US011910954B2

(12) **United States Patent**
Graham

(10) **Patent No.: US 11,910,954 B2**
(45) **Date of Patent: Feb. 27, 2024**

(54) **COVER OR LID COUNTERBALANCE ASSEMBLY**

(71) Applicant: **Weber Knapp Company**, Jamestown, NY (US)

(72) Inventor: **Daniel Mark Graham**, Ashville, NY (US)

(73) Assignee: **Weber Knapp Company**, Jamestown, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 497 days.

(21) Appl. No.: **17/231,096**

(22) Filed: **Apr. 15, 2021**

(65) **Prior Publication Data**

US 2022/0330747 A1 Oct. 20, 2022

(51) **Int. Cl.**
A47J 36/12 (2006.01)
A47J 37/07 (2006.01)
E05F 1/10 (2006.01)

(52) **U.S. Cl.**
CPC ***A47J 36/12*** (2013.01); ***E05F 1/1075*** (2013.01); *E05Y 2201/416* (2013.01)

(58) **Field of Classification Search**
CPC A47J 36/12; A47J 37/0786; E05F 1/1075; E05Y 2201/416
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,310,647	A *	7/1919	Casper	E05C 17/32 217/60 E
2,626,420	A *	1/1953	Mongin	E05F 5/027 16/80
6,581,587	B1 *	6/2003	Helms	A47J 37/0704 126/41 R
6,789,537	B1 *	9/2004	Lutz	A47J 36/12 126/41 R
7,677,540	B1 *	3/2010	Duval	F16M 11/046 267/221
10,822,851	B2	11/2020	Graham et al.	
2005/0081721	A1 *	4/2005	Craycraft	A47J 37/0718 99/450
2018/0044960	A1 *	2/2018	Saylor	E05F 1/1075
2019/0229511	A1 *	7/2019	Byrne	F21V 23/06
2020/0232264	A1 *	7/2020	Saylor	E05F 1/1075
2022/0098913	A1 *	3/2022	Saylor	A47L 15/4261

FOREIGN PATENT DOCUMENTS

CN	201589306	U *	9/2010	
CN	201764564	U *	3/2011	
CN	203797752	U *	8/2014	
DE	10134592	A1 *	1/2003	E05F 1/1075
GB	654766	A *	6/1951	

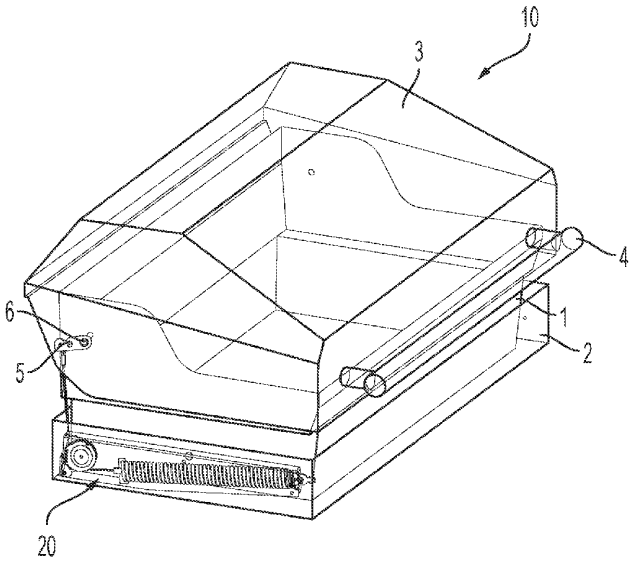
* cited by examiner

Primary Examiner — Jorge A Pereiro
Assistant Examiner — Logan P Jones
(74) *Attorney, Agent, or Firm* — Simpson & Simpson, PLLC

(57) **ABSTRACT**

A lid counterbalance assembly for a grill, the grill including a lid and a base, the lid counterbalance assembly including a pulley assembly including at least one pulley, the pulley assembly rotatably connected to the base, a spring connected to the pulley assembly via a first line, and a second line including a first end connected to the pulley assembly and a second end connected to the lid, wherein the second end is rotatable and translatable with respect to the lid.

