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Shirai et al.

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[54] **INDUCTION CHARGING APPARATUS**

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[51] **Int. Cl.**[6] **H01M 10/46**

[52] **U.S. Cl.** **320/2**; 336/DIG. 2

[58] **Field of Search** 320/2, 5; 336/224, 336/DIG. 2

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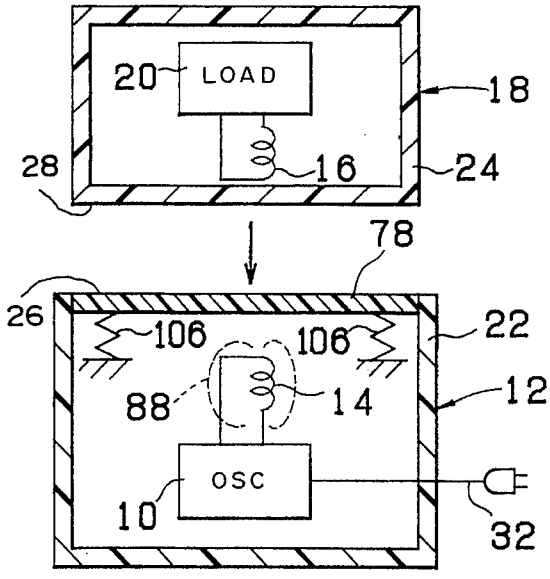
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Primary Examiner—Peter S. Wong
Assistant Examiner—Edward Tso
Attorney, Agent, or Firm—Wenderoth, Lind & Ponack

[57] **ABSTRACT**

The induction charging apparatus has a power source unit and a device unit which can be detachably coupled to the power source unit. The power source unit has a first casing having one end opened, a primary coil provided in the first casing, an oscillator for supplying an alternating current to the primary coil to generate magnetic fluxes, and a depressible member movably provided and closing the open end of the first casing. The depressible member is movable between a lift position at which the magnetic fluxes are substantially located under the depressible member, and a depressed position at which portions of the magnetic fluxes are substantially located over the depressible member. The device unit has a second casing having one end detachable to the open end of the first casing, a secondary coil provided in the second casing and adjacent to the one end, and rechargeable battery provided in said second casing for receiving power from the secondary coil. When the second casing is attached to the first casing, the depressible member is moved to the depressed position to electromagnetically couple the primary and secondary coils.

