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Description

The invention relates to a treating device for stirring treatment according to the preamble of claim 1.

JP-A-60-125240 discloses a stirring device comprising a rotary body located in a treating tank. On this rotary body permanent magnets are provided in opposed relation to permanent magnets which are arranged on a shaft structure rotatably provided in the tank and rotated by a drive apparatus provided outside the tank. In this way the motor must be provided separately from the stirring blades and some problems arise as to sealing the treatment tank.

It is the object of the invention to provide a treating device of the above mentioned kind in such a way that the stirring blades can be driven directly and sealing problems are avoided.

This object is achieved according to the invention by the features in the characterizing part of claim 1. Due to the fact that an electro-magnetic coil is located within the treating tank no motor must be provided separately and the stirring shaft extending from outside to inside of the tank is eliminated. The stirring blades are rotated directly by the revolving magnetic field generated by the electro-magnetic coil.

According to this invention, a rotary body having a stirring blade is made of conducting material and is rotatably supported within the treating tank. Adjacent the rotary body, an electro-magnetic coil which generates a revolving magnetic field is located, and by the electro magnetic inductive action of the revolving magnetic field, the rotary body is rotated to effect stirring treatment. The relation between the rotary body and the electro-magnetic coil includes the case where the rotary body is located to surround the electro-magnetic coil and the case where the electro-magnetic coil is located to surround the rotary body.

The device according to this invention can be applied to the stirring treatments for mixing, stirring, agitating, kneading, blending, dispersion, medium dispersion and the like. Following description is directed to a case of stirring treatment as an example, where the material to be treated is received in a stirring tank.

Other objects and features of this invention will become apparent from the following description with reference to the accompanying drawings.

Fig. 1 is a vertical sectional view of a device according to this invention, wherein a rotary body is located outside of an electro-magnetic coil.

Fig. 2 is a vertical sectional view of other embodiment of this invention, having a sleeve-shaped rotary body.

Fig. 3 is a vertical sectional view of other embodiment of this invention, wherein a stirring blade is hung down.

Fig. 4 is a vertical sectional view of other embodiment of this invention, wherein a stirring tank is laterally set up.

Fig. 5 is a vertical sectional view of other embodiment, wherein a rotary body is located inside of an electro-magnetic coil.

Fig. 6 is a vertical sectional view of other embodiment of this invention, wherein a rotary body is located without providing a wall member between the rotary body and the electro-magnetic coil.

In Fig. 1, a tank 1 has a canopy plate 2 on its top, in a hole 3 of the plate, a flange 5 of a cover plate 4 is inserted and secured by bolts (not shown), and a bearing 6 is attached to the flange. A supporting member 7 is attached to the cover plate 4 by bolts (not shown) to seal the tank. The supporting member is provided with a closed cylindrical wall member 8 extending within the tank, and by means of the wall member, an isolated space 9 is formed within the tank. Within the space, an electro-magnetic coil 10 which generates a revolving magnetic field is provided. Preferably a cooling pipe 11 is provided inside of the coil and the cooling pipe is passed by such a cooling medium as water, air and the like, to absorb the generated heat of the coil. In the drawing, the electro-magnetic coil 10 is shown as one set; however, plural sets may be provided if desired. On the outside of the wall member 8, a rotary body 12 is provided so as to be driven by an electro-magnetic induction due to the revolving magnetic field. The rotary body shown in Fig. 1 is a cylindrical body having a bottom 13 surrounding the outer periphery of the wall member, and it may be an annular body (not shown) loosely put on the wall member. And, in case of the annular body, it is suported by suitable means at a position corresponding to the outside of the electro-magnetic coil. The whole portion of the rotary body or at least a portion corresponding to the electro-magnetic coil is formed of the conducting material such as iron, silicon steel plate, amorphous metal and the like, so as to be rotated by the electro-magnetic inductive action, as mentioned above. The rotary body 12 is supported on its upper portion by a sliding bearing of Teflon ®, roller bearing, magnetic bearing and other suitable bearing 6, and an axis 14 provided on the inside of the bottom 13 is supported by a bearing 16 attached to a bottom 15 of the wall member 8. To the cylindrical body or the rotary body 12, a stirring blade 17 is fitted, and the stirring blade may be provided in plural.

On the outside of the tank 1, a jacket 18 is provided, in which a temperature controlled medium such as water is circulated to be able to

control the temperature of the material to be treated.

When the material to be treated with stirring is received in the tank through an inlet (not shown) and the electro-magnet coil 10 is energized, a revolving magnetic field is generated. By the revolving magnetic field, the rotary body 12 will begin to rotate, thus, enabling the stirring treatment. After treatment, the material may be taken out from an exit (not shown). In the device according to this invention, two or more rotary bodies may be provided within the tank.

