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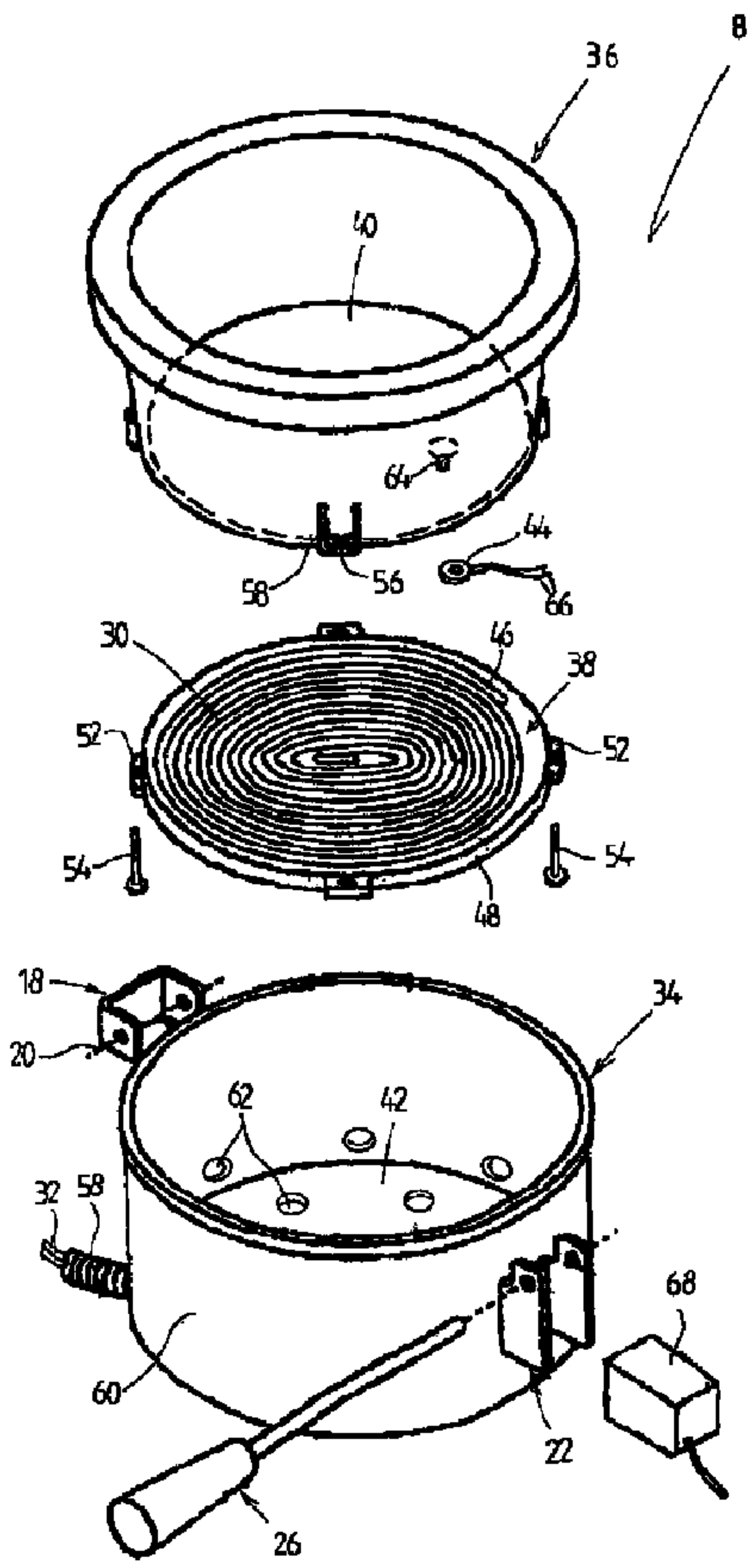
(54) Titre : MACHINE A POP-CORN A CHAUFFAGE PAR INDUCTION
(54) Title: POPCORN MACHINE COMPRISING AN INDUCTION HEATER



(57) **Abrégé/Abstract:**
The invention relates to a popcorn machine (2) comprising a housing (4; 70), a receptacle (8) for heating corn and fat that are fed into the receptacle (8) to make popcorn. The receptacle (8) can be swiveled relative to the housing (4; 70) in order to be emptied. The popcorn machine (2) further comprises an induction heater encompassing an induction coil (30; 116) that is arranged below the receptacle (8) to generate a high-frequency alternating magnetic field. The induction coil (30; 116) can be swiveled along with the receptacle (8).

Abstract

The invention relates to a popcorn machine (2) having a housing (4; 70), a receptacle (8) for heating corn and fat introduced into the receptacle (8) for popcorn making, wherein the receptacle (8) can be pivoted with respect to the housing (4) for emptying, and an induction heater comprising an induction coil (30; 116) disposed beneath the receptacle (8) for generating a alternating high-frequency alternating magnetic field. It is provided that the induction coil (30; 116) is pivotable along with the receptacle (8).

(Fig. 2)

Popcorn machine comprising an induction heater

The invention relates to a popcorn machine having a housing, a receptacle for making popcorn by heating corn and fat introduced into the receptacle, wherein the receptacle can be pivoted with respect to the housing for emptying, and an induction heating comprising an induction coil arranged beneath the receptacle for generating a high-frequency alternating magnetic field.

Popcorn machines normally have a housing and a pot- or kettle-type receptacle, which can be pivoted with respect to the housing and which is used to heat corn, fat and eventually further ingredients for popcorn making. To this end mostly a bent tubular heating element of a resistance heater is mounted beneath the bottom wall of the receptacle. The heating element can be supplied with power from the mains for heating the bottom wall of the receptacle and therefore the ingredients for popcorn making having been introduced into the receptacle, and for keeping them on the temperature necessary for popcorn making. In addition popcorn machines have an agitator for agitating the contents of the receptacle during the heating in order to provide for a more homogenous warming up of the corn kernels until the popping will take place. As the volume of the corn kernels increases strongly during the popping while their specific weight decreases strongly, the corn kernels having not yet popped will remain at the bottom of the receptacle whereas the finished popcorn will be transported upwardly by the action of the agitator. When the receptacle is full, the popcorn will urge the receptacle lid open, which until then has prevented the corn kernels from being thrown out of the receptacle, and will then fall down into a collecting bowl normally arranged in a warm-keeping room of the housing. In smaller popcorn machines the receptacle is pivotably suspended from an upper or roof part of the housing whereas in larger poppers it is pivotably mounted on a pedestal above the collecting bowl. Due to this the receptacle can be pivoted into an emptying position after the popcorn has been finished, in which position the remaining popcorn will fall from the receptacle into the collecting bowl from where it can be collected at will. After the receptacle has been pivoted back in its working position, it is ready for receiving a new load of fat and corn.

