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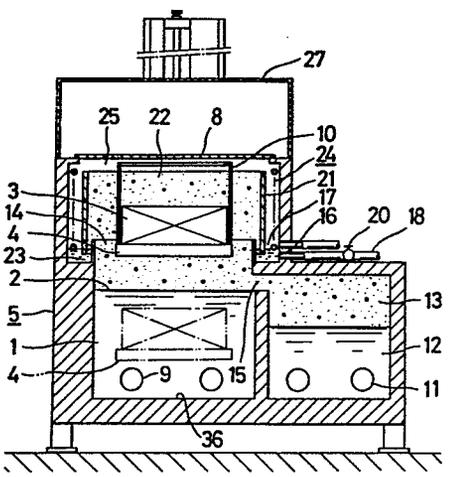
## (54) Apparatus for vapour cleaning.

(57) An extremely wholly small-sized apparatus for cleaning mechanical parts, medical instruments and other objects, using a single cleaning space which permits vapor cleaning, cooling and drying.

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TITLE MODIFIED
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# CLEANING APPARATUS

The present invention relates to a cleaning apparatus for cleaning mechanical parts, medical instruments and other objects.

## BACKGROUND OF THE INVENTION:

Various cleaning apparatus have heretofore been proposed each of which as a single cleaning apparatus permits vapor cleaning, cooling and drying. In one of them, a vapor cleaning vessel and a cooling and drying vessel are positioned in a transverse direction. But this apparatus is disadvantageous in that an extremely large floor space is needed. As an apparatus developed with a view to eliminating such drawback there is known, as disclosed, for example, in Japanese Utility Model Laid Open No. 39684/1982, a cleaning apparatus in which two separate spaces are provided in a vertical direction, one being a vapor cleaning portion and the other a cooling and drying portion. This apparatus is advantageous in that the floor space is reduced, but is not desirable from the aspects of installation space and operability because the height of the apparatus is large.

SUMMARY OF THE INVENTION:

The present invention, which has been accomplished for overcoming the above conventional inconveniences, aims at providing a cleaning apparatus in which a vapor cleaning portion and a cooling and drying portion are disposed in a single cleaning space thereby permitting the floor space and vertical height of the apparatus to be reduced.

The above and other objects, advantages, features and uses will become more apparent from the following description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS:

The accompanying drawings illustrate embodiments of the present invention, in which:

Fig. 1 is a sectional view showing a state of vapor cleaning according to a first embodiment;

Fig. 2 is a sectional view showing a state of cooling and drying in the first embodiment;

Fig. 3 is a sectional view taken on line A-A of Fig. 2;

Fig. 4 is a sectional view showing a state of vapor cleaning according to a second embodiment;

Fig. 5 is a sectional view showing a state of cooling and drying in the second embodiment;

Fig. 6 is a sectional view taken on line B-B of Fig. 5;

Fig. 7 is a sectional view showing a state of vapor cleaning according to a third embodiment;

Fig. 8 is a sectional view showing a state of cooling and drying in the third embodiment;

Fig. 9 is a sectional view showing a state of vapor cleaning according to a fourth embodiment;

Fig. 10 is a sectional view showing a state of cooling and drying in the fourth embodiment;

Fig. 11 is a sectional view showing another vertically moving method for a partition wall in the fifth embodiment;

Fig. 12 is a sectional view showing a state of vapor cleaning according to a fifth embodiment; and

Fig. 13 is a sectional view showing a state of cooling and drying in the fifth embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

A first embodiment of the present invention will now be described with reference to Figs. 1, 2 and 3. Numeral 1 denotes a liquid cleaning vessel charged

with a suitable cleaning liquid 2, e.g. trichloroethylene. A heater 9 for heating the cleaning liquid 2 as necessary to produce cleaning vapor is inserted in the liquid cleaning vessel 1 and a cleaning stand 4 for putting thereon an article 3 to be cleaned is also inserted in the same vessel vertically movably. The cleaning stand 4 is fixed to a lower end of a vertically moving member 7 which is adapted to move vertically within a cleaning vessel body 5 in interlock with a lift cylinder 6 positioned outside the cleaning vessel body 5. Further, it has a pushing-up frame 10 for pushing up an inner lid 8, the pushing-up frame 10 projecting from an upper surface of the cleaning stand 4, as will be explained later. A vapor generating portion 12 with a heater 11 inserted therein is disposed in a position adjacent to the liquid cleaning vessel 1. An upper space 13 of the vapor generating portion 12 and a vapor inlet opening 14 formed above the liquid cleaning vessel 1 are interconnected through a communication port 15. An annular recess 17 capable of receiving therein a sealing liquid 16 is formed along an outer periphery of the vapor inlet opening 14, and a feed/discharge pipe 18 for feeding and discharging the sealing liquid 16 into and from the annular recess 17 is

connected to the annular recess 17. The feed/discharge pipe 18 is connected on the other side thereof to a feed/discharge device such as a pump or a water separator through a solenoid valve 20. An upper outer peripheral portion of the vapor inlet opening 14 is covered with an annular partition wall 21 and the interior defined by the annular partition wall 21 is used as a cleaning portion 22 which serves as both a vapor cleaning portion and a cooling and drying portion. A lower end of the annular partition wall 21 is inserted into the annular recess 17 so that a communicating portion 23 is formed between the wall lower end and the bottom of the annular recess 17. When the sealing liquid 16 is fed into the annular recess 17 through the feed/discharge pipe 18, the lower end of the annular partition wall 21 is sealed by the sealing liquid 16. Between the annular partition wall 21 and the cleaning vessel body 5 is provided a cooling portion 24 for condensing vapor which is constituted by a coiled pipe with cooling water flowing therein. A lift opening 25 for the article 3 to be cleaned, provided above the cleaning portion 22 formed by the cooling portion 24 and the annular partition wall 21, is covered with the inner lid 8 put on the upper surface of the cleaning vessel

body 5. With ascent of the cleaning stand 4, the inner lid 8 is pushed up in an opening direction by means of the pushing-up frame 10. The upper surface of the inner lid 8 is covered with a hood 27, and a stand 31 is formed in a position adjacent to an entrance 30 provided with a shutter 28.

In the cleaning apparatus of the above construction, liquid cleaning can be done using the cleaning liquid 2 after placing the article 3 to be cleaned on the cleaning stand 4 capable of being moved vertically by the lift cylinder 6 and subsequent insertion thereof into the liquid cleaning vessel 1. After this liquid cleaning, the cleaning stand 4 is moved upward by the lift cylinder 6 until the article 3 is positioned in the space defined by the partition wall 21, and vapor cleaning is performed. For the vapor cleaning, the sealing liquid 16 is fed from the feed/discharge pipe 18 into the annular recess 17 provided along the outer periphery of the vapor inlet opening 14 formed above the liquid cleaning vessel 1, whereby the lower end of the annular partition wall 21 is immersed in the sealing liquid 16 in the annular recess 17, so that the communication between the cooling portion 24 for vapor condensing and the inner surface of

the annular partition wall 21 through the communicating portion 23 is cut off, thus permitting the cleaning vapor to flow from the vapor generating portion 12 adjacent to the liquid cleaning vessel 1 into the cleaning portion 22 inside the partition wall 21 through the communication port 15 and further through the vapor inlet opening 14. The cleaning vapor thus introduced into the cleaning portion 22 contacts the article 3 to be cleaned to effect vapor cleaning. After completion of the vapor cleaning operation, the sealing liquid 16 is discharged from the annular recess 17 through the feed/discharge pipe 18, whereby the communicating portion 23 is formed between the lower end of the partition wall 21 and the bottom of the annular recess 17. The cleaning vapor heavier in specific gravity than the air inside the partition wall 21 is conducted through the communicating portion 23 to the cooling portion 24, where the vapor is condensed into liquid. Thus, the cleaning vapor in the cleaning portion inside the partition wall 21 disappears and at the same time the cleaning portion 22 inside the partition wall 21 is cooled by the coldness of the cooling portion 24, now ready for cooling and drying of the article 3. After completion of the cooling and drying operation, the

cleaning stand 4 is further moved upward by operation of the lift cylinder 6, so that the inner lid 8 which has prevented the cleaning vapor from flowing out to the exterior is pushed up and opened by the pushing-up frame 10. Then, the shutter 28 is opened and the article 3 thus cleaned is taken out from the entrance 30 onto the stand 31. Further, the article 3 to be cleaned next is put onto the cleaning stand 4 through the entrance 30 and lift cylinder 6 is operated downward, whereby the article 3 is inserted into liquid cleaning vessel 1 and the inner lid 8 closes the lift opening 25 of the cleaning vessel body 5 to prevent the cleaning vapor from escaping to the exterior.

Thus in the first embodiment described above the annular partition wall 21 is inserted into the sealing liquid 16 and this sealing liquid is fed and discharged through the feed/discharge pipe 18 to thereby open and close the communicating portion 23.