11 Claims, 7 Drawing Sheets



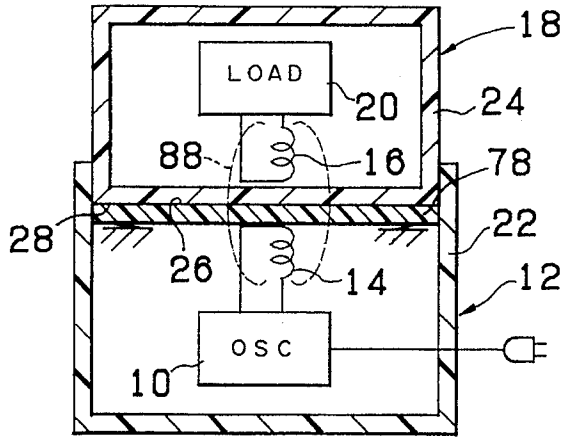


Fig.1 A

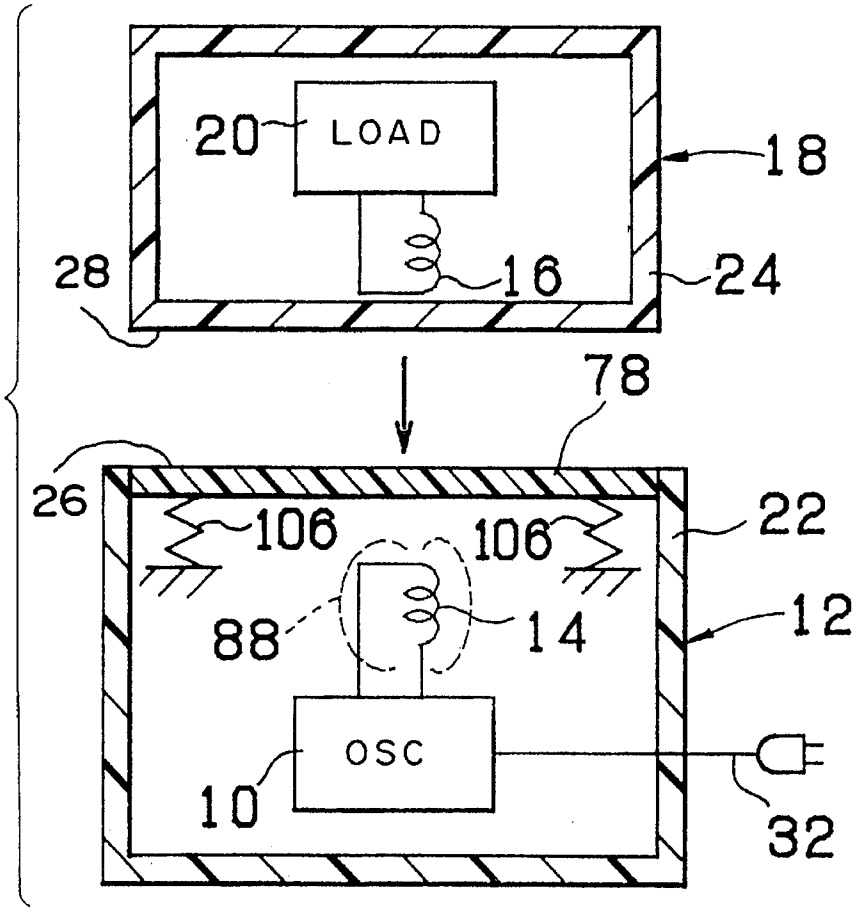

20
LOAD
18
28
16
24
78
26
106
106
22
88
14
12
OSC
10
32

Fig.1B

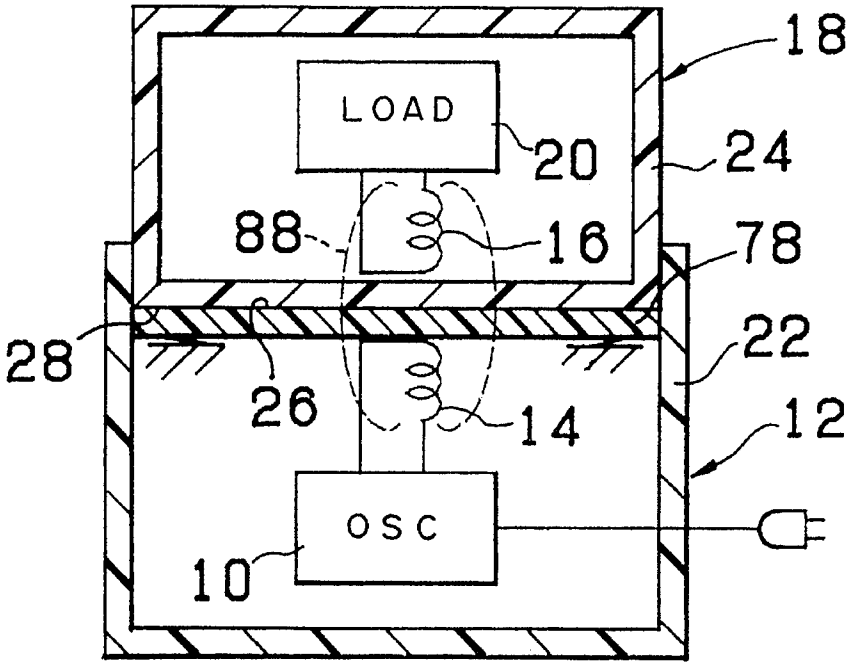

18
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Fig.2

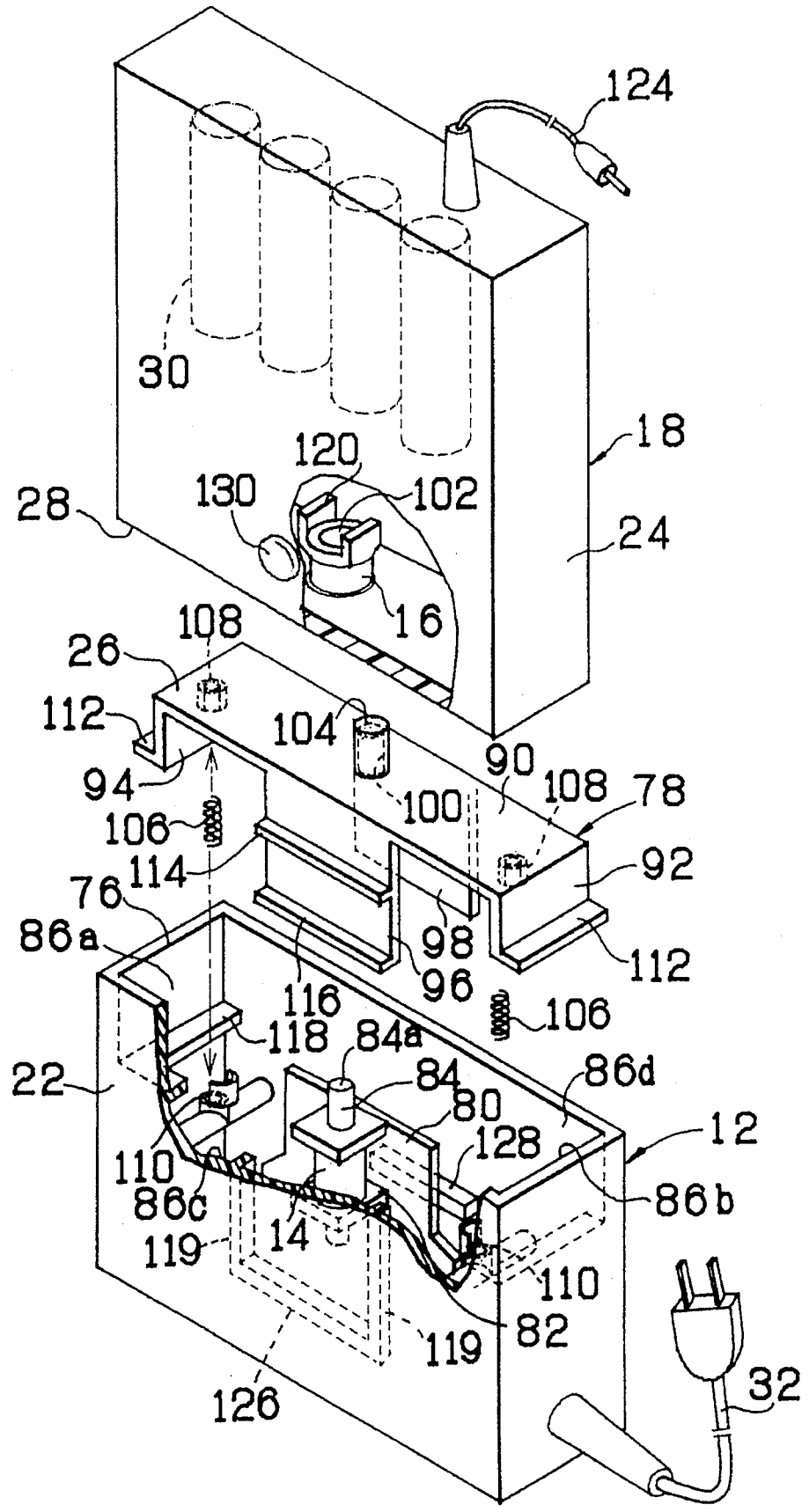

124
30
18
120
130
102
28
24
16
108
26
112
104
90
94
100
108
78
106
92
114
76
98
86a
112
96
116
106
118
84a
22
84
86d
80
12
110
128
86c
86b
119
14
110
82
119
32
126

