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Barbati et al.

(54) **INDUCTION COIL ASSEMBLY**

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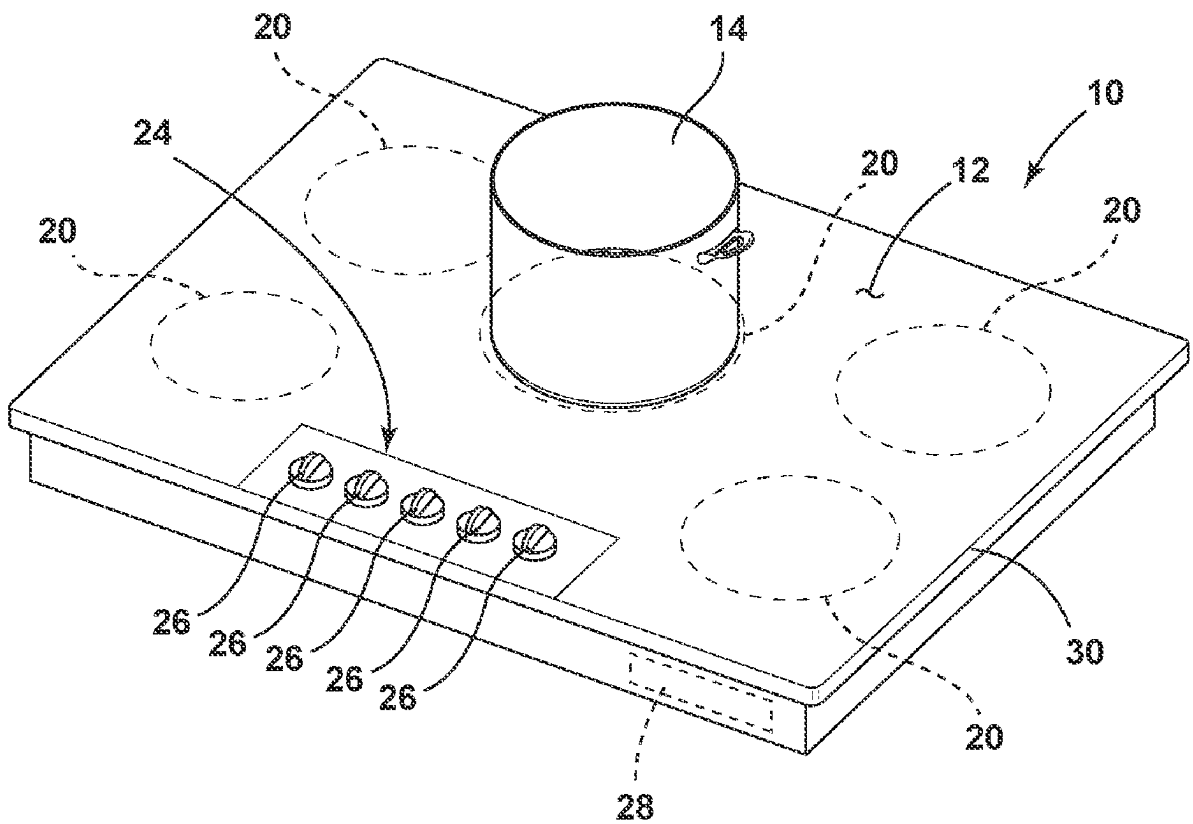
H05B 6/06 (2006.01)
H05B 6/44 (2006.01)

(52) **U.S. Cl.**
CPC ***H05B 6/1281*** (2013.01); ***H05B 6/062*** (2013.01); ***H05B 6/44*** (2013.01)

(57) **ABSTRACT**

An induction cooktop includes a cooking surface operable to support cookware and a resonant circuit having a resonant frequency in the range of 40 kHz to 60 kHz. The resonant circuit includes a capacitor having capacitance of between 0.1 micro-Farads and 0.6 micro-Farads and a coil disposed under the cooking surface and configured to operate at a working frequency of between 50 kHz and 150 kHz. The induction cooktop includes an induction control circuit configured to power the resonant circuit at the working frequency.



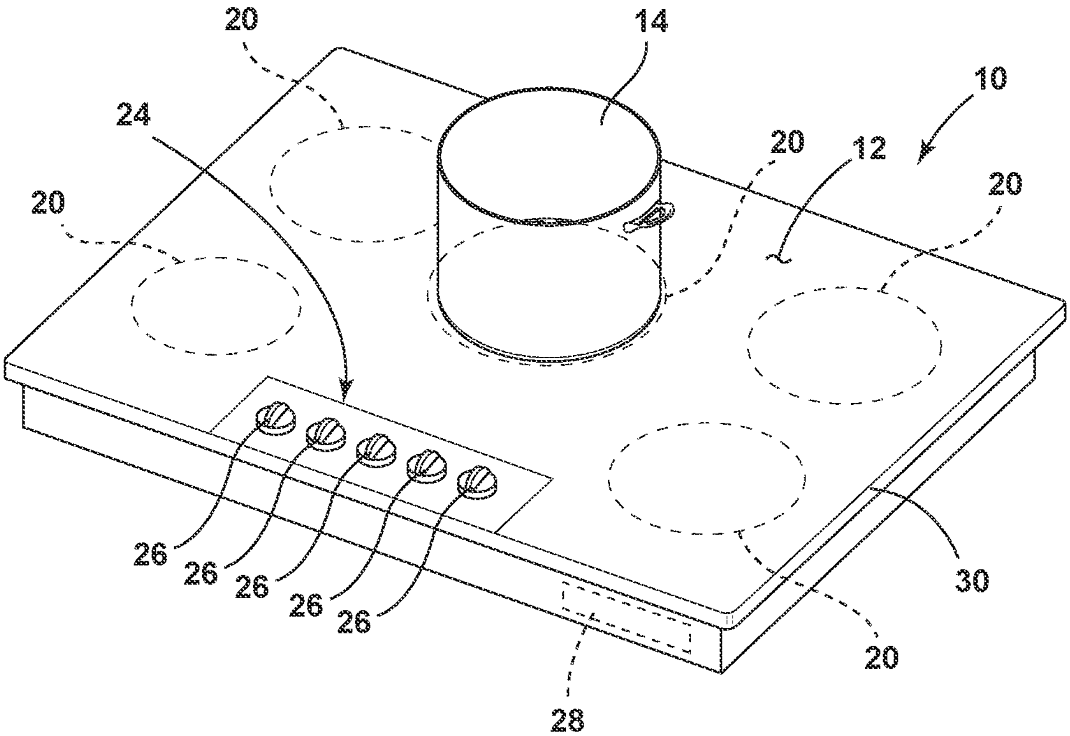


FIG. 1

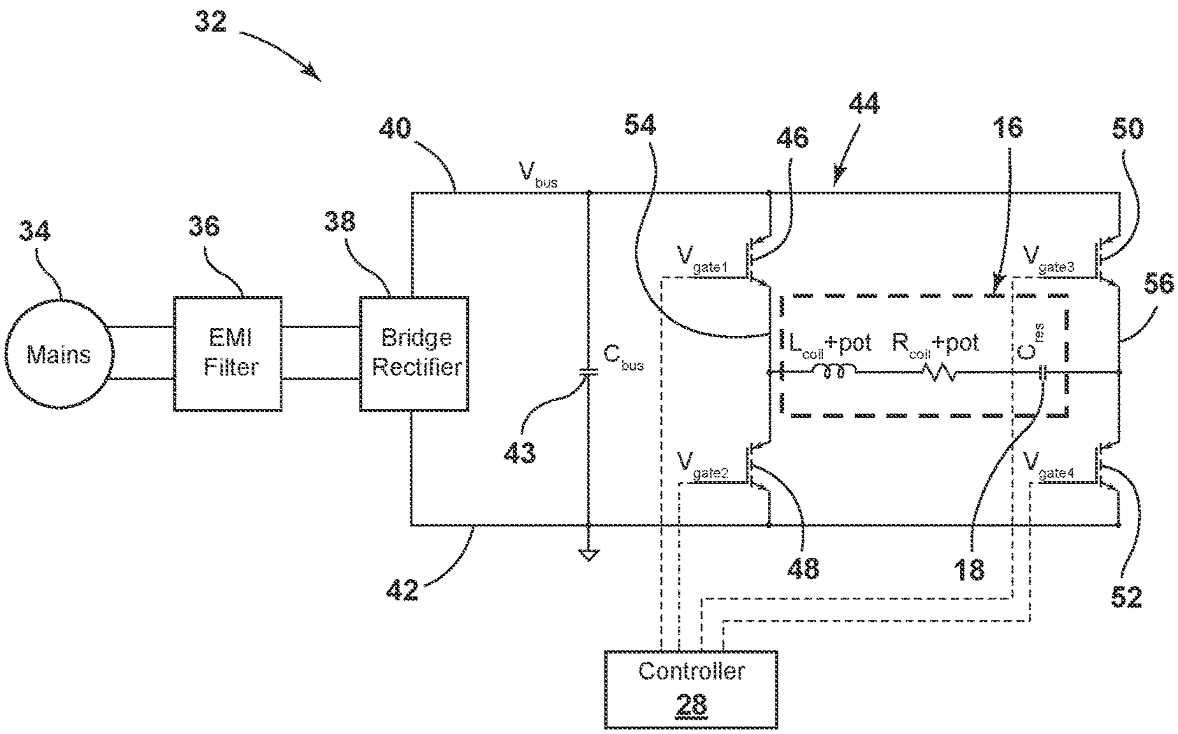

32
40
V_{bus}
54
46
44
16
50
34
36
38
V_{gate1}
V_{gate3}
56
Mains
EMI Filter
Bridge Rectifier
C_{bus}
L_{coil}+pot
R_{coil}+pot
C_{res}
43
V_{gate2}
V_{gate4}
42
48
18
52
Controller
28

FIG. 2

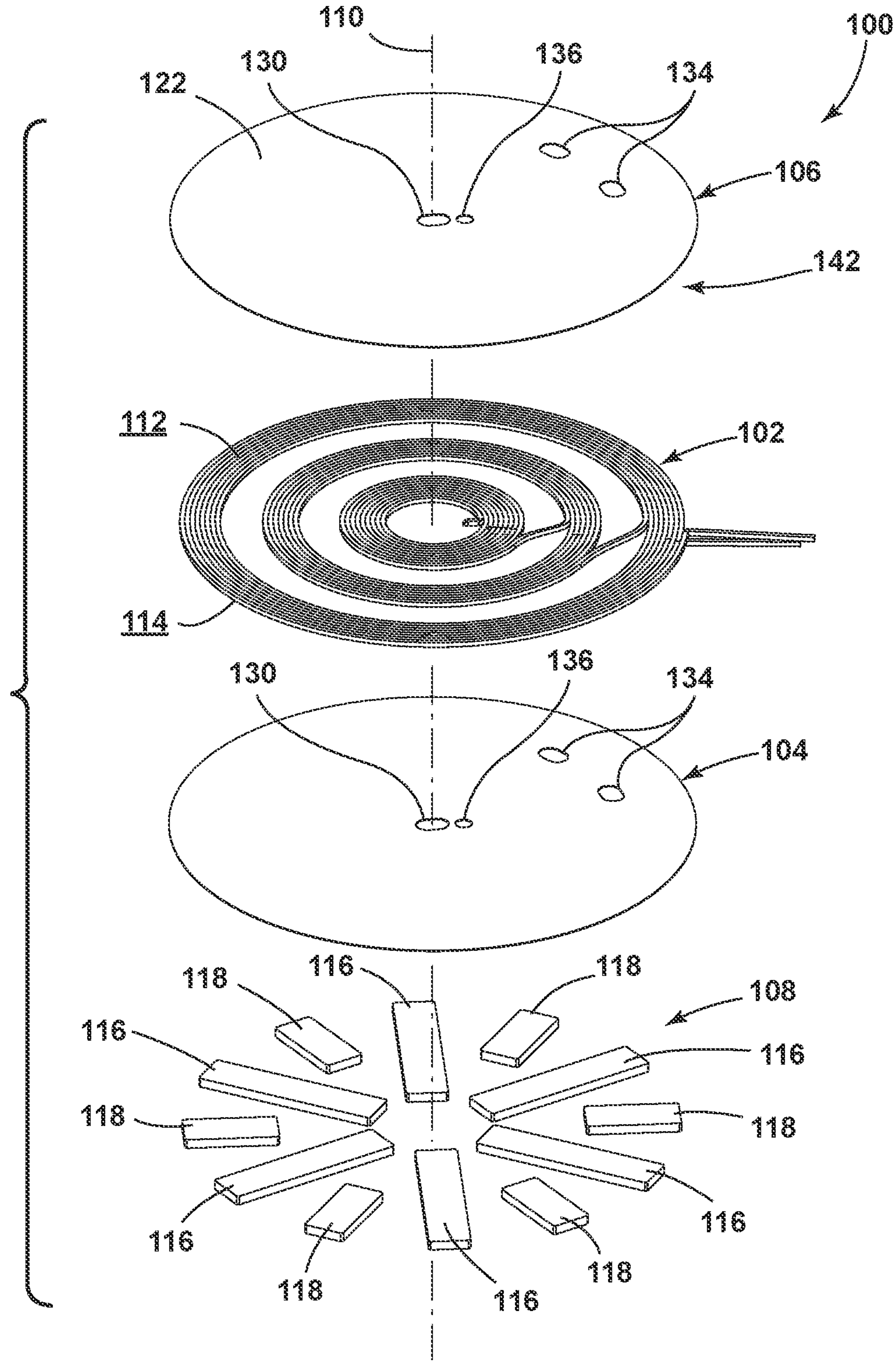

110
100
130
136
134
122
106
142
112
102
114
130
136
134
104
116
118
118
108
116
116
118
118
116
116
116
118
118
116

FIG. 3

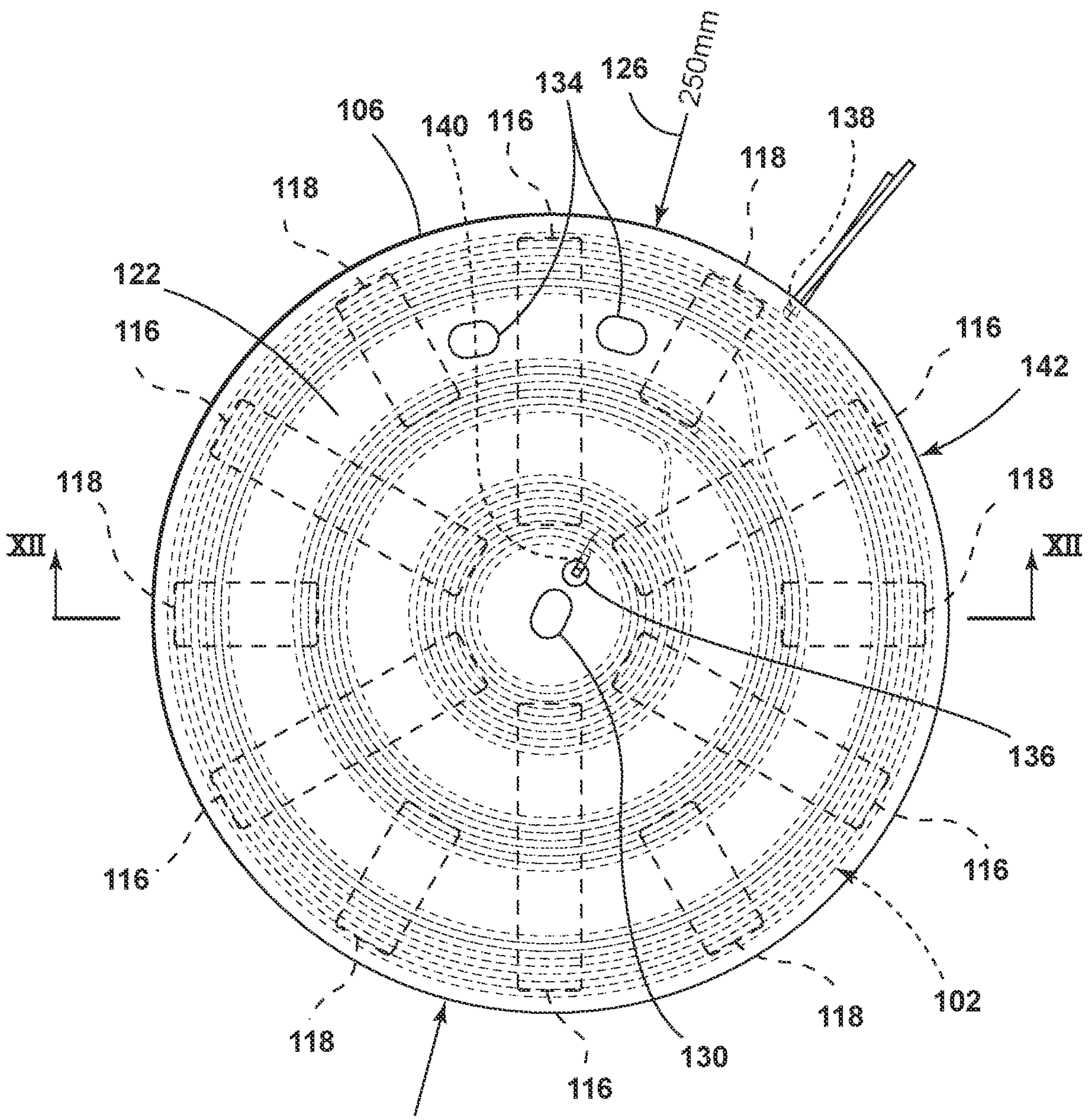

250mm
134
126
106
140
116
138
118
118
122
116
116
142
118
118
XII
XII
136
116
116
102
118
118
130
116

FIG. 4

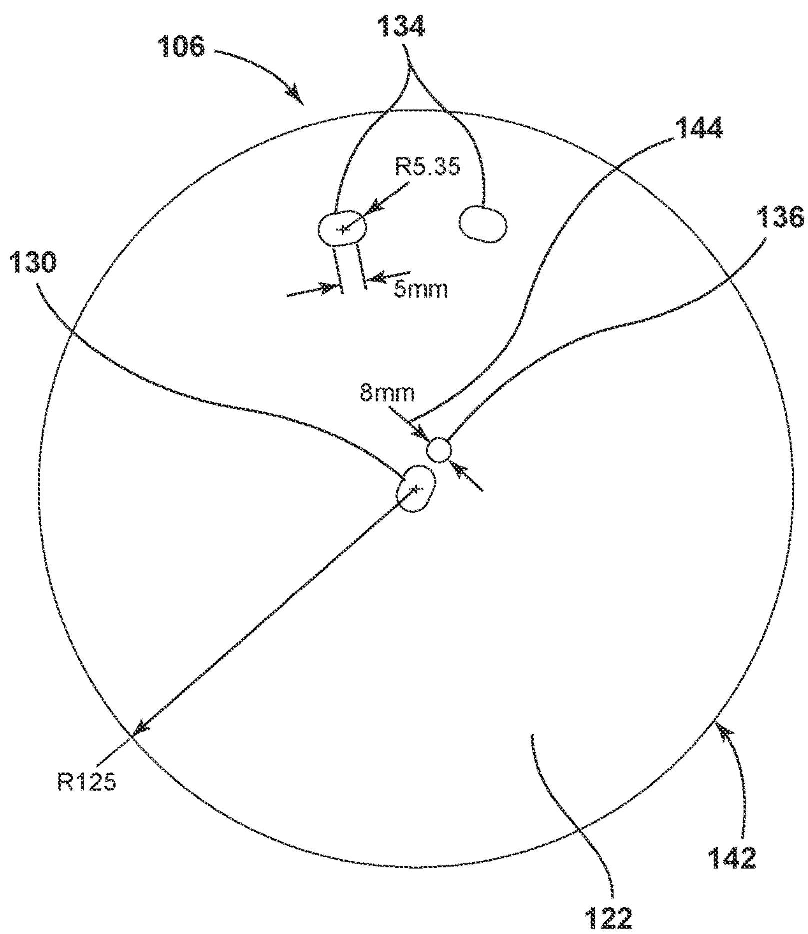

106
134
R5.35
144
136
130
5mm
8mm
R125
142
122

FIG. 5

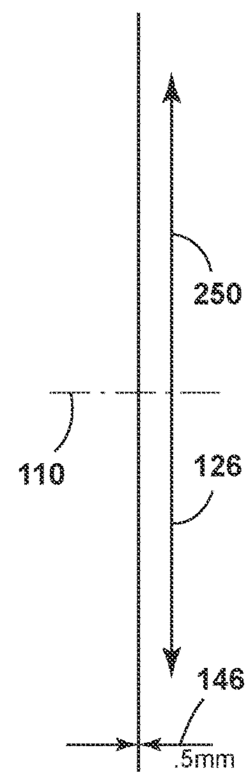

250
110
126
146
.5mm

FIG. 6

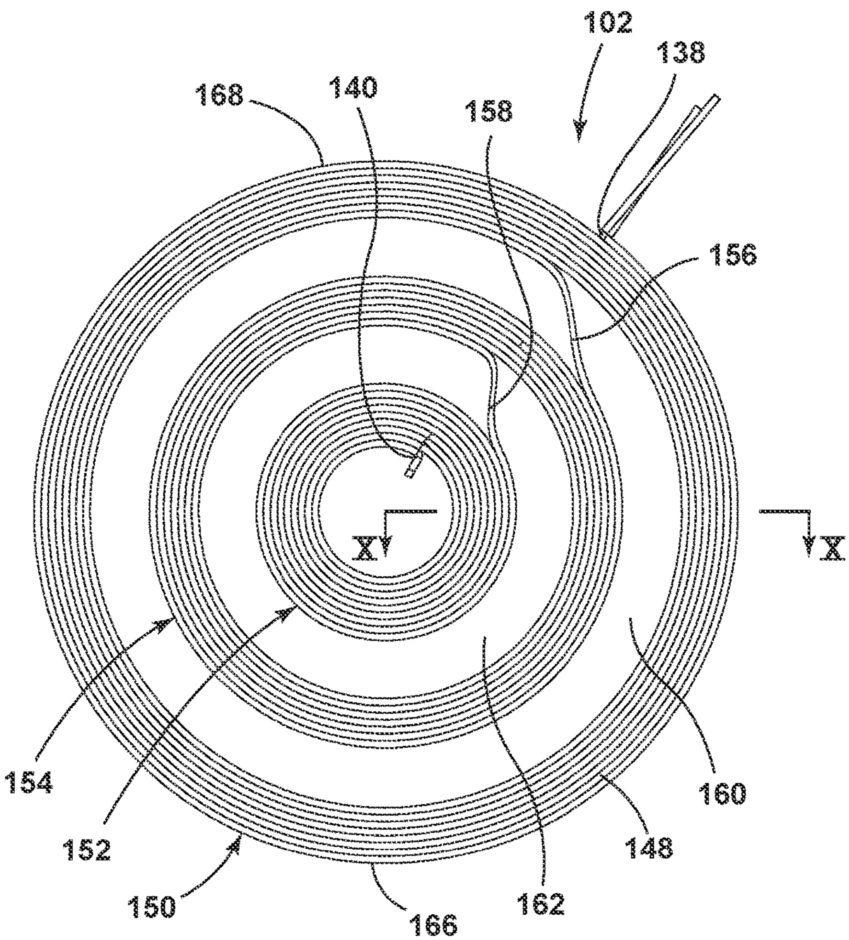

102
138
168
140
158
156
X
X
154
152
150
166
162
148
160

FIG. 7

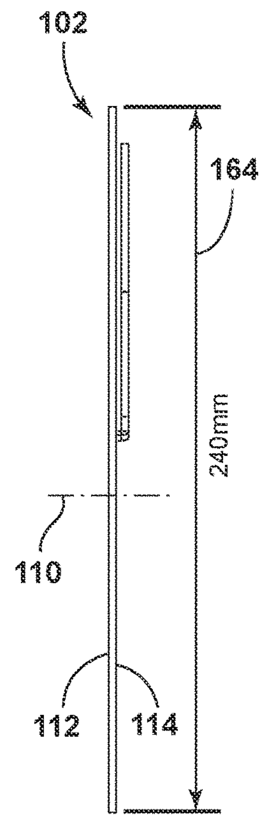

102
164
240mm
110
112
114

FIG. 8

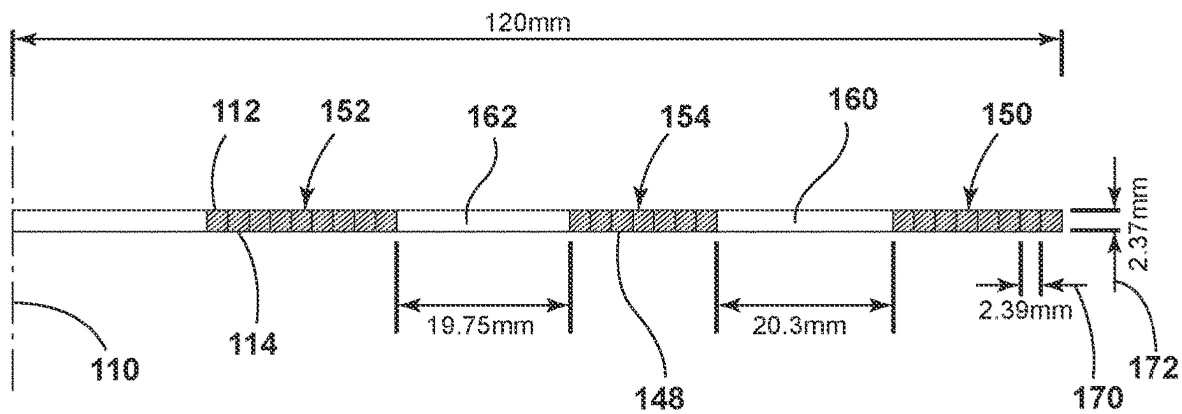

120mm
112
152
162
154
160
150
2.37mm
19.75mm
20.3mm
2.39mm
110
114
148
170
172

FIG. 9

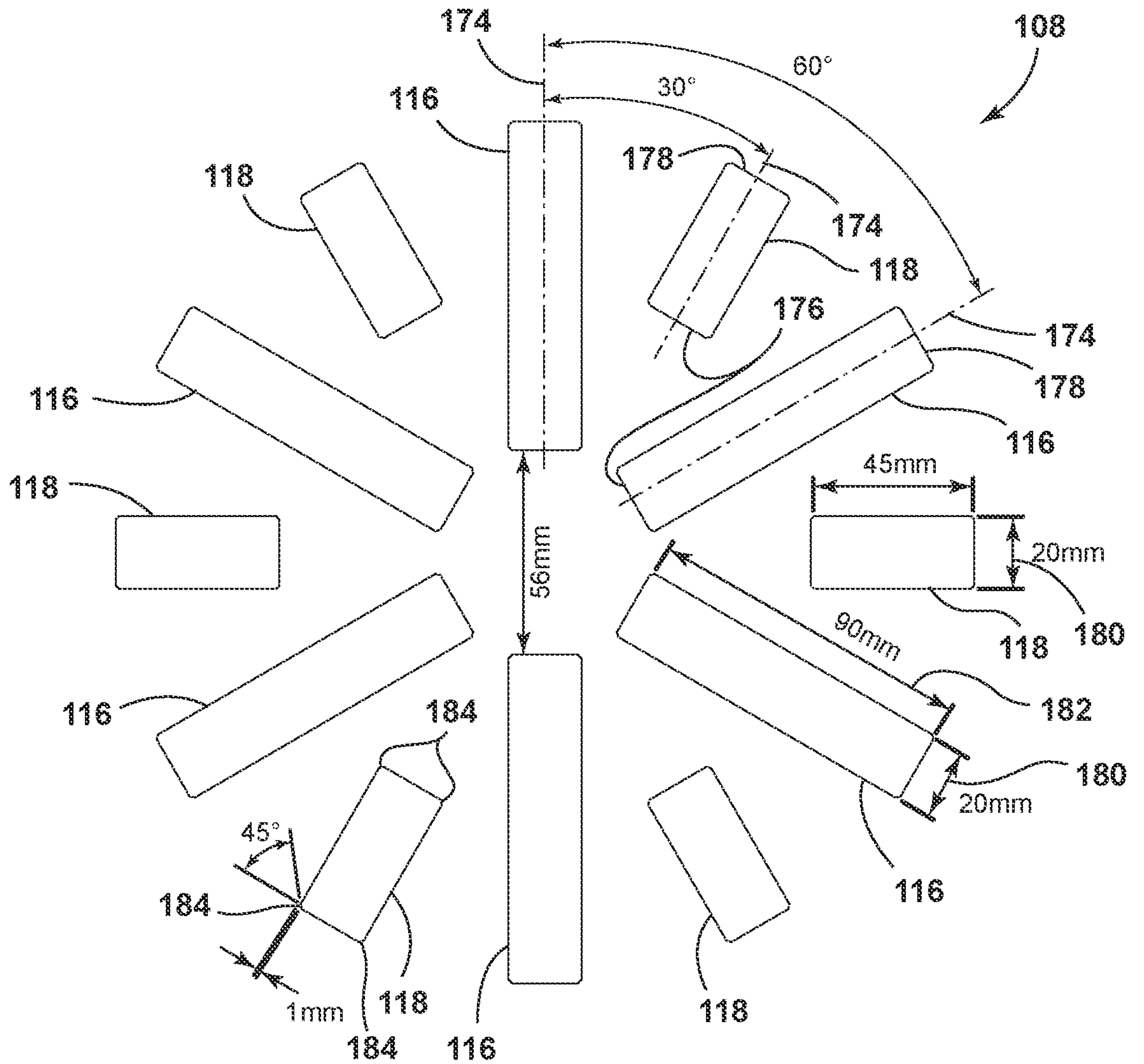

174
108
60°
30°
116
178
118
174
118
118
176
174
116
178
116
116
45mm
118
118
20mm
56mm
90mm
118
180
182
116
184
180
20mm
45°
116
184
118
1mm
118
118
184
116

