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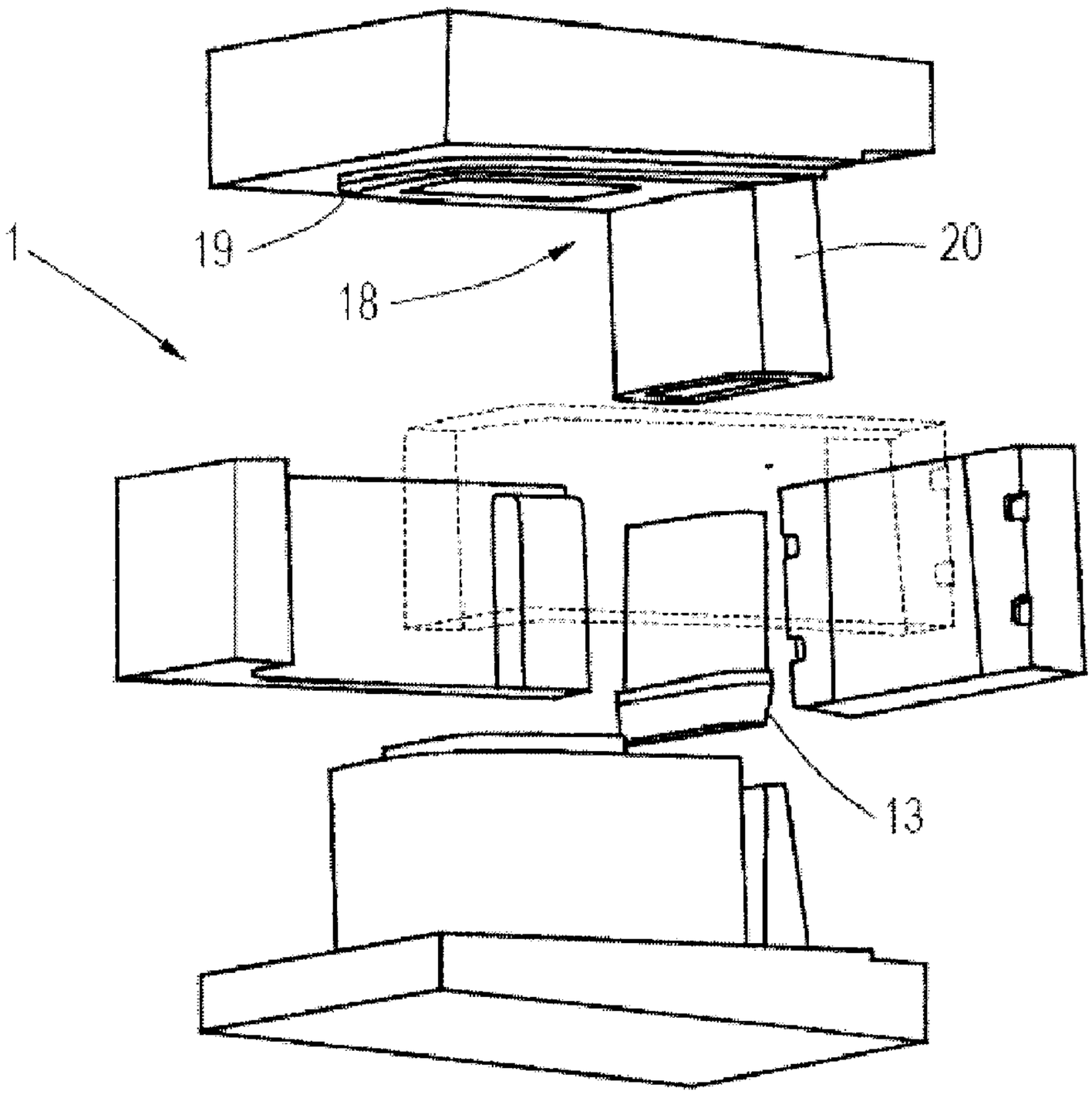
(72) **Inventeurs/Inventors:**
DE LA CORTE, JUAN ANGEL, DE;
LEDERMANN, CHRISTIAN, FR

(73) **Propriétaire/Owner:**
DURAVIT AKTIENGESELLSCHAFT, DE

(74) **Agent:** FETHERSTONHAUGH & CO.

(54) **Titre : MOULE POUR COULEE SOUS PRESSION POUR LA FABRICATION DE PIECE MOULEE**
(54) **Title: PRESSURE CASTING MOLD FOR PRODUCING A CAST PART**



(57) **Abrégé/Abstract:**
Pressure casting mold for producing a cast part which is part of a one-piece toilet comprising a body, a water ring and a tank, wherein the cast part as one-piece component comprises the water ring and the tank which is open on the top side, wherein the

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(57) **Abrégé(suite)/Abstract(continued):**
pressure casting mold consists of at least five mold parts that are detachably connectable to one another, namely of a bottom part, two side parts each with a molded-on front wall half, a rear wall, and a cover part, wherein the mold parts delimit a cavity which corresponds to the outer shape of the cast part, and wherein, on the bottom part, a wedge element is provided, which delimits the inner shape of the water tank at least in some sections.

Abstract

Pressure casting mold for producing a cast part which is part of a one-piece toilet comprising a body, a water ring and a tank, wherein the cast part as one-piece component comprises the water ring and the tank which is open on the top side, wherein the pressure casting mold consists of at least five mold parts that are detachably connectable to one another, namely of a bottom part, two side parts each with a molded-on front wall half, a rear wall, and a cover part, wherein the mold parts delimit a cavity which corresponds to the outer shape of the cast part, and wherein, on the bottom part, a wedge element is provided, which delimits the inner shape of the water tank at least in some sections.

Pressure Casting Mold for Producing a Cast Part

The present disclosure relates to a pressure casting mold for producing a cast part which is part of a one-piece toilet comprising a body, a water ring, and a tank, wherein the cast part, as a one-piece component, comprises the water ring and the tank which is open at the top.

The term "one-piece toilet" denotes a sanitary object usually made of ceramic or porcelain, which in the end consists of three components, namely, on the one hand, the body itself comprising the bowl area and the corresponding arrangements used for connecting the plumbing as well as the corresponding attachment devices either for arrangement on the floor side or for installation on the wall side. The second part is the so-called water ring, which is placed on the body on the top side and used for the distribution of the injected rinsing water. Finally, the third part is the tank, which is also placed on the body side and through which the rinsing water reaches the water ring. In the prior art, these three components are produced in three separate pressure casting molds, i.e., this means that the body, the water ring and the tank are each separate cast parts, which, after molding in the respective pressure casting mold, are put together and placed one on top of the other. In this as yet unfired state, the three parts are then slightly connected to one another along the separation line by the local application of a slip composition; the term "garnishing" is used here. Subsequently, the blank so produced is fired. The connecting lines, that are the bonding lines, along which the three originally separate parts were connected to one another by adhesive bonding using the slip composition are visible on the fired toilet.

Besides the fact that these bonding lines are in the end in fact not desirable, the production and handling of three separate parts for producing such a one-piece toilet is elaborate and expensive.

It is thus desirable to indicate a possibility of how the production of such a one-piece toilet consisting of the sections mentioned in the introduction can be simplified.

In an aspect, there is provided a pressure casting mold for producing a cast part which is part of a one-piece toilet comprising a body, a water ring and a tank, wherein the cast part as one-piece component consists of the water ring and the tank, the tank being open on a top side, the pressure casting mold consisting of at least five mold parts that are detachably connectable to one another, namely of a bottom part, two side parts each with a molded-on front wall half, a rear wall, and a cover part, wherein the mold parts delimit a cavity which corresponds to the outer shape of the cast part, and wherein, on the bottom part, a first wedge element is provided, which delimits an inner shape of the water tank at least in some sections.

In another aspect, there is provided a method for producing a one-piece toilet comprising a body, a water ring and a tank, the method comprising: using a first pressure casting mold as disclosed in the preceding paragraph, to produce a first cast part consisting of water ring and tank; using a second multiple-part pressure casting mold, to produce a second cast part which forms the body; after opening the first pressure casting mold, picking up the first cast part with a transport element and transporting the first cast part to the second pressure casting mold; and, after at least partial opening of the second pressure casting mold, positioning the first cast part beneath the

body, after which opening the second pressure casting mold, and holding the body in a correct position relative to the first cast part on the transport element.

In another aspect, there is provided a casting device for producing a one-piece toilet, comprising a first pressing machine associated with a first pressure casting mold as described herein, a second pressing machine associated with a second pressure casting mold, and a transport element for transporting the cast part from the first pressing machine to the second pressing machine.

In the case of a pressure casting mold of the type mentioned in the introduction, it is provided according to an embodiment of the present disclosure that the pressure casting mold may include at least five mold parts that are detachably connectable to one another, namely a bottom part, two side parts each with a molded-on front wall half, a rear wall, and a cover part, wherein the mold parts delimit a cavity which corresponds to the outer shape of the cast part, and wherein, on the bottom part, a wedge element is provided, which delimits the inner shape of the water tank at least in some sections

The pressure mold, due to its special design, allows the combination of the water ring and of the tank in a single component, that is to say it allows the production of a cast part that has the two elements. Accordingly, for the production of a one-piece toilet, now only two components need to be produced, namely, on the one hand, the body, using a separate pressure casting mold, and, on the other hand, the second component comprising the water ring and the tank, using the pressure casting mold according to an embodiment of present disclosure. Also, after the casting, only two components consequently remain to be handled, i.e., this means that the body and the

second component with the water ring and the tank need to be put together, resulting in the end in only one bonding line that is visible. The second bonding line, as is currently present in the prior art, is eliminated.

In order to make this possible, the pressure mold according to an embodiment of the present disclosure provides an at least five-piece design. What is provided is a bottom part as well as two side parts each comprising a molded-on half or section of a front wall. If the bottom part and the side parts are put together, the mold is consequently already closed on all four sides, namely on the bottom side, on the two mutually facing sides as well as on the front side. The rearward closure occurs by means of a corresponding rear wall, and the upper-side closure by means of a cover part. In the put-together state, these mold parts delimit a cavity which defines the outer shape of the cast part. Then in order to be able to mold the tank, which is a hollow part, in a defined manner, a wedge element is provided according to an embodiment of the present disclosure on the bottom part, which delimits the inner shape of the water tank at least in some sections. This wedge element consequently entirely fills in the hollow space of the tank at least in some sections, so that said tank can be pressure cast with a corresponding defined wall thickness. The design of this element as wedge element is advantageous in terms of demolding capability, since, after the casting, it can easily be pulled out of the cast part.

