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(54) **FRAME CONSTRUCTION FOR A MASONRY FIREPLACE, AND A CORRESPONDING ASSEMBLY KIT, ARRANGEMENT AND FIREPLACE**

(57) The invention relates to a frame construction for a masonry fireplace for feeding secondary air to firebox of the fireplace, to which frame construction (10) a firebox (12) door (9) is arranged to be attached and which frame construction (10) includes

- at least one air intake (18) for drawing secondary air from outside the fireplace (12),
- vertical ducts (4,5), each comprising two ends (20) and forming side edges (22) of the frame construction (10),
- a feed opening (24) for feeding the secondary air in the vertical ducts (4,5) to the firebox (26) of the fireplace (12),
- a horizontal duct (6,7) for distributing secondary air over a depth of the firebox (26), comprising two ends (30) connected to the said vertical duct (4,5) at one end (30), which horizontal duct (6,7) extends in depth direction of the firebox (26) essentially over the whole firebox (26) in the depth direction and the said feed opening (24) is formed in the horizontal duct (6,7), which horizontal duct (6,7) is arranged to be bricked in as part of the firebox (26) of the fireplace (12).

The invention also relates to a corresponding assembly kit, arrangement, and fireplace.

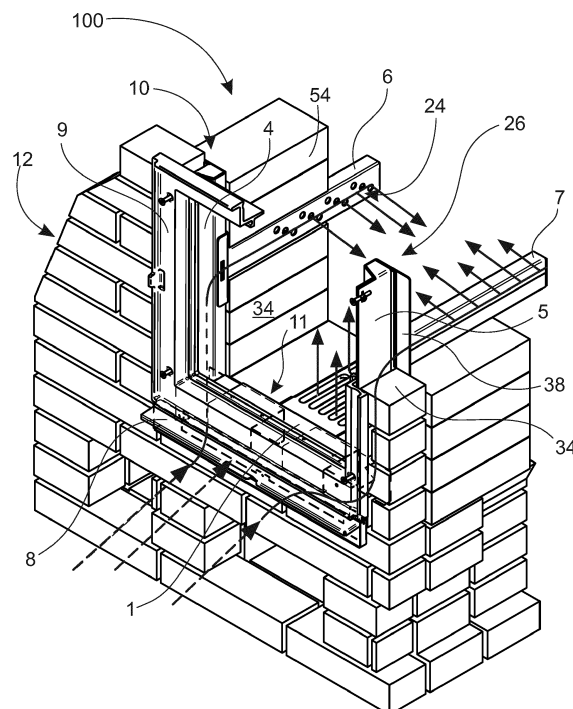


Fig. 1

Description

[0001] The invention relates to a frame construction for a masonry fireplace, for feeding secondary air to a firebox of the fireplace, to which frame construction a door of the firebox is arranged to be attached and which frame construction includes

- at least one air intake for drawing secondary air from outside the fireplace,
- vertical ducts, each comprising two ends and forming the side edges of the frame construction,
- a feed opening in the vertical ducts, for feeding secondary air to the firebox of the fireplace.

The invention also relates to a corresponding assembly kit, and arrangement, and a fireplace.

[0002] Due to incomplete combustion, the small-scale burning of firewood in fireplaces causes a significant amount of small-particle emissions. To reduce these, attempts have been made to boost combustion by improving the supply of air to the firebox. In masonry fireplaces, the air required for combustion, i.e. the so-called primary air, is led to the firebox primarily through a damper, but publication WO 98/35187 discloses a frame construction for a firebox, in which the secondary air is led to the firebox through the frame construction. With the aid of the frame construction, air can also be fed to the upper parts of the firebox, so that there too is the oxygen required for combustion, thus permitting material to be burned more efficiently and cleanly.

[0003] However, such a construction has the drawback that secondary air is fed only to a small part of the firebox, mainly the front part of the firebox near the door. For this reason, particularly in large fireboxes the rear parts of the firebox remain without a secondary-air supply and therefore combustion still remains incomplete, thus causing small-particle emissions.

[0004] The invention is intended to create a better frame construction than the prior art for a masonry fireplace, with the aid of which secondary air can be distributed effectively and evenly to the firebox, with the aid of a simpler construction than previously. The characteristic features of the present invention are stated in Claim 1. The invention is also intended to create an assembly kit for producing a frame construction according to the invention, with the aid of which the frame construction can be easily transported to the installation site. The characteristic features of this invention are stated in the accompanying Claim 13. The invention is also intended to create a better arrangement than arrangements according to the prior art for feeding secondary air to the firebox of a masonry fireplace, with the aid of which secondary air is distributed more effectively and evenly with the aid of a simpler construction than previously. The characteristic features of this invention are stated in the accompanying Claim 14. Further, the invention is intended to create a better masonry fireplace than fireplaces according to the

prior art, in which secondary air is fed to the firebox effectively and evenly with the aid of a simpler construction than previously. The characteristic features of this invention are stated in the accompanying Claim 15.

[0005] This intention can be achieved by means of a frame construction for a masonry fireplace for feeding secondary air to the firebox of the fireplace, to which frame construction the door of the fireplace is arranged to be attached, and which frame construction includes at least one air intake, vertical ducts, a horizontal duct, and a feed opening formed in the horizontal duct for feeding the secondary air in the vertical ducts to the firebox of the fireplace. At least one air intake is arranged to draw secondary air from outside the fireplace. The vertical ducts each comprise two ends and form the side edges of the frame construction. The horizontal duct for distributing secondary air to the full depth of the firebox comprises two ends and is connected at one end to a vertical duct. In the depth direction of the firebox the horizontal duct extends over essentially the whole depth of the firebox and is arranged to be bricked in to form part of the firebox of the fireplace. In the frame construction according to the invention, the horizontal duct, which extends in the depth direction essentially to the back of the firebox, permits secondary air to be distributed essentially evenly over the entire firebox, and not only to the front part of the firebox as in frame constructions according to the prior art. When travelling through the vertical ducts of the frame, the secondary air drawn from outside the fireplace heats and is sufficiently warm in terms of combustion already when it discharges from the horizontal duct into the firebox. When installed during the laying of the brickwork, the frame construction according to the invention can be integrated as part of the structure of the brickwork of the firebox with the horizontal duct replacing one brick course on the side or sides of the firebox, or over the whole circumference of the firebox. The horizontal duct is then part of the structure of the firebox and neither causes flow obstacles to the firebox nor reduces the volume of the firebox.