FIG. 10

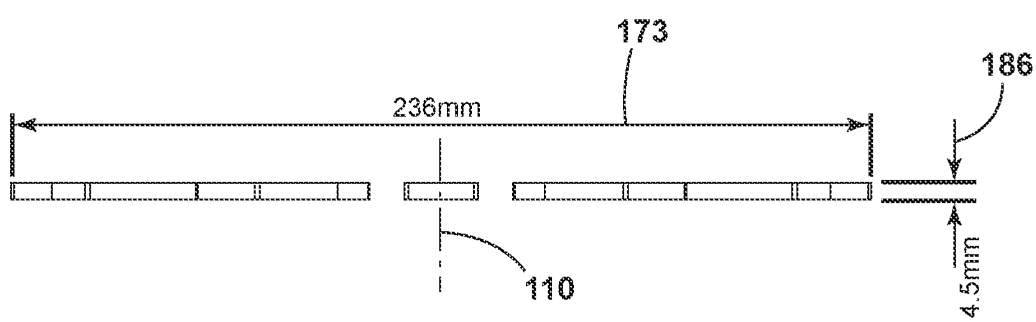

173
186
236mm
110
4.5mm

FIG. 11

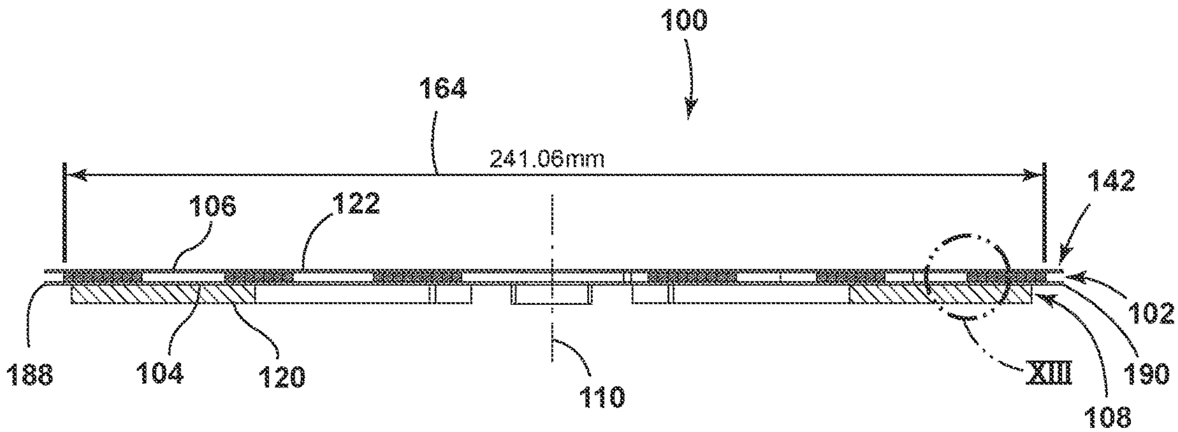

100
164
241.06mm
142
106
122
102
188
104
120
110
XIII
190
108

FIG. 12

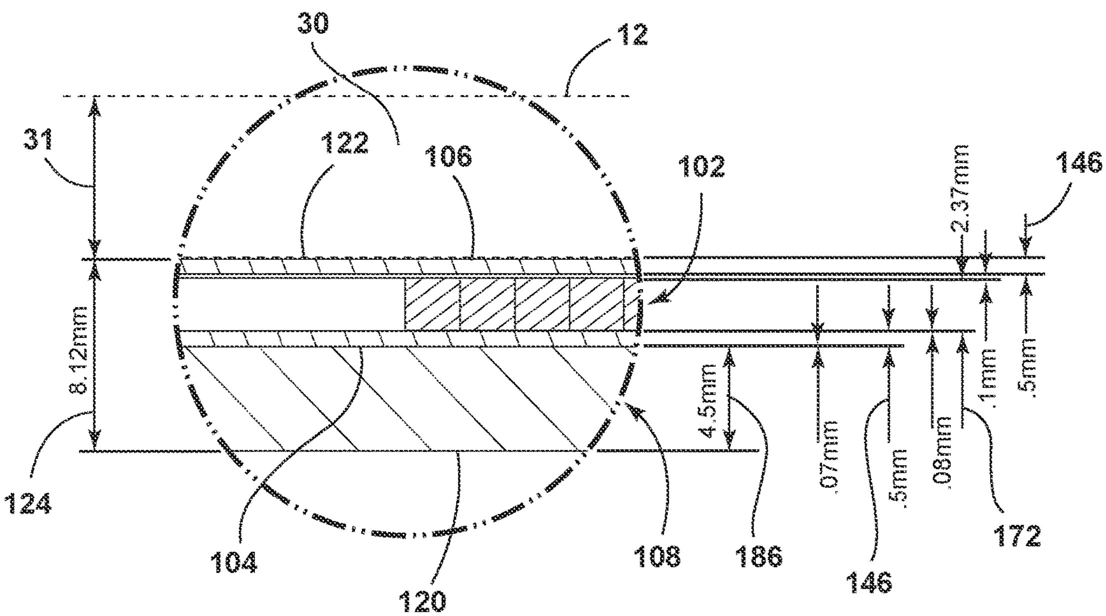

30
12
31
122
106
102
2.37mm
146
8.12mm
4.5mm
.07mm
.5mm
.08mm
.1mm
.5mm
124
104
120
108
186
146
172

FIG. 13

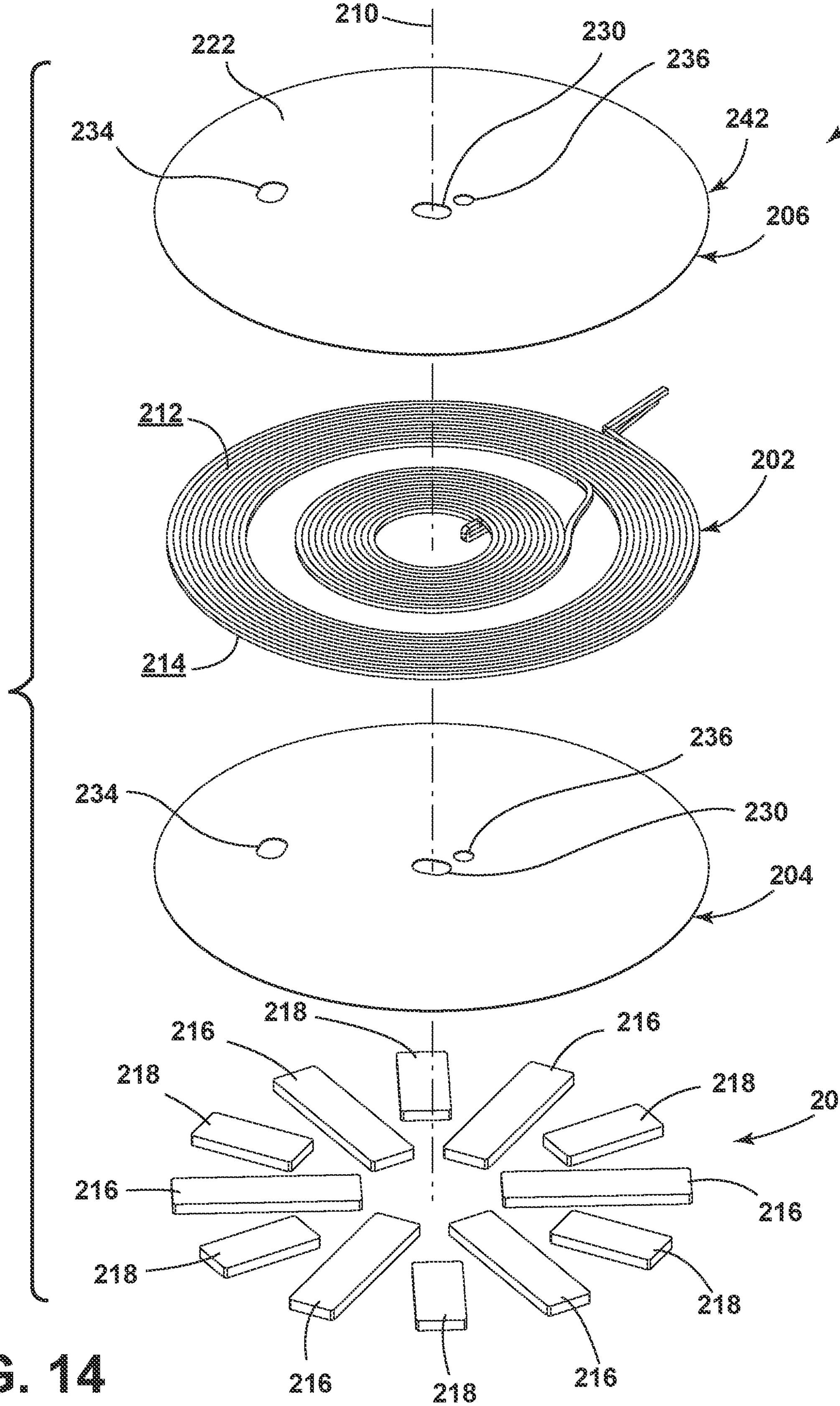

210
222
230
236
200
234
242
206
212
202
214
236
234
230
204
218
216
216
218
218
208
216
216
218
218
216
218
216

FIG. 14

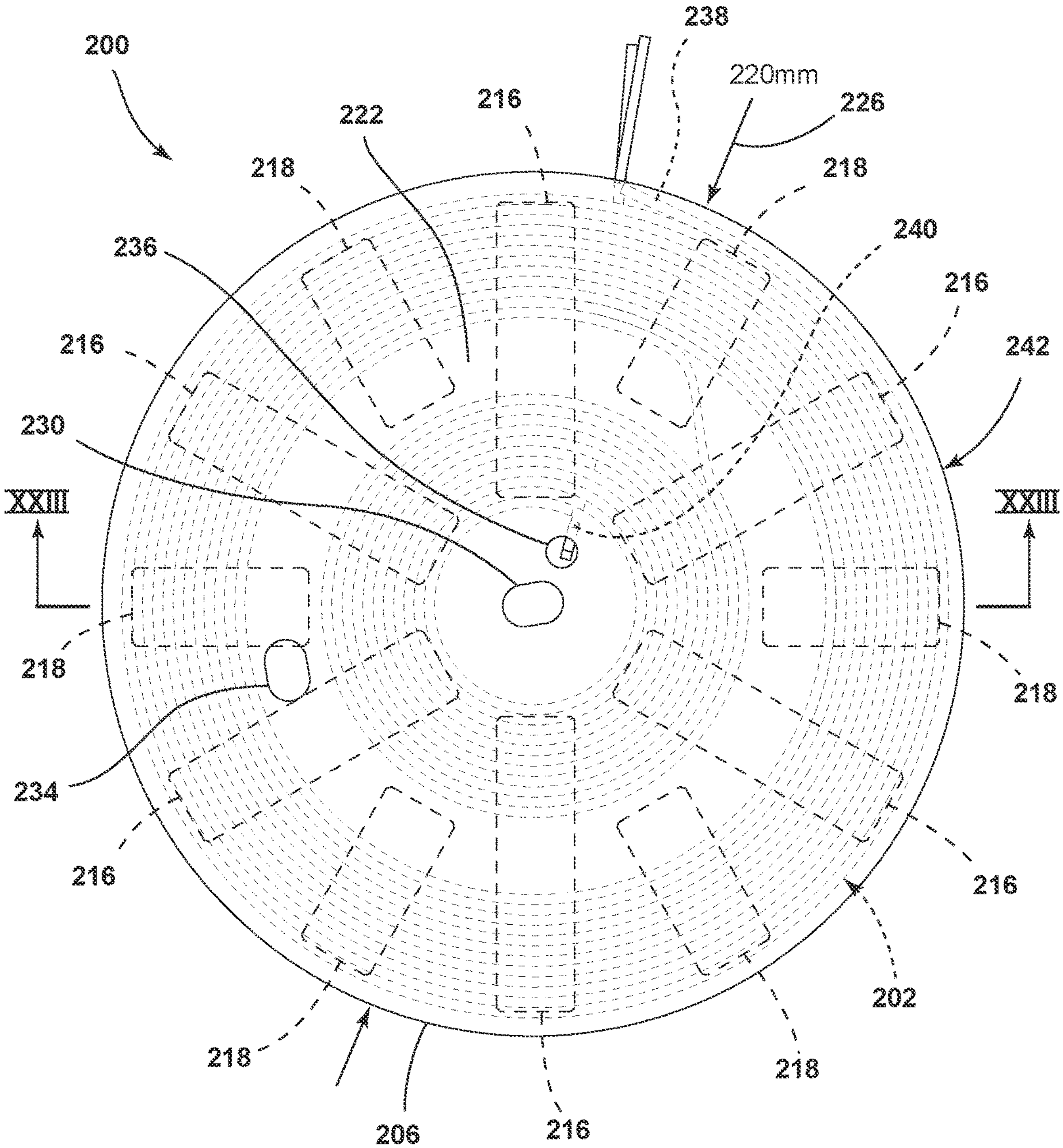

200
238
220mm
226
216
222
218
218
236
240
216
216
242
230
XXIII
XXIII
218
218
234
216
216
202
218
218
206
216

FIG. 15

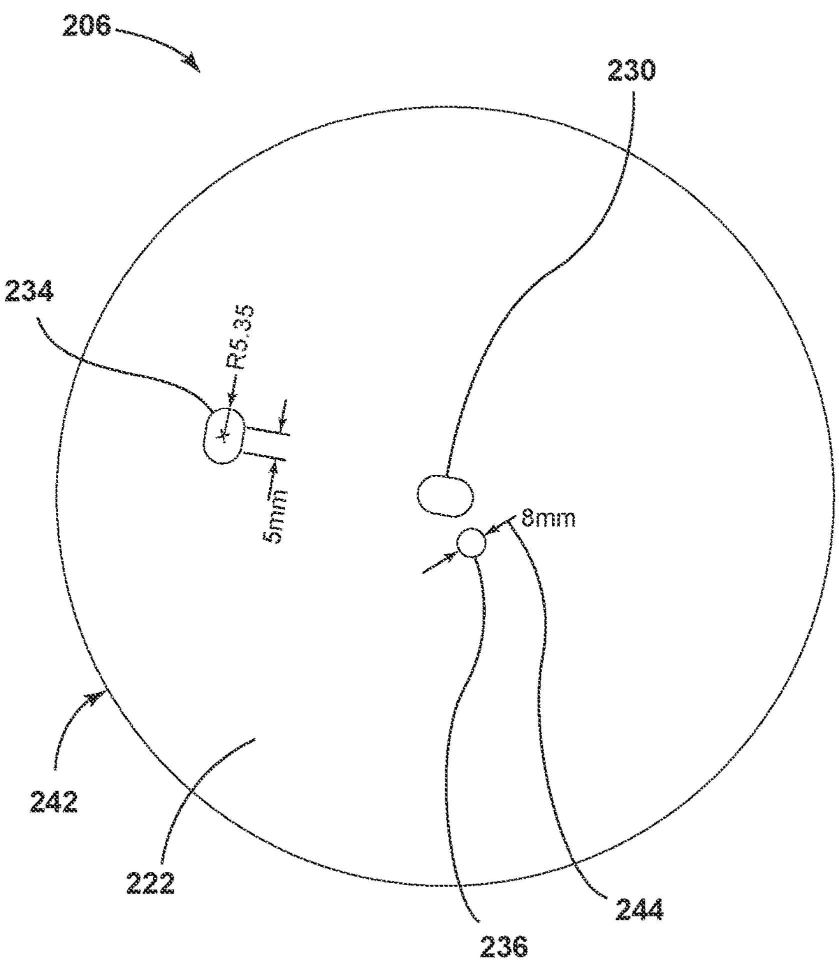


FIG. 16

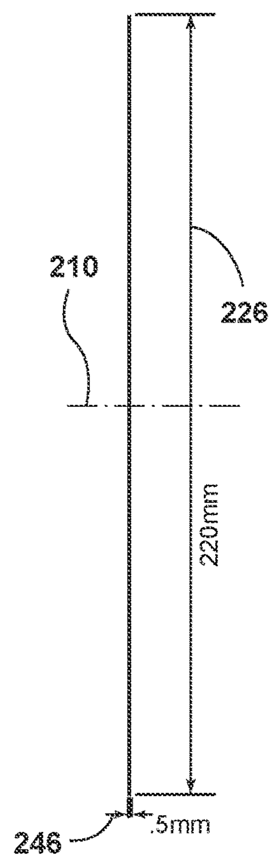


FIG. 17

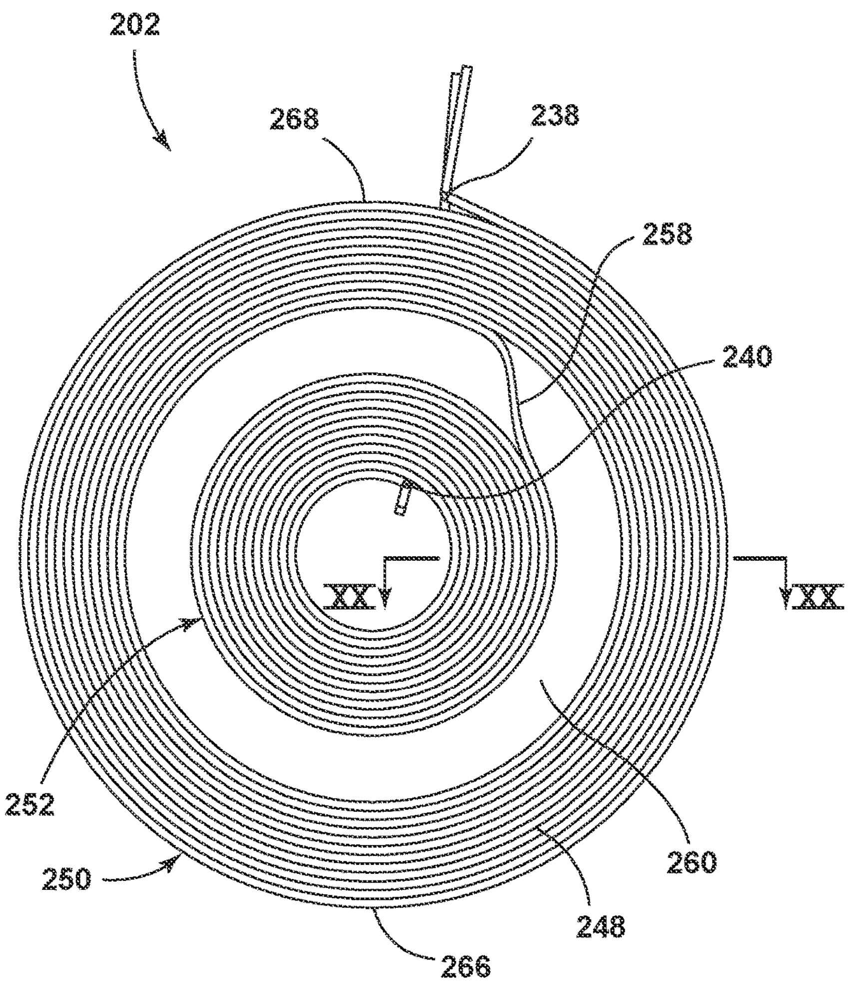

202
268
238
258
240
XX
XX
252
260
250
248
266

FIG. 18

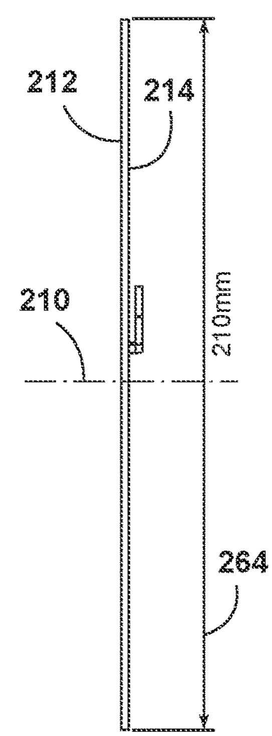

212
214
210
210mm
264

FIG. 19

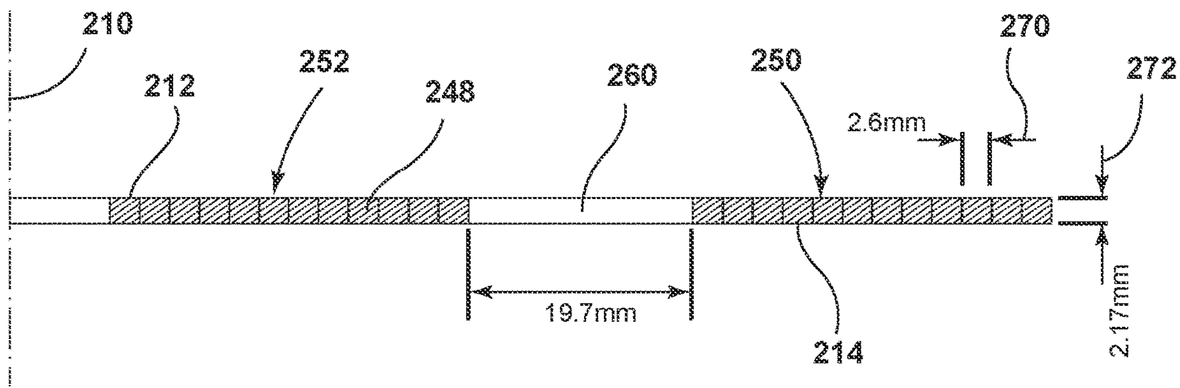


FIG. 20

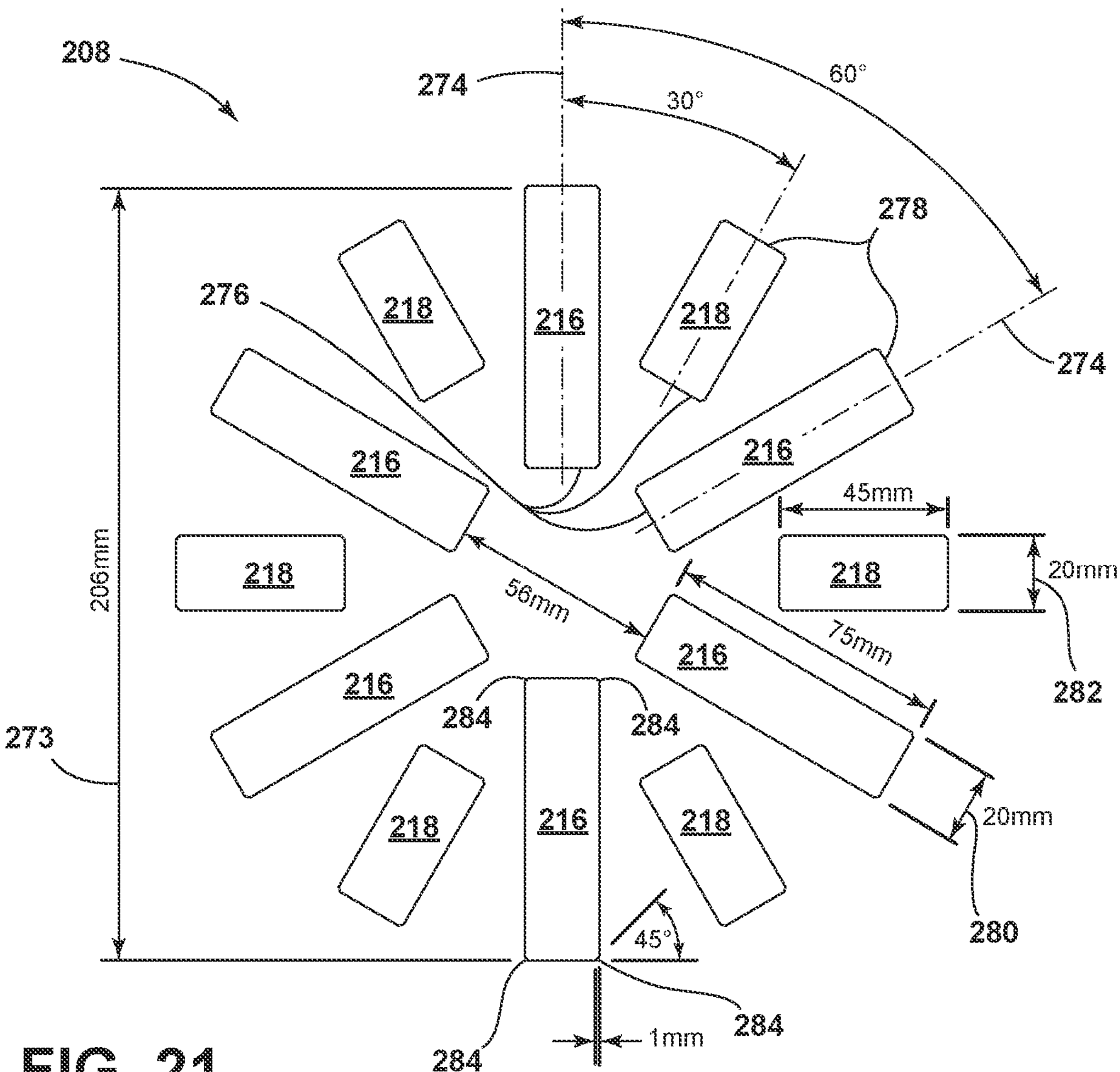

208
274
30°
60°
278
276
218
216
218
274
216
216
45mm
218
218
20mm
56mm
75mm
282
216
216
284
284
273
218
216
218
20mm
280
45°
284
284
1mm
206mm

FIG. 21

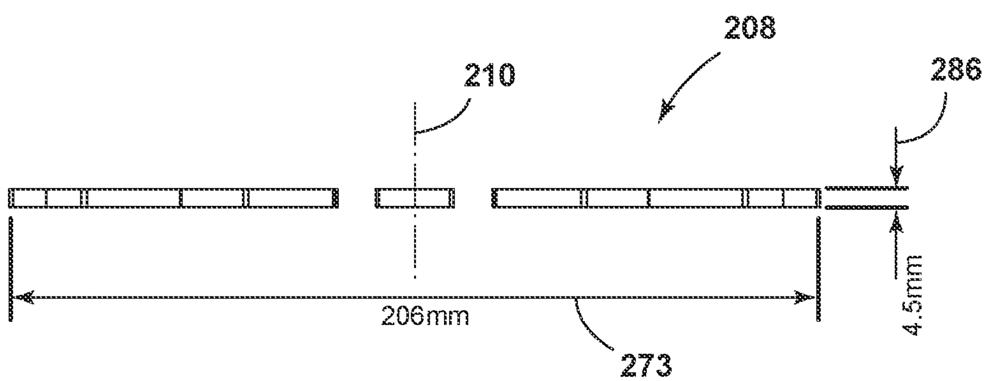

208
210
286
206mm
4.5mm
273

FIG. 22

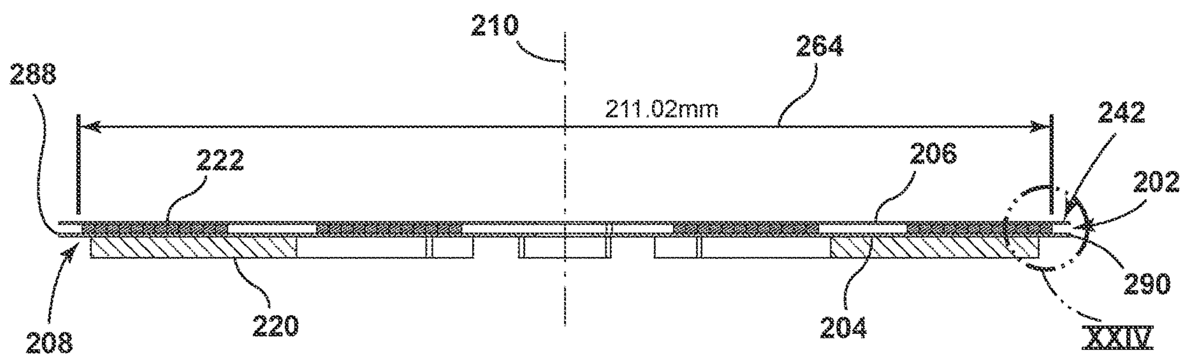

210
264
288
211.02mm
242
222
206
202
290
208
220
204
XXIV

FIG. 23

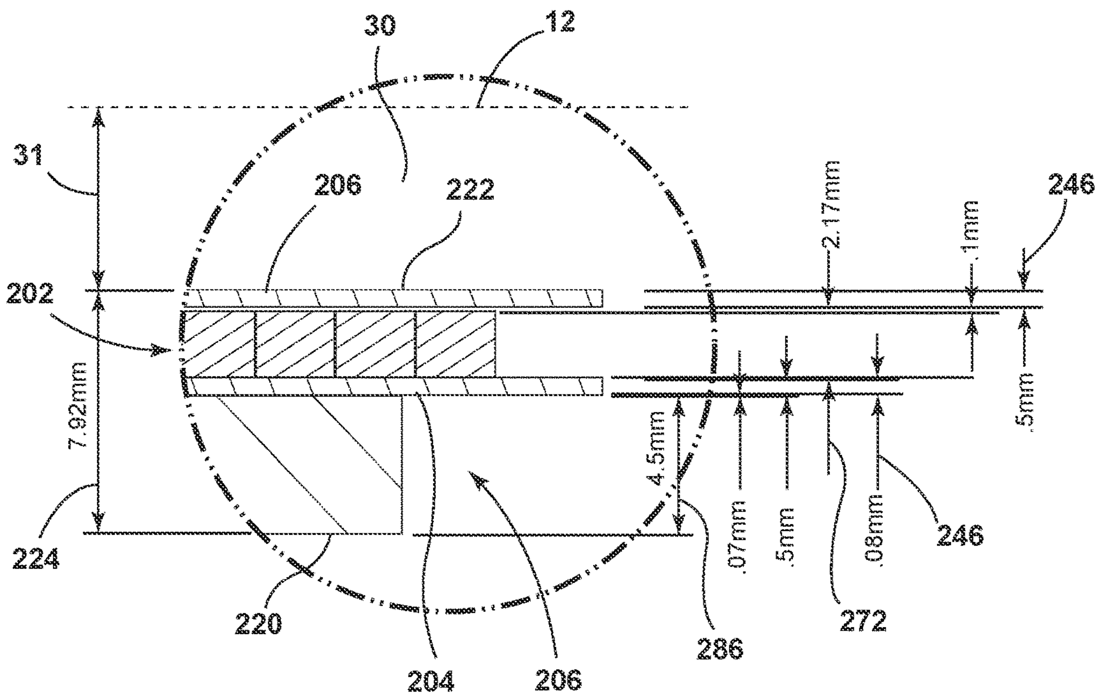

30
12
31
206
222
2.17mm
.1mm
246
202
7.92mm
4.5mm
.5mm
.07mm
.5mm
.08mm
224
220
286
272
246
204
206