The pressure casting mold, after closing, is arranged in the pressing machine, and then the slip is pressed in, so that the cast part forms. After a defined holding time, the pressure casting mold is taken out and opened, after which the cast part can be connected in a second pressing machine naturally preferably arranged adjacently, and garnished, after which the firing itself occurs.

The pressure casting mold consequently allows the production of a cast part comprising the two toilet components, "water ring" and "tank," so that, in the end, only two separate cast parts need to be adhesively bonded to form a one-piece toilet. A third special casting mold is consequently no longer needed. The production can be simplified and accelerated, since now only two pressing machines are required, in which the two cast parts can be produced in parallel. The handling is also simplified, since now only two components need to be handled.

In a variant of the present disclosure, a second, separately movable wedge element is provided advantageously for the molding of the hollow space of the water tank, wedge element which is put together with the wedge element provided on the bottom part in the casting position, and which forms a molding wedge that delimits the entire inner shape of the water tank. The molding wedge, which fills in the entire hollow space of the water tank, is implemented as a two-piece component consisting of the bottom-part-side wedge element and a second, movable wedge element, which is preferably positioned by means of a robotic arm. The two wedge elements complement each other to form the molding wedge. Since the movable wedge element can be handled as an independent part, it can also be removed first after the production of the cast part, so that the entire molding wedge comes apart, and the cast part can be removed more easily from the mold.

In order to design the demolding as simply as possible, the molding wedge formed preferably has a tapered shape in the x and y direction towards its free end. I.e., the molding wedge is slightly

tapered in both dimensions. The water tank accordingly is also tapered, at least as far as its inner space is concerned, from its top end to its bottom end which is directed toward the water ring. In order to be able to remove the separately movable second wedge element from the mold after the casting, a pressurized air connection is advantageously provided on the cover, with a downstream line which leads into the area of the second wedge element, so that the latter, after the opening of the pressure casting mold, can be blown out after the injection of pressurized air. i.e., this means that, by applying a sufficient excess pressure, the wedge element is almost pushed out and it is handled again appropriately by means of the already described robotic arm, after which the final demolding occurs.

In addition to relating to the pressure casting mold, the present disclosure further relates to a method for producing a multi-part toilet comprising a body, a water ring and a tank. This method is characterized in that, using a first pressure casting mold of the above-described type, a first cast part consisting of a water ring and a tank is produced; in that, using a second multiple-part pressure casting mold, a second cast part, which forms the body, is produced; in that, after opening the first pressure casting mold, the cast part is picked up by a transport element and transported to the second pressure casting mold, and, after the at least partial opening of the lateral pressure casting mold, is positioned beneath the body, after which the second pressure casting mold is opened, and the body is held in a correct positional arrangement relative to the first cast part on the transport element. If the two elements on the transport element have been held in the correct position, then the adhesive layer can be produced by the slip application, after which the toilet, which now has already been adhesively bonded to form one piece, is fired. All

that remains after the firing is the attachment of an injection tube and of a connection retainer, if any, by adhesive bonding or by mechanical means.

The second, separately movable wedge element of the first pressure casting mold is here introduced into and removed from the first casting mold preferably by means of a robotic arm. By means of such a robotic arm, which in the end is movable in space around multiple linear and swivel axes, the second wedge element can be moved very precisely and accurately positioned.

The present disclosure further relates to a casting device for producing a one-piece toilet, comprising a first pressing machine associated with the first pressure casting mold according to an embodiment of the present disclosure of the above described-type, a second pressing machine associated with the second pressure casting mold, as well as a transport element for transporting the first cast part from the first pressing machine to the second pressing machine. Moreover, a handling device with a robotic arm for handling the second wedge element can be provided, wherein the robotic arm is accordingly movable in space.

Additional advantages, features and details of the present disclosure result from the embodiment example described below and in reference to the drawings.

Figure 1 shows an exploded view of the pressure casting mold according to an embodiment of the disclosure,

Figure 2 shows a top view of the bottom part with the second wedge element added,

Figure 3 shows a perspective view of the bottom part in longitudinal section,

Figure 4 shows a side view of the cross section of the bottom part from Figure 3,

Figure 5 shows an exploded view of the pressure casting mold with representation of the finished cast part,

Figure 6 shows a view of the partially opened pressure casting mold with cast part shown,

Figure 7 shows a perspective view of the casting device, wherein only the two first and second pressure casting molds are represented, with partially opened first and second casting molds,

Figure 8 shows a representation of the casting device according to Figure 7 with the transport element holding the cast part,

Figure 9 shows a representation with the transport element transporting the cast part from the first to the second pressure casting mold,

Figure 10 shows a representation with the transport element positioned beneath the second pressure casting mold,

Figure 11 shows the now also opened second pressure casting mold, wherein the body is held on the cast part,

Figure 12 shows a perspective view of the transport element with body and cast part picked up, and

Figure 13 shows an exploded view of the body and of the cast part before the assembly.

Figure 1 shows, in an exploded view, a pressure casting mold 1 according to an embodiment of the present disclosure consisting of a bottom part 2, two side parts 3, 4 on each of which a half 5, 6 of a front wall is provided, and, in addition, a rear wall 7 as well as a cover part 8. In the closed

state, the mold parts define a cavity in which a cast part is produced, consisting of a water ring and of a tank, wherein the two form a one-piece cast part.

Figures 2-4 show the bottom part 2 in top and sectional views. This bottom part consists of the base plate 9 and of a mold body 10 located in front of it, on the top side of which a mold structure 11 is formed for the formation of the water ring. Adjacently to the mold body 10, a first wedge element 12 protrudes from the base plate 9. Arranged adjacently to the latter wedge element, a detachable, that is to say separate second wedge element 13 is arranged. The wedge elements 12, 13 complement each other to form a molding wedge 14 which fills in the hollow cavity of the water tank of the cast part, that is to say delimits the inner surface of the water tank. A gap 15, which defines the front side of the tank, can be seen between the second wedge element 13 and the mold body 10. The rear side of the tank as well as sides of the tank are defined via the side parts 3, 4 and respectively the rear wall 7, which in the installation position, that is with the mold closed, extend adjacently to the molding wedge 14.

The two wedge elements 12, 13 are in contact with each other via a flat surface 16 extending at a slant. This makes it possible to pull out the bottom part 2 downward relative to the closed mold, wherein the first wedge element 12 separates from the second wedge element 13. The second wedge element 13 can then usually also be taken out, when this does not already occur simultaneously or respectively immediately thereafter, by the injection of pressurized air via a corresponding pressurized air connection on one of the mold parts.

As shown in Figures 2-4, the molding wedge is tapered both in the width and also in the length direction from the lower end near the base plate to the upper free end. This allows the corresponding mold release of the wedge elements 12, 13 from the cast tank.

The side walls 3, 4 as well as the rear wall 7 are used primarily for the lateral delimitation in the area of the tank and as supports for the cover part 8. The cover part 8 itself has a corresponding mold geometry 17 which defines the water ring, in connection with the corresponding mold recess 11 on the body 10, and which defines the lower side of the water tank. All the mold parts are made, as is known, of porous plastic material and thus allow the use of the mold 1 in a pressing machine.

Figure 5 again shows as an example an exploded view of the pressure casting mold 1, wherein here the second wedge element 13 is represented separately, after it has been manipulated as a separate mold part by means of a robotic arm not shown in further detail, that is, in particular, it has been set on the bottom part 2 or respectively also gripped above it at the time of demolding. The front side part is here drawn only with broken lines.

Also shown is the cast part 18 consisting of the water ring 19 as well as of the tank 20, which is molded therein to form one piece and which is hollow on the inside and defined, as described, via the molding wedge 14 formed from the wedge elements 12, 13.

Figure 6 shows a representation of the pressure casting mold 1 after the production of the cast part 18, wherein here the bottom part 2 has been removed, in addition to its wedge element 12 molded thereto to form one piece as well as the one side wall. Consequently, also represented are the cover part 8, the rear wall 7 as well as the one side wall 3 and the second wedge element 13 which is still held in the interior of the tank 20. The cast part 18, consequently a one-piece component consisting of water ring 19 and tank 20, can be seen.

Figures 7-11 diagrammatically show the course of a method for producing a one-piece toilet. The first pressure casting mold 1 according to an embodiment of the present disclosure is provided, which is used for producing the cast part 18 consisting of water ring 19 and tank 20. Moreover, a second pressure casting mold 21 is provided, which is used for the production of the body 22 which sits beneath the water ring 19 and the tank 20.

The two pressure casting molds 1 and 21 are associated with separate pressing machines, which are not shown in further detail here. They are conventional pressing machines used for carrying out ceramic pressure casting.

As shown in Figure 7, the cast part 18 has already been cast, the mold in this respect has been opened, and only the second wedge element 13 is here still shown inside the tank 20. It is taken out by means of a corresponding robotic arm, which is not shown in further detail here, so that in the end the cast part 18 can be taken out. The pressure casting mold 21 is also represented here already partially opened; the bottom part 23 located there has already been removed; and the two side walls 24, 25, which here too comprise the corresponding halves 26, 27 for the formation of the front wall, the rear wall 28 as well as the cover part 29 are still closed. The cast part formed, that is the body 22, is still held in the interior.

As shown in Figure 8, a transport element 30 is now positioned by means of a handling device not shown in further detail such as, for example, also a robotic arm or the like, beneath the cast part 18. The water ring 19 here protrudes slightly from the cover part 8, so that the transport element 30 moving beneath bears both against the tank 20 on the margin and also against the

water ring 19. The latter also bears against the transport element 30 with its side that is free due to the opening of the mold. In this way, during the final demolding of the cast part 18, an uncontrolled, albeit slight, downward movement of the cast part and impact against the transport element 30, which could lead to a deformation, are avoided. The transport element 30 consequently holds the cast part 18 reliably and without movement.

