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(72) Inventeurs/Inventors:
DOUCET, MICHEL, FR;
VAILIONIS, THOMAS G., US;
FRIGIERE, RENE, FR;
AMOROS NOLLAS, ENRIQUE, ES;
ADAMS, PAUL H., ES

(73) Propriétaire/Owner:
BIC CORPORATION, US

(74) Agent: OSLER, HOSKIN & HARCOURT LLP

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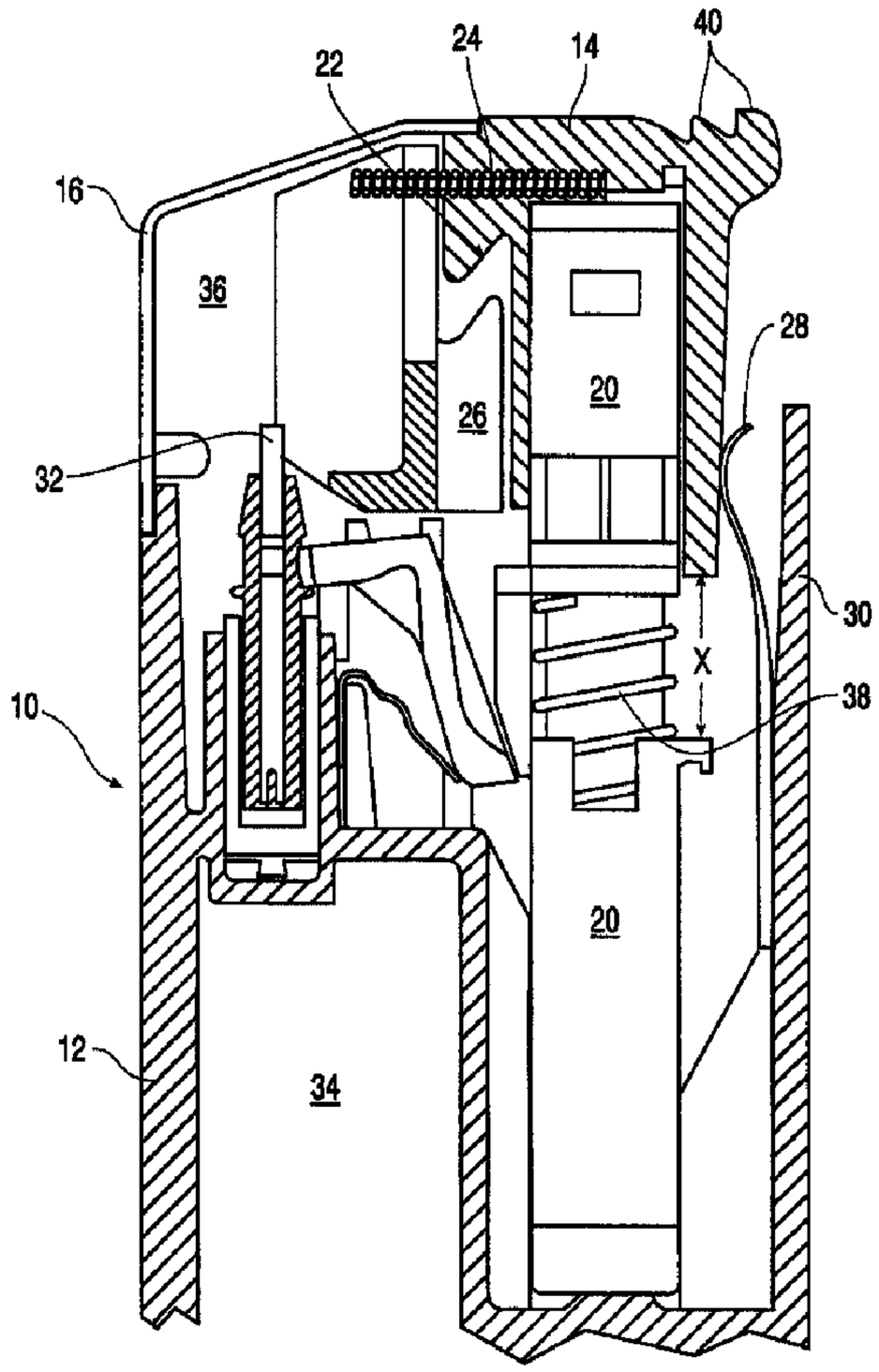

(57) Abrégé/Abstract:
A lighter (10) of the disposable type, ignition of which requires depression of an actuator (14) that is resistant to the manipulations of unintended users. The lighter (10) is normally maintained in a position that prevents depression of the actuator through the

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(57) Abrégé(suite)/Abstract(continued):
incorporation of a mechanism that increases the difficulty of operation. The actuation inhibiting mechanism (22, 26, 42, 44) requires a downward displacement and a tilted displacement in order to allow full depression of the actuator (14) and activation of an ignition mechanism (20, 20a, 20b). Preferably, at least one biasing element (28, 38, 80) is provided so that when the actuator is displaced through the application of force by a user, it returns to the initial blocking position when the force is removed.

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(71) Applicant: BIC CORPORATION [US/US]; 500 BIC Drive, Milford, CT 06460 (US).

(72) Inventors: DOUCET, Michel; La Croix Verte, F–35600 Bains–sur–Oust (FR). FRIGIERE, Rene; La Plessis Rivault, F–56350 Allaire (FR). VAILIONIS, Thomas, G.; 50 Burton Street, Watertown, CT 06795 (US). NOLLAS, Enrique Amoros; Avenida Sant Jordi, 29, E–43201 Reus (ES). ADAMS, Paul, H.; 21 Perry Drive, Monroe, CT 06468 (US).

(74) Agents: MARSHALL, Jonathan, A. et al.; Pennie & Edmonds LLP, 1155 Avenue of the Americas, New York, NY 10036 (US).

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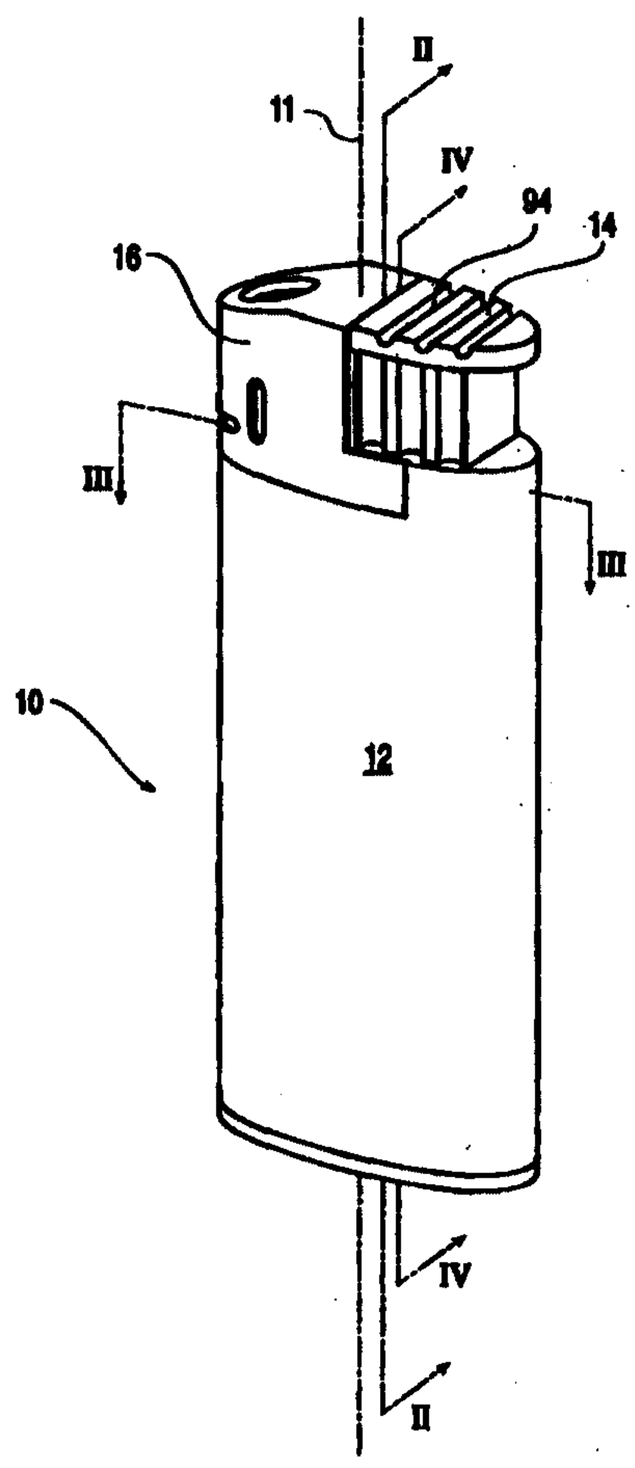
(54) Title: CHILD RESISTANT LIGHTER

(57) Abstract

A lighter (10) of the disposable type, ignition of which requires depression of an actuator (14) that is resistant to the manipulations of unintended users. The lighter (10) is normally maintained in a position that prevents depression of the actuator through the incorporation of a mechanism that increases the difficulty of operation. The actuation inhibiting mechanism (22, 26, 42, 44) requires a downward displacement and a tilted displacement in order to allow full depression of the actuator (14) and activation of an ignition mechanism (20, 20a, 20b). Preferably, at least one biasing element (28, 38, 80) is provided so that when the actuator is displaced through the application of force by a user, it returns to the initial blocking position when the force is removed.



CHILD RESISTANT LIGHTER

BACKGROUND OF THE INVENTION

Technical Field

The present invention relates to a lighter employing an ignition system which presents increased difficulty of operation by unintended users and, more particularly, relates to a piezoelectric lighter with such a system.

Discussion of the Related Art

Disposable gas lighters are available in a variety of forms. One common element of disposable lighters is an actuator pad or lever used to initiate the flow of fuel. An actuator pad is operated in conjunction with a spark producing mechanism so that the flow of fuel is ignited soon after it commences. For example, lighters employing conventional spark wheels require a user to rotate a toothed spark wheel against a flint in order to generate a spark. The user then depresses the actuator pad, releasing gas and producing a flame.

Another means of ignition for disposable lighters employs a piezoelectric mechanism. In this type of ignition mechanism, a piezoelectric element, such as a crystal, is struck by a hammer or anvil in order to produce an electric spark. The spark is conducted to a location near the opening of the valve to ignite the gaseous fuel. The actuator pad, upon forced depression by a user, commences both the flow of the fuel and the ignition process. An example of such a piezoelectric ignition mechanism is disclosed in U.S. Patent No. 5,262,697, entitled "Piezoelectric Mechanism For Gas Lighters."

As with spark wheel ignition mechanisms, measures have been introduced to increase difficulty of activation such as to prevent unintended activation of piezoelectric mechanisms or activation by unintended users (*e.g.*, children 5 years old and younger). One typical method employed is to incorporate a separate latch member disposed under the actuator pad which inhibits depression of the actuator pad. Examples of such mechanisms are shown in U.S. Patent Nos. 5,435,719, 5,584,682, and 5,636,979.

There remains, however, a need in the art for improved mechanisms which increase the difficulty of operation unintentionally or by unintended users, and at the same time which are user-friendly for the intentional and intended user.

SUMMARY OF THE INVENTION

It is thus an object of the present invention to provide a lighter that is operable by an adult upon intended actuation movements, but which is resistant to operation by unintended users.

It is a related object of the present invention to provide a lighter that has an actuator that is preferably movable in at least two directions and preferably in more than two directions to actuate the lighter.

These and other objects of the present invention are met by providing a lighter having an elongated body defining a fuel reservoir and a valve for dispensing such fuel. An ignition system, including a spark producing mechanism such as a piezoelectric mechanism, is also provided to generate a spark at about the time fuel is selectively released from the reservoir to generate a flame. The lighter further includes an actuator that, upon depression, activates the ignition system, which requires the release of fuel from the reservoir and activation of a piezoelectric mechanism which makes a spark. Depression of the actuator is normally barred, however, by a blocking mechanism. Displacement of the blocking mechanism in the specified manner allows the actuator to be depressed. The blocking mechanism, which is integral to the actuator, is displaced through pressure by a user. Upon removal of the displacing force the blocking mechanism returns to its initial blocked position, once again preventing the actuator from being depressed sufficiently to activate the ignition system. The blocking mechanism requires tilted displacement in both the horizontal and vertical directions in order to permit ignition.

In another aspect of the invention, the lighter includes an actuator that, upon movements along a predetermined path, actuates the ignition system. An actuation inhibiting mechanism is provided to define the predetermined path that the actuator is moved in order to actuate the ignition system.