FIG. 24

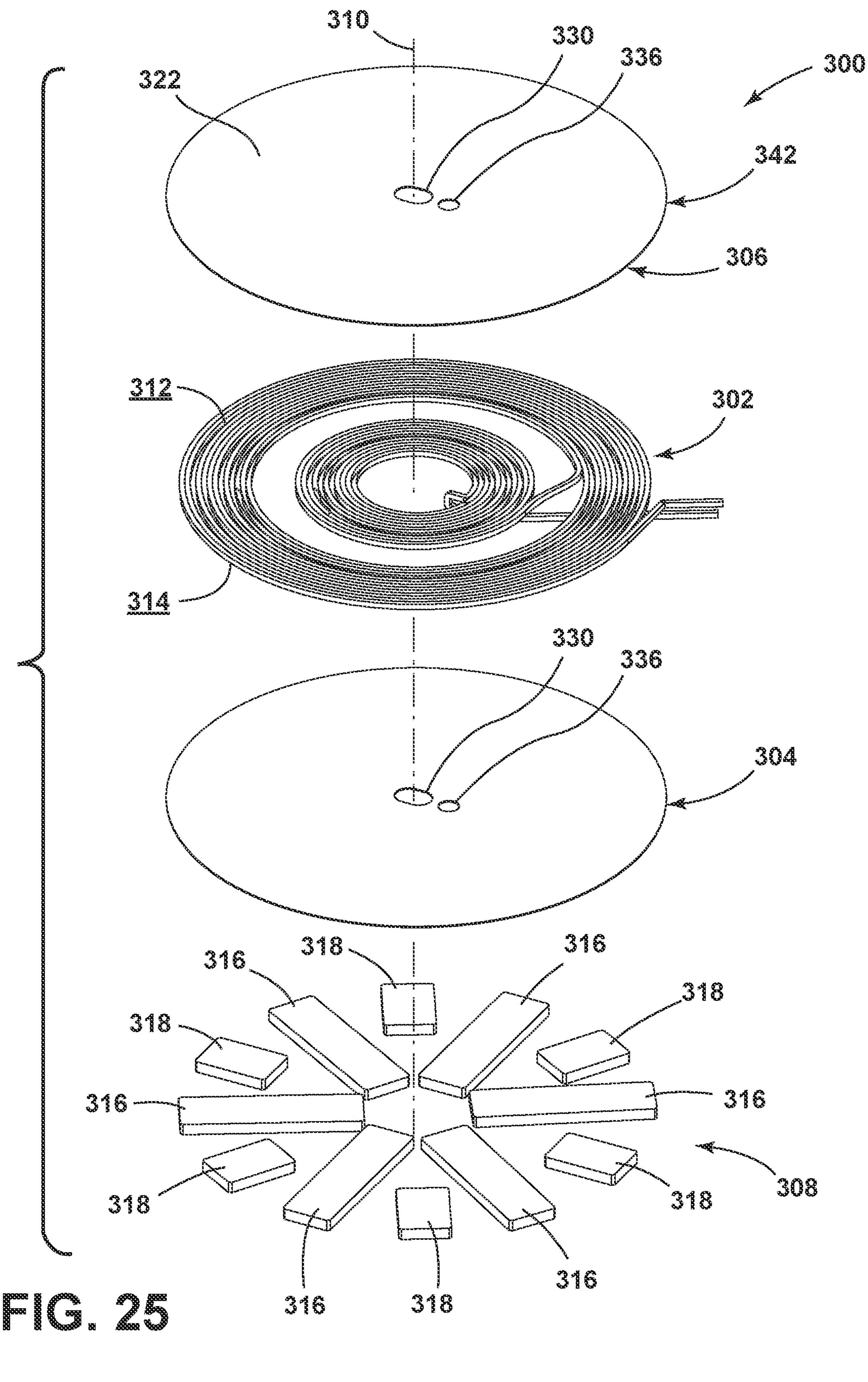

310
330
336
300
322
342
306
312
302
314
330
336
304
318
316
316
318
318
316
316
318
318
308
316
318
316

FIG. 25

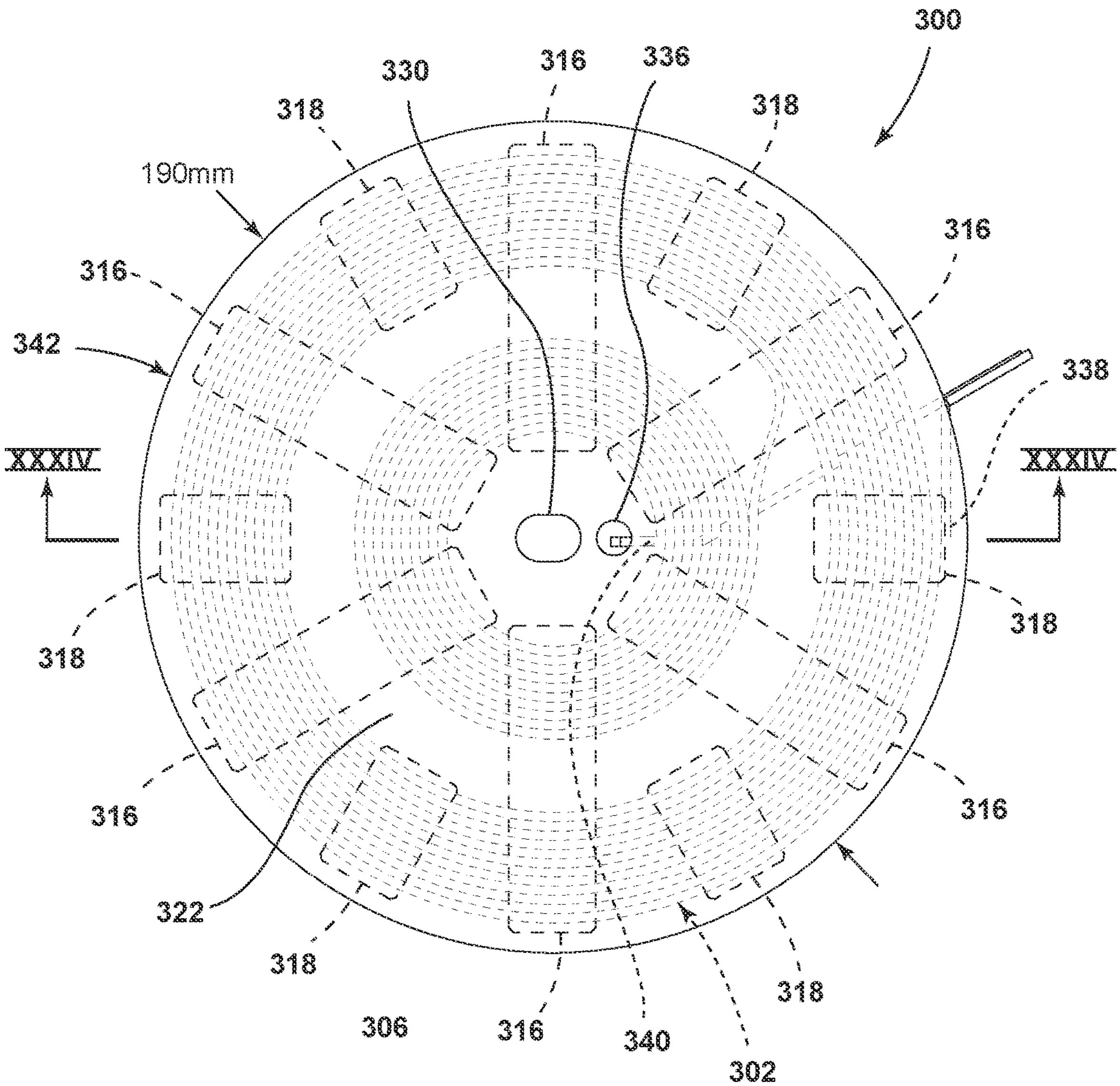

300
330
316
336
318
318
190mm
316
316
342
338
XXXIV
XXXIV
318
318
316
316
322
318
318
306
316
340
302

FIG. 26

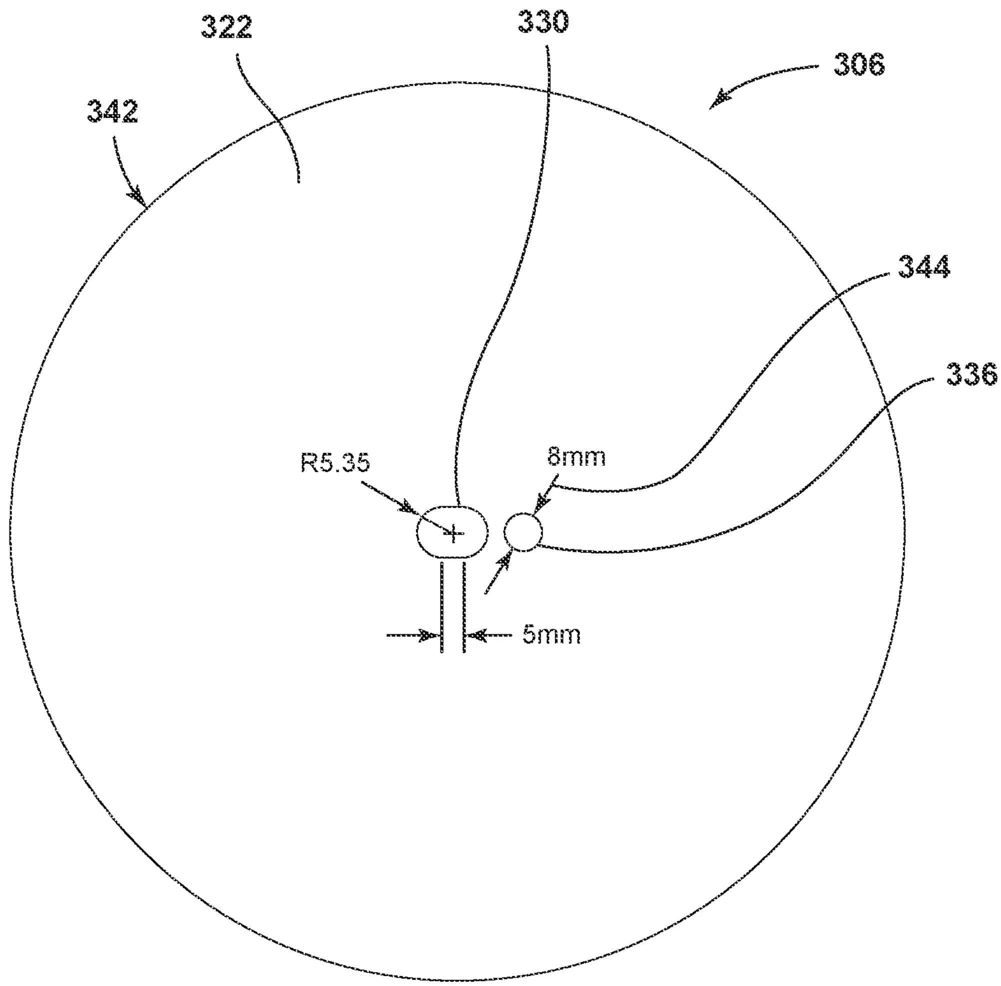


FIG. 27

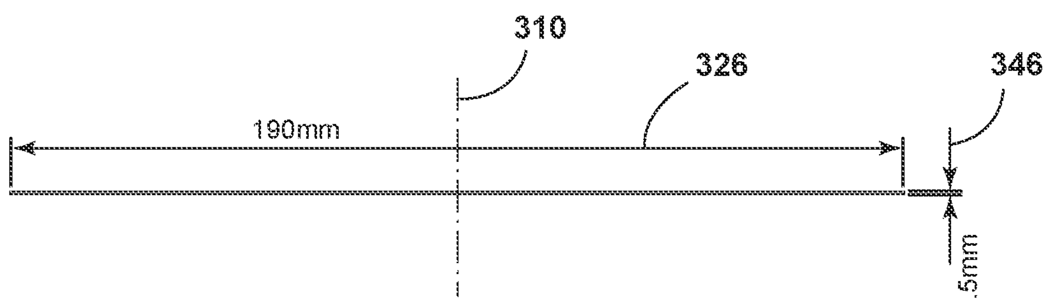


FIG. 28

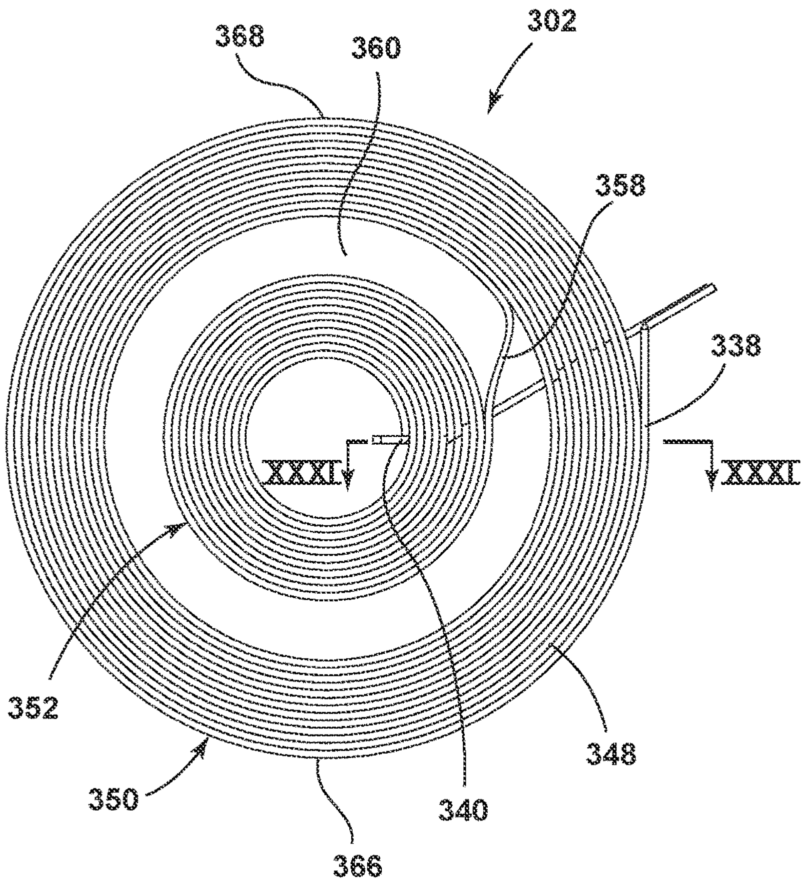

368
360
302
358
338
XXXI
XXXI
352
350
366
340
348

FIG. 29

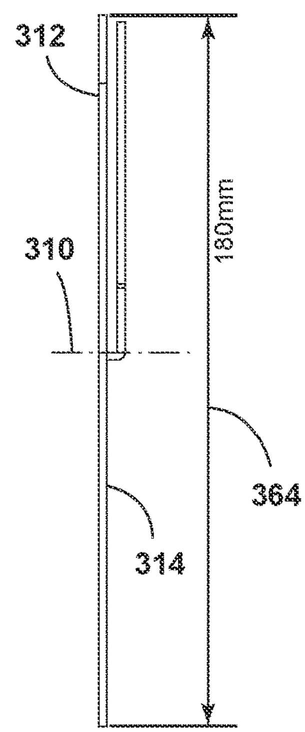

312
310
180mm
364
314

FIG. 30

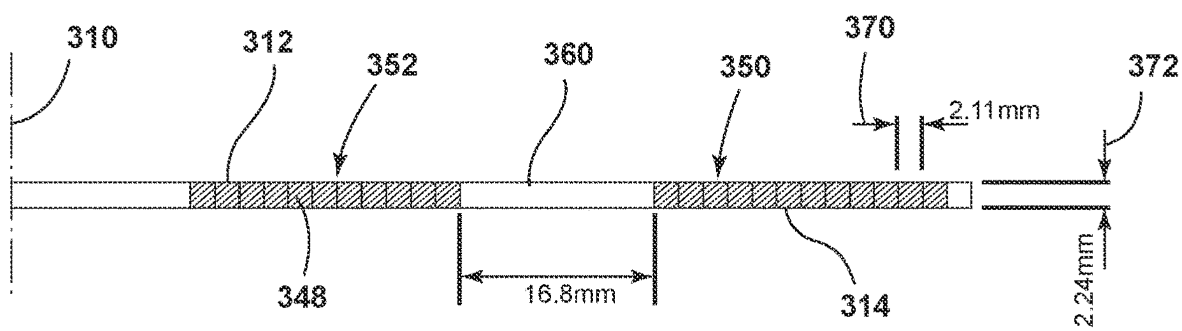


FIG. 31

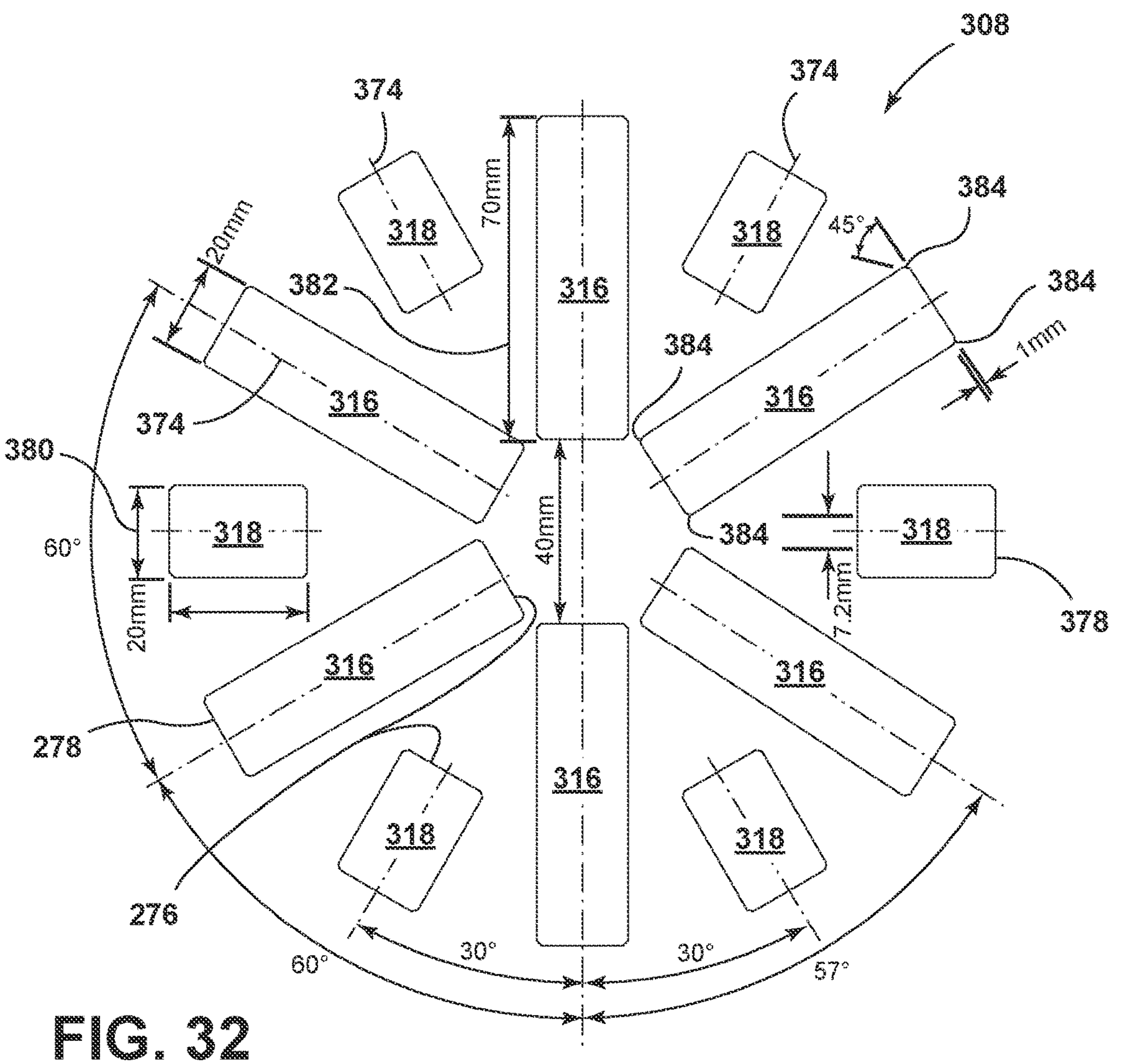

308
374
374
318
318
70mm
20mm
45°
384
382
316
384
384
1mm
316
316
374
380
318
318
384
318
60°
40mm
7.2mm
378
20mm
316
316
278
316
318
318
276
30°
30°
60°
57°

FIG. 32

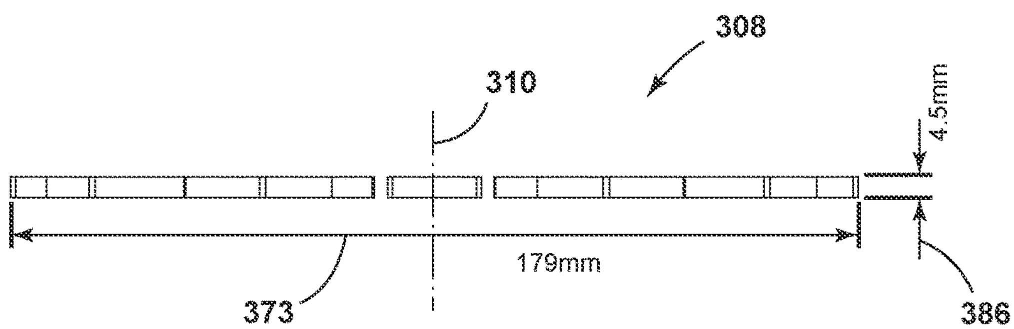

308
310
4.5mm
179mm
373
386

FIG. 33

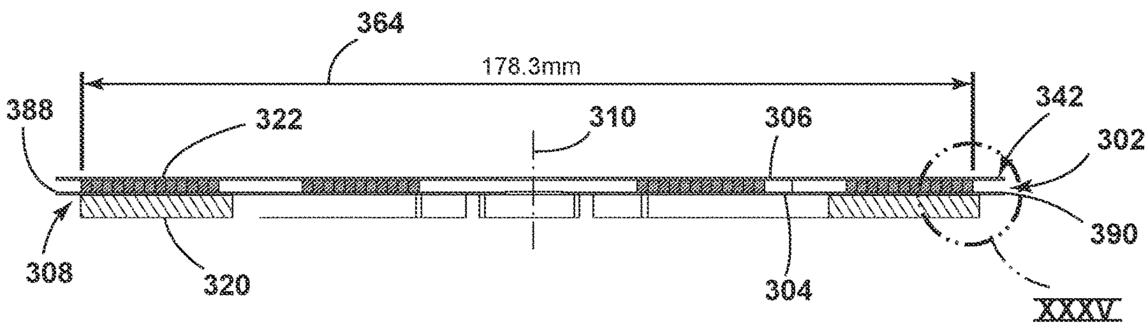

364
178.3mm
388
322
310
306
342
302
390
308
320
304
XXXV

FIG. 34

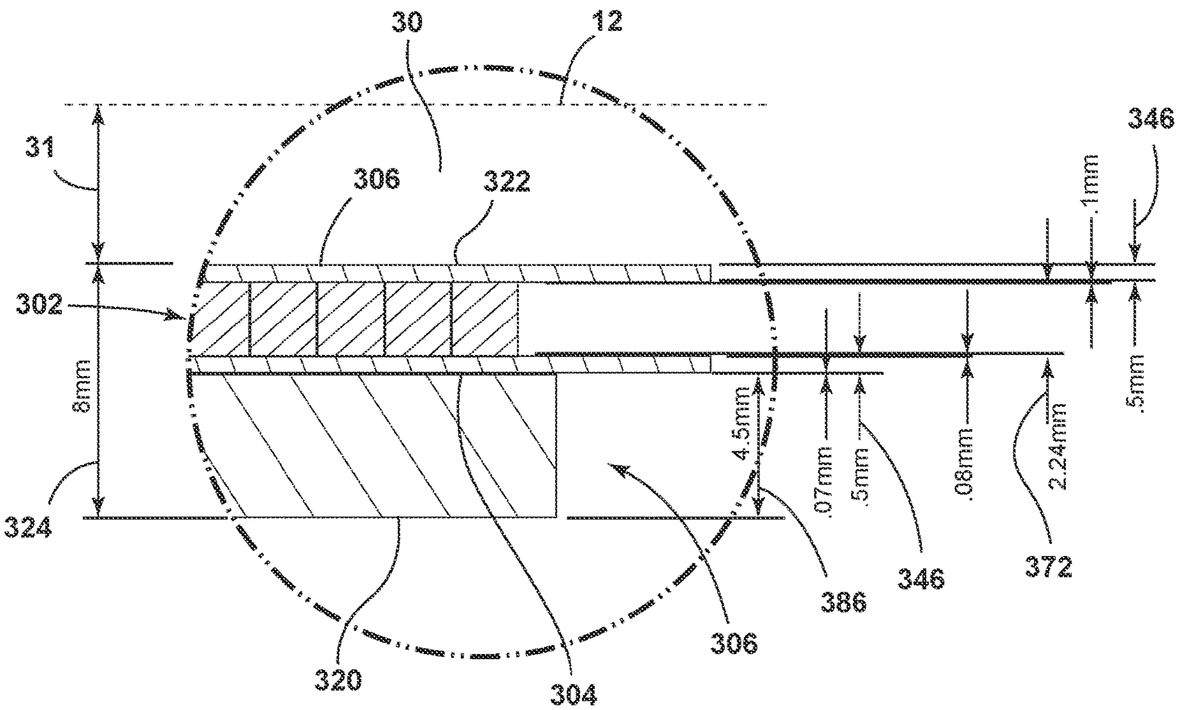
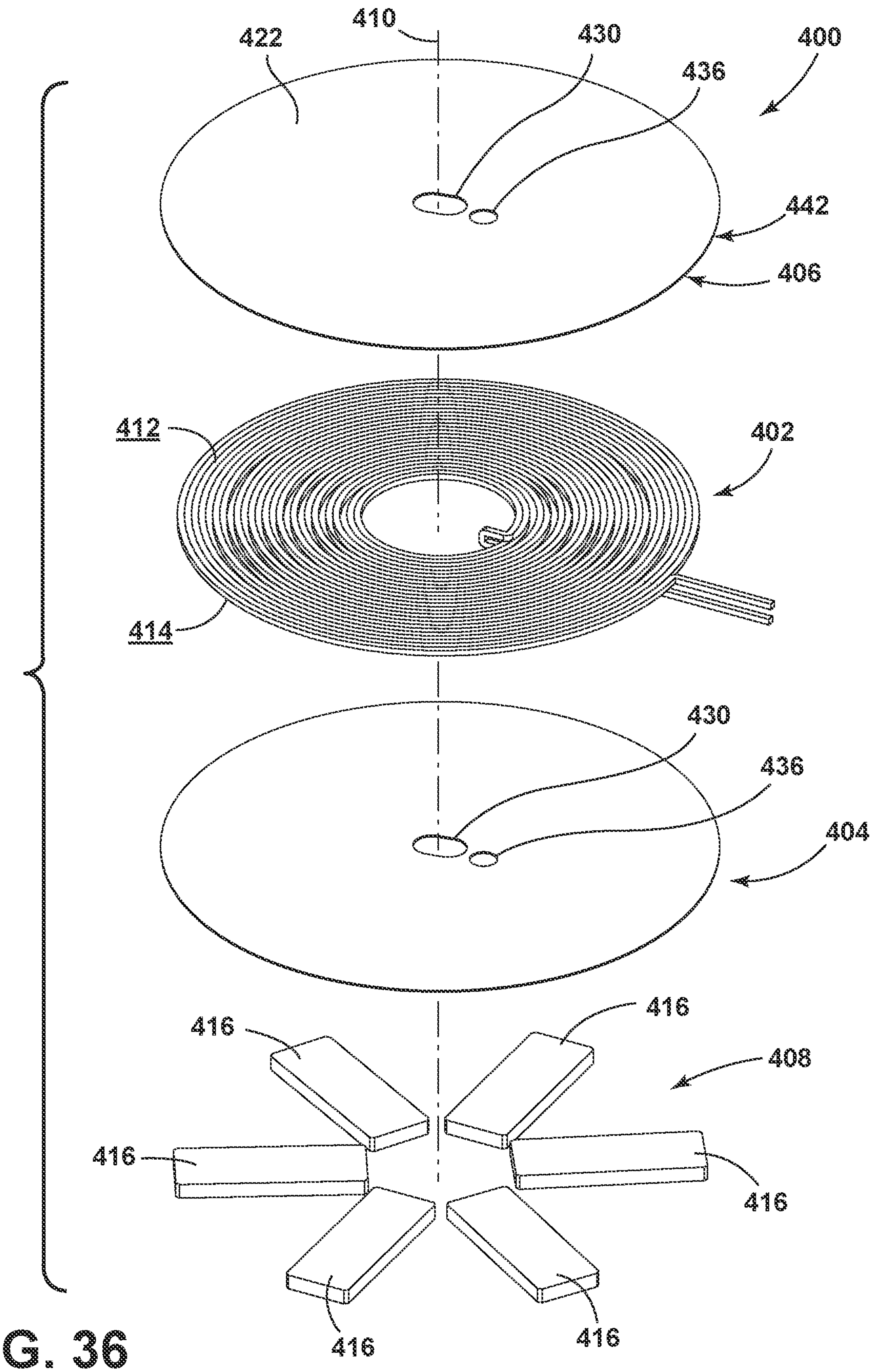

30
12
346
31
306
322
.1mm
302
8mm
4.5mm
.07mm
.5mm
.08mm
2.24mm
.5mm
324
386
346
372
306
320
304

