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(57) Abstract :
MULTI-FUNCTIONAL INDUCTION FURNACE FOR HEATING AND MELTING OF MATERIALS METHOD AND THEREOF Multi-functional electrical induction furnace is disclosed. The invention provides an induction furnace comprising an electrically non-conductive crucible defining a melting cavity; an electrically conductive member disposed adjacent the crucible; an induction member for inductively heating materials within the melting cavity; and a portion of the melting cavity being closer to the induction member than is the conductive member. Present invention comprising with primary and secondary water reservoirs, pumps, heat exchanger, upper and bottom induction shell. Including the major parts of this invention are crucible (1), holder (2), rotation enabler (3), crucible sliding screw bar (4), actuator (5), clip (6), base body (14), base body sliding handle (31), base body rolling motion enabler (32), central controller (36). Meanwhile having adjustable height and easy transferable of proposed utility model is capacity of crucible of 20 kg and minimum of 5 kg for melting and as well as heating of conductive or non-conductive materials. Moreover, melting and power supply factors are taken into account for excellent heating or melting the induction coil and conductive materials. Also, induction heating device includes a power source and an induction coil disposed around the length of the susceptor with multiple coil sections.

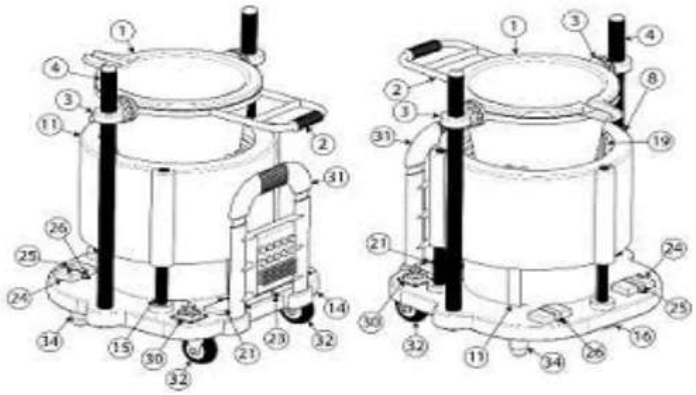

Figure 4: Isometric auxiliary view in assembled state

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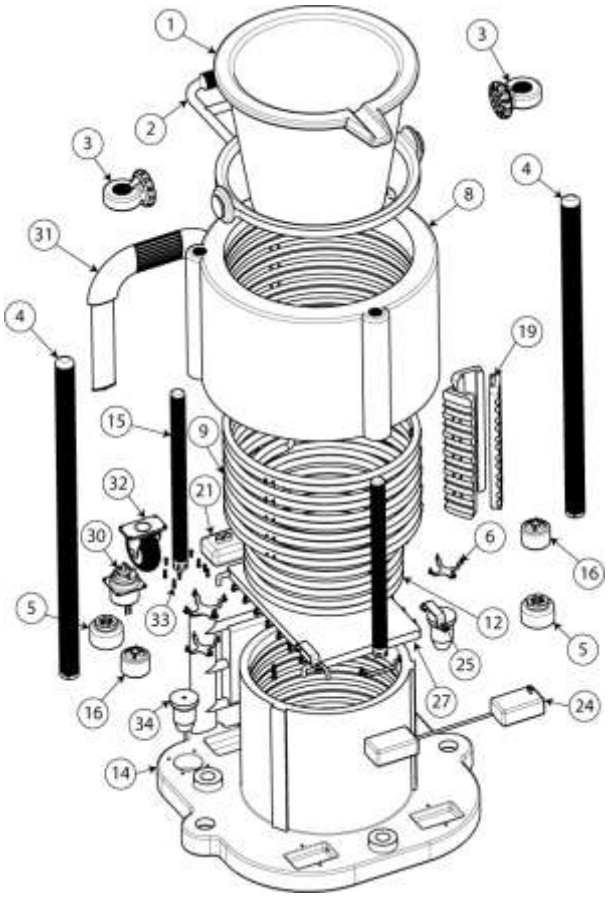

Figure 1: Fully exploded view

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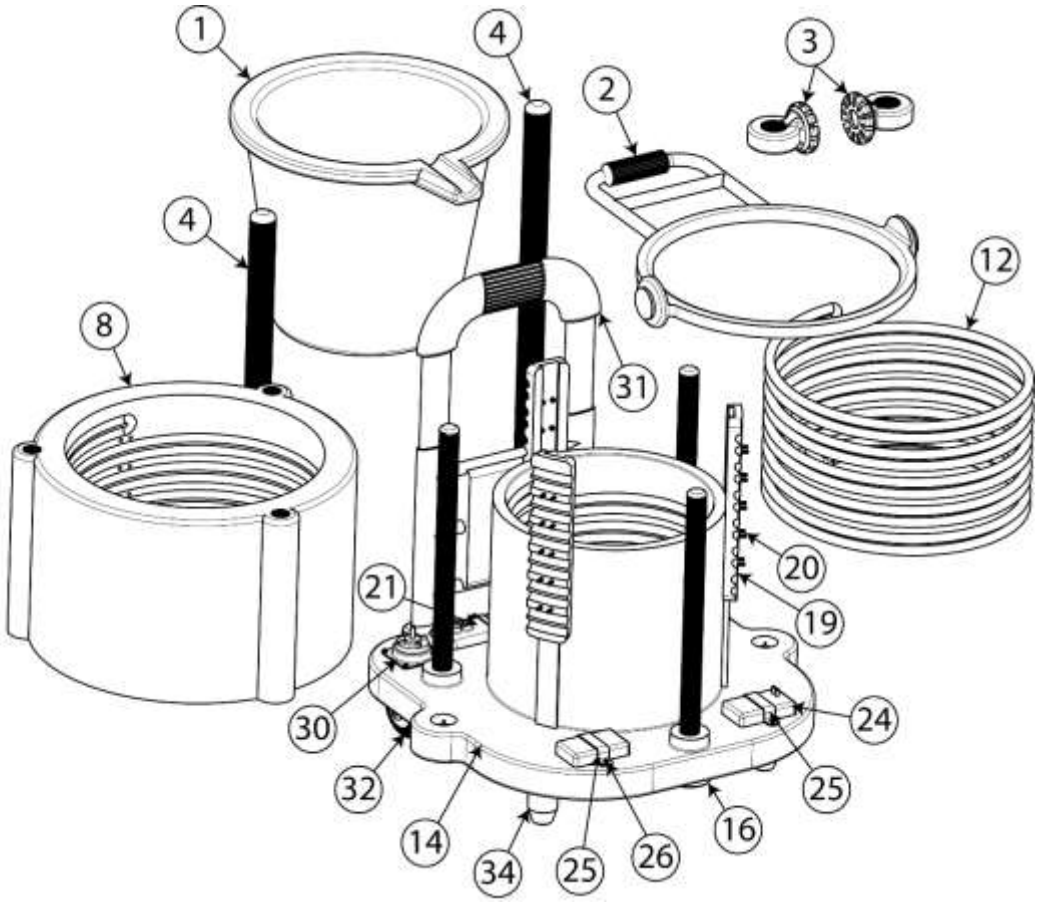

Figure 1: Upper portion partial exploded view

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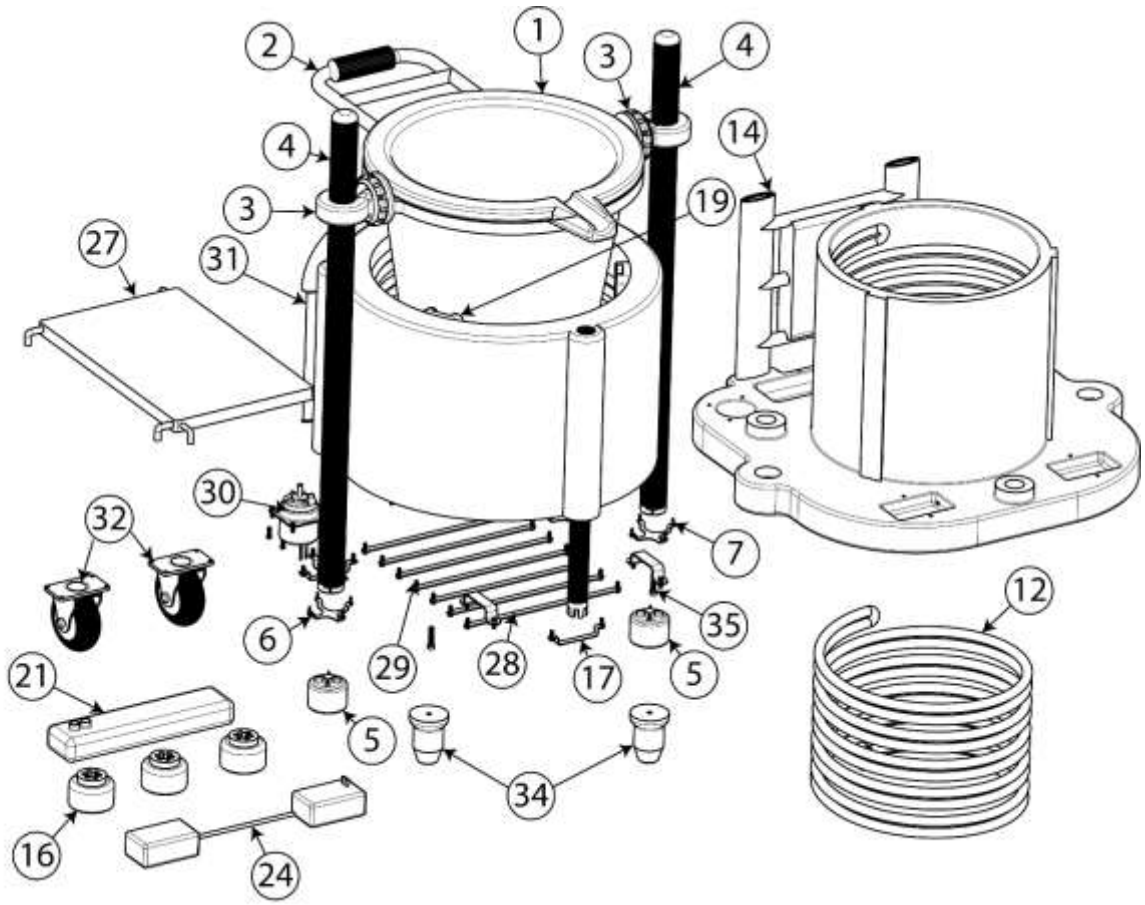