Fig. 2 shows other embodiment of this invention, quite alike the device of Fig. 1. In the device of Fig. 1, the rotary body 12 is a cylindrical body having a bottom, while in Fig. 2, the rotary body is a sleeve-shaped rotary body 19, whose bearing 20 is a magnetic bearing. Others are constructions similar to the device of Fig. 1.

Fig. 3 shows another embodiment of this invention. A tank 21 has a canopy plate 22 on its top and a flange 23 provided on the canopy plate has a bearing 24, on which a flange 26 provided on the upper portion of a rotary body 25 is hung, thereby the rotary body is rotatably fitted. On the canopy plate, a supporting member 27 is attached, and on that member a cylindrical wall member 28 is provided. In a space 29 inside of the wall member, an electro-magnetic coil 30 which generates the revolving magnetic field is provided. The rotary body 25 is made of conducting material, and an axis 32 provided on a bottom 31 is supported by a bearing 34 provided on a bottom 33 of the wall member 28. On the outside of the bottom 31 of the rotary body an attaching portion 37 for attaching a shaft 36 of a stirring blade 35 is provided. A cooling pipe 38 for cooling the electro-magnetic coil and a jacket 39 to be provided on the outer periphery of the tank are provided in the same manner as the device of Fig. 1. An exit 40 provided on the bottom of the tank can be opened and closed by a valve (not shown).

In the same manner as the device of Fig. 1, the rotary body 25 is rotated by energizing the electro-magnetic coil 30, thereby the stirring blade 35 is rotated to enable stirring treatment. In this embodiment, when various stirring blades are prepared corresponding to the material to be treated and the objects of treatment, the device may be used by simply changing the stirring blades.

An embodiment shown in Fig. 4 is a device for continuous treatment. A tank 41 is horizontally disposed and a cover plate 43 and a supporting member 44 are attached to the side of an end plate 42. The supporting member 44 is provided with a cylindrical wall member 45 in the horizontal direction, and within the wall member, an electro-magnetic coil 46 which generates a revolving magnetic field. A rotary body 47 is located surrounding the outer periphery of the wall member; a flange 48 provided on its one end is supported by a bearing 49 provided on a cover plate 42; an axis 50 provided on the other end is supported by a bearing 51 on the wall member 45. Then the rotary body is rotatably supported. On the periphery of the rotary body 47, plural stirring blades 52 are provided. And, the electro-magnetic coil 46 has a length corresponding to the portion of the rotary body provided with the stirring blades; however, plural electro-magnetic coils may be provided corresponding to the portion of each stirring blade. On the periphery of the tank 41, a jacket 53 is provided and inside of the electro-magnetic coil 46, a cooling pipe 54 is provided for cooling.

When the electro-magnetic coil 46 is energized, the rotary body and the stirring blades 52 are rotated. The material to be treated entered from an inlet 55 is treated by the stirring blades 52 and can be continuously taken out from an exit 56. If a screen 57 is provided within the tank, and the media are put in, the device may also be used as a continuous media dispersion machine and a wet crusher.

Fig. 5 shows an embodiment of this invention, wherein a rotary body is located inside of an electro-magnetic coil.

In Fig. 5, a tank 58 has a canopy plate 59 on its top, and a cover plate 60 is attached onto the canopy plate. To the cover plate 60, a supporting member 61 is attached, and an upper portion of a rotary shaft 64 having a stirring blade 62 and a rotary body 63 is rotatably attached to the supporting member. In the drawing, the rotary shaft 64 is provided with a flange 65, which is supported by the magnetic bearing 66 in a floating manner, and the bearing portion is covered by a top plate 67. On the rotary shaft, a rotary body 63 made of conducting material is provided, and a wall member 69 is provided on the supporting member 61 so as to form a receiving portion 68 around the rotary body. In the receiving portion, an electro-magnetic coil 70 which generates a revolving magnetic field is provided. The rotary body and electro-magenetic coil may be provided in plural and in parallel. On the back of the cover plate 60, a jacket 71 through which a cooling media such as water, air and the like will pass so as to absorb generated heat of the electro-magnetic coil 70, is provided. However, the jacket may be provided on the receiving portion adjacent the electro-magnetic coil. And, on the outside of the tank (58), a jacket 72 is provided, in which a temperature controlled media such as water are passed through to control the temperature of the material to be treated.

When the material to be treated by stirring is received in a tank through the inlet (not shown) and the electro-magnetic coil 70 is energized, a revolv-

ing magnetic field is generated, and by the magnetic field the rotary body 63 is rotated, thereby the stirring blade 62 is rotated to enable the stirring treatment. After treatment, the material may be taken out from the exit (not shown).