The production of popcorn in a receptacle which is heated with a resistance heater will consume a lot of energy. On one hand the receptacle must have a relatively large heat capacity for homogenously heating corn and fat so that it will dissipate a lot of radiation heat into the surroundings which therefore will not be available for heating the ingredients. Furthermore the receptacle must be also heated in the time after it has been emptied and before it will be filled again, in order to prevent an undesirable cooling down of the receptacle before the introduction of the next load, what will also lead to a loss of much energy.

Due to this reason US-Patent 5,928,550 already proposes a popcorn popper of the type mentioned in the beginning which has an induction heater instead of a resistance heater. The induction heater of this popcorn popper comprises a generator and an induction coil for generating a high-frequency alternating magnetic field. The generator and the induction coil are arranged beneath the pivotable receptacle in a stationary pedestal which stands up from the collecting bowl and protrudes into the warm-keeping room. This arrangement has several drawbacks: On one hand the pedestal occupies comparatively much space in the warm-keeping room which is actually intended for containing popcorn, and in addition makes the withdrawal of popcorn from the warm-keeping room and the collecting bowl more difficult, in particular the withdrawal of the popcorn which drops between the circular pedestal and the rear wall of the housing. In order to enable a pivoting of the receptacle suspended from the roof of the warm-keeping room from a working position, where the opening of the receptacle faces upwardly, by more than 90 degrees into an emptying position, where the opening of the receptacle faces downwardly, on the other hand there must be a large distance between the top of the pedestal and the bottom wall of the receptacle. This however results in a considerable weakening of the alternating magnetic field produced by the induction coil before it will reach the receptacle bottom wall to be heated. This means, that a large amount of time and electrical power will be needed for the heating of the receptacle bottom wall. In addition during the emptying of the receptacle popcorn will fall on top of the pedestal from where it will have to be carefully removed because else it can be burned from the heat radiating downwardly from the receptacle bottom wall once the receptacle is back in the working position and the induction coil is energized. Not at least the receptacle of US-Patent 5,928,550 does not house any electrical components in order to be able to submerge it in water during cleaning. However this will make it quite difficult to measure the temperature of the receptacle bottom wall exactly and to keep it in a narrow temperature range desired for popcorn making.

Starting out from this, it is an aim of the invention to avoid a weakening of the alternating magnetic field generated by the induction coil due to an excessively large distance between the induction coil and the bottom wall of the receptacle in a popcorn popper of the prior art mentioned in the beginning.

It is another aim of the invention to decrease the time needed for the production of one load of popcorn.

In addition it is a further aim of the invention to use as much space as possible in the warm-keeping room for popcorn storage and to facilitate the withdrawal of popcorn from the collecting bowl or the warm-keeping room respectively.

Furthermore it is another aim of the invention to positively prevent an overheating of popcorn inside or outside the receptacle.

According to the invention these aims are accomplished in that the induction coil is pivotable along with the receptacle and preferably is integrated into the bottom of the receptacle.

Tests conducted with a popcorn machine according to the invention have demonstrated that in comparison with a conventional popcorn machine having an resistance heater a load of corn with the same quantity can be popped with 30 to 35 % less energy, the time needed for the popping being 30 to 50 % shorter.

It is already known from popcorn machines with a resistance heater to accommodate the heating elements of the resistance heater in a double walled bottom of the receptacle. However the heating elements of resistance heaters are made of a metal with a high electric resistance, e.g. nickel, in order to provide for a fast heating of the heating elements when they are energized, whereas the leads extending from a mains adapter in the housing of the popcorn machine to the heating elements are made from copper or another material with a very low electric resistance, so that they will only heat up to a very small degree when the heating elements are energized, and therefore the heating is restricted to the heating elements themselves. In contrast to this besides a mains adapter induction heaters comprise a high-frequency generator or frequency transformer which is connected to the induction coil and which should be positioned in a distance from the induction coil due to the influence of the alternating magnetic field of the induction coil onto its electrical components so that it cannot be integrated into the receptacle of a popcorn machine together with the induction coil without making the receptacle considerably larger. However, if the high-frequency generator or frequency transformer is accommodated stationary in the housing of the popcorn machine and is connected by leads with the induction coil an alternating magnetic field will be generated around each of the leads. These alternating magnetic fields will pose some problems as they can lead to eddy currents in adjacent metallic parts of the housing, which will result in an unwanted heating of these parts as well as in safety problems.

However it has been found that theses problems can be avoided if according to a preferred embodiment of the invention the stationary high-frequency generator or frequency transformer in the housing of the popcorn machine is connected to the induction coil by two leads extending in close proximity to each other, because in this case the high-frequency alternating magnetic fields generated around the two leads will essentially cancel out each other.

According to a further preferred embodiment of the invention the induction coil is disposed in a space between inner and outer bottom walls of the receptacle. The inner bottom wall, which is disposed above the induction coil, is made of an electrically conductive metal, wherein eddy currents will be generated by the high-frequency alternating magnetic field of the induction coil when the latter is energized with a high-frequency alternating current. Most preferably the inner bottom wall is made of a ferromagnetic metal with a high magnetic permeability. The lines of force of the magnetic field will then be concentrated in the inner bottom wall where strong eddy currents will be induced. Due to the relatively high electric resistivity the eddy currents will lead to a very fast heating of the bottom wall. Furthermore in ferromagnetic materials additional heat will be produced by an unsynchronous pole inversion of Weiss' domains.

In order to avoid an excessive heating of the induction coil due to the heat radiated downwardly by the inner bottom wall preferably the induction coil will be positioned in a distance from 10 mm to 30 mm beneath the inner bottom wall, the outer diameter of the induction coil being conveniently the same as the diameter of the inner bottom wall. Advantageously the induction coil consists of at least one spirally extending conductor which is mounted on a heat resistant flat support in parallel orientation to the inner bottom wall. In order to avoid that the alternating magnetic field will extend downwardly beyond the support preferably flux conducting pieces with a high magnetic permeability are attached to the lower surface of the support. In contrast to the inner bottom wall however the flux conducting pieces are made from an electrically isolating material and conveniently from ferrite in order to counteract an induction of eddy currents.

The outer bottom wall of the receptacle, which primarily serves as a shield to prevent touching of the induction coil and the leads, will be conveniently arranged in a small distance beneath the induction coil and advantageously is made of an electric isolator with dia- or paramagnetic characteristics. Preferably a heat-resistant plastics or ceramic material is used for the outer bottom wall that will resist the heat radiated downwardly from the inner bottom wall and will not heat up in the weak stray magnetic field generated below the induction coil.