On the other hand, in the second embodiment of the present invention which is different from the first embodiment, as illustrated in Figs. 4, 5 and 6, a sealing portion 32 is formed along the outer periphery of a vapor inlet opening 14. In the sealing portion 32, there is formed an annular recess 17 capable of

receiving therein a sealing liquid 16 and an overflow pipe 33 is connected to the annular recess 17, and further a water separator is connected to the overflow pipe 33. An upper outer periphery of the inlet opening 14 which is for the cleaning vapor, is covered with a vertically movable, annular partition wall 21, and the space surrounded with the annular partition wall 21 is used as a cleaning portion 22 which serves as both a vapor cleaning portion and a cooling and drying portion. The lower end of the annular partition wall 21 is opposed to the surface of the sealing liquid 16 in the annular recess 17 through a communicating portion 23 having a spacing which permits flow of vapor therethrough, or the partition wall 21 is moved downward until the lower end thereof is inserted into the sealing liquid 16 to seal the communicating portion 23. Between the annular partition wall 21 and the cleaning vessel body 5 is provided a cooling portion 24 for vapor condensing which is constituted by a coiled pipe for the flow of cooling water therethrough. A lift opening 25 for the article 3 to be cleaned, provided above the cleaning portion 22 formed by the cooling portion 24 and the annular partition wall 21, is covered with an inner lid 8 put on an upper surface of a cleaning vessel body

5. The inner lid 8 is positioned on an upper frame 34 projecting above the partition wall 21 and it normally urges the partition wall 21 downward by virtue of its weight. A pushing-up spring 26 having a restoring force weaker than the pushing-down force of the inner lid 8 but enough to push up the partition wall 21 itself is interposed between the partition wall 21 and the cleaning vessel body 5.

For performing vapor cleaning in the apparatus of the above construction, the lower end of the annular partition wall 21 is inserted in the annular recess 17 formed along the outer periphery of the cleaning vapor inlet opening 14, whereby it is immersed in the sealing liquid 16 in the annular recess 17, so that the communication between the cooling portion 24 for vapor condensing and the inner surface of the annular partition wall 21 is cut off, thus allowing the cleaning portion 22 inside the partition wall 21 to be filled with the cleaning vapor fed from the vapor generating portion 12 adjacent to the liquid cleaning vessel 1 through a communication port 15 and further through the vapor inlet opening 14. The cleaning vapor thus introduced into the cleaning portion 22 contacts the article 3 to be cleaned to effect vapor cleaning. After

completion of the vapor cleaning operation, a cleaning stand 4 inserted in the cleaning portion 22 inside the annular partition wall 21 is moved upward whereby a pushing-up frame of the same structure as in the previous embodiment projecting from an upper surface of the cleaning stand 4 is brought into contact with an inner surface of the inner lid 8 to push up and open the latter. As a result, the partition wall 21 which has been released from the action of a downwardly urging force is pushed up by the restoring force of the pushing-up spring 26, whereby the communicating portion 23 which permits the flow of vapor therethrough is formed between the lower end of the annular partition wall 21 and the surface of the cleaning liquid in the annular recess 17, so that the cleaning vapor disappears under the same action as in the previous first embodiment, now ready for cooling and drying of the article 3.

In the above second embodiment the sealing portion 32 is formed so that the communicating portion 23 is closed by inserting the lower end of the annular partition wall 21 into the sealing liquid 16 in the annular recess 17. But in a further embodiment which is different from the previous embodiments, as illustrated

in Figs. 7 and 8, a communicating portion 23 between a vapor inlet opening 14 and a cooling portion 24 can be closed by pressure contact of a sealing portion 32 formed of a ring making its upper surface flat with an annular partition wall 21 having a lower end formed as a flange portion 35. The communicating portion 23 can be opened by raising the partition wall 21 under the same action as in the previous embodiment.

Although in each of the embodiments described hereinabove the liquid cleaning vessel 1 is provided below the cleaning portion 22, it is not always necessary to do so. Only the cleaning portion 22 may be provided without using the liquid cleaning vessel 1. Whether the liquid cleaning vessel 1 is to be used or not can be determined optionally according to purposes of cleaning. Moreover, although in each of the above embodiments the cleaning vapor is introduced into the vapor inlet opening 14 from the vapor generating portion 12 through the communication port 15, the vapor generating portion 12 may be omitted and instead the cleaning liquid 2 may be heated by the heater 9 in the liquid cleaning vessel 1 to generate vapor. In this case, the immersion for cleaning of the article 3 into the cleaning liquid 2 is not performed, that is, only vapor cleaning is effected.

Further, in each of the above embodiments, the communicating portion 23 is provided in association with the annular recess 17 and the sealing portion 32, which are provided separately from the vapor generating portion 12, and it is thereby opened and closed. But in a fourth embodiment which is different from the above embodiments, as illustrated in Figs. 9 and 10, an upper half of a cleaning vessel body 5 is formed as a cleaning portion 22 and a cleaning stand 4 for an article 3 to be cleaned is inserted into the cleaning portion 22 vertically movably. The cleaning stand 4 is fixed to the lower end of a vertically movable member 7 which is adapted to move vertically within the cleaning vessel body 5 in interlock with a lift cylinder 6 positioned outside the cleaning vessel body 5. And a pushing-up frame 10 for pushing up an inner lid 8 projects from an upper surface of the cleaning stand 4. Further, in the interior of the cleaning vessel body 5, an approximately upper half portion thereof is surrounded with an annular partition wall 21 and the inside portion thus defined by the same wall is used as the cleaning portion 22 which serves as both a vapor cleaning portion and a cooling and drying portion. Moreover, an annular engaging flange 38 projects in a horizontal direction from an

inner peripheral portion of the lower end of the annular partition wall 21. With the lower surface of the annular engaging flange 38 is engaged an upper end of a spring 37. The engaging flange 38, the spring 37 and the cleaning stand 4 interlocked with the lift cylinder 6, constitute means for moving the partition wall 21 vertically. Between the annular partition wall 21 and the cleaning vessel body 5 is provided a cooling portion 24 for vapor condensing constituted by a coiled pipe for the flow of cooling water therethrough.

For carrying out vapor cleaning in the apparatus of the above construction, the cleaning stand 4 is brought down in a state of its engagement with the engaging flange 38 of the annular partition wall 21 by operation of the lift cylinder 6, whereby the lower end of the partition wall 21 is inserted into a cleaning liquid 2 in the vapor generating portion 12, so that the communication between the cooling portion 24 for vapor condensing and the inner surface of the annular partition wall 21 is cut off, thus allowing the cleaning portion 22 inside the annular partition wall 21 to be filled with the cleaning vapor from the vapor generating portion 12. The cleaning vapor comes into contact with the article 3 to effect vapor cleaning. After

completion of this vapor cleaning operation, the lift cylinder 6 is again operated to move the cleaning stand 4 upward, so that the partition wall 21 is moved upward by the biasing force of the spring 37, whereby a communicating portion 23 which permits the flow of vapor therethrough is formed between the lower end of the partition wall 21 and the surface of the cleaning liquid 2. The cleaning vapor which is heavier in specific gravity than the air inside the partition wall 21, is conducted through the communicating portion 23 into the cooling portion 24, where it is condensed into liquid. Therefore, the cleaning vapor in the cleaning portion 22 inside the partition wall 21 disappears and at the same time the cleaning portion 22 inside the partition wall 21 is cooled by the coldness of the cooling portion 24, now ready for cooling and drying of the article 3. Upon completion of cooling and drying, the article 3 is taken out onto a stand 31 and the article 3 to be cleaned next is put onto the cleaned stand 4 through an entrance 30 and then moved downward by operation of the lift cylinder 6, in the same manner as in the previous embodiments, whereby the article 3 is inserted into the cleaning portion 22 and the cleaning stand 4 comes into engagement with the engaging flange 38, and the lower

end of the annular partition wall 21 is inserted into the cleaning liquid 2 to close the communicating portion 23, thereby permitting vapor cleaning.

In a modification of the fourth embodiment, as illustrated in Fig. 11, means for moving the annular partition wall 21 is composed of a rotatable pulley 40 provided at an upper end portion of the vertically moving member 7 and a rope 41 having a base end portion fixed to an upper end portion of the partition wall 21. A fore end portion of the rope 41 is conducted through the pulley 40 to the exterior of the cleaning vessel body 5 and is connected to and pulled up by a cylinder device or any other suitable device, whereby the partition wall 21 is kept suspended within the cleaning vessel body 5.

In the apparatus of Fig. 11, when the rope 41 is loosened, the annular partition wall 21 goes down by virtue of its own weight and the lower end portion thereof is inserted into the cleaning liquid 2 to close the communicating portion 23, whereby the communication between the cooling portion 24 for vapor condensing and the inner surface of the partition wall 21 is cut off, so that the article 3 is vapor-cleaned in the same manner as in Fig. 9. Next, by pulling the rope 41 to

pull up the partition wall 21, there is formed the communicating portion 23 which permits the flow of vapor therethrough between the lower end of the partition wall 21 and the surface of the cleaning liquid 2, so that cooling and drying of the article 3 are performed in the same manner as in Fig. 10.

Although in the modification illustrated in Fig. 11 the rope 41 was used to suspend the partition wall 21, there may be used any other suitable member for the same purpose, e.g. cord, chain or wire.

Further, in the embodiment and modification illustrated in Figs. 9 to 11 the partition wall 21 is moved up and down, while in a still further fifth embodiment, a cleaning liquid 2 itself is moved up and down to close and open a communicating portion 23, as illustrated in Figs. 12 and 13.

More specifically, a pump 42 and a reserve tank 43 which contains the cleaning liquid 2 are disposed in positions adjacent to a cleaning vessel body 5. The reserve tank 43 and the pump 42 are interconnected through a conduit 44, and the pump 42 and a lower part of the cleaning vessel body 5 are interconnected through a feed/discharge pipe 18. Further, in the interior of the cleaning vessel body 5,

an approximately upper half portion thereof is surrounded with an annular partition wall 21 to form a cleaning portion 22 which serves as both a vapor cleaning portion and a cooling and drying portion. The lower end of the annular partition wall 21 is located in a position higher than the feed/discharge pipe 18 which opens into a vapor generating portion 12 of the same structure as the foregoing. Other constructional points are the same as in the previous embodiments, so will not be explained here.