[0006] The frame construction can include an intake-air duct forming the upper or lower edge of the frame construction, preferably the lower edge, and comprising two ends, to which at least one air intake is formed in the intake-air duct for drawing secondary air from outside the fireplace into the said intake-air duct and openings in both ends for leading the secondary air into the firebox. The intake-air duct reinforces the vertical ducts and facilitates the installation of the frame construction. In addition, secondary air can be brought through the intake-air duct to both vertical ducts simultaneously.

[0007] The intake-air duct is preferably of a similar material to the vertical ducts. The intake-air duct can then be easily manufactured.

[0008] According to one embodiment, there are two air intakes, which are formed directly in the vertical duct. The intake-air duct can then be omitted from the frame construction. Further, each vertical duct then includes an

adjustment mechanism for regulating the amount of secondary air.

[0009] Alternatively, the intake-air duct can also be a masonry structure, through which air is brought to the vertical ducts, for example, through the ash-pan door by utilizing a separate distribution duct. A separate adjustment mechanism for regulating the secondary air will then not be required.

[0010] Preferably each vertical duct is connected at one end to one end of the intake-air duct, in such a way that one vertical duct is connected to each end of the intake-air duct.

[0011] The intake-air duct is preferably the same width as the firebox. The intake-air duct can then be a straight structure, which is easily manufactured, for example, by bending.

[0012] The intake-air duct is preferably an intake-air casing, which is arranged to form, with the brickwork of the fireplace, an air duct for distributing secondary air to the vertical ducts, being open on at least one side to form an air intake. Such an intake-air-duct structure can be manufactured entirely without welding.

[0013] The horizontal duct is preferably at right angles to both the vertical duct and the intake-air duct. Thus, it extends directly in the depth direction of the firebox parallel to the bricks of the brickwork and can easily be integrated as part of the brickwork.

[0014] The intake-air duct can have a telescopic construction, thus permitting changes to the width of the frame structure. Thus, the same frame construction can be used in fireboxes of different widths without changes to the frame construction. At the same time, the telescopic construction facilitates detaching the frame construction from the firebox to clean the ducts of the frame construction and service the firebox.

[0015] The horizontal duct can be connected to a joint of the vertical duct or ducts, which is at a distance d from one end of the vertical duct, which distance d corresponds to 40 - 60 % of the distance D between the ends of the vertical ducts. The horizontal duct will then be correctly situated for combustion, as flame that is very low in the firebox will receive sufficient oxygen from the primary air, i.e. from the larger amount of air coming through the damper and grate, while on the other hand combustion will no longer take place in the upper part of the firebox.

[0016] The frame construction preferably includes an adjustment mechanism attached to the intake-air duct, for regulating the amount of intake air. With the aid of the adjustment mechanism, the efficiency and speed of combustion can be regulated by regulating the amount of secondary air. With the aid of the adjustment mechanism, lighting the firebox can also be facilitated by shutting off the supply of secondary air, so that the draught travels effectively through the grate bringing primary air to the flames.

[0017] The horizontal duct can be detachably attached to the vertical duct or ducts. The vertical duct or ducts

and the intake-air duct can then be detached from the horizontal duct for maintenance.

[0018] The frame construction can include a second adjustment mechanism for attaching the horizontal duct to the vertical duct or ducts adjustably in the direction between the ends of the vertical duct. This permits the use of the same frame construction without changes in varying kinds of brickwork, in which the location of the horizontal duct running according to the bricks in the height direction of the firebox can vary.

[0019] According to one embodiment, the frame construction includes two horizontal ducts, each attached to one vertical duct. Secondary air can then be fed from both sides of the firebox, to boost the fire.

[0020] According to another embodiment, the horizontal duct is joined to both vertical ducts and the horizontal duct includes a junction duct, which is essentially parallel to the intake-air duct. In practice, in such a construction there is one horizontal duct, which, seen from above, forms a U-shaped structure running around the firebox. By means of such a construction, secondary air can be brought to the firebox from three sides, thus further boosting combustion.

[0021] The width of the frame construction's intake-air duct and the height of the vertical ducts are preferably such that the opening delimited between the intake-air duct and the vertical ducts essentially corresponds in size to the firebox opening.

[0022] The frame construction's intake-air duct, vertical duct, and horizontal duct are preferably detachably attached to each other. The installation of the frame construction will then be easier and the components can be replaced and serviced without detaching the whole construction.

[0023] The intake-air duct is preferably situated lower than the horizontal duct, to facilitate the flow of warmer air.

[0024] The frame construction can include attachment means for attaching the vertical ducts to the brickwork of the firebox. The attachment means are preferably flanges. With the aid of the attachment means and especially the flanges the frame construction can be firmly supported in the brickwork of the firebox.

[0025] According to one embodiment, the frame construction includes anchors, which are preferably welded, as attachment means, with the aid of which the frame construction can be effectively locked to the brickwork.

[0026] The feed opening is preferably fitted to the vertical part belonging to the horizontal duct, to feed secondary air horizontally. In other words, the feed opening is in the side wall of the horizontal duct, which opens towards the firebox. Secondary air can then be fed directly into the firebox from the feed opening.

[0027] The components of the frame construction are preferably made from thin sheet metal. The construction will then be very durable and easily transported.

[0028] The intention of the assembly kit according to the invention can be achieved by means of an assembly

kit for implementing the frame construction, which includes, as components to be attached to each other, components of any of the aforementioned embodiments of the said frame construction. In the form of components to be attached to each other, the frame construction can be easily packaged and sent to retailers, and from retailers to customers.

