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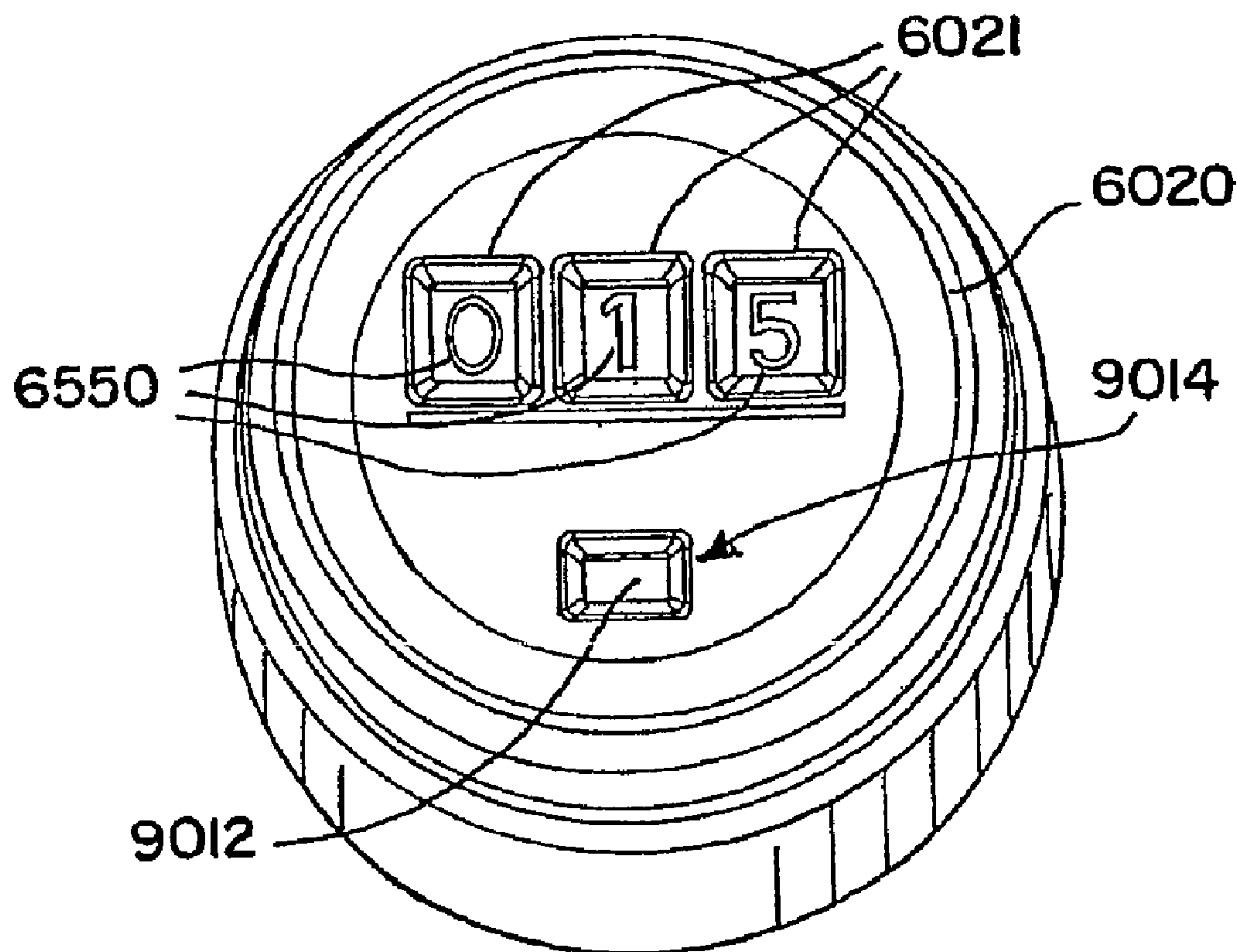
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(54) Titre : DISPOSITIF INDICATEUR A INDICATEUR DE DOSAGE D'ALARME

(54) Title: INDICATING DEVICE WITH WARNING DOSAGE INDICATOR



(57) Abrégé/Abstract:

An indicating device suitable for indicating the number of dosages of a substance that have been dispensed from or remain in a container includes at least one first indicator member incrementally moveable to a plurality of positions and a second indicator



(57) Abrégé(suite)/Abstract(continued):

member moveable in response to a predetermined number of movements of the at least one first indicator member. The at least one first indicator member includes primary dosage indicia adapted to indicate the number of dosages of substance that have been dispensed from or remain in the container. The second indicator member includes secondary dosage indicia adapted to indicate that less than a minimum predetermined number of dosages of substance remain in the container. In one preferred embodiment, the primary dosage indicia are configured as numerical indicia and the secondary dosage indicia are configured as color indicia. In another aspect, a device for dispensing dosages of a substance includes a dispenser housing and a container disposed in the dispenser housing. The indicating device is located adjacent to and is actuated by one or the other of the top or bottom of the container. A method for indicating the number of metered dosages of medicaments dispensed from or remaining in the container is also provided.

Abstract:

An indicating device suitable for indicating the number of dosages of a substance that have been dispensed from or remain in a container includes at least one first indicator member incrementally moveable to a plurality of positions and a second indicator member moveable in response to a predetermined number of movements of the at least one first indicator member. The at least one first indicator member includes primary dosage indicia adapted to indicate the number of dosages of substance that have been dispensed from or remain in the container. The second indicator member includes secondary dosage indicia adapted to indicate that less than a minimum predetermined number of dosages of substance remain in the container. In one preferred embodiment, the primary dosage indicia are configured as numerical indicia and the secondary dosage indicia are configured as color indicia. In another aspect, a device for dispensing dosages of a substance includes a dispenser housing and a container disposed in the dispenser housing. The indicating device is located adjacent to and is actuated by one or the other of the top or bottom of the container. A method for indicating the number of metered dosages of medicaments dispensed from or remaining in the container is also provided.

INDICATING DEVICE WITH WARNING DOSAGE INDICATOR

This application claims the benefit of U.S. Provisional Application Serial No. 60/515,316, filed October 28, 2003, the entire disclosure of which is hereby incorporated herein by reference.

5 BACKGROUND

The present invention relates generally to an indicating device for indicating the number of dosages that have been dispensed from or remain in a container, and in particular, to an indicating device having at least a first and second indicator member with primary and secondary dosage indicia respectively.

10 Aerosol dispensing devices have been developed that include a dose indicating device to indicate the number of metered doses that have been dispensed from the device, or to indicate the number of doses remaining therein. For example, patients have certain conditions that can be treated with medicaments dispensed in an aerosol and administered to the patient by inhalation. In one format, the aerosol with medicaments are contained in a container, and dispensed in metered, or measured, dosages with an inhalation device, or actuator boot. In such an arrangement, it can be important for the patient to be able to ascertain the number of metered doses remaining in the container, either by an indication of the number remaining therein or by knowledge of the number already dispensed therefrom, such that the patient is not caught unaware with an empty container when in need of the medicament. Thus, it may be important for the inhalation device to provide an accurate indication of either the number of doses remaining in the container, or the number of doses already dispensed therefrom.

25 Typically, a conventional aerosol container includes a body and a valve stem that can be depressed relative to the body so as to emit the metered dose of aerosol and medicament. The container typically is supplied with a predetermined number of metered doses, generally on the order of about 30 200, such that the counting of the number of valve stem depressions, and

corresponding number of dispensed metered doses, can be directly correlated with the number of doses remaining in the container.

5 In operation, the container is typically received within a housing of the inhalation device, wherein the valve is brought into engagement with a support block in the housing. The user administers the medicament by moving the container relative to the housing so as to depress the valve stem and internal valve and thereby release a metered dose, which is typically administered to the user through a port or mouthpiece extending from the housing. After the dose is administered, the valve stem, which is typically
10 spring loaded, biases the container away from the support block so as to again move the container relative to the housing. In this way, a metered dose of medicament is administered by each cycle of linear reciprocal movement of the container relative to the housing.

Some actuator boots, or other devices attached to the medicament
15 container, have indicating devices that convert the linear reciprocal movement of the container relative to the housing into a one-way, or single-cycle, movement of an indicator, wherein the indicator identifies the relative fullness of the container, the number of metered doses remaining therein or the number of doses already administered. Although these actuator boots with
20 indicators, or separate indicator devices, have provided the advantage of generally being able to keep track of the number of dosages, there remains room for improvement.

For example, many known indicating devices provide only a numerical indication of the number of doses of substance that have been dispensed
25 from or remain in the container. As such, over the course of dispensing dozens and/or hundreds of doses of medicament, the user can become desensitized to the indicating device and may become caught unaware that the medicament in the container has been dissipated notwithstanding that the indicating device is working properly and provides an accurate accounting of
30 the number of doses of medicament dispensed from or remaining in the container.

SUMMARY

Briefly stated, in one preferred embodiment, an indicating device suitable for indicating the number of dosages of a substance that have been dispensed from or remain in a container includes at least one first indicator member moveable to a plurality of positions and a second indicator member moveable in response to a predetermined number of movements of the at least one first indicator member. The at least one first indicator member includes primary dosage indicia adapted to indicate the number of dosages of substance that have been dispensed from or remain in the container. The second indicator member includes secondary dosage indicia adapted to indicate that less than a minimum predetermined number of dosages of substance remain in the container. In one preferred embodiment, the primary dosage indicia are configured as numerical indicia and the secondary dosage indicia are configured as color indicia.

In one preferred embodiment, the at least one first indicator member includes a plurality of coaxially mounted primary indicator members rotatable about a first axis of rotation. In various preferred embodiments, the second indicating member is rotatably mounted about a second axis of rotation, or is translatably moveable within a plane.

In another aspect, a device for dispensing dosages of a substance from the container includes a dispenser housing having a longitudinally extending cavity and a well located at a bottom of said cavity. The housing has an exhaust port communicating with the well. The container includes a valve stem extending longitudinally therefrom and moveable between a closed position and an open position. The valve stem dispenses one of the plurality of dosages of substance when moved to the open position. The container is disposed in the cavity of the dispenser housing with the valve stem being received within the well. The container is reciprocally moveable within the dispenser housing along the longitudinal extend of the cavity such that the valve stem is moved between the closed and open positions by engagement with the well.

In one preferred embodiment, the valve stem extends from the top of the container and the indicating device is disposed on the bottom of the container. In another embodiment, the indicating device is disposed in the bottom of the dispenser housing cavity adjacent the top of the container.

5 A method for indicating the number of metered dosages of medicaments dispensed from or remaining in the container is also provided.

The present invention provides significant advantages over other dispensing devices and indicating devices used therewith. In particular, the second indicator member, with its secondary dosage indicia, serves as an
10 auxiliary indicator that provides the user with a warning that the container has less than a minimum predetermined number of dosages of substance remaining therein. For example and without limitation, the secondary indicia can include color indicia that changes once a predetermined number of actuations has occurred. In particular, user is provided with new indicia or
15 stimulus that draws the user's attention and alerts the user that the container may be running low in the event that the user has become desensitized to the primary dosage indicia. In this way, the user is provided with advance warning that the container is running low, so as to thereby minimize the chance that they may be caught unaware with an empty container when in
20 need of the substance, such as a medicament. Moreover, the auxiliary indicator can be incorporated with a minimal number of additional parts and is relatively robust in operation.

The foregoing paragraphs have been provided by way of general introduction, and are not intended to limit the scope of the following claims.
25 The various preferred embodiments, together with further advantages, will be best understood by reference to the following detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a top view of an indicating device having a viewing
30 window.

FIGURE 1A is a top view of the indicating device showing an alternative embodiment of the viewing window with indicia visible therethrough.

5 FIGURE 1B is a top view of the indicating device showing an alternative embodiment of the indicia.

FIGURE 2 is a side view of the indicating device being mounted to the top of a container shown in cross-section.

FIGURE 3 is a top perspective view of the indicating device with the viewing window positioned in the top of the cap member.

10 FIGURE 3A is a top perspective view of the indicating device with the viewing window positioned along a side portion of the cap member.

FIGURE 4 is a bottom perspective view of the cap member with the indicator member mounted therein.

15 FIGURE 5 is an exploded perspective view of the cap member and indicator member shown in Figure 4.

FIGURE 6 is an exploded perspective view of an alternative embodiment of the indicating device, including a base member, a cap member, an indicator member, a ratchet wheel and drive member and a spring.

20 FIGURE 7 is a bottom perspective view of the cap member and indicator member of Figure 6, with the indicator member mounted in the cap member.

25 FIGURE 8 is an enlarged partial view of the indicator member and cap member of Figure 7 showing an engagement of the indicator member by the cap member.

FIGURE 9 is a bottom perspective assembly view of the cap member, indicator member, ratchet wheel, drive member and spring shown in Figure 6.

30 FIGURE 10 is an exploded perspective view of the base member and the cap member with the drive mechanism and indicator member mounted therein.

FIGURE 11 is a perspective assembly view of the indicating device shown in Figure 10.

FIGURE 12 is a cross-sectional view of the indicating device taken along line 12-12 of Figure 11, wherein the cap member is in a fully extended position relative to the base member prior to the application of an axial force by the user.

FIGURE 13 is a cross-sectional view of the indicating device similar to Figure 12 but with the cap member shown as moving toward the base member at an intermediate position of the stroke as indicated by the directional arrows.

FIGURE 14 is a cross-sectional view of the indicating device similar to Figure 12 but with the cap member reaching the bottom of the stroke as indicated by the directional arrows.

FIGURE 15 is a cross-sectional view of the indicating device similar to Figure 12 showing the cap member as it returns to the fully extended position relative to said base member as indicated by the directional arrows.

FIGURE 16 is a cross-sectional view of the indicating device taken through the middle of the indicating device and showing engagement members disposed in pockets formed in the base member.

FIGURE 17 is a cross-sectional view of the indicating device taken through the middle of the indicating device and showing an alternative return mechanism for the cap member.

FIGURE 18 is a bottom view of the assembly of Figure 9 (without the spring) at initial setting before a first actuation of the indicator device and container.

FIGURE 19 is a cross-sectional view taken along line 19-19 of Figure 18.

FIGURE 20 is a bottom view of the assembly of Figure 9 (without the spring) after the ratchet wheel and drive member have completed one revolution corresponding to a predetermined number of actuations.

FIGURE 21 is a cross-sectional view taken along line 21-21 of Figure 20.

FIGURE 22 is an enlarged partial bottom view of the cap member and indicator member showing the indicator member having an indexing member engaging an indentation formed on the cap member.

5 FIGURE 23 is a side view of an alternative embodiment of the indicating device.

FIGURE 24 is a top view of the indicating device shown in Figure 23.

FIGURE 25 is a cross-section view of the indicating device taken along line 25-25 of Figure 24.

10 FIGURE 26 is a cross-section view of the indicating device taken along line 26-26 of Figure 23.

FIGURE 27 is a perspective view of an indicating device with a reset device.

FIGURE 28 is a perspective view of an indicating device with an alternative embodiment of the reset device.

15 FIGURE 29 is an exploded view of an alternative embodiment of the indicating device with an alternative embodiment of the reset device and an adapter.

FIGURE 30 is a bottom perspective view of the indicating device and adapter shown in Figure 29.

20 FIGURE 31 is an exploded side view of an indicating device and adapter being applied to the bottom of a container supported in a dispenser housing shown in cross-section.

25 FIGURE 32 is a side view of an indicating device having an adapter applied to the bottom of a container supported in a dispenser housing shown in cross-section.

FIGURE 33 is a side view of the indicator member and a lock member in a disengaged position.

FIGURE 34 is a bottom view of the indicator member and lock member shown in Figure 33.

30 FIGURE 35 is a side view of the indicator member and lock member in an engaged position.

FIGURE 36 is a bottom view of the indicator member and lock member shown in Figure 35.

FIGURE 37 is a perspective view of an alternative embodiment of an indicating device having at least one indicator member with dosage indicia
5 and an indicator member with usage indicia.

FIGURE 38 is an exploded perspective view of the indicating device shown in Figure 37.

FIGURE 39 is a bottom perspective view of the cap member shown in Figure 38.

10 FIGURE 40 is a bottom perspective view of a dosage indicator member shown in Figure 38.

FIGURE 41 is a top perspective view of a usage indicator member shown in Figure 38.

15 FIGURE 42 is a perspective view of a drive assembly and dosage indicator member shown in Figure 38.

FIGURE 43 is a perspective view of the reset member shown in the indicating device shown in Figure 38.

20 FIGURE 44 is an exploded perspective view of an alternative embodiment of an indicating device having indicator members with dosage indicia and an indicator member with usage indicia.

FIGURE 45 is a bottom perspective view of the cap member shown in Figure 44 with a usage indicator member installed therein and a dosage indicator member exploded out therefrom.

25 FIGURE 46 is a bottom perspective view of a dosage indicator member shown in Figure 44.

FIGURE 47 is a perspective view of a reset assembly shown in Figure 44.

FIGURE 48 is a perspective view of the drive member shown in Figure 44.

30 FIGURE 49 is a bottom perspective view of the usage indicator member shown in Figure 44.

FIGURE 50 is a top perspective view of the usage indicator member shown in Figure 44.

FIGURE 51 is a bottom perspective view of the cap member shown in Figure 44.

5 FIGURE 52 is a cut-away perspective view of the reset member shown in Figure 44 with the drive member in a disengaged position.

FIGURE 53 is a cut-away perspective view of the reset member shown in Figure 44 with the drive member in the engaged reset position.

10 FIGURE 54 is a side view of a first and second dosage indicator member with the reset member and drive member in a disengaged position.

FIGURE 55 is a side view of a first and second dosage indicator member with the reset member and drive member in an engaged reset position.

15 FIGURE 56 is a top perspective view of a first and second dosage indicator member, a usage indicator member and a drive assembly.

FIGURE 57 is a bottom perspective view of the base member shown in Figure 38.

20 FIGURE 58 is a bottom exploded perspective view of one preferred embodiment of the base member, indicator member, drive member and ratchet wheel.

FIGURE 59 is a bottom perspective assembly view of one preferred embodiment of the indicator member, drive member and ratchet wheel during the completion of a final predetermined actuation.

25 FIGURE 60 is a bottom perspective assembly view of the embodiment of the indicator member, drive member and ratchet wheel shown in FIG. 59 following the completion of the final predetermined actuation.

30 FIGURE 61 is a cross-sectional view of the indicating device, wherein the cap member is in a fully extended position relative to the base member immediately after the application of a final predetermined actuation of the container by the user.

FIGURE 62 is a cross-sectional view of the indicating device similar to FIG. 61, but with the cap member shown as moving toward the base member

in an intermediate position of the next downward stroke of the cap member after the final predetermined actuation of the container as indicated by the directional arrows.

5 FIGURE 63 is a cross-sectional view of the indicating device similar to FIG. 61, but with the cap member shown as it returns to the fully extended position relative to the base on subsequent strokes of the cap member after the final predetermined actuation of the container.

10 FIGURE 64 is a cross-sectional view of the indicating device similar to FIG. 61, but with the cap member shown as moving toward the base member in an intermediate position during subsequent strokes of the cap member after the final predetermined actuation of the container as indicated by the directional arrows.

15 FIGURE 65 is a cross-sectional view of the indicating device showing the drive member engaging the indicator member as the cap member is moved toward the base member during the final predetermined actuation of the container as indicated by the directional arrows.

20 FIGURE 66 is a cross-sectional view of the indicating device similar to FIG. 65, but with the cap member shown as it returns to the fully extended position relative to the base after the final predetermined actuation of the container.

FIGURE 67 is a cross-sectional view of the indicating device, wherein the cap member is in a fully extended position relative to the base member immediately after the application of a final predetermined actuation of the container by the user.

25 FIGURE 68 is a cross-sectional view of one preferred embodiment of an indicating device with first and second lock members engaged after the final predetermined actuation of the container.

30 FIGURE 69 is a cross-sectional view of another preferred embodiment of the indicating device with first and second lock members engaged after the final predetermined actuation of the container.

FIGURE 70 is a perspective view of a dispensing device with a viewing window revealing dosage indicia.

FIGURE 71 is a perspective view of one embodiment of the dispensing device with a portion of the housing cut away.

FIGURE 72 is a perspective view of one embodiment of the indicator assembly.

5 FIGURE 73 is a perspective view of an alternative embodiment of the dispensing device.

FIGURE 74 is a perspective view of the dispensing device shown in Figure 73 with a portion of the housing cut away.

10 FIGURE 75 is a perspective view of a container, a dispenser housing and one embodiment of an indicator module with a portion of the housing cut away.

FIGURE 76 is an exploded perspective view of a container, a dispenser housing and one embodiment of the indicator module with a portion of the housing cut away.

15 FIGURE 77 is an exploded perspective view of one embodiment of the indicator module.

FIGURE 78 is an exploded perspective view of the indicator module from the opposite side as shown in Figure 77.

20 FIGURE 79 is an exploded perspective view of a container, and an alternative embodiment of the dispenser housing and the indicator module.

FIGURE 80 is a perspective view of the alternative embodiment of the indicator module shown in Figure 79.

FIGURE 81 is a section cut of a housing and an indicator module mounted therein.

25 FIGURE 82 is a top view of one embodiment of the indicator module.

FIGURE 83 is a rear view of the indicator module shown in Figure 82.

FIGURE 84 is a cross-sectional view of the indicator module taken along line 84-84 of Figure 82.

30 FIGURE 85 is a cross-sectional view of the indicator module taken along line 85-85 of Figure 82.

FIGURE 86 is a cross-sectional view of the indicator module taken along line 86-86 of Figure 82.

FIGURE 87 is a cross-sectional view of the indicator module taken along line 87-87 of Figure 82.

FIGURE 88 is a perspective view of an alternative embodiment of the module.

5 FIGURE 89 is a cross-sectional view of the indicator module taken along line 89-89 of Figure 83.

FIGURE 90 is an exploded view of a container, a key member and an indicator module.

FIGURE 91 is a top view of the key member.

10 FIGURE 92 is a cross-sectional view of the key member taken along line 92-92 of Figure 91.

FIGURE 93 is a perspective view of a container and an alternative embodiment of the indicator module mounted in a dispenser housing with a portion of the housing cut away.

15 FIGURE 94 is an exploded perspective view of an alternative embodiment of an indicator module, key member and indicator assembly.

FIGURE 95 is a top perspective view of a first member of one embodiment of the indicator module housing.

20 FIGURE 96 is a bottom perspective view of the member shown in Figure 95.

FIGURE 97 is a perspective view of one embodiment of an indicator member.

FIGURE 98 is an opposite perspective view of the indicator member shown in Figure 97.

25 FIGURE 99 is a top perspective view of a second member of one embodiment of the indicator module with an axle installed therein.

FIGURE 100 is a perspective view of an actuator member.

30 FIGURE 101 is a perspective view of a container with an alternative embodiment of a key member installed thereon positioned above one embodiment of an indicator module.

FIGURE 102 is a perspective view of an alternative embodiment of the key member.

FIGURE 103 is an exploded perspective view of an alternative embodiment of a key member being applied to a container.

FIGURE 104 is a cross-sectional view of an indicator module showing an advancement member of a first indicator member, an engagement member and a second indicator member.

FIGURE 105 is a cross-sectional view of the advancement member of the first indicator member as it is first engaged by the engagement member in the indicator module housing.

FIGURE 106 is a cross-sectional view of the advancement member as it is biased by the engagement member into engagement with the second indicator member so as to rotate the second indicator member.

FIGURE 107 is a cross-sectional view of the advancement member as it is released by the engagement member and disengages from the second indicator member.

FIGURE 108 is an exploded perspective view of an alternative embodiment of an indicator module and indicator assembly.

FIGURE 109 is an enlarged side view of an actuator member in a disengaged position adjacent a first indicator member.

FIGURE 110 is a side view of the actuator member engaging the first indicator member with the non-return being biased outwardly.

FIGURE 111 is a perspective side view of an alternative embodiment of an indicator member.

FIGURE 112 is an opposite perspective side view of the indicator member of Figure 111.

FIGURE 113 is a cross-sectional view of an advancement member on a first indicator member, a second indicator member and an engagement member.

FIGURE 114 is a cross-sectional view of the advancement member as it is first engaged by the engagement member.

FIGURE 115 is a cross-sectional view of the advancement member as it is biased by the engagement member into engagement with the indicator member.

FIGURE 116 is a cross-sectional view of the advancement member as it is further biased by the engagement member into engagement with the second indicator member.

5 FIGURE 117 is a perspective view of an alternative embodiment of an indicator assembly disposed on a lower member of the module housing.

FIGURE 118 is a perspective view of one embodiment of an indicating device having an auxiliary dosage indicator.

FIGURE 119 is a bottom plan view of one embodiment of a cap member and indicator members.

10 FIGURE 120 is a perspective view of the cap member and indicator members shown in Figure 119.

FIGURE 121 is a top plan view of the cap member and indicator members shown in Figure 119.

15 FIGURE 122 is a right perspective view of an assembly of a plurality of indicator members.

FIGURE 123 is a left perspective view of the assembly shown in Figure 122.

20 FIGURE 124 is a partial side view of an indicating device, with various components shown in partial section cut and with a second indicator member shown in an intermediate display position.

FIGURE 125 is a partial side view of the indicating device shown in Figure 124 with the second indicator member shown in a final display position.

25 FIGURE 126 is a partial side view of the indicating device, with various components shown in partial section cut and with a second indicator member being moved from an initial display position to an intermediate display position.

30 FIGURE 127 is a top view of the indicating device with arrows illustrating the movement of the second indicator member from an initial display position to an intermediate display position and then to a final display position.

FIGURE 128 is a top perspective view of another embodiment of an indicating device.

FIGURE 129 is a left bottom perspective view of the cap member and indicator members shown in Figure 128.

5 FIGURE 130 is a right bottom perspective view of the cap member and indicator members shown in Figure 128.

FIGURE 131 is a perspective view of one of the indicator members shown in Figures 129 and 130.

10 FIGURE 132 is a partial side view of the embodiment of the indicating device shown in Figure 128 with various components shown in partial section cut and with a second indicator member being advanced from a first position to a second position.

15 FIGURE 133 is a partial side view of the indicating device shown in Figure 130 with the second indicator member being advanced from a second position to a third position.

FIGURE 134 is a partial cross-sectional side view of the indicating device shown in Figure 128 with first and second indicator members visible through a pair of viewing windows.

20 FIGURE 135 is a partial cross-sectional side view of the indicating device shown in Figure 128 with the second indicator member visible through a viewing window.

FIGURE 136 is an exploded perspective view of a dispensing device including a dispenser housing, indicating device and container.

25 FIGURE 137 is a partial perspective view of a first and second indicator members visible through windows provided in a dispenser housing.

FIGURE 138 is a front perspective view of one embodiment of an indicating device.

FIGURE 139 is an exploded perspective view of the indicating device shown in Figure 138.

30 FIGURE 140 is a top perspective view of the indicating device shown in Figure 138.

FIGURE 141 is a top perspective view of one embodiment of a cap member.

FIGURE 142 is a top perspective view of one embodiment of a base member.

5 FIGURE 143 is a top perspective view of one embodiment of one member of a module housing.

FIGURE 144 is a bottom perspective view of one embodiment of a second member of a module housing.

10 FIGURE 145 is a bottom plan view of an alternative embodiment of an primary indicating device installed in a cap member.

FIGURE 146 is a bottom plan view of an alternative embodiment of a primary indicating device installed in a cap member.

FIGURE 147 is a bottom perspective view of an alternative embodiment of a cap member and indicator members.

15 FIGURE 148 is a perspective view of a secondary indicator member.

FIGURE 149 is a top perspective view of an indicating device with primary and auxiliary indicating members indicating an initial number of dosages of substance remaining in a container.

20 FIGURE 150 is a top perspective view of the indicating device shown in Figure 149 with primary and auxiliary indicating members indicating the number of dosages of substance remaining in a container.

FIGURE 151 is a top perspective view of the indicating device shown in Figure 149 with primary and auxiliary indicating members indicating the number of dosages of substance remaining in a container.

25 FIGURE 152 is a top perspective view of the indicating device shown in Figure 149 with primary and auxiliary indicating members indicating the number of dosages of substance remaining in a container.

FIGURE 153 is a perspective view of an alternative embodiment of an assembly of a plurality of indicator members.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

General Description of Dispenser:

5 Referring to the drawings, and in particular FIGS. **31**, **32**, **136** and **137**,
an aerosol dispenser is shown as including a housing **200**, or actuator boot,
and a container **12** disposed therein. The housing has a longitudinally
extending cavity **202** shaped to receive the container. A top portion of the
housing is generally open such that the container can be inserted in the
10 housing through an opening **204** and be installed therein with a bottom end
14 of the container protruding from the housing so as to be exposed to the
user for actuation.

 The terms "longitudinal" and "axial" as used herein are intended to
indicate the direction of the reciprocal movement of the container relative to
15 the housing, and of an indicating device cap member relative to a base
member. The terms "top," "bottom," "upwardly" and "downwardly" are
intended to indicate directions when viewing the inhalation devices as shown
in the Figures, but with the understanding that the container is inverted such
that the top surface thereof is located adjacent the bottom of the housing and
vice versa. Moreover, it should be understood that a user can use the
20 container and dispenser in any number of positions, including but not limited
to the preferred upright position shown in FIGS. **31** and **32**. The terms
"connect," "connected," "couple," and "coupled," and equivalents thereof,
refers to the connection of two components directly, or indirectly, i.e., by way
25 of one or more intervening components.

 As shown in FIGS. **31** and **32**, a cylindrical support block **212** having a
well **214** is formed in a bottom portion **206** of the housing. An orifice **210**
penetrates the support block to communicate with a bottom portion of the
well. In one embodiment, a mouthpiece **208**, intended for insertion into the
30 mouth of a patient, forms an exhaust port **216** that communicates with the
orifice and well. The mouthpiece **208** extends laterally from the housing so as
to facilitate insertion of the mouthpiece into the mouth of the patient.

As shown in FIGS. 31, 32 and 136, the container 12 is cylindrical and has a hub 16 disposed on a top surface 17 thereof. A valve stem 18 extends longitudinally from the hub. The valve stem extends coaxially from the container and is biased outwardly therefrom by a spring (not shown) mounted
5 within the valve stem of the container. The container 12 is mounted in the housing by press fitting the valve stem 18 in the well 214 of the support block.

In a preferred embodiment, the container 12 is filled with a substance which is dispensed therefrom in specific metered doses by an actuation thereof effected by depressing or moving the valve stem 18 from an extended
10 closed position to a depressed open position. Preferably the substance is a medicament, although it should be understood that the container may be used to hold a variety of non-medicinal substances, including, but not limited to, various liquids, foams or aerosols. In one preferred embodiment, the container is a pressurized, metered dose inhaler. A single metered dose is
15 dispensed from the container by each reciprocal, longitudinal movement of the valve stem, or actuation of the container. It should also be understood that the valve system can be actuated by a variety of actuators, including, but not limited to, various pumps, levers, actuator boots, buttons and the like. In some embodiments, the container and valve system is breath-actuated,
20 meaning they are actuated in response to the user inhaling, for example by inhaling through the mouthpiece. In such embodiments, the valve system can be actuated by an actuator moveable relative to the container and housing such that the container remains stationary relative to the housing.

In operation, the opening of the valve stem is effected by moving the
25 container 12 reciprocally within the housing 200 along a longitudinal axis, defined by the valve stem and the reciprocal movement of the container, by depressing the bottom end 14 of the container relative to the housing so as to move the valve stem 18 to the open position as it is supported within the well by the support block. As the valve stem is moved to the open position, the
30 container dispenses a metered dose of a substance through the well 214 and orifice 210. The substance, for example an aerosol and medicament, are

then transmitted to the patient through the exhaust port **216** of the mouthpiece by way of either a self-generated or assisted airflow.

5 In other delivery systems, the housing and holder for the container are attached to a component having a chamber with an output end. Examples of these kinds of delivery systems are shown for example in U.S. Patent 5,012,803, issued May 7, 1991, and U.S. Patent 4,460,412, issued September 11, 1984, both of which are hereby incorporated herein by reference. (No license, expressed or implied, is intended to be granted to any patent by reason of the incorporation by reference herein). In these kinds of
10 delivery systems, the component having the chamber can be adapted to receive the mouthpiece of the housing, or it can be integrally connected with a holder supporting the container. In either embodiment, the metered dose of medicament in aerosol is first dispensed from the container into the chamber, and thereafter inhaled by the patient.

15 In a preferred embodiment, the container **12** is intended to dispense a predetermined number of metered doses of a substance, such as a medicament, upon a corresponding number of predetermined actuations of the container. For example, conventional inhaler containers typically hold on the order of 100 to 200 metered doses. It should be understood, however,
20 that the range of available doses could potentially vary from as few as one dose to as many as 500, or even more, depending, for example, on the capacity of the container, and/or the size of the metering dose valve. In operation, it can be important for the patient to be aware of the number of metered doses remaining in the container such that the patient is not caught
25 unaware with an empty container when in need of the medicament.

Description of Primary Indicating Devices Mounted to Bottom of Container:

Now generally referring to Figures 1-69, various primary dose
indicating devices are shown. The primary indicating device **10** indicates the
30 number of metered doses that have been dispensed from or remain in the container. As shown in the embodiments of FIGS. 1-3A and 10-11,

respectively, the primary indicating device **10, 200, 500** includes an indicating device housing comprised of a cap member **20, 220, 520** disposed in a base member **40, 540**. The base member **40** is configured such that it can be mounted to the bottom of the container **12**. In a first embodiment, shown in
5 FIGS. 2, 6 and 12-17, the base member includes a convex, or curved bottom portion **50**, or floor, which is shaped to be received in and to mate with the bottom end **14** of the container, which has a concave or inwardly curved contour (see FIG. 2). The base member **40** is preferably connected to the bottom of the container, for example and without limitation by bonding with
10 adhesive, double sided tape, or similar bonding agent. In one preferred embodiment, a label, or other wrapper, is wrapped around the side of the base and the container to join the base to the container. In one preferred embodiment, the outer circumferential surface of the base is substantially the same as outer circumferential surface of the container, which facilitates the
15 joining thereof by way of a wrapper.

As shown in FIGS. 6 and 10-15, a circumferential skirt member **94** extends upwardly from the base portion to form a cavity **96**. Alternatively, as shown in FIG. 25, the base member **140** includes a bottom portion **150**, a downwardly depending circumferential skirt **152** and an upwardly depending circumferential skirt **156**. Depending skirt **152** forms a recess or cavity **154**
20 which is shaped to receive the bottom end of the container. The base member is fixedly mounted on the container by connecting one or more of the bottom portion or skirt to the container, for example and without limitation by bonding or by press fitting the container in the cavity **154** so as to provide an interference fit between the container and the depending skirt. The upwardly
25 depending skirt **156** and bottom portion form an upper cavity **158** overlying the lower cavity **154**.

In yet another embodiment, shown in FIGS. 29-32, an adapter member **90** is connected to one of the above-mentioned base members, for example
30 and without limitation by way of bonding, an interference fit, a snap fit, or a threadable engagement. The adapter member **90** preferably has a cylindrical

configuration and comprises a circumferential skirt **92** that is shaped to receive the bottom end of the container. Again, the adapter can be connected to the container, for example by way of bonding, an interference fit, or both. Adapters having different internal diameters can be provided such that a single indicating device having a modular base member can be mounted on various aerosol containers having a variety of outer diameters.

Alternatively, as shown in FIG. 57, the base member **1040** includes a downwardly depending circumferential skirt **1152** forming a recess **1154**. The skirt **1152** includes one or more steps **1155** or shoulders, which form various inner diameters in the base member **1040**. In this way, a single base member **1040** can be used with containers having different diameters. It should be understood that although only one step is shown, so as to thereby form two inner diameters on the skirt **1152**, the base member could be configured with additional steps so as to provide a plurality of various inner diameters dimensioned to receive various containers by way of a friction fit. The skirt **1152** is also configured with a plurality of cut-outs, or slits **1153**, which permit enhanced air flow around the base member in embodiments where the base member may be in close proximity to the area where the medicament or aerosol is being dispensed.

Although the disclosed container and indicating device, and in particular, the cap member and base member, are shown as preferably having a circular cross section, those skilled in the art should understand that the container and indicating device, including any adapter, can be configured in other shapes, including for example, but not limited to, a rectangular or triangular cross-section.

As best shown in FIGS. 1, 1A and 1B, the cap member **20** has a top portion **52** with a first viewing window **34**, **59** formed therein. Preferably, the cap member **20** is circular and the viewing window is formed in the top portion adjacent the outer periphery of the cap member so as to overlie indicia applied to the top of an indicator member supported beneath the cap member. The viewing window can be configured in a number of various

shapes. For example, the viewing window **34** can be tapered as shown in FIG. 1, or it can be an arcuate shaped window **59** bounded by coaxial inner and outer curved borders **57**, **58** and radial side borders **56** as shown in FIGS. 1A and 1B. Of course, one of skill in the art should understand that any shaped window would work so long as the indicia is visible. The top of the cap member preferably has a plurality of raised portions **54** forming a grippable pattern for the user's thumb, or finger. In this way, the user can firmly press down on the cap member without slippage. One of skill in the art should recognize that other patterns or grippable surfaces, such as a knurled pattern, can be applied to the cap member to facilitate the use of the indicating device.

Referring to FIGS. 4, 6, 38, 44 and 119 the cap member **20**, **220**, **1020**, **2020**, **6020** comprises a circumferential skirt **92**, **292**, **1092**, **2092**, **6092** depending downwardly from the top portion **52**, **252**, **1052**, **2052**, **6052**. The skirt preferably has a smaller diameter than the upwardly depending skirt of the base member, such that the cap member skirt nests within the upwardly extending skirt of the base member. Alternatively, the cap member can be configured with a skirt having a larger diameter than the skirt of the base member such that the base member skirt nests in the cap member skirt. The cap member **20**, **220**, **1052**, **2052** is moveably mounted to the base member **40**, **1040**, **2040** by way of a snap fit.

In particular, as shown in FIGS. 5, 6, 7, 9, 10, 16, 29 and 44, the cap member includes a plurality of engagement members **28**, **228**, **428** extending from an outer circumferential surface of the skirt. The cap member **20**, **220**, **420** is inserted axially within the recess or cavity **96** of the base member such that the engagement members **28**, **228**, **428**, which have a tapered surface, slide past the rim **42** of the base member skirt until the engagement members are disposed in a plurality of pockets **43** formed along the inner circumferential surface of the base member skirt to form a snap-lock fit. In particular, the upper surface of the engagement member engages an engagement surface **45** defining the top of the pocket. In this way, the cap

member is moveable with respect to the base member along an axial, or longitudinal, path. Alternatively, the rim of the base member can be curved slightly inward such that the engagement members engage the inwardly curved rim portion so as to prevent the cap member from being separated from the base member.

The axial movement of the cap member **20, 220, 1020, 2020** relative to the base member **40** is bounded or constrained by the engagement of the engagement members with the top of the base member pockets (or the base member rim) at a fully extended position and by engagement of a bottom rim **21, 221, 1021, 2021** of the cap member skirt with the upper surface of the bottom portion at the bottom of the stroke as shown for example in FIGS. 12-15. One of skill in the art should understand that the engagement members can alternatively be formed on the base member skirt so as to engage pockets or openings, or a rim (or like protrusion), formed on the cap member skirt.

As shown in FIGS. 6, 9, 16 and 17, a spring **100** is disposed between the cap member and the base member. The spring is preferably disposed in a downwardly extending hub portion **30, 230** of the cap member (shown in FIGS. 4 and 6) and an upwardly extending hub portion **44** (shown in FIGS. 10, 16 and 17) of the base member, which are received one in the other. Alternatively, as shown in FIG. 25, a spring **300** is disposed between the cap member and base member and is of such a size that the coils are positioned adjacent the inner circumferential surface of the cap member skirt **392**. The spring **100, 300** functions as a return mechanism and biases the cap member **60, 260, 360** upwardly in the base member such that the engagement members **28, 228** of the cap member engage the upper portion of the pockets of the base member. Although a compression spring is shown in the Figures, it should be understood that a belleville washer, cantilever, torsion, leaf and/or tension springs would also work to bias the cap member upwardly into engagement with the base member. The springs can be made of metal or plastic.

As shown in FIGS. 4, 5, 16, 17, 45, 119, 141 and 142, the return mechanism acting between the cap member and base member includes a plurality of resilient arm members **400**, **2400**, **6400** extending downwardly from the cap member. As the cap member is moved toward the base member, one or more of the arm members engages a ramped biasing surface **402**, **6401** formed along an outer portion of the hub portion **44**, or along the inside of the circumferential skirt **94**. The ramped biasing surface biases one or more of the resilient arm members outwardly as the cap member moves toward the base member. As shown in the embodiment of FIGS. 4 and 5, six arm members **400** are arranged circumferentially around the hub portion **30**. Alternatively, as shown in the embodiment of FIG. 39, six arm members **1400** are arranged in an "X" pattern around the hub **1030** so as to conserve space and provide additional room under the cap member **1020**. Corresponding ramps, or ramped biasing surfaces are similarly arranged in the base member **1140**. In yet another embodiment, shown in FIGS. 119, 141 and 142, the arm members **6400** are integrally formed in the circumferential skirt **6092** of the cap member and also adjacent various guide members **6571**, **6569**. The guide members are received in guides **6579**, **6581**, **6591** formed in the base member. Referring to FIGS. 141 and 142, one of the guide members **6569** is shaped to be received in only one of the guides **6581**, such that the cap member can be properly installed with the various indicator members connected thereto aligned with the pawl **48** formed in the base member. The guides and guide members further act as key members to prevent the cap member from rotating relative to the base member. The guides can take any shape, for example rectangular or T-shaped. Alternatively, as shown in FIG. 145, a pair of guide members **6583**, **6585** have different shapes, e.g., diameters, that are received in matingly shaped guides formed in the base member. Again, the unique shapes of the guide members and guides ensures that the cap member is properly aligned with the base member as those components are being secured one to the other.

The resilient arm member(s) act as cantilever springs to bias the cap member away from the base member when the cap member is released by the user. One of skill in the art should understand that the resilient arm members can also be formed on the base member so as to engage a ramped surface formed on the cap member. One of skill in the art should also understand that the spring and resilient arm members can be used together, as shown in FIGS. 16 and 17, or separately. In addition, it should be understood that one or more arm members and/or ramps may be used, with the size and shape of the arm member and/or ramp members being modified to provide more space between the cap member and base member.

As shown in FIGS. 4, 6, and 44 a key member **32, 232**, or alignment rib, extends radially from the cap member hub portion **30, 230**. As shown in FIG. 10, a key hole **47**, or slot, is formed in a radially extending portion of the hub portion **44** of the base member. The slot extends radially from the opening in the hub portion. During assembly, the key member of the cap member is received in the key hole of the base member so as to prevent rotation therebetween.

Referring to the various embodiments of FIGS. 4-9, 12-15, 38, 40, and 44-46, a dosage indicator member **60, 260, 1060, 2060** is rotatably mounted in the cap member **20, 220, 1020, 2020** about an axis substantially parallel to the axial movement of the cap member relative to the base member. The indicator member is generally open in the middle and includes a top portion **76, 276, 1076, 2076** having an upper surface **62, 262** that rotatably slides along a bottom surface of the top portion of the cap member. Alternatively, the indicator member can be mounted on the outside of the cap member with a viewing window formed in the indicator member for viewing indicia applied to the top of the cap member.

As shown in the embodiments of FIGS. 5, 6, 38 and 44, the indicator member **60, 260, 1060, 2060** includes a circumferential skirt **74, 274, 1074, 2074** depending downwardly from the top portion. Referring to FIGS. 5 and 8, a plurality of protrusions **26, 226**, or engagement tab members, extend

from an inner circumferential surface of the cap member skirt and engage a rim **64, 264** formed on the bottom of the indicator member skirt. Alternatively, the indicator member can include an engagement member, or rim, that engages a groove or similar opening in the cap member. In this way, the indicator member is secured to the cap member so as to prevent axial movement therebetween but where the indicator member is permitted to rotate relative to the cap member. The indicator member is installed by snap-fitting the indicator member within the cap member. One of skill in the art should understand that the indicator member could alternatively be rotatably mounted on the cap member hub portion (having a portion of the key member cut away), or on a similar axle secured to the cap member.

In yet another alternative embodiment, shown in FIGS. 25 and 26, a plate member **380** holds the indicator member **360** against the inner surface of the top portion of the cap member **320**, wherein the spring **300** engages a bottom surface of the plate member **380** to bias a top portion **398** of the plate member against the cap member **320** and the cap member away from the base member. The indicator member **360** is nested in the recess formed between an outer flat portion of the plate member and the bottom surface of the cap member. Referring to FIG. 26, the drive assembly is mounted to the plate member **380** by inserting axle **384** through openings in downwardly extending walls **388** of the plate member. An enlarged portion **396** on the end of the axle engages one of the walls, while the ratchet wheel **382** and drive member **386** are mounted to the other end of the axle to complete the assembly. A top portion of the plate member abuts the cap member.

As shown in the embodiments of FIGS. 4-9, 40 and 46 the indicator member **60, 260, 1060, 2060** has a plurality of inwardly facing teeth **66, 266, 1066, 2066** formed around the inner circumference of the skirt. As shown in FIGS. 5, 6, and 40, the teeth are preferably formed about only a portion of the circumference, such that a gap **1061** is formed therebetween.

Alternatively, as shown in the embodiment of FIGS. 25 and 26, the indicator member **360** has a plurality of teeth **366** formed radially inwardly

about an inner rim of an opening formed in the indicator member, which is configured as a relatively flat ring that does not include a skirt. In yet another embodiment, shown in FIG. 29, the plurality of teeth **466** extend axially downwardly from a ring-like indicator member **460**.

5 As shown in the embodiments of FIGS. 5 and 44-46, the indicator member **60**, **2060** includes a plurality of indentations **68**, **2068** formed about the outer circumferential surface of the skirt **74**, **2074**. The cap member includes a pair of upwardly extending resilient indexing members **22**, **2022** each having an end portion that engages one of the indentations so as to
10 releasably engage the indicator member and prevent rotation therebetween. The angular distance between the indentations **68**, **2068** is substantially the same as the angular distance between the plurality of indicator member teeth **66**, **2066**. In this way, the indexing member selectively engages the next indentation upon each incremental advancement of the indicator member
15 defined by the distance between adjacent teeth. In the embodiment shown in FIG. 46, the indentations are preferably formed as ratchet teeth which only permit one-way rotation of the indicator member **2060** relative to the cap member.

 Alternatively, as shown in the embodiments of FIGS. 6 and 38-39, the
20 indentations and indexing member are reversed, *i.e.*, the indentations **224**, **1224** are formed about an inner circumferential surface of the cap member skirt and, and shown in FIG 6, an indexing member **270** depends downwardly from the indicator member in a void formed in the skirt of the indicator member, or, as shown in FIG. 38, a pair of index members **1270** are
25 configured as flexible arms formed along a rim portion **1078** along the bottom edge of the skirt **1074**. In the embodiment shown in FIGS. 38, 39 and 40, the interaction between the index members **1270** and the indentations **1224**, which are preferably shaped as ratchet teeth, function to index the indicator member by holding it in place between actuations of the cap member and
30 also to prevent the backward rotation of the indicator member **1060**. It should be understood that one or more index members can be engaged with a

plurality of indentations, preferably formed as ratchet teeth, to control the rotational movement of the indicator member, regardless of whether the index members or indentations are formed on the cap member or the indicator member.

5 In yet another alternative, shown in FIG. 26, the plate member **380** includes a resilient indexing member **370** that engages one of the plurality of teeth **366** to selectively engage the indicator member so as to prevent the inadvertent rotation thereof. Alternatively, the indexing member can extend from the cap member.

10 As shown in FIGS. 1A and 1B, primary dosage indicia **72**, **172** in the form of numbers or color codings are provided on the top surface of the indicator member and are visible to the user through the viewing window **34**, **59** provided in the top of the cap member. Alternatively, as shown in the embodiment of FIGS. 24 and 26, a zero is positioned adjacent a rectangular
15 viewing window **334**, preferably by permanent etching, to indicate a multiplication by ten of the indicia visible in the viewing window. One and two digit primary dosage indicia **372** are formed on the top of the indicator member **360** such that a three digit number is indicated to the user.

 In yet another alternative embodiment shown in FIG. 3A, the viewing
20 window **534** is formed in an upper portion of the downwardly depending circumferential skirt **592** of the cap member. The primary dosage indicia are applied to the outer circumferential surface of the indicator member skirt **574** so as to be visible through the window. In this embodiment, a rim **542** of the base member is preferably scalloped in alignment with the viewing window
25 **534** to provide an unobstructed view of the indicia and to inform the user as to the location of the viewing window.

 One of the skill in the art should understand that other primary dosage indicia indicating the number of doses remaining in or dispensed from the container would include, but not be limited to, various alpha-numerical
30 characters, words, terms or phrases (such as "full" and "empty"), scales, grids, arrows, raised portions, indentations, color coding and segmentation,

shading and like markings, or any combination thereof. For example, a segmented color grid **172** displayed in the viewing window (as shown, e.g., in FIG. 1B) could turn from green, indicating a full container, to yellow, indicating an intermediate capacity, and finally to red, indicating an empty container. It should also be understood that the indicia can be formed integrally with the counter member, or applied thereto by means of paint, dye, etching, pad printing, hot stamping or adhesive labels. When using numerical indicia, the numbers can be arranged to go from 0 (or some beginning number) to the predetermined number of available doses such that a display of that number to the user indicates that the container should be replaced, or, conversely, to go from the starting predetermined number to 0 (or some ending number), which again indicates to the user that the container should be replaced.

In a preferred embodiment, the indicator member is made of acrylonitrile butadiene styrene ("ABS"), which is receptive to certain alternative processes of printing or applying the indicia, including pad printing and hot stamping. The cap member and base member are preferably made of a hard plastic material such as Acetel. In various preferred alternative embodiments, one or both of the base member and cap member can be made of polycarbonate.

Referring to FIGS. 5-9 and 12-18, a drive mechanism is shown as including a drive assembly **80**. The drive assembly includes a ratchet wheel **82** coaxially mounted to a drive member **86** on an axle **84**. The ratchet wheel, drive member and axle can be made separately, with the ratchet wheel and drive member then mounted on the axle, or all three parts can be integrally molded as a one-piece component. The drive assembly is preferably made of hard plastic material such as Acetel.

In an alternative embodiment, shown in FIGS. 38 and 42, the drive assembly further includes a second primary dosage indicator member **1800** coaxially mounted with and between the drive member **86** and ratchet wheel **82**. The indicator member **1800** is configured as a wheel and preferably includes primary dosage indicia positioned around the peripheral surface

1802 thereof. Preferably, the indicia are comprised of consecutive numerals running from 0 to 9.

In yet another alternative embodiment, shown in FIG. 44, the drive assembly includes a ratchet wheel **82** coaxially mounted with an indicator member **1800**. The drive member **86** is formed separately from the ratchet wheel and indicator member and includes a single tooth **89** that is dimensioned to be received in a groove **1801** formed in a collar **1082** extending axially from the indicator member **1800**. The tooth **89** of the drive member **86** is received in the groove **1801** of the collar and can be moved axially with respect to the collar, ratchet wheel and indicator member.

The ratchet wheel **82** includes a plurality of teeth **88** (preferably ten) formed around its periphery. Each of the teeth includes an engagement surface **89** and a tapered surface **87**. As noted above, the drive member **86**, whether integrally formed with the ratchet wheel or separately connected thereto, includes a single tooth **81** extending radially from the axle **84**, or drive member collar.

In the embodiments shown in FIGS. 5, 6 and 45, the drive assembly is mounted to the cap member by engaging opposite ends of the axle **84** with downwardly extending hub portions **36**, **236**, **2236** such that the axle, ratchet wheel and drive member rotate about an axis substantially perpendicular to the axial movement of the cap member relative to the base member and to the axis of rotation of the indicator member. Alternatively, the drive assembly can be mounted to the base member, along with the indicator member, in a similar manner.

Alternatively, as shown in the embodiment of FIGS. 38-39, the axle **84** is received in a single hub **1036**, or flexible snap enclosure rib. In this embodiment, the drive assembly further includes a ramp **1083**, which ramps up to a plurality of radially extending teeth **1085** formed around the rotational axis of the drive assembly. A larger diameter axle **1084** extends outwardly from the teeth. A reset member **1106** includes a grippable wheel portion **1107** and a collar **1109** that is dimensioned to be received in a laterally facing

opening **1302** formed in the skirt of the cap member. A bearing support **1300** is formed around the periphery of the opening so as to provide support for the collar. The reset member **1106** further includes four flexible, resilient fingers **1304** extending axially from the collar **1109**. Each finger **1304** includes an engagement portion **1306** extending radially inward from the end of the finger. The engagement portion is shaped to engage one of the teeth **1085** formed on the drive assembly. A protrusion **1308**, or rib, is formed on one of the fingers so as to extend radially outward therefrom. The protrusion **1308** acts as a drive portion and engages a downwardly depending protrusion **1310** formed on the bottom of the indicator member adjacent the gap **1061** formed between the teeth on the indicator member, as shown in FIG. 40. Preferably, the protrusion **1310** is positioned so as to be at the angular midpoint between the two teeth spanning the gap.

As shown in FIGS. 12-15, the drive mechanism further includes a pawl member **48**, shown as a flexible rod or finger, which extends upwardly from the bottom portion of the base member and selectively engages one of the teeth of the ratchet wheel. The base member with the pawl are referred to and function as an actuator for the indicating device as the base is connected to and engaged by the container. Alternatively, the pawl member can be moveably secured to the cap member and extend through the base member to engage the top of the container, such that the axial movement of the cap member toward the container causes the pawl to move toward the ratchet wheel and engage one of the teeth thereon as described below. A non-return member **238**, also shown as a flexible rod or finger, extends downwardly from the top portion of the cap member and selectively engages another of the teeth **88** of the ratchet wheel. It should be understood that the pawl member could alternatively extend from the cap member (and the non-return member from the base member) when the drive assembly is mounted to the base member, as described above. Of course, when formed integrally with one or the other of the cap member and base member, the pawl member and non-

return member are preferably made of the same materials as the respective cap member and base member.

Referring to FIGS. 118-123, 132, 133, and 145-153, a plurality of primary indicator members (shown as three) **6550** are coaxially mounted on an axle **6556** and rotatable thereabout. The ends of the axle are supported on a pair of bearing supports **6631** formed in the cap member **6020**. As best shown in FIGS. 122 and 123, each of the indicator members includes an indicator wheel **6558** having a circumferential skirt **6559** with an outer circumferential surface **6560** on which indicia (shown as numbers) are applied, and a ratchet gear **6552** coaxially mounted with the indicator wheel. Referring to FIGS. 118, 128, 134 and 149-152, a plurality of primary viewing windows **6021** are formed in the top portion of the cap member such that the indicia are visible in the windows. In one embodiment, first and second rings are visible in a viewing window, as shown for example in U.S. Patent No. 6,283,365, which is hereby incorporated herein by reference. It should be understood that a single window could be provided, with all of the indicia visible through the window.

The indicator wheel and ratchet gear have an opening shaped to receive an axle. Alternatively, the middle indicator member is integrally formed with an axle portion extending from opposite sides thereof, with the other indicator wheels mounted thereon. The axle can be formed with an asymmetrical cross-section, e.g., a T-shaped cross-section, such that the axle is non-rotatably secured to the indicator wheels. The ratchet gear **6552** includes a plurality of teeth **6554** formed around its periphery. The ratchet gear is preferably integrally molded with the indicator wheel, although it should be understood that the gear and wheel can be made separately and thereafter attached one to the other by welding, adhesive and the like.

Referring to FIGS. 122-125, 130, 146 and 153, in one embodiment of the indicator member, a resilient advancement member **6600** extends from the indicator wheel. The advancement member **6600** includes a tooth portion **6604** having an engagement surface. The three indicator members are

coaxially mounted such that the tooth portion **6604** of the advancement member of a first indicator member overlies the ratchet gear teeth **6652** of the second indicator member, and such that the tooth portion of the advancement member of the second indicator member overlies the ratchet gear teeth of the third indicator member. When only three indicator members are used, the third indicator member does not require an advancement member, although for the sake of simplicity in manufacturing, a modular indicator member with the same indicia applied thereto and the same advancement member formed thereon can be used for each of the first, second and third indicator members. It should be understood by one of skill in the art that one or more indicator members may be used to provide an indication of dosages used or available, and that the three indicator members shown in the Figures is meant to be illustrative, rather than limiting. In addition, it should be understood that a plurality of indicator members refers to any number of indicator members greater than one. In various alternative embodiments, the advancement member **6600** includes a first end connected to a planar side portion or hub of the indicator wheel. The advancement member includes a curved resilient portion having a free end with the tooth portion **6604** formed on the end thereof. Indicia, preferably in the form of numbers, are applied to the circumferential surface **6560** of the skirt. Of course, the indicia can take any form as herein described, including color coding, text, etc. It should be understood that the advancement member, indicator wheel and ratchet gear can take any of the forms described herein.

Referring to FIGS. 126, 141, and 142, an actuator member **48**, otherwise referred to as a pawl or ratchet member, is configured as a resilient arm member that extends upwardly from the base member and terminates in an end portion shaped to selectively engage at least one of the teeth of the ratchet gear of the first indicator member. Referring to FIG. 119, 120, 141, and 146 the cap member has at least a pair of engagement members **6573** formed integrally therewith and including ramped surfaces. A plurality of non-return members **6900** extend from the cap member and selectively engage

the ratchet gears to ensure unidirectional rotation of the primary indicator members. Although the engagement members and non-return members are shown as being formed in the cap member, it should be understood that the primary indicator members could be mounted in the base member, with the engagement members and non-return members also formed therein, and with the actuator extending from the cap member.

In one embodiment, arm members serve as a combined engagement member and non-return member. In particular, the arm member functions as a non-return member and includes an end portion that is biased away from the teeth on the ratchet gear as the actuator member, or adjacent indicator member with its advancement member, is actuated to advance the ratchet gear. The arm member snaps back so that the end portion engages one of the teeth of the ratchet gear so as to ensure that the rotation of the ratchet gear is unidirectional. The arm member overlying the ratchet gears of the second and third indicator members also serves as an engagement member that selectively engages the advancement members connected to the indicator members.

In the embodiment of FIGS. 145 and 146, each indicator wheel **6550** includes a ratchet gear **6552** and an indexing gear **6551** disposed on opposite sides of the respective wheels. The indexing gear **6551** is engaged and indexed by the return member, otherwise referred to as the indexing member. In the embodiment of FIG. 145, a pair of advancing gears **6533** are rotatable mounted on an axle **6537** parallel to the axis of rotation of the indicator wheels. The gears **6533** are independently rotatable on the axle. The axle **6537** is supported by a pair of bearing supports **6539** extending from the cap member. The indicator wheels each include an advancement tooth **6535** that engages the advancement gear upon one rotation of the indicator wheel. The first advancement gear **6533** is meshed with the ratchet gear on the adjacent second indicator wheel. As the advancement gear **6533** is advanced by the advancement tooth **6535**, the gear advances the adjacent indicator wheel an incremental amount. The advancement of the third indicator wheel is made

by way of the second advancement gear being advanced by an advancement tooth of the second indicator wheel.

5 In the embodiments shown in FIGS. 122-123, 129, 145, and 146 the indicia are preferably formed around the circumferential surface 6560 of the indicator wheel in the form of numbers ranging from 0 to 9, with the ratchet gear on the indicator member having 10 teeth. In operation, it should be understood that the three, or more or less, indicator members can be preset to the maximum number of dosages contained within the container, with the indicia, or in this case numbers, arranged about the periphery of the indicator wheel, such that successive, sequential actuations of the container cause the indicator members to count down.

10 Alternatively, the indicator members are assembled such that the zero (0) of each indicator member is displayed in the viewing window to the user. The container is then actuated by the user such that the first indicator member rotates within the housing to sequentially display the number of doses that have been dispensed from 1 to 9. Upon the tenth actuation, the indicator member completes a single revolution, by virtue of the ten teeth preferably formed about the ratchet gear which correspond to the predetermined number of actuations, and causes the second indicator member to advance one number from 0 to 1 as the first indicator member again displays a 0 such that the two members together indicate that 10 dosages have been dispensed. The first indicator member is again rotated by successive actuations until another single rotation is completed to further rotate the second indicator to reveal the 2, so as to indicate that 20 dosages have been dispensed. Upon a complete rotation of the second indicator member, corresponding to 100 actuations, the third indicator member is advanced to reveal a 1 in the viewing window with the first and second indicator members revealing a 0, and so on.

Description of Operation of Various Embodiments of Primary Indicating
Devices Mounted to Bottom of Container:

5 In operation, as shown in FIGS. 12-21, the user depresses the cap **220**
member from a fully extended position (see FIG. 12) toward the base member
such that the cap member bottoms out in the base member at the bottom of
the stroke (FIG. 14) and such that the base member imparts an axial load on
the container until a metered dosage is dispensed therefrom. In a preferred
embodiment, the biasing force of the spring **100** (shown in FIG. 6), or
10 alternative return mechanism such as the resilient arm members which act as
springs, is less than the biasing force of the spring located in the metering
valve of the container, such that the cap member first bottoms out in the base
member with the container then being moved downwardly in the housing until
a metered dose is dispensed.

15 Referring to FIGS. 12, 13 and 14, as the cap member **220** is
depressed toward the base member **40**, the pawl **48** selectively engages the
engagement surface **89** of one of the ratchet wheel teeth and rotates the
ratchet wheel. The tapered surface **87** of one of the teeth formed on the
ratchet wheel simultaneously biases the non-return member **238** outwardly
20 until it selectively engages the next tooth near the bottom of the stroke. The
return member provides an audible click as it engages the next tooth. The
user then releases the cap member whereinafter the spring **100** (shown in
FIG. 6), or similar return mechanism, biases the cap member **220** away from
the base member **40** until the engagement member engages the base portion
25 at the top of the stroke as shown in FIG. 15. When the cap member is
released by the user, the container is biased upwardly within the housing
along the longitudinal axis such that the valve stem is moved to the closed
position within the container. Simultaneously, as the cap member is released
and allowed to move away from the base member, the pawl **48** is biased
30 outwardly by the tapered surface **87** of one of the teeth on the ratchet wheel
as the non-return member **238** prevents a backwards rotation thereof so as to
maintain a unidirectional rotation of the ratchet wheel. At the top of the stroke

(shown in FIG. 15), the pawl **48** is again placed in position for selective engagement with one of the teeth of the ratchet wheel. Again, the pawl provides an audible click as it engages the next tooth. In summary, on the down stroke the non-return member makes a clicking sound as it slides over one or more ratchet teeth, while on the up stroke, the pawl member also makes a clicking sound as it slides over one or more ratchet teeth. In this way, the ratchet wheel **82**, and connected drive member **86** (shown in FIGS. 18-21), are advanced an incremental amount for every actuation of the container and the attendant release of medicament. The incremental amount is defined by and dependent on the number of teeth formed about the periphery of the ratchet wheel. When formed with ten teeth, as shown in the preferred embodiment, the ratchet wheel will make one full revolution for every ten actuations of the indicator device and container, or a tenth of a revolution for each actuation. One skilled in the art will appreciate that the ratchet wheel can be provided with various numbers of teeth formed about its periphery such that the more or less axial movements or actuations of the container are required to make one full rotation of the ratchet wheel.

Alternatively, the operation of the ratchet wheel can be reversed. In this embodiment, the pawl is biased outwardly by the tapered surface of one of the ratchet wheel teeth on the downstroke. At the bottom of the stroke, the pawl is biased into engagement with one of the teeth. When the cap member is released by the patient, the spring, or equivalent return mechanism, biases the cap member upwardly within the base member along the longitudinal axis such that the pawl member engages one of the teeth and thereby rotates the ratchet wheel an incremental amount. In this embodiment, the non-return member maintains the rotational position of the ratchet wheel on the downstroke.

As shown in FIGS. 18-20, 38 and 44 the drive member **86** is shown as preferably having a single tooth **81** or segment. Therefore, upon every tenth actuation, the drive member **86** is rotated such that the tooth selectively engages one of the teeth **266** formed on the indicator member so as to rotate

the indicator member an incremental amount. The incremental amount of rotation is defined by the distance between adjacent teeth, otherwise defined as the circular pitch of the teeth. In this way, the drive member is selectively engaged with at least one of the teeth of the indicator member after and upon
5 a predetermined number of axial movements of the cap member relative to the base member so as to rotate the indicator member the incremental amount. The predetermined number of axial movements required to cause the indicator member to rotate is defined by and dependent upon the reduction ratio of the ratchet wheel and drive member, which, in turn, is
10 defined by dividing the number of teeth formed on the ratchet wheel by the number of teeth formed on the drive member. For example, as shown in the preferred embodiment, a ratchet wheel having ten teeth and a drive member having one tooth will result in an incremental movement of the indicator member, otherwise defined as the advancement of one tooth of the indicator
15 member, upon every ten axial movements. Similarly, if the drive member had four teeth, and the ratchet wheel twenty, the predetermined number would equate to five axial movements, and so on. A one-to-one gear ratio would result in a predetermined number of one axial movement, wherein the indicator member would be moved upon every axial movement.

20 Referring to FIG. 19, the indicator member **260** and drive member **86** are shown prior to an initial actuation or use by the user. In particular, the drive member tooth is positioned adjacent the first tooth **266** on the indicator member. In this embodiment, wherein the ratchet wheel comprises ten teeth, ten actuations are required before the tooth **81** engages the first tooth **266** on
25 the indicator member as shown in FIG. 21. At this point, the indicator has completed a single cycle equal to the number of predetermined number of axial movements, which results or culminates in the incremental movement of the indicator member. The cycle is then repeated (by again making the predetermined number of axial movements) so as to again culminate in the
30 incremental movement of the indicator member. Preferably, as shown in FIGS. 1A, 3A, 24 and 26, numerical indicia (including numbers and dots) are

applied in increments of ten to correlate to the preferred embodiment requiring ten axial movements for one incremental advancement of the indicator wheel.

5 The ratchet wheel and drive member with their reduction ratio provide a simple but reliable mechanism for advancing the indicator member. In particular, the indicator member can be made with fewer teeth than if it were required to advance upon every actuation of the indicator member and container. For ease of manufacturing, it is desirable to provide as coarse a pitch on each of the indicator member and ratchet wheel as possible, 10 although the gears are still defined as fine-toothed gears. However, it is also intended that the indicator member make only a single revolution (single-cycle) corresponding to a complete evacuation of medicament from the container. Thus, when a large number of doses (on the order of 200 or more) are contained within the container, it is important for the ratchet wheel and drive member to provide a relatively high reduction ratio, such that 200 15 linear reciprocal movements of the cap member and container correspond to one or less revolutions of the indicator member. As such, the indicator member can be made with coarser teeth at less cost. In addition, larger coarser teeth interacting with a relatively large drive member tooth helps to 20 improve the accuracy of the device as those parts mesh. In addition, the mechanism, and its attendant reduction ratio, permits the indicator member to make only a single revolution during the life of the container, i.e., until it is emptied, even when the container contains a relatively large number of metered doses (on the order of 200 or more doses). This single revolution 25 corresponds to a usage cycle, which is defined as the movement of the dosage indicator from an initial reading, which indicates that the container is full, to a final reading, which indicates that the container should be replaced. Of course, the indicator member, if initially set to a smaller number of dosages, may make less than a complete revolution in completing a usage cycle. 30

In the alternative embodiments shown in FIGS. 38 and 44, the viewing window 1034, 2034 is large enough such that the first and second dosage

indicator members **1060, 2060, 1800** with their indicia are visible therein. In the operation of these embodiments, the indicator member **1800** rotates with each actuation of the cap member **1020, 2020** relative to the base member **1040, 2040** as the ratchet wheel **82** is driven by the pawl member. The
5 indicator member **1800** rotates about an axis substantially perpendicular to the axial movement of the cap member relative to the base member and to the rotational axis of the indicator member **1060, 2060**. In the preferred embodiment, with the indicator member **1800** having "ones" indicia and the ratchet wheel **82** having ten teeth, the indicator member **1800** is advanced
10 upon each actuation and provides indicia visible to the user to notify them of such advancement. As the indicator member **1800** completes a cycle, or rotation, the indicator member **1060, 2060** is advanced one increment by the drive member **86** and the indicator member **1800** begins another cycle. In this way, the user is advised as to each actuation of the indicating device and
15 the attendant dispensement of a dosage from the attached container.

Where, as shown in FIGS. 5, 40 and 58, the teeth **66, 266, 1066** extend only partially around the periphery of the indicator member, the indicator member **60, 260, 1060** is not advanced after the drive member engages the last tooth, even when the cap member is repeatedly moved to
20 actuate the container. This ensures that the indicator member cannot be advanced past the last indicia indicating that the container is empty, or should otherwise be replaced, to a first indicia indicating that the container is full, so as to confuse the user.

In one preferred alternative embodiment, shown in FIGS. 58-67, the
25 drive member has an additional finger **3002**, or stop member circumferentially spaced from the single tooth **81**. For purposes of simplicity and clarity, various feature and components previously described are referenced in the Figures with the same reference numbers. The stop member **3002** has a lesser radial length than the tooth **81** such that it clears the teeth **66** formed
30 on the indicator member **60** as the drive member is rotated by actuations of the container, and as it is engaged with the indicator member after and upon

the predetermined number of movements of the cap member relative to the base member.

As best shown in FIG. 58-60, 65 and 66, the indicator member has a corresponding stop member **3004** spaced circumferentially from the last tooth **66**. The stop member preferably extends downwardly from the upper surface a greater extent and is longer than the teeth **66**. Preferably, the stop member **3004** has a stop surface **3006** formed at an angle of about 15 degrees from the horizontal, such that it slopes up and away from the drive member stop member **3002**. Preferably, the angle is greater than 0 degrees from the horizontal such that the stop member **3002** on the drive member cannot slip past the stop surface **3006** and thereby allow subsequent rotations of the ratchet wheel **82**.

Referring to FIGS. 61-67, in operation of the preferred embodiment of FIGS. 58-67, the user moves the cap member **20** toward the base member **40** a first predetermined number of times corresponding to the total number of metered dosages, such that the indicator member **60** is rotated between an initial position, wherein indicia indicate to the user that the container is full, and a final position, wherein the indicia indicate to the user that the container should be replaced. During the first predetermined number of actuations, the drive member, and in particular, the tooth **81**, is successively engaged with at least one of the teeth **66** of the indicator member upon a second predetermined number of axial movements of the cap member **20** relative to the base member **40**, wherein the indicator member is moved an incremental amount. Preferably, the first predetermined number of actuations is greater than and some multiple of the second predetermined number of actuations. However, it should be understood that the first and second predetermined number of actuations can be equal, preferably with the second predetermined number being greater than one.

Referring to FIGS. 65 and 66, as the cap member **20** is moved toward the base member **40** on the final predetermined actuation of the container **12**, the drive tooth **81** moves indicator member **60** a final incremental amount as

the pawl **48** engages one of the teeth **89** and moves the ratchet wheel **82**, and thereby rotates the stop member **3004** formed on the indicator member into vertical alignment over and with the stop member **3002** formed on the drive member. Accordingly, the stop members **3002**, **3004** must be
5 dimensioned and located on the drive member and indicator member respectively and relative to the other teeth on the drive member and indicator member so as to allow the stop member **3004** to pass over the stop member **3002** during the final actuation. In this location, with the stop members **3002**, **3004** engaged, the drive member **86**, and connected ratchet wheel **82**, can no
10 longer be rotated relative to the cap member **20** upon subsequent actuations.

As best shown in FIGS. 61 and 62, upon the next subsequent actuation of the container **12** after the final predetermined actuation, the cap member **20** is again moved toward the base member **40**. However, since the drive member is locked and unable to rotate, the engagement surface **89** of
15 one of the teeth on the ratchet wheel engages the pawl **48** and deforms the pawl, preferably by bending, as the cap member **20** moves toward the base member **40**. As such, neither the non-return member **238** nor the pawl **48** moves past any teeth of the ratchet wheel **82** and the audible click is thereby eliminated. In this way, an auxiliary warning system, or indicia, is provided to
20 inform the user that the final predetermined dose of medication has been dispensed, and/or that the container should be replaced. At the same time, however, the container can still be actuated, such that if certain residual doses were available therein they can be dispensed in an emergency situation.

Referring to FIGS. 63 and 64, preferably, the pawl **48** is configured to bend over after the final predetermined actuation such that it does not provide a false audible indication that the container does not need to be replaced, e.g., that additional doses are available upon subsequent actuations after the
25 next subsequent actuation following the final predetermined actuation. In addition, the bent pawl **48** prevents tampering and unintended resetting by
30 the user.

In particular, the pawl **48** has fillets **3008** formed along its base each having a preferred radius of about 1.40 mm, or preferably a radius greater than a minimum value required to prevent stress concentrations in the plastic during the bending process that occurs during the next subsequent actuation or movement of the cap member after the final predetermined actuation of the container. The overall height of the pawl is preferably about 5.20 mm. The width of a pawl head **3020** is preferably about 1.80 mm, and the width of a stem **3018** is preferably about 0.65 mm. The overall height of the pawl **48** and the width or thickness (or diameter if round) of the stem **3018** are preferably greater than minimum permissible values that will provide the pawl with enough strength and resistance to buckling during normal operation, but which allows the pawl to bend during the next subsequent actuation of the container and movement of the cap member after the final predetermined actuation of the container. The width of the head **3020** of the pawl allows it to function during the normal operation of the device, and further allows it to be nested with the ratchet wheel **82** after the pawl is bent when the cap member **20** and ratchet wheel **82** are at the bottom of subsequent strokes after the final predetermined actuation. Obviously, the various preferred dimensions described herein can be scaled up or down depending on the size of the overall indicator and force required to actuate the container, and the corresponding force of the return springs.

In alternative preferred embodiments, shown in FIGS. 33-36, 68 and 69, the indicating device includes a lock device. In particular, in one preferred embodiment, the base member includes a first lock member **702**, configured as a post member extending upwardly from the bottom of the base member. The indicator member **760** includes a second lock member **704**, shown in FIG. 35 as a radial extension of one of the plurality of teeth **776** formed around the circumference of the indicator member, and shown in FIG. 69 as a separate post member. In operation, the cap member is moved towards and away from the base member between a fully extended position, wherein the cap member is distal to the base member, and a bottom of the stroke

position, wherein the cap member is proximate the base member, so as to rotate the indicator member as described above. During this operation, as shown in FIGS. 33 and 34, the first lock member **702** is positioned inside the inner diametrical surface of the plurality of teeth so as to not interfere therewith as it is moved into the recess formed by the indicator member as shown in FIG. 33. After the indicator member has made one complete rotation, which preferably correlates to an emptying of the container, the second lock member **704** is rotated over the first lock member **702** as shown in FIGS. 35, 36 and 69. In this position, the cap member cannot be moved toward the base member. In particular, during the final downstroke of the cap member, one or both of the first and second lock members **702**, **704** are biased against the other such that they snap into position, one over the other, upon completion of the final upstroke.

The immobility of the cap member provides visual and physical secondary indicia that the container should be replaced, and further prevents the mechanism from clicking or the indicator member from moving, thereby providing both a visual as well as an audible indication that the container should be replaced. One of skill in the art should understand that the size and shape of the first and second lock members can be varied. For example, a post member may extend from the cap member so as to engage a stepped surface in the base member, which functions as a stop member.

In addition, it should be understood that, in one alternative preferred embodiment, the pawl **48** can be made sufficiently robust, for example by thickening the stem, such that when it is used with the stop members **3002**, **3004**, the pawl **48** engages the ratchet wheel **82** and prevents the cap member **20** from being moved toward the base member **40**, rather than bending or buckling as described above with respect to another preferred embodiment. As such, the immobility of the cap member **20** relative to the base member **40**, and the elimination of any clicking sound, provides further indicia to the user that the container should be replaced. It should also be

understood that the lock member can extend from the cap member and engage a corresponding lock member on the base member.

Referring to FIG. 68, an alternative preferred embodiment of the lock device is shown. In particular, the lock device includes a pair of catch members **3010**, **3012** formed on the indicator member **60** and the base member **40** respectively. Alternatively, one of the catch members can extend from the cap member and engage a catch member formed on the base member. In the preferred embodiment, each catch member **3010**, **3012** includes an end portion **3014**, **3016** having opposing hooks, which engage at the bottom of the final predetermined stroke of the cap member **20** relative to the base member **40**. In this position, the cap member **20** cannot be moved away from the base member **40**. The immobility of the cap member provides a secondary indicia that the container should be replaced, and further prevents the mechanism from clicking or the indicator member from moving, thereby providing both a visual as well as an audible indication that the container should be replaced. One of skill in the art should understand that the size and shape of the first and second catch members can be varied. In addition, the catch members can be configured as any two members that engage, for example by using adhesives, hook and loop type fasteners, detents, etc.

As shown in FIGS. 29 and 30, a reset wheel **106** is coaxially mounted with the ratchet wheel **82** and drive member **86**. The outer periphery **108** of the wheel, which includes a plurality of teeth for gripping by the user's thumb, is exposed as it extends through the bottom surface **50** of the base member. One of skill in the art should understand that the reset wheel can be exposed by extending from other portions of the indicator device for access by the user. The user rotates the reset wheel **106** to manually rotate the indicator member to its original starting position, or any other desired setting, without having to move the cap member relative to the base member. In this way, the indicator member can be recycled for use on a new container, or can be moved to the proper setting prior to installing the indicating device on the

container. In this way, the same indicating device can be used with various containers containing varying numbers of metered dosages of medicament. During the movement of the indicator wheel relative to the cap member, the force of the indexing member against the indentations in one of the cap member and indicator member is overcome such that the indexing member repeatedly moves into and out of engagement with the indentations as the indicator member is rotated by the user to the desired setting. This movement is similar to the movement of the indexing member occurring upon each incremental advancement of the indicator member relative to the cap member.

Preferably, the reset wheel of FIGS. 29 and 30 is used with an indicator member having teeth formed about its entire periphery, such that the indicator wheel need only be moved a few teeth (one or more) to return it to the zero (or full, e.g., 200) position. The reset wheel can be used with or without the lock device described above, since the wheel can be used to move or rotate the indicator wheel independent of any axial movement between the cap member and base member.

In an alternative embodiment shown in FIG. 28, a reset selector member **602** is mounted to the end of the axle and is exposed in an opening **604** in the side or skirt **694** of the base member. The reset selector member **602** is mounted on the axle. The selector member **602** is provided with a slot adapted to receive the head of a screw driver or like tool, which can be actuated by the user to rotate the axle, coaxially mounted drive member and indicator member until the desired indicia are visible in the viewing window. This feature can be valuable for resetting an indicating device for use on a new container, or for initially setting the device for the proper number of doses contained in the container. One of skill in the art should understand that recesses and/or protrusions other than the disclosed slot can be exposed on the selector member to allow the user to grip or otherwise operably engage the selector member and to thereafter rotate the indicator member. One of skill in the art should also understand that the opening in the base member

could be positioned anywhere along the longitudinal path of the axle as the cap member moves relative to the base member so as to expose the selector member when aligned with the opening.

5 In yet another alternative embodiment, shown in FIG. 27, a selector window **806** is formed in the top of the cap member. A reset selector member **802**, configured as a protrusion or like grippable member, is exposed in the window as the indicator member is rotated to the empty position. In one embodiment, as described above, the plurality of teeth are formed only around a portion of the periphery of the indicator member so as to leave a gap between the first and last tooth. In such an embodiment, the selector window **806** is preferably of such length that the user can move the reset selector member **802** within the window until the first tooth is again in position for engagement with the drive member. It should be understood, however, that the reset selector member can also be used with an indicator member having teeth formed around the entire periphery of the member.

10 In an alternative embodiment, a plurality of reset members, or a similar grippable surface, configured for example as a plurality of notches or teeth, can be formed around the entire periphery of the indicator member and exposed in a selector window, or alternatively, in the viewing window. In such an embodiment, the indicator wheel can be rotated to expose different indicia at any time simply by engaging the reset selector members on the indicator member with the user's thumb or like member.

20 In yet another embodiment, shown in FIG. 24, an opening, or selector window **906**, is provided in the top of the cap member. A thin tool, such as a paper clip, is inserted through the opening to bias the resilient indexing member **370** out of engagement with the indicator member. The user can then operably engage the indicator member with their finger or the like, either through the viewing window or a selector window, to move the indicator member to the desired setting.

30 In yet another alternative embodiment, shown in FIG. 43, the reset member, with the collar **1109** disposed on the axle **1084** of the drive

assembly, is pulled axially outward with respect thereto from a disengaged position, where the engagement portions **1306** of the flexible fingers **1304** are positioned circumferentially around the axle **84**, to an engaged reset position, such that the engagement portions **1306** of the flexible fingers are biased
5 outwardly as they ride up the ramp **1083** and are thereafter moved into engagement with the teeth **1085** formed around the axle of the drive assembly. The user then rotates the reset member **1106** about a rotation axis, which is substantially perpendicular to the axial movement of the cap member relative to the base member. As the reset member is rotated, the
10 protrusion **1308** on the flexible fingers is brought into engagement with the protrusion **1310** on the indicator member **1060** so as to rotate the indicator member an incremental amount and thereby bring the first tooth on the other side of the gap **1061** into position for engagement by the drive member, thus bridging the gap **1061** between the teeth of the indicator member. As the
15 reset member **1106** is further rotated, the drive member tooth **89** engages the teeth **1066** of the indicator member, and the reset member can be rotated to manually drive the indicator member, or indicator members, to the desired preset condition. For example, the indicator members can be reset to indicate 200 dosages for use with a container having 200 dosages.

20 In a preferred embodiment, the engagement portions **1306** and/or teeth **1085** formed on the axle of the drive assembly are configured to allow rotation of the drive member in only one direction. Therefore, rotation of the reset wheel in an opposite direction will not effect a rotation of the drive member in that same direction as the flexible fingers, with their engagement
25 portions, will simply slide over the teeth formed about the axle. This one-way rotation prevents the drive member from engaging and rotating the indicator member in an opposite direction, which direction is opposed both by the non-return member engaging the ratchet wheel, and the one-way indexing interface between the cap member and indicator member.

30 To install the reset member and drive assembly, the drive assembly is installed in a vertical manner such that the axle **84** is received in the flexible

5 snap enclosure **1036**. Once the drive assembly is snapped in place, the reset member **1106** is inserted through the opening in the cap member and over the axle **1084** until the fingers eventually are disposed around the axle **84** in the disengaged position. In this way, the reset member, which is supported by the bearing surface **1300** of the cap member, further supports the drive assembly.

10 In yet another embodiment, best shown in FIGS. 52-55, the indicator member **2060** has a plurality of teeth extending around the entire circumference thereof. At least one of the teeth **2067** has a cut-away portion **2069** aligned with the tooth **89** of the drive member. Accordingly, at the end of a cycle, the drive member is positioned in a disengaged position where even repetitive actuations of the indicating device do not lead to the advancement of the indicator member as the drive member, with its one or more teeth **89**, merely passes through the cut-away portion **2069** of the tooth, with which it is aligned. In this embodiment, however, the drive member **86** is axially moveable with respect to the indicator member **1800** and ratchet wheel **82**.

20 As best shown in FIGS. 44, 47 and 52-56, a reset member **2106** includes a grippable wheel **2107** connected to a drive shaft **2109**. As shown in the preferred embodiment of FIG. 47, the end of the drive shaft includes a plurality of teeth **2306**, that engage slots **2308** or openings dimensioned to receive the teeth formed in one end of the drive member **86**. The drive member is installed on the shaft of the reset wheel such that the teeth **2306** formed on the end thereof engage the slots **2308** formed in the drive member. 25 The drive member is then inserted into the groove **1801** of the collar **1082** extending from the indicator member.

30 In operation, the user pulls the reset member **1206** axially outward so as to move axially the drive member **86** from a disengaged position, where the drive member tooth **89**, or teeth, is aligned with the cut-away portion **2069** of the tooth on the indicator member, to an engaged or reset position, where the drive member tooth is brought into engagement with the portion **2067** of

the tooth that is not cut-away. In the reset position, the user rotates the reset wheel **2107** and connected drive member **86** so as to advance the indicator member **2060**, or indicator members, to the desired setting independent of the axial movement of the cap member relative to the base member. In the
5 disengaged position, the reset wheel is recessed between a pair of tapered flanges formed around the circumference of the base member.

As shown in FIGS. 44 and 52-56, the indicator member **2060** includes a cover portion **2087** that extends radially inward from the top portion of the indicator member. The cover portion is brought into alignment with the
10 viewing window at the end of the usage cycle such that the indicator **1800**, which can continue to be spun beneath the cover portion is not visible. Indicia, such as the number "0" or the words "end" or "empty" can be applied to the cover portion to inform the user that the container is empty, or should otherwise be replaced.

As shown in FIGS. 37-43, the indicating device also includes a usage
15 indicator member **1500**. The indicator member **1500** is configured as a ring and is disposed around the skirt **1074** of the dosage indicator member **1060** where it is trapped between the rim flange **1078** of the indicator member and the bottom surface of the top of the cap member. In this way, the usage
20 indicator member **1500** is supported by and is moveable about the dosage indicator member **1060**. The indicator member **1060** also is thereby rotatably mounted about an axis substantially parallel to the axial movement of the cap member relative to the base member. The indicator member **1500**, which is configured as a ring, has a plurality of teeth **1502** formed around the
25 outwardly facing radial periphery thereof. As the indicator member **1500** is advanced as explained above, a flexible finger **1273** formed along the circumferential rim **1078** of the indicator member **1060** is biased radially inward by a ramp **1277** formed on the inside of the cap member so as to engage at least one of the plurality of teeth **1502** formed on the indicator
30 member and thereby advance the indicator member an incremental amount, defined by the distance between adjacent teeth. The number of teeth formed

around the indicator member corresponds to the number of intended usage cycles of the indicating device.

5 In the preferred embodiment, which has only a single ramp **1277**, the usage indicator member **1500** is advanced one tooth upon each complete rotation of the dosage indicator member **1060**, which corresponds to one complete usage cycle for the indicating device. For example, the indicating device can be initially set to reveal an initial count of 200 dosages. As the indicating device is successively actuated to dispense the dosages, the indicator members **1060**, **1800**, with indicia, are actuated to count down until
10 they reveal a final count of 0 dosages available for use. At that time, the drive assembly is positioned in the disengaged position, as explained above.

As the reset member **1106** is used to actuate the drive assembly to reset the device for another usage cycle, the indicator member **1060** with its resilient finger **1273** is biased into engagement by the ramp **1277** such that
15 the usage indicator member is rotated. In this way, the usage indicator member **1500** is rotated, or advanced, upon the completion of each successive usage cycle. The number of teeth **1502** on the indicator member **1500** corresponds to the number of intended uses for the indicator. For example, in the embodiment shown in FIGS. 38 and 41, the indicator member
20 **1500** has twelve teeth corresponding to an intended twelve uses of the indicating device with twelve different containers. As noted above, the reset member can be used to reset the indicia at any desired reading, such that one indicating device can be used with successive containers having different numbers of dosages contained therein. The indicator member **1500** also
25 includes a stop member **1506** formed as a protrusion that extends radially inward from the top of the indicator member. The stop member **1506** engages a stop member extending downwardly from the top portion of the cap member upon completion of the final usage cycle. This engagement prevents the user from attempting to advance the dosage indicator member
30 **1060** by way of the reset member and drive assembly, because the finger **1273** is biased into engagement with at least one of the teeth on the usage

indicator member, which is immobilized. In this way, the entire device is immobilized. It should be understood that although the preferred embodiment is configured for twelve usage cycles, the usage indicator member could be provided with more or less teeth corresponding to more or less total available usage cycles.

Referring to FIG. 41, the usage indicator member **1500** further includes an indexing member **1510** configured as a protrusion extending radially outward from the outer circumferential surface of the indicator member. The indexing member **1510** selectively engages a plurality of teeth **1512** formed around the inner circumferential surface of the skirt of the cap member. The indexing member **1510** and teeth **1512** are configured as a ratchet to allow one-way rotation of the indicator member **1500** relative to the cap member **1020**. In a preferred embodiment, the indexing member and teeth are tapered to interact and provide for the one-way action.

As shown in FIGS. 37 and 38, a plurality of viewing windows **1600** are arranged around the outer periphery of the top of the cap member. A plurality of indicia **1602**, shown as successive numbers, are affixed to the top of the cap member adjacent the viewing windows. The upper edge **1514** of the usage indicator member is provided with indicia that is visible through the viewing windows **1600**, such that the user can ascertain which usage cycle the indicating device is currently functioning in. For example, in the embodiment shown in FIGS. 37 and 38, twelve viewing windows **1600** are provided with the numbers 1 to 12 arranged adjacent thereto, which correspond to the 12 usage cycles defining the life of the indicating device. The numbers, or other indicia such as various colors, can be applied to the cap member by printing, molding or any other of the techniques described above. Alternatively, a single viewing window can be provided to expose the indicator member, whereupon indicia can be applied to the top surface or upper edge **1514** thereof, or, if the window is provided in the side of the cap member, along the outer circumferential surface thereof.

In the embodiment shown in FIGS. 44-45 and 49-51, the usage indicator member **2500** includes a hub **2520** having an opening **2521** that is rotatably mounted on a post **2522** extending downwardly from the inner surface of the top portion of the cap member **2020**. In this way, the usage indicator member **2500** is rotatably mounted to the cap member **2020** about an axis substantially parallel to and spaced from the rotational axis of the dosage indicator member **2060**. The axis of rotation for the dosage usage indicator member is also substantially parallel to the axial movement of the cap member relative to the base member.

The indicator member **2500** includes a ring **2524** formed about the hub **2520** which is connected thereto with a rib **2526** and a bottom surface **2528**. The indicator member **2500** has a plurality of inwardly, radially extending teeth **2514** formed about the inner periphery of the ring, and a plurality of outwardly, radially extending teeth **2502** formed on the bottom surface of the indicator member around the outer periphery thereof. Both pluralities of teeth are configured as ratchet teeth to allow only for one-way rotation of the indicator member **2500**.

Referring to FIG. 46, an engagement member **2573** extends from the indicator member **2060** and engages an engagement surface of one of the ratchet teeth **2502** as the dosage indicator member **2060** completes one full cycle. As the engagement member **2573** engages the engagement surface of one of the teeth **2502**, the indicator member is rotated an incremental amount.