15 Claims, 12 Drawing Sheets



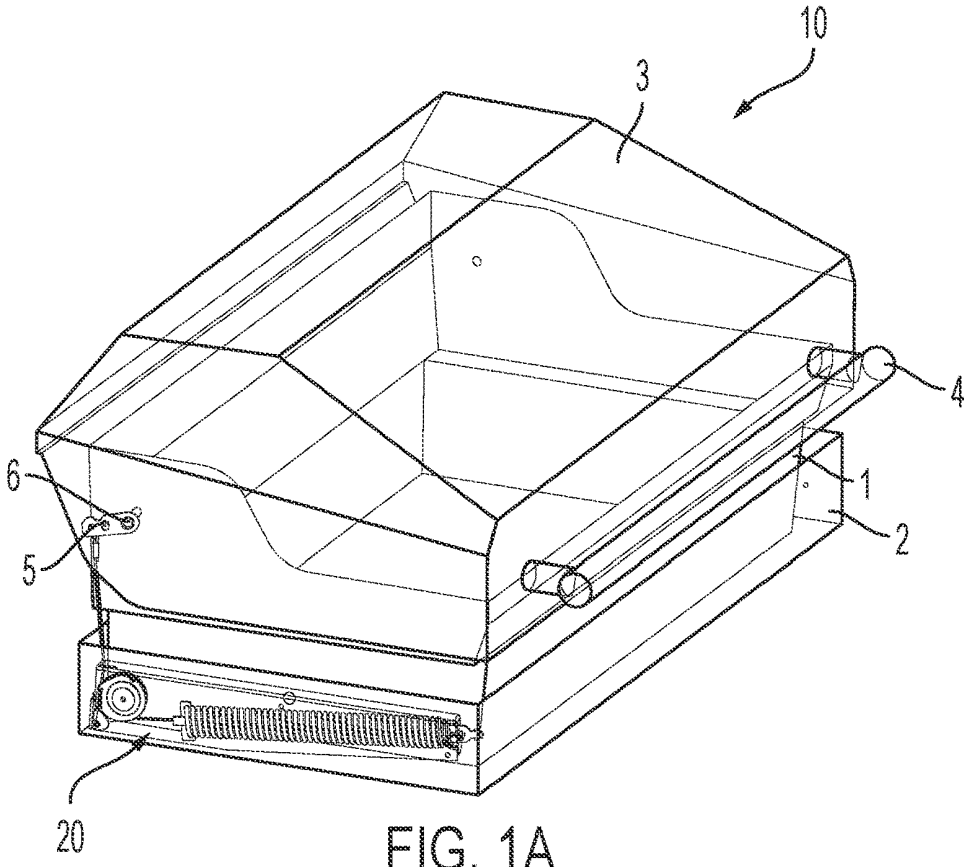


FIG. 1A

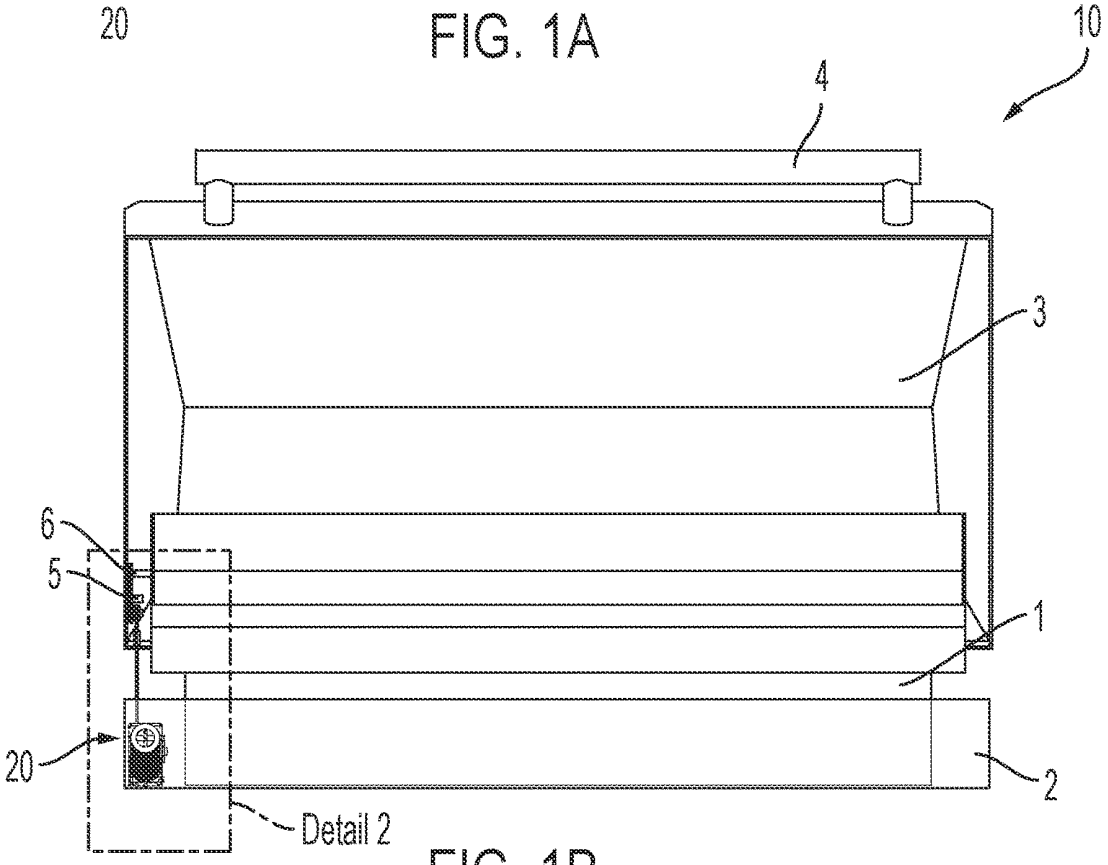


FIG. 1B

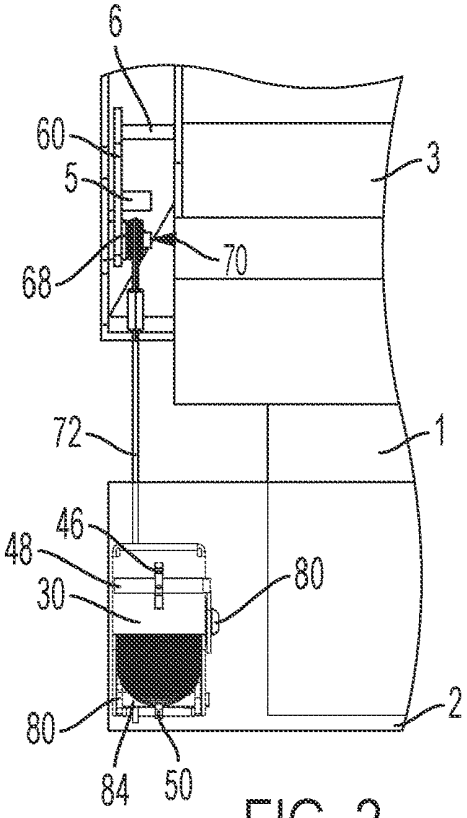

6
60
5
3
70
68
72
1
46
48
30
80
80
2
84
50

FIG. 2

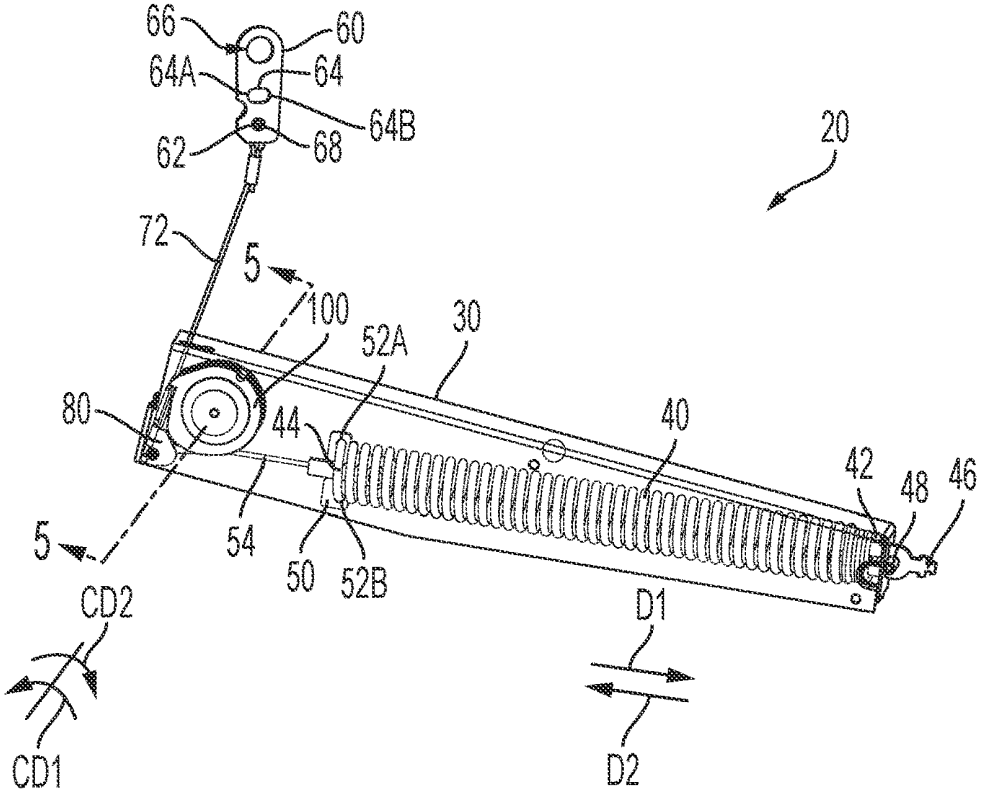

66
60
64A
64
64B
62
68
20
72
5
100
52A
30
80
44
40
42
48
46
5
54
50
52B
CD2
D1
CD1
D2

FIG. 3

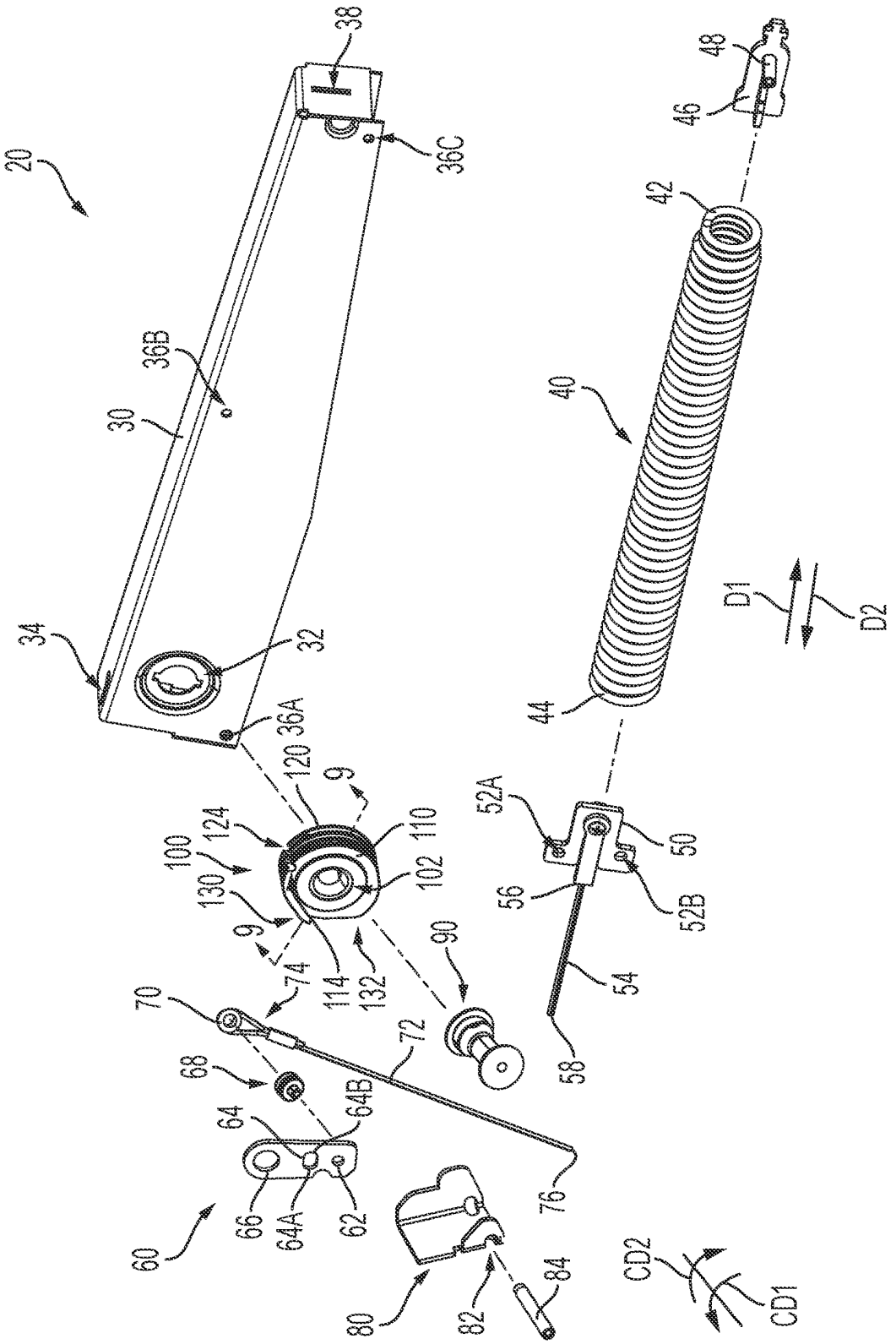

20
38
36C
36B
30
34
32
36A
120
9
124
100
130
110
102
74
114
132
90
70
72
68
64
64B
66
64A
62
60
76
80
82
84
CD2
CD1
48
46
42
40
44
D1
D2
52A
50
56
52B
54
58