[0029] The intention of the invention can be achieved by means of an arrangement for feeding secondary air to the firebox of a fireplace, which arrangement includes a masonry fireplace, comprising a firebox, a firebox door, and a frame construction for attaching the door to the masonry of the firebox. According to the invention, the frame construction is a frame construction according to any of the embodiments described above. The arrangement according to the invention is quite simple compared to fireplace linings known from the prior art, with the aid of which it has been possible to bring at least some secondary air to the firebox. In the arrangement according to the invention, the appearance of the firebox remains aesthetically first-class, as the horizontal duct is integrated inconspicuously to form part of the structure of the firebox, the brickwork being the visually dominant element. At the same time, the horizontal duct also does not limit the volume of the firebox, as it is integrated to form part of the firebox. In addition, the use of the frame construction permits the various components to be detached for maintenance.

[0030] The fireplace is preferably an open hearth, a stove, or other corresponding masonry fireplace used for heating, in which wood or similar material is burned.

[0031] According to one embodiment, the fireplace is of brickwork and the height of the said horizontal duct is equal to the height of an individual brick. The horizontal duct can then be fitted as part of the firebox without cutting bricks or other similar additional work stages. However, it is preferable not to make the horizontal duct part of the brickwork, so that the horizontal duct can be detached for cleaning.

[0032] Preferably at least one brick includes a recess for the horizontal duct. This permits the horizontal duct to be fitted as part of the firebox without being bricked in.

[0033] The horizontal duct is preferably arranged to be part of the firebox, in such a way that the horizontal duct and the wall belonging to the firebox form together a planar surface to boost the flow of combustion gases. The frame construction can then be integrated to form part of the firebox, without weakening the flow of combustion gases in the firebox.

[0034] The intention of the fireplace according to the invention can be achieved by means of a fireplace, which includes a firebox door and a frame construction according to any of the embodiments described above for attaching the door to the masonry of the firebox.

[0035] By means of the frame construction according to the invention, the feed of secondary air to a firebox can be implemented more simply than when using constructions according to the prior art, while at the same

time the secondary air travelling inside the frame construction cools the frame construction and keeps the firebox door cooler. The frame construction according to the invention also has the advantage that its attachment to the fireplace is very secure and firm, as the vertical ducts are bricked in as part of the fireplace.

[0036] The frame construction can also be referred to as a frame.

[0037] In the following, the invention is described in detail with reference to the accompanying drawings showing some embodiments of the invention in which

- Figure 1 shows an axonometric view of the arrangement according to the invention,
- Figure 2 shows an axonometric view of the frame construction according to the invention, when detached,
- Figure 3 shows an axonometric exploded view of the frame construction according to the invention,
- Figure 4a shows an axonometric view of the frame construction according to the invention in partial cross-section,
- Figure 4b shows an axonometric view of detail A of Figure 4a,
- Figure 4c shows an axonometric view of detail B of Figure 4a,
- Figure 5 shows a longitudinal cross-section of the intake-air duct from one vertical duct to the other,
- Figure 6 shows an axonometric view of a second embodiment of the arrangement according to the invention.

[0038] Figure 1 shows a first embodiment of the frame construction 10 according to the invention, in which the frame construction 10 preferably includes an intake-air duct 11, vertical ducts 4 and 5, and two horizontal ducts 6 and 7. In addition, this embodiment preferably includes a telescopic construction 1,1.1 for the intake-air duct 11, and an adjustment mechanism 8, with the aid of which the amount of secondary air can be regulated. According to Figure 1, the intake-air duct 11 is a box-like structure, which, set on top of the masonry 34 of the fireplace 12, delimits the duct-like structure inside it, preferably forming the lower edge 14 of the frame construction 10. According to one embodiment, the intake-air duct can, differing from the figure, form the upper edge of the frame construction, but in that case the travel of the air will be weaker than when the intake-air duct is the lower edge.

[0039] According to Figure 3, the telescopic structure 1,1.1 of the intake-air duct 11 is preferably formed of two end parts 1.1 and a middle part 1, each of which is formed of a cover plate 2 and side plates 3. The end parts 1.1 form the ends 16 of the intake-air duct 11. The end parts 1.1 and the middle part 1 are preferably formed from individual metal pieces by bending. According to Figure 4c, also the ends of the side plates 3 are preferably bent

to form edges 44 and 46 parallel to the cover plate 2. The edge 44 of the side plate 3 next to the firebox can also be formed into a channel, the function of which is to stiffen the structure of the intake-air duct 11 and hold the middle part 1 essentially on top of the end parts 1.1. The end parts 1.1 can thus be slid inside the middle part 1 to adjust the width of the frame construction 10. Preferably, the end parts 1.1 of intake-air duct 11 are formed to be permanently attached parts to the vertical ducts 4 and 5, which are attached to each other, in such a way that a gap, i.e. the intake air's air intake 18, remains between the side plate 3 on the side of intake air duct's 11 door and the masonry, from which the secondary air is able to flow inside the intake-air duct 11, according to Figure 5. Alternatively, the vertical ducts and end parts of the intake-air duct can also be components detachably attached to each other.

[0040] With the aid of the adjustment mechanism 8 preferably attached in front of the masonry and intake-air duct 11, the amount of secondary air coming to the intake-air duct 11 can be limited to the desired level. According to Figure 3, the adjustment mechanism 8 can also be a frame construction 47 made of metal, which preferably includes a hinged door 48. Alternatively, the adjustment mechanism can include openings, in front of which a limiter damper can be moved to reduce or entirely block the diameter of the openings. With the aid of the adjustment mechanism, the amount of secondary air fed to the firebox can be regulated.

[0041] The intake-air duct 11 distributes the secondary air through the opening or openings of the cover plate 2 belonging to each end part 1.1 to one end 20 of the vertical ducts 4 and 5. The vertical ducts 4 and 5 can be P-shaped structures 40, when seen from above, in which the secondary air can move upwards towards the horizontal ducts 6 and 7. The vertical ducts 4 and 5 form the side edges 22 of the frame construction 10. Each vertical duct 4 and 5 has two ends 20. According to Figure 4b, openings 50, at the locations of which the horizontal duct 6, or preferably ducts are joined, are formed in the vertical ducts 4 and 5 and point towards the firebox. One end 30 of each of the horizontal ducts 6 and 7 include an opening 42, through which secondary air enters the horizontal duct 6.