In the embodiment, the tank is a vertical type, but it may be a horizontal type, and the material may be continuously treated.

In the above mentioned embodiment, a wall member is provided between the electro-magnetic coil and a rotary body; however, the wall member may be dispensed with. And, Fig. 6 shows such embodiment of this invention.

In Fig. 6, a canopy plate 74 provided on a tank 73 has a cylindrical portion 75 near its center, and in that portion a supporting cylinder 76 is fitted. The upper portion of the supporting cylinder is closed by a cover plate 77. Within the supporting cylinder, a rotary body 78 is provided, whose upper part is closed by the cover plate, and a flange 79 formed on the upper edge and a middle portion of the rotary body are supported by a sliding bearing of Teflon ®, roller bearing, magnetic bearing, and other suitable bearings 80, 81.

Within the rotary body, an electro-magnetic coil 83 which generates the revolving magnetic field adjacent a cylindrical wall 82, is located and in the drawing, a set of the electro-magnetic coil is attached to a supporting rod 84, but in case of need, plural sets may be provided. Inside of the coil, a cooling pipe 85 is provided to circulate the cooling medium so as to absorb the generated heat of the coil. And, the whole portion of the rotary body or at least a portion corresponding to the electro-magnetic coil is formed of suitable conducting material similar to the above mentioned embodiment. The rotary body may be directly connected with the stirring blade, but in the drawing, a shaft 86 is fitted to the lower part, and on that shaft, a stirring blade 87 is provided. Further, plural numbers of stirring blade shafts and of rotary body shafts may be provided.

On the outside of the tank 73, a jacket 88 is provided.

The material to be treated is received within the tank from an inlet (not shown) provided in the suitable position of the tank, then the electro-magnetic coil 83 is energized, so that the revolving magnetic field is generated, the rotary body 78 will rotate and the stirring blade 87 is rotated, enabling the stirring treatment. And, the outlet 89 is closed by a valve (not shown).

Since this invention is formed as mentioned above and the rotary body for stirring treatment of the material to be treated is driven by the revolving magnetic field, usual mechanical loss are never caused, and also problems of the shaft sealing do not arise. Therefore the inventive device may be suitably used for sealable treating tank, reaction tank, etc.

Claims

1. Treating device for stirring treatment, such as mixing, stirring, agitating, kneading, dispersion of materials to be treated which are received within a treating tank (1), comprising
a stirring blade (17) provided on a rotary body (12) which rotary body (12) is rotatably provided in the treating tank (1) and rotated by a revolving magnetic field,
characterized in
that an electro-magnetic coil (10) is located within the tank (1) for generating the revolving magnetic field and
that the rotary body (12) is made of conducting material or comprises a conducting material so that the rotary body (12) is rotated directly by said revolving magnetic field from said electro-magnetic coil (10).

2. A treating device according to claim 1, wherein said rotary body (12;19;25;47;78) is located surrounding an outer periphery of said electro-magnetic coil (10;30;46;83).

3. A treating device according to claim 1, wherein said rotary body (63) is surrounded by said electro-magnetic coil (70).

4. A treating device according to claim 1, wherein said rotary body (12;19;25;47;63;78) is cylindrically provided.

5. A treating device according to claim 1, wherein said rotary body is annularly provided.

6. A treating device according to claim 1, wherein said electro-magnetic coil (10;30;46) is provided within a cylindrical wall member (8;28;45), outside of which said rotary body (12;19;25;47) is located.

7. A treating device according to claim 1, wherein said electro-magnetic coil (70) is provided within a receiving portion formed by a wall member (69) and extending around the rotary body (63).

8. A treating device according to claim 1, wherein the longitudinal axes of said treating tank (41) and of said rotary body (47) are horizontally provided.

9. A treating device according to claim 1, wherein the generated heat of said electro-magentic

coil (10;30;46;83) is absorbed by a cooling-medium passing inside of said coil (10;30;46;83), and the temperature of treating material within said tank (1;21;41;58;73) is controlled by a temperature controlled medium passing outside of said tank (1).

Revendications

1. Dispositif de traitement pour les opérations d'agitation, de mélange, de malaxage, de dispersion de matière à traiter qui sont introduites dans un réservoir de traitement (1), comprenant

   une pale d'agitation (17) montée sur un corps rotatif (12) lequel corps rotatif (12) est monté de façon rotative dans le réservoir de traitement (1) et mis en rotation par un champ magnétique tournant,

   caractérisé en ce qu'une bobine éléctromagnétique (10) est située à l'intérieur du réservoir (1) pour produire le champ magnétique tournant et

   en ce que le corps rotatif (12) est réalisé en matière conductrice ou comprend une matière conductrice de sorte que le corps rotatif (12) est mis en rotation directement par le champ magnétique tournant émis par la bobine électromagnétique (10).