Referring to FIG. 51, an indexing member **2577** extends downwardly from the cap member **2020** in a parallel and spaced apart relationship with the post **2522**. The indexing member **2577** is disposed in the space between the hub **2520** and the ring **2524** and selectively engages the inner teeth **2514** formed around the inner periphery of the ring. Again, the indexing member **2577** and teeth **2514** are preferably configured to allow for only one-way rotation of the usage indicator member **2500** relative to the cap member **2020**. The number and angular spacing between the inner and outer teeth

2514, 2502 correspond such that the advancement of the indicator member 2500 by way of engagement of the engagement member 2573 with one of the outer 2502 teeth further advances the indexing member 2577 one tooth 2514 along the inner periphery of the ring. The predetermined number of usages
5 for the indicating device corresponds to the number of teeth formed around the inner periphery of the ring. After the completion of the final usage cycle, the indexing member 2577 is brought into engagement with the rib 2526, which functions as a stop member and does not permit the indicator member to be further rotated or advanced. At the same time, the engagement
10 member 2573 is brought into engagement with one of the teeth 2502 formed about the outer periphery of the ring such that the indicator member also cannot be advanced. In this way, the device is immobilized. Again, the indicating device can be provided with a predetermined number of inner and outer teeth, which corresponds to the number of predetermined usage cycles
15 for the indicating device.

The upper surface 2528 of the indicator member ring, which is preferably domed, is provided with usage indicia to indicate the number of usage cycles completed or remaining for the indicating device. The usage indicia is visible to the user through a viewing window 2600 provided in the
20 cap member, as shown in FIG. 44. Again, the usage indicia can take the form of various alphanumeric characters, colors or any of the other varieties described above.

Referring to the embodiments shown in FIGS. 118-135, 141, 142 and 145-153 the operation of the indicator assembly includes moving the cap
25 member toward the base member as the container is moved longitudinally within the housing 10 so as to depress the valve stem 110 to the open position so as to open the valve as explained above. As the cap member is moved toward the base member, in one embodiment, the pawl 48 is moved longitudinally toward such that the end portion thereof biased outwardly by
30 the ratchet gear 6552 on a first outer indicator member. At the bottom of the stroke, the end portion, formed for example as a hook, slips into an overlying

relationship with the teeth on the ratchet gear. When the cap member is released by the user, the spring biases the cap member away from the base member along the longitudinal axis. As the cap member moves away from the base member, the resilient arm member **6570** moves longitudinally such
5 that the end portion rotates the first indicator member a predetermined angular or incremented amount corresponding to the pitch of the teeth disposed around the periphery of the ratchet gear. As the cap member and ratchet gear reach the top of the stroke, the pawl **48** is positioned for the next cycle. The term incremental is meant to refer to the angular amount the
10 indicator member is moved by the advancement of one actuation, which corresponds to the movement of one tooth, regardless of whether the indicating device is indicating the number of doses left (e.g., counting down) or indicating the number of doses administered (e.g., counting up).

Alternatively, the operation of the pawl and ratchet gear can be
15 reversed. In particular, the pawl engages and rotates the ratchet gear on the first primary indicator wheel as the cap member is moved toward the base member. On the return stroke, as the cap member moves away from the base member, the arm member is biased over the teeth until it is engaged with another tooth at the top of the stroke.

20 The reciprocal movement of the cap member relative to the base member is repeated until the first primary indicator member **6550**, and its ratchet gear, are rotated one complete revolution. The predetermined number of reciprocal movements required to advance the first indicator member one revolution is equal to the number of teeth disposed about the
25 periphery of the ratchet gear **6552**. As the first indicator member is rotated by successive movements of the cap member relative to the base member, the advancement member **6600** of the first indicator member is brought into selective engagement with the engagement member, configured as either the ramped surface formed in the cap member or as an arm member extending
30 from the cap member. In particular, the engagement member biases the

tooth portion of the advancement member into engagement with one of the teeth of the ratchet gear on the second primary indicator member.

5 The second primary indicator member with its advancement member similarly interacts with a second engagement member overlying the teeth of the third indicator member so as to selectively engage and advance the third primary indicator member a predetermined incremental amount for each complete rotation of the second indicator member. It should be understood that more indicator members could be similarly assembled to provide an incremental indicating device.

10 Alternatively, as explained above with respect to the embodiment of FIG. 145, the advancement tooth rotates the advancing gear, which rotates the next adjacent indicator wheel.

Various indicating devices and components thereof are disclosed in U.S. Patent Nos. 6,082,358, 6,336,453 and 6,328,037, all of which are hereby
15 incorporated herein by reference.

Description of Primary Indicating Device Disposed in Bottom of Dispenser Housing:

20 Now referring to FIGS. 71 and 72, an aerosol dispenser is shown as including a housing, a container mounted therein as described above and an indicator assembly. The indicator assembly includes a ratchet gear **7032** coaxially mounted with a worm **7040** on an axle **7042** in a lower portion of the housing. A plurality of teeth **7034** are formed about the periphery of the ratchet gear. The teeth **7034** are cut or formed with a tapered surface **7036**
25 and engagement surface **7038**. In a preferred embodiment, the ratchet and worm are formed out of a hard durable plastic. It should be understood, however, that other materials such as metal would also work. The ratchet and worm can be made as separate parts, or molded as a single integral member.

30 In a preferred embodiment, the axle **7042** and worm **7040** define an axis of rotation transverse, or perpendicular, to the longitudinal axis defined

by the valve stem and reciprocal movement of the container relative to the housing. Opposite ends of the axle **7042** are rotatably supported in the housing.

Also as shown in FIGS. 71 and 72, an indicator member **7050**
5 comprises a circular worm gear **7052** and indicator wheel **7058** coaxially mounted on an axle. In a preferred embodiment, the axle **7056** defines an axis of rotation transverse to the axis defined by the worm and also transverse to the longitudinal axis defined by the reciprocal movement of the container relative to the housing. The axle **7056** is rotatably supported in the
10 housing. Teeth **7054** are formed around the periphery of the worm gear **7052** and are shaped to permanently engage the worm **7040**. As shown in FIG. 71, the indicator wheel **7058** has a planar face **7060** which is exposed to the patient through a viewing window **7028** formed in the housing.

The ratchet gear **7032**, worm **7040**, worm gear **7052** and indicator
15 wheel **7058** provide an ideal arrangement for indicating the number of doses remaining in the container, or the number dispensed therefrom. In particular, relatively high reduction ratios are made possible through use of the ratchet, worm and worm gear without the corresponding requirement of providing extremely fine teeth on one or more of the ratchet gear and worm gear.
20 Moreover, the worm and worm gear interface avoids the associated inaccuracies introduced by the mating, and potential skipping, of conventional spur gears having fine teeth. Furthermore, the installation of the indicator member is effected by the installation of a simple axle which can be supported in a plurality of positions and angular orientations within the
25 housing. Importantly, the high reduction ratio realized with the worm **7040** allows for the worm gear **7052** to have a relatively small diameter, such that it can be easily mounted within small spaces within the housing. Indeed, as shown in FIGS. 75 and 81, the entire indicator assembly can be mounted behind the support block **7016** and below the upper surface **7017** thereof
30 such that the assembly does not interfere with the dispensing of the

medicament from the orifice or with the airflow generated by the patient in administering the medicament.

Referring to FIG. 74, an actuator member **7070** is configured as a post member **7072** moveably supported in the housing along an axis parallel to the longitudinal axis defined by the reciprocal movement of the container within the housing. In an alternative embodiment shown in FIGS. 76-78, the post member includes an upper portion **7074**, a middle portion **7076** and a lower portion **7078**. A resilient arm member **7080** extends from the middle portion of the post member and terminates in a tapered hook member **7082** shaped to selectively engage one of the ratchet wheel teeth. The middle portion **7076** is defined by upper and lower stop surface **7084**, **7086**. A spring **7088** is disposed about the lower portion **7078** of the post member and engages the lower stop surface **7086** so as to bias the actuator member upwardly against the top surface of the canister as shown in FIG. 76. Although a compression spring is shown in the Figures, it should be understood that cantilever, torsion, leaf and tension springs, and the like, would also work to bias the actuator member upwardly into engagement with the container. The springs can be made of metal or plastic.

In an alternative embodiment, shown in FIGS. 71 and 72, actuator member **7090** includes locking ring **7092** and a resilient arm member **7094** extending longitudinally downwardly therefrom. A longitudinal slit **7096** is formed in the locking ring so as to allow for the locking ring **7092** to be expanded and disposed around the hub **16** (shown in FIG. 74) of the canister in a snap fit configuration such that the valve stem of the container extends through opening **7098** of the locking ring. In this way the actuator member is fixedly attached to the container and is removable therewith. If the actuator member is further secured within the module housing, such that it cannot be disengaged therefrom, the entire indicator module is fixedly secured to the container and is removable therewith from the dispenser housing. A distal end of the resilient arm member terminates in a hook member **95** that is shaped to selectively engage the teeth of the ratchet wheel.

Referring to FIGS. 94 and 138-140, an alternative embodiment of an indicator assembly is shown. The indicator assembly includes three indicator members **7550** coaxially mounted on an axle **7556** and rotatable thereabout. As best shown in FIGS. 97, 98 and 138-140, each of the indicator members includes an indicator wheel **7558** having a circumferential skirt **7559** with an outer circumferential surface **7560** on which indicia (shown as numbers) are applied, and a ratchet gear **7552** coaxially mounted with the indicator wheel. The indicator wheel and ratchet gear have an opening **7553** shaped to receive the axle. Alternatively, the middle indicator wheel is integrally formed with an axle portion extending laterally from both sides thereof, with the other indicator wheels mounted thereon on opposite sides thereof. The ratchet gear **7552** includes a plurality of teeth **7554** formed around its periphery. The ratchet gear is preferably integrally molded with the indicator wheel, although it should be understood that the gear and wheel can be made separately and thereafter attached one to the other by welding, adhesive and the like.

In one embodiment of the indicator member, a resilient advancement member **7600** is formed from a portion of the circumferential skirt **7559** by providing an elongated cutout **7602** in the indicator wheel radially inward from and beneath the skirt. The advancement member **7600** includes a laterally extending tooth portion **7604** having an engagement surface **7606**. The three indicator members are coaxially mounted such that the tooth portion **7604** of the advancement member of a first indicator member overlies the ratchet gear teeth **7554** of the second indicator member, and such that the tooth portion **7604** of the advancement member of the second indicator member overlies the ratchet gear teeth **7554** of the third indicator member. When only three indicator members are used (as shown in FIGS. 94 and 138-140), the third indicator member does not require an advancement member, although for the sake of simplicity in manufacturing, a modular indicator member with the same indicia applied thereto and the same advancement member formed thereon is preferably used for each of the first, second and third indicator members. It should be understood by one of skill in the art that one or more

indicator members may be used to provide an indication of dosages used or available, and that the three indicator members shown in the Figures is meant to be illustrative, rather than limiting. In addition, it should be understood that a plurality of indicator members refers to any number of indicator members greater than one.

5 In an alternative embodiment of the indicator member **7650**, shown in FIGS. 108, 111 and 112, an advancement member **7800** is disposed radially inward from a circumferential skirt **7659** and includes a first end **7657** connected to a planar side portion or hub **7655** of the indicator wheel. The advancement member includes a curved resilient portion **7708** having a free end with a tooth portion **7704** extending laterally outward therefrom so as to extend laterally from beneath the skirt **7659** of the indicator wheel such that it overlies the teeth of the ratchet gear of an adjacent indicator member coaxially mounted therewith as shown in FIG. 48. Indicia, preferably in the form of numbers, are applied to the circumferential surface **7660** of the skirt. A ratchet gear **7652**, having a plurality of teeth **7654** is coaxially mounted with the indicator wheel. As shown in FIG. 117, three indicator members are coaxially mounted on axle **7656**.

Referring to FIGS. 94, 108 and 138-140, an actuator member **7570**, **7670**, otherwise referred to as a ratchet member, is shown as having an upper portion **7574**, **7674** extending upwardly from a lower portion **7578**, **7678** and a resilient arm member **7580**, **7680** extending outwardly therefrom and terminating in a resilient hook member **7582**, **7682** shaped to selectively engage at least one of the teeth of the ratchet gear of the first indicator member. A spring **7588**, **7688** is disposed around the lower portion of the actuator member and biases the upper portion **7574**, **7674** of the actuator member into engagement with the container.

Referring to FIGS. 96 and 143, a housing **7820** is shown as having a pair of engagement members **7770** formed integrally with the housing and including ramped surfaces **7772**. A plurality of non-return members **7900** extend from the housing and selectively engage the ratchet gear to ensure

unidirectional rotation of the indicator member as shown in FIGS. 104-107. Although the engagement members and non-return members are shown as being formed in or extending from a module housing, as described below, one of skill in the art should understand that those members or equivalent features could also be formed in or connected to the dispenser housing or actuator boot that supports the container, or disposed on or connected to the container itself.

Referring to FIGS. 94, 104-107 and 136-140, the operation of the indicator assembly is generally shown. In particular, the container is moved longitudinally within the housing **200** so as to depress the valve stem **18** to the open position so as to open the valve as explained above. As the container is moved downwardly within the housing, or downwardly with respect to the module housing described below, the actuator member **7570** is moved longitudinally downward such that the hook member **7582** is biased outwardly by the ratchet gear **7552** on a first outer indicator member. At the bottom of the stroke, the hook member **7582** slips into an underlying relationship with the teeth on the ratchet gear. When the container is released by the user, the spring (not shown) within the container biases the container upwardly within the housing along the longitudinal axis such that the valve stem **18** and valve are moved to the closed position within the container. As the container moves upwardly, the resilient arm member **7580** moves longitudinally upward such that the hook member **7582** rotates the first indicator member a predetermined angular or incremented amount corresponding to the pitch of the teeth disposed around the periphery of the ratchet gear. As the container and resilient arm member reach the top of the stroke, wherein the valve stem and valve are moved completely to the closed position, the resilient arm member **7580** is positioned over the ratchet gear for the next cycle. Alternatively, the operation of the actuator member and ratchet gear can be reversed as explained above with respect to the embodiment shown in FIGS. 75-78.

Referring to FIGS. 107-110 and 113-117, a plurality of resilient arm members **7700** are shown as extending from a module housing so as to be aligned with the ratchet gears on each of the indicator members. The arm members **7700** each serve as a combined engagement member and non-
5 return member. In particular, as shown in FIGS. 109 and 110, the arm member **7700** functions as a non-return member and includes an end portion that is biased away from the teeth on the ratchet gear as the actuator member, or adjacent indicator member with its advancement member, is actuated to advance the ratchet gear. The operation of the actuator member
10 **7670** and ratchet gear is similar to the operation of the ratchet gear shown in FIGS. 75-78 as explained above. The arm member **7700** snaps back so that the end portion engages one of the teeth of the ratchet gear so as to ensure that the rotation of the ratchet gear is unidirectional. As shown in FIGS. 113-
15 117, the arm member **7700** overlying the ratchet gears of the second and third indicator members also serves as an engagement member that selectively engages the advancement members connected to the indicator members.

In a preferred embodiment of the dispenser, shown in FIGS. 75-79, 87, 89, 93, 94, 108, 136-40, 143 and 144, the indicator assembly is arranged in
20 an indicator module **7120, 8020, 8120, 8220**. The indicator module **7120, 8020, 8120, 8220** is shaped to be received within the housing where it is disposed around a portion of the support block **212**. In particular, the support block is spaced apart from the wall of the dispenser housing, otherwise referred to as the actuator boot, so as to form a donut-shaped socket in the
25 bottom of the housing. The module includes a module housing **7130, 8030, 8130, 8230** having an inner concave surface **7132, 8032, 8132, 8232** that is shaped to mate with an outer convex surface of the cylindrical support block and an outer convex **7134, 8034, 8134, 8234** surface that is shaped to mate with the inner concave surface of the housing which is also generally
30 cylindrical. In this way, the module housing is shaped to be received within the socket formed around the support block. Preferably, the module housing

has a semicircular shape and fits around a portion of the support block opposite the orifice opening so as to not interfere with the dispensing of the medicament, or the airflow transmitting the medicament to the patient. In this way, the module is maintained rearwardly of the midpoint of the support
5 block. One of skill in the art should understand, however, that the module, or module housing, can be configured in any number of different sizes and shapes so as to be accommodated in a variety of housings or cap assemblies, with or without support blocks and the like.

As shown in FIGS. 77-78, one embodiment of the module preferably
10 includes a face portion **7210** that extends from the rear convex surface of the module and includes a module viewing window **7064**. The face portion snaps into the housing viewing window opening (circular opening not shown) so as to secure the module thereto. As shown in an alternative embodiment in FIGS. 79-81, the face portion includes a vertically oriented rectangular
15 viewing window **768** and a downwardly extending locking member **7122** which extends through the dispenser viewing window opening **7124** and engages a bottom wall of the housing. In yet other embodiments, shown for example in FIGS. 93 and 99, the face portion **8031**, **8131** and viewing window **8064**,
20 **8164** have an elongated horizontal orientation so as to provide the user with a view of the plurality of indicator members mounted within the module. It should be understood, however, that the module can be secured within the housing by any number of conventional means, including the use of fasteners or adhesive. Alternatively, the module can simply be press fit into the socket formed between the support block and housing wall.

25 In the embodiment shown in FIG. 77, the circular viewing window **7064** is provided in the module housing so as to expose a substantial portion of the planar indicator wheel. Numerical indicia, corresponding to the number of doses in the container, are provided on the face **7060** of the indicator wheel. An arrow, or like indicator, is applied to the housing adjacent the viewing
30 window and provides an indication of the number of doses remaining in the

housing, or the number dispensed therefrom, as the indicator wheel is rotated.

In other alternative embodiments, shown for example in FIGS. 79, 80, 94, 108 and 136-138, the indicia are applied to a circumferential surface
5 **7062, 7560, 7660** of the indicator wheel. The module viewing window **7068, 7064, 8164**, which is preferably rectangular, and indicator wheel are arranged such that the circumference, or periphery, of the wheel, or wheels, is visible through the module and dispenser viewing windows. Alternatively, as shown in FIG. 138, a plurality of viewing windows are provides in the module
10 housing. As with the other embodiments, the indicia can take the form of color coding, shading, alpha-numerical characters and the like.

In the embodiments shown in FIGS. 97-98, 111-112 and 138-140, the indicia are preferably formed around the circumferential surface **7560, 7660** of the indicator wheel in the form of numbers ranging from 0 to 9, with the
15 ratchet gear on the indicator member having 10 teeth. In operation, it should be understood that the three, or more or less, indicator members can be preset to the maximum number of dosages contained within the container, with the indicia, or in this case numbers, arranged about the periphery of the indicator wheel, such that successive, sequential actuations of the container
20 cause the indicator members to count down.

Alternatively, the indicator members are assembled such that the zero (0) of each indicator member is displayed in the viewing window to the user. The container is then actuated by the user such that the first indicator member rotates within the housing to sequentially display the number of
25 doses that have been dispensed from 1 to 9. Upon the tenth actuation, the indicator member completes a single revolution, by virtue of the ten teeth preferably formed about the ratchet gear which correspond to the predetermined number of actuations, and causes the second indicator member to advance one number from 0 to 1 as the first indicator member
30 again displays a 0 such that the two members together indicate that 10 dosages have been dispensed. The first indicator member is again rotated by

successive actuations until another single rotation is completed to further rotate the second indicator to reveal the 2, so as to indicate that 20 dosages have been dispensed. Upon a complete rotation of the second indicator member, corresponding to 100 actuations, the third indicator member is
5 advanced to reveal a 1 in the viewing window with the first and second indicator members revealing a 0, and so on.

As shown in FIG. 75-79, 82-87 and 99, one embodiment of the indicator assembly, including the worm, worm gear, ratchet gear and indicator member, is mounted within the module housing **7130**. Similarly, the
10 embodiments of the indicator assembly shown in FIGS. 94, 108, 136-140, 143 and 144 are also preferably supported in a module housing **8030, 8130, 8230**. The module housing is preferably formed from a first and second cover member **7136, 7138, 8036, 8038, 8136, 8138, 8236, 8238** although it should be understood that a single, integral piece of material would also work, as
15 would any plurality of members joined together. Referring to FIGS. 75-79, 99, 108, 138-140, 143 and 144 the first cover member **7136, 8136, 8036, 8236** has a vertical wall **7140, 8140, 8040, 8240** defining at least a portion of the outer convex surface **7134, 8034, 8134, 8234** shaped to mate with the inner surface of the housing as described above. The secondary viewing window
20 **764, 8064, 8164** of the module is provided in the vertical wall **7140, 8040, 8140** so as to be aligned with the viewing window of the housing when the module is installed therein. The viewing window is framed by the face portion. In the embodiment of FIGS. 136-140, 143 and 144 the cover member **8236** is made of a clear material, such that it is see-through.
25 alternatively, the first cover member can be omitted altogether, with the module housing formed only from the second cover member **8238** such that the indicator members are exposed to the ambient environment. The cover has a protrusion **8231** that is shaped with and extends into an opening formed in the dispenser housing. The first cover member **8236** further
30 includes a top wall **8154** or flange that extends from the wall **8240**.

In one embodiment, shown in FIG. 78, the first member also includes a pair of opposing bearing seats **7144** formed on an inner surface of the vertical wall. The bearing seats **7144** are shaped to support the ends of axle **7042**. Alternatively, as shown in FIGS. 96 and 99 a bearing seat or lug **8044** can be formed on each of the first and second cover members. Alternatively, as shown in FIG. 140, the bearing seats **7144** are formed in the cover **8236**. As best shown in FIGS. 78 and 99, a post member **7146**, **8046** extends upwardly from a base **7150**, **8050** of the first member adjacent one of the bearing seats and has a socket **7148**, **8048** formed coaxially therein. Alternatively, as best shown in FIG. 108, the base **8150** is formed as part of the second cover member and includes an opening **8148** shaped to receive the lower portion **7678** of the actuator member.

Referring to FIGS. 77-78, 140, 143 and 144, the second cover member **7138**, **8038**, **8138**, **8238** mates with the first cover **7136**, **8036**, **8136**, **8236** to form an enclosure therebetween. The second cover member includes a vertical wall **7152**, **8052**, **8152**, **8252** a portion of which defines the concave surface **7132**, **8032**, **8132**, **8232** shaped to mate with the outer surface of the support block. An upper horizontal flange **7154**, **8054**, **8154** extends from the vertical wall **7152**, **8052**, **8152** and mates with the vertical wall of the second member in overlying relationship therewith so as to close off the top of the module. In an alternate embodiment, shown in FIGS. 143 and 144, the upper flange **8154** is formed as part of the first cover member. The upper flange **7154**, **8054**, **8154** has an opening **7156**, **8056**, **8156** formed therein which is shaped to receive the upper portion **7074**, **7574**, **7674** of the post member. In one embodiment, the upper surface of the flange is maintained parallel with or below the top surface of the support block so as not to interfere with the container as it is depressed toward the support block. Alternatively, as shown in FIGS. 77 and 78, the module housing is provided with a semi-circular recess **7155** shaped to receive the hub as the container is actuated whereby a surface of the container engages the upper portion **7074** of the actuator member and the surface is positioned adjacent to the surface **7154** of the

module housing when the valve is moved to the open position. A bottom edge **7158** of the vertical wall mates with the base **7150** of the first cover member to close off the bottom of the module. As shown in FIGS. 77-78, 94-96 and 99, the cover members are joined by slidably engaging vertical flanges **7160, 8060** on the first cover member with grooves **7162, 8062** formed on the second cover member. Inwardly extending tabs **7220, 8061** snap fit into slots **7222, 8063** formed in the second cover member. In the embodiment shown in FIGS. 95, 96 and 109, a tab member **8067** engages opening **8071** formed in a wall member **8069** that further defines a portion of the outer concave surface of the module housing. In the embodiment of FIGS. 143 and 144, the first and second cover members also are preferably connected by snap fit. Alternatively, it should be understood that the first and second cover members can be joined with fasteners, adhesive and the like.

As best shown in FIGS. 26, 84, 101, 117 and 138, when the cover members are assembled to form the module housing, the upper portion **7074, 7574, 7674** of the post member extends through the opening in the upper flange of the first cover member and engages the top surface of the container, which is inverted in the housing. Alternatively, the actuator member can be attached to the hub of the container with the locking ring as previously described. In such an embodiment, the arm member of the actuator member extends downwardly from the ring through the opening in the top of the first cover member and is positioned to selectively engage the ratchet gear. The insertion of the arm in the opening prevents the canister and attached locking ring from being rotated so as to move the arm member out of position for selective engagement with the ratchet gear.

As best shown in FIGS. 78 and 94, the lower portion **7078, 7578** of the post member is moveably received within the socket **7148, 8048** formed in the post member **7146, 8040** extending from the base of the second cover member. Alternatively, the lower portion **7678** is received in the opening **8148** as shown in FIG. 108. Referring to FIGS. 78, 94, 108 and 138-140, springs **7088, 7588, 7688** is disposed about the lower portion **7078, 7578**,

5 **7678**, and in certain embodiments includes a lower end mounted on the post member **7146, 8046**. The upper end of the spring engages the lower stop surface **7086, 7586, 7686** of the post member **7072, 7572, 7672**. The spring biases the post member upwardly within the housing such that the upper portion **7074, 7574, 7674** protrudes through the opening and into engagement with the top surface of the container.

10 In one embodiment, shown in FIGS. 77 and 78, the worm **7040** and ratchet gear **7032** are rotatably supported on the bearing seats **7144** formed in the second member. Preferably, opposite ends of axle **7042** are snap fitted into the bearing seats. The indicator member **7050** is rotatably supported by the second cover member such that the worm gear engages the worm when the cover members are joined together. In particular, the second cover includes a pair of downwardly opening lug members **7164, 7166**. The axle **7056** of the indicator member is received in the first lug member **7164** and a hub portion **7059** positioned between the worm gear and the indicator wheel is received within the second lug member **7166**. Preferably, the axle and hub are snap fitted into the lugs, but are permitted to freely rotate therein. When the cover members are joined, the indicator member, and in particular the worm gear, are trapped between the lug members and the worm.

20 In an alternative embodiment shown in FIGS. 94-96, 99, 140, and 143 the axle **7556** is supported on opposite ends by the lug portion **1044, 7144** extending from each of an upper and lower cover members **1036, 1038, 8238**. In one embodiment, the axle **7556** has a T-shaped cross-section formed as a result of a molding process. When the axle can be integrally formed or molded with one or more of the module housing cover members. In one embodiment, the shape of the axle permits it to act as a key member when received in similarly shaped sockets formed in one or more of the lug portions. The axle extends outwardly from the lug portion. In one embodiment, the axle includes opposite curved surfaces **7555, 7557**, as best shown in FIGS. 94-97 that provide a supporting surface for the indicator members that are rotatably mounted thereon. One of skill in the art should

understand that the axle could have a circular cross-section and could be rotatably mounted to the housing. In such an embodiment, at least one of the indicator members can be integrally formed with the axle, or all of the member can be separately mounted thereon.

5 It should be understood that in the alternative embodiment of FIGS. 71-74, the supporting structure for the worm and ratchet, including the bearing seats or like supports, and the supporting structure for the indicator member, including the lug members, are similar to the structure provided in the module housing, but are integrally molded into the housing. Similarly, a
10 post and socket member can be integrally molded into the bottom of the housing so as to support the actuator member and spring.

 Similarly, although the indicator assembly embodiments of FIGS. 94, 108 and 136-140 are shown as preferably being mounted in the indicator module, one of skill in the art should understand that the assembly, including
15 the axle, indicator members, actuator member and spring could be mounted directly in the dispenser housing or actuator boot that supports the container. Similarly, the engagement member, or members, and non-return member, or members, could be formed in the dispenser housing that supports the container, otherwise referred to as the actuator boot.

20 In an alternative embodiment shown in FIG. 88, a lower portion **7172** of the outer vertical wall of the module housing is angled so as to a mate with a housing having a similar angled planar bottom surface. As shown in FIG. 88, the axis of rotation of the indicator member is oriented at an angle of approximately 45 degrees from the longitudinal axis so that the face of the
25 indicator wheel **7060** is substantially parallel to the angled surface of the housing. A viewing window is provided in the angled surface **7172** and is aligned with a similar viewing window provided in the angled wall of the dispenser housing.

 Now referring to FIGS. 90-92, a key member **7300** is shown as
30 including a base portion **7302** having a recess **7304** shaped to receive the top of the container. The base portion is circular shaped and is open in the

middle. The key member is mounted on the container by press fitting a circumferential flange **7306**, which forms the recess, about the container such that the valve stem and hub passes through an opening **7308** formed in the middle of the key member. Alternatively, the key member can be mounted to
5 the container with adhesive or other fasteners. The key member also includes a key portion **7310** extending downwardly from the base portion. The key portion is preferably configured as a circular flange member, although other shapes would also work.

In alternative embodiments shown in FIGS. 94 and 101-102, the key
10 member **8300** includes a mounting portion **8302**, configured as a hoop member having a plurality of ribbed portions **8304**. The mounting member **8302** is sized to fit over the end of the container such that the ribbed portions grip a portion of the container. A plurality of arm members **8306** secure a key portion **8308** to the mounting member.

15 In another alternative embodiment shown in FIG. 103, the mounting member **8402** has a smaller diameter than the key portion, and is coaxially disposed with the key portion. A base member **8404** connects the mounting member and key portion. The mounting member includes a plurality of inwardly facing tab members **8410** that engage an outer tapered surface of
20 the hub portion **7106** of the container.

In the embodiments shown in FIGS. 94 and 103, the key portion **8308**,
8408 is formed as a circular flange member having a plurality of openings **8312**, **8412** formed therein about the circumference thereof so as to allow air to flow through the key member with less restriction. In the embodiment
25 shown in FIGS. 101 and 102, the key portion **8508** includes two coaxially mounted key portions of different diameters, each with a plurality of openings **8512** to facilitate air flow therethrough.

The embodiment of the indicator module shown in FIG. 20 has a key
entry passageway configured as a recess **7312** formed in an upper surface of
30 the module housing. Preferably, in this embodiment, the recess is formed as an arcuate shaped, or semi-circular, slot. The actuator member **7314** extends

upwardly from the module housing into the slot. The actuator member **7314** is maintained substantially flush with or below the upper surface of the module **7316**. In this way, the actuator cannot be actuated by a user's finger or the like so as to inadvertently advance the indicator member and thereby provide an inaccurate reading of the number of dosages remaining in the container, or the number dispensed therefrom.

The shape or diameter of the key portion and corresponding entry passageway are configured so that the key portion communicates with and is received in the passageway formed in the module housing. When the container is mounted in the dispenser housing such that the valve stem is received in the well in the support block, the key portion is received in the passageway and engages the actuator member.

In this way, key members having differently shaped key portions can be applied to containers holding different types of substances, such as a medicament, so as to prevent the user from mixing up the containers and dispensers. In operation, a container having a certain key member with a specific key portion can be installed only in a dispenser housing having a passageway shaped to receive that key portion. If the key portion does not fit the recess, the key ring will engage the upper surface of the module housing so as to prevent the actuation of the container relative to the dispenser housing and the attendant opening of the valve. This in turn prevents a user from installing containers having different substances in different dispensers, which could thereby adversely affect the counting of doses dispensed from the container, or the counting of the number of doses remaining therein. For example, a key member having a key portion with a thickness of 1mm and an inner diameter of 13 mm is prevented from being installed in a passageway having a width of 1mm and an inner diameter of 15 mm, and vice versa.

In the alternative embodiment of FIG. 94, the module housing includes three pairs of upstanding members **8080**, **8082** forming a slot or recess **8084** between each pair. In addition, the upstanding members of one pair **8082** are formed as channels opening towards each other. The elongated recess **8056**

formed between the pair of members is shaped to receive the upper portion of the actuator member **7574**. In operation, the key portion **8308** of the key member is shaped to be received in the various radially formed slots or recesses, or key entry passageways, so as to engage the actuator member
5 disposed in the elongated recess. When the container is moved with respect to the module housing so as to move the valve to the open position, the hub of the container nests in a recess formed between the inner upstanding member of each pair.

In the embodiment shown in FIGS. 101 and 102, three sets of three
10 upstanding members **8180**, **8182** are provided, with each set of three having two slots **8184** formed between the members so as to be shaped to receive the two key portions **8508** of the key member **8500**. Again, one set of three members **8182** forms an elongated passageway, or recess **8056**, that is shaped to receive the actuator member. The two key portion configuration
15 allows for multiple combinations of shapes and diameters of key portions so as to provide for a different key combination for each of the multiplicity of substances being dispensed from the various containers.

Although the circular configurations of the key portion and corresponding slots shaped to receive the key portion, as shown in the
20 figures, are preferred since they allow the container to be rotated within the dispenser housing about its longitudinal axis, it should be understood that the key portion and slot, or like passageway or keyhole, can be shaped in any type of mating configuration and that the mating shapes are not limited to the circular configuration shown in the figures.

25 The indicator module provides an inexpensive and accurate device for counting dosages of medicament and the like. The module can be sized for easy installation as a separate unit in most conventional inhalation housings with minimal modification of the housing, including providing a viewing window in the housing in alignment with the module viewing window and the
30 removal of any structure formed between the support block and outer wall of the housing. In addition, the module can be installed rearwardly of the

support block so as not to interfere with or otherwise impede the air flow dispensing the medicament.

5 Description of Operation of Primary Indicating Device Disposed in Bottom of Dispenser Housing:

10 In the operation of the embodiment shown in FIGS. 75-78, 82-87 and 89, the container is moved longitudinally within the housing so as to depress the valve stem to the open position so as to open the valve as explained above. As the container is moved downwardly within the housing, the actuator member **7070** is moved longitudinally downward such that the hook member **7082** engages the ratchet wheel and rotates it a predetermined angular amount corresponding to the pitch of the teeth. When the container is released by the user, the spring (not shown) within the container biases the container upwardly within the housing along the longitudinal axis such that the valve stem **18** is moved to the closed position within the container so as to close the valve. As the container moves upwardly, the resilient arm member **7080** is biased laterally outward as a tapered end portion of the hook member **7082** slides against the tapered surface **7036** of one of the ratchet teeth. As the container and resilient arm member reach the top of the stroke, wherein the valve stem is moved completely to the closed position, the resilient arm member **7080** returns to its normal straightened configuration as the hook member **7082** slips past the tapered surface of one of the teeth so as to be positioned over the engagement surface **7038** of that tooth **7034** for the next cycle.

25 Alternatively, the operation of the ratchet wheel can be reversed as shown in FIG. 72. In this embodiment, the resilient arm member **7094** is biased outwardly by the tapered surface of one of the ratchet gear teeth on the downstroke. At the bottom of the stroke, the hook member **7095** slips into an underlying relationship with the engagement surface of the tooth. When the container is released by the user, the spring (not shown) within the canister biases the container upwardly within the housing along the

30

longitudinal axis such that the valve stem is moved to the closed position within the container. As the container moves upwardly with respect to the housing, the resilient arm member **7094** moves longitudinally upward such that the hook member **7095** engages the engagement surface **7038** of one of the teeth and thereby rotates the ratchet wheel an incremental amount.

In the embodiment shown in FIGS. 75-78, 82-87 and 89, it is the force of the spring **7088** that moves the arm member **7080** upwardly so as to return the actuator member in preparation for another cycle. In the alternative embodiment shown in FIGS. 71 and 72, it is the movement of the container, as it is biased upwardly by the internal spring acting on the valve stem, that causes the locking ring **7092** and arm member **7094** to move upwardly and thereby rotate the ratchet gear.

Referring to FIGS. 77 and 86, a resilient non-return member **7200** engages the ratchet gear adjacent the hook member so as to ensure that the rotation of the ratchet gear is unidirectional. Alternatively, the non-return member can be positioned to engage the ratchet gear opposite the actuator arm member. The non-return member includes an end portion adapted to engage the engagement surface of the ratchet gear teeth. As the ratchet gear is rotated by the actuator, the non-return member slides along the tapered surface of one of the teeth of the ratchet wheel and does not interfere with the rotation thereof.

The rotation of the ratchet gear causes the worm **7040** to rotate a desired predetermined amount. It should be understood that the desired amount of rotation is dependent upon the diameter of the ratchet wheel and the number of teeth positioned thereabout. Rotation of the worm, which permanently engages the teeth of the worm gear, causes the worm gear and indicator wheel to rotate a predetermined incremental amount. The amount of rotation of the indicator wheel is dependent upon the pitch of the worm, the number of worm threads and the pitch of the worm gear and the number of worm gear teeth. In a preferred embodiment, the worm has a single thread.

For ease of manufacturing, it is desirable to provide as coarse a pitch on each of the ratchet and worm gears as possible, although the gears are still defined as fine-toothed gears. However, it is also intended that the indicator member make only a single revolution (single-cycle) corresponding to a complete evacuation of medicament from the container. Thus, when a large number of doses (on the order of 200 or more) are contained within the canister, it is important for the ratchet, worm and worm gear to provide a relatively high reduction ratio, such that 200 linear reciprocal movements of the actuator member correspond to one or less revolutions of the indicator member. Because the ratchet gear and worm rotate together, it should be understood that the number of teeth on the ratchet gear and worm gear, and the number of threads of the worm, determine the ultimate reduction ratio between the rotation of the ratchet gear and the rotation of the indicator wheel.

For example, when the container holds 240 metered doses, an acceptable ratio is realized if the ratchet is made relatively coarse with 10 teeth and the worm gear is provided with 28 teeth. In operation, the dispensing of 10 metered doses will cause the worm to make one complete revolution so as to thereby move the worm gear one tooth. After 240 linear reciprocal movements, the worm gear has been advanced by 24 teeth. Extra teeth are provided so that the starting and ending indicia, indicating a relative fullness or emptiness of the container respectively, are not labeled one on top of the other.

In a preferred embodiment, shown in FIGS. 78 and 84, the worm gear **7052** has teeth formed around only a portion of its periphery so that a gap is formed between the teeth around the remaining portion of the periphery. In operation, the gears are configured so that the worm **7040** disengages from the last tooth of the worm gear as the final prescribed dose of medicament is dispensed. In this position, the indicia on the indicator wheel **7058** will indicate to the user that the canister is empty. Therefore, although the user can continue to move the container so as to open the valve, the resultant

movement of the actuator **7070**, ratchet gear **7032** and worm will not in turn rotate the indicator member as the gap in the teeth on the worm gear results in the disengagement of the worm and worm gear. In this way, the indicator wheel is prevented from being inadvertently rotated from a full to empty
5 reading and then back again to a full reading, which could confuse the user about the number of doses remaining in the canister.

The indicator wheel **7058**, indicia **7066** and viewing window **7028** can be arranged in a variety of configurations for viewing by the user. For example, the viewing window **7028**, **7124** can be configured as a rectangular
10 shaped window as shown in FIG. 21 or 79 respectively, as an arcuate shaped window **7029** as shown in FIG. 73, wherein approximately 1/3 of the face of the indicator wheel is visible at any time, as a circular shaped window (not shown) or as any other shape allowing the user to view the indicator wheel and the indicia located thereon. In one embodiment, the indicia take the form
15 of a color code, where, for example, a portion of the wheel is colored green to indicate the starting full position, a portion is colored yellow to indicate a medium fullness and a portion is colored red to indicate that the container is empty. Obviously, other colors, shading or alpha-numerical indicia can be provided on the indicator wheel to indicate the relative fullness or emptiness
20 of the container.

In an alternative embodiment, the indicator wheel can be oriented within the housing such that either its planar face or its circumferential surface, with indicia applied thereto, are visible to the user through the exhaust port of the mouthpiece.

25 In operation of the embodiments shown in FIGS. 94-117 and 136-140, the reciprocal movement of the container relative to the housing is repeated until the first indicator member **7550**, **7650**, and its ratchet gear, are rotated one complete revolution. The predetermined number of reciprocal movements required to advance the first indicator member one revolution is
30 equal to the number of teeth disposed about the periphery of the ratchet gear **7552**, **7652**. As the first indicator member is rotated by successive

movements of the container relative to the housing, the advancement member **7600, 7800** of the first indicator member is brought into selective engagement with the engagement member, configured as the ramped surface **7772** formed in the housing or as the upwardly extending arm member **7700**. In particular, the engagement member **7700, 7772** biases the tooth portion **7604, 7704** of the advancement member into engagement with one of the teeth **7554, 7654** of the ratchet gear on the second indicator member.

As the first indicator member is further rotated by successive movements of the container relative to the housing, whether it be the dispenser housing for the container or the module housing described below, the advancement member **7600** engages one of the teeth on the ratchet wheel of the adjacent indicator member and advances the indicator member a predetermined incremental angular amount corresponding to the pitch of the ratchet gear teeth. The term incremental is meant to refer to the angular amount the indicator member is moved by the advancement of one actuation, which corresponds to the movement of one tooth, regardless of whether the indicating device is indicating the number of doses left (e.g., counting down) or indicating the number of doses administered (e.g., counting up).

As the resilient advancement member **7600, 7800** clears the engagement member **7772, 7700**, it springs away from the ratchet gear such that further advancements of the first indicator member do not effect a rotation of the second indicator member until the first indicator member completes yet another cycle so as to again bring the advancement member into engagement with the next tooth of the second indicator member ratchet gear, and so on. The second indicator member **7550, 7650** with its advancement member **7600, 7800**, similarly interacts with a second engagement member overlying the teeth of the third indicator member so as to selectively engage and advance the third indicator member a predetermined incremental amount for each complete rotation of the second

indicator member. It should be understood that more indicator members could be similarly assembled to provide an incremental indicating device.

Description of Various Embodiments of Secondary Indicator Devices Having
5 Warning Indicator Member:

Referring to the FIGS. in general, the various indicating devices are configured with a secondary or warning indicator member **9002**, **9102** that advises the user when the container has less than a minimum predetermined number of dosages of substance left therein, or stated another way, that a
10 predetermined number of dosages have been dispensed therefrom.

Referring to the embodiments shown in FIGS. 129-140 and 147-153, a plurality of primary indicator members **6550**, **7550** are arranged in either the module housing **8230**, cap member **6020** or base member as explained above. One of the primary indicator members **6550**, **7550**, hereinafter
15 referred to as a first indicator member and shown as either the first outer indicator member (ones counter) (FIGS. 147 and 153) or the middle indicator member (tens counter) (FIGS. 129 and 132), includes a drive member **9004**, configured as a tooth extending from the circumferential skirt of the indicator member. It should be understood that either of the end indicator members
20 can be configured with the drive member.

The secondary or warning indicator member **9002**, hereinafter referred to as the second indicator member is rotatably mounted about an axis of rotation **9006** parallel to and spaced apart from the axis of rotation of the primary indicator members **7550**, **6550**, including the first indicator member.
25 The second indicator member **9002** includes an axle **9008** that is rotatably mounted on a pair of bearing support members **9010** formed in one of the cap member, base member or module housing. The second indicator member **9002** has an outer circumferential surface **9012** with warning dosage indicia applied thereto. Preferably, the warning dosage indicia takes the form
30 of a color coding, for example a portion or zone of the surface is green, while another portion or zone is red. Preferably a plurality of zones is used, for

example and without limitation two zones of green and red respectively, or three zones of green, yellow and red. Alternatively, alphanumeric characters, text messages etc. as herein described can be used as indicia. It should be understood that a surface of the indicator member perpendicular to the axis of rotation also can be configured with the indicia. The surface **9012** of the indicator member is visible through a viewing window **9014** formed in the top of the cap member as shown in FIGS. 128, 134, 135 and 149-152. In the embodiment of FIGS. 136, the indicia are visible through a viewing window **9016** formed in the dispenser housing. Preferably, the cap member, base member, module housing and/or dispenser housing are provided with at least a pair of viewing windows, one or more viewing windows for the primary dosage indicia and at least one viewing window **9012**, **9014** for the secondary warning, dosage indicia, although it should be understood that both types of indicia can be viewed through a single window.

Referring to FIGS. 131, 132 and 148, the second indicator member **9002** further includes at least one driven member **9018**, and preferably a plurality of driven members (shown as four in FIGS. 131 and 132 and as ten in FIG. 148), configured in one embodiment as a tooth extending radially outward from the second indicator member on one side of the circumferential indicia surface **9012**. Taking into account the spacing between the axes of rotation for the first and second indicator members **7550**, **9012**, the drive member **9004** and driven members **9018** are configured and have sufficient lengths so as to mesh after a predetermined number of rotations of the first indicator member configured with the drive member. The second indicator member **9002** is also provided with a plurality of ratchet teeth **9020** formed circumferentially around the axis of rotation on the side of the indicator member opposite the driver member **9018**. A non-return member **9022** extends from one of the cap and module housing and successively, selectively engages one or more of the ratchet teeth **9020** so as to allow the second indicator member to rotate in only one direction.

Referring to the embodiment of FIGS. 118-127, a second indicator member **9102** is configured as a plate member slidably or translatably mounted to the cap member, which includes guides **9106** or tracks, which can be formed by tabs, for the indicator member. The second indicator member **9102** has a surface **9104** with indicia applied thereto. The surface **9104** and indicia are visible in a viewing window formed in the cap member. The second indicator member is translatable in a plane substantially parallel to the axis of rotation of the primary indicator members **6550**. In this embodiment, a third primary indicator member is provided with a drive member **9110** having a ramped or tapered surface. The second primary indicator member is also provided with a drive member **9114**.

Referring to FIGS. 5, 6, 7, 9, 20, 29, 36, 38, 44, 45, 71, 72, 74, 77 and 80, a secondary warning indicator member **9202** is provided to be advanced or moved in response to the movement of the primary indicator **7062** members **60, 260, 460, 760, 1060, 2060, 7050, 7062**. In particular, each of the primary indicator members **7062** is provided with a drive member **9210**, configured as a tooth in a preferred embodiment. The second indicator member **9202** is mounted to one of the cap member, base member, module housing or dispenser housing and is rotatable or pivotable about an axis. The axis is preferably parallel to the axis of rotation of the primary indicator members. The second indicator member can be configured with a circular shape, pie shape or any other shape that fills a viewing window **9208**, and includes a driven member **9212**, configured as a tooth in one preferred embodiment.

In an alternative embodiment, shown for example in FIG. 6, the second indicator member **9102** is configured as a plate or other member that is engaged by the drive member **9210** of the first indicator member and is translated relative to the first indicator member. Preferably, the second indicator member **9102** is translated within a plane either substantially perpendicular to the axis of rotation of the primary indicator member **60, 260,**

460, 760, 1060, 2060, 7050 7062, or substantially parallel to the axis, although other orientations are possible.

Operation of Secondary Indicating Device Having Warning Indicator Member:

5 In operation of the embodiment shown in FIGS. 129-140, the container and actuator, configured either as an arm or cap member, are moved relative to the dispenser housing so as to dispense a dose of substance. After one rotation of a first one of the primary indicator members **6550, 7550** resulting in a plurality of actuations of the container, the middle primary indicator member
10 is rotated an incremental amount as explained above.

 In one illustrative and non-limiting example, and referring to FIGS. 130-135 and 147-153, the dosage indicator is provided with 200 or 210 dosages of substance. Referring to the embodiment of FIGS. 130-135, wherein the second indicator member **9002** is driven the middle primary indicator
15 member, and after a predetermined number of actuations (e.g., 80), the drive member **9004** on the middle primary indicator member engages a first driven member **9018** on the second indicator member and rotates the second indicator member **9002** an incremental amount. In this embodiment, the drive member **9004** is positioned adjacent one of a numerical indicia (e.g., "8") on
20 the first indicator member corresponding to the numerical indicia (e.g., "2") being displayed in the viewing window. After another predetermined number of actuations (e.g., 180), the drive member **9004** on the middle primary indicator member **6560** engages a second driven member **9018** on the second indicator member and thereby moves the second indicator member
25 another incremental amount. The indicia on the second indicator member is configured such that the indicia visible to the user in the viewing window **9014** transitions from an initial display (e.g., green) to warning display (e.g., red) on the second rotational movement of the second indicator member, with the indicia remaining in the initial display (e.g., green) through the first rotational
30 movement of the second indicator member. Accordingly, in this embodiment, the user is advised or warned by the change in indicia that less than a

minimum predetermined number (e.g., 20) of dosages of substance remain in the container. The user can quickly reference the first indicator members to determine the exact numerical quantity of dosages (e.g., nineteen (19)) remaining in the container. Of course, it should be understood that if the container has only one hundred (100) dosages of substance, the indicia can be configured to change from an initial indicia display (e.g., green) to warning indicia display (e.g., red) in the viewing window **9014** upon the first advancement of the second indicator member **9002**, e.g., when less than 20 dosages remain in the container. Conversely, if more than 200 dosages are contained in the container, the dosage indicia can be arranged on the indicator member such that the displayed indicia changes from the initial display to the warning display only in response to the advancement of additional driven members. For example, the indicia visible in the viewing window may remain green for two advancements of the second indicator member, and then turn red upon the third advancement. Of course, it should be understood that indicia other than the color can be used to warn the user, for example textual messages that the container is "low," "empty," etc. Likewise, the initial display can be nothing, e.g., blank, or textual, e.g., "full," "reserves," etc.

It should also be understood that the drive member **9004** and driven members **9018** can be configured such that the second indicator member **9002** is advanced after any number of predetermined number of actuations corresponding to a minimum number of dosages of substance remaining in the container, whether it be 180 actuations, 80 actuations, or any other number of actuations. Thus for example, if the container is provided with 240 dosages of substance, and it is desired to warn the user when less than 30 dosages remain, the second indicator member **9002** is positioned such that the driven member **9018** is engaged by the drive member **9004** on the middle primary indicator member **6560** each time the numerical indicia "3" on the middle primary indicator member appears in the viewing window **9014**, and further such that it warns the user with the secondary indicia when 210

actuations have been made. In this example, the primary indicator members **6560** preferably initially display the number of dosages remaining in the container, rather than the number dispensed. One of skill in the art should understand that second indicator member **9002** can be positioned for the opposite sequence (i.e., a counting of the number of dosages dispensed from the container). The second indicator member **9002** is rotationally positioned relative to the primary indicator member **6560** in this example such that the three driven members **9018** are engaged, with three incremental rotations of the second indicator member, before the indicia visible in the window **9018** turns from green to red. Of course, the indicia can also be provided with a transition between multiple displays (e.g., green to yellow to red) to give the user further advance warning about the depletion of dosages of substance in the container.

Referring to the embodiment of FIGS. 147-153, the second indicator member is provided with two regions **9103**, **9105** (e.g., initial and warning indicia) that are stepped around the circumference of the indicator member **9002**. In this embodiment, the second indicator member is advanced or moved upon every tenth actuation of the container, since the driven members **9018** are aligned with the drive member **9004** formed on the first outer primary indicator member (ones counter), such that the predetermined number of movements of the first primary indicator member required to move the second indicator member is ten. Referring to FIGS. 148-150, the regions **9103**, **9105** can be configured and stepped such that the second region **9105** is partially brought into view through the viewing window **9014** upon a predetermined number of actuations (e.g., 100). Additional portions of the second region **9105** are made visible in the window (see, e.g., FIG. 151), until the entirety of the second indicator member visible in the window consists of the second region **9105** of warning indicia (see, e.g., FIG. 152) upon a predetermined number of actuations (e.g., 190) such that the user is provided with a warning that less than a predetermined number of dosages of substance (e.g., 21) remain in the container. In this way, the secondary

indicator member provides a progressive secondary warning to the user about the number of doses remaining in the container, with a final warning that less than a predetermined number remain therein.

Referring to the operation of the embodiment of FIGS. 118-128, as the
5 third primary indicator member **6550** completes one rotation, the drive member **9110** formed thereon engages a first edge **9112** of the second indicator member **9102** and translates the second indicator member in a first direction **9116** parallel to the axis of rotation **9124** of the primary indicator members. During this movement, the indicia visible to the user remains in the
10 initial display (e.g., green) as the second indicator member is moved in the first direction. As the second indicator member **9102** is moved in the first direction **9116**, a second edge **9120** of the second indicator member, or driven portion, is moved into alignment with the drive member **9114** formed on the second primary indicator member.

15 Upon completion of a predetermined number of actuations, and a corresponding rotation of the second primary indicator member, the drive member **9114** on the second or middle primary indicator member is brought into engagement with the second edge and translates the second indicator member **9102** in a second direction **9118**, preferably substantially
20 perpendicular to the first direction. As the second indicator member **9102** is translated in the second direction **9118**, the indicia visible to the user in the viewing window **9108** transitions from the initial display (e.g., green) to the warning display (e.g., red) thereby warning the user that less than a minimum predetermined number of dosages remain in the container. In this
25 embodiment, the second indicator member **9102** is provided with two colored regions **9103**, **9105**, for example green and red, with the green region visible through the viewing window when the second indicator member is in the initial position and when it is moved in the first direction. The red region **9105** becomes visible in the window as the second indicator member is moved in
30 the second direction.

For example, if the container initially contains 200 or less dosages of substance, the drive member **9110** on the third primary indicator member engages and translates the second indicator member in the first direction after 100 dosages have been dispensed (i.e., after the third primary indicator member completes one revolution), thereby positioning the second edge of the second indicator **1114** on the member for subsequent engagement by the drive member on the second, middle primary indicator member. The drive member on the second, middle primary indicator member is positioned such that it engages the second end after a predetermined number of actuations, with a predetermined number of remaining or dispensed dosages appearing in the viewing window. For example, if it is desired to warn the user when less than 20 dosages remain, the drive member **9114** is positioned on the second primary indicator member such that it engages the second edge **9120** as the second, middle primary indicator member is moved from 2 to 1 and as the first primary indicator member is moved from 0 to 9 (i.e., as the visible numerical indicia move from 20 to 19). One of skill in the art will understand that the drive member **9114** can be positioned such that the indicia transitions when the count moves from 90 to 89, from 80 to 79, from 70 to 69, from 60 to 59, from 50 to 49, from 40 to 39 from 30 to 29 or from 10 to 9.

In any of the embodiments, and referring for example to FIG. 123, after the primary indicator members reach a count of "000," thereby indicating that the container is empty, a stop arm **9111** on the third primary indicator member, which stop arm extends radially outward from the other teeth, engages a non-return member **6900** so as to prevent further rotation of the primary indicator members. A subsequent force applied to the cap member will bend or deform the pawl **48**.

In an alternative embodiment, the second indicator member **9102** is provided with indicia that transition to warn the user as the third primary indicator member moves the second indicator member **9102** in either a first or second direction **9116**, **9118**, e.g., when less than 200, 100, etc., dosages remain in the container.

In operation of the embodiments shown in FIGS. 5, 6, 7, 9, 20, 29, 36, 38, 44, 45, 71, 72, 74, 77 and 80, as the indicator member **60, 260, 460, 760, 1060, 2060, 7050, 7062** is advanced a predetermined number of times to indicate the dispensing of a predetermined number of dosages, e.g., 180, such that a predetermined minimum number of dosages of substance remain in the container, e.g., 20, the drive member **9210** on the primary indicator member engages the driven member **9212** on the second indicator member **9202** and rotates or pivots the second indicator member an incremental amount, with the indicia on an outer surface of the second indicator member transitioning in the viewing window **9208** to indicate to the user that less than the minimum predetermined number of dosages of substance remain in the container. Alternatively, as explained above, the second indicator member is translated by the primary indicator member.

Although the present invention has been described with reference to preferred embodiments, those skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention. As such, it is intended that the foregoing detailed description be regarded as illustrative rather than limiting and that it is the appended claims, including all equivalents thereof, which are intended to define the scope of the invention.

What is claimed is:

1. An indicating device suitable for indicating the number of dosages of a substance that have been dispensed from or remain in a container, said indicating device comprising:
 - 5 at least one first indicator member moveable to a plurality of positions; and
 - a second indicator member moveable in response to a predetermined number of movements of said at least one first indicator member, wherein said at least one first indicator member comprises primary dosage indicia adapted to indicate the number of dosages of substance that have been dispensed from or remain in the container, and wherein said
 - 10 second indicator member comprises secondary dosage indicia adapted to indicate that less than a minimum predetermined number of dosages of substance remain in the container.
- 15 2. The indicating device of claim 1 wherein one of said primary and secondary dosage indicia comprises numerical indicia and wherein the other of said primary and secondary dosage indicia comprises color indicia.
- 20 3. The indicating device of claim 2 wherein said primary dosage indicia comprises numerical indicia and wherein said secondary dosage indicia comprise color indicia.
- 25 4. The indicating device of claim 1 wherein said at least one first indicator member is rotatable about a first axis and said second indicator member is rotatable about a second axis, wherein said first axis and said second axis are substantially parallel.
- 30 5. The indicating device of claim 4 wherein said first axis and said second axis are spaced apart.

6. The indicating device of claim 1 wherein said at least one first indicator member comprises a drive member, wherein said drive member engages said second indicator member upon said predetermined number of movements of said at least one first indicator member.

5

7. The indicating device of claim 6 wherein said second indicator member comprises at least one driven member, wherein said drive member engages said at least one driven member upon said predetermined number of movements of said at least one first indicator member.

10

8. The indicating device of claim 7 wherein said at least one drive member comprises a plurality of teeth.

9. The indicating device of claim 8 wherein said at least one first indicator member is moveable through a plurality of cycles of predetermined movements, wherein said drive member successively engages said plurality of teeth of second indicator member upon completion of each of said plurality of cycles and thereby moves said second indicator member an incremental amount.

20

10. The indicating device of claim 1 further comprising a housing, wherein said at least one first indicator member and said second indicator member are rotatably mounted in said housing.

25

11. The indicating device of claim 10 wherein said housing comprises a base member and a cap member moveably connected to said base member.

12. The indicating device of claim 11 wherein said at least one first indicator member and said second indicator member are rotatably mounted to said cap member.

30

13. The indicating device of claim 10 further comprising an actuator adapted to be engaged by the container, wherein said actuator is moveable relative to said housing and is operably coupled to said at least one first indicator member to move said first indicator member between said plurality
5 of positions.

14. The indicating device of claim 11 wherein said actuator comprises a base member and wherein said indicator housing comprises a cap member moveably connected to said base member.
10

15. The indicating device of claim 1 wherein said at least one first indicator member comprises a plurality of coaxially mounted primary indicator members, wherein said plurality of primary indicator members are rotatably mounted about an axis of rotation.
15

16. The indicating device of claim 15 wherein at least one of said plurality of primary indicator members comprises a drive member, wherein said drive member engages said second indicator member upon a predetermined number of movements of said at least one of said plurality of
20 primary indicator members.

17. The indicating device of claim 16 wherein said plurality of primary indicator members comprises at least first and second primary indicator members, wherein at least one of said first and second primary
25 indicator members comprises an advancement member and at least the other of said first and second primary indicator members comprises a plurality of teeth, and wherein at least one engagement member is selectively engaged with said advancement member so as to bias said advancement member into operable engagement with at least one of said plurality of teeth of the other of
30 said first and second primary indicator members as said first and second primary indicator members are rotated relative to each other.

18. The indicating device of claim 17 wherein said plurality of primary indicator members comprises a third primary indicator member coaxially mounted with said first and second primary indicator members adjacent said second primary indicator member, wherein at least one of said
5 second and third primary indicator members comprises a second advancement member and at least the other of said second and third primary indicator members comprises a second plurality of teeth, and further comprising at least a second engagement member, wherein said at least said second engagement member is selectively engaged with said second
10 advancement member of said at least one of said second and third primary indicator members so as to bias said second advancement member into operable engagement with at least one of said third plurality of teeth of said other of said second and third primary indicator members as said second primary indicator member is rotated relative to said third primary indicator
15 member.

19. The indicating device of claim 18 wherein said drive member is disposed on said second primary indicator member.

20. The indicating device of claim 19 wherein said drive member comprises a first drive member, wherein said first drive member engages said second indicator member upon a predetermined number of movements of said second primary indicator member and wherein said engagement of said first drive member with said second indicator moves said second indicator in
25 a first direction, and wherein said third primary indicator member comprises a second drive member, wherein said second drive member engages said second indicator member upon a predetermined number of movements of said third primary indicator member and wherein said engagement of said second drive member with said second indicator moves said second indicator
30 in a second direction different than said first direction.

21. The indicating device of claim 20 wherein said first and second directions are substantially perpendicular.

5 22. The indicating device of claim 1 wherein said second indicator member is translatable moveable within a plane.

10 23. The indicating device of claim 22 wherein said first indicator member is rotatable about an axis and wherein said plane is substantially parallel to said axis.

24. The indicating device of claim 1 wherein said second indicator member comprises a plate member.

15 25. The indicating device of claim 1 wherein said minimum predetermined number is a multiple of 10.

20 26. An indicating device suitable for indicating the number of dosages of a substance that have been dispensed from or remain in a container, said indicating device comprising:
a first indicator member rotatably mounted about an axis of rotation and incrementally rotatable about said axis to a plurality of positions;
and
a second indicator member translatable moveable in response to a predetermined number of movements of said first indicator member,
25 wherein said second indicator member is translatable moveable within a plane substantially parallel to said axis of rotation

30 27. The indicating device of claim 26 wherein said second indicator member comprises a plate member.

28. The indicating device of claim 26 wherein one of said first and second indicator members comprises primary dosage indicia adapted to

5 indicate the number of dosages of substance that have been dispensed from or remain in the container, and wherein the other of said first and second indicator members comprises secondary dosage indicia adapted to indicate that less than a minimum predetermined number of dosages of substance remain in the container.

10 29. The indicating device of claim 26 wherein said first indicator member comprises a plurality of primary indicator members coaxially mounted about said axis of rotation.

30. The indicating device of claim 26 wherein said second indicator member is translatable in at least a first and second direction.

15 31. The indicating device of claim 30 wherein said first and second directions are substantially perpendicular.

