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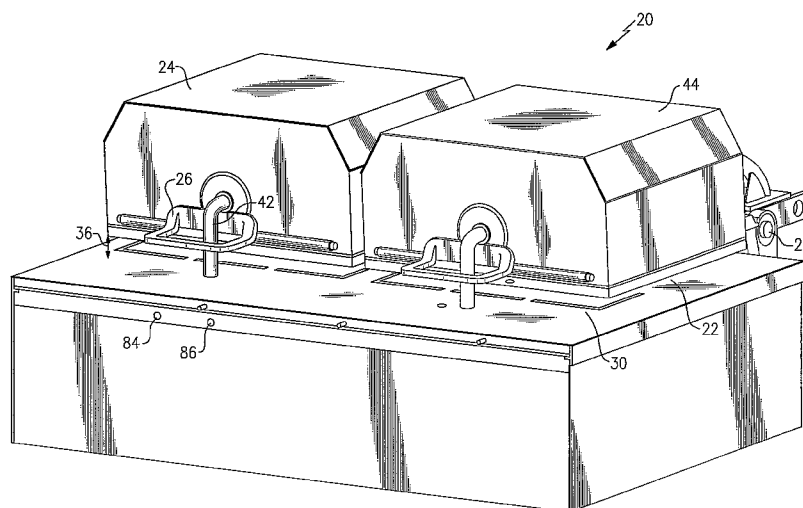
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(54) Title: GRILL INCLUDING AUTOMATIC GAP CALIBRATION



(57) Abstract: A grill (20) includes a lower platen assembly (22) having a lower grilling surface and a pivotally attached upper platen assembly (24) having an upper grilling surface. The upper platen assembly includes three motors (46a, 46b, 46c) encased in a shell (44). A cable (58a, 58b, 58c) attached to each motor suspends the upper grilling surface. The grill (20) is automatically calibrated to ensure that the upper grilling surface is level. Each motor independently and sequentially raises the upper grilling surface from the lower grilling surface. When the upper grilling surface lifts from the lower grilling surface, the current in the motor changes. The settings of each motor at this instant are stored in a control to determine the calibration point when the upper grilling surface is level. The grill (20) also automatically recognizes a food item placed on the lower grilling surface to determine the cooking parameters of the grill.

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GRILL INCLUDING AUTOMATIC GAP CALIBRATION

BACKGROUND OF THE INVENTION

The present invention relates generally to a grill that automatically calibrates a gap between an upper grilling surface and a lower grilling surface.

Grills or griddles are used to cook various foods, such as hamburgers. In one prior grill, the sides of the food are grilled separately. The food is placed on a grilling surface, grilling the side of the food that contacts the grilling surface. After that side of the food is cooked, the food is manually flipped to cook the opposite side. After the food is cooked, the food is manually removed from the grill for serving.

In another prior grill, both sides of the food are grilled simultaneously. After manually programming the type of food into a control unit, the food is placed on a lower grilling surface. An upper platen assembly having an upper grilling surface is then lowered onto the food, positioning the food in a gap between the upper and lower grilling surfaces to simultaneously grill both sides of the food. After a predetermined amount of time has passed, the upper platen assembly raises, and the food can be manually removed from the grill.

To ensure optimal performance, the upper grilling surface should be level to ensure that the upper grilling surface uniformly contacts the food. If the upper platen assembly is not level, a service technician must travel to the site to manually calibrate the grill. This requires additional cost and labor.

Hence, there is a need in the art for a grill that automatically calibrates a gap between an upper grilling surface and a lower grilling surface and that overcomes the drawbacks of the prior art.

SUMMARY OF THE INVENTION

A grill includes an upper platen assembly pivotally attached to a lower platen assembly. The lower platen assembly and the upper platen assembly each include a respective grilling surface. When the upper platen assembly is lifted by an operator to a raised position, the lower grilling surface is exposed. Food items are placed on the lower grilling surface by the operator for cooking. The upper platen assembly is pivoted

downwardly to a lowered position, positioning the food items in a gap between the lower grilling surface and the upper grilling surface.

The upper platen assembly includes three motors encased in a shell. A control operates and controls the three motors. The motors each operate independently to rotate a shaft including a disc. The upper grilling surface suspends from cables. A first end of each cable is attached to the upper grilling surface, and an opposing second end of each cable is attached to one of the discs.

The grill is automatically calibrated to ensure that the upper grilling surface is level. An operator presses a button to initiate the auto-calibration sequence. The upper grilling surface is lowered to contact the lower grilling surface. One motor is then operated to rotate the shaft, raising a portion of the upper grilling surface. A current sensor detects the current in the motor. When the upper grilling surface is slightly lifted from the lower grilling surface, the current of the motor changes. When the percent change in the current increases over a threshold value, the position of the upper grilling surface and the motor setting are stored in the control. The calibration steps are then repeated.

The calibration steps are then performed by the other two motors individually and sequentially. After the calibrations steps are performed by all three motors, the upper grilling surface is level.

The grill also automatically recognizes a food item placed on the lower grilling surface. An operator presses a button to initiate a cooking cycle. The upper grilling surface lowers towards the lower grilling surface and onto the food items. When the upper grilling surface lifts from the food items on the lower grilling surface, the current in the motors changes. When the current sensor detects that the current changes, the size of the gap between the upper grilling surface and the lower grilling surface is determined, indicating the size of the food item. Based on the size of the food item, the cooking parameters of the grill are determined.