FIG. 4

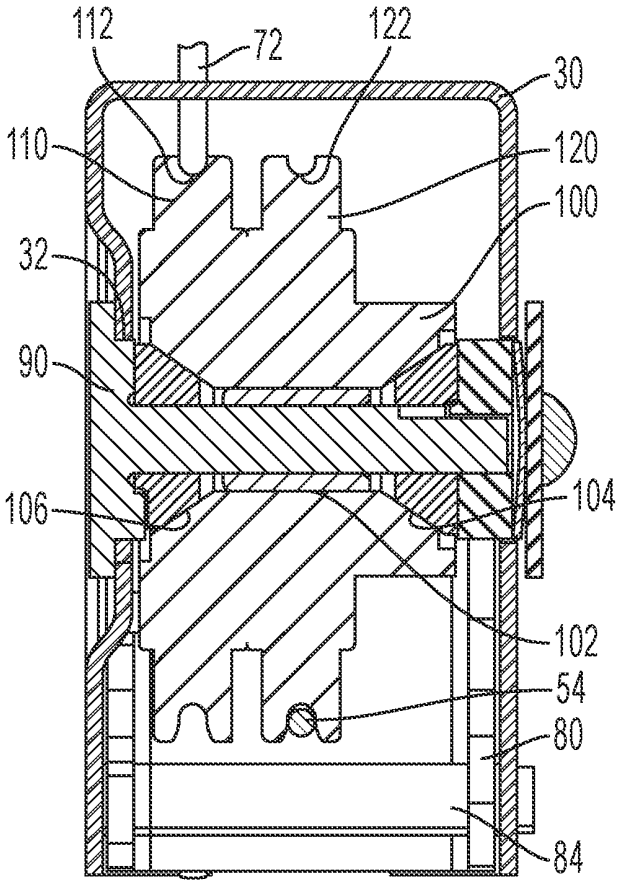

112
72
122
30
110
120
100
32
90
106
104
102
54
80
84

FIG. 5

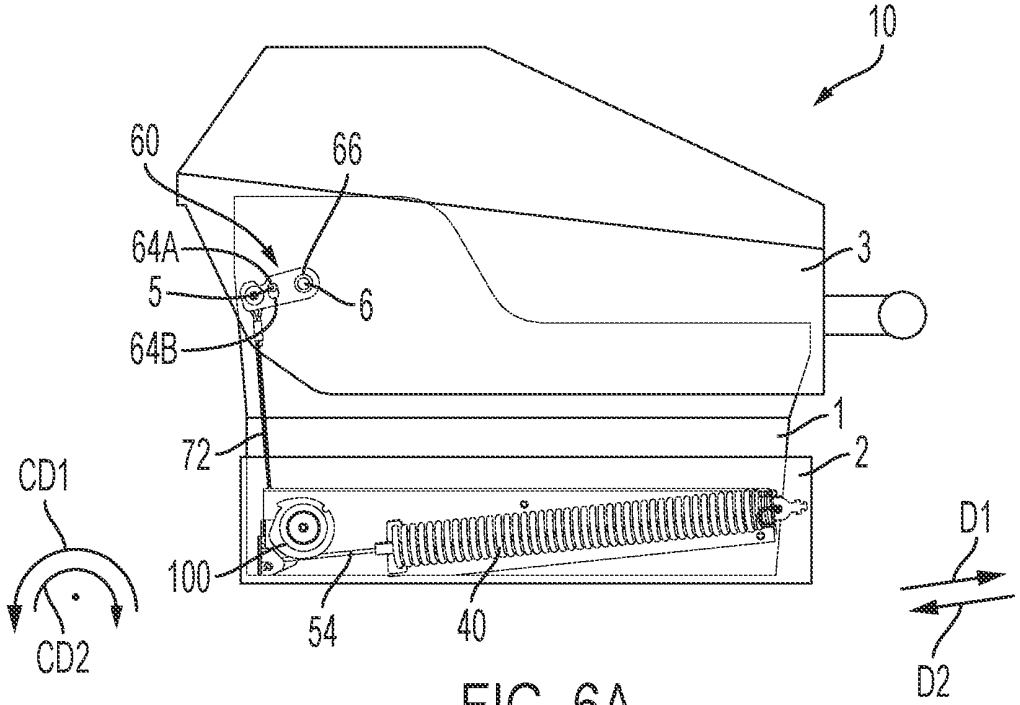

10
60
66
64A
5
6
64B
3
1
2
72
CD1
CD2
100
54
40
D1
D2

FIG. 6A

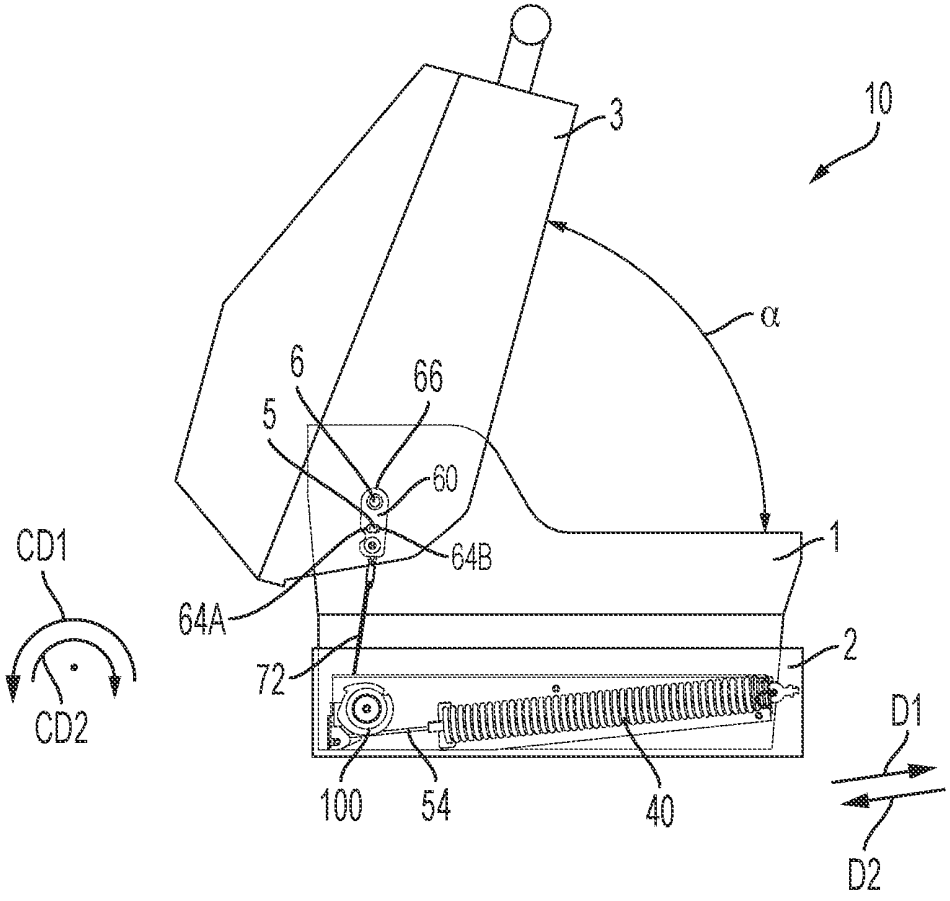


FIG. 6B

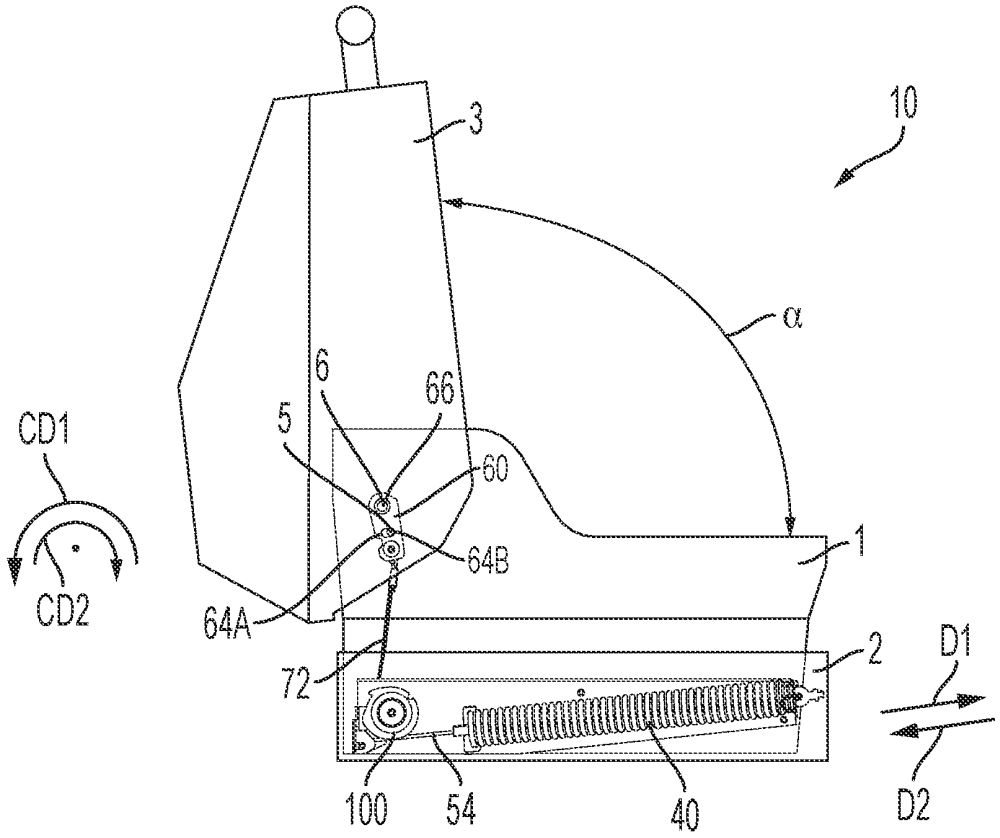


FIG. 6C

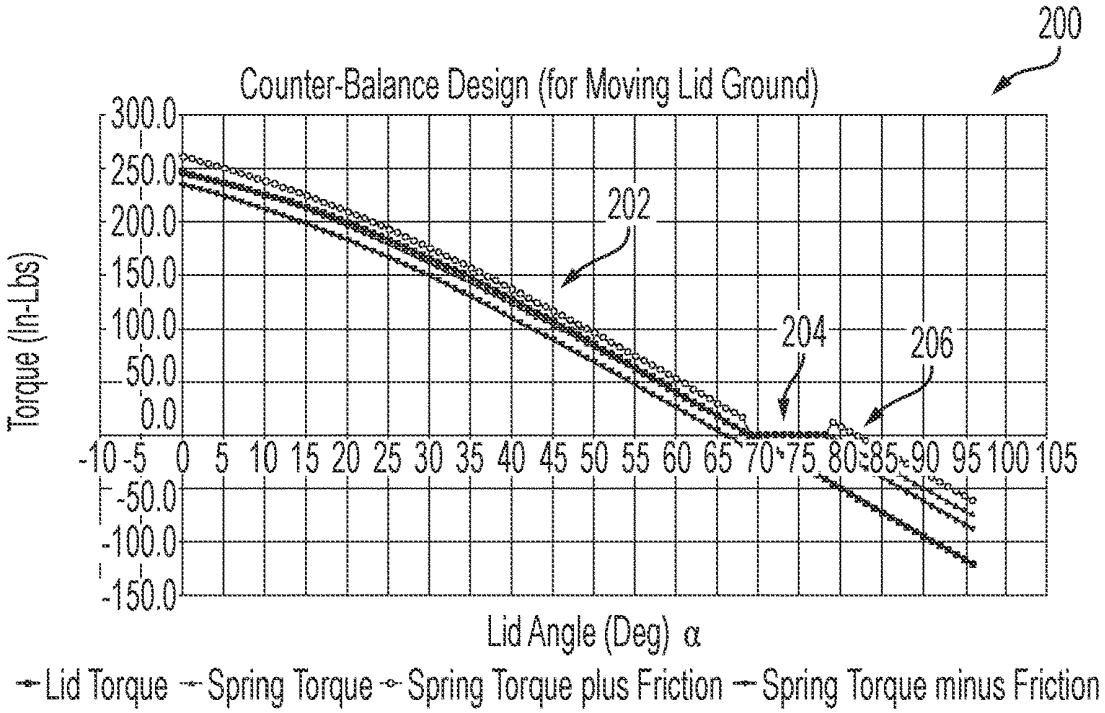

200
Counter-Balance Design (for Moving Lid Ground)
Torque (In-Lbs)
300.0
250.0
200.0
150.0
100.0
50.0
0.0
-50.0
-100.0
-150.0
-10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105
202
204
206
Lid Angle (Deg) α
Lid Torque
Spring Torque
Spring Torque plus Friction
Spring Torque minus Friction

FIG. 7

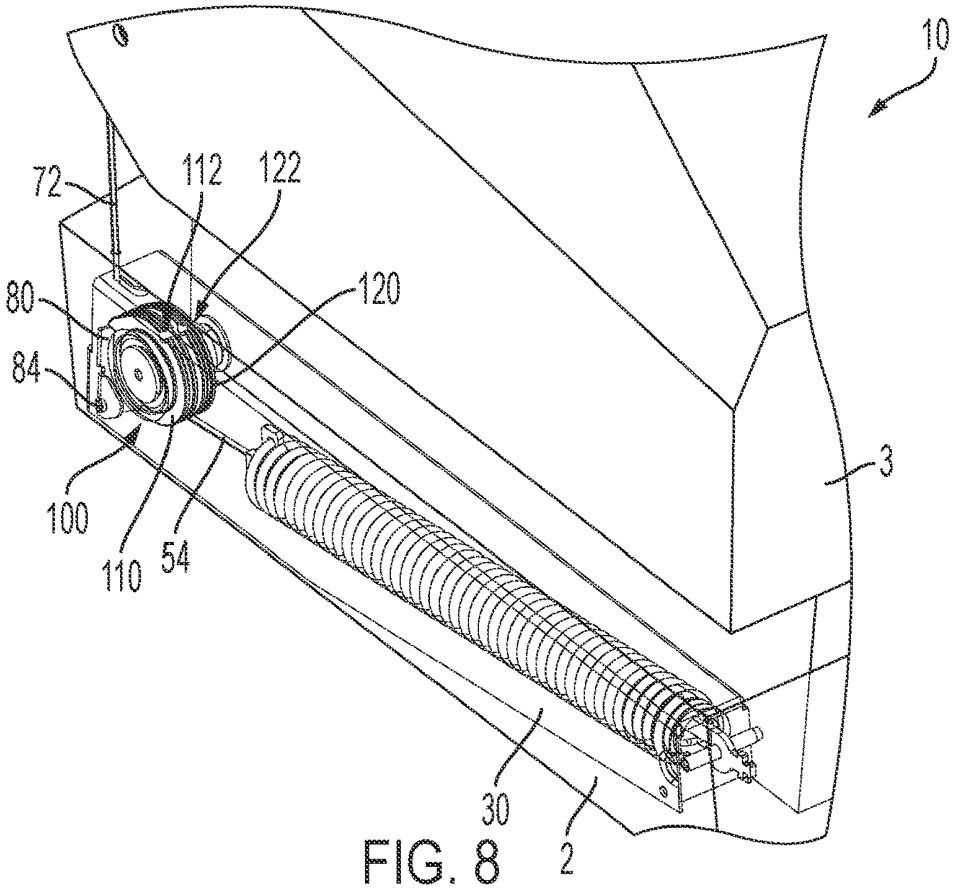

10
72
112
122
120
80
84
100
110
54
3
30
2

FIG. 8

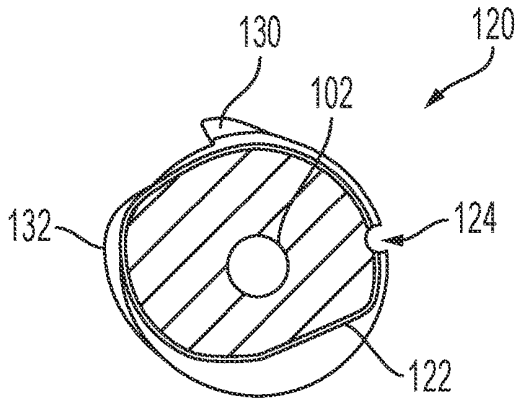

130
120
102
132
124
122

FIG. 9

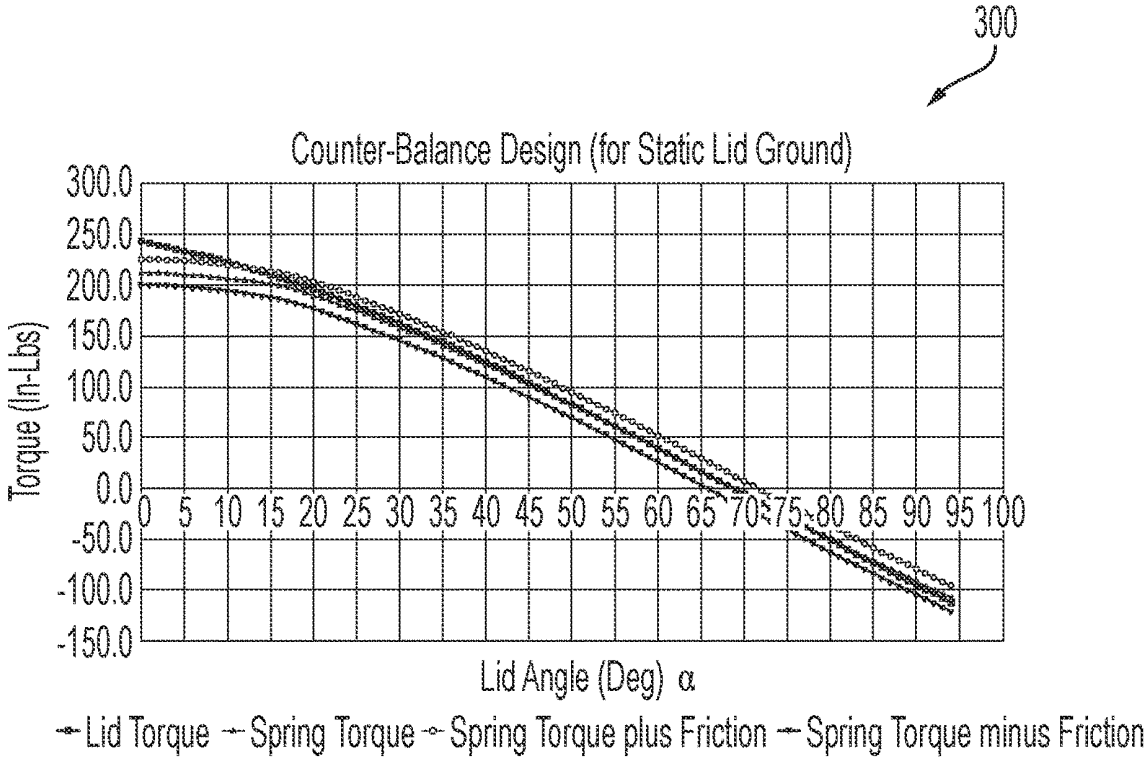

300
Counter-Balance Design (for Static Lid Ground)
300.0
250.0
200.0
150.0
100.0
50.0
0.0
-50.0
-100.0
-150.0
Torque (In-Lbs)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Lid Angle (Deg) α
Lid Torque
Spring Torque
Spring Torque plus Friction
Spring Torque minus Friction