The actuation inhibiting mechanism includes a blocking mechanism and an interlocking mechanism selectively positioned relative to the lighter body to define the predetermined path. The actuation inhibiting mechanism is preferably arranged so that the actuator is moved at least in an actuation direction (in the direction the spark producing mechanism is moved to generate a spark) and in a direction transverse to the actuation direction (in a generally tilted direction, predominantly in the transverse direction) to actuate the ignition mechanism. Upon removal of the applied force required to depress the actuator, the actuation inhibiting mechanism is biased to return to its initial position wherein movement of the actuator along the predetermined path is needed in order to actuate the ignition system.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects, features, and advantages of the invention will become more readily apparent from the following detailed description of the invention, which should be read in conjunction with the accompanying drawings, in which like reference characters represent like elements, and in which:

FIG. 1 is a perspective view of a lighter having a actuation inhibiting mechanism formed in accordance with the principles of the present invention;

FIG. 2 is a partial cross-sectional view of the lighter depicted in FIG. 1;

FIG. 3 is a partial cross-sectional view of the lighter depicted in FIG. 1 in a locked position;

FIG. 4 is a partial cross-sectional view of the lighter depicted in FIG. 1, in which the actuator is displaced prior to activation of the ignition system;

FIG. 5 is a partial cross-sectional view of the lighter depicted in FIG. 1 in an ignition position;

FIG. 6 is a partial cross-sectional view, along line II-II, of the lighter of FIG. 1, showing the actuator in an initial position and a substantially central cross-sectional view of the actuation inhibiting mechanism;

FIG. 7 is a partial cross-sectional view, along line III-III, of FIG. 1 of the lighter of the present invention;

FIG. 8 is a cross-sectional view, along line IV-IV, of the lighter of FIG. 1, showing the actuator in the initial position and illustrating another cross-sectional plane of the actuation inhibiting mechanism;

FIG. 9 is a perspective view of the actuator of the present invention, showing a movable portion of an interlocking mechanism of the actuation inhibiting mechanism of the present invention;

FIG. 10 is a top plan view of the actuator of FIG. 9;

FIG. 11 is a side elevational view of the actuator of FIG. 9;

FIG. 12 is a perspective view of the stationary portion of the interlocking mechanism of the actuation inhibiting mechanism of the present invention;

FIG. 13 is a top plan view of the stationary portion of the interlocking mechanism of FIG. 12;

FIG. 14 is a cross-sectional view, along line IV-IV of Fig. 1 and similar to that of Fig. 8, of the lighter of FIG. 1 showing the actuator in an intermediate position;

FIG. 15 is a cross-sectional view similar to that of FIG. 14, but with the actuator disengaging from the blocking mechanism of the actuation inhibiting mechanism;

FIG. 16 is a cross-sectional view similar to that of FIG. 14, but with the actuator in the ignition actuation position; and

FIG. 17 is a cross-sectional view of another embodiment of the blocking mechanism.

DETAILED DESCRIPTION OF THE INVENTION

A lighter 10 having an actuation inhibiting mechanism formed in accordance with the principles of the present invention is shown in FIG. 1. Lighter 10 has a longitudinal axis 11, a body portion 12, a depressible valve actuator 14, and a wind guard or shield 16. Additionally, a valve 18 and an ignition mechanism 20 (20a, 20b) is provided within lighter 10, as may be seen in, for example, the cross-sectional views of FIGS. 2, 3, and 6.

Referring now to FIG. 2, further details of the ignition system and safety feature of lighter 10 are depicted. An upper portion of piezoelectric ignition mechanism 20 is connected to actuator 14, as is blocking ridge 22. Spark conductor 24 is electrically connected to ignition mechanism 20 in a known manner. A lower portion of ignition mechanism 20 is received in a cooperating recess in body 12. Projection 26 is connected to an appropriate section of body portion 12, preferably at an upper central area of the housing. Coil spring 38 is positioned between the upper and lower portions of ignition mechanism 20.

Leaf spring 28 is positioned between rear wall 30 and actuator 14 so as to exert an inward biasing force upon actuator 14 to resist outward movement of the actuator toward rear wall 30 of body 12. Coil spring 38 serves to resist the compression of ignition mechanism 20. Coil spring 38 also applies an upward bias against, thereby resisting the depression of, actuator 14.

The upper and lower portions of ignition mechanism 20 are compressibly joined. When at rest, the upper and lower portions of ignition mechanism 20 are separated by a gap, denoted by X in FIG. 2. In piezoelectric lighters such as the present invention, depression of actuator 14 compresses ignition mechanism 20, thereby causing a hammer (not shown) within ignition mechanism 20 to strike a piezoelectric element (not shown), also within ignition mechanism 20. Depression of actuator 14 also opens the fuel valve, thus releasing fuel from reservoir 34 through nozzle 32. Striking the piezoelectric element, or crystal, produces an electrical impulse that is conducted across spark conductor 24 to ignition cavity 36. An electrical arc is generated across the gap from spark conductor 24 to metal nozzle 32, thus igniting the escaping fuel. The basic operation of disposable piezoelectric lighters is well known.

In FIG. 2, actuator 14 is shown in its normal or at-rest position. From its normal position, depression of actuator 14 will cause blocking ridge 22 to engage projection 26, thus allowing only minimal, if any, compression of ignition mechanism 20. Referring now to FIG. 3, actuator 14 is depressed as far as blocking ridge 22 and projection 26 will allow. The upper and lower portions of ignition mechanism 20 remain separated by distance X' and cannot be compressed sufficiently to activate the ignition system, thus preventing the production of a flame.

In order for intended users to operate lighter 10, actuator 14 must first be displaced outwardly or rearwardly from nozzle 32, away from its normal position. Alternatively, the actuator may be moved away from the nozzle in a sideways motion. When moved to this "ready" position, demonstrated in FIG. 4, the biasing force of leaf spring 28 has been overcome by an outward force applied by the user. It can also be seen that outward displacement of actuator 14 causes ignition mechanism 20, spark conductor 24, and blocking ridge 22 to be proportionally displaced. To aid the user in displacing actuator 14 from the normal position to the ready position, in the present embodiment of the invention the rear surface of actuator 14 may be shaped to increase friction between actuator 14 and the user. Illustratively, this may be accomplished by forming actuator 14 to include one or more ridges 40.

In the ready position, blocking ridge 22 is clear of projection 26. Thus, as shown in FIG. 5, actuator 14 can be depressed by the user in order to cause the activation of the ignition system, at which time the gap between the upper and lower portions of ignition mechanism 20, denoted by X'' in FIG. 5, is at a minimum. The upward bias exerted by coil spring 38 forces actuator 14 upward when the downward pressure applied by the user is removed. The combined inward and upward biases imparted by leaf spring 28 and coil spring 38, respectively, ensure that lighter 10 returns to the normal (locked) position after use.

Referring now to FIG. 6, another embodiment of the ignition system and actuation inhibiting mechanism of lighter 10 are depicted. An upper portion 20a of ignition mechanism 20 is coupled to or is held in a cavity 21 within actuator 14. Although a tight fit between upper portion 20a and actuator 14 may be desirable, such a tight fit may slightly bend ignition mechanism 20 during use. Alternatively, to alleviate such bending, sufficient clearance may be provided between cavity 21 of actuator 14 and upper portion 20a of ignition mechanism 20 so that ignition mechanism 20 is not subjected to excessive bending forces during actuation of lighter 10, as will be appreciated with reference to the operation of the lighter as described below. A spring member may be disposed in the clearance between cavity 21 and upper portion 20a to ensure sufficient contact and support between upper portion 20a and actuator 14.

A lower portion 20b of ignition mechanism 20 is received in a cooperating recess 23 in body 12. It will be appreciated that the terms "upper" and "lower" only describe the relative positions of portions 20a, 20b as depicted in the Figures, and do not limit these portions to such positions. Biasing element 38, such as a coil spring, is positioned between upper and lower portions 20a, 20b of ignition mechanism 20. Coil spring 38 resists the movements of portions 20a and 20b relative to each other, and thus the actuation of ignition mechanism 20. Biasing element 38 also biases against, thereby resisting the movement of, actuator 14. Thus, the upper and lower portions 20a, 20b of ignition mechanism 20 are compressibly joined and actuator 14 is maintained in an initial position in which upper and lower portions 20a, 20b are spaced apart as shown in FIG. 6.

The basic operation of disposable lighters, particularly piezoelectric lighters, is well known and therefore is only briefly described herein. When at an "initial position," the upper and lower portions 20a, 20b of ignition mechanism 20 are separated by a gap, denoted by X in FIG. 6, and top surface 15 of actuator 14 is located at a position "P1". Movement of the top surface 15 of actuator 14 from the initial position P1 to an actuation position "P2" (See FIG. 16) causes upper and lower portions 20a, 20b to move along an actuation axis 25 and thereby compresses ignition mechanism 20. In piezoelectric lighters such as the present invention, compression of ignition mechanism 20 causes an anvil (not shown), which is slideably disposed within ignition mechanism 20, to strike a piezoelectric element fixedly located within ignition mechanism 20. The operation of this piezoelectric ignition system is fully described in the '697 patent.

A spark conductor 24, electrically coupled to ignition mechanism 20 in a known manner, is mounted on actuator 14 to move therewith. A ramping member 27 is attached to the ignition mechanism 20 such that the ramping member 27 is moved along the actuation axis when the ignition mechanism is moved along actuation axis. Ramping member acts on lever 29 to rotate lever 29 (in the counter-clockwise direction as shown in the drawings) to lift valve 18. Successful movement of actuator 14 sufficient to ignite ignition mechanism 20 opens valve 18, thus selectively releasing fuel from reservoir 34 through nozzle 32, and moves spark conductor 24 closer to an electrically

conductive diffuser 29 located above nozzle 32. Actuation of the piezoelectric element (or other form of ignition mechanism usable in the lighter of the present invention), upon successful movement of actuator 14, produces an electrical impulse across spark conductor 24 and diffuser 29 through ignition cavity 36. An electrical arc is generated across the gap from spark conductor 24 to the electrically conductive diffuser 29, thus igniting the fuel selectively released through valve 18.

An actuation inhibiting mechanism is provided to inhibit depression of actuator 14 and to increase the difficulty of actuating the ignition mechanism 20 and lighting of lighter 10. The actuation inhibiting mechanism includes a blocking mechanism 42 and an interlocking mechanism 44 which direct movements along actuation axis 25 and movements transverse to actuation axis 25, respectively.

Blocking mechanism 42 includes a blocking element 50 attached to or located on or near inner wall 52 of lighter body 12. As may be seen in FIG. 7, preferably two blocking elements 50 are provided within lighter body 12, one on each side of cavity 54 in lighter body 12. When top surface 15 of actuator 14 is at initial elevation P1, before depression of actuator 14, a lower surface 56 of actuator 14 is aligned with and spaced from blocking surface 58 of blocking element 50. Actuator 14 thus may only be depressed a distance B (FIG. 6) along actuation axis 25 before the lower surface 56 of actuator 14 engages blocking surface 58 of blocking element 50. Thus, further depression along actuation axis 25 is arrested. Accordingly, upper and lower portions 20a, 20b of ignition mechanism 20 remain separated by distance X', as may be seen in FIG. 14 (described in further detail below). Preferably, ignition mechanism 20 is configured and dimensioned such that compression of the ignition mechanism to the distance X' is insufficient to cause the anvil to strike the piezoelectric element, to produce a flame. Likewise, top surface 15 of actuator 14 can only be moved from the initial position P1, to an intermediate position "IP" without being able to reach actuation position P2. It will be appreciated that other arrangements including a blocking element fixed to lighter body 12 and arranged to engage actuator 14 or an element coupled thereto to inhibit movement of actuator 14 are within the scope of the present invention.

In order for actuator 14 to clear or misalign with blocking element 50, *i.e.*, in order to move lower surface 56 of actuator 14 out of alignment with blocking surface 58 of blocking element 50 from the intermediate position IP, actuator 14 is moved in a direction transverse to actuation axis 25 and away from blocking element 50. However, interlocking mechanism 44 of the actuation inhibiting mechanism inhibits such transverse movement of actuator 14 from its initial position. Thus, until interlocking mechanism 44 is disengaged, actuator 14 cannot be moved to a position out of alignment with blocking mechanism 42.