FIG. 35



410
422
430
400
436
442
406
412
402
414
430
436
404
416
416
408
416
416
416
416

FIG. 36

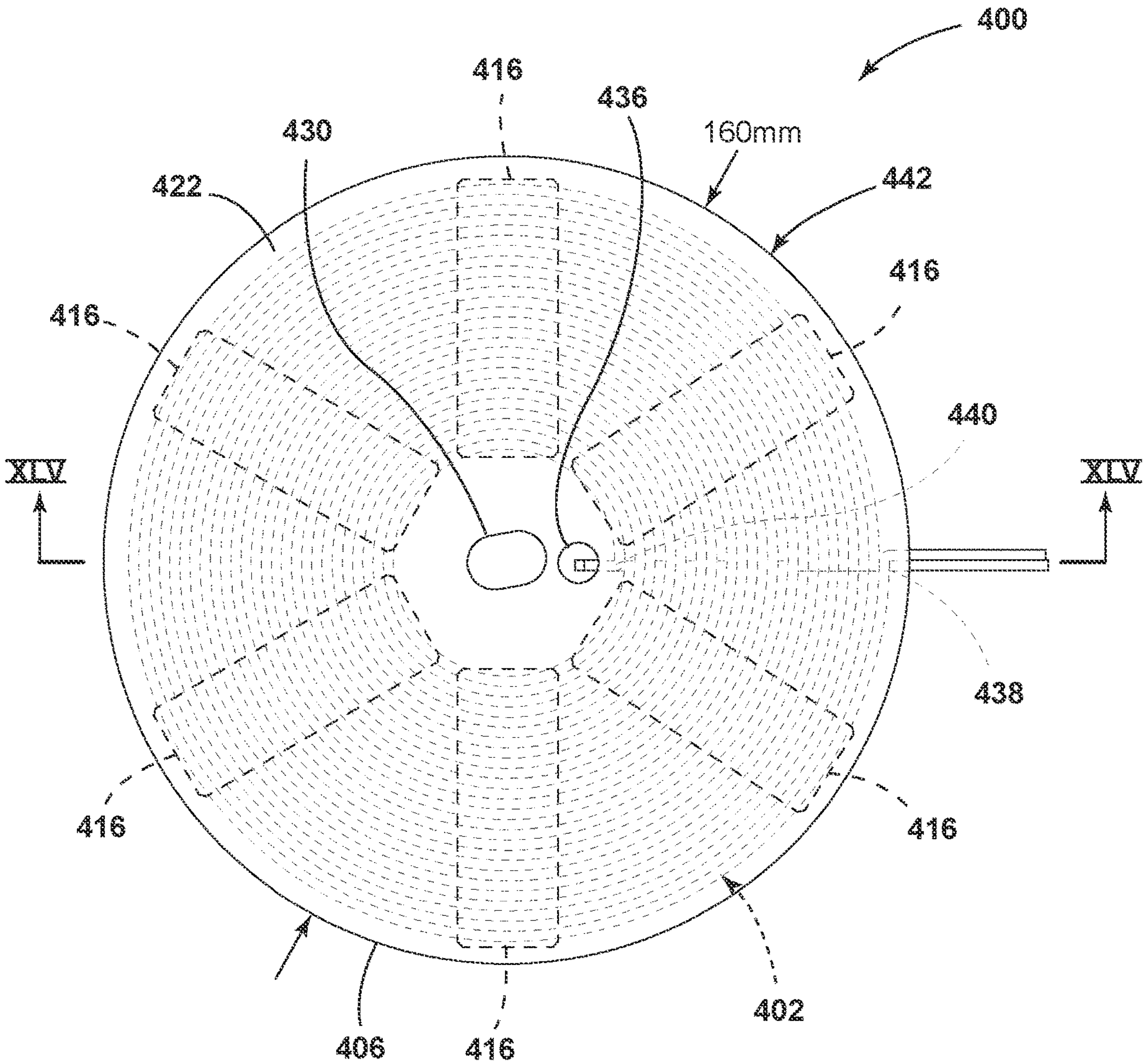

400
416
436
430
160mm
422
442
416
416
440
XLV
XLV
438
416
416
402
406
416

FIG. 37

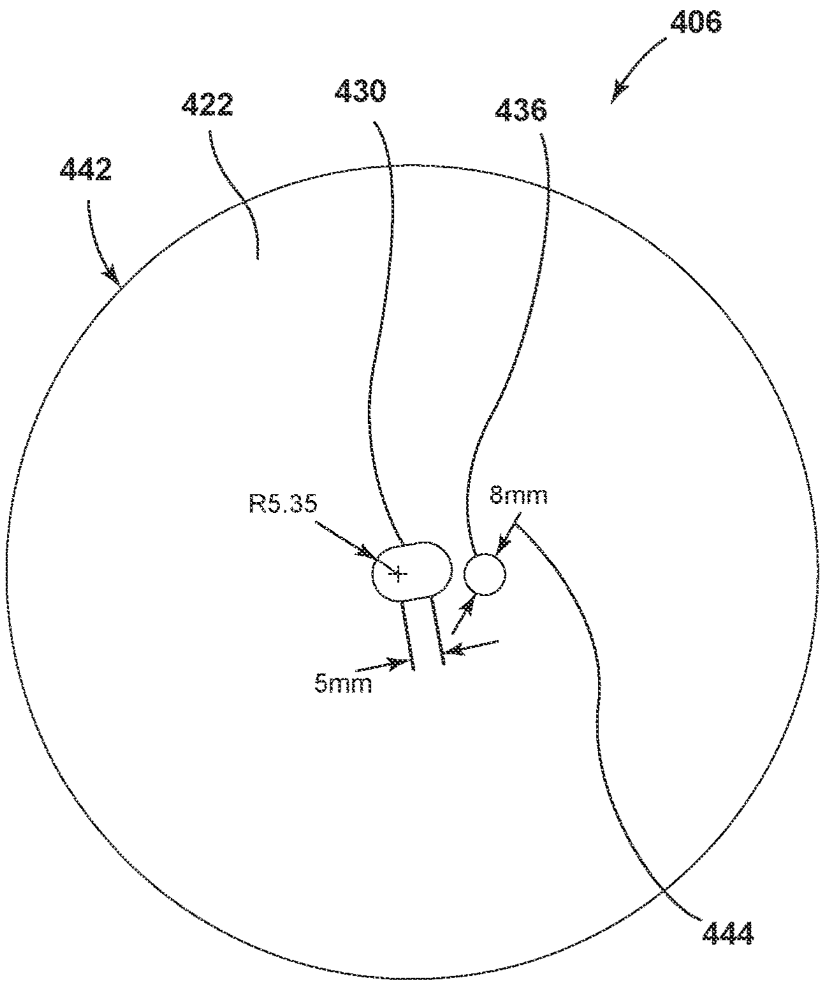


FIG. 38

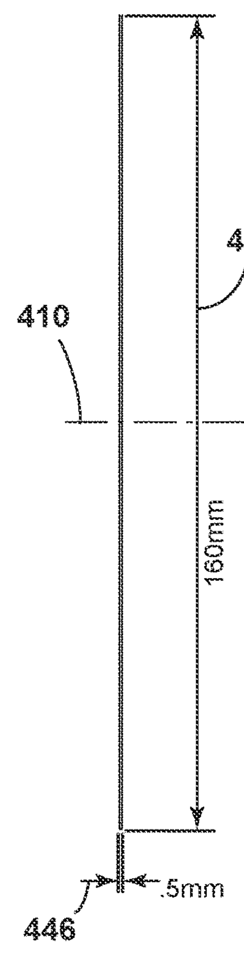


FIG. 39

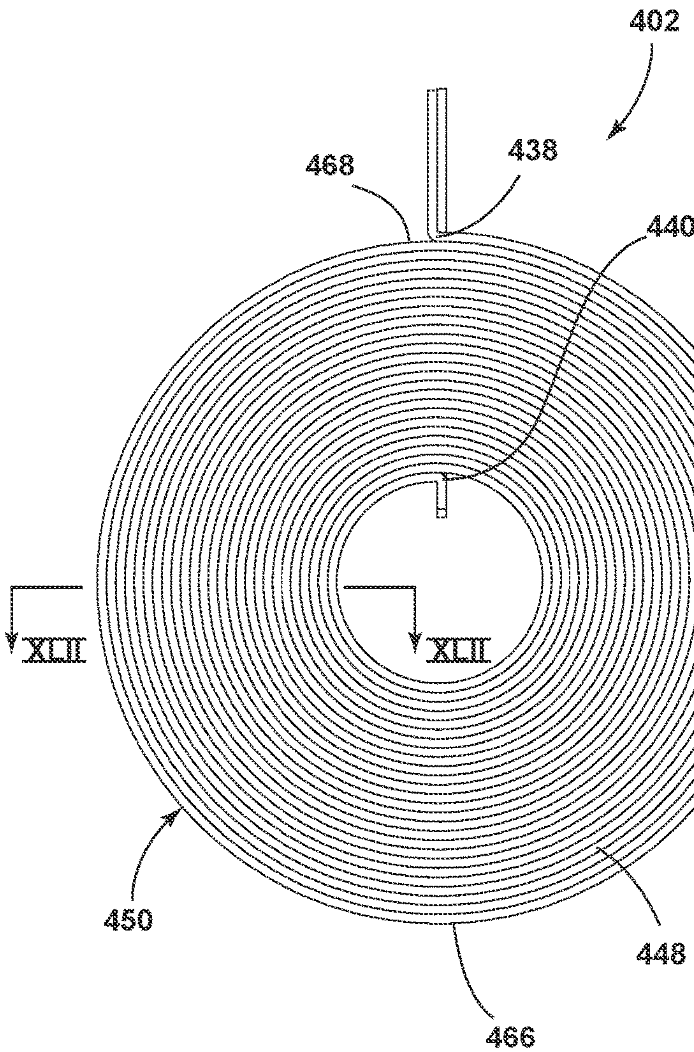


FIG. 40

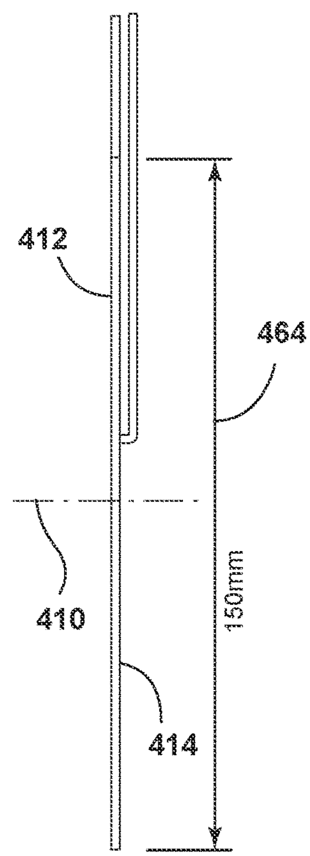


FIG. 41

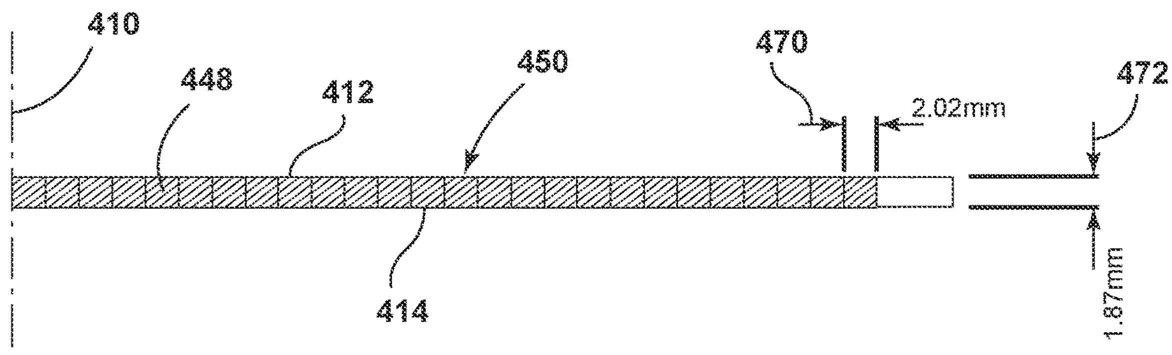
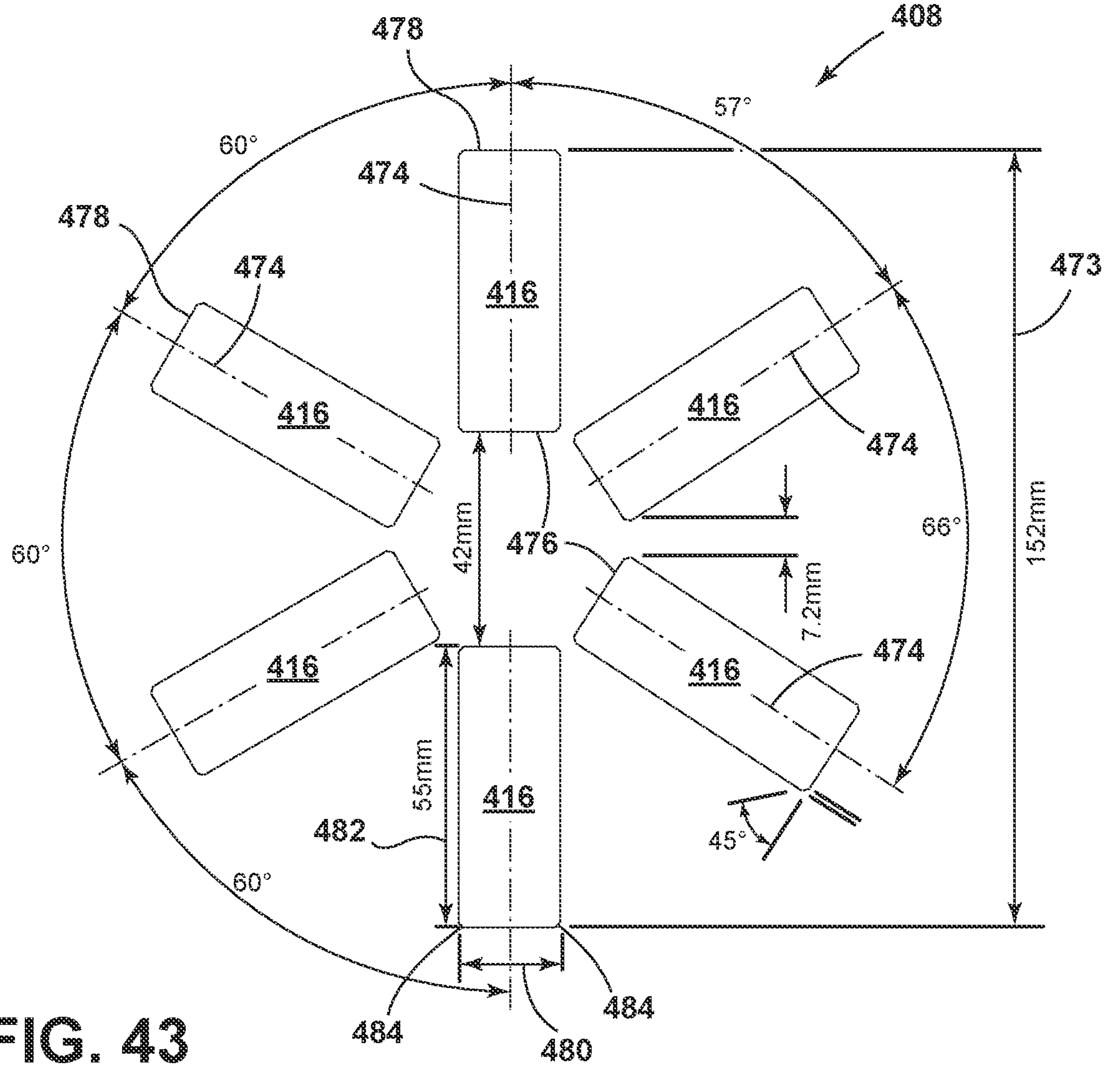
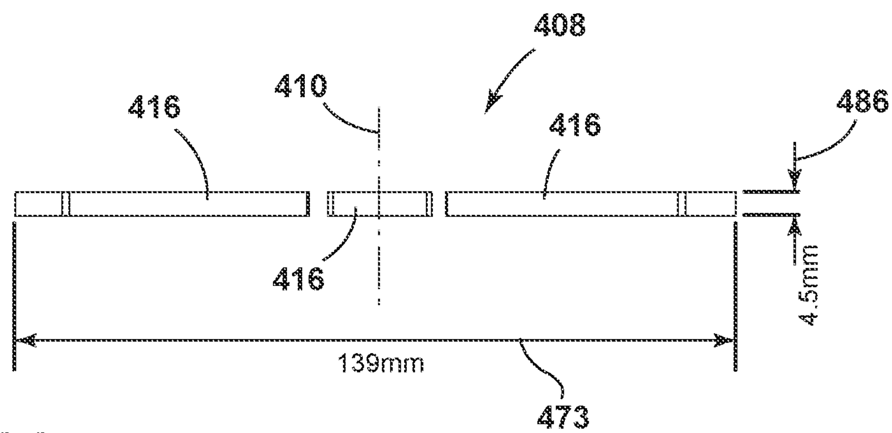


FIG. 42



408
478
57°
60°
474
478
474
416
473
416
474
416
42mm
476
66°
152mm
60°
7.2mm
416
474
416
416
55mm
45°
482
60°
484
484
480

FIG. 43



408
410
416
416
486
416
4.5mm
139mm
473

FIG. 44

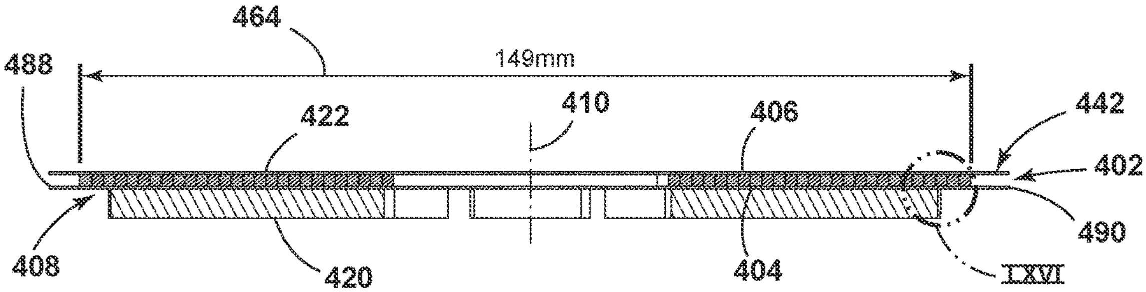

464
149mm
488
422
410
406
442
402
490
408
420
404
LXVI

FIG. 45

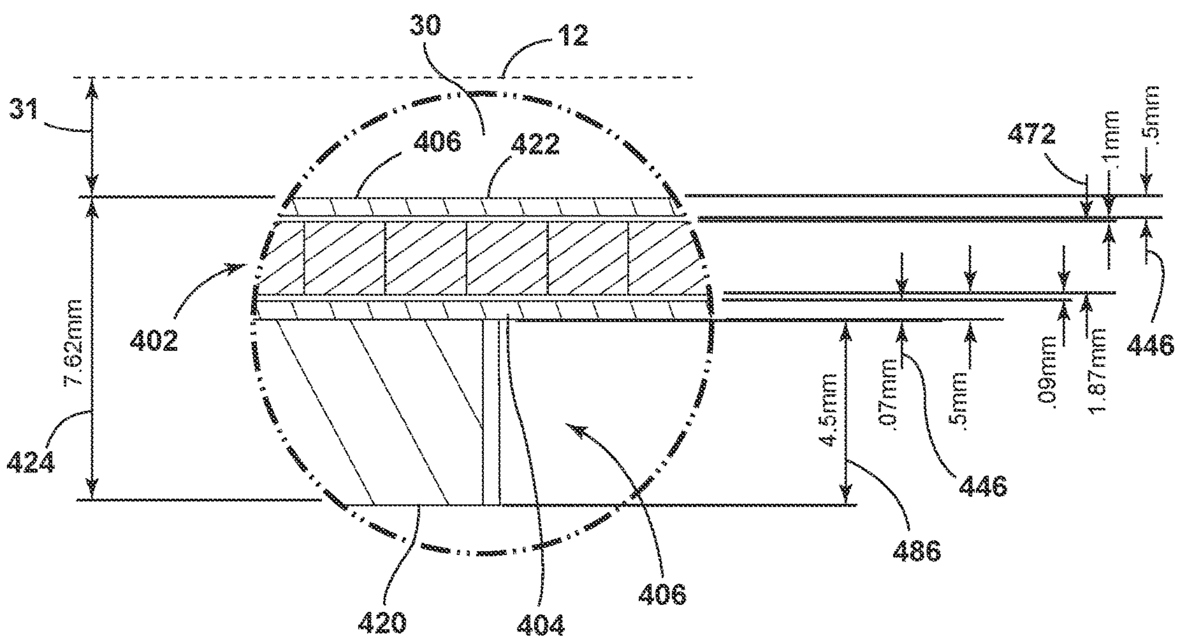

30
12
31
406
422
472
.1mm
.5mm
402
7.62mm
424
4.5mm
.07mm
.5mm
.09mm
1.87mm
446
446
486
420
404
406

FIG. 46

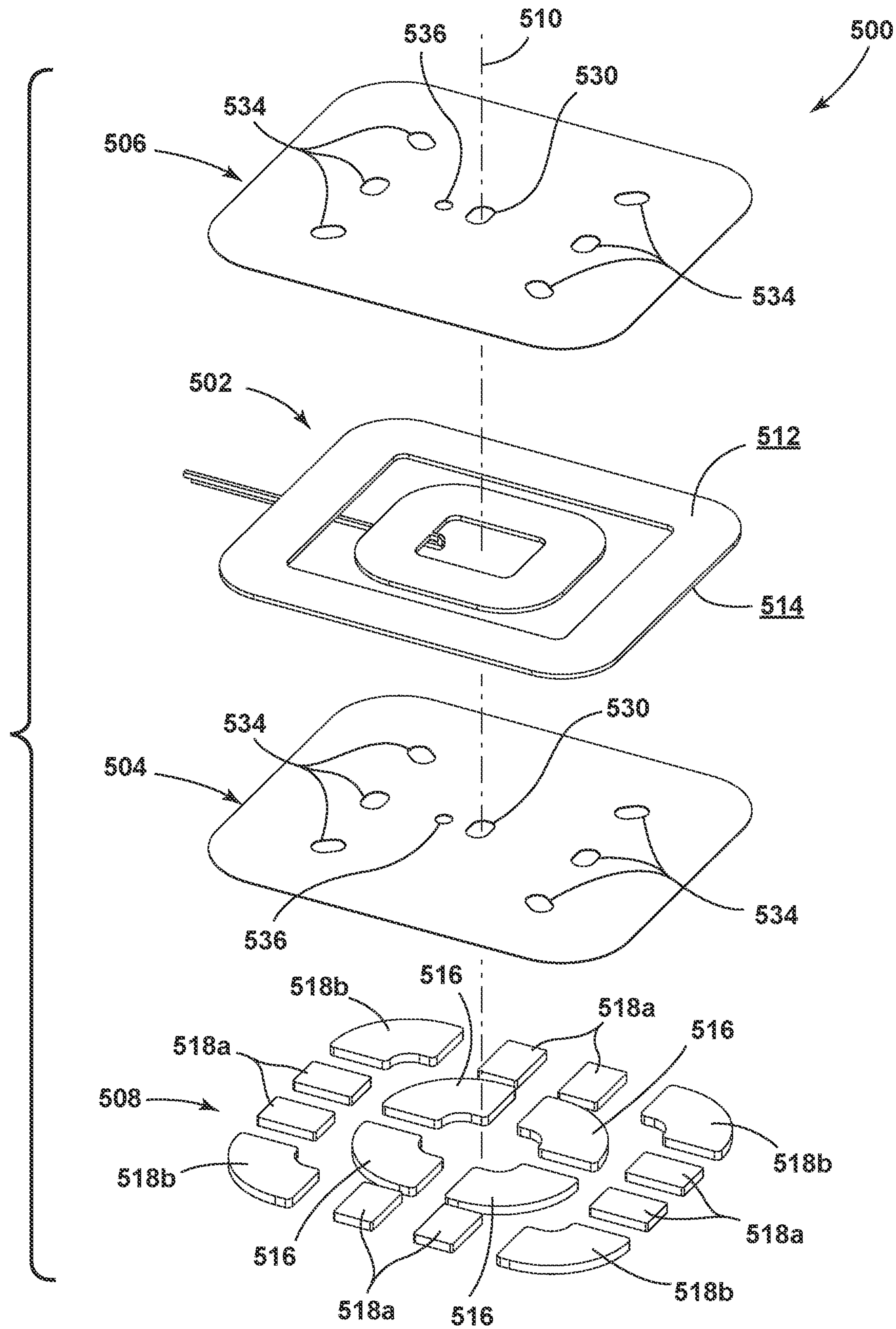

500
510
536
530
534
506
534
502
512
514
534
530
504
536
534
516
518b
518a
508
518b
518b
516
518a
516
518a
516
518b

FIG. 47

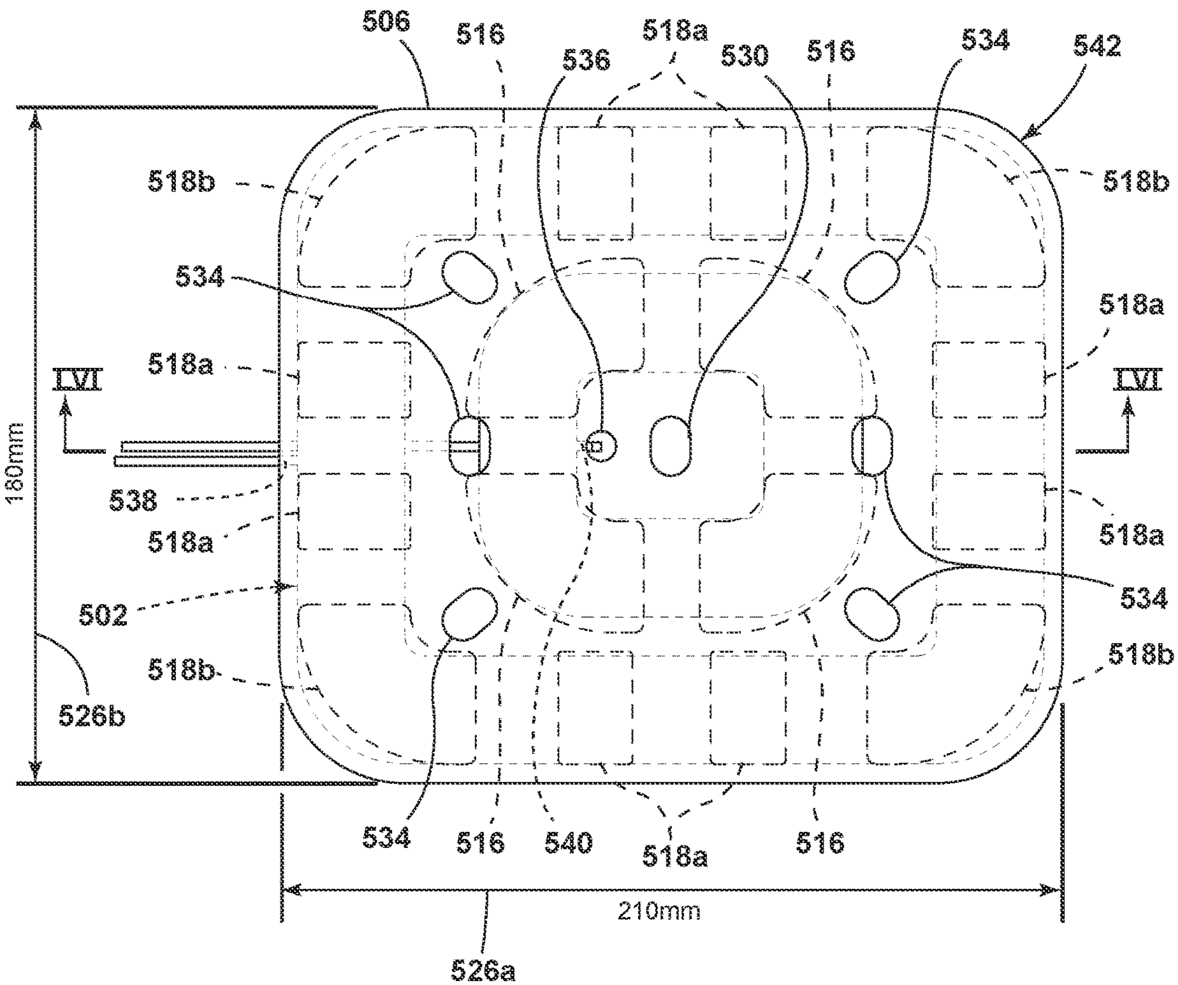

506
516
518a
536
530
516
534
542
518b
518b
534
518a
518a
LVI
LVI
180mm
538
518a
518a
502
534
518b
518b
526b
534
516
540
518a
516
210mm
526a

FIG. 48

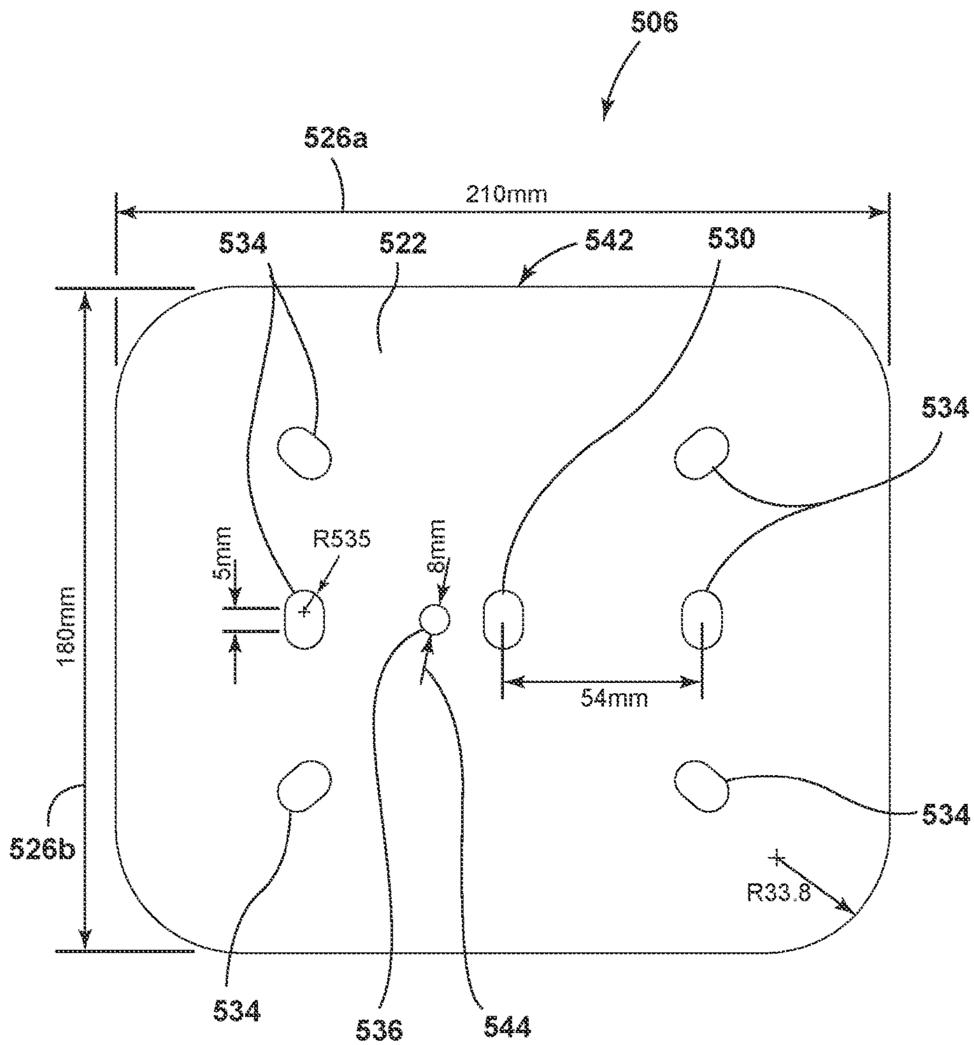

506
526a
210mm
534
522
542
530
534
5mm
R535
8mm
180mm
54mm
534
526b
R33.8
534
536
544