In the construction just described above, the article 3 to be cleaned is put on a cleaning stand 4 which can be moved up and down by means of a lift cylinder 6, and it is thereby brought into the cleaning portion 22 to effect vapor cleaning. For the vapor cleaning, the cleaning liquid 2 in the reserve tank 43 is fed into the cleaning vessel body 5 through the feed/discharge pipe 18 by operation of the pump 42, whereby the lower end of the annular partition wall 21 is inserted into the cleaning liquid 2 in the vapor generating portion 12 to cut off the communication between a cooling portion 24 for vapor condensing and an inner surface of the partition wall 21, so that the cleaning portion 22 inside the partition wall 21 is

filled with the cleaning vapor from the vapor generating portion 12, which vapor contacts the article 3 to effect vapor cleaning.

After completion of the vapor cleaning operation, the portion of the cleaning liquid 2 positioned higher than the feed/discharge pipe 18 is returned to the reserve tank 43 through the pipe 18 and the conduit 44 by operation of the pump 42, whereby the communicating portion 23 having a spacing which permits the flow of vapor therethrough is formed between the lower end of the partition wall 21 and the surface of the cleaning liquid 2 in the vapor generating portion 12, so that the cleaning vapor heavier in specific gravity than the air inside the partition wall 21 is conducted through the communicating portion 23 to the cooling portion 24, where it is condensed into liquid. Therefore, the cleaning vapor in the cleaning portion 22 inside the partition wall 21 disappears and the cleaning portion 22 inside the partition wall 21 is cooled by the coldness of the cooling portion 24, now ready for cooling and drying of the article 3.

Although in each of the above embodiments the partition wall 21 is formed annularly, it may be formed in the shape of a flat plate to partition the interior

of the cleaning vessel body 5 into two portions, one of which serves as a box-like cooling portion 24 and the other a vapor cleaning portion 22. In this case, the opening and closing operation for the communicating portion 23 by the flat plate-like partition wall 21 is the same as in the above embodiments.

According to the present invention constructed as above, it becomes possible to use a single space for both a vapor cleaning portion and a cooling and drying portion which have heretofore been formed as separate spaces. Consequently, the height of the cleaning apparatus can be made much smaller than that of conventional like apparatus and the place for installation can be determined freely. Besides, a good operability is attainable.

WHAT IS CLAIMED IS:

1. A cleaning apparatus characterized in that a cleaning portion for performing vapor cleaning of an article to be cleaned and cooling and drying of said article is defined by a partition wall within a cleaning vessel body, that a cooling portion for condensing cleaning vapor is provided between said partition wall and an inner peripheral surface of said cleaning vessel body, and that a communicating portion for communication between said cooling portion and a vapor generating portion for generating cleaning vapor is formed below a lower end of said partition wall so that it can be opened and closed, and said cleaning portion and said vapor generating portion being in communication with each other.

2. A cleaning apparatus according to Claim 1, wherein said communicating portion is formed in such a manner that a feed/discharge pipe for feeding and discharging a sealing liquid is connected to a recess formed in an inner periphery of said cleaning vessel body and the lower end of said partition wall is inserted into said recess in an opposed relation to the bottom of the recess through a spacing which permits the flow of vapor therethrough.

3. A cleaning apparatus according to Claim 1, wherein said communicating portion is formed in such a manner that the lower end of said partition wall is brought into contact with a sealing portion provided at the cleaning vessel body to cut off the communication between a cleaning vapor inlet opening and said cooling portion and a spacing which permits the flow of vapor therethrough is formed between the lower end of said partition wall and said sealing portion as the partition wall goes up.

4. A cleaning apparatus according to Claim 1, wherein said communicating portion is formed by providing said cleaning vapor generating portion under said cleaning portion and also providing means for moving said partition wall vertically, said means moving the partition wall downward until the lower end of the partition wall is inserted into a cleaning liquid in said vapor generating portion during cleaning of the article to be cleaned, and said means moving said partition wall upward to form a spacing which permits the flow of vapor therethrough between the lower end of the partition wall and the surface of said cleaning liquid during cooling and drying of the article after cleaning.

5. A cleaning apparatus according to Claim 1, wherein said communicating portion is formed by providing said cleaning vapor generating portion under said cleaning portion and also providing a cleaning liquid feeding/discharging pump, said pump feeding a cleaning liquid to said vapor generating portion until the level of the cleaning liquid rises higher than the lower end of said partition wall during cleaning of the article to be cleaned, and said pump discharging the cleaning liquid from the vapor generating portion to form a spacing which permits the flow of vapor therethrough between the lower end of the partition wall and the surface of the cleaning liquid during cooling and drying of the article after cleaning.

6. A cleaning apparatus according to Claim 1, wherein under said cleaning portion is provided a liquid cleaning vessel for performing an immersion cleaning of the article to be cleaned using a cleaning liquid.

7. A cleaning apparatus according to Claim 1, wherein a lift opening is formed in an upper opening of said cleaning vessel body in which said partition wall is positioned, said lift opening being covered with an inner lid which is opened by pushing up from below.

8. A cleaning apparatus according to claim 6, wherein the vapor for vapor cleaning is introduced into a vapor inlet opening through an inlet port from said vapor generating portion which is provided in a position adjacent to said liquid cleaning vessel.

9. A cleaning apparatus according to Claim 6, wherein the cleaning vapor is generated by heating the cleaning liquid in said liquid cleaning vessel by means of a heater.

10. A cleaning apparatus according to Claim 7, wherein said inner lid is pushed up with a pushing-up frame projecting from a cleaning stand which is for putting thereon the article to be cleaned, by operation of a lift cylinder positioned outside the vapor generating portion and connected to said cleaning stand.

11. A cleaning apparatus according to Claim 3, wherein said sealing portion is provided with a recess and a sealing liquid is poured into said recess, and wherein the communication between said inlet opening and said cooling portion is cut off by inserting the lower end of said partition wall into said cleaning liquid, and said communication is made by raising the lower end of the partition wall out of the cleaning liquid.

12. A cleaning apparatus according to Claim 3, wherein the communication between said inlet opening and said cooling portion is cut off by pressure contact of said sealing portion formed of a ring making its upper surface flat with a flange portion formed at the lower end of said partition wall, and said communication is made by raising the partition wall.

13. A cleaning apparatus according to Claim 7, wherein said partition wall is normally urged downward by virtue of the weight of said inner lid which covers said lift opening.

14. A cleaning apparatus according to Claim 4, wherein said means for moving the partition wall vertically comprises an engaging flange projecting approximately horizontally from a peripheral portion of the partition wall; a spring engaging one end portion of said engaging flange to raise the partition wall higher than the level of the cleaning liquid in said vapor generating portion, thereby forming a communicating portion between the lower end of the partition wall and said liquid level; and a cleaning stand which can be moved vertically by means of a lift cylinder and which when moved downward comes into engagement with said engaging flange to force down the partition wall against

the biasing force of said spring until the lower end portion of the partition wall is inserted into the cleaning liquid.

15. A cleaning apparatus according to Claim 4, wherein said means for moving the partition wall vertically has a rope or chain which holds the partition wall in a suspended state and brings down the partition wall until the lower end portion the partition wall is inserted into the cleaning liquid in the vapor generating portion during cleaning of the article to be cleaned and pulls the partition wall upward from the level of the cleaning liquid during cooling and drying of the article after cleaning.

16. A cleaning apparatus according to Claim 1, wherein said cooling portion is formed by a coiled cooling pipe disposed between said partition wall and said cleaning vessel body.

17. A cleaning apparatus according to Claim 1, wherein said cooling portion is formed in the shape of a box and positioned between said partition wall and said cleaning vessel body.

18. A cleaning apparatus according to any of Claims 1, 2, 3, 4, 5, 7, 11, 12, 13, 14, 15 and 16, wherein said partition wall is formed annularly.

19. A cleaning apparatus according to any of Claims 1, 2, 3, 4, 5, 7, 12, 13, 14, 15 and 17, wherein said partition wall is formed in the shape of a flat plate.