Interlocking mechanism 44 includes a stationary interlocking portion 60 fixedly mounted to lighter body 12 and a movable interlocking portion 62, mounted to actuator 14. Reference is made to the cross-sectional views of FIGS. 6 and 8 for an illustration of the interrelationship between stationary interlocking portion 60 and movable interlocking portion 62. Movable interlocking portion 62 preferably extends from an interior wall of actuator 14 to cooperate with stationary interlocking portion 60. Movable interlocking portion 62 thus moves along with actuator 14 with respect to lighter body 12 and stationary interlocking portion 60. Preferably, actuator 14 is formed integral with movable interlocking portion 62.

Further reference is made to FIGS. 9-13 for an illustration of the features of portions 60 and 62 of interlocking mechanism 44. As may be appreciated from FIGS. 9-11, movable interlocking portion 62 preferably includes a base projection 66 from which at least one wing 68 extends. Preferably, wings 68a, 68b extend from each side of base projection 66 such that movable interlocking portion 62 has the form of a T-shaped flange. Spark conductor 24 is preferably mounted on a mounting portion 70 of base extension 66 that extends above wings 68a, 68b.

As may be appreciated with reference to FIGS. 12 and 13, stationary interlocking portion 60 includes projections 72 extending towards movable interlocking portion 62 and having slots 74 formed therein to receive wings 68 of movable interlocking portion 62. It will be appreciated that the number of projections 72 on stationary portion 60 preferably corresponds to the number of wings provided on movable portion 62. When actuator 14 is in the initial position P1, as shown in FIG. 8, wings 68 are movably received within slots 74. This interlocked configuration of

movable interlocking portion 62 to stationary interlocking portion 60 at the initial position P1 inhibits movement of actuator 14, in the transverse direction. Accordingly, lower surface 56 of actuator 14 cannot be moved out of alignment with blocking surface 58 of blocking element 50 at the initial position P1.

In order to move actuator 14 to actuation position P2, movable interlocking portion 62 and actuator 14 are disengaged from stationary interlocking portion 60. Such disengagement of interlocking mechanism 44 includes a movement of actuator 14 transverse to actuation axis 25 to permit further movement of actuator 14 along actuation axis 25 (substantially parallel to the movement of actuator 14 between initial position P1 and intermediate position IP) to reach actuation position P2. Accordingly, projections 72 have angled undercuts 76 which preferably guide the removal of wings 68 from slots 74 by movement of movable interlocking portion 62 away from stationary interlocking portion 60 as follows. Upon movement of actuator 14 along actuation axis 25, wings 68 slide through slots 74 towards undercuts 76 until tops 78 of wings 68 reach undercuts 76, whereupon wings 68 may be slid out and removed from slots 74. It will be appreciated that tops 78 of wings 68 reach undercuts 76 as lower surface 56 of actuator 14 approaches blocking surface 58 of blocking element 50 -- before or substantially at the same time that actuator 14 reaches intermediate position IP. Hence intermediate position IP may also be any position where transverse movement of actuator 14 is allowed.

Removal of wings 68 from slots 74, and consequent disengagement of interlocking portions 60 and 62, generally includes a movement of actuator 14 transverse to actuation axis 25 most typically achieved by a tilting movement, as shown in FIG. 15 and described in greater detail below. If desired, a biasing element 80, as shown in FIG. 6, such as a leaf spring, may be positioned to resist motion of actuator 14 in the transverse direction. Preferably, undercuts 76 are angled to facilitate removal of wings 68a,b from slots 74 by such tilting movement of actuator 14, as well as to facilitate re-entry of wings 68a,b into slots 74 after actuation of ignition mechanism 20. Such re-entry is further facilitated by biasing element 80. Preferably, tops 78 of wings 68a,b maintain contact with undercuts 76 during the removal of wings 68a,b from slots 74.

Several features are provided to enhance engagement of interlocking portions 60 and 62, when such engagement is desired, and thus improve the appearance and function of actuator 14 with respect to lighter 10. In order to position interlocking portions 60 and 62 as close as possible to each other, grooves 82 are preferably provided along interior wall 64 of actuator 14 (in the region of movable interlocking portion 62) to receive projections 72 of stationary interlocking portion 60, as may be appreciated with reference to FIGS. 8, 10, 11, and 13 so that actuator 14 may return to initial position P1 as described in greater detail below. Additionally, an ignition cutout 84 is formed in the wall 86 connecting projections 72 of stationary interlocking portion 60. Ignition cutout 84 is aligned with base projection 66 of movable interlocking portion 62, and thus with mounting portion 70 on which spark conductor 24 is mounted. Thus, upon depression of actuator 14, spark conductor 24 is depressed and passes through ignition cutout 84 to approach conductive nozzle 32 to permit generation of an electrical arc.

The series of steps required to generate a flame, described briefly above, are illustrated with respect to FIGS. 6 and 14-16. In order for intended users to operate lighter 10, actuator 14 is first depressed from initial position P1 to intermediate position IP, as shown in FIG. 14. To aid the user in moving actuator 14, top surface 15 may be shaped and configured to provide increased friction with the user's finger to facilitate movement thereof by the user. Illustratively, this may be accomplished by forming on top surface 15 one or more ridges 94, as shown in FIGS. 1, 9 and 10.

As described above, blocking element 50 prevents actuator 14 from being depressed below intermediate position IP to reach actuation position P2. Moreover, interlocking mechanism 44 prevents transversal movement of actuator 14 out of blocking alignment with blocking element 50 in the initial position P1. It will be appreciated that once actuator 14 substantially reaches intermediate position IP, tops 78 of wings 68 are adjacent undercuts 76. Thus, the user may begin to move actuator 14 transverse to actuation axis 25 to disengage interlocking mechanism 44 and to bring actuator 14 out of alignment with blocking element 50, as shown in FIG. 15. If desired, actuator 14 may be pivoted against blocking element 50 and tilted (a motion including a component transverse to actuation axis 25) to achieve the desired motion necessary to release wings

68 from slots 74 and thus to disengage movable interlocking portion 62 from stationary interlocking portion 60.

The motion of actuator 14 from the intermediate position IP in the transverse direction, as illustrated in FIG. 15, moves movable portion 62 out of alignment with stationary portion 60, and also moves bottom surface 56 of actuator 14 out of alignment with top surface 58 of blocking element 50. Thus, blocking mechanism 42 is disengaged and actuator 14 may be further moved within cavity 54 of lighter body 12 along actuation axis 25 to further compress upper and lower portions 20a and 20b of ignition mechanism 20, and to actuate ignition mechanism 20, as shown in FIG. 16. Upon actuation of ignition mechanism 20, the gap between upper and lower portions 20a, 20b of ignition mechanism 20, denoted by X'' in FIG. 16, is at a minimum. Moreover, top surface 15 of actuator 14 reaches actuation elevation level P2.

Biasing elements 38 and 80 (if provided) bias actuator 14 to return to initial position P1 when the force applied by the user is removed. As discussed above, the shape of undercuts 76 of projection 72 as well as grooves 82 in wall 64 of actuator 14 facilitate such return of actuator 14 to the initial position P1.

FIG. 17 depicts a further feature which may be incorporated into blocking mechanism 42. Lower surface 62 may have an extension 96 dependent therefrom, and top surface 58 of blocking element 50 may have a recess 98 defined thereon. Extension 96 and recess 98 are configured and dimensioned such that actuator 14 reaches the intermediate position IP before extension 96 is received within recess 98 and where transverse movement of actuator 14 is allowed. Extension 96 and recess 98 can resist actuation of the lighter by resisting transverse movement of the actuator, when the user-applied displacement is greater than necessary to disengage the stationary portion 60 from the movable portion 62 of the interlocking mechanism.

The actuation inhibiting mechanism, as described above, may also increase the difficulty of selectively releasing fuel gas through valve 18. For example, ramping member 27 and lever 29 may be configured and dimensioned such that when the actuator 14 is at position IP, ramping member 27 does not act on lever 29 to selectively release gas.

The above description is intended to be illustrative, not limitative. Thus, it will be apparent to those skilled in the art that modifications may be made to the invention as described without departing from the scope of the claims set out below. For example, biasing element 38 is illustrated as a coil spring, but any other suitable biasing element may be employed instead or additionally, such as a leaf spring or an integrally molded plastic spring. Likewise, although biasing elements 28 and 80 are illustrated as a leaf spring, any other suitable biasing element may be employed instead, or additionally, such as a coil spring or an integrally molded plastic spring.

The ignition mechanism and actuation inhibiting mechanism described herein are not limited to use in a lighter. These mechanisms can also be incorporated in other devices that require an enhanced child resistant mechanism, such as piezoelectric ignitions for gas grills, etc.

WHAT IS CLAIMED IS:

1. A lighter resistant to use by unintended users, said lighter comprising:

a lighter body having a fuel compartment;

a valve for supplying fuel from said fuel compartment;

an actuator mounted for movement with respect to said lighter body;

an ignition mechanism having an actuation axis, movement of said actuator from a first position along said actuation axis to an actuation position along said actuation axis causing said ignition mechanism to ignite said fuel, the actuator passing through an intermediate position between said first position and said actuated position; and

an actuation inhibiting mechanism arranged to limit movement of said actuator along said actuation axis and transverse to said actuation axis when said actuation inhibiting mechanism is engaged so that actuation of said ignition mechanism is resisted, whereupon passing through the intermediate position, disengagement of said actuation inhibiting mechanism permits movement of said actuator from said first position to said actuation position to actuate said ignition mechanism to ignite said fuel.

2. A lighter as in claim 1, wherein:

when engaged, said actuation inhibiting mechanism permits partial movement of said actuator along said actuation axis between said first position and said intermediate position; and

said actuation inhibiting mechanism resists movement of said actuator from said intermediate position to said actuation position; and said actuation inhibiting mechanism resists movement of said actuator transverse to said actuation axis as said actuator is moved from said first position towards said intermediate position.

3. A lighter as in claim 2, wherein said actuation inhibiting mechanism permits movement of said actuator transverse to said actuation axis when said actuator is at said intermediate position such that said actuator may be moved transverse to and then along said actuation axis toward said actuation position.

4. A lighter as in claim 1, wherein said actuation inhibiting mechanism comprises an interlocking mechanism arranged to engage said actuator to resist

movement of said actuator transverse to said actuation axis when said actuator is located between said first position and said intermediate position.

5. A lighter as in claim 4, wherein said interlocking mechanism comprises:

a first projection moveable with said actuator; and

a second projection fixed with respect to said lighter body;

wherein said first and second projections are movable with respect to each other between an engaged configuration where said interlocking mechanism prevents movement of said actuator transverse to said actuation axis and a disengaged configuration where said first projection is movable away from said second projection and said actuator is movable transverse to said actuation axis.

6. A lighter as in claim 5, wherein:

said first projection comprises a base projection and at least one wing extending therefrom; and

said second projection includes a slot for receiving said at least one wing, and an undercut permitting removal of said at least one wing from said slot as said actuator approaches said intermediate position.

7. A lighter as in claim 6, further comprising a blocking mechanism arranged to permit movement of said actuator from said first position to said intermediate position and to resist further movement of said actuator toward said actuation position when said blocking mechanism is engaged.

8. A lighter as in claim 7, wherein movement of said actuator from said first position toward said intermediate position permits disengagement of said interlocking mechanism such that said actuator may be moved away from said blocking mechanism and thereafter further moveable towards said actuation position to actuate said ignition mechanism.

9. A lighter as in claim 8, wherein said actuator is tiltable relative to said lighter body when in said intermediate position to disengage said interlocking

mechanism and said blocking mechanism and thus to permit further movement of said actuator to said actuation position.

10. A lighter as in claim 1, further comprising a blocking mechanism arranged to permit movement of said actuator from said first position to said intermediate position between said first position and said actuation position, and to inhibit further movement of said actuator toward said actuation position when said blocking mechanism is engaged.

11. A lighter as in claim 10, wherein said actuator is tiltable when in said intermediate position to disengage said blocking mechanism and to permit further movement of said actuator toward said actuation position.

12. A lighter as in claim 10, further comprising a biasing element biasing said actuator toward a position where said blocking mechanism is engaged.

13. A lighter as in claim 1, wherein:

said actuation inhibiting mechanism permits partial movement of said actuator between said first position and said intermediate position; and

said actuator being tiltable with respect to said actuation axis when said actuator is in said intermediate position to permit further movement of said actuator from said intermediate position to said actuation position.

14. A lighter as in claim 13, wherein:

said actuation inhibiting mechanism permits movement of said actuator at said intermediate position to cause bending of said ignition mechanism and disengagement of said actuation inhibiting mechanism upon tilting of said actuator; and

disengagement of said actuation inhibiting mechanism permits further movement of said actuator from said intermediate position to said actuation position.