FIG. 10

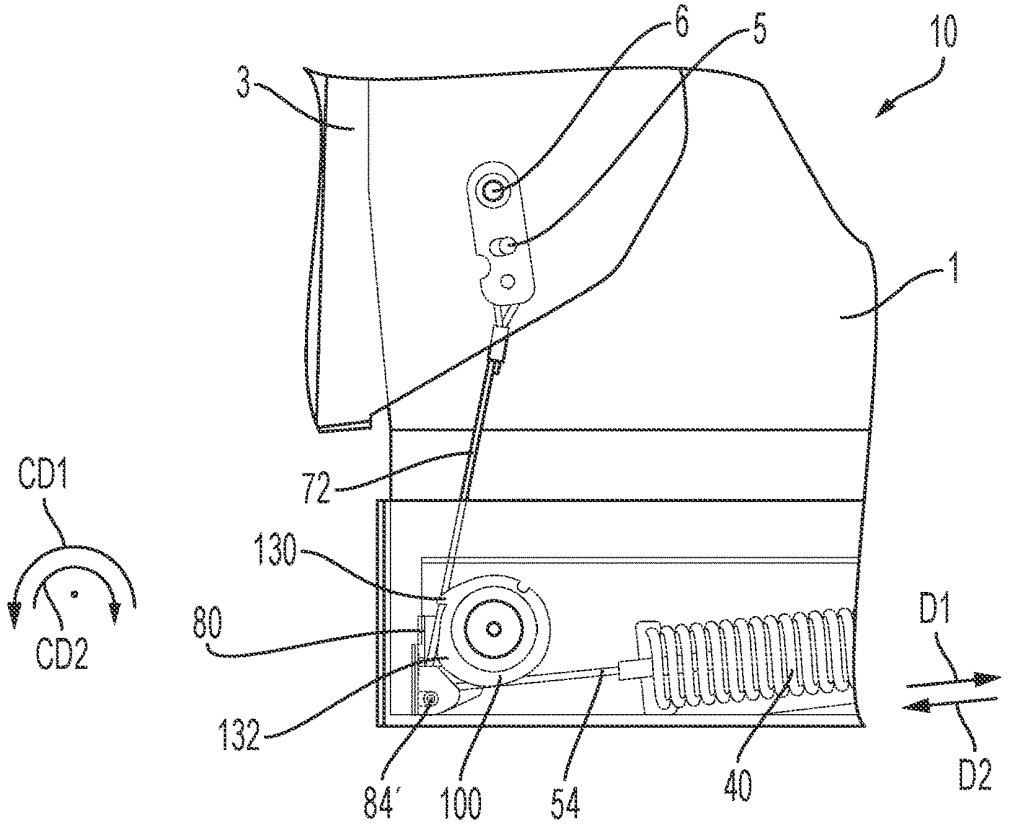


FIG. 11A

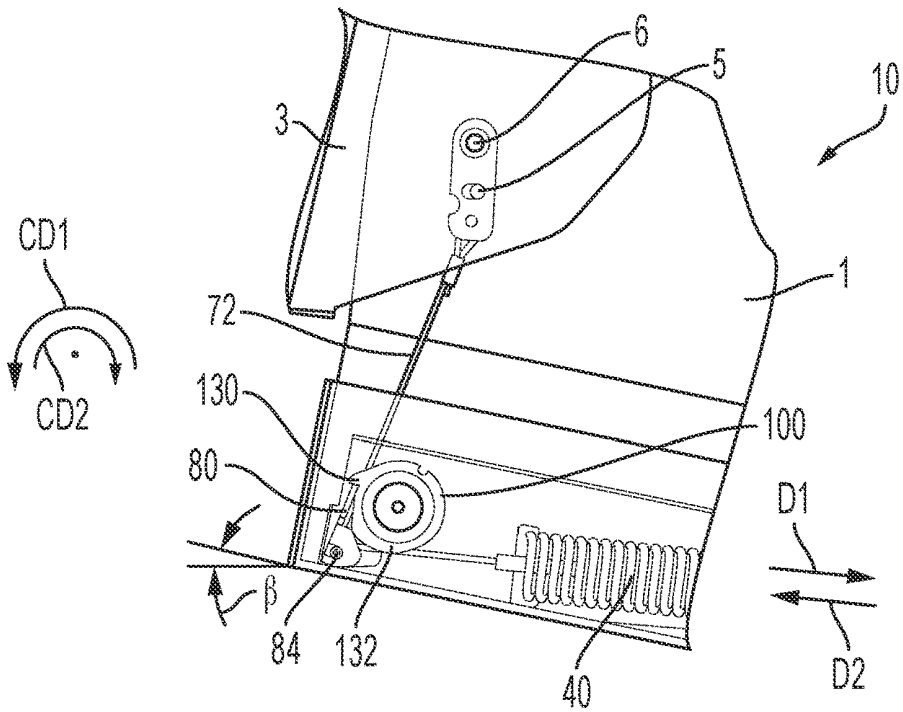


FIG. 11B

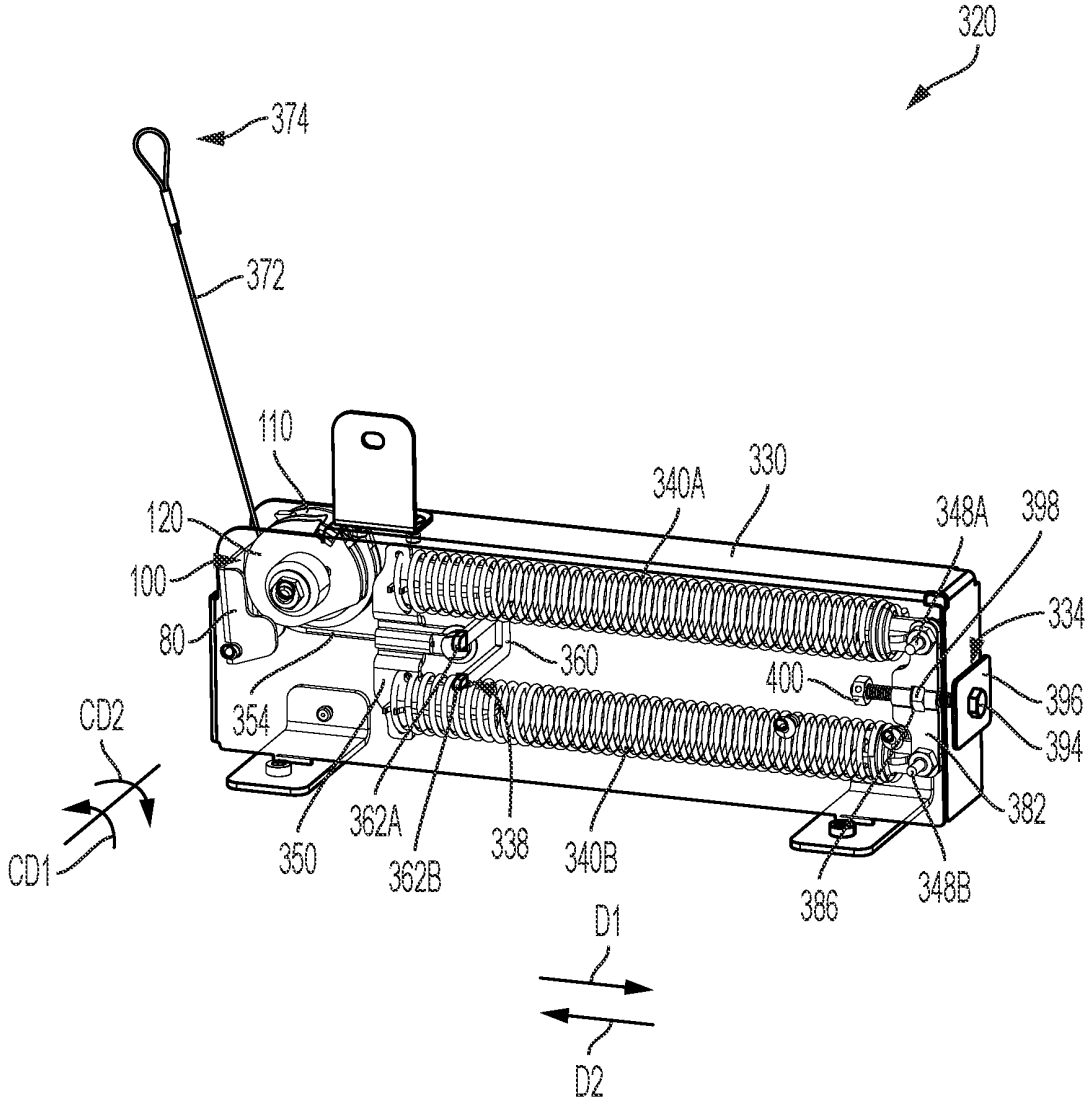

320
374
372
110
120
100
80
354
340A
330
348A
398
334
360
400
396
394
382
CD2
CD1
350
362A
362B
338
340B
386
348B
D1
D2

FIG. 12A

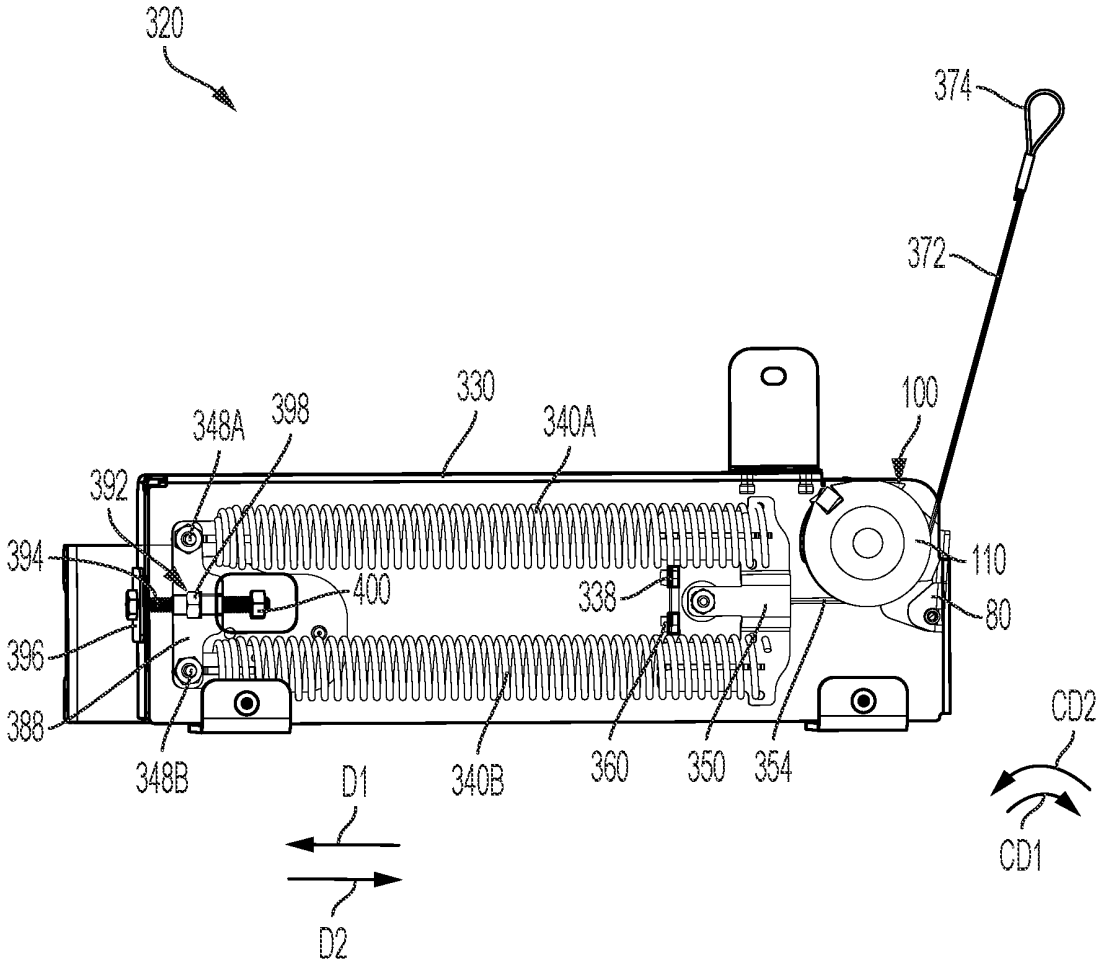

320
374
372
330
340A
348A
398
100
392
394
400
338
110
80
396
388
348B
340B
360
350
354
CD2
CD1
D1
D2

FIG. 12B

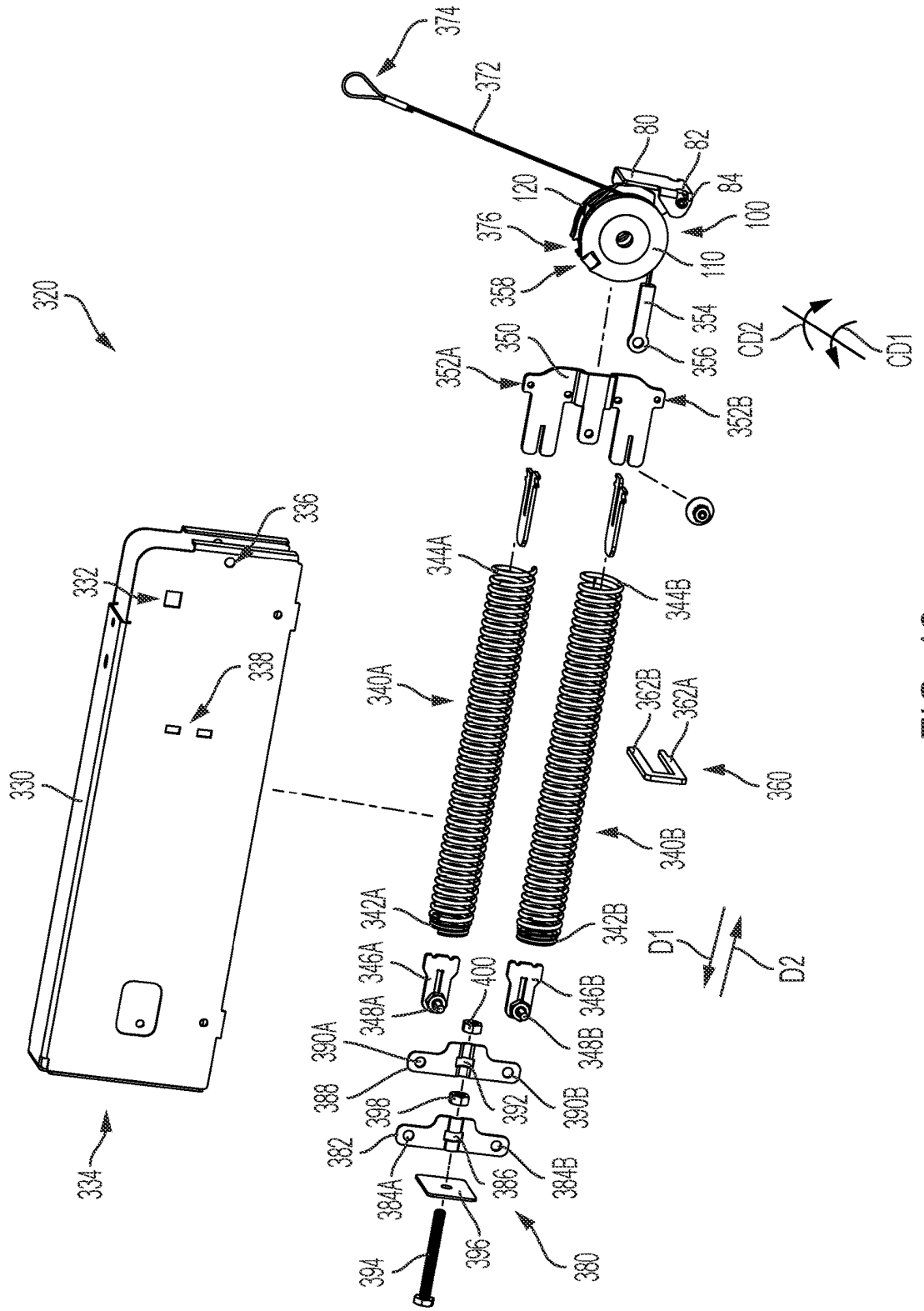

374
372
80
82
84
120
376
100
110
358
354
356
350
352A
352B
CD2
CD1
320
336
332
338
344A
344B
340A
362B
362A
360
330
340B
342A
342B
D1
D2
346A
348A
400
346B
348B
390A
388
398
392
390B
382
384A
386
384B
394
396
380
334

FIG. 13

COVER OR LID COUNTERBALANCE ASSEMBLY

FIELD

The present disclosure relates to hinged cover assemblies, and more particularly, to lid counterbalance and assist assemblies for grills and smokers.

BACKGROUND

A barbecue grill or smoker is a device that cooks food by applying heat from below. Many grills comprise a base, which houses either the gas burners or charcoal, and a lid, also known as a cover or hood. The lid is hingedly connected to the base. The hinged connection between the lid and the base enables the lid to be closed to trap the heat, and opened to add, remove, or check on the food being cooked therein. However, as the development of grill technology advances, the demand for grills having dense or heavy lids has increased. For example, customers prefer the look of stainless steel, which is generally a dense metal. Additionally, certain types of dense metal may have better heat transfer qualities, that is, heat cannot escape from the cooking area as quickly as less dense metals. The use of such dense materials in grills has made the opening and closing of the lid much more difficult. Furthermore, controlling the movement of the lid relative to the base has also become much more difficult.

Thus, there is a long felt need for a lid counterbalance and assist assembly operatively arranged to assist in the opening and closing of the lid. There is also a long felt need for a lid counterbalance and assist assembly including a lock out feature to prevent unwanted displacement of the lid relative to the base.

SUMMARY

According to aspects illustrated herein, there is provided a lid counterbalance assembly for a grill, the grill including a lid and a base, the lid counterbalance assembly comprising a pulley assembly including at least one pulley, the pulley assembly rotatably connected to the base, a spring connected to the pulley assembly via a first line, and a second line comprising a first end connected to the pulley assembly and a second end connected to the lid, wherein the second end is rotatable and translatable with respect to the lid.

In some embodiments, the lid counterbalance assembly further comprises a link rotatably connected to the second end, wherein the link comprises a slotted hole operatively arranged to engage a pin extending from the lid. In some embodiments, in a first state of the lid counterbalance assembly, the pin is engaged with a first end of the slotted hole, and in a second state of the lid counterbalance assembly, the pin is engaged with a second end of the slotted hole. In some embodiments, the lid counterbalance assembly further comprises a housing operatively arranged to be fixedly secured to the base, wherein the pulley assembly and the spring are connected to the housing. In some embodiments, the pulley assembly is connected to the base via a friction bearing. In some embodiments, the at least one pulley comprises a first pulley, and a second pulley non-rotatably connected to the first pulley. In some embodiments, the first line is fixedly secured to the first pulley and the second line is fixedly secured to the second pulley. In some embodiments, the first pulley comprises a constant diameter and the second pulley comprises a constant diameter. In some embodiments, the first pulley comprises a variable diameter and the second pulley comprises a constant diameter. In some embodiments, the lid counterbalance assembly further comprises a lockout bracket operatively arranged to engage the pulley assembly to prevent displacement of the pulley assembly in a first circumferential direction. In some embodiments, the pulley assembly further comprises a radially outward extending catch operatively arranged to engage the lockout bracket. In some embodiments, the pulley assembly further comprises a radially outward extending lobe operatively arranged to displace the lockout bracket in the first circumferential direction.