FIG. 1

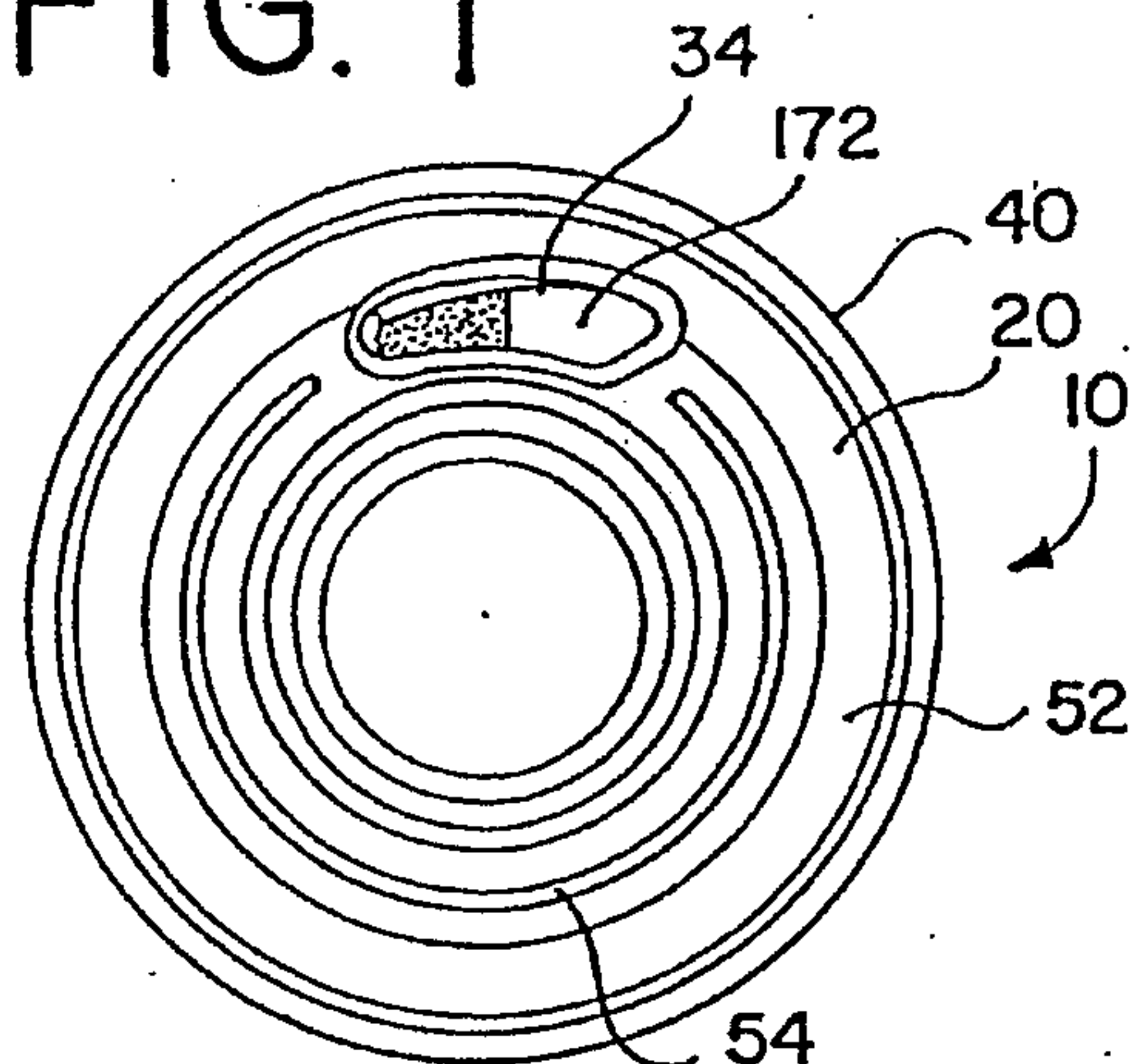


FIG. 1A

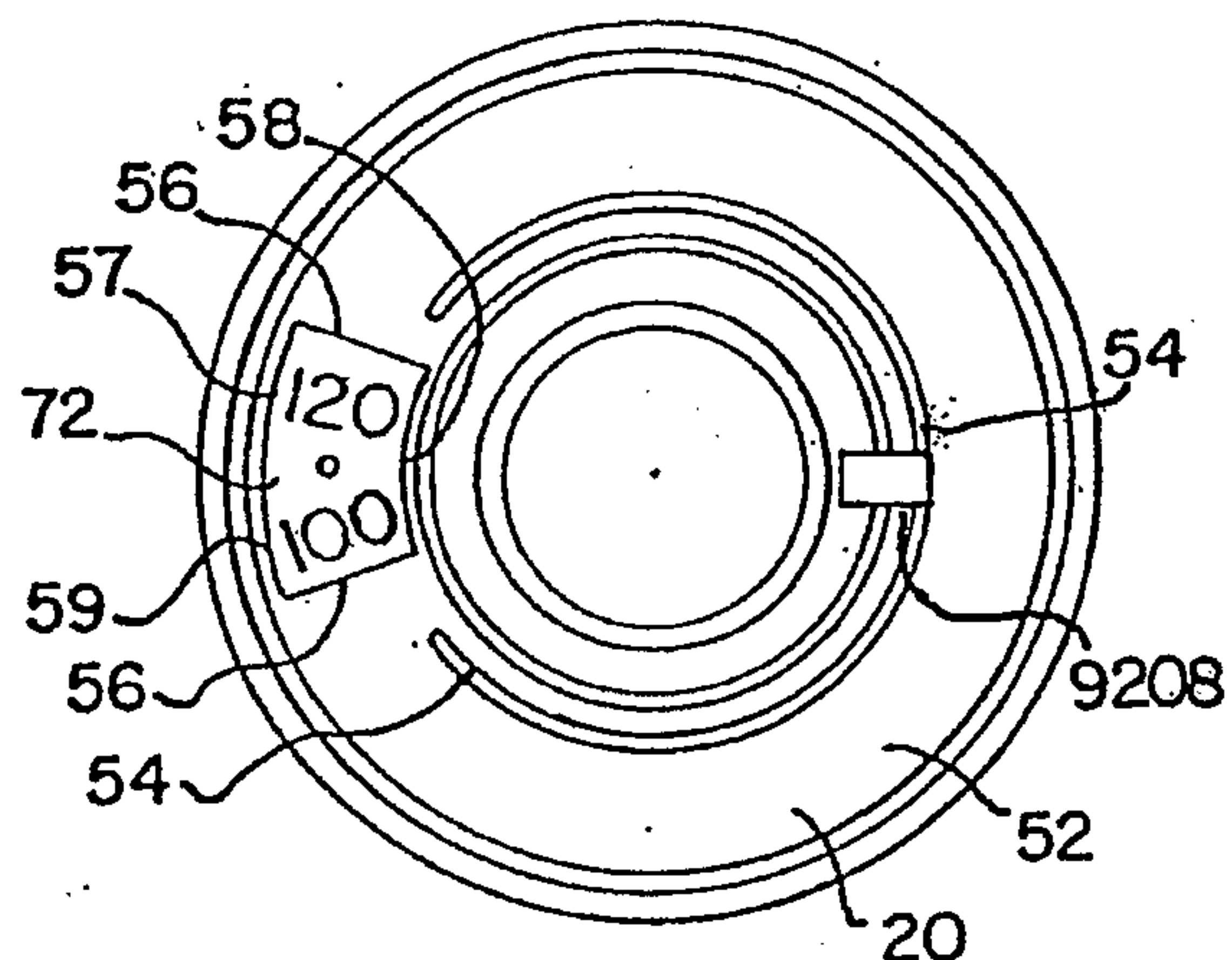


FIG. 1B

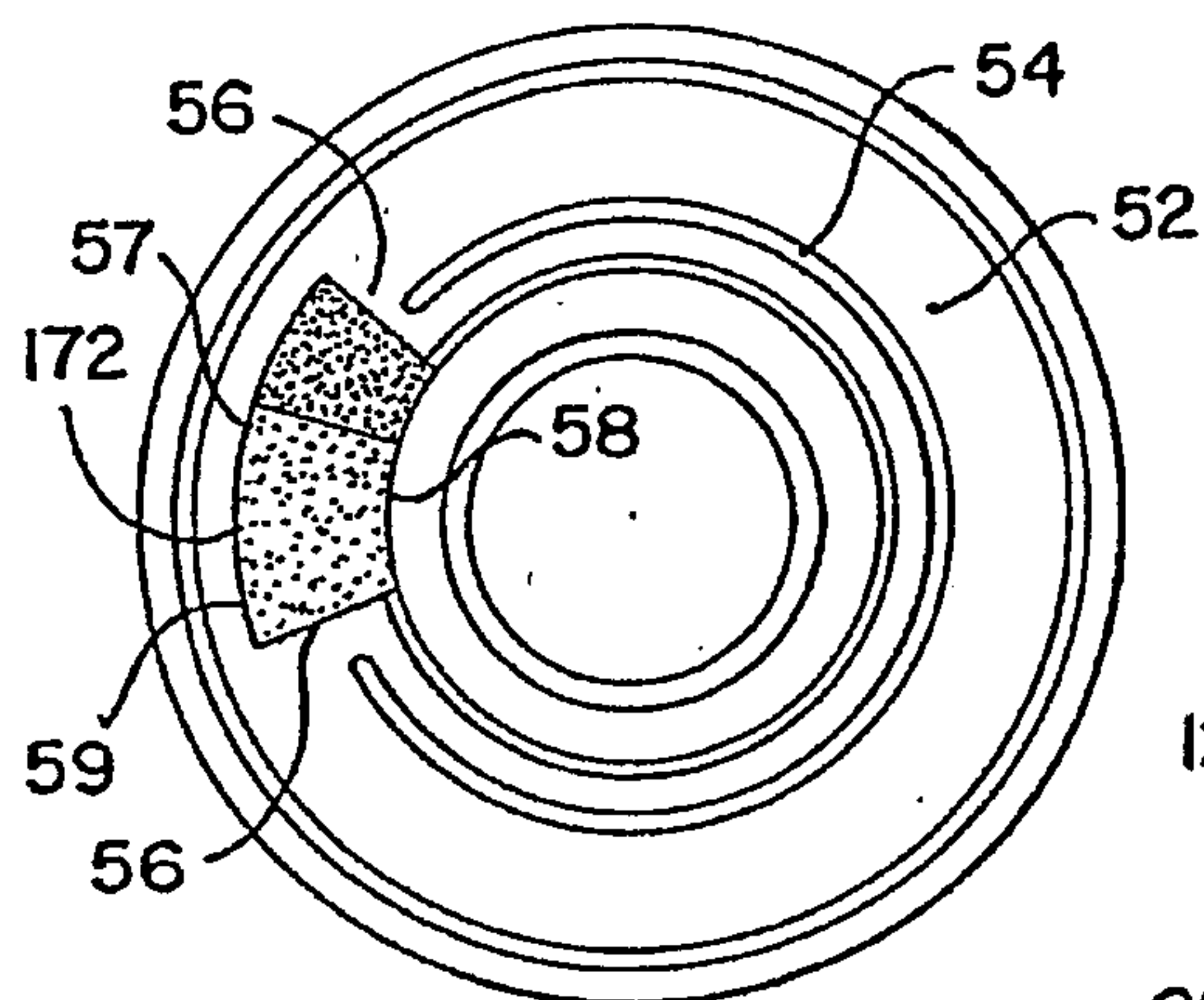


FIG. 2

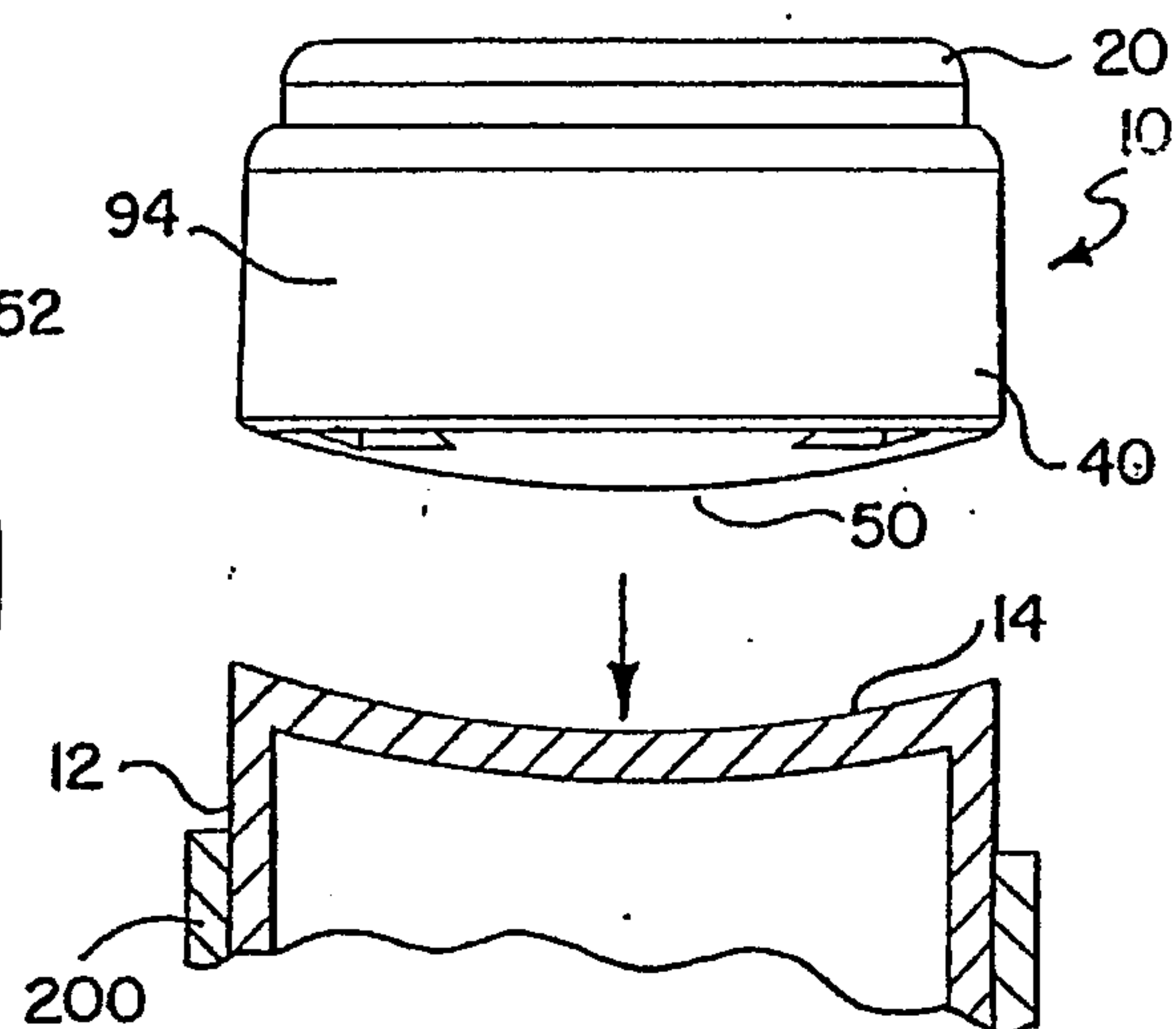


FIG. 3

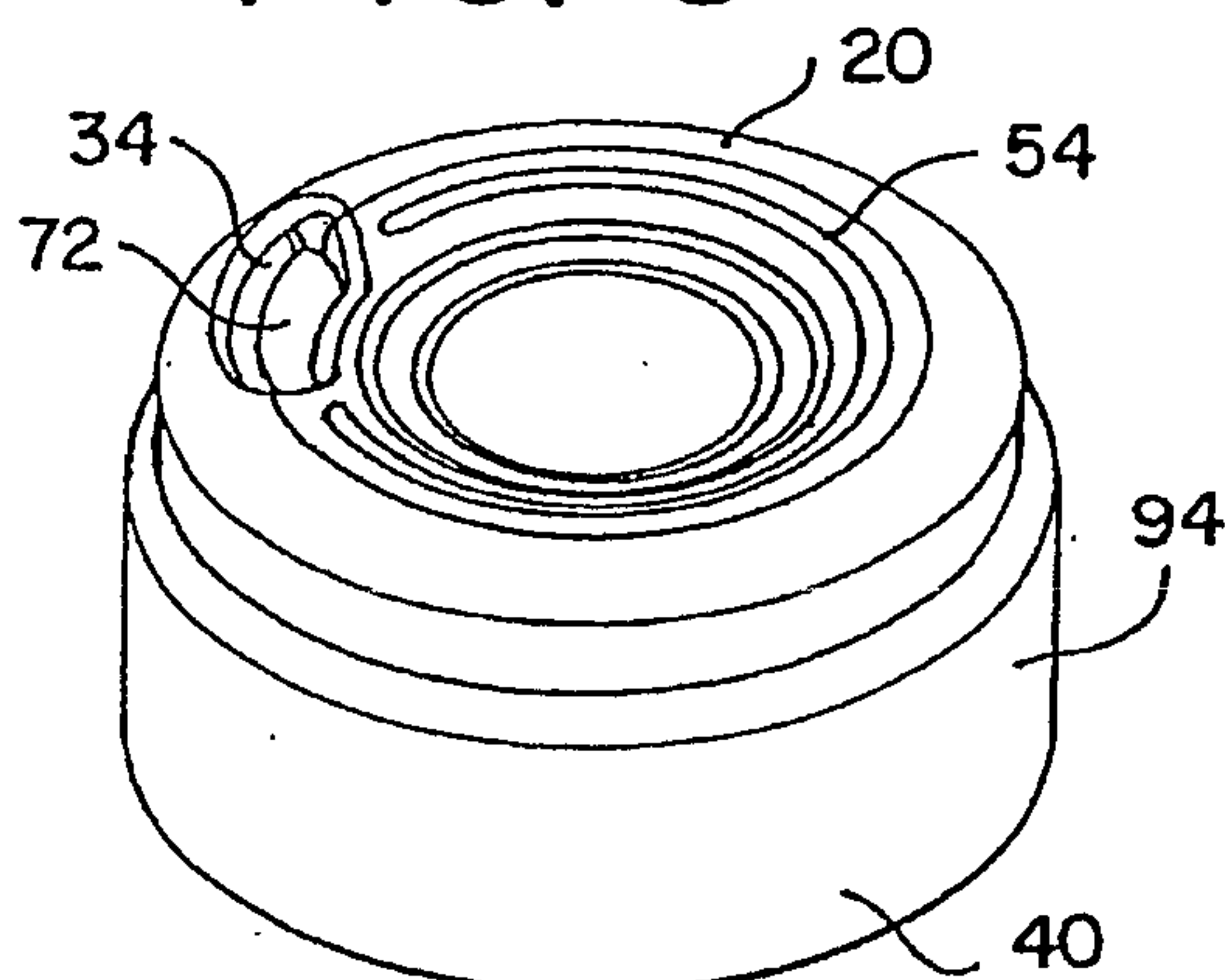


FIG. 3A

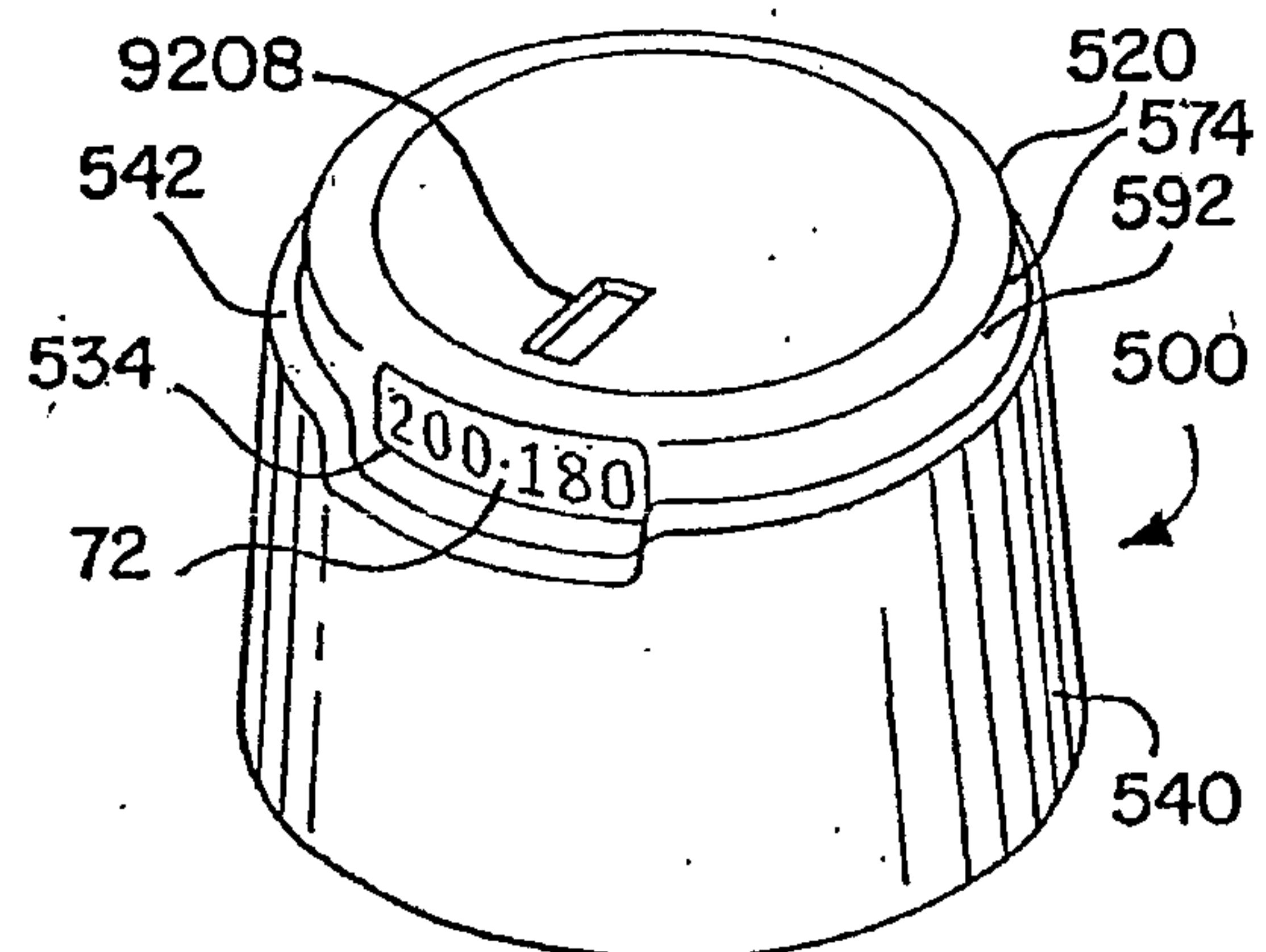


FIG. 4

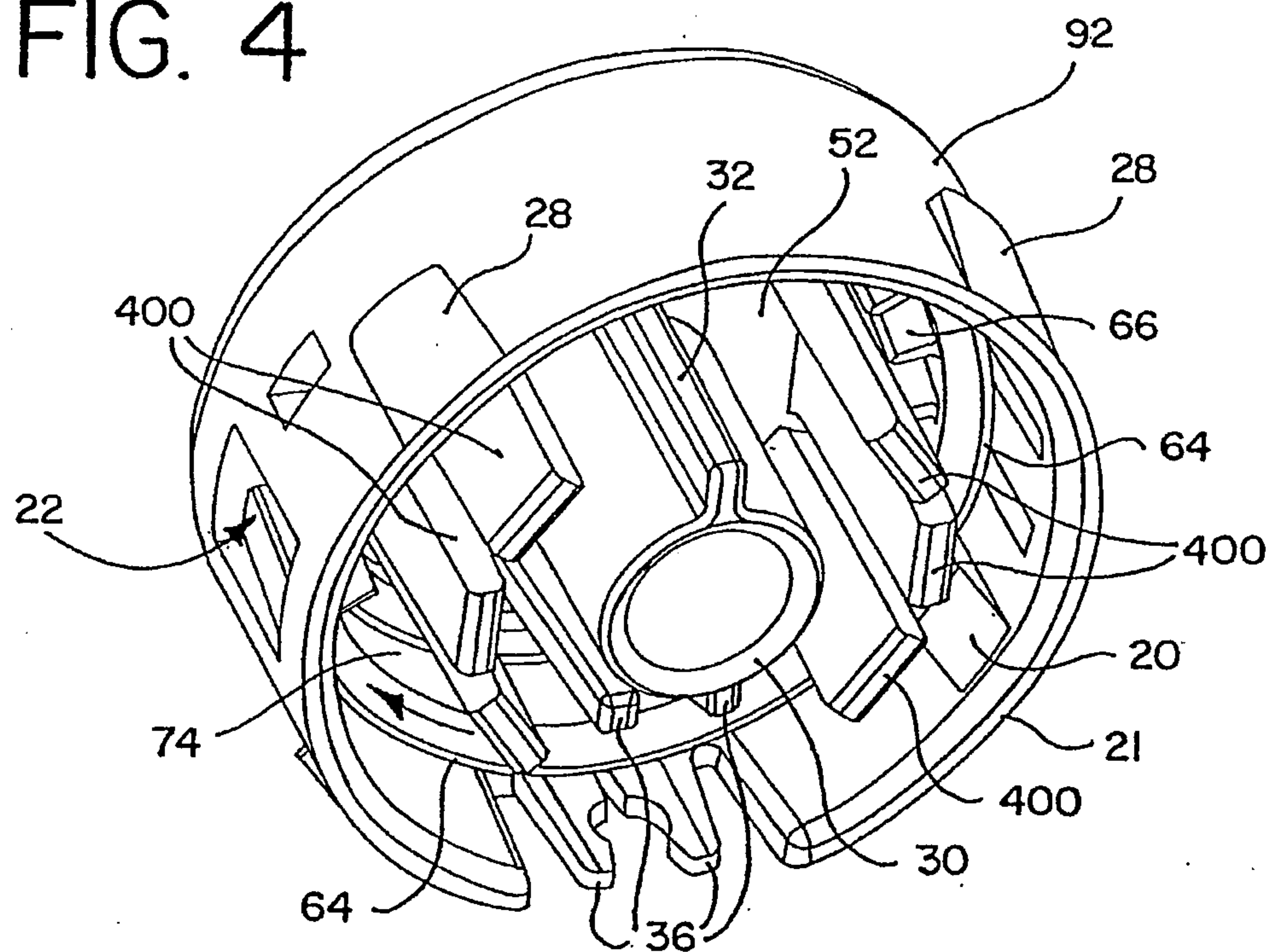


FIG. 5

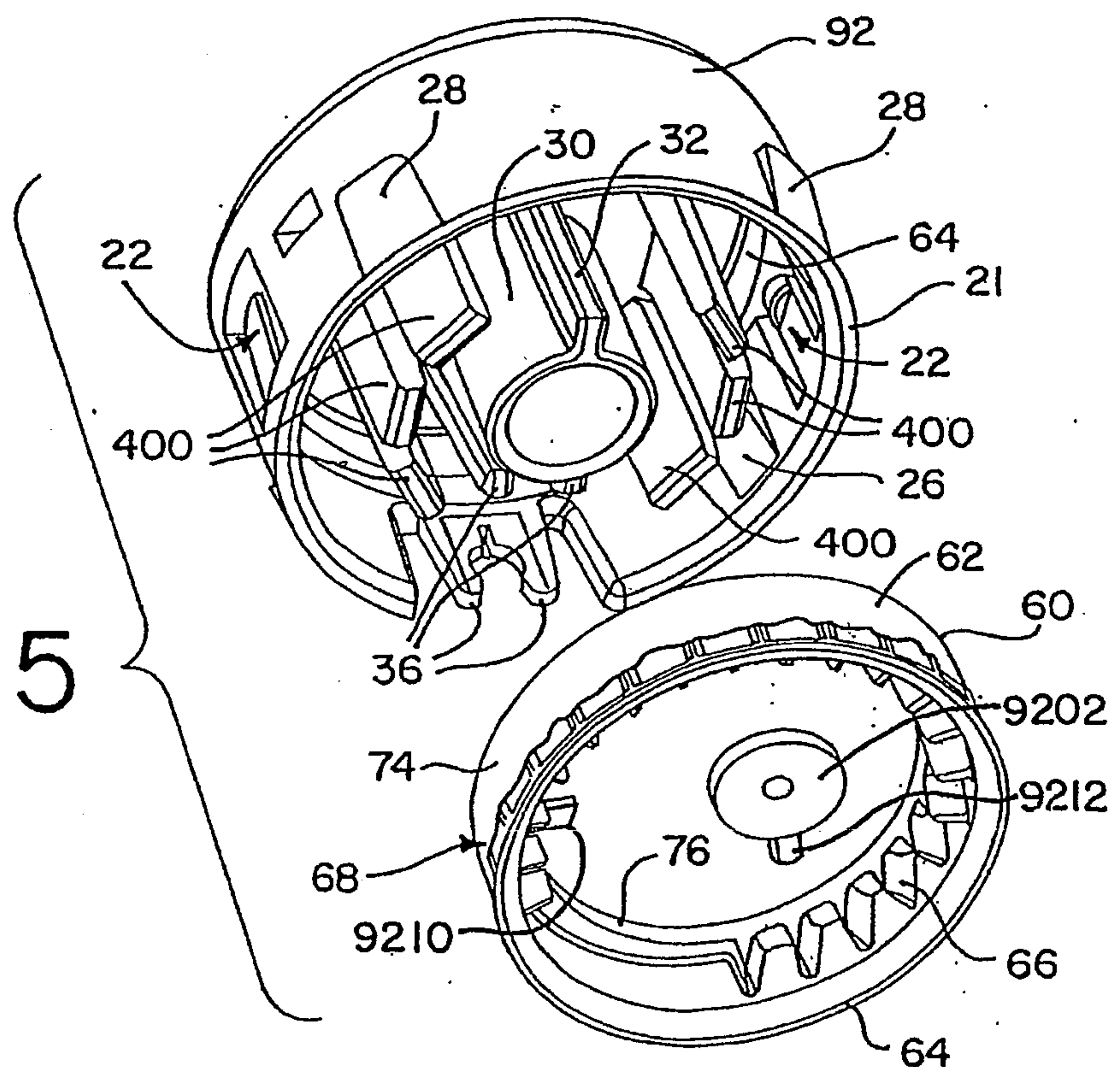


FIG. 6

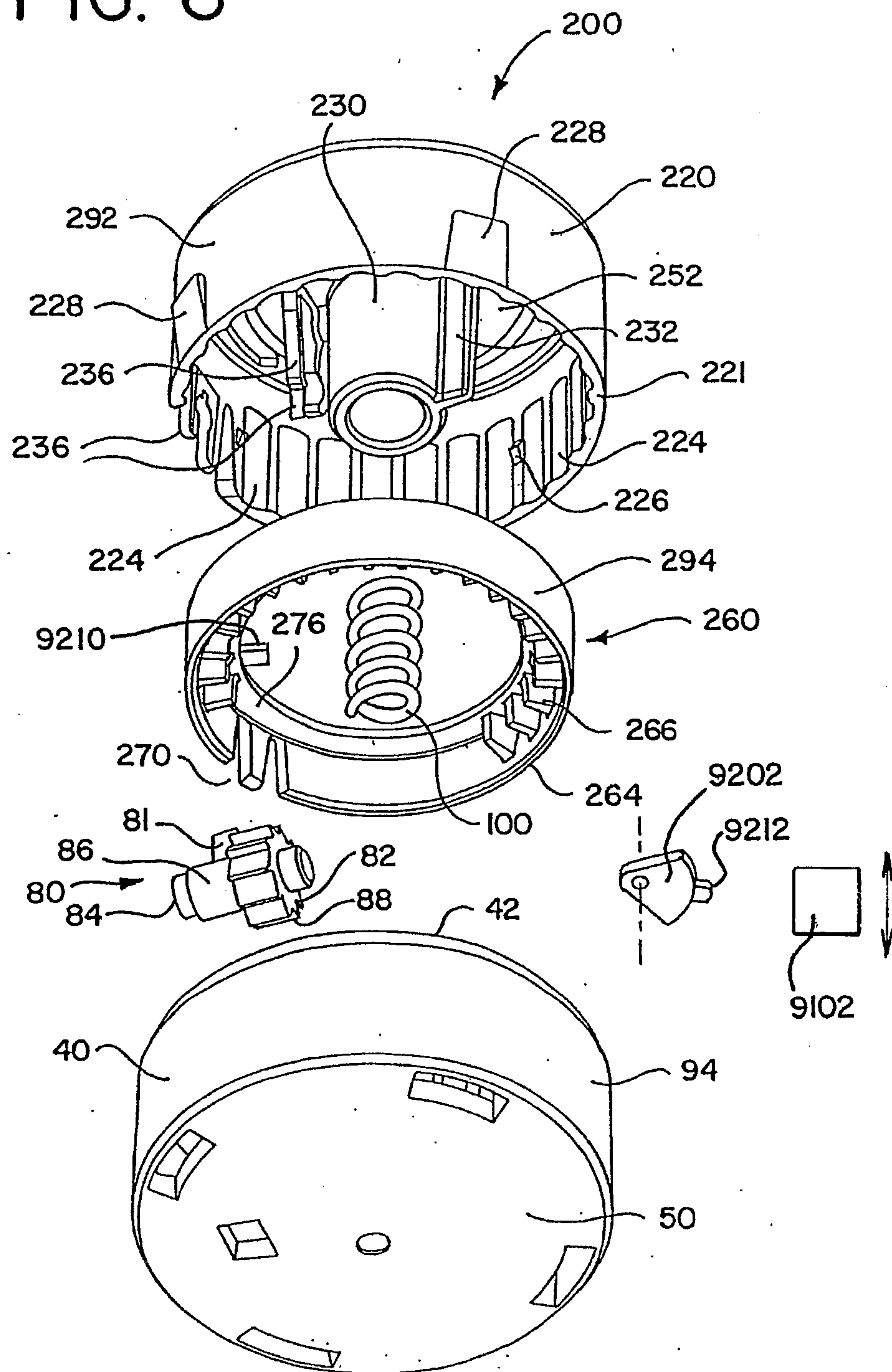


FIG. 7

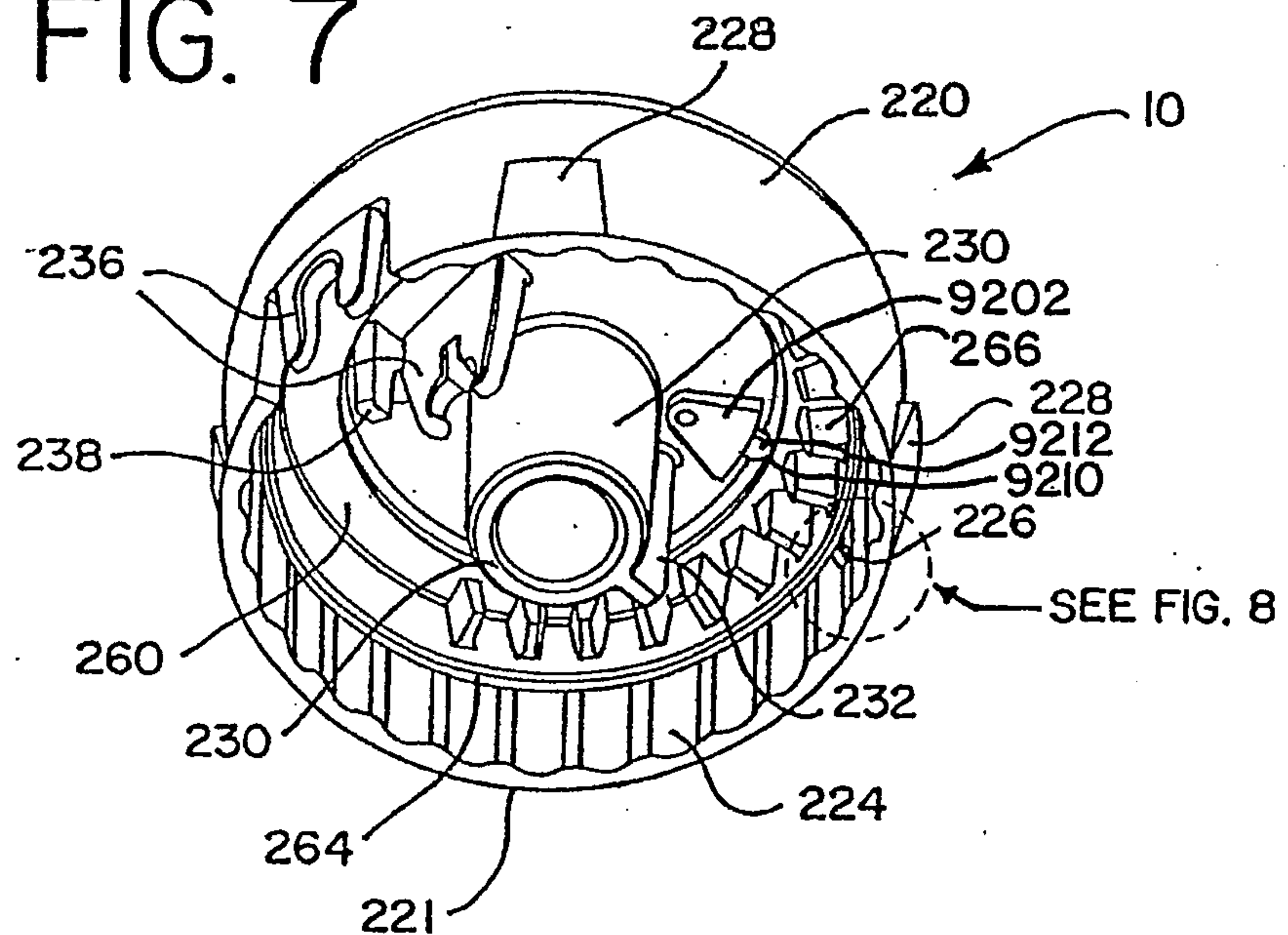


FIG. 8

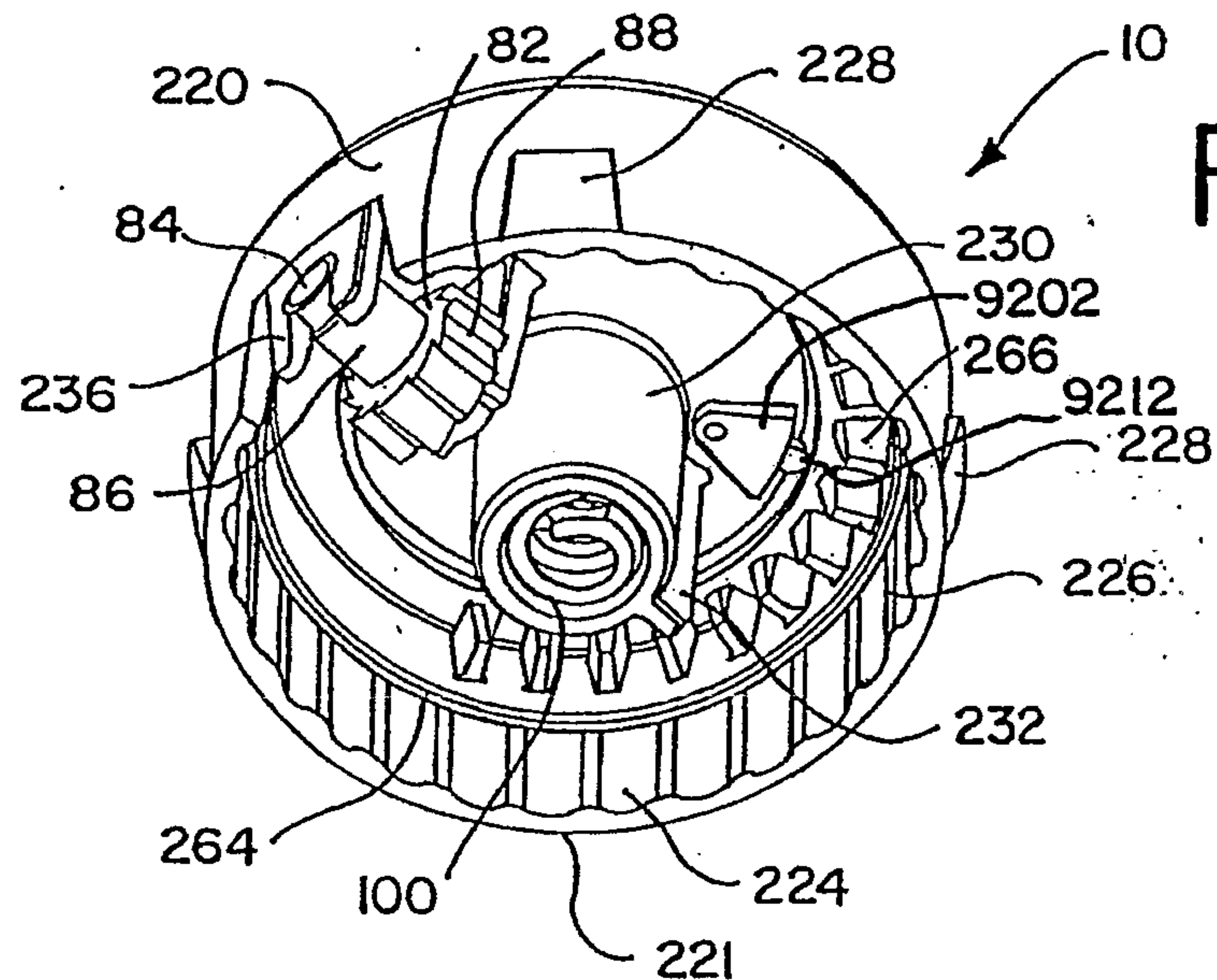
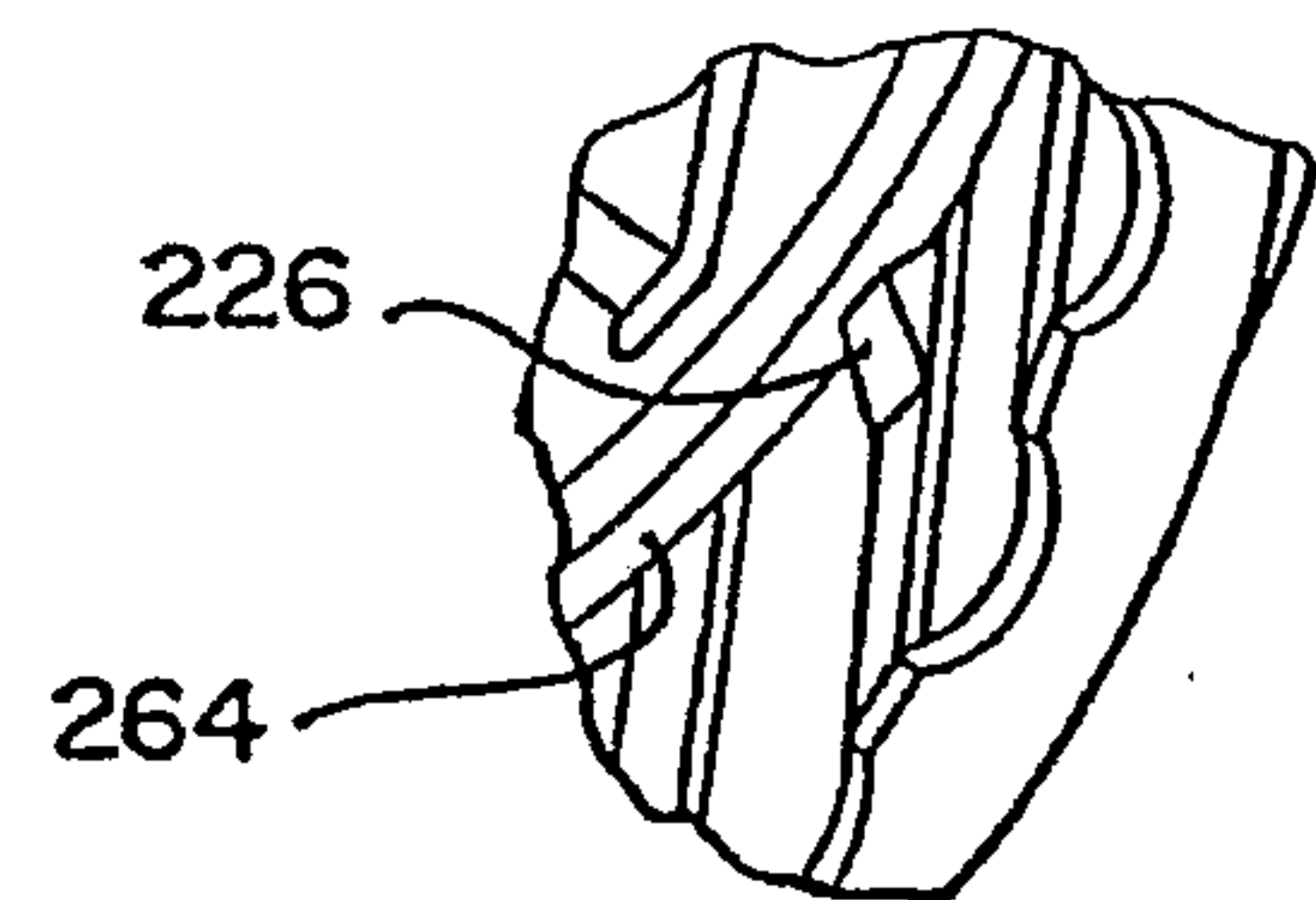


FIG. 9

FIG. 10

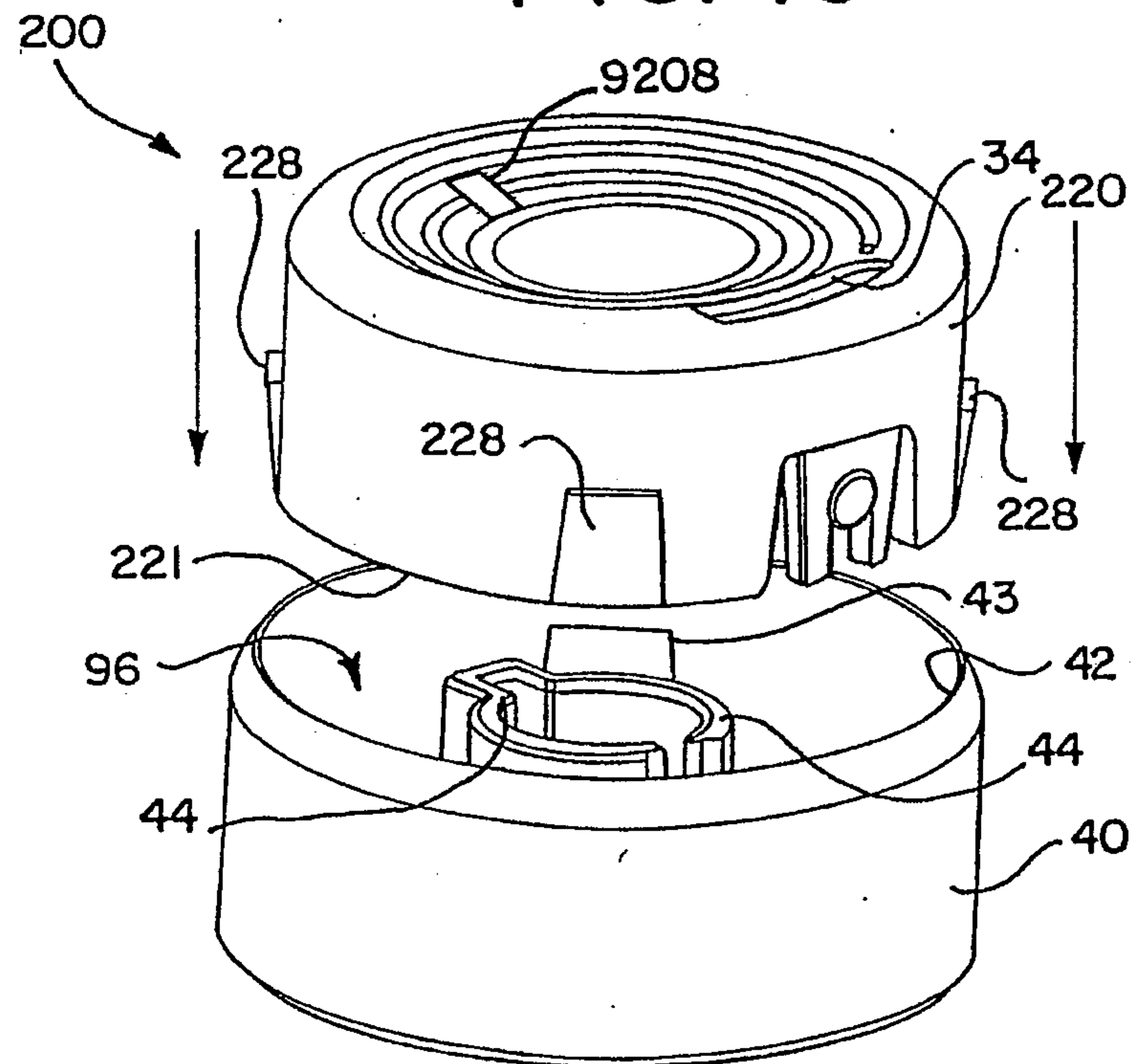


FIG. 11

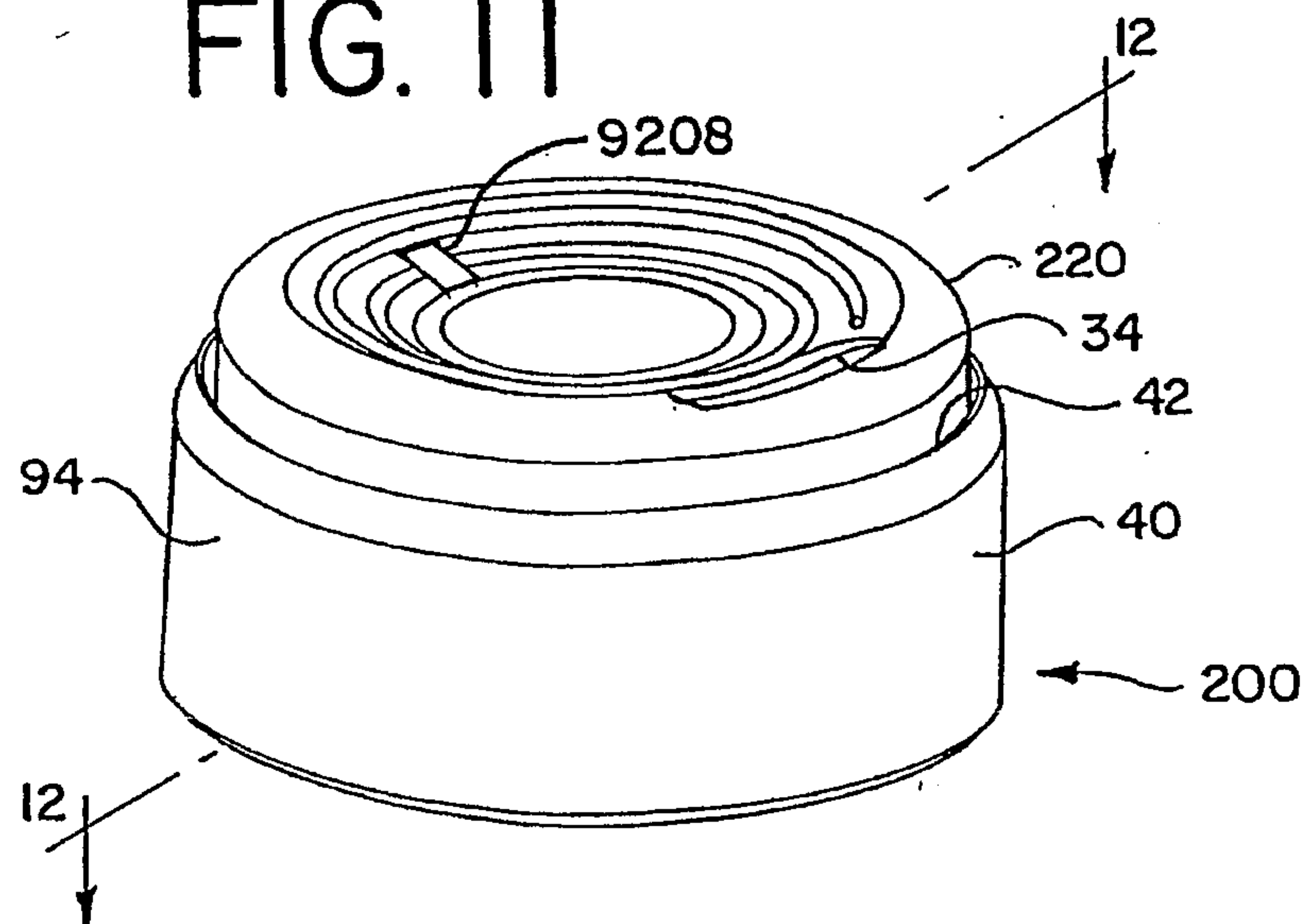


FIG. 12

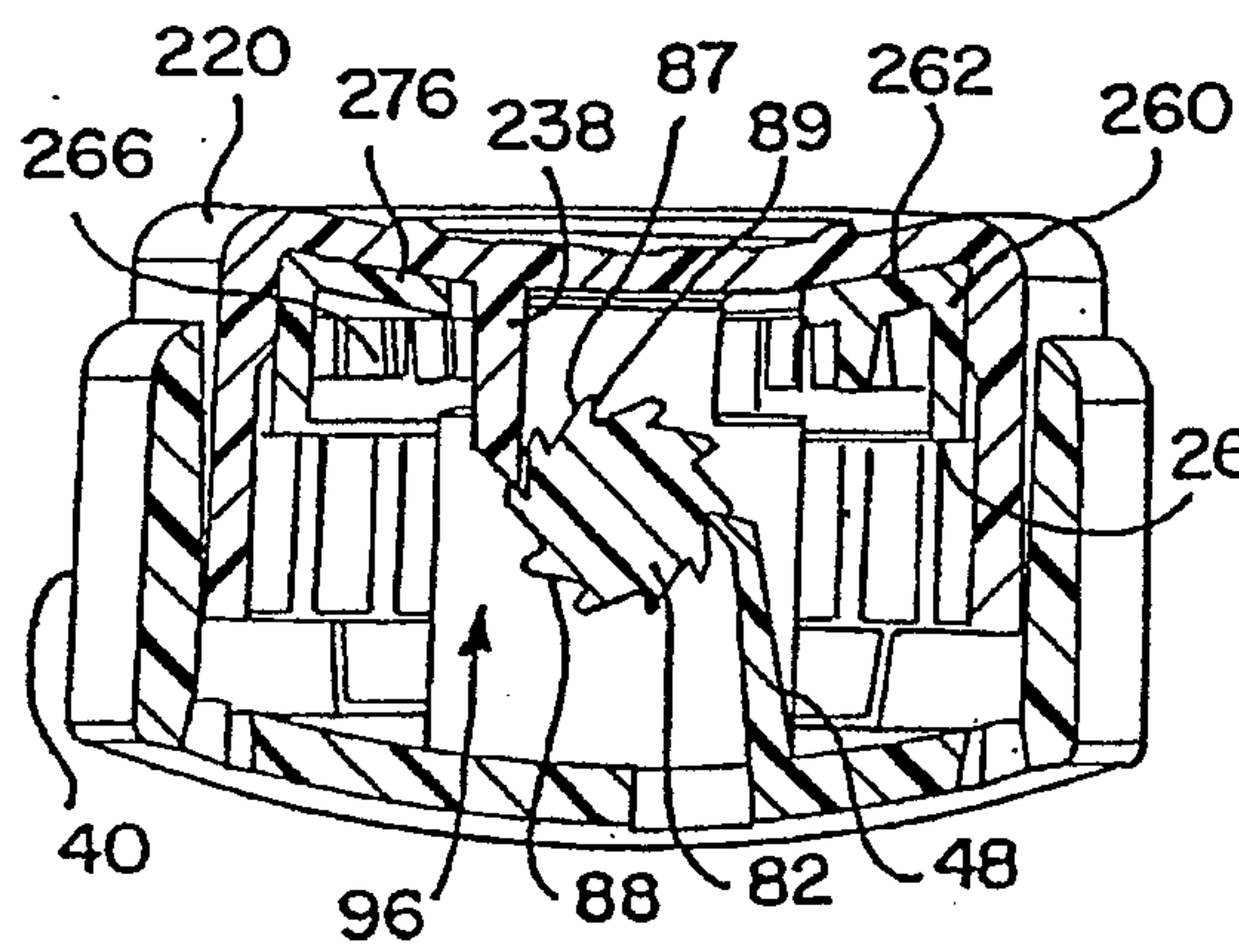


FIG. 13

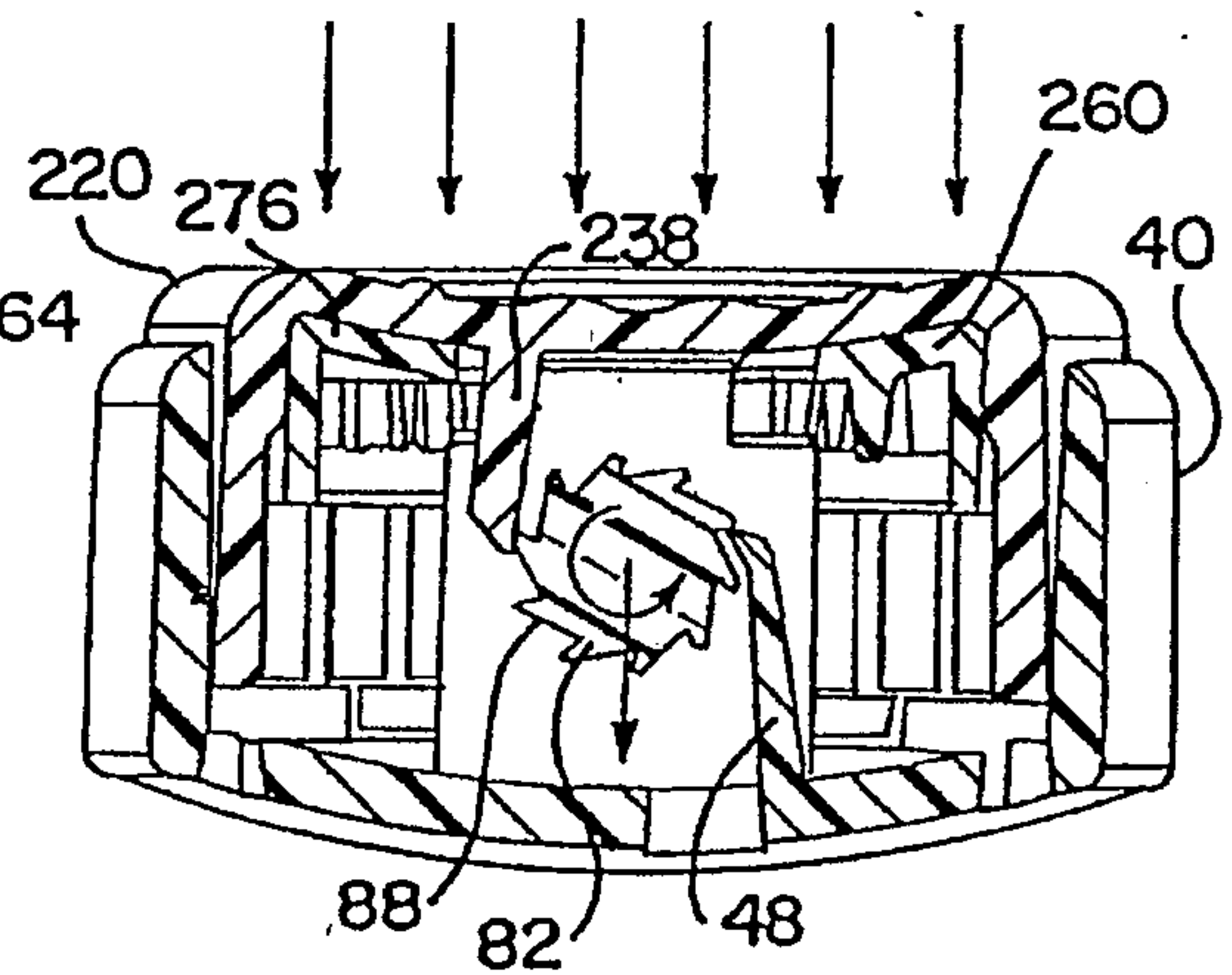


FIG. 14

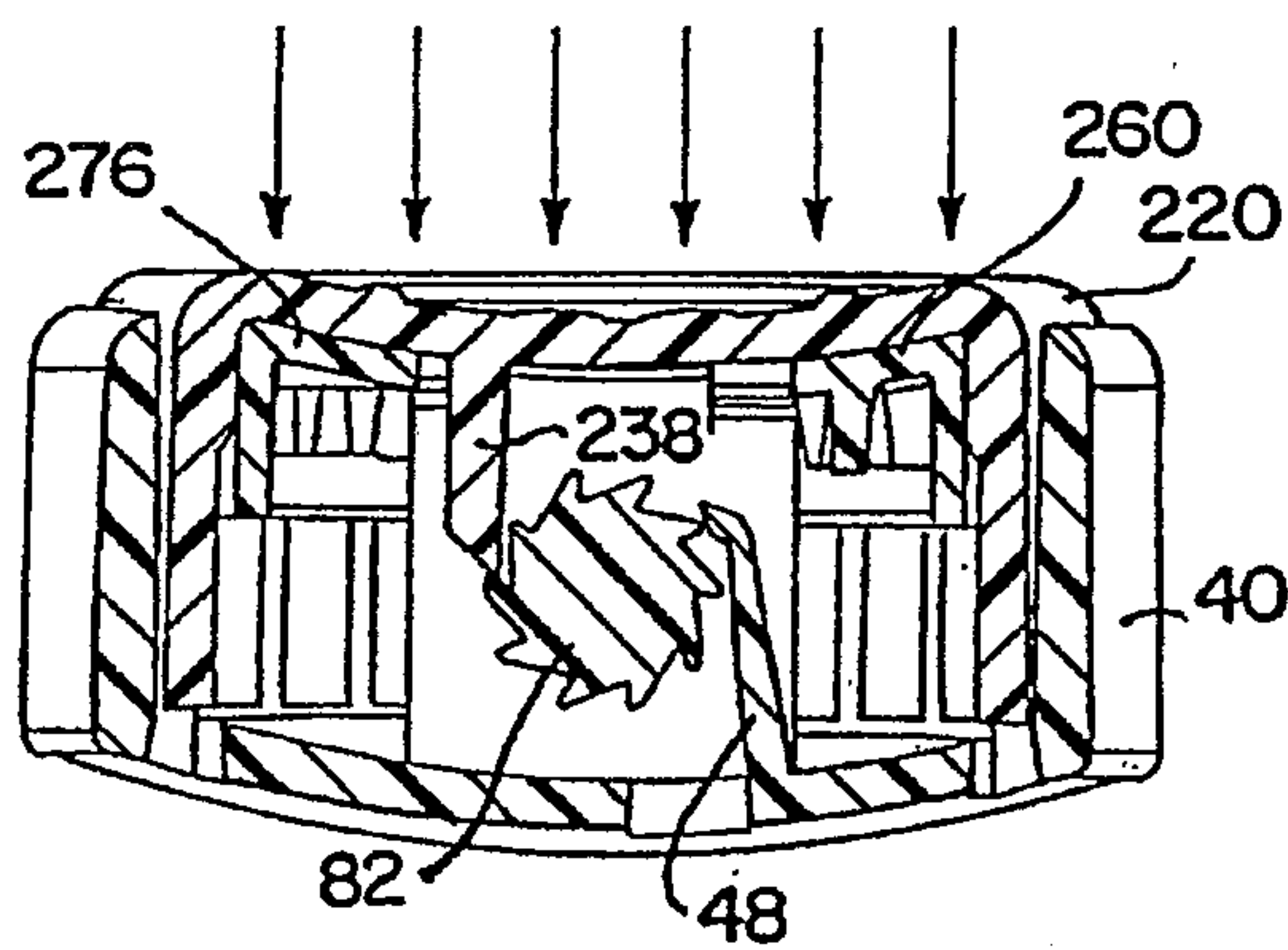


FIG. 15

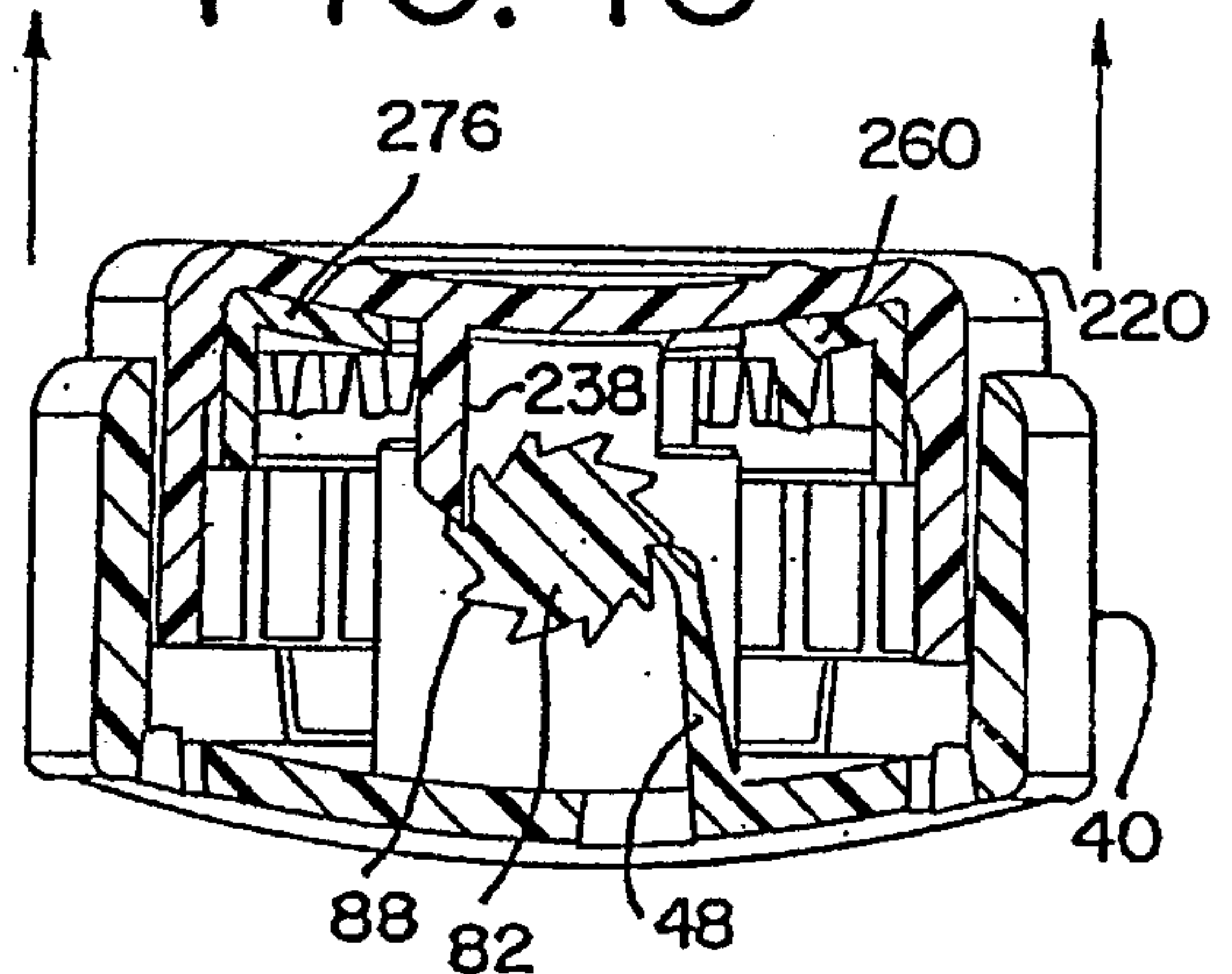


FIG. 16

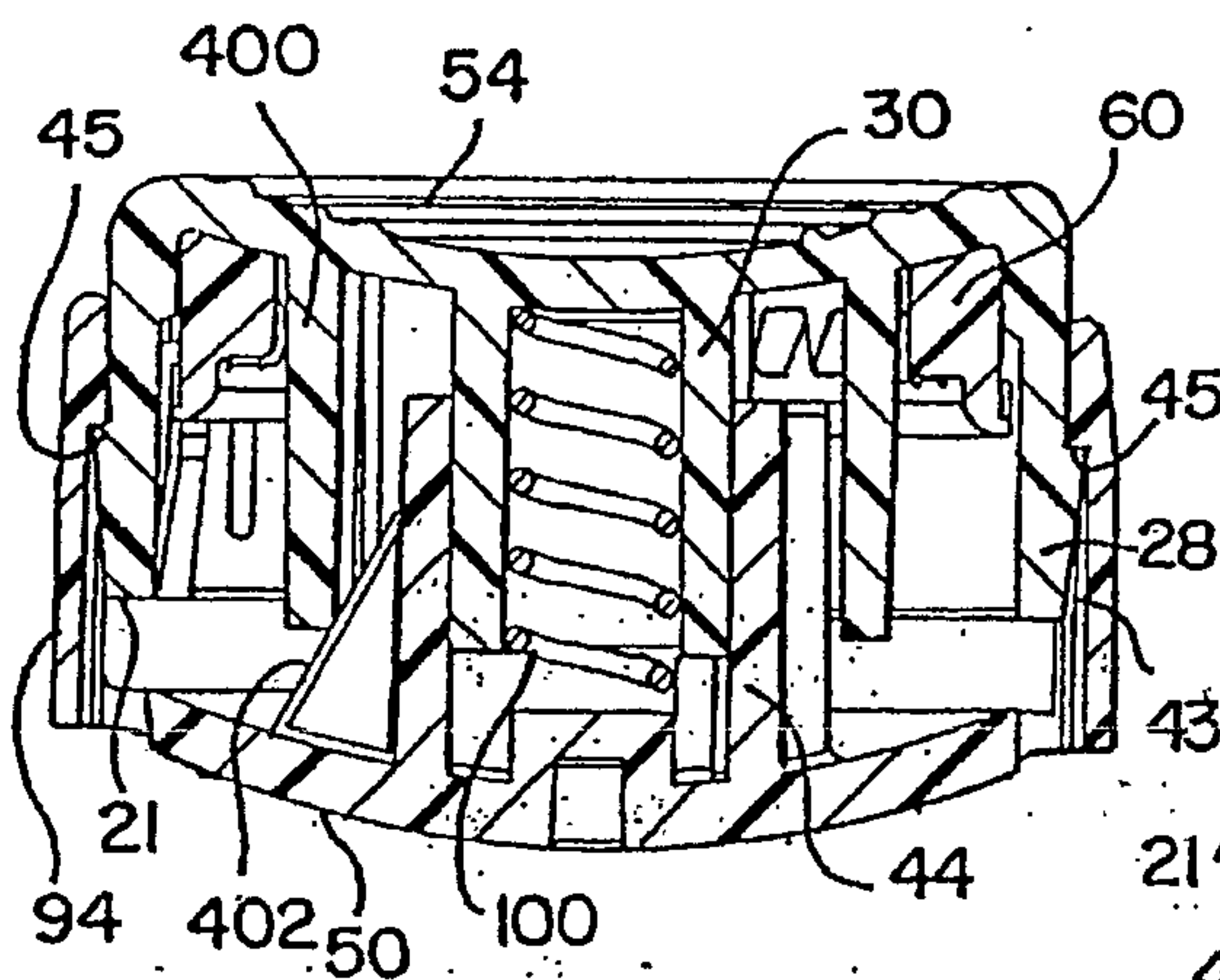


FIG. 17

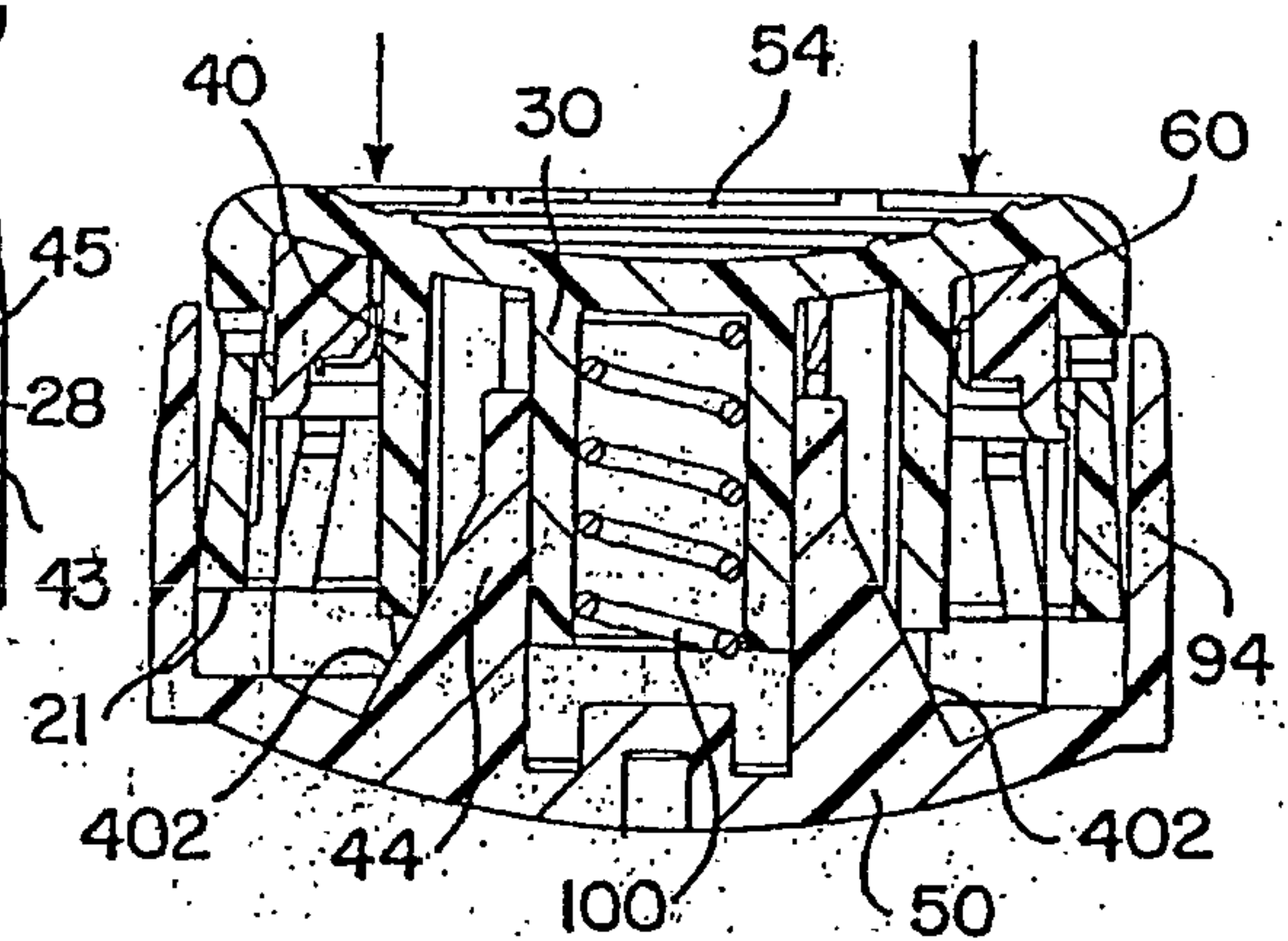


FIG. 18

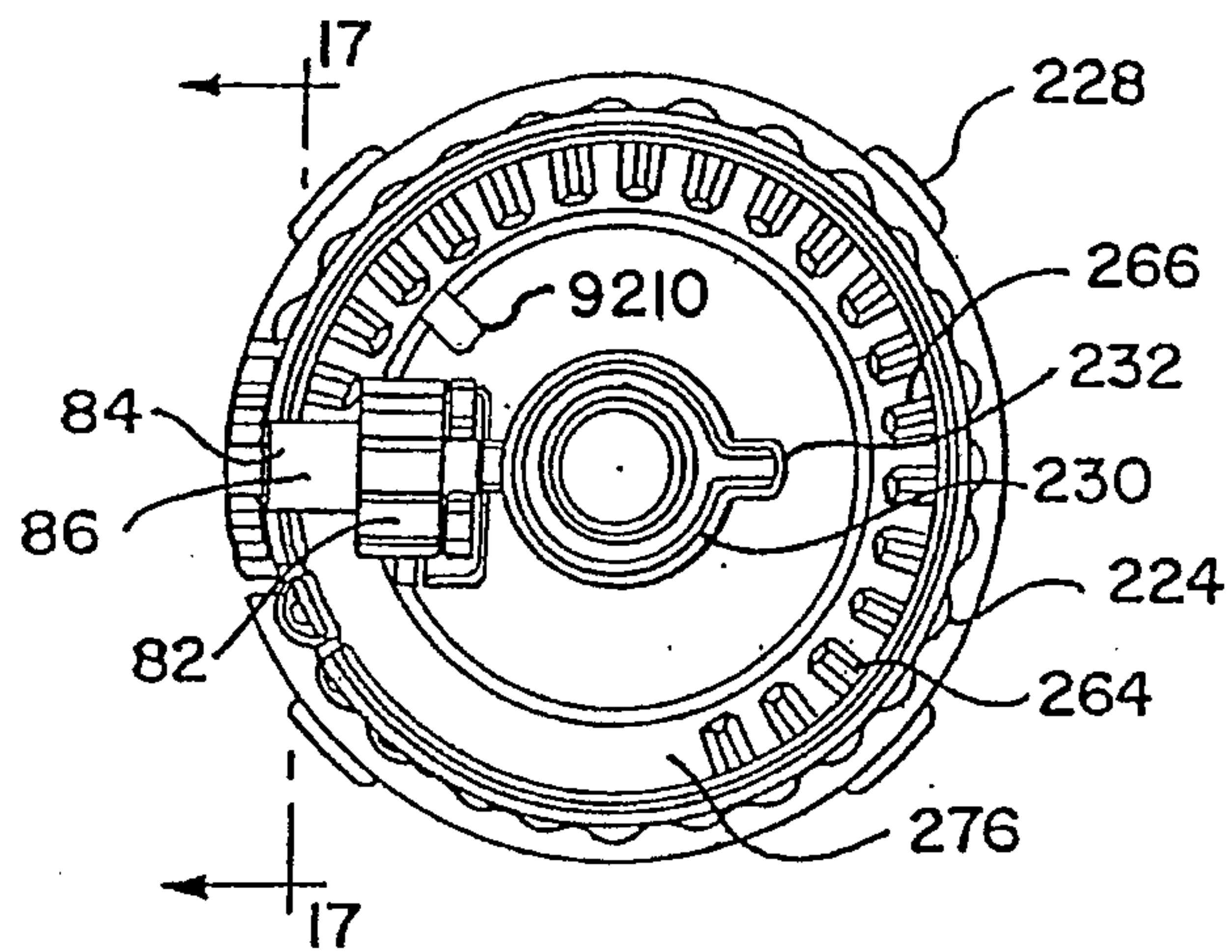


FIG. 19

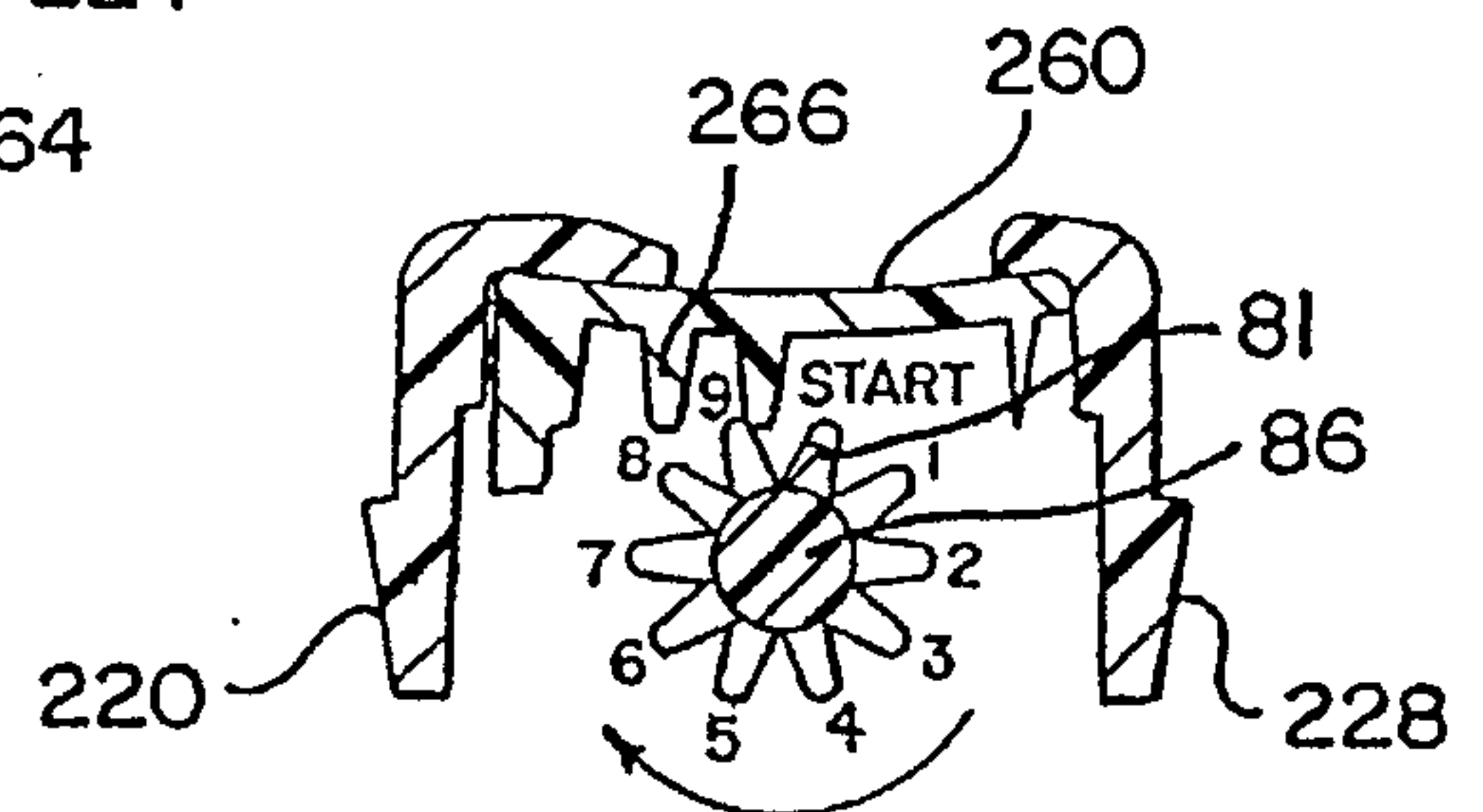


FIG. 20

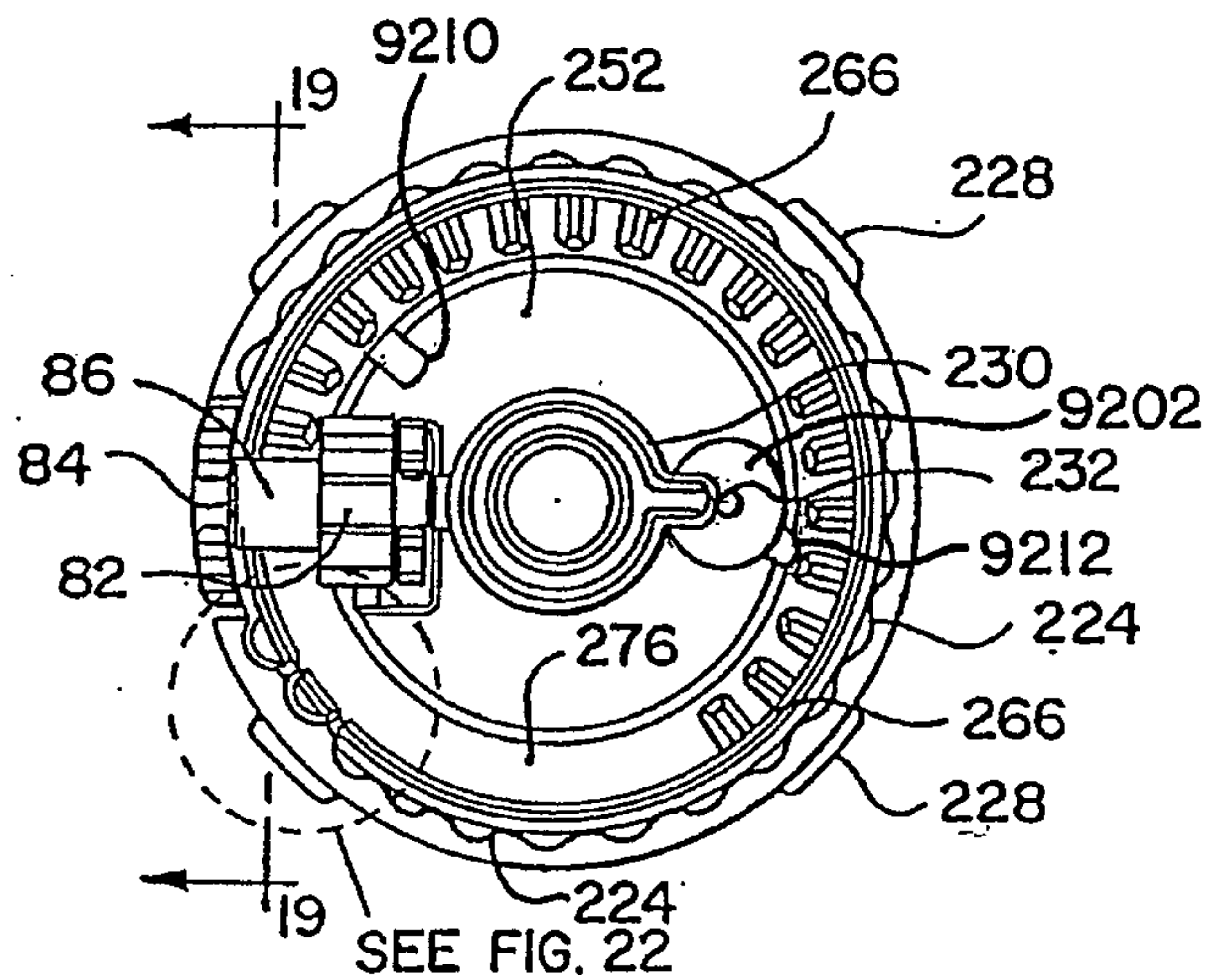


FIG. 21

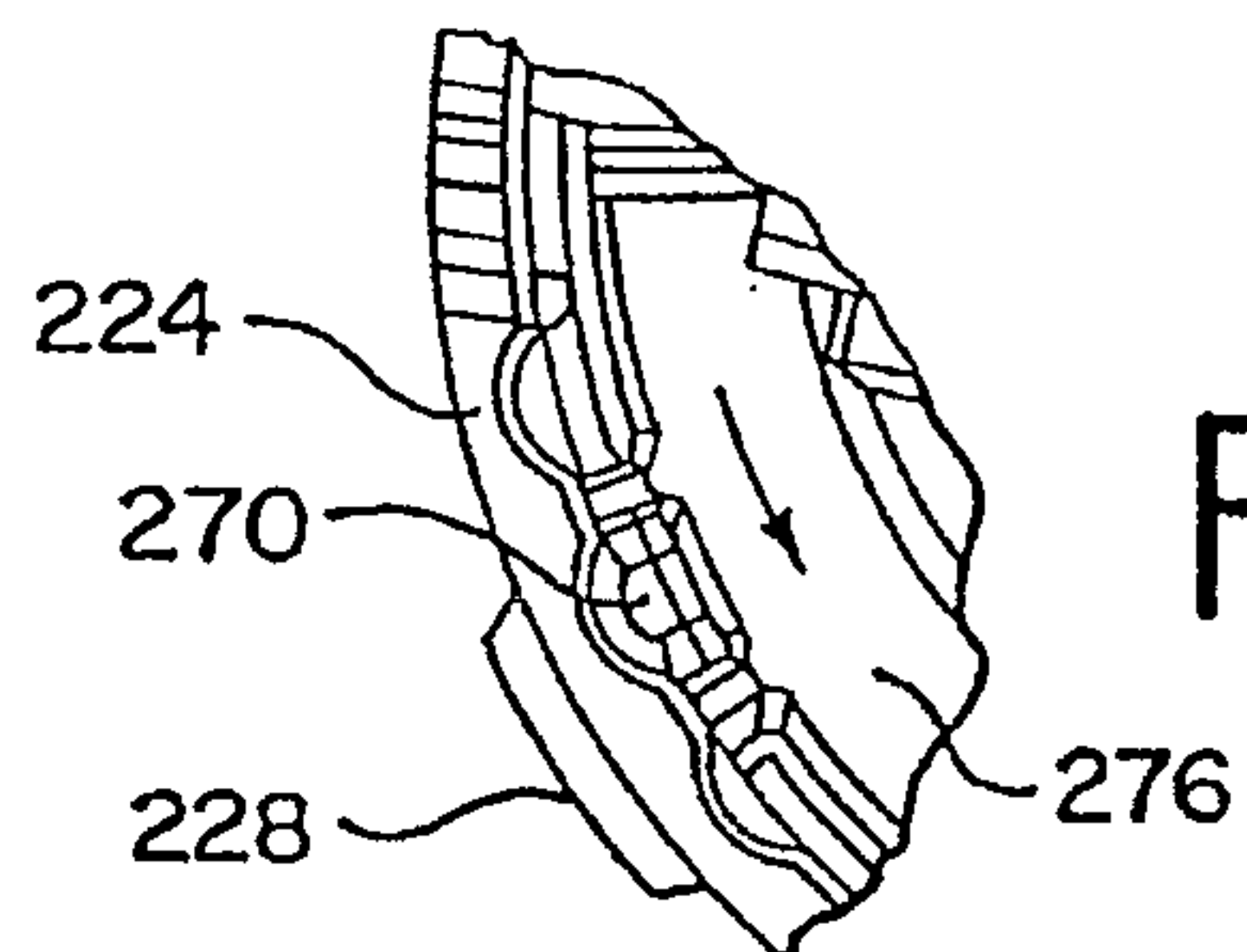
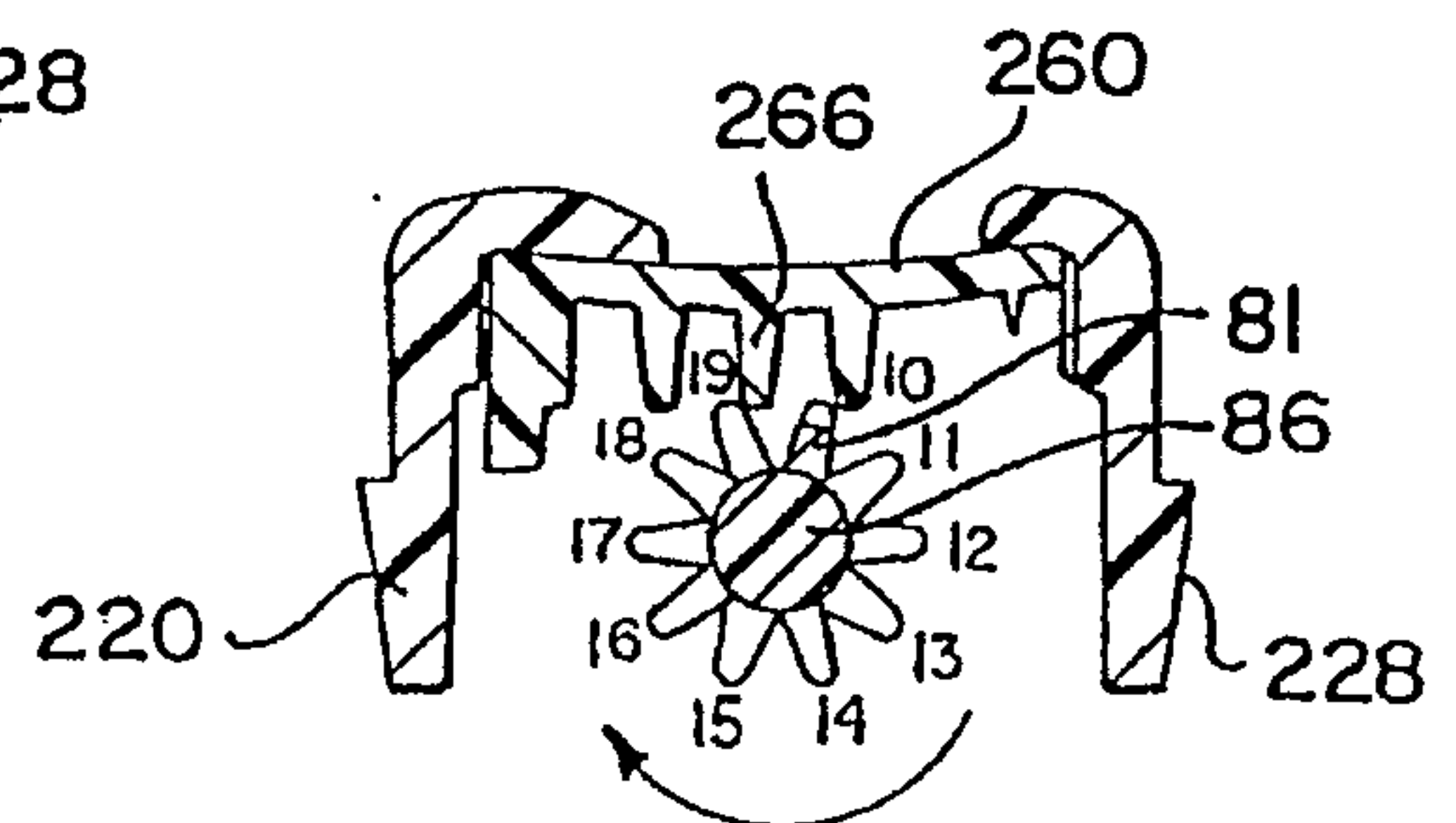


