (102) and additional (108) heat-recovery sections, for conveying said fumes from said main pipe coils (105) to said additional pipe coils (109). 45
18. An apparatus according to claim 16, characterized in that, following said additional heat-recovery section (108) provision is made for a duct (112) designed to receive and convey the fumes (112) coming from said additional section (108) as well as a pipe coil (113) disposed within said duct (112) and adapted to convey the water coming from said additional heat-exchange chamber (110), the major extension of said duct (112) and pipe coil (113) running in a substantially horizontal direction. 50

FIG 1









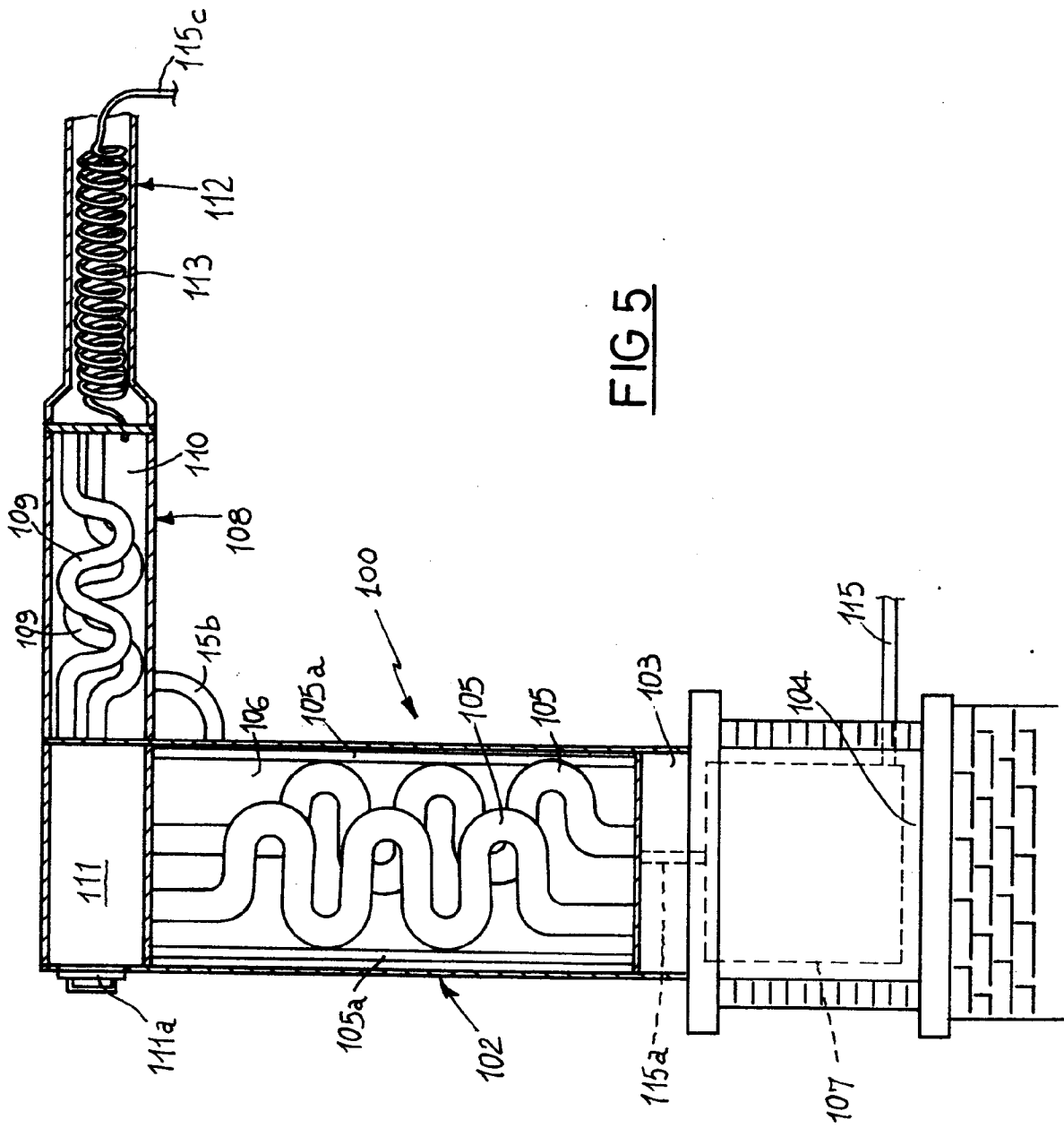


FIG 5



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 83 0137

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	US-A-4 100 913 (ARMSTRONG) * the whole document * ---	1,2,4-7	F24B1/188 F24B1/183
X	FR-A-2 467 358 (JOST) * the whole document * ---	1,2,5-7	
X	US-A-2 277 381 (BLACK) * the whole document * ---	1,2,5-7	
X	FR-A-2 510 725 (VERGES) * claims; figures * ---	1,2, 13-15	
X	FR-A-2 294 403 (LAMBERT) * page 5, line 6 - line 40; figures 1,2 * -----	1,2,5,6	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			F24B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 1 August 1994	Examiner Vanheusden, J
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