These and other features of the present invention will be best understood from the following specification and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The various features and advantages of the invention will become apparent to those skilled in the art from the following detailed description of the currently preferred embodiment. The drawings that accompany the detailed description can be briefly described as follows:

Figure 1 schematically illustrates a perspective view of a grill of the present invention in a lowered position;

Figure 2 schematically illustrates a perspective view of the grill in a raised position;

Figure 3 schematically illustrates a perspective view of the grill in a closed position with a shell removed;

Figure 4 schematically illustrates a top view of the grill with the shell removed;

Figure 5 schematically illustrates a perspective view of a disc and a cable of a motor;

Figure 6 schematically illustrates a side view of the motor when rotating the disc in a first direction; and

Figure 7 schematically illustrates a side view of the motor when rotating the disc in a second opposite direction.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figures 1 and 2 illustrate a grill 20 in a lowered position and a raised position, respectively. The grill 20 includes a lower platen assembly 22 and an upper platen assembly 24 pivotally attached to the lower platen assembly 22 by a hinge 28. A handle 26 on the upper platen assembly 24 can be grabbed by an operator to pivot the upper platen assembly 24 relative to the lower platen assembly 22 between the lowered position and the raised position. The lower platen assembly 22 and the upper platen assembly 24 each include a respective grilling surface 30 and 32. When the upper platen assembly 24 is lifted by an operator to the raised position, the lower grilling surface 30 is exposed.

Food items 34 are placed on the lower grilling surface 30 by the operator for cooking. In one example, the food items 34 are hamburgers. The operator grabs the

handle 26 and pivots the upper platen assembly 24 downwardly to the lowered position, positioning the food item 34 in a gap 36 between the lower grilling surface 30 and the upper grilling surface 32. An arm 42 contacts the lower grilling surface 30 to provide a mechanical stop that defines the gap 36 between the upper grilling surface 32 and the lower grilling surface 30. The grilling surfaces 30 and 32 are heated by a heater (not shown) to cook the food items 34.

As shown in Figures 3 and 4, the upper platen assembly 24 includes a leveling mechanism 38 that automatically levels the upper grilling surface 32 relative to the lower grilling surface 30. The leveling mechanism 38 includes three motors 46a, 46b and 46c encased in a shell 44 (shown in Figures 1 and 2). Each of the motors 46a, 46b and 46c operate independently to level a portion of the upper grilling surface 32. A control 78 independently controls the three motors 46a, 46b and 46c. Although three motors 46a, 46b and 46c are illustrated and described, it is to be understood that any number of motors 46a, 46b and 46c can be used. The motors 46a, 46b and 46c each operate to rotate a shaft 48a, 48b and 48c, respectively. Each shaft 48a, 48b and 48c rotates a respective disc 52a, 52b and 52c having a respective groove 54a, 54b and 54c.

The upper grilling surface 32 suspends from cables 58a, 58b and 58c. A first end 60a, 60b and 60c of each cable 58a, 58b and 58c, respectively, is attached to an upper surface 88 of the upper grilling surface 32 by an attachment member 62a, 62b and 62c, respectively. As shown in Figure 5, an opposing second end 64a, 64b and 64c of each cable 58a, 58b and 58c is attached in the grooves 54a, 54b and 54c, respectively, of the disc 52a, 52b and 52c, respectively, such that a portion of each of the cables 58a, 58b and 58c is received in a groove 54a, 54b and 54c, respectively. Although cables 58a, 58b and 58c are illustrated and described, it is to be understood that metal drive belts can be employed.

Returning to Figure 4, the cable 58a is attached near a first corner 66 of the upper grilling surface 32 with the attachment member 62a, and the cable 58b is attached near a second corner 68 of the upper grilling surface 32 with the attachment member 62b. An edge 70 is located between the first corner 66 and the second corner 68. The third cable 58c is attached to the upper grilling surface 32 with the attachment member 62c at a location between a third corner 72 and a fourth corner 74 of the upper grilling surface 32.

In one example, the attachment member 62c is substantially centrally between the third corner 72 and the fourth corner 74. An edge 76 opposite to the edge 70 is located between the third corner 72 and the fourth corner 74. Therefore, the cables 58a, 58b and 58c are attached to the upper grilling surface 32 in a substantially triangular pattern. However, it is understood that any configuration of the cables 58a, 58b and 58c is possible. Each of the motors 46a, 46b and 46c independently move and level a portion of the upper grilling surface 32 that is near the respective attachment members 62a, 62b and 62c.

As shown in Figure 6, as the motor 46a rotates the disc 52a in a first direction A, the cable 58a lengthens, lowering the upper grilling surface 32 toward the lower grilling surface 30. As shown in Figure 7, as the motor 46a rotates the disc 52a in an opposing second direction B, the cable 58a shortens and wraps around the disc 52a, raising the upper grilling surface 32 away from the lower grilling surface 30. Although only the motor 46a, the disc 52a and the cable 58a are illustrated and described, the motors 46b and 46c, the discs 52b and 52c and the cables 58b and 58c operate in a similar manner.

The grill 20 is automatically calibrated to ensure that the gap 36 is maintained at the desired size between the lower grilling surface 30 and the upper grilling surface 32. By calibrated, it is meant that the upper grilling surface 32 is level relative to the lower grilling surface 30 to ensure proper cooking of the food items 34 in the grill 20. In one example, the grill 20 is calibrated daily. If the upper grilling surface 32 becomes unlevel during the day, the calibration steps performed the following day will correct this. However, if the operator notices that the upper grilling surface 32 has become unlevel during use of the grill 20, for example by observing the quality or appearance of the food items 34, the operator can press a button 84 to initiate the auto-calibration sequence, as described below.

When the grill 20 is first used on a given day, an operator presses the button 84 to initiate the auto-calibration sequence that levels the upper grilling surface 32. The button 84 communicates with the control 78. The control 78 sends a signal for the motors 46a, 46b and 46c to rotate the respective shafts 48a, 48b and 48c in the direction A, lengthening the respective cables 58a, 58b and 58c and lowering the upper grilling

surface 32 onto the lower grilling surface 30, providing a hard stop for the upper grilling surface 32 and providing slack in the cables 58a, 58b and 58c.