Fig.3

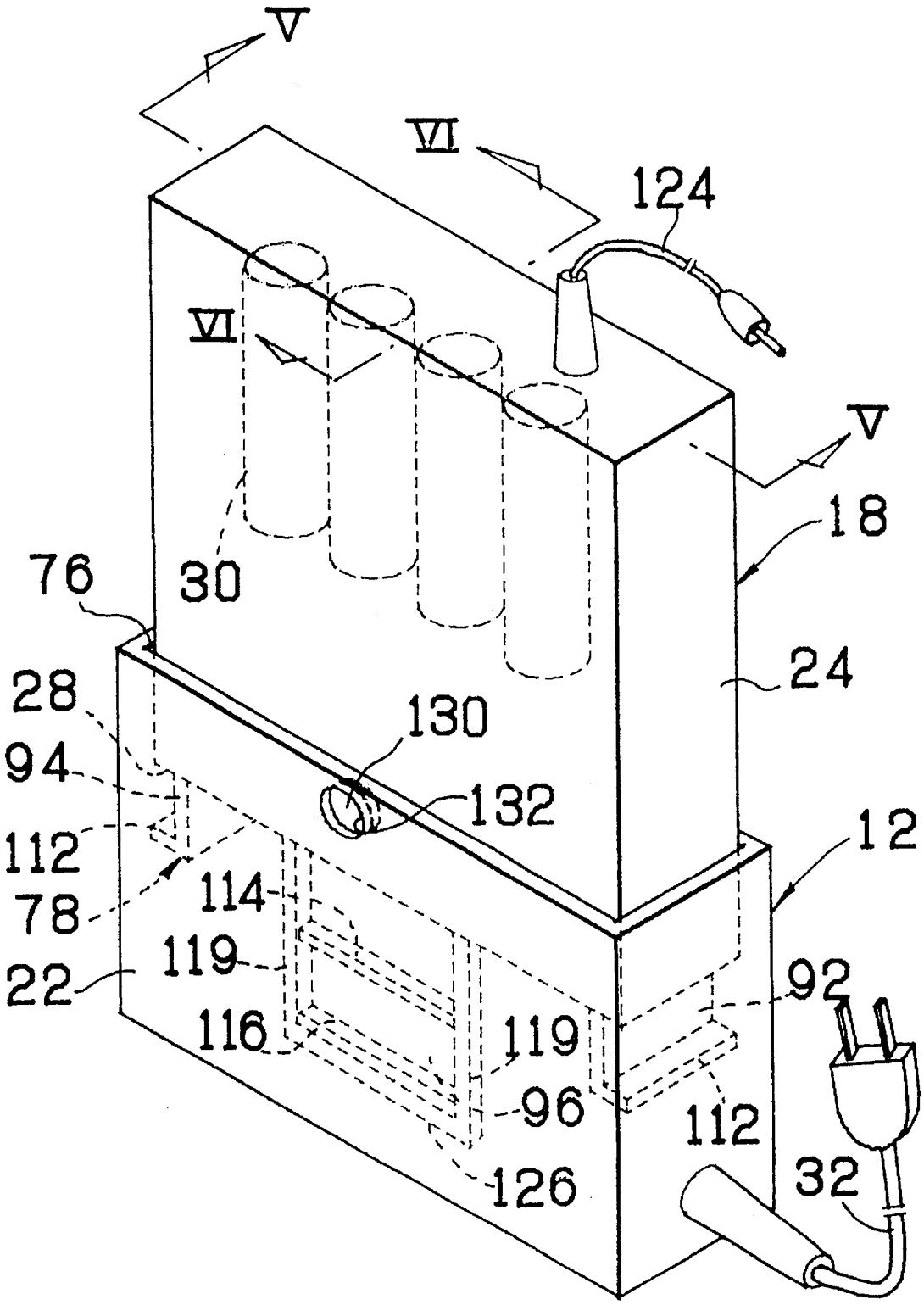

V
VI
124
VI
V
18
76
30
24
28
130
94
132
12
112
114
78
119
22
92
116
119
96
112
126
32

Fig.4

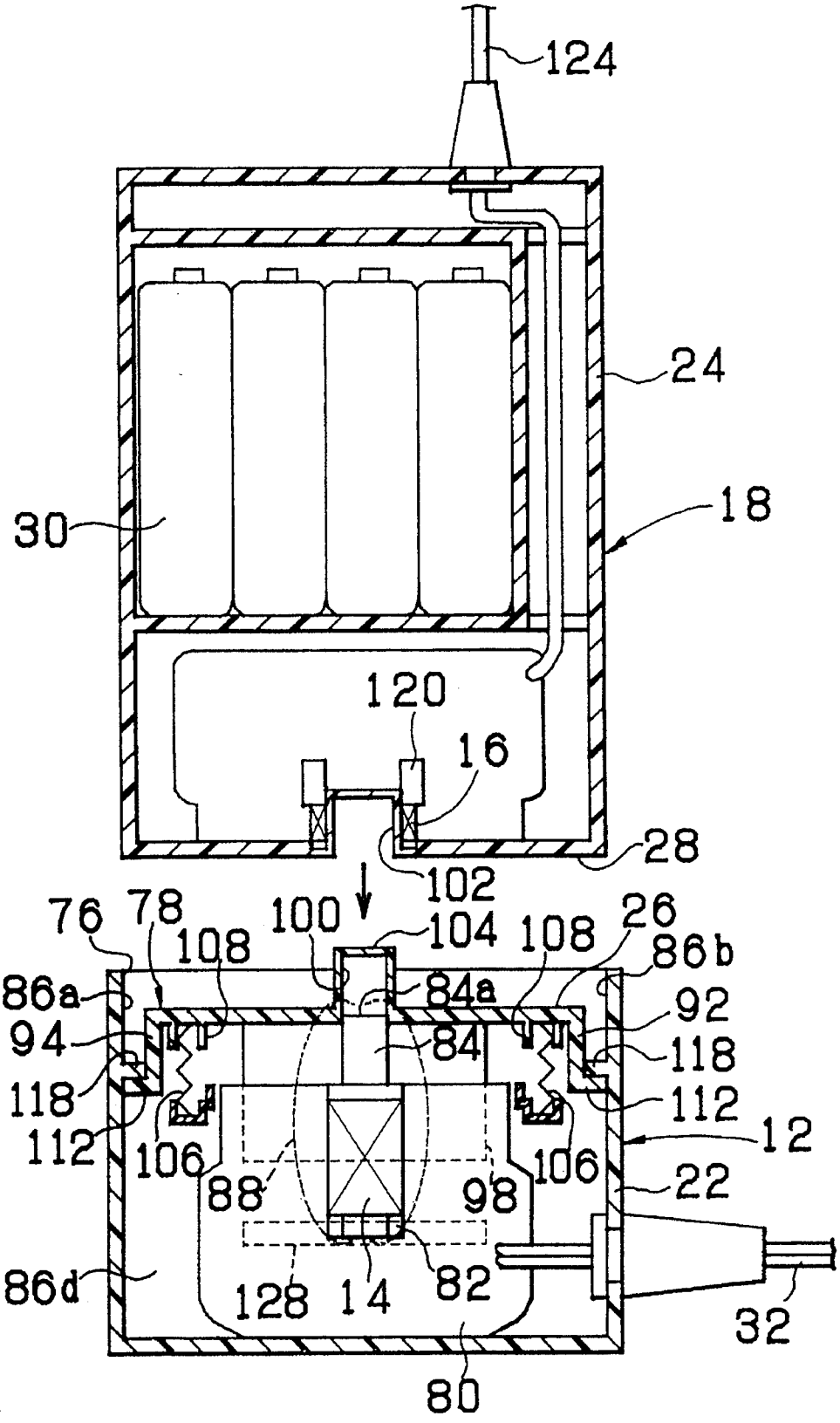

124
24
18
30
120
16
28
102
76
78
108
100
104
108
26
86b
86a
84a
92
94
84
118
118
112
112
106
106
12
88
98
22
86d
128
14
82
32
80