[0042] The frame construction 10 is preferably attached to the outer covering or body masonry of the fireplace. The vertical ducts 4 and 5 preferably includes attachment means 39, which in this embodiment are a flange 38, which is bent to be parallel to the plane of the firebox door. This flange 38 preferably remains inside the brickwork 34, according to Figure 1. According to Figure 4b, a second adjustment mechanism 36, one form of the implementation of which is the slot 52 according to Figure 4b, can be used in the attachment of the horizontal ducts 6 and 7. With the aid of the slot 52, the horizontal duct 6 can be attached, within the amount of adjustment permitted by the slot 52, at a slightly different height to the junction 32 with the vertical duct 4 or 5, according to each

application. The horizontal duct 6, 7 is preferably connected to the junction 32 with the vertical duct 4 or 5 or ducts, which is at a distance d from one end 20 of the vertical duct 4, 5. The distance d preferably corresponds to 40 - 60 % of the distance D between the ends 20 of the vertical ducts 4, 5, according to Figure 2. Preferably a screw or similar attachment means can be set through the slot 52, by means of which the horizontal duct 6 or 7 is locked in place to the vertical duct 4 or 5. According to Figure 1, the horizontal duct 6 is situated at an individual brick course of the masonry 34, when the aesthetic appearance of the firebox will remain first-class and the horizontal ducts 6 and 7 will not reduce the volume of the firebox. The height of the horizontal duct 6 or 7 is preferably the same as the height of an individual brick 54.

[0043] According to the figures, the horizontal ducts 6 and 7 include secondary-air feed openings 24, through which secondary air is fed to the firebox. The feed openings 24 can be, according to the figures, for example, three openings in a slanting row, to distribute secondary air as evenly as possible to the whole area of the firebox 26. In this connection, the terms openings can also refer to slots or other differently-shaped openings, through which secondary air can flow from the horizontal ducts to the firebox. The horizontal ducts are preferably straight ducts, so that they are easy to manufacture and preferably include only one welded seam. The width of the intake-air duct 11 of the frame construction 10 and the height of the vertical ducts 4 and 5 are such that the gap delimited between the intake-air duct 11 and the vertical ducts 4 and 5 corresponds in size essentially to the opening in the firebox 26.

[0044] According to Figure 3, the vertical ducts 4 and 5 preferably include attachment counter-pieces 58, to which, according to Figure 1, the door 9 is attached with the aid of the attachment means. In addition, the lower part of the vertical ducts 4 and 5 preferably also include second attachment counter-pieces 60, to which the adjustment mechanism 8 can be attached according to Figure 1. The vertical ducts 4 and 5 are preferably continuous at the height of the firebox 26 door 9, so that the firebox 26 door 9, and the frame possibly belonging to it, can be supported from above and below on the frame construction 10 according to the invention, according to Figure 1.

[0045] The frame construction 10 according to the invention can be made, for example, from individual thin sheet-metal or cast iron pieces, which are joined together by welded, screwed, or riveted joints, to assemble the frame construction 10. The metal sheets can be 0.2 - 4.0-mm, preferably 1.5 - 2.5-mm thick and the material can be, for example, stainless steel or cast iron.

[0046] When using the frame construction according to the invention, the structure of the masonry fireplace can be, except for the space required by the horizontal ducts, similar to that of a normal fireplace, i.e. the fireplace does not require separate air ducts or similar, as secondary air is drawn into the frame construction from

outside the fireplace.

[0047] According to Figure 6, the frame construction according to the invention can also be implemented in such a way that the horizontal duct 6, 7 is a single U-shaped duct structure, which is joined to both vertical ducts 4 and 5. In this case there is a junction duct 6.5 between the horizontal ducts 6 and 7, which connects the horizontal ducts 6 and 7 to form a single horizontal duct structure. There can be feed openings 24 in the junction duct 6.5 too. By means of such a duct structure secondary air can be also supplied to the rear of the firebox, i.e. fed to the firebox from three different directions.

Claims

1. Frame construction for a masonry fireplace for feeding secondary air to a firebox of the fireplace, to which frame construction (10) a door (12) of the fireplace (12) is arranged to be attached and which frame construction (10) includes

- at least one air intake (18) for drawing secondary air from outside the fireplace (12),
- vertical ducts (4,5), each comprising two ends (20), and thus forming side edges (22) of the frame construction (10),
- a feed opening (24) in the vertical ducts (4,5), for feeding secondary air to the firebox (26) of the fireplace (12),

characterized in that the frame construction (10) includes a horizontal duct (6,7) for feeding secondary air to the full depth of the firebox (26), comprising two ends (30) joined at one end (30) to the said vertical duct (4,5), which horizontal duct (6,7) extends in direction of depth of the firebox (26) essentially over the whole firebox (26) in the depth direction, and the said feed opening (24) is formed in the horizontal duct (6,7), which horizontal duct (6,7) is arranged to be bricked in as part of the firebox (26) of the fireplace (12).

2. Frame construction according to Claim 1, **characterized in that** the frame construction (10) includes an intake-air duct (11) forming an upper or lower edge (14), preferably the lower edge (14) of the frame construction (10) and comprising two ends (16), in which in the intake-air duct (11) the said at least one air intake (18) is formed for drawing secondary air from outside the fireplace (12) into the said intake-air duct (11) and openings in both ends for leading secondary air to the firebox.
3. Frame construction according to Claim 1 or 2, **characterized in that** each vertical duct (4,5) is connected at one end (20) to one end (16) of the said intake-air duct (11) in such a way that one vertical duct (4,5)

is connected to each end (16) of the intake-air duct (11).