FIG. 22

FIG. 23

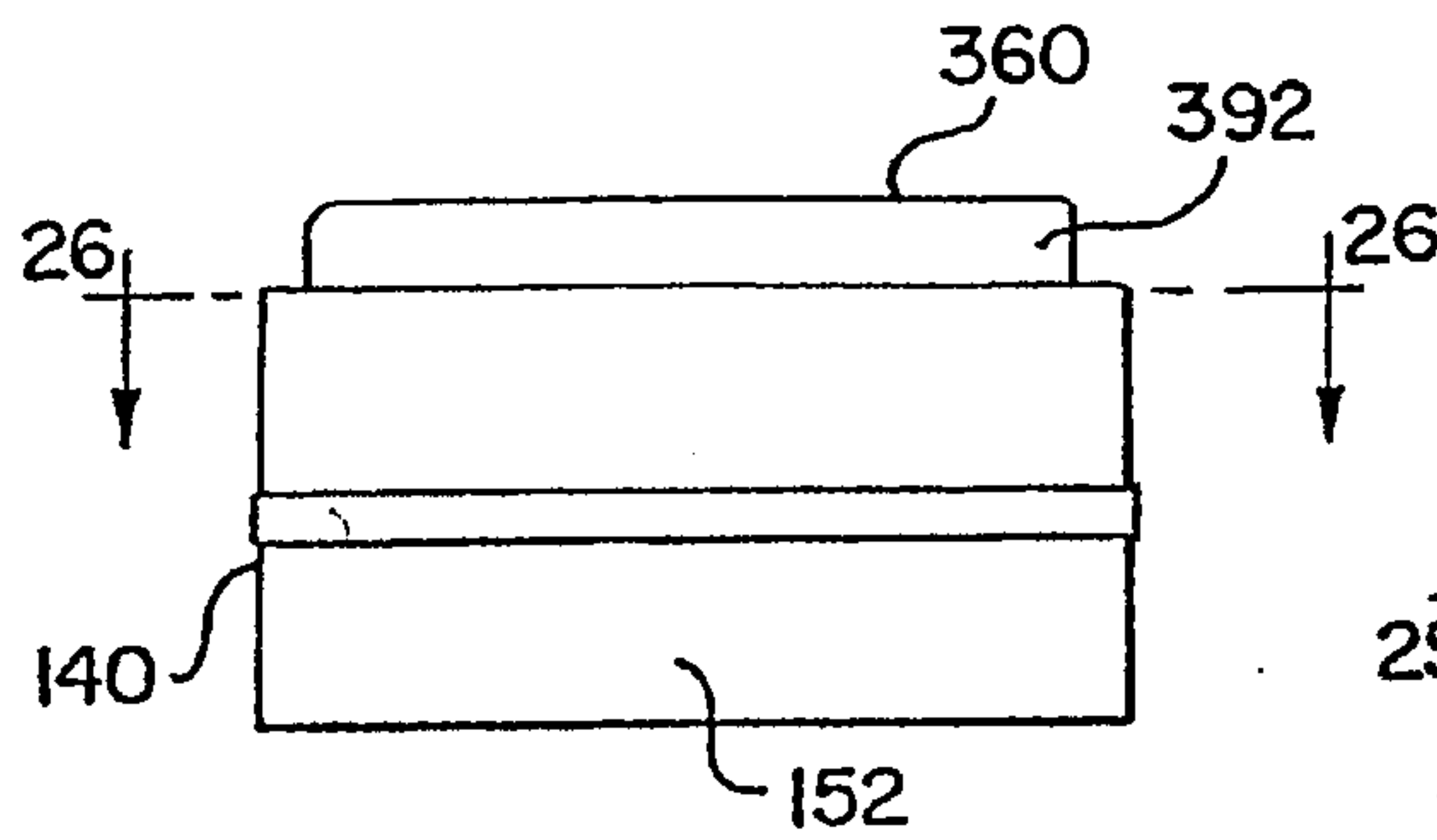


FIG. 24

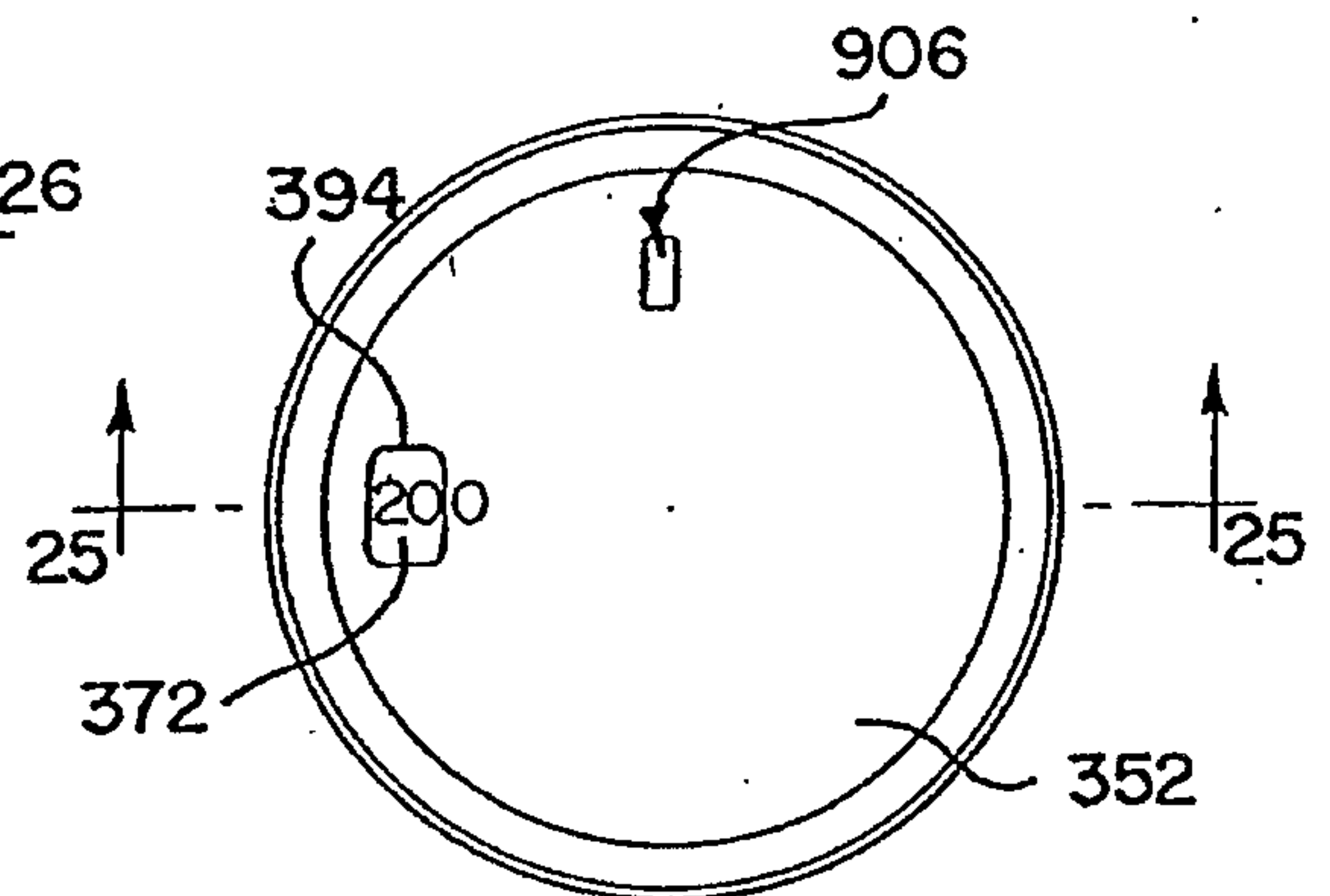


FIG. 25

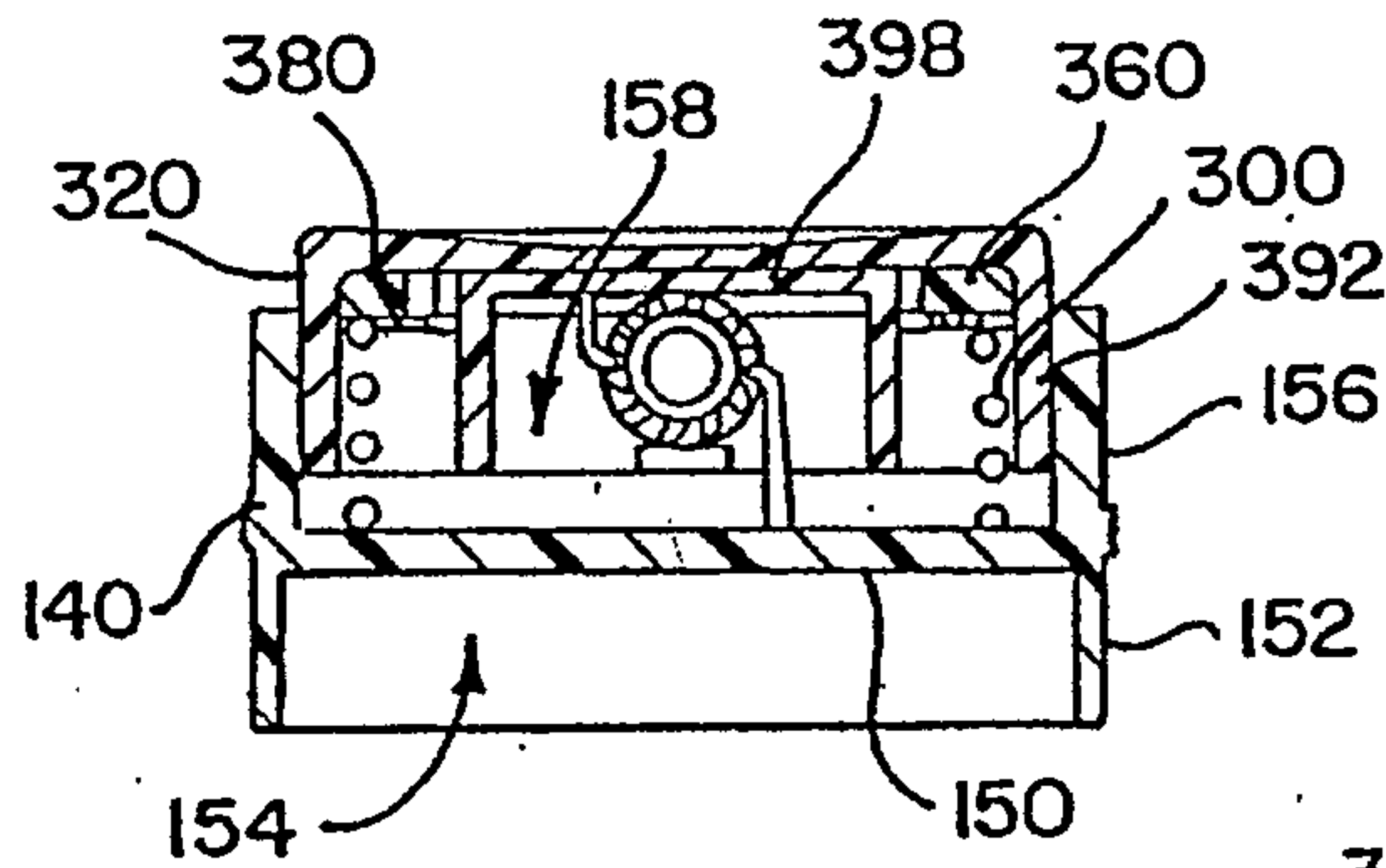


FIG. 26

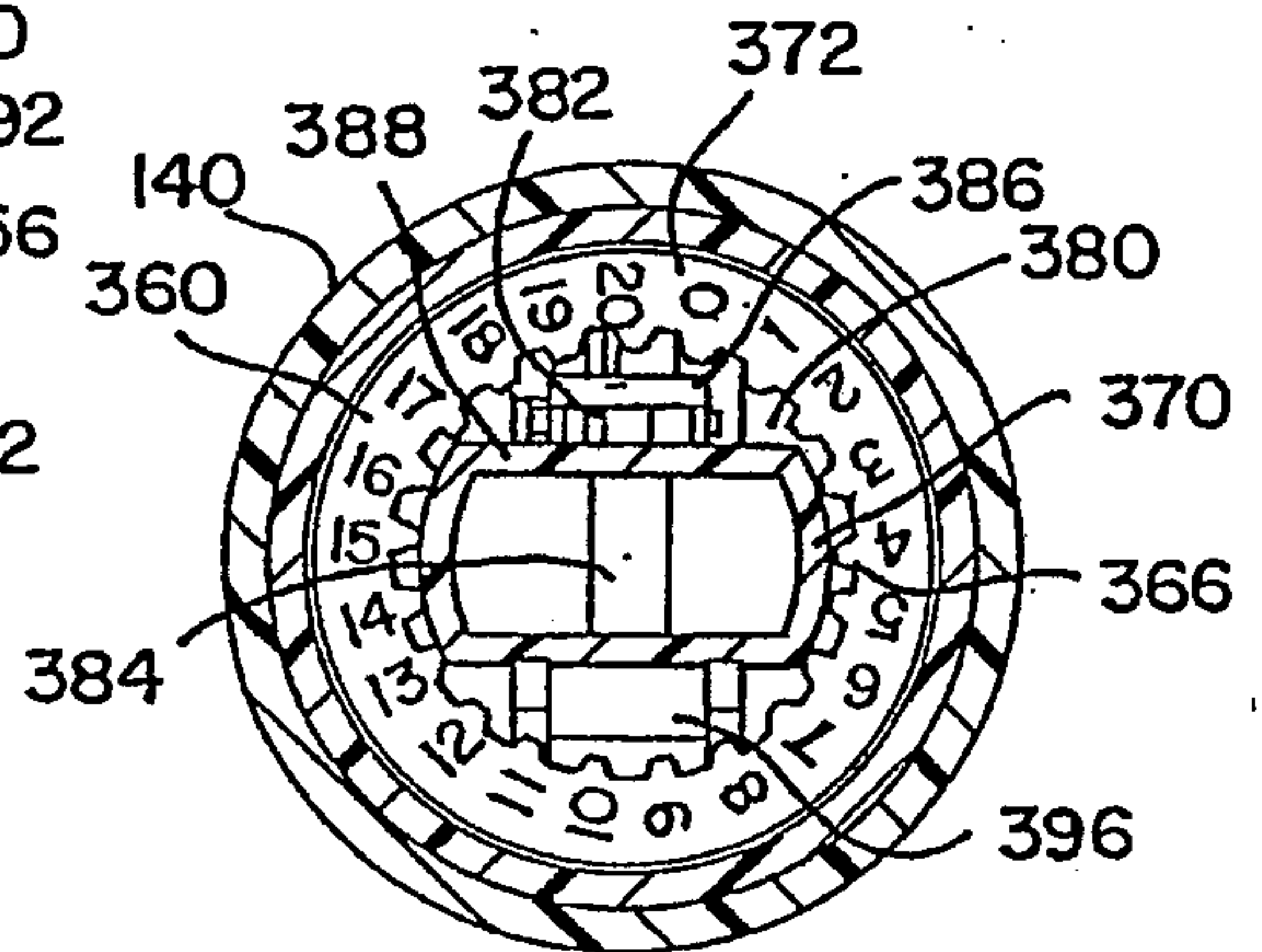


FIG. 27

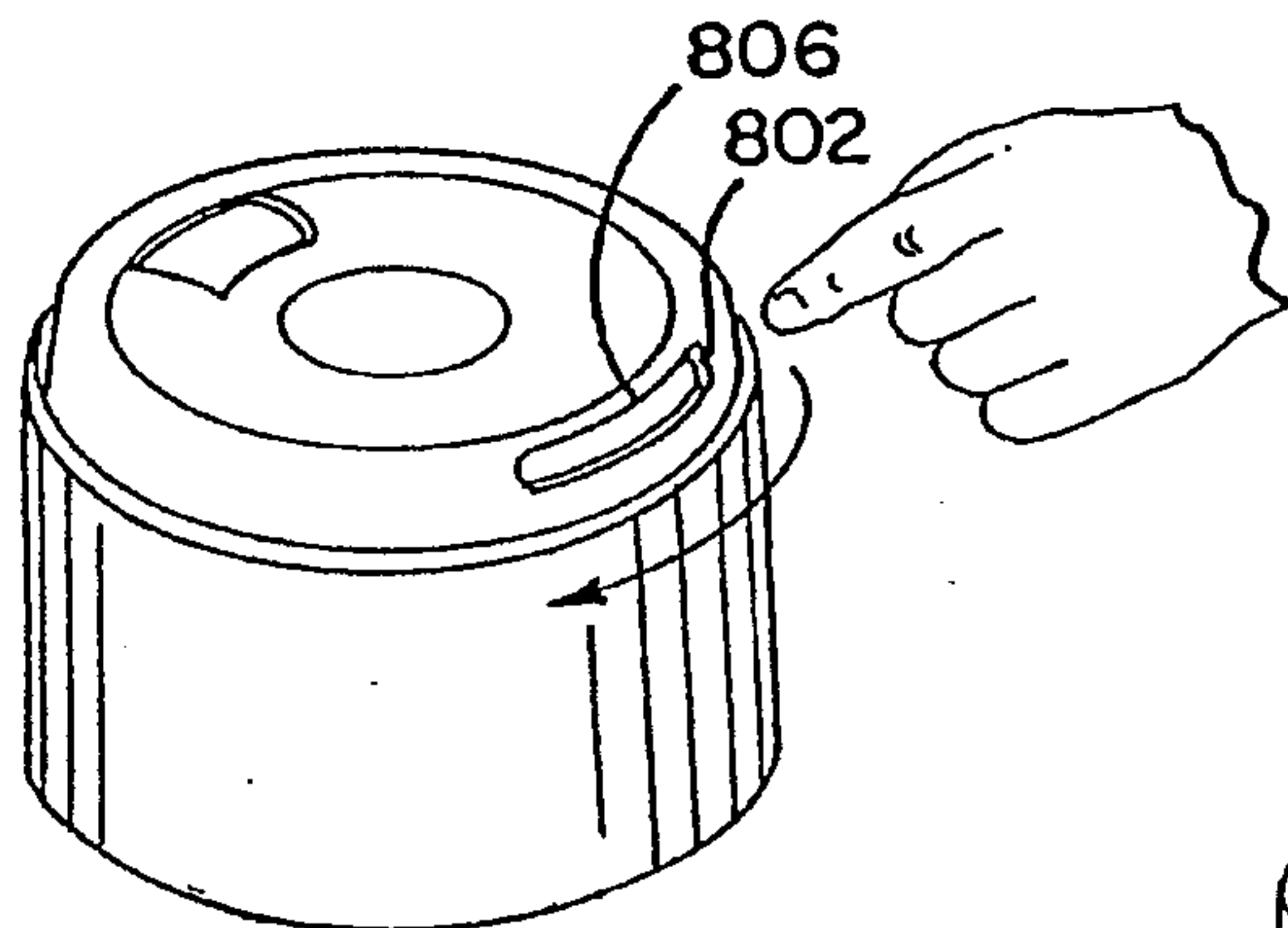


FIG. 28

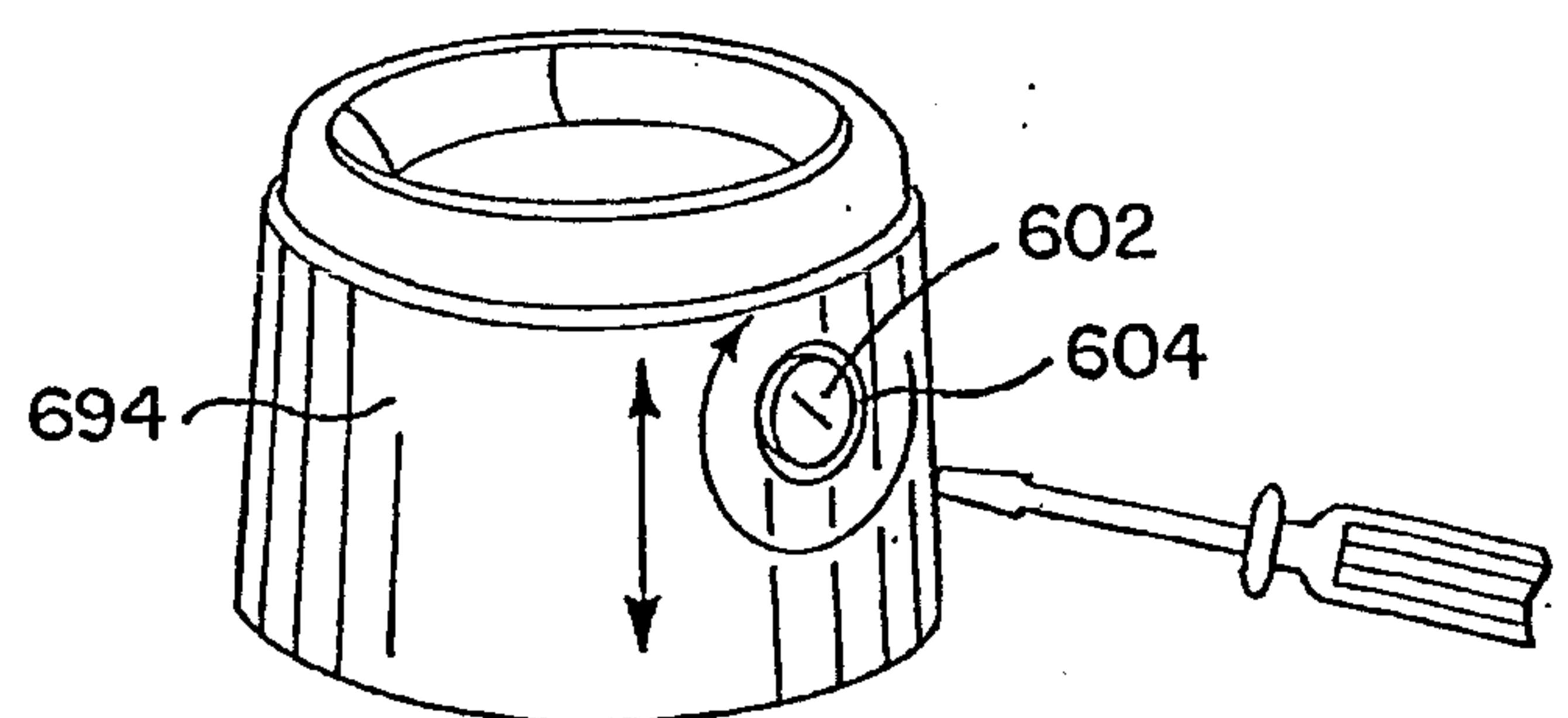


FIG. 29

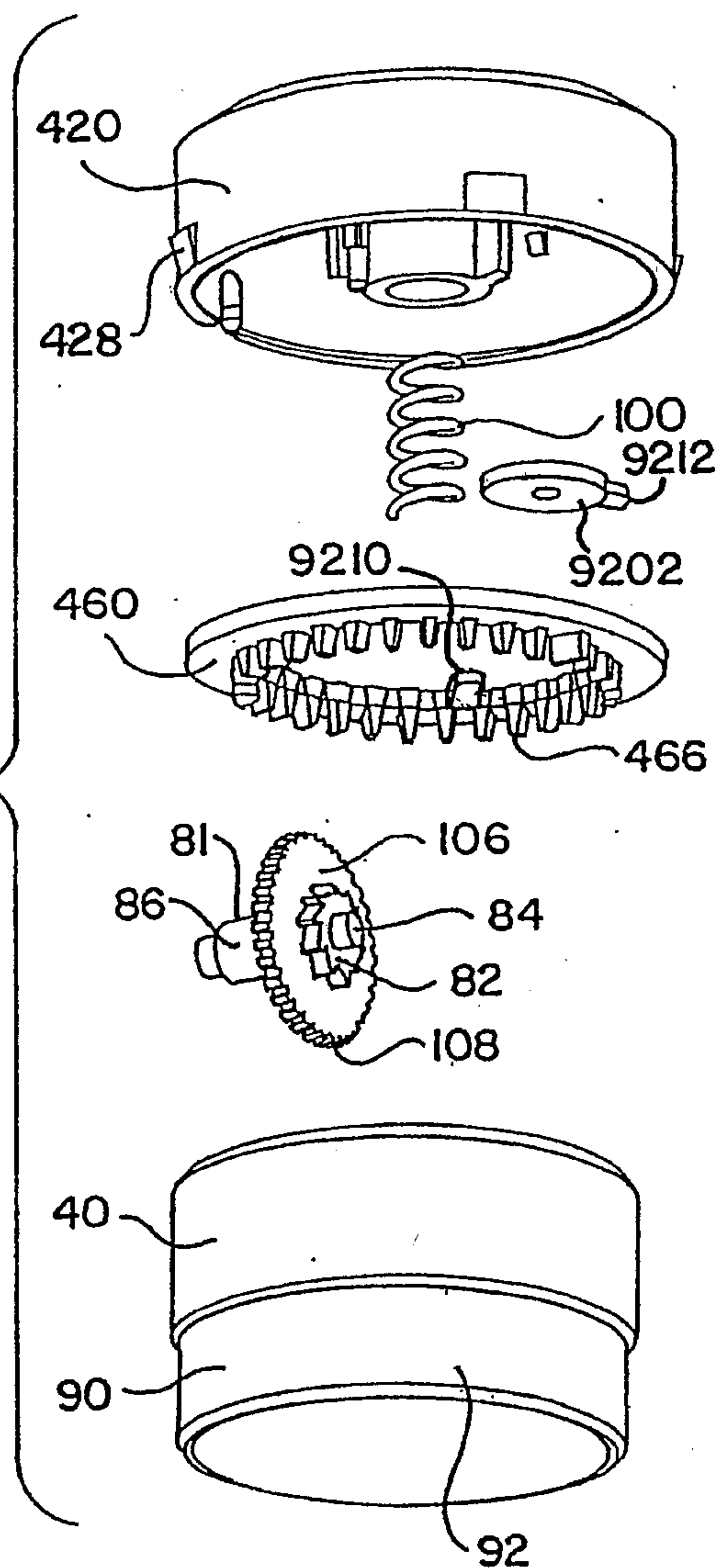


FIG. 30

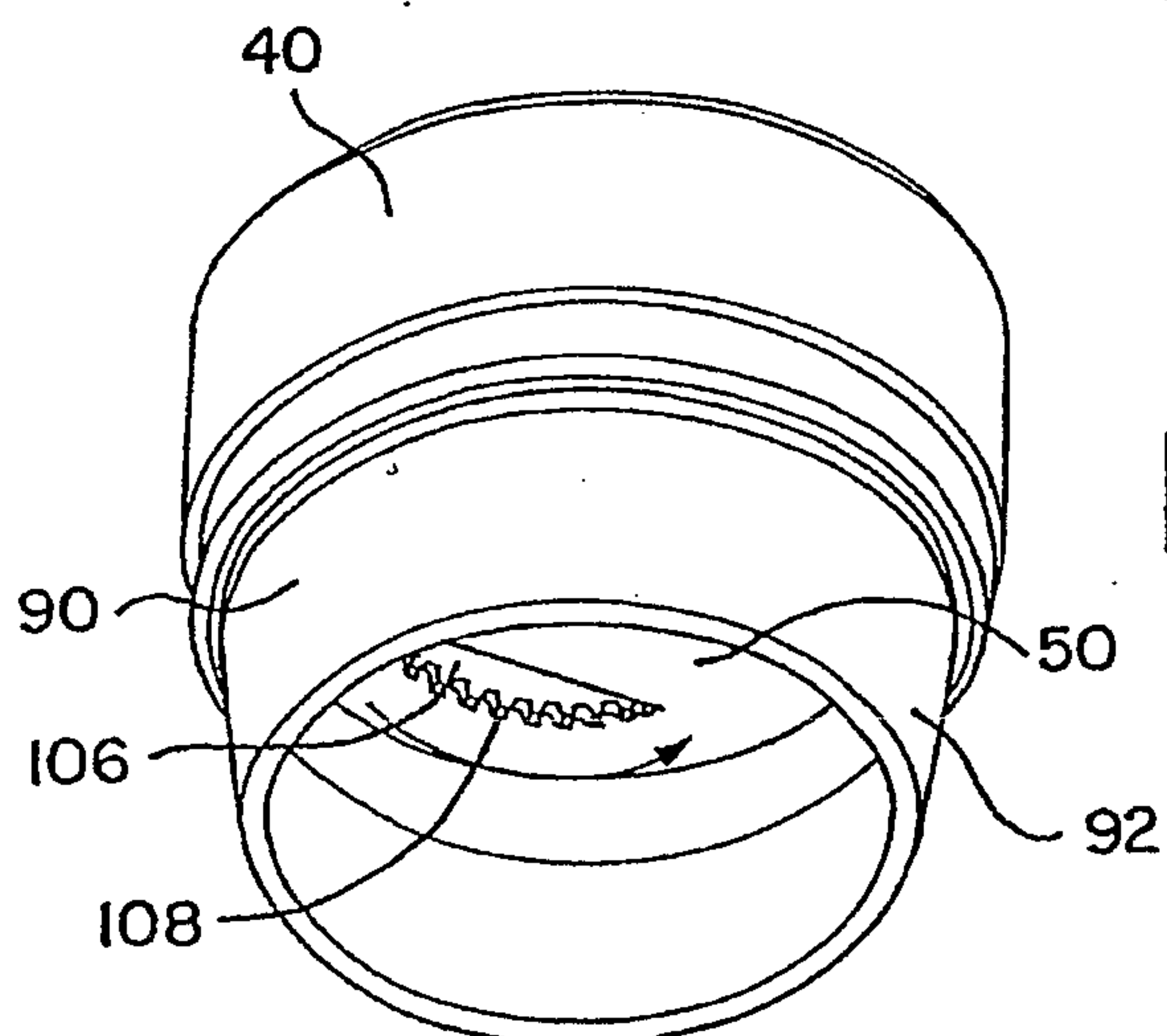


FIG. 31

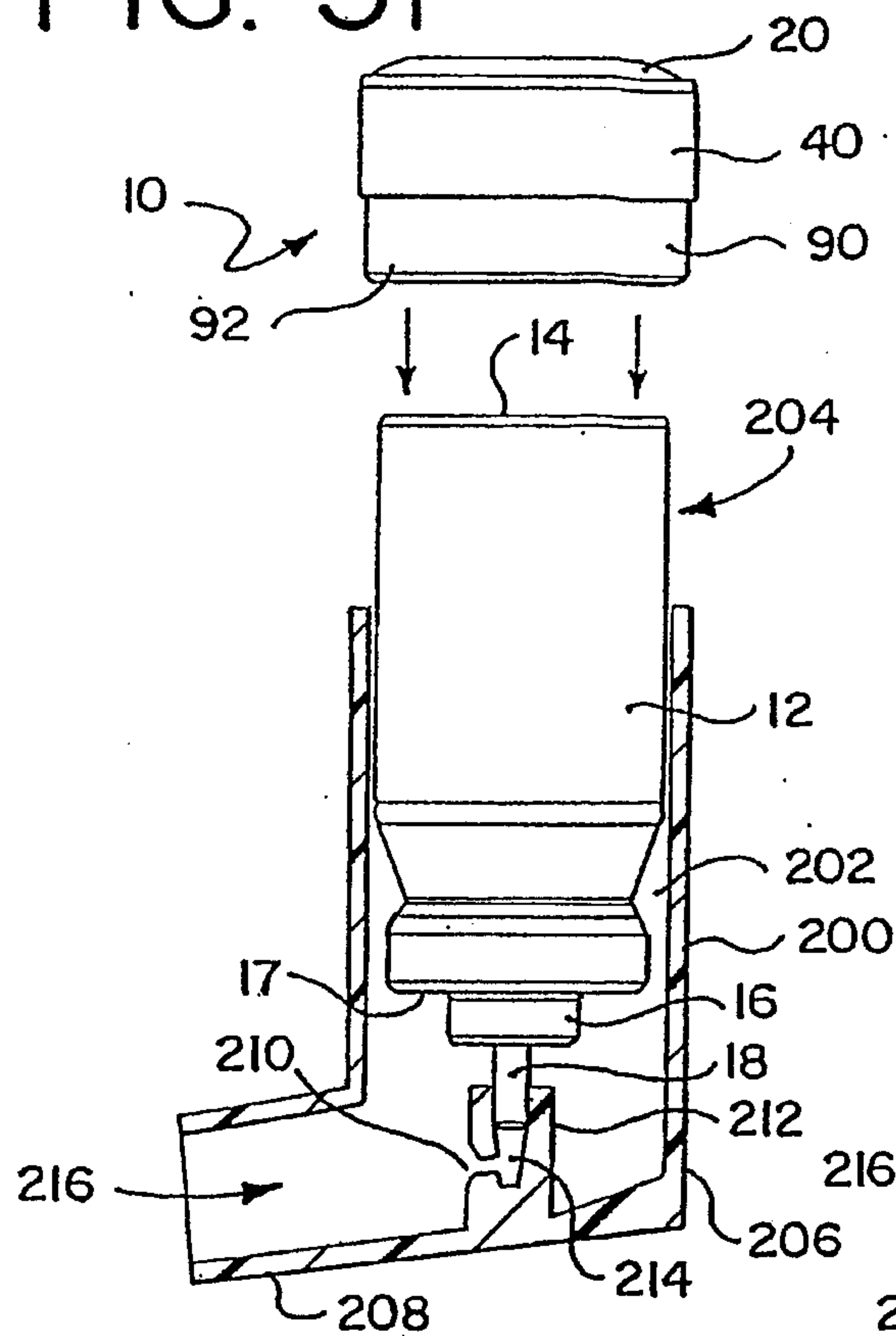


FIG. 32

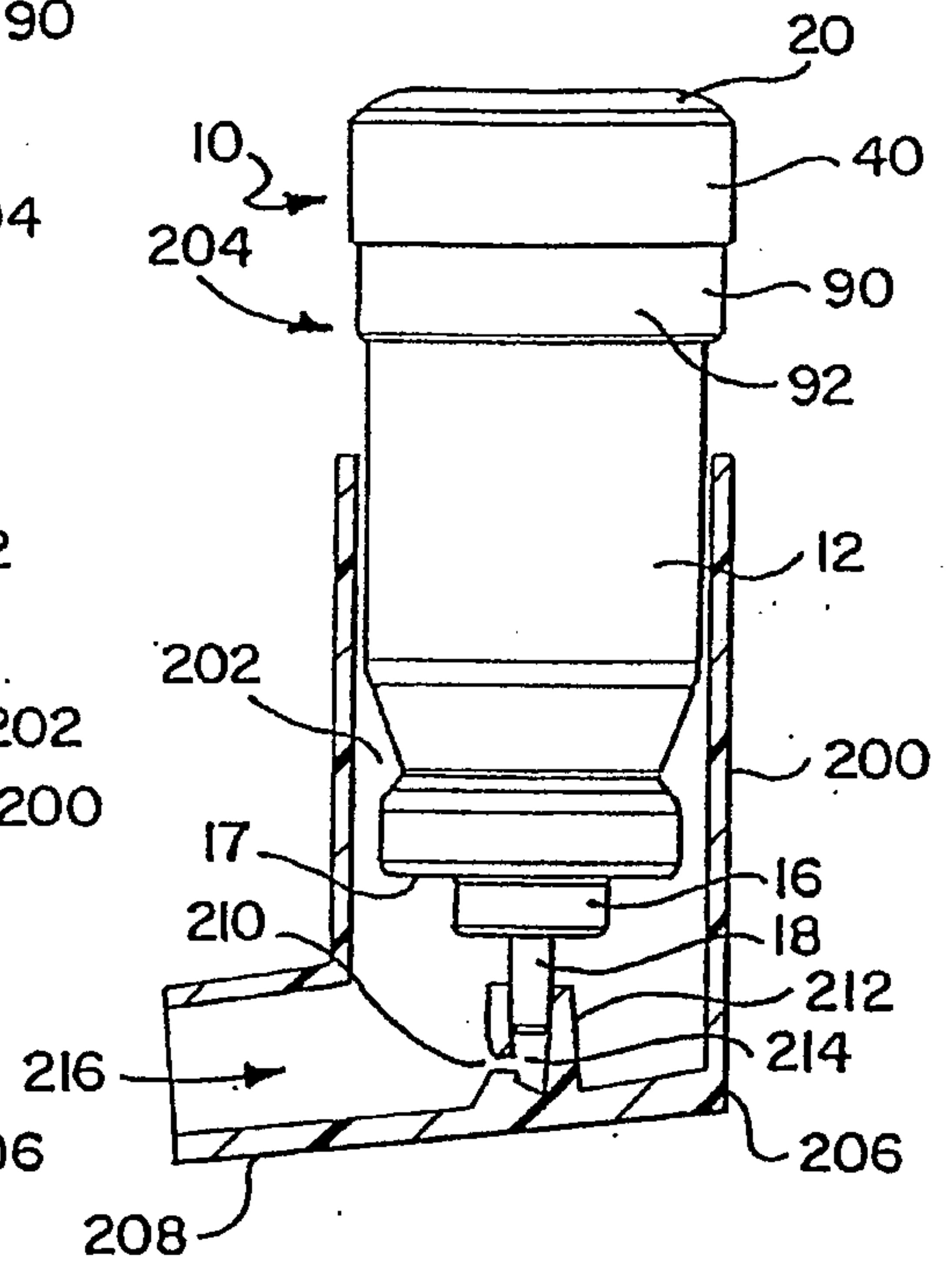


FIG. 33

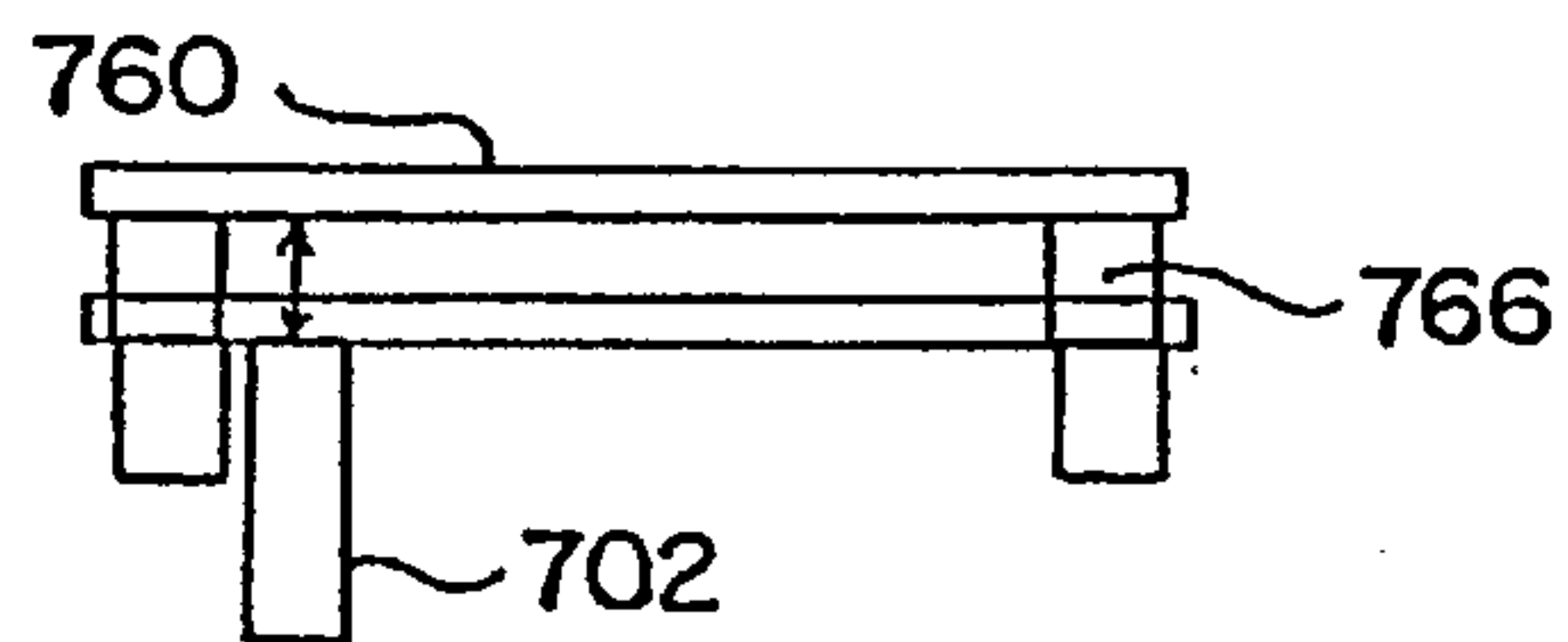


FIG. 35

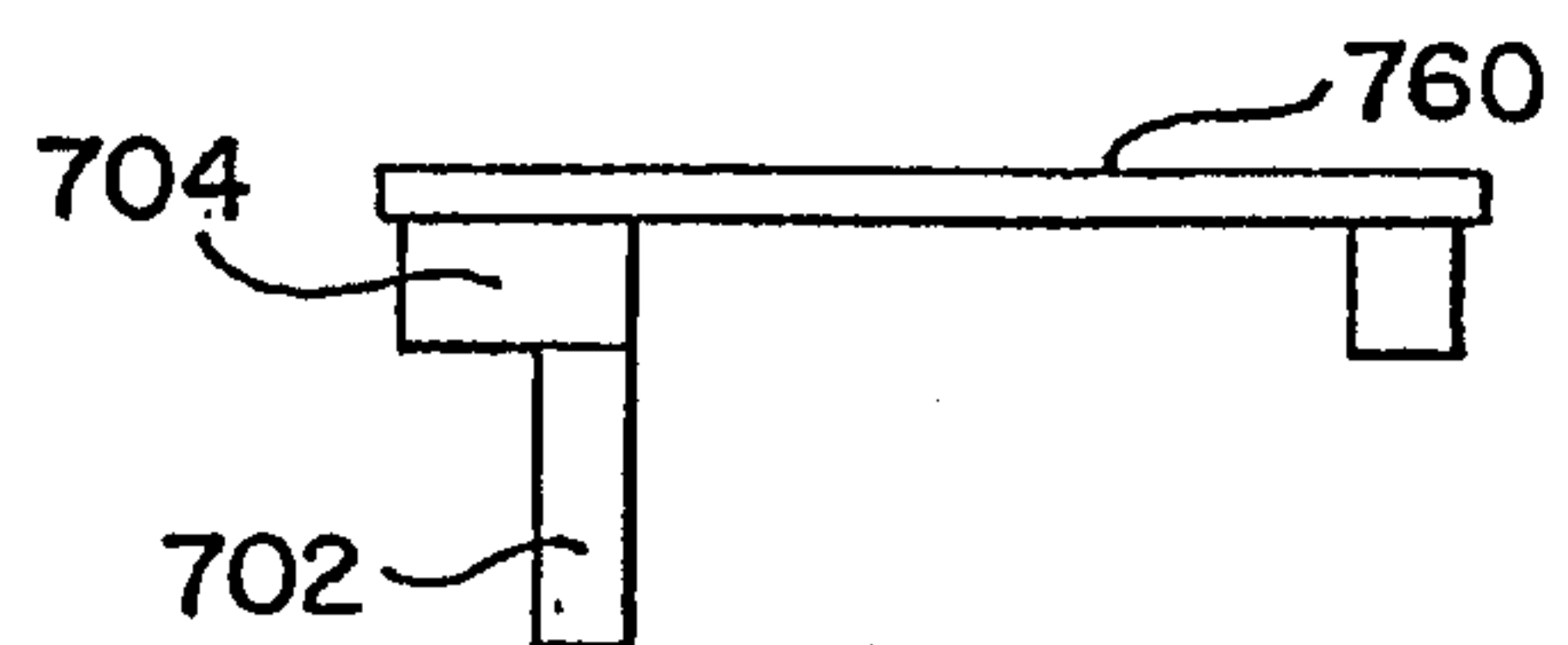


FIG. 34

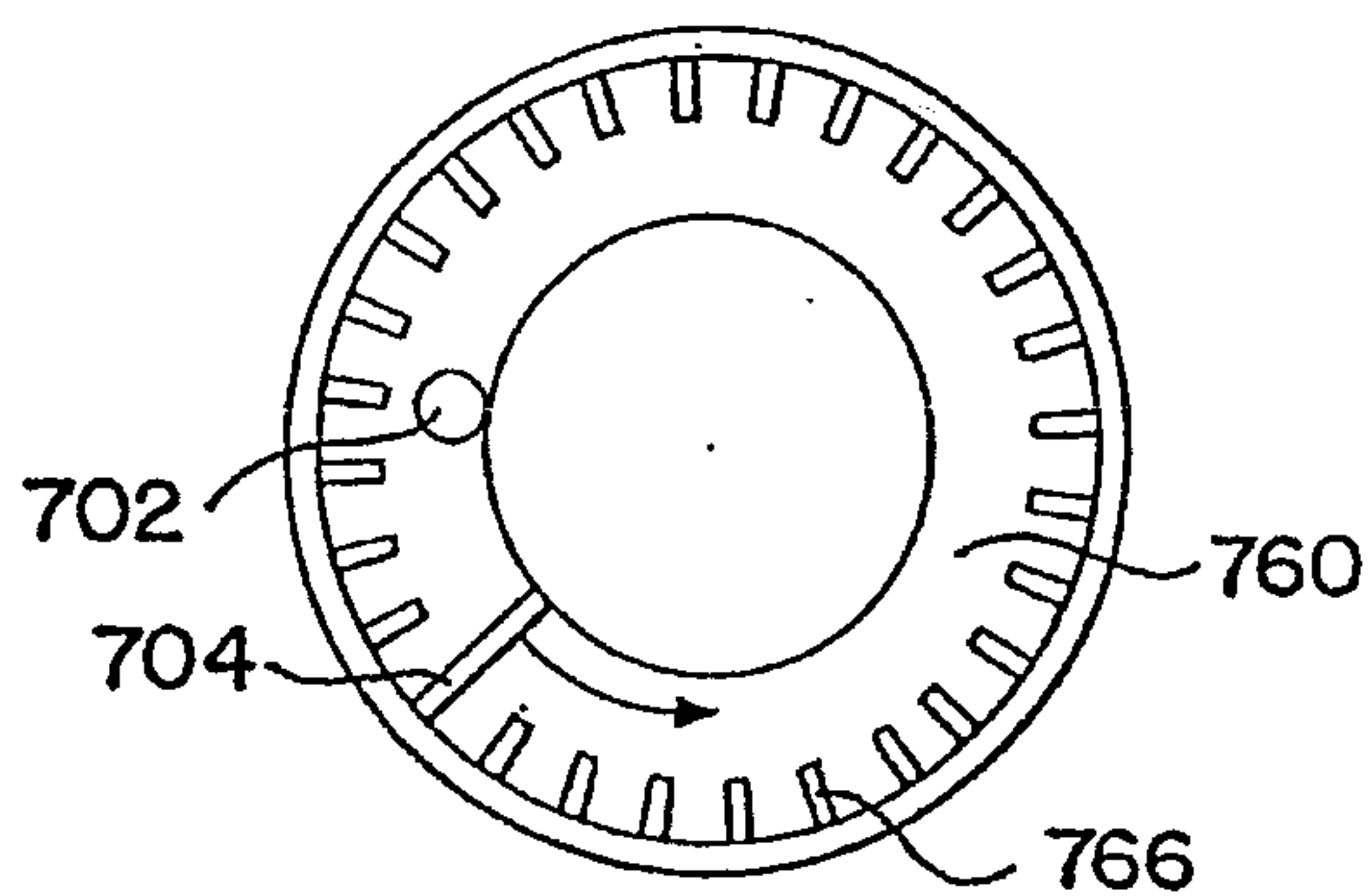


FIG. 36

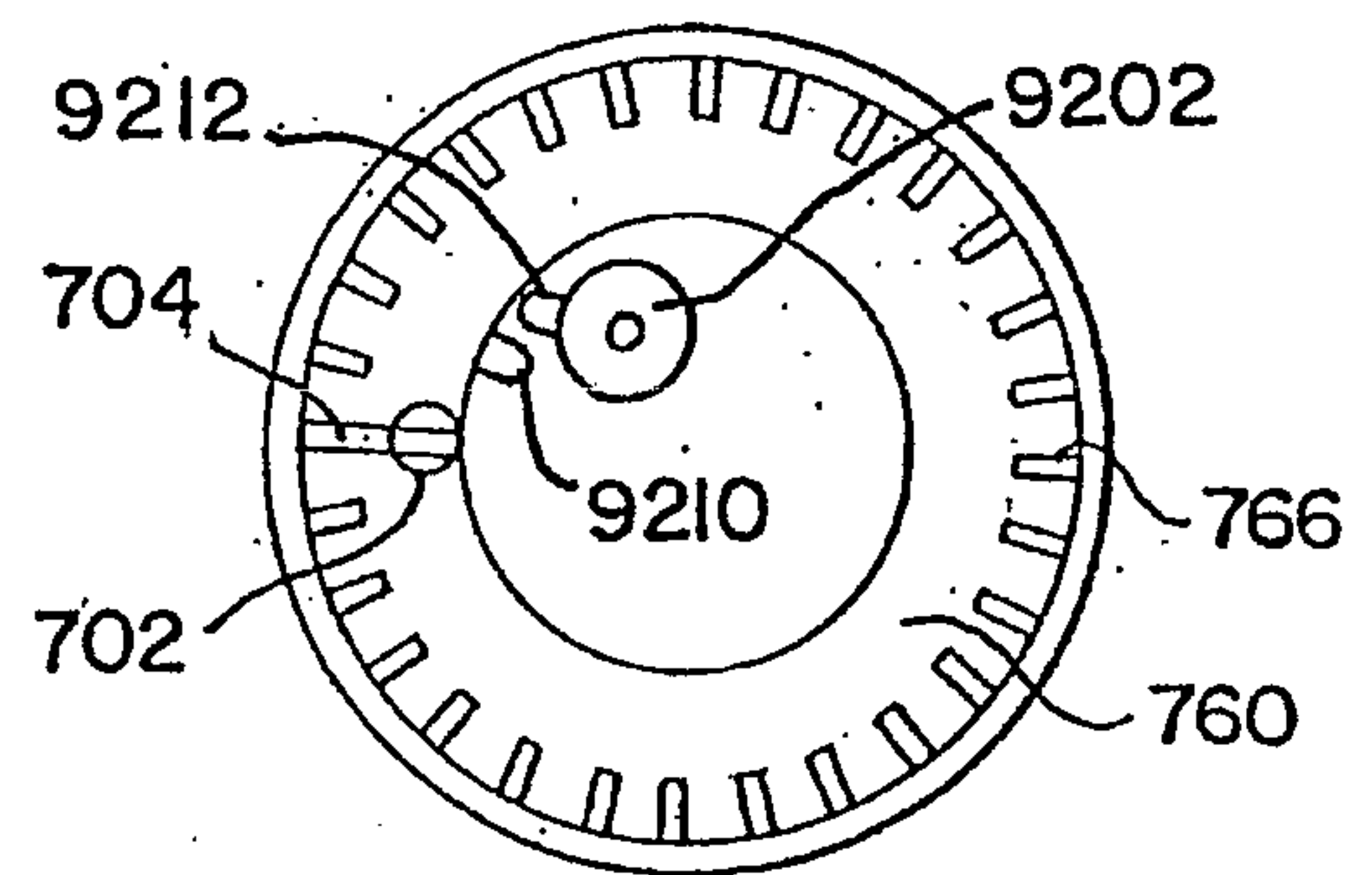


FIG. 37

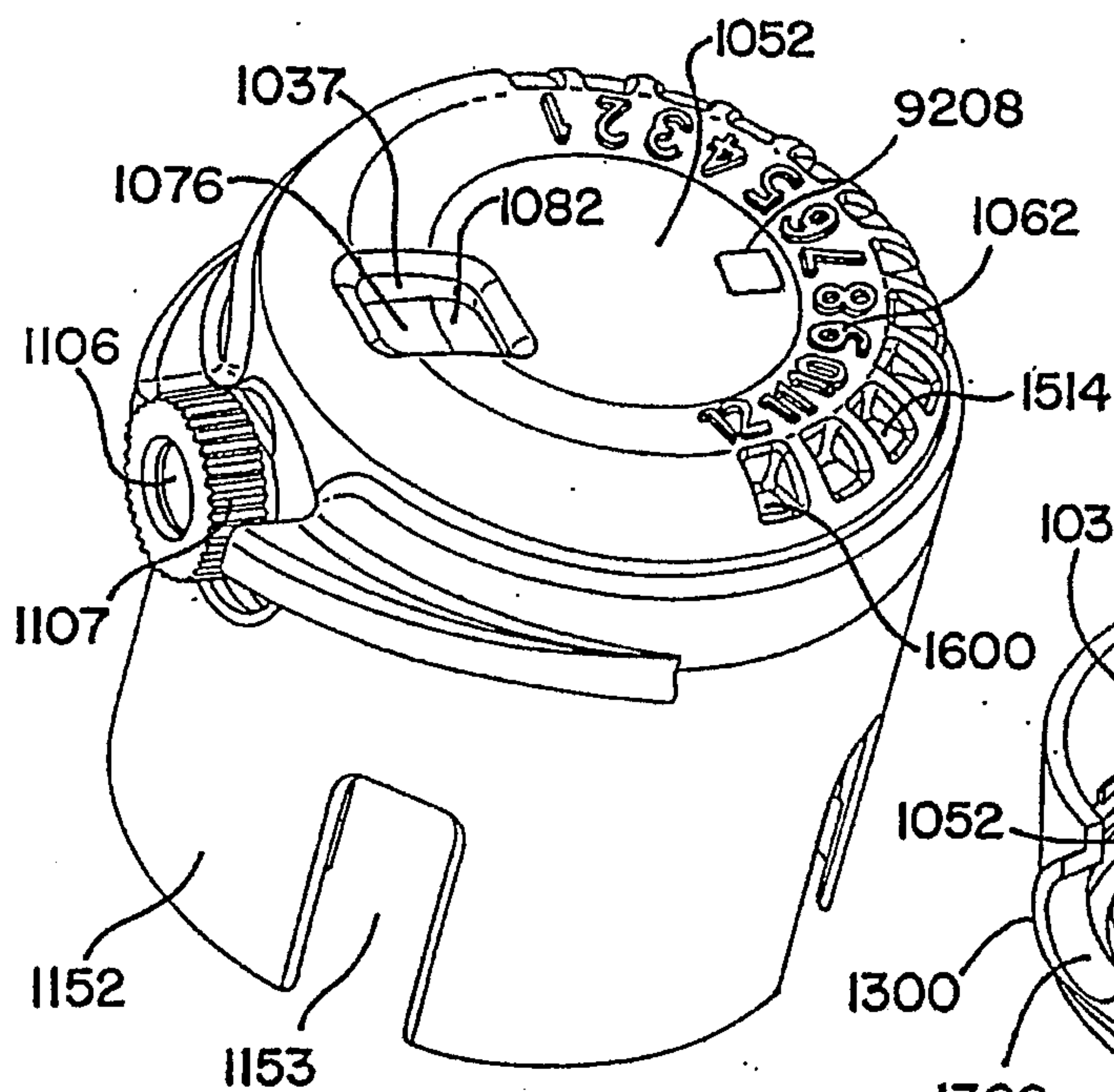


FIG. 39

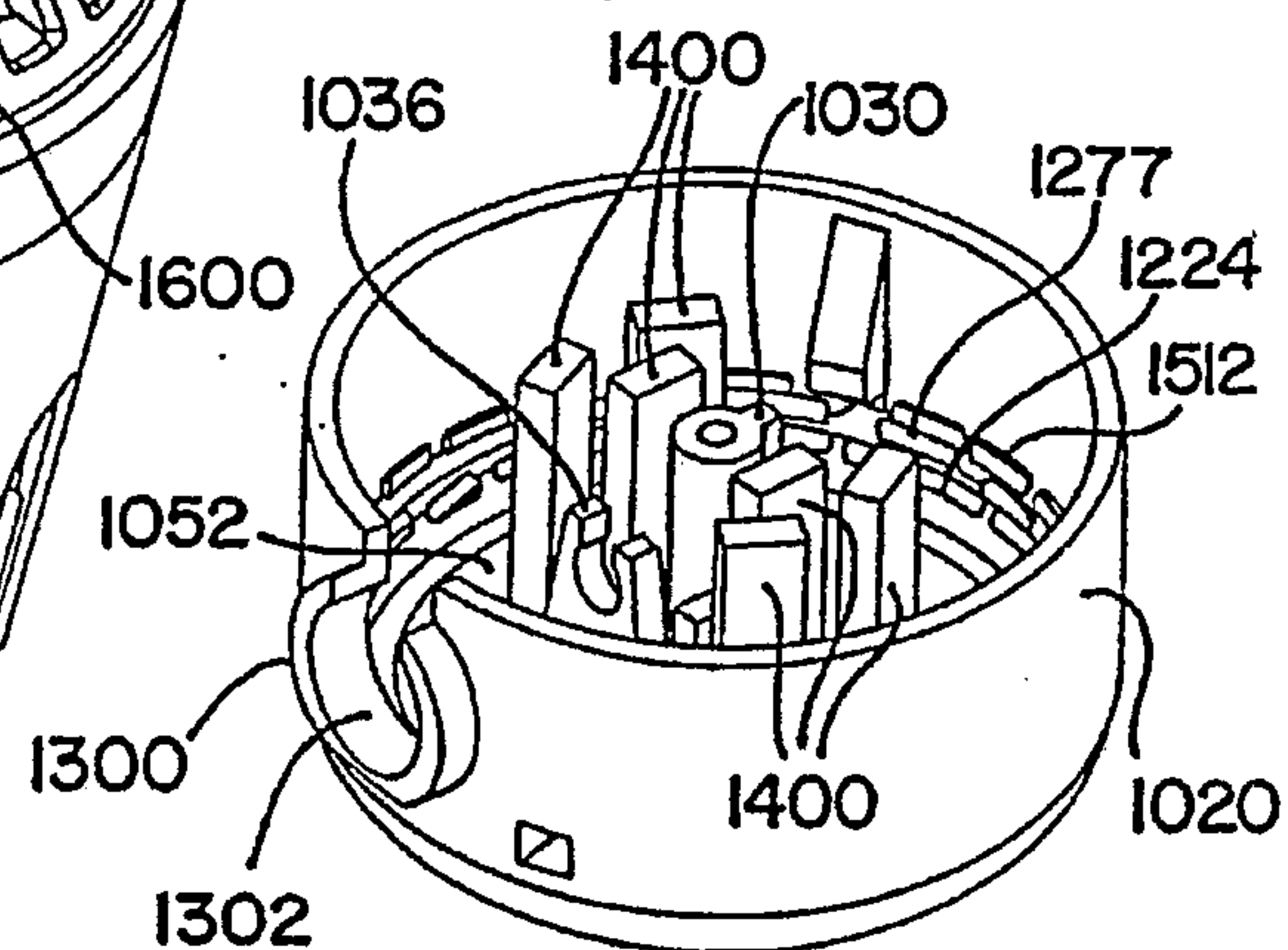


FIG. 40

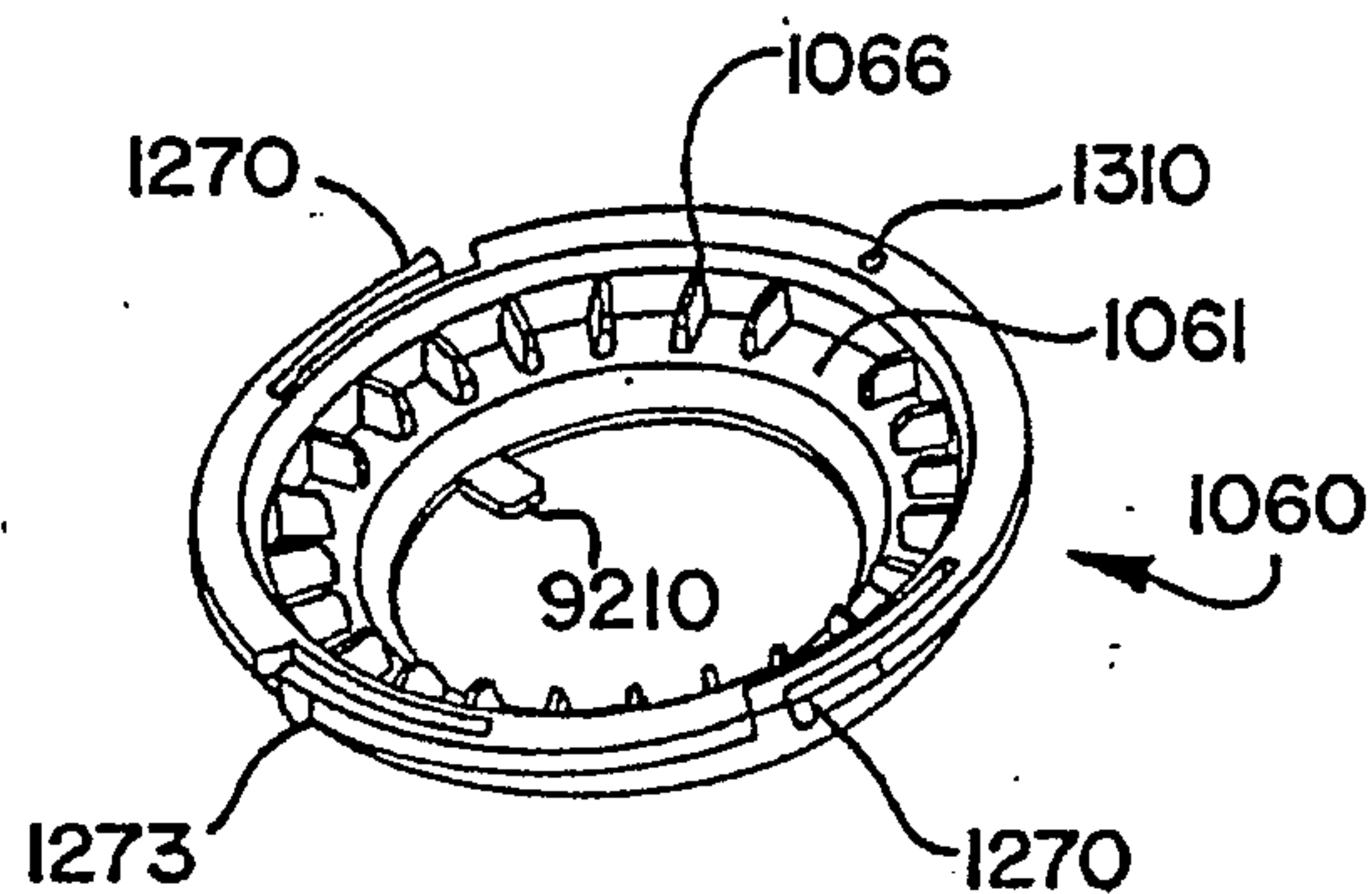


FIG. 41

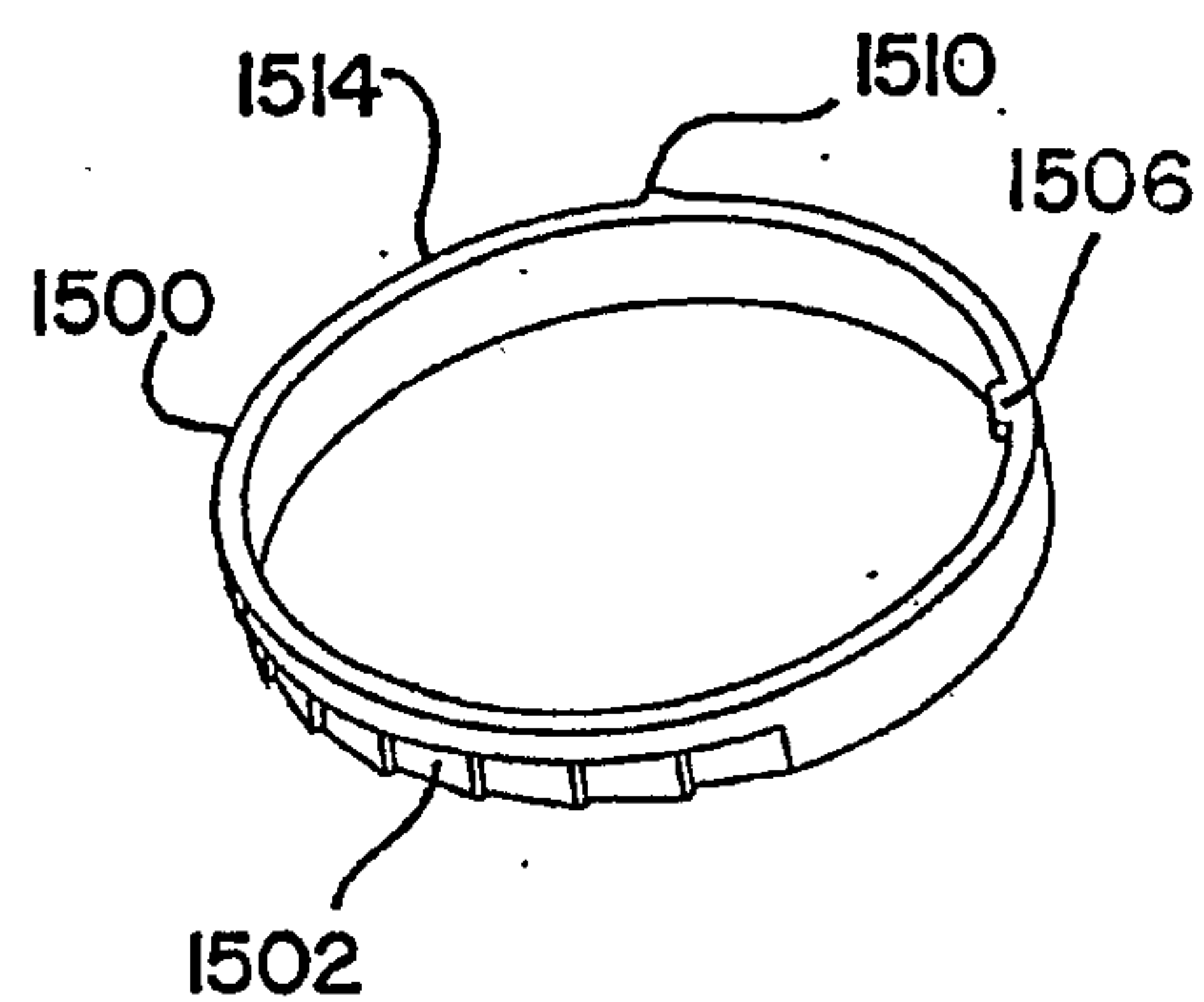


FIG. 42

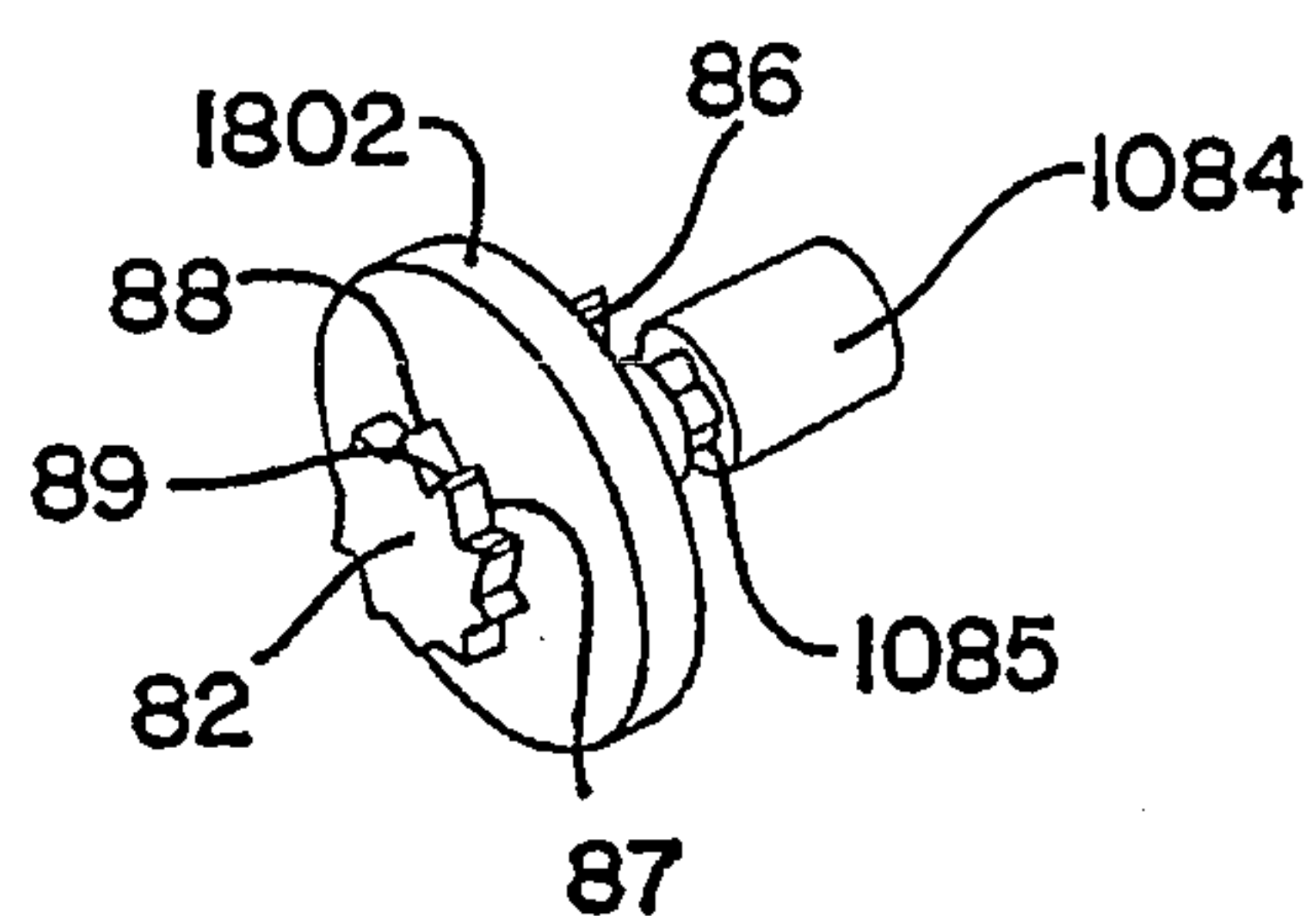


FIG. 43

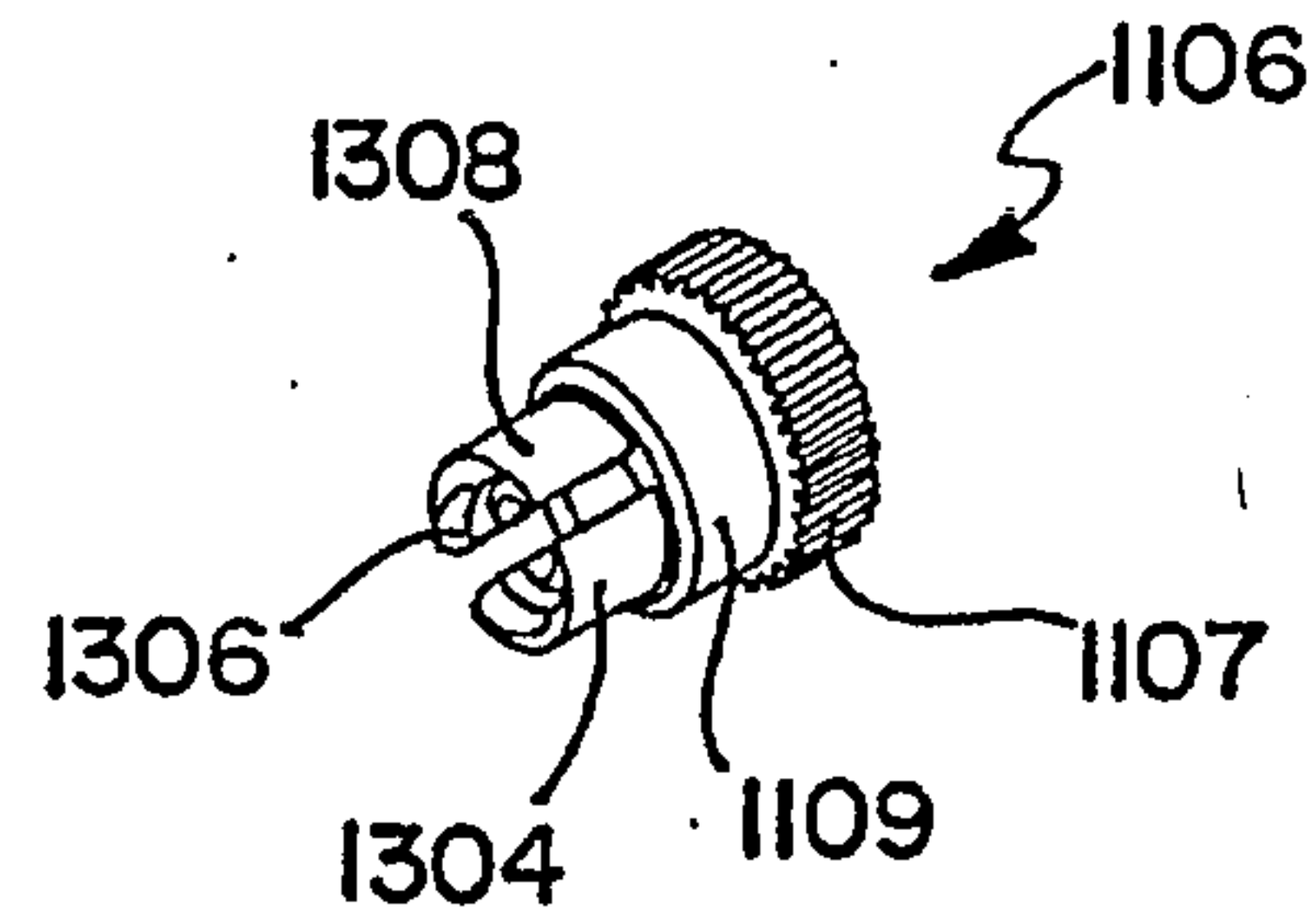


FIG. 38

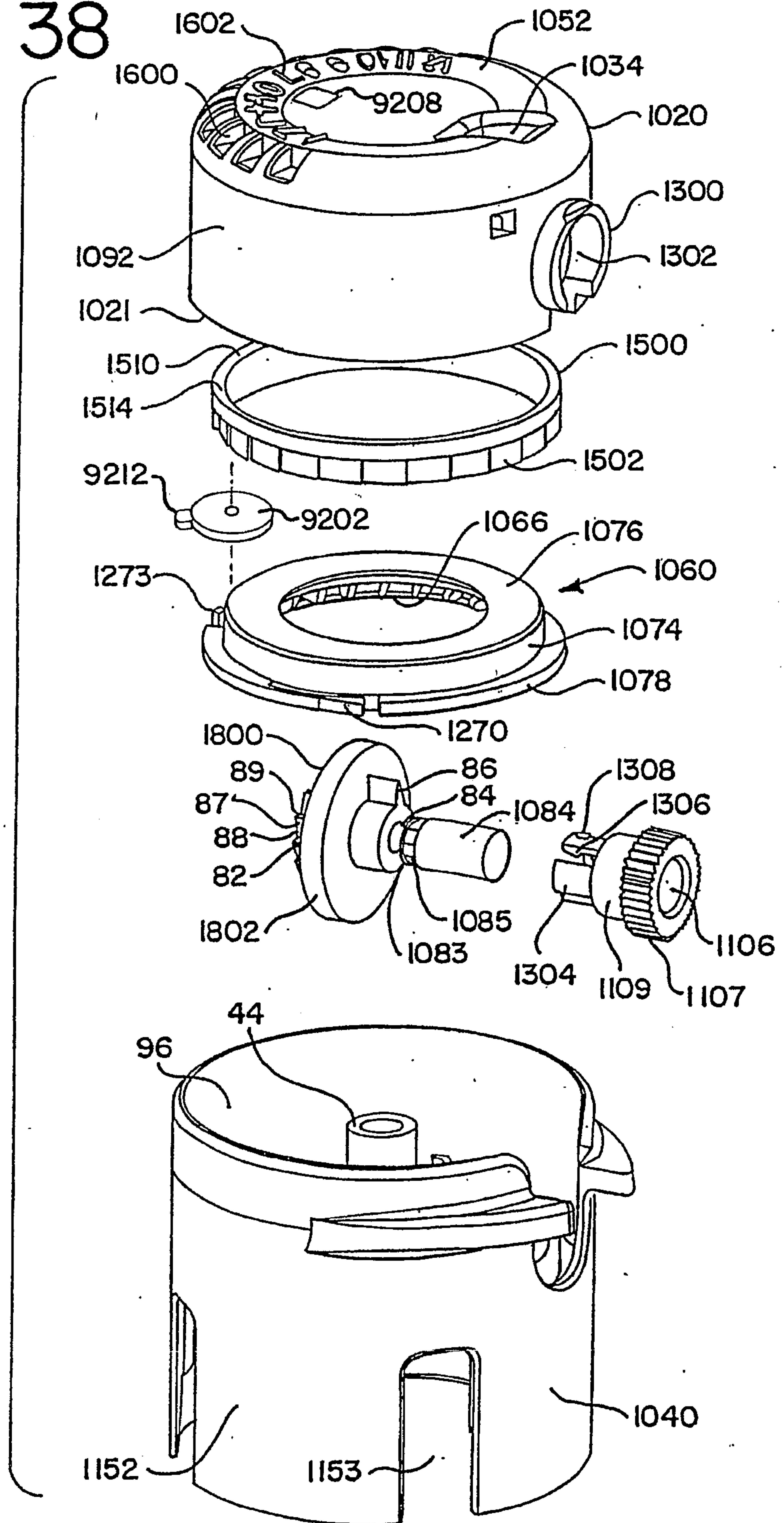


FIG. 45

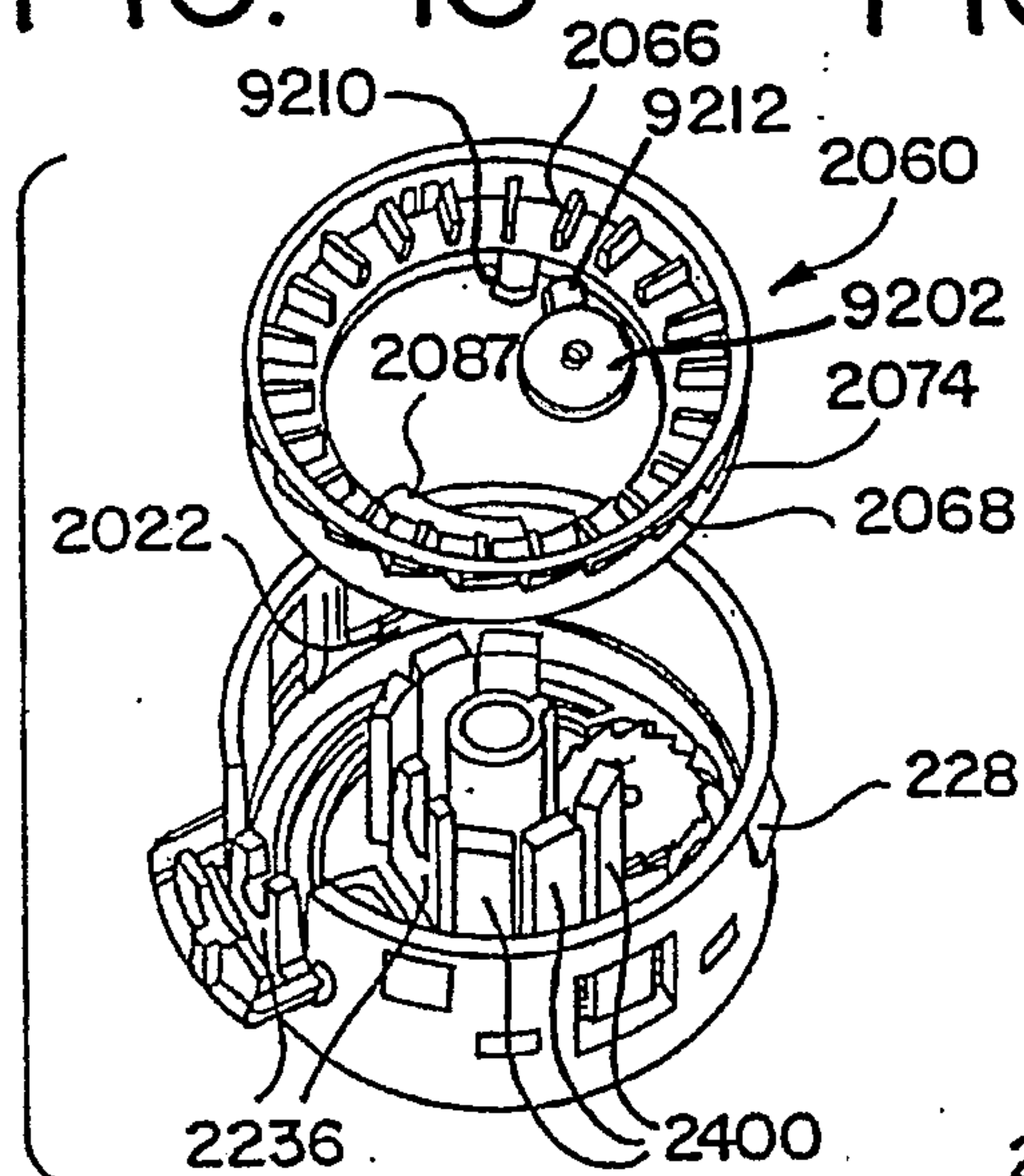


FIG. 44

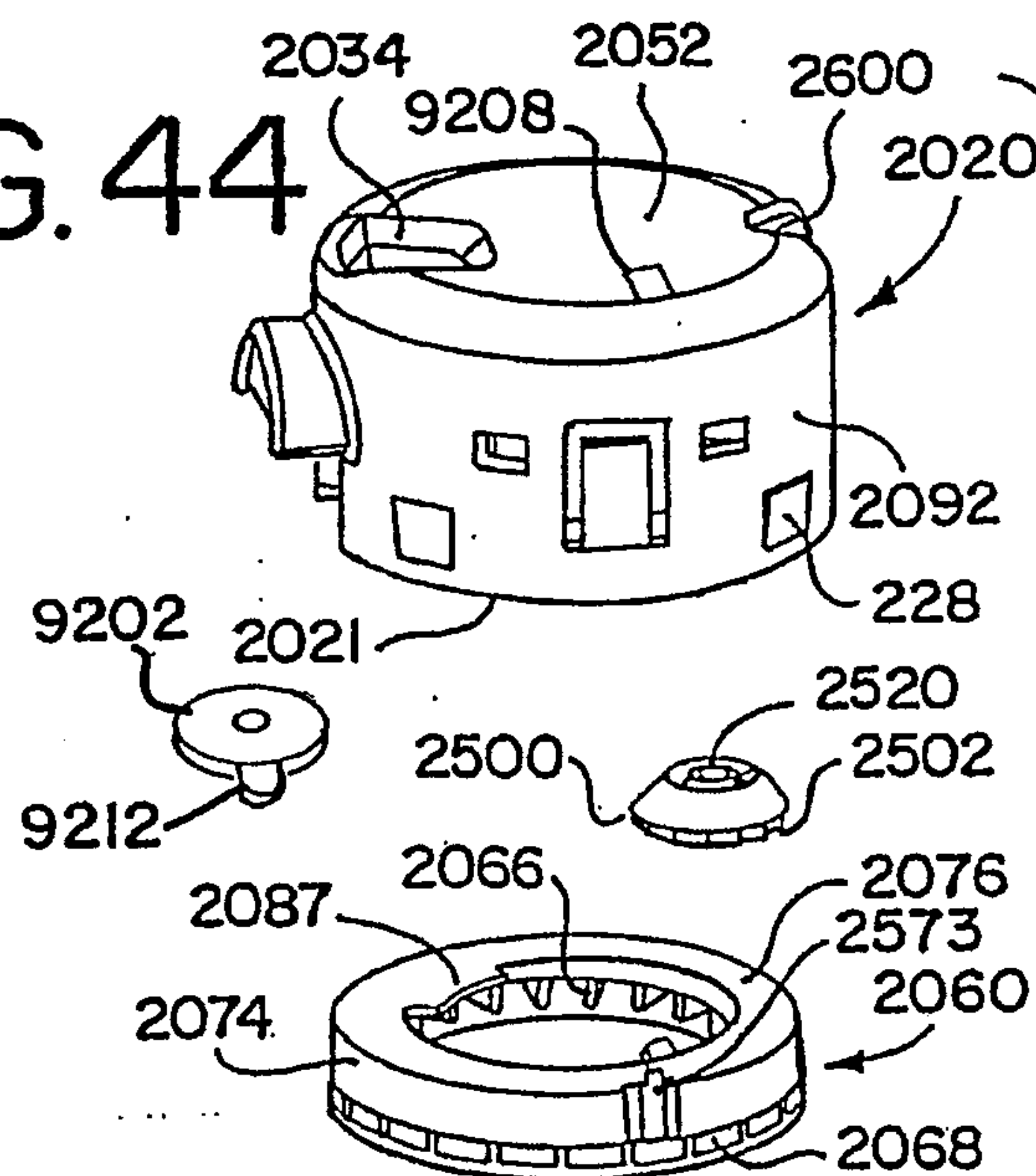


FIG. 46

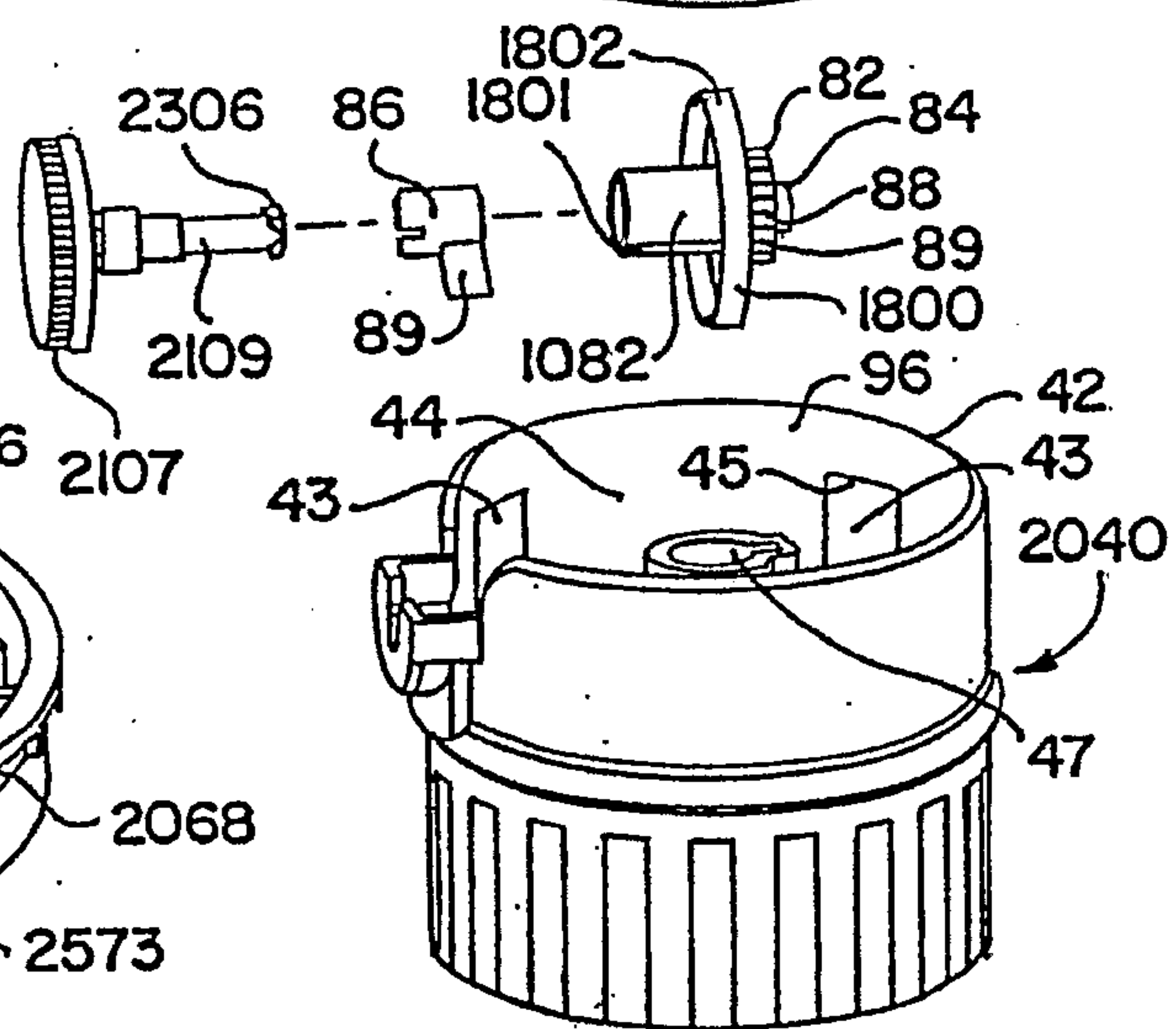
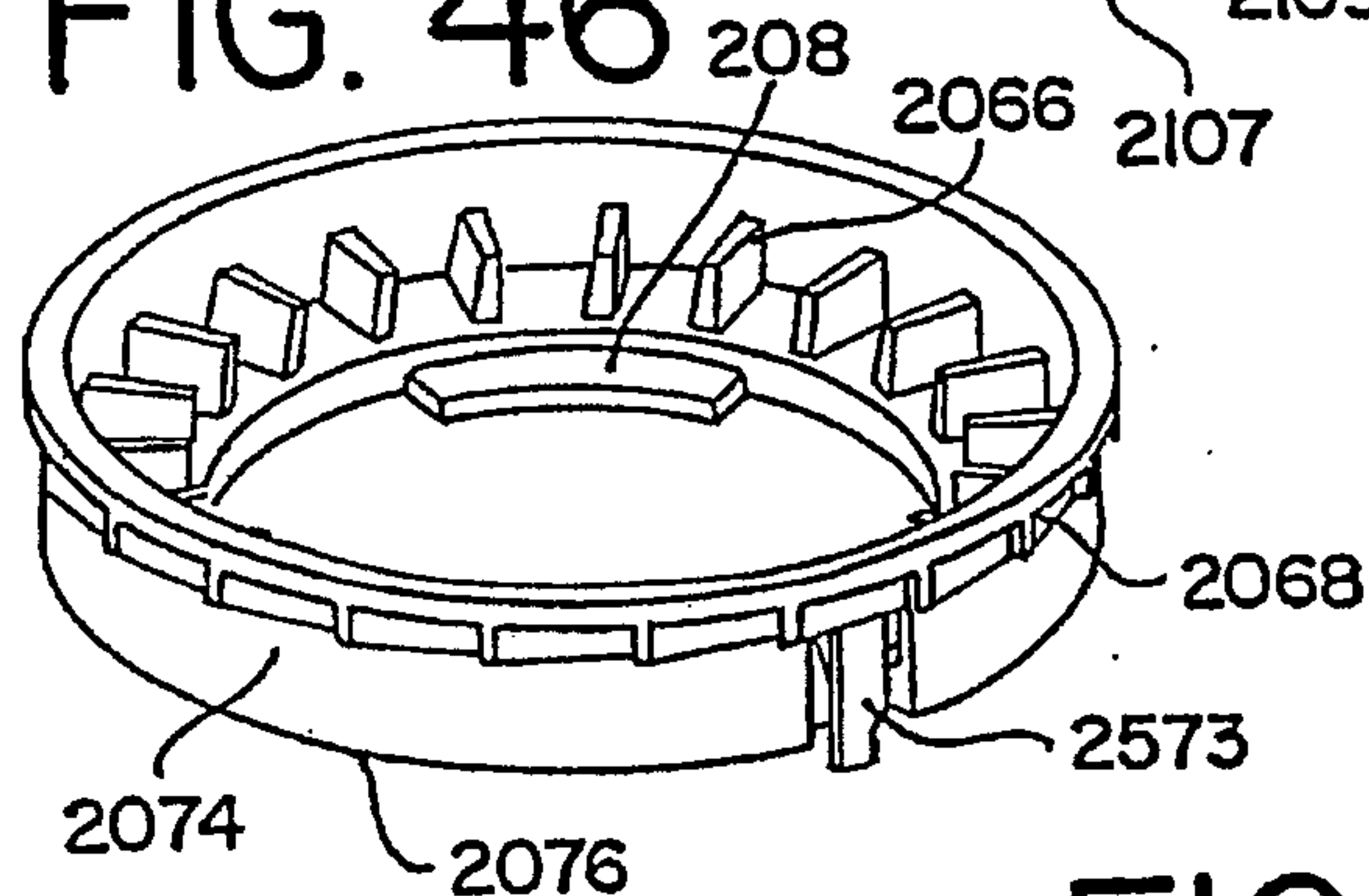


FIG. 47

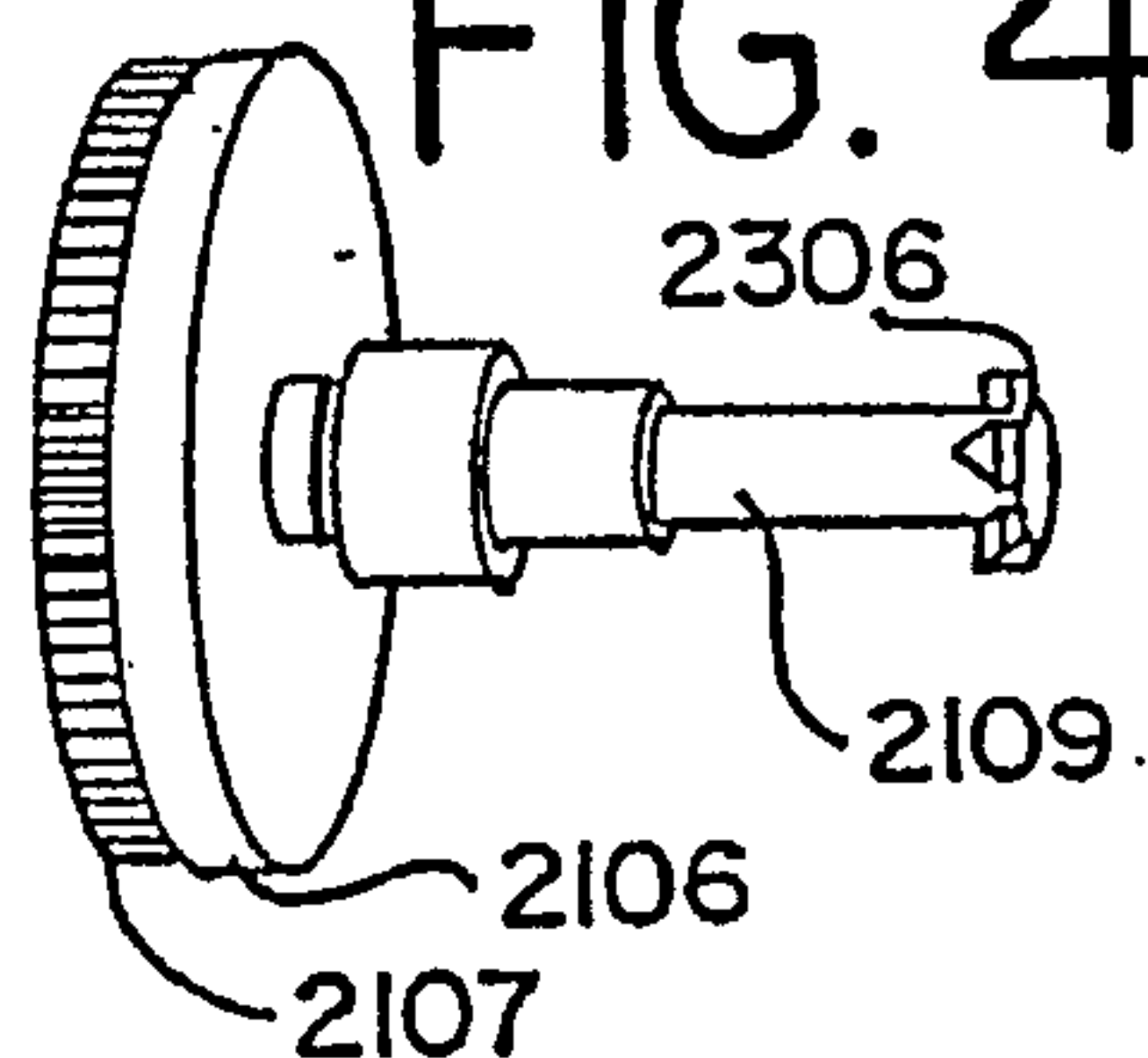


FIG. 49

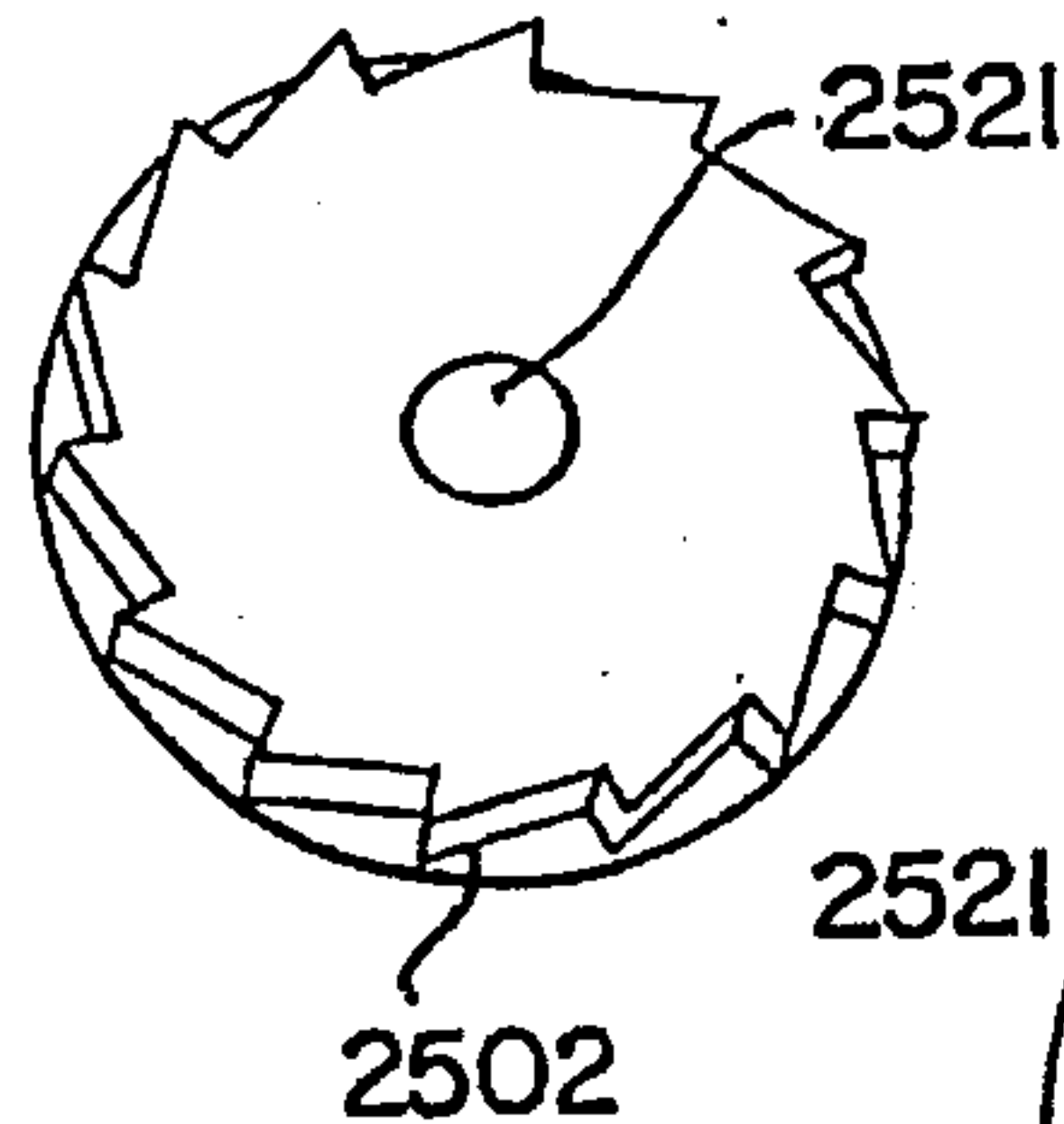


FIG. 50

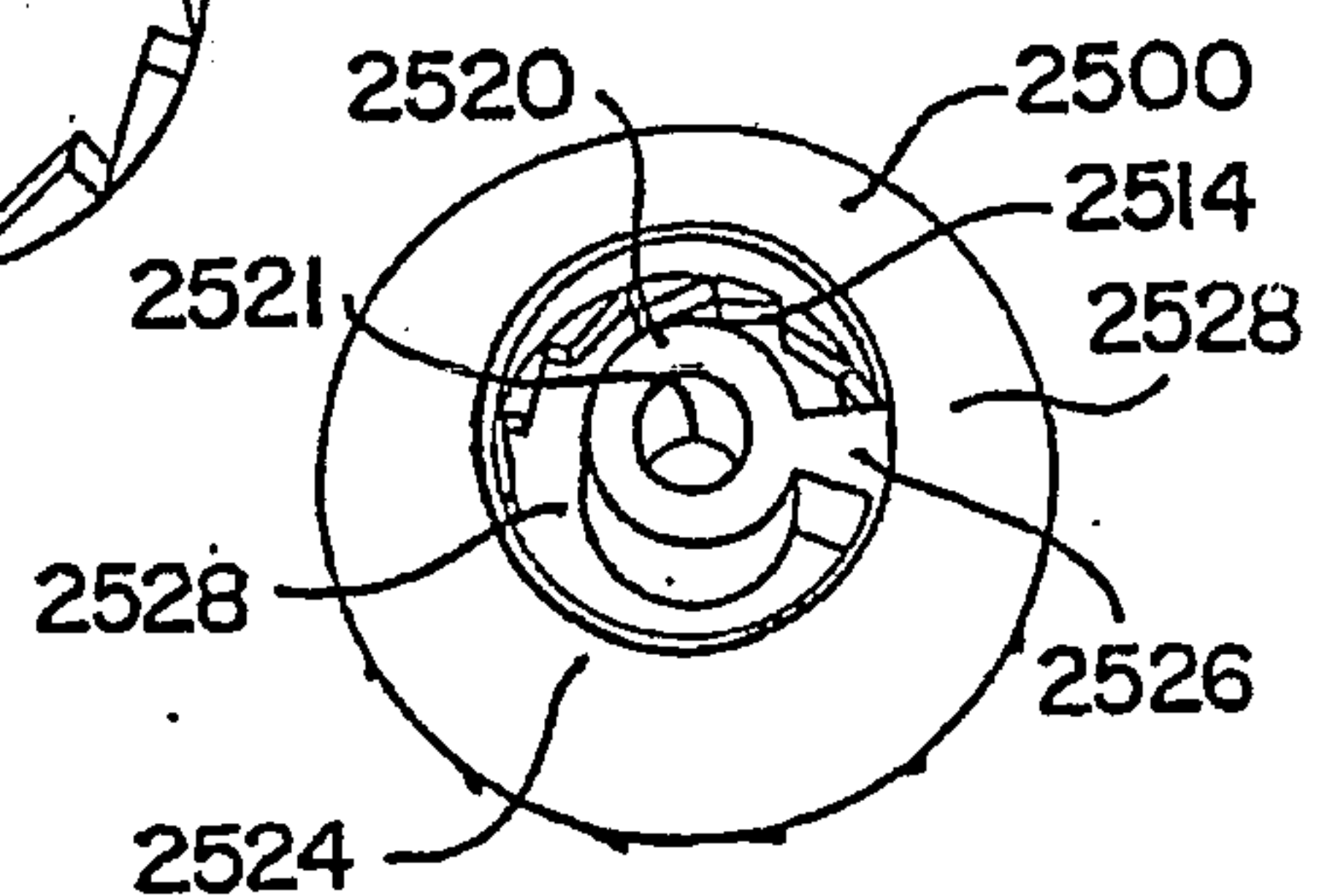


FIG. 48

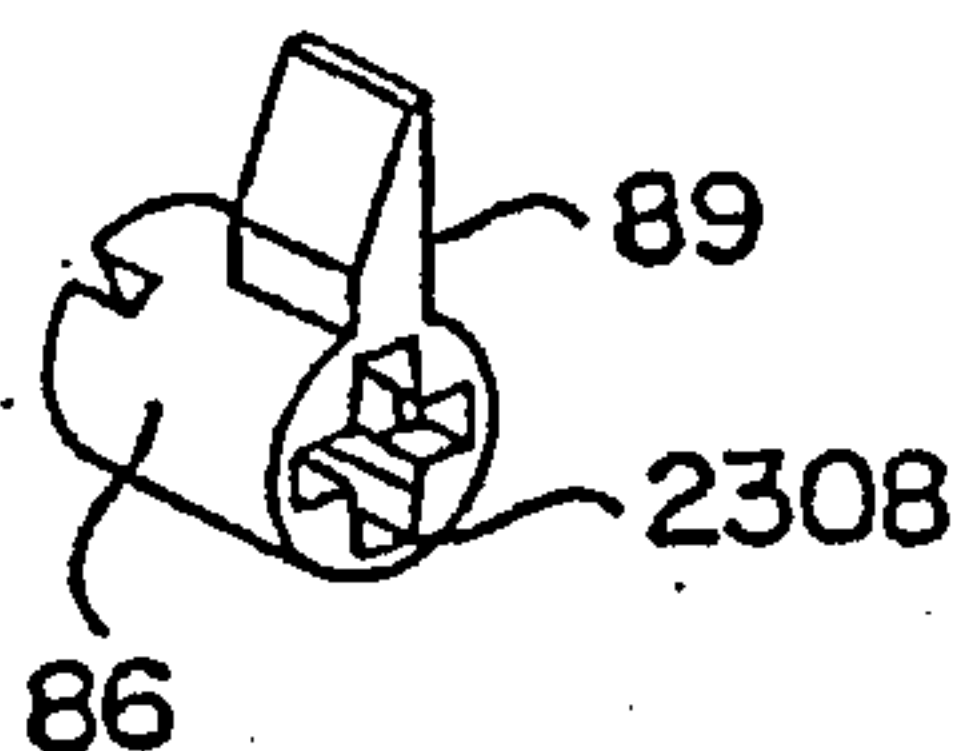


FIG. 51

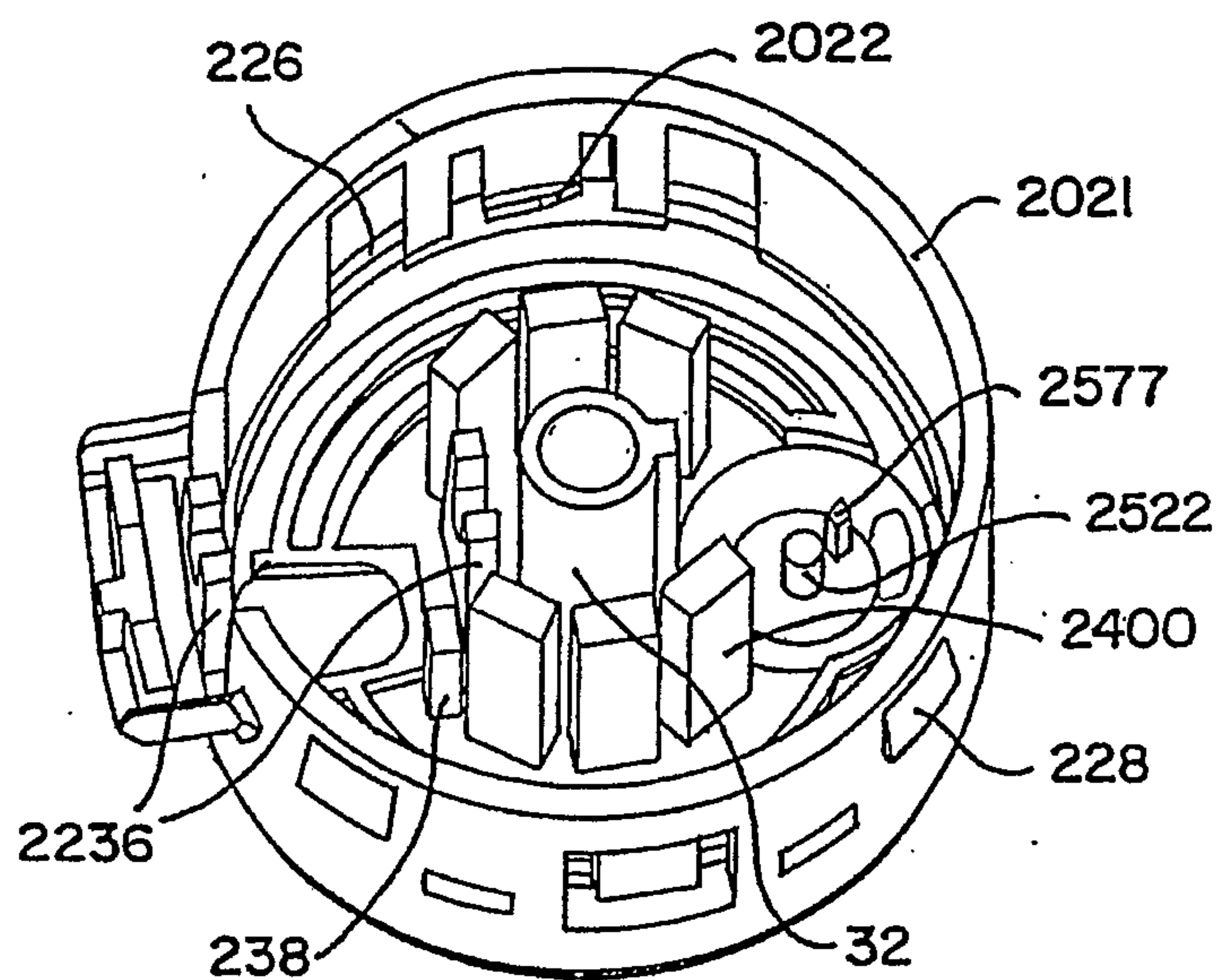


FIG. 52

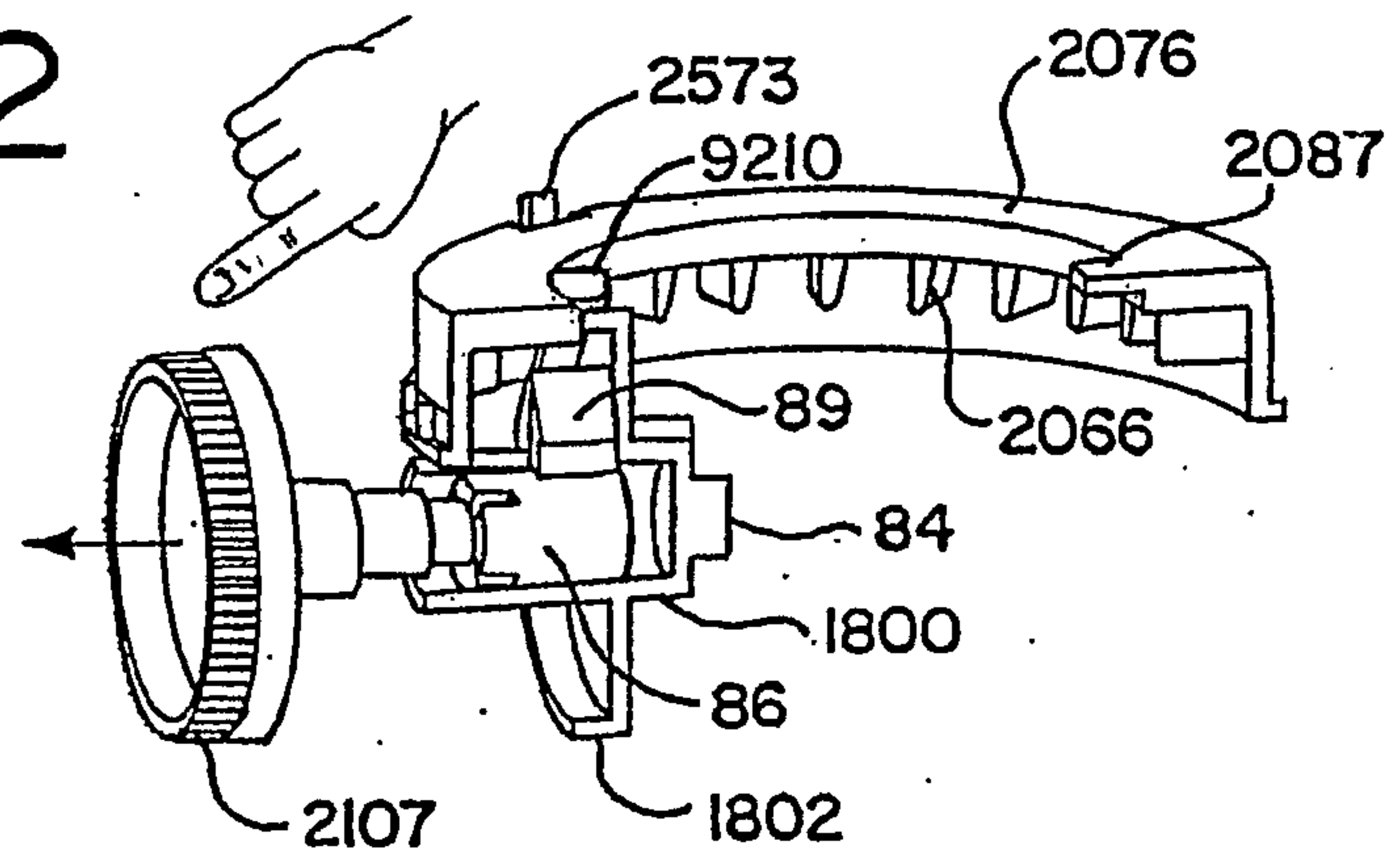
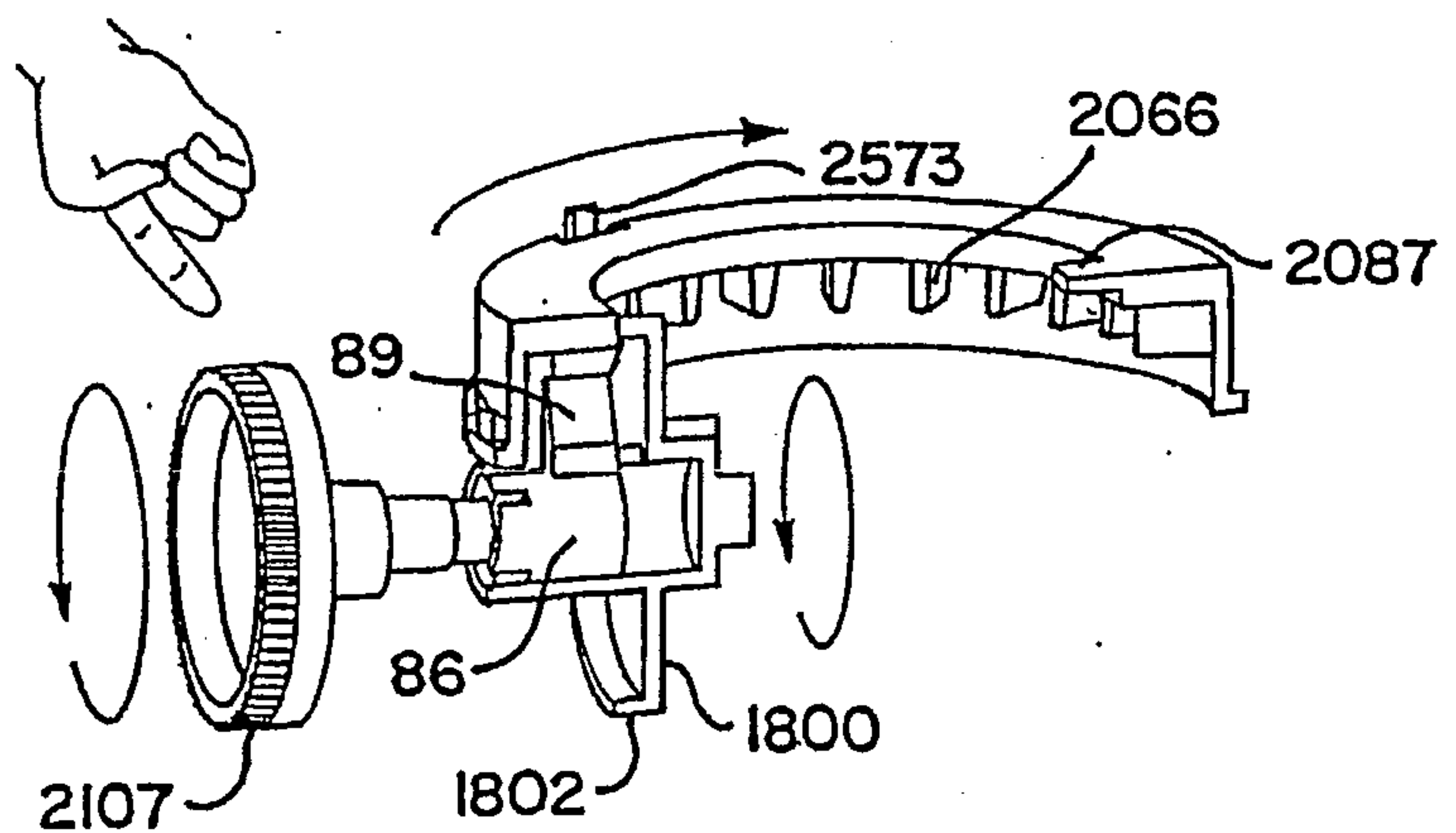