Figure 2: Bottom portion partial exploded view

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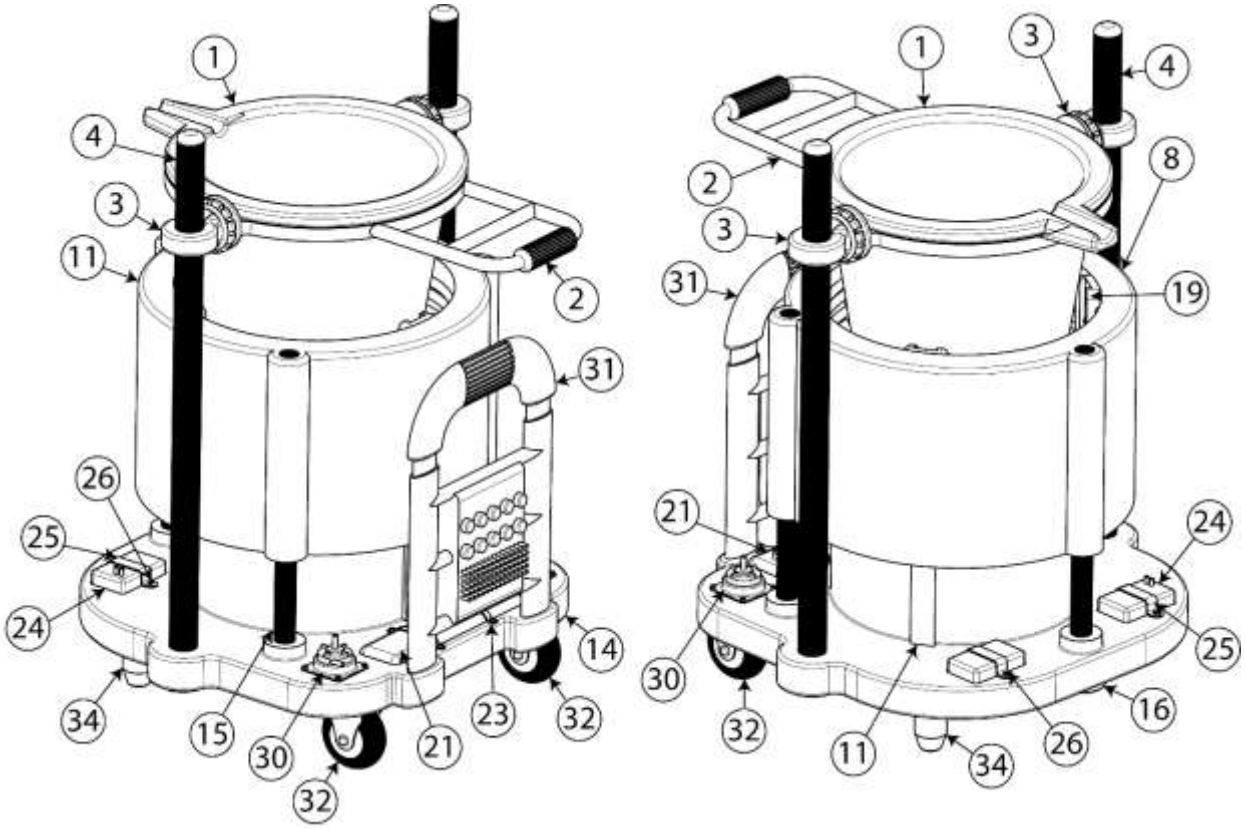

Figure 4: Isometric auxiliary view in assembled state

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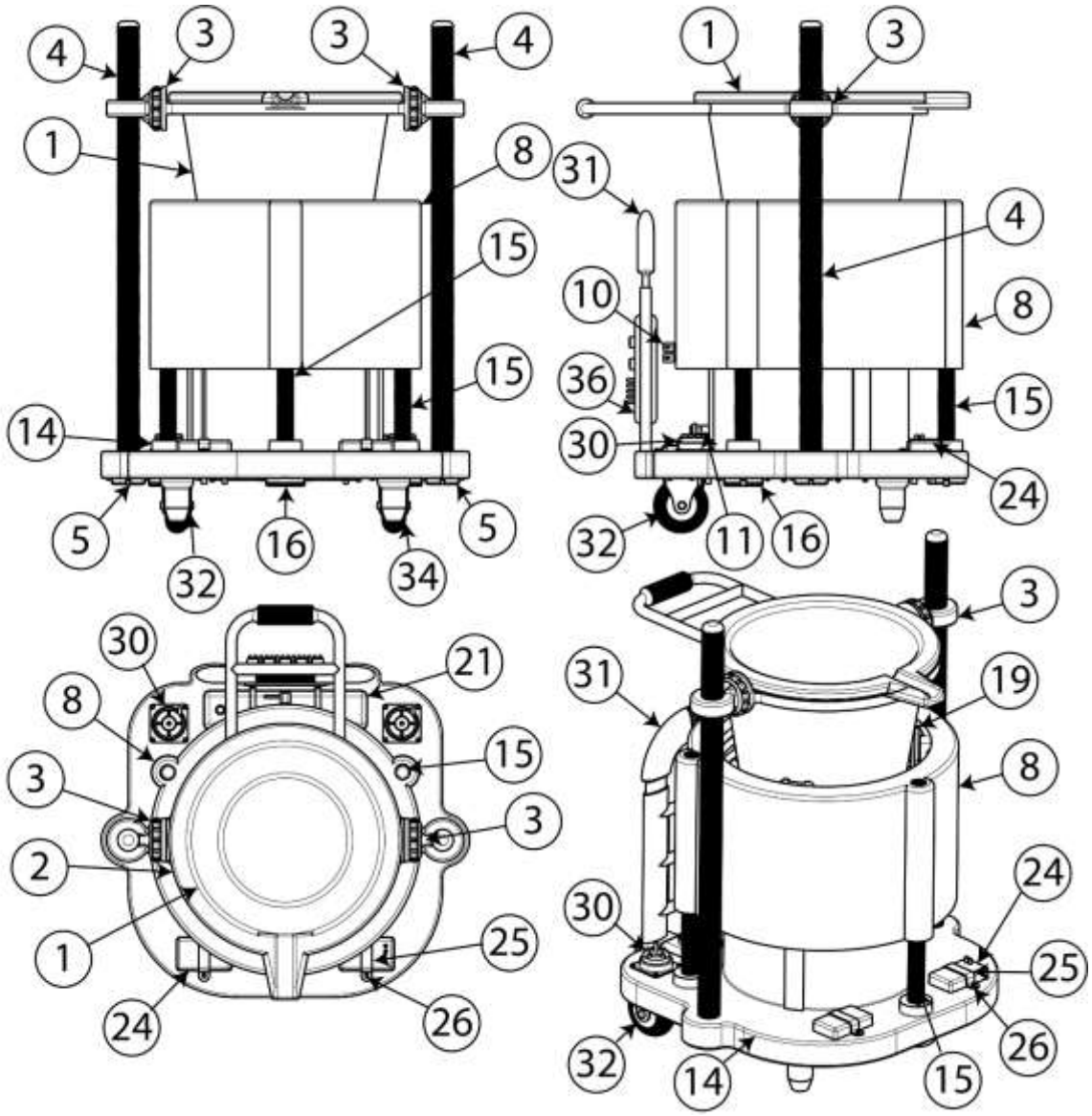