4. Frame construction according to any of Claims 1 - 3, **characterized in that** the said intake-air duct (11) is essentially of same width as the firebox (26).
5. Frame construction according to any of Claims 1 - 4, **characterized in that** the said intake-air duct (11) is a telescopic construction (1,1.1) thus permitting a change in the width of the frame construction (10).
6. Frame construction according to any of Claims 1 - 5, **characterized in that** the said horizontal duct (6,7) is connected to the junction (32) of the vertical duct (4,5) or ducts, which is at a distance d from one end (20) of the vertical duct (4,5), which distance d corresponds to 40 - 60 % of a distance D between the ends (20) of the vertical duct (4,5).
7. Frame construction according to any of Claims 1 - 6, **characterized in that** the frame construction (10) includes a second adjustment mechanism (36) for connecting the horizontal duct (6,7) adjustably, in the direction between the ends (20) of the vertical duct (4,5) to the vertical duct (4,5) or ducts.
8. Frame construction according to any of Claims 1 - 7, **characterized in that** the frame construction (10) includes two horizontal ducts (6,7), each connected to one vertical duct (4, 5).
9. Frame construction according to any of Claims 1 - 8, **characterized in that** the said horizontal duct (6,7) is connected to both vertical ducts (4,5) and the horizontal duct (6,7) includes a junction duct (6.5), which is essentially parallel to the intake-air duct (11).
10. Frame construction according to any of Claims 1 - 9, **characterized in that** the said frame construction (10) includes attachment means (39) for attaching the vertical ducts (4,5) to the masonry of the firebox (26).
11. Frame construction according to any of Claims 1 - 10, **characterized in that** the said feed opening (24) is arranged in the vertical portion belonging to the horizontal duct (6,7) to feed secondary air horizontally.
12. Frame construction according to any of Claims 1 - 11, **characterized in that** the frame construction's (10) intake-air duct (11), vertical ducts (4,5), and horizontal duct (6,7) are detachably attached to each other.
13. Assembly kit for implementing a frame construction,

characterized in that the assembly kit includes, as parts to be joined together, components of a frame construction (10) according to any of Claims 1 - 12.

14. Arrangement for feeding secondary air to a firebox of a fireplace, which arrangement (100) includes a masonry fireplace (12) comprising a firebox (26), a firebox door (9), and a frame construction (10) for attaching the door (9) to the masonry of the firebox (26), **characterized in that** the said frame construction (10) is a frame construction (10) according to any of Claims 1 - 12.
15. Fireplace, which includes a firebox door (9) and a frame construction (10) for attaching the door (9) to the masonry of the firebox (26), **characterized in that** the said frame construction (10) is a frame construction (10) according to any of Claims 1 - 12.

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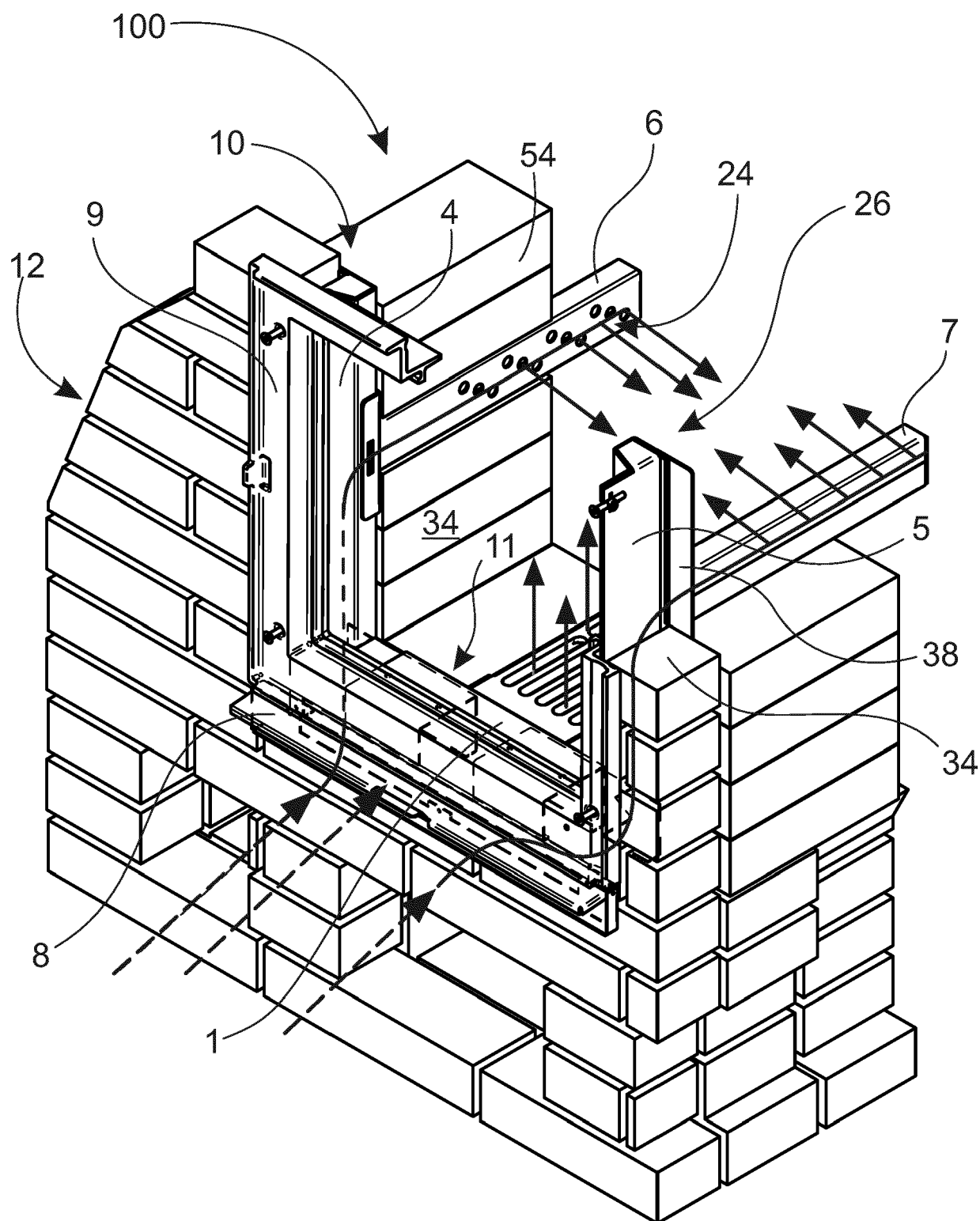