Then, after the final demolding of the cast part 18, the transport element 30 is moved to the second pressure casting mold 21, see Figure 9. It is positioned, see Figure 10, beneath the pressure casting mold 21, in particular in such a manner that the cast part 18 is accurately positioned beneath the body 22. The free upper side of the cast part 18 (see Figure 9), when the transport element 30 has reached its final position in Figure 10, is positioned so that it is in contact with the body 22. Then, see Figure 11, the second pressure casting mold 21 is also opened, and the body 22 is released. It is positioned, see Figure 11 and in particular Figure 12, precisely relative to the cast part 18. This now results in only one circumferential separating line 31 at the transition from the bottom side of the body 22 to the top side of the cast part 18. Along this line, prior to the firing, line of adhesive is produced by use of slip composition, and consequently the two cast parts are connected to one another. Now only one line of adhesive can be seen here, since only two cast parts had to be connected to one another to form a one-piece toilet.

Finally, Figure 13 again shows, in an exploded view, the two cast parts, namely, on the one hand, the cast part 18 consisting of water ring 19 and tank 20, and on the other hand, the cast part which forms the body 22. In the assembled state, see Figure 12, they form in the end a one-piece

toilet 32 which, after firing, forms a one-piece component now connected undetachably due to the adhesive connection.

The first pressure casting mold 1 with its special design is an essential element here, particularly with a view to the two-piece molding wedge 14 which fills in the tank 20 or delimits it on the inner side, and which, due to its geometry which is tapered in the two directions, facilitates the removal from the mold. This in turn allows the one-piece molding of the tank 20 on the water ring 19, and consequently also the formation of the one-piece cast part 18.

Finally, it should be noted that the casting position can also be rotated by 180° with respect to the representations shown in the figures, i.e., that the casting molds 1 and 21 can be positioned rotated by 180° around the horizontal. The cast part 18 would then be placed on the body 22.

Claims

1. Pressure casting mold for producing a cast part which is part of a one-piece toilet comprising a body, a water ring and a tank, wherein the cast part as one-piece component consists of the water ring and the tank, the tank being open on a top side, the pressure casting mold consisting of at least five mold parts that are detachably connectable to one another, namely of a bottom part, two side parts each with a molded-on front wall half, a rear wall, and a cover part, wherein the mold parts delimit a cavity which corresponds to the outer shape of the cast part, and wherein, on the bottom part, a first wedge element is provided, which delimits an inner shape of the water tank at least in some sections.

2. Pressure casting mold according to Claim 1, wherein a second, separately movable wedge element is provided, which is put together with the first wedge element provided on the bottom part in the casting position and forms a molding wedge which delimits the entire inner shape of the water tank.

3. Pressure casting mold according to Claim 2, wherein the molding wedge has a shape tapered in x and y directions toward its free end.

4. Pressure casting mold according to Claim 2 or 3, wherein, on the cover part, a pressurized air connection with downstream line is provided, which leads into the area of the second wedge element, to allow said second wedge element, after the opening of the pressure casting mold, be blown out by injecting pressurized air.

5. Method for producing a one-piece toilet comprising a body, a water ring and a tank, the method comprising:

using a first pressure casting mold according to any one of claims 1 to 4, to produce a first cast part consisting of water ring and tank;

using a second multiple-part pressure casting mold, to produce a second cast part which forms the body;

after opening the first pressure casting mold, picking up the first cast part with a transport element and transporting the first cast part to the second pressure casting mold; and,

after at least partial opening of the second pressure casting mold, positioning the first cast part beneath the body, after which opening the second pressure casting mold, and holding the body in a correct position relative to the first cast part on the transport element.

6. Method according to Claim 5 as dependent from any one of claims 2 to 4, wherein the second, separately movable wedge element is introduced into and removed from the first pressure casting mold by means of a robotic arm.

7. Casting device for producing a one-piece toilet, comprising a first pressing machine associated with a first pressure casting mold according to any one of Claims 1 to 4, a second pressing machine associated with a second pressure casting mold, and a transport element for transporting the cast part from the first pressing machine to the second pressing machine.

8. Casting device according to Claim 7 as dependent from any one of claims 2 to 4, wherein a handling device with a robotic arm for handling the second wedge element is provided.