15. A lighter as in claim 13, wherein:

said ignition mechanism comprises a first portion mounted in a cavity defined in said actuator and a second portion mounted in said lighter body; and

said first portion is tightly fit within said cavity in said actuator such that tilting of said actuator causes said second portion to contact an inner surface of said body causing bending of said ignition mechanism.

16. A lighter as in claim 13, wherein:

said ignition mechanism comprises a first portion mounted in a cavity defined in said actuator and a second portion mounted in said lighter body; and

said first portion fits within said cavity in said actuator with sufficient clearance such that tilting of said actuator does not impart bending forces to said ignition mechanism.

17. A lighter as in claim 16, wherein an end of a biasing member is disposed in the clearance between the first portion of the ignition mechanism and walls of said cavity.

18. A lighter as in claim 8 wherein the blocking mechanism comprises an extension member cooperatively engaging with a recess to resist movement between the intermediate position and the actuating position when a user-applied displacement is greater than necessary to disengage the first projection from the second projection of the interlocking mechanism.

19. A method of preventing unintended use of a lighter comprising the steps of:

providing a lighter having a lighter body, a fuel compartment, a nozzle coupled to said fuel reservoir, an ignition mechanism having an actuation axis, an actuator movable along said actuation axis from a first position to an actuation position in which said actuator causes said ignition mechanism to create a flame, and an actuation inhibiting mechanism;

arranging said actuation inhibiting mechanism to inhibit movement of said actuator transverse to said actuation axis when at said first position;

arranging said actuation inhibiting mechanism to inhibit movement of said actuator from said first position to said actuation position by inhibiting movement of said actuator along said actuation axis beyond an intermediate position between said first position and said actuation position and by inhibiting movement of said actuator transverse to said actuation axis; and

arranging said actuation inhibiting mechanism to permit movement of said actuator from said intermediate position to said actuation position to actuate said ignition mechanism after said actuator is moved transverse to said actuation axis.

20. A method as in claim 19, further comprising the step of arranging said actuation inhibiting mechanism to permit movement of said actuator transverse to said actuation axis only after movement of said actuator from said first position to said intermediate position.

21. A method as in claim 20, further comprising the step of mounting said actuator in said housing to be tiltable when in said intermediate position to move said actuator transverse to said actuation axis and to permit further movement of said actuator from said intermediate position to said actuation position.