FIG. 1

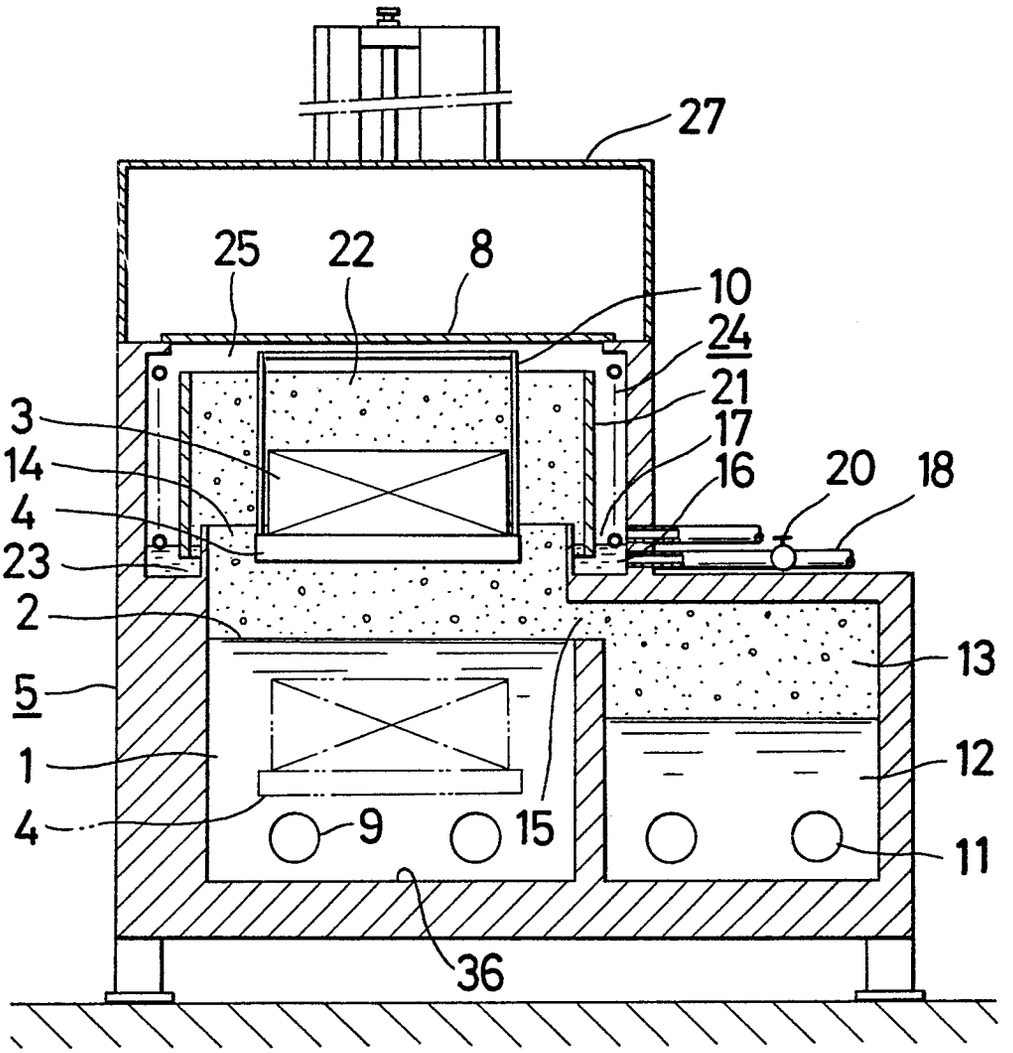


FIG. 2

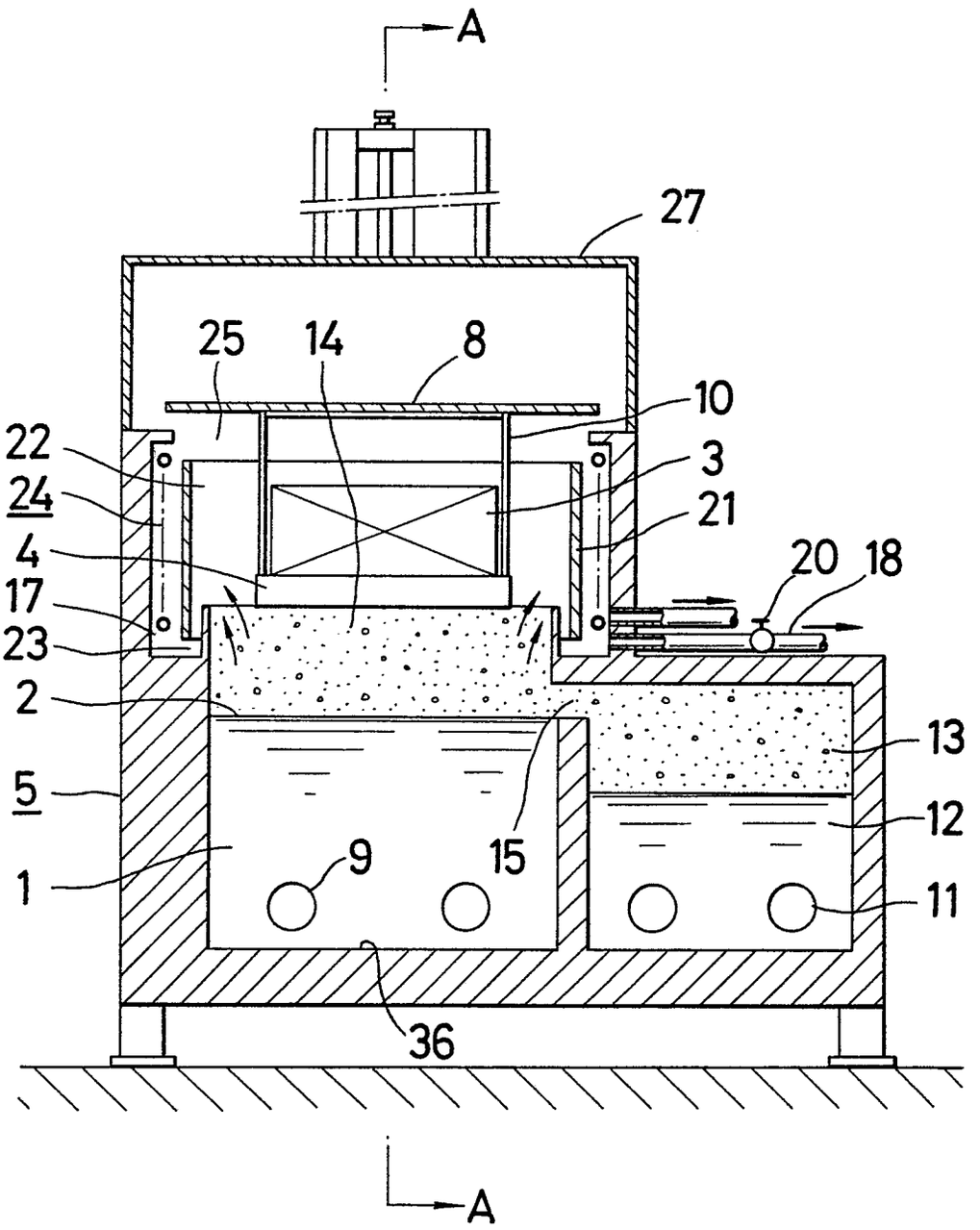


FIG. 3

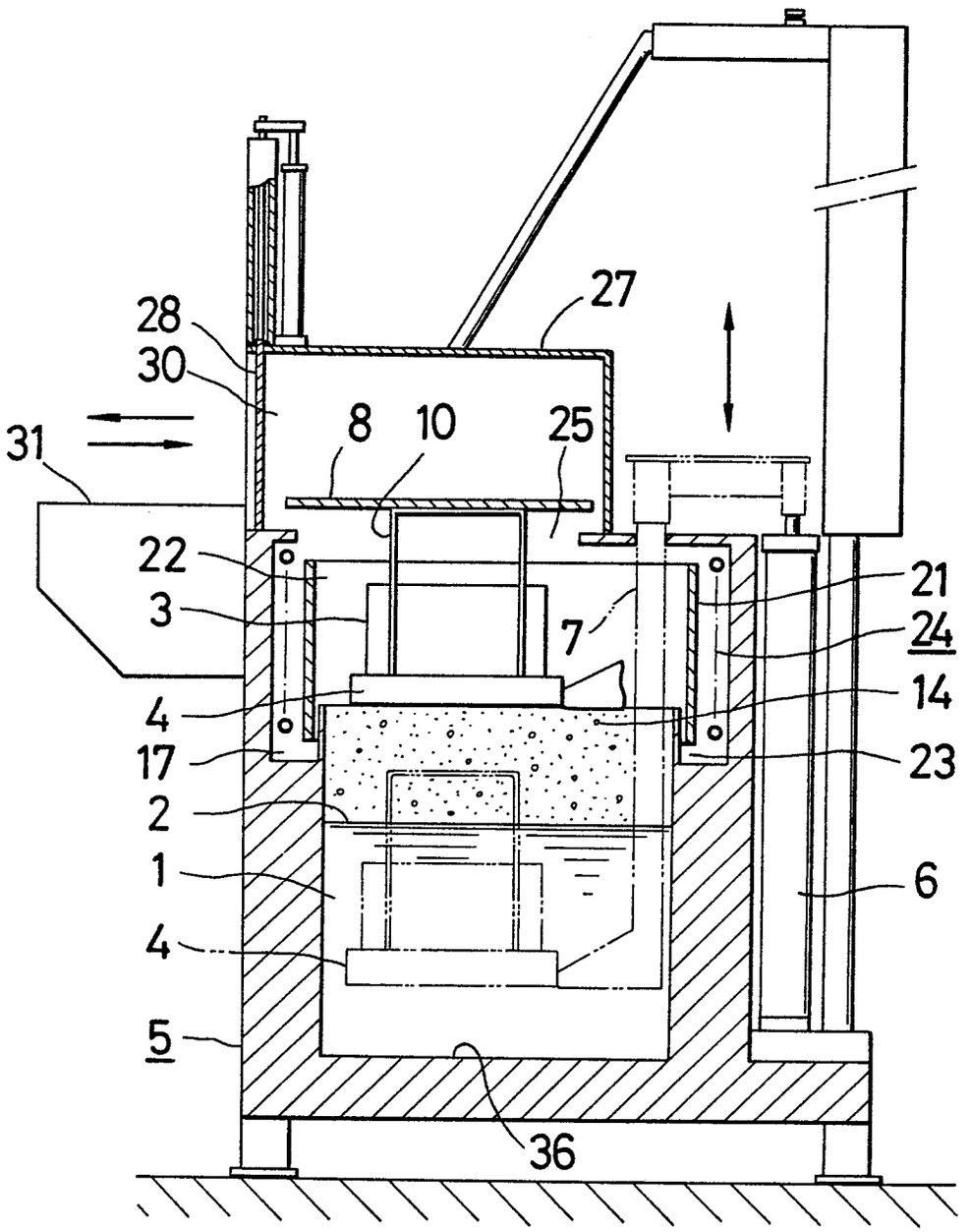


FIG. 4

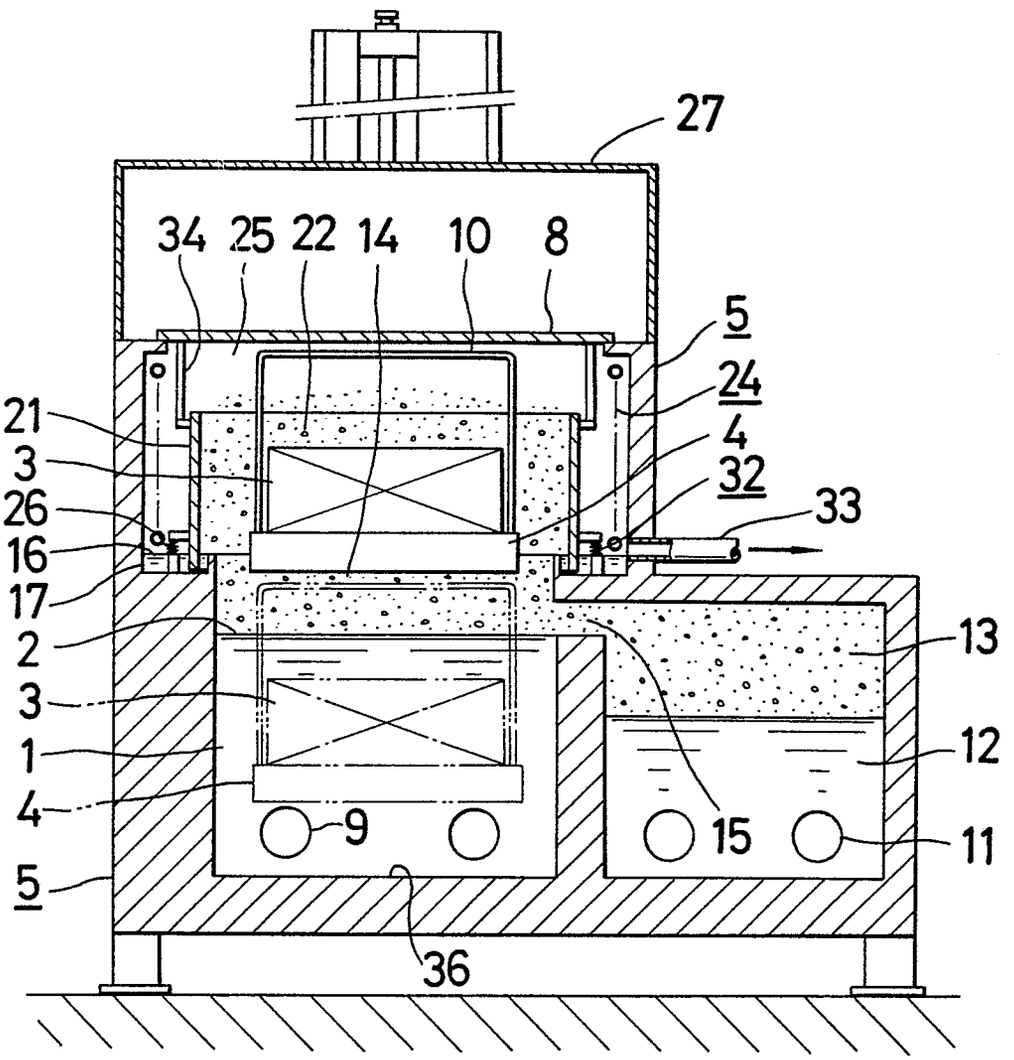


FIG. 5

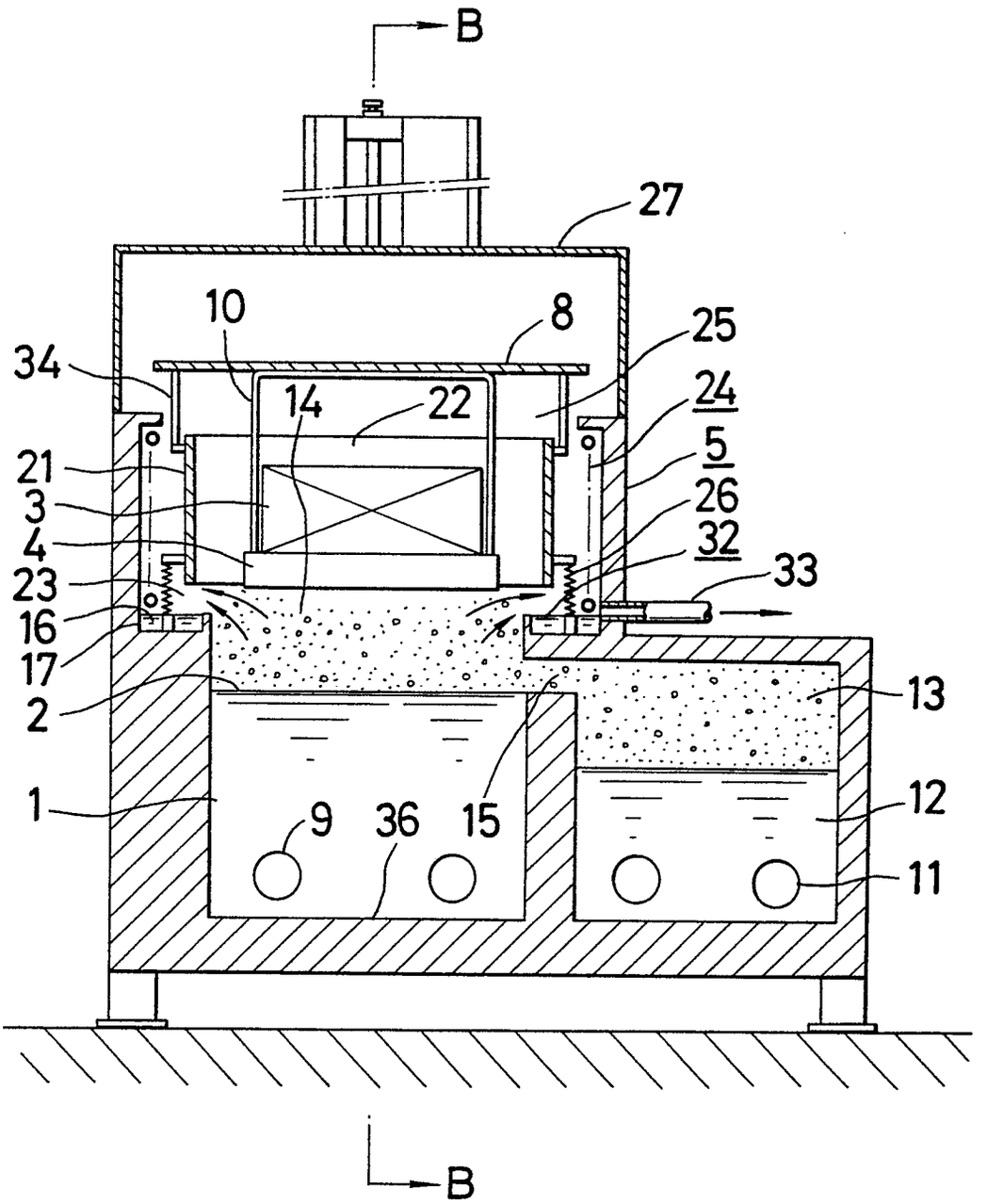


FIG. 6