Figure 5: Front, top, side and isometric view in assembled state

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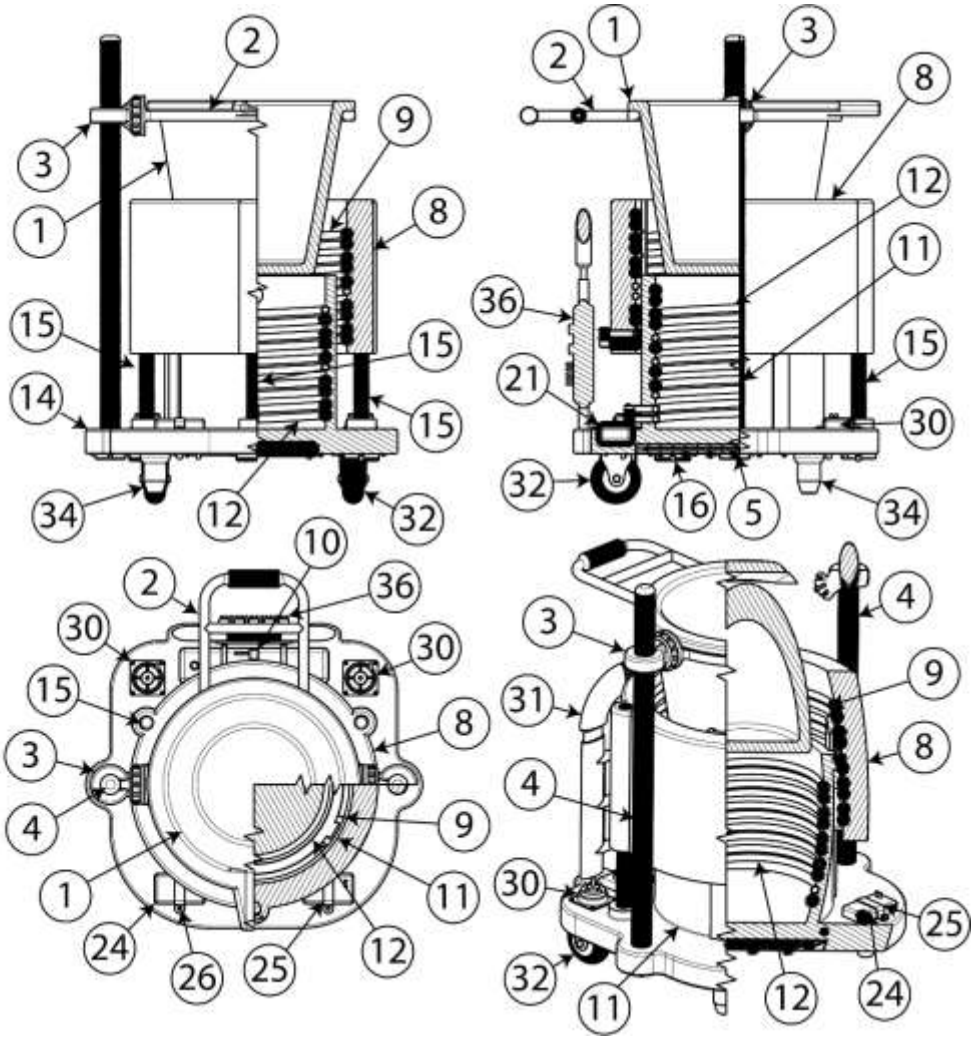

Figure 6: Broken front, top, side and isometric view in assembled state

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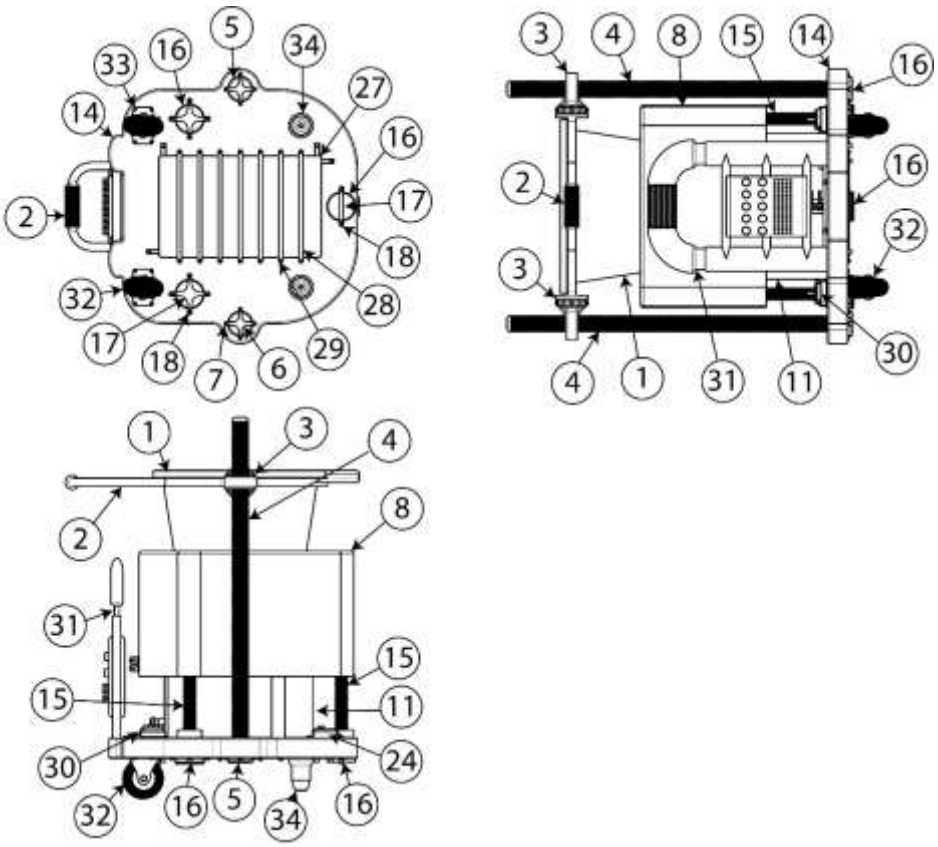

Figure 7: Bottom, top and side view in assembled state

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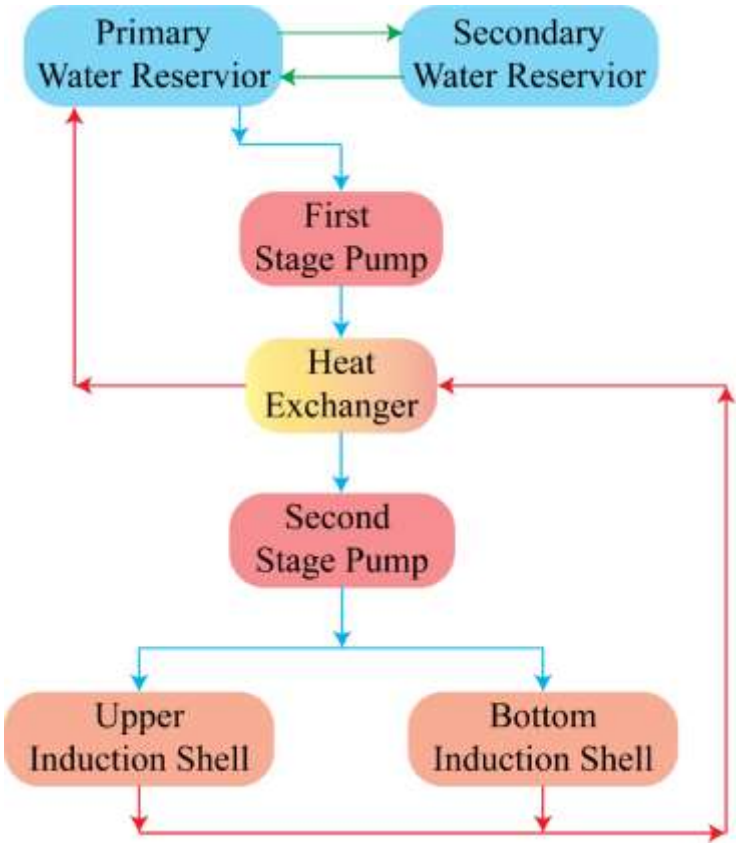

Figure 8: Water flow and connection diagram

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FORM 2

THE PATENTS ACT 1970
(39 of 1970)
&
THE PATENT RULES, 2003
COMPLETE SPECIFICATION
(See section 10 and rule 13)

1. **TITLE OF THE INVENTION:** MULTI-FUNCTIONAL INDUCTION FURNACE FOR HEATING AND MELTING OF MATERIALS METHOD AND THEREOF
2. **Applicant(s)**

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3. PREAMBLE OF THE DESCRIPTION

The following specification particularly describes the invention and the manner in which it is to be performed.