According to aspects illustrated herein, there is provided a grill assembly, comprising a base, a lid hingedly connected to the base, and a counterbalance assembly, including a pulley assembly rotatably connected to the base, the pulley assembly comprising a first pulley, and a second pulley non-rotatably connected to the first pulley, a spring connected to the first pulley via a first line, the spring biasing the pulley assembly in a first circumferential direction, and a second line comprising a first end connected to the second pulley and a second end connected to the lid, wherein the second end is rotatable and translatable with respect to the lid.

In some embodiments, the lid comprises a pin extending therefrom, and the counterbalance assembly further comprises a link rotatably connected to the second end, the link comprising a slotted hole engaged with the pin. In some embodiments, in a first state of the lid counterbalance assembly, the pin is engaged with a first end of the slotted hole, and in a second state of the lid counterbalance assembly, the pin is engaged with a second end of the slotted hole. In some embodiments, the first pulley comprises a constant diameter and the second pulley comprises a constant diameter. In some embodiments, the first pulley comprises a variable diameter and the second pulley comprises a constant diameter. In some embodiments, the lid counterbalance assembly further comprises a lockout bracket operatively arranged to engage a radially extending catch of the pulley assembly to prevent displacement of the pulley assembly in the first circumferential direction. In some embodiments, the pulley assembly further comprises a radially outward extending lobe operatively arranged to displace the lockout bracket in the first circumferential direction to disengage the catch.

According to aspects illustrated herein, there is provided a grill assembly, comprising a base, a lid hingedly connected to the base, the lid comprising a pin, and a counterbalance assembly, including a pulley assembly rotatably connected to the base, the pulley assembly comprising a first pulley, and a second pulley non-rotatably connected to the first pulley, a spring connected to the first pulley via a first line, and a link connected to the second pulley via a second line, the link comprising a slotted hole engaged with the pin.

According to aspects illustrated herein, there is provided a cover or lid or hood counterbalance assembly for a grill or smoker. In some embodiments, the lid counterbalance assembly provides torque on the lid to balance the effects of gravity on the lid through the opening range (for fully counterbalanced state). In some embodiments, the lid counterbalance assembly comprises a rotatable link at the point where the spring cable attaches to the lid to create an open bias condition. This allows for self-opening near the opened position. In some embodiments, the lid counterbalance assembly comprises a variable radius pulley between the spring and the lid to create a closing bias near the closed position. In some embodiments, the lid counterbalance

assembly provides rotation friction to the system to compensate for mismatches in lid torque to spring torque due to manufacturing tolerances in the grill lid and the counterbalance. In some embodiments, the lid counterbalance assembly comprises a feature that locks out the counterbalance torque when the grill is tipped forward with the lid open. This prevents the counterbalance torque from causing the lid to suddenly close and potentially flip the grill over. In such embodiments, no separate unlocking action is required by the user to deactivate the lock-out feature. Normal operation of the grill lid will disengage the lock-out feature.