FIG. 53



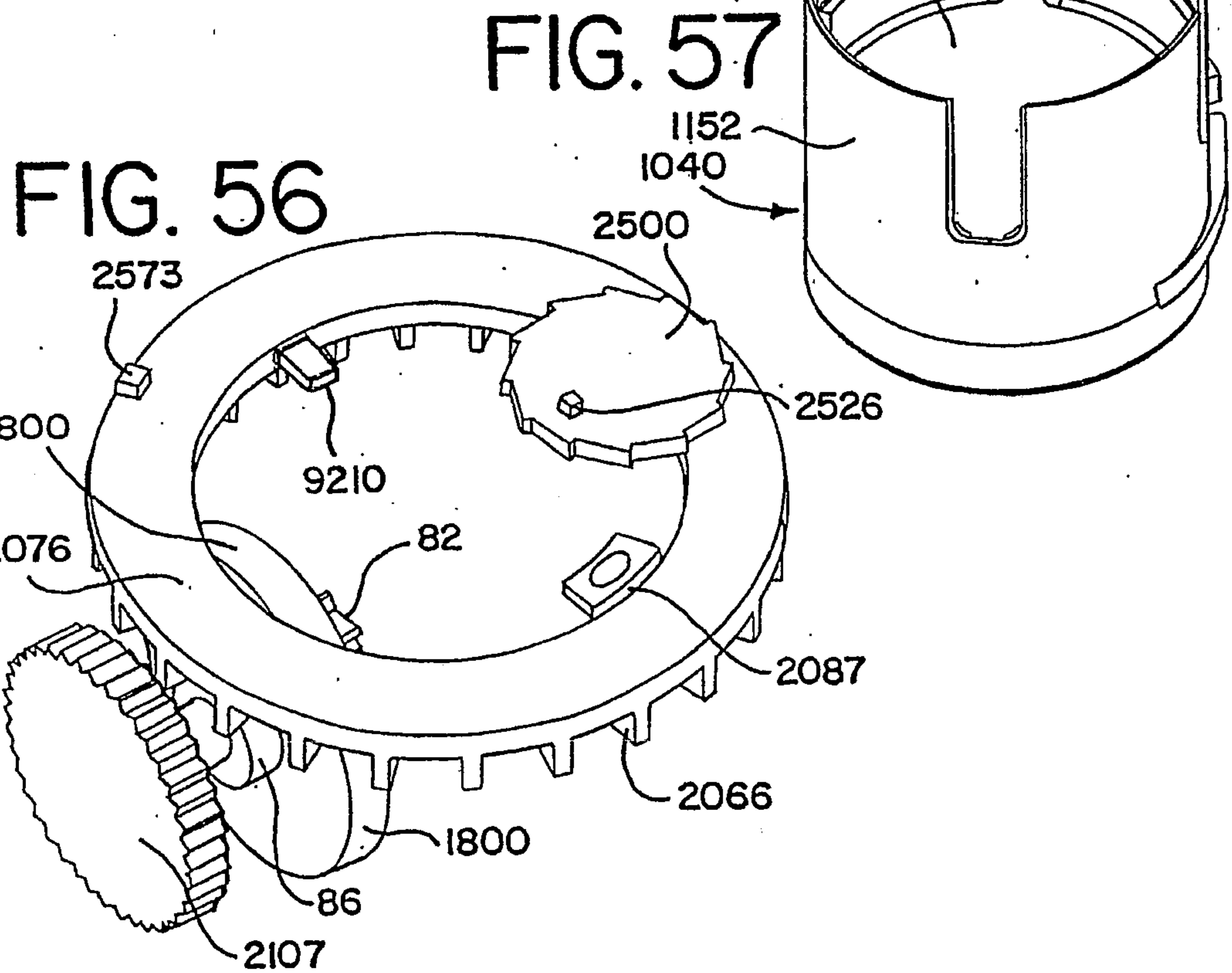
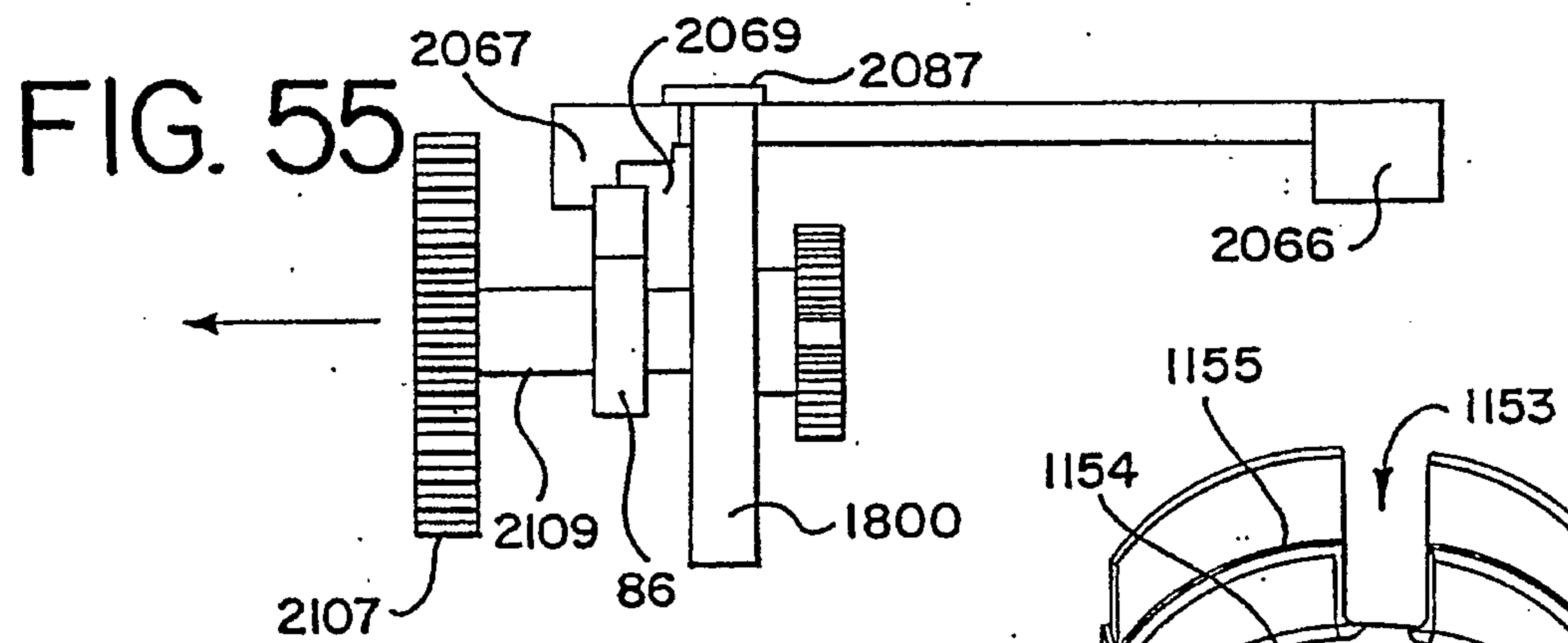
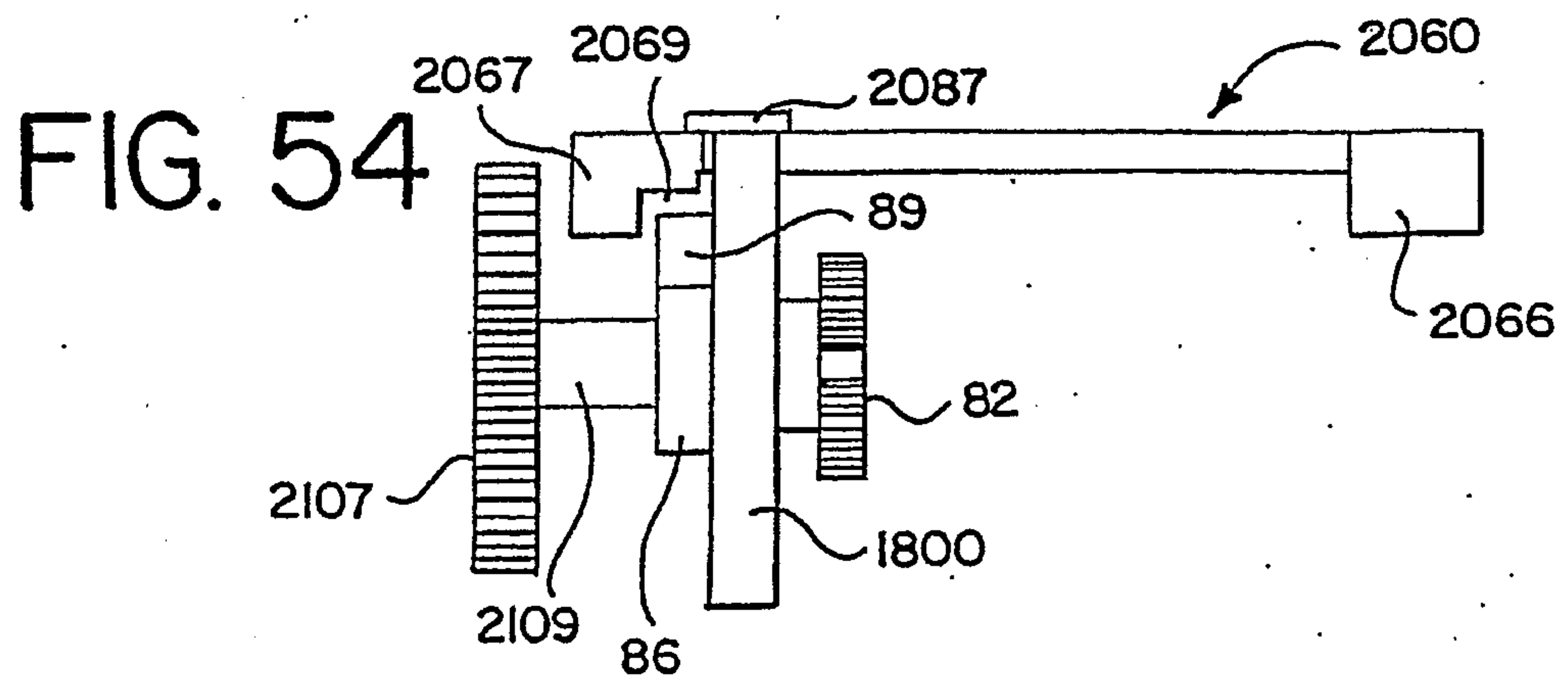


FIG. 58

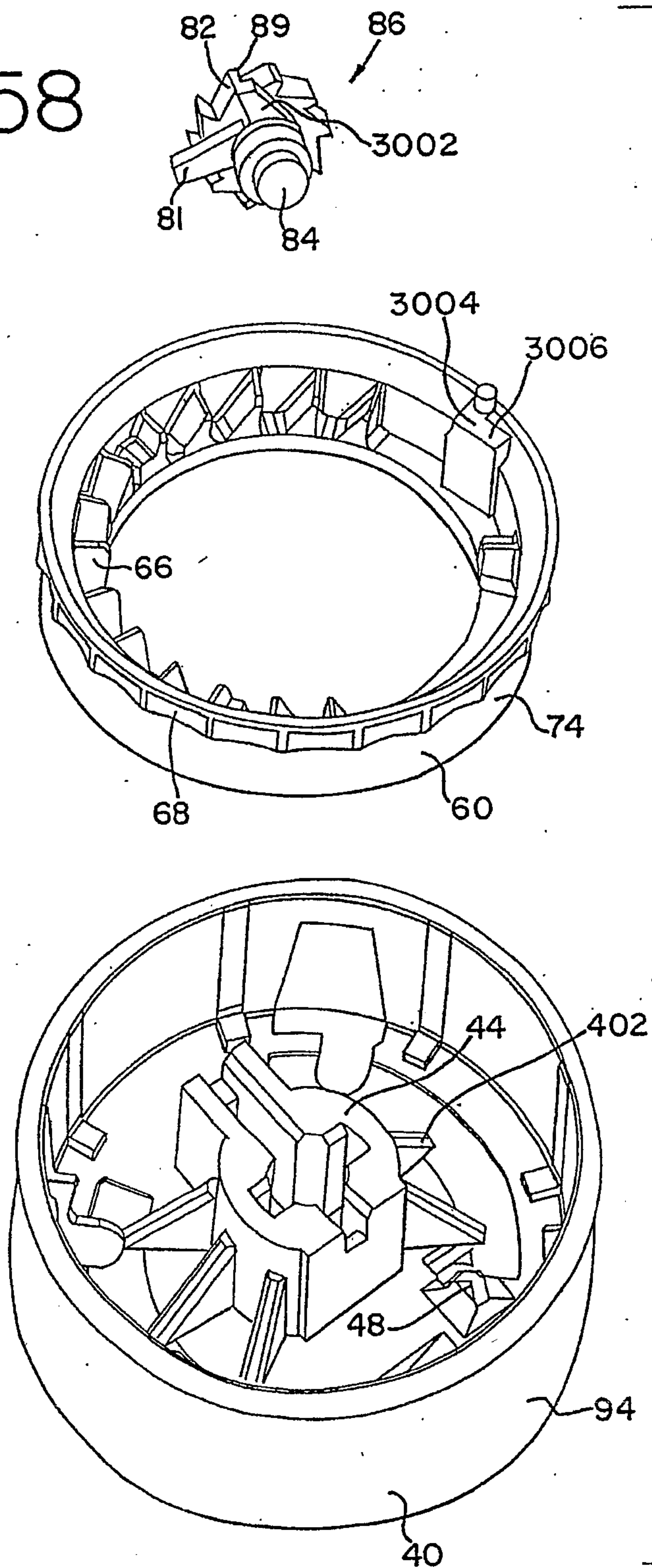


FIG. 59

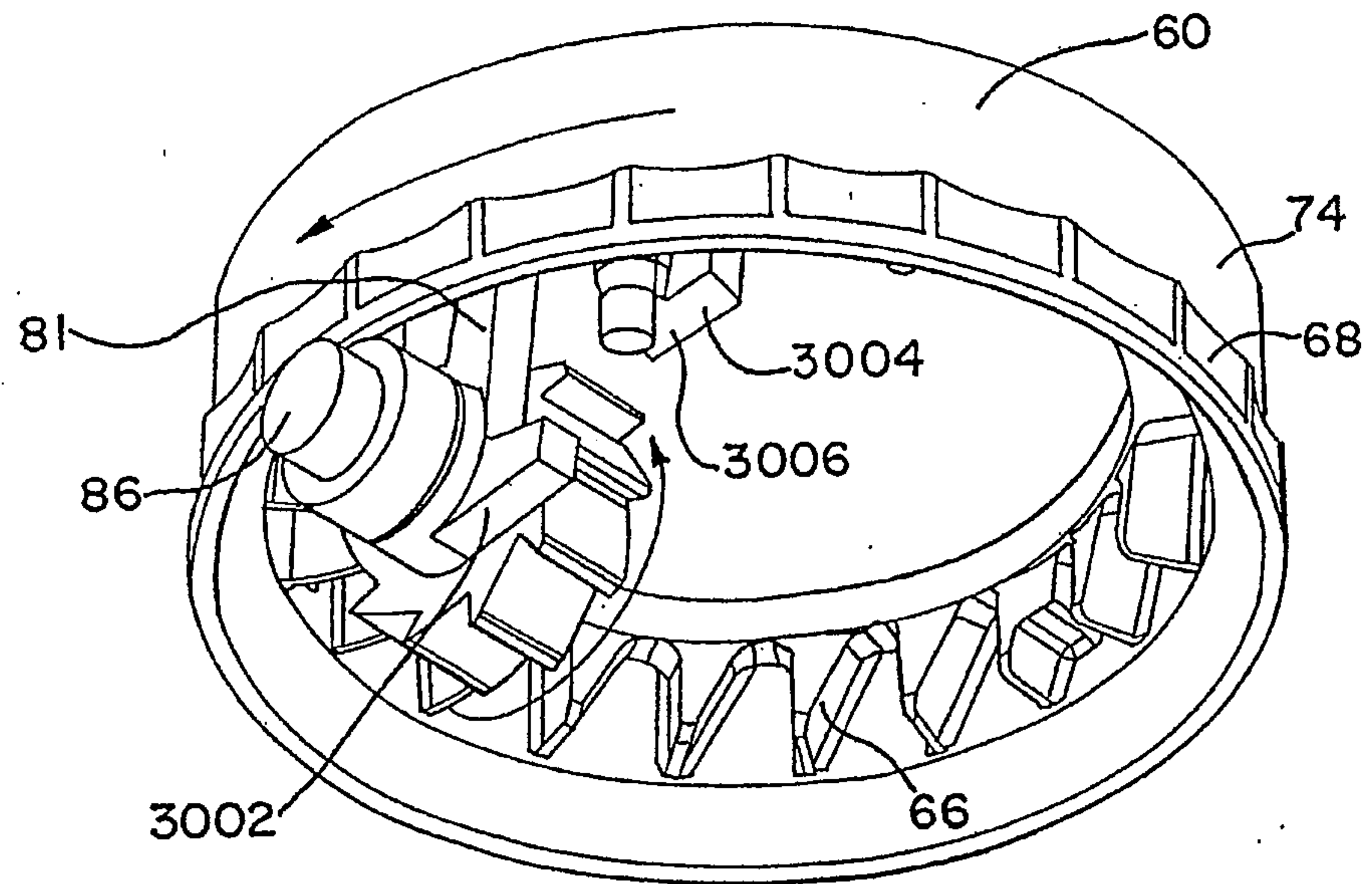
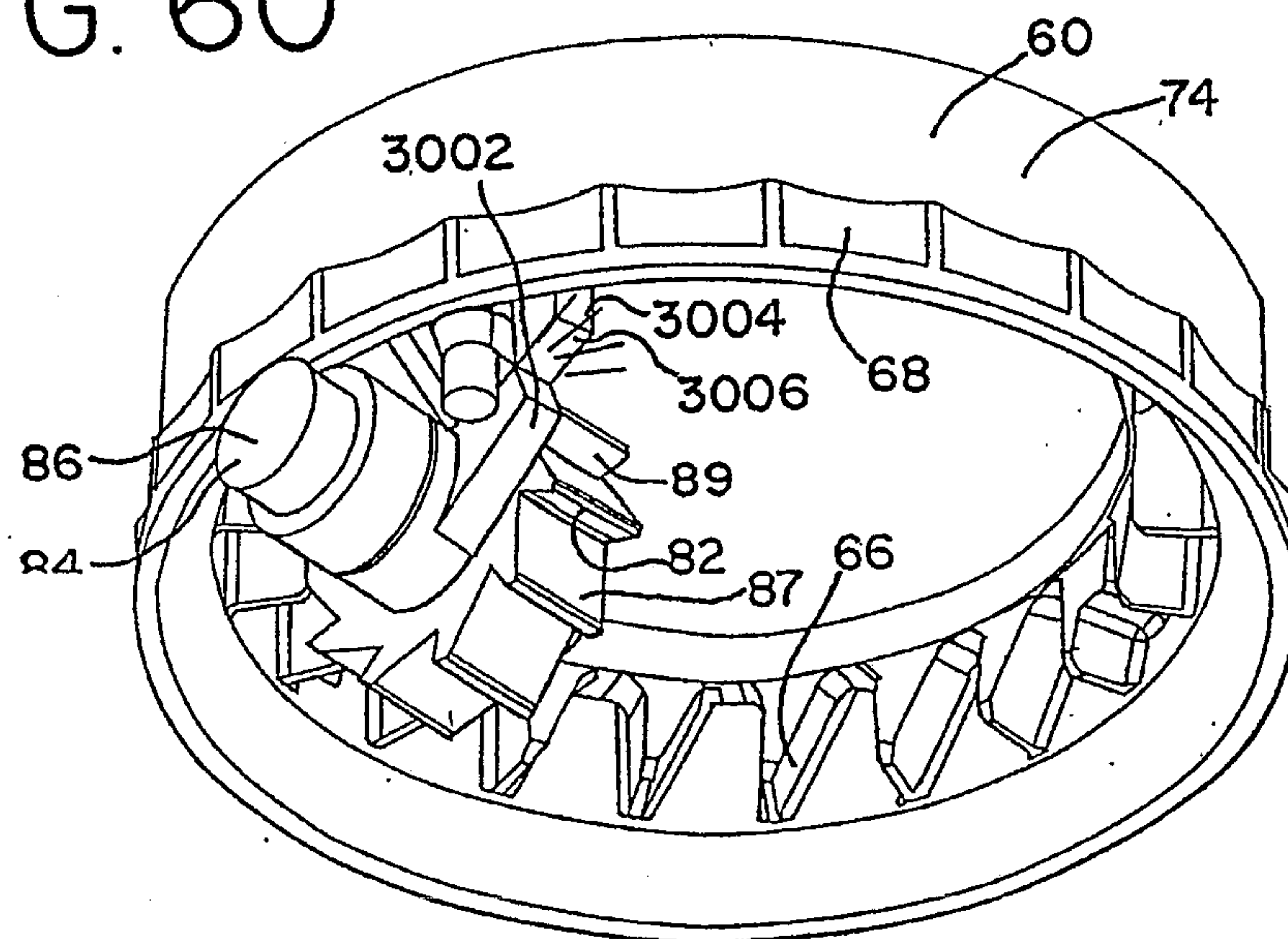