FIELD OF INVENTION

The invention relates to a novel melting process of metal objects and more particularly, this invention reveals a kind of using novel portable and height adjustable induction melting furnace structure for melting the metal objects comprising with crucible (1), holder (2), rotation enabler (3), crucible sliding screw bar (4), actuator (5), actuator clip (6), fasteners (7), upper furnace shell (8), upper furnace coil (9), connectors (10), bottom furnace shell (11), coil (12), connectors (13), base body (14), upper furnace shell sliding screw bar (15), actuator (16), clip, fastener (17, 18), grooved slider, fasteners (19, 20), primary water reservoir (21), clip, fastener (22, 23), secondary water reservoir (24), reservoir, clip, fastener (25, 26), heat exchanger (27), heat exchanger clip (28), fasteners (29), water pump (30), base body sliding handle (31), base body rolling motion enabler (32), fastener (33), base supporter (34), fastener (35), central controller (36), moreover, melting and power supply factors are taken into account for excellent heating or melting the induction coil and insulating properties owing to using an insulating material as an outer cover of utility model.

USE OF THE INVENTION

The invention induction heating or melting occurs in an electrically conducting materials when such materials are placed in an electrically non-conductive crucible by an alternating current (AC) flowing in an induction heating upper and bottom furnace coil (9, 11). Eddy currents induced in the material create a source of heat in the material itself. Induction heating can also be used to heat or melt non-electrically conducting materials, such as silicon-based, non-electrically conductive fibers. Subsequently, eddy currents cannot to be induced in non-electrically conductive materials, they cannot be heated or melted directly by induction. However, the non-electrically conductive material can be placed within an electrically conductive enclosure defined as a susceptor. One type of susceptor is a cylinder through which the non-electrically conductive material can be passed. In a similar manner an

induction coil disposed around the refractory crucible of an induction furnace, an induction coil can be placed around a susceptor so that the electromagnetic field generated by the coil will pass through the susceptor. Unlike a refractory crucible, the susceptor is electrically conductive. An induction furnaces are generally used to heat and melt the metals and other conductive or non-conductive materials. The invention provides an induction furnace comprising an electrically non-conductive crucible defining a melting cavity; an electrically conductive member disposed adjacent the crucible. Present invention comprising with primary and secondary water reservoirs, pumps, heat exchanger, upper and bottom induction shell. Including the major parts of this invention are crucible (1), holder (2), rotation enabler (3), crucible sliding screw bar (4), actuator (5), clip (6), base body (14), base body sliding handle (31), base body rolling motion enabler (32), central controller (36). Meanwhile having adjustable height and easy transferable of proposed utility model is capacity of crucible of 20 kg and minimum of 5 kg for melting and as well as heating of conductive or non-conductive materials. Moreover, melting and power supply factors are taken into account for excellent heating or melting the induction coil and conductive materials. Induction heating device includes a power source and an induction coil disposed around the length of the susceptor with multiple coil sections (two coil section is used in present invention). Also, the present invention provides a method of heating and melting process by comprising the steps of placing the material within a melting cavity of an electrically non-conductive crucible.

BACKGROUND OF THE INVENTION

US6542535B2: Oleg S. Fishman Vladimir V. Nadot Vitaly A. Peysakhovich John H. Mortimer, an induction furnace system has an active induction coil surrounding a crucible. A passive induction coil also surrounds the crucible. The passive induction coil is connected in parallel with a capacitor to form an L-C tank circuit. A source of ac current is provided to the active induction coil to produce a magnetic field that inductively heats and melts an

electrically conductive material in the crucible. The magnetic field also magnetically couples with the passive induction coil to induce a current in the passive induction coil. This induced current generates a magnetic field that inductively heats and melts the material. The resistance of the L-C tank circuit is reflected back into the circuit of the active induction coil to improve the overall efficiency of the induction furnace system. The crucible may be open-ended to allow the passage of the electrically conductive material through the crucible during the heating process.

US6831939B2: James E. BratinaFred M. Fehsenfeld, Sr., a method of operating an induction furnace so as to receive electric arc furnace (EAF) dust, basic oxygen furnace (BOF) sludge/dust and/or other iron and volatile metals containing materials as a feed stream on a batch, continuous or semi-continuous basis together with a iron-containing material feed, and therefrom produce an iron-containing hot metal or pig iron product while recovering iron value from the feed materials and recovering volatile metal components contained in the feed materials.

US7814767B2: Giacomo Stefano Roba Massimo Nutini Franco Veronelli, an induction furnace capable of drawing large diameter preforms of up to 130 mm is described. The induction furnace has top and bottom chimneys surrounding the entire preform during operation of the furnace with an inert conditioning gas which is introduced into the top chimney and flows downward through the furnace body and bottom chimney without significant turbulence. A distributor ring inside the top chimney redirects flow from a circumferential direction to a downward direction. The top chimney also includes a resilient seal to releasably hold the top of the preform. The bottom chimney has a smoothly decreasing cross-sectional area preventing turbulence at the furnace exit. The furnace insulation is preferably a rigid self-supporting graphite cylinder. A method of drawing large diameter

preforms either to an optical fiber or to a preform of smaller diameter using such a furnace is also described.

US4174462A: Michael L. Pearce, an induction furnace for high temperature continuous melting applications utilizes low frequency induction heating of novel graphite susceptor systems and includes means for varying both the amount of power and the distribution of power over the susceptor in order to maintain continuous pollution-free melting of the raw material over a range of melt rates while maintaining constant tap temperature. The furnace has a long campaign life, short start-up and shut-down times, and low operating cost.

US20030103546A1: Louis Fourie, an induction-heated furnace is disclosed. The furnace comprises a shell lined with refractory material and has walls and a floor. At least one induction heater is located in the floor of the furnace, the induction heater communicating with the interior of the furnace through a throat. The throat length is a substantial part of the service length of the induction heater. The invention also discloses structures in the induction heater throat that aids the distribution of molten metal in the furnace.

US4740989A: Othmar Steipe Harald Berger, a plant for the production of steel from scrap and optionally fluxes include a shaft furnace section having a bottom to receive a liquid sump of pre-melt and heating means laterally entering into the lower part of its interior. A hearth type furnace section is integrally connected with the shaft furnace section, into which the pre-melt is transferable from the shaft furnace section. In order to produce steel from scrap without addition of pig iron and with an energy supply as low as possible, the lower part of the shaft furnace section is designed to diverge downwardly with respect to the upper part receiving the scrap column, the heating means disposed in this lower part are designed as plasma burners, the hearth type furnace section follows immediately upon the lower part of the shaft furnace section, and the hearth type furnace section includes at least one further

heating means operated with electric energy for the treatment of the pre-melt transferred from the sump of the shaft furnace section, in particular an electric arc aggregate.

SUMMARY OF THE INVENTION

The induction heating or melting furnaces are well known in the art. However, there are a variety of obstacle related to the inductive heating and melting of conductive or non-conductive materials. Many prior art induction furnaces utilize a conductive crucible such that an induction coil with the crucible to transfer energy directly to the crucible to heat the crucible. Heat is then transferred from the crucible to the material to be melted through thermal conduction. In certain cases, the induction frequency and the thickness of the crucible wall may be selected so that a portion of the electromagnetic field from the coil allows coupling with any electrically conductive material inside the crucible to heat the material directly. An induction coil disposed around the refractory crucible of an induction furnace; an induction coil can be placed around a susceptor so that the electromagnetic field generated by the coil will pass through the susceptor. The present invention relates to induction heating or melting as well as an improved induction furnace quality. In more particularly, the invention relates to an induction furnace for heating or melting materials not allowing to inductive heating at lower temperatures but is allowing to inductive heating at higher temperatures, especially upon melting.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1: Fully exploded view