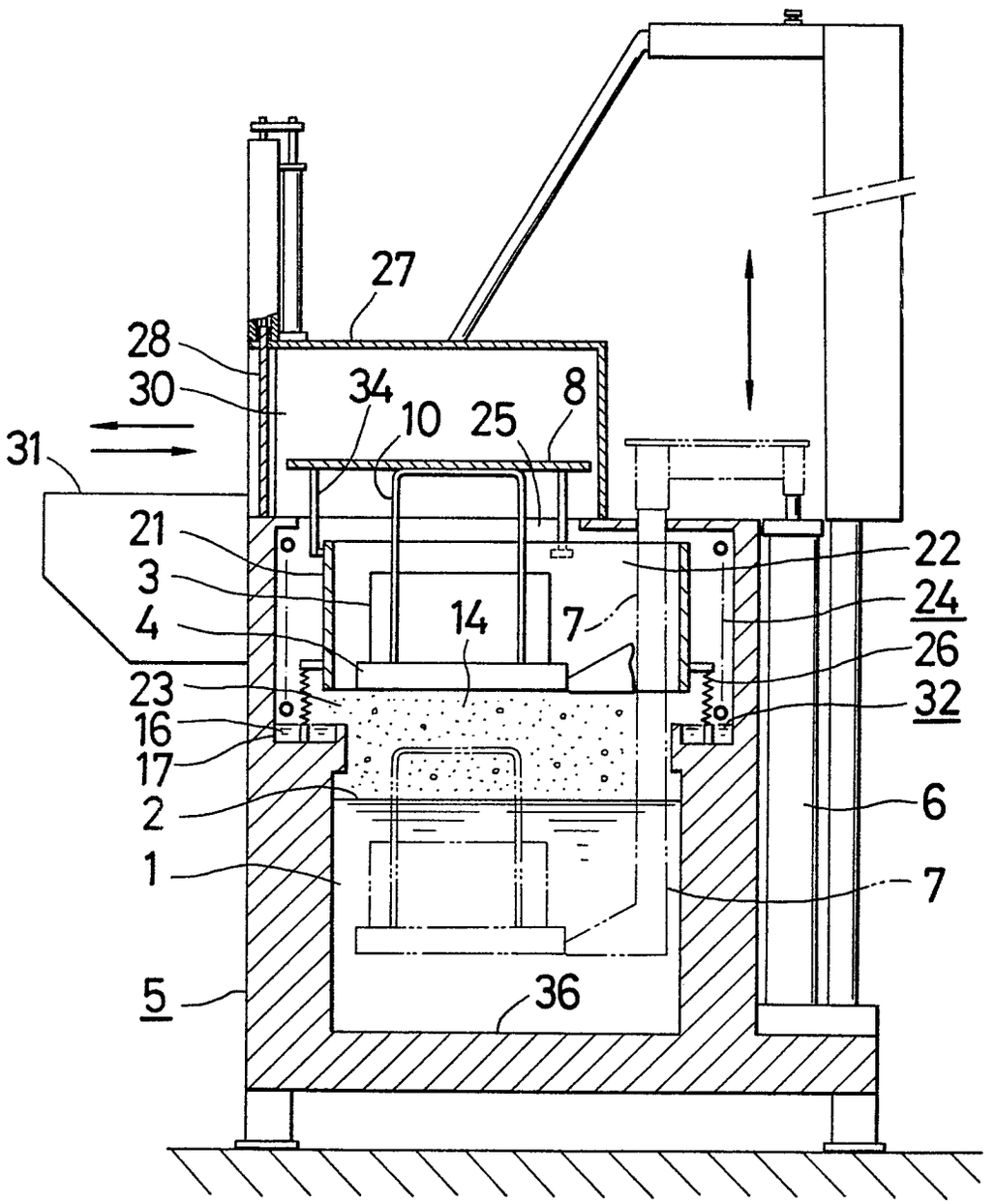


FIG. 7

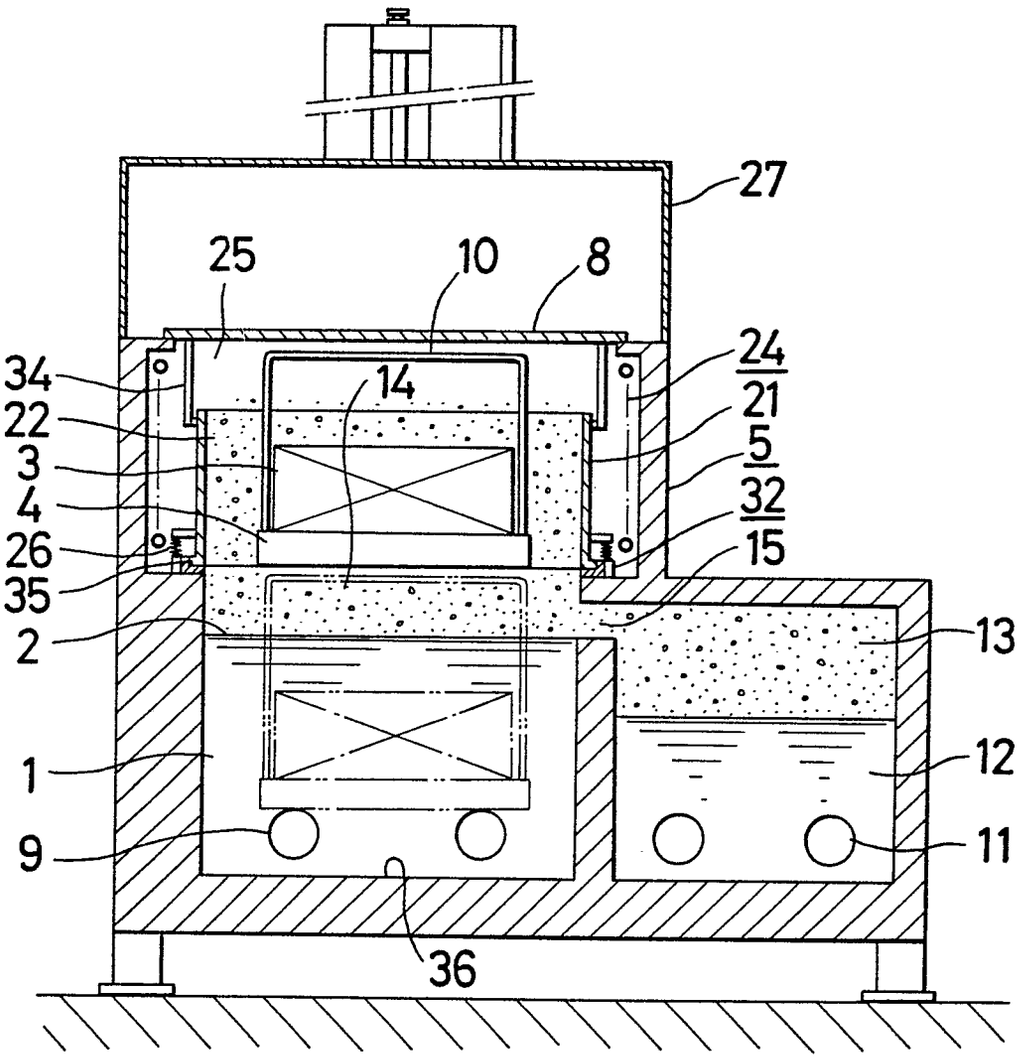


FIG. 8

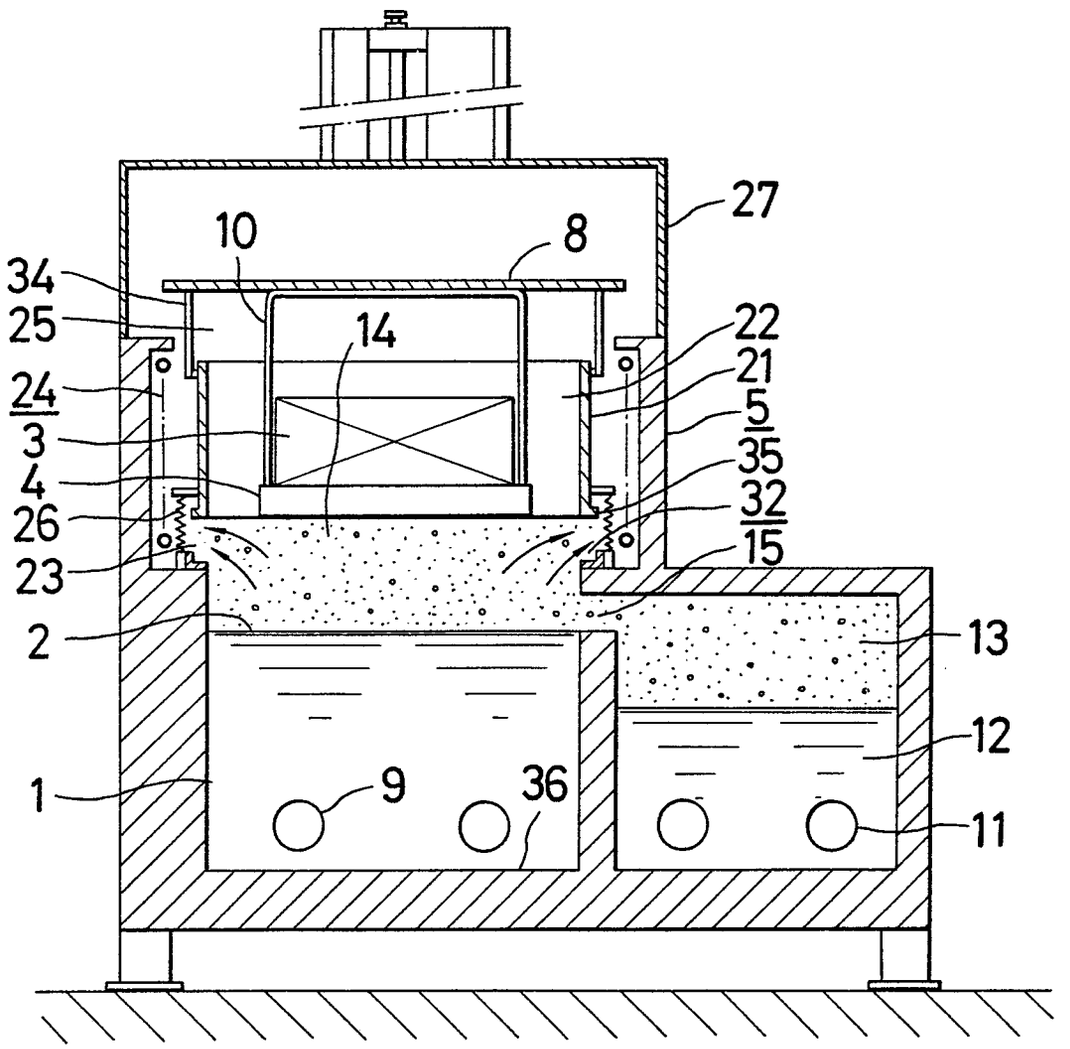


FIG. 9

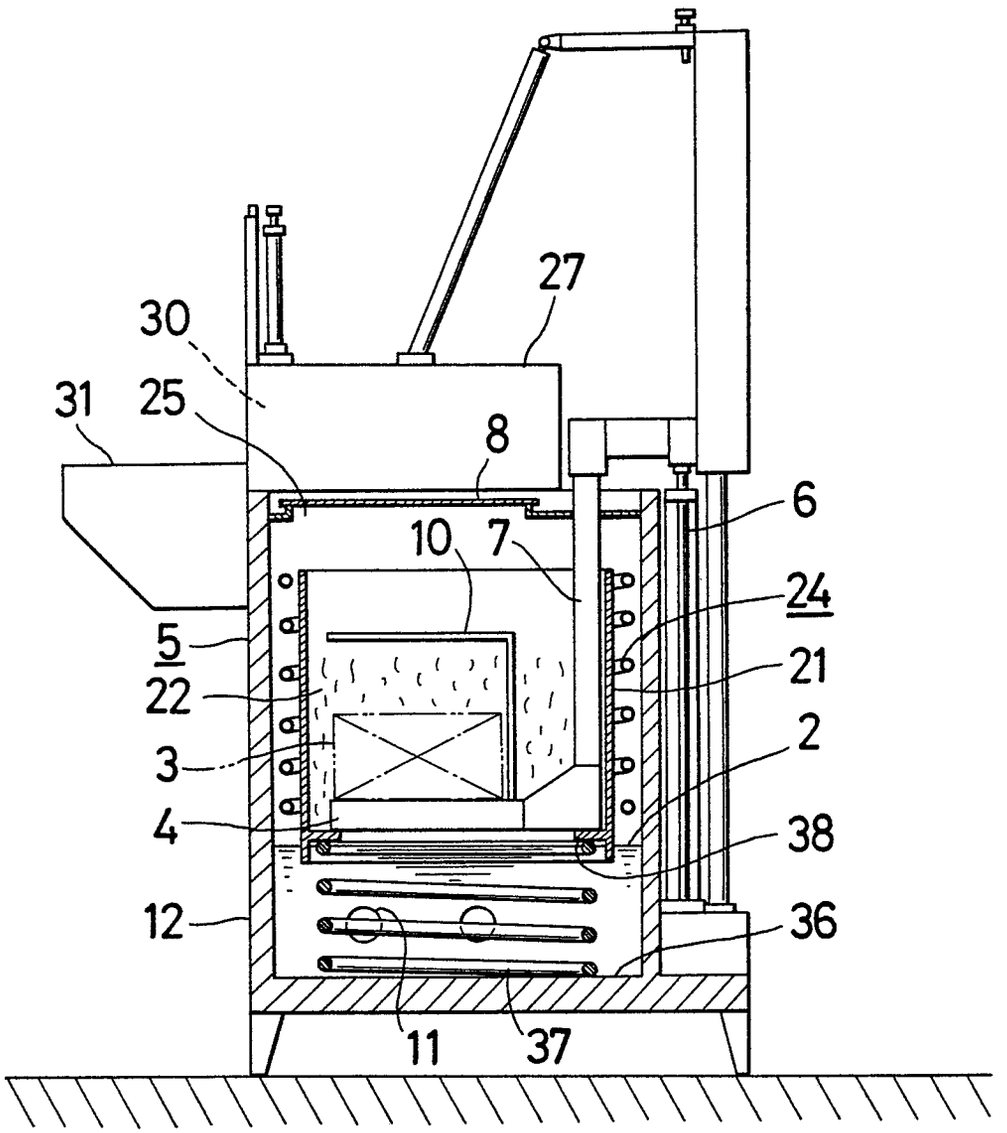


FIG. 10

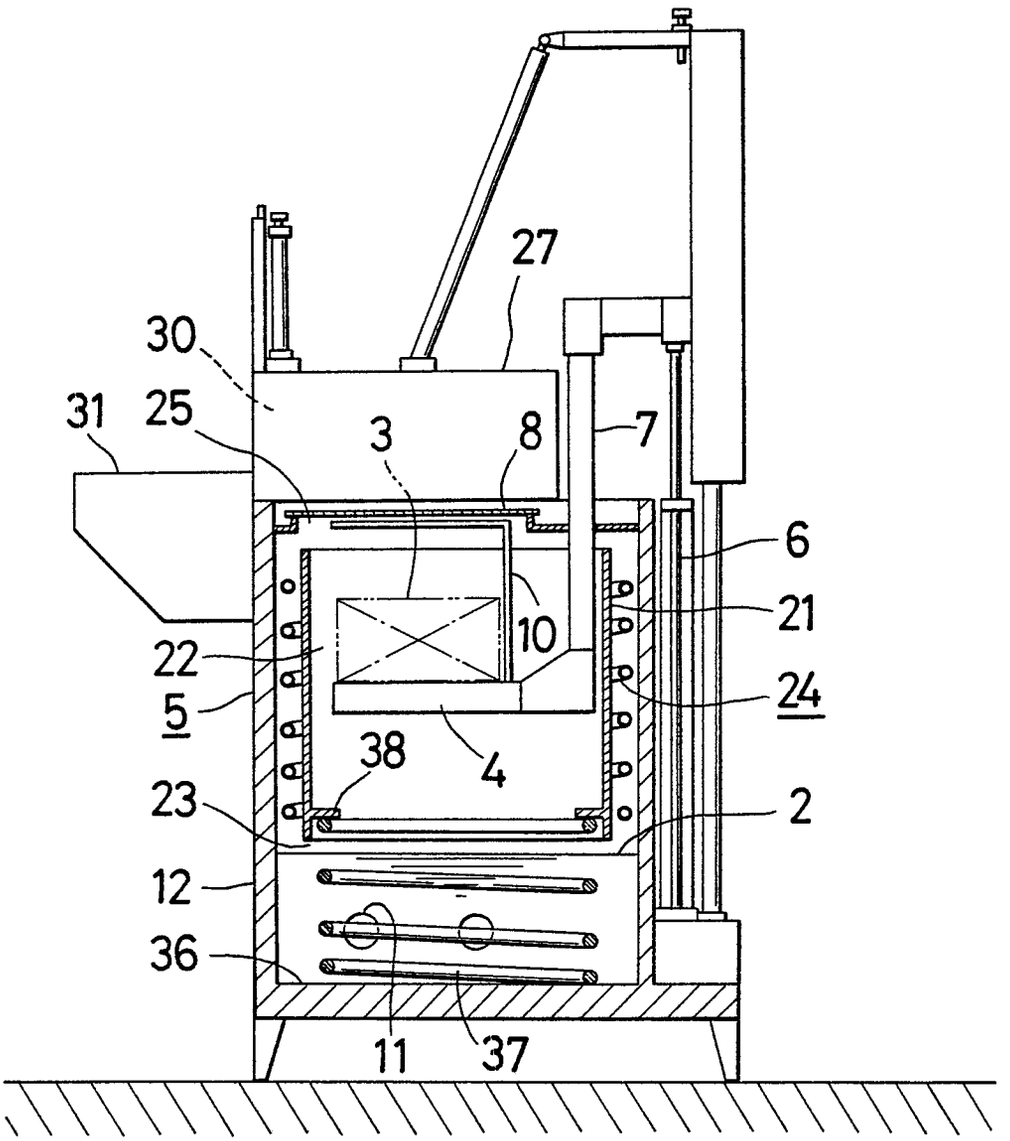


FIG. 11

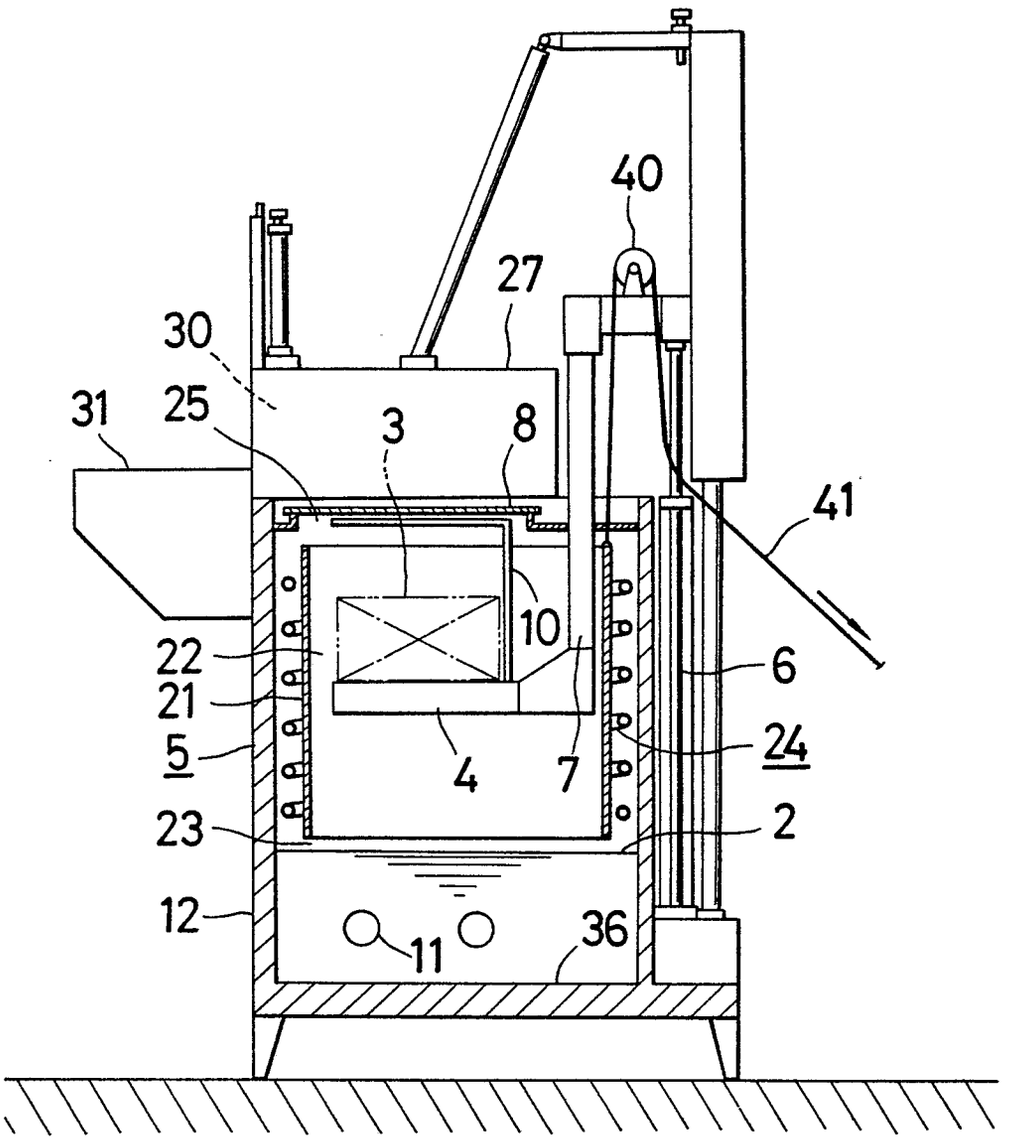


FIG. 12