2. Dispositif de traitement selon la revendication 1, dans lequel le corps rotatif (12 ; 19 ; 25 ; 47 ; 78) entoure une périphérie extérieure de la bobine électromagnétique (10 ; 30 ; 46 ; 83).

3. Dispositif de traitement selon la revendication 1, dans lequel le corps rotatif (63) est entouré de la bobine électromagnétique (70).

4. Dispositif de traitement selon la revendication 1, dans lequel le corps rotatif (12 ; 19 ; 25 ; 47 ; 63 ; 78) est cylindrique.

5. Dispositif de traitement selon la revendication 1, dans lequel le corps rotatif est annulaire.

6. Dispositif de traitement selon la revendication 1, dans lequel la bobine électromagnétique (10 ; 30 ; 46) est prévue à l'intérieur d'un élément de paroi cylindrique (8 ; 28 ; 45) à l'extérieur duquel est situé le corps rotatif (12 ; 13 ; 25 ; 47).

7. Dispositif de traitement selon la revendication 1, dans lequel la bobine électromagnétique (70) est disposée à l'intérieur d'une portion de réception formée par un élément de paroi (69) et s'étendant autour du corps rotatif (63).

8. Dispositif de traitement selon la revendication 1, dans lequel les axes longitudinaux du réservoir de traitement (41) et du corps rotatif (47) sont horizontaux.

9. Dispositif de traitement selon la revendication 1, dans lequel la chaleur produite par la bobine électromagnétique (10) est absorbée par un agent de refroidissement passant à l'intérieur de la bobine (10) et la température de la matière de traitement à l'intérieur du réservoir (1 ; 21 ; 41 ; 58 ; 73) est régulée par un agent à température régulée acheminé à l'extérieur du réservoir (1).

Patentansprüche

1. Vorrichtung für eine Rührbehandlung, wie z. B. Mischen, Rühren, Agitieren, Kneten, Dispergieren von zu behandelnden Materialien, die innerhalb eines Behandlungstankes (1) aufgenommen werden, umfassend
   eine Rührlamelle (17),vorgesehen auf einem Drehkörper (12), wobei der Drehkörper (12) drehbar in dem Behandlungstank (1) vorgesehen ist und durch ein magnetisches, umlaufendes Feld gedreht wird,
   dadurch gekennzeichnet,
   daß eine elektromagnetische Spule (10) innerhalb des Tankes (1) angeordnet ist, um das umlaufende magnetische Feld zu erzeugen und
   daß der Drehkörper (12) aus leitendem Material hergestellt ist oder leitendes Material umfaßt, sodaß der Drehkörper (12) direkt durch das umlaufende magnetische Feld von der elektromagnetischen Spule (10) gedreht wird.

2. Vorrichtung nach Anspruch 1,
   wobei der Drehkörper (12; 19; 25; 47; 78) um einen äußeren Umfang der elektromagnetischen Spule (10; 30; 46; 83) angeordnet ist.

3. Vorrichtung nach Anspruch 1,
   wobei der Drehkörper (63) von der elektromagnetischen Spule (70) umgeben wird.

4. Vorrichtung nach Anspruch 1,
   wobei der Drehkörper (12; 19; 25; 47; 63; 78) zylinderförmig vorgesehen ist.

5. Vorrichtung nach Anspruch 1,
   wobei der Drehkörper ringförmig vorgesehen ist.

6. Vorrichtung nach Anspruch 1,
   wobei die elektromagnetische Spule (10; 30; 46) innerhalb eines zylindrischen Wandele-

ments (8; 28; 45) vorgesehen ist, außerhalb dessen der Drehkörper (12; 13; 25; 47) angeordnet ist.

7. Vorrichtung nach Anspruch 1, wobei die elektromagnetische Spule (70) innerhalb eines Aufnahmeabschnittes vorgesehen ist, der durch ein Wandelement (69) ausgebildet ist und sich um den Drehkörper (63) erstreckt.

8. Vorrichtung nach Anspruch 1, wobei die longitudinalen Achsen des Behandlungstankes (41) und des Drehkörpers (47) horizontal vorgesehen sind.

9. Vorrichtung nach Anspruch 1, wobei die erzeugte Wärme der elektromagnetischen Spule (10; 30, 46, 83) durch ein Kühlmittel aufgenommen wird, das innerhalb der Spule (10; 30; 46; 83) strömt und die Temperatur des Behandlungsmaterials innerhalb des Tanks (1; 21; 41; 53; 73) durch ein temperaturgesteuertes Mittel, das außerhalb des Tanks (1) strömt, gesteuert wird.