In some embodiments, the lid counterbalance assembly can be set in an open bias condition or state through the use of a slotted link. The link that attaches the cable to the lid comprises an opening (i.e., slotted hole) that allows it to rotate within a specified range. This rotation changes the line of action of the cable and the output torque of the counterbalance to yield an open bias condition. In some embodiments, in the open bias state of the lid counterbalance assembly, the pulley comprises a constant radius.

In some embodiments, the lid counterbalance assembly can be set in a closed bias condition or state by connecting the springs to one side of the pulley via a first cable and the lid to the other side of the pulley via a second cable (i.e., there are two separate cables). The spring side of the pulley comprises a variable radius or radii, which allows the spring torque to be modified to create a close bias near the closed position.

In some embodiments, the lid counterbalance assembly can be set in an open bias condition and a closed bias condition through the use of a slotted hole in the link and a variable pulley.

In some embodiments, the lid counterbalance assembly comprises a lockout for tipped conditions of the grill. The counterbalance torque output is unaffected by the attitude of the grill. In the open state of the lid, the counterbalance is applying a closing torque to counteract the opening torque due to gravity. When the grill is tipped forward the opening torque due to gravity is decreased. This tipping action, required by various agencies for grill and smoker certification, when combined with the counterbalance closing toque could cause the lid to slam closed which would result in a testing/certification failure. The counterbalance lockout feature engages at a low tip angle and eliminates the counterbalance closing toque. This prevents the lid from slamming closed as it is tipped further (typically 10°-15°). When the grill is in an untipped open condition, the lockout bracket is disengaged from the pulley by the operator closing the lid normally. The steps or catches on the pulley move away from the lockout bracket and a lobe on the pulley pushes the lockout bracket back into its disengaged resting position. When the grill is tipped forward (e.g., 10°), the lockout bracket rotates due to gravity to engage steps on the outside profile of the pulley preventing spring force from being transmitted to the lid.

In some embodiments, the lid counterbalance assembly further comprises a friction element. The friction element adds friction to the system through the pulley pivot using, for example, a conical rotation friction device construction.

These and other objects, features, and advantages of the present disclosure will become readily apparent upon a review of the following detailed description of the disclosure, in view of the drawings and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Various embodiments are disclosed, by way of example only, with reference to the accompanying schematic drawings in which corresponding reference symbols indicate corresponding parts, in which:

FIG. **1**A is a perspective view of a grill assembly in, a closed state;

FIG. **1**B is a front elevational view of the grill assembly shown in FIG. **1**A, in an open state;

FIG. **2** is a detail view of the grill assembly taken generally along detail **2** in FIG. **1**B;

FIG. **3** is a perspective view of a lid counterbalance assembly;

FIG. **4** is an exploded perspective view of the lid counterbalance assembly shown in FIG. **3**;

FIG. **5** is a cross-sectional view of the lid counterbalance assembly taken generally along line **5**-**5** in FIG. **3**;

FIG. **6**A is a side elevational view of the grill assembly shown in FIG. **1**A in the closed state;

FIG. **6**B is a side elevational view of the grill assembly shown in FIG. **1**A in a balanced state;

FIG. **6**C is a side elevational view of the grill assembly shown in FIG. **1**A in the open state;

FIG. **7** shows a graph detailing the relationship of torque and lid angle for elements of the grill assembly shown in FIG. **1**A;

FIG. **8** is a detailed perspective view of the grill assembly shown in FIG. **1**A;

FIG. **9** is a cross-sectional view of the pulley assembly taken generally along line **9**-**9** in FIG. **4**;

FIG. **10** shows a graph detailing the relationship of torque and lid angle for elements of the grill assembly shown in FIG. **1**A;

FIG. **11**A is a detailed side elevational view of the grill assembly shown in FIG. **1**A, in the open state, arranged horizontally;

FIG. **11**B is a detailed side elevational view of the grill assembly shown in FIG. **1**A, in the open state, arranged at an angle;

FIG. **12**A is a front perspective view of a lid counterbalance assembly;

FIG. **12**B is a rear perspective view of a lid counterbalance assembly; and,

FIG. **13** is an exploded perspective view of the lid counterbalance assembly shown in FIG. **12**A.

DETAILED DESCRIPTION

At the outset, it should be appreciated that like drawing numbers on different drawing views identify identical, or functionally similar, structural elements. It is to be understood that the claims are not limited to the disclosed aspects.

Furthermore, it is understood that this disclosure is not limited to the particular methodology, materials and modifications described and as such may, of course, vary. It is also understood that the terminology used herein is for the purpose of describing particular aspects only, and is not intended to limit the scope of the claims.

Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood to one of ordinary skill in the art to which this disclosure pertains. It should be understood that any methods, devices or materials similar or equivalent to those described herein can be used in the practice or testing of the example embodiments. The assembly of the present disclosure could be driven by hydraulics, electronics, pneumatics, and/or springs.

It should be appreciated that the term "substantially" is synonymous with terms such as "nearly," "very nearly," "about," "approximately," "around," "bordering on," "close

to," "essentially," "in the neighborhood of," "in the vicinity of," etc., and such terms may be used interchangeably as appearing in the specification and claims. It should be appreciated that the term "proximate" is synonymous with terms such as "nearby," "close," "adjacent," "neighboring," "immediate," "adjoining," etc., and such terms may be used interchangeably as appearing in the specification and claims. The term "approximately" is intended to mean values within ten percent of the specified value.

It should be understood that use of "or" in the present application is with respect to a "non-exclusive" arrangement, unless stated otherwise. For example, when saying that "item x is A or B," it is understood that this can mean one of the following: (1) item x is only one or the other of A and B; (2) item x is both A and B. Alternately stated, the word "or" is not used to define an "exclusive or" arrangement. For example, an "exclusive or" arrangement for the statement "item x is A or B" would require that x can be only one of A and B. Furthermore, as used herein, "and/or" is intended to mean a grammatical conjunction used to indicate that one or more of the elements or conditions recited may be included or occur. For example, a device comprising a first element, a second element and/or a third element, is intended to be construed as any one of the following structural arrangements: a device comprising a first element; a device comprising a second element; a device comprising a third element; a device comprising a first element and a second element; a device comprising a first element and a third element; a device comprising a first element, a second element and a third element; or, a device comprising a second element and a third element.

Moreover, as used herein, the phrases "comprises at least one of" and "comprising at least one of" in combination with a system or element is intended to mean that the system or element includes one or more of the elements listed after the phrase. For example, a device comprising at least one of: a first element; a second element; and, a third element, is intended to be construed as any one of the following structural arrangements: a device comprising a first element; a device comprising a second element; a device comprising a third element; a device comprising a first element and a second element; a device comprising a first element and a third element; a device comprising a first element, a second element and a third element; or, a device comprising a second element and a third element. A similar interpretation is intended when the phrase "used in at least one of:" is used herein. Furthermore, as used herein, "and/or" is intended to mean a grammatical conjunction used to indicate that one or more of the elements or conditions recited may be included or occur. For example, a device comprising a first element, a second element and/or a third element, is intended to be construed as any one of the following structural arrangements: a device comprising a first element; a device comprising a second element; a device comprising a third element; a device comprising a first element and a second element; a device comprising a first element and a third element; a device comprising a first element, a second element and a third element; or, a device comprising a second element and a third element.

By "non-rotatably connected" elements, we mean that: the elements are connected so that whenever one of the elements rotate, all the elements rotate; and relative rotation between the elements is not possible. Radial and/or axial movement of non-rotatably connected elements with respect to each other is possible, but not required. By "rotatably connected" elements, we mean that the elements are rotatable with respect to each other.

It should be appreciated that the term grill as used herein can also mean smoker, and that the assemblies of the present disclosure can be applied to both grills and smokers. It should also be appreciated that the term lid is synonymous with the terms cover and hood, and that these terms as used herein are intended to mean the same thing, namely, the top portion of the grill or smoker that is hingedly connected to the base and operatively arranged to cover the food being cooked therein.

Referring now to the figures, FIG. **1**A is a perspective view of grill assembly **10** in, a closed state. FIG. **1**B is a front elevational view of grill assembly **10**, in an open state. FIG. **2** is a detail view of grill assembly **10** taken generally along detail **2** in FIG. **1**B. Grill assembly **10** generally comprises base **1**, lid **3** hingedly connected to base **1**, and lid counterbalance assembly **20**. In some embodiments, base **1** further comprises skirt **2** arranged therearound. In some embodiments, skirt **2** is fixedly secured to base **1**. Lid **3** comprises handle **4**.

FIG. **3** is a perspective view of lid counterbalance assembly **20**. FIG. **4** is an exploded perspective view of lid counterbalance assembly **20**. FIG. **5** is a cross-sectional view of lid counterbalance assembly **20** taken generally along line **5**-**5** in FIG. **3**. Lid counterbalance assembly **20** generally comprises housing **30**, spring **40**, at least one line, for example line **54** and line **72**, link **60**, and pulley assembly **100**. It should be appreciated that lines **54** and **72** may comprise any suitable connecting means, such as, for example, cable, wire, string, chain, rope, twine, metal strap, strap, etc. In some embodiments, lid counterbalance assembly **20** further comprises lockout bracket **80**. Lid counterbalance assembly **20** provides torque to balance the effects of gravity on lid **3** through the opening range (i.e., fully counterbalanced). The following description should be read in view of FIGS. **1**A-**5**.

Housing **30** is operatively arranged to be secured to a grill, for example, to base **1** and/or skirt **2**. Housing **30** comprises a plurality of holes, for example, hole **32**, hole or slot **34**, holes **36**A-C, and hole or slot **38**. Hole **32** is operatively arranged to engage a shaft or bearing of pulley assembly **100** to rotatably connect pulley assembly **100** to housing **30**. In some embodiments, lid counterbalance assembly **20** comprises friction bearing **90** operatively arranged to rotatably connect pulley assembly **100** to housing **30**. In some embodiments, friction bearing **90** can be adjusted to add rotational friction between lid **3** and base **1**, for example like the friction bearings disclosed in U.S. Pat. No. 10,822,851 (Graham et al.), which patent is incorporated herein by reference in its entirety. Friction bearing **90** provides rotation friction to the system to compensate for mismatches in lid torque to spring torque due to manufacturing tolerances in the grill lid and the counterbalance assembly. As best shown in FIG. **5**, friction can be added to the system through the pulley pivot using a conical rotational friction device construction (i.e., tightening friction bearing **90** causes wedges to engage resulting in increased friction and loosening friction bearing **90** results in decreased friction). In some embodiments, hole **32** is a through-bore extending through housing **30**. In some embodiments, hole **32** comprises a depression or counterbore or countersink. Line **72** extends out of housing **30** via hole **34** to connect lid **3** to pulley assembly **100**. Hole **36**A is operatively arranged to engage pin **84** to rotatably connect lockout bracket **80** to housing **30**. Housing **30** is secured to base **1** and/or skirt **2** via holes **36**B, **36**C, and/or **32** and bolts. However, it should be appreciated that housing **30** can be secured to base **1** and/or skirt **2** via any suitable means, for example, screws, nails, pins, rivets,

dowels, welding, soldering, adhesives, etc. Slot **38** is operatively arranged to engage connector **46** to connect spring **40** to housing **30**, as will be described in greater detail below.