In order to avoid an overheating of corn, fat and popcorn in the receptacle due to an overheated inner bottom wall of the receptacle the popcorn machine according to a further preferred embodiment of the invention has a temperature sensor for measuring the temperature of the inner bottom wall, the temperature sensor being conveniently in contact with the inner bottom wall and being disposed in the space between the inner and outer bottom walls.

The popcorn machine further comprises means for controlling or regulating the power supply to the induction coil and/or the frequency of the electric current supplied to the induction coil in dependency of the temperature of the inner bottom wall in order to keep the latter within an optimum temperature range.

As a measure to avoid an excessive heating of the induction coil and the outer bottom wall the outer bottom wall and/or a peripheral wall of the receptacle between the outer and inner bottom walls can be provided with vent openings. Eventually in addition a forced ventilation of the space between the outer and inner bottom walls by means of an electrically powered ventilator can be provided.

In order to avoid that the heating of the inner bottom wall is continued even though there is no more popcorn in the receptacle after the latter has been emptied preferably the popcorn machine comprises means for automatically switching off the power supply to the induction coil, which are triggered or activated as soon as the receptacle is pivoted from its horizontal working position into a slanted emptying position or as soon as a locking device of the receptacle is released or unlocked before pivoting the receptacle. After these means have been activated conveniently a switch has to be operated manually before a power supply to the induction coil is possible again.

In smaller popcorn machines where the receptacle is suspended above the collecting bowl in the warm-keeping room, the agitator will normally project into the receptacle from above and will be driven by a driving shaft of an electric drive motor mounted in the upper part of the housing above the receptacle. In contrast in larger popcorn machines with a receptacle mounted on a support pedestal above the collecting bowl the agitator will be driven by a drive motor via a drive shaft extending through the bottom wall into the receptacle. In this case the induction coil conveniently will have a central opening for the drive shaft. In order to avoid the heating of the drive shaft by the alternating magnetic field the drive shaft can be either made in this region and as well between the induction coil and the bottom wall of the receptacle of an electrically insulating dia- or paramagnetic material or can alternatively be surrounded there by a sheath of a electrically isolating ferromagnetic material, like ferrite.

In the following the invention will be explained with reference to two embodiments illustrated in the drawing. In the drawing:

Fig. 1 is a perspective view of a smaller popcorn machine with an induction heater;

Fig. 2 is an exploded perspective view of a heatable receptacle for popcorn making of the popcorn machine of Fig. 1;

Fig. 3 is an enlarged bottom view of the induction coil;

Fig. 4 is a cross sectional view of parts of a larger popcorn machine with an induction heater.

Like most machines for making popcorn from corn kernels, fat and eventually any further ingredients the popcorn machine 2 illustrated in Fig. 1 comprises a square housing 4, a lighted and heatable warm-keeping room 6 enclosed by the housing and having a collecting bowl (not visible) forming the bottom wall of the warm-keeping room 6 for receiving the finished popcorn, a heatable receptacle 8 accommodated inside the warm-keeping room 6, in which receptacle 8 the corn kernels, the fat and the eventual further ingredients can be heated until the corn kernels are popping, and a power driven agitator 10 for stirring the ingredients in the receptacle 8.

The housing 4 essentially consists of four side walls surrounding the sides of the warm-keeping room 6 and being made partially or wholly of glass, where at least one of the side walls can be opened for taking out popcorn from the warm-keeping room 6 or the collecting bowl respectively, a housing upper part 12 disposed above the warm-keeping room 6 and forming the roof of the warm-keeping room 6, and a housing bottom part 14 disposed beneath the warm-keeping room 6 or the collecting bowl respectively.

In the smaller popcorn machine 2 illustrated in Fig. 1 the heatable pot-shaped receptacle 8 is pivotably suspended in the upper part of the warm-keeping room 6, the receptacle 8 being articulated on one side to the housing upper part 12 through a supporting arm 16 with an articulating joint 18 having a horizontal pivot axle 20 whereas on the diametrically opposite side it is detachably supported by a supporting arm (not visible). Between this supporting arm and the receptacle a releasable locking mechanism 22 is provided which can hold the receptacle 8 in a horizontal working position illustrated in Fig. 1 in which position an opening of the receptacle 8 being closed by a lid 24 faces upwardly. After finishing one load of popcorn in the receptacle 8 the locking mechanism 22 can be unlocked or released by means of an unlocking lever 26 in order to turn the receptacle 8 around the pivot axle 20 into an emptying position in which position the opening of the receptacle 8 is slanted downwardly so that the popcorn in the receptacle 8 can be emptied into the collecting bowl of the warm-keeping room 6. The lid 24 of the receptacle 8 is provided in its center with an opening for a drive shaft 28 of the agitator 10. The upper end of the drive shaft 28 is coupled to a drive motor (not visible) in the housing upper part 12 whereas the free lower end of the drive shaft is equipped with agitator fingers or blades (not visible). In the horizontal working position the agitator fingers or blades project from above into the interior of the receptacle 8 so that the corn kernels in the receptacle 8 can be agitated while they are heated in order to provide for a uniform heating. The lid 24 rests loosely on an upper rim of the receptacle 8 so that it can be raised by the popcorn in the receptacle 8 once the volume of the contents of the receptacle 8 exceeds the volume of the receptacle 8 after the popping of the corn kernels. When the receptacle 8 is pivoted into the slanted emptying position the lid 24 will be retained by the drive shaft 28 so that the remaining popcorn can fall through the opening out of the receptacle 8.

For the heating of the receptacle 8 the popcorn machine 2 has an induction heater which comprises a stationary frequency transformer (not visible) accommodated in the housing upper part 12 and an induction coil 30 (Fig. 2) which is pivotable along with the receptacle 8 and is connected to the frequency transformer by leads 32.

As best shown in Fig. 2 the receptacle 8 consists essentially of a deeper pot-shaped outer receptacle 34, a somewhat shallower pot-shaped inner receptacle 36 and the flat induction coil 30 mounted on a support 38, which is disposed in a space between a planar circular bottom wall 42 of the outer receptacle 34 and a circular bottom wall 40 of the inner receptacle 36 and which is parallel to the two bottom walls 40 and 42. Furthermore beneath the bottom wall 40 of the inner receptacle 36 there is a temperature sensor 44 for measuring the temperature of the bottom wall 40.