FIG. 49

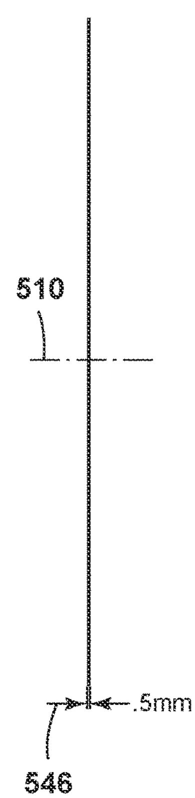

510
.5mm
546

FIG. 50

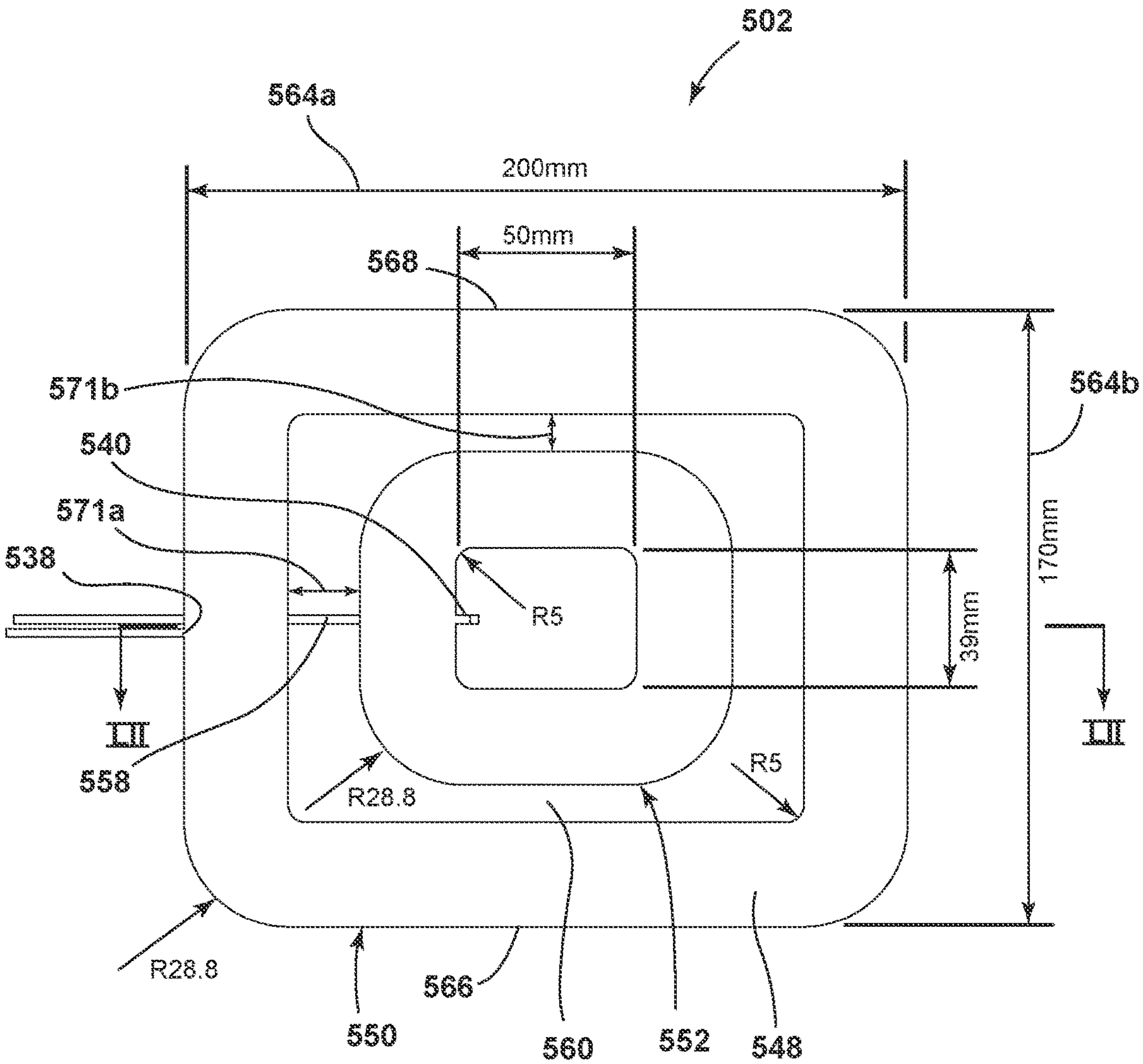

502
564a
200mm
50mm
568
571b
564b
540
571a
170mm
538
R5
39mm
III
III
558
R5
R28.8
R28.8
566
550
560
552
548

FIG. 51

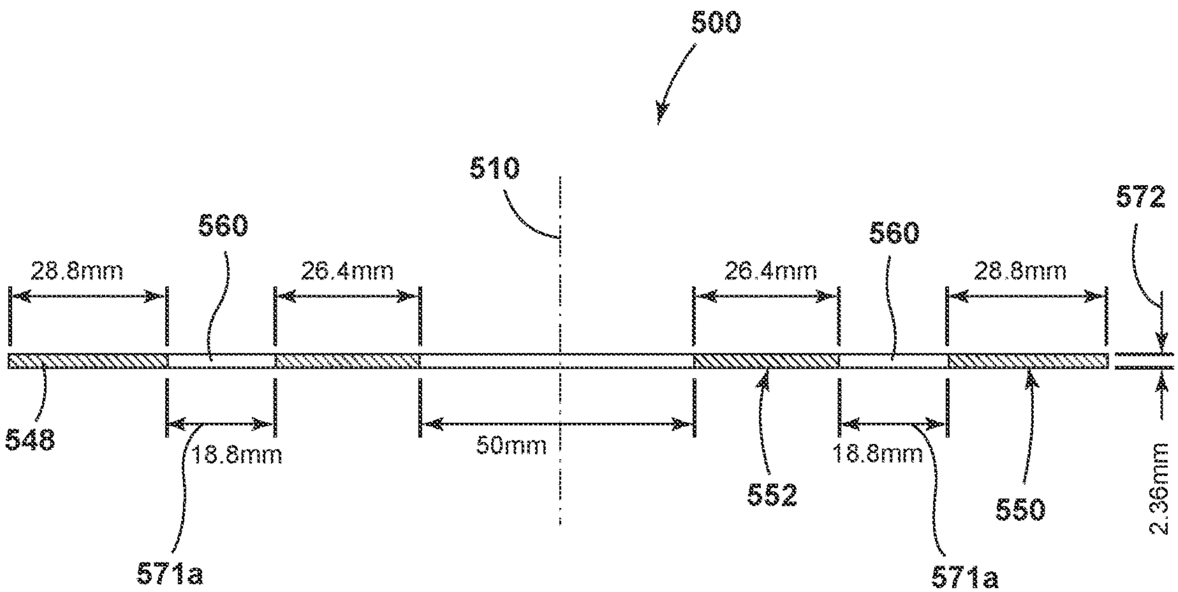

500
510
560
560
572
28.8mm
26.4mm
26.4mm
28.8mm
548
18.8mm
50mm
552
18.8mm
550
2.36mm
571a
571a

FIG. 52

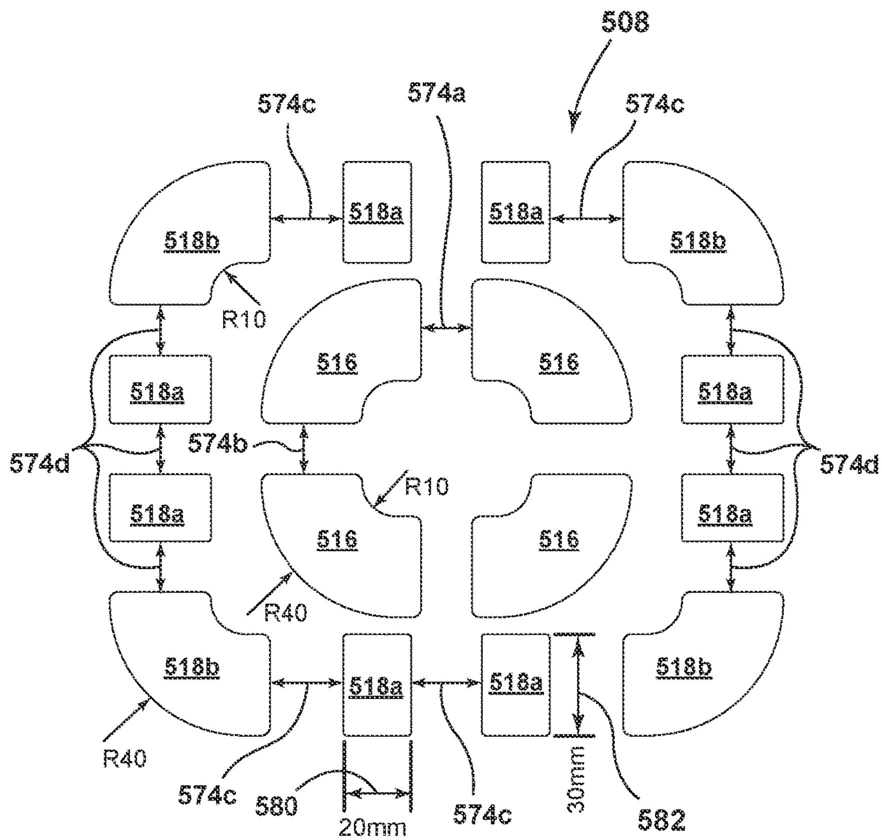


FIG. 53

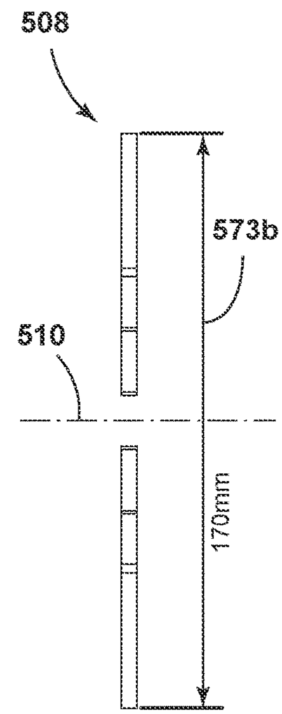


FIG. 54

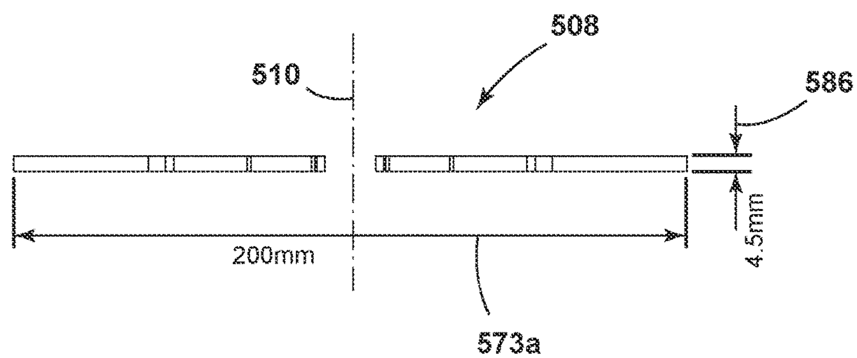


FIG. 55

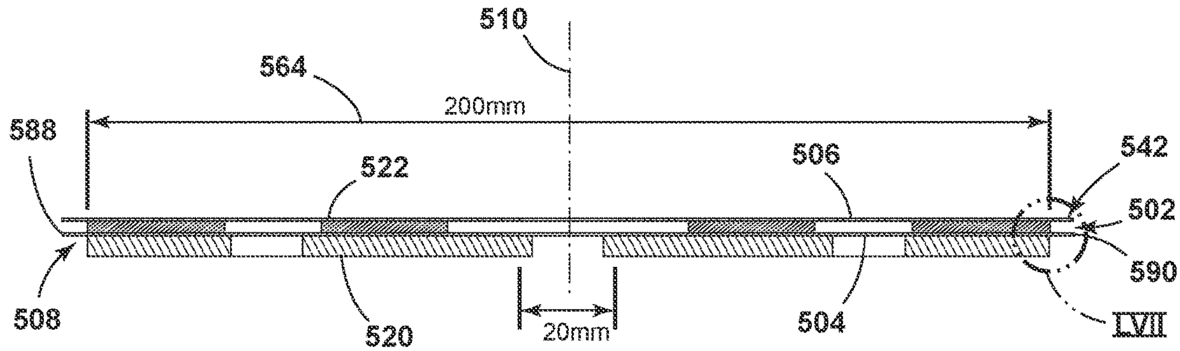

510
564
200mm
588
522
506
542
502
590
508
520
20mm
504
LVII

FIG. 56

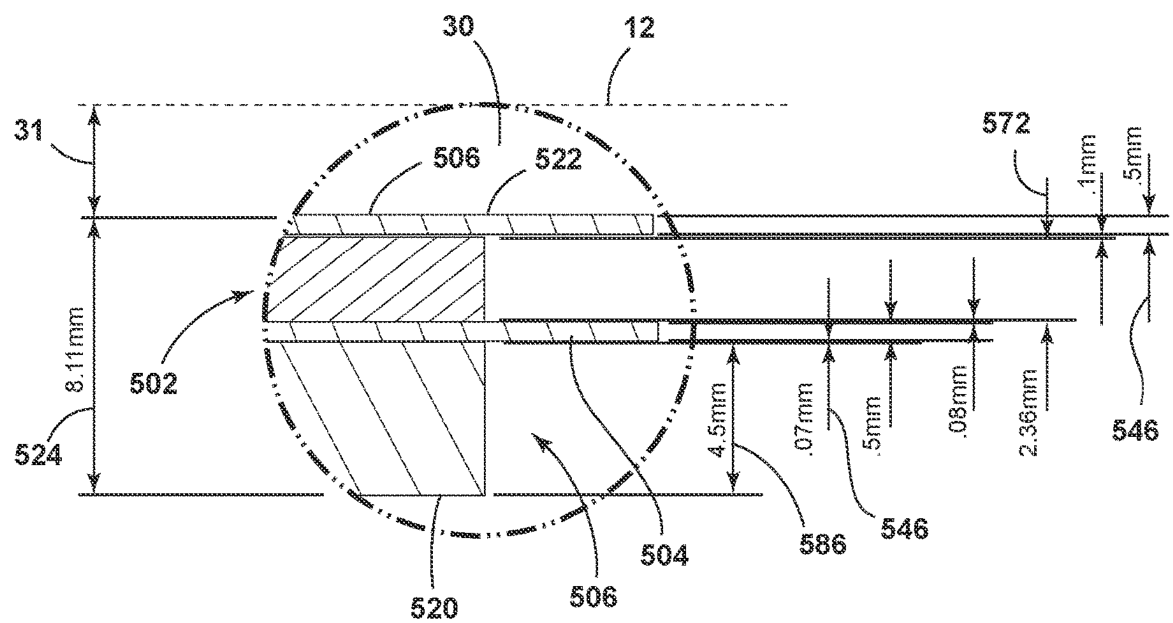

30
12
31
572
506
522
.1mm
.5mm
8.11mm
502
524
4.5mm
.07mm
.5mm
.08mm
2.36mm
546
586
546
504
520
506

FIG. 57

Coil No.	Coil Width (mm)	No. of Outer Windings	No. of Inner Windings	No. of Intermediate Windings	Inductance (uH)	Resistance (ohms)	Outer Coil Gap (mm)	Inner Coil Gap (mm)
100	240	8	9	7	45 uH	8	20	20
200	210	12	12	-	50 uH	9	20	-
300	180	13	11	-	50 uH	9	17	-
400	145	26	-	-	60 uH	11	-	-
500	200 x 175	12	11	-	55 uH	8	19 x 10	-

FIG. 58

INDUCTION COIL ASSEMBLY

FIELD OF THE DISCLOSURE

[0001] The disclosure generally relates to an induction coil assembly and, more particularly, to a heater coil with enhanced efficiency for operation with a full-bridge inverter.

SUMMARY OF THE DISCLOSURE

[0002] According to one aspect of the present disclosure, an induction cooktop includes a cooking surface operable to support cookware and a resonant circuit having a resonant frequency in the range of 40 kHz to 60 kHz. The resonant circuit includes a capacitor having capacitance of between 0.1 micro-Farads and 0.6 micro-Farads and a coil disposed under the cooking surface and configured to operate at a working frequency of between 50 kHz and 150 kHz. The induction cooktop includes an induction control circuit configured to power the resonant circuit at the working frequency.

[0003] According to another aspect of the present disclosure, an induction coil assembly for an induction cooktop includes a cooking surface operable to support cookware and a resonant circuit having a resonant frequency in the range of 40 kHz to 60 kHz. The resonant circuit includes a capacitor having capacitance of between 0.1 uF and 0.6 uF and a coil disposed under the cooking surface and configured to operate at a working frequency of between 50 kHz and 150 kHz. An induction control circuit is configured to power the resonant circuit at the working frequency via a full-bridge inverter.

[0004] According to yet another aspect of the present disclosure, an induction cooktop includes a cooking surface operable to support cookware and a resonant circuit having a resonant frequency in the range of 40 kHz to 60 kHz. The resonant circuit includes a capacitor having capacitance of between 0.1 micro-Farads and 0.6 micro-Farads and a coil disposed under the cooking surface and configured to operate at a working frequency of between 50 kHz and 150 kHz. The resonant circuit is configured to have an equivalent alternating-current (AC) resistance of between 8 ohms and 15 ohms at the working frequency when cookware overlays the coil and includes a bottom made of AISI 430. An induction control circuit is configured to power the resonant circuit at the working frequency via a full-bridge inverter.

[0005] These and other features, advantages, and objects of the present disclosure will be further understood and appreciated by those skilled in the art by reference to the following specification, claims, and appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] In the drawings:

[0007] FIG. **1** is a top perspective view of a cooktop incorporating one or more induction coil assemblies according to one aspect of the present disclosure;

[0008] FIG. **2** is an electrical schematic of an induction heating circuit for an induction coil assembly constructed according to at least one aspect of the present disclosure;

[0009] FIG. **3** is an exploded perspective view of a first induction coil assembly;

[0010] FIG. **4** is a top plan view of the first induction coil assembly;

[0011] FIG. **5** is a top plan view of a top heat-resistant layer for the first induction coil assembly;

[0012] FIG. **6** is a side view of the top heat-resistant layer for the first induction coil assembly;

[0013] FIG. **7** is a top plan view of a coil of the first induction coil assembly;

[0014] FIG. **8** is a side view of the coil of the first induction coil assembly;

[0015] FIG. **9** is a cross-sectional view of the coil of the first induction coil assembly taken along the line X-X of FIG. **7**;

[0016] FIG. **10** is a top plan view of a ferrite layer of the first induction coil assembly;

[0017] FIG. **11** is a side view of the ferrite layer of the first induction coil assembly;

[0018] FIG. **12** is a cross-sectional view of the first induction coil assembly taken along the line XII-XII of FIG. **4**;

[0019] FIG. **13** is a detailed view of a portion of the cross-sectional view of FIG. **12** taken along the section XIII-XIII of FIG. **12**;

[0020] FIG. **14** is an exploded perspective view of a second induction coil assembly;

[0021] FIG. **15** is a top plan view of the second induction coil assembly;

[0022] FIG. **16** is a top plan view of a top heat-resistant layer for the second induction coil assembly;

[0023] FIG. **17** is a side view of the top heat-resistant layer for the second induction coil assembly;

[0024] FIG. **18** is a top plan view of a coil of the second induction coil assembly;

[0025] FIG. **19** is a side view of the coil of the second induction coil assembly;

[0026] FIG. **20** is a cross-sectional view of the coil of the second induction coil assembly taken along the line XX-XX of FIG. **18**;

[0027] FIG. **21** is a top plan view of a ferrite layer of the second induction coil assembly;

[0028] FIG. **22** is a side view of the ferrite layer of the second induction coil assembly;

[0029] FIG. **23** is a cross-sectional view of the second induction coil assembly taken along the line XXIII-XXIII of FIG. **15**;

[0030] FIG. **24** is a detailed view of a portion of the cross-sectional view of FIG. **23** taken along the section XXIV-XXIV of FIG. **23**;

[0031] FIG. **25** is an exploded perspective view of a third induction coil assembly;

[0032] FIG. **26** is a top plan view of the third induction coil assembly;

[0033] FIG. **27** is a top plan view of a top heat-resistant layer for the third induction coil assembly;

[0034] FIG. **28** is a side view of the top heat-resistant layer for the third induction coil assembly;

[0035] FIG. **29** is a top plan view of a coil of the third induction coil assembly;

[0036] FIG. **30** is a side view of the coil of the third induction coil assembly;

[0037] FIG. **31** is a cross-sectional view of the coil of the third induction coil assembly taken along the line XXXI-XXXI of FIG. **29**;

[0038] FIG. **32** is a top plan view of a ferrite layer of the third induction coil assembly;

[0039] FIG. **33** is a side view of the ferrite layer of the third induction coil assembly;

[0040] FIG. **34** is a cross-sectional view of the third induction coil assembly taken along the line XXXIV-XXXIV of FIG. **26**;

[0041] FIG. **35** is a detailed view of a portion of the cross-sectional view of FIG. **23** taken along the section XXXV-XXXV FIG. **34**;

[0042] FIG. **36** is an exploded perspective view of a fourth induction coil assembly;

[0043] FIG. **37** is a top plan view of the fourth induction coil assembly;

[0044] FIG. **38** is a top plan view of a top heat-resistant layer for the fourth induction coil assembly;

[0045] FIG. **39** is a side view of the top heat-resistant layer for the fourth induction coil assembly;

[0046] FIG. **40** is a top plan view of a coil of the fourth induction coil assembly;

[0047] FIG. **41** is a side view of the coil of the fourth induction coil assembly;

[0048] FIG. **42** is a cross-sectional view of the coil of the fourth induction coil assembly taken along the line XLII-XLII of FIG. **40**;

[0049] FIG. **43** is a top plan view of a ferrite layer of the fourth induction coil assembly;

[0050] FIG. **44** is a side view of the ferrite layer of the fourth induction coil assembly;

[0051] FIG. **45** is a cross-sectional view of the fourth induction coil assembly taken along the line XLV-XLV of FIG. **37**;

[0052] FIG. **46** is a detailed view of a portion of the cross-sectional view of FIG. **45** taken along the section XLVI-XLVI of FIG. **45**;

[0053] FIG. **47** is an exploded perspective view of a fifth induction coil assembly;

[0054] FIG. **48** is a top plan view of the fifth induction coil assembly;

[0055] FIG. **49** is a top plan view of a top heat-resistant layer for the fifth induction coil assembly;

[0056] FIG. **50** is a side view of the top heat-resistant layer for the fifth induction coil assembly;

[0057] FIG. **51** is a top plan view of a coil of the fifth induction coil assembly;

[0058] FIG. **52** is a cross-sectional view of the coil of the fifth induction coil assembly taken along the line LII-LII of FIG. **50**;

[0059] FIG. **53** is a top plan view of a ferrite layer of the fifth induction coil assembly;

[0060] FIG. **54** is a first side view of the ferrite layer of the fifth induction coil assembly;

[0061] FIG. **55** is a second side view of the ferrite layer of the fifth induction coil assembly;

[0062] FIG. **56** is a cross-sectional view of the fifth induction coil assembly taken along the line LVI-LVI of FIG. **48**;

[0063] FIG. **57** is a detailed view of a portion of the cross-sectional view of FIG. **23** taken along the section LVII-LVII of FIG. **56**; and

[0064] FIG. **58** is a table of parameters for 5 exemplary coil assemblies constructed according to aspects of the present disclosure.

[0065] The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles described herein.

DETAILED DESCRIPTION

[0066] The present illustrated embodiments reside primarily in combinations of method steps and apparatus components related to an induction coil assembly. Accordingly, the apparatus components and method steps have been represented, where appropriate, by conventional symbols in the drawings, showing only those specific details that are pertinent to understanding the embodiments of the present disclosure so as not to obscure the disclosure with details that will be readily apparent to those of ordinary skill in the art having the benefit of the description herein. Further, like numerals in the description and drawings represent like elements.

[0067] For purposes of description herein, the terms "upper," "lower," "right," "left," "rear," "front," "vertical," "horizontal," and derivatives thereof shall relate to the disclosure as oriented in FIG. **1**. Unless stated otherwise, the term "front" shall refer to the surface of the element closer to an intended viewer, and the term "rear" shall refer to the surface of the element further from the intended viewer. However, it is to be understood that the disclosure may assume various alternative orientations, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.

[0068] The terms "including," "comprises," "comprising," or any other variation thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that comprises a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such process, method, article, or apparatus. An element preceded by "comprises a . . . " does not, without more constraints, preclude the existence of additional identical elements in the process, method, article, or apparatus that comprises the element.

[0069] In general, the present induction coil assembly provides a slim design that may be cost-effective. The present induction coils assembly further provides for enhanced electrical efficiencies by being configured to operate, in some examples, via a full bridge connection. The present induction coil assembly provides for increased resistance relative to traditional induction coils and a unique arrangement of a ferrite layer to provide for optimized induction heating.

[0070] Referring generally to the figures, numeral **10** generally designates an induction cooktop. The induction cooktop **10** includes a cooking surface **12** operable to Support cookware **14**. A resonant circuit **16** has a resonant frequency in the range of 40 kHz to 60 kHz. The resonant circuit **16** includes a capacitor **18** having a capacitance of between 0.1 microfarads and 0.6 microfarads. The resonant circuit **16** includes an induction heater coil **20** disposed under the cooking surface **12**. The induction heater coil **20** is configured to operate at a working frequency of between 50 kHz and 150 kHz. The induction cooktop **10** includes an induction control circuit configured to power the resonant circuit **16** at the working frequency.

[0071] Referring now to FIG. **1**, the induction cooktop **10** may include an induction hob and can include a control interface **24** which may include mechanical switches **26** and/or touch interfaces for controlling the induction cooktop **10**. For example, a controller **28** may be provided within the induction cooktop assembly for controlling power to one or more of the induction heater coils **20** of the induction cooktop **10**. A glass layer **30**, or insulating layer, may form the cooking surface **12** and provide space between the induction heater coils **20** in the induction cooktop and the cooking surface **12**. As will be described further herein, the glass layer **30** can have a glass height **31** of between 2.5 millimeters and 5 millimeters. In some examples, the glass height **31** is approximately 4 millimeters. It is contemplated that, while shown in FIG. **1** as having a circular shape, one or more of the induction heater coils **20** may have another polygonal or arcuate shape, such as a square, rectangle, a triangle, or the like. It is also contemplated that irregular polygonal shapes or partial rectangular shapes (e.g., rectangles with arcuate corners) may be provided. Accordingly, the cooktop **10** may incorporate one or more of differently shaped induction heater coils **20**, as will be described further herein. Further, the spacing and/or pattern of distribution of the induction heater coils **20** for the induction cooktop may be different than pictured or the same as pictured. For example, the induction heater coils **20** may be arranged side to side or front to back to provide a free-form induction cooking area throughout the entire cooking surface **12** or a substantial part of the cooking surface **12**. Further, different sizes of the induction heater coil **20** may be provided.

[0072] Referring now to FIG. **2**, a heating circuit **32** is provided in reference to one exemplary induction heater coil **20**, though, as will be described herein, the heating circuit **32** may be configured to power some or all of the induction heater coils **20** of the induction cooktop. The heating surface may be powered via main power **34**, which may be an alternating-current (AC) voltage. For example, the main power **34** may include 110 VAC/115 VAC, 120 VAC, 230 VAC/240 VAC with a frequency of 50 Hz/60 Hz, or another AC signal typically provided for residential or commercial power distribution. An electromagnetic interference (EMI) filter **36** is provided for reducing electromagnetic interference generated during high-frequency operation of the induction cooktop. This filter typically includes capacitors, and inductors arranged to suppress unwanted electromagnetic radiation.

[0073] Filtered power is provided to a rectifier **38** that converts alternating current power to direct current (DC) power provided along a DC bus **40** and a ground **42**. For example, the rectifier **38** can include one or more diodes arranged to isolate positive parts of the AC power, and one or more smoothing capacitors **43** to smooth the DC power. One or more inverters **44** are provided between the DC bus **40** and ground **42** for generating controlled AC signals through one or more of the induction heater coils **20**. In the present example, a full bridge inverter **44** is provided for controlling each induction heater coil **20**, though it is contemplated that other types of inverters **44** (half bridge inverters **44**) may be provided in some examples described herein. In a preferred embodiment, a full-bridge inverter **44** is used to allow for operation at higher effective AC voltages relative to those used for a half-bridge, thereby allowing for reduced operating currents for the same power levels.

[0074] In general, each inverter **44** includes switches **46**, **48**, **50**, **52**, such as transistors, that are controlled by the controller **28** to close and/or open paths for current to flow through the resonant circuit **16**. In the full bridge example, the resonant circuit **16** is provided between two intermediate nodes **54**, **56** that are electrically coupled to a pair of corresponding switches **46**, **48**, **50**, **52**. The two intermediate nodes **54**, **56** include a first intermediate node **54** that electrically interposes a first switch and a second switch **46**, **48** and a second intermediate node **56** that interposes a third switch and a fourth switch **50**, **52**. The resonant circuit **16** electrically interposes the pair of intermediate nodes **54**, **56**. In operation, the controller **28** energizes the first switch and the fourth switch **46**, **52** at a first time, then de-energizes the first switch and the fourth switch **46**, **52**, then energizes the second switch and the third switch **48**, **50**, then de-energizes the second switch and the third switch **48**, **50**, and so on. In this way, the inverter **44** is controlled to provide an effective AC voltage across the resonant circuit **16** to generate magnetic fields through the insulating layer of the cooktop **10**. For example, when alternating currents pass through the induction heater coil **20**, a magnetic field is generated. When cookware **14** is over the induction heater coils **20**, the induced magnetic fields can cause Eddy currents in the cookware **14** thereby heating the cookware **14**.

[0075] In addition to the induction heater coil **20**, the resonant circuit **16** further includes the resonant capacitor **18**, which can have a capacitance of between 0.1 microfarads and 0.6 microfarads. The capacitance of the resonant capacitor **18** allows for the present induction heater coils **20** to be constructed with relatively high resistance and/or a thinner, or shallower profile, as will be described in the foregoing examples. The resonant capacitor **18** further provides for the range of resonant frequencies (e.g., 40 kHz to 60 kHz) and the working frequency in the range of 50 kHz and 150 kHz. It is contemplated that these operable ranges may be provided in a full bridge configuration of the inverter **44**.

[0076] With continued reference to FIG. **2**, it is contemplated that the resonant circuit **16** described herein may be dependent on the type of cookware **14** (e.g., material, size, shape, etc.). For example, the representation of the resonant circuit **16** may include resistance when the cookware **14** is provided. By way of example, the cookware **14** may include stainless steel in a bottom portion of the cookware **14** (e.g., a floor of a pan or a pot). In one example, AISI-430 (American Iron and Steel Institute grade 430) is used in the floor of the cookware **14**. AISI 430 is a grade of stainless steel that is part of the AISI (American Iron and Steel Institute) steel grades. It falls under the ferritic stainless steel category, which is characterized by a high chromium content and low carbon content. The AISI 430 stainless steel has strong corrosion resistance, formability, and heat resistance. For example, AISI 430 can contain between 16 and 18% Chromium, low Carbon, and a remainder of iron. AISI 430 is generally magnetic.