A current sensor 80 detects the current in the windings of each of the motors 46a, 46b and 46c. In one example, the current sensor 80 is a Hall-Effect sensor. However, it is to be understood that any type of sensor can be employed. When the upper grilling surface 32 raises and lifts from the lower grilling surface 30, the weight of the upper grilling surface 32 is transferred from the lower grilling surface 30 to the cables 58a, 58b and 58c. When the cables 58a, 58b and 58c begin to sustain the weight of the upper grilling surface 32, the tension in the cables 58a, 58b and 58c increases and therefore the current in the windings of the motor 46a, 46b and 46c changes.

After the upper grilling surface 32 is lowered onto the lower grilling surface 30, one motor 46a is operated to rotate the shaft 48a in the direction B, wrapping the cable 58a around the disc 52a to shorten and remove any slack in the cable 58a and raise the upper grilling surface 32. As the shaft 48a rotates and the upper grilling surface 32 is lifted, the current of the windings of the motor 46a is detected by the current sensor 80. As the upper grilling surface 32 is lifted, the current is detected at each location of the upper grilling surface 32. When the current sensor 80 detects a change in the current in the windings of the motor 46a, this indicates that the upper grilling surface 32 has lifted from the lower grilling surface 30. When the percent change in the current increases over a threshold level, the settings of the motor 46a and the location of the upper grilling surface 32 are stored in the control 78.

The calibration steps are then repeated. The motor 46a rotates the shaft 48a in the direction A to lower the upper grilling surface 32 onto the lower grilling surface 30. The motor 46a is again operated to rotate the shaft 48a in the direction B, wrapping the cable 58a around the disc 52a to shorten and remove any slack in the cable 58a. The current of the windings of the motor 46a is detected by the current sensor 80. When the percent change in the current increases over a threshold level, the settings of the motor 46a and the location of the upper grilling surface 32 are stored in the control 78 and compared to the settings of the motor 46a and the location of the upper grilling surface 32 previously stored in the control 78. If the settings of the motor 46a and the location of the upper grilling surface 32 match within a given range, these values are stored and indicate the

calibration settings of the motor 46a. If the settings of the motor 46a and the location of the upper grilling surface 32 do not match, the calibration steps are repeated until they do match within a given range to settings determined in the previous set of calibration steps. By repeating the calibrating steps more than once, accurate calibration can be ensured.

Although it has been disclosed that the calibration settings of the motor 46a are determined by detecting a percent change in the current over a threshold level, it is to be understood that the calibration settings of the motor 46a can be determined by detecting a specific current or an average current.

The calibration steps performed by the motor 46a are then repeated by the motors 46b and 46c individually and sequentially. Although the motor 46a is described as performing the calibration steps first, it is to be understood that the motors 46a, 46b and 46c can perform the calibration steps in any order. Before each motor 46a, 46b and 46c performs the calibration steps, the upper grilling surface 32 is lowered onto the lower grilling surface 30. After all the motors 46a, 46b and 46c perform the calibration steps, the calibration settings of each of the motors 46a, 46b and 46c that result in the leveling of the upper grilling surface 32 are stored in the control 78. A calibration point of the upper grilling surface 32 is defined when each of the motors 46a, 46b operate in the calibration settings, resulting in the upper grilling surface 32 being level. Alternately, the motors 46a, 46b and 46c are calibrated at the same time.

Additionally, the grill 20 automatically recognizes a food item 34 that is to be cooked in the grill 20. After the food item 34 is placed on the lower grilling surface 30, the operator grabs the handle 26 to lower the upper platen assembly 24 or presses a button 86 to initiate a cooking cycle. The button 86 communicates with the control 78. The control 78 actuates the motors 46a, 46b and 46c to lower the upper grilling surface 32 towards the lower grilling surface 30. The upper grilling surface 32 lowers to a pre-determined location and compresses the food items 34 between the upper grilling surface 32 and the lower grilling surface 30 to sear the food items 34.

The motors 46a, 46b and 46c are then operated to rotate the respective shafts 48a, 48b and 48c in the direction B, wrapping the respective cables 58a, 58b and 58c around the respective discs 52a, 52b and 52c to shorten and remove the slack in the cables 58a, 58b and 58c and raise the upper grilling surface 32. As the shafts 48a, 48b and 48c

rotate, the current of the windings of the motors 46a, 46b and 46c is detected by the current sensor 80.

When the current sensor 80 detects that the percent change in the current of the windings of the motors 46a, 46b and 46c increases over a threshold level, this indicates that the upper grilling surface 32 has lifted from the food items 34. The control 78 determines the size of the gap 36 between the upper grilling surface 32 and the lower grilling surface 30 based the settings of the motor 46a, 46b and 46c and the calibration point. The size of the gap 36 indicates the size of the food item 34. Based on the size of the food item 34, the cooking parameters of the grill 20 are determined. The cooking parameters are programmed into the control 78. For example, based on the size of the gap 36, the cooking time, the cooking temperature and the size of the gap 36 during cooking of the food items 34 are determined. The control 78 sets the temperature of the heaters on the upper grilling surface 32 and the lower grilling surface 30, the size of the gap 36 between the upper grilling surface 32 and the lower grilling surface 30, and the cooking time. After the cooking time has passed, the upper platen assembly 24 raises, allowing an operator to remove the food items 34 from the lower grilling surface 30.

Alternately, the size of the gap 36 is determined by detecting when the upper grilling surface 32 contacts the food item 34 based on the detected current.