Fig. 5

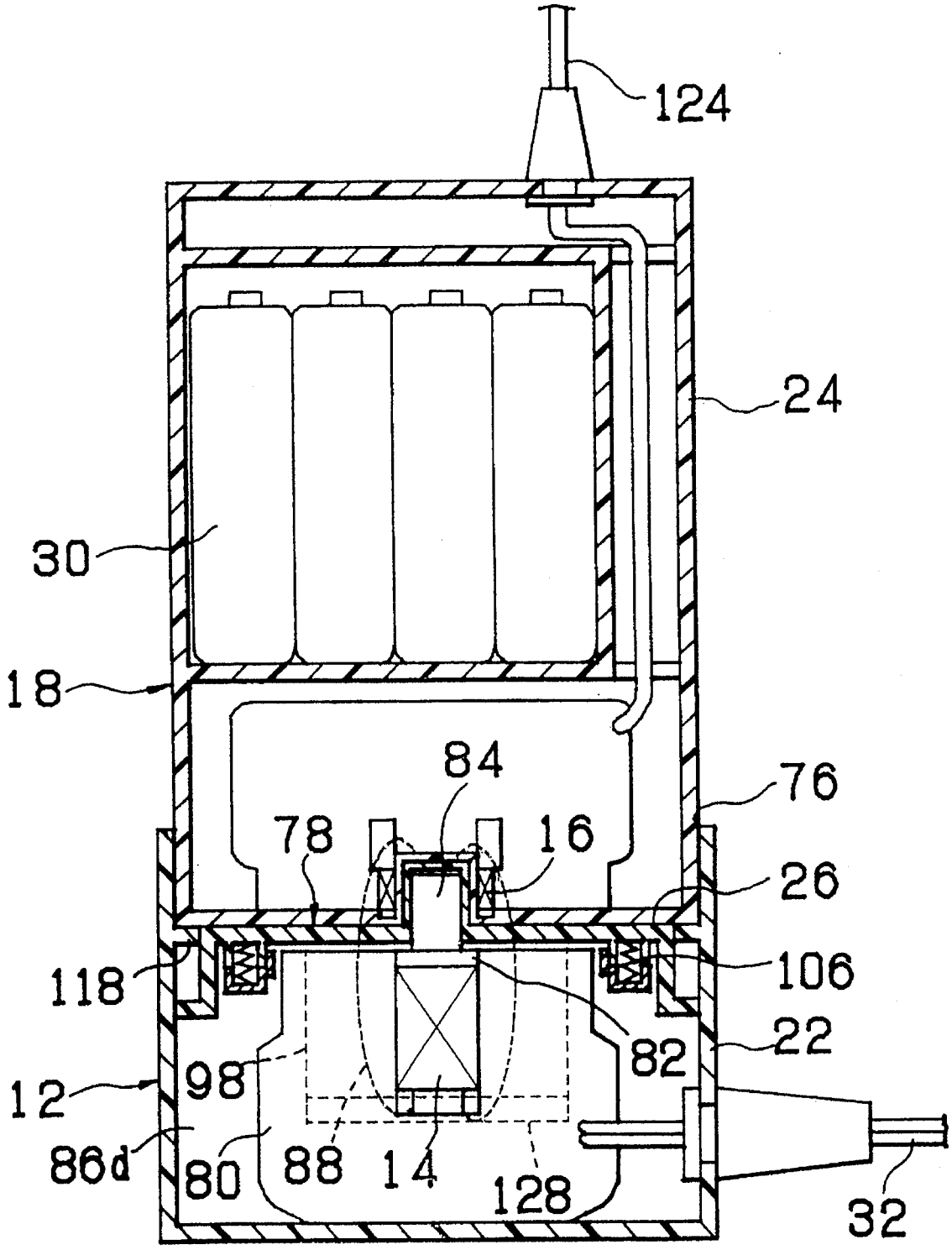
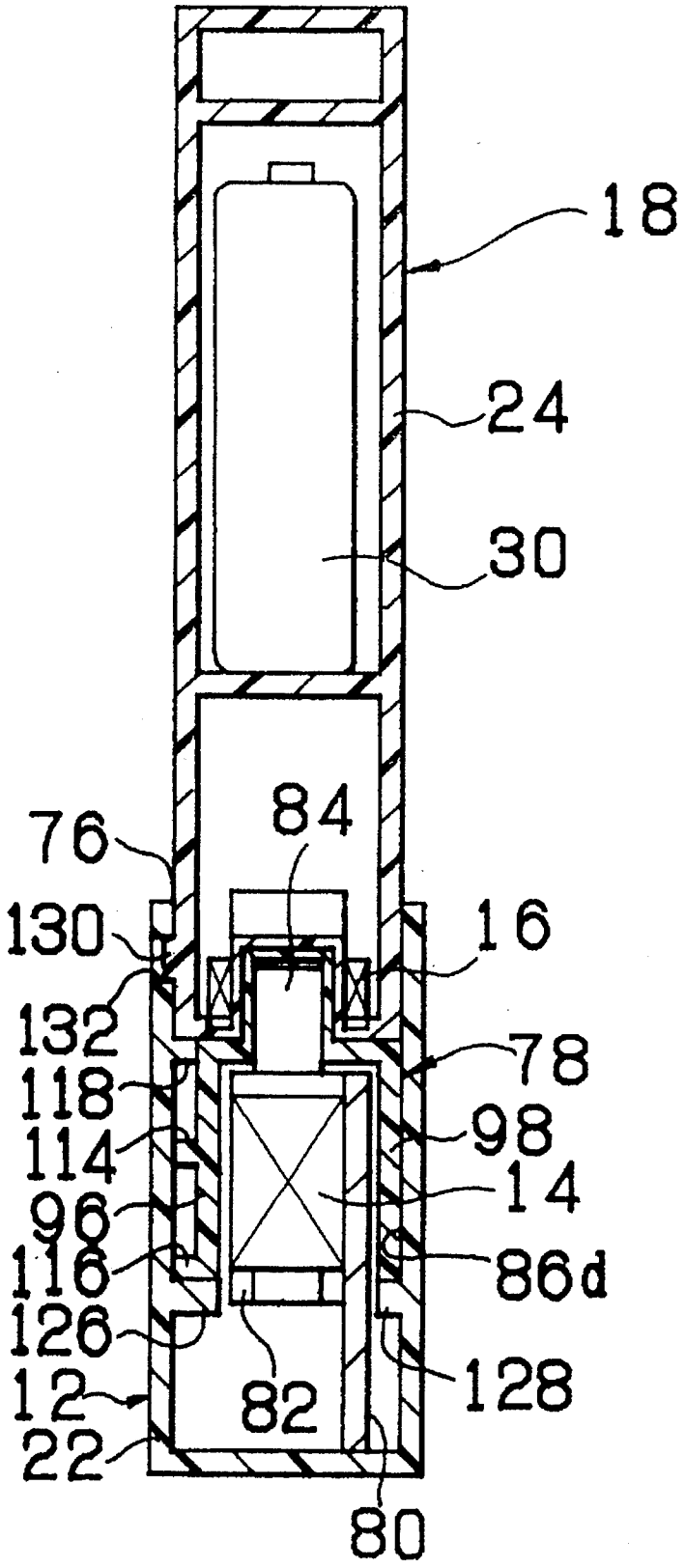