Figure 2: Upper portion partial exploded view

Figure 3: Bottom portion partial exploded view

Figure 4: Isometric auxiliary view in assembled state

Figure 5: Front, top, side and isometric view in assembled state

Figure 6: Broken front, top, side and isometric view in assembled state

Figure 7: Bottom, top and side view in assembled state

Figure 8: Water flow and connection diagram

DETAILED DESCRIPTION OF THE INVENTION

This invention disclosed the utilization of 20 Kg capacity of graphite crucible (1). The size of the crucible can be varied with varying the size of the crucible holder, the minimum amount is 5 Kg of crucible can be incorporate with proposed design furnace. Crucible holder (2), is basically a ring rounded the crucible with handle for pouring the melted metal out from the crucible. The material of the holder must consist high temperature resistance and non-conductive materials. Crucible holder rotation enabler (3), linkages enabling the rotation of the crucible through crucible holder for pouring out the melted metal. It also consists perpendicular female threaded section which engages with the sliding screw bar for enabling the height adjustment of the crucible holder. Crucible sliding screw bar (4), is a threaded bar, which is actuated by an actuator and helps in enabling the sliding or height variation of the crucible holder. Crucible sliding screw bar actuator (5), is a motor rotating threaded bar and enabling the crucible upward and downward motion. The speed of the rotation decided the speed of sliding of the crucible in up and down direction. Crucible sliding screw bar actuator clip (6), is the metal strap used for incorporating the actuator with the base body. Crucible sliding screw bar actuator clip fasteners (7), are the screws used for fastening the actuator with the base body. Upper furnace shell (8) is the cylindrical shape hollow container containing the induction coil and slides in upward or downward direction for covering the crucible. The negative temperature coefficient thermistor is also incorporated in this shell for reading the temperature of the crucible. Upper furnace coil (9) is a hollow copper coil in helical shape, through with the current is passed and inside it the water is passed for cooling it as the efficiency of heating depends on coil temperature. The coil is incorporated in the upper

furnace shell, so it is said to be upper furnace coil. Upper furnace coil connectors (10) are the connecting medium of power supply to the upper furnace coil. Bottom furnace shell (11) is the cylindrical shape hollow container containing the induction coil allows the upper furnace slides in upward or downward direction over it for covering the crucible. The NTC thermistor is also integrated in this shell for reading the temperature of the crucible. Bottom furnace coil (12) is a hollow copper coil in helical shape, through with the current is passed and inside it the water is passed for cooling it as the efficiency of heating depends on coil temperature. The coil is incorporated in the bottom furnace shell, so it is said to be bottom furnace coil. Bottom furnace coil connectors (13) are the connecting medium of power supply to the bottom furnace coil. Base body (14) is the structural component of this assembly, which incorporates all the other components in it. Upper furnace shell sliding screw bar (15) are the threaded bar enabling the sliding motion of the upper furnace shell in upward and down ward direction. Upper furnace shell sliding screw bar actuator (16) is a motor rotating the threaded bar and enabling the upper furnace shell upward and downward motion. The speed of the rotation decides the speed of sliding of the upper furnace shell in up and down direction. Upper furnace shell sliding screw bar actuator clip (17) is the metal strap used for mounting the actuator with the base body. Upper furnace shell sliding screw bar actuator clip fastener (18) is the screw for fastening the upper furnace shell sliding screw bar actuator clip with baebody. Grooved slider (19) is the block with function of holding the upper furnace coil in the furnace shell and enabling the sliding motion guidance with the bottom furnace shell through utilizing the grooves. Grooved slider fasteners (20) are the screw utilized for mounting the grooved slider inside the upper furnace shell. Primary water reservoir (21) is a water reservoir utilized for saving the water and providing when required to the heat exchanger. Primary water reservoir clip (22) is a metal strap used for mounting the primary water reservoir with base body. Primary water reservoir clip fastener (23) is the threaded

screw utilized for mounting the primary water reservoir clip with base body. Secondary water reservoir (24) is an auxiliary water reservoir utilized for storing the water and maintaining the level of water in primary water reservoir. Secondary water reservoir clip (25) is a metal strap used for mounting the secondary water reservoir with base body. Secondary water reservoir clip fastener (26) is the threaded screw utilized for mounting the secondary water reservoir clip with base body. Heat exchanger (27) is a water-to-water heat exchanger, utilized for cooling of the induction coils for their efficient operation. It is located below the base body. Heat exchanger clip (28) is a metal strap used for mounting the heat exchanger with base body. Heat exchanger clip fasteners (29) are the threaded screw utilized for mounting the heat exchanger clip with base body. Water pump (30) is a centrifugal water pump utilized for pumping the water in the cooling circuit. Base body sliding handle (31) is an integrated sliding handle utilized for moving the furnace manually. Base body rolling motion enabler (32) is a rolling wheel assembly located beneath the base body, which enables the furnace to move anywhere and hold its weight during working. Base body rolling motion enabler fastener (33) is the threaded screw utilized for mounting the base body rolling motion enabler with base body. Base supporter (34) is the rubberized cylindrical supporter utilized for supporting the weight of the furnace and limiting is from moving and providing stable position during its operation. Base supporter fastener (35), is the threaded screw utilized for mounting the base supporter with base body. Central controller (36) is a central control unit comprising total control over the power supply and temperature in the furnace, it also consists power cut-off in case of emergency or user safety.

WE CLAIM:

1. A multi-functional induction furnace for heating and melting of materials comprises crucible (1), holder (2), rotation enabler (3), crucible sliding screw bar (4), actuator (5), actuator clip (6), fasteners (7), upper furnace shell (8), upper furnace coil (9), connectors (10), bottom furnace shell (11), coil (12), connectors (13), base body (14), upper furnace shell sliding screw bar (15), actuator (16), clip, fastener (17, 18), grooved slider, fasteners (19, 20), primary water reservoir (21), clip, fastener (22, 23), secondary water reservoir (24), reservoir, clip, fastener (25, 26), heat exchanger (27), heat exchanger clip (28), fasteners (29), water pump (30), base body sliding handle (31), base body rolling motion enabler (32), fastener (33), base supporter (34), fastener (35), and central controller (36).

2. The induction furnace as claimed in claim 1, wherein graphite crucible (1); Crucible holder (2), is basically a ring rounded the crucible with handle for pouring the melted metal out from the crucible; Crucible holder rotation enabler (3), linkages enabling the rotation of the crucible through crucible holder for pouring out the melted metal.

3. The induction furnace as claimed in claim 1, wherein Crucible sliding screw bar (4), is a threaded bar; Crucible sliding screw bar actuator (5), is a motor rotating threaded bar and enabling the crucible upward and downward motion; Crucible sliding screw bar actuator clip (6), is the metal strap used for incorporating the actuator with the base body; Crucible sliding screw bar actuator clip fasteners (7), are the screws used for fastening the actuator with the base body, Upper furnace shell (8) is the cylindrical shape hollow container containing the induction coil and slides in upward or downward direction for covering the crucible; Upper furnace coil (9) is a hollow copper coil in helical shape.

4. The induction furnace as claimed in claim 1, wherein Upper furnace coil connectors (10) are the connecting medium of power supply to the upper furnace coil, Bottom furnace shell

(11) is the cylindrical shape hollow container containing the induction coil allows the upper furnace slides in upward or downward direction over it for covering the crucible; Bottom furnace coil (12) is a hollow copper coil in helical shape; Bottom furnace coil connectors (13) are the connecting medium of power supply to the bottom furnace coil; Base body (14) is the structural component of this assembly, Upper furnace shell sliding screw bar (15) are the threaded bar enabling the sliding motion of the upper furnace shell in upward and down ward direction; Upper furnace shell sliding screw bar actuator (16) is a motor rotating the threaded bar and enabling the upper furnace shell upward and downward motion.

5. The induction furnace as claimed in claim 1, wherein Upper furnace shell sliding screw bar actuator clip (17) is the metal strap used for mounting the actuator with the base body; Upper furnace shell sliding screw bar actuator clip fastener (18) is the screw for fastening the upper furnace shell sliding screw bar actuator clip with base body; Grooved slider (19) is the block with function of holding the upper furnace coil in the furnace shell and enabling the sliding motion guidance with the bottom furnace shell through utilizing the grooves; Grooved slider fasteners (20) are the screw utilized for mounting the grooved slider inside the upper furnace shell; Primary water reservoir (21) is a water reservoir utilized for saving the water and providing when required to the heat exchanger; Primary water reservoir clip (22) is a metal strap used for mounting the primary water reservoir with base body; Primary water reservoir clip fastener (23) is the threaded screw utilized for mounting the primary water reservoir clip with base body; Secondary water reservoir (24) is an auxiliary water reservoir utilized for storing the water and maintaining the level of water in primary water reservoir. Secondary water reservoir clip (25) is a metal strap used for mounting the secondary water reservoir with base body; Secondary water reservoir clip fastener (26) is the threaded screw utilized for mounting the secondary water reservoir clip with base body.

6. The induction furnace as claimed in claim 1, wherein Heat exchanger (27) is a water-to-water heat exchanger; Heat exchanger clip (28) is a metal strap used for mounting the heat exchanger with base body; Heat exchanger clip fasteners (29) are the threaded screw utilized for mounting the heat exchanger clip with base body; Water pump (30) is a centrifugal water pump utilized for pumping the water in the cooling circuit.

7. The induction furnace as claimed in claim 1, wherein Base body sliding handle (31) is an integrated sliding handle utilized for moving the furnace manually; Base body rolling motion enabler (32) is a rolling wheel assembly located beneath the base body; Base body rolling motion enabler fastener (33) is the threaded screw utilized for mounting the base body rolling motion enabler with base body.

8. The induction furnace as claimed in claim 1, wherein Base supporter (34) is the rubberized cylindrical supporter utilized for supporting the weight of the furnace and limiting is from moving and providing stable position during its operation; Base supporter fastener (35), is the threaded screw utilized for mounting the base supporter with base body; Central controller (36) is a central control unit comprising total control over the power supply and temperature in the furnace, it also consists power cut-off in case of emergency or user safety.