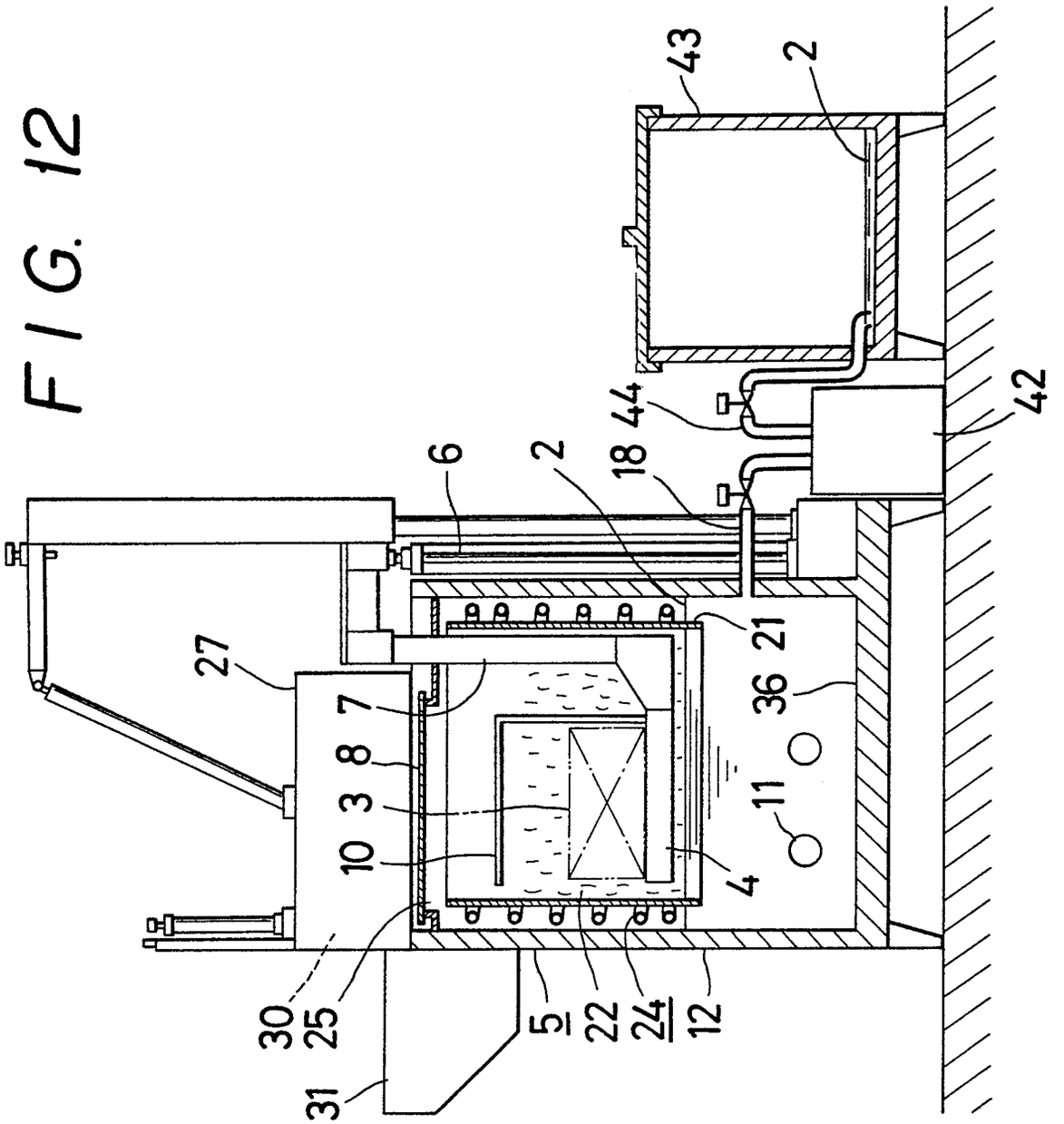
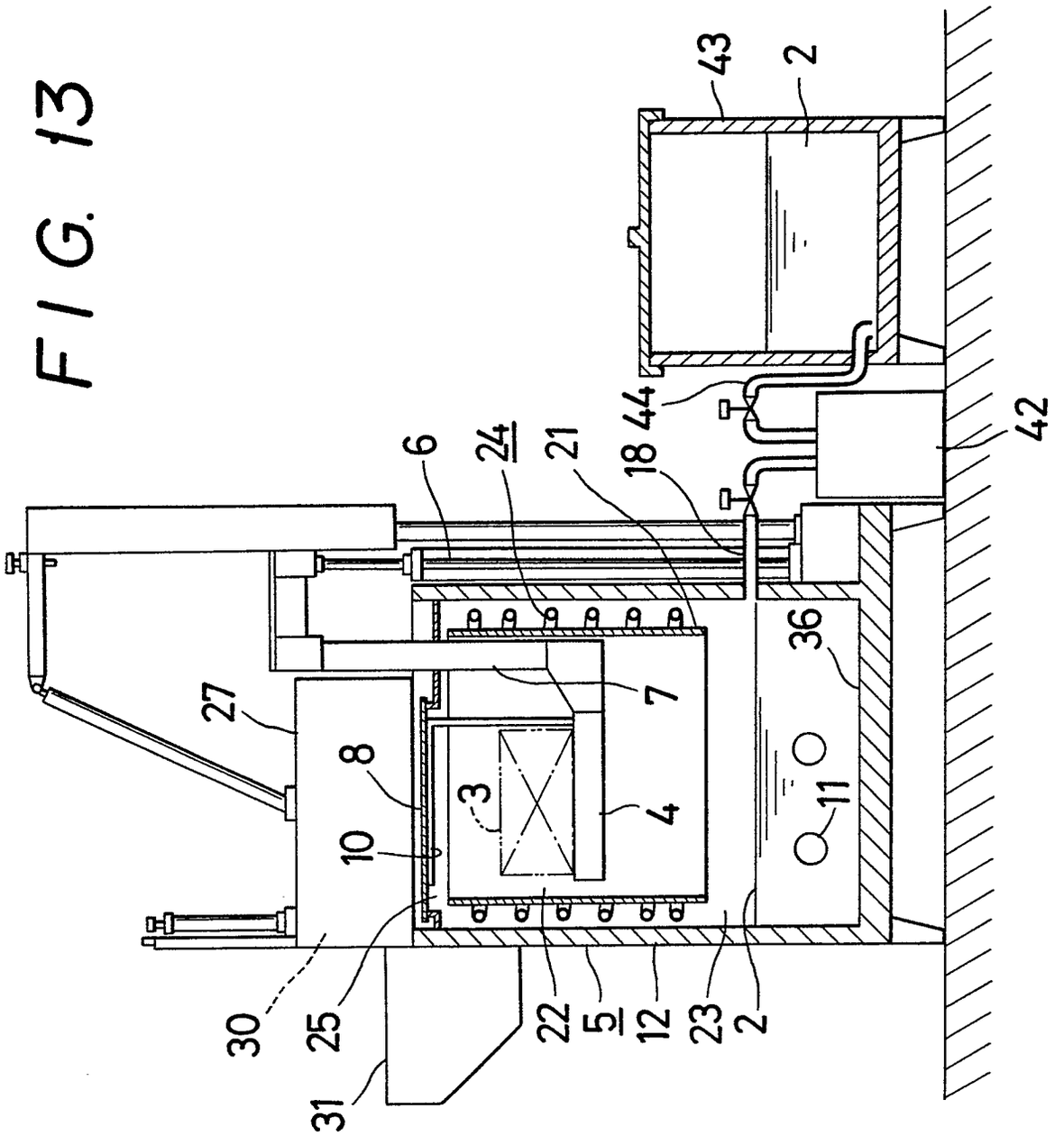


FIG. 13



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# EUROPEAN SEARCH REPORT

0235744
Application number

EP 87 10 2725

## 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.4) |
|---|---|---|---|
| X | US-A-2 057 177 (WOLFF)<br>* Whole document * | 1,3,4, 6,9,11 ,15,16 ,18 | C 23 G 5/04<br>B 08 B 3/04 |
| Y | | 8 | |
| A | | 2,7,10 ,12,17 ,19 | |
| Y | US-A-3 632 480 (SURPRENANT)<br>* Whole document * | 8 | |
| A | FR-A-2 030 273 (UDDEHOLMS AB)<br>* Page 2; figures 1,2 * | 2,3,11 | TECHNICAL FIELDS SEARCHED (Int. Cl.4) |
| A | US-A-4 101 340 (RAND)<br>* Column 3; figure * | 7,10 | C 23 G<br>B 08 B |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 17-06-1987 | VOLLERING J.P.G. |

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