Fig. 6


18
24
30
84
76
130
16
132
78
118
98
114
14
96
86d
116
126
128
12
82
22
80

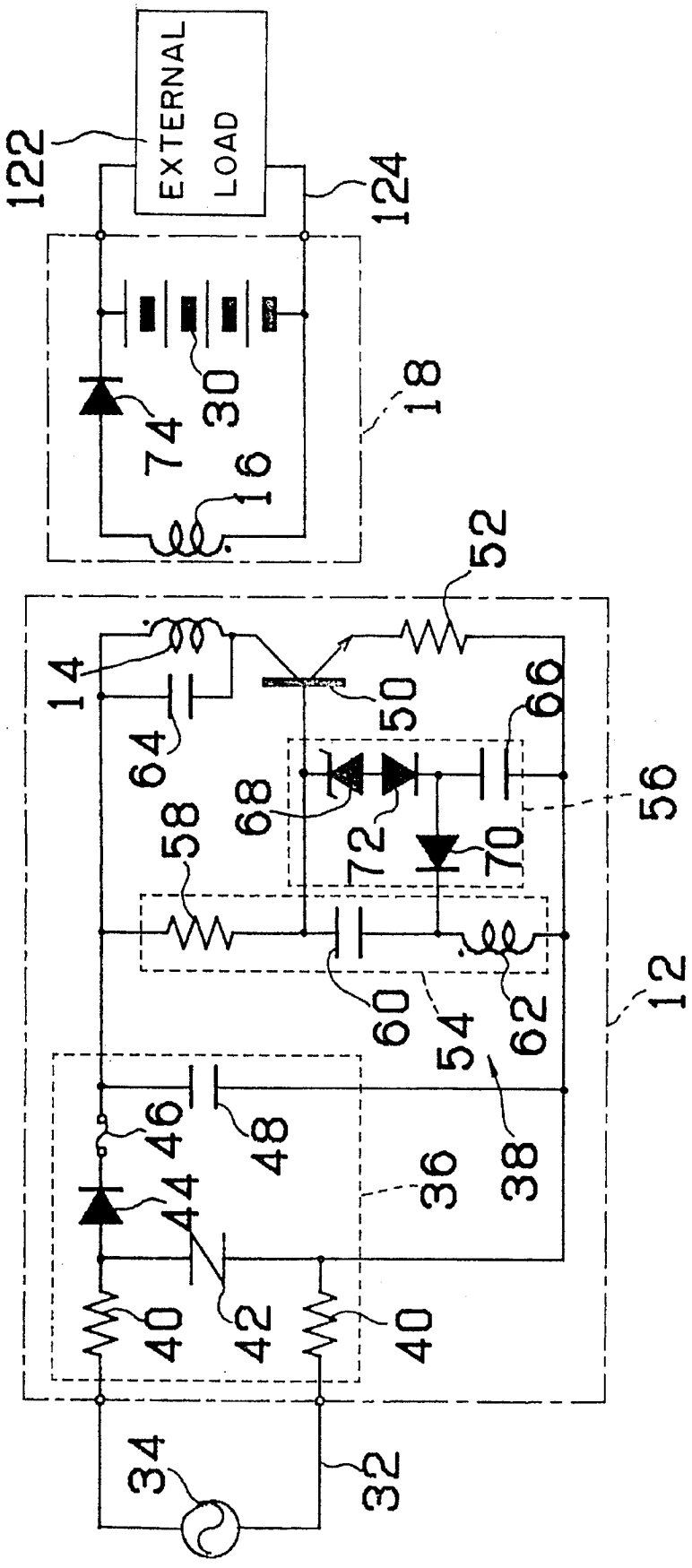

EXTERNAL LOAD
122
124
18
30
74
16
52
14
50
66
64
68
58
72
70
56
60
54
62
12
46
48
44
36
38
40
42
40
34
32

Fig.7

INDUCTION CHARGING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an induction charging apparatus for use in various kinds of electric apparatuses such as, portable game machines, power-driven tooth brushes, electric tools, or the like and, more particularly, to an induction charging device having a power source unit and a battery unit detachably connected to the power source unit for the supply of electric power from a commercial power source through the power source unit to the battery unit, utilizing the electromagnetic induction coupling between the power source unit and the battery unit.

2. Description of the Prior Art

In the conventional arrangement of induction charging apparatuses of the aforementioned type, a secondary battery (rechargeable battery) is installed in a unit of the device. Normally, the unit of the device is set to a power source and prepared to stand a short-term driving load while the secondary battery is kept charged with a minute current from the power source. Therefore, a primary oscillator section, e.g., an inverter circuit or the like at the side of the power source is always held in the driving state, and at the same time, the output of the primary oscillator section is controlled depending on the presence/absence of the load in the device unit so as to save power in case the device unit is separated from the power source for a long time.

In the arrangement as above, in the case where the available output power from the primary oscillator section is increased and if a metallic element such as a clip or the like, instead of the device unit, is brought close to a primary coil, the metallic element is erroneously recognized as a proper load. In consequence, an excessive amount of eddy current is fed and heat is generated.

The inventors have discovered from the studies of the aforementioned inconvenience that, when the primary oscillator section is maintained always in the driving state and the primary coil is accommodated in the power source unit while being separated from a touching face thereof to the power source, the magnetic flux density at the peripheral surface of a main casing can be made as small as possible, and moreover, if a touching face of the power source is made movable to the primary coil in the interlocking movement with setting of the device unit to the power source, the above inconvenience is perfectly solved.

SUMMARY OF THE INVENTION

The object of the present invention is therefore to provide an induction charging apparatus which can avoid generation of heat caused by a foreign matter, for example, a metallic element or the like disposed in proximity to a power source unit.

According to the present invention, an induction charging apparatus has a power source unit and a device unit detachable from the power source unit.

The power source unit comprises: a first casing having one end opened; a primary coil provided in said first casing; oscillator means provided in said first casing for supplying an alternating current powered by a commercial alternating current power source to said primary coil to generate magnetic fluxes; and a depressible member movably provided and closing said open end of said first casing, said depressible member movable between a lift position at which said magnetic fluxes are substantially located under said depressible member and inside said first casing, and a depressed position at which portions of said magnetic fluxes are substantially located over said depressible member and outside said first casing.

The device unit comprises: a second casing having one end detachable to said open end of said first casing; a secondary coil provided in said second casing and adjacent to said one end; and load means provided in said second casing for receiving power from said secondary coil, whereby when said second casing is attached to said first casing with said depressible member being moved to said depressed position, said primary and secondary coils are coupled to link said magnetic fluxes from said primary coil to said secondary coil, and when said second casing is detached, said depressible member is moved to said lift position to prevent the leakage of said magnetic fluxes.