Fig. 1

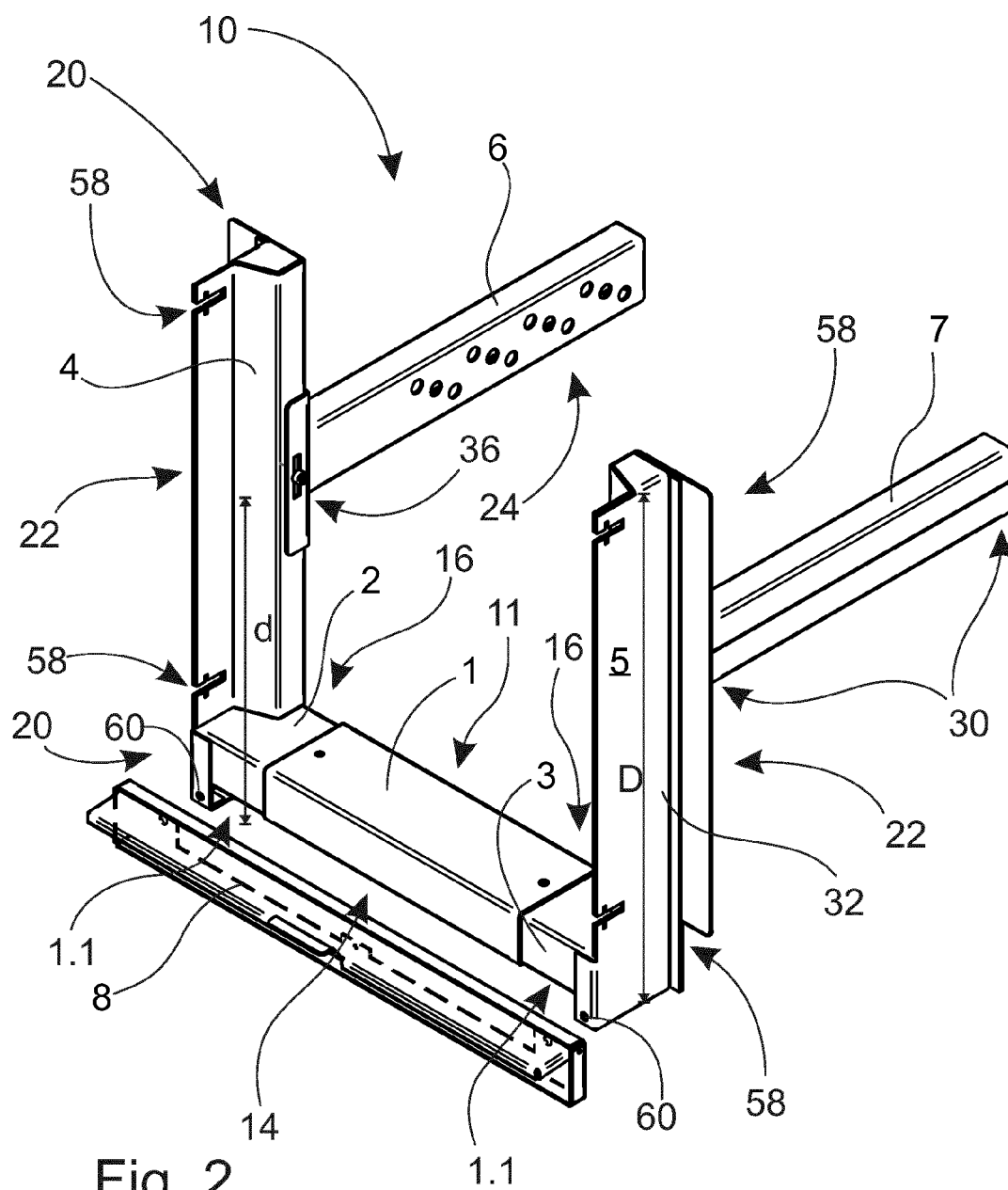


Fig. 2

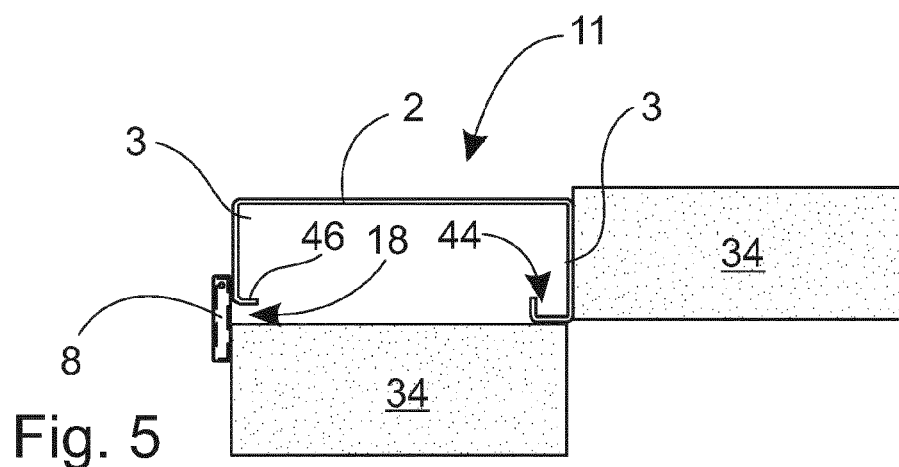


Fig. 5

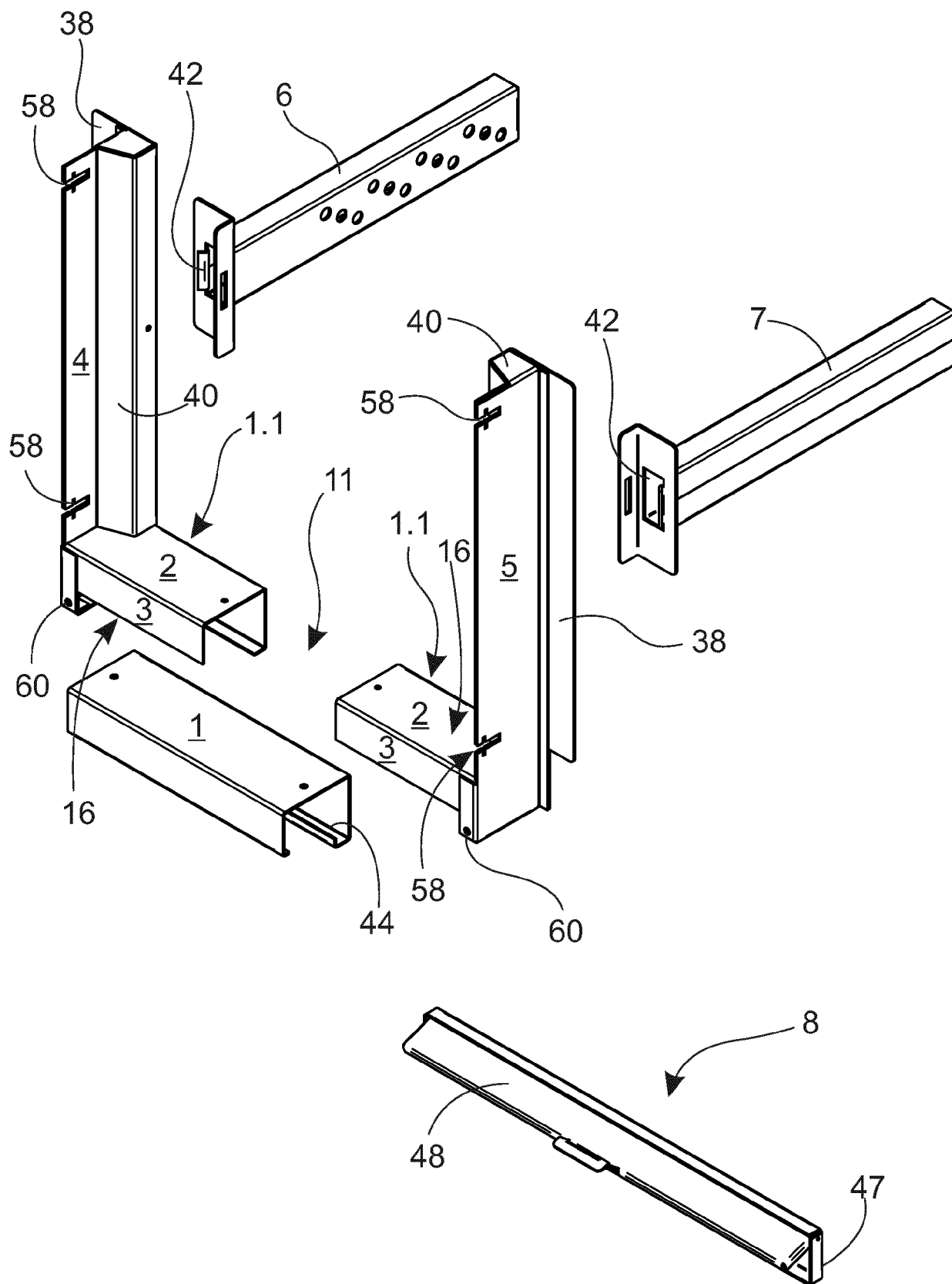