FIG. 60



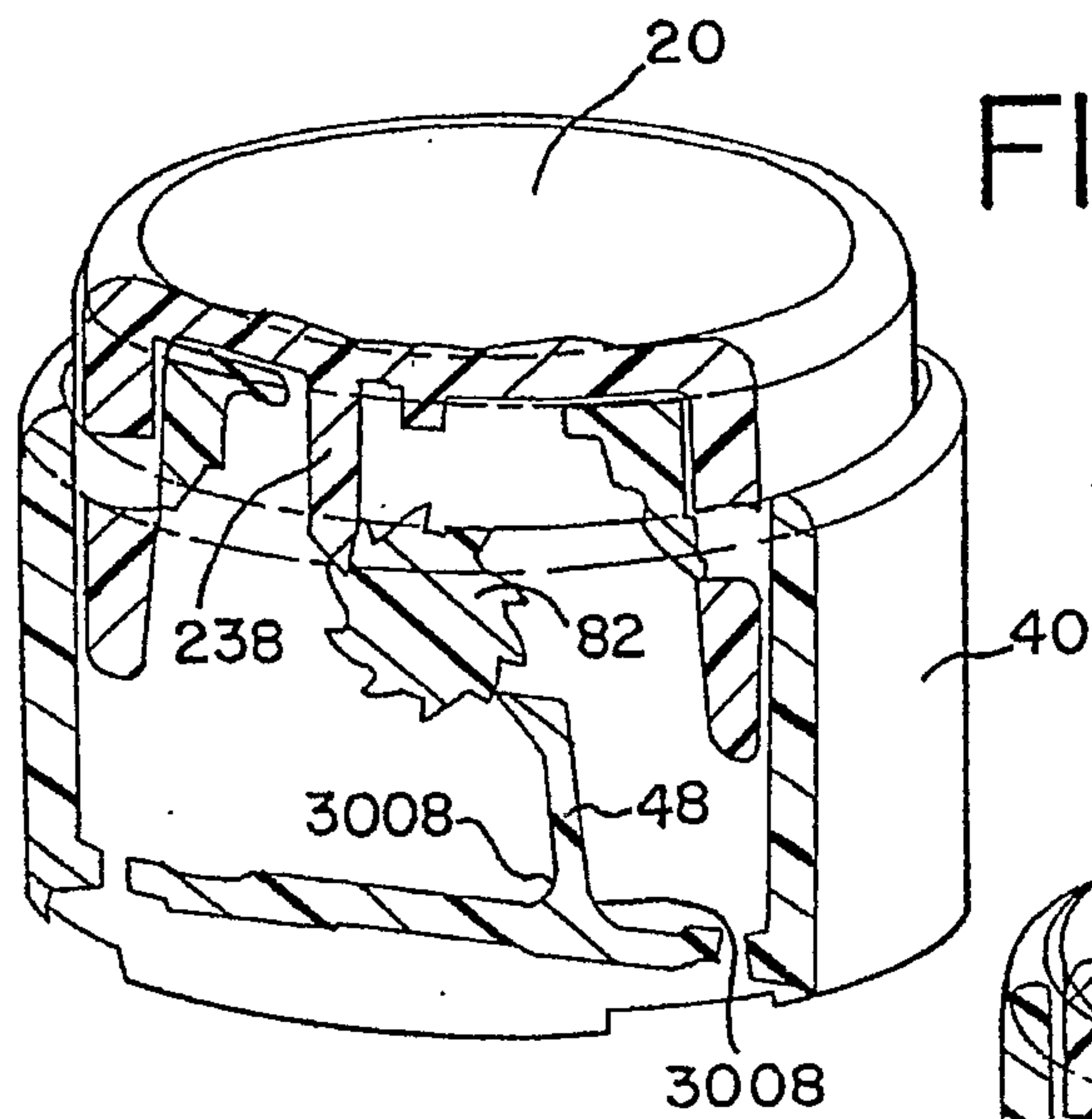


FIG. 61

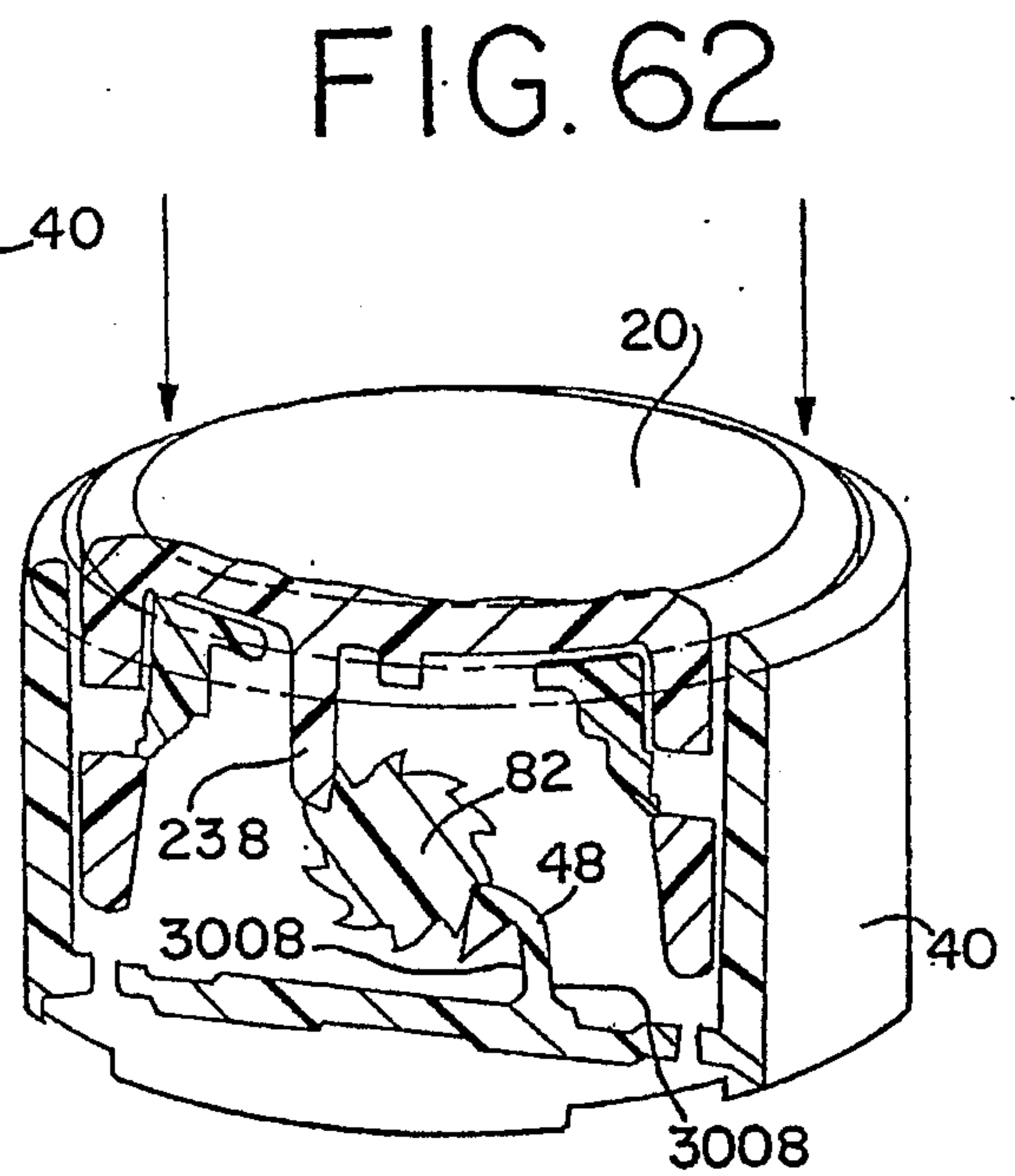


FIG. 62

FIG. 63

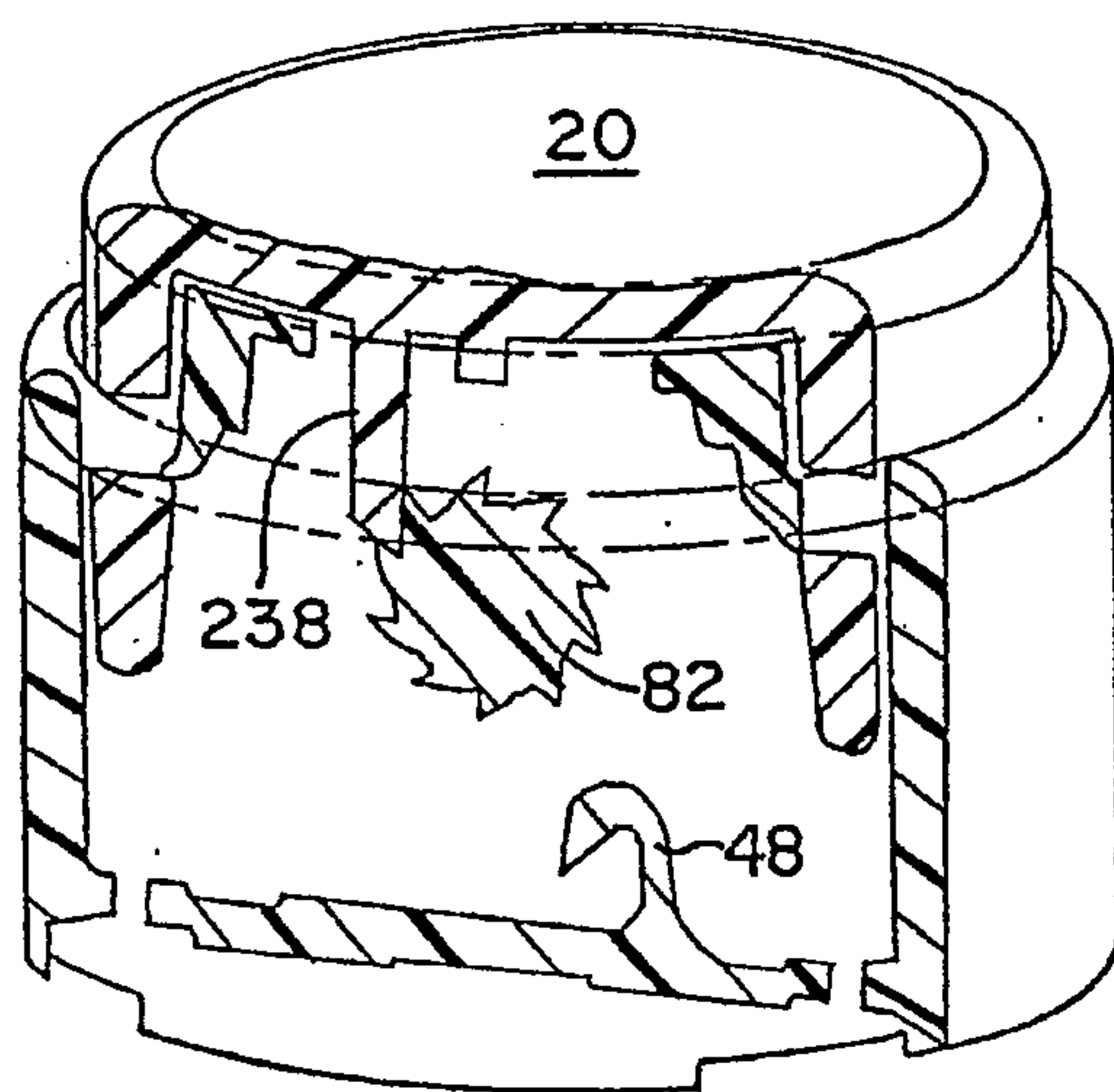


FIG. 64

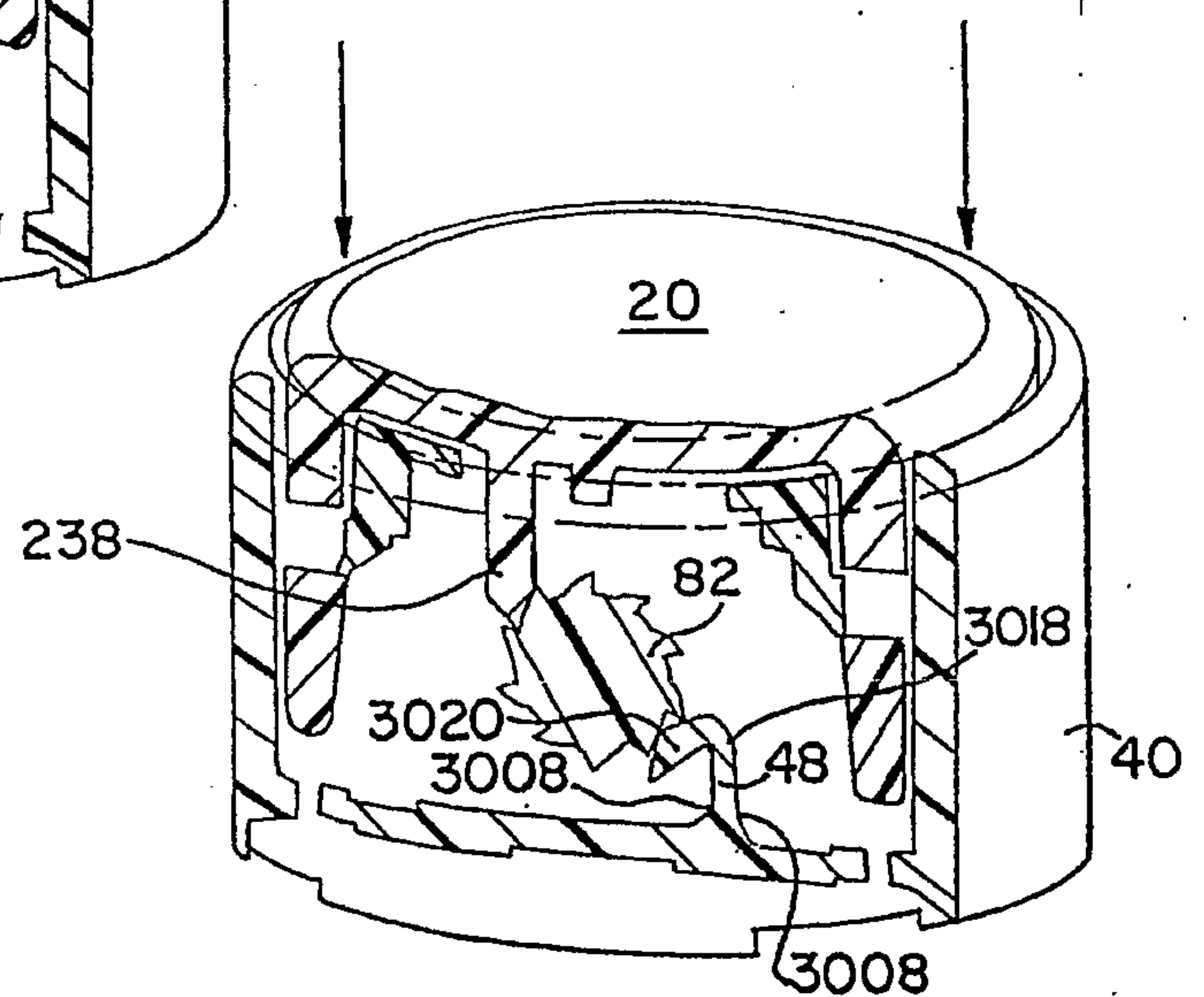


FIG. 65

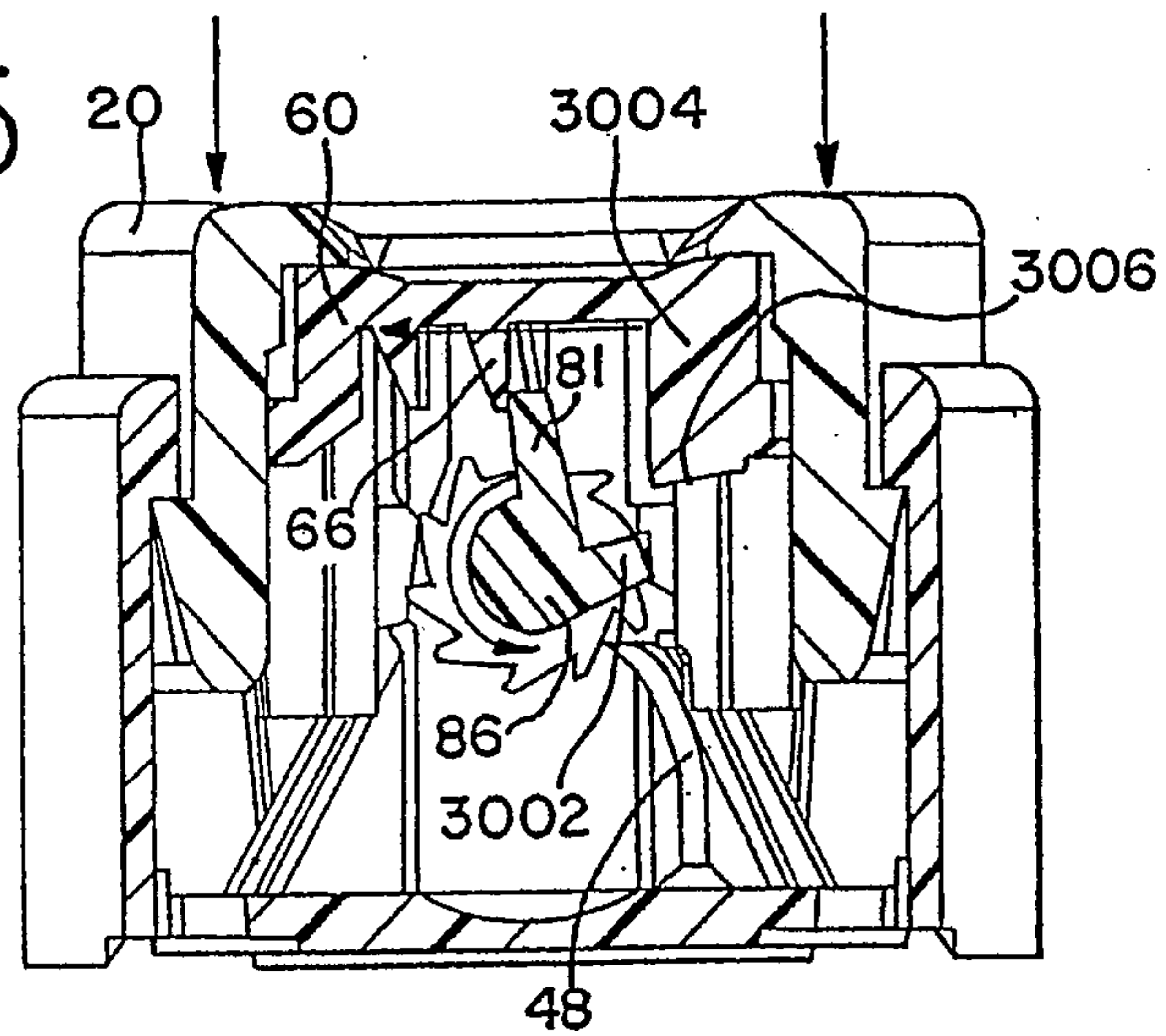


FIG. 66

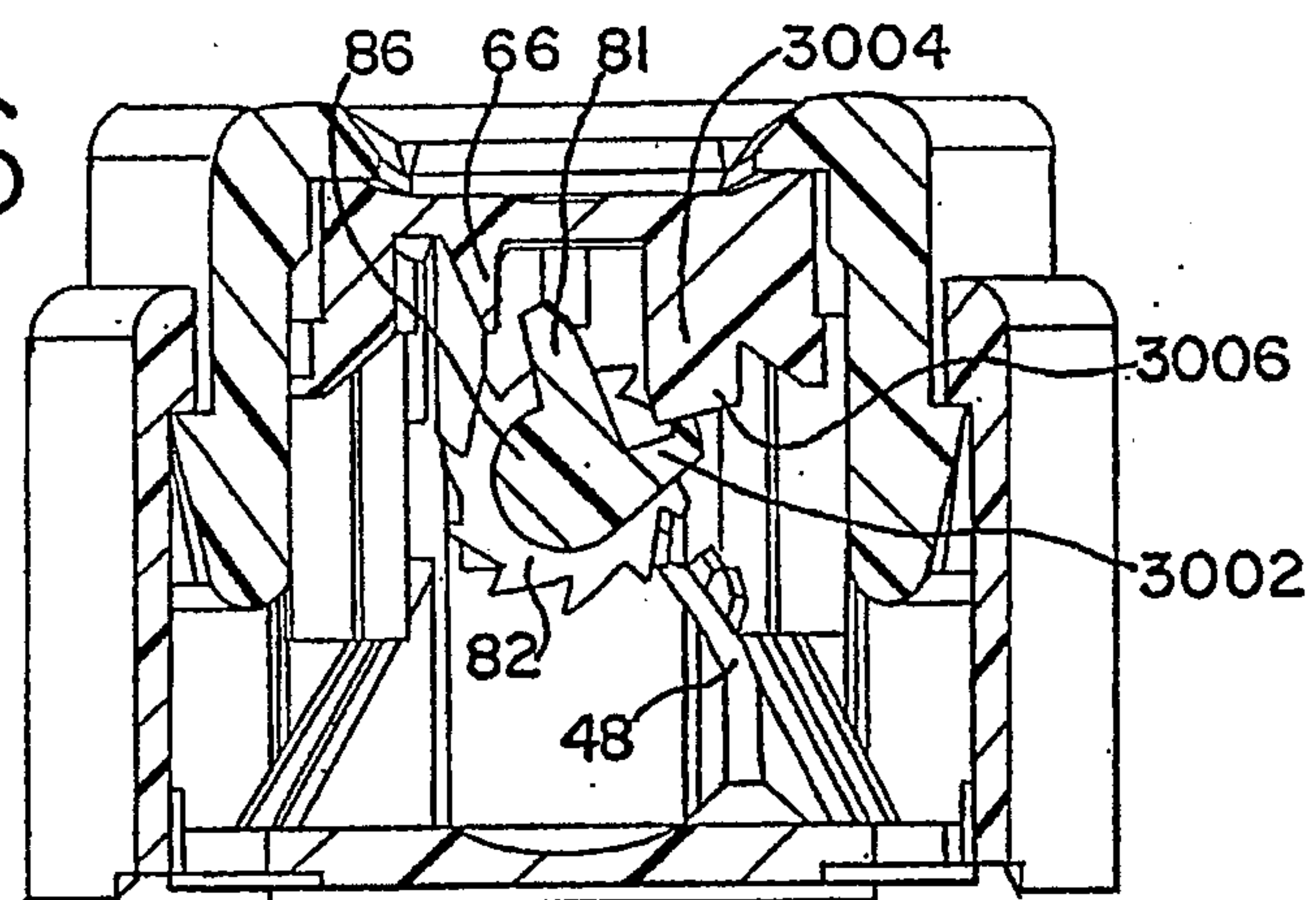


FIG. 67

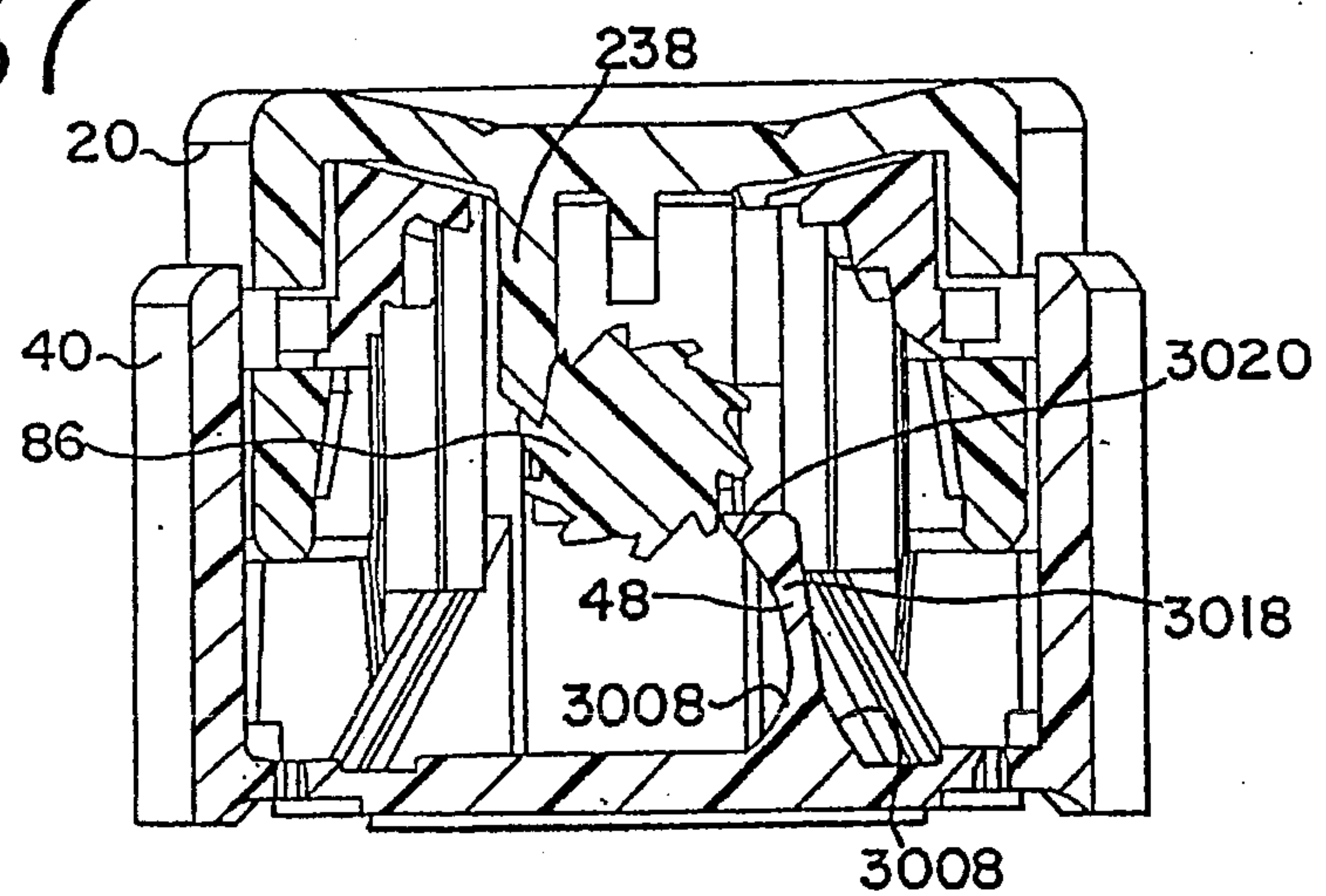


FIG. 68

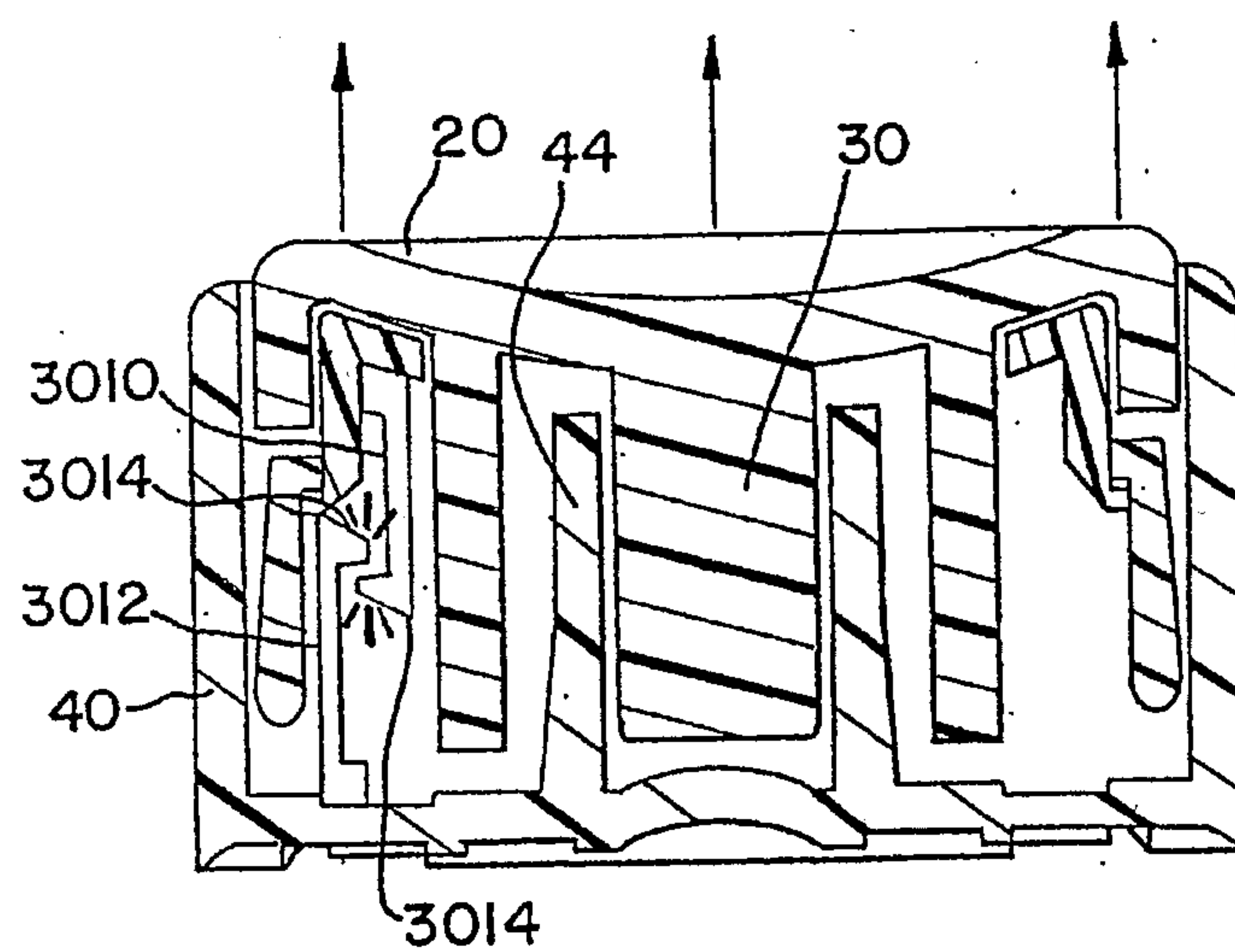


FIG. 69

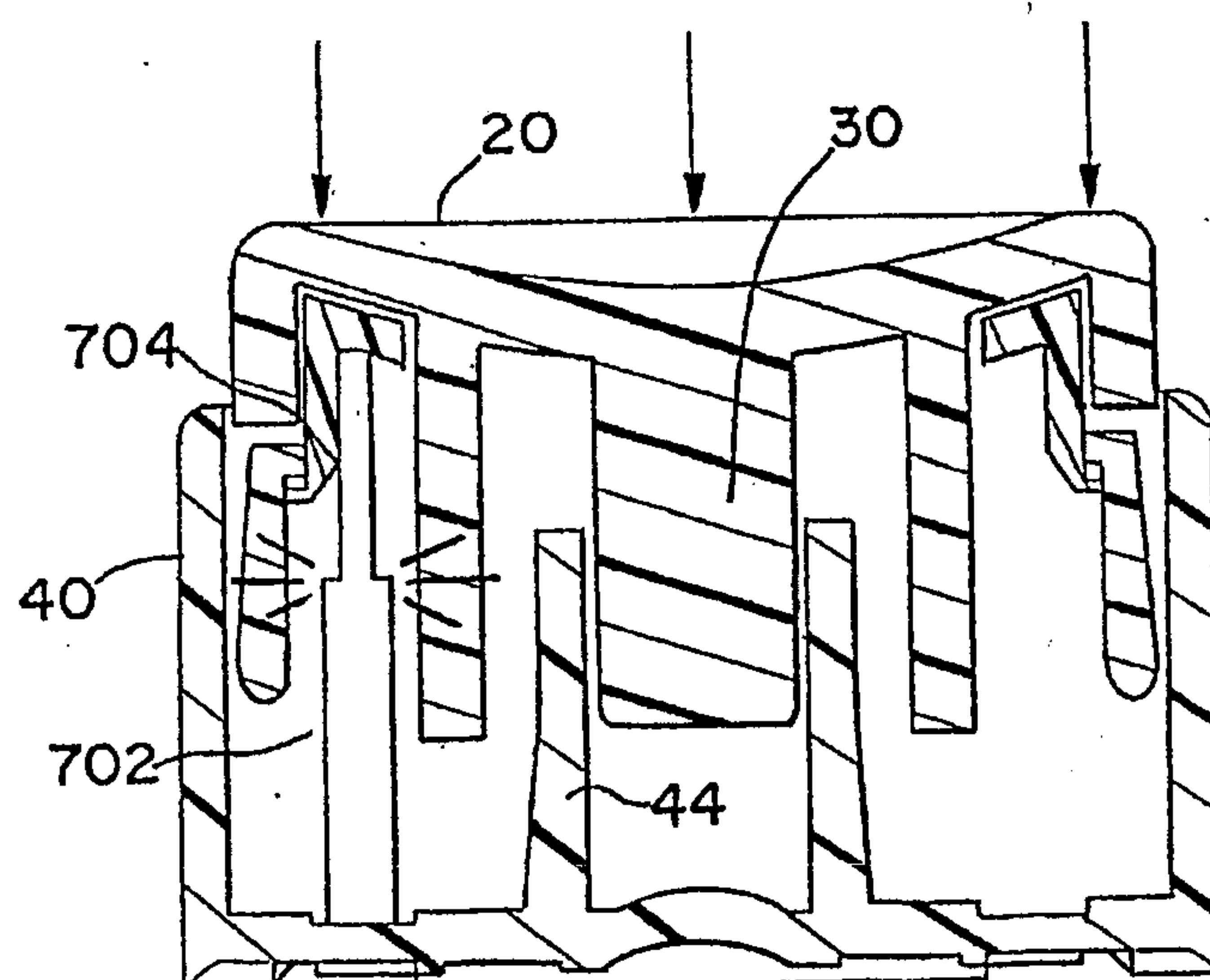


FIG. 70

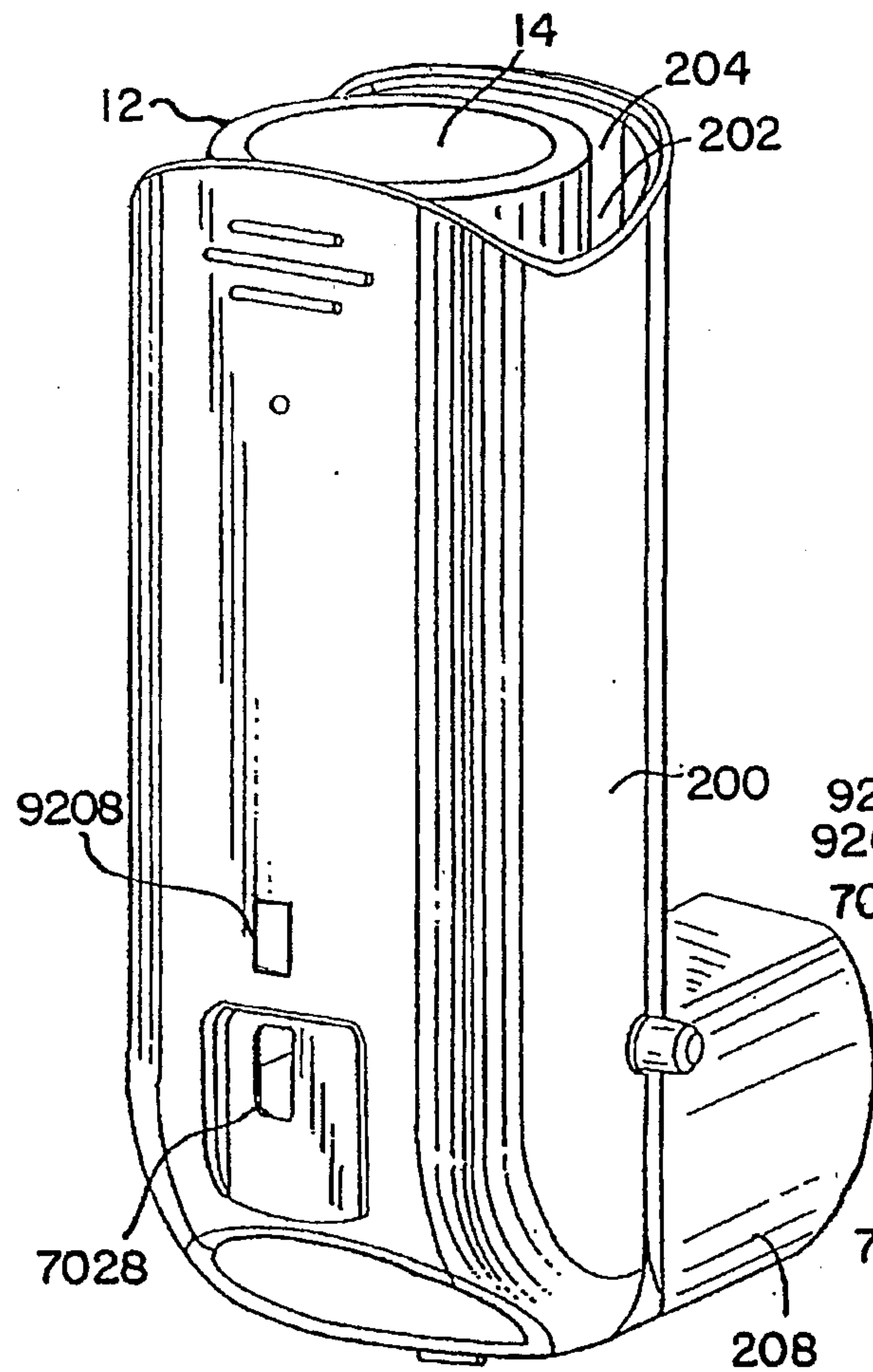


FIG. 71

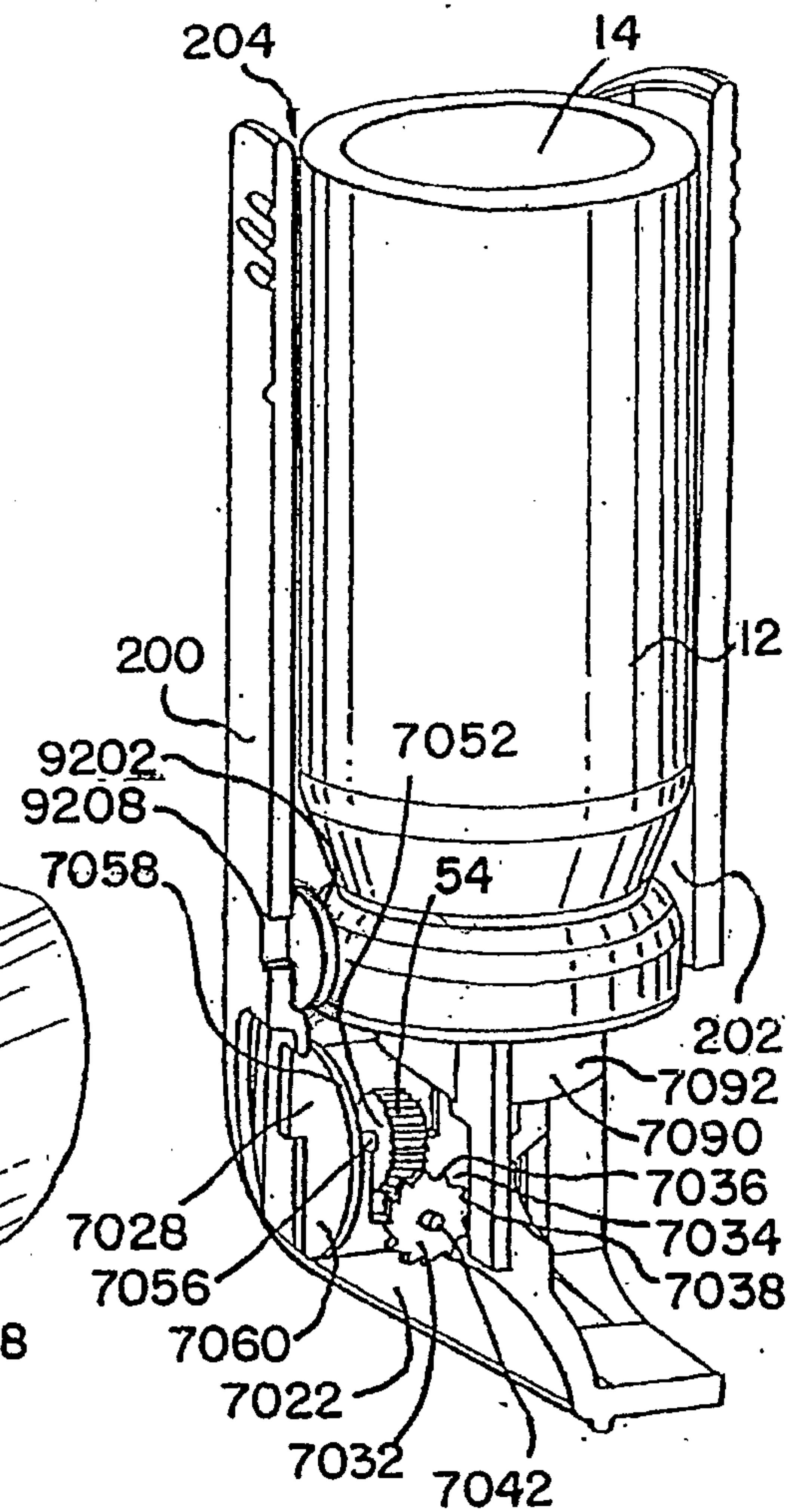


FIG. 72

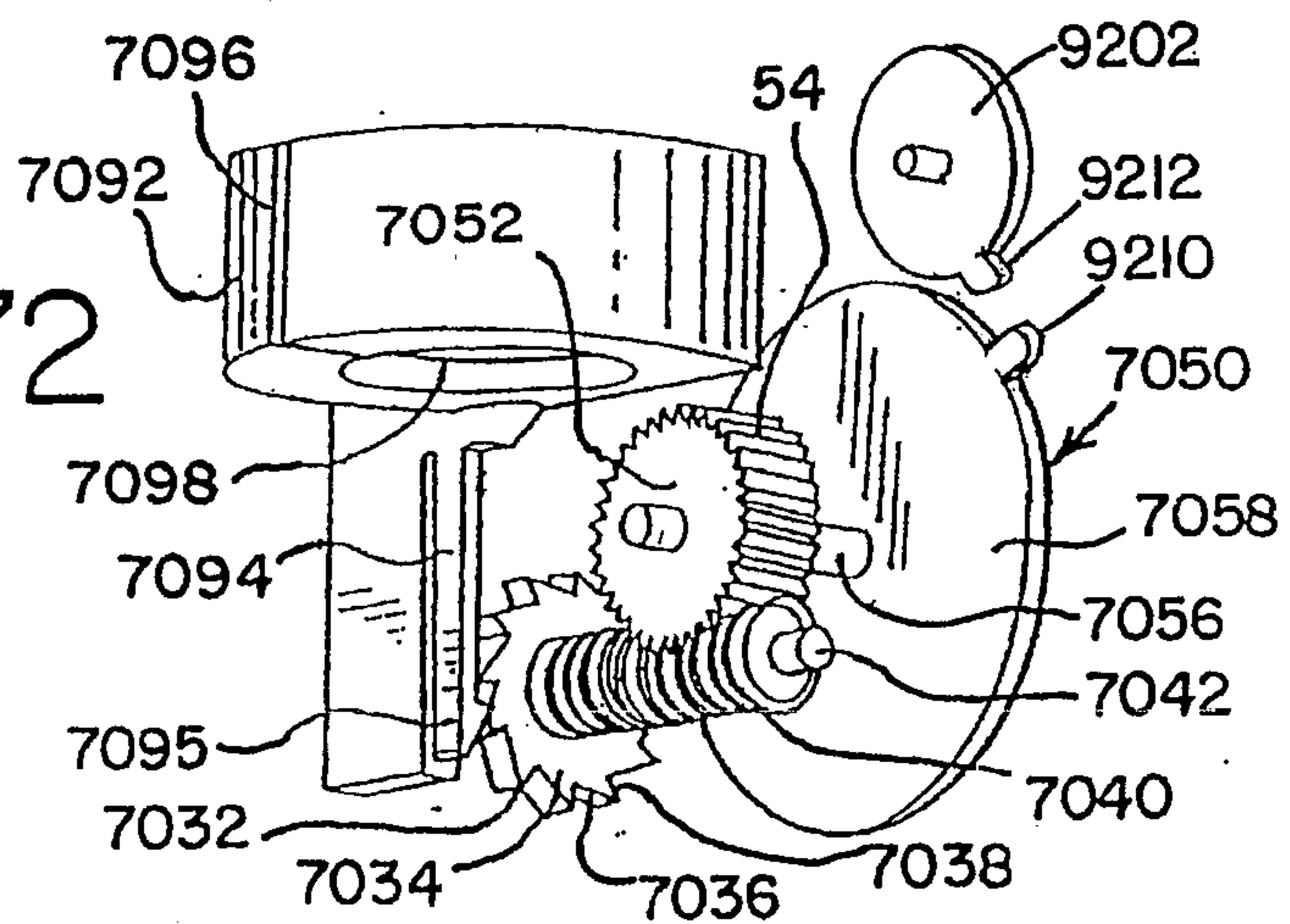


FIG. 73

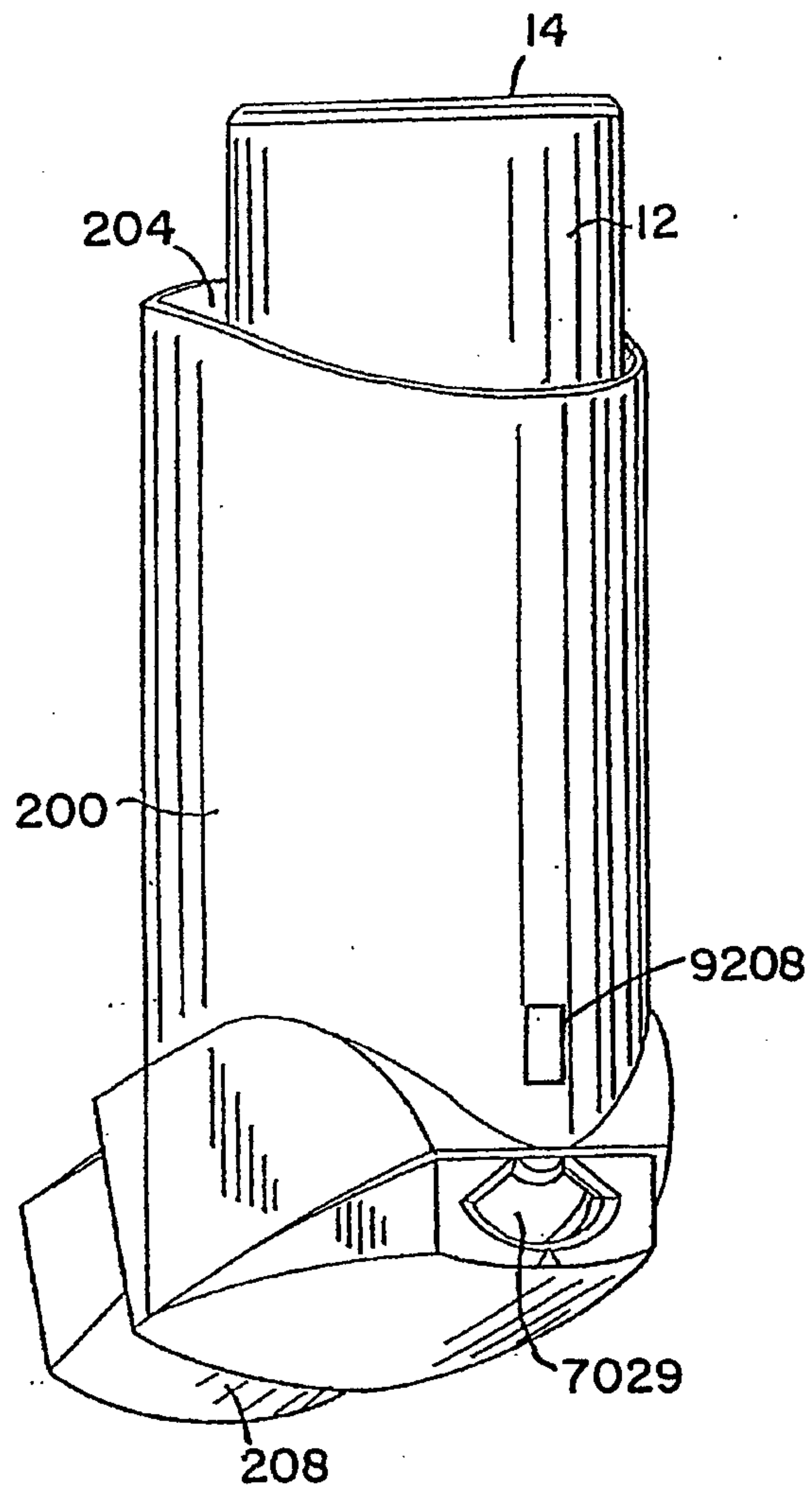


FIG. 74

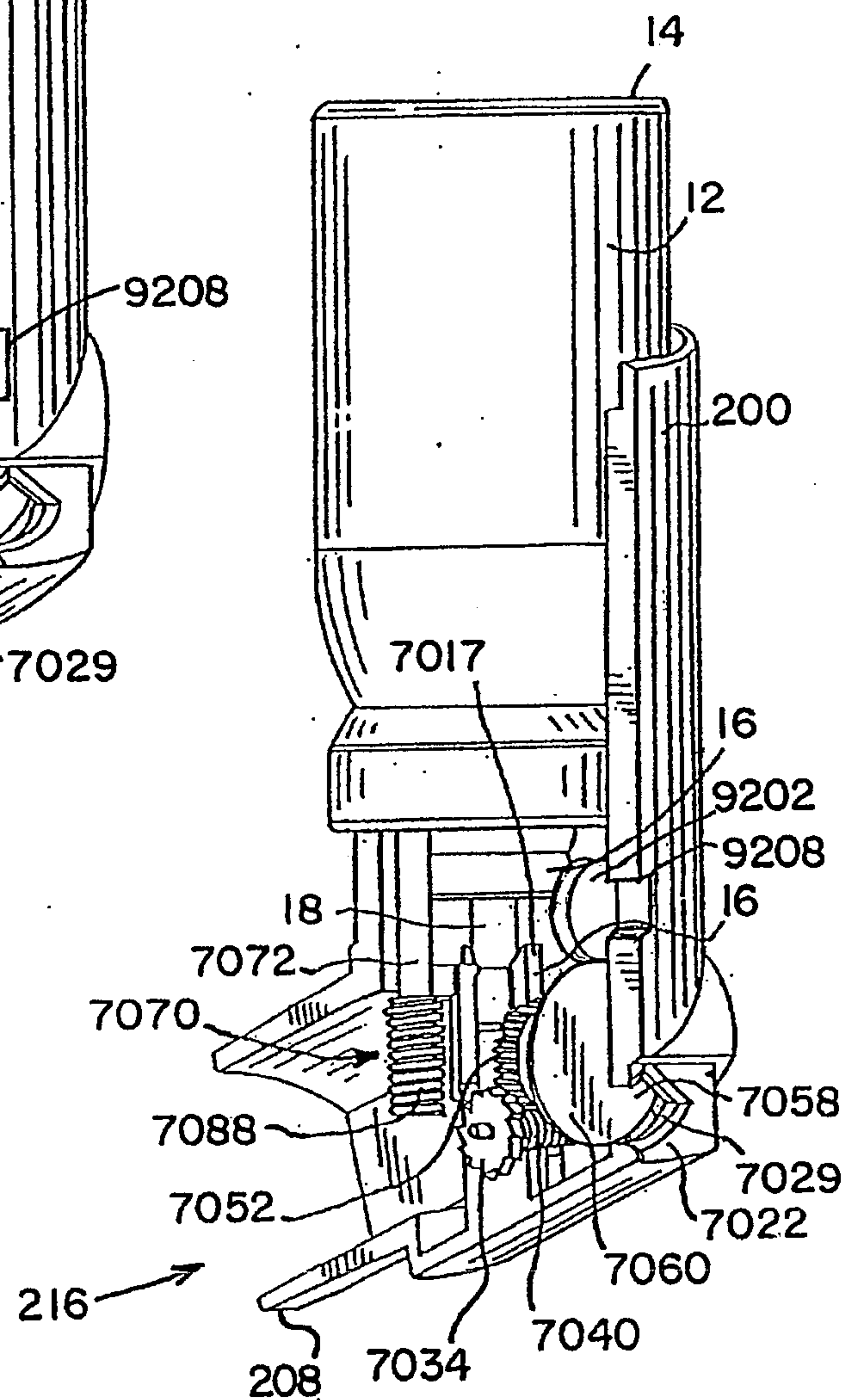


FIG. 75

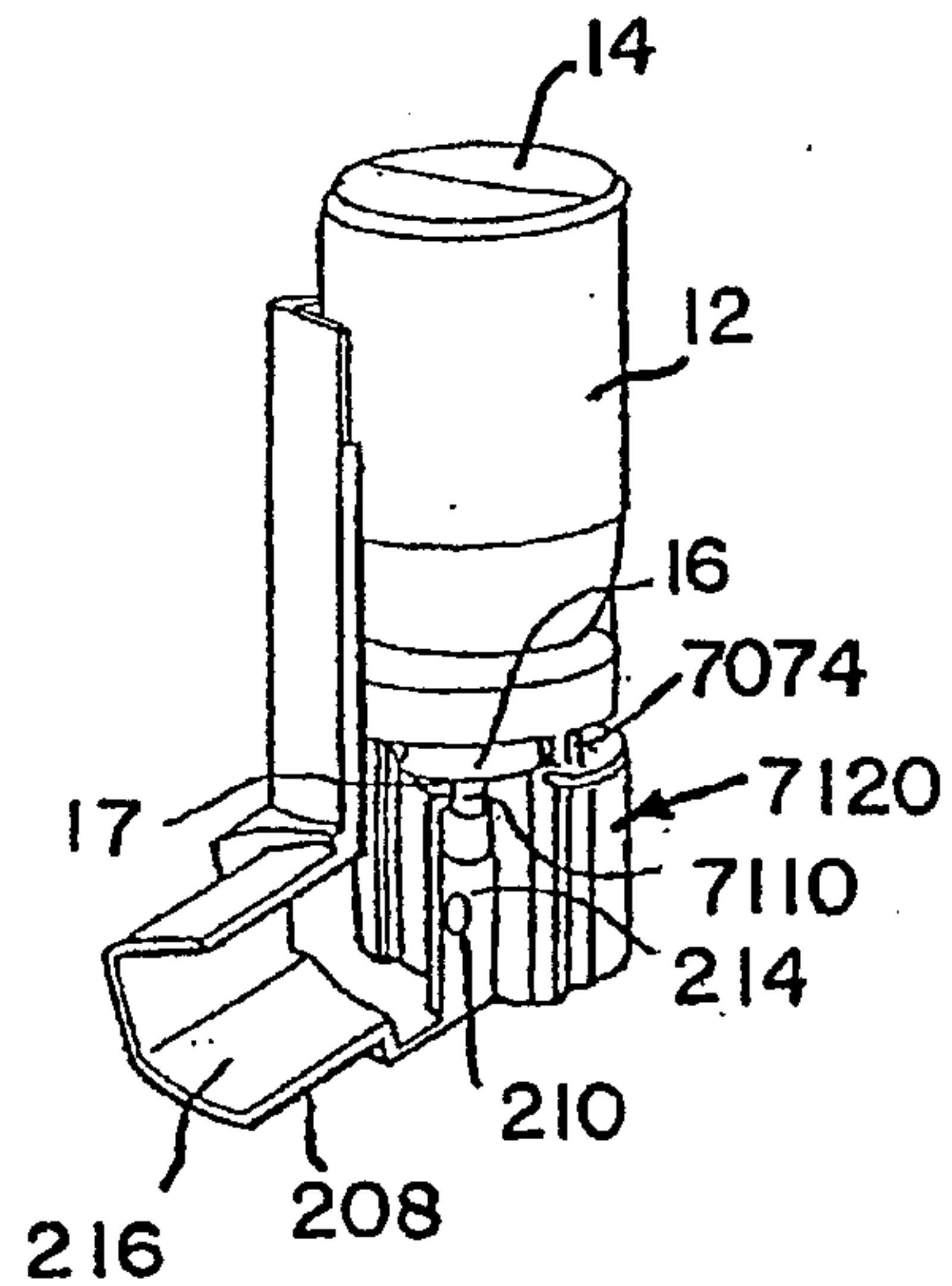


FIG. 76

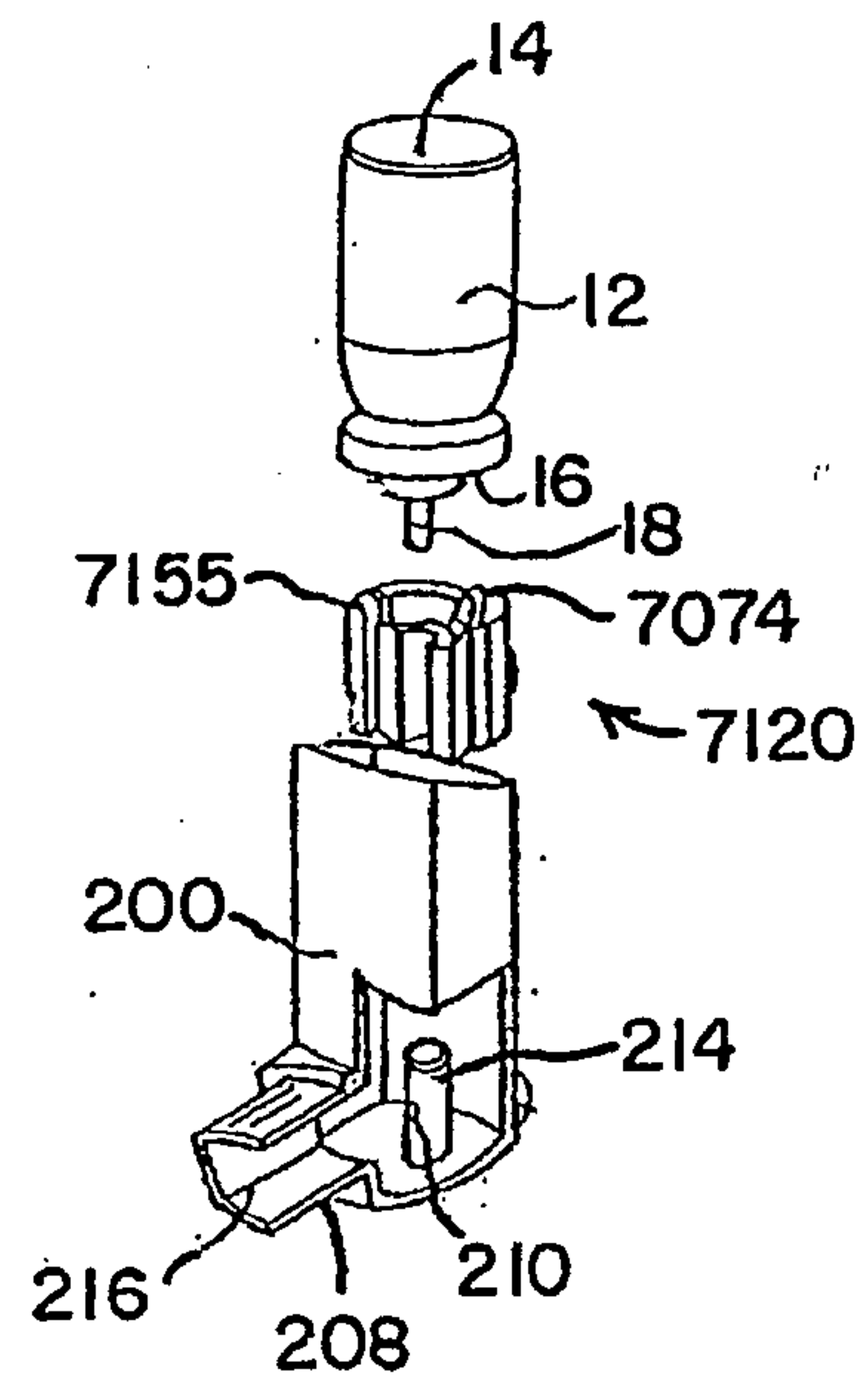


FIG. 77

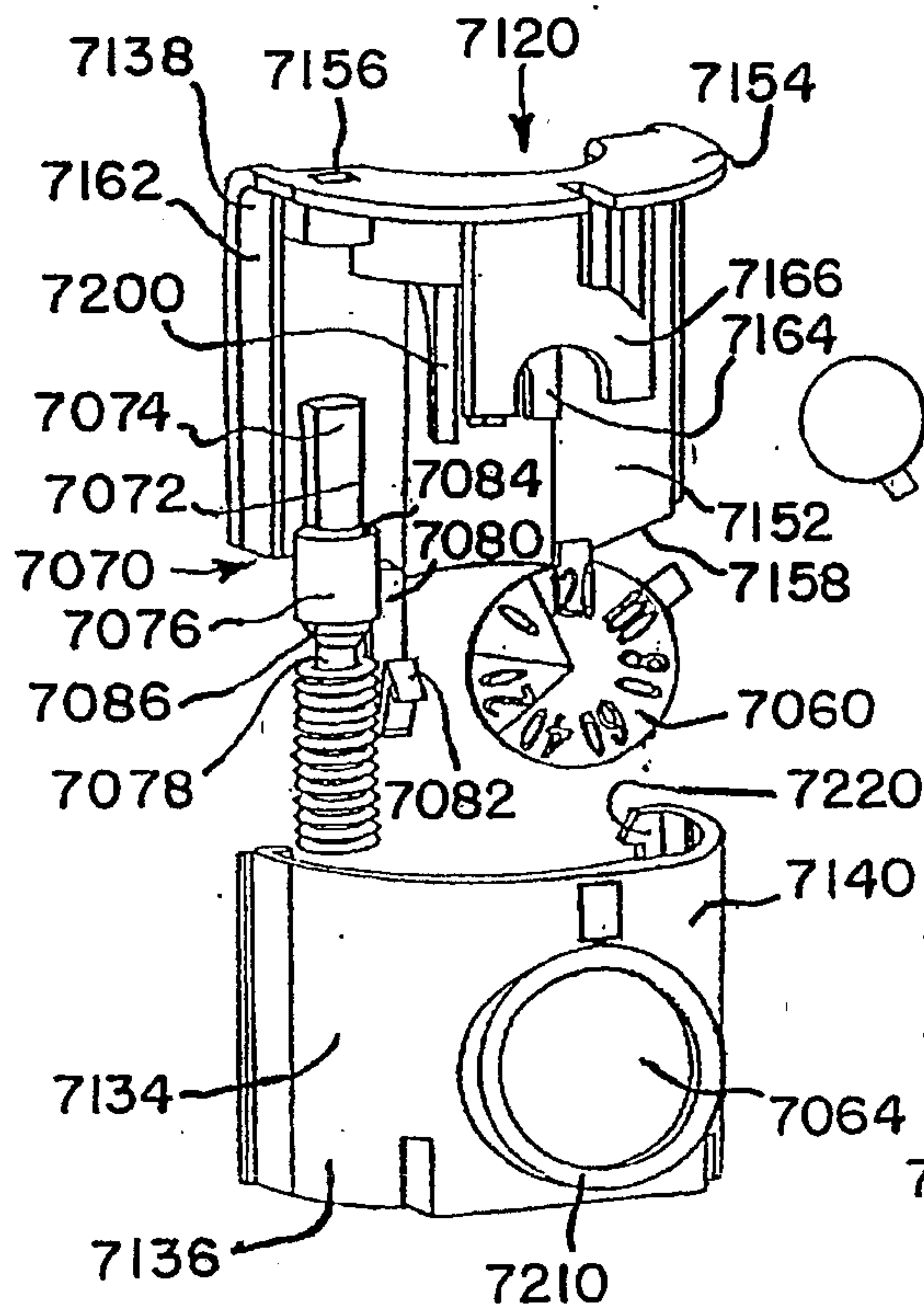


FIG. 78

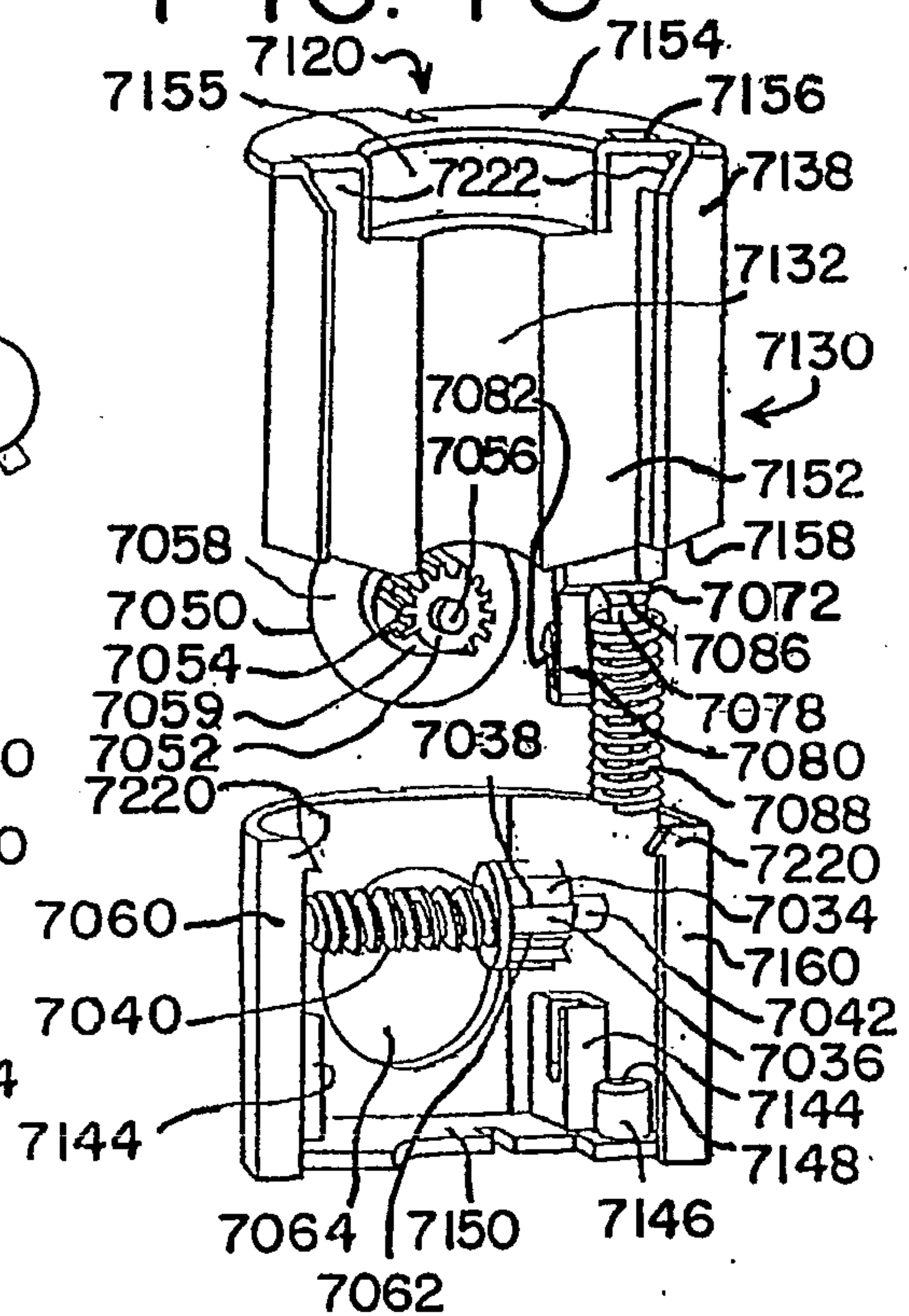


FIG. 79

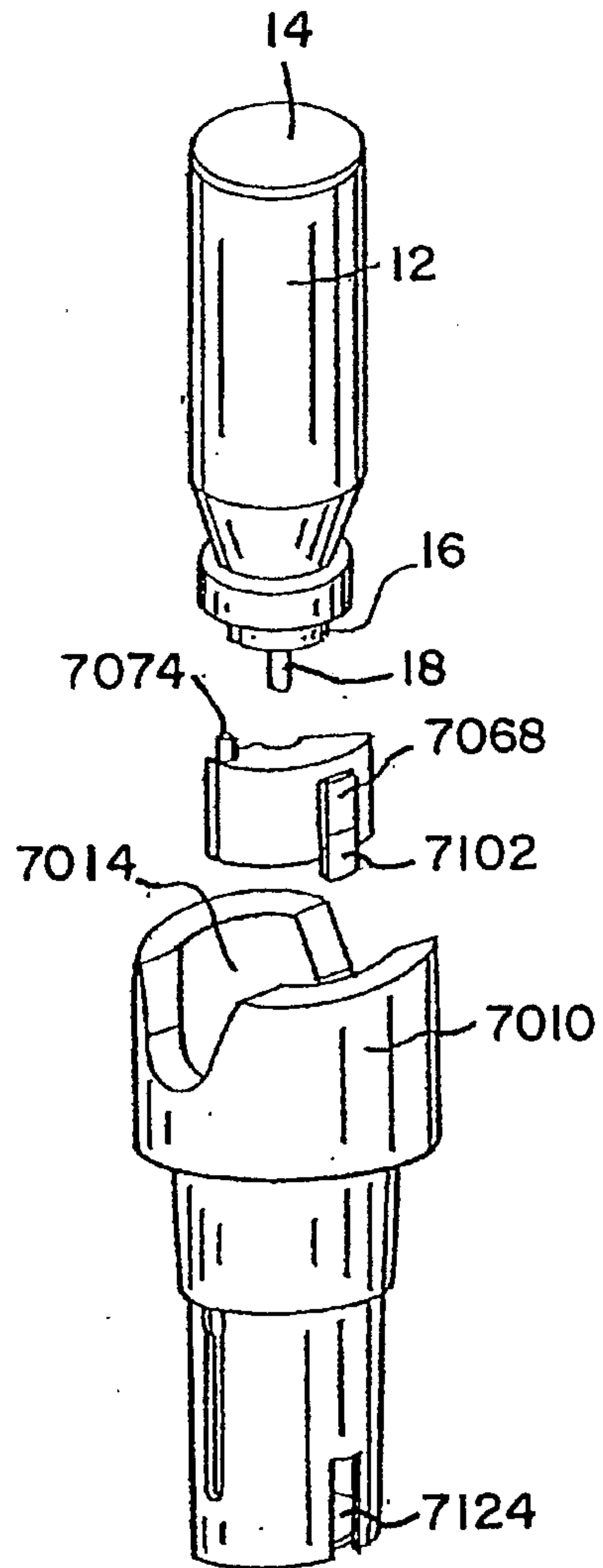


FIG. 80

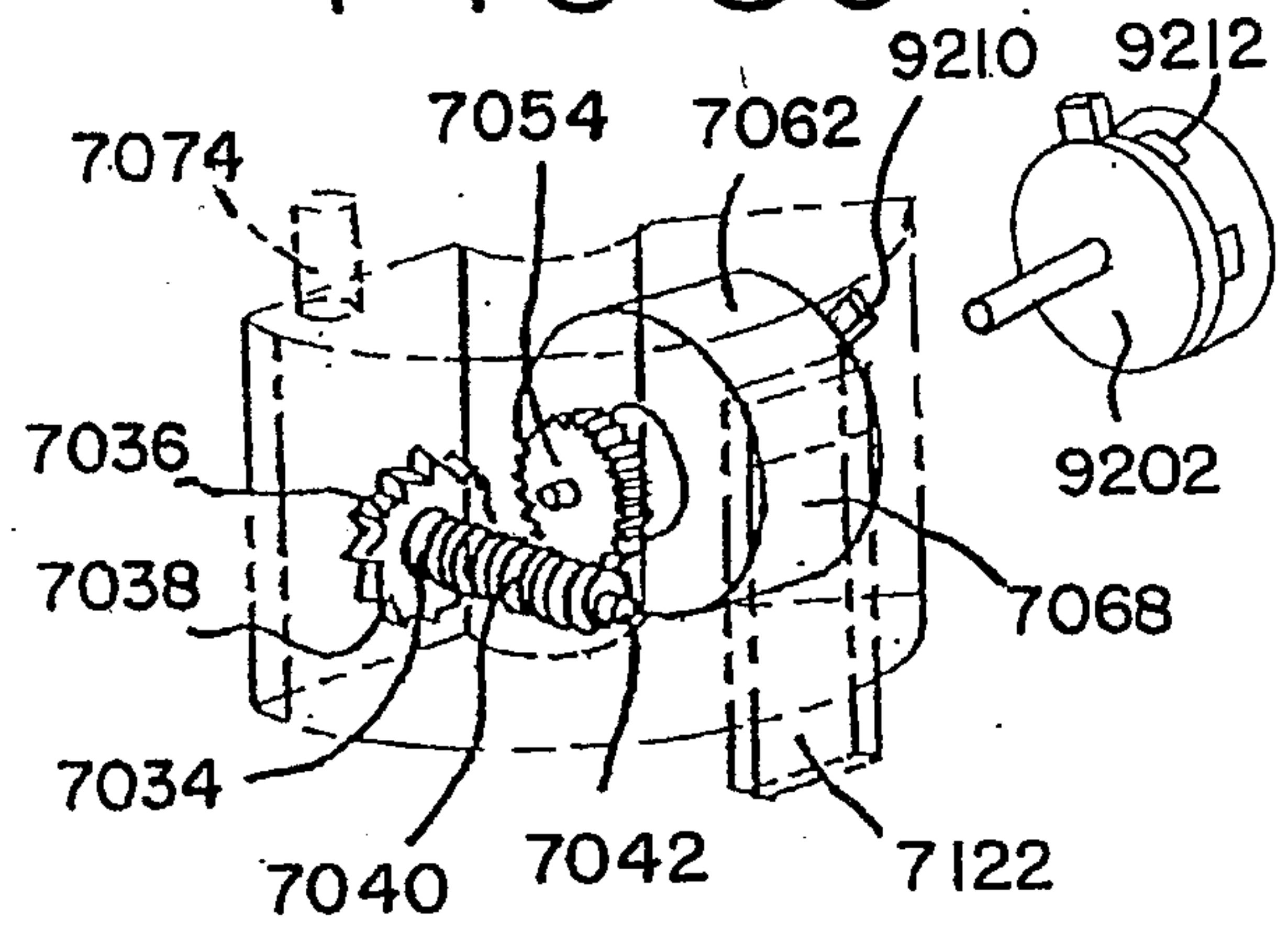


FIG. 81

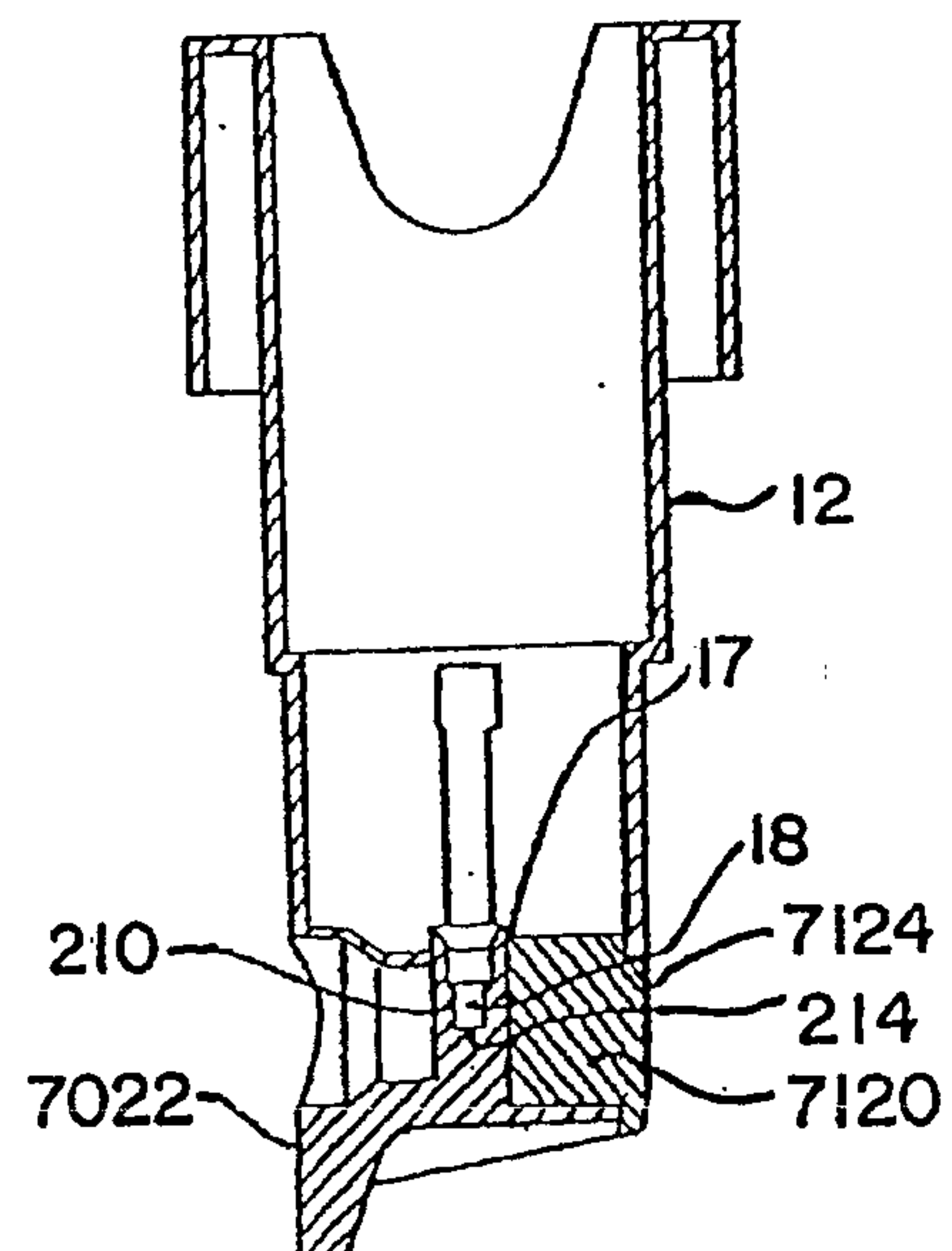


FIG. 82

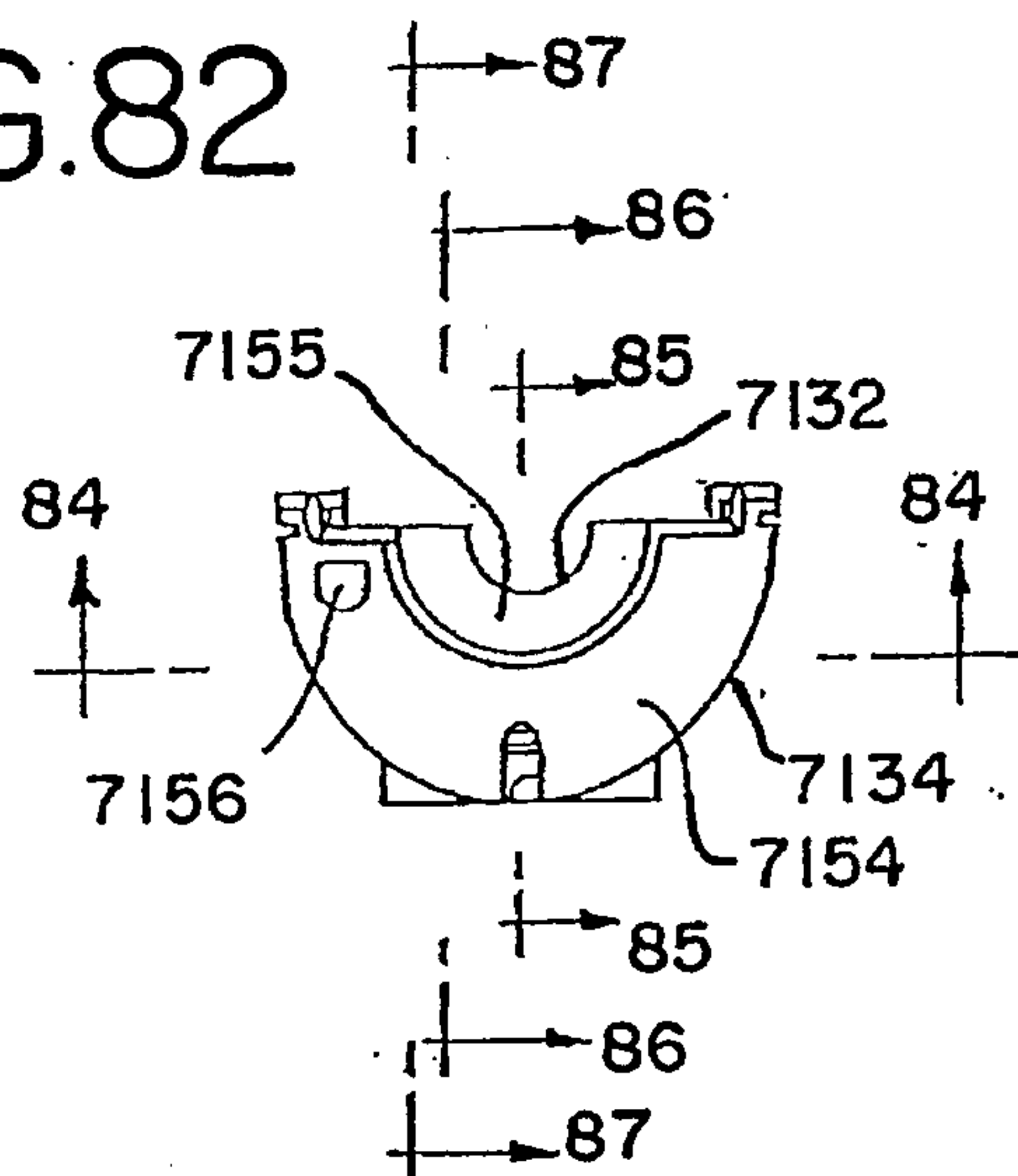


FIG. 83

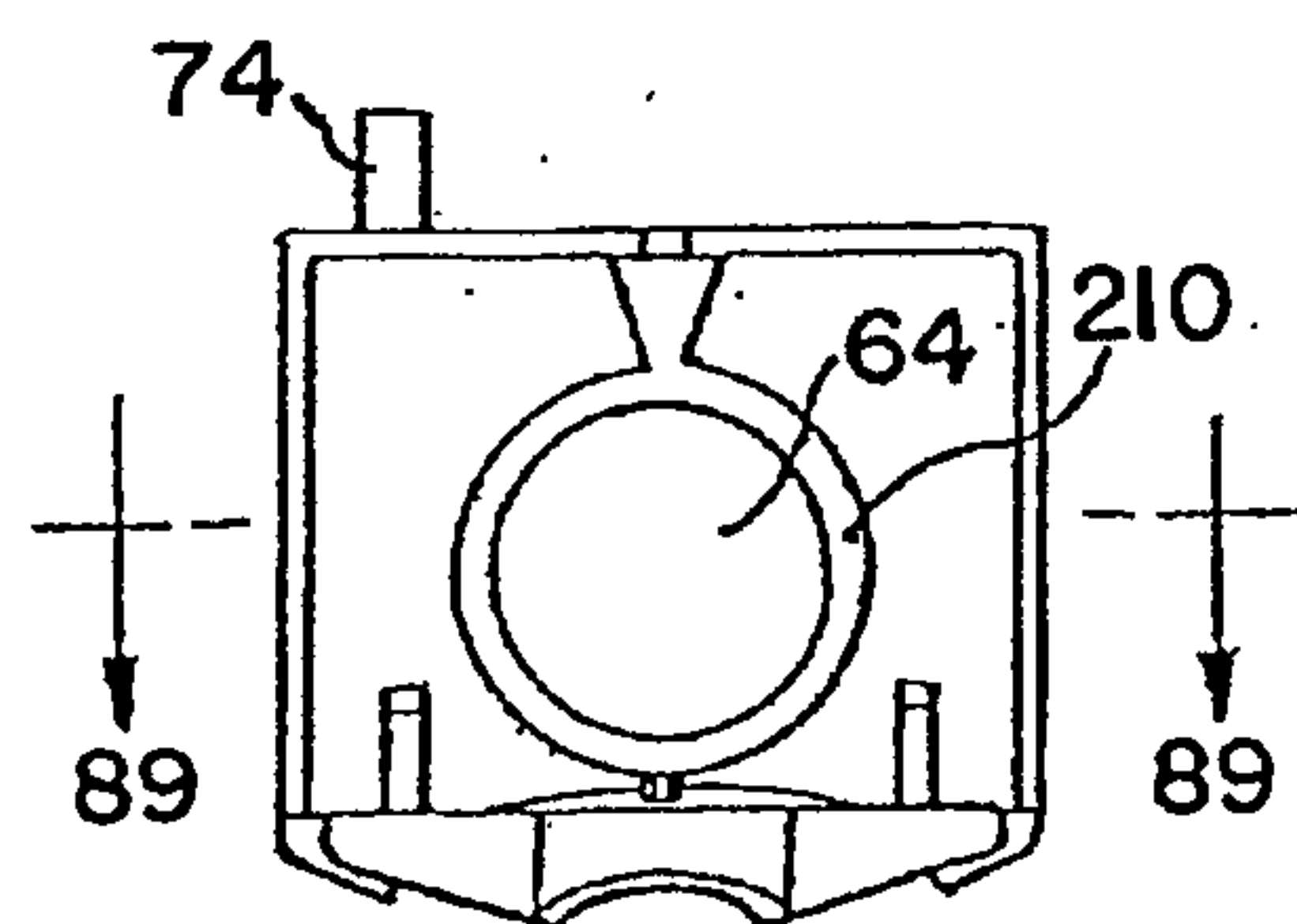


FIG. 84

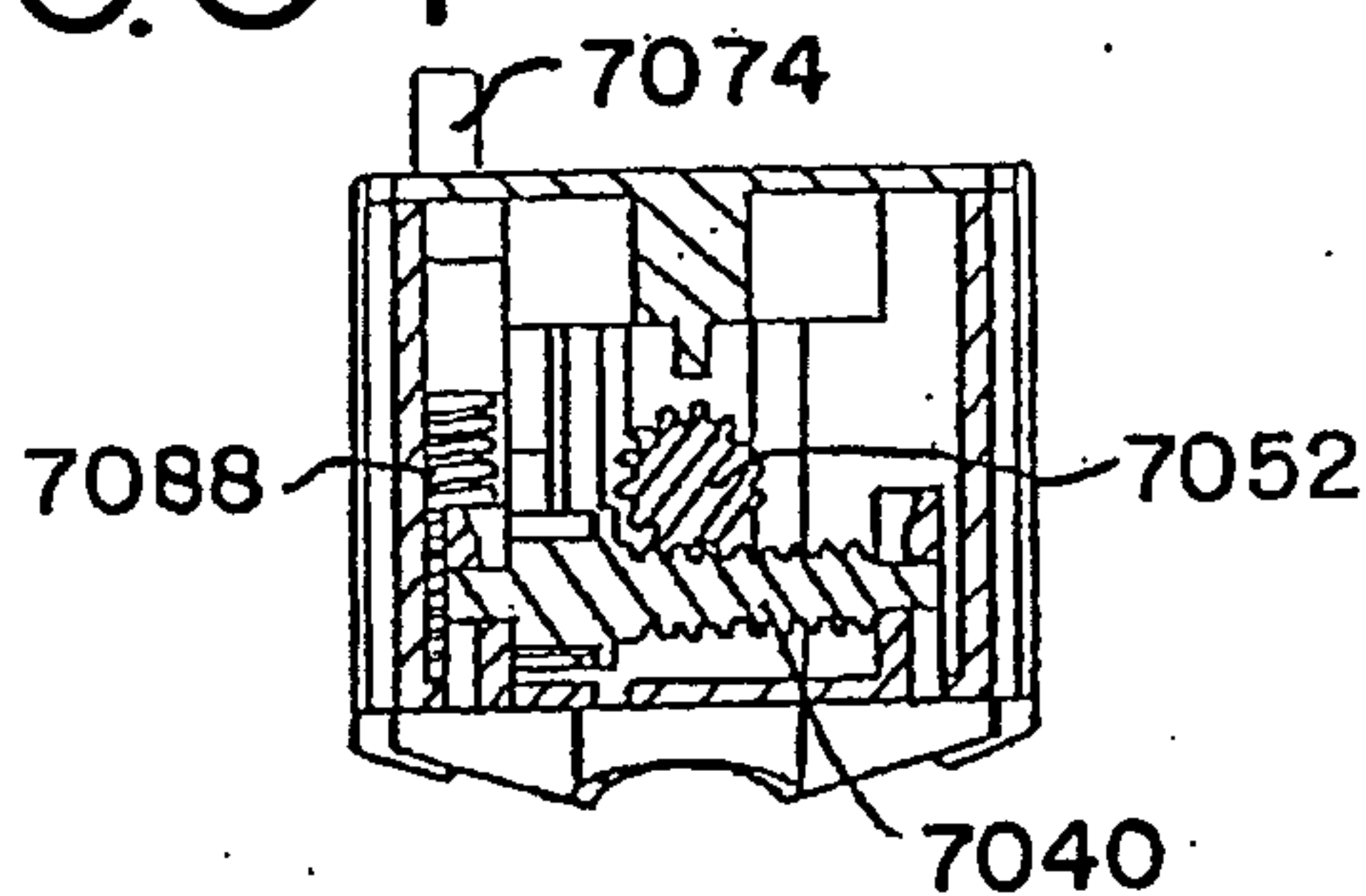


FIG. 85

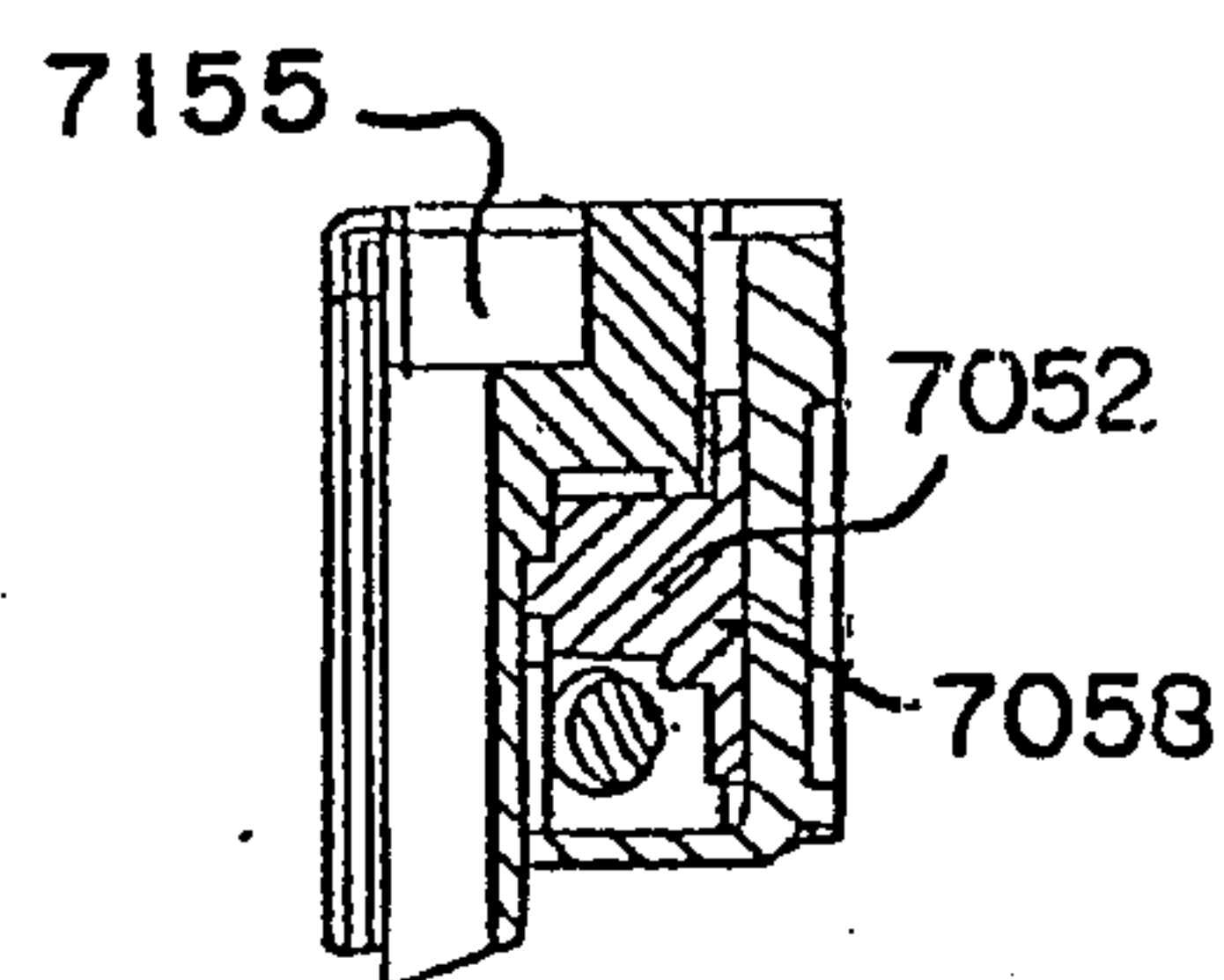


FIG. 86

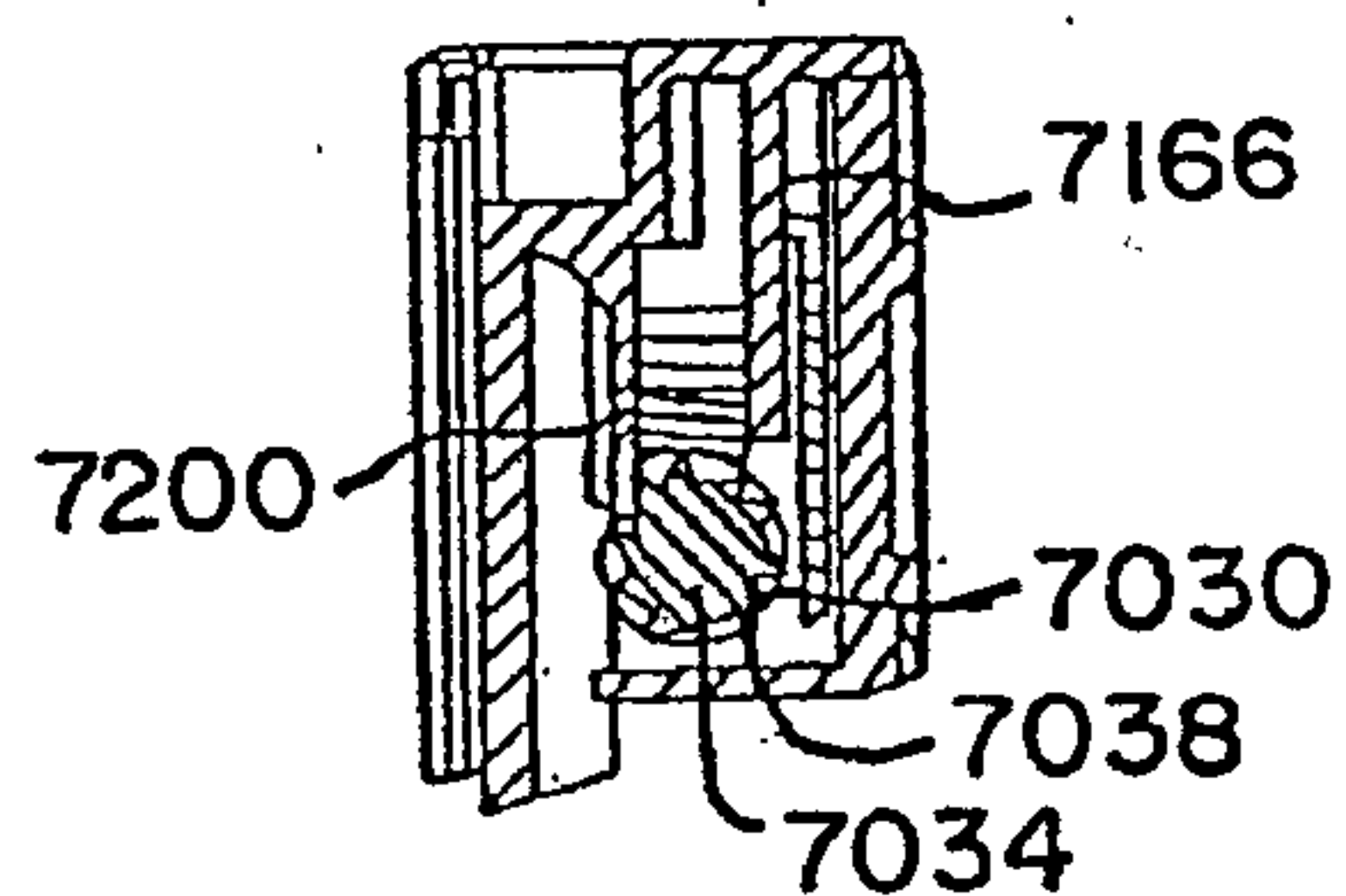


FIG. 87

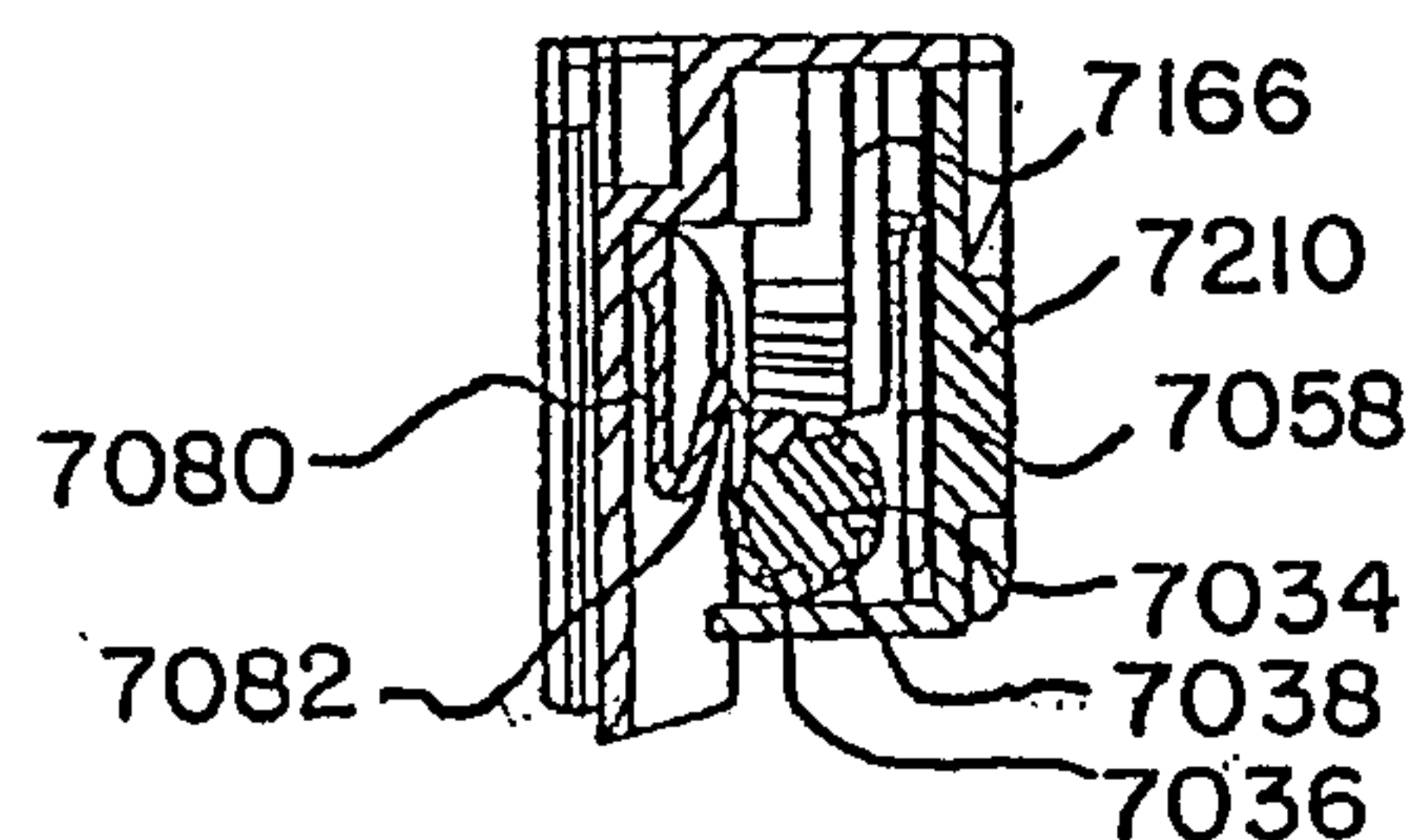


FIG. 88

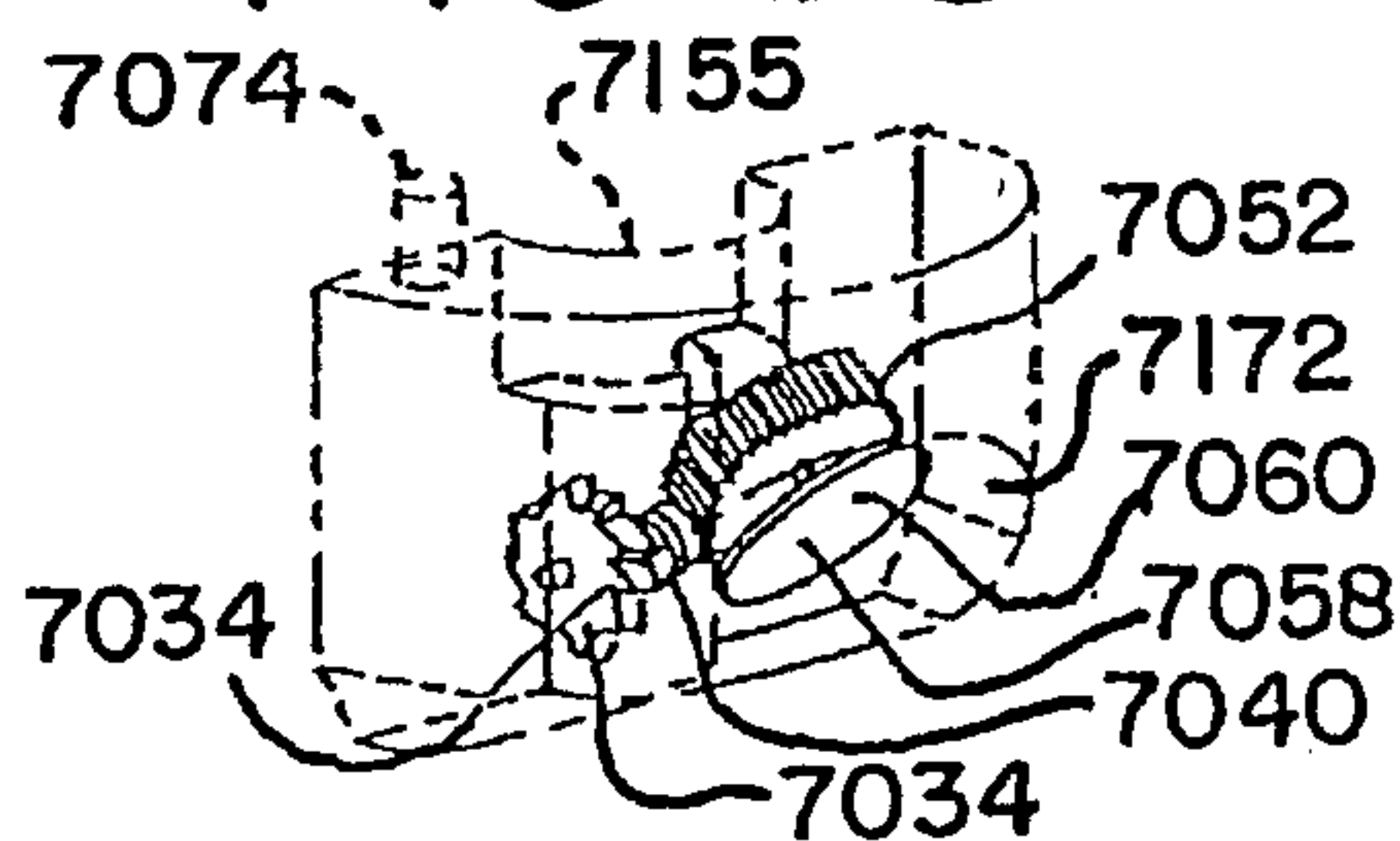


FIG. 89

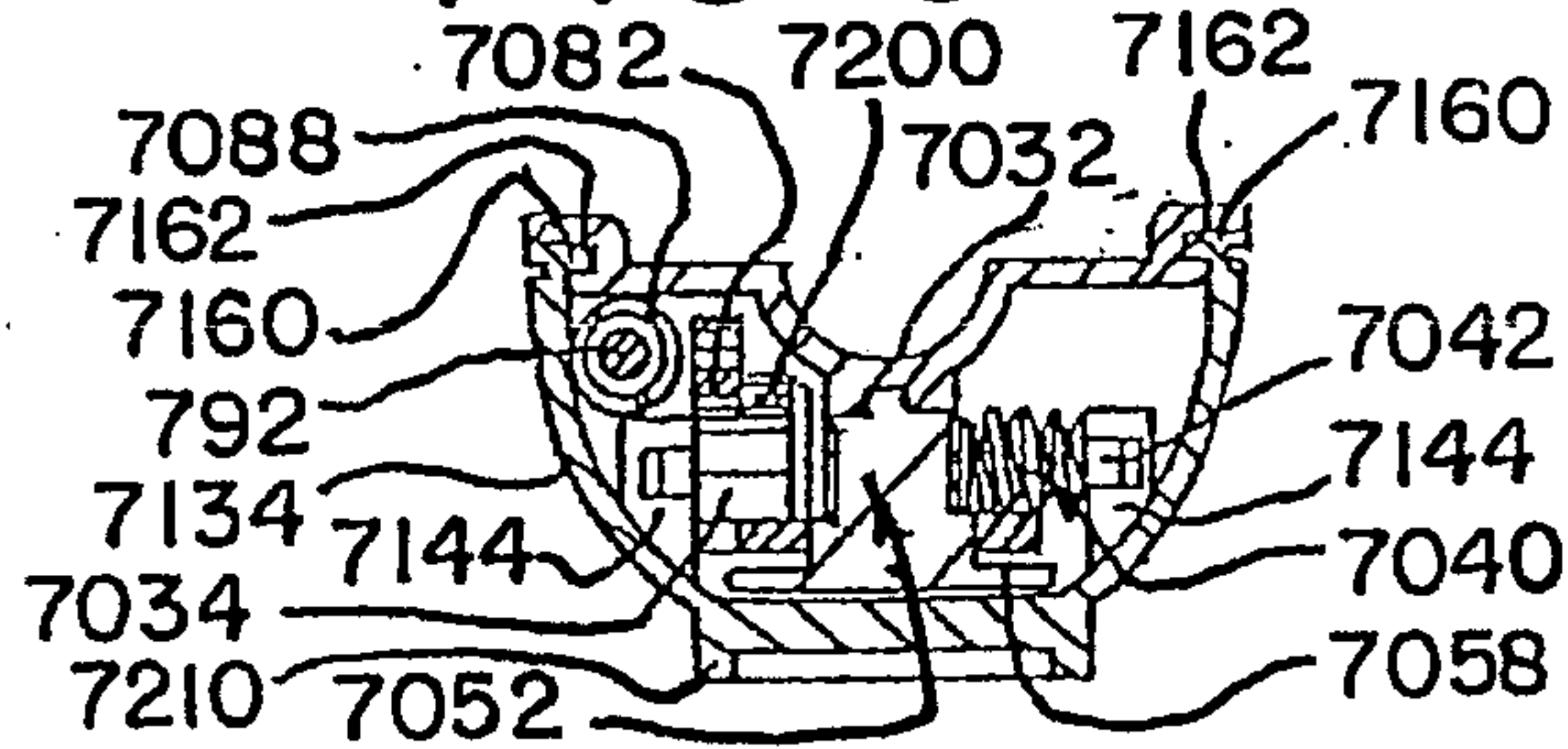


FIG. 90

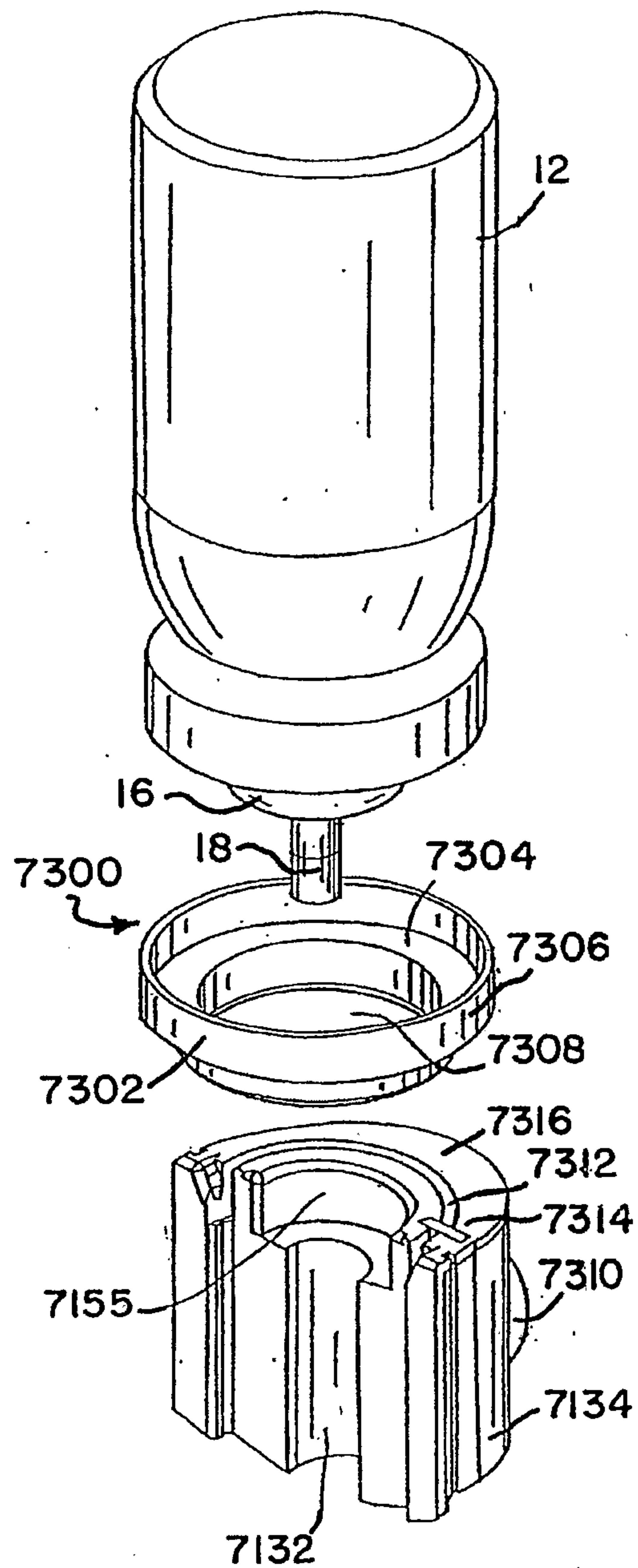


FIG. 93

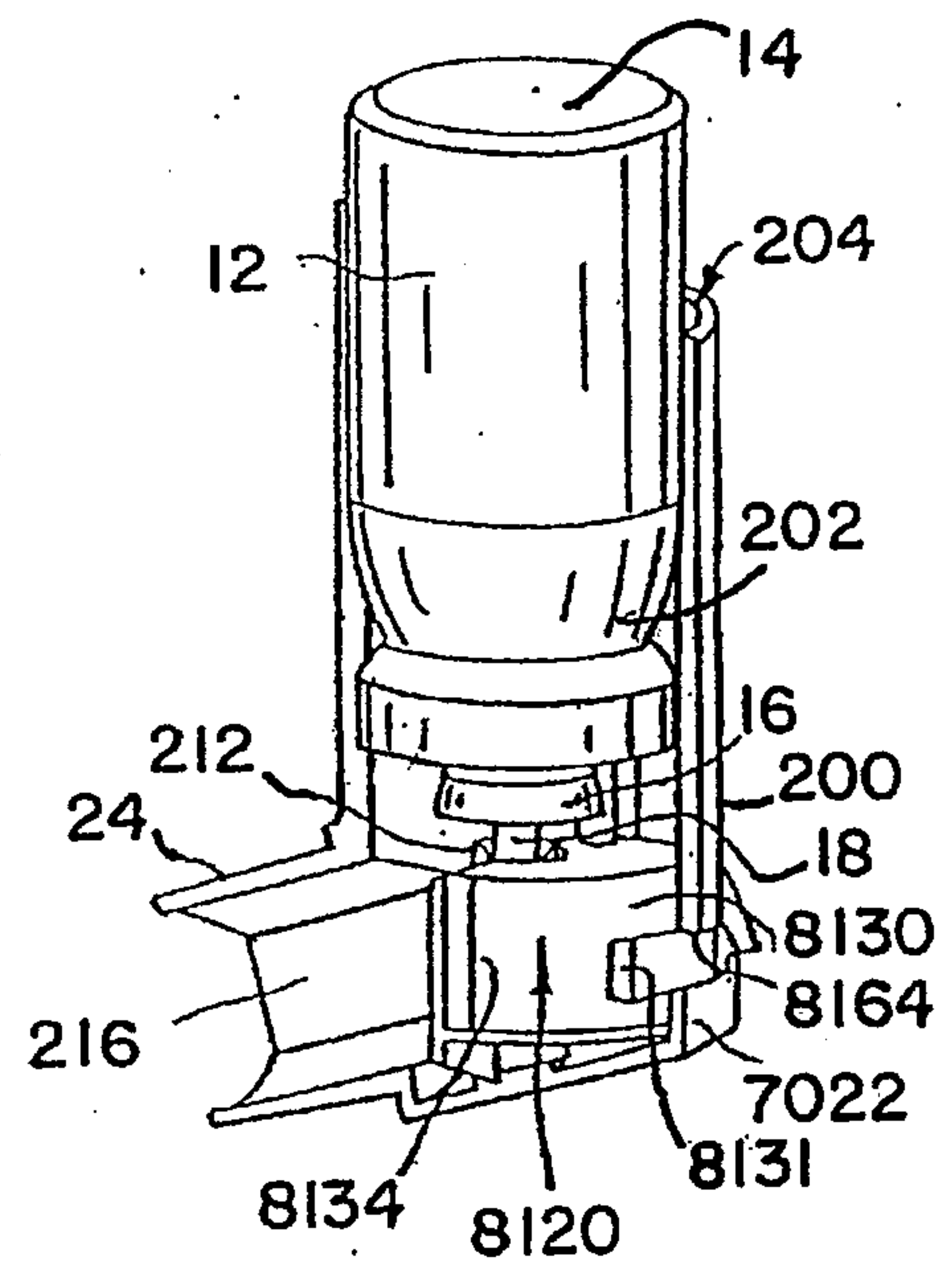


FIG. 92

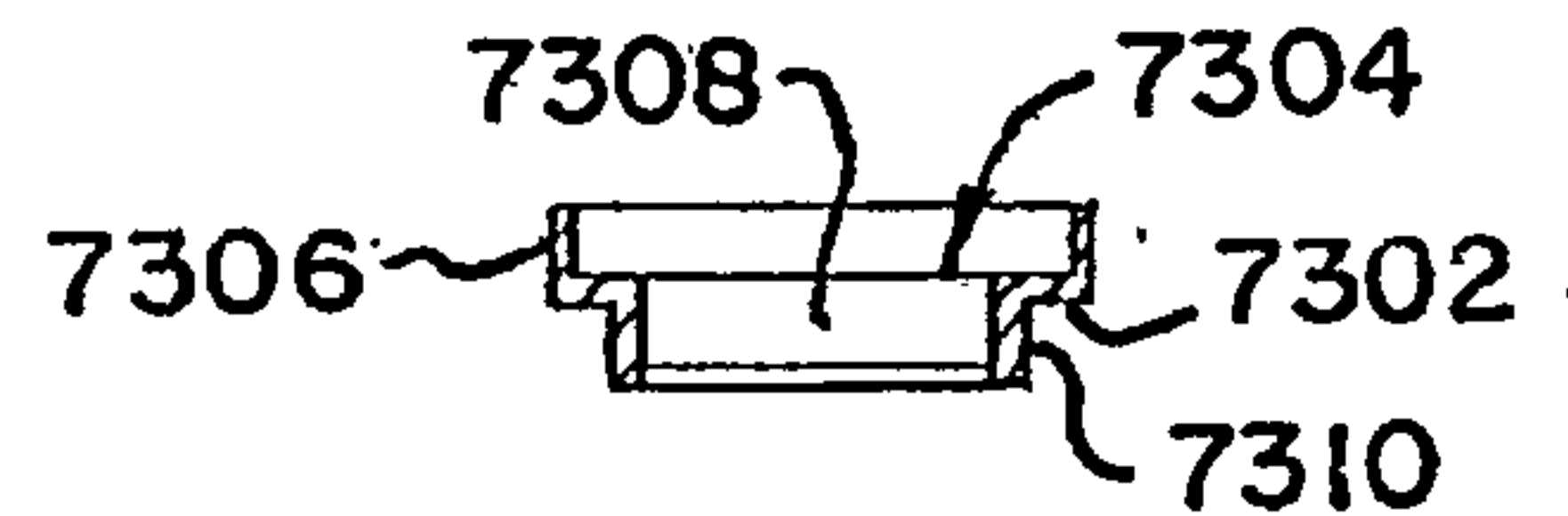


FIG. 91

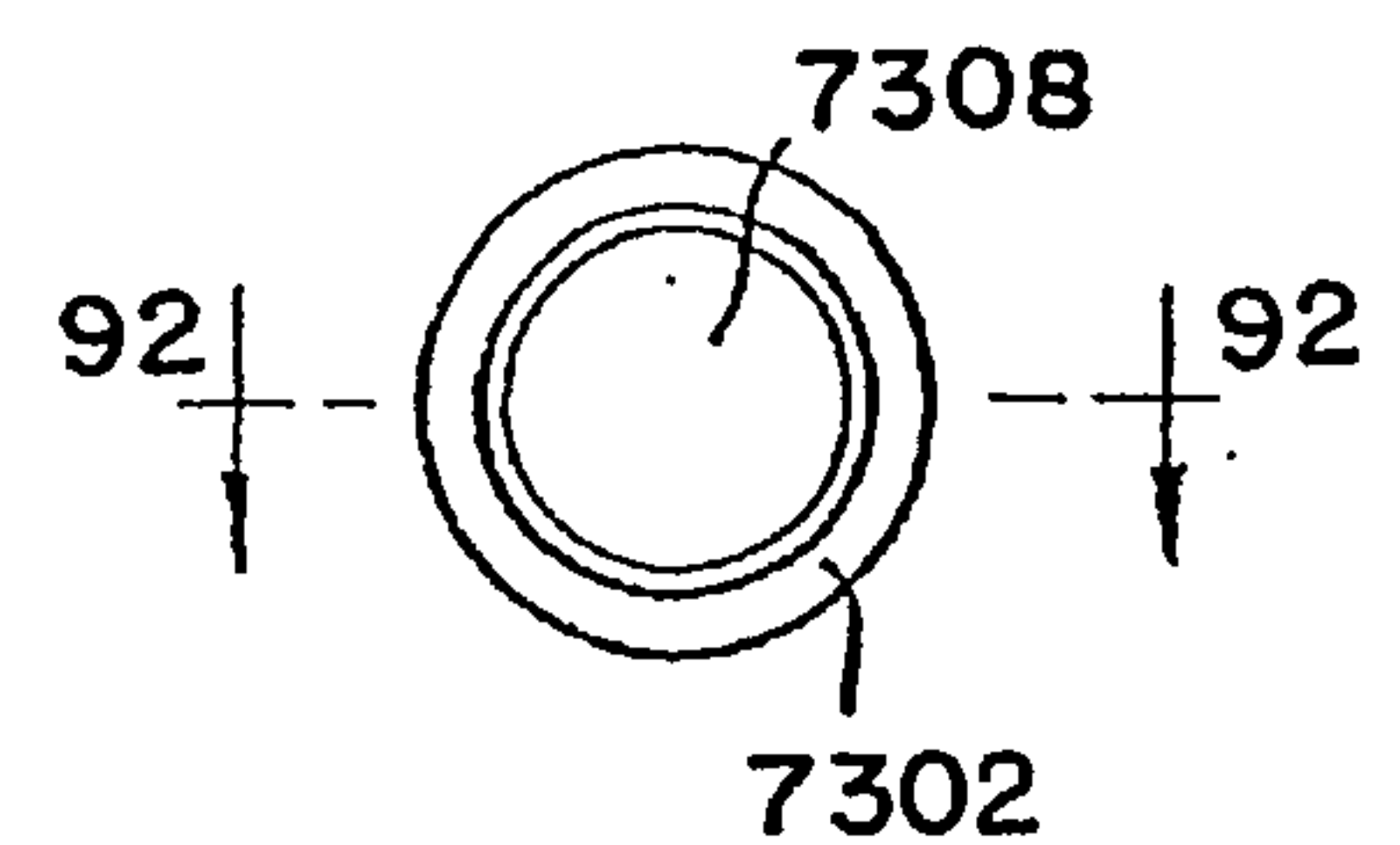


FIG. 94

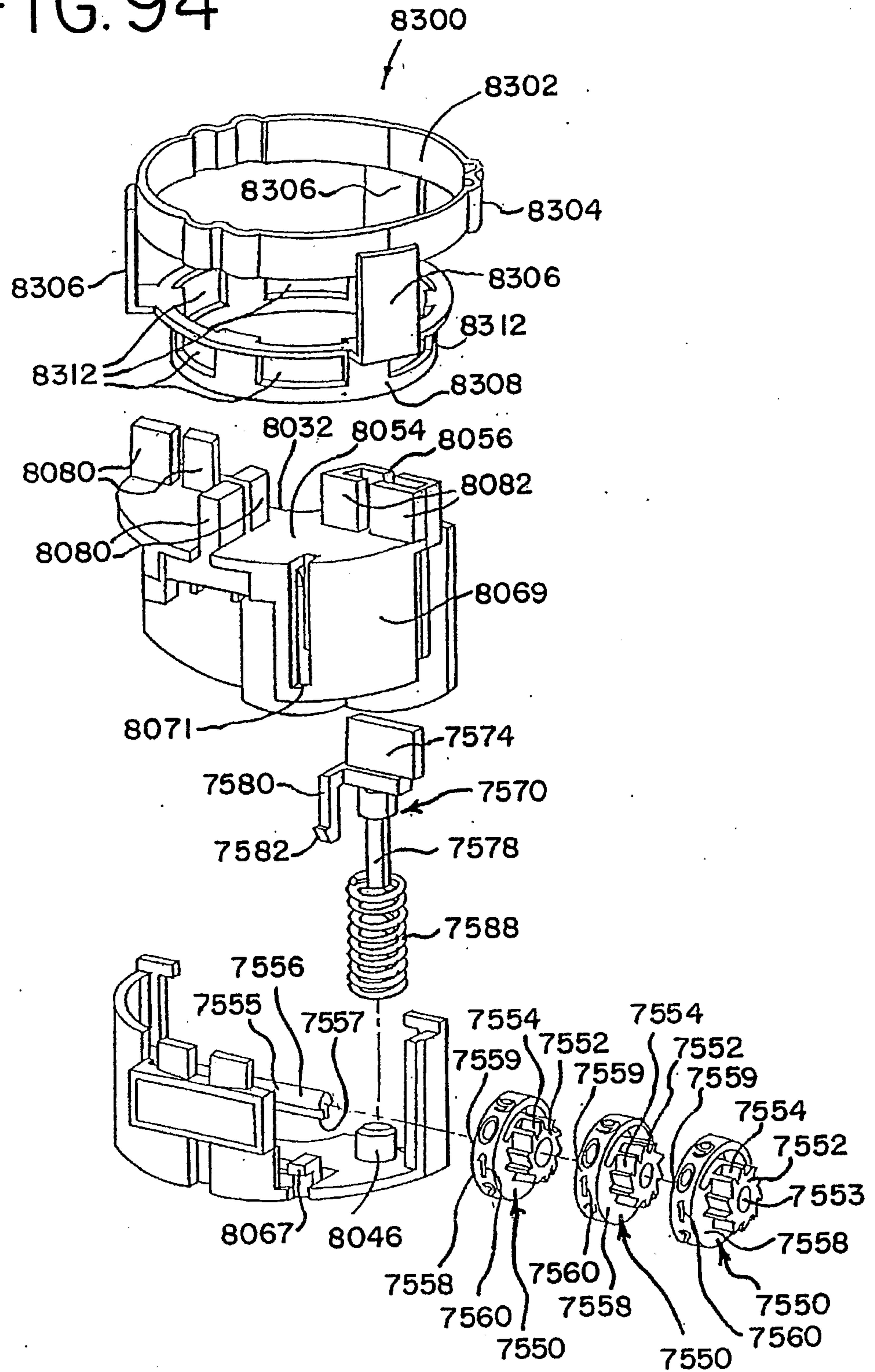


FIG. 95

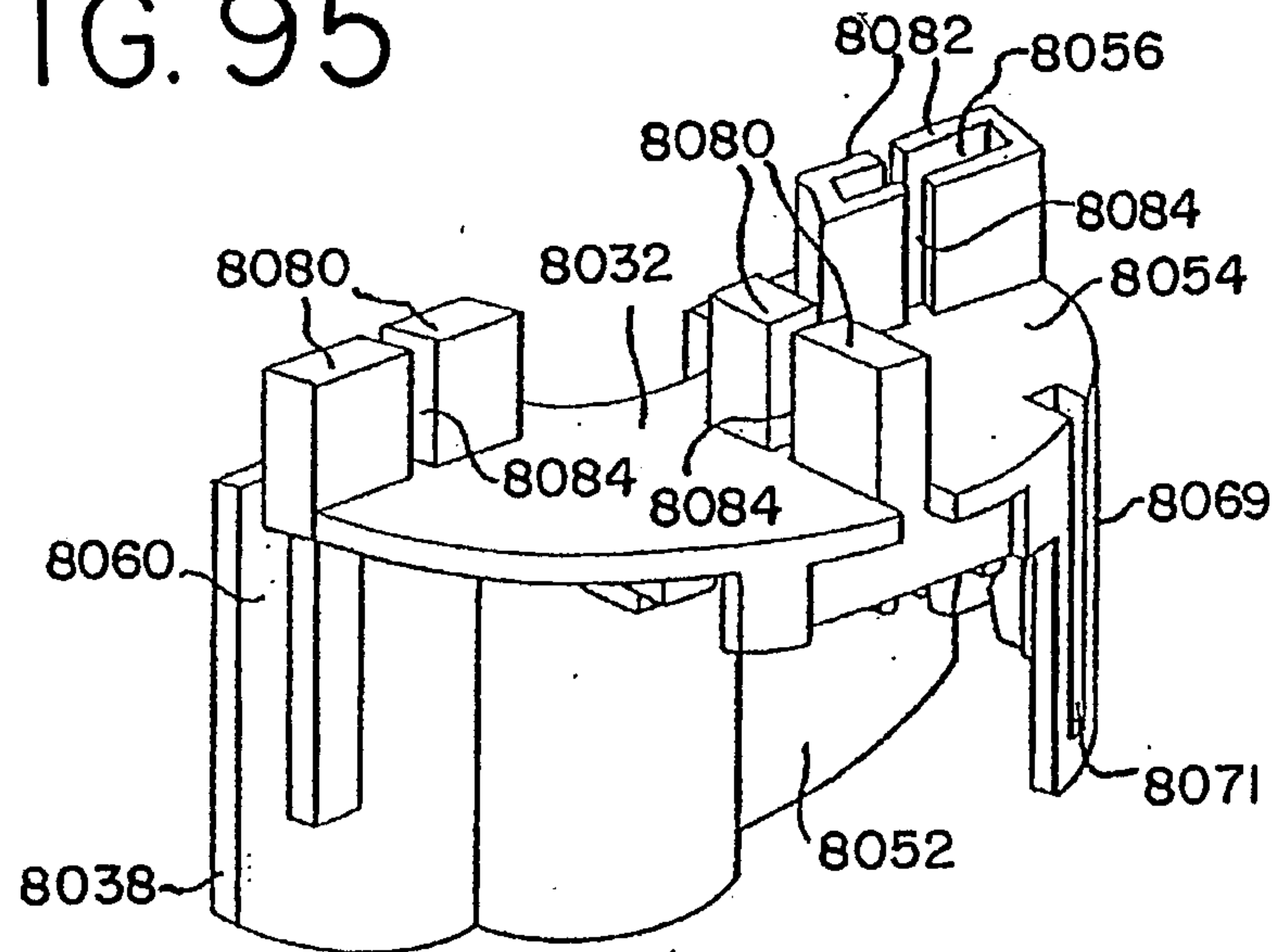


FIG. 96

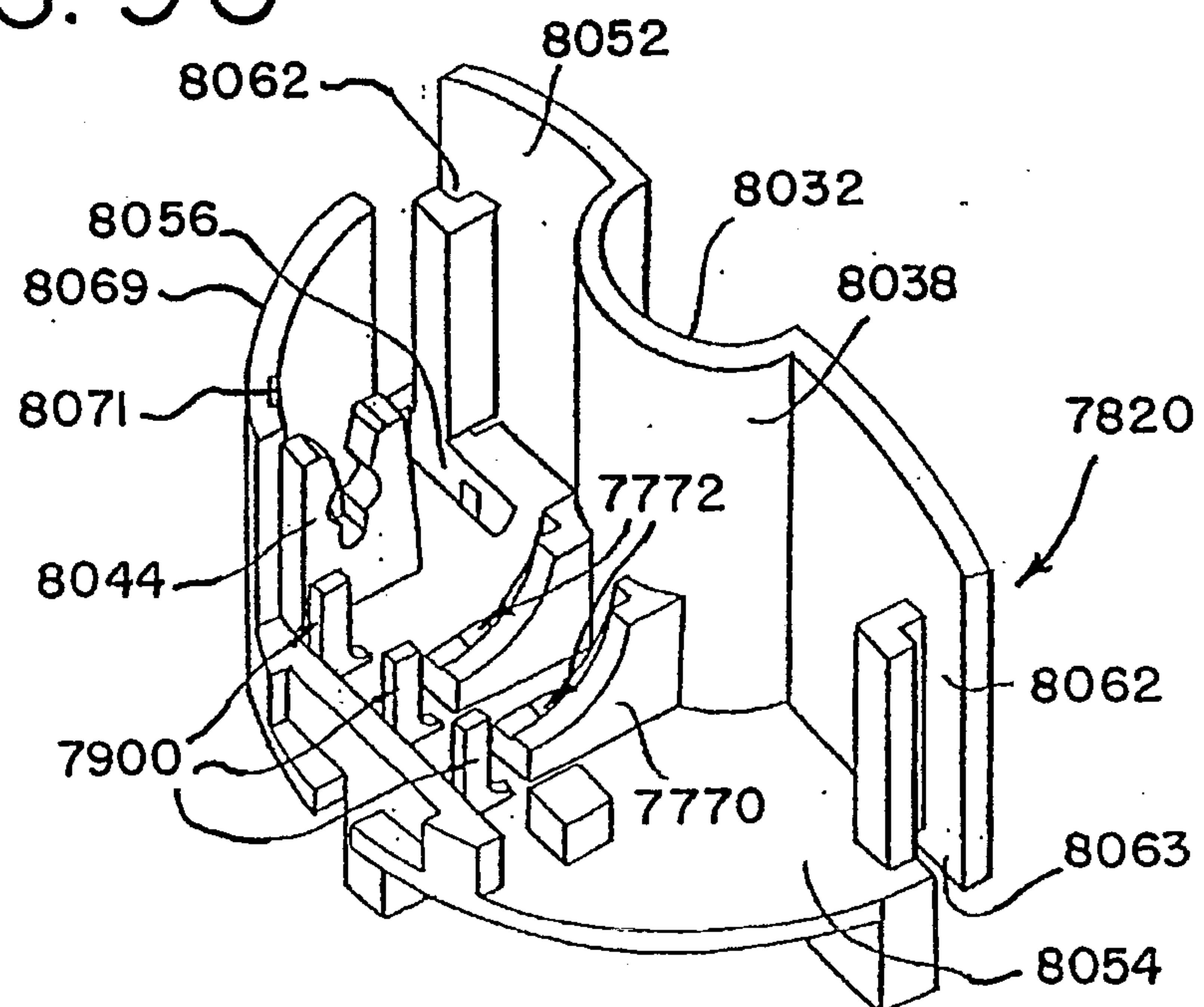


FIG. 97

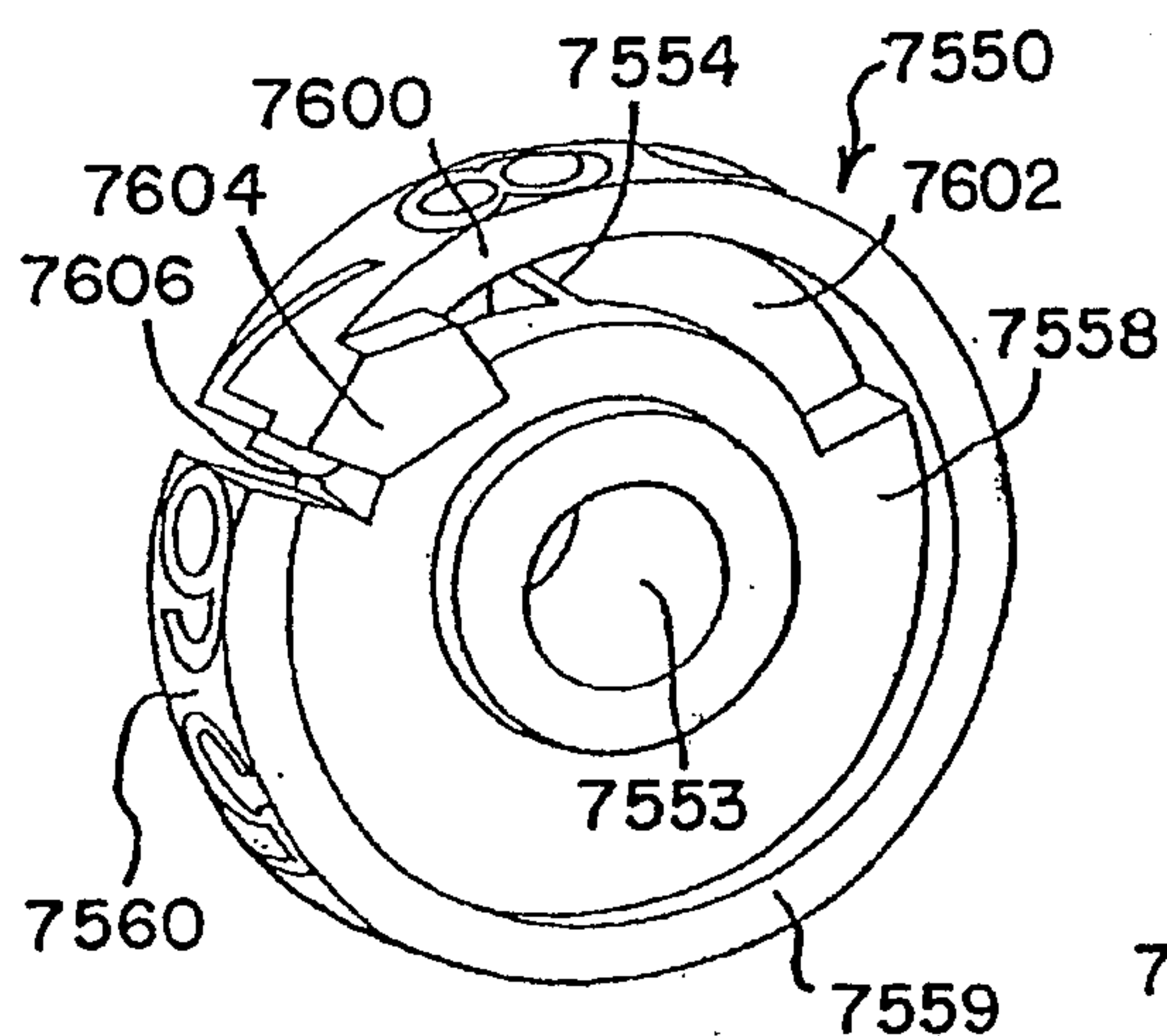


FIG. 98

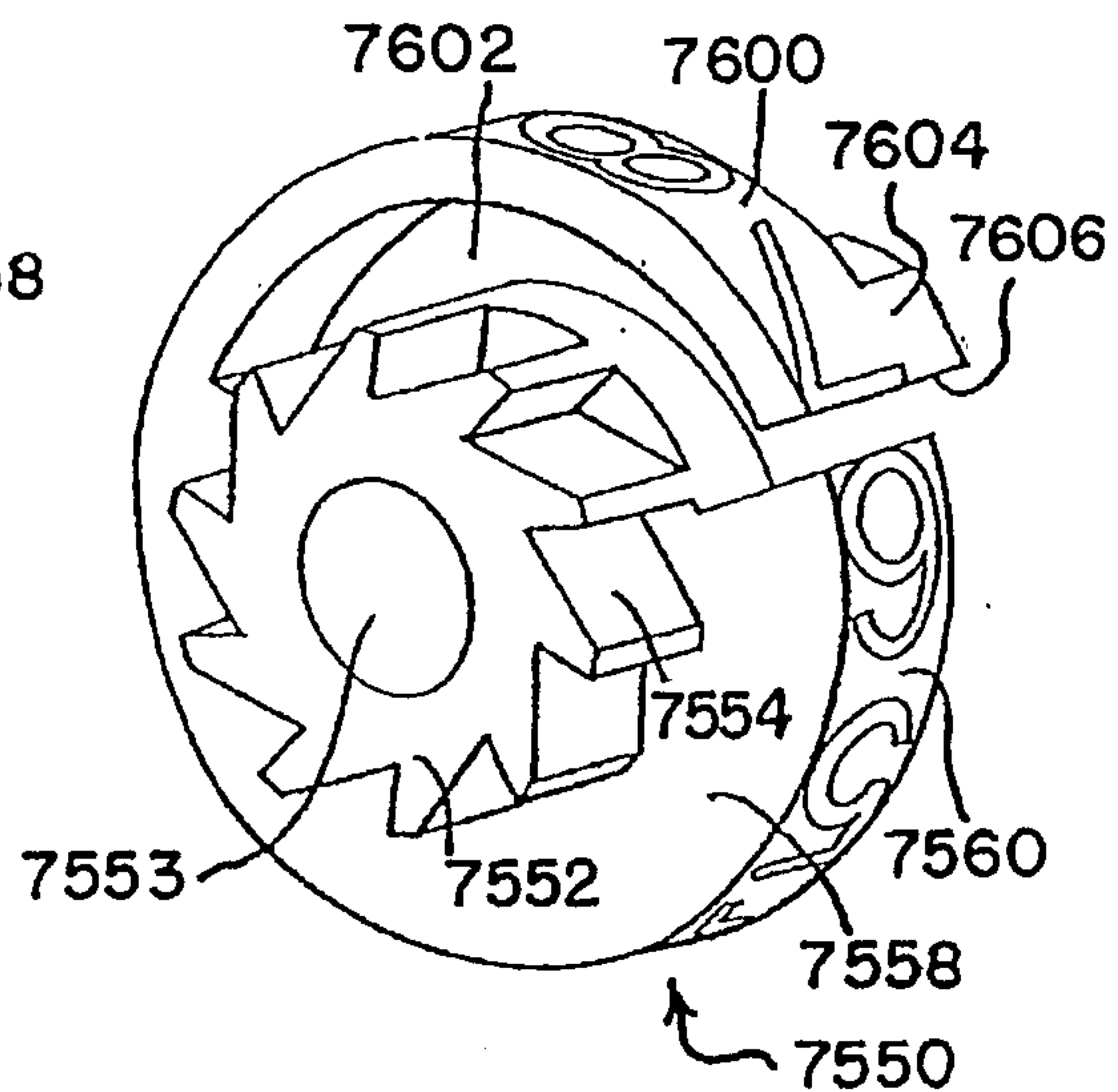


FIG. 100

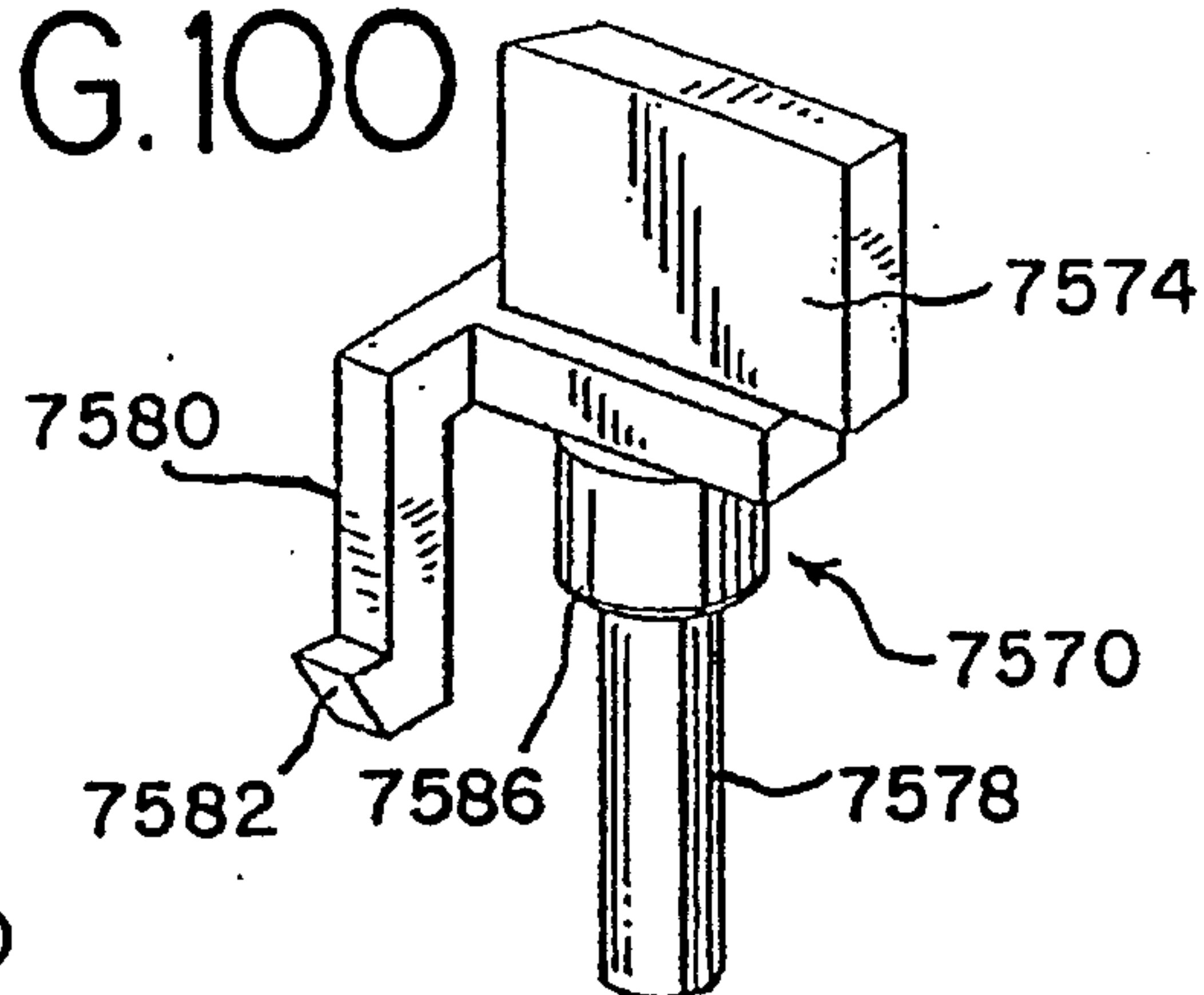


FIG. 99

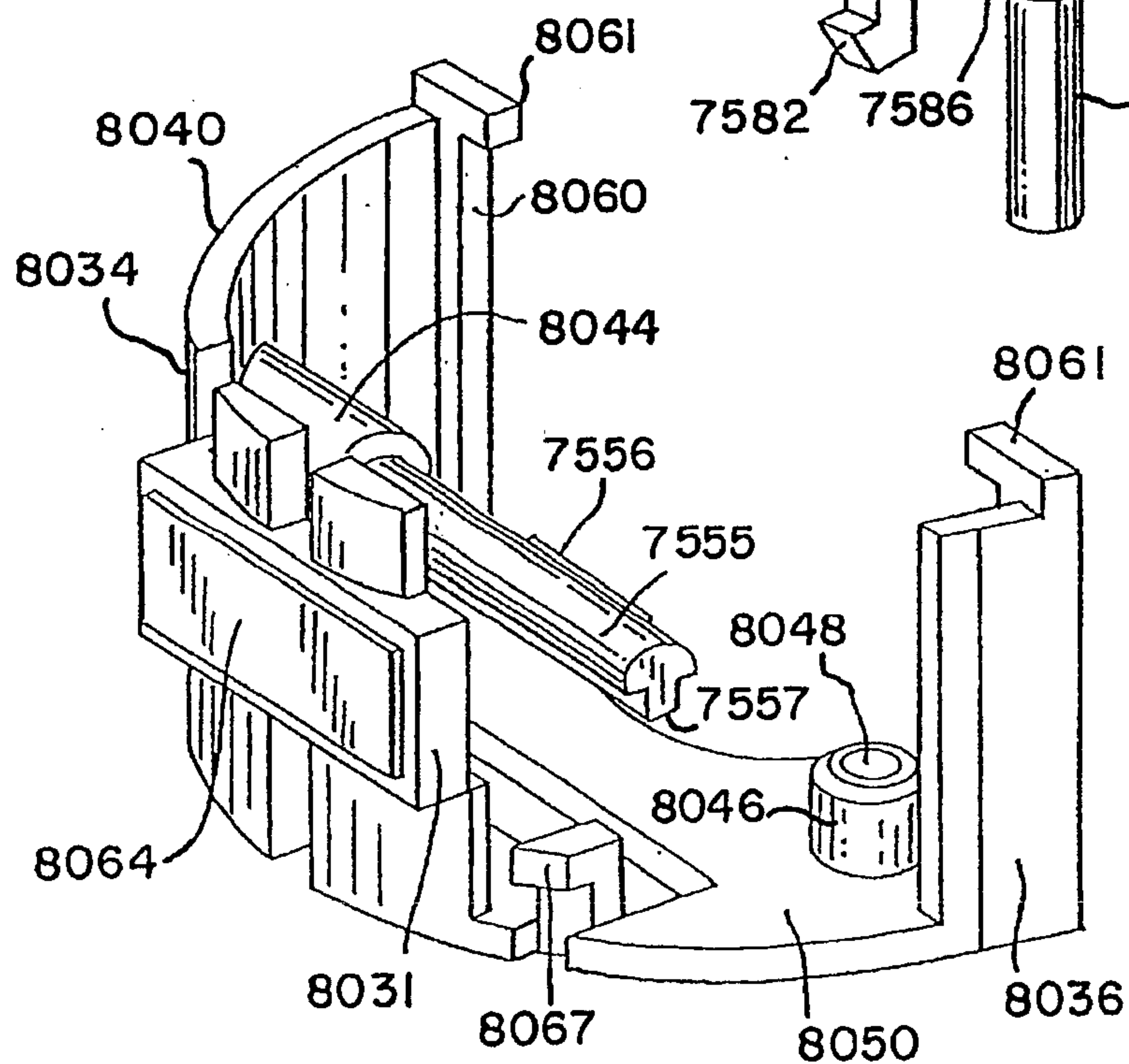


FIG. 101

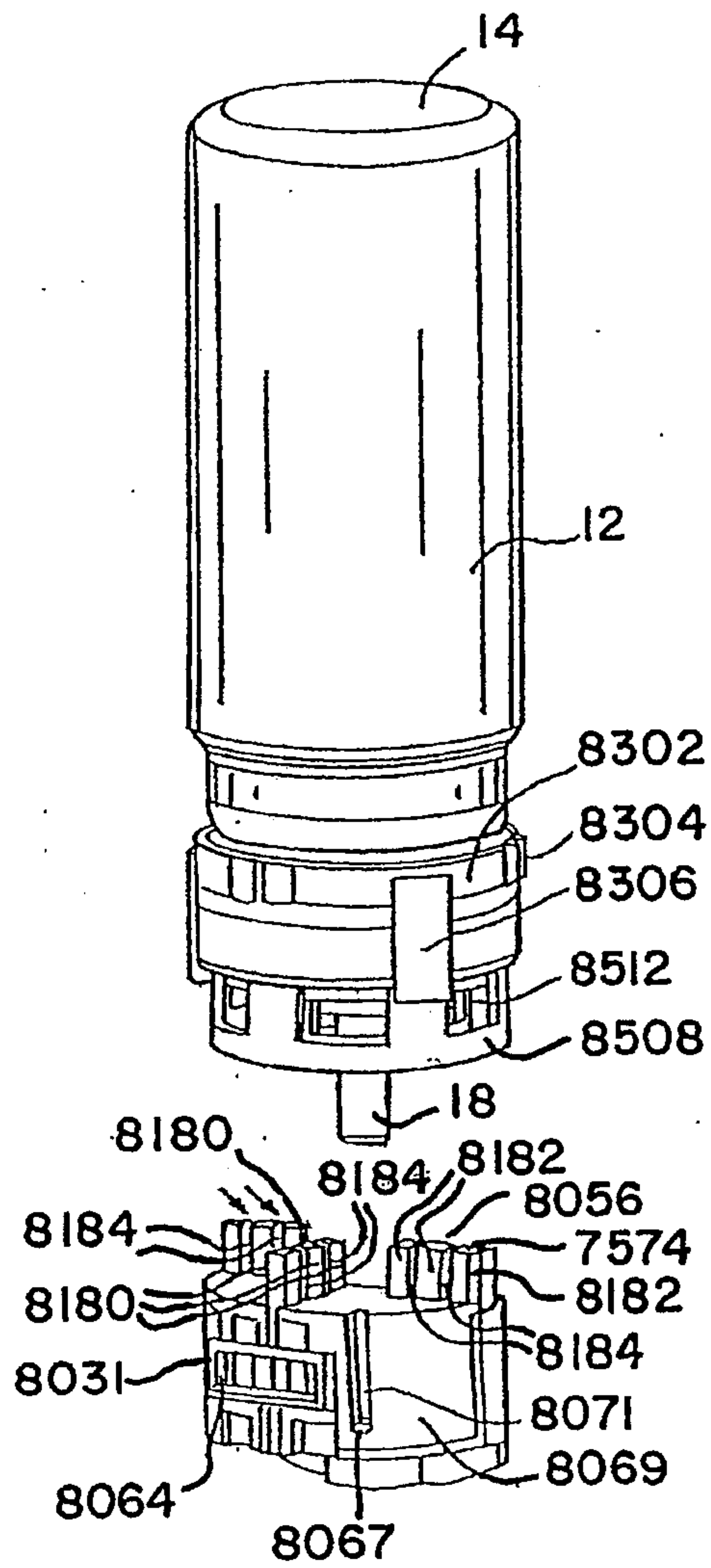


FIG. 102

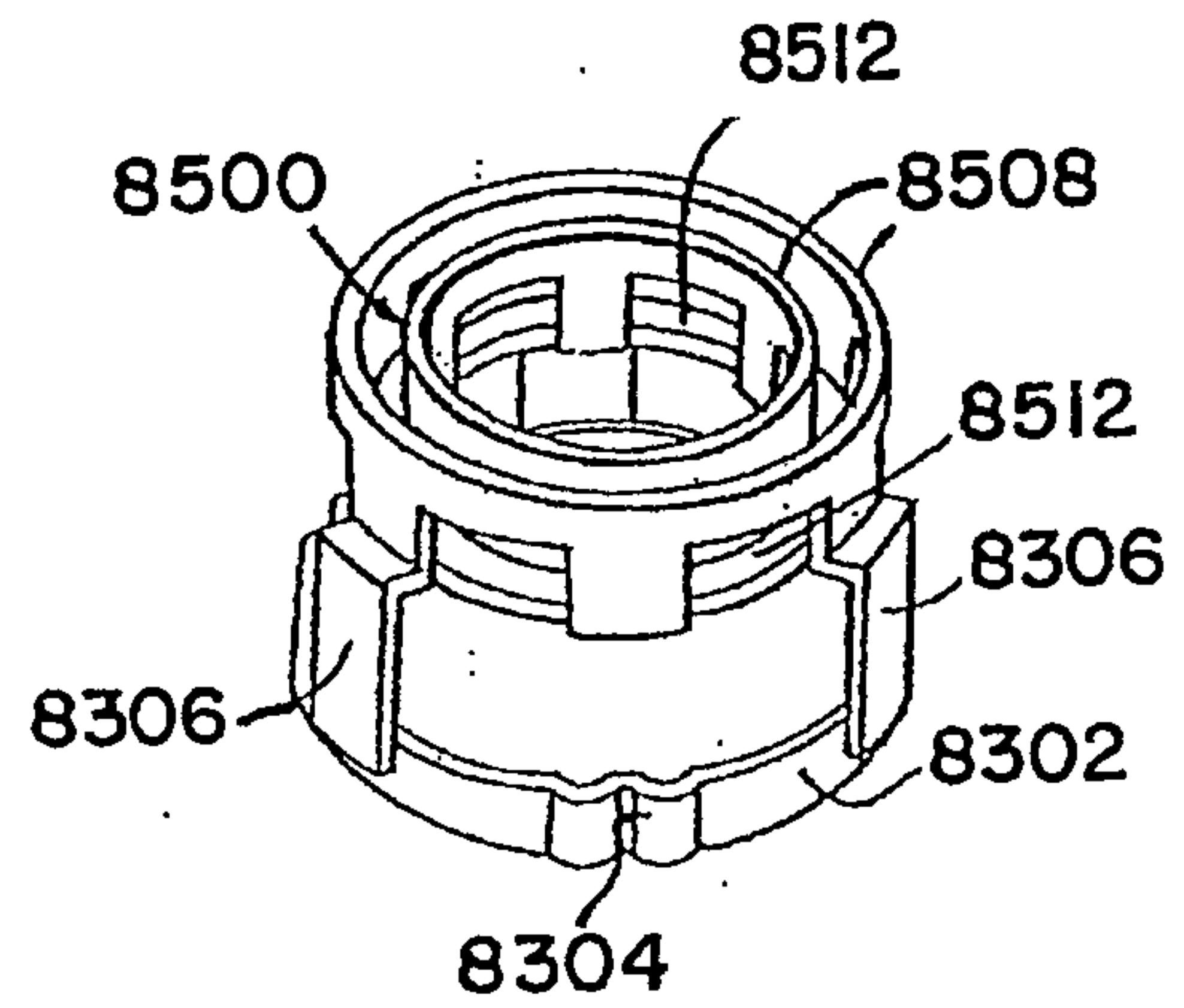


FIG. 103

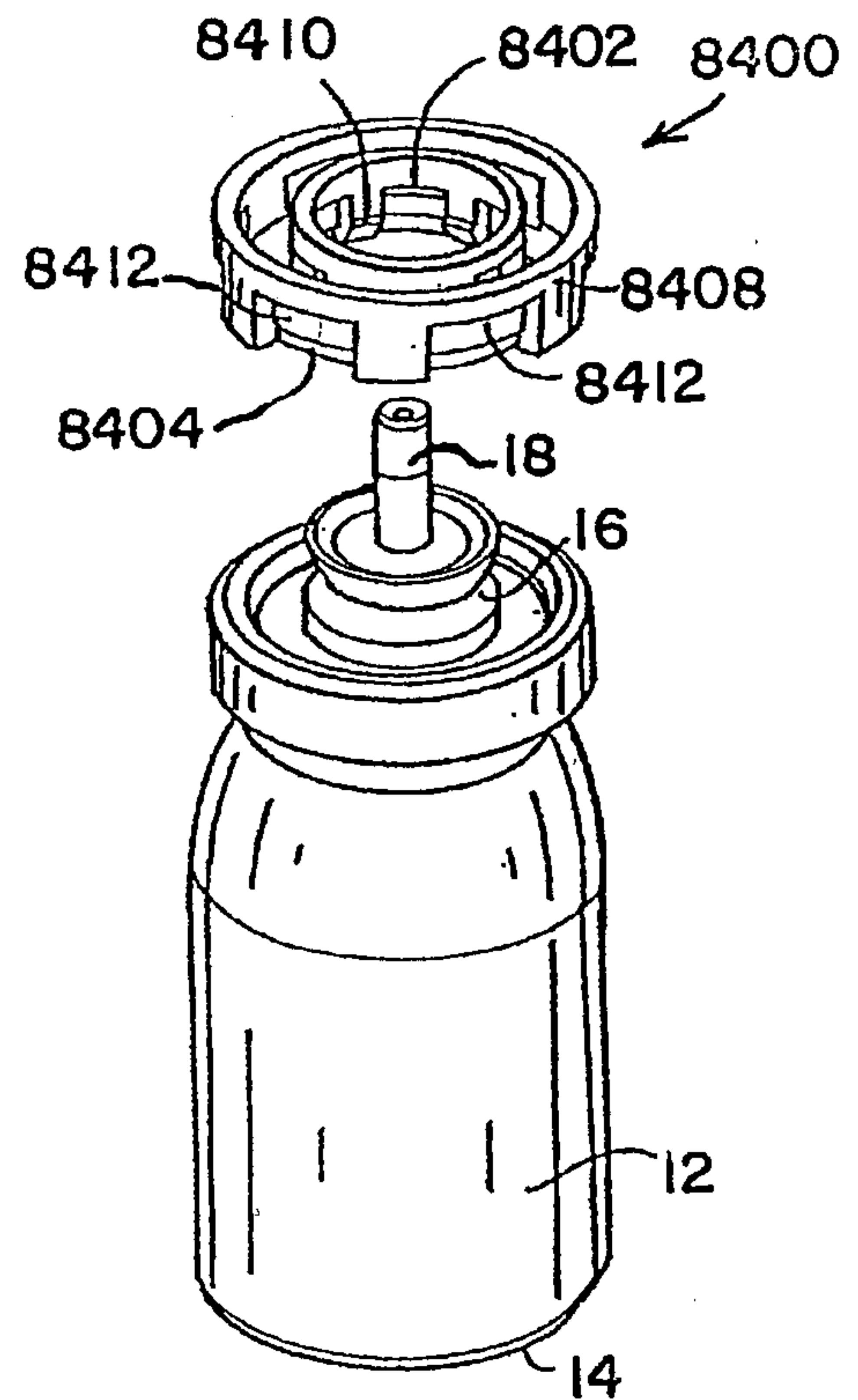


FIG. 104

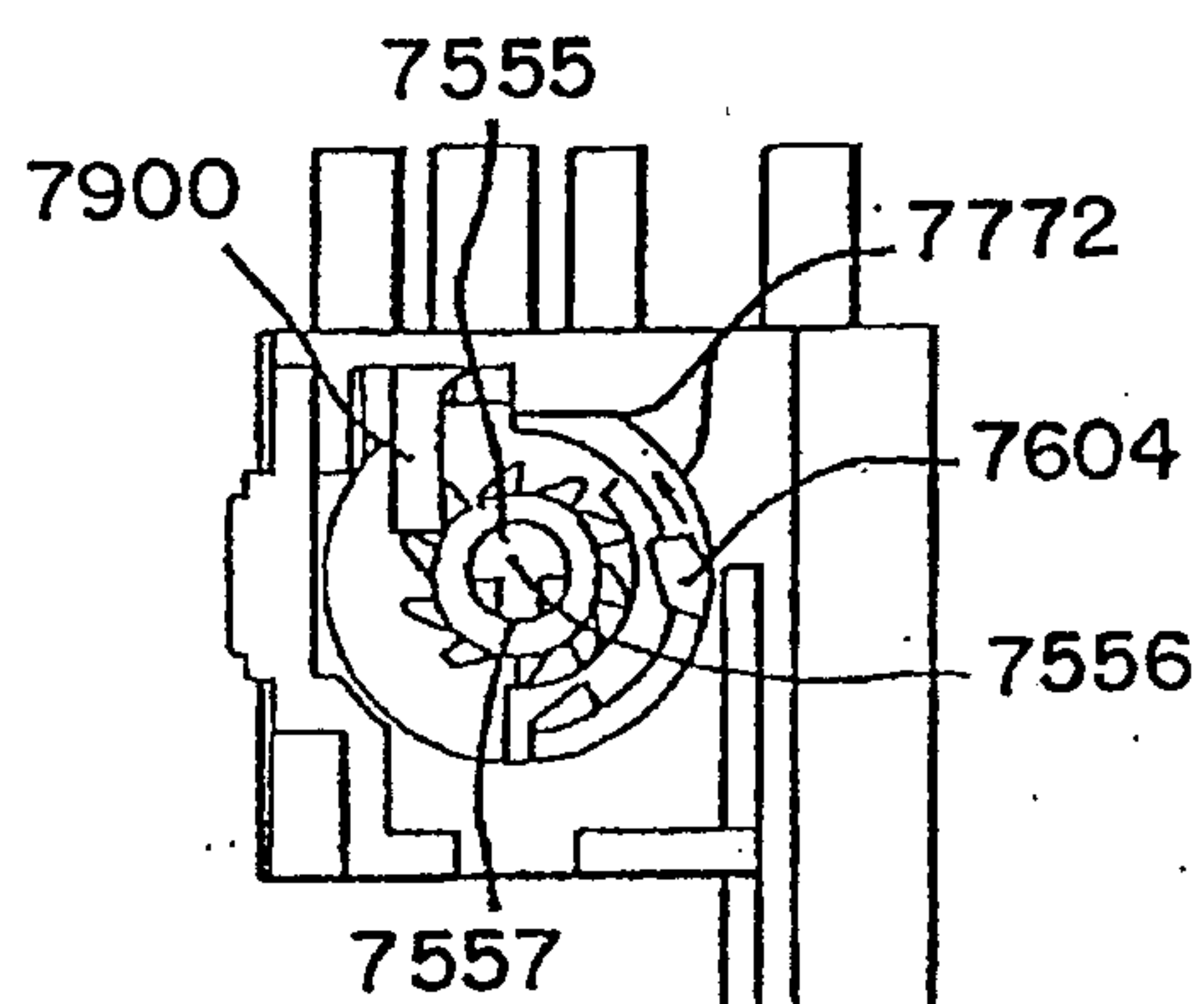


FIG. 105

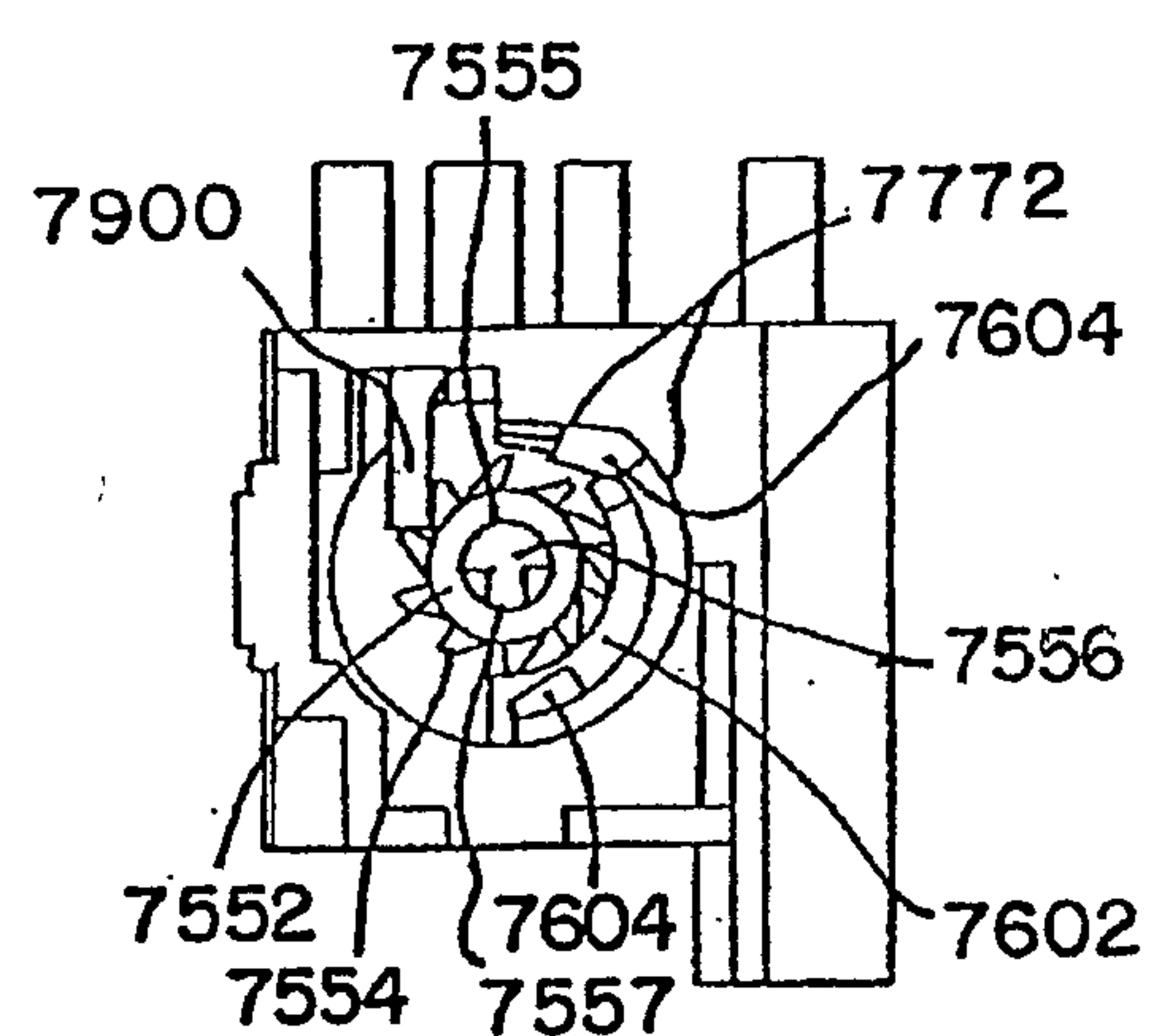


FIG. 106

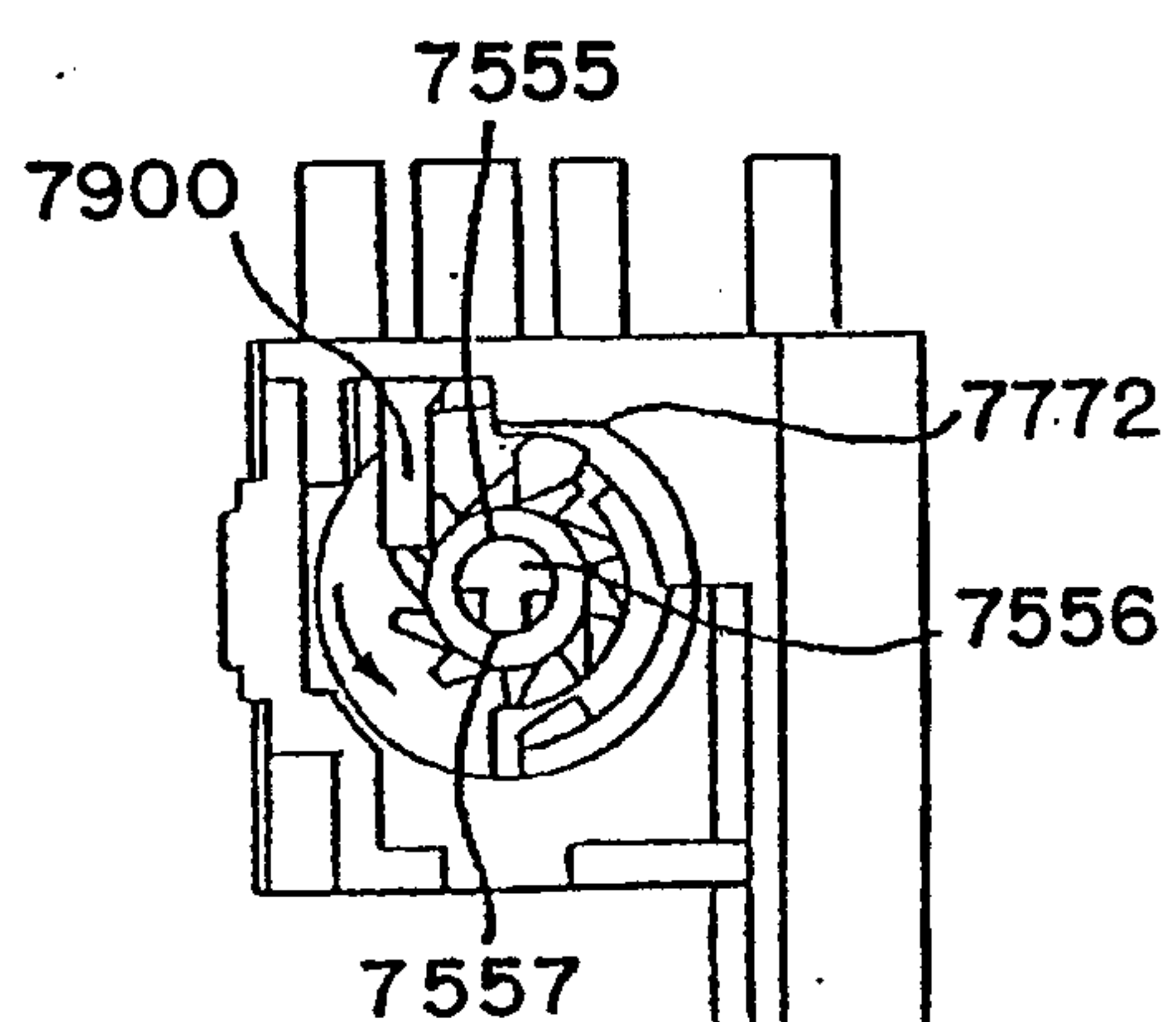


FIG. 107

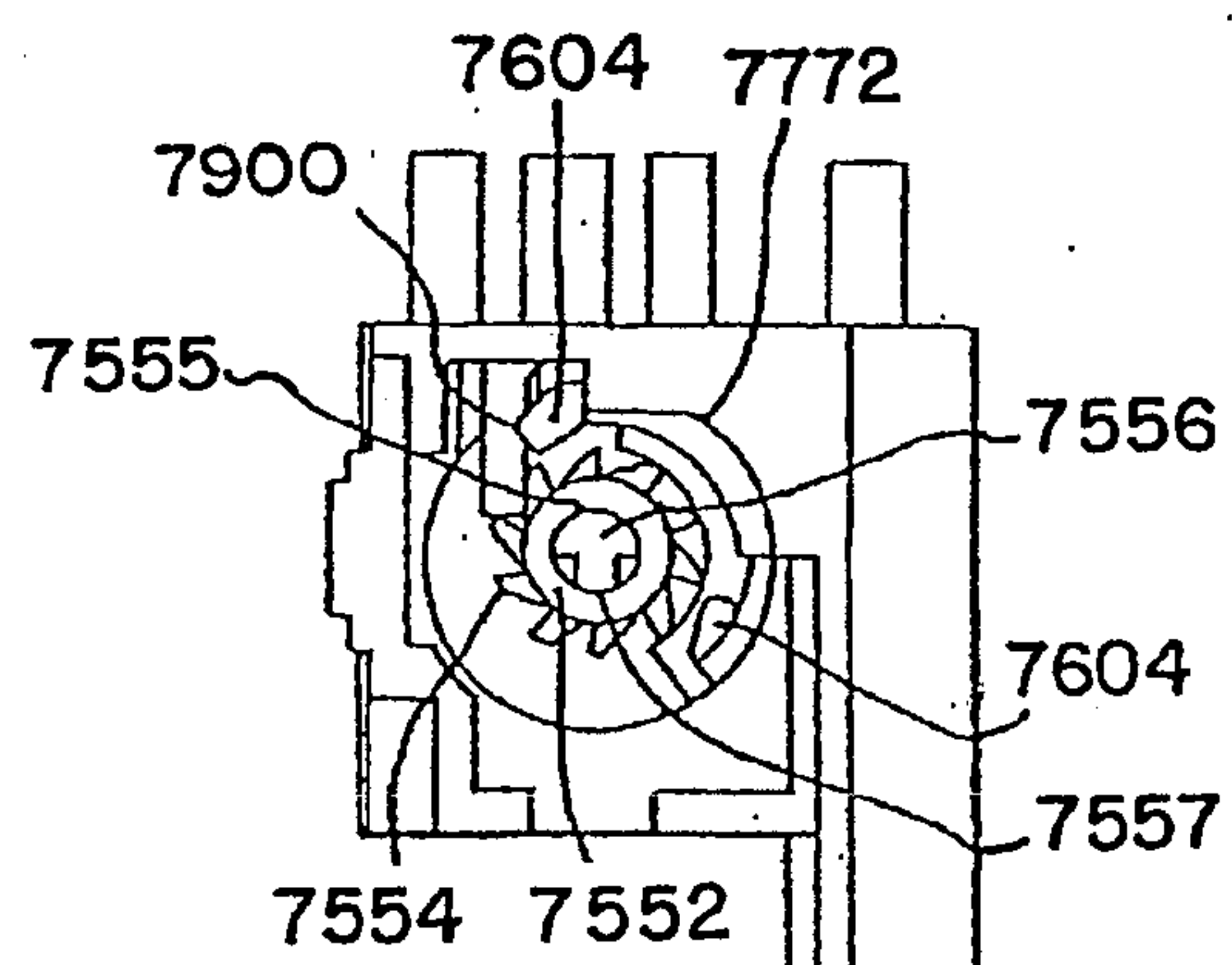


FIG. 108.