FIG. 1

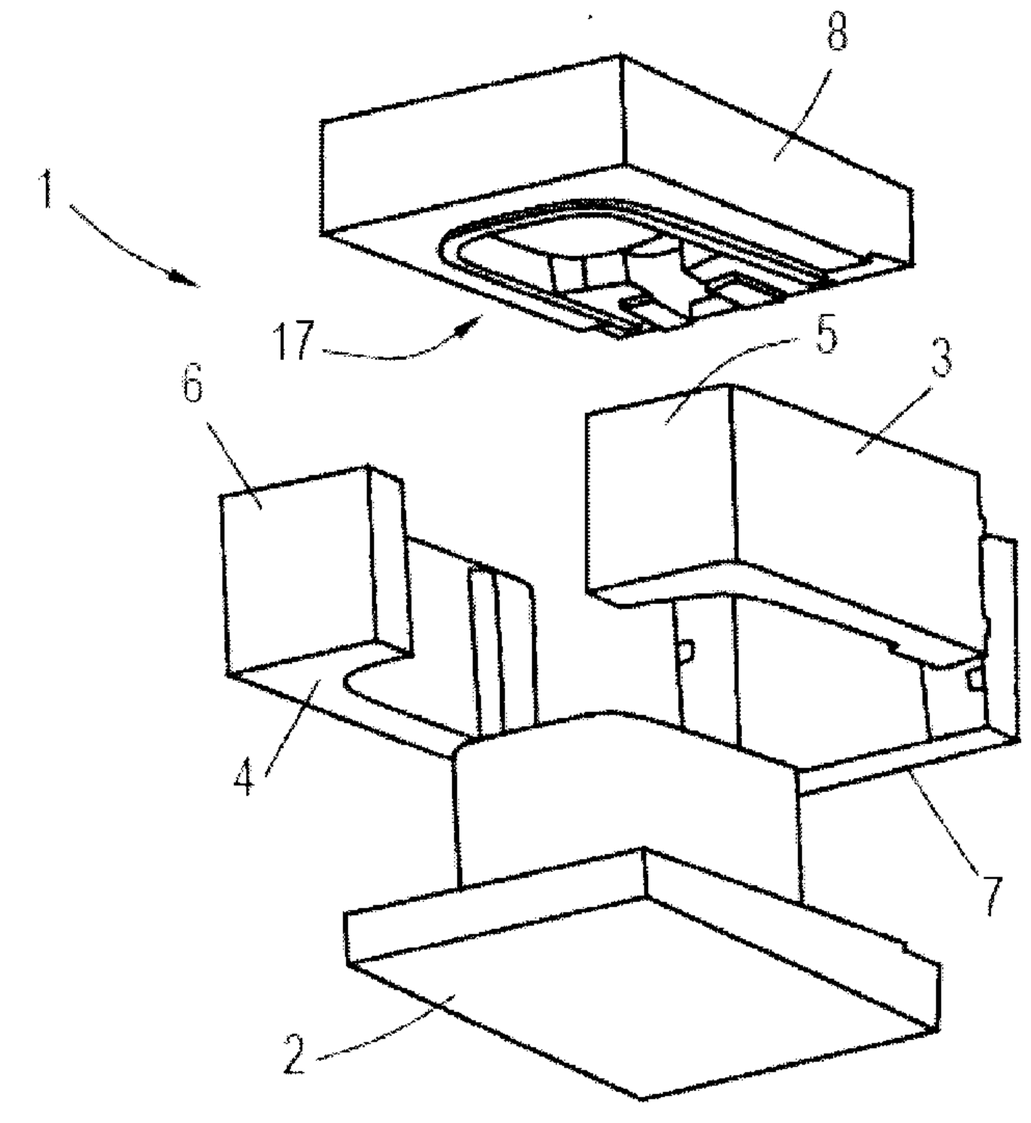

FIG. 2

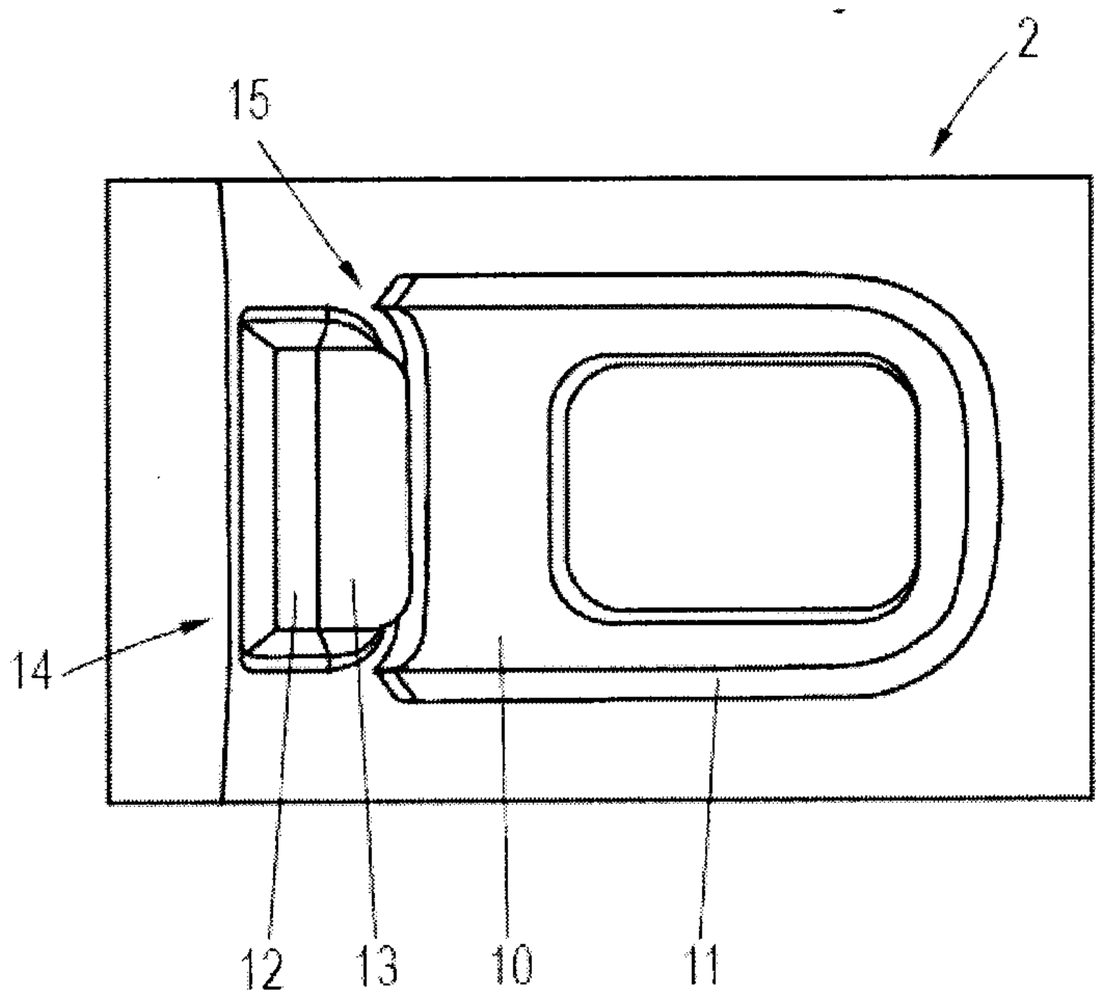

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FIG. 3

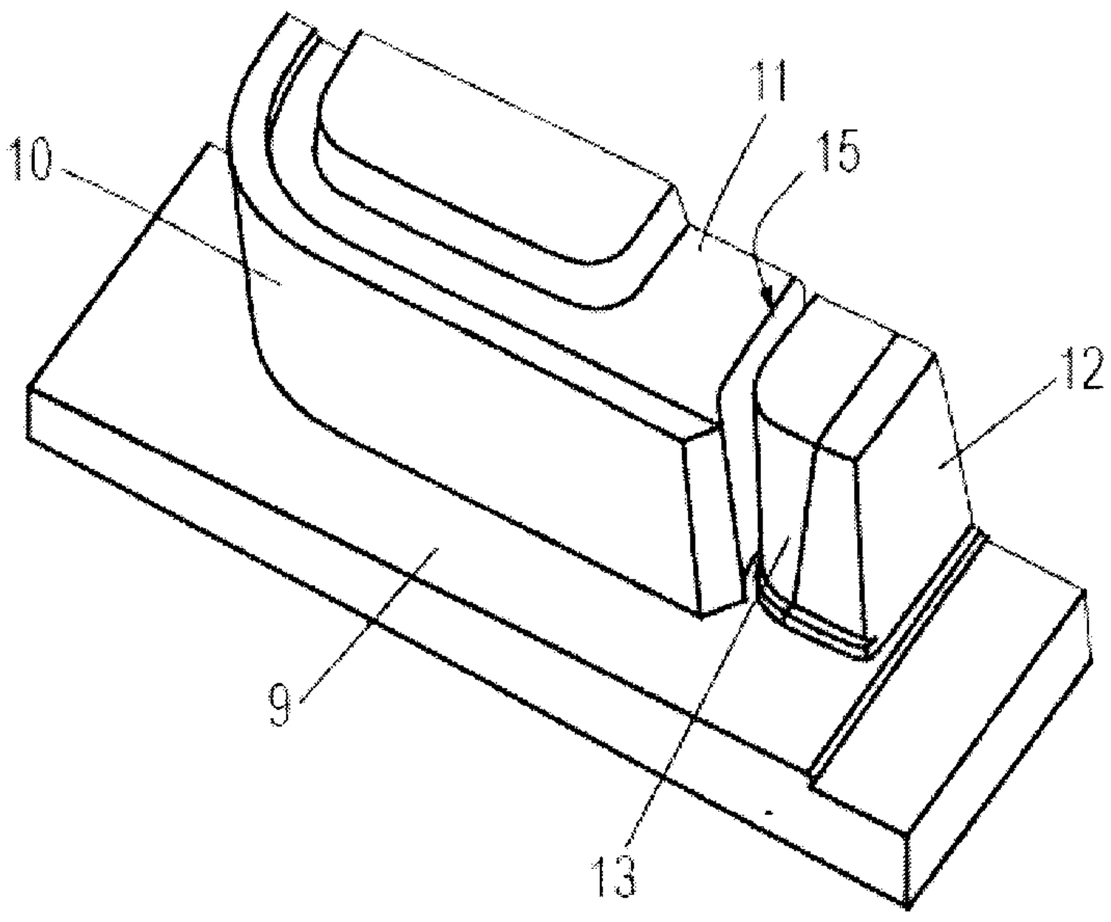

FIG. 4

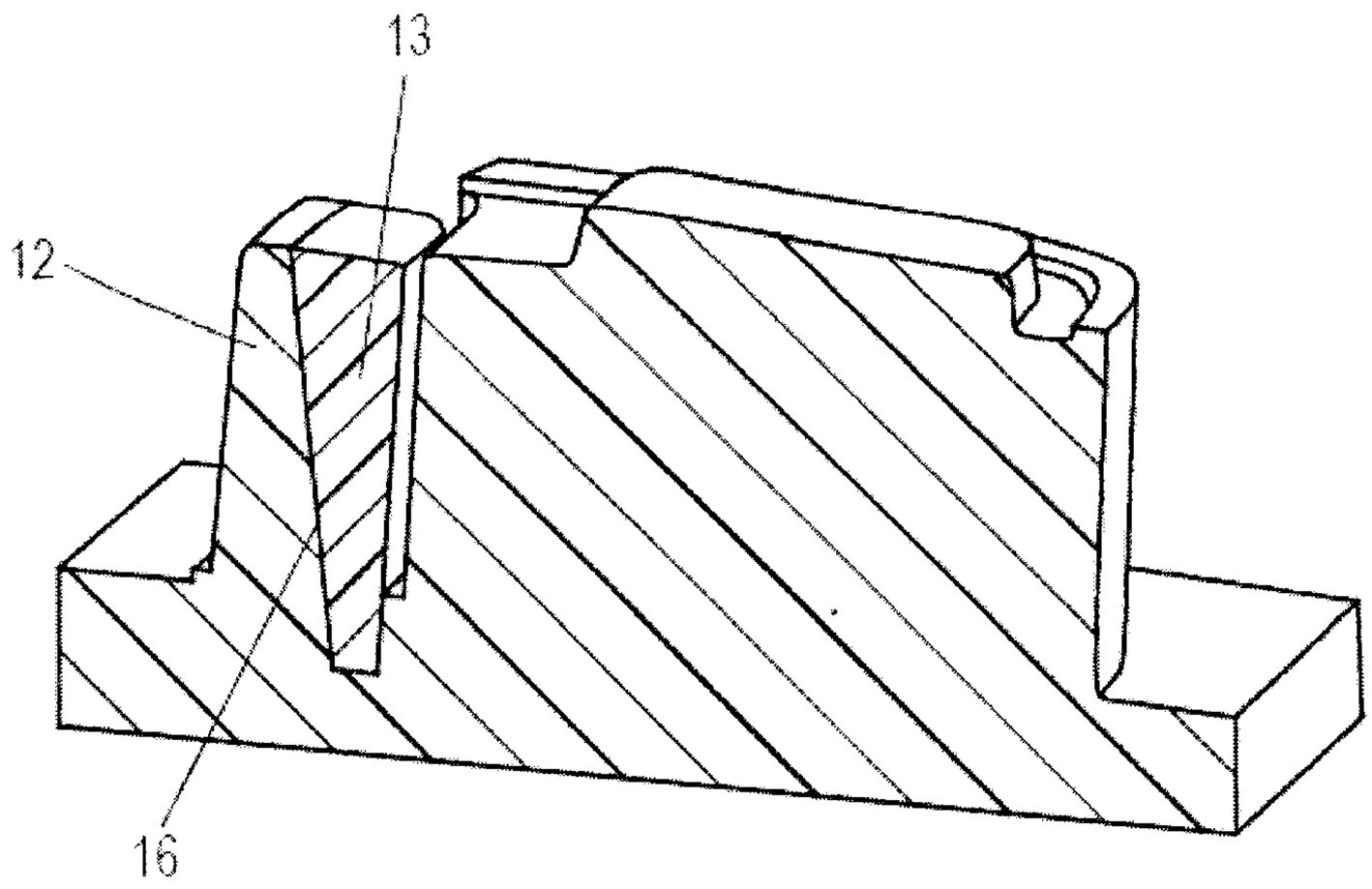