[0077] According to some examples, the resonant circuit **16** for the induction heater coil **20** is configured to have an equivalent AC resistance of between 8 and 15 ohms at the working frequency when the cookware **14** overlays the induction heater coil **20** and the bottom portion is made of AISI 430. The inductance of the induction heater coil **20** may be between 45 micro-Henries (uH) and **60** uH when the equivalent resistance is between 8 and 15 ohms at the working frequency. Other ranges of resistance, capacitance, and/or inductance may be achieved according to various examples described herein.

[0078] In general, the dimensions, parameters, values (e.g., electrical values), and the like described above and below are exemplary and non-limiting. For example, use of the term "approximately" may refer to +/−10% or +/−20% of a listed value, or target value. Use of the term "substantially" may refer to +/−5% or less of a listed value, or target value. By way of example, if an exemplary width is provided as about 9.9 millimeters, it is contemplated that such width may be in the range of 8.9 to 10.9 millimeters. Alternatively, the width may be in the range of 7.9 to 11.9 millimeters. Further, such dimension may be approximated by the value of 10 millimeters.

[0079] Referring now to FIGS. **3-13**, a first induction coil assembly **100** is configured for operation with the heating circuit **32** of the present cooktop **10**.

[0080] Referring more particularly to FIG. **3**, the induction coil assembly **100** includes a coil **102**, a pair of thermally resistant layers **104**, **106**, and a ferrite layer **108** each disposed on a central axis **110**. The coil includes an upper side **112** and a lower side **114**. The pair of thermally resistant layers **104**, **106** engage the lower side **114** and the upper side **112**, respectively. For example, the pair of thermally resistant layers **104**, **106** can include a first layer **104** that engages the lower side **114** of the coil and a second layer **106** that engages the upper side **112** of the coil **102**. In this way, the pair of thermally resistant layers **104**, **106** sandwich, or pancake, the coil **102**. The ferrite layer **108** is disposed under the first thermally resistant layer **104** and includes a plurality of ferrites **116**, **118**. The coil **102**, the pair of thermally resistant layers **104**, **106**, and the ferrite layer **108** are stacked together to form the induction coil assembly **100**, with the ferrite layer **108** defining a bottom surface **120** of the stack **100** and the second thermally resistant layer **106** forming a top surface **122** of the stack **100**. An assembly height **124** is defined between the bottom surface **120** and the top surface **122** measured in a direction orthogonal to the cooking surface **12**, the top surface **122**, and/or the bottom surface **120**.

[0081] Referring now to FIG. **4**, the pair of thermally resistant layers **104**, **106** will be described in reference to the second thermally resistant layer **106**, as the first thermally resistant layer **104** is substantially structurally similar to the first thermally resistant layer **104**. Each of the pair of thermally resistant layers **104**, **106** has a plate width **126** of 250 millimeters. As demonstrated, the pair of thermally resistant layers **104**, **106** can define a stack width of the assembly, as the pair of thermally resistant layers **104**, **106** can overhang the coil **102** and form the outermost points of the stack **100**. Stated differently, the widest part of the stack **100** may be the pair of thermally resistant layers **104**, **106**.

[0082] Referring now to FIGS. **5** and **6**, the second layer **106**, which may be structurally similar or identical to the first layer **104**, defines a central slot **130** aligned with the central axis **110**. The central slot **130** is configured to receive a temperature sensor and may have a stadium shape having radii of curvature of 5.35 millimeters and having a straight length of 5 millimeters. Each of the pair of thermally resistant layers **104**, **106** may define one or more peripheral slots **134** spaced radially outwardly from the central slot **130**.

[0083] The second layer **106** further defines a passthrough hole **136** disposed adjacent to the central slot **130**. The passthrough hole **136** is configured to receive a portion of the coil **102**, such that when the stack **100** is assembled, two coil ends **138**, **140** of the coil **102** (FIG. **7**) may be accessed along an edge **142** of the stack **100**. For example, the passthrough hole **136** can have a hole diameter **144** of 8 millimeters, which may be large enough to allow wire **148** of the coil **102** to pass through the second layer **106**.

[0084] One or more of the thermally resistant layers **104**, **106** has a plate height **146** of 0.5 millimeters. It is contemplated that the thermally resistant layers **104**, **106** may be comprised of mica, such as mica sheeting. In some examples, the thermally resistant layers **104**, **106** are made from muscovite or phlogopite mica. The thermally resistant layers **104**, **106** may also be electrically insulative to limit current from arcing between adjacent turns of the coil **102**. The thermally resistant layers **104**, **106** may comprise magnesium, potassium, aluminum, and/or silica. The thermally resistant layers **104**, **106** may include magnesium, aluminum, and silica. The thermally resistant layers **104**, **106** may also, or alternatively, provide for mechanical stability to support the turns of the induction coil **102** to maintain the shape of the coil **102** and limit deformation. It is contemplated that the second layer **106** may be omitted in some examples, such that the top surface **122** of the stack **100** may be formed by the upper side **112** of the coil **102**.

[0085] Referring now to FIGS. **7-9**, the coil **102** includes wire **148** that forms an outer portion **150**, an inner portion **152** spaced from the outer portion **150**, and an intermediate portion **154** of the coil **102** spaced from and between the outer portion **150** and the inner portion **152**. The wire **148** may be formed of Litz wire having individually insulated strands. The strands may be twisted or braided together forming windings, or turns, of the coil **102**. In general, the wire **148** may provide for limited skin effect and proximity effect at high frequencies (e.g., the working frequency). For example, due to the skin effect, the flow of electric current tends to concentrate near the surface of a conductor. Litz wire may counteract this effect by providing the multiple insulated strands to distribute the current more evenly across a wire cross-sectional area.

[0086] The coil **102** includes a first coil end **138** and a second coil end **140**. The first coil end **138** is disposed radially outwardly relative to the second coil end **140**. The first coil end **138** may be coupled with the heating circuit **32** via connection between the pair of thermally resistant layers **104**, **106** along the edge **142** of the stack **100**, and the second coil end **140** may be coupled with the heating circuit **32** via access through the passthrough hole **136**. For example, the wire **148** may pass through the passthrough hole **136** and extend radially outwardly toward the edge **142** of the stack **100** along the bottom side of the stack **100**.

[0087] The portions of the coil **102** are connected with one another via interconnecting portions **156**, **158** of the coil **102** that span coil gaps **160**, **162**. For example, an outer interconnecting portion **156** spans an outer coil gap **160** to connect the outer portion **150** and the intermediate portion **154** together, and an inner interconnecting portion **158** spans an inner coil gap **162** to connect the intermediate portion **154** and the inner portion **152** together. It is contemplated that, while the coil ends **138**, **140** and the interconnecting portions **156**, **158** are substantially aligned along a common radius of the coil **102**, in some examples, the interconnecting portions **156**, **158** are circumferentially spaced, or offset, from one or both of the coil ends **138**, **140**.

[0088] With particular reference to FIGS. **8** and **9**, the coil **102** defines a coil width **164** of about 240 millimeters measured in a front-most part **166** to rear-most part **168** of the coil **102**. The wire **148** has a wire width **170** of 2.39 millimeters. Accordingly, the pair of thermally resistant layers **104**, **106** may overhang, or extend, radially past the coil **102** by about 5 millimeters, depending on the radial position of the coil **102**.

[0089] The wire **148** may have a substantially square-shaped cross-section. For example, the wire **148** has a wire height **172** equivalent to the coil height of 2.37 millimeters. The cross-sectional area is 5.66 square millimeters. The outer portion **150** has 8 windings. The inner portion **152** has 9 windings. The intermediate portion **154** has 7 windings. The coil **102** has an inductance of 45 microhenries and a resistance of 8 ohms. The outer coil gap **160** is 20.3 millimeters. The inner coil gap **162** is 19.75 millimeters. Accordingly, the outer portion **150** is spaced from the inner portion **152** by 56.15 millimeters.

[0090] Referring now to FIGS. **10** and **11**, the ferrite layer **108** includes ferrite material that may be a ceramic material with magnetic properties to direct the magnetic field generated by the coil **102**. The ferrite layer **108** includes ceramic compounds that may include iron oxide combined with other metal oxides, such as zinc, nickel, and/or manganese to provide high magnetic permeability and low electrical conductivity. For example, the ferrite layer **108** includes a plurality of ferrites **116**, **118** distributed in the ferrite layer **108** for shaping and focusing the magnetic fields produced by the coil **102**, as well as the magnetic flux of the magnetic fields. The ferrites **116**, **118** may be distributed evenly or unevenly. For example, the ferrites **116**, **118** can be radially distributed evenly, while the individual shapes, lengths, and/or other dimensions of the ferrites **116**, **118** may differ. In general, the ferrites **116**, **118** may be rod- or bar-shaped to concentrate the magnetic field along the axis of the rod. This shape may be effective for creating a strong and focused magnetic field in a specific direction (e.g., radially inward or radially outwardly relative to the central axis **110**).

[0091] The ferrite layer **108** has a ferrite layer width **173** of 236 millimeters. The plurality of ferrites **116**, **118** includes a set of inner ferrites **116** and a set of outer ferrites **118**, with the set of inner ferrites **116** extending more proximate to the central axis **110** relative to the set of outer ferrites **118**. The set of inner ferrites **116** includes 6 ferrites **116** extending radially and evenly distributed about the central axis **110**. The set of outer ferrites **118** also includes 6 ferrites extending radially and evenly distributed about the central axis **110**. Accordingly, each of the set of inner ferrites **116** extends along an extension axis **174** central to each of the set of inner ferrites **116** that is 60 degrees offset from its adjacent inner ferrites **116**, thereby forming a hexagonal distribution of the inner ferrites **116**. Each inner ferrite **116** is radially spaced from the central axis **110** by about 28 millimeters at the extension axis **174**. For example, each ferrite **116**, **118** has a ferrite central end **176** and a ferrite peripheral end **178**. The ferrite central end **176** of the inner ferrite **116** is spaced from the central axis **110** by about 28 millimeters at the extension axis **174**. Each of the ferrites **116**, **118** has a ferrite width **180** of 20 millimeters. The inner ferrites **116** have a ferrite length **182** of 90 millimeters. Further, each of the inner ferrites **116** and the outer ferrites **118** has 4 filleted vertices **184** each having legs (e.g., of a right triangle) equal to 1 millimeter. The inner ferrites **116** have a ferrite height **186** of 4.5 mm. Accordingly, each ferrite **116**, **118** is substantially bar-shaped.

[0092] The set of outer ferrites **118** has the same ferrite width **180** as the set of inner ferrites **116** (e.g., 20 millimeters) and half of the ferrite length **182** of the outer ferrites **118** (e.g., 45 millimeters). The outer ferrites **118** are distributed in the same way as the distribution of the inner ferrites **116** but offset by 30 degrees relative to the distribution of the inner ferrites **116**. The ferrite peripheral end **178** of each of the inner ferrites **116** and the outer ferrites **118** are spaced from the central axis **110** by 118 millimeters at the extension axis **174**. The outer ferrites **118** similarly form rod-shaped bodies, and together, the inner and outer ferrites **116**, **118** form a star-shaped distribution of the ferrite layer **108**.

[0093] A circular area of the coil **102** (e.g., the area of the coil **102** parallel to the cooking surface **12** on one side of the coil **102**) can influence the magnetic field strength and distribution generated by the coil **102**. Further, the percentage of the circular area, or footprint, of the coil **102** covered by (or not covered by) the ferrite layer **108** can influence the distribution and flux of the magnetic field. Accordingly, the ferrite layer **108** may be sized, in terms of target area, volume, or the like, to provide enhanced magnetic field guidance. For example, the circular area of the coil **102** may be between 40,000 and 50,000 square millimeters. In the present example, the circular area of the coil **102** is about 45,000 square millimeters, and the target area (e.g., footprint area) of the ferrite layer **108** may be about 16,000 square millimeters. The target area of the ferrite layer **108** may be between 12,000 square millimeters and 20,000 square millimeters. Accordingly, the ferrite layer **108** may cover about 33% of the circular area of the coil **102**. In this way, the magnetic fields may be focused directly to the cookware **14**.

[0094] The distribution of the ferrite layer **108** enhances magnetic flux of the magnetic field by providing multiple sources relatively evenly distributed about the central axis **110**. The enhanced magnetic properties provided by the ferrite layer **108**, coupled with the ferrite layer width **173**, provide for slim yet efficient functionality of the induction coil assembly **100**.

[0095] Referring now to FIGS. **12** and **13**, the coil **102** has a cross-sectional width of 241.06 millimeters measured between a left-most part **188** to right-most part **190** of the coil **102**. The stack **100** has an assembly height **124** of 8.12 millimeters, which is comprised of each plate height **146** (0.5 millimeters×2), the coil height **172** of 2.37 millimeters, and the ferrite height **186** of 4.5 millimeters. It is contemplated that stack **100** may maintain room for minor expansion or retraction (e.g., tolerance) of the components of the stack **100** that amount to about 0.25 millimeters. The top surface **122** of the stack **100** can be spaced from the cooking surface **12** by between 2.5 millimeters and 7 millimeters.

[0096] While specific parameters of the first induction coil assembly **100** are shown and described, it is contemplated that these parameters may differ without deviating from the aspects of the first induction coil assembly **100**. For example, ratios, percentages, or proportions may differ. For example, the spacings between the outer portion **150**, the inner portion **152**, and the intermediate portions **154**, as a ratio to the number of windings, may be similar in a first induction coil assembly **100** that is bigger or smaller than the example shown and described. For example, the various dimensional values and/or electrical values may be in the range of +/−10-20% of the listed value.

[0097] In general, the short stack height **124** of the first induction coil assembly **100** provides for enhanced space saving within the induction cooktop **10**. By incorporating the full-bridge circuit in combination with a higher-resistance coil **102** and distribution of ferrites of the ferrite layer **108**, a lower-cost dynamic solution may be provided.

[0098] Referring now to FIGS. **14-24**, a second induction coil assembly **200** is configured for operation with the heating circuit **32** of the present cooktop **10**.

[0099] Referring more particularly to FIG. **14**, the induction coil assembly **200** includes a coil **202**, a pair of thermally resistant layers **204**, **206**, and a ferrite layer **208** each disposed on a central axis **210**. The coil includes an upper side **212** and a lower side **214**. The pair of thermally resistant layers **204**, **206** engage the lower side **214** and the upper side **212**, respectively. For example, the pair of thermally resistant layers **204**, **206** can include a first layer **204** that engages the lower side **214** of the coil and a second layer **206** that engages the upper side **212** of the coil **202**. In this way, the pair of thermally resistant layers **204**, **206** sandwich, or pancake, the coil **202**. The ferrite layer **208** is disposed under the first thermally resistant layer **204** and includes a plurality of ferrites **216**, **218**. The coil **202**, the pair of thermally resistant layers **204**, **206**, and the ferrite layer **208** are stacked together to form the induction coil assembly **200**, with the ferrite layer **208** defining a bottom surface **220** of the stack **200** and the second thermally resistant layer **206** forming a top surface **222** of the stack **200**. An assembly height **224** is defined between the bottom surface **220** and the top surface **222** measured in a direction orthogonal to the cooking surface **12**, the top surface **222**, and/or the bottom surface **220**.

[0100] Referring now to FIG. **15**, the pair of thermally resistant layers **204**, **206** will be described in reference to the second thermally resistant layer **206**, as the first thermally resistant layer **204** is substantially structurally similar to the first thermally resistant layer **204**. Each of the pair of thermally resistant layers **204**, **206** has a plate width **226** of 220 millimeters. As demonstrated, the pair of thermally resistant layers **204**, **206** can define a stack width of the assembly, as the pair of thermally resistant layers **204**, **206** can overhang the coil **202** and form the outermost points of the stack **200**. Stated differently, the widest part of the stack **200** may be the pair of thermally resistant layers **204**, **206**.

[0101] Referring now to FIGS. **16** and **17**, the second layer **206**, which may be structurally similar or identical to the first layer **204**, defines a central slot **230** aligned with the central axis **210**. The central slot **230** is configured to receive a temperature sensor and may have a stadium shape having radii of curvature of 5.35 millimeters and having a straight length of 5 millimeters. Each of the pair of thermally resistant layers **204**, **206** may define one or more peripheral slots **234** spaced radially outwardly from the central slot **230**.

[0102] The second layer **206** further defines a passthrough hole **236** disposed adjacent to the central slot **230**. The passthrough hole **236** is configured to receive a portion of the coil **202**, such that when the stack **200** is assembled, two coil ends **238**, **240** of the coil **202** (FIG. **18**) may be accessed along an edge **242** of the stack **200**. For example, the passthrough hole **236** can have a hole diameter **244** of 8 millimeters, which may be large enough to allow wire **248** of the coil **202** to pass through the second layer **206**.

[0103] One or more of the thermally resistant layers **204**, **206** has a plate height **246** of 0.5 millimeters. It is contemplated that the thermally resistant layers **204**, **206** may be comprised of mica, such as mica sheeting. In some examples, the thermally resistant layers **204**, **206** are made from muscovite or phlogopite mica. The thermally resistant layers **204**, **206** may also be electrically insulative to limit current from arcing between adjacent turns of the coil **202**. The thermally resistant layers **204**, **206** may comprise magnesium, potassium, aluminum, and/or silica. The thermally resistant layers **204**, **206** may include magnesium, aluminum, and silica. The thermally resistant layers **204**, **206** may also, or alternatively, provide for mechanical stability to support the turns of the induction coil **202** to maintain the shape of the coil **202** and limit deformation. It is contemplated that the second layer **206** may be omitted in some examples, such that the top surface **222** of the stack **200** may be formed by the upper side **212** of the coil **202**.

[0104] Referring now to FIGS. **18-20**, the coil **202** includes wire **248** that forms an outer portion **250** and an inner portion **252** spaced from the outer portion **250**. The wire **248** may be formed of Litz wire having individually insulated strands. The strands may be twisted or braided together forming windings, or turns, of the coil **202**. In general, the wire **248** may provide for limited skin effect and proximity effect at high frequencies (e.g., the working frequency). For example, due to the skin effect, the flow of electric current tends to concentrate near the surface of a conductor. Litz wire may counteract this effect by providing the multiple insulated strands to distribute the current more evenly across a wire cross-sectional area.

[0105] The coil **202** includes a first coil end **238** and a second coil end **240**. The first coil end **238** is disposed radially outwardly relative to the second coil end **240**. The first coil end **238** may be coupled with the heating circuit **32** via connection between the pair of thermally resistant layers **204**, **206** along the edge **242** of the stack **200**, and the second coil end **240** may be coupled with the heating circuit **32** via access through the passthrough hole **236**. For example, the wire **248** may pass through the passthrough hole **236** and extend radially outwardly toward the edge **242** of the stack **200** along the bottom side of the stack **200**.

[0106] The portions **250**, **252** of the coil **202** are connected with one another via an interconnecting portions **258** of the coil **202** that span outer coil gap **260**. For example, the interconnecting portion **258** spans the outer coil gap **260** to connect the outer portion **250** and the inner portion **252** together. It is contemplated that, while the coil ends **238**, **240** and the interconnecting portion **258** may be substantially aligned along a common radius of the coil **202**, in some examples, the interconnecting portion **258** may be circumferentially spaced, or offset, from one or both of the coil ends **238**, **240**.

[0107] With particular reference to FIGS. **19** and **20**, the coil **202** defines a coil width **264** of about 210 millimeters measured in a front-most part **266** to rear-most part **268** of the coil **202**. The wire **248** has a wire width **270** of 2.6 millimeters. Accordingly, the pair of thermally resistant layers **204**, **206** may overhang, or extend, radially past the coil **202** by about 5 millimeters, depending on the radial position of the coil **202**.

[0108] The wire **248** may have a substantially square-shaped cross-section. For example, the wire **248** has a wire height **272** equivalent to the coil height of 2.17 millimeters. The cross-sectional area is 5.64 square millimeters. The outer portion **250** has 12 windings. The inner portion **252** has

12 windings. The coil **202** has an inductance of 50 microhenries and a resistance of 9 ohms. The outer coil gap **260** is 19.7 millimeters.

[0109] Referring now to FIGS. **21** and **22**, the ferrite layer **208** includes ferrite material that may be a ceramic material with magnetic properties to direct the magnetic field generated by the coil **202**. The ferrite layer **208** includes ceramic compounds that may include iron oxide combined with other metal oxides, such as zinc, nickel, and/or manganese to provide high magnetic permeability and low electrical conductivity. For example, the ferrite layer **208** includes a plurality of ferrites **216**, **218** distributed in the ferrite layer **208** for shaping and focusing the magnetic fields produced by the coil **202**, as well as the magnetic flux of the magnetic fields. The ferrites **216**, **218** may be distributed evenly or unevenly. For example, the ferrites **216**, **218** can be radially distributed evenly, while the individual shapes, lengths, and/or other dimensions of the ferrites **216**, **218** may differ. In general, the ferrites **216**, **218** may be rod- or bar-shaped to concentrate the magnetic field along the axis of the rod. This shape may be effective for creating a strong and focused magnetic field in a specific direction (e.g., radially inward or radially outwardly relative to the central axis **210**).

[0110] The ferrite layer **208** has a ferrite layer width **273** of 206 millimeters. The plurality of ferrites **216**, **218** includes a set of inner ferrites **216** and a set of outer ferrites **218**, with the set of inner ferrites **216** extending more proximate to the central axis **210** relative to the set of outer ferrites **218**. The set of inner ferrites **216** includes 6 ferrites **216** extending radially and evenly distributed about the central axis **210**. The set of outer ferrites **218** also includes 6 ferrites extending radially and evenly distributed about the central axis **210**. Accordingly, each of the set of inner ferrites **216** extends along an extension axis **274** central to each of the set of inner ferrites **216** that is 60 degrees offset from its adjacent inner ferrites **216**, thereby forming a hexagonal distribution of the inner ferrites **216**. Each inner ferrite **216** is radially spaced from the central axis **210** by about 28 millimeters at the extension axis **274**. For example, each ferrite **216**, **218** has a ferrite central end **276** and a ferrite peripheral end **278**. The ferrite central end **276** of the inner ferrite **216** is spaced from the central axis **210** by about 28 millimeters at the extension axis **274**. Each of the ferrites **216**, **218** has a ferrite width **280** of 20 millimeters. The inner ferrites **216** have a ferrite length **282** of 75 millimeters. Further, each of the inner ferrites **216** and the outer ferrites **218** has 4 filleted vertices **284** each having legs (e.g., of a right triangle) equal to 1 millimeter. The inner ferrites **216** have a ferrite height **286** of 4.5 mm. Accordingly, each ferrite **216**, **218** is substantially bar-shaped.

[0111] The set of outer ferrites **218** has the same ferrite width **280** as the set of inner ferrites **216** (e.g., 20 millimeters) and 60% of the ferrite length **282** of the outer ferrites **218** (e.g., 45 millimeters). The outer ferrites **218** are distributed in the same way as the distribution of the inner ferrites **216** but offset by 30 degrees relative to the distribution of the inner ferrites **216**. The ferrite peripheral end **278** of each of the inner ferrites **216** and the outer ferrites **218** are spaced from the central axis **210** by 103 millimeters at the extension axis **274**. The outer ferrites **218** similarly form rod-shaped bodies, and together, the inner and outer ferrites **216**, **218** form a star-shaped distribution of the ferrite layer **208**.

[0112] A circular area of the coil **202** (e.g., the area of the coil **202** parallel to the cooking surface **12** on one side of the coil **202**) can influence the magnetic field strength and distribution generated by the coil **202**. Further, the percentage of the circular area, or footprint, of the coil **202** covered by (or not covered by) the ferrite layer **208** can influence the distribution and flux of the magnetic field. Accordingly, the ferrite layer **208** may be sized, in terms of target area, volume, or the like, to provide enhanced magnetic field guidance. For example, the circular area of the coil **202** may be between 30,000 and 40,000 square millimeters. In the present example, the circular area of the coil **202** is about 35,000 square millimeters, and the target area (e.g., footprint area) of the ferrite layer **208** may be about 14,000-15,000 square millimeters. The target area of the ferrite layer **208** may be between 11,500 square millimeters and 17,500 square millimeters. Accordingly, the ferrite layer **208** may cover between 35% and 45% of the circular area of the coil **202**. In this way, the magnetic fields may be focused directly to the cookware **14**.

[0113] The distribution of the ferrite layer **208** enhances magnetic flux of the magnetic field by providing multiple sources relatively evenly distributed about the central axis **210**. The enhanced magnetic properties provided by the ferrite layer **208**, coupled with the ferrite layer width **273**, provide for slim yet efficient functionality of the induction coil assembly **200**.

[0114] Referring now to FIGS. **23** and **24**, the coil **202** has a cross-sectional width of 211.02 millimeters measured between a left-most part **288** to right-most part **290** of the coil **202**. The stack **200** has an assembly height **224** of 7.92 millimeters, which is comprised of each plate height **246** (0.5 millimeters×2), the coil height **272** of 2.17 millimeters, and the ferrite height **286** of 4.5 millimeters. It is contemplated that stack **200** may maintain room for minor expansion or retraction (e.g., tolerance) of the components of the stack **200** that amount to about 0.25 millimeters. The top surface **222** of the stack **200** can be spaced from the cooking surface **12** by between 2.5 millimeters and 7 millimeters.

[0115] While specific parameters of the second induction coil assembly **200** are shown and described, it is contemplated that these parameters may differ without deviating from the aspects of the second induction coil assembly **200**. For example, ratios, percentages, or proportions may differ. For example, the spacing between the outer portion **250** and the inner portion **252**, as a ratio to the number of windings, may be similar in a second induction coil assembly **200** that is bigger or smaller than the example shown and described. For example, the various dimensional values and/or electrical values may be in the range of +/−10-20% of the listed value.

[0116] In general, the short stack height **224** of the second induction coil assembly **200** provides for enhanced space saving within the induction cooktop **10**. By incorporating the full-bridge circuit in combination with a higher-resistance coil **202** and distribution of ferrites of the ferrite layer **208**, a lower-cost dynamic solution may be provided.

[0117] Referring now to FIGS. **25-35**, a third induction coil assembly **300** is configured for operation with the heating circuit **32** of the present cooktop **10**.

[0118] Referring more particularly to FIG. **25**, the induction coil assembly **300** includes a coil **302**, a pair of thermally resistant layers **304**, **306**, and a ferrite layer **308** each disposed on a central axis **310**. The coil includes an upper side **312** and a lower side **314**. The pair of thermally resistant layers **304**, **306** engage the lower side **314** and the upper side **312**, respectively. For example, the pair of thermally resistant layers **304**, **306** can include a first layer **304** that engages the lower side **314** of the coil and a second layer **306** that engages the upper side **312** of the coil **302**. In this way, the pair of thermally resistant layers **304**, **306** sandwich, or pancake, the coil **302**. The ferrite layer **308** is disposed under the first thermally resistant layer **304** and includes a plurality of ferrites **316**, **318**. The coil **302**, the pair of thermally resistant layers **304**, **306**, and the ferrite layer **308** are stacked together to form the induction coil assembly **300**, with the ferrite layer **308** defining a bottom surface **320** of the stack **300** and the second thermally resistant layer **306** forming a top surface **322** of the stack **300**. An assembly height **324** is defined between the bottom surface **320** and the top surface **322** measured in a direction orthogonal to the cooking surface **12**, the top surface **322**, and/or the bottom surface **320**.

[0119] Referring now to FIG. **26**, the pair of thermally resistant layers **304**, **306** will be described in reference to the second thermally resistant layer **306**, as the first thermally resistant layer **304** is substantially structurally similar to the first thermally resistant layer **304**. Each of the pair of thermally resistant layers **304**, **306** has a plate width **326** of 190 millimeters. As demonstrated, the pair of thermally resistant layers **304**, **306** can define a stack width of the assembly, as the pair of thermally resistant layers **304**, **306** can overhang the coil **302** and form the outermost points of the stack **300**. Stated differently, the widest part of the stack **300** may be the pair of thermally resistant layers **304**, **306**.

[0120] Referring now to FIGS. **27** and **28**, the second layer **306**, which may be structurally similar or identical to the first layer **304**, defines a central slot **330** aligned with the central axis **310**. The central slot **330** is configured to receive a temperature sensor and may have a stadium shape having radii of curvature of 5.35 millimeters and having a straight length of 5 millimeters.

[0121] The second layer **306** further defines a passthrough hole **336** disposed adjacent to the central slot **330**. The passthrough hole **336** is configured to receive a portion of the coil **302**, such that when the stack **300** is assembled, two coil ends **338**, **340** of the coil **302** (FIG. **29**) may be accessed along an edge **342** of the stack **300**. For example, the passthrough hole **336** can have a hole diameter **344** of 8 millimeters, which may be large enough to allow wire **348** of the coil **302** to pass through the second layer **306**.

[0122] One or more of the thermally resistant layers **304**, **306** has a plate height **346** of 0.5 millimeters. It is contemplated that the thermally resistant layers **304**, **306** may be comprised of mica, such as mica sheeting. In some examples, the thermally resistant layers **304**, **306** are made from muscovite or phlogopite mica. The thermally resistant layers **304**, **306** may also be electrically insulative to limit current from arcing between adjacent turns of the coil **302**. The thermally resistant layers **304**, **306** may comprise magnesium, potassium, aluminum, and/or silica. The thermally resistant layers **304**, **306** may include magnesium, aluminum, and silica. The thermally resistant layers **304**, **306** may also, or alternatively, provide for mechanical stability to support the turns of the induction coil **302** to maintain the shape of the coil **302** and limit deformation. It is contemplated that the second layer **306** may be omitted in some examples, such that the top surface **322** of the stack **300** may be formed by the upper side **312** of the coil **302**.

[0123] Referring now to FIGS. **29**-**31**, the coil **302** includes wire **348** that forms an outer portion **350** and an inner portion **352** spaced from the outer portion **350**. The wire **348** may be formed of Litz wire having individually insulated strands. The strands may be twisted or braided together forming windings, or turns, of the coil **302**. In general, the wire **348** may provide for limited skin effect and proximity effect at high frequencies (e.g., the working frequency). For example, due to the skin effect, the flow of electric current tends to concentrate near the surface of a conductor. Litz wire may counteract this effect by providing the multiple insulated strands to distribute the current more evenly across a wire cross-sectional area.

[0124] The coil **302** includes a first coil end **338** and a second coil end **340**. The first coil end **338** is disposed radially outwardly relative to the second coil end **340**. The first coil end **338** may be coupled with the heating circuit **32** via connection between the pair of thermally resistant layers **304**, **306** along the edge **342** of the stack **300**, and the second coil end **340** may be coupled with the heating circuit **32** via access through the passthrough hole **336**. For example, the wire **348** may pass through the passthrough hole **336** and extend radially outwardly toward the edge **342** of the stack **300** along the bottom side of the stack **300**.