FIG.1

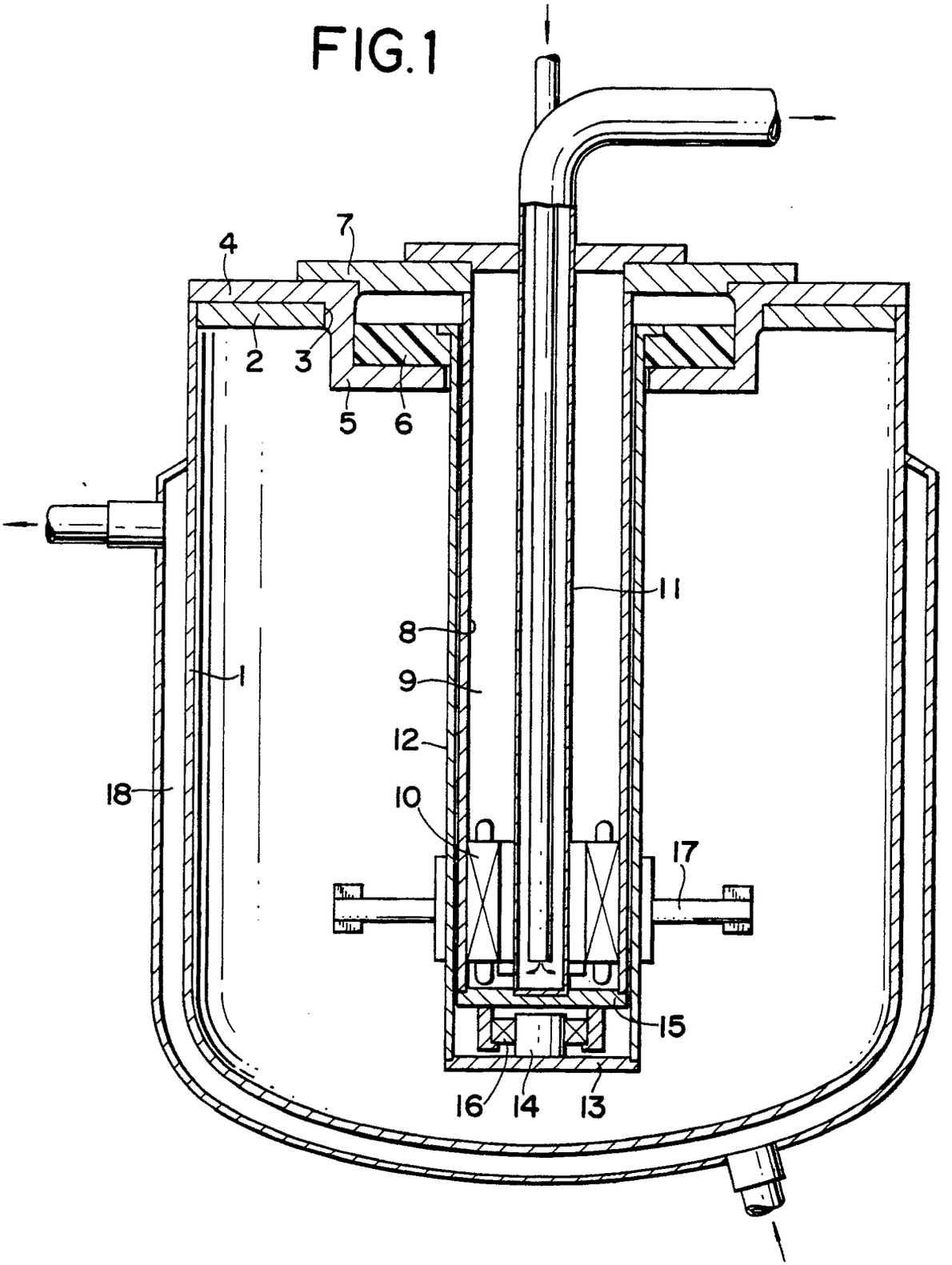

FIG.2