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FIG. 5

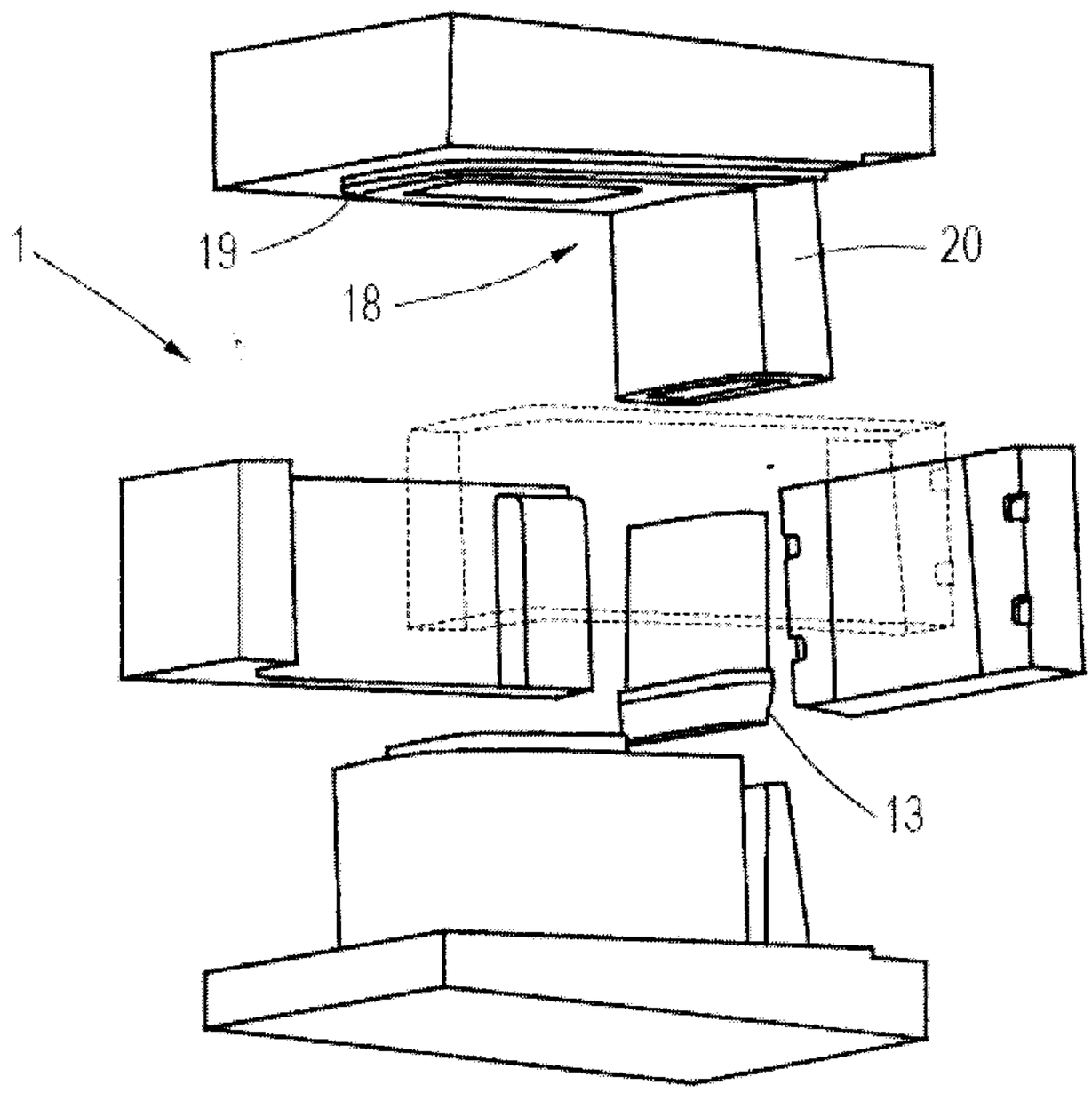
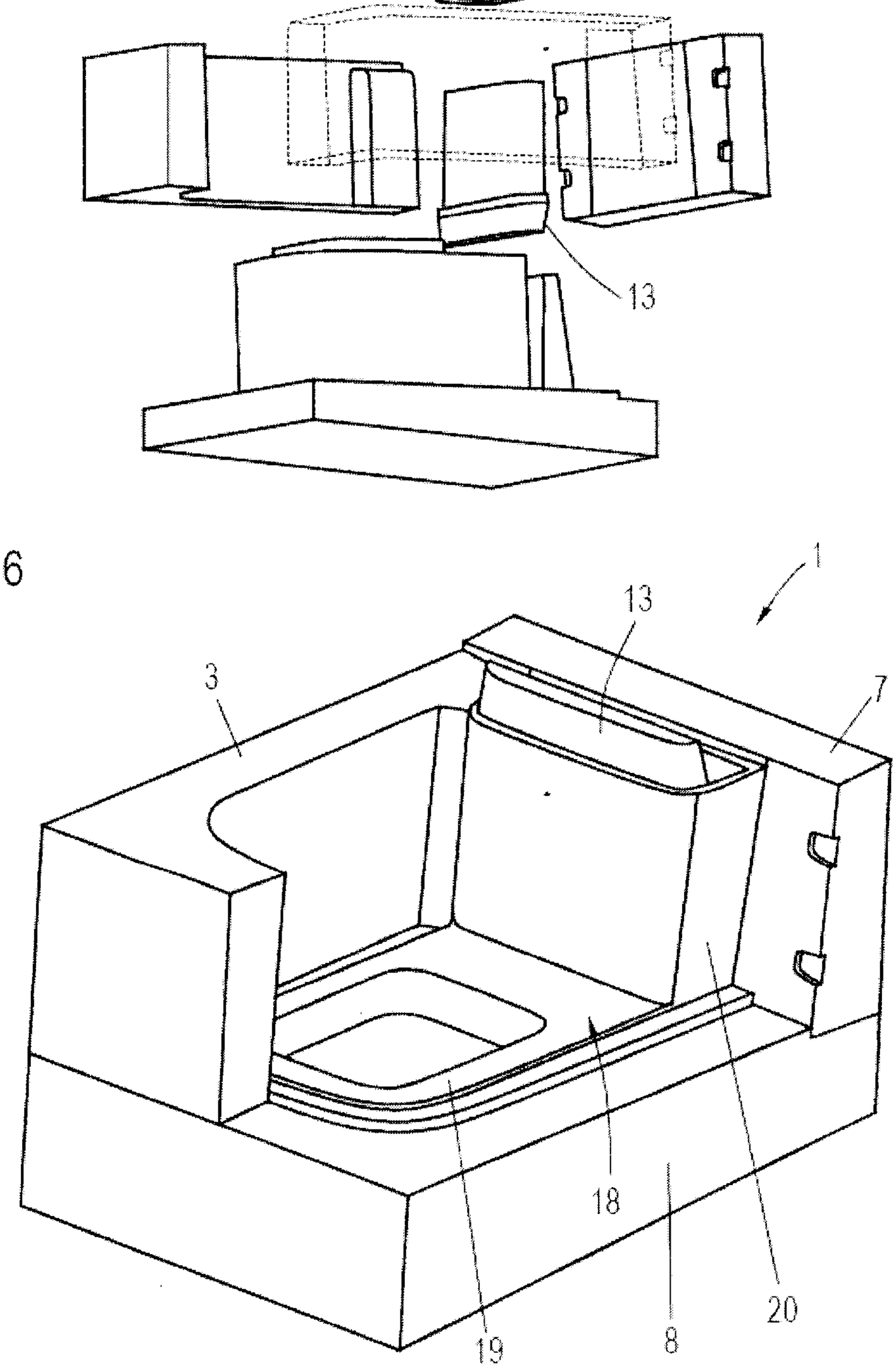


FIG. 6



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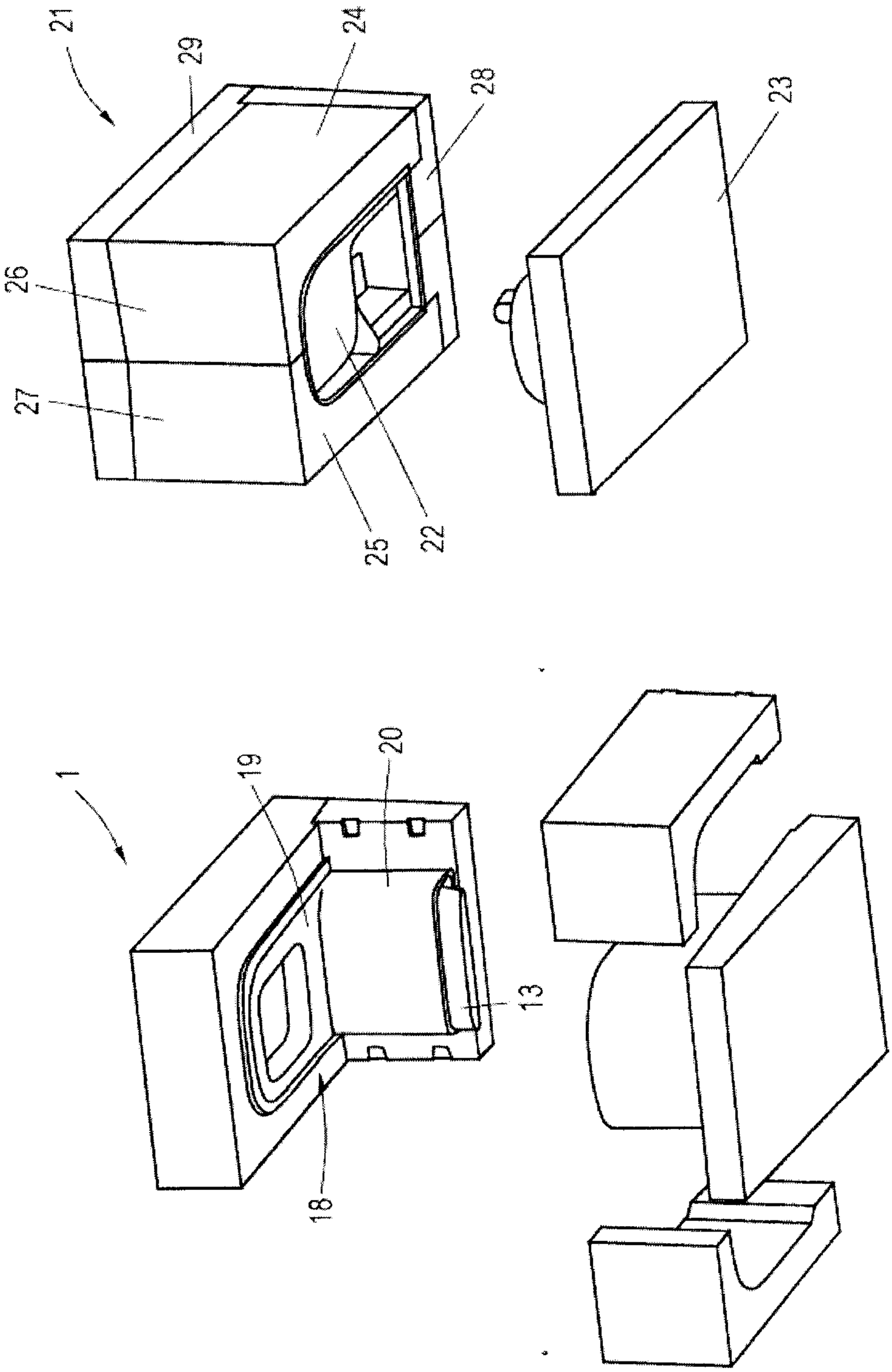