Spring **40** is generally a coil spring arranged in housing **30** comprising end **42** and end **44**. End **42** is connected to housing **30** via connector **46**. Specifically, connector **46** is connected to end **42** and extends through slot **38**. Rod **48** is arranged in a hole in connector **46** to fixedly secure end **42** to housing **30**. In some embodiments, spring **40** is tapered or frusto-conical at end **42**. End **44** is connected to line **54** via connector **50**. Connector **50** comprises at least one hole, for example holes **52**A-B. End **44** is fed through holes **52**A-B to secure spring **40** to connector **50**, as best shown in FIG. **3**. Line **54** is fixedly secured to connector **50** and comprises end **56** and end **58**. For example, end **56** is secured to connector **50** via a screw. However, it should be appreciated that end **56** can be secured to connector **50** via any suitable means, for example, bolts, nails, pins, rivets, dowels, welding, soldering, adhesives, etc. End **58** is connected to pulley assembly **100**. Specifically, end **58** is fixedly secured to pulley assembly **100** as will be described in greater detail below.

Pulley assembly **100** generally comprises through-bore **102**, pulley **110**, and pulley **120**. Pulley **110** comprises groove **112** and channel **114**. Pulley **120** is non-rotatably connected and arranged adjacent to pulley **110** and comprises groove **122** and channel **124**. Pulley **120** and pulley **110** are concentrically aligned, that is, about the same center axis of through-bore **102**. In some embodiments, pulley **120** is fixedly secured to pulley **110**. Shaft or friction bearing **90** extends through through-bore **102** to rotatably connect pulley assembly **100** to housing **30**. In some embodiments, spring **40** is connected to pulley **120** via line **54** and link **60** is connected to pulley **110** via line **72**. In some embodiments, pulley assembly **100** comprises one pulley and both of lines **54** and **72** are connected thereto. In some embodiments, and as shown, end **58** is fixedly secured in groove **122**. For example, end **58** may be connected to a perpendicular rod that engages channel **124**. Similarly, end **76** of line **72** is fixedly secured in groove **112**. For example, end **76** may be connected to a perpendicular rod that engages channel **114**. It should be appreciated that lines **54** and **72** may be connected to pulley assembly **100** via any suitable means, for example, screws, nails, pins, rivets, dowels, welding, soldering, adhesives, etc. In some embodiments, through-bore **102** comprises radially inward facing surfaces or counter-sinks **104** and **106**. Frusto-conical surfaces **104** and **106** are operatively arranged to engage wedges of friction bearing **90** to increase or decrease rotational friction of pulley assembly **100** with respect to housing **30**. Decreasing friction of friction bearing **90** results in lid **3** being more freely rotatable displaceable, whereas increasing friction of friction bearing **90** results in lid **3** being less freely rotatably displaceable. In some embodiments, pulley assembly **100** further comprises catch **130** and lobe **132**. Catch **130** is a radially outward extending protrusion operatively arranged to engage lockout bracket **80** to remove spring bias from lid **3**. This is desirable if, for example, grill assembly **10** is arranged on a graded surface and will be described in greater detail below with respect to FIGS. **11**A-B. Lobe **132** is operatively arranged to engage lockout bracket **80** to disengage lockout bracket **80** from catch **130**. As pulley assembly **100** is rotated, lobe **132** rotatably displaces lockout bracket **80** away from pulley assembly **100**, thus disengaging it from catch **130**.

Link **60** is connected to pulley assembly **100** via line **72**. Line **72** comprises end **74** and end **76** fixedly secured to pulley assembly **100**. End **74** is connected to link **60** via connector **68** and connector **70**. Connectors **68** and **70** allow for rotatable connection between link **60** and line **72**. It should be appreciated that line **72** may be connected to link **60** via any means suitable for rotatable connection, for example, bolts, rivets, nails, screws, dowels, pins, etc.

Link **60** generally comprises a plate operatively arranged to connect line **72** to lid **3** in order to create a desirable and shiftable bias on lid **3** (e.g., open bias or closing bias) to aid in displacement of lid **3** relative to base **1**. Link **60** comprises hole **62** and hole or slot **64**. Hole **62** is operatively arranged to engage connector **68** to rotatably connect link **60** with line **72**. Hole **64** comprises a slot or ovular or ellipsoidal or elongate shape and comprises end **64**A and end **64**B. Hole **64** is operatively arranged to engage pin **5** of lid **3**. The elongate shape of hole **64** allows link **60** to shift from, for example, an open bias to aid in opening lid **3** or a closing bias to aid in closing lid **3**, as will be described in greater detail below. In some embodiments, link **60** further comprises hole **66**. Hole **66** is rotatably engaged with pin **6**. Pin **6** rotatably connects lid **3** and base **1**, thereby providing a hinged or rotatable connection between lid **3** and base **1**. Pin **6** may comprise a bearing, bolt, shaft, etc. It should be appreciated, however, that lid **3** may be hingedly or rotatably connected to base **1** using any suitable means. Link **60** is "rotatable" and connects line **72**, and essentially spring **40**, to lid **3** to create an open bias condition. This allows for self-opening near the opening position or the closed state. Specifically, opening or hole **64** allows link **60** to rotate within a specified range. This rotation changes the line of action of the cable and the output torque of the counterbalance assembly **20** to yield an open bias condition or a close bias condition. It should be appreciated that, although the present disclosure shows link **60** as a separate component from lid **3**, line **72** can be directly connected to a slotted hole in lid **3** to allow for the same "shift" action. For example, end **74** of line **72** can be connected to an oblong or ellipsoidal hole in lid **3** via connector **68**, wherein connector **68** allows for rotational connection between line **72** and lid **3** and also is slidable within the hole.

Lockout bracket **80** is rotatably connected to housing **30** via pin **84** and hole **36**A. Lockout bracket **80** is operatively arranged to displace in circumferential direction CD**2** to engage catch **130** of pulley assembly **100**, thereby removing spring bias from spring **40** on link **60** and thus lid **30**. Lobe **132** is operatively arranged to engage lockout bracket **80** to displace it in circumferential direction CD**1** to disengage it from catch **130**. In some embodiments, housing **30** prevents or limits circumferential displacement of lockout bracket **80** in circumferential direction CD**1**. Lockout bracket **80** is operatively arranged to lock out the counterbalance torque when grill assembly **10** is tipped forward with lid **3** in the open state. This prevents the counterbalance torque from causing the lid to suddenly close and potentially flip the grill over. No separate unlocking action is required by the user to deactivate this feature, and normal operation of the grill lid will disengage this feature. Lockout bracket **80** will be described in greater detail below with respect to FIGS. **11**A-B.

FIG. **6**A is a side elevational view of grill assembly **10** in the closed state. In the closed state, link **60** is arranged such that pin **5** is engaged with end **64**A of hole **64**. In such arrangement, spring **40** provides a linear biasing force on line **54** in direction D**1**, which is translated into a rotatable biasing force or torque on lid **3** in circumferential direction CD**1**, or, an open bias. The open bias aids in the opening of lid **3**. This is especially desirable as the material of lid **3**

becomes denser adding to its mass. Essentially, pin **5** acts as a fulcrum on end **64**A, with line **72** pulling lid **3** in circumferential direction CD**1** therearound.

FIG. **6**B is a side elevational view of grill assembly **10** in a balanced state. In the balanced state, lid **3** is arranged at angle α relative to base **1** and link **60** is arranged such that pin **5** is arranged between, and disengaged with, both of ends **64**A-B. Link **60**, including hole **66**, hole **64**, and hole **62**, and line **72** are generally linearly aligned. In such arrangement, there is no circumferential bias or torque on lid **3** from spring **40**. FIG. **6**B shows the balanced state or balance point, wherein the center of gravity is directly above the pivot.

FIG. **6**C is a side elevational view of grill assembly **10** in the open state. In the open state, lid **3** is arranged at angle α relative to base **1** and link **60** is arranged such that pin **5** is engaged with end **64**B of hole **64**. Angle α in the open state as shown in FIG. **6**C is greater than angle α in the balanced state as shown in FIG. **6**B. In such arrangement, spring **40** provides a linear biasing force on line **54** in direction D**1**, which is translated into a rotatable biasing force or torque on lid **3** in circumferential direction CD**2**, or, a close bias. The close bias aids in the closing of lid **3**. Link **60** has "shifted" and pin **5** now acts as a fulcrum on end **64**B, with line **72** pulling lid **3** in circumferential direction CD**2** therearound. Thus, the slotted hole **64** allows link **60** to shift thus allowing spring **40** to provide an open bias, when lid **3** is closed, as well as a close bias, when lid **3** is open.

FIG. **7** shows graph **200** detailing an example of the relationship of torque versus lid angle α for elements of grill assembly **10**. Graph **200** comprises sections **202**, **204**, and **206**. Section **202** represents the open bias of lid counterbalance assembly **20**, wherein spring **40** applies an open bias on lid **3** in circumferential direction CD**1** as shown in FIG. **6**A. The spring torque as well as the gravity torque applied to lid **3** is at its greatest when angle α is equal to zero. The torque applied to lid **3** decreases as angle α increases until the torque reaches zero at the balanced state. Section **204** represents the balanced state of grill assembly **10**, wherein no circumferential bias or torque is applied to lid **3** from spring **40**, as shown in FIG. **6**B. Section **206** represents the close bias of lid counterbalance assembly **20**, wherein spring **40** applies a close bias on lid **3** in circumferential direction CD**2** as shown in FIG. **6**C. The torque applied to lid **3** increases as angle α increases.

FIG. **8** is a detailed perspective view of grill assembly **10**. FIG. **8** shows a more detailed view of the arrangement of pulley assembly **100**. Specifically, line **54** is fixedly secured to pulley **120** and line **72** if fixedly secured to pulley **110**. In some embodiments, pulley **110** is circular and comprises a constant radius. In some embodiments, pulley **120** is circular and comprises a constant radius.

FIG. **9** is a cross-sectional view of pulley assembly **100** taken generally along line **9**-**9** in FIG. **4**. In some embodiments, and as shown in FIG. **9**, pulley **120** is non-circular and comprises a variable radius. The use of a variable radius pulley between spring **40** and lid **3** can create a closing bias near the closed position or state. As shown, pulley **120**, and specifically groove **122**, comprises a variable radius including two substantial linear sections and two curvilinear sections. The variable radius pulley will allow lid **3** to slowly close on its own as it nears the closed state. FIG. **10** shows graph **300** detailing the relationship of torque versus lid angle α for elements of grill assembly **10**. As shown in FIG. **10**, when angle α is equal to zero, the lid torque due to gravity and the variable radius pulley **120** is greater than the spring torque, and thus when lid **3** is nearer the closed state, lid **3** tends to close on its own due to gravity as well as the variable radius pulley.

FIG. **11**A is a detailed side elevational view of grill assembly **10**, in the open state and arranged horizontally. By horizontally, it is meant that grill assembly **10** is positioned on level ground. On level ground, or in the untipped condition, lockout bracket **80** is in the disengaged state, that is, lockout bracket **80** is displaced in circumferential direction CD**1** such that it is disengaged with catch **130** of pulley assembly **100**.

FIG. **11**B is a detailed side elevational view of grill assembly **10**, in the open state, arranged at an angle. By arranged at an angle, it is meant that grill assembly **10** is positioned on unlevel ground. For example, base **1** is arranged at angle β (e.g., 10°-15°), which is representative of the grading of the ground surface. On angled ground or in the tipped condition, lockout bracket **80** displaces in circumferential direction CD**2** (i.e., falls forward due to gravity) to engage catch **130**. When lockout bracket **80** is engaged with catch **130**, close bias or torque from spring **40** is no longer applied to lid **3**. The removal of the biasing force on lid **3** prevents lid **3** from slamming shut or closed, which may occur as a result of the grading of the ground surface coupled with the close bias force applied by lid counterbalance assembly **20**. If lid **3** were to slam shut, grill assembly **10** could tip over.

When grill assembly **10** is on flat ground, lockout bracket **80** is disengaged by the user closing lid **3** normally. By closing lid **3**, pulley assembly **100** displaces in circumferential direction CD**2** which displaces catch **130** away from lockout bracket **80**. Lobe **132** displaces in circumferential direction CD**2** as well and engages lockout bracket **80** pushing it back into its resting position (i.e., lobe **132** displaces lockout bracket **80** in circumferential direction CD**1**).