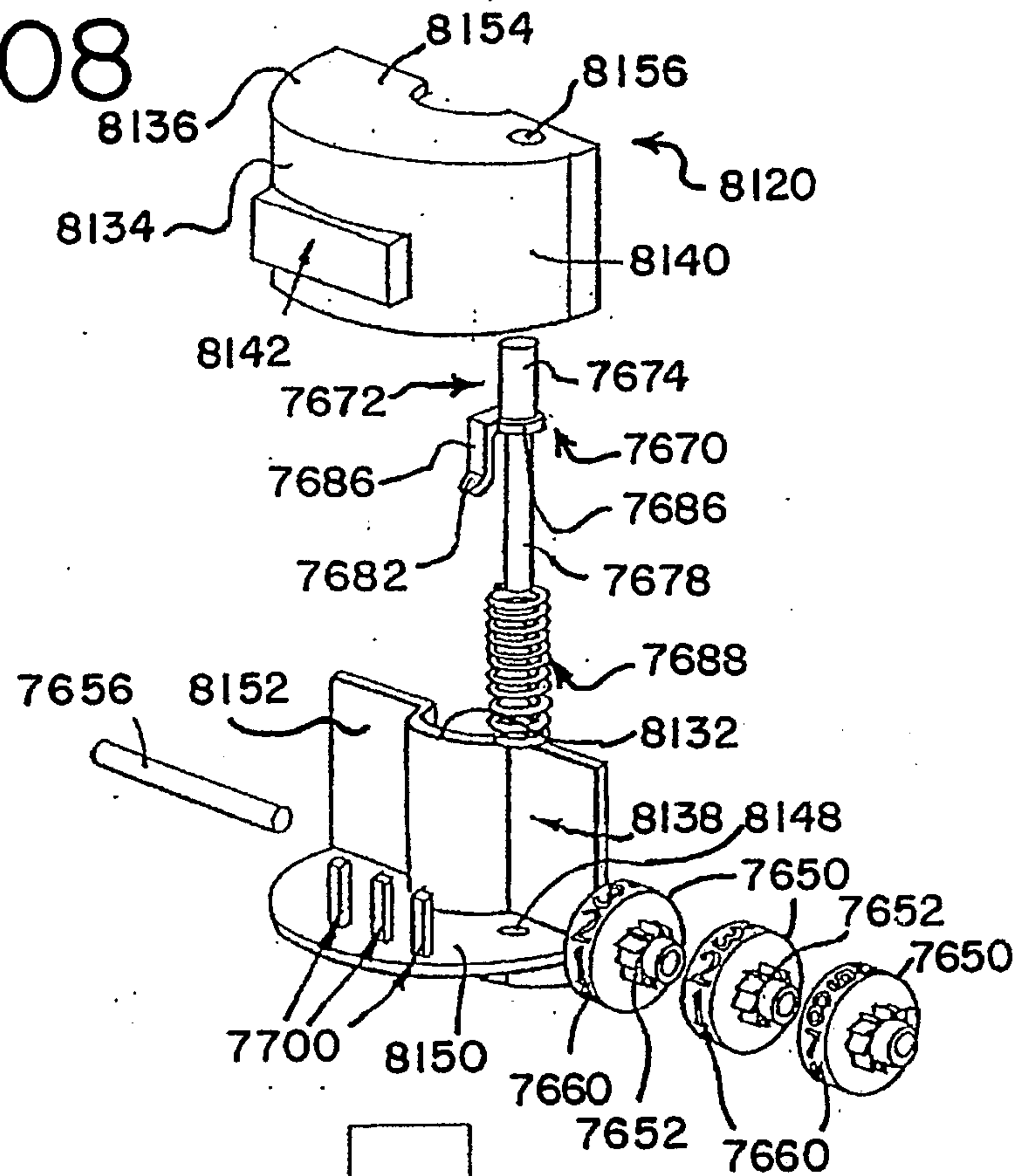


FIG. 109

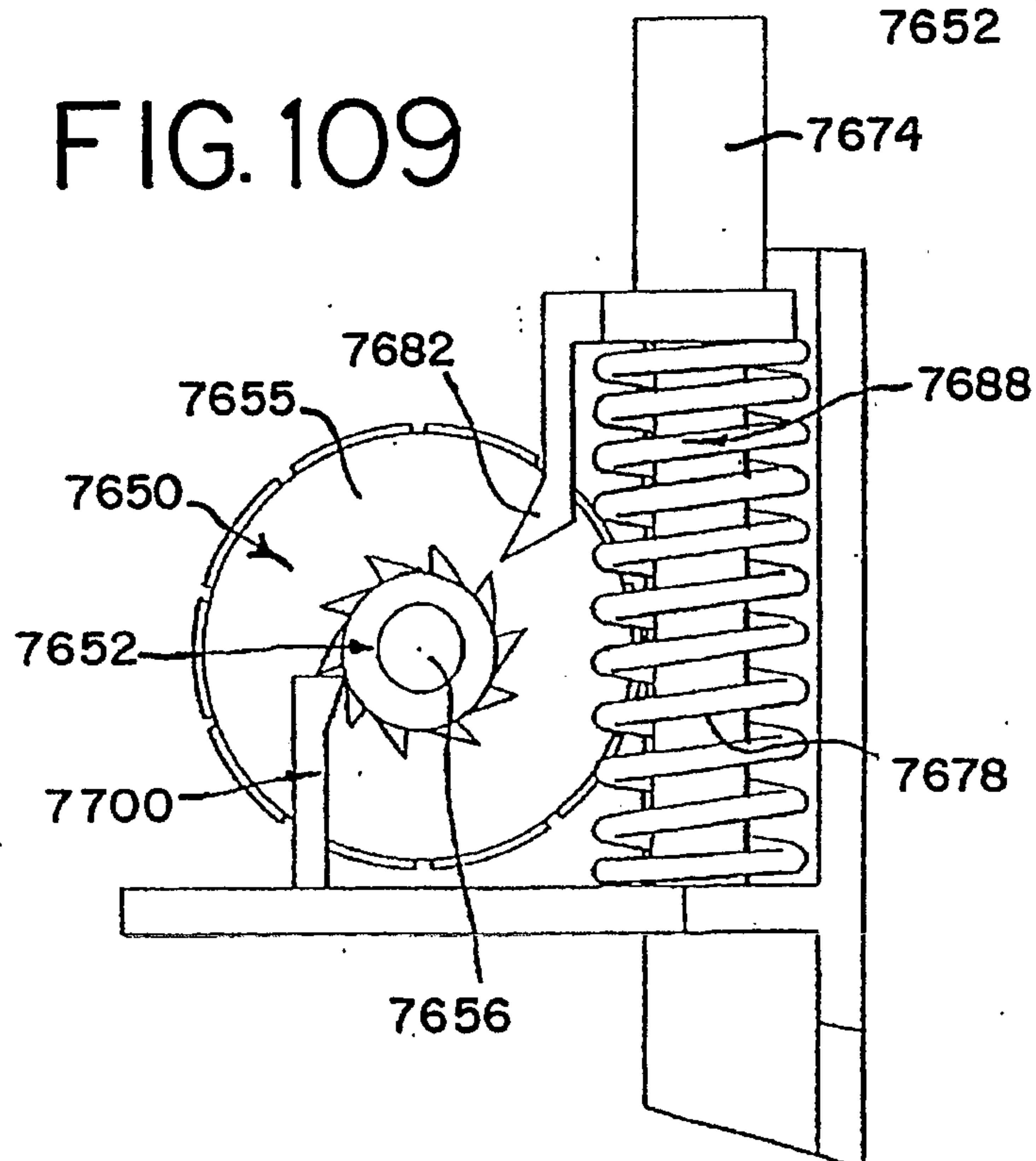


FIG. 110

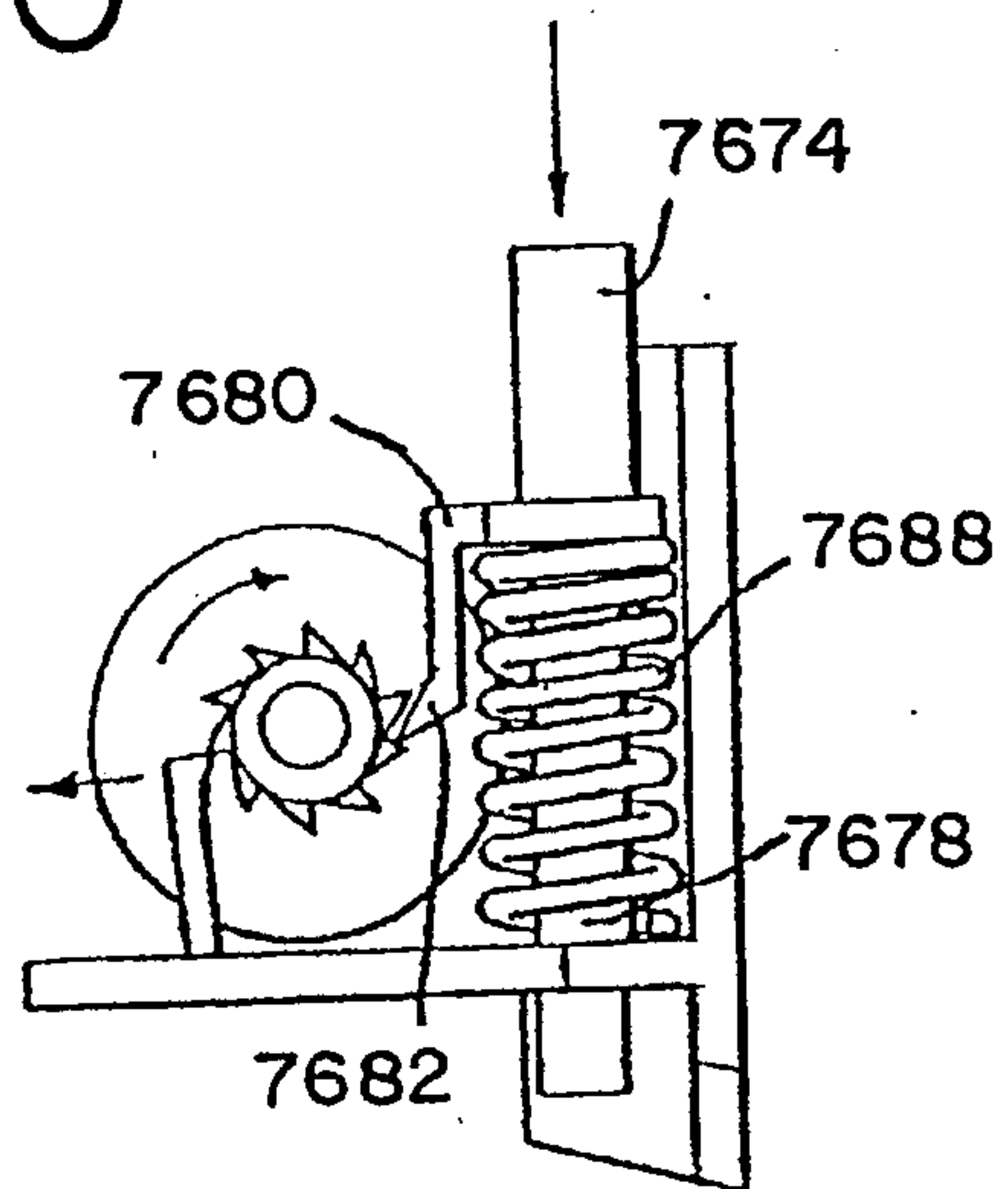


FIG. 111

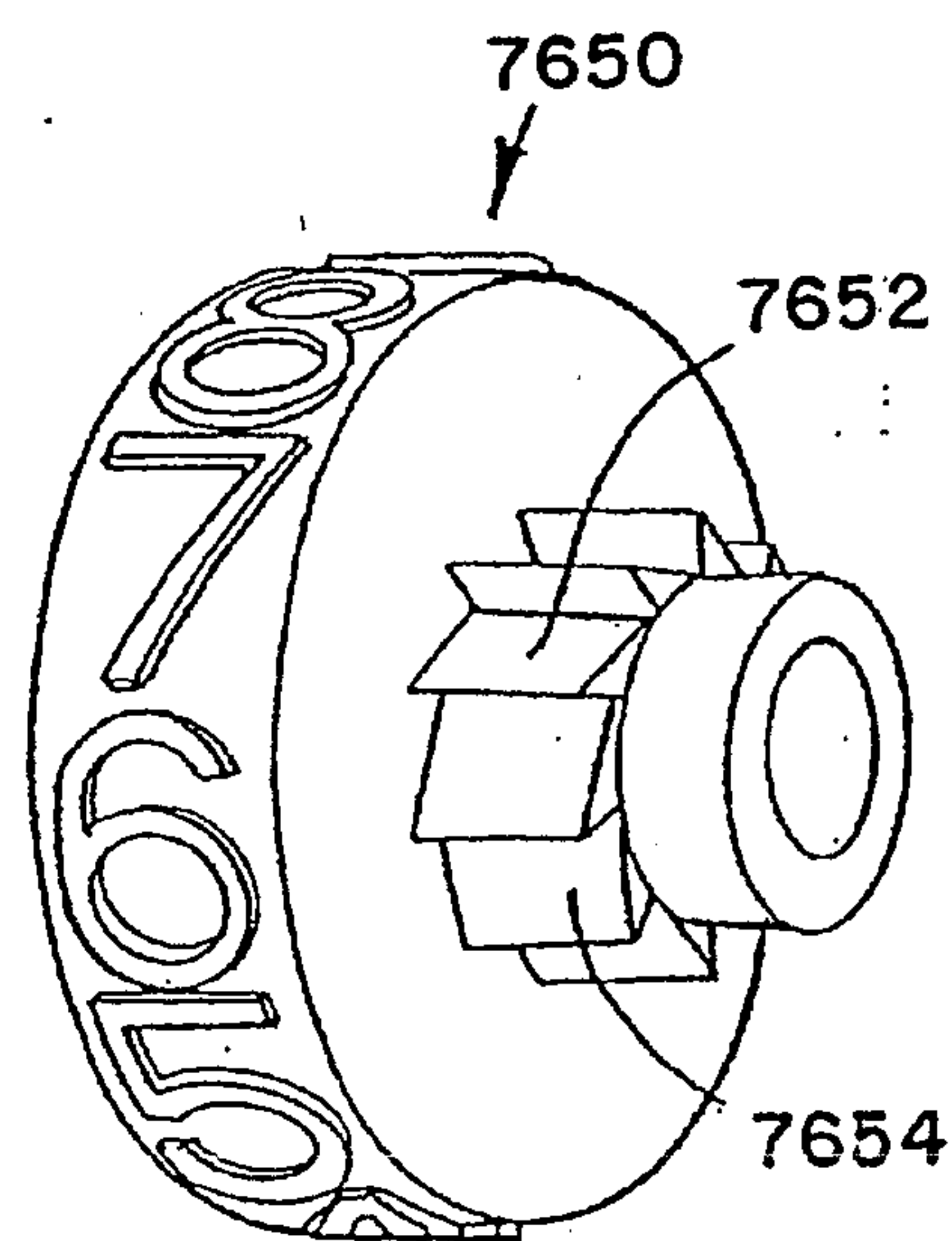
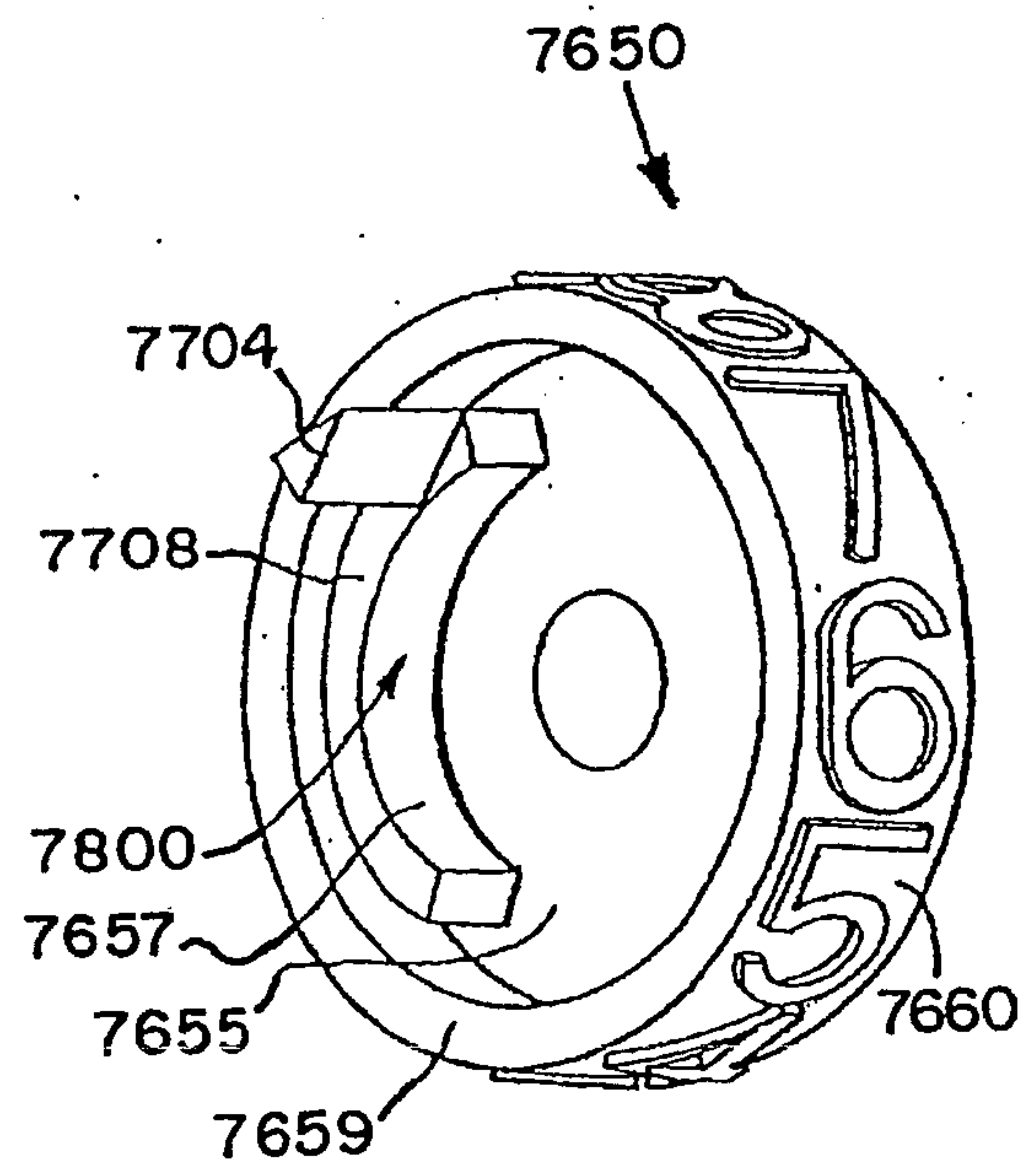


FIG. 112



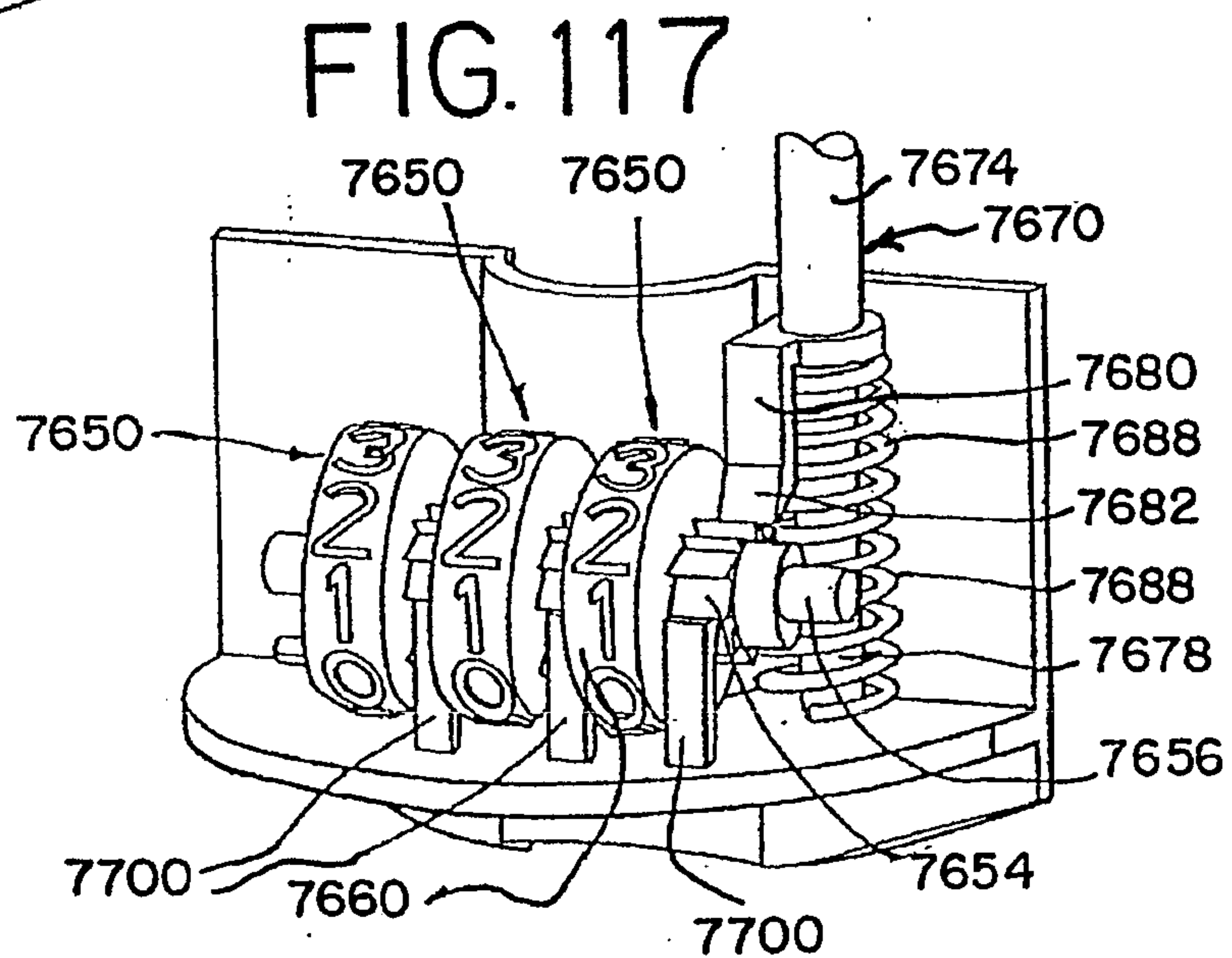
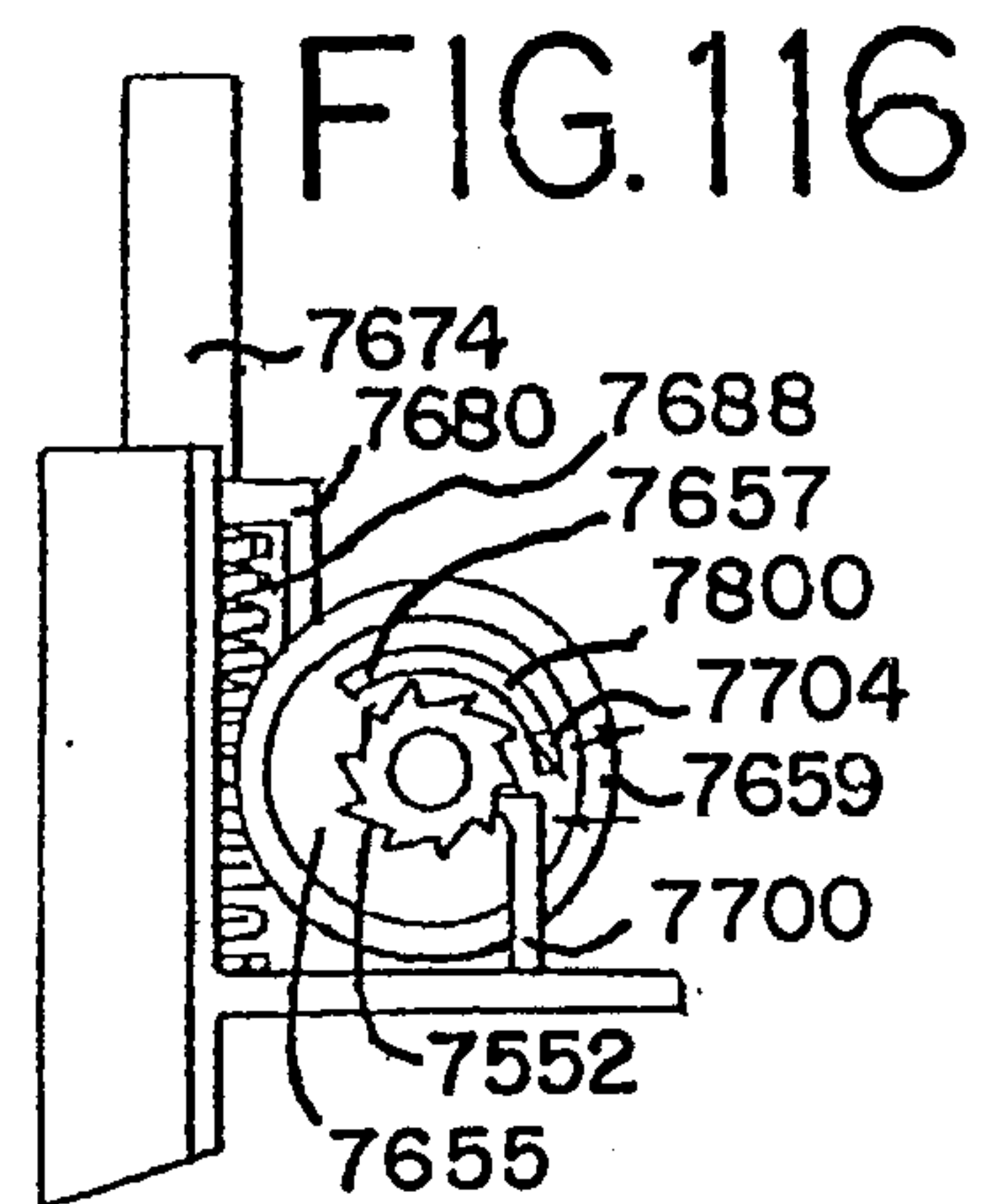
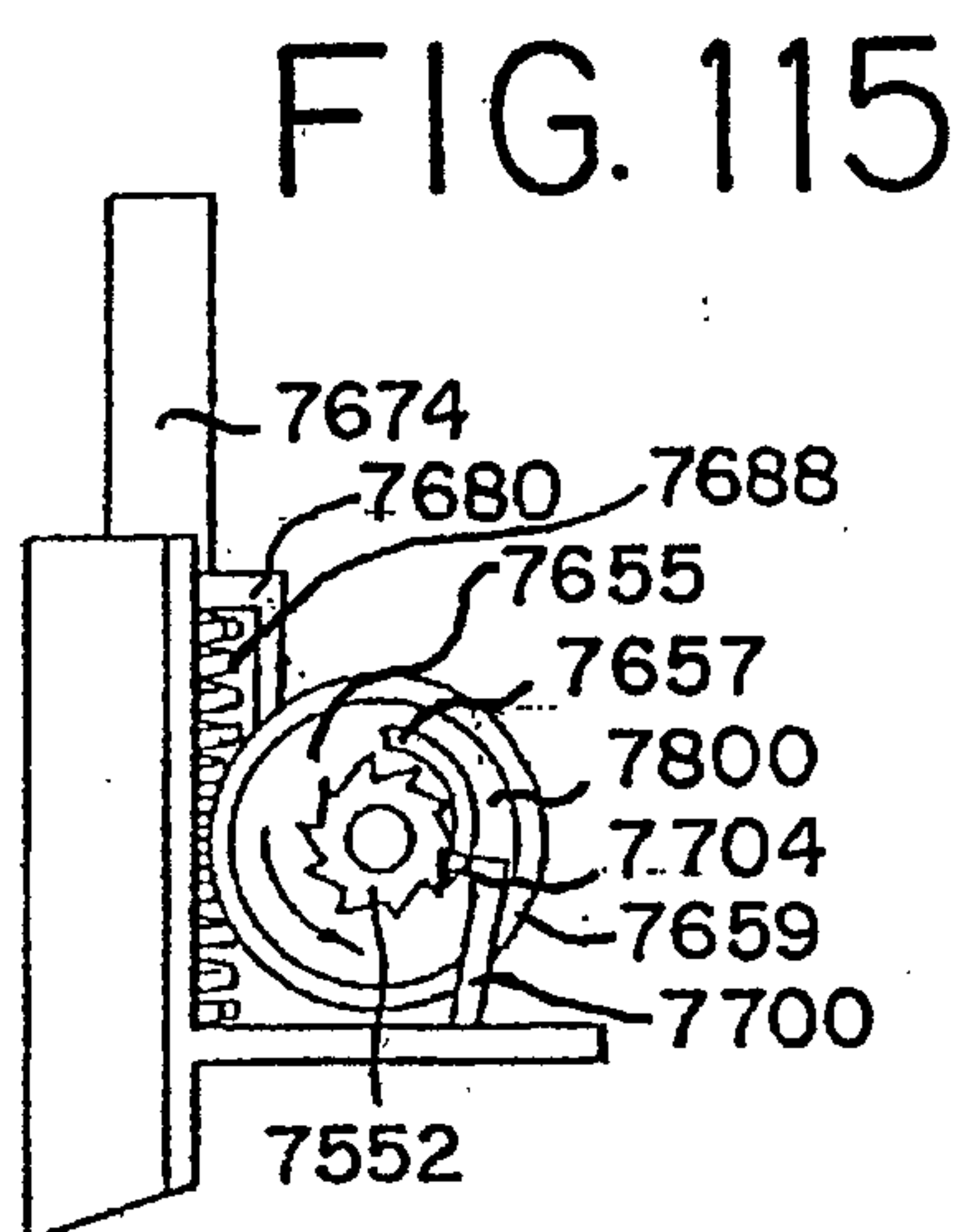
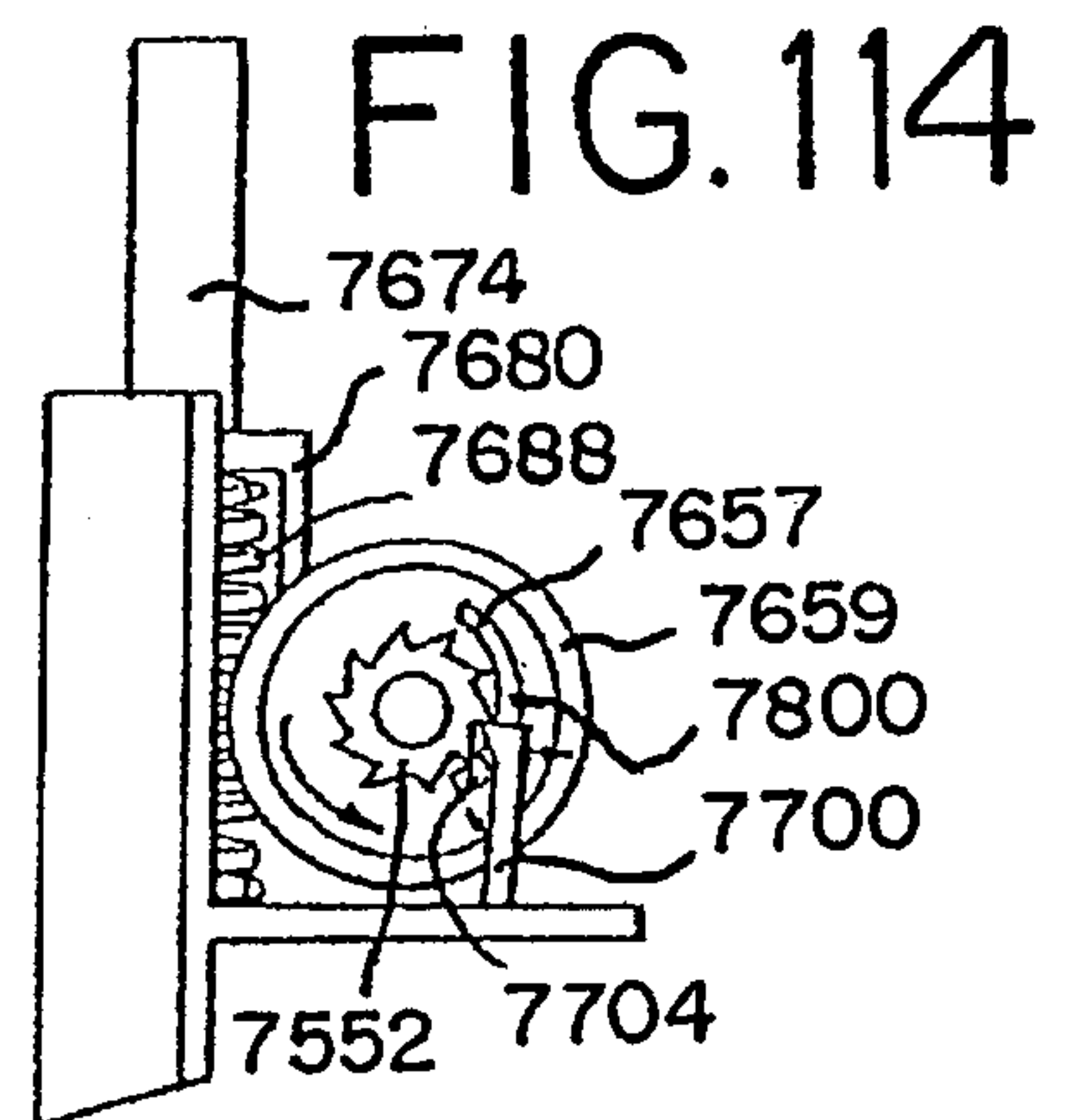
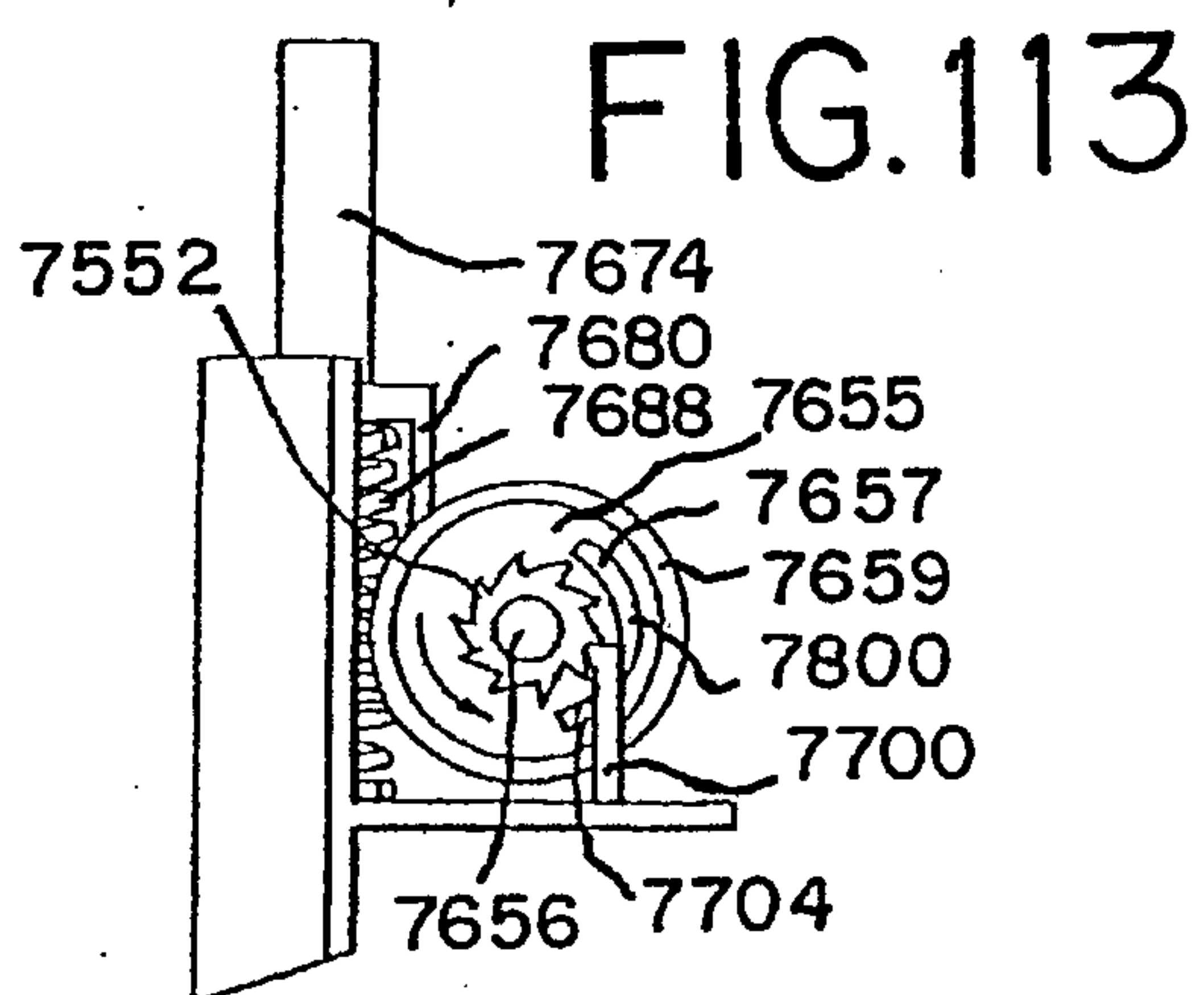