FIG. 7

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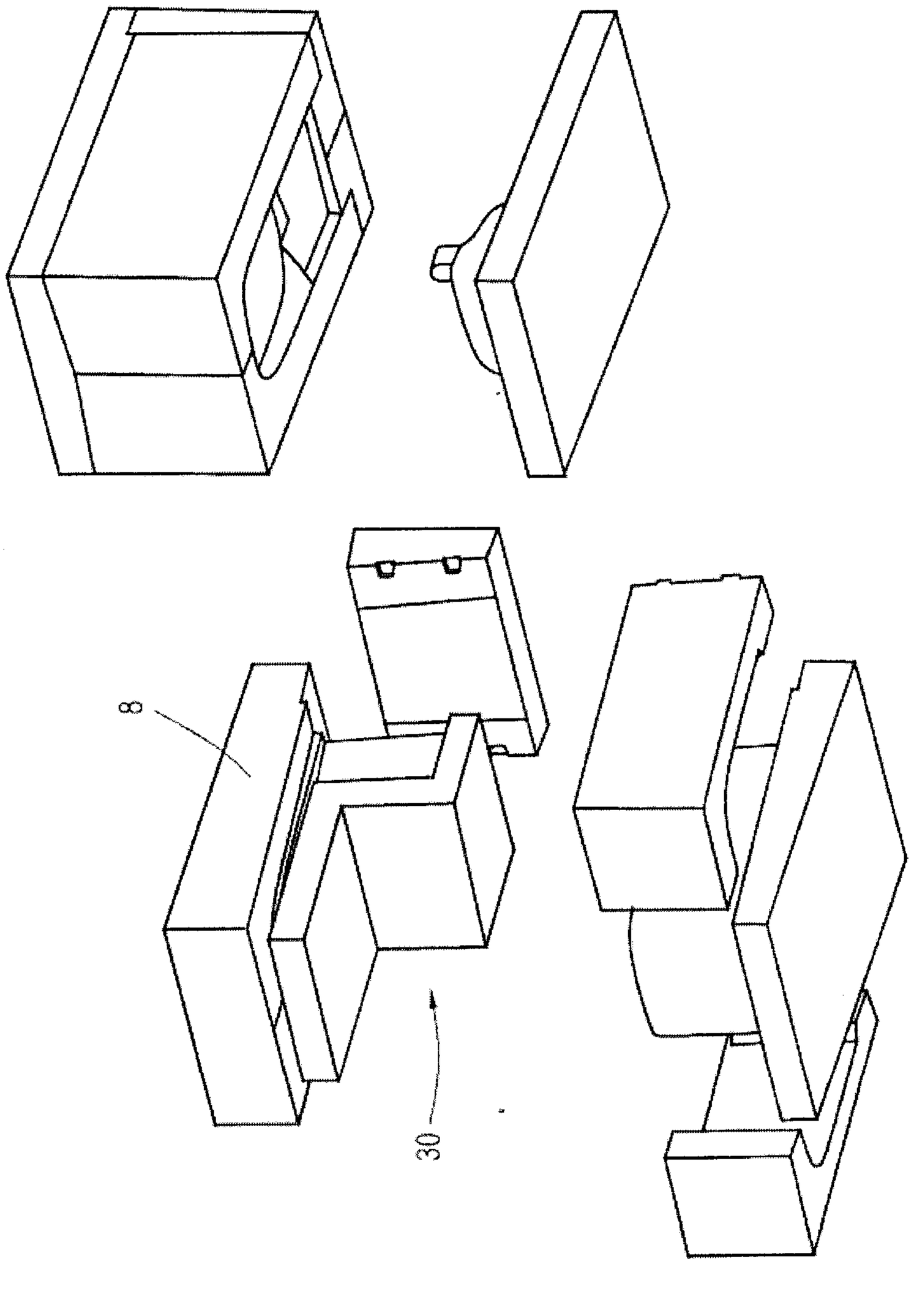


FIG. 8

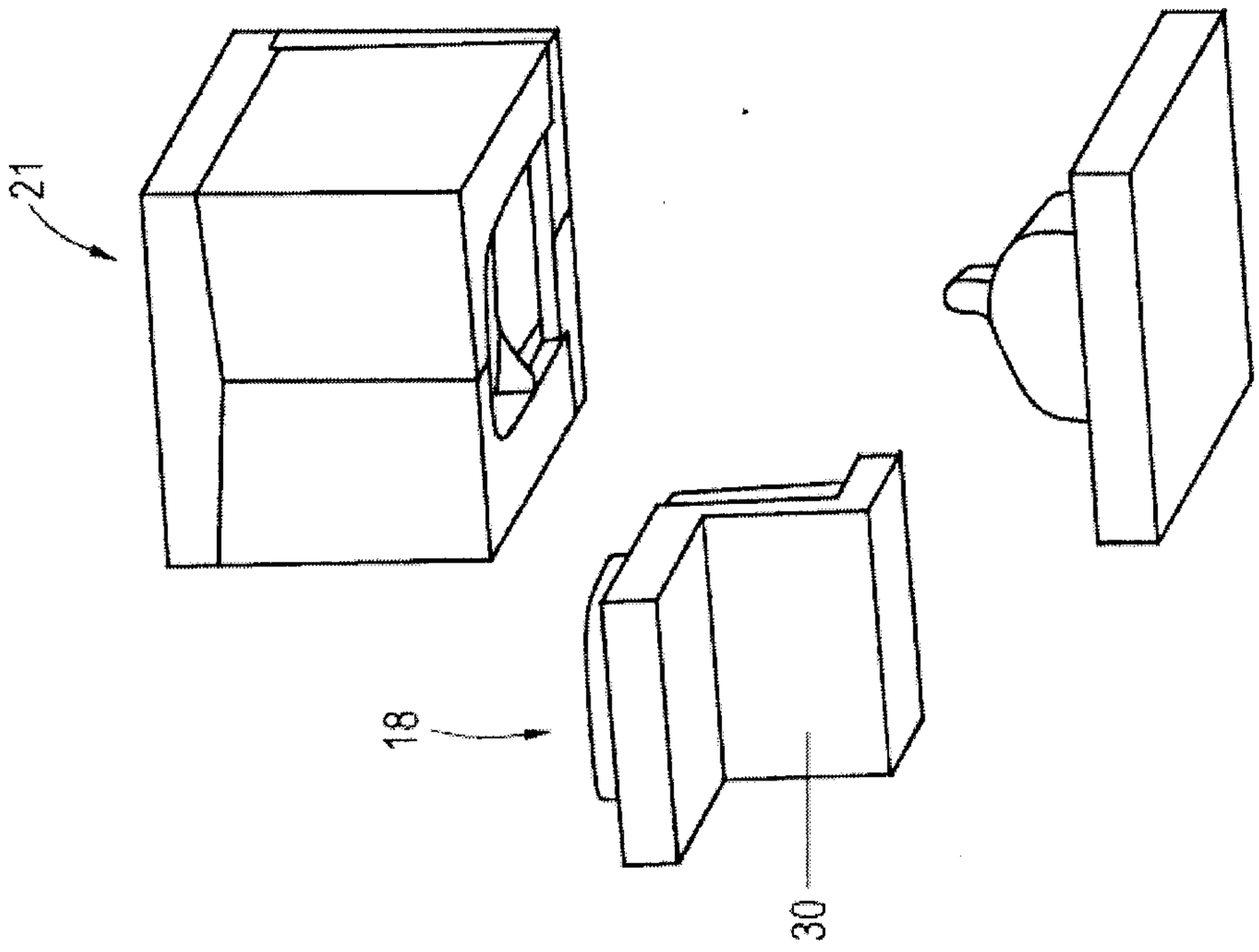
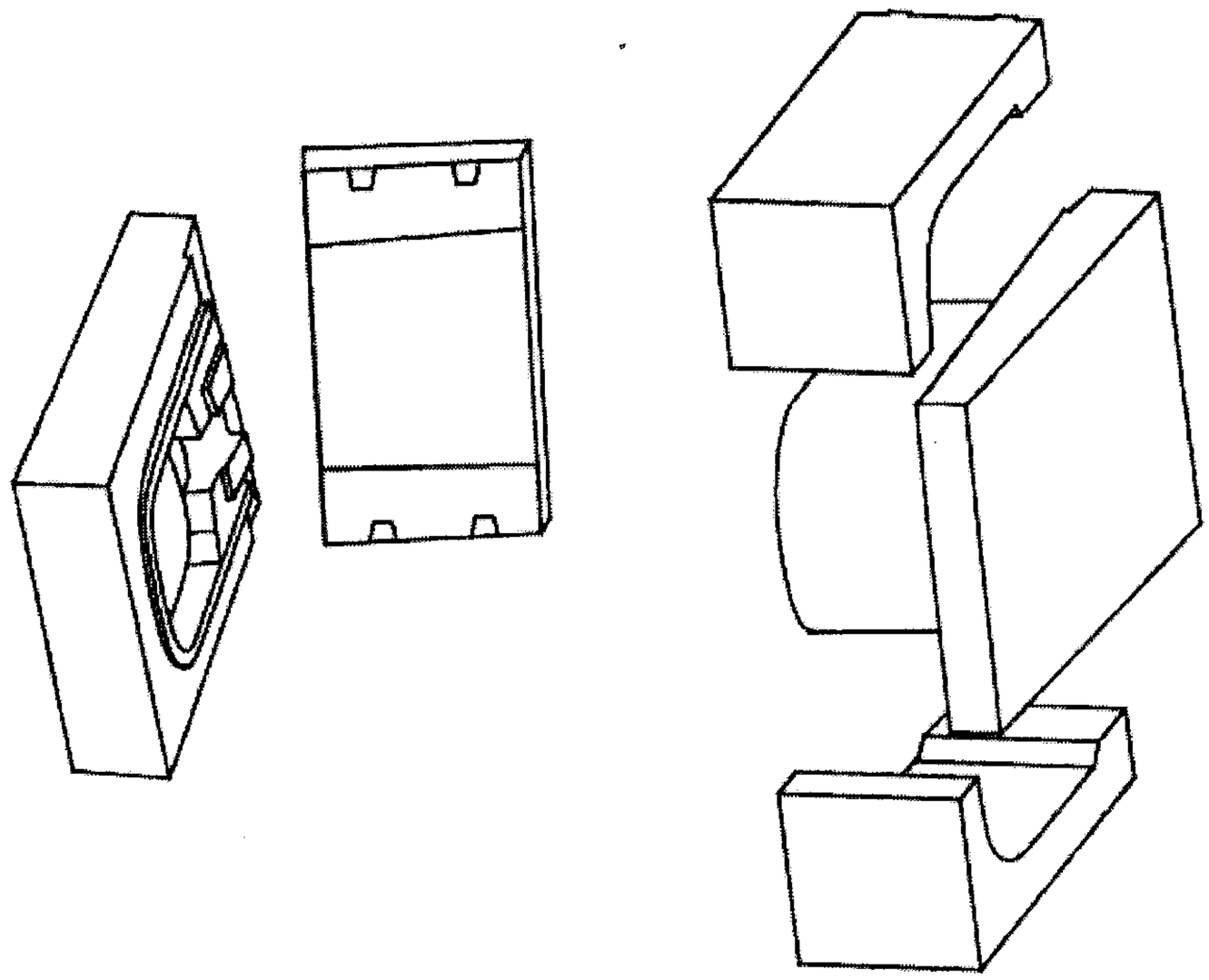