The foregoing description is only exemplary of the principles of the invention. Many modifications and variations are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims, the invention may be practiced otherwise than using the example embodiments which have been specifically described. For that reason the following claims should be studied to determine the true scope and content of this invention.

CLAIMS

What is claimed is:

1. A grill comprising:
a lower platen assembly including a lower grilling surface;
an upper platen assembly pivotally attached to the lower platen assembly, wherein the upper platen assembly includes an upper grilling surface; and
a leveling mechanism to automatically level the upper grilling surface relative to the lower grilling surface, wherein the leveling mechanism includes a plurality of motors that each independently move a portion of the upper grilling surface to level the upper grilling surface.
2. The grill as recited in claim 1 wherein the leveling mechanism includes a control that independently controls each of the plurality of motors.
3. The grill as recited in claim 1 wherein each of the plurality of motors includes a rotatable shaft having an end, wherein a disc is attached to the end of the shaft.
4. The grill as recited in claim 3 wherein the leveling mechanism includes a cable associated with each of the plurality of motors having a first end and a second end, wherein the first end of each of the cables is attached to one of the discs and the second end of each of the cables is attached to the upper grilling surface, wherein the upper grilling surface is suspended from the cables.
5. The grill as recited in claim 4 further including a current sensor that senses current in each of the plurality of motors.

6. The grill as recited in claim 5 further including a control that independently controls each of the plurality of motors,

wherein, when the leveling mechanism is activated, the plurality of motors lower the upper grilling surface onto the lower grilling surface,

wherein each of the plurality of motors sequentially raises the portion of the upper grilling surface and the current in each of the plurality of motors changes when the upper grilling surface lifts from the lower grilling surface,

wherein the current sensor detects a change in the current, and

wherein calibration settings of each of the plurality of motors when the current sensor detects that the change in the current is over a threshold value are stored in the control to define a calibration point.

7. The grill as recited in claim 5 wherein food is grilled in a gap between the lower grilling surface and the upper grilling surface, the current in each of the plurality of motors changes when the upper grilling surface lifts from the food, the current sensor detects the change in the current, and a size of the gap is determined to recognize the food and determine cooking parameters.

8. The grill as recited in claim 7 wherein the cooking parameters are one of a cooking time, a cooking temperature and a gap distance.

9. The grill as recited in claim 4 wherein the rotatable shaft rotates in a first direction to lengthen each of the cables to lower the upper grilling surface towards the lower grilling surface and the rotatable shaft rotates in an opposing second direction to shorten each of the cables to raise the upper grilling surface relative to the upper grilling surface.

10. The grill as recited in claim 4 wherein the plurality of motors comprise three motors, and the cables are attached to the upper grilling surface in a substantially triangular configuration.

11. The grill as recited in claim 1 further including a button that is pressed by an operator to activate the leveling mechanism to automatically level the upper grilling surface relative to the lower grilling surface.

12. A grill comprising:

- a lower platen assembly including a lower grilling surface;
- an upper platen assembly pivotally attached to the lower platen assembly, wherein the upper platen assembly includes an upper grilling surface; and
- a leveling mechanism to automatically level the upper grilling surface relative to the lower grilling surface, wherein the leveling mechanism includes:
 - a plurality of motors that each independently move a portion of the upper grilling surface to level the upper grilling surface relative to the lower grilling surface, wherein each of the plurality of motors includes a rotatable shaft having an end, wherein a disc is attached to the end of the shaft,
 - a cable associated with each of the plurality of motors having a first end and a second end, wherein the first end of each of the cables is attached to one of the discs and the second end of each of the cables is attached to the upper grilling surface, wherein the upper grilling surface is suspended from the cables,
 - a control that independently controls each of the plurality of motors, and
 - a current sensor that senses current in each of the plurality of motors.

13. The grill as recited in claim 12
wherein, when the leveling mechanism is activated, the plurality of motors lower the upper grilling surface onto the lower grilling surface,
wherein each of the plurality of motors sequentially raises the portion of the upper grilling surface and the current in each of the plurality of motors changes when the upper grilling surface lifts from the lower grilling surface,
wherein the current sensor detects a change in the current, and
wherein calibration settings of each of the plurality of motors when the current sensor detects that the change in the current is over a threshold value are stored in the control to define a calibration point.

14. The grill as recited in claim 12 wherein food is grilled in a gap between the lower grilling surface and the upper grilling surface, the current in each of the plurality of motors changes when the upper grilling surface lifts from the food, the current sensor detects the change in the current, and a size of the gap is determined to recognize the food and determine cooking parameters.

15. The grill as recited in claim 14 wherein the cooking parameters are one of a cooking time, a cooking temperature and a gap distance.

16. A method of calibrating a grill comprising the steps of:
lowering an upper grilling surface of an upper platen assembly onto a lower grilling surface of a lower grilling assembly; and
automatically leveling the upper grilling surface relative to the lower grilling surface with a leveling mechanism, wherein the leveling mechanism includes a plurality of motors that each move a portion of the upper grilling surface.

17. The method as recited in claim 16 wherein the step of automatically leveling the upper grilling surface includes:

- lowering the upper grilling surface onto the lower grilling surface,
- operating each of the plurality of motors independently and sequentially to raise the portion of the upper grilling surface,
- detecting a current in the each of the plurality of the motors,
- determining when a change in the current is over a threshold value,
- storing calibration settings of the each of the plurality of motors when the change in the current is over the threshold value, and
- employing the calibration settings of each of the plurality of motors to determine a calibration point of the upper grilling surface that levels the upper grilling surface relative to the lower grilling surface.

18. The method as recited in claim 17 further including the step of repeating the step of automatically leveling the upper grilling surface for each of the plurality of motors.