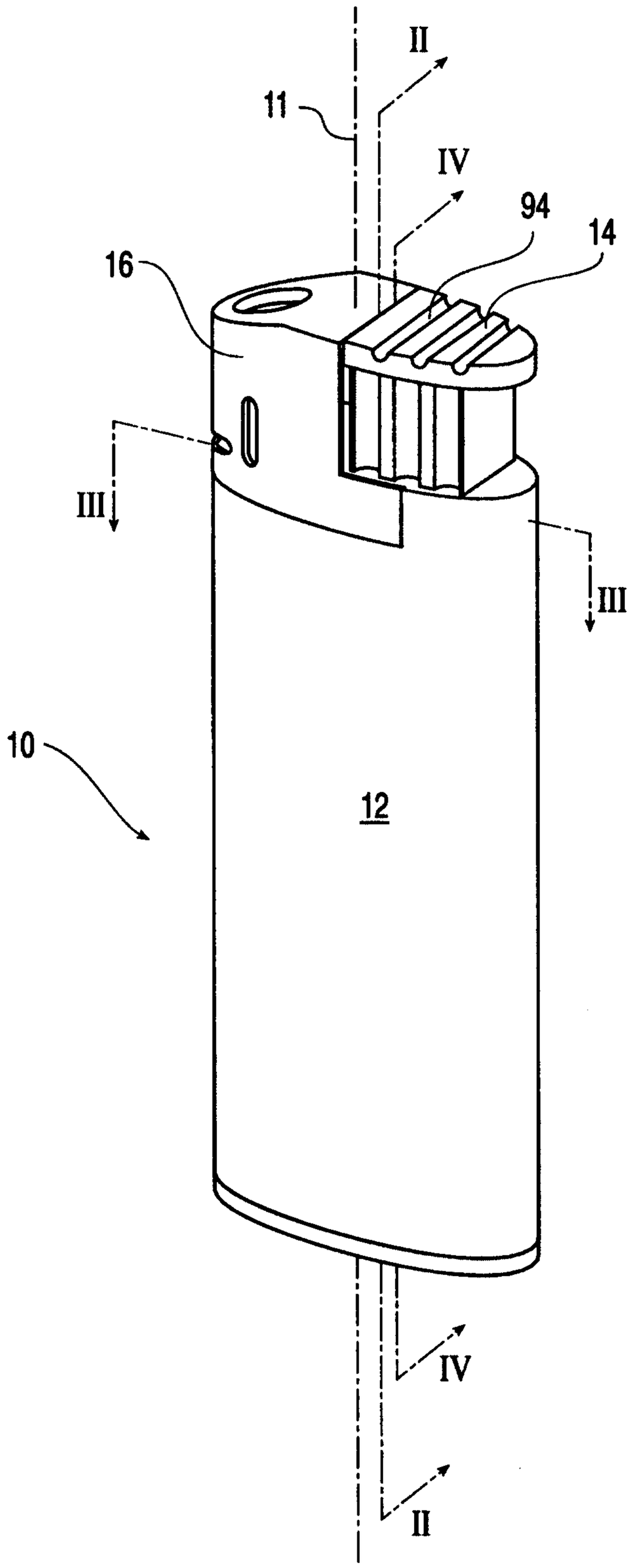


FIG. 1

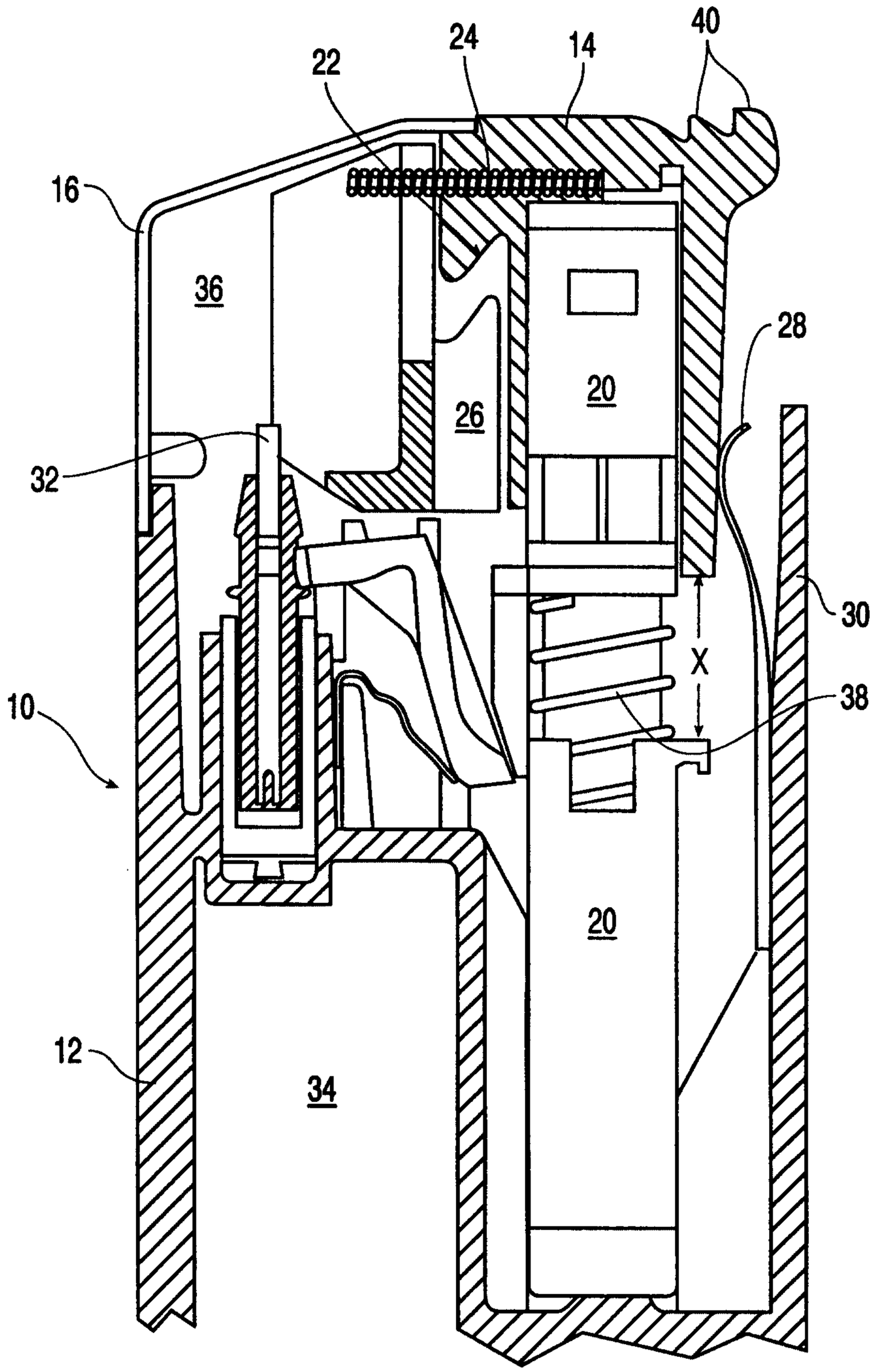


FIG. 2

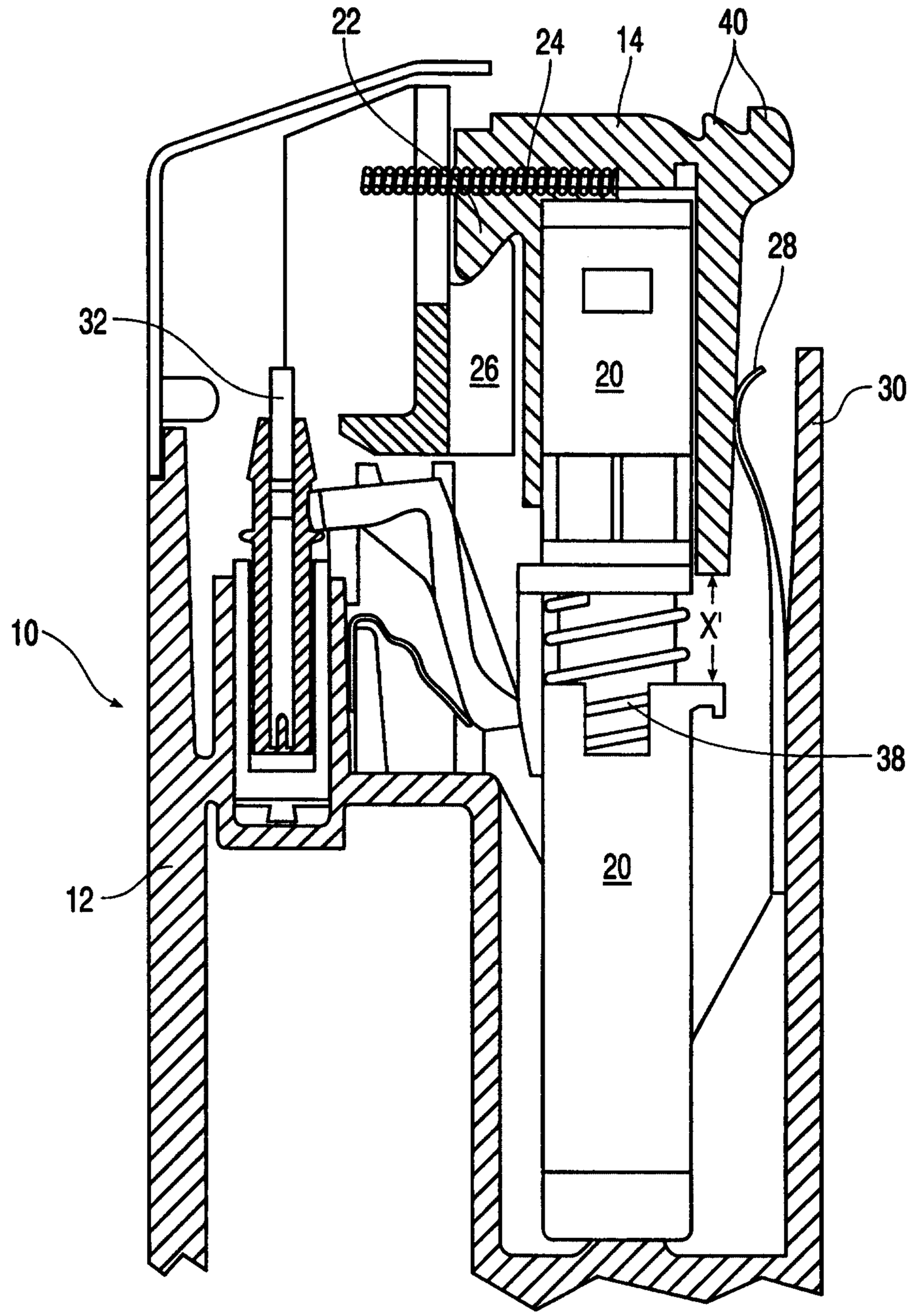


FIG. 3

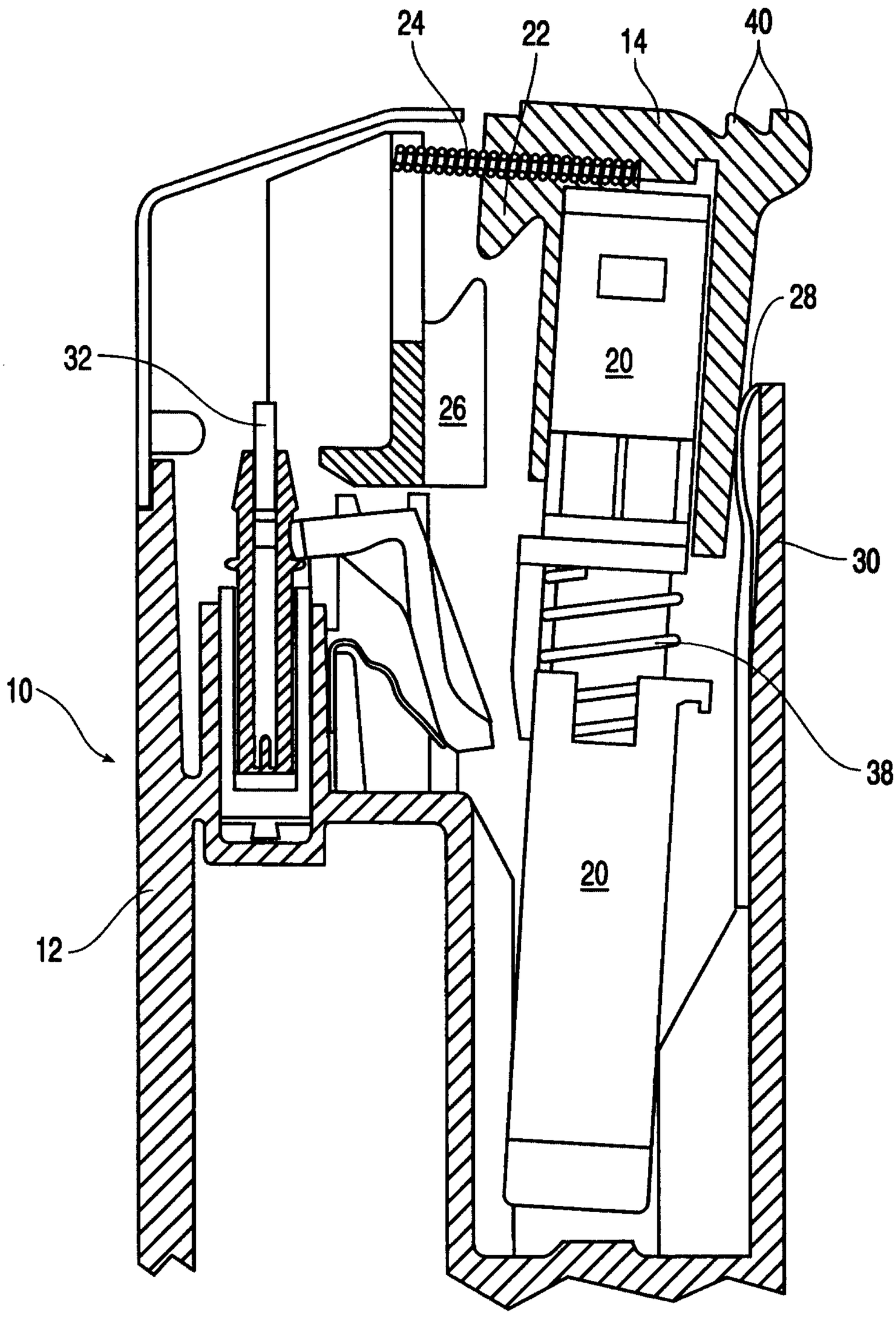


FIG. 4

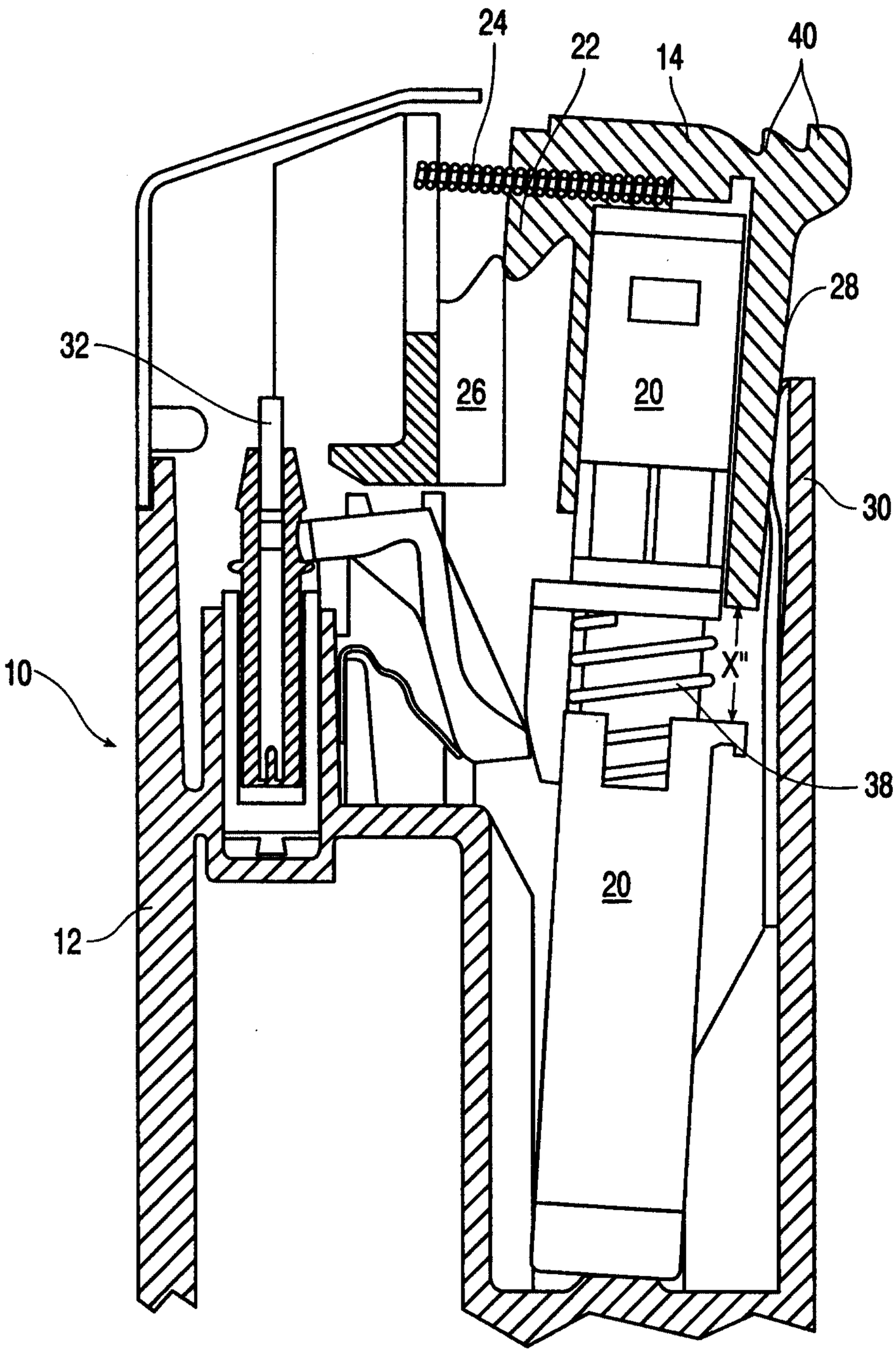


FIG. 5