The present application is based upon Japanese Patent Application Serial No. 5-204581 which was filed on Jul. 26, 1993, the entire content of which is expressly incorporated by reference herein.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and features of the present invention will become clear from the following description taken in conjunction with the preferred embodiment thereof with reference to the accompanying drawings throughout which like parts are designated by like reference numerals, and in which:

FIGS. **1A** and **1B** are diagrams showing basic structure of an induction charging apparatus of the present invention, FIG. **1A** particularly showing a state when a device unit is separated from a power source unit, and FIG. **1B** particularly showing a state when the units are coupled to each other;

FIG. **2** is a partially-cut exploded perspective view of an induction charging apparatus according to a preferred embodiment of the present invention;

FIG. **3** is a perspective view of the induction charging apparatus of the present invention particularly showing a state when the device unit and the power source unit are coupled;

FIG. **4** is a cross-sectional view of the induction charging apparatus of FIG. **1**, particularly showing a state when the device unit and the power source unit are separated;

FIG. **5** is a cross-sectional view taken along a line V—V shown in FIG. **3**;

FIG. **6** is a cross-sectional view taken along a line VI—VI shown in FIG. **3**; and

FIG. **7** is a circuit diagram of an induction charger employed in the preferred embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

First the principle of the present invention will be described. The induction charging apparatus of the present invention is, as schematically shown in FIGS. **1A** and **1B**, and includes a power source unit **12** and a device unit **18**. For supplying power to a load **20** in the device unit **18**, the units **12** and **18** are held in contact with each other at least partly at confronting surfaces thereof, and after the power supply, the units **12** and **18** are detached from each other. The power source unit **12** includes a first casing **22**, a primary coil **14** accommodated in the first casing **22**, and a primary oscillator

section **10** also provided in the first casing **22** for feeding an alternating current power supplied from a commercial alternating current power source to the primary coil **14**.

The device unit **18** has a second casing **24**, a secondary coil **16** inside the secondary casing **24** which is to be coupled to the primary coil **14** through electromagnetic induction, and a load **20**, such as a rechargeable battery, housed in the second casing **24** and receiving electric power from the secondary coil **16**.

When the device unit **18** is separated from the power source unit **12**, an outer face **26** of a depressible member **78** of the first casing **22** which comes in contact with the second casing **24** is held away by a predetermined distance from the primary coil **14**. When the device unit **18** is mounted, the outer face **26** is depressed down by a part of a face **28** of the second casing **24** so that the depressible member **78** moves towards the primary coil **14**.

As shown in FIG. **1**A, while the power source unit **12** is separated from the device unit **18**, the depressible member **78** is held a predetermined distance away from the primary coil **14**. Thus, the magnetic flux density of a magnetic field **88** generated from the primary coil **14** is very small at places over the outer face **26** of the depressible member **78**, giving no or very little electromagnetic influences to a foreign matter such as a metallic element or the like which is put on the outer face **26** of the power source unit **12**.

When the device unit **18** is coupled to the power source unit **12** with the depressible member **78** depressed down, as indicated in FIG. **1**B, the primary and secondary coils **14** and **16** come close to each other. Thus, the coils **14** and **16** are electromagnetically induced and coupled with each other, so that a predetermined power is supplied to the load **20** of the device unit **18** from the source unit **12**.

As depicted hereinabove, since the magnetic field **88** leaking outside the first casing **22** when the device unit **18** is detached from the power source unit **12** is restricted to be as small as possible, it is possible to prevent a metallic element in the vicinity of the source unit **12** from being heated by the electromagnetic influence, such as by the eddy current.

On the other hand, in the case where the device unit **18** is coupled to the power source unit **12**, the depressible member **78** of the power source unit **12** is depressed and moved closely adjacent to the primary coil **14**, whereby the power is efficiently supplied to the load **20** in the device unit **18** from the power source unit **12**.

Next, a preferred embodiment of the present invention will be described hereinbelow. It is needless to say, however, that the present invention is not limited to the example, but may be generally similarly applied in power-driven tooth brushes, power-driven tools and the like kinds of electric apparatuses.

As is understood from the total structure shown in FIGS. **2**, **3**, the charger of the invention is constituted of an inverter equipped power source unit **12** and a device unit **18**. The power source unit **12** and the device unit **18** can be detachably engaged so that a secondary battery **30** provided inside the device unit **18** can be charged by a charging current sent from the power source unit **12** through electromagnetic induction coupling.

Referring to FIG. **7**, an electric circuit of an induction charger provided in the power source unit **12** and device unit **18** is shown. The charger has a socket that can be connected to a commercial alternating current power source **34** via a power source cable **32** extending outside a first casing **22** of the power source unit **12**. The alternating current power is applied to a protecting circuit **36** and in turn to an inverter circuit **38**.

In the protecting circuit **36**, a large current is blocked by metallic film resistor **40** connected in series to a power line of the inverter circuit **38**, while a surge voltage is shut by an voltage absorbing element **42** connected parallel to the power line. The input voltage is rectified by a rectifier **44**. If a current more than a permitted level should flow, a fuse **46** connected between the rectifier **44** and the inverter circuit **38** will brake to prevent the overflow of the current. Also, noise signals from the inverter circuit **38** are cut off by a capacitor **48**.

The inverter circuit **38** has a primary coil **14** and a protecting resistor **52** which are connected respectively to a collector and an emitter of a switching transistor **50**. The base of the switching transistor **50** is connected to controllers **54** and **56**.

The controller **54** has a series circuit of a resistor **58**, a capacitor **60** and a feedback coil **62**. The ON/OFF cycle of the switching transistor **50** is regulated to about 40 KHz by a time constant of the resistor **58** and capacitor **60** of the controller **54**. The switching transistor **50** is also controlled to be turned ON by the feedback coil **62** and capacitor **60**.

More specifically, when capacitor **60** is charged via resistor **58** to provide a predetermined voltage to the base of switching transistor **50**, a collector current starts to flow in the primary coil **14**. The increase of the collector current causes the feedback coil **62** to generate voltage which will eventually turn the switching transistor **50** ON. As a result, the transistor **50** is abruptly turned ON. After the turn On of the switching transistor **50**, the charging and discharging of the capacitor **60** proceeds, resulting in the reduction of the base current to reverse the voltage generated across the feedback coil **62**. Accordingly, a reverse bias is added between the base and emitter of the transistor **50**, causing transistor **50** to rapidly turn OFF. By the turn ON and OFF of transistor **50** repeatedly in the above-described manner, the inverter circuit **38** makes self-excited oscillation at a predetermined frequency.