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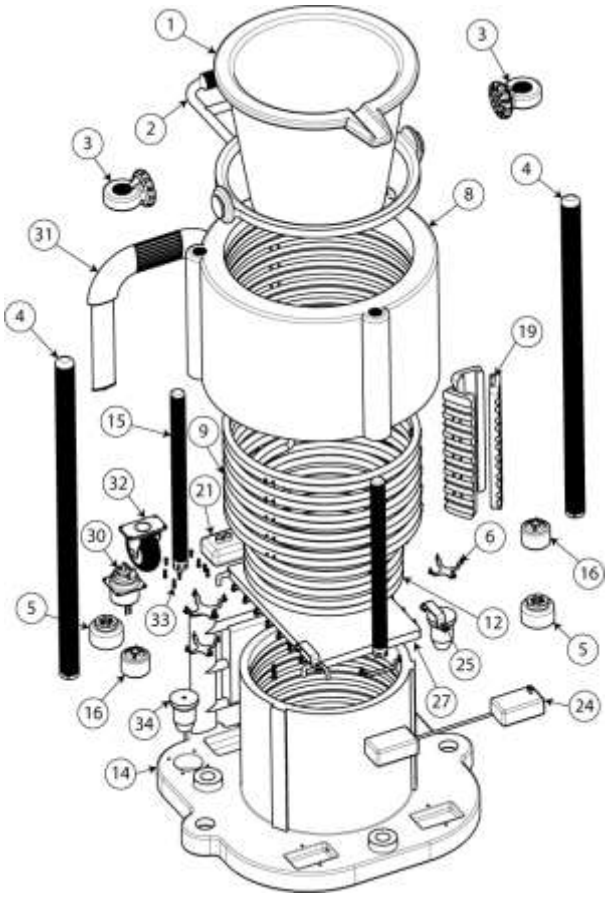

Figure 1: Fully exploded view

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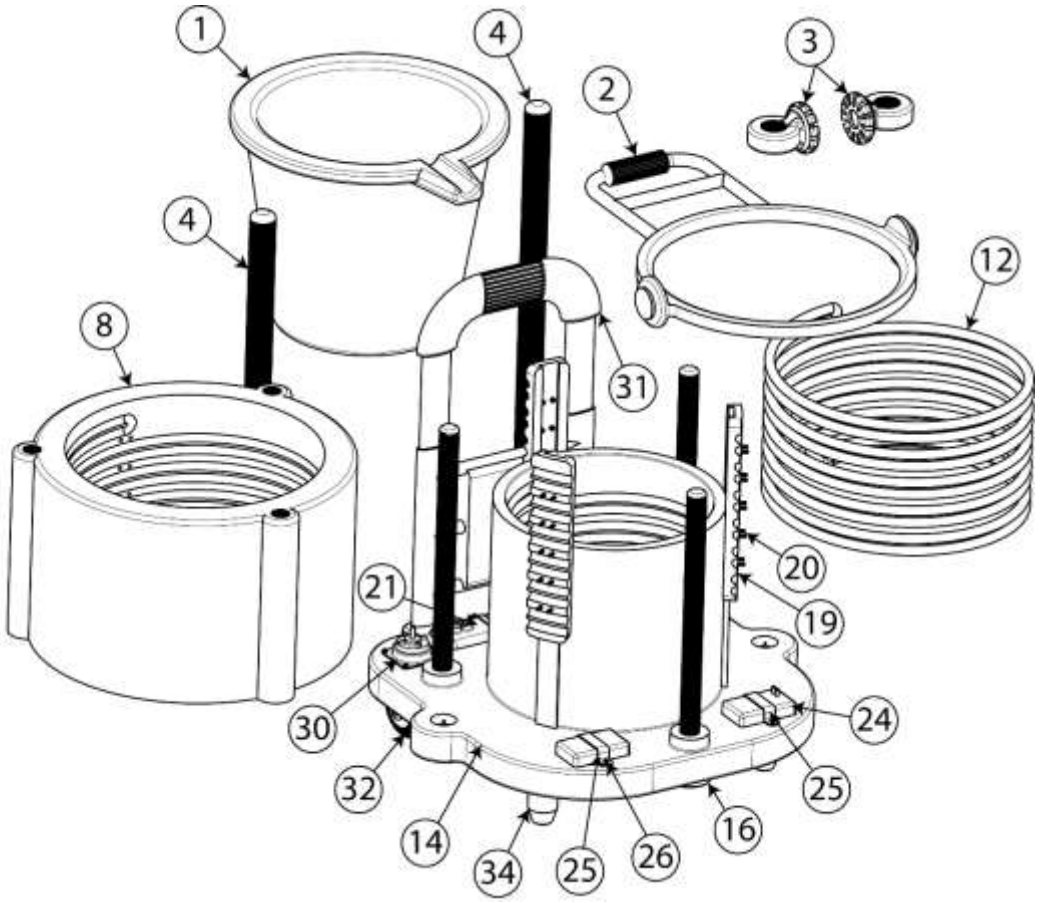

Figure 1: Upper portion partial exploded view

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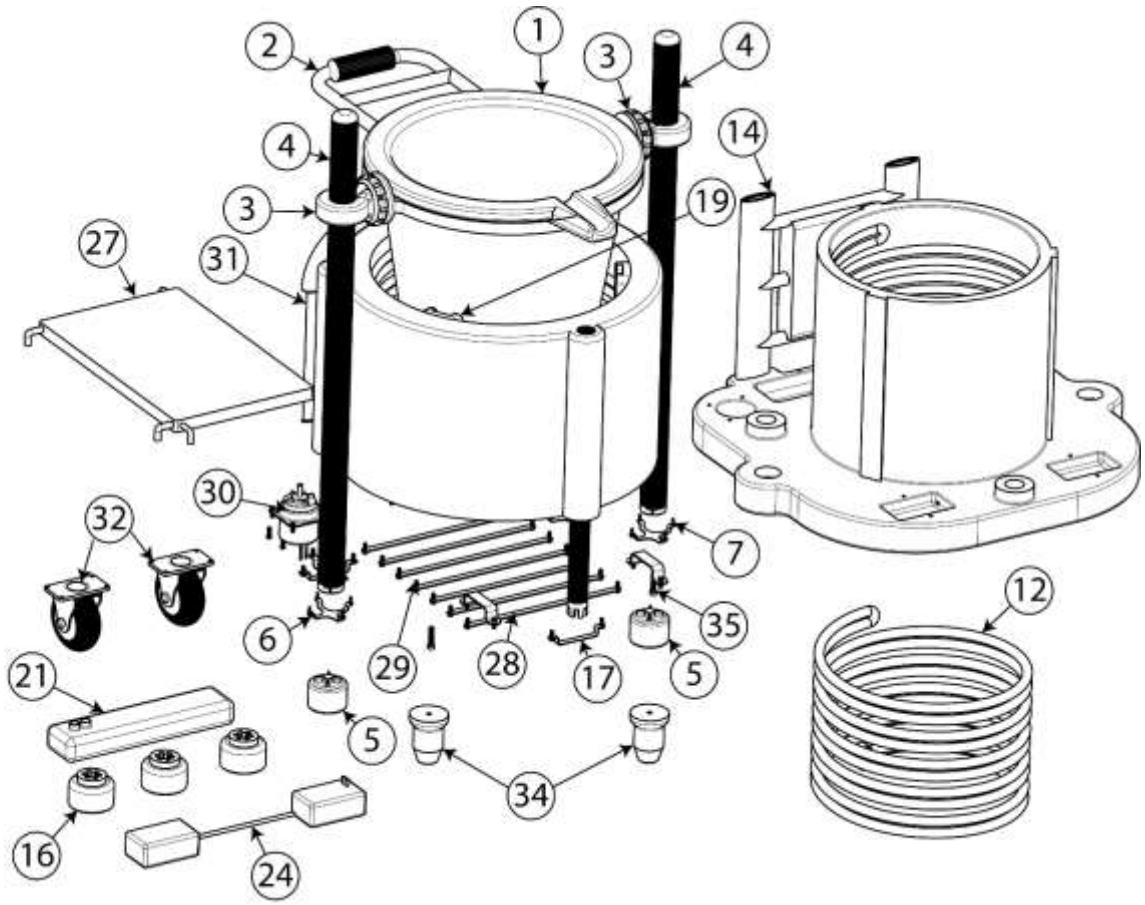