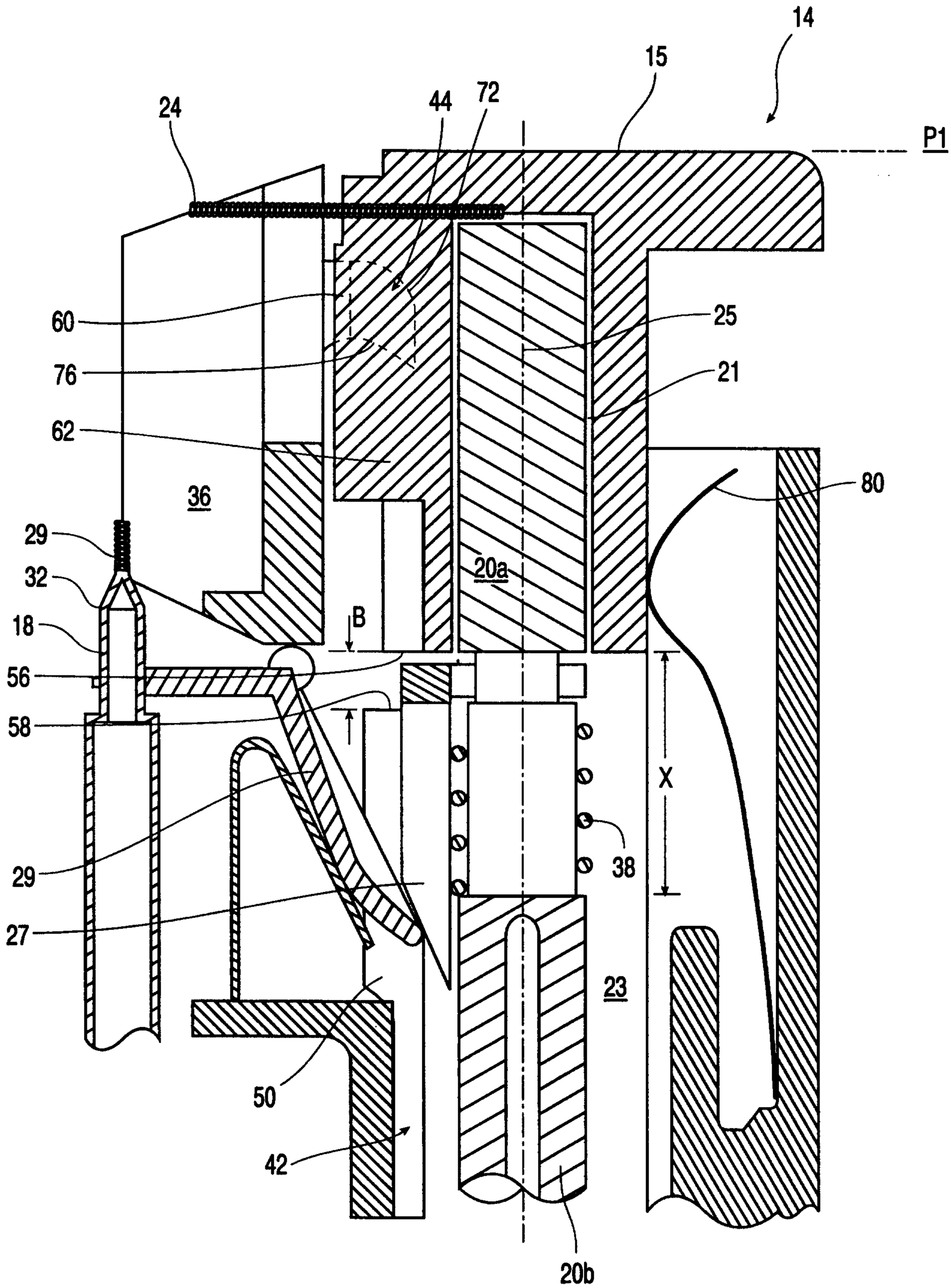

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FIG. 6

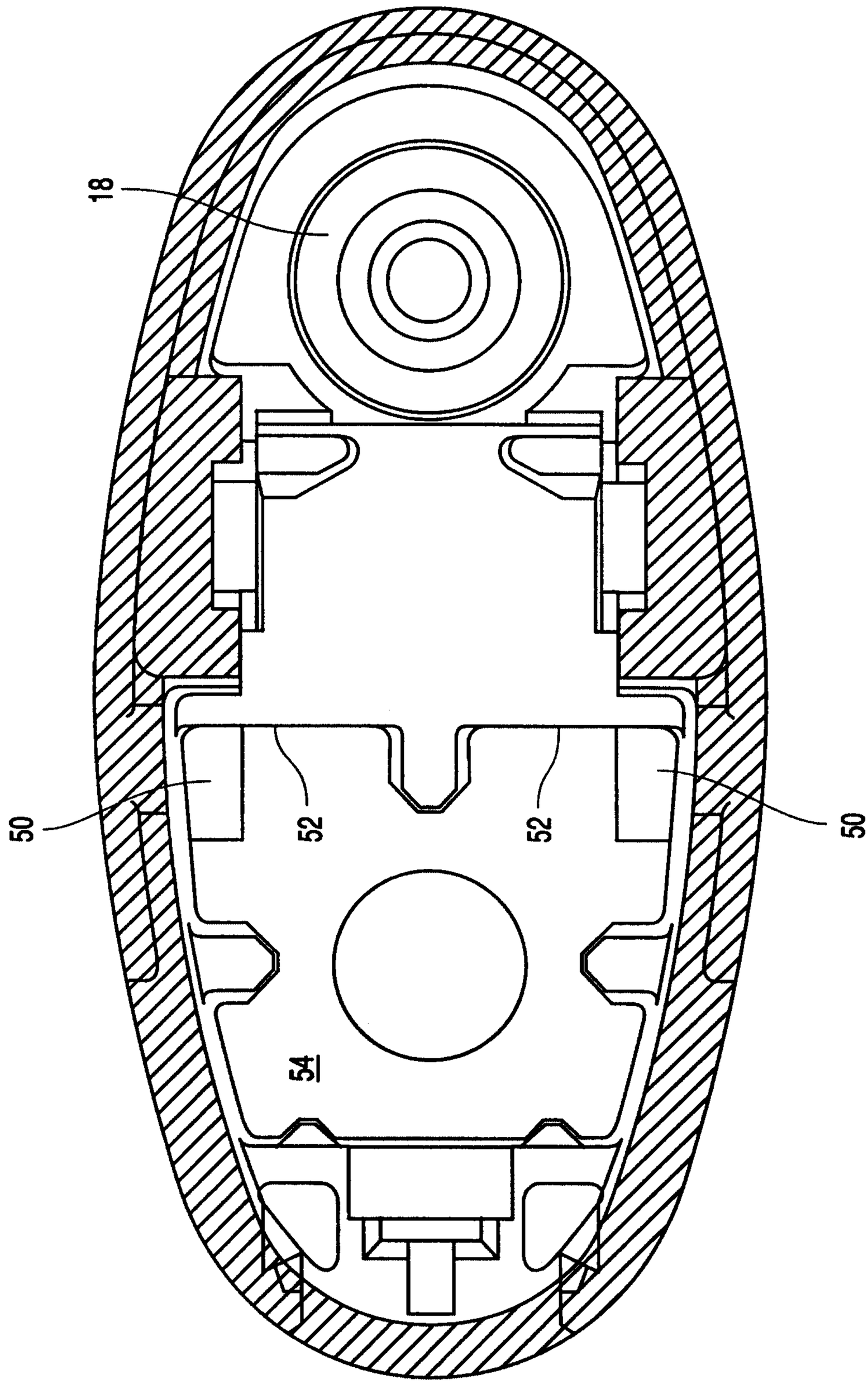


FIG. 7

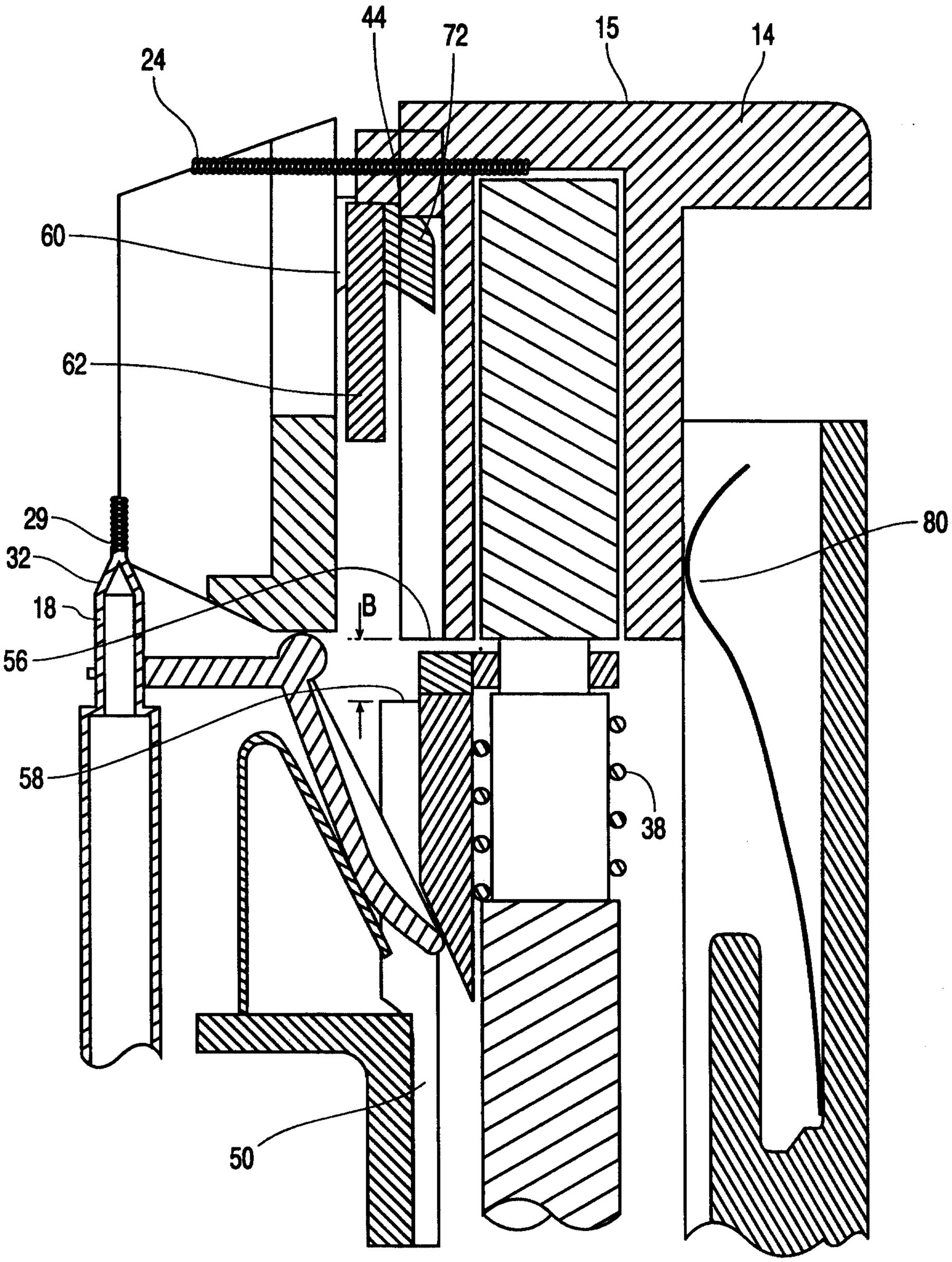


FIG. 8

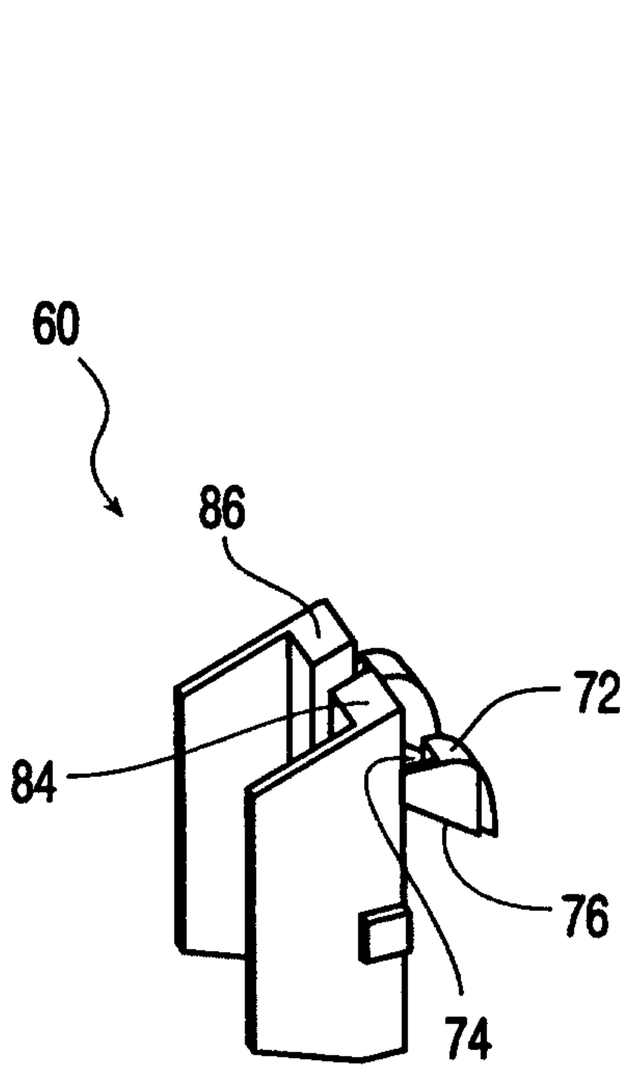


FIG. 12