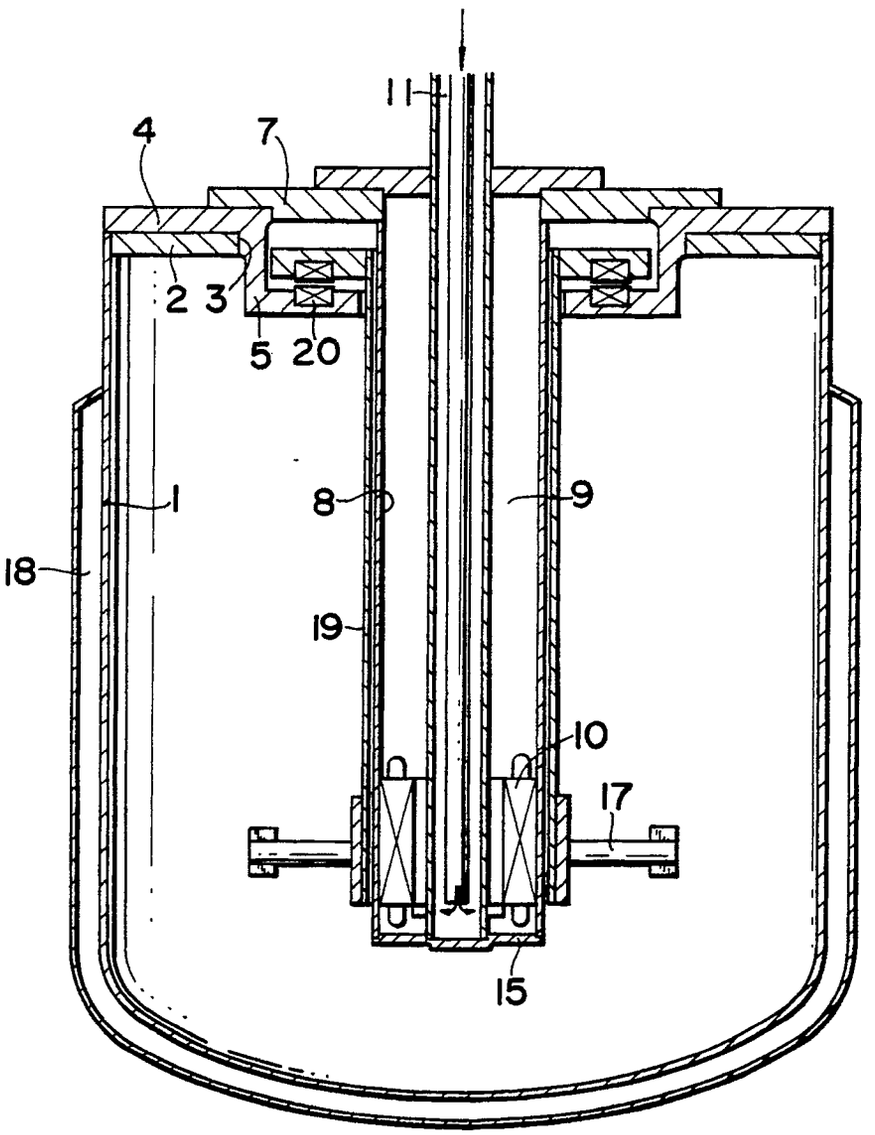

FIG.3