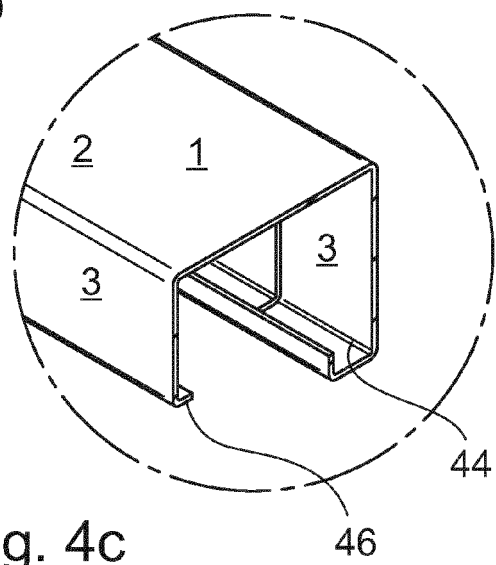
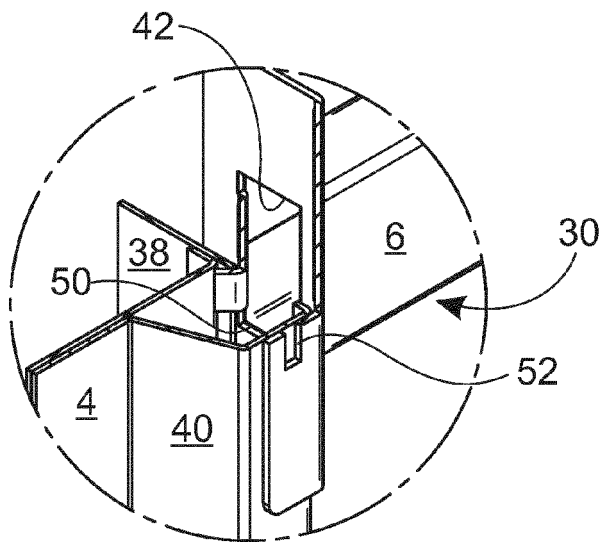
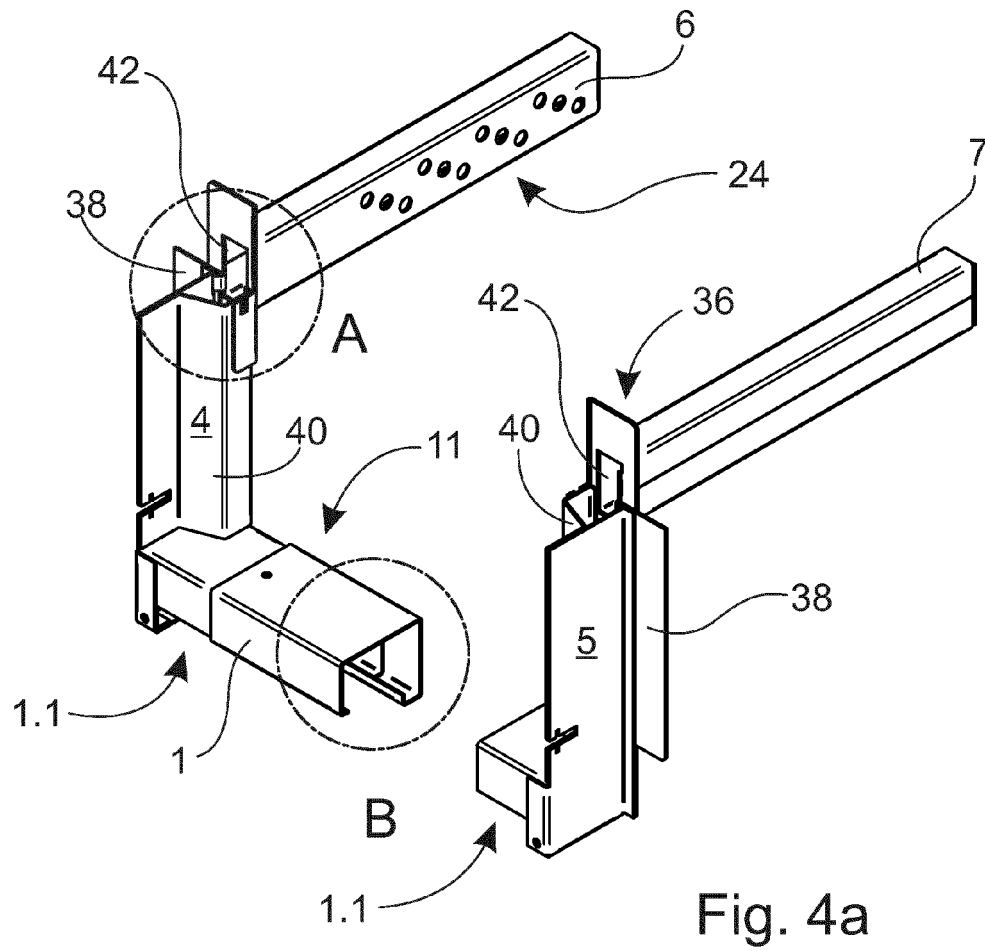