A capacitor **64** connected in parallel to the primary coil **14** absorbs an impulse voltage generated when the transistor **50** is brought to OFF state. The protecting resistor **52** connected to the emitter of the transistor **50** causes to increase the emitter voltage of the transistor **50** in response to the increase of the collector current, thereby regulating the timing when the transistor is turned OFF and preventing the entry of an excessive current to the transistor **50**.

The controller **56** has a capacitor **66** connected in parallel to the feedback coil **62** and a Zener diode **68** connected in series to the capacitor **66** through a diode **72**. A diode **70** inserted between the feedback coil **62** and capacitor **66** allows the transistor **50** to be charged only when the transistor **50** is in the OFF state. Diode **72** between the Zener diodes **68** and capacitor **66** is turned ON by the base voltage of the switching transistor **50** in the ON state thereby to discharge the capacitor **66**.

The charging voltage of the capacitor **66** charged by the feedback coil **62** during OFF of the switching transistor **50** is increased as the load current of the inverter circuit **38** becomes smaller. This is caused by the poor regulating characteristic of an inverter transformer formed by primary and secondary coils **14** and **16**. The charging voltage which is added to the base voltage serves to turn the Zener diode **68** ON. Accordingly, the Zener diode **68** is turned ON by a base voltage lower than that at the normal time, dividing the base current and shortening the ON time of the transistor **50**.

By this arrangement, the power consumed in the inverter circuit **38** is made as small as possible when the device unit **18** is detached from the power source unit **12**, i.e., when no load or little load is impressed.

The power signal from inverter **38** with a frequency higher than the commercial frequency is, after being lowered to the charging voltage in the secondary coil **16** of the device unit **18** which is electromagnetically induced and coupled to the primary coil **14**, rectified by diode **74** to half-wave voltage and is used for charging the secondary battery **30**.

According to the present invention, the coupling mechanism of the primary and secondary coils **14** and **16**, particularly, the structure of the power source unit **12** is novel. As shown in FIG. **2**, the electric circuit of the power source unit **12** is accommodated in the first casing **22** which is opened at **76**. Further, the power source unit **12** is provided with a depressible member **78** made of non-magnetic material, such as plastics, and having a cover plate **90** for covering the opening **76**. The depressible member **78** can be depressed down in the opening **76**.

The primary coil **14** is provided inside the first casing **22** such that the primary coil **14** is wound around a coil bobbin **82** secured to a flat printed circuit board **80**. A magnetic core **84** of a ferromagnetic body of high magnetic permeability, e.g., ferrite, is inserted through the primary coil **14**. A portion of the magnetic core **84** protrudes from the upper face of the bobbin coil **82** by a predetermined distance. The rear face of the printed circuit board **80** is fixed to the inner face **86*d*** of the first casing **22** with a suitable stop bar **128**, serving as a spacer. The magnetic core **84** of the primary coil **14** is hence disposed approximately at the center inside the first casing **22** and directed upward in the vertical direction.

The depressible member **78** is normally held up and separated from the primary coil **14**, as shown in FIG. **4**, so that the region above the depressible member **78** in the normal position is spaced a predetermined distance from the magnetic core **84**. Thus, density of the magnetic flux **88** generated by the primary coil **14** will not so be intense above the depressible member **78**. Thus, even if some metallic object, such as a paper clip, should be placed on a face **26** of the depressible member **78**, very few magnetic flux **88** will intersect the paper clip, resulting in very low power consumption in the paper clip.

On the other hand, when the face **26** is depressed by the device unit **18**, the depressible member **78** slides down towards the primary coil **14** to closely couple the primary coil **14** with the secondary coil **16** via the magnetic core **84**.

Specifically, cylindrical engaging parts **108** are formed at opposite ends, in the longitudinal direction, of the lower face of the depressible member **78**. At each end, an urging member **106** such as a coil spring or the like is fitted. The other end of the urging member **106** is inserted in receiving recess **110** formed in the first casing **22**. The depressible member **78** is urged upward by the elasticity of the urging members **106** when the device unit **18** is not coupled to the power source unit **12**.

Further, the depressible member **78** has four guide plates **92, 94, 96, 98** extending downwardly from the four sides of the rectangular cover plate **90** which is slightly smaller than the opening **76**. Each of the first and second guide plates **92, 94** as a first and a second guide means extending from opposing short sides of the cover plate **90** have approximately the same length as the depress distance of the cover plate **90**. A rib **112** is formed extending outward from the lower end of each of the guide plates **92** and **94**. The third and fourth guide plates **96, 98** extending respectively from opposing long sides of the cover plate **90** are slightly longer than the first and second guide plates **92** and **94**. The rib **114** is provided at the same level as the rib **112** and also a guide rib **116** is arranged at further lower end of the third guide plate **96**. The ribs are provided for engagement with corresponding ribs provided in the casing **22** to prevent the depressible member **78** from falling out from the casing **22**, as described below.

Formed inside the first casing **22** is a U-shaped rib **118** extending along the three inner faces **86*a***, **86*b*** and **86*c*** at places confronting to the first-third guide plates **92, 94, 96**. Therefore, as shown in FIG. **4**, the rib **118** of the first casing **22** is normally engaged and held in contact with the ribs **112, 114** of the depressible member **78** by the springs **106**. When the device unit **18** is separated, the distance of an upper face **26** of the depressible member **78** to the primary coil **14** is maintained to be a predetermined distance, and the depressible member **78** is prevented from falling off from the first casing **22**.

As best shown in FIG. **2**, the length of guide ribs **116** and **114** of the third guide plate **96** is made slightly shorter than the distance between columns **119** provided on the inner face **86*c***, so that opposite ends of ribs **116** and **114** slides along the side faces of the columns **119**. By this arrangement, the sideway wobbling movement (in a direction parallel to ribs **116** and **114**) of the depressible member **78** can be prevented. Also, the fourth guide plate **98** is slidingly inserted in a space between the rear face of the printed circuit board **80** and the inner face **86*d*** of the first casing **22**. By this arrangement, back and force wobbling movement (in a direction parallel to ribs **112**) of the depressible member **78** can be prevented. Furthermore, when the depressible member **78** is depressed a predetermined distance, a further depression of the depressible member **78** is prevented by the contact between the bottom face of rib **116** and stop bar **126** extending between columns **119**, and also by the contact between the bottom face of fourth guide plate **98** and stop bar **128**. The depressible member **78** is accordingly prevented from being pressed excessively into the first casing **22**. Also, by the above arrangement, the depressible member **78** is prevented from being caught in the opening **76** and becoming unable to slide when the depressible member **78** is depressed in a slanted direction.

Further, an engaging projection **104** is formed almost at the center of the cover plate **90**, projecting upward from the face **26** of the cover plate **90**. The engaging projection **104** has a hole **100** into which the front end of the magnetic core **84** of the primary coil **14** is fitted from below. While the power source unit **12** and the device unit **18** are coupled together, the engaging projection **104** is inserted into an engaging hole **102** at the center of the secondary coil **16** in the device unit **18**.