The induction coil 30 comprises a spirally wound conductor 46 made from twisted copper wires, the conductor being positioned in a winding plane on the upper surface of the support 38 and being covered with a heat-resistant isolating resin. As can be best seen in Figs. 2 and 3, the support 38 consists of a flat disc 48 made from a heat-resistant plastics material which is provided with several through openings 50 for a better cooling of the spiral-shaped conductor 46. For its assembly to the inner receptacle 36 the disc 48 is provided with four radially protruding fixation lugs 52 each having a borehole. The boreholes will receive set screws 54 which can be screwed through the boreholes into threaded bores 56 in projections 58 of the inner receptacle 36 in order to mount the induction coil 30 in a desired distance from the bottom wall 40 of the inner receptacle 36. On the bottom surface of the disc 48 between the through openings 50 there are disposed a plurality of radially oriented elongated flux conducting pieces 52 made of an electrically isolating ferrite material with a high magnetic permeability, which will concentrate the magnetic field lines beneath the support 38 between its outer periphery and its center and will prevent the magnetic field from extending beyond the bottom surface of the disc 48.

From the outer and inner ends of the induction coil 30, which are close to the periphery and the center of the support 38 respectively, the conductor 46 extends through boreholes 54, 56 of the support 38 into a space between the support 38 and the bottom wall 42 of the outer receptacle 34 where the ends of the conductor 46 are connected to the leads 32.

The leads 32 are also made from twisted copper wire and have the same cross sectional area as the conductor 36. They extend from the outer receptacle 34 through a flexible hose 58 to the housing upper part 12 where their ends are connected to terminals of the frequency transformer. In order to prevent a heating of the hose 58 by the alternating magnetic field generated around the leads 32 the leads 32 extend in close proximity to each other through the hose 58 so that the two alternating magnetic fields will essentially cancel out each other. In addition the hose 58 is either made of non-conducting heat-resistant plastics material or alternatively of non-magnetic stainless steel.

The outer receptacle 34 comprises a cylindrical wall portion 60, at which wall portion close to the upper rim are fastened parts of the articulating joint 18 and the locking mechanism 22 as well as the unlocking lever 26, so that the latter can be grasped by a user in order to unlock and hold the receptacle 8 during its pivoting movement. The bottom wall 42 fixed to the lower end of the wall portion 60 is made from a non-conducting para- or diamagnetic material, for example ceramics or a heat-resistant plastics material, like polycarbonate. In the bottom wall 42 and in the lower rim of the wall portion 60 there are vent openings 62, so that the heat radiating downwardly from the heated bottom wall 40 of the inner receptacle 36 can be dissipated from the space between the bottom walls 40 and 42 by air circulation. In connection with a measurement of the temperature of the bottom wall 40 of the inner receptacle 36 by means of the temperature sensor 44 and a control of the power supply to the induction coil 30 as a function of the measured temperature an overheating of the induction coil 30 and the two bottom walls 40, 42 as well as of the fat and the corn kernels or the finished popcorn in the receptacle 8 respectively can be avoided and the temperature of the bottom wall 40 can be maintained within an optimum narrow temperature range.

The inner receptacle 36, and particularly the bottom wall 40 of the inner receptacle 36, is made of magnetic stainless steel or another ferromagnetic metal with a high magnetic permeability. With the aid of the set screws 54 the bottom wall 40 can be disposed in a desired distance of between 20 to 30 mm above the induction coil 30. This distance ensures that the bottom wall 40 on one hand will protrude far into the alternating magnetic field generated by the induction coil 30, however that on the other hand an overheating of the induction coil 30 by the heat radiated downwardly from the bottom wall 40 during the heating of the receptacle 8 is avoided. The temperature sensor 44 is a contact sensor formed as an eyelet which is fastened by means of a nut (not shown) to a screw 64 protruding beyond the lower surface of the bottom wall 40.

The housing lower part 14 of the popcorn machine 2 in Fig. 2 can comprise one or more heating elements (not shown) of a resistance heater serving for heating the warm-keeping room 6, whereas the housing upper part 12 encloses, besides the drive motor for the agitator 10, a mains adapter (not shown) connectable to the mains, the frequency transformer for transforming the frequency of the alternating current from the mains into a frequency of about 50 to 60 kHz, and a control unit (not visible) for controlling the induction heater by switching on and off the power supply to the induction coil 30.

The control unit serves to supply the induction coil 30 with power from the frequency transformer after the popcorn machine 2 has been manually switched on by actuation of a switch on an operating panel disposed at the rear of the housing upper part 12 after a load of corn kernels and fat has been filled into the inner receptacle 36. After having been switched on the frequency transformer will generate an alternating current with a frequency of 50 to 60 kHz which current is fed to the induction coil 30 whereby the induction coil 30 will generate a alternating magnetic field with the same frequency. The alternating magnetic field induces eddy currents in the bottom wall 40 of the inner receptacle 36 whereupon the latter will heat up quite fast as it has only a relatively small wall thickness of 2 to 3 mm. Because beneath the induction coil there is no electrically conductive material and because the magnetic force lines of the alternating magnetic field are concentrated and conducted by the magnetic flux conducting pieces 52 made of ferrite from the outer periphery of the support 38 to the center thereof there will occur no heating up beneath the induction coil 30. However due to the heating of the upper bottom wall 40 heat will be radiated downwardly into the space which will then be dissipated by the air circulating through the vent openings 62.

When the temperature of the bottom wall 40 rises above a predetermined upper temperature limit of more than 250°C, preferably of about 210°C to 220°C, and when this temperature increase is detected by the temperature sensor 44 and transmitted to the control unit the latter will switch off the power supply to the induction coil 30 for a short period of time, until the temperature of the bottom wall 40 has fallen again below a lower temperature limit of less than 150°C, preferably about 180°C to 190°C. In this temperature range of the bottom wall 40 there will occur an optimum popping of the corn kernels in the receptacle 8 because the corn kernels will then be heated neither too fast nor too slow. The temperature sensor 44 is connected to the control unit by signal lines 66 extending through the hose 58 together with the leads 32.

As also best illustrated in Fig. 2, in the vicinity of the part of the locking mechanism 22 mounted to the wall portion 60 of the outer receptacle 34 a switch 68 is mounted to the support arm of the housing 4. The switch 68 may be for example in the form of a contact switch, a solenoid switch or a proximity switch and will interrupt the power supply to the induction coil 30 when the unlocking lever 26 is actuated by a user for unlocking the locking mechanism 22 in order to be able to turn the receptacle 8. This will ensure that the induction coil 30 will be energized only when the receptacle 8 is in its working position illustrated in Fig. 1. The switch 68 is connected to the control unit in such a way that the induction coil 30 can be energized again only after a switch on the operating panel has been manually operated.

In larger popcorn machines 2 the receptacle 8 is not suspended from the housing upper part12 like in the popcorn machine 2 described before. As illustrated in Fig. 4 instead the receptacle 8 is mounted on a supporting pedestal 70 protruding upwardly beyond a collecting bowl (in Fig. 4 not illustrated) of the popcorn machine. The receptacle 8 can be turned around a horizontal pivot axle 72 disposed beneath the receptacle 8 and laterally of the supporting pedestal 70. The receptacle 8 also consists of an outer receptacle and an inner receptacle 74 and 76 respectively which are separated by a space 78 from each other. Like the inner receptacle 36 in Fig. 2 the inner receptacle 76 has a thin bottom wall 80 made of ferromagnetic metal with a high magnetic permeability, whereas the bottom wall 82 of the outer receptacle 74 is made of a heat-resistant non-conducting dia- or paramagnetic material.