[0125] The portions of the coil **302** are connected with one another via an interconnecting portion **358** of the coil **302** that spans outer coil gap **360**. For example, the outer interconnecting portion **358** spans an outer coil gap **360** to connect the outer portion **350** and the inner portion **352** together. It is contemplated that, while the coil ends **338**, **340** and the interconnecting portion **358** may be substantially aligned along a common radius of the coil **302**, in some examples, the interconnecting portion **358** may be circumferentially spaced, or offset, from one or both of the coil ends **338**, **340**.

[0126] With particular reference to FIGS. **30** and **31**, the coil **302** defines a coil width **364** of about 180 millimeters measured in a front-most part **366** to rear-most part **368** of the coil **302**. The wire **348** has a wire width **370** of 2.11 millimeters. Accordingly, the pair of thermally resistant layers **304**, **306** may overhang, or extend, radially past the coil **302** by about 5 millimeters, depending on the radial position of the coil **302**.

[0127] The wire **348** may have a substantially square-shaped cross-section. For example, the wire **348** has a wire height **372** equivalent to the coil height of 2.24 millimeters. The cross-sectional area is 4.73 square millimeters. The outer portion **350** has 13 windings. The inner portion **352** has 11 windings. The coil **302** has an inductance of 50 microhenries and a resistance of 9 ohms. The outer coil gap **360** is 16.8 millimeters.

[0128] Referring now to FIGS. **32** and **33**, the ferrite layer **308** includes ferrite material that may be a ceramic material with magnetic properties to direct the magnetic field generated by the coil **302**. The ferrite layer **308** includes ceramic compounds that may include iron oxide combined with other metal oxides, such as zinc, nickel, and/or manganese to provide high magnetic permeability and low electrical conductivity. For example, the ferrite layer **308** includes a plurality of ferrites **316**, **318** distributed in the ferrite layer **308** for shaping and focusing the magnetic fields produced by the coil **302**, as well as the magnetic flux of the magnetic fields. The ferrites **316**, **318** may be distributed evenly or unevenly. For example, the ferrites **316**, **318** can be radially distributed evenly, while the individual shapes, lengths, and/or other dimensions of the ferrites **316**, **318** may differ. In general, the ferrites **316**, **318** may be rod- or bar-shaped to concentrate the magnetic field along the axis of the rod. This shape may be effective for creating a strong and focused magnetic field in a specific direction (e.g., radially inward or radially outwardly relative to the central axis **310**).

[0129] The ferrite layer **308** has a ferrite layer width **373** of 179 millimeters. The plurality of ferrites **316**, **318** includes a set of inner ferrites **316** and a set of outer ferrites **318**, with the set of inner ferrites **316** extending more proximate to the central axis **310** relative to the set of outer ferrites **318**. The set of inner ferrites **316** includes 6 ferrites **316** extending radially and evenly distributed about the central axis **310**. The set of outer ferrites **318** also includes 6 ferrites extending radially and evenly distributed about the central axis **310**. Accordingly, each of the set of inner ferrites **316** extends along an extension axis **374** central to each of the set of inner ferrites **316** that is 60 degrees offset from its adjacent inner ferrites **316**, thereby forming a hexagonal distribution of the inner ferrites **316**. Each inner ferrite **316** is radially spaced from the central axis **310** by about 20 millimeters at the extension axis **374**. For example, each ferrite **316**, **318** has a ferrite central end **376** and a ferrite peripheral end **378**. The ferrite central end **376** of the inner ferrite **316** is spaced from the central axis **310** by about 20 millimeters at the extension axis **374**. Each of the ferrites **316**, **318** has a ferrite width **380** of 20 millimeters. The inner ferrites **316** have a ferrite length **382** of 70 millimeters. Further, each of the inner ferrites **316** and the outer ferrites **318** has 4 filleted vertices **384** each having legs (e.g., of a right triangle) equal to 1 millimeter. The inner ferrites **316** have a ferrite height **386** of 4.5 mm. Accordingly, each ferrite **316**, **318** is substantially bar-shaped.

[0130] The set of outer ferrites **318** has the same ferrite width **380** as the set of inner ferrites **316** (e.g., 20 millimeters) and between 40 and 50% of the ferrite length **382** of the outer ferrites **318** (e.g., 45 millimeters). The outer ferrites **318** are distributed in the same way as the distribution of the inner ferrites **316** but offset by 30 degrees relative to the distribution of the inner ferrites **316**. The ferrite peripheral end **378** of each of the inner ferrites **316** and the outer ferrites **318** are spaced from the central axis **310** by about 90 millimeters at the extension axis **374**. The outer ferrites **318** similarly form rod-shaped bodies, and together, the inner and outer ferrites **316**, **318** form a star-shaped distribution of the ferrite layer **308**.

[0131] A circular area of the coil **302** (e.g., the area of the coil **302** parallel to the cooking surface **12** on one side of the coil **302**) can influence the magnetic field strength and distribution generated by the coil **302**. Further, the percentage of the circular area, or footprint, of the coil **302** covered by (or not covered by) the ferrite layer **308** can influence the distribution and flux of the magnetic field. Accordingly, the ferrite layer **308** may be sized, in terms of target area, volume, or the like, to provide enhanced magnetic field guidance. For example, the circular area of the coil **302** may be between 20,000 and 30,000 square millimeters. In the present example, the circular area of the coil **302** is about 25,000 square millimeters, and the target area (e.g., footprint area) of the ferrite layer **308** may be about 12,000 square millimeters. The target area of the ferrite layer **308** may be between 10,000 square millimeters and 14,000 square millimeters. Accordingly, the ferrite layer **308** may cover about 50% of the circular area of the coil **302**. In this way, the magnetic fields may be focused directly to the cookware **14**.

[0132] The distribution of the ferrite layer **308** enhances magnetic flux of the magnetic field by providing multiple sources relatively evenly distributed about the central axis **310**. The enhanced magnetic properties provided by the ferrite layer **308**, coupled with the ferrite layer width **373**, provide for slim yet efficient functionality of the induction coil assembly **300**.

[0133] Referring now to FIGS. **34** and **35**, the coil **302** has a cross-sectional width of 178.3 millimeters measured between a left-most part **388** to right-most part **390** of the coil **302**. The stack **300** has an assembly height **324** of 8 millimeters, which is comprised of each plate height **346** (0.5 millimeters×2), the coil height **372** of 2.24 millimeters, and the ferrite height **386** of 4.5 millimeters. It is contemplated that stack **300** may maintain room for minor expansion or retraction (e.g., tolerance) of the components of the stack **300** that amount to about 0.25 millimeters. The top surface **322** of the stack **300** can be spaced from the cooking surface **12** by between 2.5 millimeters and 7 millimeters.

[0134] While specific parameters of the third induction coil assembly **300** are shown and described, it is contemplated that these parameters may differ without deviating from the aspects of the third induction coil assembly **300**. For example, ratios, percentages, or proportions may differ. For example, the spacings between the outer portion **350**, the inner portion **352**, and the intermediate portions **354**, as a ratio to the number of windings, may be similar in a third induction coil assembly **300** that is bigger or smaller than the example shown and described. For example, the various dimensional values and/or electrical values may be in the range of +/−10-20% of the listed value.

[0135] In general, the short stack height **324** of the third induction coil assembly **300** provides for enhanced space saving within the induction cooktop **10**. By incorporating the full-bridge circuit in combination with a higher-resistance coil **302** and distribution of ferrites of the ferrite layer **308**, a lower-cost dynamic solution may be provided.

[0136] Referring now to FIGS. **36-46**, a fourth induction coil assembly **400** is configured for operation with the heating circuit **32** of the present cooktop **10**.

[0137] Referring more particularly to FIG. **36**, the induction coil assembly **400** includes a coil **402**, a pair of thermally resistant layers **404**, **406**, and a ferrite layer **408** each disposed on a central axis **410**. The coil includes an upper side **412** and a lower side **414**. The pair of thermally resistant layers **404**, **406** engage the lower side **414** and the upper side **412**, respectively. For example, the pair of thermally resistant layers **404**, **406** can include a first layer **404** that engages the lower side **414** of the coil and a second layer **406** that engages the upper side **412** of the coil **402**. In this way, the pair of thermally resistant layers **404**, **406** sandwich, or pancake, the coil **402**. The ferrite layer **408** is disposed under the first thermally resistant layer **404** and includes a plurality of ferrites **416**. The coil **402**, the pair of thermally resistant layers **404**, **406**, and the ferrite layer **408** are stacked together to form the induction coil assembly **400**, with the ferrite layer **408** defining a bottom surface **420** of the stack **400** and the second thermally resistant layer **406** forming a top surface **422** of the stack **400**. An assembly height **424** is defined between the bottom surface **420** and the top surface **422** measured in a direction orthogonal to the cooking surface **12**, the top surface **422**, and/or the bottom surface **420**.

[0138] Referring now to FIG. **37**, the pair of thermally resistant layers **404**, **406** will be described in reference to the second thermally resistant layer **406**, as the first thermally resistant layer **404** is substantially structurally similar to the first thermally resistant layer **404**. Each of the pair of thermally resistant layers **404**, **406** has a plate width **426** of 160 millimeters (FIG. **39**). As demonstrated, the pair of thermally resistant layers **404**, **406** can define a stack width of the assembly, as the pair of thermally resistant layers **404**, **406** can overhang the coil **402** and form the outermost points of the stack **400**. Stated differently, the widest part of the stack **400** may be the pair of thermally resistant layers **404**, **406**.

[0139] Referring now to FIGS. **38** and **39**, the second layer **406**, which may be structurally similar or identical to the first layer **404**, defines a central slot **430** aligned with the central axis **410**. The central slot **430** is configured to receive a temperature sensor and may have a stadium shape having radii of curvature of 5.35 millimeters and having a straight length of 5 millimeters.

[0140] The second layer **406** further defines a passthrough hole **436** disposed adjacent to the central slot **430**. The passthrough hole **436** is configured to receive a portion of the coil **402**, such that when the stack **400** is assembled, two coil ends **438**, **440** of the coil **402** (FIG. **40**) may be accessed along an edge **442** of the stack **400**. For example, the passthrough hole **436** can have a hole diameter **444** of 8 millimeters, which may be large enough to allow wire **448** of the coil **402** to pass through the second layer **406**.

[0141] One or more of the thermally resistant layers **404**, **406** has a plate height **446** of 0.5 millimeters. It is contemplated that the thermally resistant layers **404**, **406** may be comprised of mica, such as mica sheeting. In some examples, the thermally resistant layers **404**, **406** are made from muscovite or phlogopite mica. The thermally resistant layers **404**, **406** may also be electrically insulative to limit current from arcing between adjacent turns of the coil **402**. The thermally resistant layers **404**, **406** may comprise magnesium, potassium, aluminum, and/or silica. The thermally resistant layers **404**, **406** may include magnesium, aluminum, and silica. The thermally resistant layers **404**, **406** may also, or alternatively, provide for mechanical stability to support the turns of the induction coil **402** to maintain the shape of the coil **402** and limit deformation. It is contemplated that the second layer **406** may be omitted in some examples, such that the top surface **422** of the stack **400** may be formed by the upper side **412** of the coil **402**.

[0142] Referring now to FIGS. **40-42**, the coil **402** includes wire **448** that forms a single coil portion **450** with abutting windings. For example, there may be no coil gaps akin to the coil gaps of the other examples described here. The wire **448** may be formed of Litz wire having individually insulated strands. The strands may be twisted or braided together forming windings, or turns, of the coil **402**. In general, the wire **448** may provide for limited skin effect and proximity effect at high frequencies (e.g., the working frequency). For example, due to the skin effect, the flow of electric current tends to concentrate near the surface of a conductor. Litz wire may counteract this effect by providing the multiple insulated strands to distribute the current more evenly across a wire cross-sectional area.

[0143] The coil **402** includes a first coil end **438** and a second coil end **440**. The first coil end **438** is disposed radially outwardly relative to the second coil end **440**. The first coil end **438** may be coupled with the heating circuit **32** via connection between the pair of thermally resistant layers **404**, **406** along the edge **442** of the stack **400**, and the second coil end **440** may be coupled with the heating circuit **32** via access through the passthrough hole **436**. For example, the wire **448** may pass through the passthrough hole **436** and extend radially outwardly toward the edge **442** of the stack **400** along the bottom side of the stack **400**.

[0144] With particular reference to FIGS. **41** and **42**, the coil **402** defines a coil width **464** of about 150 millimeters measured in a front-most part **466** to rear-most part **468** of the coil **402**. The wire **448** has a wire width of 2.02 millimeters. Accordingly, the pair of thermally resistant layers **404**, **406** may overhang, or extend, radially past the coil **402** by about 5 millimeters, depending on the radial position of the coil **402**.

[0145] The wire **448** may have a substantially square-shaped cross-section. For example, the wire **448** has a wire height **472** equivalent to the coil height of 1.87 millimeters. The cross-sectional area is 3.78 square millimeters. The coil portion **450** has 26 windings. The coil **402** has an inductance of 60 microhenries and a resistance of 11 ohms.

[0146] Referring now to FIGS. **43** and **44**, the ferrite layer **408** includes ferrite material that may be a ceramic material with magnetic properties to direct the magnetic field generated by the coil **402**. The ferrite layer **408** includes ceramic compounds that may include iron oxide combined with other metal oxides, such as zinc, nickel, and/or manganese to provide high magnetic permeability and low electrical conductivity. For example, the ferrite layer **408** includes a plurality of ferrites **416** distributed in the ferrite layer **408** for shaping and focusing the magnetic fields produced by the coil **402**, as well as the magnetic flux of the magnetic fields. The ferrites **416** may be distributed evenly or unevenly. For example, the ferrites **416** can be radially distributed evenly, while the individual shapes, lengths, and/or other dimensions of the ferrites **416** may differ. In general, the ferrites **416** may be rod- or bar-shaped to concentrate the magnetic field along the axis of the rod. This shape may be effective for creating a strong and focused magnetic field in a specific direction (e.g., radially inward or radially outwardly relative to the central axis **410**).

[0147] The ferrite layer **408** has a ferrite layer width **473** of 152 millimeters. The set of ferrites **416** includes 6 ferrites **416** extending radially and evenly distributed about the central axis **410**. Accordingly, each of the set of ferrites **416** extends along an extension axis **474** central to each of the set of ferrites **416** that is 60 degrees offset from its adjacent ferrites **416**, thereby forming a hexagonal distribution of the ferrites **416**. Each ferrite **416** is radially spaced from the central axis **410** by about 21 millimeters at the extension axis **474**. For example, each ferrite **416** has a ferrite central end **476** and a ferrite peripheral end **478**. The ferrite central end **476** of the ferrite **416** is spaced from the central axis **410** by about 21 millimeters at the extension axis **474**. Each of the ferrites **416** has a ferrite width **480** of 20 millimeters. The ferrites **416** have a ferrite length **482** of 55 millimeters. Further, each of the ferrites **416** has 4 filleted vertices **484** each having legs (e.g., of a right triangle) equal to 1 millimeter. The ferrites **416** have a ferrite height **486** of 4.5 mm. Accordingly, each ferrite **416** is substantially bar-shaped. The ferrite peripheral end **478** of each of the ferrites **416** is spaced from the central axis **410** by about 70 millimeters at the extension axis **474**.

[0148] A circular area of the coil **402** (e.g., the area of the coil **402** parallel to the cooking surface **12** on one side of the coil **402**) can influence the magnetic field strength and distribution generated by the coil **402**. Further, the percentage of the circular area, or footprint, of the coil **402** covered by (or not covered by) the ferrite layer **408** can influence the distribution and flux of the magnetic field. Accordingly, the ferrite layer **408** may be sized, in terms of target area, volume, or the like, to provide enhanced magnetic field guidance. For example, the circular area of the coil **402** may be between 15,000 and 25,000 square millimeters. In the present example, the circular area of the coil **402** is about 17,700 square millimeters, and the target area (e.g., footprint area) of the ferrite layer **408** may be about 6,600 square millimeters. The target area of the ferrite layer **408** may be between 5,000 square millimeters and 8,000 square millimeters. Accordingly, the ferrite layer **408** may cover between 30% and 40% of the circular area of the coil **402**. In this way, the magnetic fields may be focused directly to the cookware **14**.

[0149] The distribution of the ferrite layer **408** enhances magnetic flux of the magnetic field by providing multiple sources relatively evenly distributed about the central axis **410**. The enhanced magnetic properties provided by the ferrite layer **408**, coupled with the ferrite layer width **473**, provide for slim yet efficient functionality of the induction coil assembly **400**.

[0150] Referring now to FIGS. **45** and **46**, the coil **402** has a cross-sectional width of 149 millimeters measured between a left-most part **488** to right-most part **490** of the coil **402**. The stack **400** has an assembly height **424** of 7.62 millimeters, which is comprised of each plate height **446** (0.5 millimeters×2), the coil height **472** of 1.87 millimeters, and the ferrite height **486** of 4.5 millimeters. It is contemplated that stack **400** may maintain room for minor expansion or retraction (e.g., tolerance) of the components of the stack **400** that amount to about 0.26 millimeters. The top surface **422** of the stack **400** can be spaced from the cooking surface **12** by between 2.5 millimeters and 7 millimeters.

[0151] While specific parameters of the fourth induction coil assembly **400** are shown and described, it is contemplated that these parameters may differ without deviating from the aspects of the fourth induction coil assembly **400**. For example, ratios, percentages, or proportions may differ. For example, the various dimensional values and/or electrical values may be in the range of +/−10-20% of the listed value.

[0152] In general, the short stack height **424** of the fourth induction coil assembly **400** provides for enhanced space saving within the induction cooktop **10**. By incorporating the full-bridge circuit in combination with a higher-resistance coil **402** and distribution of ferrites of the ferrite layer **408**, a lower-cost dynamic solution may be provided.

[0153] Referring now to FIGS. **47-57**, a fourth induction coil assembly **500** is configured for operation with the heating circuit **32** of the present cooktop **10**. The fourth induction coil assembly **500** may have a rectangular shape, with corner of the rectangles being arcuate to accommodate curvature of windings and the other components (e.g., the ferrites).

[0154] Referring more particularly to FIG. **47**, the induction coil assembly **500** includes a coil **502**, a pair of thermally resistant layers **504**, **506**, and a ferrite layer **508** each disposed on a central axis **510**. The coil includes an upper side **512** and a lower side **514**. The pair of thermally resistant layers **504**, **506** engage the lower side **514** and the upper side **512**, respectively. For example, the pair of thermally resistant layers **504**, **506** can include a first layer **504** that engages the lower side **514** of the coil and a second layer **506** that engages the upper side **512** of the coil **502**. In this way, the pair of thermally resistant layers **504**, **506** sandwich, or pancake, the coil **502**. The ferrite layer **508** is disposed under the first thermally resistant layer **504** and includes a plurality of ferrites **516**, **518***a*, **518***b*. The coil **502**, the pair of thermally resistant layers **504**, **506**, and the ferrite layer **508** are stacked together to form the induction coil assembly **500**, with the ferrite layer **508** defining a bottom surface **520** of the stack **500** and the second thermally resistant layer **506** forming a top surface **522** of the stack **500**. An assembly height **524** is defined between the bottom surface **520** and the top surface **522** measured in a direction orthogonal to the cooking surface **12**, the top surface **522**, and/or the bottom surface **520**.

[0155] Referring now to FIG. **48-50**, the pair of thermally resistant layers **504**, **506** will be described in reference to the second thermally resistant layer **506**, as the first thermally resistant layer **504** is substantially structurally similar to the first thermally resistant layer **504**. Each of the pair of thermally resistant layers **504**, **506** has a first plate width **526***a* of 210 millimeters and a second plate width **526***b* of 180 millimeters. As demonstrated, the pair of thermally resistant layers **504**, **506** can define a stack width of the assembly, as the pair of thermally resistant layers **504**, **506** can overhang the coil **502** and form the outermost points of the stack **500**. Stated differently, the widest part of the stack **500** may be the pair of thermally resistant layers **504**, **506**.

[0156] Referring now to FIGS. **49** and **50**, the second layer **506**, which may be structurally similar or identical to the first layer **504**, defines a central slot **530** aligned with the central axis **510**. The central slot **530** is configured to receive a temperature sensor and may have a stadium shape having radii of curvature of 5.35 millimeters and having a straight length of 5 millimeters. Each of the pair of thermally resistant layers **504**, **506** may define one or more peripheral slots **534** spaced radially outwardly from the central slot **530**.

[0157] The second layer **506** further defines a passthrough hole **536** disposed adjacent to the central slot **530**. The passthrough hole **536** is configured to receive a portion of the coil **502**, such that when the stack **500** is assembled, two coil ends **538**, **540** of the coil **502** (FIG. **51**) may be accessed along an edge **542** of the stack **500**. For example, the passthrough hole **536** can have a hole diameter **544** of 8 millimeters, which may be large enough to allow wire **548** of the coil **502** to pass through the second layer **506**.

[0158] One or more of the thermally resistant layers **504**, **506** has a plate height **546** of 0.5 millimeters. It is contemplated that the thermally resistant layers **504**, **506** may be comprised of mica, such as mica sheeting. In some examples, the thermally resistant layers **504**, **506** are made from muscovite or phlogopite mica. The thermally resistant layers **504**, **506** may also be electrically insulative to limit current from arcing between adjacent turns of the coil **502**. The thermally resistant layers **504**, **506** may comprise magnesium, potassium, aluminum, and/or silica. The thermally resistant layers **504**, **506** may include magnesium, aluminum, and silica. The thermally resistant layers **504**, **506** may also, or alternatively, provide for mechanical stability to support the turns of the induction coil **502** to maintain the shape of the coil **502** and limit deformation. It is contemplated that the second layer **506** may be omitted in some examples, such that the top surface **522** of the stack **500** may be formed by the upper side **512** of the coil **502**.

[0159] Referring now to FIGS. **51-52**, the coil **502** includes wire **548** that forms an outer portion **550** and an inner portion **552** spaced from the outer portion **550**. The wire **548** may be formed of Litz wire having individually insulated strands. The strands may be twisted or braided together forming windings, or turns, of the coil **502**. In general, the wire **548** may provide for limited skin effect and proximity effect at high frequencies (e.g., the working frequency). For example, due to the skin effect, the flow of electric current tends to concentrate near the surface of a conductor. Litz wire may counteract this effect by providing the multiple insulated strands to distribute the current more evenly across a wire cross-sectional area.

[0160] The coil **502** includes a first coil end **538** and a second coil end **540**. The first coil end **538** is disposed further from the central axis **510** than the second coil end **540** is from the central axis **510**. The first coil end **538** may be coupled with the heating circuit **32** via connection between the pair of thermally resistant layers **504**, **506** along the edge **542** of the stack **500**, and the second coil end **540** may be coupled with the heating circuit **32** via access through the passthrough hole **536**. For example, the wire **548** may pass through the passthrough hole **536** and extend radially outwardly toward the edge **542** of the stack **500** along the bottom side of the stack **500**.

[0161] The portions of the coil **502** are connected with one another via an interconnecting portion **558** of the coil **502** that span a coil gap **560**. For example, the interconnecting portion **558** spans the coil gap **502** to connect the outer portion **550** and the inner portion **552** together. It is contemplated that, while the coil ends **538**, **540** and the interconnecting portion **558** may be substantially aligned along a common ray (e.g., to the left) of the coil **502**, but in some examples, the interconnecting portion **558** is circumferentially spaced, or offset, from one or both of the coil ends **538**, **540**.

[0162] With continued reference to FIGS. **51** and **52**, the coil **502** defines a first coil width **564***a* of about 200 millimeters measured in side-to-side direction and a second coil width **564***b* of about 170 millimeters measured in a front-to-back direction. The wire **548** has a wire width of 2.4 mm. The pair of thermally resistant layers **504**, **506** may overhang, or extend, past the coil **502** by about 5 millimeters, depending on the frontward/sideward position along the edge **542**.

[0163] The wire **548** may have a substantially square-shaped cross-section similar to the other examples described herein. The wire **548** can have a wire height **572** equivalent to the coil height of 2.36 millimeters. The outer portion **550** has 12 windings. The inner portion **552** has 11 windings. The coil **502** has an inductance of 55 microhenries and a resistance of 8 ohms. The coil gap **560** has varying depths **571***a*, **571***b*. For example, the gap **560** can have a lateral depth **571** measured laterally between the outer portion **550** and the inner portion **552** along right and left sides of the gap **560** of 18.8 millimeters. The gap **560** can have a medial depth **571***b* measured medially between the outer portion **550** and the inner portion **552** along front and back sides of the gap **560** of 10.3 millimeters.

[0164] Referring now to FIGS. **53-55**, the ferrite layer **508** includes ferrite material that may be a ceramic material with magnetic properties to direct the magnetic field generated by the coil **502**. The ferrite layer **508** includes ceramic compounds that may include iron oxide combined with other metal oxides, such as zinc, nickel, and/or manganese to provide high magnetic permeability and low electrical conductivity. For example, the ferrite layer **508** includes a plurality of ferrites **516**, **518***a*, **518***b* distributed in the ferrite layer **508** for shaping and focusing the magnetic fields produced by the coil **502**, as well as the magnetic flux of the magnetic fields.

[0165] The ferrites **516**, **518***a*, **518***b* may be distributed evenly or unevenly. For example, the inner ferrites **516** may form an oblong shape or pill-shape forming rounded corners that lay under the inner portion **552**. The each pair of adjacent inner ferrites **516** are spaced from one another by a first span **574***a* measured in a direction parallel to the first width **564***a* and by a second span **574***b* measured in a direction parallel to the second width **564***b*. The first span **574***a* may be 15 millimeters. The second span **574***b* may be 15 millimeters.

[0166] The outer ferrites **518***a*, **518***b* include intermediate ferrites **518***a* distributed along the sides, front, and rear of the ferrite layer **508**, and corner ferrites **518***b* disposed at the corners of the ferrite layer **508**. The intermediate ferrites **518***a* are spaced along the front and rear from adjacent ferrites **518***a*, **518***b* by a third span **574***c* of about 22 millimeters and are spaced along the sides from adjacent ferrites **518***a*, **518***b* by a fourth span **574***d* of about 15 millimeters.

[0167] Each of the intermediate ferrites **518***a* has a ferrite width **580** of 20 millimeters and a ferrite length **582** of 30 millimeters. Further, each of the inner ferrites **516** and the outer ferrites **518***a*, **518***b* has 4 filleted vertices **584** each having legs (e.g., of a right triangle) equal to 1 millimeter.

[0168] A footprint of the coil **502** (e.g., the area of the coil **502** parallel to the cooking surface **12** on one side of the coil **502**) can influence the magnetic field strength and distribution generated by the coil **502**. Further, the percentage of the area, or footprint, of the coil **502** covered by (or not covered by) the ferrite layer **508** can influence the distribution and flux of the magnetic field. Accordingly, the ferrite layer **508** may be sized, in terms of target area, volume, or the like, to provide enhanced magnetic field guidance. For example, the footprint of the coil **502** may have two target areas corresponding to footprints of the outer portion **550** and the inner portion **552** which overlay the outer ferrites **518***a*, **51***b* and the inner ferrites **516** accordingly. In this way, the ferrite layer **508** can be geometrically aligned with the portions **550**, **552** in terms of footprint.

[0169] The distribution of the ferrite layer **508** enhances magnetic flux of the magnetic field by providing multiple sources relatively evenly distributed about the central axis **510**. The enhanced magnetic properties provided by the ferrite layer **508**, coupled with the ferrite layer widths **573***a*, **573***b*, provide for slim yet efficient functionality of the induction coil assembly **500**.

[0170] Referring now to FIGS. **56** and **57**, the stack **500** has an assembly height **524** of 8.11 millimeters, which is comprised of each plate height **546** (0.5 millimeters×2), the coil height **570** of 2.36 millimeters, and the ferrite height **586** of 4.5 millimeters. It is contemplated that stack **500** may maintain room for minor expansion or retraction (e.g., tolerance) of the components of the stack **500** that amount to about 0.25 millimeters. The top surface **522** of the stack **500** can be spaced from the cooking surface **12** by between 2.5 millimeters and 7 millimeters.

[0171] While specific parameters of the fourth induction coil assembly **500** are shown and described, it is contemplated that these parameters may differ without deviating from the aspects of the fourth induction coil assembly **500**. For example, ratios, percentages, or proportions may differ. For example, the spacings between the outer portion **550** and the inner portion **552**, as well as a ratio to the number of windings, may be similar in a fifth induction coil assembly **500** that is bigger or smaller than the example shown and described. For example, the various dimensional values and/or electrical values may be in the range of +/−10-20% of the listed value.

[0172] In general, the short stack height **524** of the fourth induction coil assembly **500** provides for enhanced space saving within the induction cooktop **10**. By incorporating the full-bridge circuit in combination with a higher-resistance coil **502** and distribution of ferrites of the ferrite layer **508**, a lower-cost dynamic solution may be provided.

[0173] Referring generally to FIG. **58**, a table demonstrating a breakdown of approximate parameters for each of the induction coil assemblies **100**, **200**, **300**, **400**, **500** described herein is demonstrated. It is contemplated that these parameters are approximate. For example, there may be standard variance in the dimensions/parameters, such as the spacing between portions, which may vary as the induction heater coil **10** turns in on itself. Further, minor tolerances (e.g., +/−10%) may be summarized in the table shown.

[0174] In general, the induction coil assemblies **100**, **200**, **300**, **400**, **500** constructed according to the aspects described above provide for a light-weight, thermally-efficient, and slim solution for enhanced operation at high voltage (e.g., via full-bridge inverter **44**). For example, the induction heater coil **10** of the induction coil assemblies **100**, **200**, **300**, **400**, **500** can have a weight of less than 300 grams and a height previously described. By working at high voltage, the circulating current is lower and it is therefore possible to use a wire with a small section, therefore less copper and therefore lower costs.

[0175] The invention disclosed herein is further summarized in the following paragraphs and is further characterized by combinations of any and all of the various aspects described therein.

[0176] According to one aspect of the present disclosure, an induction cooktop includes a cooking surface operable to support cookware and a resonant circuit having a resonant frequency in the range of 40 kHz to 60 kHz. The resonant circuit includes a capacitor having capacitance of between 0.1 micro-Farads and 0.6 micro-Farads and a coil disposed under the cooking surface and configured to operate at a working frequency of between 50 kHz and 150 kHz. The induction cooktop includes an induction control circuit configured to power the resonant circuit at the working frequency.

[0177] According to one aspect, the induction control circuit includes a full-bridge inverter that controls current through the coil.

[0178] According to one aspect, the resonant circuit is configured to have an equivalent alternating-current (AC) resistance of between 8 ohms and 15 ohms at the working frequency when cookware overlays the coil and includes a bottom made of AISI 430.

[0179] According to one aspect, the inductance of the coil is between 45 micro-Henries and 60 micro-Henries when the equivalent resistance is between 8 and 15 ohms at the working frequency.