FIG. **12**A is a front perspective view of lid counterbalance assembly **320**. FIG. **12**B is a rear perspective view of lid counterbalance assembly **320**. FIG. **13** is an exploded perspective view of lid counterbalance assembly **320**. Lid counterbalance assembly **320** generally comprises housing **330**, one or more springs, for example, springs **340**A-B, at least one line, for example line **354** and line **372**, link **60**, and pulley assembly **100**. It should be appreciated that lines **354** and **372** may comprise any suitable connecting means, such as, for example, cable, wire, string, chain, rope, twine, metal strap, strap, etc. In some embodiments, lid counterbalance assembly **320** further comprises lockout bracket **80**. Lid counterbalance assembly **320** provides torque to balance the effects of gravity on lid **3** through the opening range (i.e., fully counterbalanced). It should be appreciated that counterbalance assembly **320** can be assembled in place of or in addition to counterbalance assembly **20**, namely, as part of grill assembly **10** shown in FIGS. **1**A-**11**B. The following description should be read in view of FIGS. **1**A-**13**.

Housing **330** is operatively arranged to be secured to a grill, for example, to base **1** and/or skirt **2**. Housing **330** comprises a plurality of holes, for example, hole **332**, hole **334**, hole **336**, and hole or holes **338**. Hole **332** is operatively arranged to engage a shaft or bearing of pulley assembly **100** to rotatably connect pulley assembly **100** to housing **330**. In some embodiments, lid counterbalance assembly **320** comprises friction bearing **90** operatively arranged to rotatably connect pulley assembly **100** to housing **330**. In some embodiments, hole **332** is a through-hole extending through housing **330**. Line **372** extends out of housing **330** to connect lid **3** to pulley assembly **100**. Hole **336** is operatively

arranged to engage pin **84** to rotatably connect lockout bracket **80** to housing **330**. Housing **330** is secured to base **1** and/or skirt **2** via holes and bolts. However, it should be appreciated that housing **330** can be secured to base **1** and/or skirt **2** via any suitable means, for example, screws, nails, pins, rivets, dowels, brackets, welding, soldering, adhesives, etc. Hole **334** is operatively arranged to engage bolt **394** of tensioner **380** to connect springs **340**A-B to housing **330**, as will be described in greater detail below. Hole or holes **338** are operatively arranged to engage clip **360** to maintain a spring length during shipping and assembly, as will be described in greater detail below.

Spring **340**A and spring **340**B are generally coil springs arranged in housing **330** comprising end **342**A and end **344**A, and end **342**B and **344**B, respectively. Ends **342**A-B are connected to housing **330** via connectors **346**A-B, respectively, and tensioner **380**. Tensioner generally comprises plate **382**, plate **388**, bolt **394**, plate or washer **396**, nut **398**, and nut **400**. Specifically, connector **346**A connects end **342**A to plates **382** and **388** via rod **348**A. Rod **348**A extends through hole **384**A, hole **390**A, and connector **346**A. Connector **346**B connects end **342**B to plates **382** and **388** via rod **348**B. Rod **348**B extends through hole **384**B, hole **390**B, and connector **346**B. Bolt **394** extends through plate **396** and hole **334** in housing **330** to engage nut **398**. Nut **398** is rotatably connected to plates **382** and **388**. Specifically, nut **398** is rotatably engaged with hole **386** and hole **392**. The engagement of bolt **394** with nut **398** allows for adjustability of tensioner **380**. For example, rotation of bolt **398** in a first circumferential direction displaces plates **382** and **388** in direction D**1** thereby increasing the tension within springs **340**A-B. Rotation of bolt **398** in a second circumferential direction, opposite the first circumferential direction, displaces plates **382** and **388** in direction D**2** thereby decreasing the tension within springs **340**A-B. Plate **396** acts as a washer to distribute force between bolt **394** and housing **330**. In some embodiments, tensioner **380** further comprises nut or limiter **400** that acts as a limit on bolt **394** to prevent bolt **394** from being completely removed.

In some embodiments, springs **340**A-B are tapered or frusto-conical at ends **342**A-B, respectively. Ends **344**A-B are connected to line **354** via connector **350**. Connector **350** comprises a plurality of holes, for example, two holes in first or upper portion **352**A and two holes in second or lower portion **352**B. End **344**A is fed through the two holes in upper portion **352**A to secure spring **340**A to connector **350**, and end **344**B is fed through the two holes in lower portion **352**B to secure spring **340**B to connector **350**.

Line **354** is fixedly secured to connector **350** and comprises end **356** and end **358**. For example, end **356** is secured to connector **350** via a screw. However, it should be appreciated that end **354** can be secured to connector **350** via any suitable means, for example, bolts, nails, pins, rivets, dowels, welding, soldering, adhesives, etc. End **358** is connected to pulley assembly **100**. In some embodiments, end **358** is fixedly secured to pulley assembly **100**.

Line **372** comprises end **374** and end **376** fixedly secured to pulley assembly **100**. End **374** is connected to link **60**, for example, via connector **68** and connector **70**. Connectors **68** and **70** allow for rotatable connection between link **60** and line **372**. It should be appreciated that line **372** may be connected to link **60** via any means suitable for rotatable connection, for example, bolts, rivets, nails, screws, dowels, pins, etc.

Clip **360** is operatively arranged to engage both housing **330** and connector **350**. In order to maintain proper assembly during shipping, as well as to allow adequate slack in line **372** such that it can be assembled on grill assembly **10**, it is desirable to elongate springs **340**A-B. As such, and as best shown in FIGS. **12**A-B, connector **350** is displaced in direction D**2** with respect to housing **330**. Then clip **360**, specifically prongs **362**A-B, is inserted through housing **330** via holes **338**. Connector **350** may then be released and tension in springs **340**A-B cause connector **350** to abut against clip **360**. Once lid counterbalance assembly **320** has arrived at its destination and is properly installed on grill assembly **10**, clip **360** can be removed thereby allowing springs **340**A-B to load tension into pulley assembly **100** and thus line **372**. In other words, assembly of clip **360** in housing **330** removes tension in springs **340**A-B (similar to the effect of the engagement of lockout bracket **80** with catch **130**).

It should be appreciated that the springs herein, for example, spring **40**, spring **340**A, and/or spring **340**B may comprise any suitable component that provides a biasing force on pulley assembly **100**. For example, instead of a linear spring such as a tension or compression spring, a linear actuator, tension element, gas or pneumatic cylinder, electric drive, elastic element, or other biasing element can be used.

It will be appreciated that various aspects of the disclosure above and other features and functions, or alternatives thereof, may be desirably combined into many other different systems or applications. Various presently unforeseen or unanticipated alternatives, modifications, variations, or improvements therein may be subsequently made by those skilled in the art which are also intended to be encompassed by the following claims.

REFERENCE NUMERALS

1 Base
2 Skirt
3 Lid
4 Handle
5 Pin
6 Pin
10 Grill or smoker assembly
20 Lid or cover or hood counterbalance assembly
30 Housing
32 Hole
34 Hole
36A Hole
36B Hole
36C Hole
38 Slot
40 Spring
42 End
44 End
46 Connector
48 Rod
50 Connector
52A Hole
52B Hole
54 Line
56 End
58 End
60 Link
62 Hole
64 Hole
64A End
64B End
66 Hole
70 Connector

72 Line
74 End
76 End
80 Lockout bracket
82 Hole or holes
84 Pin
90 Shaft or bearing or friction bearing
100 Pulley Assembly
102 Through-bore
104 Radially inward facing surface
106 Radially inward facing surface
110 Pulley
112 Groove
114 Channel
120 Pulley
122 Groove
124 Channel
130 Catch
132 Lobe
200 Graph
202 Section
204 Section
206 Section
300 Graph
320 Lid or cover or hood counterbalance assembly
330 Housing
332 Hole
334 Hole
336 Hole
338 Hole(s)
340A Spring
340B Spring
342A End
342B End
344A End
344B End
346A Connector
346B Connector
348A Rod
348B Rod
350 Connector
352A Portion
352B Portion
354 Line
356 End
358 End
360 Clip
362A Prong
362B Prong
372 Line
374 End
376 End
380 Tensioner
382 Plate
384A Hole
384B Hole
386 Hole
388 Plate
390A Hole
390B Hole
392 Hole
394 Bolt
396 Plate or washer
398 Nut
400 Nut
CD1 Circumferential direction
CD2 Circumferential direction
D1 Direction
D2 Direction
α Angle
β Angle

What is claimed is:

1. A lid counterbalance assembly for a grill, the grill including a lid and a base, the lid counterbalance assembly comprising:
a pulley assembly including at least one pulley, the pulley assembly rotatably connected to the base;
a spring connected to the pulley assembly via a first line;
a second line comprising a first end connected to the pulley assembly and a second end connected to the lid, wherein the second end is rotatable and translatable with respect to the lid;
a lockout bracket operatively arranged to engage the pulley assembly to prevent displacement of the pulley assembly in a first circumferential direction; and
wherein the pulley assembly further comprises a radially outward extending lobe operatively arranged to displace the lockout bracket in the first circumferential direction.

2. The lid counterbalance assembly as recited in claim 1, further comprising a link rotatably connected to the second end, wherein the link comprises a slotted hole operatively arranged to engage a pin extending from the lid.

3. The lid counterbalance assembly as recited in claim 2, wherein:
in a first state of the lid counterbalance assembly, the pin is engaged with a first end of the slotted hole; and,
in a second state of the lid counterbalance assembly, the pin is engaged with a second end of the slotted hole.

4. The lid counterbalance assembly as recited in claim 1, further comprising a housing operatively arranged to be fixedly secured to the base, wherein the pulley assembly and the spring are connected to the housing.

5. The lid counterbalance assembly as recited in claim 1, wherein the pulley assembly is connected to the base via a friction bearing.

6. The lid counterbalance assembly as recited in claim 1, wherein the at least one pulley comprises:
a first pulley; and,
a second pulley non-rotatably connected to the first pulley.

7. The lid counterbalance assembly as recited in claim 6, wherein the first line is fixedly secured to the first pulley and the second line is fixedly secured to the second pulley.

8. The lid counterbalance assembly as recited in claim 7, wherein the first pulley comprises a constant diameter and the second pulley comprises a constant diameter.

9. The lid counterbalance assembly as recited in claim 7, wherein the first pulley comprises a variable diameter and the second pulley comprises a constant diameter.

10. The lid counterbalance assembly as recited in claim 1, wherein the pulley assembly further comprises a radially outward extending catch operatively arranged to engage the lockout bracket.

11. A grill assembly, comprising:
a base;
a lid hingedly connected to the base; and,
a counterbalance assembly, including:
a pulley assembly rotatably connected to the base, the pulley assembly comprising:
a first pulley; and,
a second pulley non-rotatably connected to the first pulley;

a spring connected to the first pulley via a first line, the spring biasing the pulley assembly in a first circumferential direction;

a second line comprising a first end connected to the second pulley and a second end connected to the lid, wherein the second end is rotatable and translatable with respect to the lid;

a lockout bracket operatively arranged to engage a radially extending catch of the pulley assembly to prevent displacement of the pulley assembly in the first circumferential direction; and

a radially outward extending lobe operatively arranged to displace the lockout bracket in the first circumferential direction to disengage the catch.

12. The grill assembly as recited in claim **11**, wherein:

the lid comprises a pin extending therefrom; and,

the counterbalance assembly further comprises a link rotatably connected to the second end, the link comprising a slotted hole engaged with the pin.

13. The grill assembly as recited in claim **12**, wherein: in a first state of the lid counterbalance assembly, the pin is engaged with a first end of the slotted hole; and, in a second state of the lid counterbalance assembly, the pin is engaged with a second end of the slotted hole.

14. The lid counterbalance assembly as recited in claim **11**, wherein the first pulley comprises a constant diameter and the second pulley comprises a constant diameter.

15. The lid counterbalance assembly as recited in claim **11**, wherein the first pulley comprises a variable diameter and the second pulley comprises a constant diameter.

* * * * *