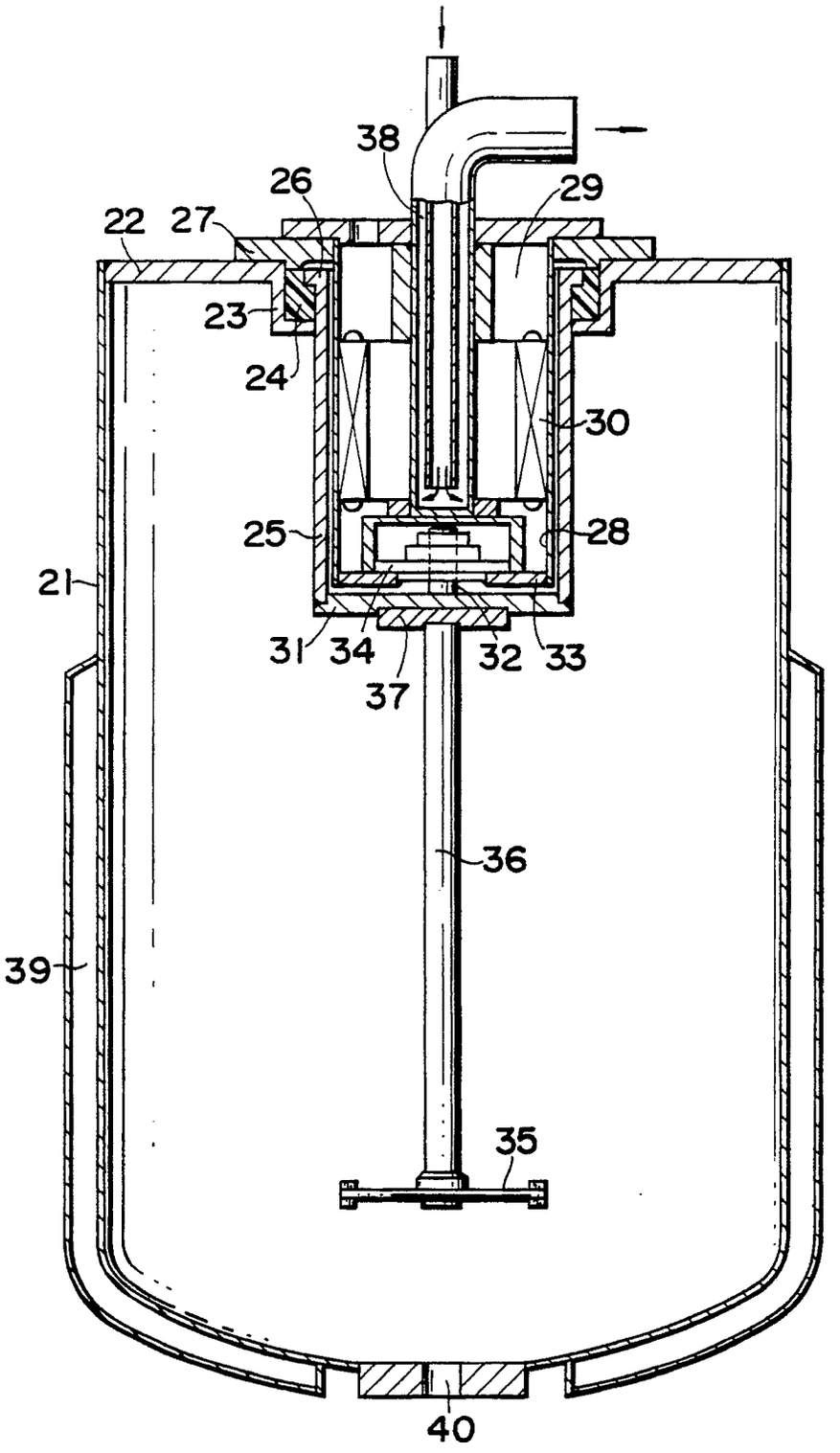

FIG.4

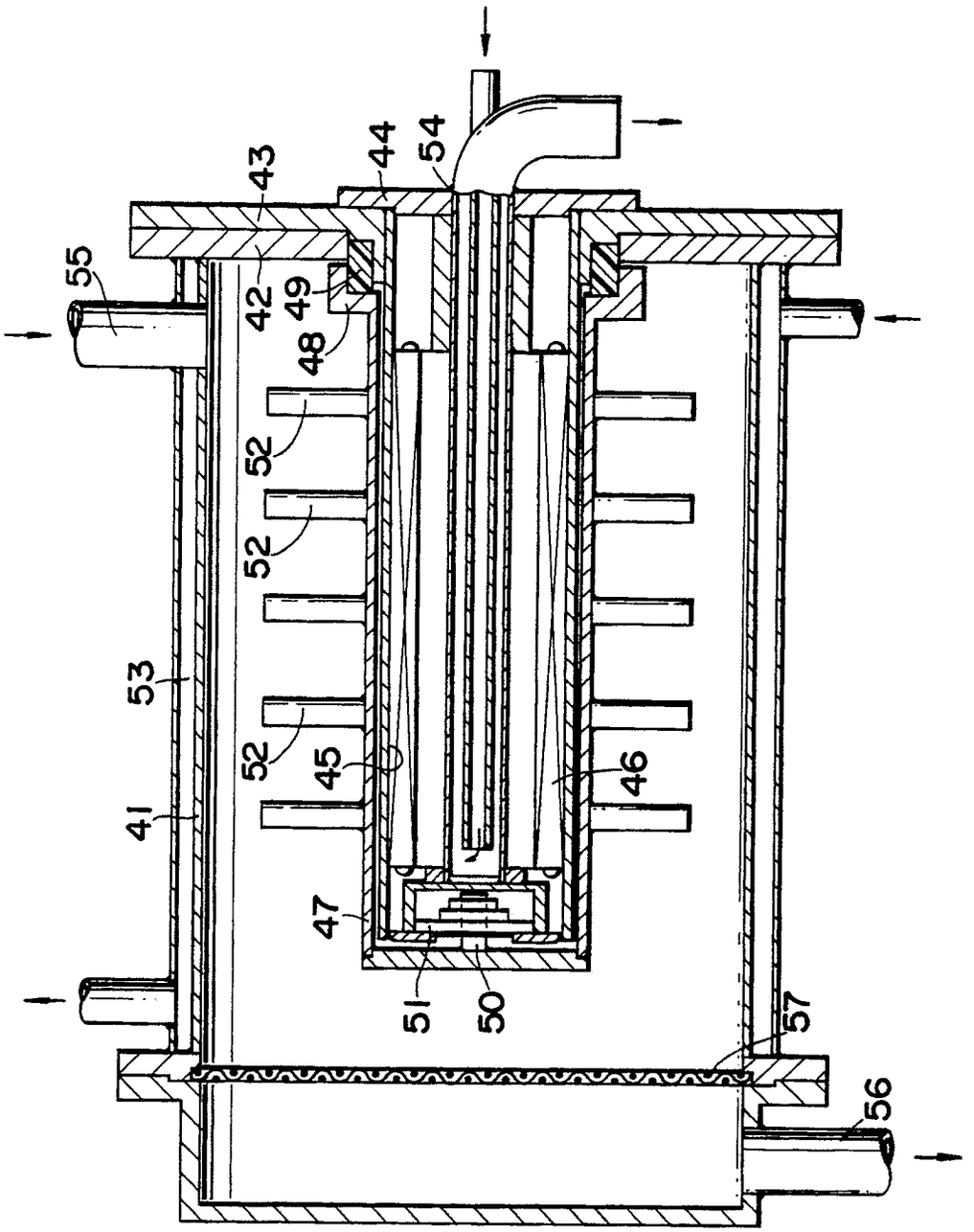