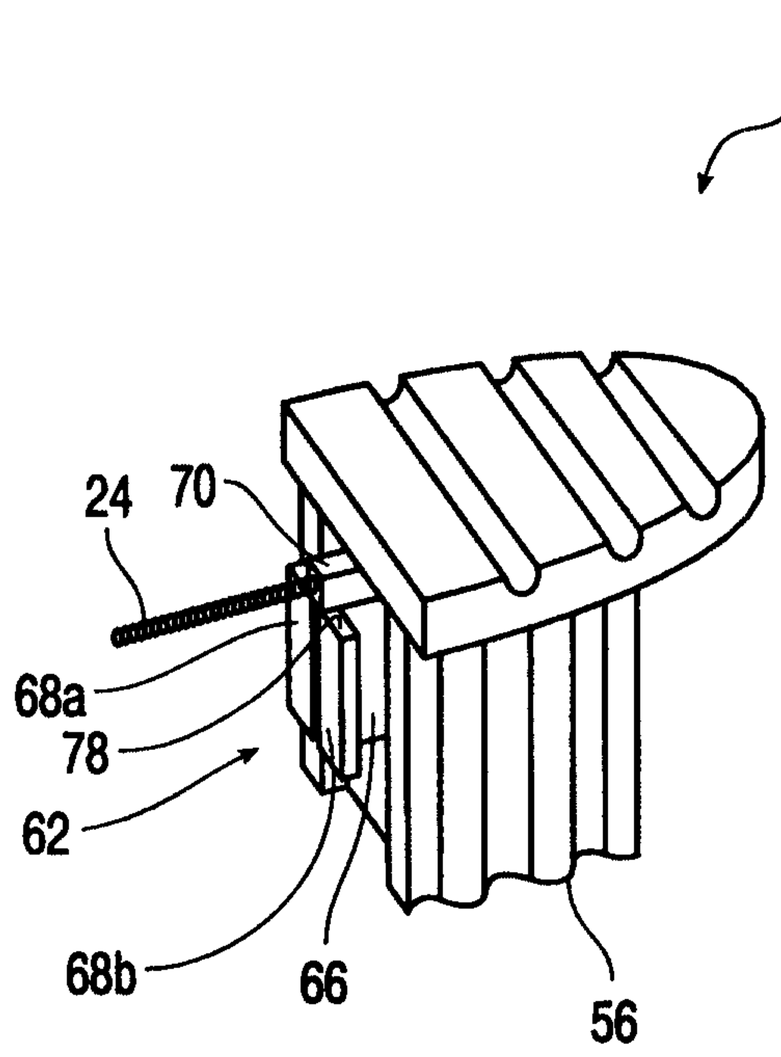


FIG. 9

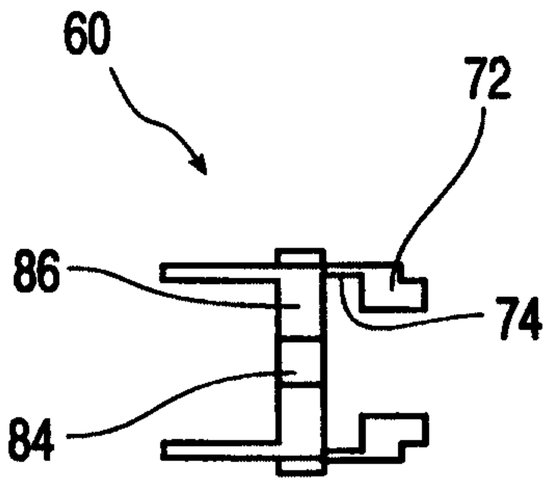


FIG. 13

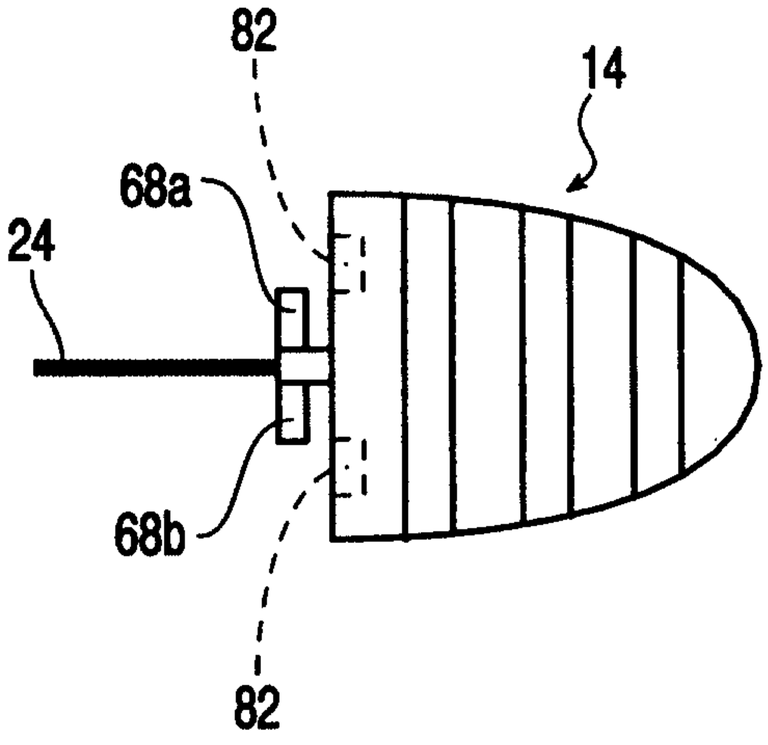


FIG. 10

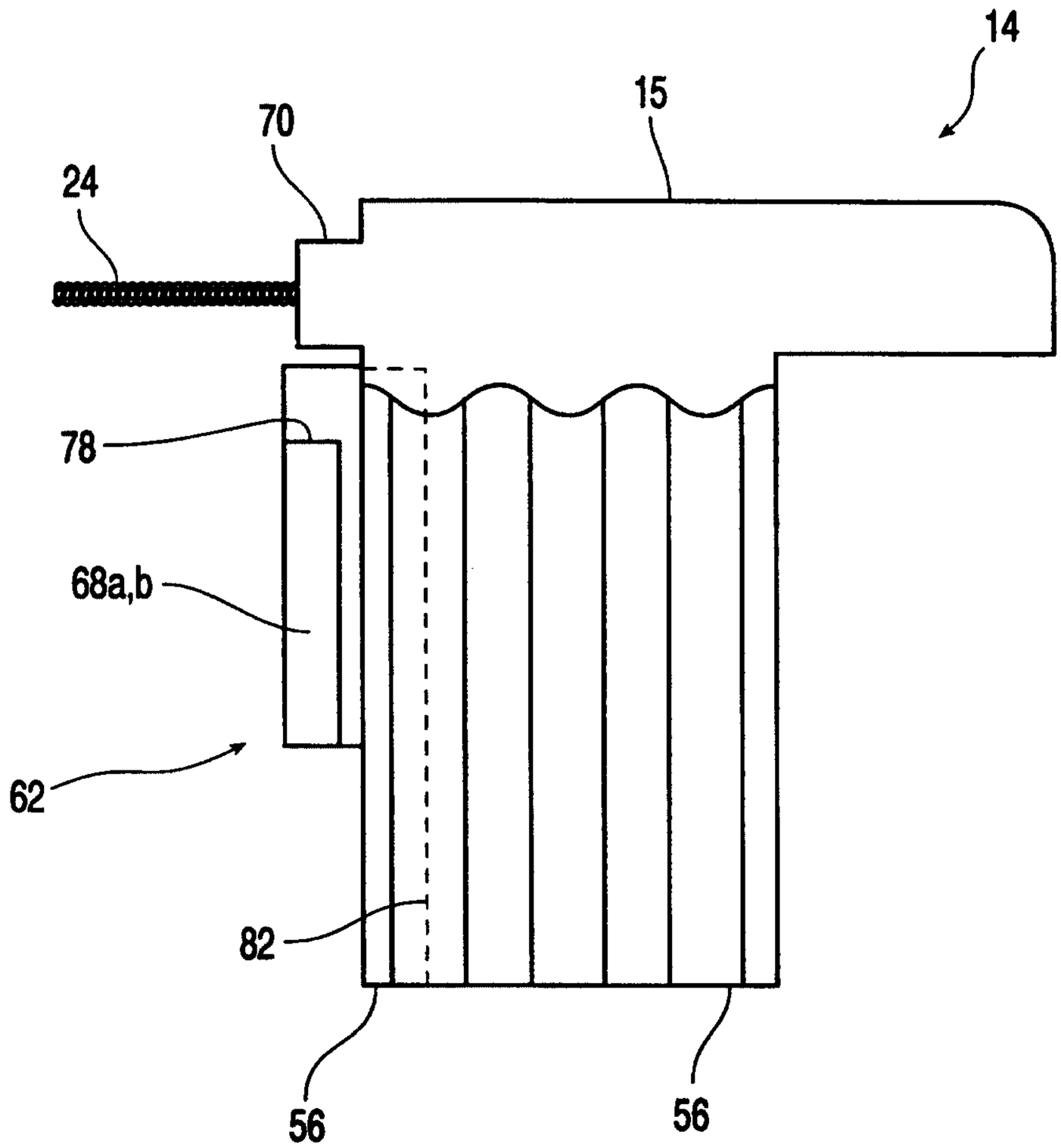


FIG. 11

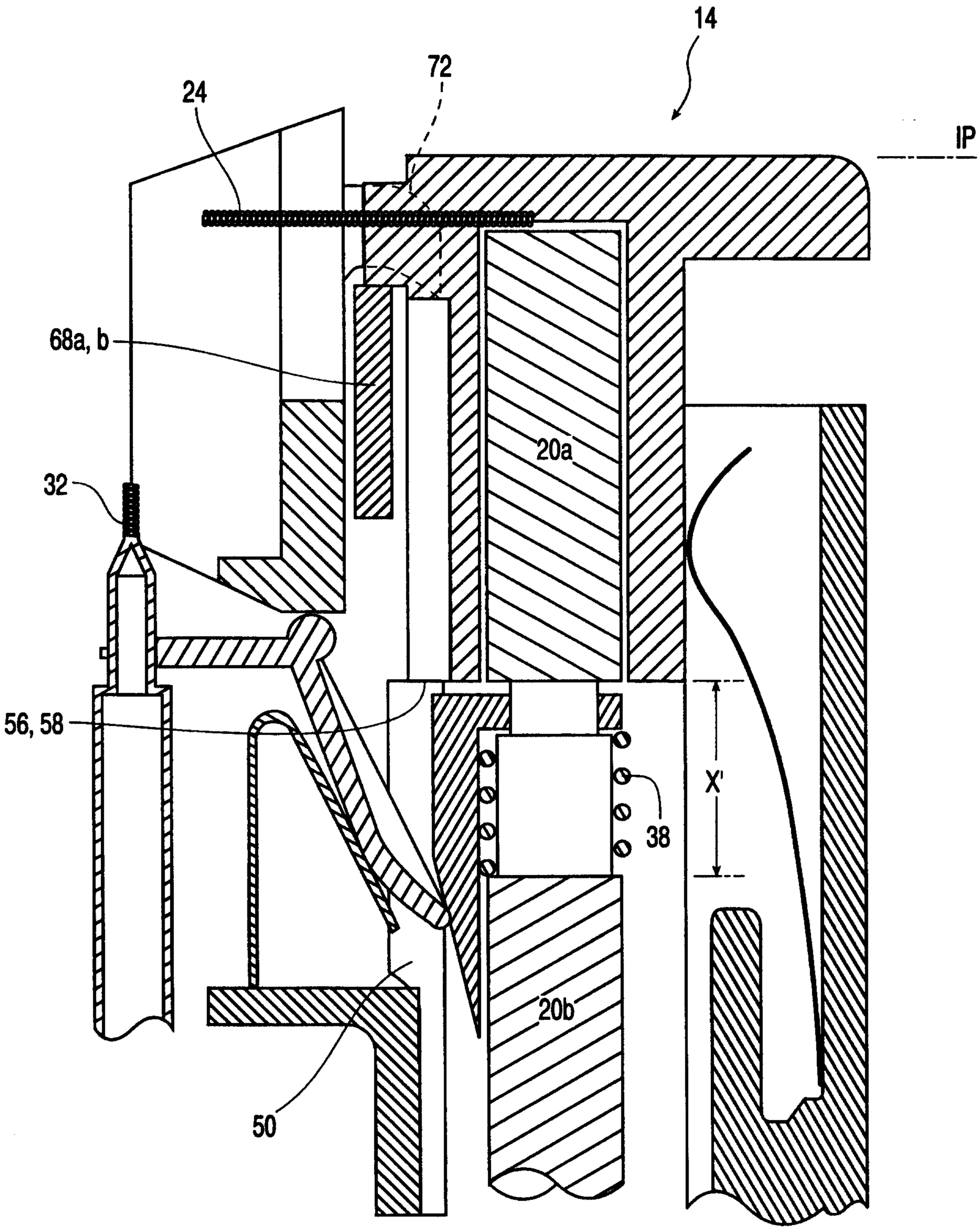