To the top the receptacle 8 is closed by a fixed lid 84. At one side the receptacle 8 has a dispensing channel 86 situated somewhat below the lid 84 and closed by a pivotable flap 88. The flap 88 is maintained in its closed position by counterweights 90 until the pressure of the finished popcorn in the receptacle 8 will force it upwardly into an open position as soon as the receptacle 8 is completely filled with popcorn. A part of the popcorn can then be dispensed through the dispensing channel 86 into the collecting bowl, which can disposed in a warm-keeping room like the one in the popcorn machine of Fig. 1.

The agitator 92 of the receptacle 8 illustrated in Fig. 3 comprises a drive motor 94 disposed beneath the receptacle 8 inside the supporting pedestal 70 and a two part drive shaft the vertical lower part 96 of which is journalled in the supporting pedestal 70 whereas the upper part 98 is journalled in a bearing sleeve 100 extending through the bottom walls 80, 82 of the receptacle 8 and can be pivoted together with the receptacle 8. The two parts 96, 98 are coupled at 102 by means of a coupling which will be automatically brought in and out of engagement when the receptacle 8 is pivoted. The agitator 92 comprises a plurality of radial agitator fingers or blades 104 which in the vicinity of the bottom wall 80 and in a larger distance from the bottom wall 80 respectively project from a rotatable cover cap 106. The cover cap 106 is attached to the upper part 98 of the drive shaft by means of a pin 108 and surrounds the bearing sleeve 100, which projects into the receptacle 8.

Here the fat needed for the popcorn making is supplied in liquid form through an oil delivery tube 110 into the receptacle 8.

The induction heater comprises a frequency transformer 112 connected to a mains adapter (not illustrated) and accommodated inside the supporting pedestal 70 and an induction coil 116 disposed on a support 114 in the space 78 between the bottom walls 80, 82 of the inner and outer receptacles 74, 76 and being pivotable along with the receptacle 8. Like in the popcorn machine 2 of Figs. 1 and 2 the frequency transformer 102 is connected to the induction coil 116 by leads 118 which, after their exit from the supporting pedestal 70, extend through a flexible hose 120 to the outside of the outer receptacle 78 and from there into the space 78.

The induction coil 116 and the support 114 essentially have the same configuration as the ones shown in Fig. 2, except that the support 114 and the induction coil 116 surround a central opening. In the opening a retaining ring 122 is fastened to the support 114 which retaining ring is slid onto the bearing sleeve 100 in a distance below the bottom wall 80 of the inner receptacle 74 and is fixedly connected to the bearing sleeve 100, so that the rotatable upper part 98 of the drive shaft will extend axially through the opening of the support 114 and the induction coil 116. Like the flux conducting pieces 124 on the bottom surface of the support 114 the retaining ring 122 can be made from a ferrite material, in order to avoid that the force lines of the alternating magnetic field extend up to the bearing sleeve 100 and the drive shaft for preventing the heating of the bearing sleeve 100 and the upper part 98 of the drive shaft. Alternatively the bearing sleeve 100 and the upper part 98 of the drive shaft can be made of an non-conducting dia- or paramagnetic material, for example a plastics materials, so that they do not heat up in the alternating magnetic field extending through the opening.

In order to avoid the heating of the support 114 and the induction coil 116 by the heat radiated downwardly from the bottom wall 80 a ventilator 124 is disposed in the space 78, which ventilator will draw in air from below through an opening into the space 78 and blow it against the bottom surface of the support 114. From there the air will flow along the bottom surface of the support 114 to vent openings 126 on the opposite side of the outer receptacle 76. For the cooling of the frequency transformer 112 there is also a ventilator 128 in the supporting pedestal 70.

Like with the receptacle 8 in Fig. 2 the temperature of the bottom wall 80 will be measured by a temperature sensor (not shown) and the power supply to the induction coil 116 will be controlled as a function of the measured temperature. When the receptacle 8 is turned over the power supply will be interrupted as well.

Claims

1. A popcorn machine having a housing, a receptacle for heating corn and fat introduced into the receptacle for popcorn making, wherein the receptacle is pivotable with respect to the housing for emptying, and an induction heater comprising an induction coil disposed beneath the receptacle for generating a high-frequency alternating magnetic field, characterized in that the induction coil is pivotable along with the receptacle, in that the induction heater comprises a high-frequency generator or frequency transformer stationary accommodated in a housing of the popcorn machine and in that the high-frequency generator or frequency transformer is connected to the induction coil by two leads extending in close proximity of each other.

2. A popcorn machine according to claim 1, characterized in that between the receptacle and the housing or inside the housing the leads extend in close proximity of each other.

3. A popcorn machine according to claim 2, characterized in that between the receptacle and the housing the leads extend through a flexible hose made of a dia- or a paramagnetic material.

4. A popcorn machine according to any one of claims 1 to 3, characterized in that the induction coil is

disposed in a space between inner and outer bottom walls of the receptacle.

5. A popcorn machine according to any one of claims 1 to 4, characterized in that the induction coil is disposed in a distance of 10 to 30 mm beneath an inner bottom wall of the receptacle.

6. A popcorn machine according to any one of claims 1 to 5, characterized in that the induction coil is disposed on a flat disc-shaped support.

7. A popcorn machine according to claim 6, characterized by radial flux conducting pieces on the bottom surface of the support.

8. A popcorn machine according to any one of claims 4 to 7, characterized by a temperature sensor for measuring the temperature of the inner bottom wall.

9. A popcorn machine according to claim 8, characterized in that the temperature sensor is in contact with the inner bottom wall.

10. A popcorn machine according to any one of claims 4 to 9, characterized by means for controlling the power supply to the induction coil or the frequency of the current supplied to the induction coil in dependency of the temperature of the inner bottom wall.

11. A popcorn machine according to any one of claims 4 to 10, characterized in that the inner bottom wall is made of a ferromagnetic metal.

12. A popcorn machine according to any one of claims 4 to 11, characterized in that the outer bottom wall is made of a non-conducting heat-resistant material.

13. A popcorn machine according to any one of claims 4to 12, characterized in that the outer bottom wall or an outer wall of the receptacle are provided with vent openings.

14. A popcorn machine according to any one of claims 4to 13, characterized by means for a forced ventilation of the space between the inner and outer bottom walls.