Figure 2: Bottom portion partial exploded view

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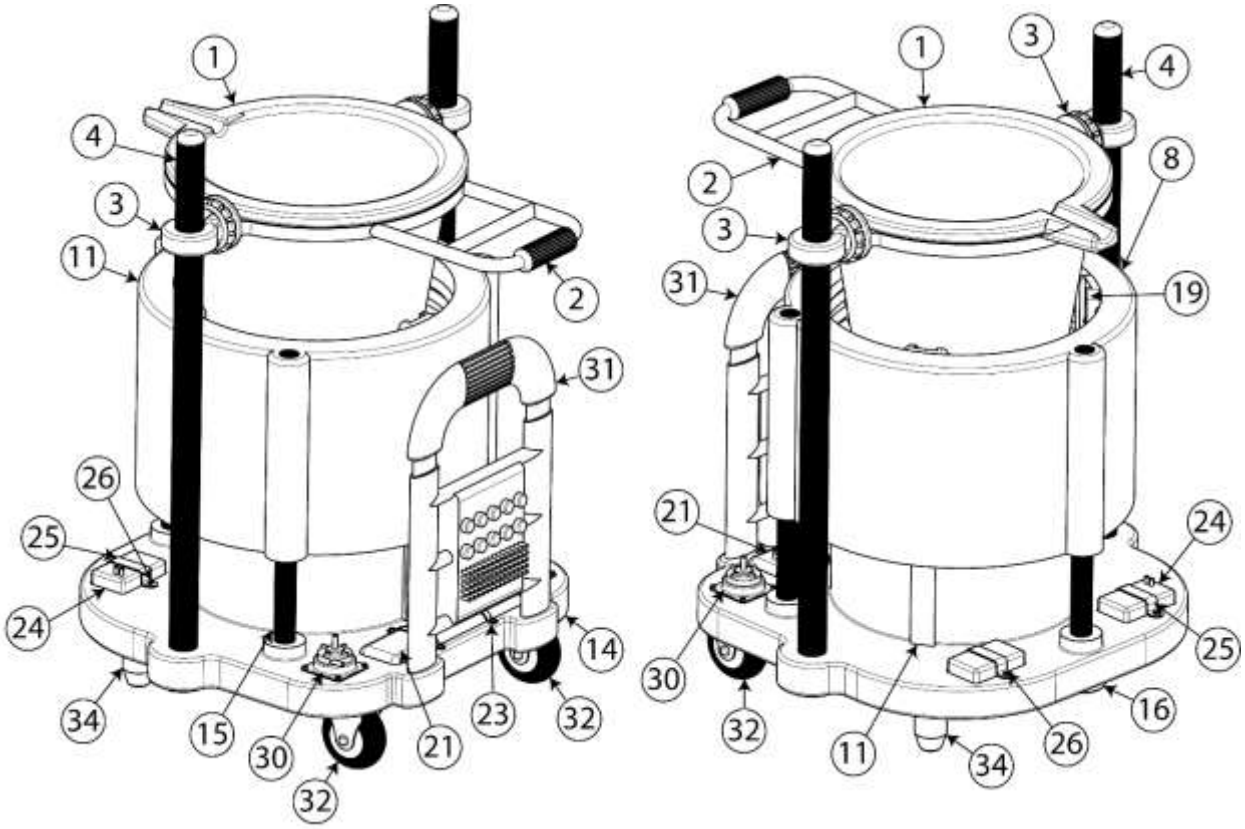

Figure 4: Isometric auxiliary view in assembled state

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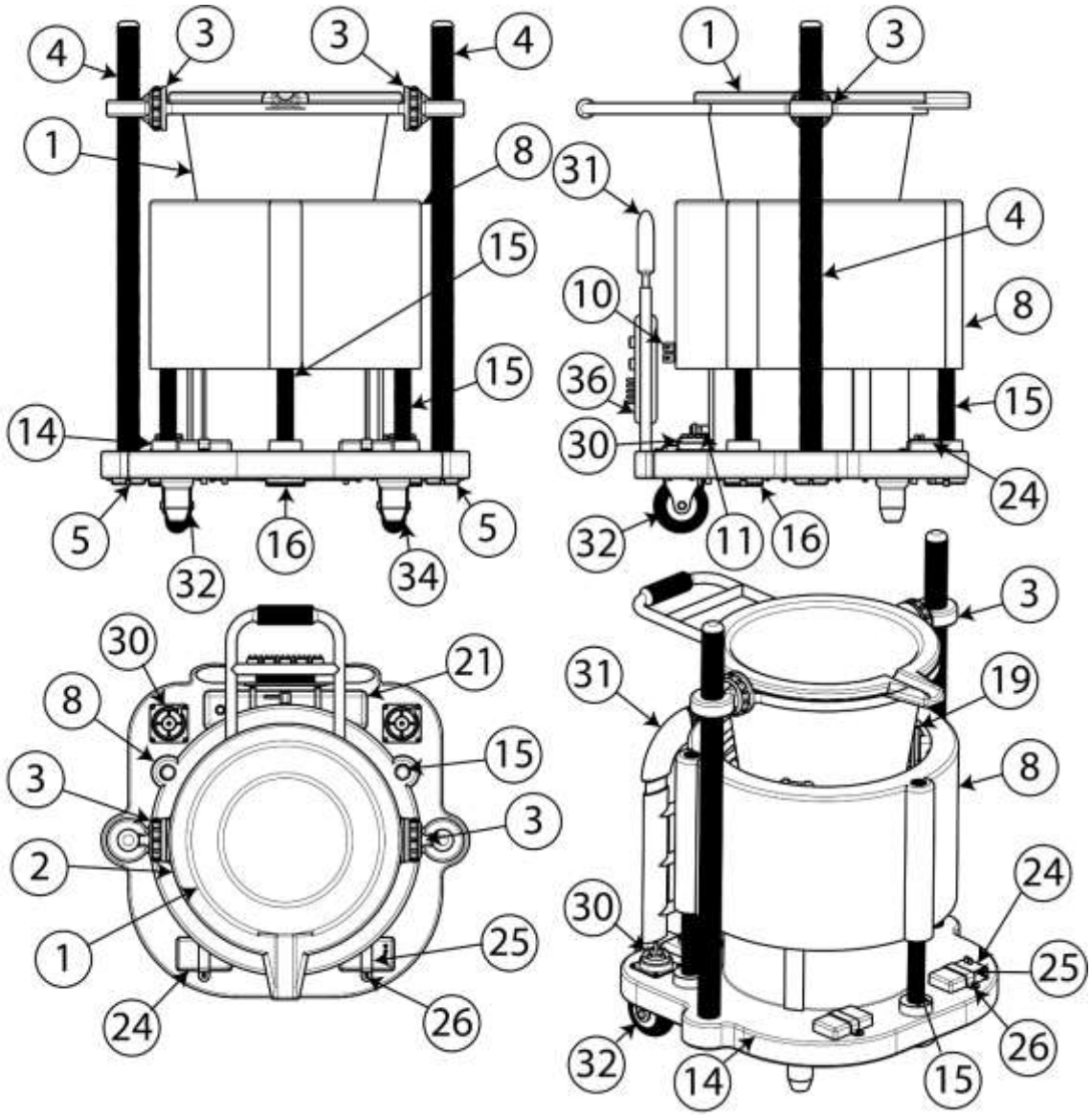

Figure 5: Front, top, side and isometric view in assembled state

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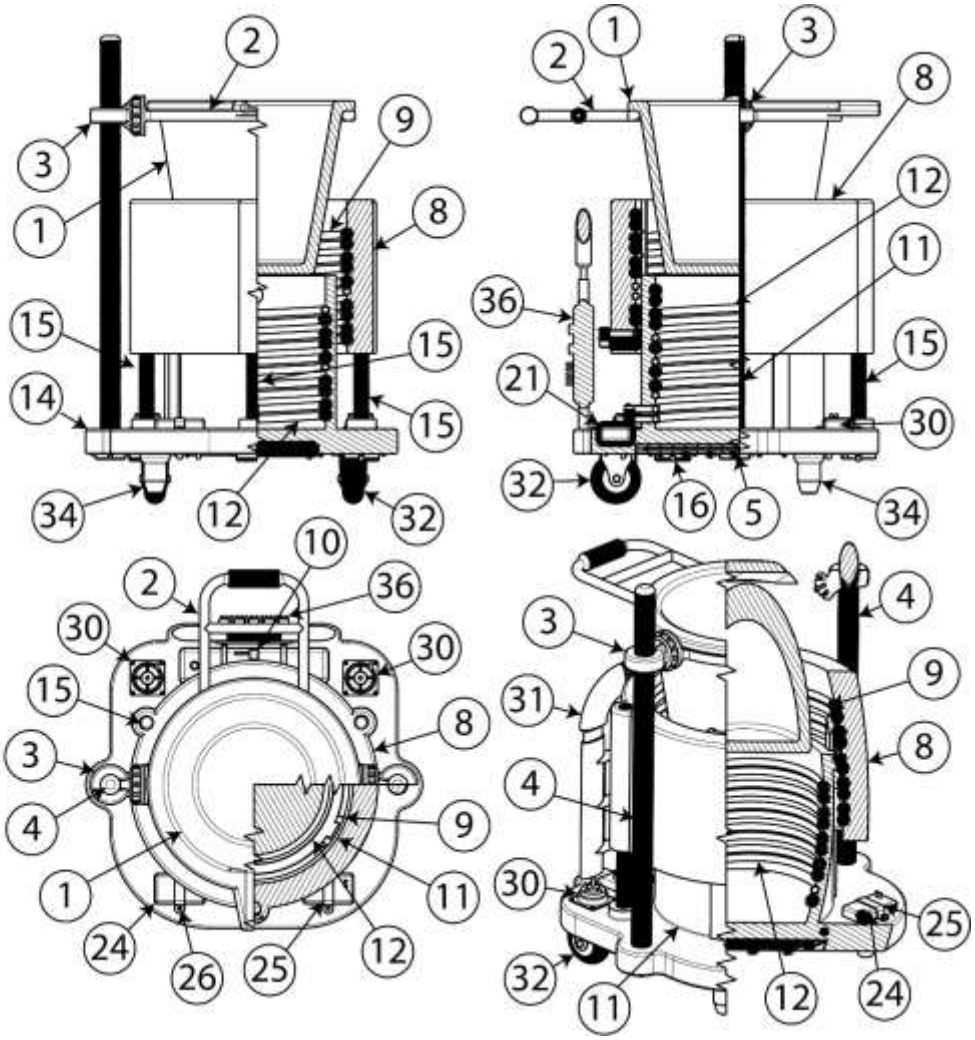