FIG. 14

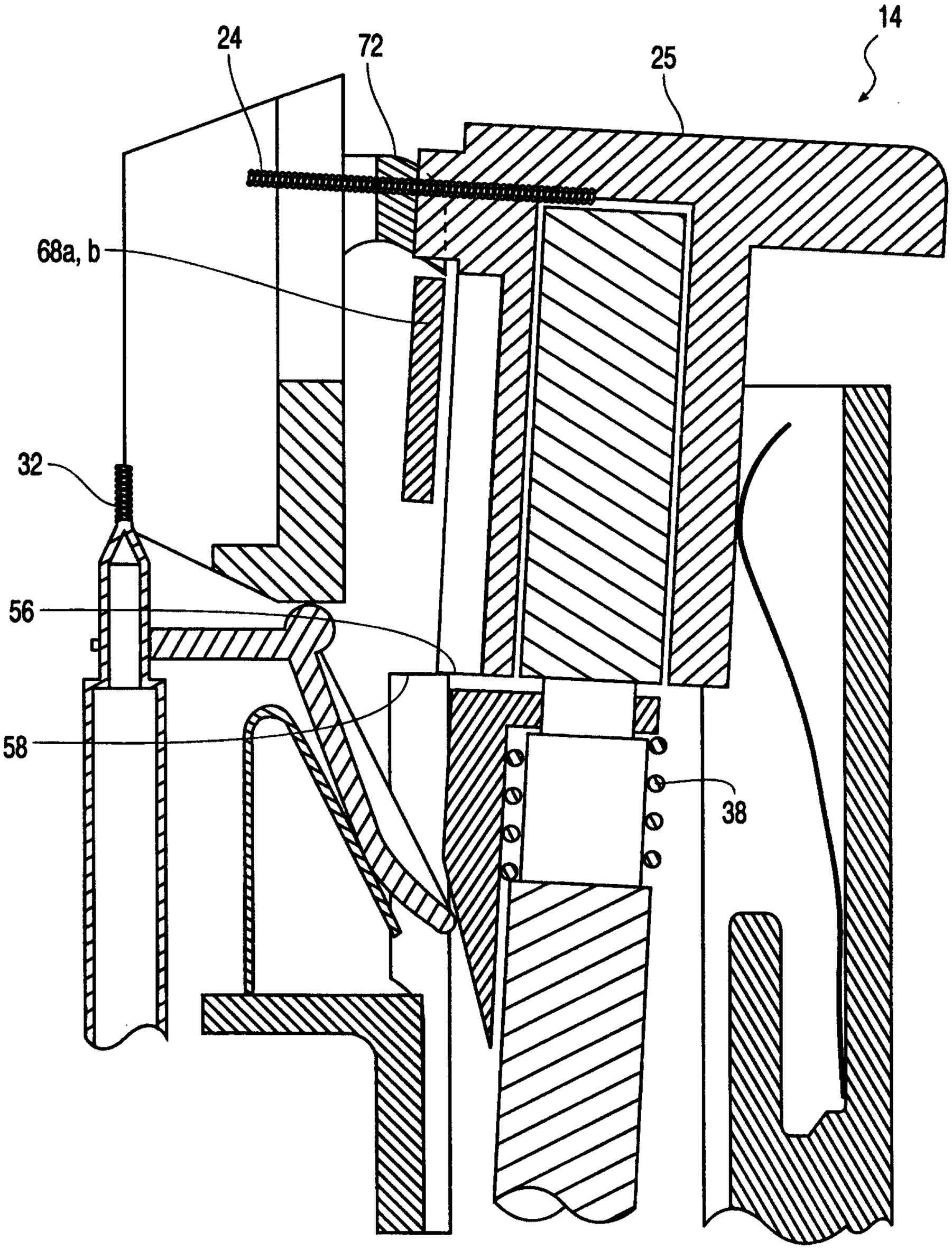


FIG. 15

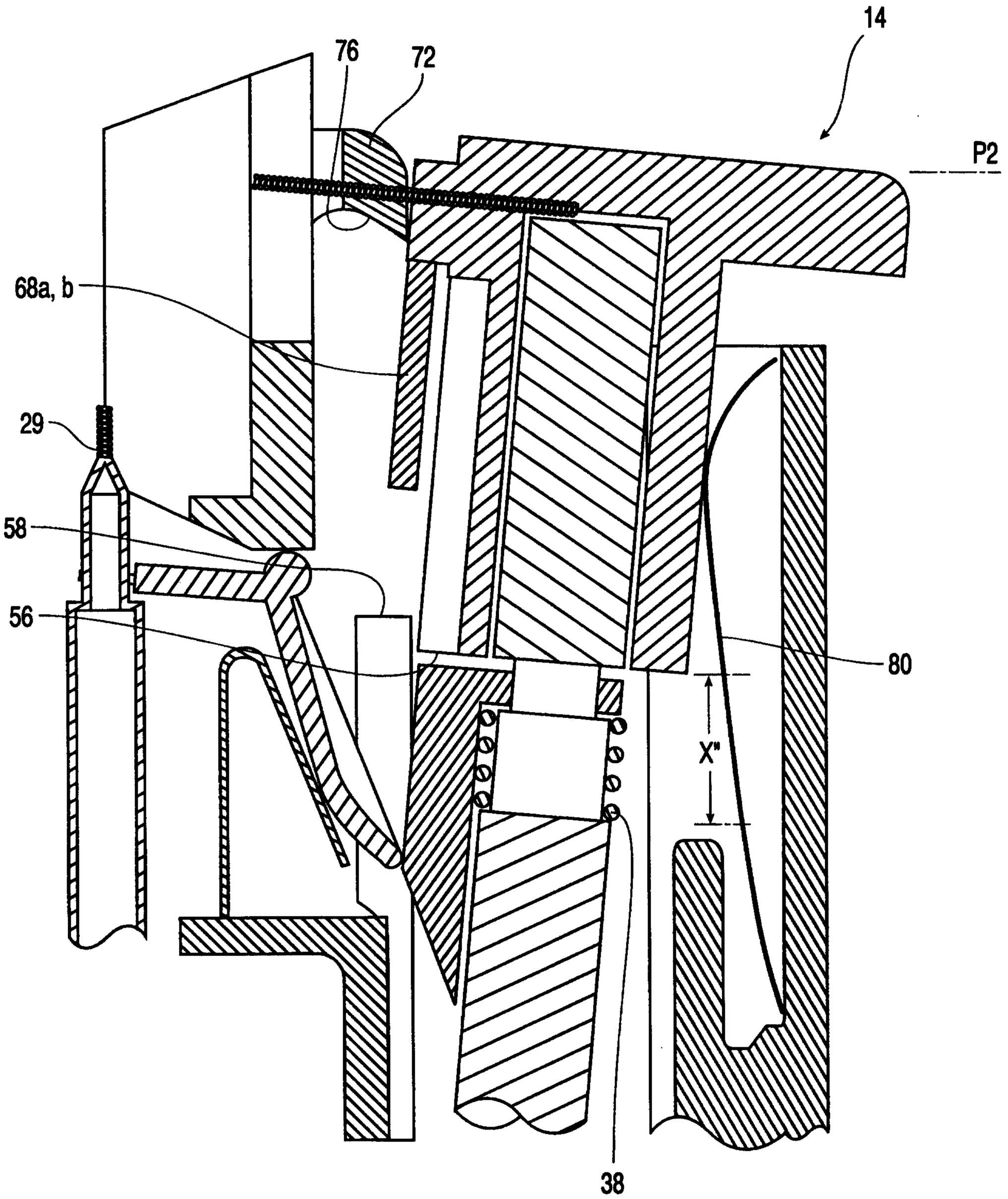


FIG. 16

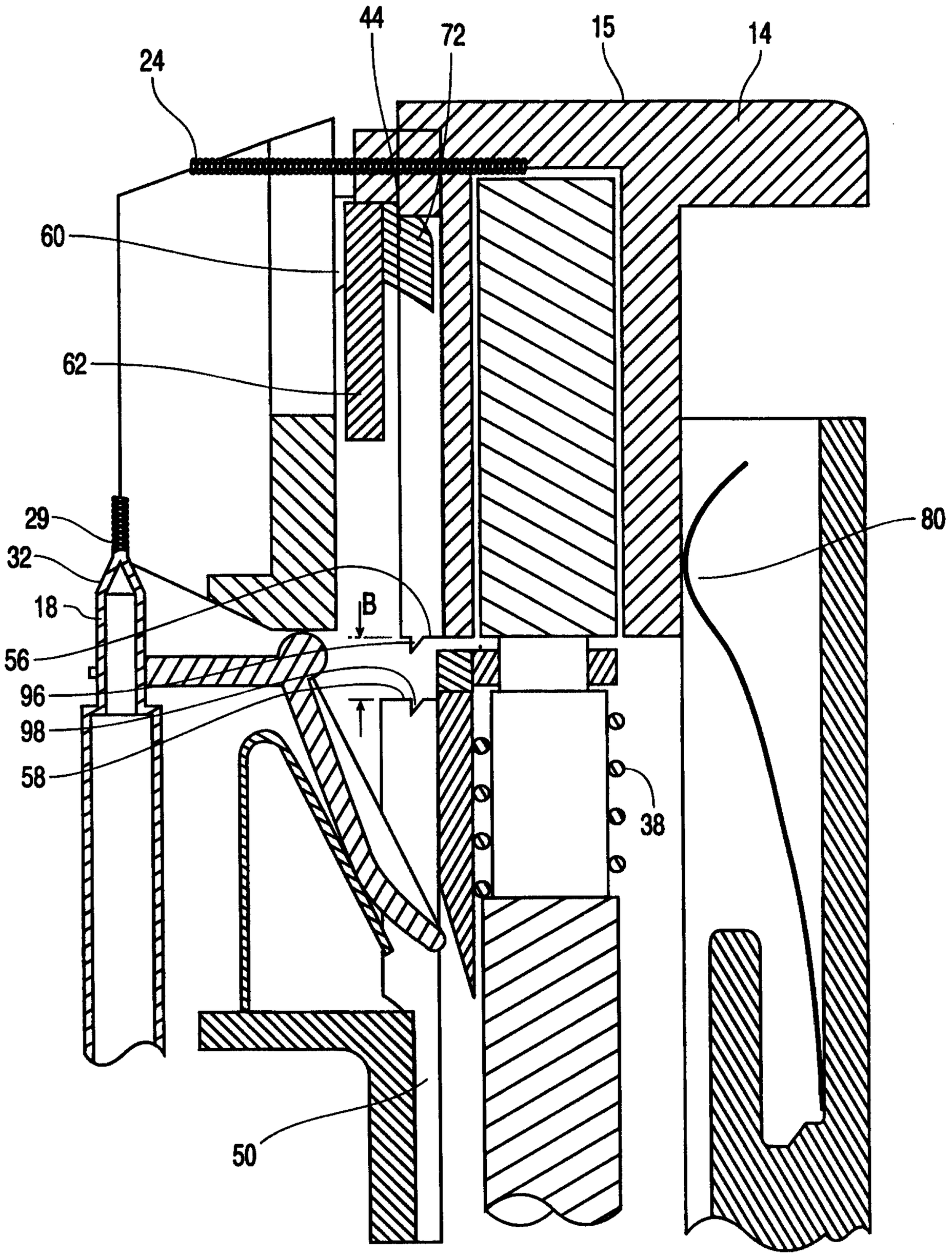
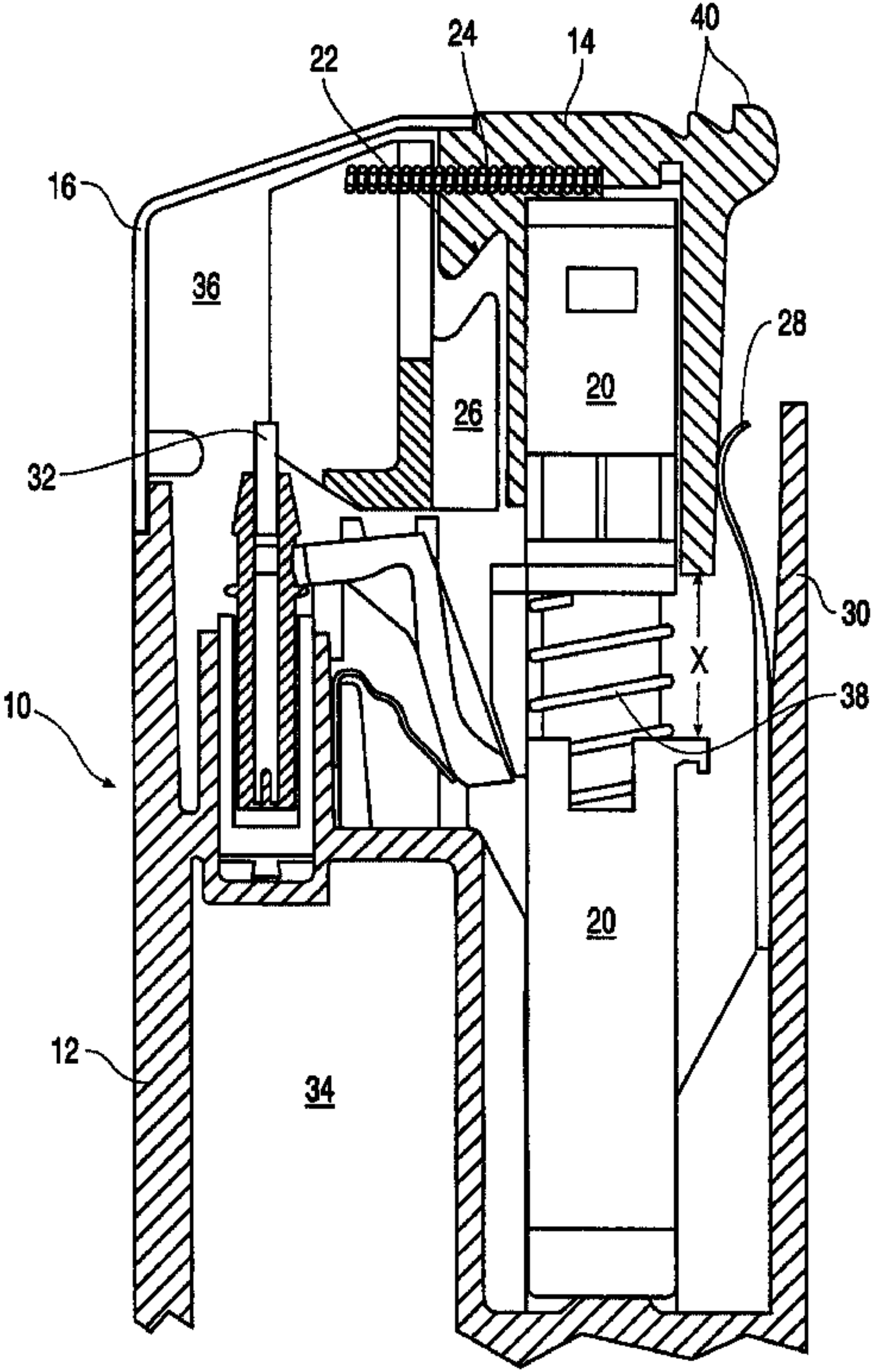


FIG. 17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