19. The method as recited in claim 16 further including the steps of:

- placing food on the lower grilling surface,
- lowering the upper grilling surface onto the food,
- detecting a change in current when the upper grilling surface lifts from the food,
- determining a size of a gap between the upper grilling surface and the lower grilling surface when the upper grilling surface contacts the food, and
- determining cooking parameters based on the size of the gap.

20. The method as recited in claim 19 wherein the cooking parameters are one of a cooking time, a cooking temperature and a gap distance.

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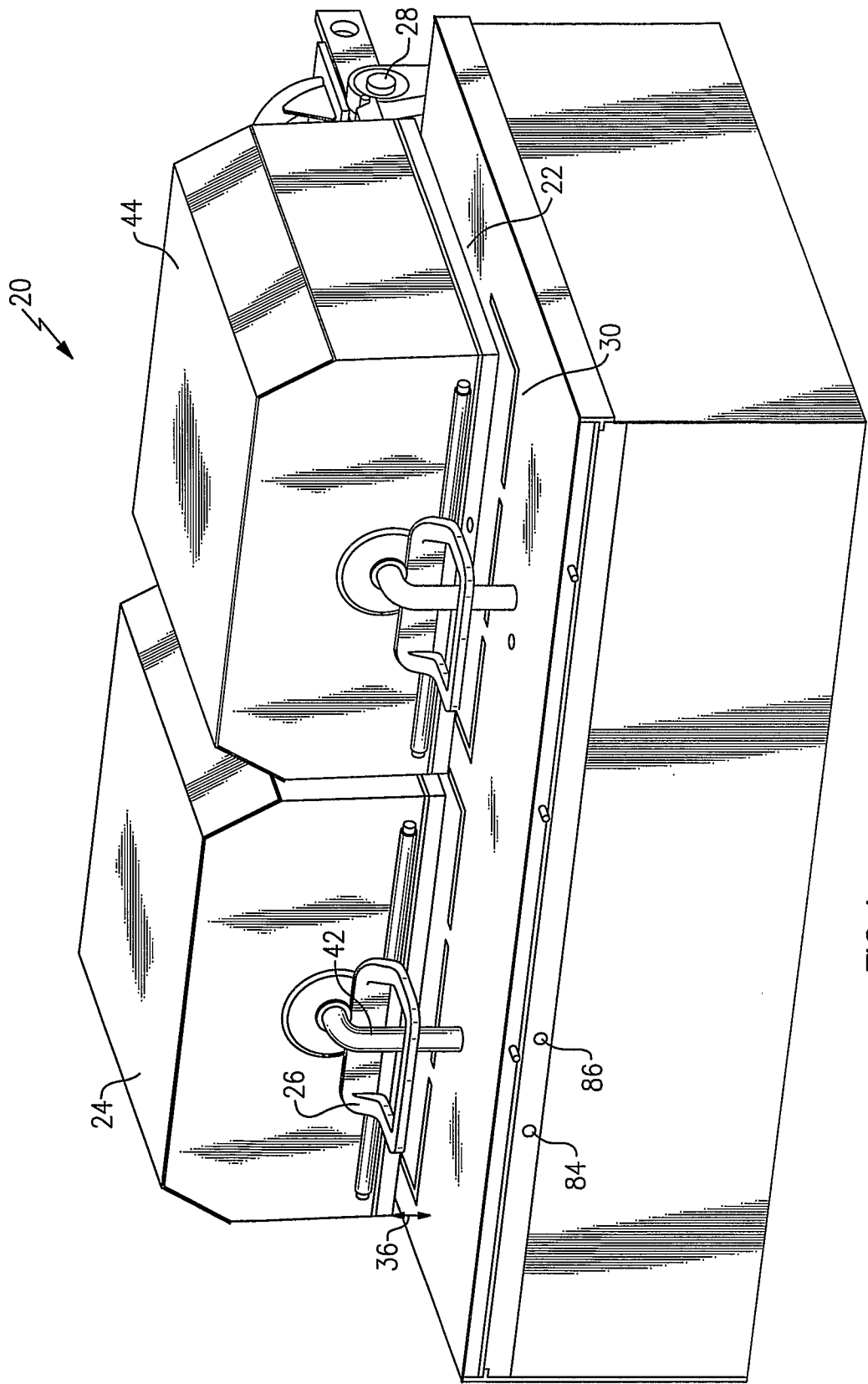