Since the magnetic core **84** can be easily broken or chipped, the size of the hole **100** is so arranged that some clearance is provided around the magnetic core **84** even after the depressible member **78** is fully depressed. The break or detachment of the magnetic core **84** not only decreases the charging efficiency, but is dangerous to cause a fire or the like by the generated heat.

The cross-sectional size of the second casing **24** is slightly smaller than the cross-sectional size of the first casing **22**. A bobbin **120** of the secondary coil **16** is fixed inside the second casing **24**, with its center aligned with the center of the engaging hole **102**. Secondary battery **30** is provided in the second casing **24** for changing electric power transmitted from coil **14** to coil **16**. A direct current power source cable

124 extends from the upper face of the second casing 24 to supply DC power from the secondary battery 30 to an external load 122 of the electric apparatus, such as a motor or the like.

As indicated in FIGS. 3, 5, 6, when the lower end of the device unit 18 is pressed into the opening 76 of the power source unit 12, the depressible member 78 is depressed against the urging of springs 106, whereby the exposed part of the magnetic core 84 from the bobbin 82 is completely covered by engaging projection 104 which is in turn inserted in engaging hole 102. In this depressed and engaged position, the secondary coil 16 is magnetically coupled to the primary coil 14.

The casing 24 of the device unit 18 has a projection 130, serving as a first engaging means, formed at a lower center portion, as best shown in FIG. 2. The height of the projection 130 is slightly smaller than the thickness of the casing 22. Also, the casing 22 of the power source unit 12 is formed with a recess or an opening 132, serving as a second engaging means, at an upper center portion, as best shown in FIG. 3. The opening 132 is slightly larger than the circumference of the projection 130.

Thus, when the device unit 18 is pushed and inserted into the opening 76 of the power source unit 12 in the above described manner to magnetically couple the coils 14 and 16, the projection 130 engages the opening 132 to maintain the device unit 18 in the inserted position.

In the above-described embodiment, the magnetic core 84 is provided at the side of the primary coil 14 and arranged to penetrate the secondary coil 16 when the power source unit 12 is coupled to the device unit 18. However, the present invention is not limited to the above embodiment, and a similar magnetic core may be arranged at the side of the secondary coil 16 as well. Moreover, the magnetic core itself may be omitted if the oscillating frequency of the inverter circuit 38 is raised. In this case, the coils may be formed by printing. In any case, the faces 26, 28 can be made flat.

Alternatively, the inverter circuit 38 is not limited to the self-excited model as above and may be suitably modified, for example, to be excited by a separate oscillator. Alternatively, the primary oscillator section 10 may be adapted to utilize the frequency of the commercial alternating current power source 34 directly, in place of using the inverter circuit 38.

The distance between the primary and secondary coils 14, 16 may be changed in different degree, so that the power supplied from the power source unit 12 to the device unit 18, namely, the charging current to the secondary battery 30 can be changed.

Furthermore, although the ribs, such as 119, are formed by separate members and are adhered on the inner face 86*c* of the first casing 22, such ribs may be integrally formed with the casing 22 by forming a suitable step at locations where the ribs are necessary. The same can be said to stop bars 126, 128.

Alternatively, step portions may be formed in the inner faces 86*c*, 86*d* to function both as the guide ribs 119 and as the stop bars 126, 128. The lower end of the guide plate 96 may be formed with uniform thick plate from guide rib 116 to guide rib 114 at the thickness equal to that of guide rib 116.

Also, the device unit 18 can be formed uniformly with the electric apparatus.

Although the present invention has been fully described in connection with one preferred embodiment thereof with reference to the accompanying drawings, it is to be noted that various changes and modifications are apparent to those skilled in the art. Such changes and modifications are to be understood as included within the scope of the present invention as defined by the appended claims unless they depart therefrom.

What is claimed is:

1. An induction charging apparatus having a power source unit and a device unit detachable from said power source unit, said induction charging apparatus comprising:

said power source unit comprising:

a first casing having one end opened;

a primary coil provided in said first casing;

oscillator means provided in said first casing for supplying an alternating current powered by a commercial alternating current power source to said primary coil to generate magnetic fluxes; and

a depressible member movably provided and closing said open end of said first casing, said depressible member movable between a lift position at which said magnetic fluxes are substantially located under said depressible member and inside said first casing, and a depressed position at which portions of said magnetic fluxes are substantially located over said depressible member and outside said first casing;

said device unit comprising:

a second casing having one end detachable to said open end of said first casing;

a secondary coil provided in said second casing and adjacent to said one end; and

load means provided in said second casing for receiving power from said secondary coil, whereby when said second casing is attached to said first casing with said depressible member being moved to said depressed position, said primary and secondary coils are coupled to link said magnetic fluxes from said primary coil to said secondary coil, and when said second casing is detached, said depressible member is moved to said lift position to prevent the leakage of said magnetic fluxes.

2. An induction charging apparatus according to claim 1, wherein said depressible member comprises a cover plate and at least one guide plate extending toward inside of said first casing along inner wall of said first casing from at least one side edge of said cover plate so as to guide said depressible member.

3. An induction charging apparatus according to claim 2, wherein said power source unit further comprises a guiding means for guiding said guide plate during the movement of said depressible member between said lift position and depressed position.

4. An induction charging apparatus according to claim 1, wherein said power source unit further comprises urging means for urging said depressible member towards said lift position.

5. An induction charging apparatus according to claim 4, wherein said power source unit further comprises first engaging means provided to said depressible member and upper engagable means provided to said first casing, said first engaging means and said upper engagable means being engaged to each other when said depressible member is moved by said urging means to said lift position for limiting a further upper movement of said depressible member.

6. An induction charging apparatus according to claim 4, wherein said power source unit further comprises second engaging means provided to said depressible member and lower engagable means provided to said first casing, said

second engaging means and said lower engagable means being engaged to each other when said depressible member is moved against said urging means to said depressed position for limiting a further downward movement of said depressible member.

7. An induction charging apparatus according to claim 1, wherein said power source unit further comprises

a third engaging means, and said device unit further comprises a fourth engaging means engagable to said third engaging means for holding said power source unit and said device unit in the attached position.

8. An induction charging apparatus according to claim 1, wherein said power source unit further comprises a magnetic core inserted to said primary coil.

9. An induction charging apparatus according to claim 8, wherein said depressible member is formed with a projected recess for receiving an end portion of said magnetic core when said depressible member is moved to said depressed position.

10. An induction charging apparatus according to claim 9, wherein said device unit is formed with a receiving recess for receiving said projected recess, said secondary coil being position around said receiving recess.

11. An induction charging apparatus according to claim 1, wherein said load means is a rechargeable battery.

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