FIG. 118

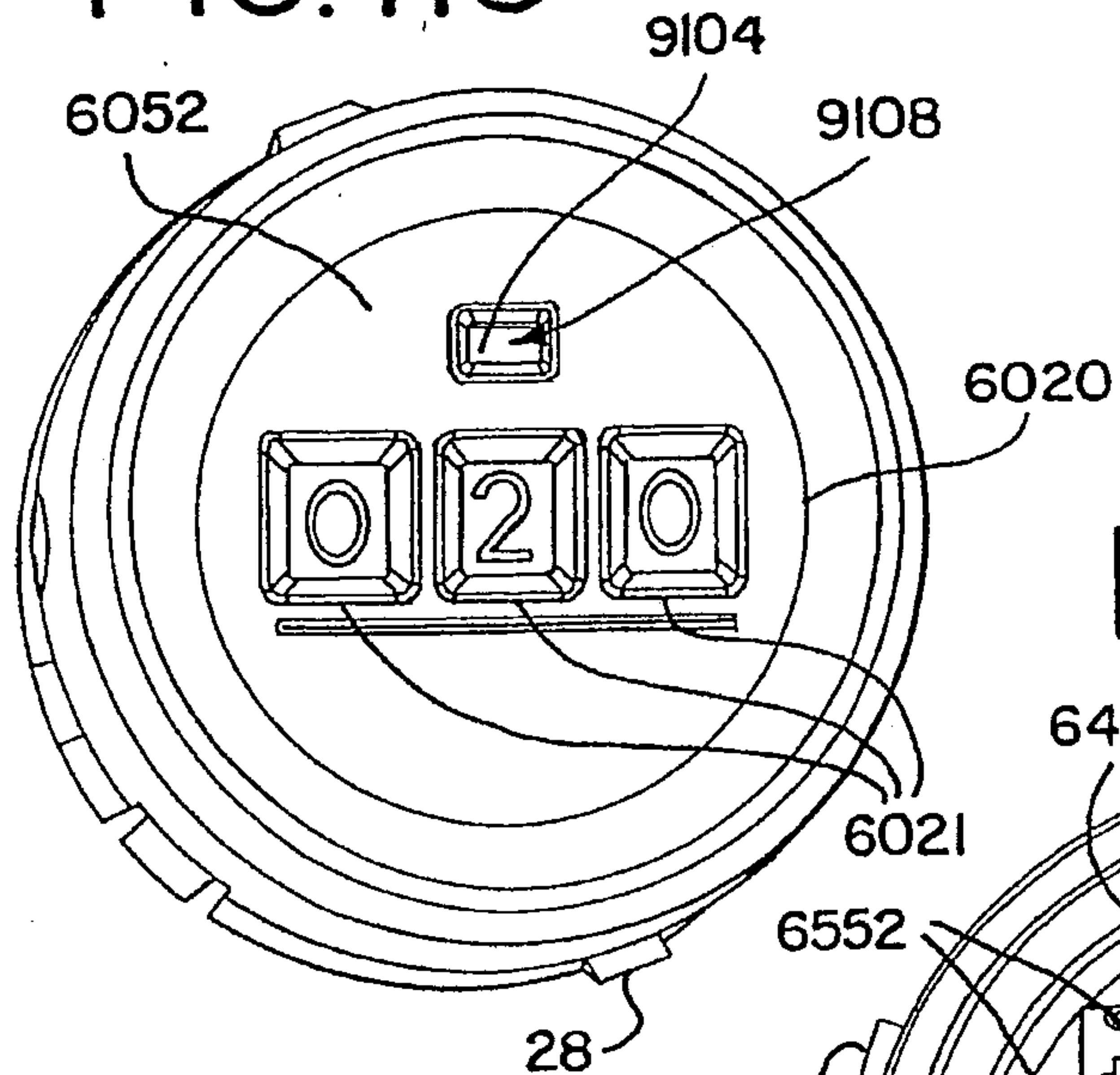


FIG. 119

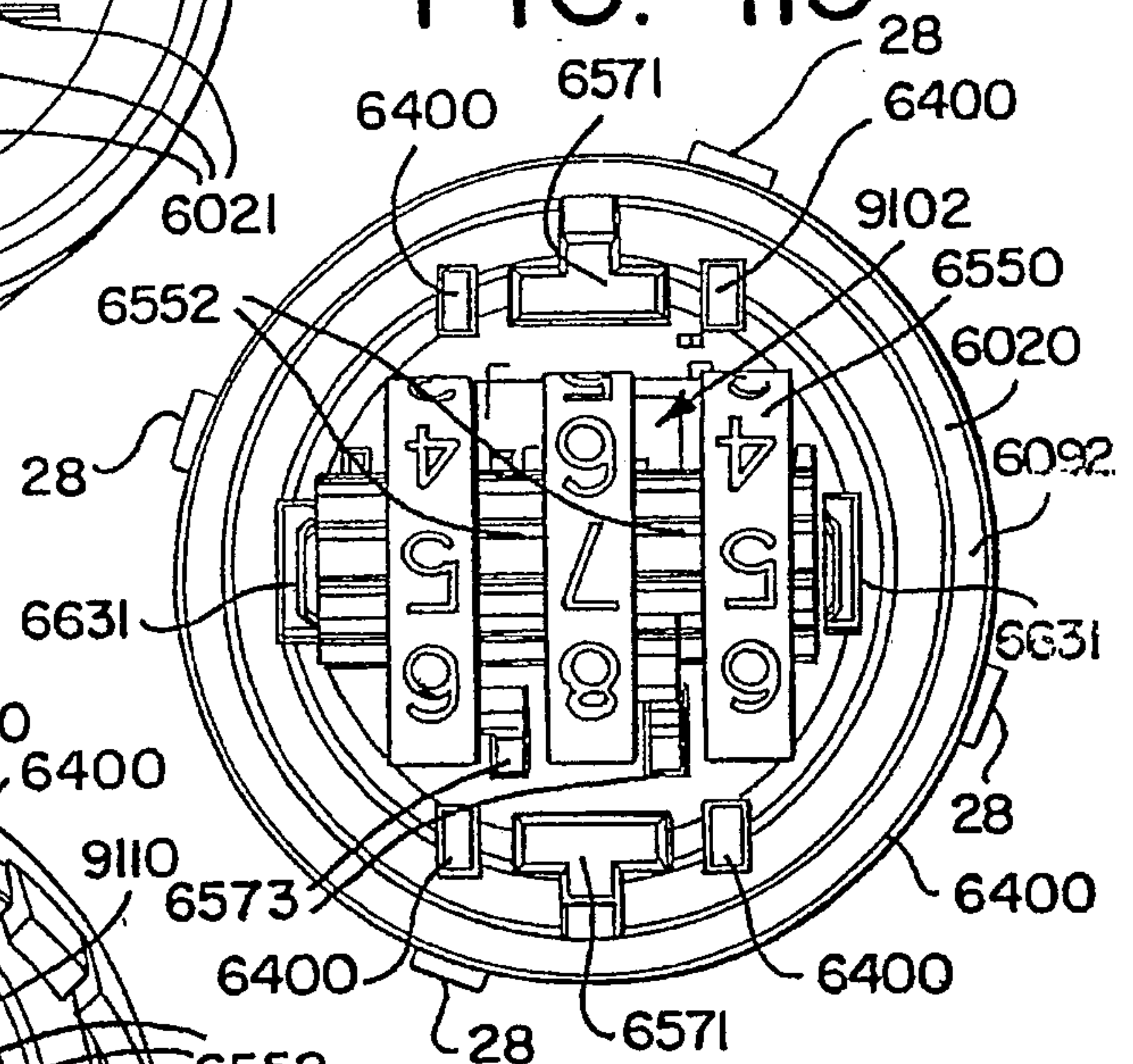


FIG. 120

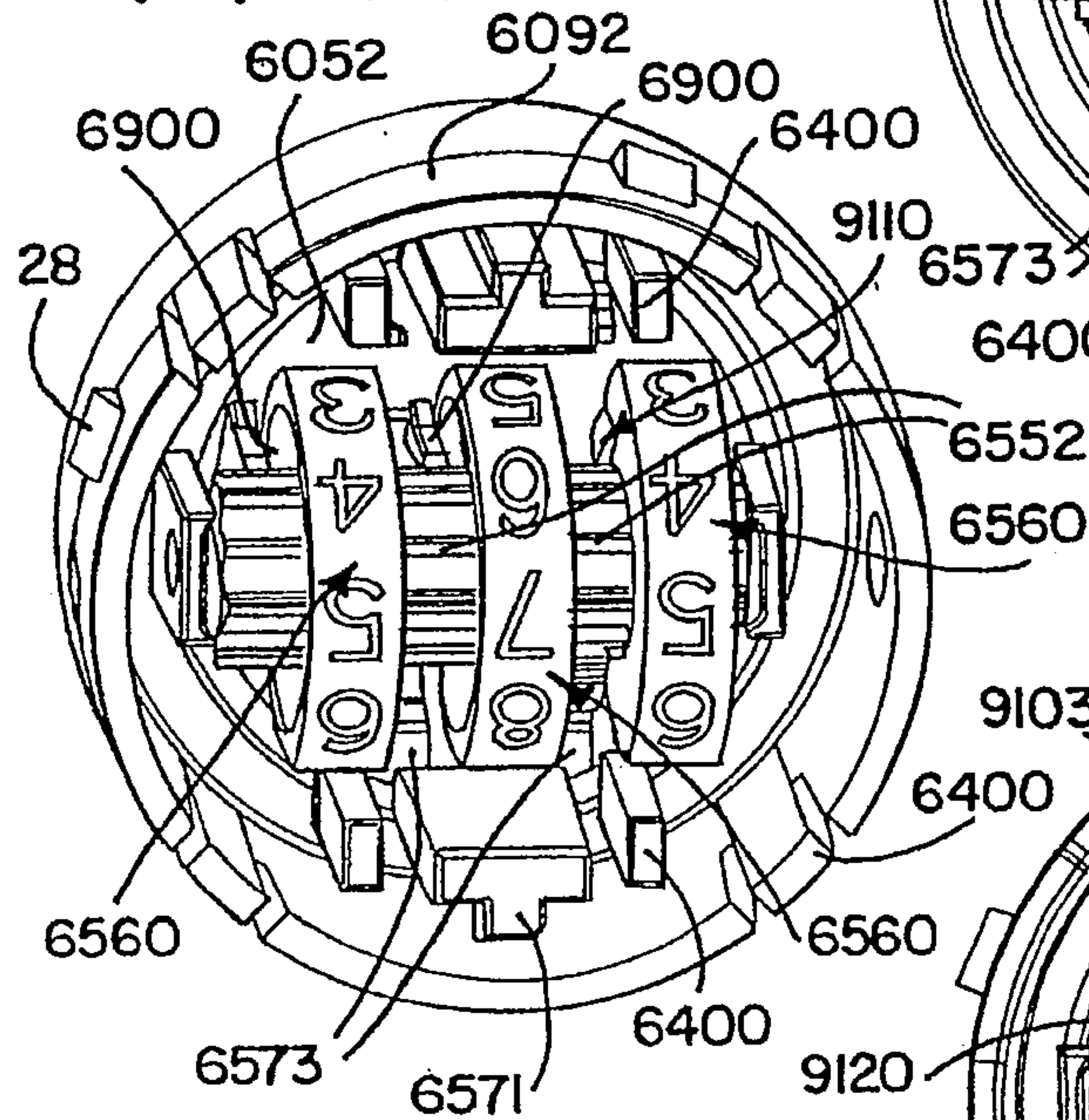


FIG. 121

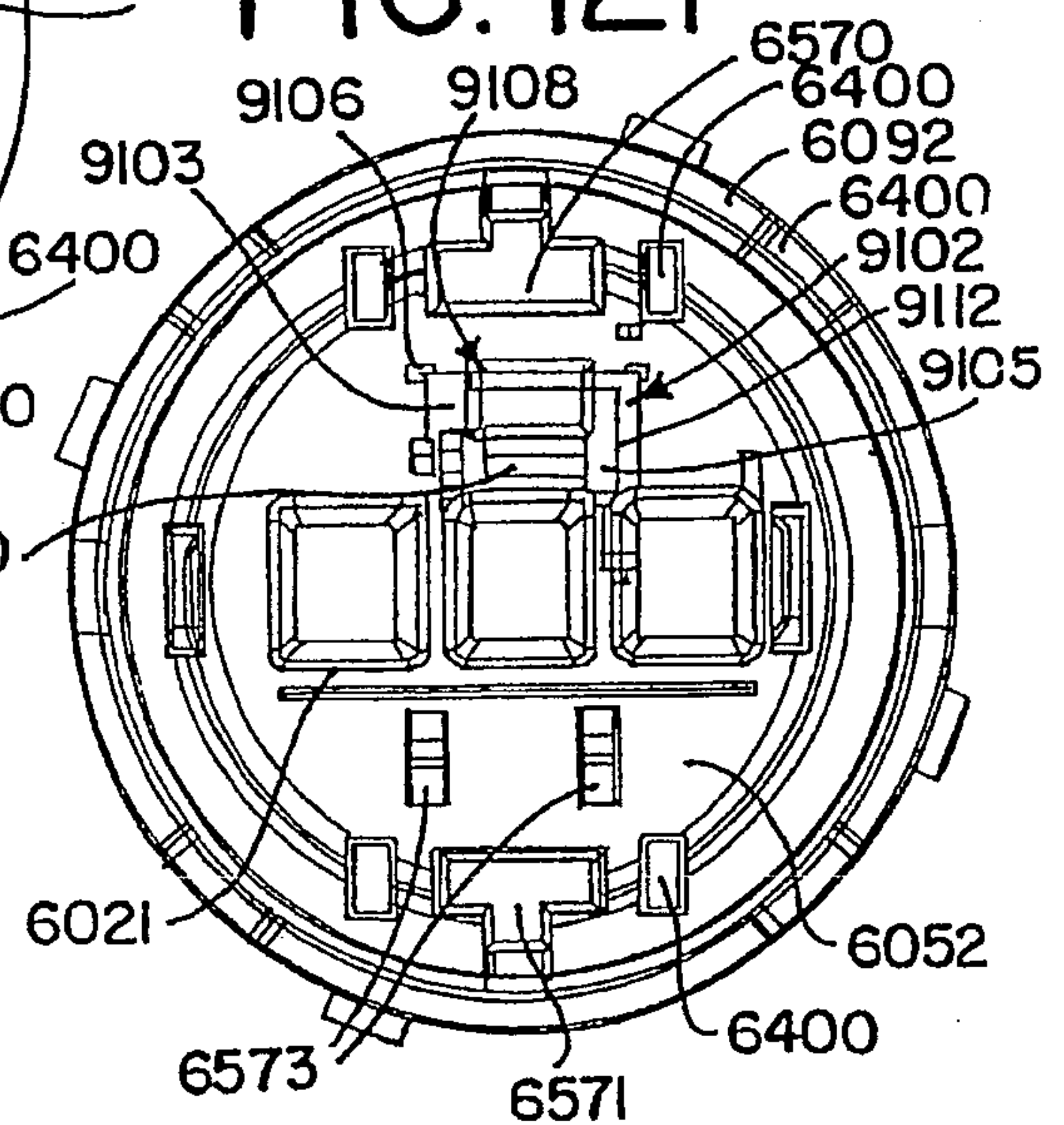


FIG. 122

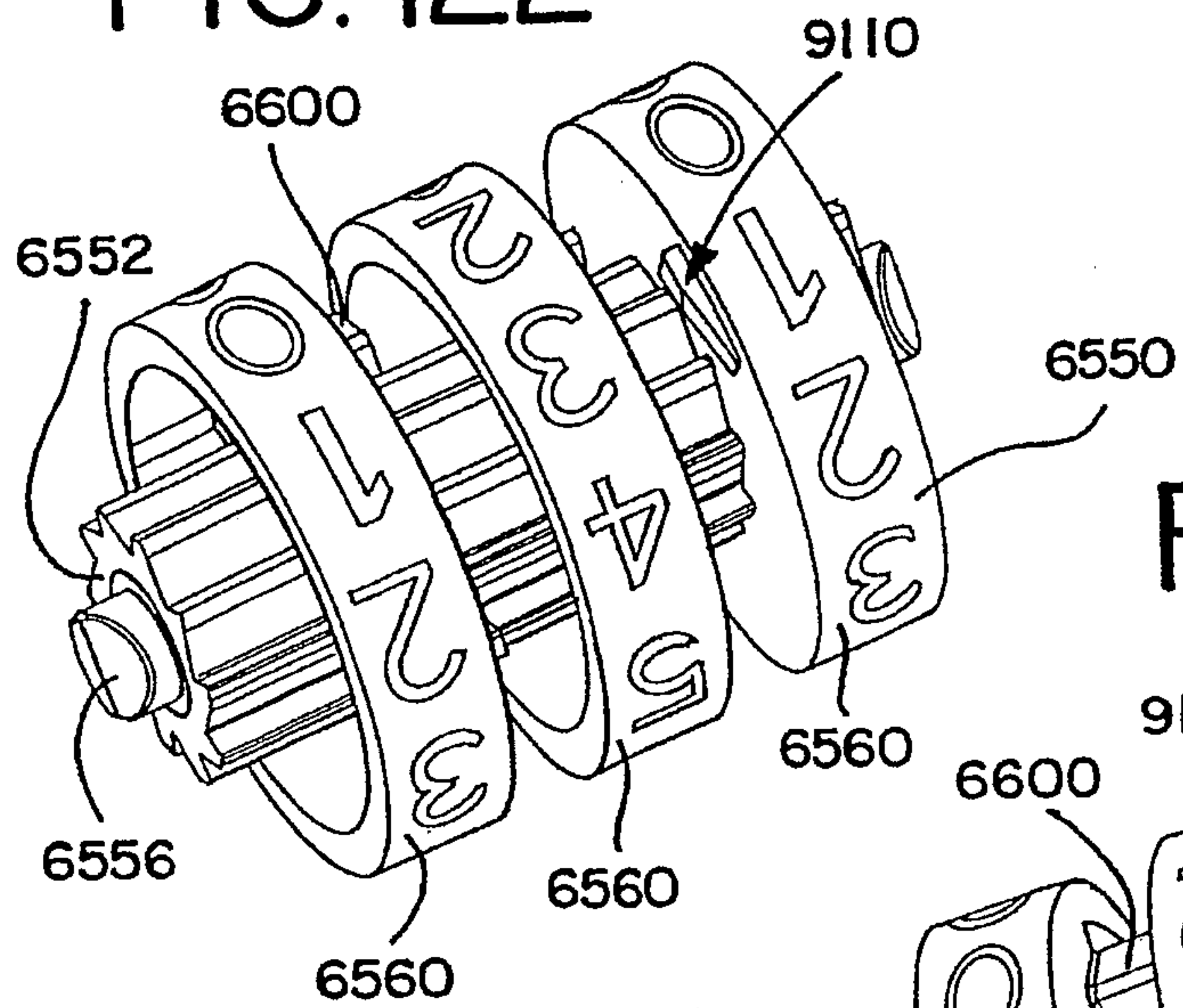


FIG. 123

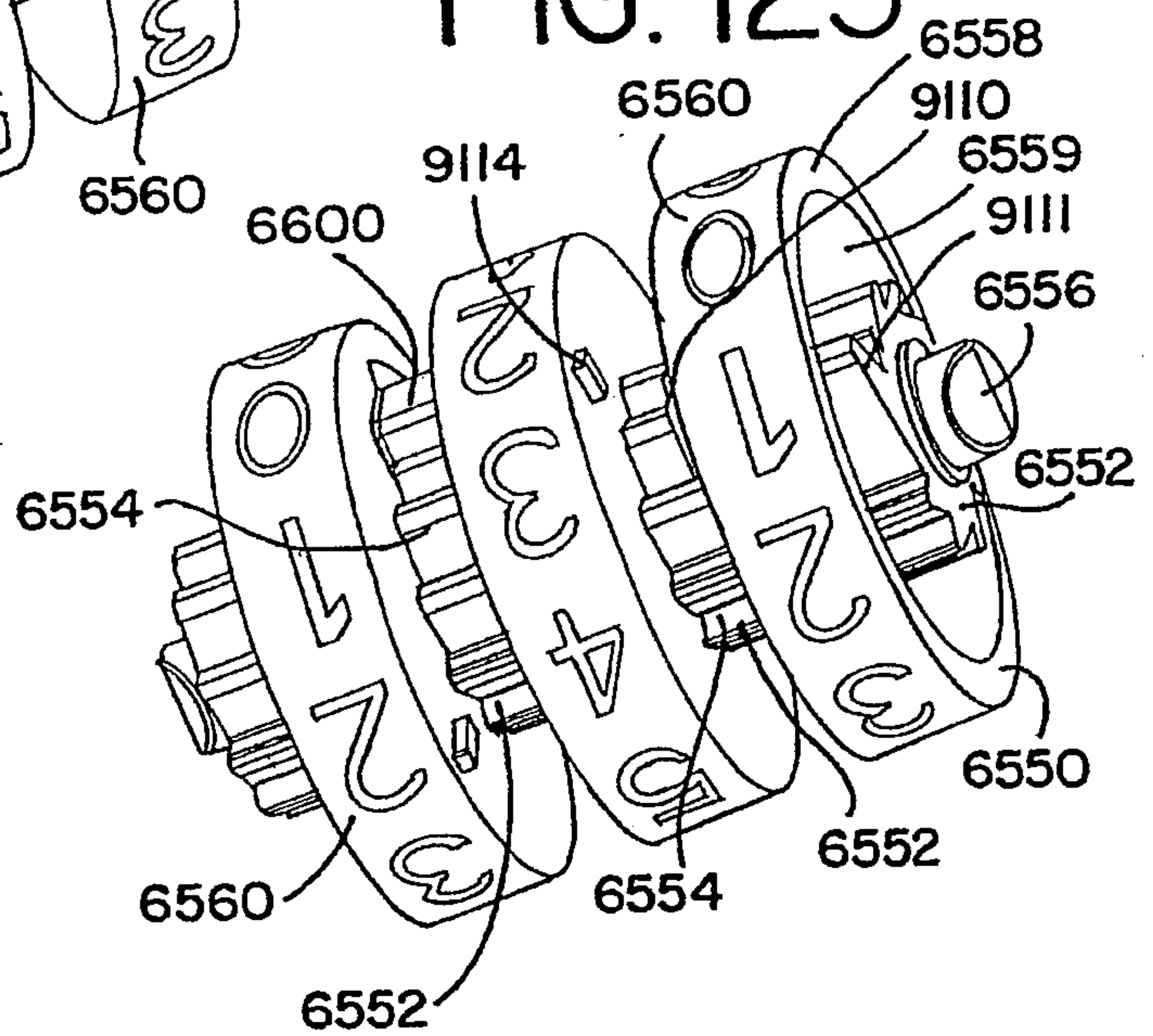


FIG. 124

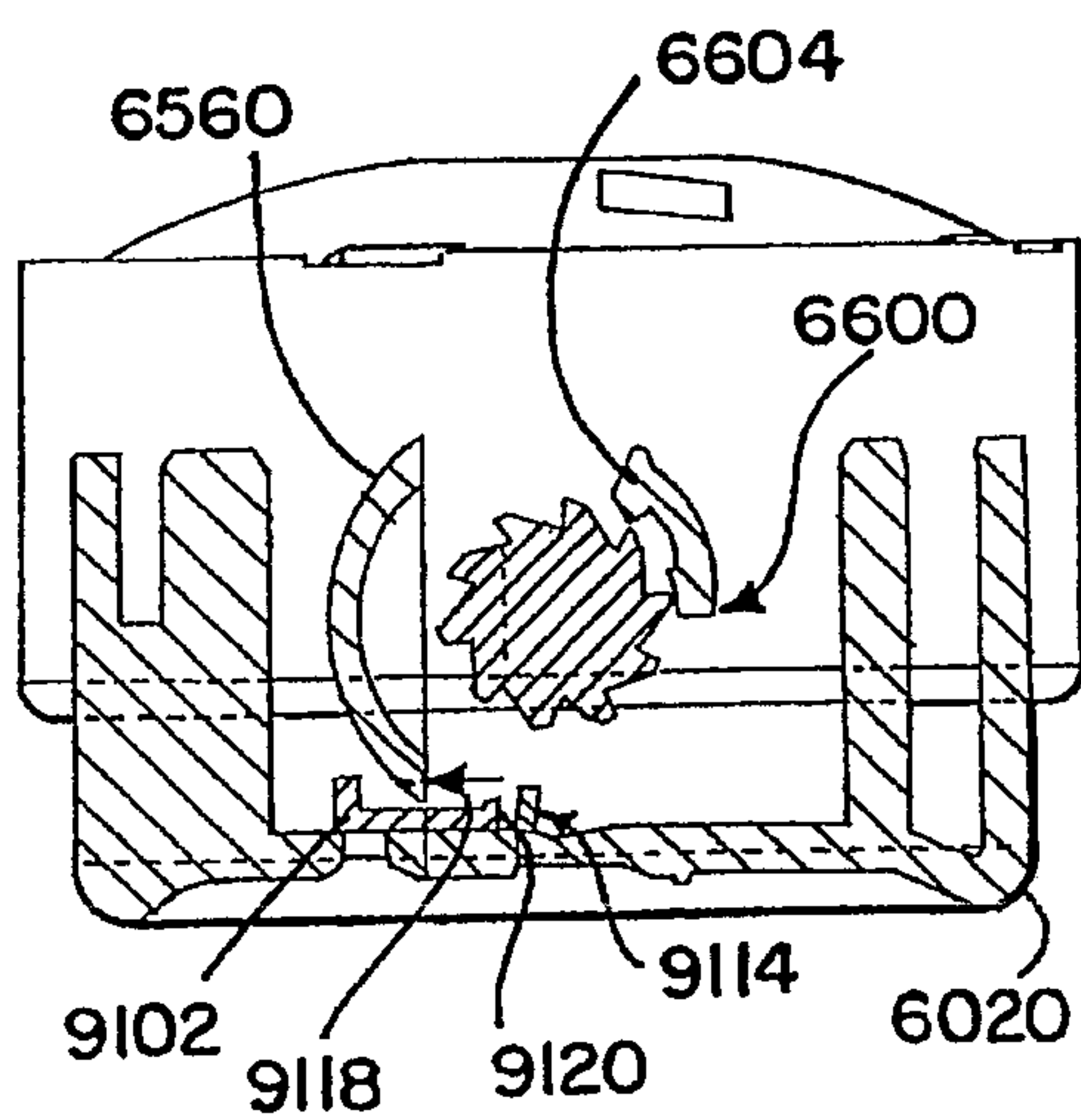


FIG. 125

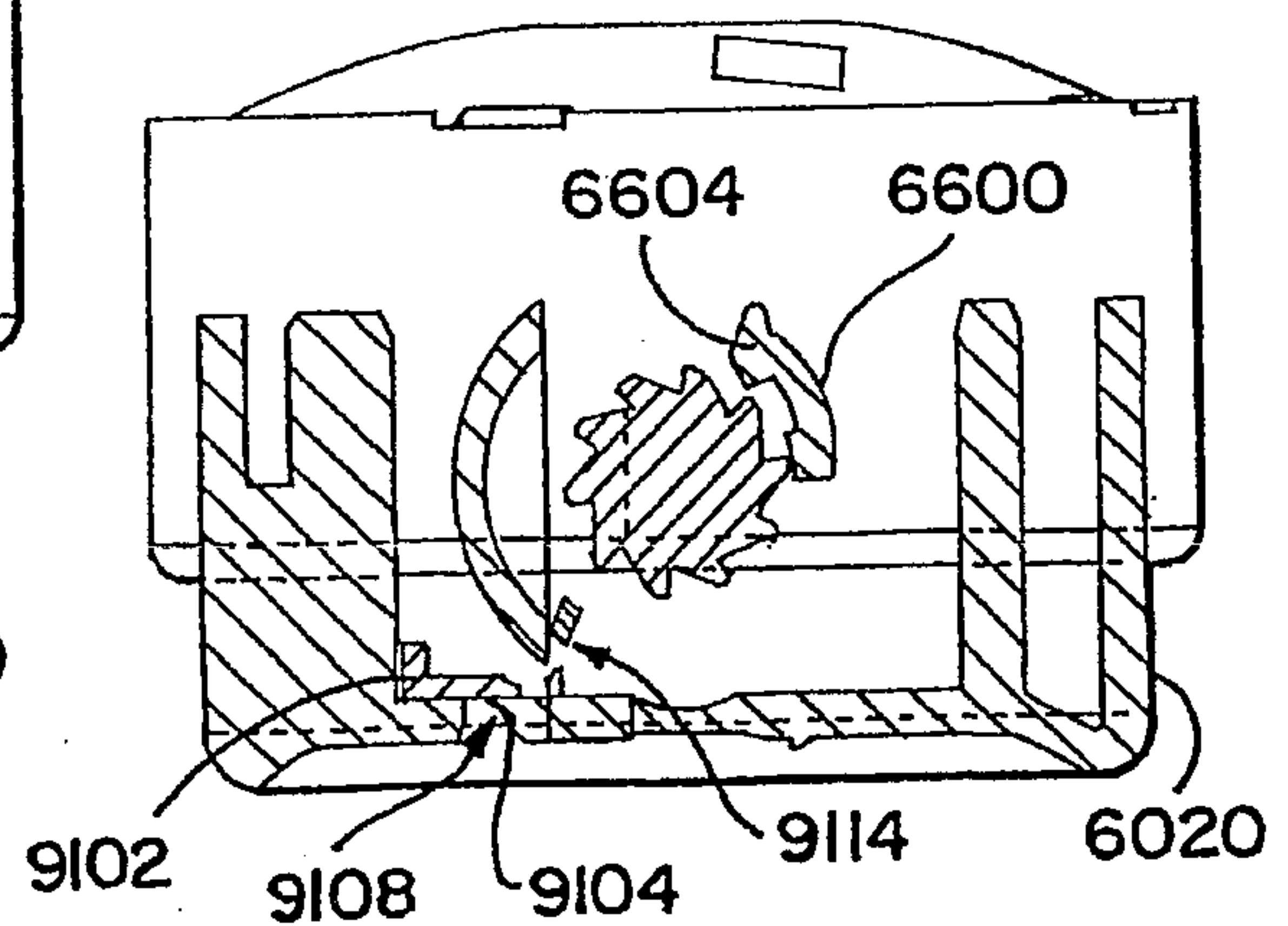


FIG. 126

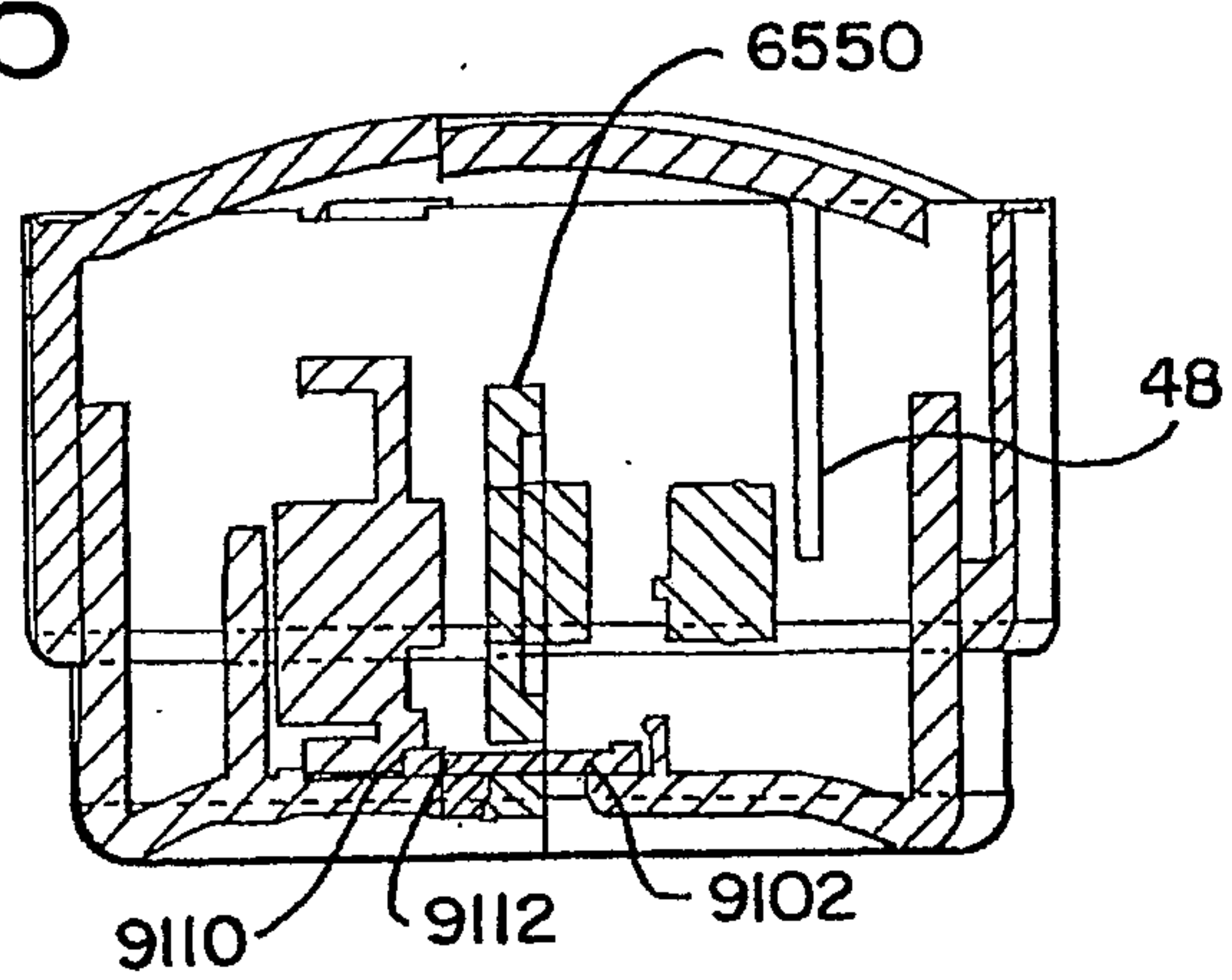


FIG. 127

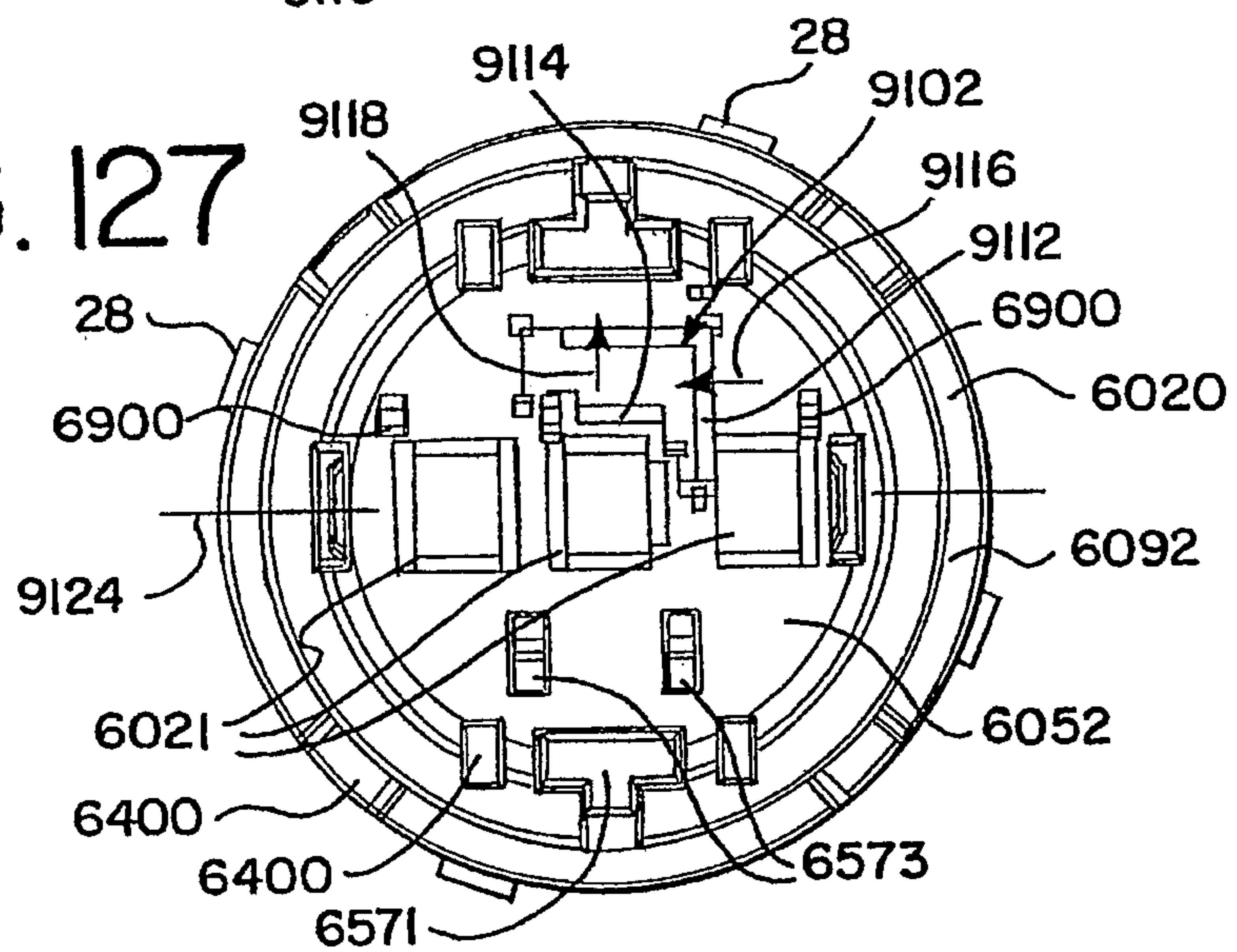


FIG. 128

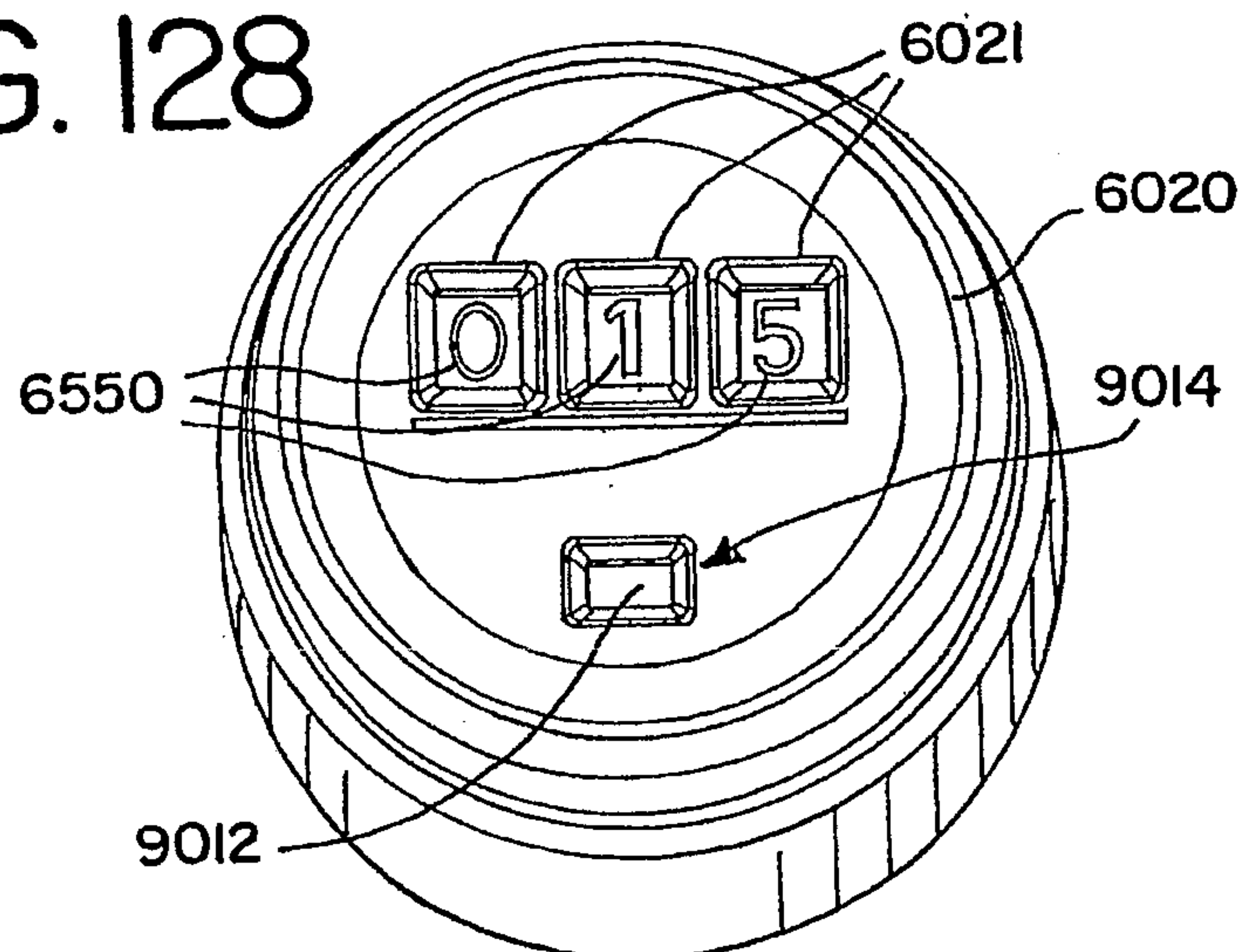


FIG. 129

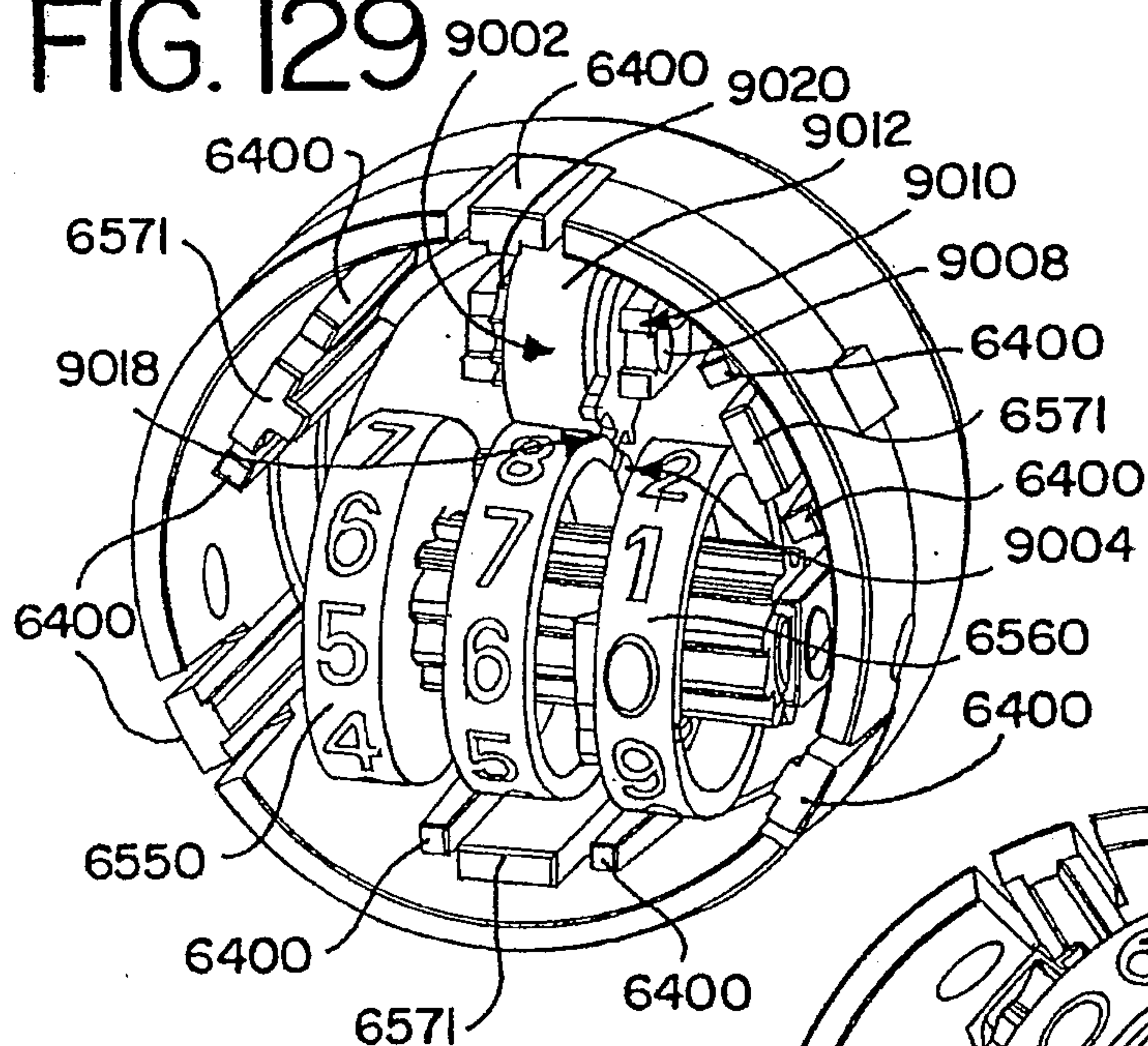


FIG. 130

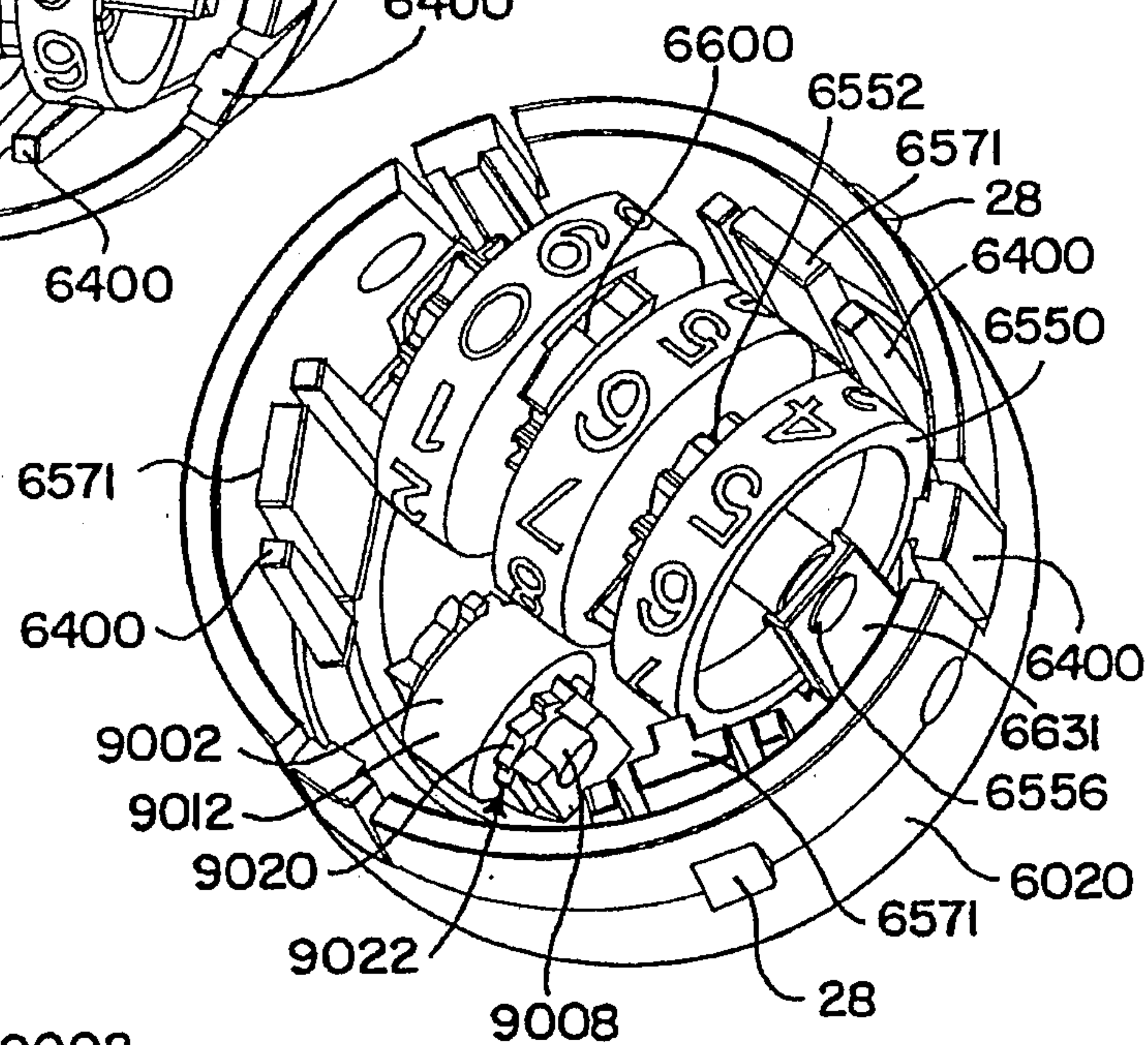


FIG. 131

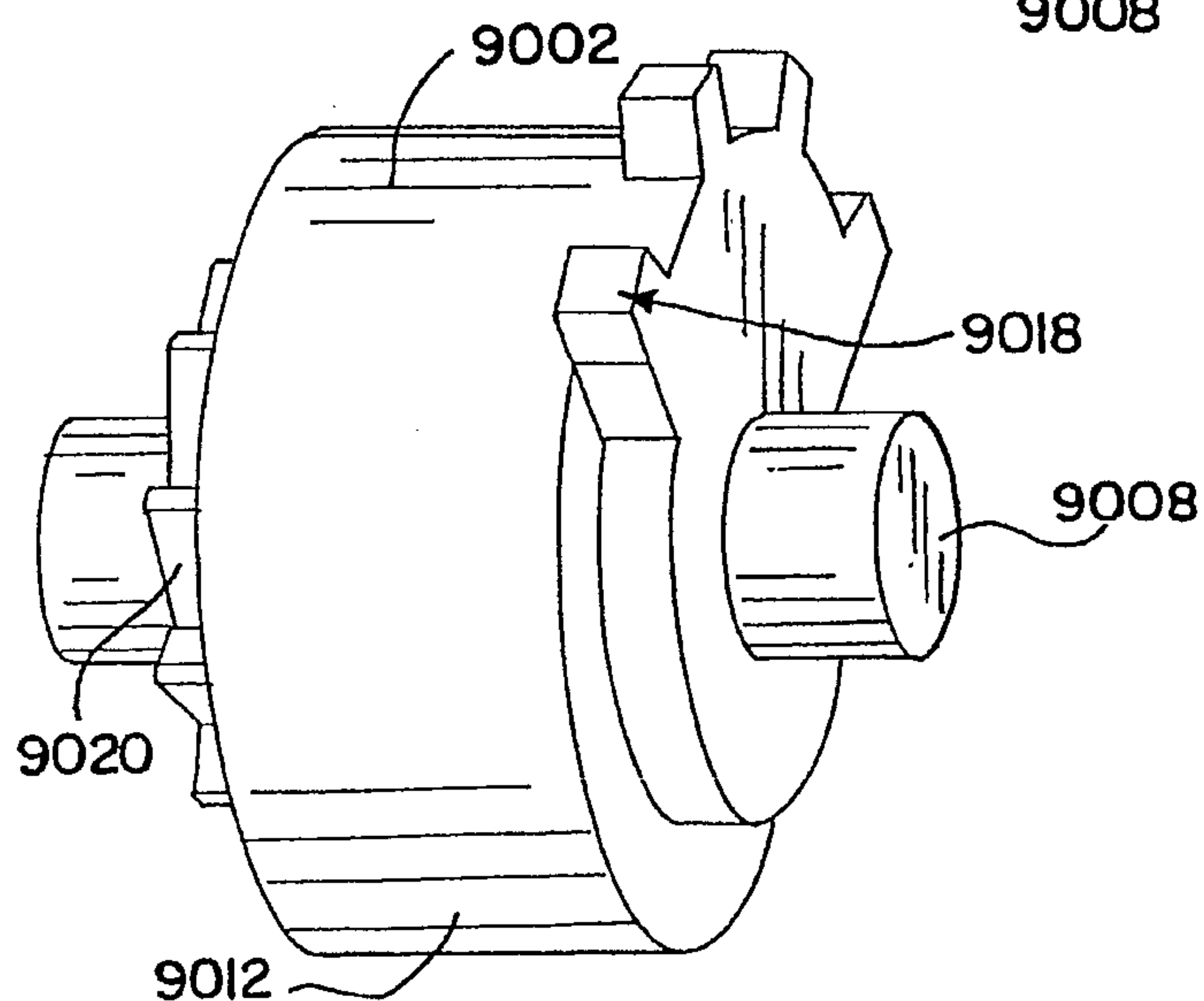


FIG. 132

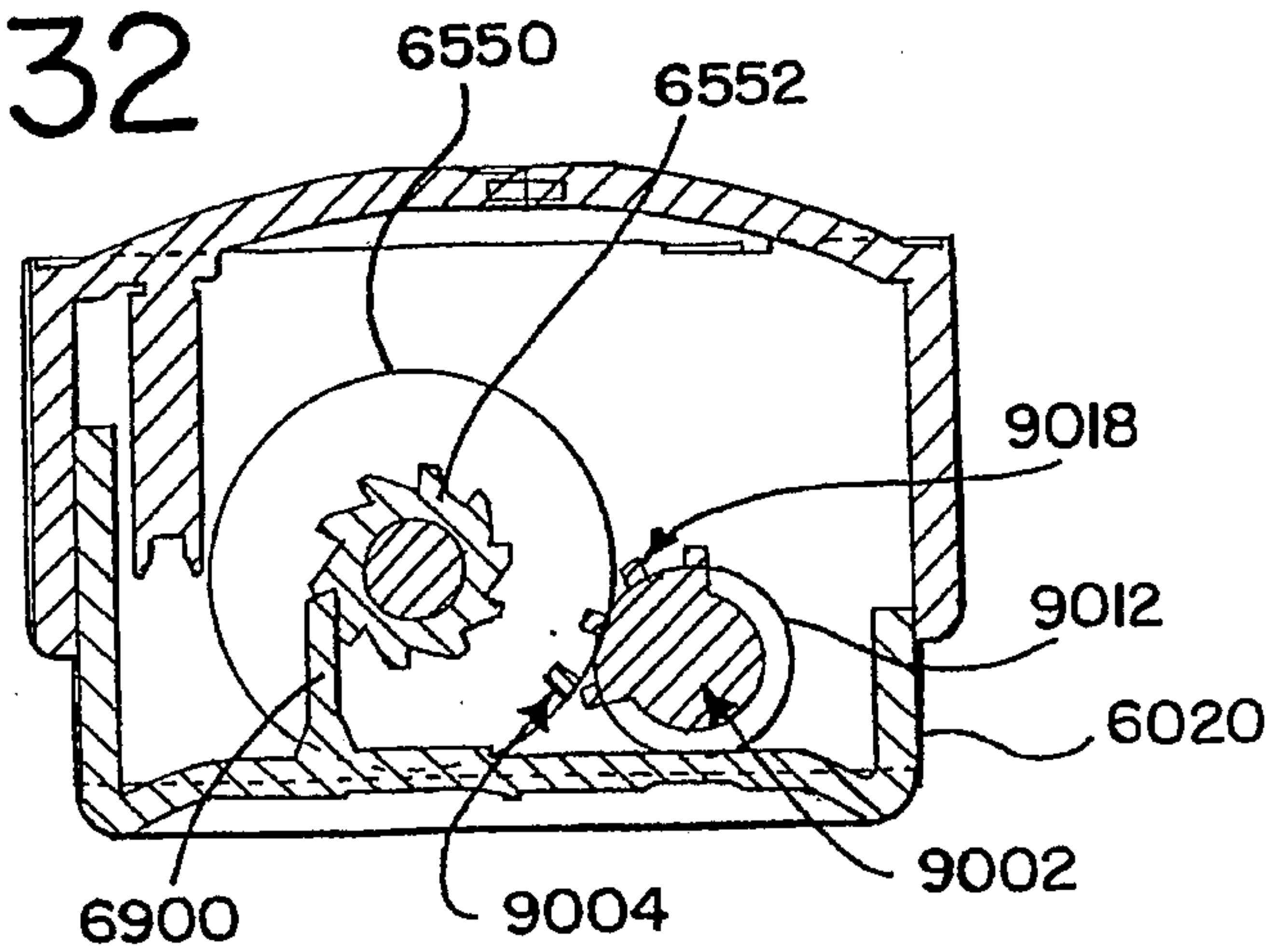


FIG. 133

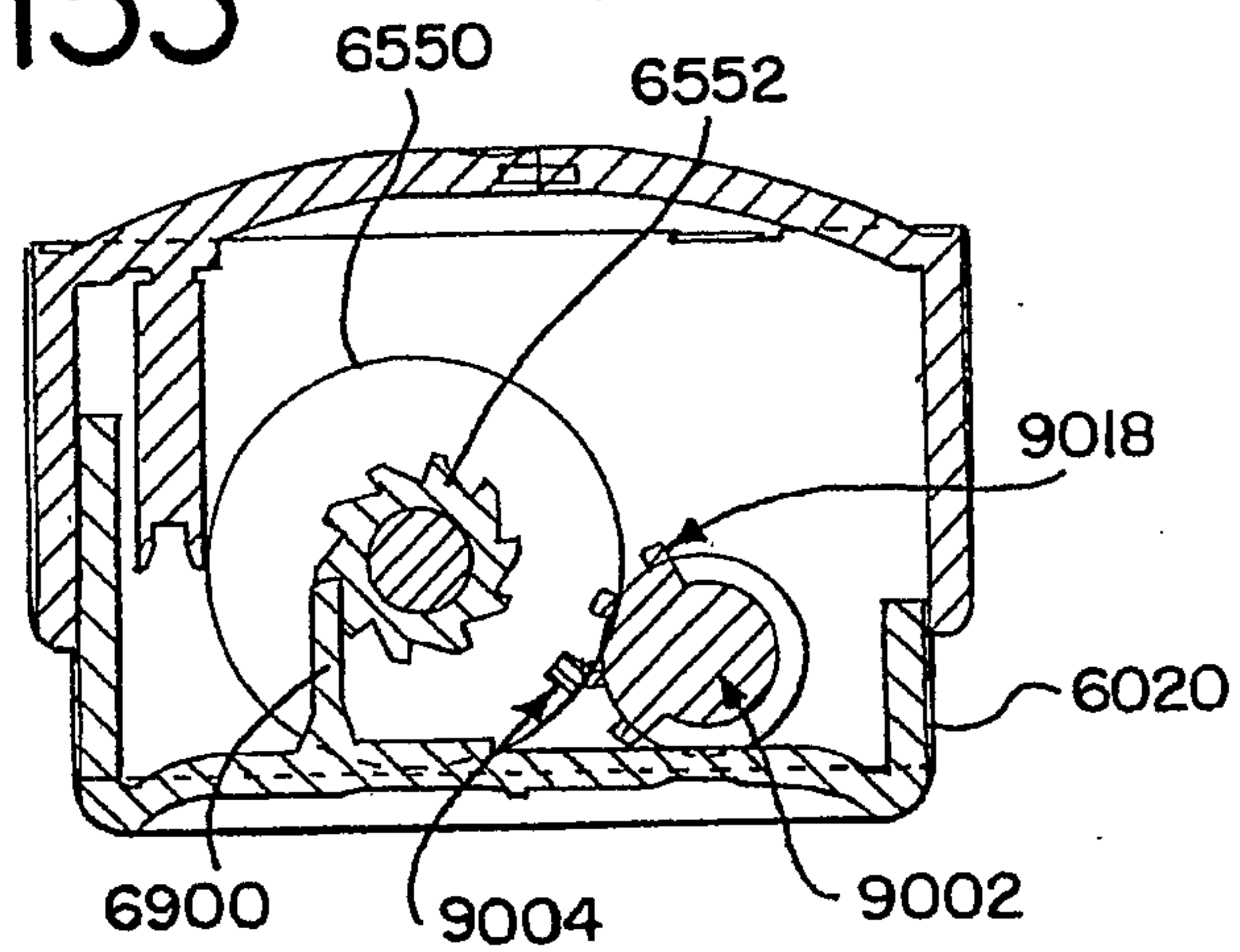


FIG. 134

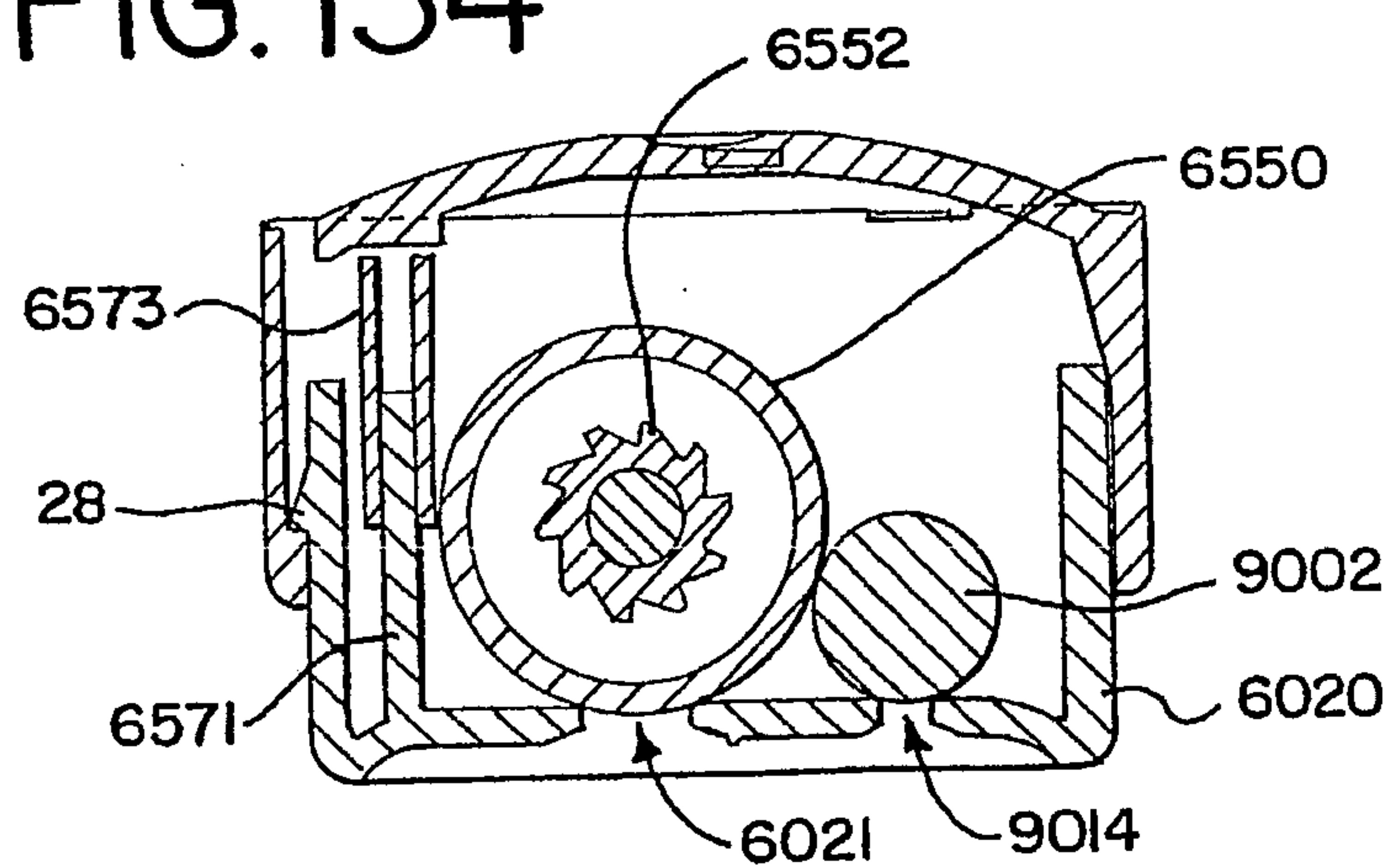


FIG. 135

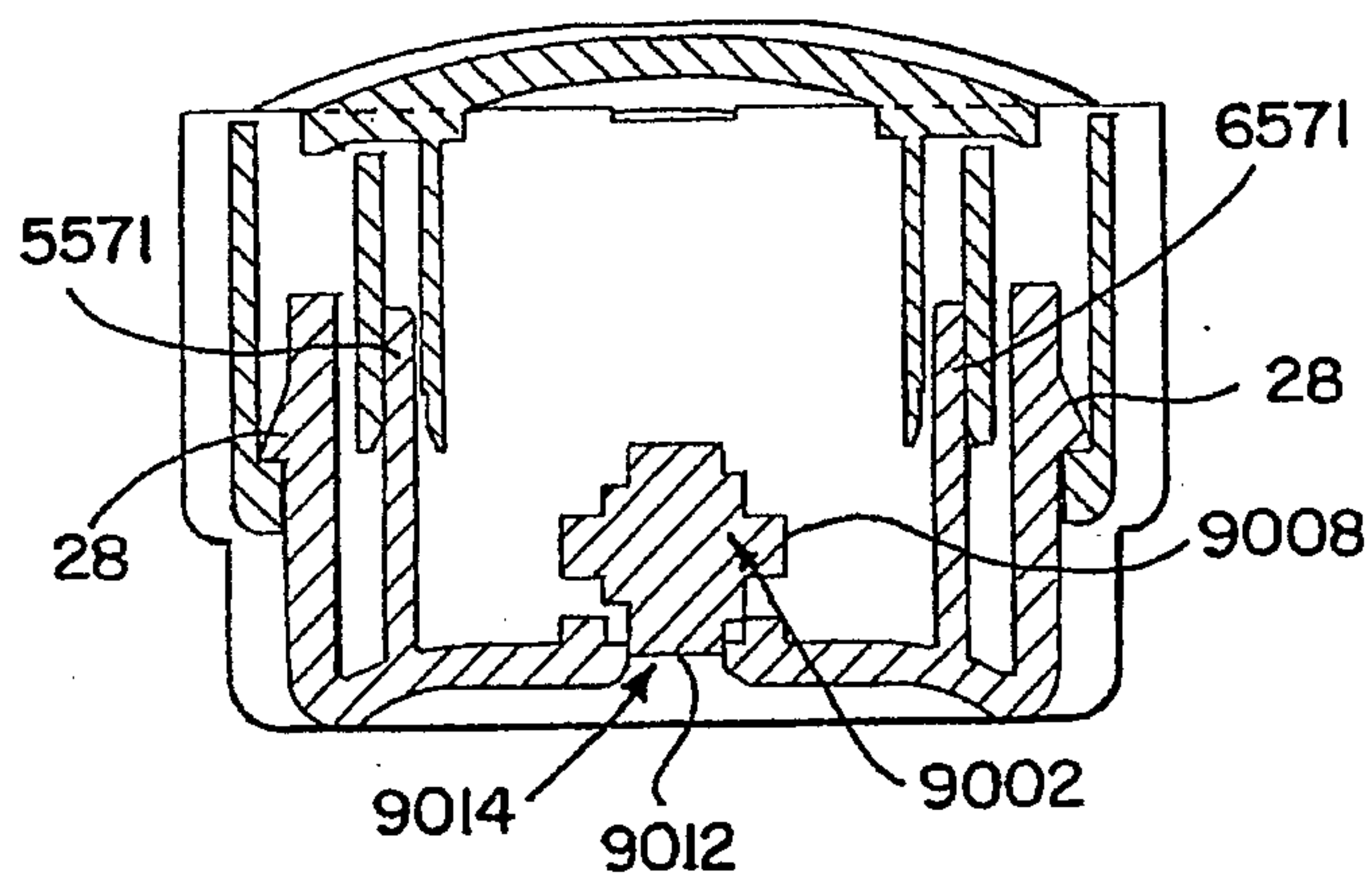


FIG. 136

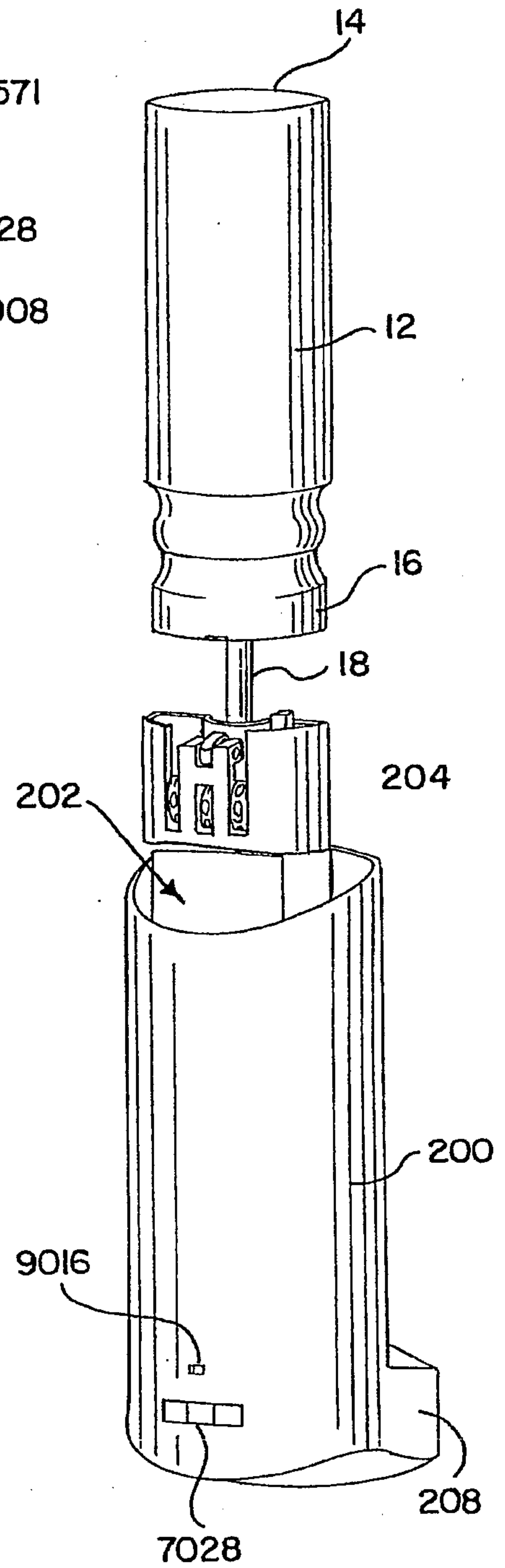


FIG. 137

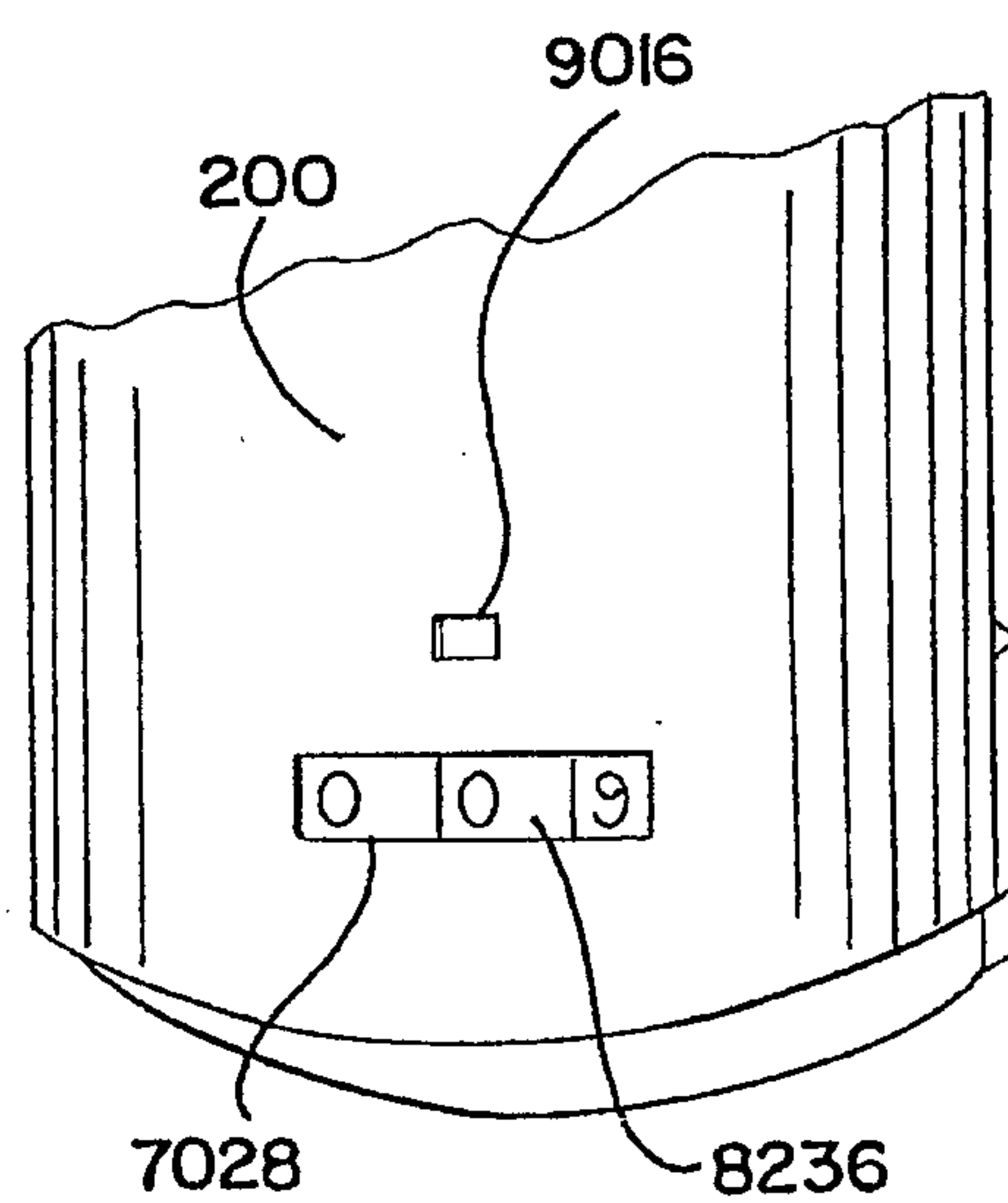


FIG. 138

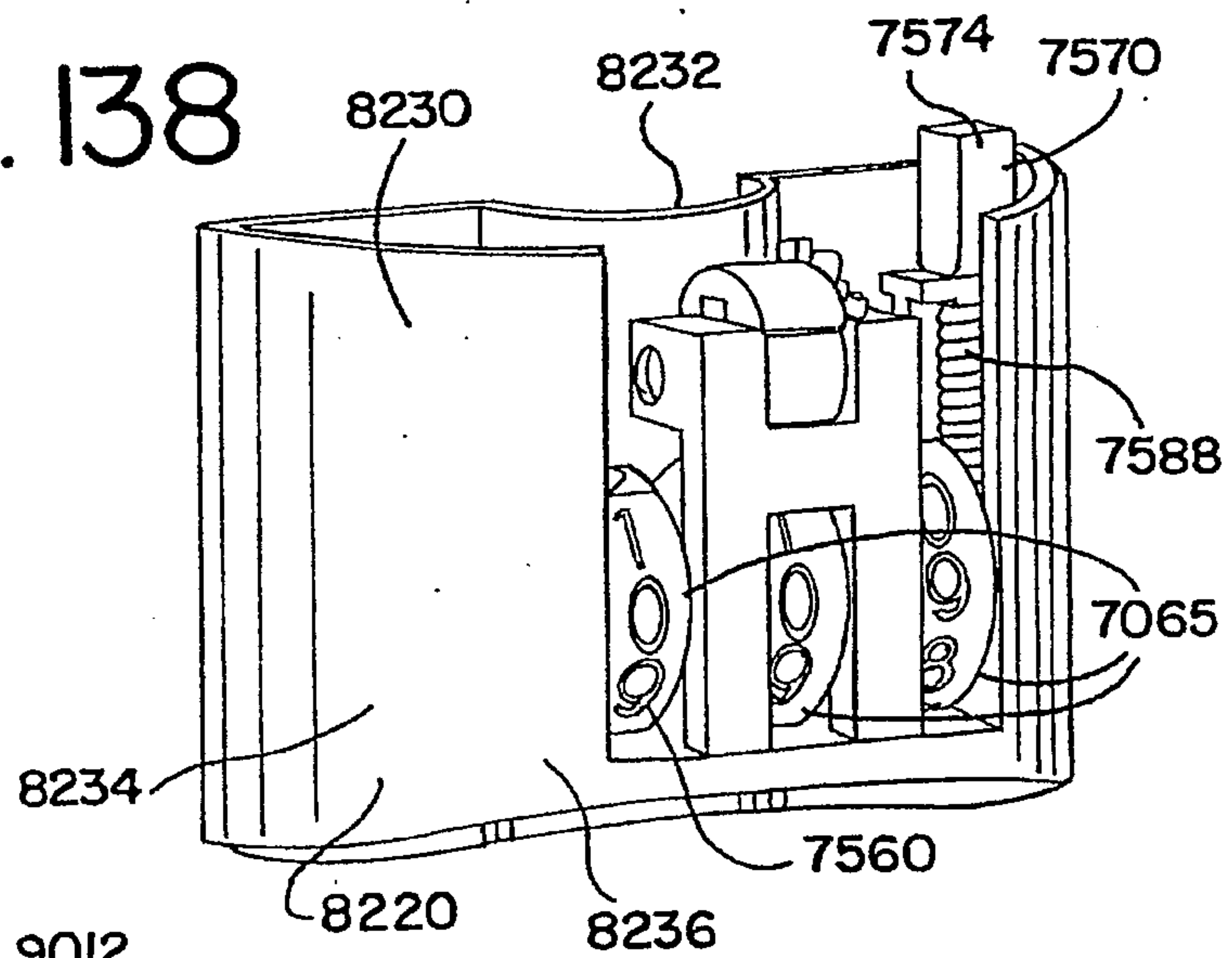


FIG. 139

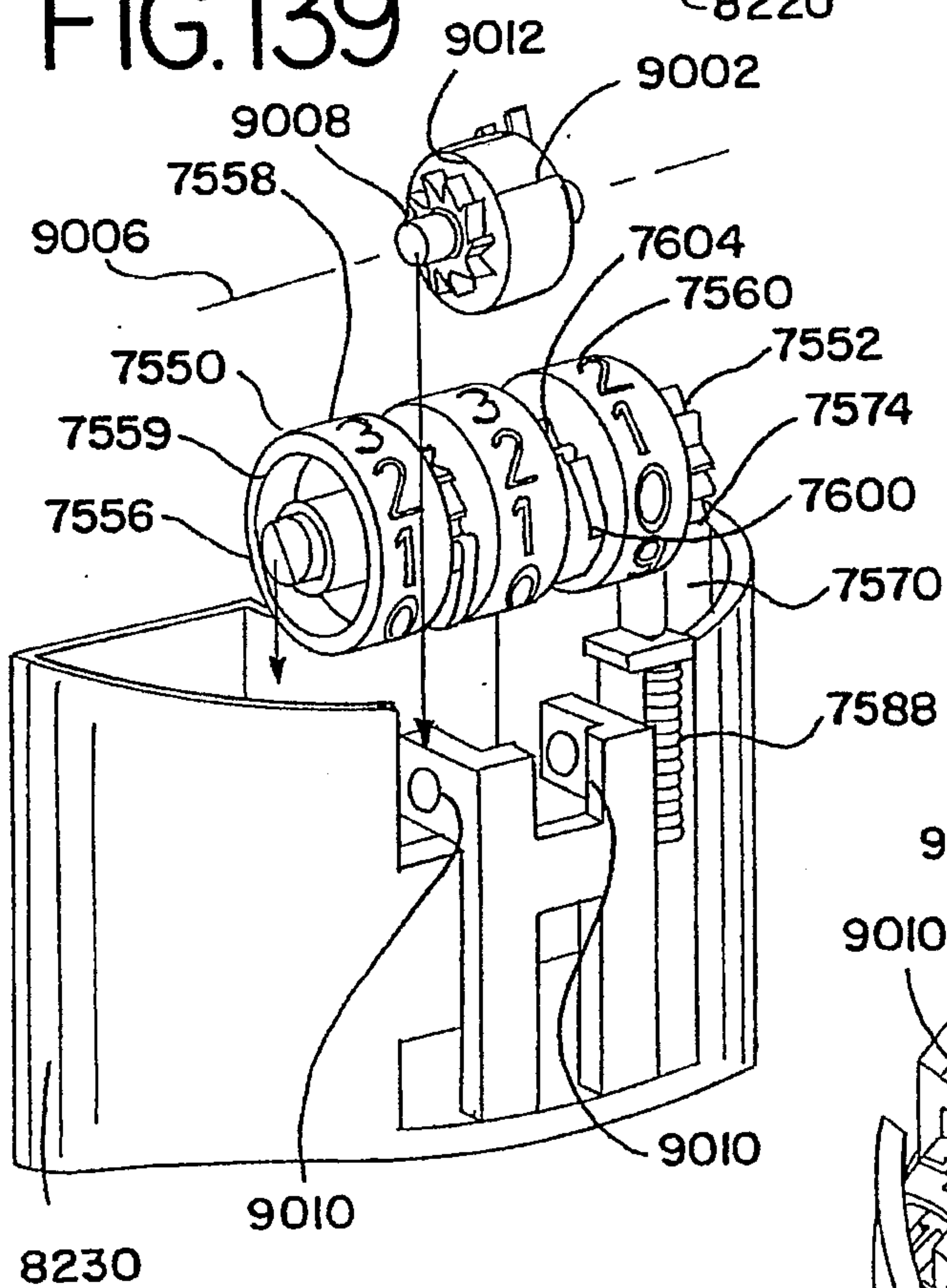


FIG. 140

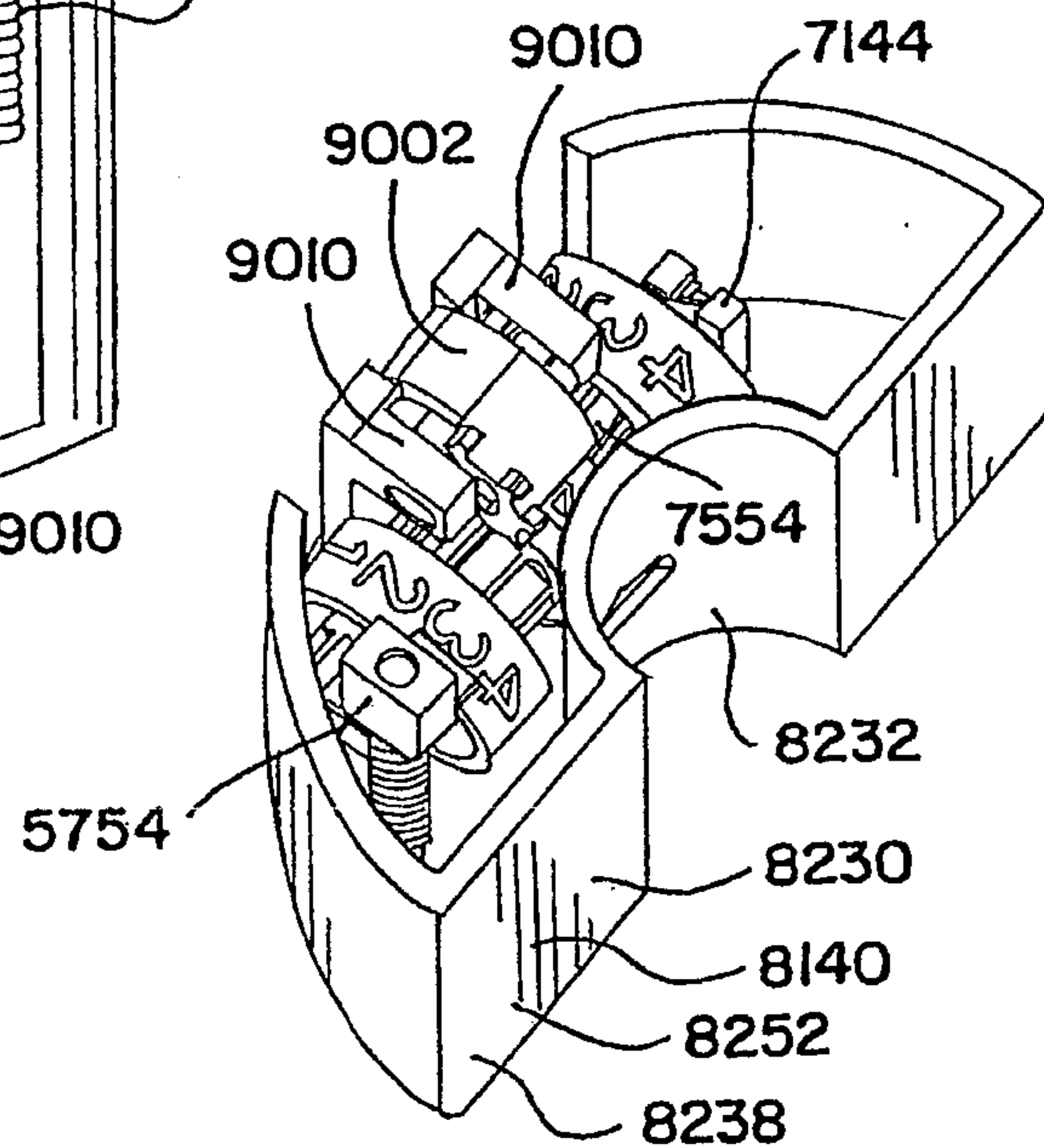


FIG. 141

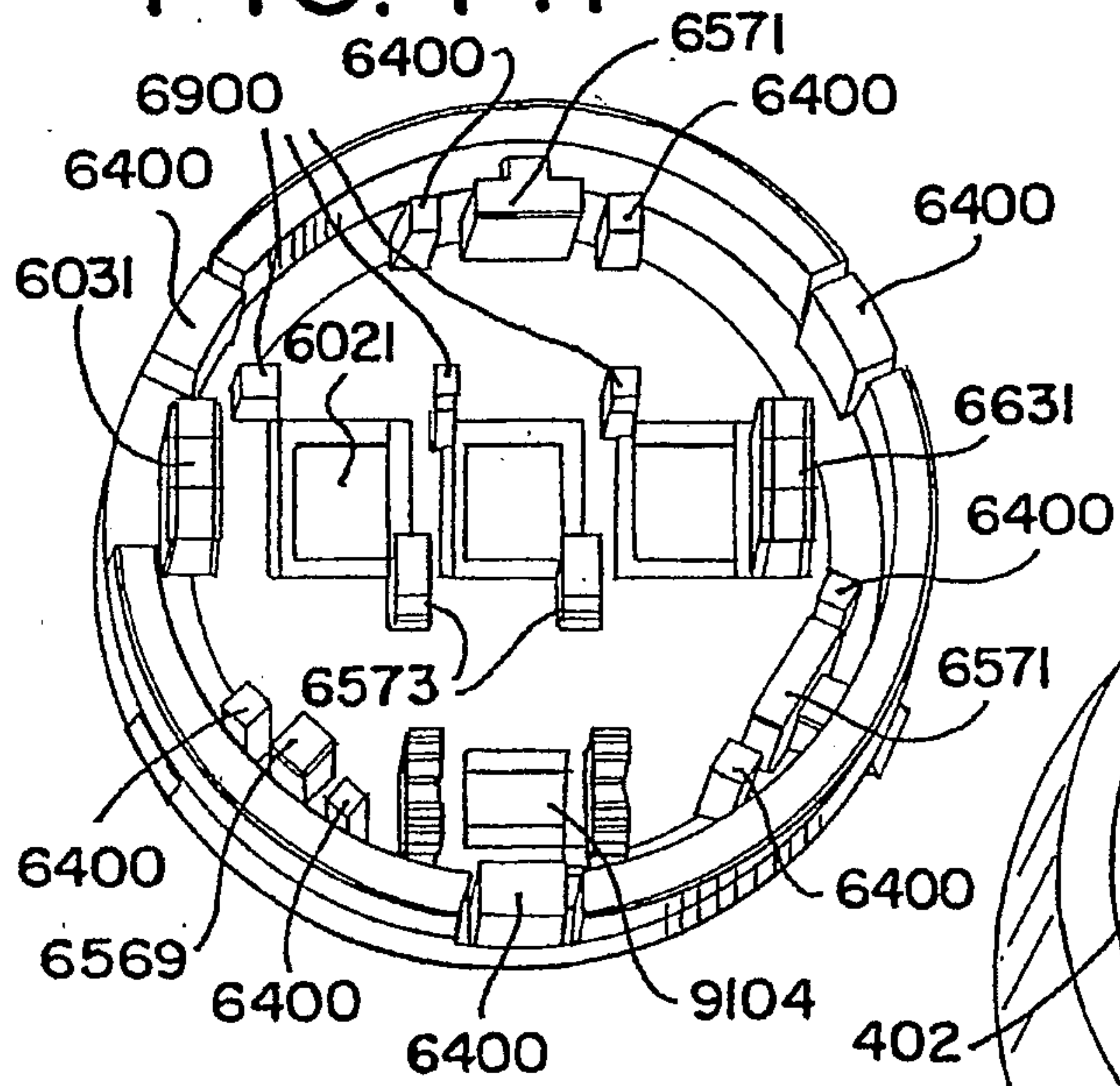


FIG. 142

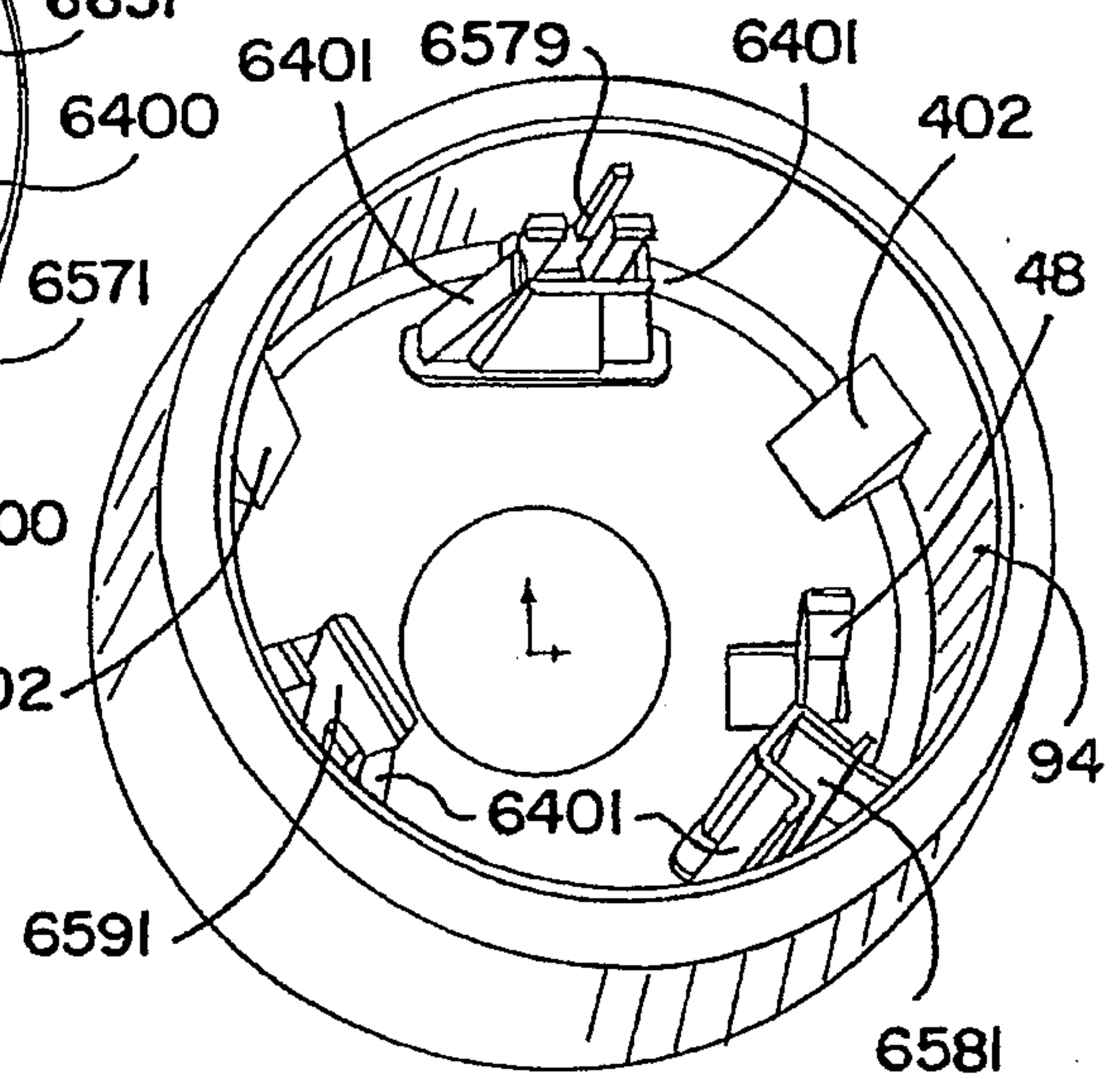


FIG. 143

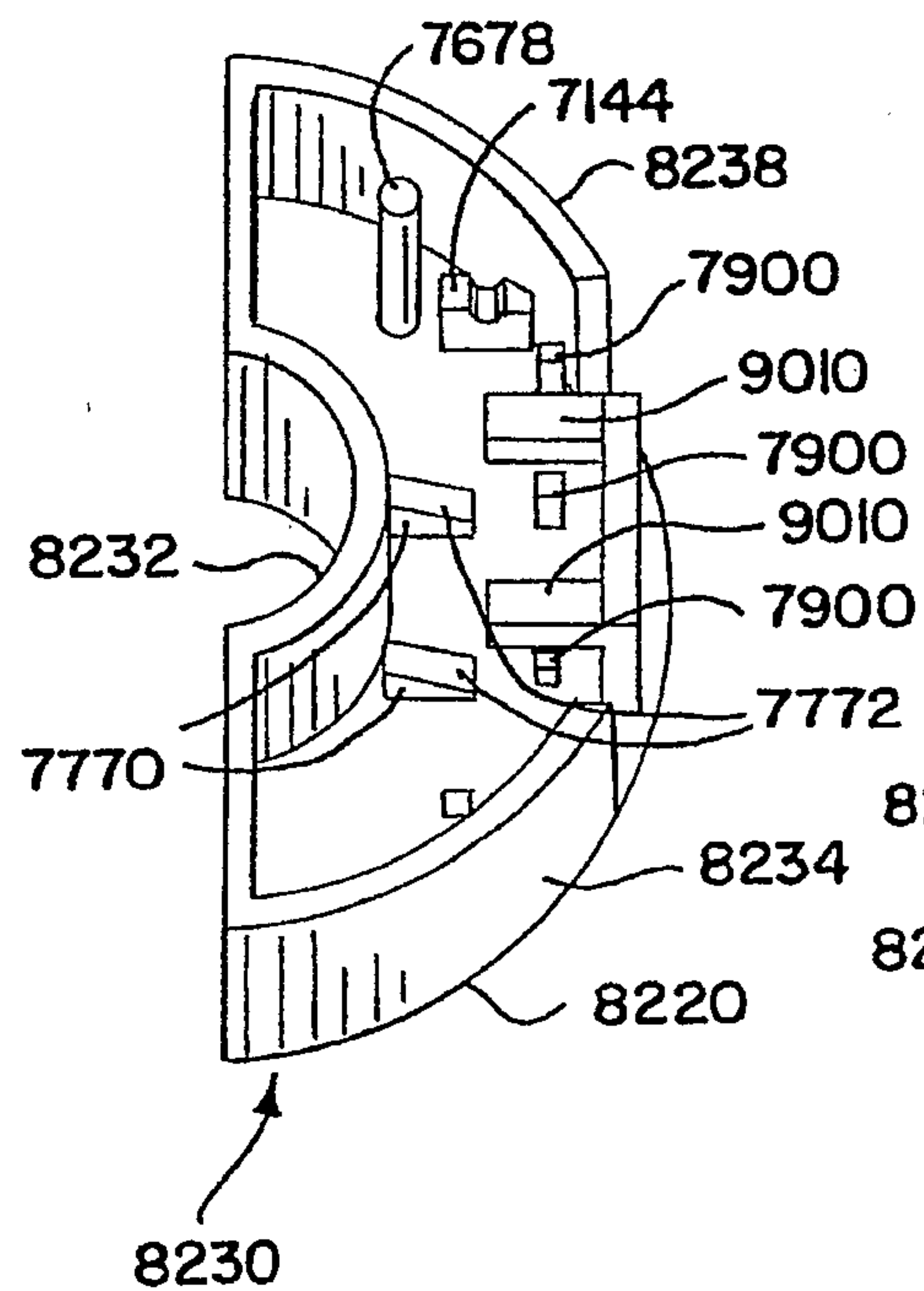


FIG. 144

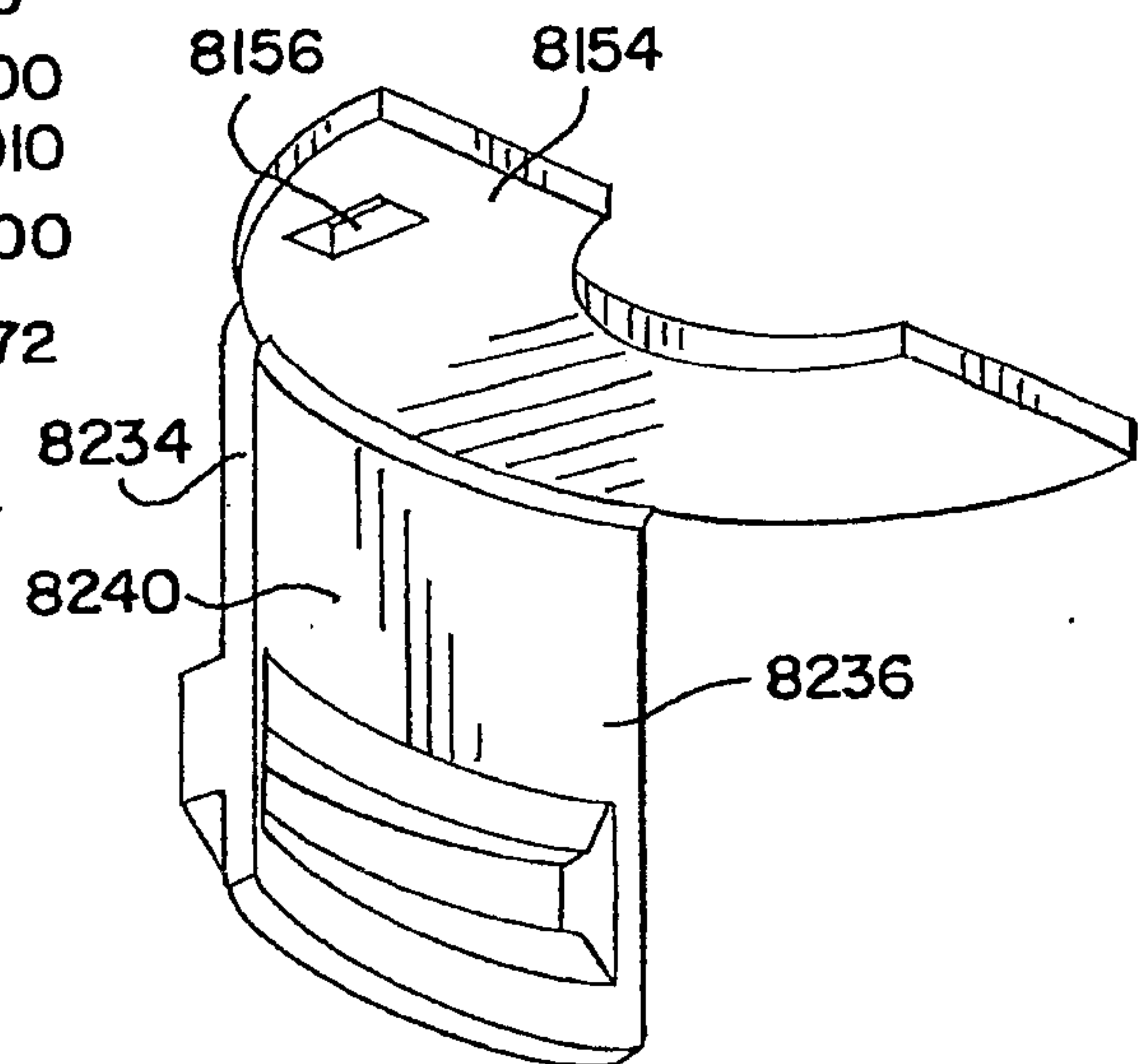


FIG. 145

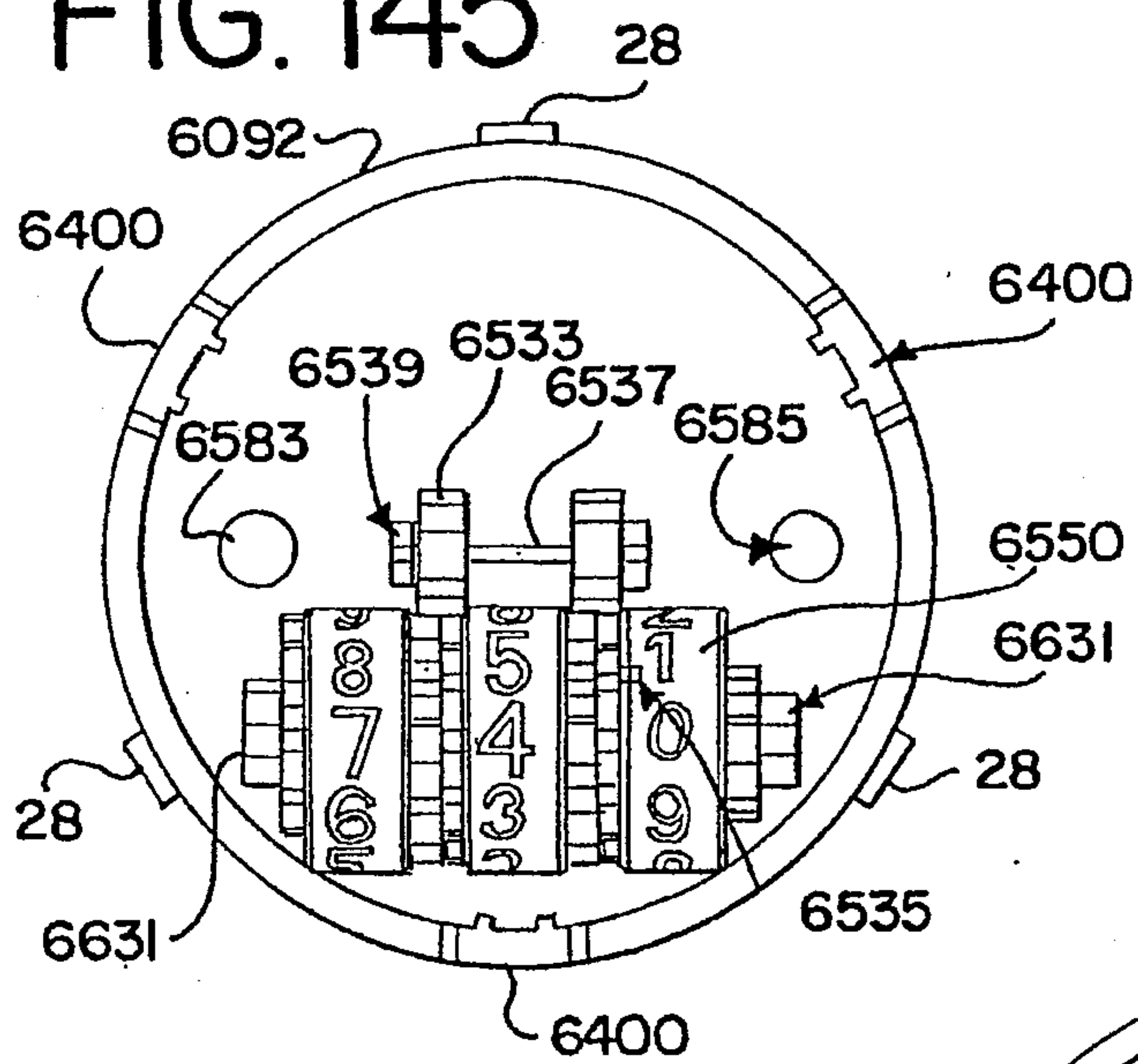


FIG. 146

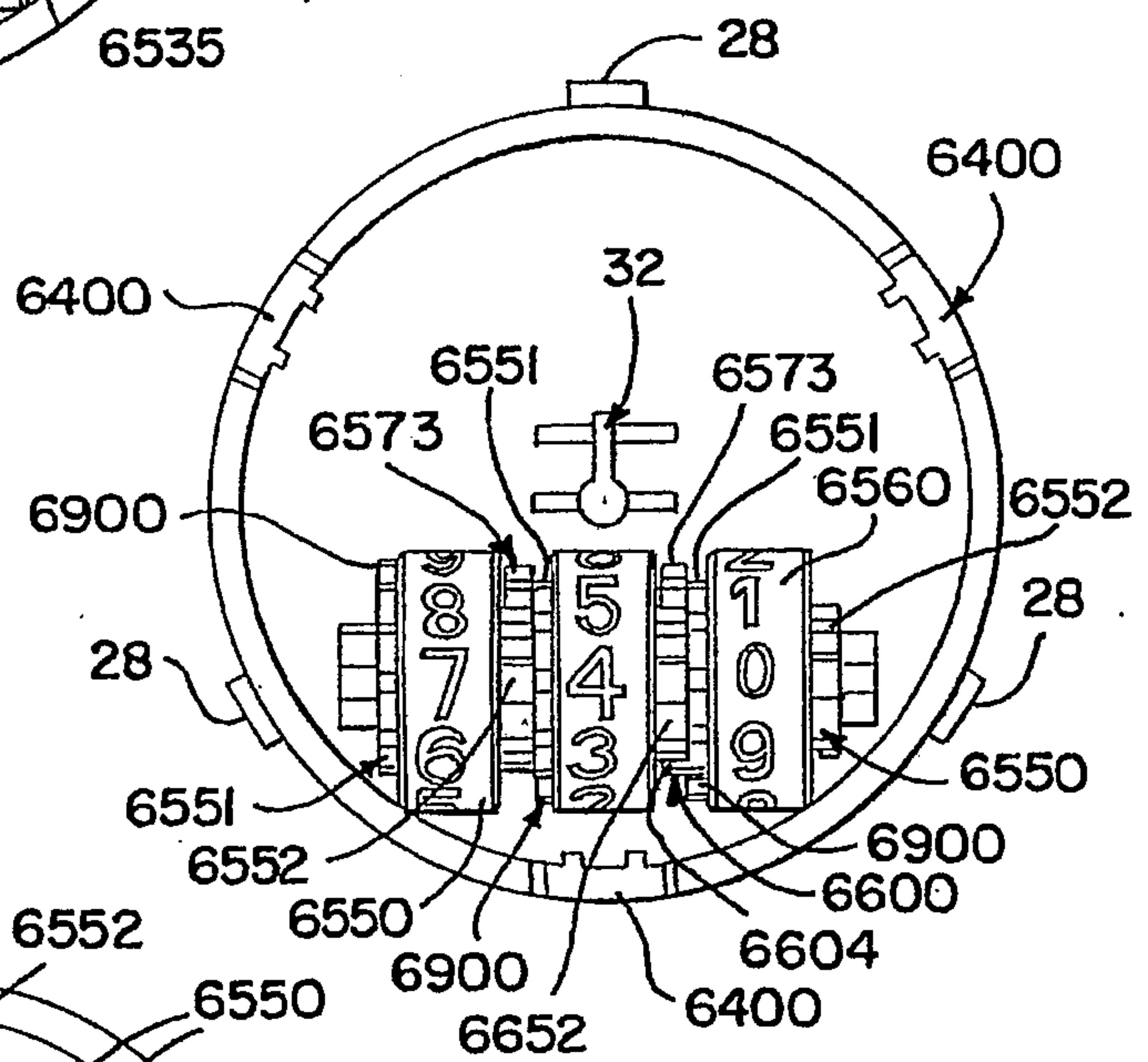


FIG. 147

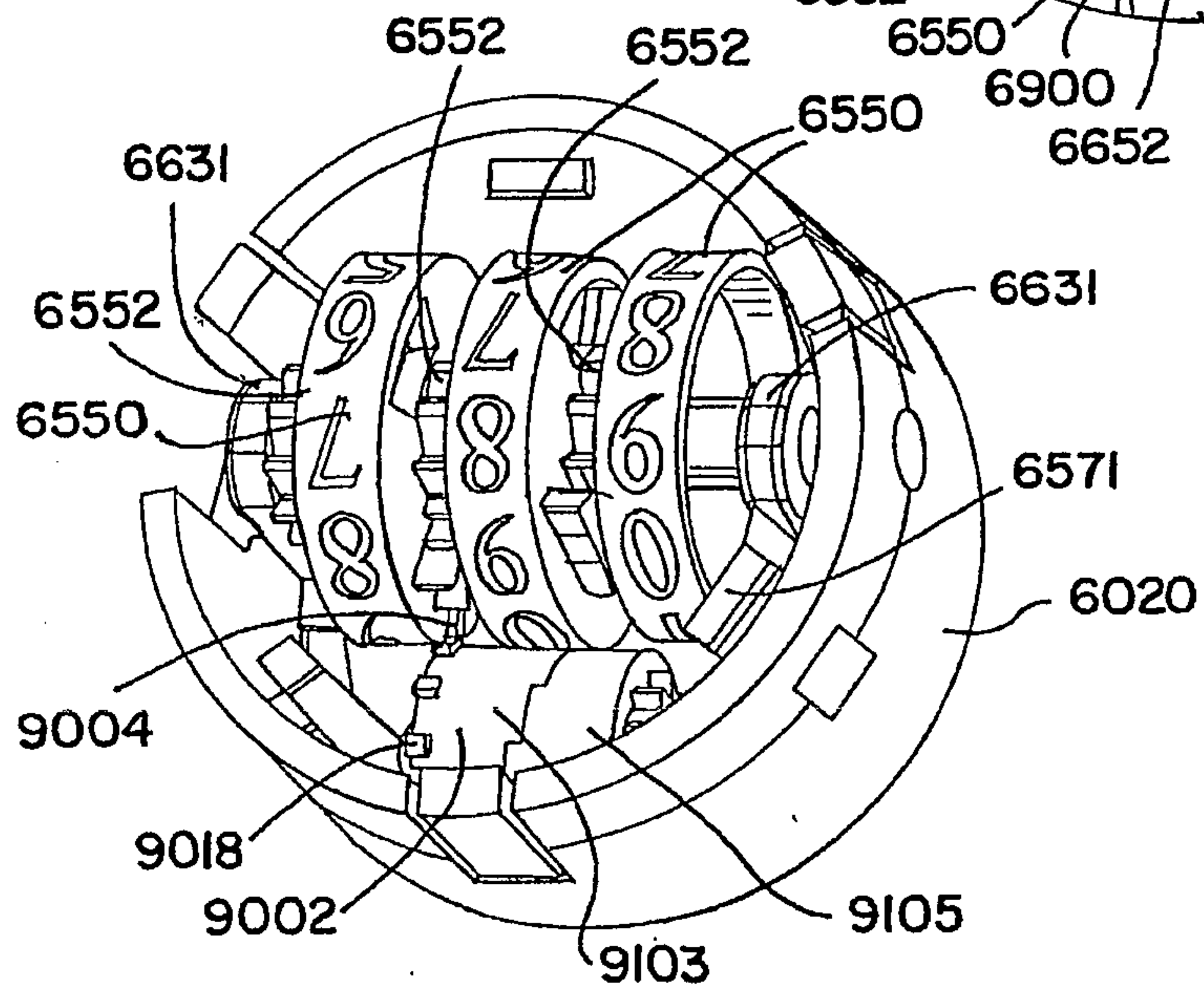


FIG. 148

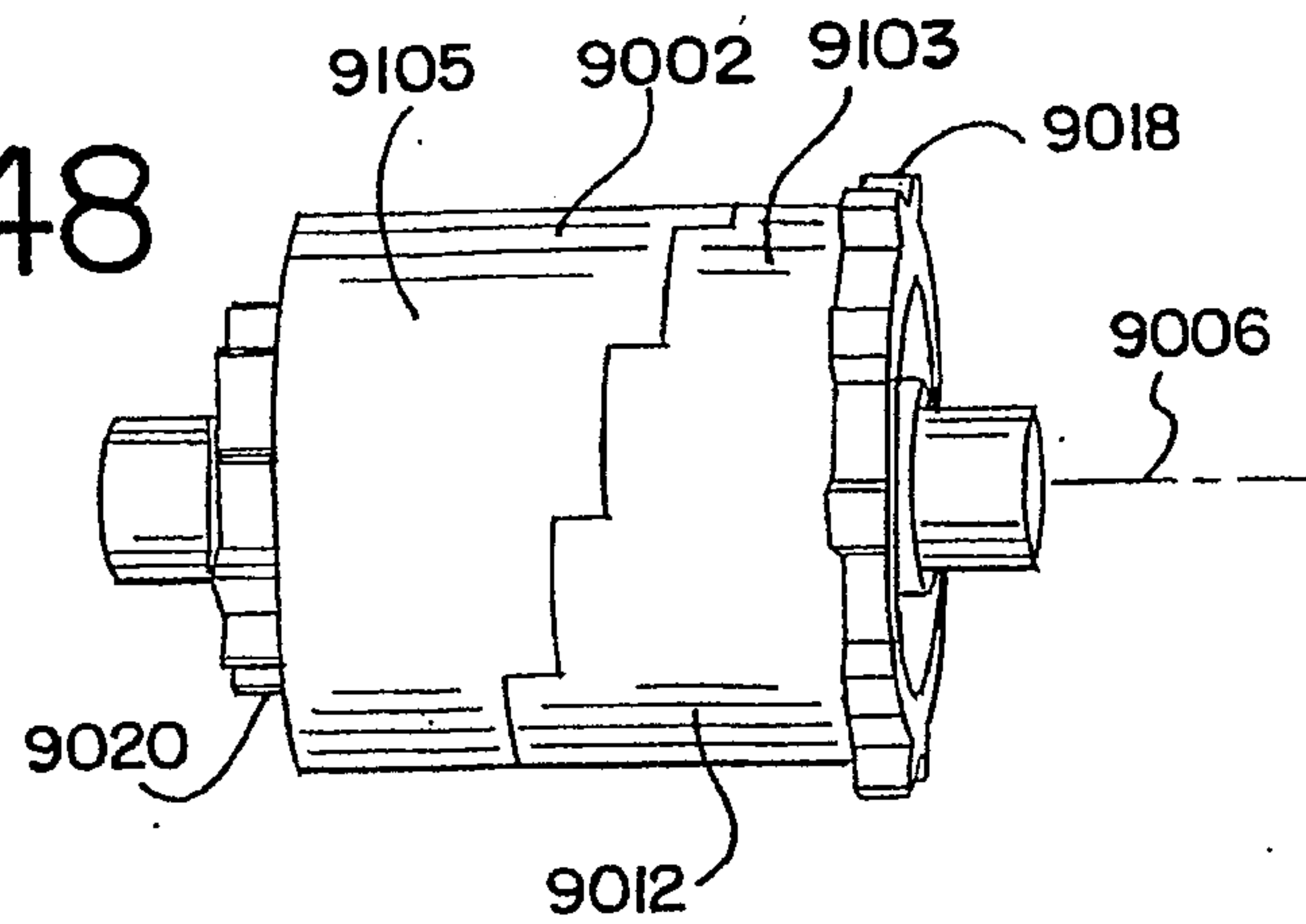


FIG. 149

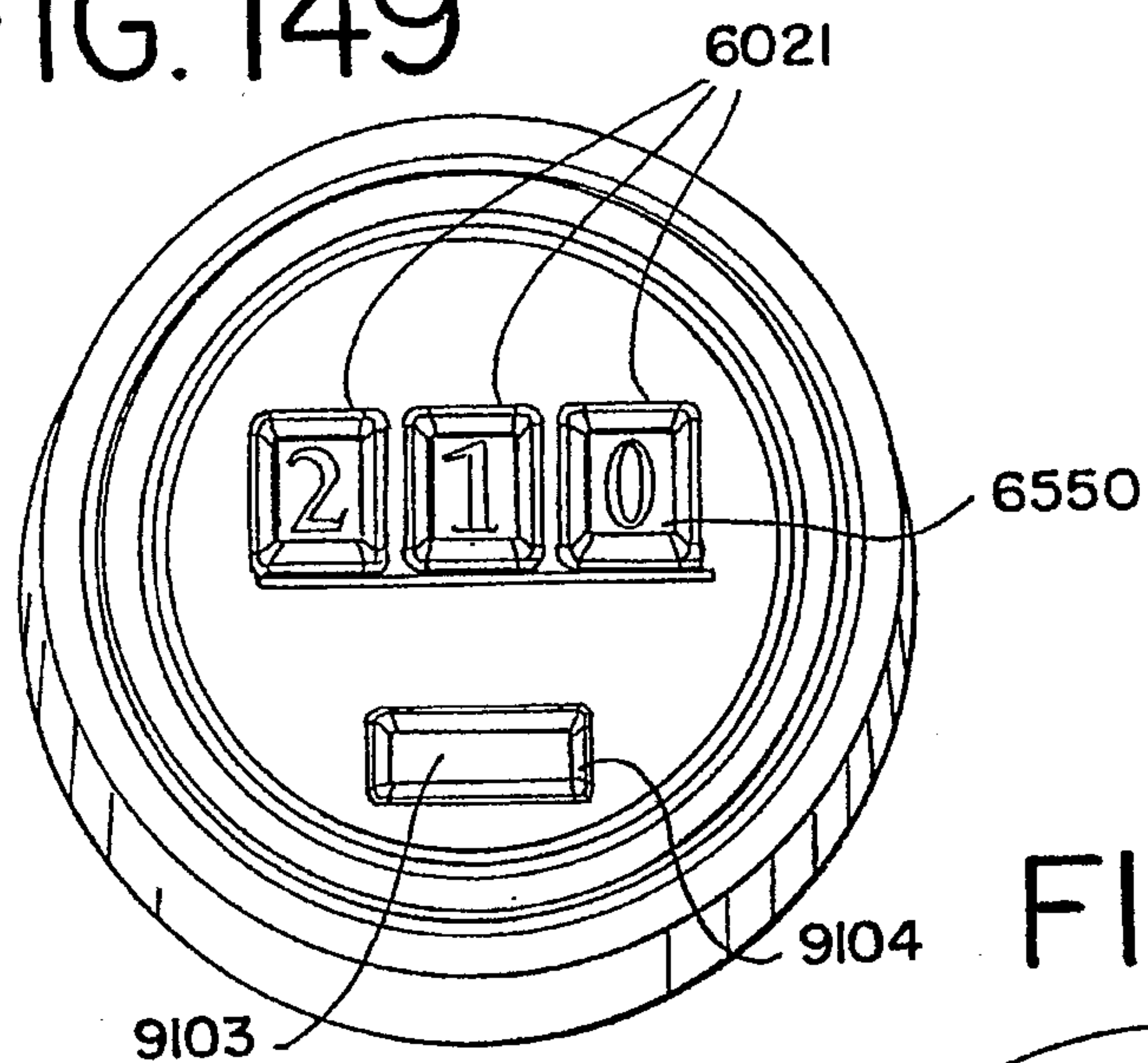


FIG. 150

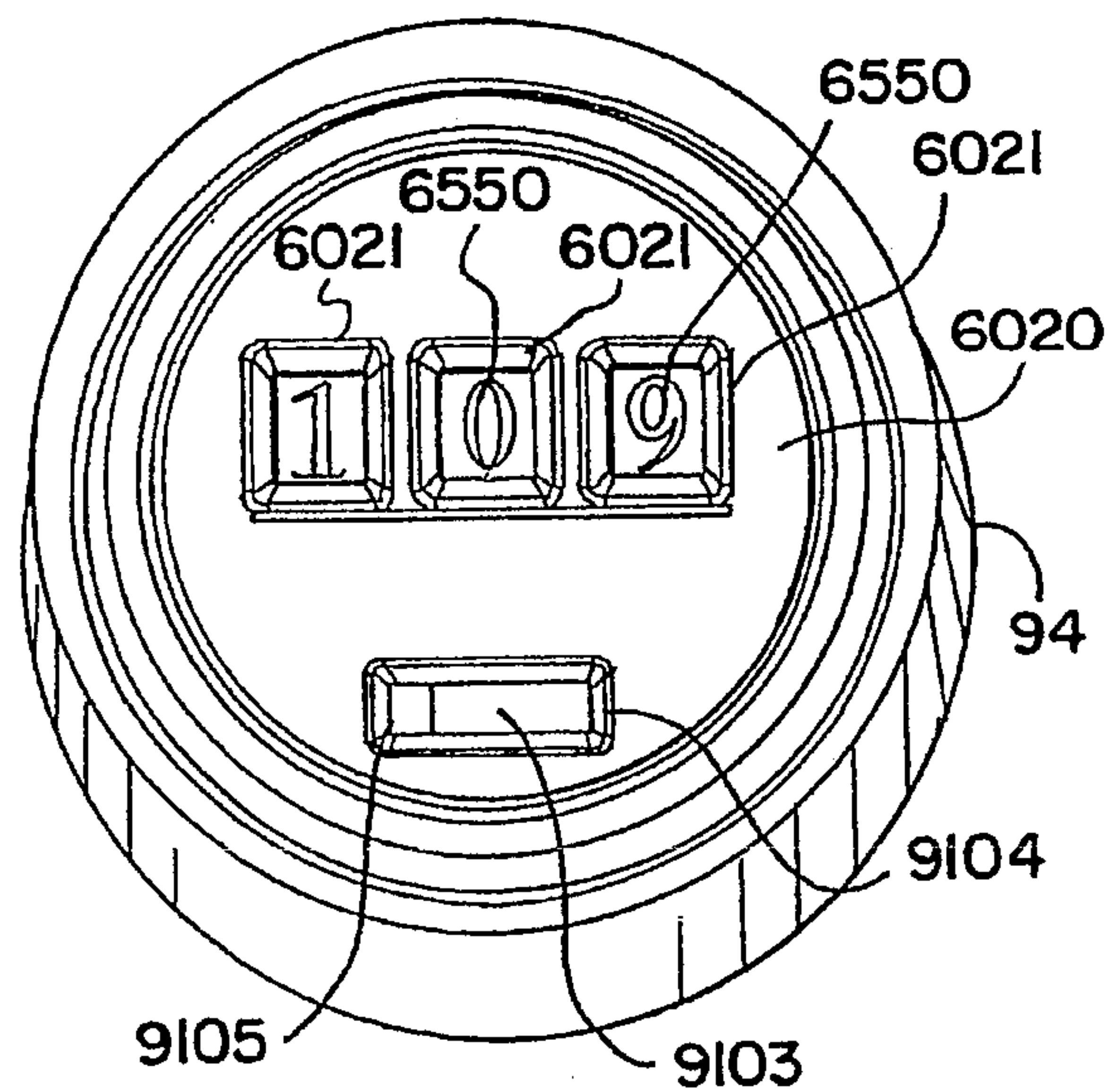


FIG. 151

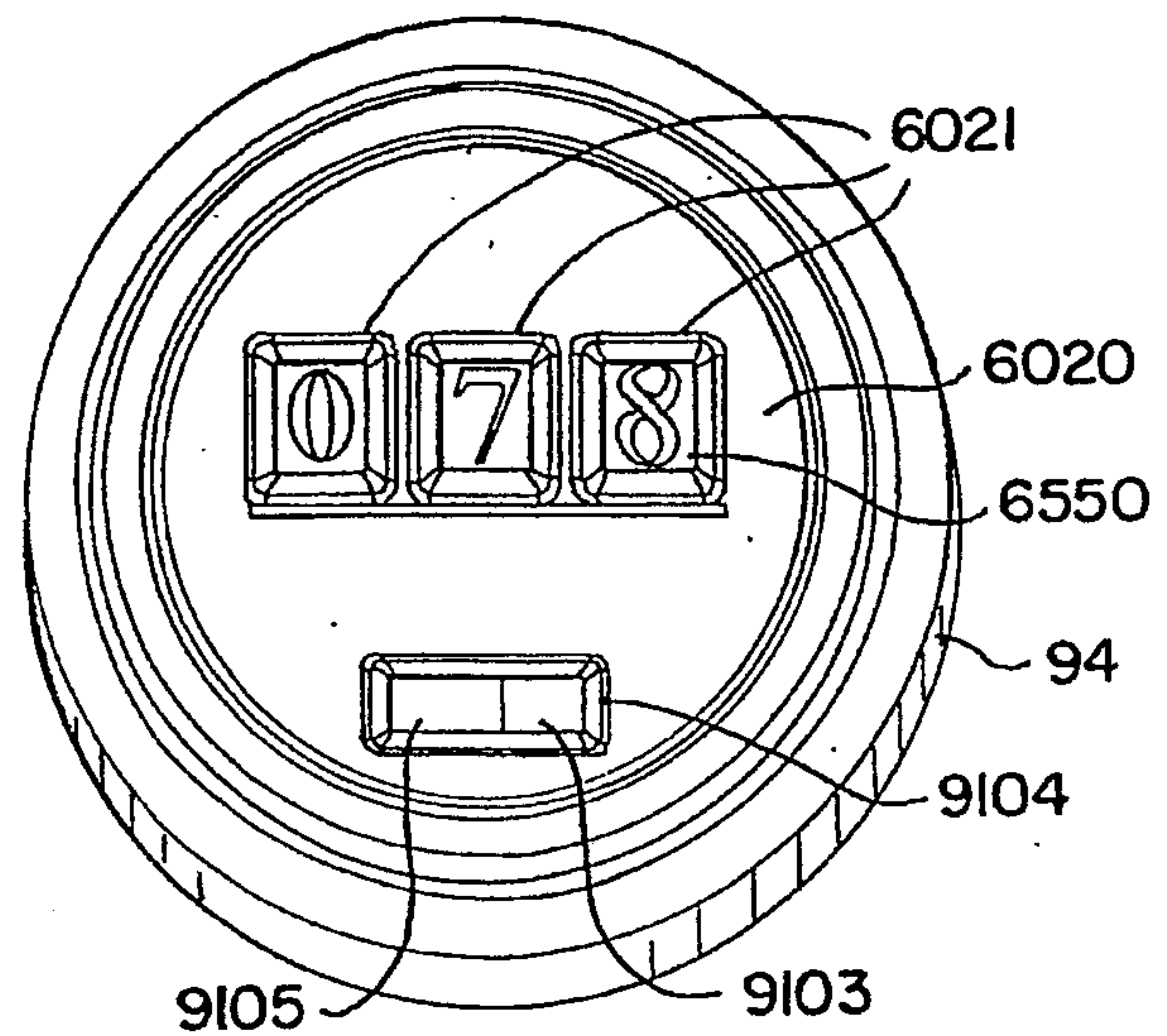


FIG. 152

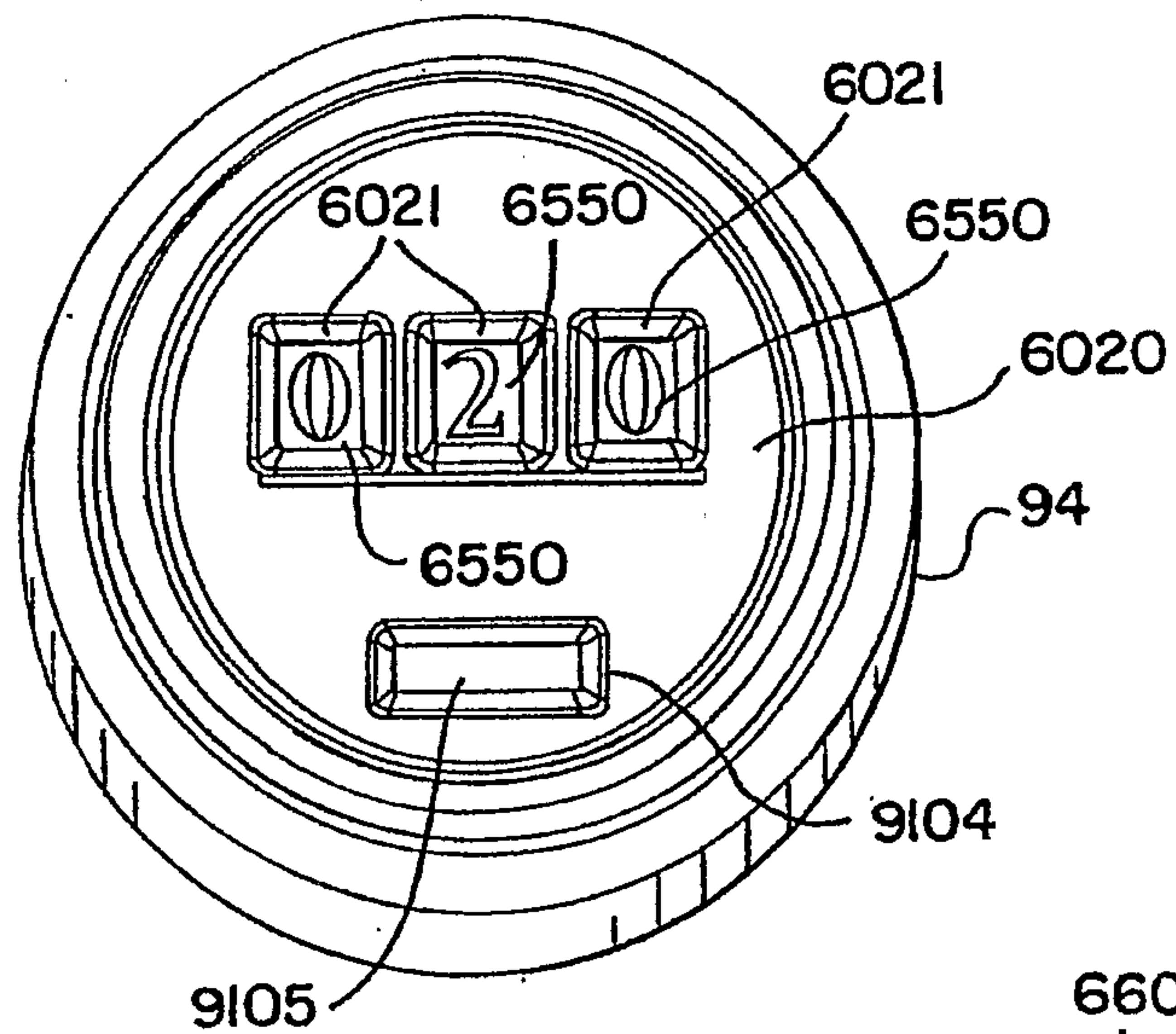


FIG. 153