[0180] According to one aspect, the coil includes wire forming a plurality of windings and having a height in a direction orthogonal to the cooking surface of between 1.5 millimeters and 2.5 millimeters.

[0181] According to one aspect, the wire has a width in a direction parallel to the cooking surface of between 1.5 millimeters and 3 millimeters.

[0182] According to one aspect, a cross-sectional area of the wire is between 1.8 square millimeters and 3.0 square millimeters.

[0183] According to one aspect, a total weight of the coil is less than 300 grams.

[0184] According to one aspect, the coil is spaced below the cooking surface by at most 7 millimeters.

[0185] According to one aspect, the coil is part of an induction coil assembly that includes a ferrite layer spaced from and below the coil, wherein the ferrite layer includes a plurality of ferrites having a height in a direction orthogonal to the cooking surface of between 3 millimeters and 5 millimeters.

[0186] According to one aspect, the induction coil assembly has a stack height in a direction orthogonal to the cooking surface between a bottom surface of the induction coil assembly and a top surface of the of the induction coil assembly between 7 millimeters and 10 millimeters.

[0187] According to another aspect of the present disclosure, an induction coil assembly for an induction cooktop includes a cooking surface operable to support cookware and a resonant circuit having a resonant frequency in the range of 40 kHz to 60 kHz. The resonant circuit includes a capacitor having capacitance of between 0.1 uF and 0.6 uF and a coil disposed under the cooking surface and configured to operate at a working frequency of between 50 kHz and 150 kHz. An induction control circuit is configured to power the resonant circuit at the working frequency via a full-bridge inverter.

[0188] According to one aspect, the resonant circuit is configured to have an equivalent alternating-current (AC) resistance of between 8 ohms and 15 ohms at the working frequency when cookware overlays the coil and includes a bottom made of AISI 430.

[0189] According to one aspect, the inductance of the coil is between 45 micro-Henries and 60 micro-Henries when the equivalent resistance is between 8 and 15 ohms at the working frequency.

[0190] According to one aspect, the coil includes wire forming a plurality of windings and having a cross-sectional area between 1.8 square millimeters and 3.0 square millimeters.

[0191] According to one aspect, the coil is spaced below the cooking surface by at most 7 millimeters.

[0192] According to one aspect, the coil is part of an induction coil assembly that includes a ferrite layer spaced from and below the coil, wherein the ferrite layer includes a plurality of ferrites having a height in a direction orthogonal to the cooking surface of between 3 millimeters and 5 millimeters.

[0193] According to one aspect, the induction coil assembly has a stack height in a direction orthogonal to the cooking surface between a bottom surface of the induction coil assembly and a top surface of the of the induction coil assembly between 7 millimeters and 10 millimeters.

[0194] According to yet another aspect of the present disclosure, an induction cooktop includes a cooking surface operable to support cookware and a resonant circuit having a resonant frequency in the range of 40 kHz to 60 kHz. The resonant circuit includes a capacitor having capacitance of between 0.1 micro-Farads and 0.6 micro-Farads and a coil disposed under the cooking surface and configured to operate at a working frequency of between 50 kHz and 150 kHz. The resonant circuit is configured to have an equivalent alternating-current (AC) resistance of between 8 ohms and 15 ohms at the working frequency when cookware overlays the coil and includes a bottom made of AISI 430. An induction control circuit is configured to power the resonant circuit at the working frequency via a full-bridge inverter.

[0195] According to one aspect, the inductance of the coil is between 45 micro-Henries and 60 micro-Henries when the equivalent resistance is between 8 and 15 ohms at the working frequency.

[0196] According to one aspect, an induction coil assembly for a cooktop includes a coil disposed on a central axis and including wire forming an outer coil portion, and inner coil portion spaced from the outer coil portion, and an intermediate coil portion spaced from and between the outer coil and the inner coil, a first thermally resistant layer disposed under the coil and supporting the coil, the first thermally resistant layer extending radially outwardly beyond the outer coil portion, and a ferrite layer disposed under the first thermally resistant layer and including a plurality of first ferrites and a plurality of second ferrites each distributed about the central axis, wherein the first ferrites have a first length of double a second length of the second ferrites and a common width to a width of the second ferrites, and wherein one second ferrite interposes each of a pair of adjacent first ferrites.

[0197] According to one aspect, a radial spacing between the outer coil portion and the intermediate coil portion is substantially equal to a radial spacing between the inner coil portion and the intermediate coil portion.

[0198] According to one aspect, each of the coil portions includes between 7 and 9 windings.

[0199] According to one aspect, the induction coil assembly includes a second thermally resistant layer overlaying the coil and disposed between the coil and a glass layer of the cooktop.

[0200] According to one aspect, the induction coil assembly is configured to engage an underside of an insulative layer that supports cookware for the cooktop, wherein the induction coil assembly has a height orthogonal to the insulative layer of between 7 millimeters and 10 millimeters.

[0201] According to one aspect, the height is less than 9 millimeters.

[0202] According to one aspect, the wire has a cross-sectional area of between 5 square millimeters and 6 square millimeters.

[0203] According to one aspect, the wire has a wire width orthogonal to the central axis of between 2 millimeters and 3 millimeters.

[0204] According to one aspect, the wire has a wire height parallel to the central axis of between 2 millimeters and 3 millimeters.

[0205] According to one aspect, the ferrite layer includes 12 ferrite bars evenly distributed about the central axis with an angular spacing between each adjacent pair of ferrite bars of 30 degrees.

[0206] According to one aspect, the coil includes a bottom side having a coil footprint area and the ferrite bars have a target area facing the coil footprint area, wherein the target area is between 30% and 40% of the coil footprint area.

[0207] According to one aspect, an induction coil assembly for a cooktop includes a coil disposed on a central axis and including wire forming an outer coil portion, and inner coil portion spaced from the outer coil portion, and an intermediate coil portion spaced from and between the outer coil and the inner coil, a first thermally resistant layer disposed under the coil and supporting the coil, the first thermally resistant layer extending radially outwardly beyond the outer coil portion, and a ferrite layer disposed under the first thermally resistant layer and including a plurality of first ferrites and a plurality of second ferrites each distributed about the central axis, wherein the first ferrites have a first length of double a second length of the second ferrites and a common width to a width of the second ferrites, and wherein one second ferrite interposes each of a pair of adjacent first ferrites, wherein a radial spacing between the outer coil portion and the intermediate coil portion is substantially equal to a radial spacing between the inner coil portion and the intermediate coil portion.

[0208] According to one aspect, the wire has a cross-sectional area of between 5 square millimeters and 6 square millimeters.

[0209] According to one aspect, the wire has a wire width orthogonal to the central axis of between 2 millimeters and 3 millimeters.

[0210] According to one aspect, the wire has a wire height parallel to the central axis of between 2 millimeters and 3 millimeters.

[0211] According to one aspect, the ferrite layer includes 12 ferrite bars evenly distributed about the central axis with an angular spacing between each adjacent pair of ferrite bars of 30 degrees.

[0212] According to one aspect, the coil includes a bottom side having a coil footprint area and the ferrite bars have a target area facing the coil footprint area, wherein the target area is between 30% and 40% of the coil footprint area.

[0213] According to one aspect, an induction coil assembly for a cooktop includes a coil disposed on a central axis and including wire forming an outer coil portion, and inner coil portion spaced from the outer coil portion, and an intermediate coil portion spaced from and between the outer coil and the inner coil, a first thermally resistant layer disposed under the coil and supporting the coil, the first thermally resistant layer extending radially outwardly beyond the outer coil portion, and a ferrite layer disposed under the first thermally resistant layer and including a plurality of first ferrites and a plurality of second ferrites each distributed about the central axis, wherein the first ferrites have a first length of double a second length of the second ferrites and a common width to a width of the second ferrites, wherein one second ferrite interposes each of a pair of adjacent first ferrites, wherein a radial spacing between the outer coil portion and the intermediate coil portion is substantially equal to a radial spacing between the inner coil portion and the intermediate coil portion, and wherein the induction coil assembly has a height parallel to the central axis of between 7 millimeters and 10 millimeters.

[0214] According to one aspect, the wire has a cross-sectional area of between 5 square and 6 square millimeters.

[0215] According to one aspect, the wire has a wire width orthogonal to the central axis of between 2 millimeters and 3 millimeters.

[0216] According to one aspect, an induction coil assembly for a cooktop includes a coil portion spaced from the outer coil portion by a gap, a first thermally resistant layer disposed under the coil and supporting the coil, the first thermally resistant layer extending radially outwardly beyond the outer coil portion, and a ferrite layer disposed under the first thermally resistant layer and including a plurality of first ferrites and a plurality of second ferrites each distributed about the central axis, wherein the second ferrites have a second length of 60% a first length of the first ferrites and a common width to a width of the first ferrites, and wherein one second ferrite interposes each of a pair of adjacent first ferrites.

[0217] According to one aspect, the gap is approximately 33% of a sum of a width of the outer coil portion and a width of the inner coil portion.

[0218] According to one aspect, the outer coil portion and the inner coil portion have a common number of windings.

[0219] According to one aspect, the outer coil portion and the inner coil portion each include 12 windings.

[0220] According to one aspect, a second thermally resistant layer overlays the coil and is disposed between the coil and a glass layer of the cooktop.

[0221] According to one aspect, the induction coil assembly is configured to engage an underside of an insulative layer that supports cookware for the cooktop, wherein the induction coil assembly has a height orthogonal to the insulative layer of between 7 millimeters and 10 millimeters.

[0222] According to one aspect, the height is less than 8 millimeters.

[0223] According to one aspect, the wire has a cross-sectional area of between 5 square millimeters and 6 square millimeters.

[0224] According to one aspect, the wire has a wire width orthogonal to the central axis of between 2 millimeters and 3 millimeters.

[0225] According to one aspect, the wire has a wire height parallel to the central axis of between 2 millimeters and 3 millimeters.

[0226] According to one aspect, the ferrite layer includes 12 ferrite bars evenly distributed about the central axis with an angular spacing between each adjacent pair of ferrite bars of 30 degrees.

[0227] According to one aspect, the coil includes a bottom side having a coil footprint area and the ferrite bars have a target area facing the coil footprint area, wherein the target area is between 35% and 45% of the coil footprint area.

[0228] According to one aspect, an induction coil assembly for a cooktop includes a coil disposed on a central axis and including wire forming an outer coil portion and an inner coil portion spaced from the outer coil portion by a gap approximately 33% of a sum of a width of the outer coil portion and a width of the inner coil portion, a first thermally resistant layer disposed under the coil and supporting the coil, the first thermally resistant layer extending radially outwardly beyond the outer coil portion, and a ferrite layer disposed under the first thermally resistant layer and including a plurality of first ferrites and a plurality of second ferrites each distributed about the central axis, wherein the second ferrites have a second length of 60% a first length of the first ferrites and a common width to a width of the first ferrites, and wherein one second ferrite interposes each of a pair of adjacent first ferrites.

[0229] According to one aspect, the wire has a cross-sectional area of between 5 square millimeters and 6 square millimeters.

[0230] According to one aspect, the wire has a wire width orthogonal to the central axis of between 2 millimeters and 3 millimeters.

[0231] According to one aspect, the wire has a wire height parallel to the central axis of between 2 millimeters and 3 millimeters.

[0232] According to one aspect, the ferrite layer includes 12 ferrite bars evenly distributed about the central axis with an angular spacing between each adjacent pair of ferrite bars of 30 degrees.

[0233] According to one aspect, the coil includes a bottom side having a coil footprint area and the ferrite bars have a target area facing the coil footprint area, wherein the target area is between 35% and 45% of the coil footprint area.

[0234] According to one aspect, an induction coil assembly for a cooktop includes a coil portion spaced from the outer coil portion by a gap approximately 33% of a sum of a width of the outer coil portion and a width of the inner coil portion, a first thermally resistant layer disposed under the coil and supporting the coil, the first thermally resistant layer extending radially outwardly beyond the outer coil portion, and a ferrite layer disposed under the first thermally resistant layer and including a plurality of first ferrites and a plurality of second ferrites each distributed about the central axis, wherein the second ferrites have a second length of 60% a first length of the first ferrites and a common width to a width of the first ferrites, and wherein one second ferrite interposes each of a pair of adjacent first ferrites, wherein the outer coil portion and the inner coil portion have a common number of windings.

[0235] According to one aspect, the outer coil portion and the inner coil portion each include 12 windings.

[0236] According to one aspect, an induction coil assembly for a cooktop includes a coil disposed on a central axis and including wire forming an outer coil portion and an inner coil portion spaced from the outer coil portion by a gap, a first thermally resistant layer disposed under the coil and supporting the coil, the first thermally resistant layer extending radially outwardly beyond the outer coil portion, and a ferrite layer disposed under the first thermally resistant layer and including a plurality of first ferrites and a plurality of second ferrites each distributed about the central axis, wherein the second ferrites have a second length of between 40% and 50% of a first length of the first ferrites and a common width to a width of the first ferrites, and wherein one second ferrite interposes each of a pair of adjacent first ferrites.

[0237] According to one aspect, the gap is approximately 33% of a sum of a width of the outer coil portion and a width of the inner coil portion.

[0238] According to one aspect, the inner coil portion has less windings than a number of windings of the outer coil portion.

[0239] According to one aspect, the outer coil portion includes 13 windings and the inner coil portion includes 11 windings.

[0240] According to one aspect, the induction coil assembly includes a second thermally resistant layer overlaying the coil and disposed between the coil and a glass layer of the cooktop.

[0241] According to one aspect, the induction coil assembly is configured to engage an underside of an insulative layer that supports cookware for the cooktop, wherein the induction coil assembly has a height orthogonal to the insulative layer of between 7 millimeters and 9 millimeters.

[0242] According to one aspect, the height is equal to 8 millimeters.

[0243] According to one aspect, wherein the wire has a cross-sectional area of less than 5 square millimeters.

[0244] According to one aspect, the wire has a wire width orthogonal to the central axis of between 2 millimeters and 3 millimeters.

[0245] According to one aspect, the wire has a wire height parallel to the central axis of between 2 millimeters and 3 millimeters.

[0246] According to one aspect, the ferrite layer includes 12 ferrite bars evenly distributed about the central axis with an angular spacing between each adjacent pair of ferrite bars of 30 degrees.

[0247] According to one aspect, the coil includes a bottom side having a coil footprint area and the ferrite bars have a target area facing the coil footprint area, wherein the target area about 50% of the coil footprint area.

[0248] According to one aspect, an induction coil assembly for a cooktop includes a coil disposed on a central axis and including wire forming an outer coil portion and an inner coil portion spaced from the outer coil portion by a gap approximately 33% of a sum of a width of the outer coil portion and a width of the inner coil portion, a first thermally resistant layer disposed under the coil and supporting the coil, the first thermally resistant layer extending radially outwardly beyond the outer coil portion, a ferrite layer disposed under the first thermally resistant layer and including a plurality of first ferrites and a plurality of second ferrites each distributed about the central axis, wherein the second ferrites have a second length of between 40% and 50% of a first length of the first ferrites and a common width to a width of the first ferrites, and wherein one second ferrite interposes each of a pair of adjacent first ferrites.

[0249] According to one aspect, the wire has a cross-sectional area of less than 5 square millimeters.

[0250] According to one aspect, the wire has a wire width orthogonal to the central axis of between 2 millimeters and 3 millimeters.

[0251] According to one aspect, the wire has a wire height parallel to the central axis of between 2 millimeters and 3 millimeters.

[0252] According to one aspect, the ferrite layer includes 12 ferrite bars evenly distributed about the central axis with an angular spacing between each adjacent pair of ferrite bars of 30 degrees.

[0253] According to one aspect, the coil includes a bottom side having a coil footprint area and the ferrite bars have a target area facing the coil footprint area, wherein the target area is about 50% of the coil footprint area.

[0254] According to one aspect, an induction coil assembly for a cooktop includes a coil disposed on a central axis and including wire forming an outer coil portion and an inner coil portion spaced from the outer coil portion by a gap approximately 33% of a sum of a width of the outer coil portion and a width of the inner coil portion, a first thermally resistant layer disposed under the coil and supporting the coil, the first thermally resistant layer extending radially outwardly beyond the outer coil portion, and a ferrite layer disposed under the first thermally resistant layer and including a plurality of first ferrites and a plurality of second ferrites each distributed about the central axis, wherein the second ferrites have a second length of between 40% and % 50 a first length of the first ferrites and a common width to a width of the first ferrites, and wherein one second ferrite interposes each of a pair of adjacent first ferrites, wherein the inner coil portion has less windings than a number of windings of the outer coil portion.

[0255] According to one aspect, the outer coil portion includes 13 windings and the inner coil portion includes 11 windings.

[0256] According to one aspect, an induction coil assembly for a cooktop includes a coil disposed on a central axis and including wire forming a plurality of windings; a first thermally resistant layer disposed under the coil and supporting the coil, the first thermally resistant layer extending radially outwardly beyond the outer coil portion; and a ferrite layer disposed under the first thermally resistant layer and including a plurality of ferrites distributed about the central axis, wherein a width of each ferrite is between 30% and 40% of a length of each ferrite.

[0257] According to one aspect, the plurality of windings form a single coil portion with abutting windings.

[0258] According to one aspect, the induction coil assembly includes a second thermally resistant layer overlaying the coil and disposed between the coil and a glass layer of the cooktop.

[0259] According to one aspect, the induction coil assembly is configured to engage an underside of an insulative layer that supports cookware for the cooktop, wherein the induction coil assembly has a height orthogonal to the insulative layer of between 7 millimeters and 9 millimeters.

[0260] According to one aspect, the height is less than 8 millimeters.

[0261] According to one aspect, the wire has a cross-sectional area of less than 4 square millimeters.

[0262] According to one aspect, the wire has a wire width orthogonal to the central axis of between 2 millimeters and 3 millimeters.

[0263] According to one aspect, the wire has a wire height parallel to the central axis of less than 2 millimeters.

[0264] According to one aspect, the ferrite layer includes 6 ferrite bars evenly distributed about the central axis with an angular spacing between each adjacent pair of ferrite bars of 60 degrees.

[0265] According to one aspect, the coil includes a bottom side having a coil footprint area and the ferrite bars have a target area facing the coil footprint area, wherein the target area is between 30% and 40% of the coil footprint area.

[0266] According to one aspect, an induction coil assembly for a cooktop includes a coil disposed on a central axis and including wire forming a plurality of windings forming a single coil portion with abutting windings; a first thermally resistant layer disposed under the coil and supporting the coil, the first thermally resistant layer extending radially outwardly beyond the outer coil portion; and a ferrite layer disposed under the first thermally resistant layer and including a plurality of first ferrites and a plurality of second ferrites each distributed about the central axis, wherein the second ferrites have a second length of between 40% and 50% of a first length of the first ferrites and a common width to a width of the first ferrites, and wherein one second ferrite interposes each of a pair of adjacent first ferrites.

[0267] According to one aspect, the wire has a cross-sectional area of less than 4 square millimeters.

[0268] According to one aspect, the wire has a wire width orthogonal to the central axis of between 2 millimeters and 3 millimeters.

[0269] According to one aspect, the wire has a wire height parallel to the central axis of less than 2 millimeters.

[0270] According to one aspect, the ferrite layer includes 6 ferrite bars evenly distributed about the central axis with an angular spacing between each adjacent pair of ferrite bars of 60 degrees.

[0271] According to one aspect, the coil includes a bottom side having a coil footprint area and the ferrite bars have a target area facing the coil footprint area, wherein the target area is between 30% and 40% of the coil footprint area.

[0272] According to one aspect, an induction coil assembly for a cooktop includes a coil disposed on a central axis and including wire forming a plurality of windings forming a single coil portion with abutting windings; a first thermally resistant layer disposed under the coil and supporting the coil, the first thermally resistant layer extending radially outwardly beyond the outer coil portion; and a ferrite layer disposed under the first thermally resistant layer and including a plurality of first ferrites and a plurality of second ferrites each distributed about the central axis, wherein the second ferrites have a second length of between 40% and 50% of a first length of the first ferrites and a common width to a width of the first ferrites, and wherein one second ferrite interposes each of a pair of adjacent first ferrites, wherein the coil includes no other coil portions other than the single coil portion.

[0273] According to one aspect, the coil includes 26 windings.

[0274] According to one aspect, an induction coil assembly for a cooktop includes a coil disposed on a central axis and including wire forming an outer coil portion and an inner coil portion spaced from the outer coil portion by a gap; a first thermally resistant layer disposed under the coil and supporting the coil, the first thermally resistant layer extending radially outwardly beyond the outer coil portion; and a ferrite layer disposed under the first thermally resistant layer and including a plurality of first ferrites and a plurality of second ferrites each distributed about the central axis, the gap has a first depth along sides of the coil and a second depth along a front and a rear of the coil, wherein the first depth is approximately half of the second depth.

[0275] According to one aspect, the coil is rectangular.

[0276] According to one aspect, the outer coil portion and the inner coil portion have approximately the same number of windings.

[0277] According to one aspect, the outer coil portion and the inner coil portion each include at least 11 windings.

[0278] According to one aspect, the induction coil assembly includes a second thermally resistant layer overlaying the coil and disposed between the coil and a glass layer of the cooktop.

[0279] According to one aspect, the induction coil assembly is configured to engage an underside of an insulative layer that supports cookware for the cooktop, wherein the induction coil assembly has a height orthogonal to the insulative layer of between 7 millimeters and 10 millimeters.

[0280] According to one aspect, the height is less than 9 millimeters.

[0281] According to one aspect, the wire has a wire height parallel to the central axis of between 2 millimeters and 3 millimeters.

[0282] According to one aspect, the ferrite layer includes outer ferrites and inner ferrites, wherein all of the inner ferrites are disposed closer to the central axis than the outer ferrites.

[0283] According to one aspect, the inner portion overlays the inner ferrites and the outer portion overlays the outer ferrites. According to one aspect, the outer ferrites include corner ferrites and intermediate ferrites interposing the corner ferrites.

[0284] According to one aspect, the intermediate ferrites are spaced from one another by between 10 millimeters and 20 millimeters.

[0285] According to one aspect, an induction coil assembly for a cooktop includes a coil disposed on a central axis and including wire forming an outer coil portion and an inner coil portion spaced from the outer coil portion by a gap, wherein the coil is rectangular; a first thermally resistant layer disposed under the coil and supporting the coil, the first thermally resistant layer extending radially outwardly beyond the outer coil portion; and a ferrite layer disposed under the first thermally resistant layer and including a plurality of first ferrites and a plurality of second ferrites each distributed about the central axis, the gap has a first depth along sides of the coil and a second depth along a front and a rear of the coil, wherein the first depth is approximately half of the second depth, wherein the ferrite layer includes outer ferrites and inner ferrites, wherein all of the inner ferrites are disposed closer to the central axis than the outer ferrites.

[0286] According to one aspect, the outer coil portion and the inner coil portion have approximately the same number of windings.

[0287] According to one aspect, the outer coil portion and the inner coil portion each include at least 11 windings.

[0288] According to one aspect, the induction coil assembly includes a second thermally resistant layer overlaying the coil and disposed between the coil and a glass layer of the cooktop.

[0289] According to one aspect, the inner portion overlays the inner ferrites and the outer portion overlays the outer ferrites.

[0290] According to one aspect, the outer ferrites include corner ferrites and intermediate ferrites interposing the corner ferrites.

[0291] According to one aspect, the intermediate ferrites are spaced from one another by between 10 millimeters and 20 millimeters.

[0292] According to one aspect, an induction coil assembly for a cooktop includes a coil portion spaced from the outer coil portion by a gap, wherein the coil is rectangular;

a first thermally resistant layer disposed under the coil and supporting the coil, the first thermally resistant layer extending radially outwardly beyond the outer coil portion; and a ferrite layer disposed under the first thermally resistant layer and including a plurality of first ferrites and a plurality of second ferrites each distributed about the central axis, the gap has a first depth along sides of the coil and a second depth along a front and a rear of the coil, wherein the first depth is approximately half of the second depth, wherein the ferrite layer includes outer ferrites and inner ferrites, wherein all of the inner ferrites are disposed closer to the central axis than the outer ferrites, wherein the inner portion overlays the inner ferrites and the outer portion overlays the outer ferrites.

[0293] It will be understood by one having ordinary skill in the art that construction of the described disclosure and other components is not limited to any specific material. Other exemplary embodiments of the disclosure disclosed herein may be formed from a wide variety of materials, unless described otherwise herein.

[0294] For purposes of this disclosure, the term "coupled" (in all of its forms, couple, coupling, coupled, etc.) generally means the joining of two components (electrical or mechanical) directly or indirectly to one another. Such joining may be stationary in nature or movable in nature. Such joining may be achieved with the two components (electrical or mechanical) and any additional intermediate members being integrally formed as a single unitary body with one another or with the two components. Such joining may be permanent in nature or may be removable or releasable in nature unless otherwise stated.

[0295] It is also important to note that the construction and arrangement of the elements of the disclosure as shown in the exemplary embodiments is illustrative only. Although only a few embodiments of the present innovations have been described in detail in this disclosure, those skilled in the art who review this disclosure will readily appreciate that many modifications are possible (e.g., variations in sizes, dimensions, structures, shapes and proportions of the various elements, values of parameters, mounting arrangements, use of materials, colors, orientations, etc.) without materially departing from the novel teachings and advantages of the subject matter recited. For example, elements shown as integrally formed may be constructed of multiple parts or elements shown as multiple parts may be integrally formed, the operation of the interfaces may be reversed or otherwise varied, the length or width of the structures and/or members or connector or other elements of the system may be varied, the nature or number of adjustment positions provided between the elements may be varied. It should be noted that the elements and/or assemblies of the system may be constructed from any of a wide variety of materials that provide sufficient strength or durability, in any of a wide variety of colors, textures, and combinations. Accordingly, all such modifications are intended to be included within the scope of the present innovations. Other substitutions, modifications, changes, and omissions may be made in the design, operating conditions, and arrangement of the desired and other exemplary embodiments without departing from the spirit of the present innovations.

[0296] It will be understood that any described processes or steps within described processes may be combined with other disclosed processes or steps to form structures within the scope of the present disclosure. The exemplary structures and processes disclosed herein are for illustrative purposes and are not to be construed as limiting.

What is claimed is:

1. An induction cooktop, comprising:

a cooking surface operable to support cookware;

a resonant circuit having a resonant frequency in the range of 40 kHz to 60 kHz and including:

a capacitor having capacitance of between 0.1 micro-Farads and 0.6 micro-Farads; and

a coil disposed under the cooking surface and configured to operate at a working frequency of between 50 kHz and 150 kHz; and

an induction control circuit configured to power the resonant circuit at the working frequency.

2. The induction cooktop of claim **1**, wherein the induction control circuit includes a full-bridge inverter that controls current through the coil.

3. The induction cooktop of claim **1**, wherein the resonant circuit is configured to have an equivalent alternating-current (AC) resistance of between 8 ohms and 15 ohms at the working frequency when cookware overlays the coil and includes a bottom made of AISI 430.

4. The induction cooktop of claim **3**, wherein the inductance of the coil is between 45 micro-Henries and 60 micro-Henries when the equivalent resistance is between 8 and 15 ohms at the working frequency.

5. The induction cooktop of claim **1**, wherein the coil includes wire forming a plurality of windings and having a height in a direction orthogonal to the cooking surface of between 1.5 millimeters and 2.5 millimeters.

6. The induction cooktop of claim **5**, wherein the wire has a width in a direction parallel to the cooking surface of between 1.5 millimeters and 3 millimeters.

7. The induction cooktop of claim **5**, wherein a cross-sectional area of the wire is between 1.8 square millimeters and 3.0 square millimeters.

8. The induction cooktop of claim **7**, wherein a total weight of the coil is less than 300 grams.

9. The induction cooktop of claim **1**, wherein the coil is spaced below the cooking surface by at most 7 millimeters.

10. The induction cooktop of claim **1**, wherein the coil is part of an induction coil assembly that includes a ferrite layer spaced from and below the coil, wherein the ferrite layer includes a plurality of ferrites having a height in a direction orthogonal to the cooking surface of between 3 millimeters and 5 millimeters.

11. The induction cooktop of claim **10**, wherein the induction coil assembly has a stack height in a direction orthogonal to the cooking surface between a bottom surface of the induction coil assembly and a top surface of the of the induction coil assembly between 7 millimeters and 10 millimeters.

12. An induction coil assembly for an induction cooktop, comprising:

a cooking surface operable to support cookware;

a resonant circuit having a resonant frequency in the range of 40 kHz to 60 kHz and including:

a capacitor having capacitance of between 0.1 uF and 0.6 uF; and

a coil disposed under the cooking surface and configured to operate at a working frequency of between 50 kHz and 150 kHz; and an induction control circuit configured to power the resonant circuit at the working frequency via a full-bridge inverter.

13. The induction cooktop of claim **12**, wherein the resonant circuit is configured to have an equivalent alternating-current (AC) resistance of between 8 ohms and 15 ohms at the working frequency when cookware overlays the coil and includes a bottom made of AISI 430.

14. The induction cooktop of claim **13**, wherein the inductance of the coil is between 45 micro-Henries- and 60 micro-Henries when the equivalent resistance is between 8 and 15 ohms at the working frequency.

15. The induction cooktop of claim **12**, wherein the coil includes wire forming a plurality of windings and having a cross-sectional area between 1.8 square millimeters and 3.0 square millimeters.

16. The induction cooktop of claim **12**, wherein the coil is spaced below the cooking surface by at most 7 millimeters.

17. The induction cooktop of claim **12**, wherein the coil is part of an induction coil assembly that includes a ferrite layer spaced from and below the coil, wherein the ferrite layer includes a plurality of ferrites having a height in a direction orthogonal to the cooking surface of between 3 millimeters and 5 millimeters.

18. The induction cooktop of claim **17**, wherein the induction coil assembly has a stack height in a direction orthogonal to the cooking surface between a bottom surface of the induction coil assembly and a top surface of the of the induction coil assembly between 7 millimeters and 10 millimeters.

19. An induction cooktop, comprising:

a cooking surface operable to support cookware;

a resonant circuit having a resonant frequency in the range of 40 kHz to 60 kHz and including:

a capacitor having capacitance of between 0.1 micro-Farads and 0.6 micro-Farads; and

a coil disposed under the cooking surface and configured to operate at a working frequency of between 50 kHz and 150 kHz, wherein the resonant circuit is configured to have an equivalent alternating-current (AC) resistance of between 8 ohms and 15 ohms at the working frequency when cookware overlays the coil and includes a bottom made of AISI 430; and

an induction control circuit configured to power the resonant circuit at the working frequency via a full-bridge inverter.

20. The induction cooktop of claim **19**, wherein the inductance of the coil is between 45 micro-Henries and 60 micro-Henries when the equivalent resistance is between 8 and 15 ohms at the working frequency.

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