Fig. 3



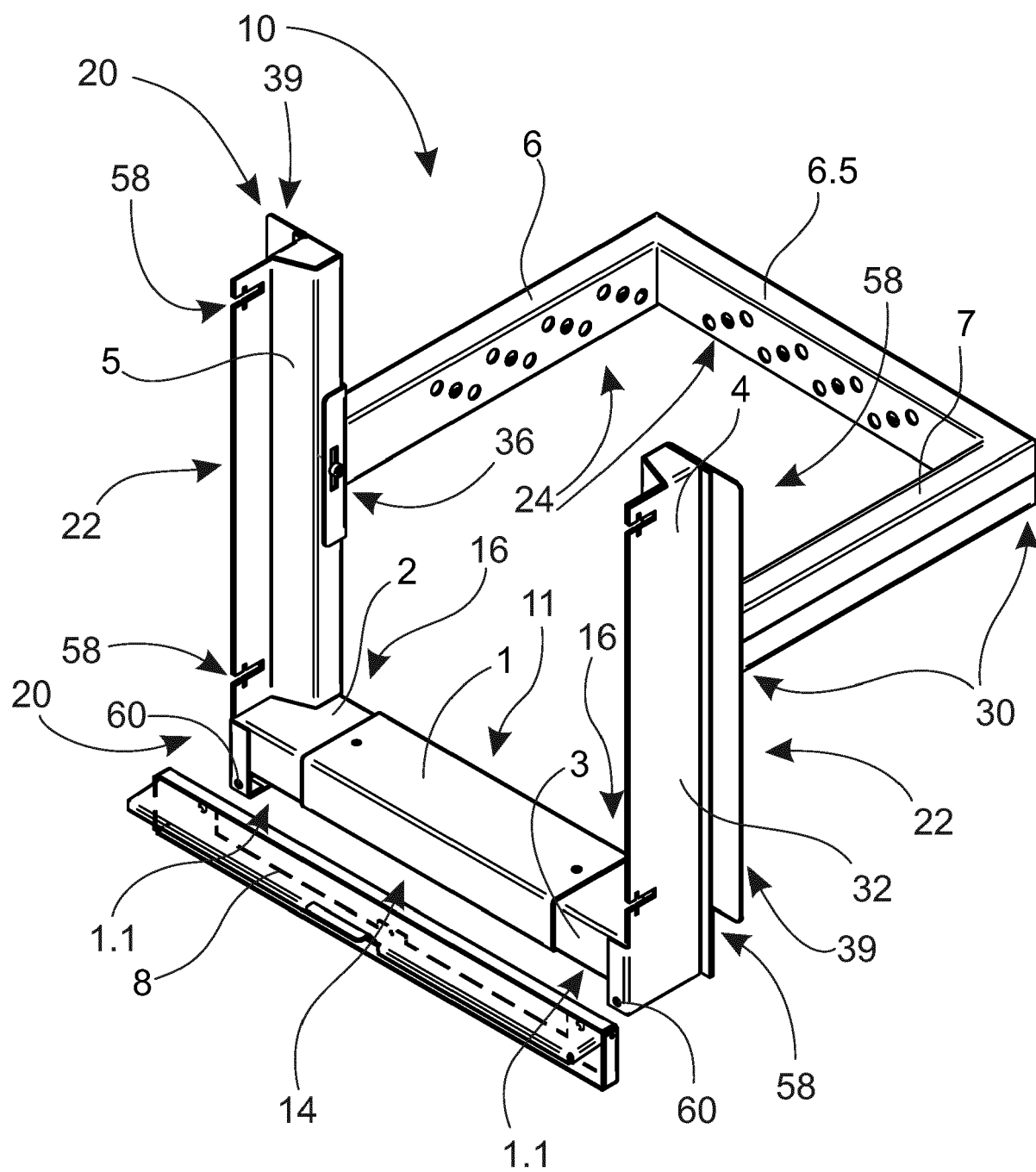


Fig. 6



EUROPEAN SEARCH REPORT

 Application Number
EP 17 15 3040

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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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