FIG. 9



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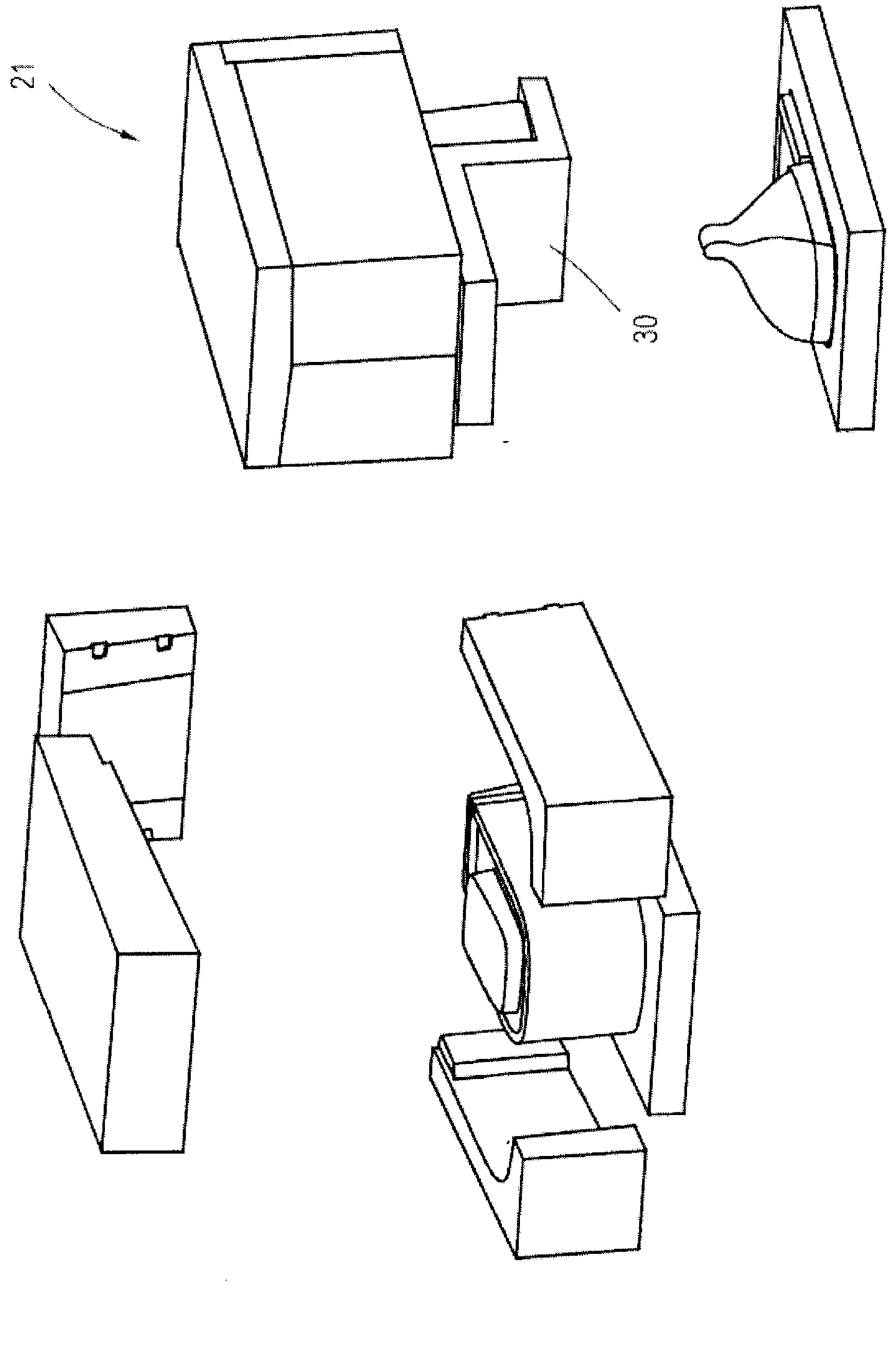

FIG. 1

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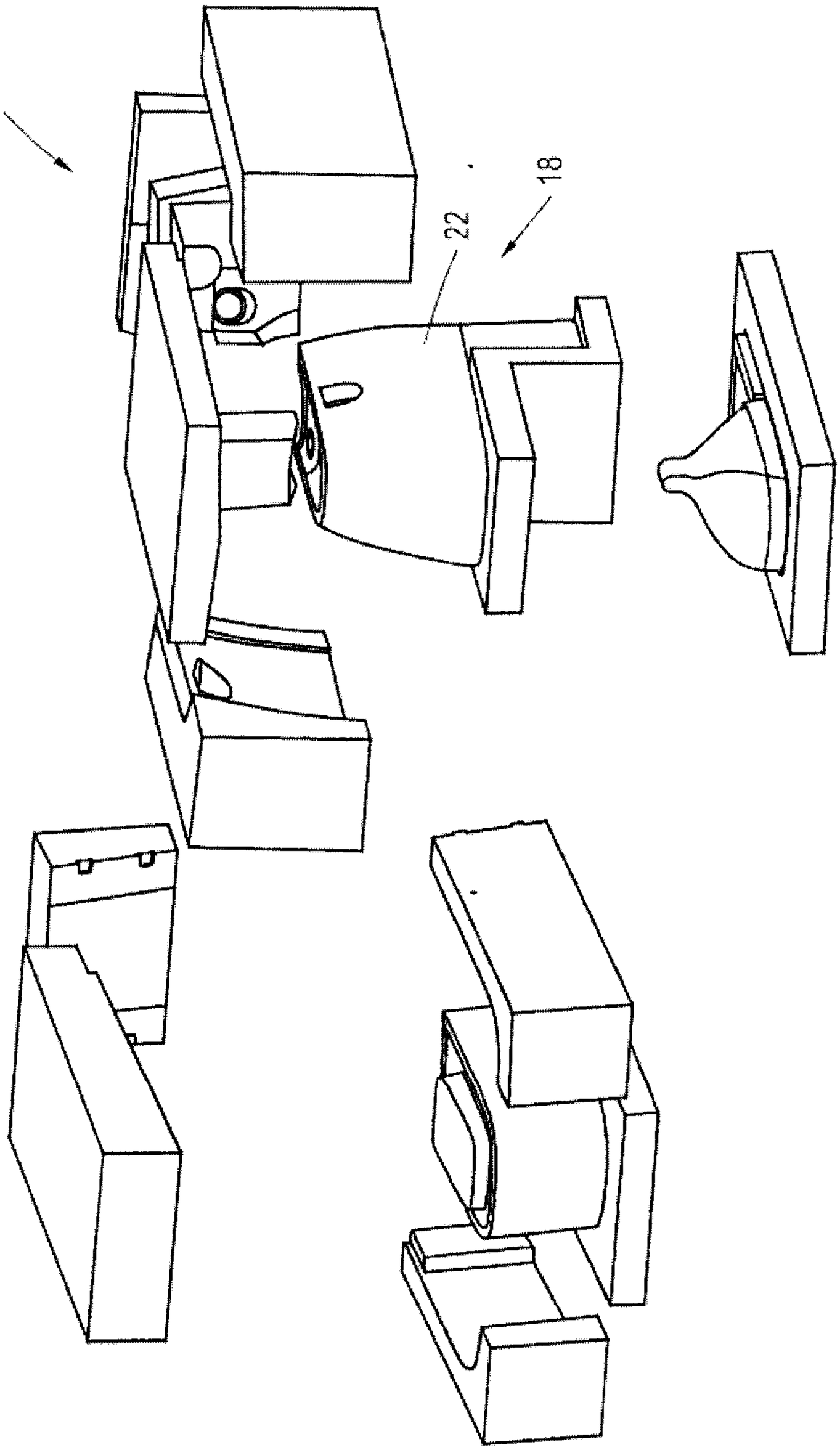