FIG.5

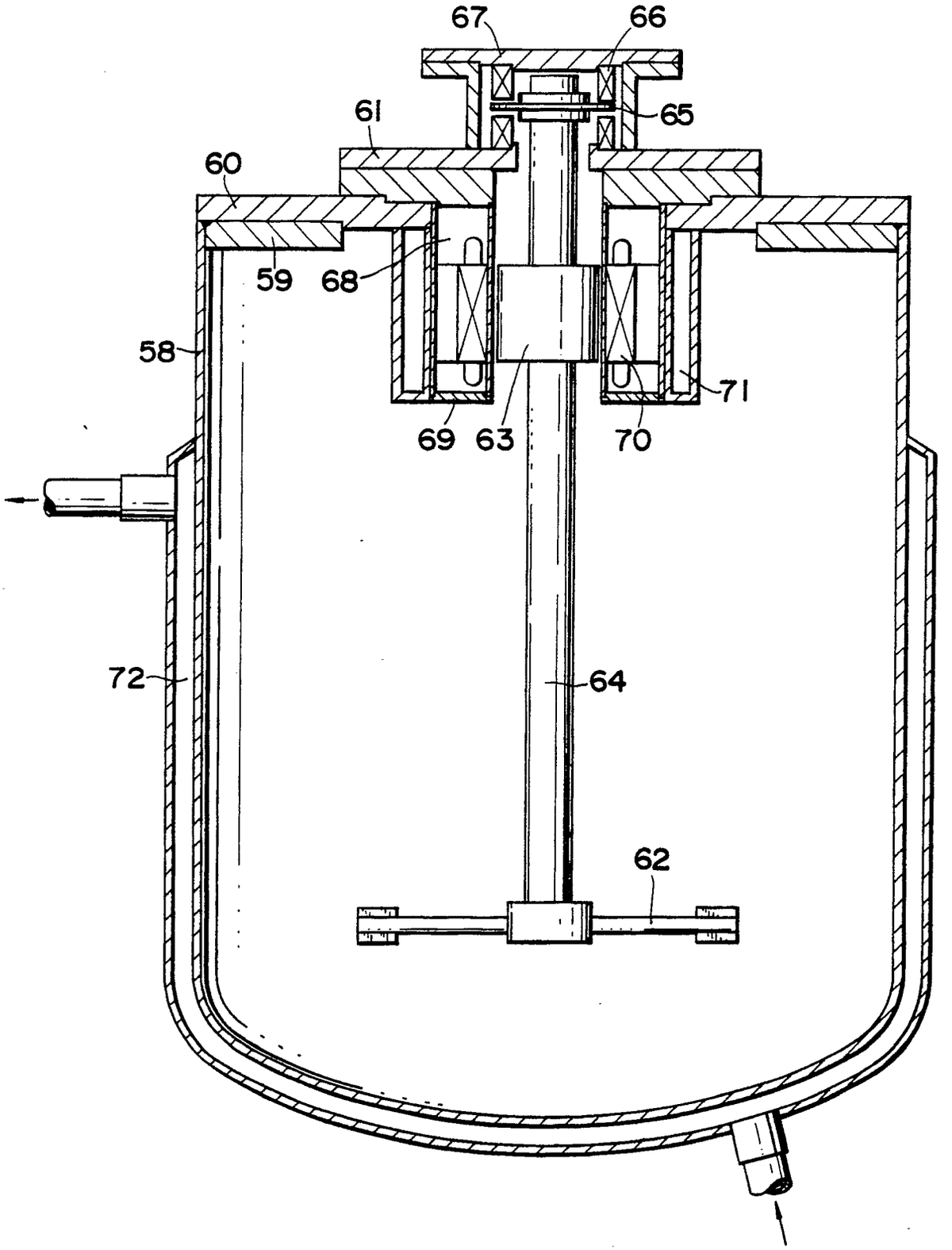

FIG.6