FIG. 1

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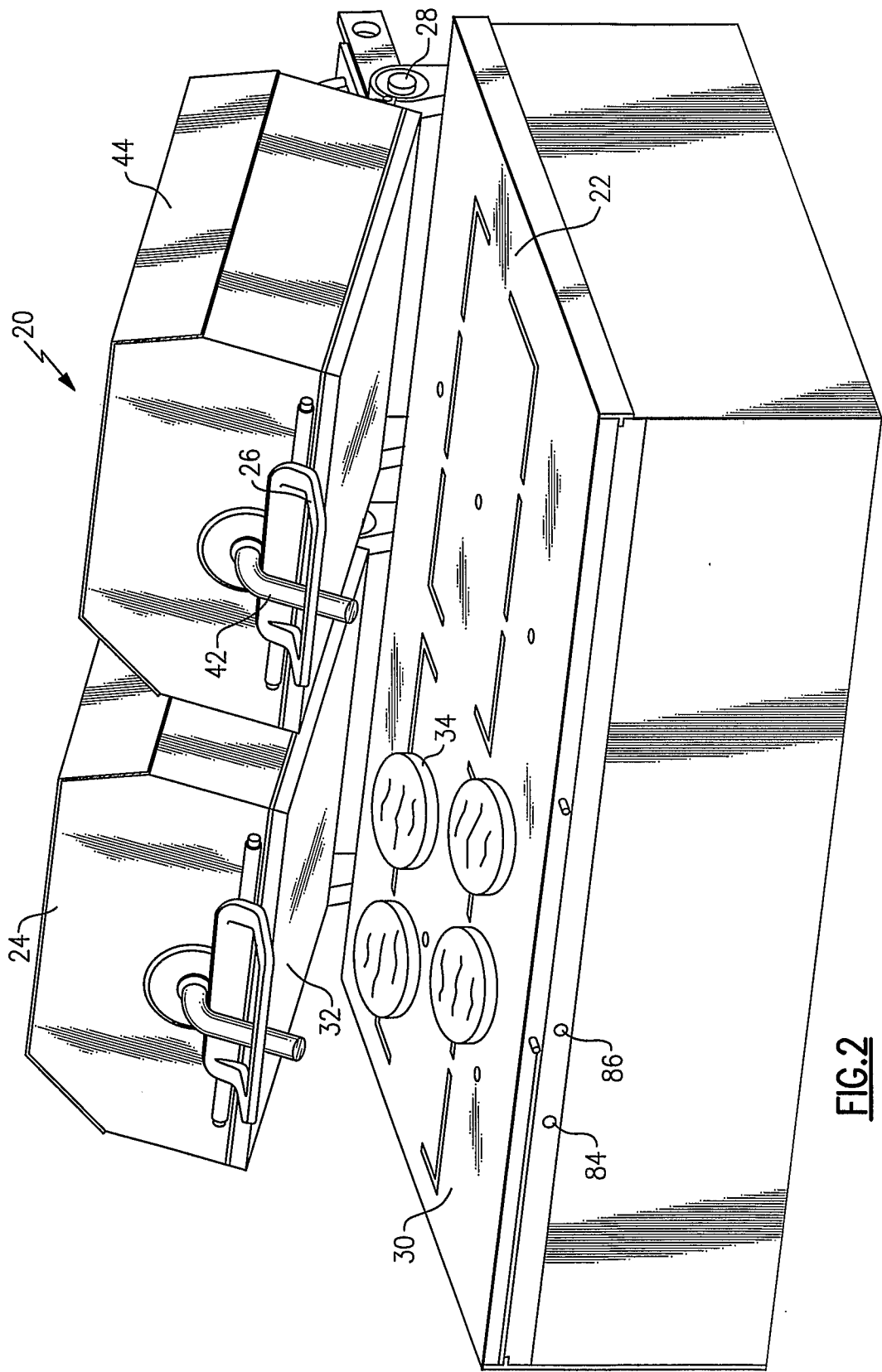