FIG. 11

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FIG. 12

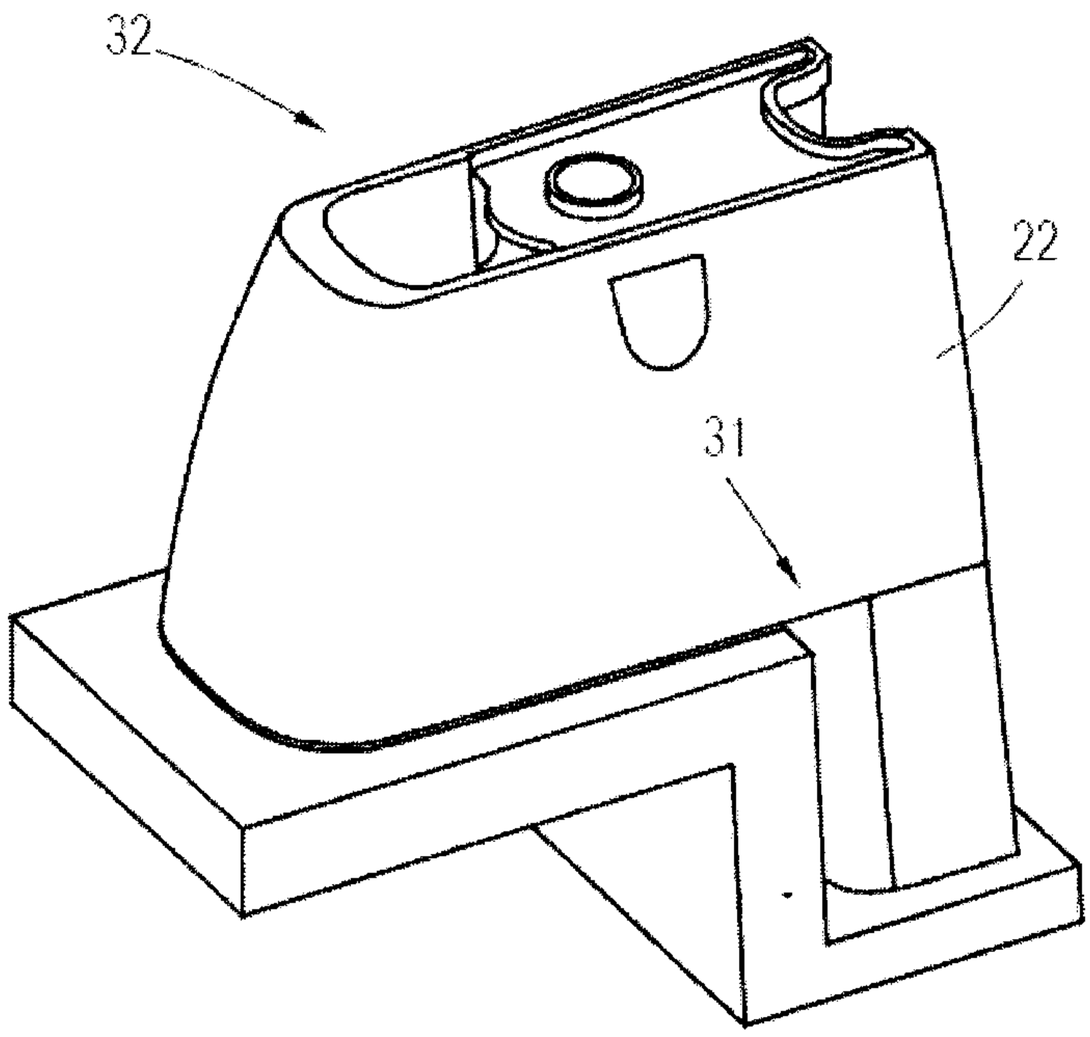
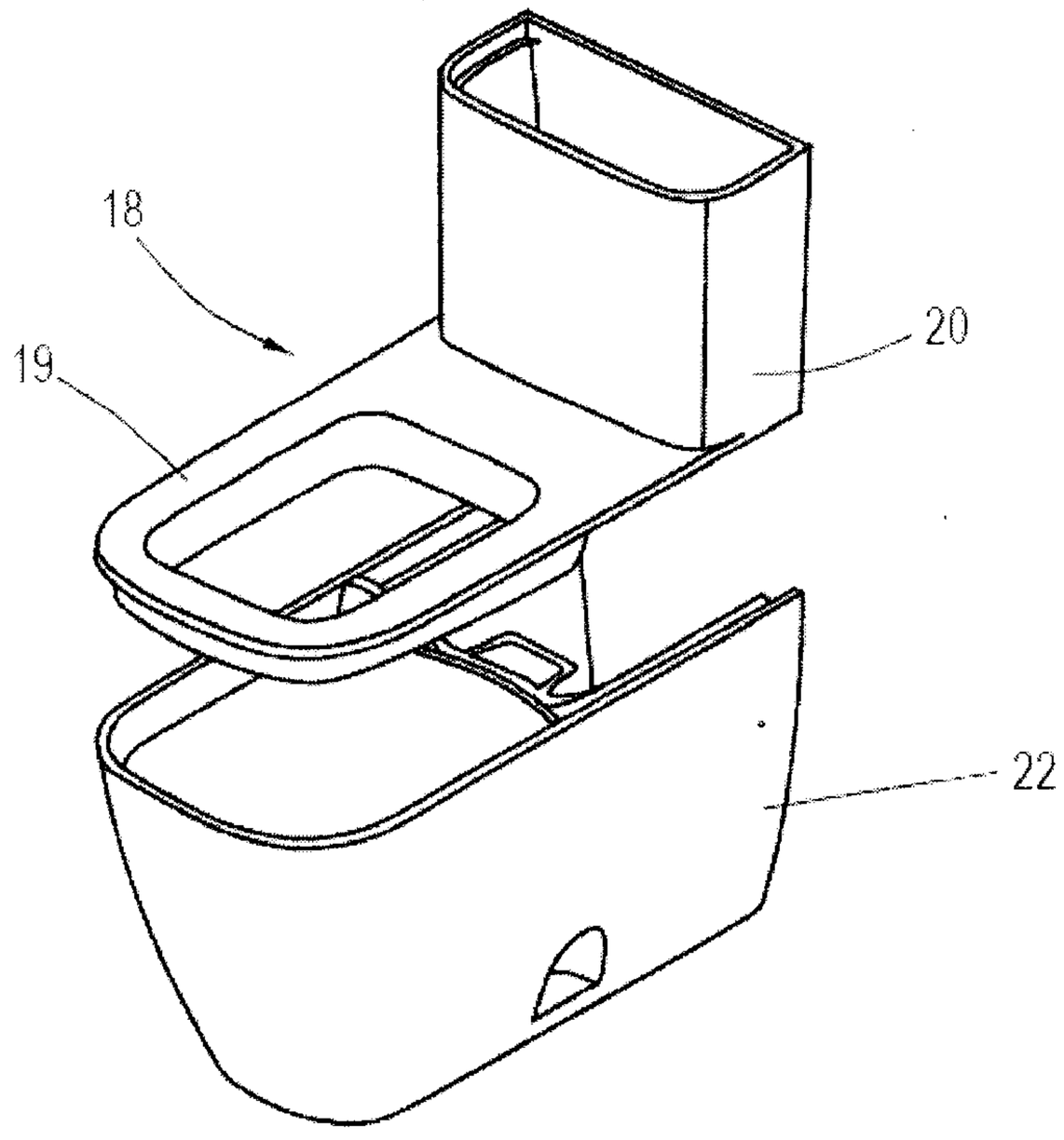
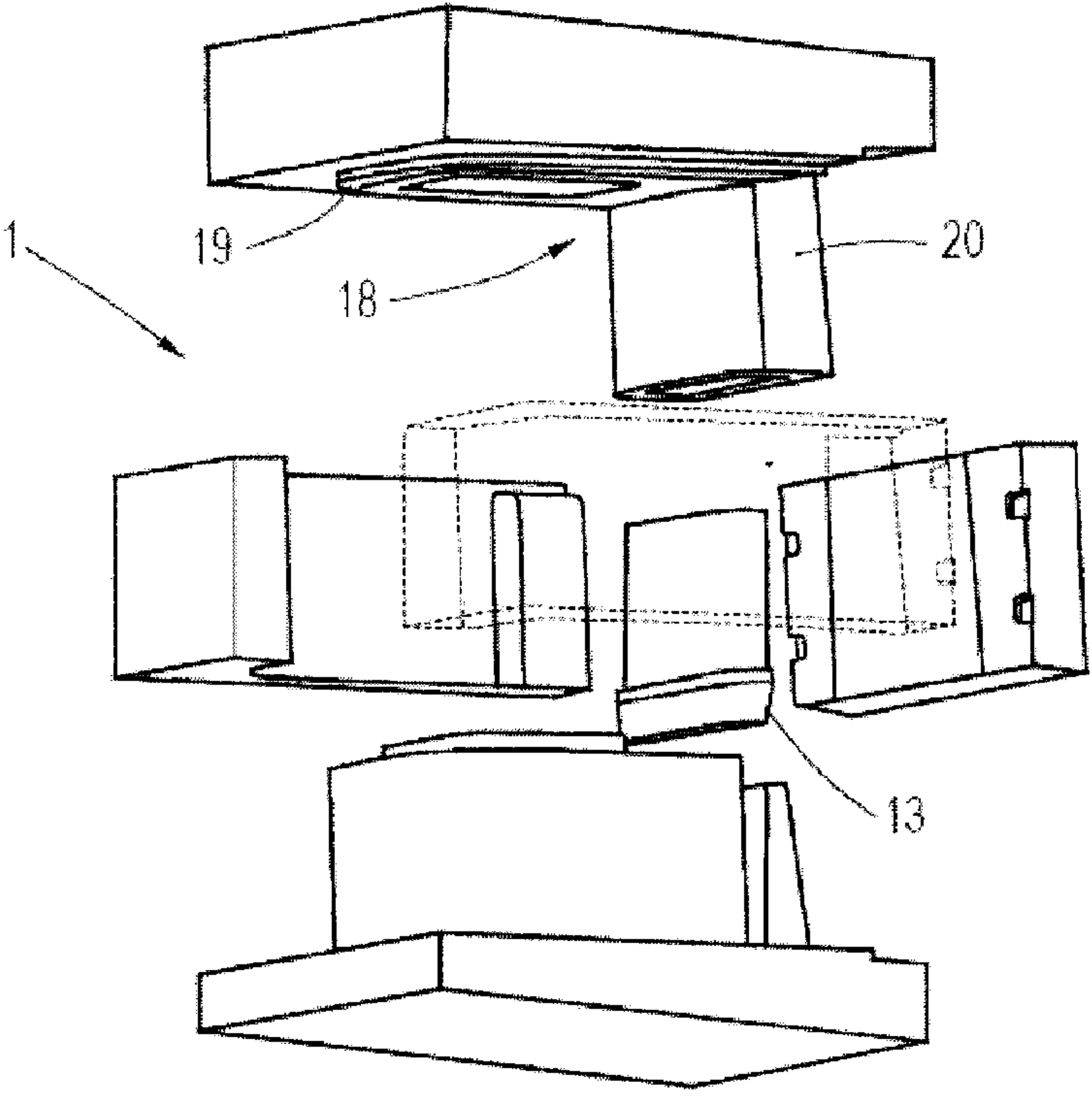


FIG. 13



Patent Agents
Fetherstonhaugh & Co.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