Figure 6: Broken front, top, side and isometric view in assembled state

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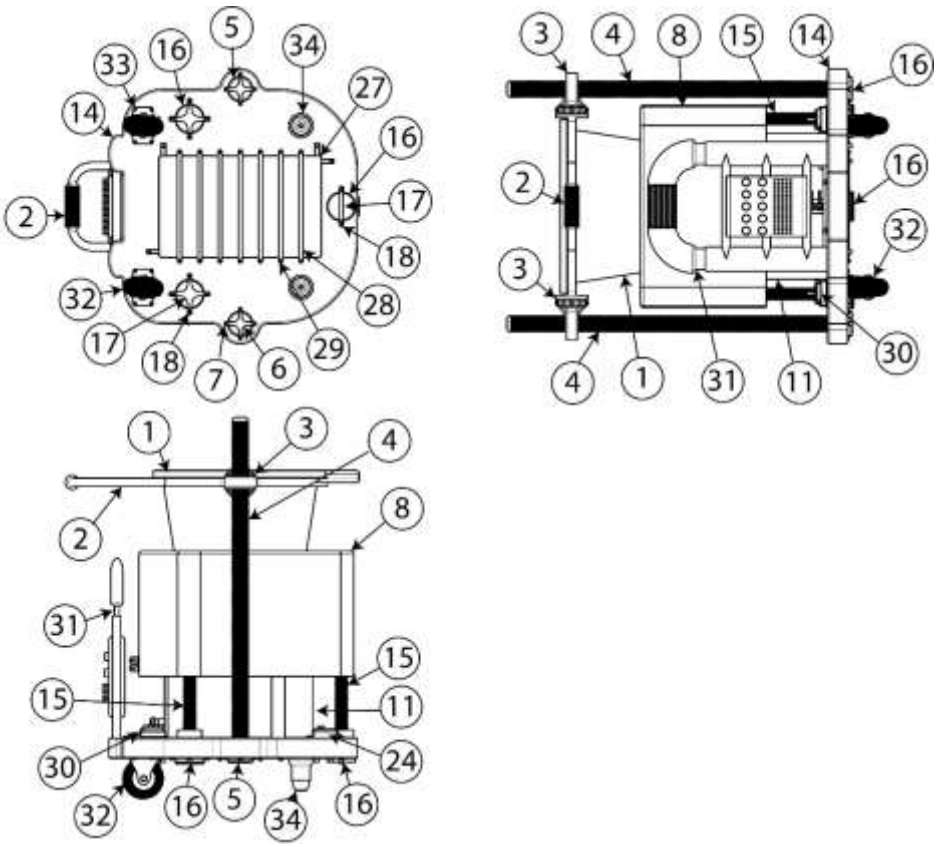

Figure 7: Bottom, top and side view in assembled state

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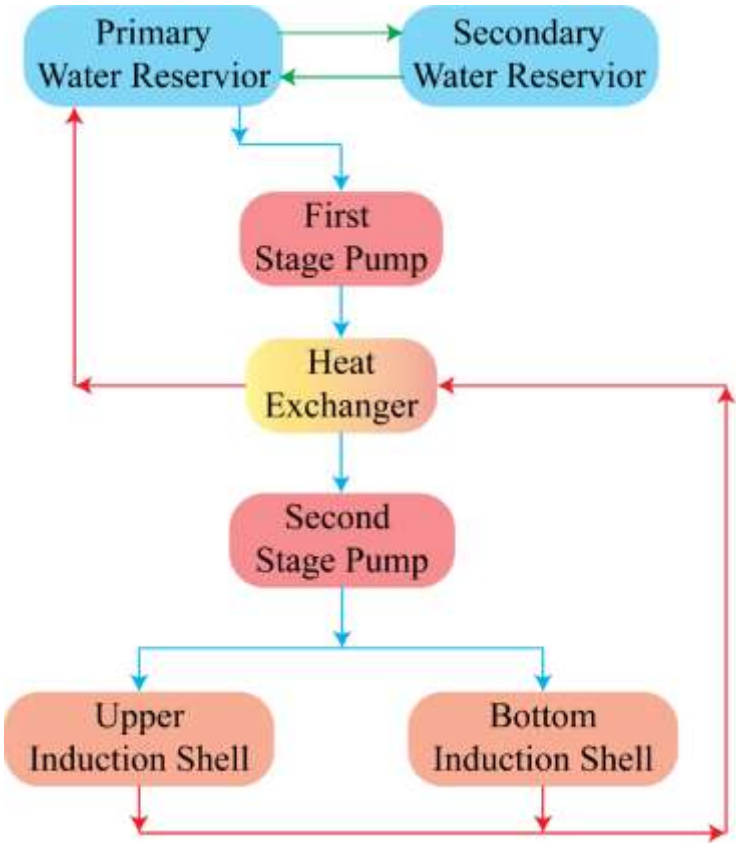

Figure 8: Water flow and connection diagram

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ABSTRACT

MULTI-FUNCTIONAL INDUCTION FURNACE FOR HEATING AND MELTING OF MATERIALS METHOD AND THEREOF

Multi-functional electrical induction furnace is disclosed. The invention provides an induction furnace comprising an electrically non-conductive crucible defining a melting cavity; an electrically conductive member disposed adjacent the crucible; an induction member for inductively heating materials within the melting cavity; and a portion of the melting cavity being closer to the induction member than is the conductive member. Present invention comprising with primary and secondary water reservoirs, pumps, heat exchanger, upper and bottom induction shell. Including the major parts of this invention are crucible (1), holder (2), rotation enabler (3), crucible sliding screw bar (4), actuator (5), clip (6), base body (14), base body sliding handle (31), base body rolling motion enabler (32), central controller (36). Meanwhile having adjustable height and easy transferable of proposed utility model is capacity of crucible of 20 kg and minimum of 5 kg for melting and as well as heating of conductive or non-conductive materials. Moreover, melting and power supply factors are taken into account for excellent heating or melting the induction coil and conductive materials. Also, induction heating device includes a power source and an induction coil disposed around the length of the susceptor with multiple coil sections.

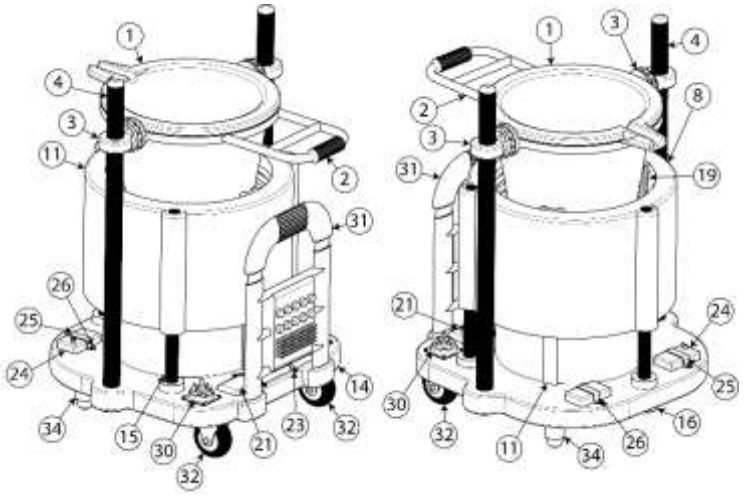

Figure 4: Isometric auxiliary view in assembled state