FIG. 2

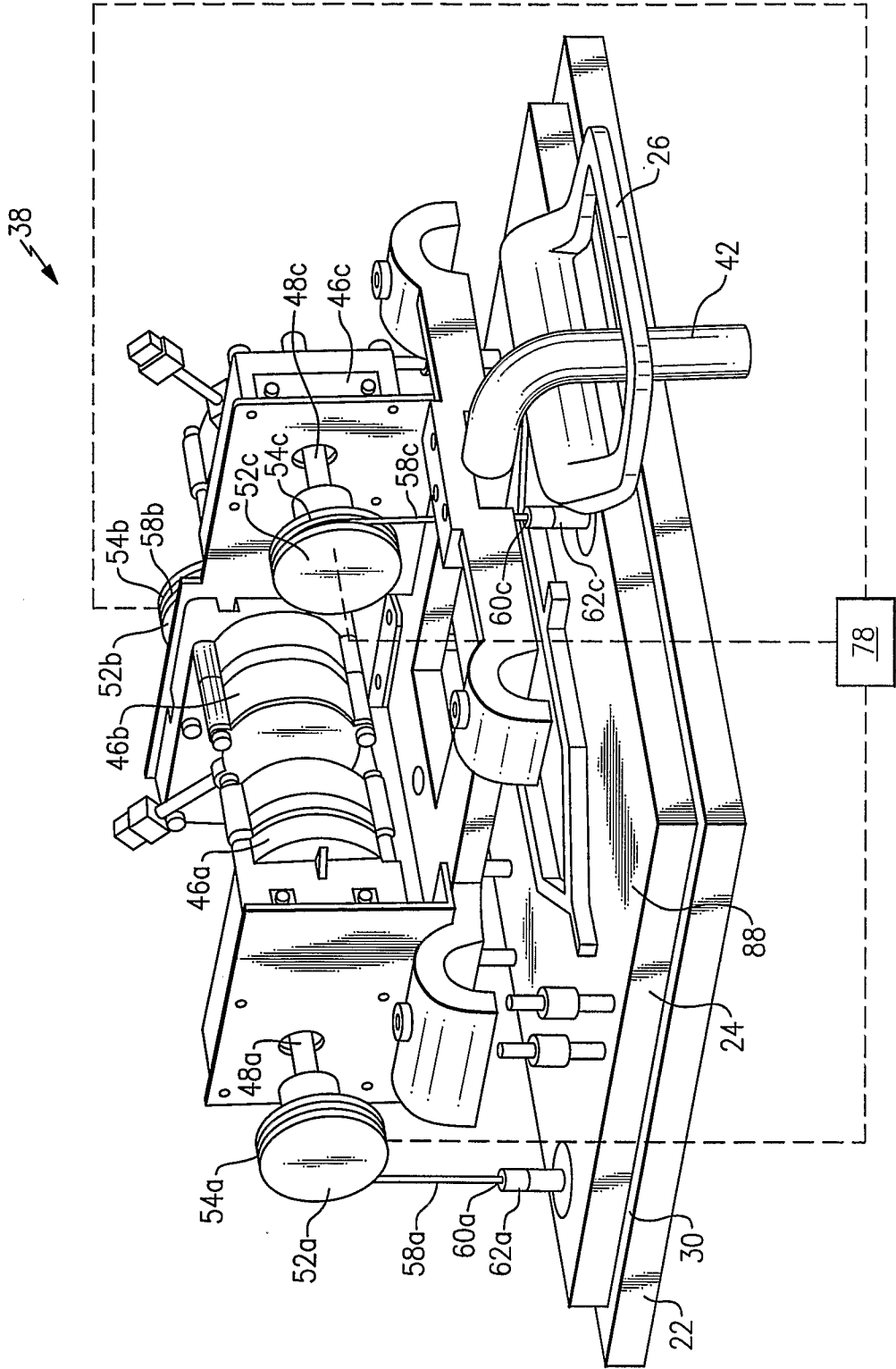


FIG. 3

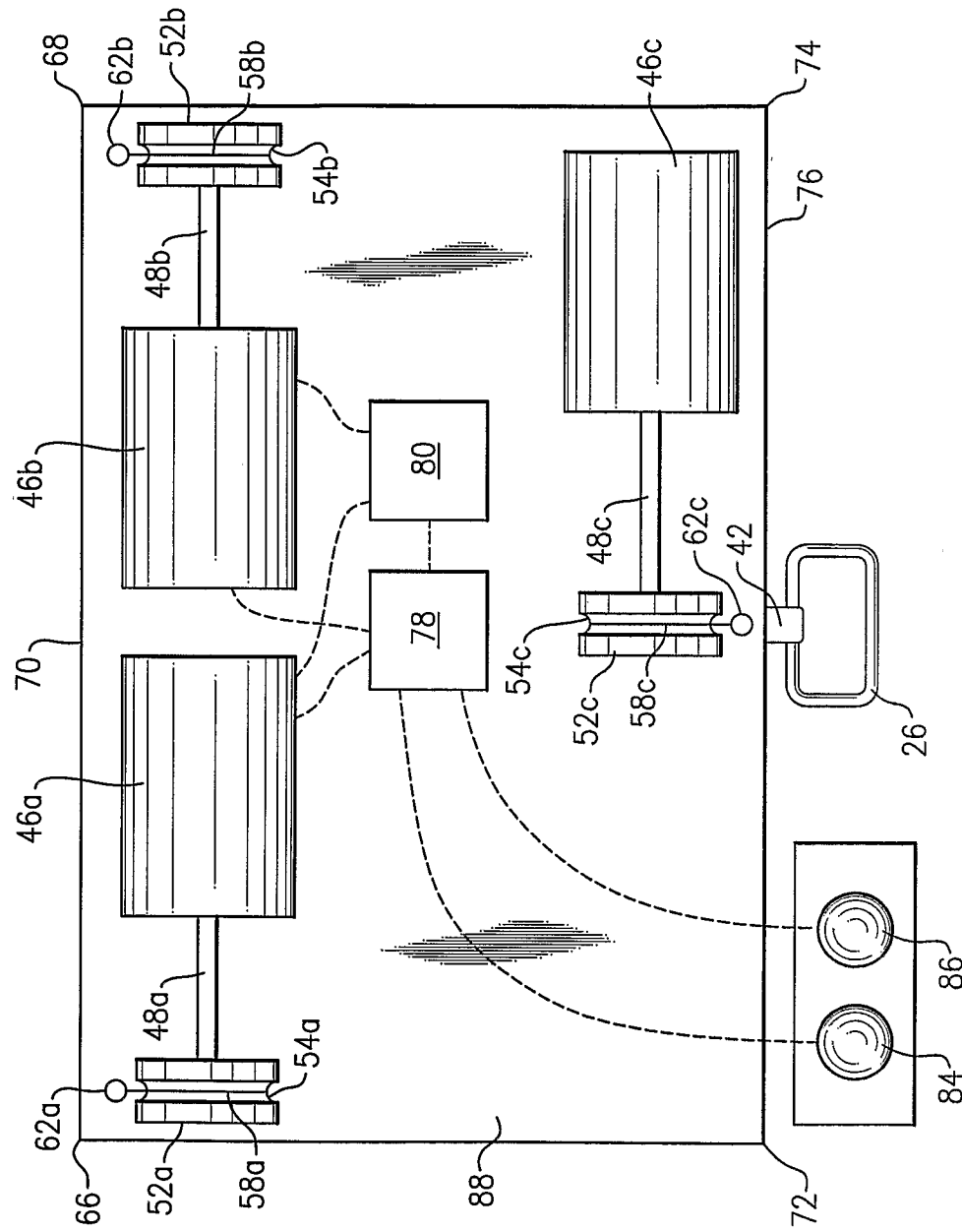


FIG. 4

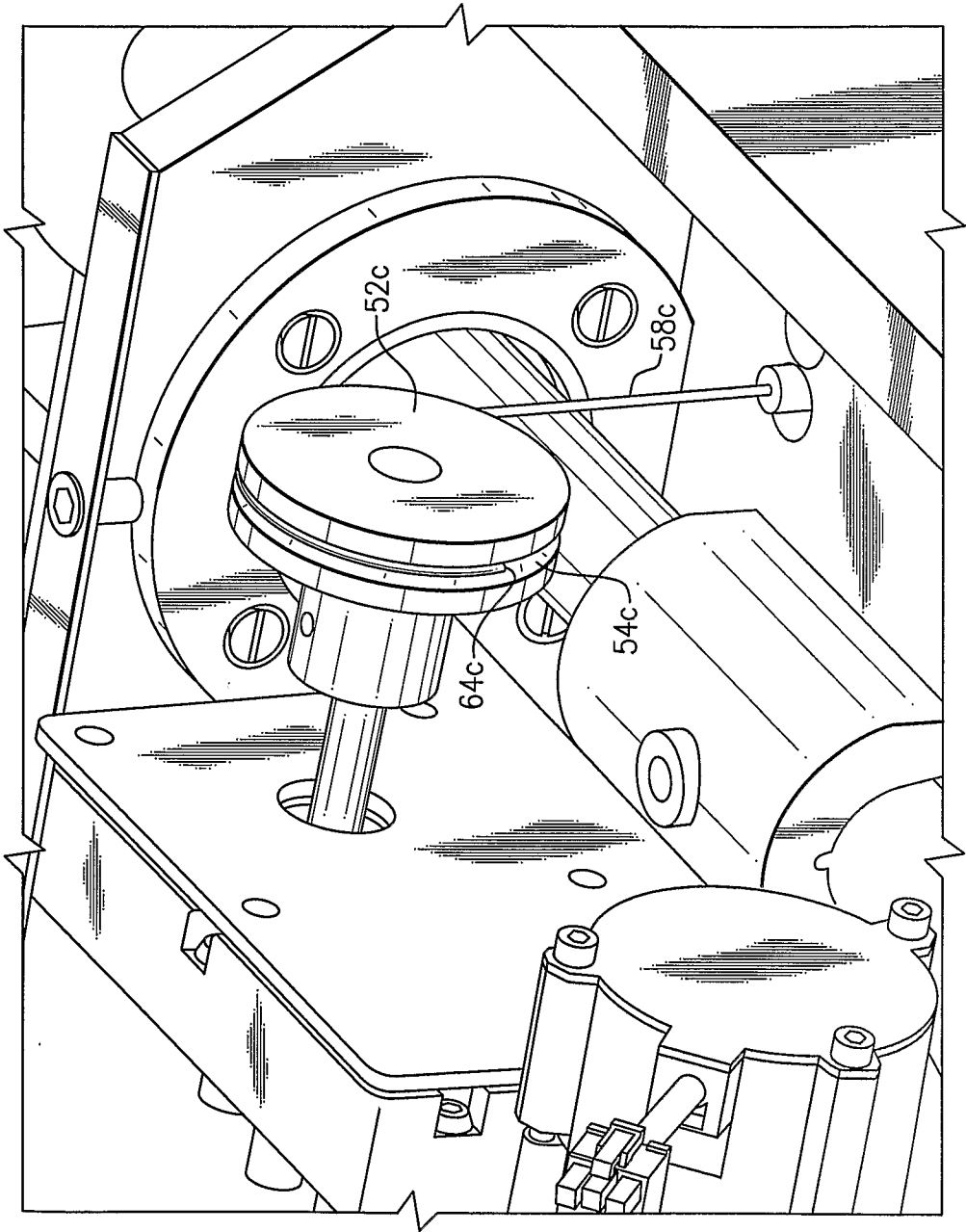


FIG. 5

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FIG.7

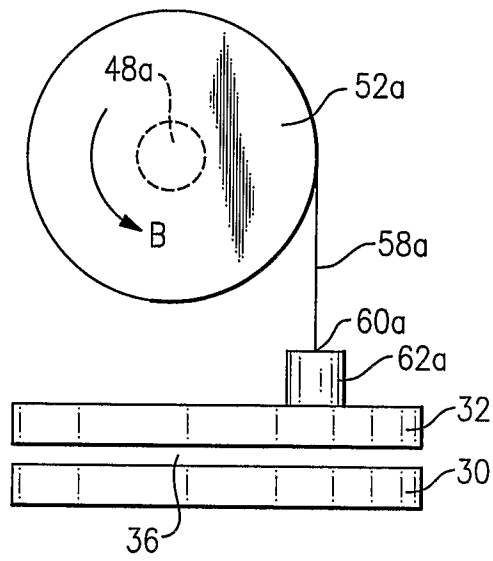
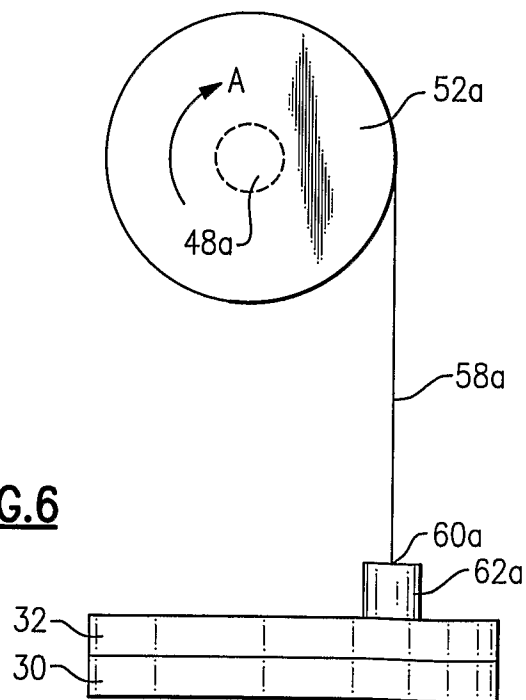


FIG.6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US06/15157

A. CLASSIFICATION OF SUBJECT MATTER

IPC: A47J 37/00(2006.01)
A23L 1/00(2006.01)

USPC: 99/349

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 99/349-351, 372-380, 444-450, 352-355

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,257,126 B1 (VELJKOVIC, et al) 10 July 2001 (10.07.2001), entire document.	1-15
A	US 6,467,400 B2 (RAIO et al) 22 October 2002 (22.10.2002), entire document.	1-20
A	US 6,539,839 B1 (TIPPMANN) 01 April 2003 (01.04.2003), entire document.	16-20



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Date of the actual completion of the international search

28 June 2006 (28.06.2006)

Date of mailing of the international search report

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