15. A popcorn machine according to any one of claims 4 to 14, characterized by means for interrupting the power supply to the induction coil as the receptacle is pivoted from a horizontal working position into a slanted emptying position.

16. A popcorn machine according to claim 15, characterized in that after an activation of the means a switch must be operated, before a power supply to the induction coil is possible again.

17. A popcorn machine according to any one of claims 4 to 16, characterized by an agitator having a drive shaft extending into the receptacle from below which extends through a central opening of the induction coil.

18. A popcorn machine according to claim 17, characterized in that at least in the region of the induction coil the drive shaft is made of a non-conducting dia- or paramagnetic material.

19. A popcorn machine according to claim 17, characterized in that at least in the region of the induction coil the drive shaft is surrounded by a sleeve made of a non-conducting ferromagnetic material.

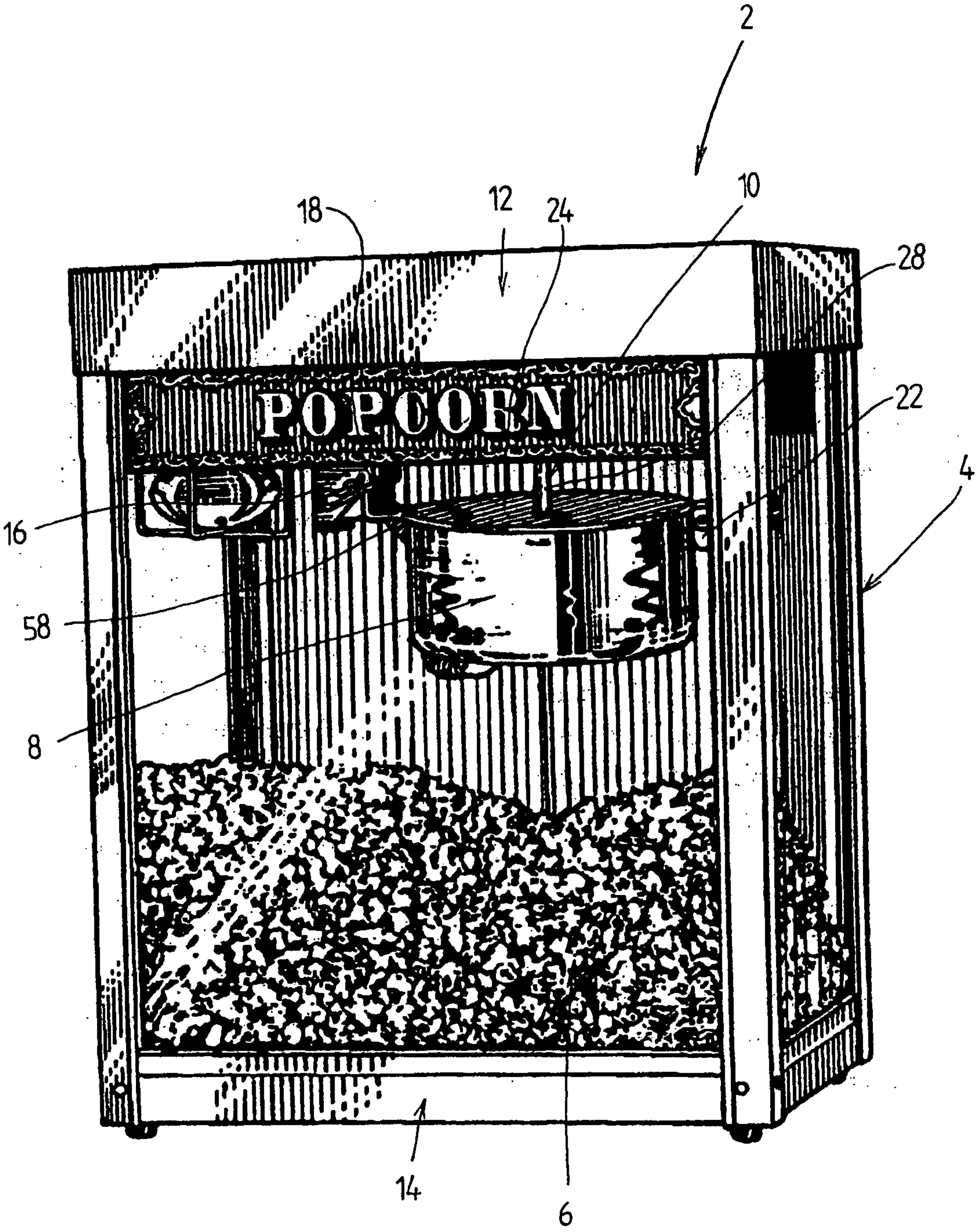


Fig. 1

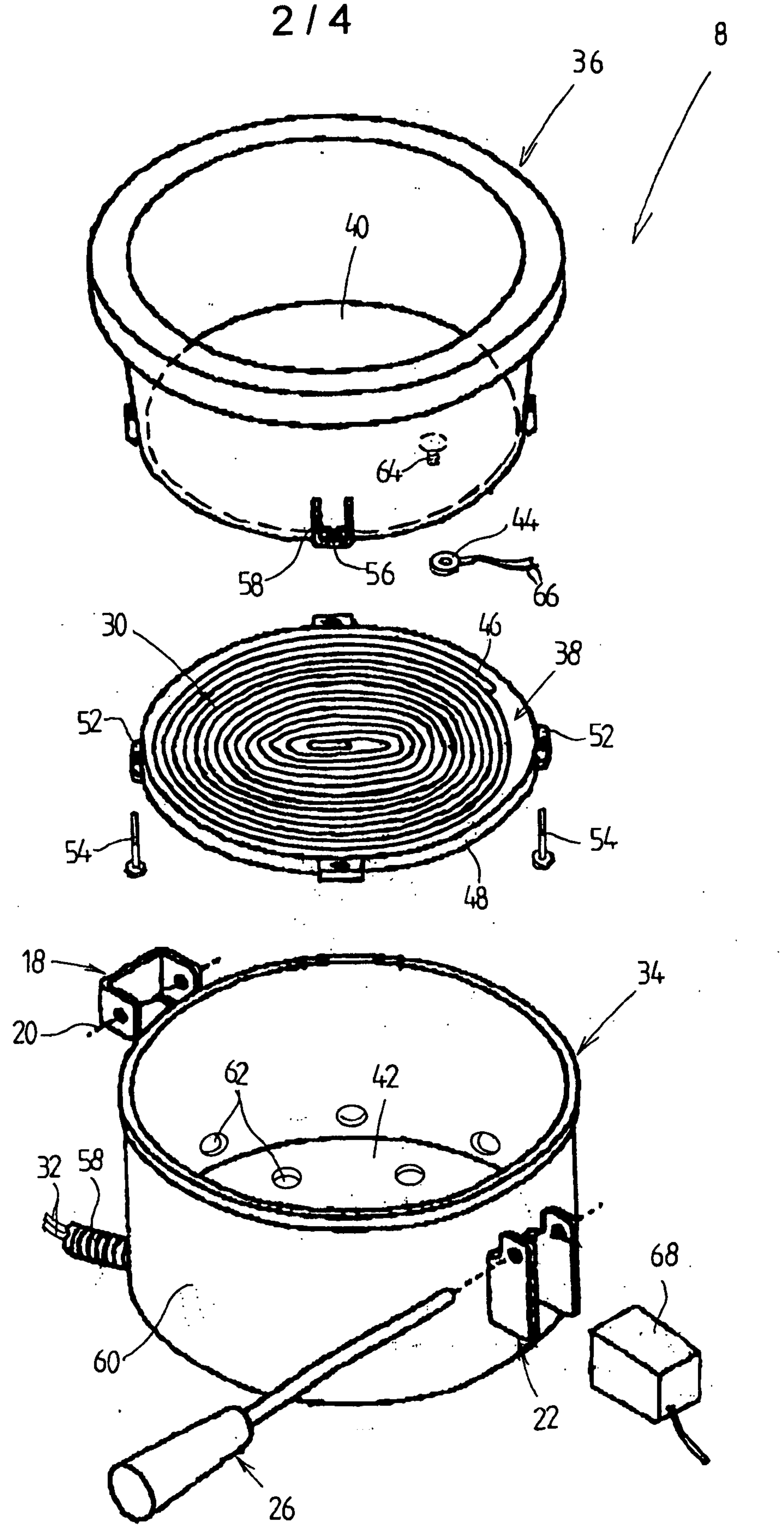

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Fig. 2

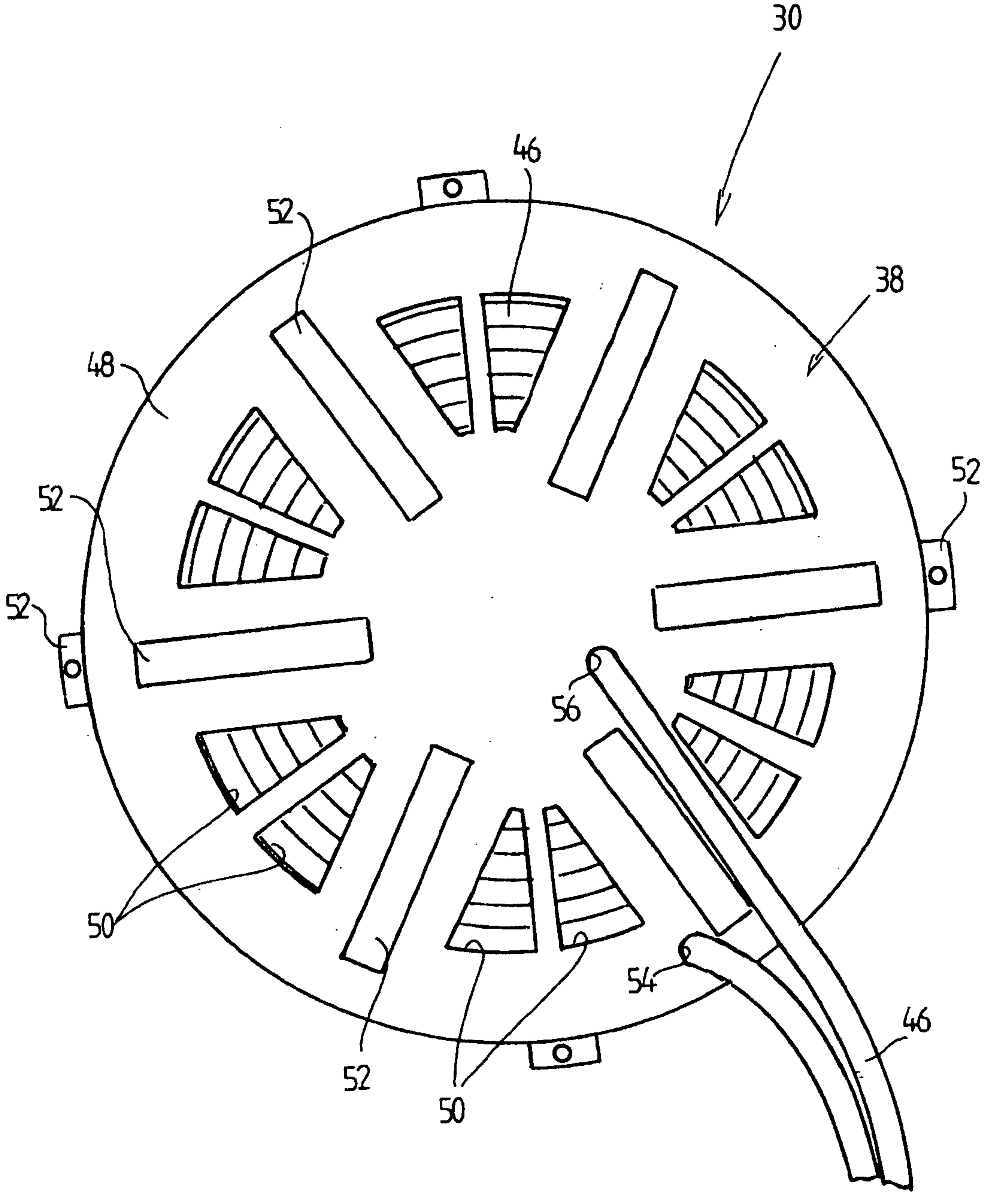

Fig. 3

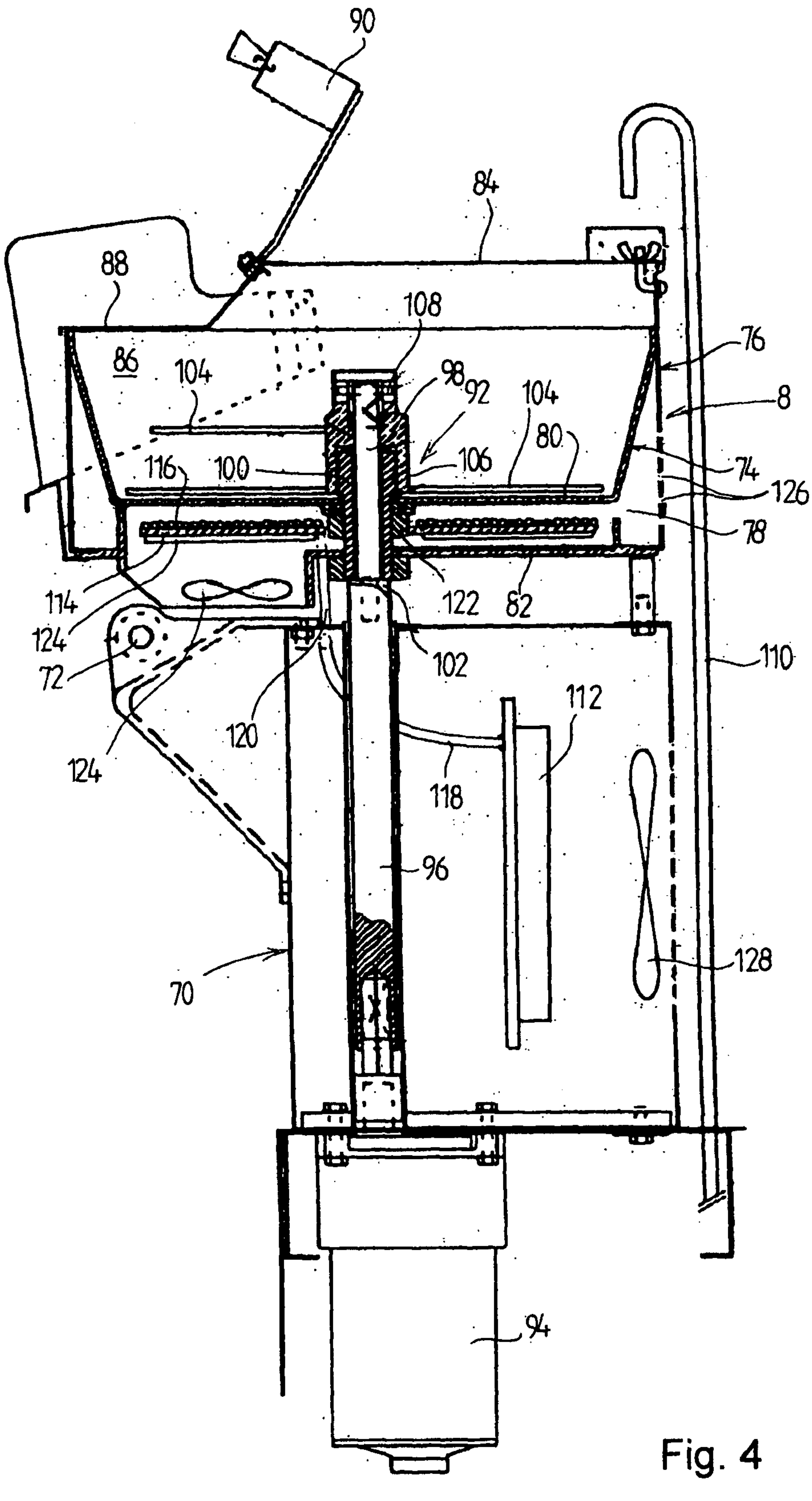
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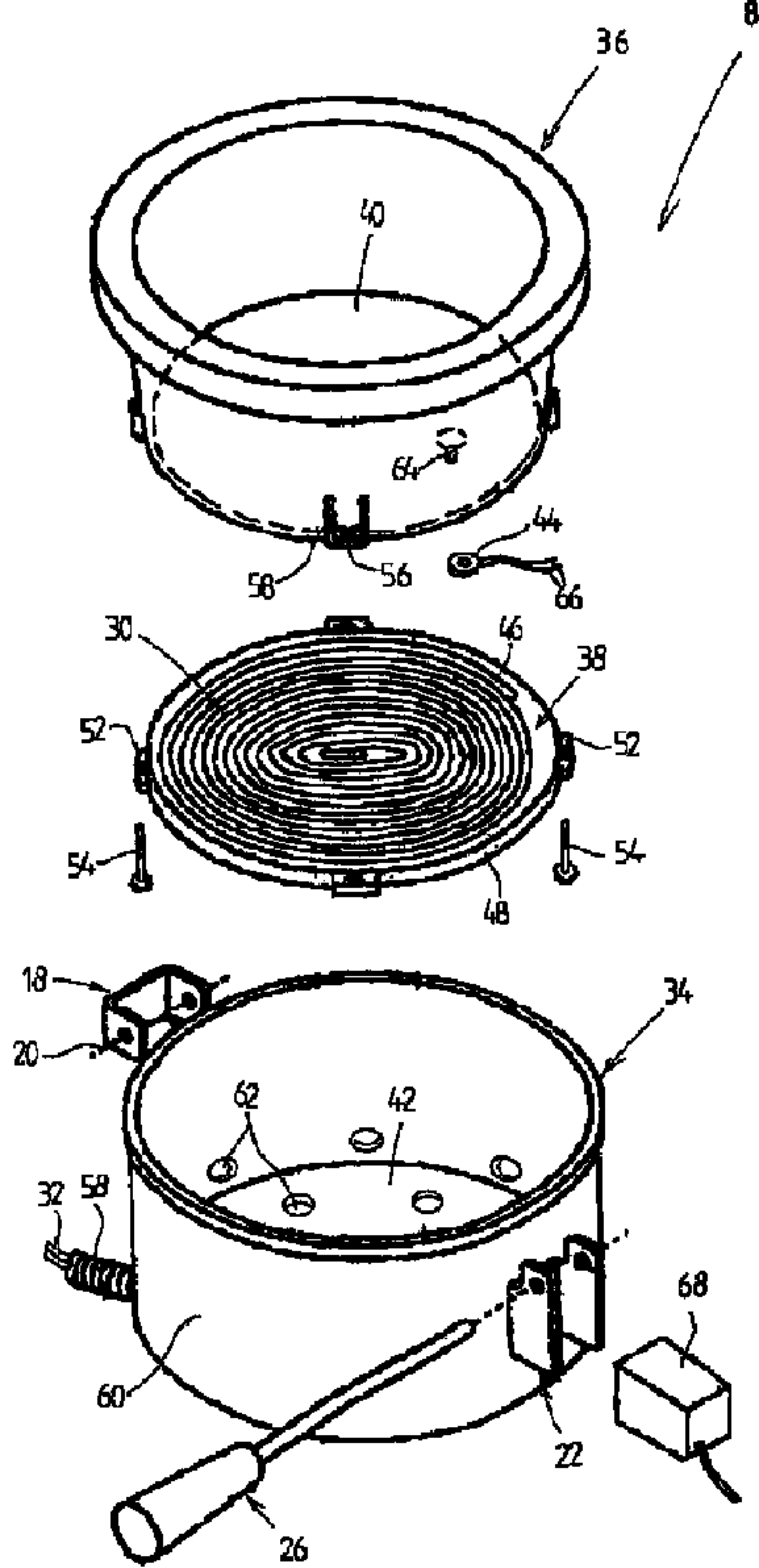
Fig. 4



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