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(54) **SHAVING RAZOR WITH ONE OR MORE RECIPROCATING BLADES**

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None
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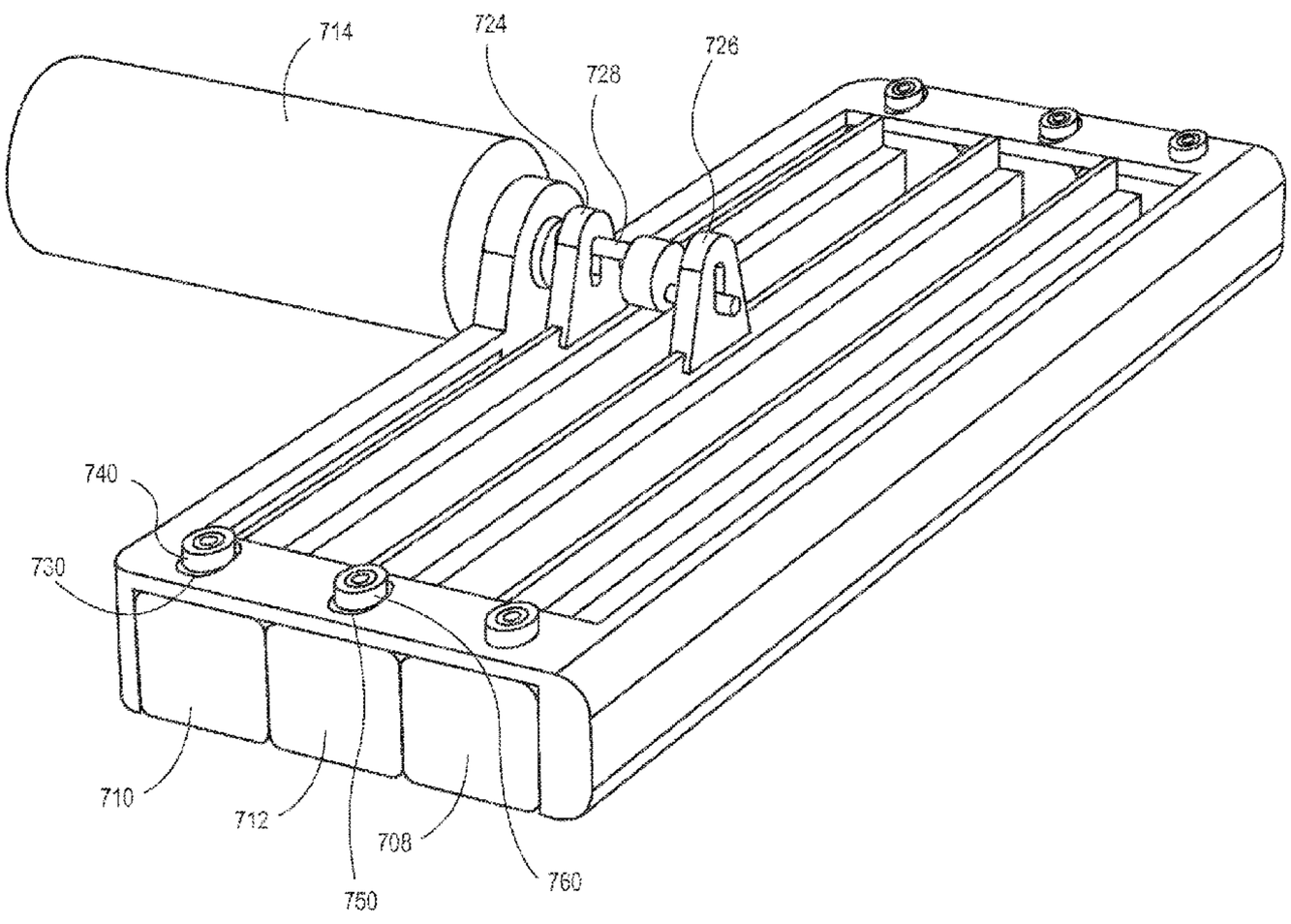
(74) *Attorney, Agent, or Firm* — Thomas Coester Intellectual Property

(57) **ABSTRACT**

A shaving razor having a handle and a shaving head with an exposed reciprocating blade. A power source is disposed within the handle with an actuator that causes at least one blade of a multi-blade razor head to reciprocate within a zone of motion. Other embodiments are also described and claimed.

15 Claims, 5 Drawing Sheets



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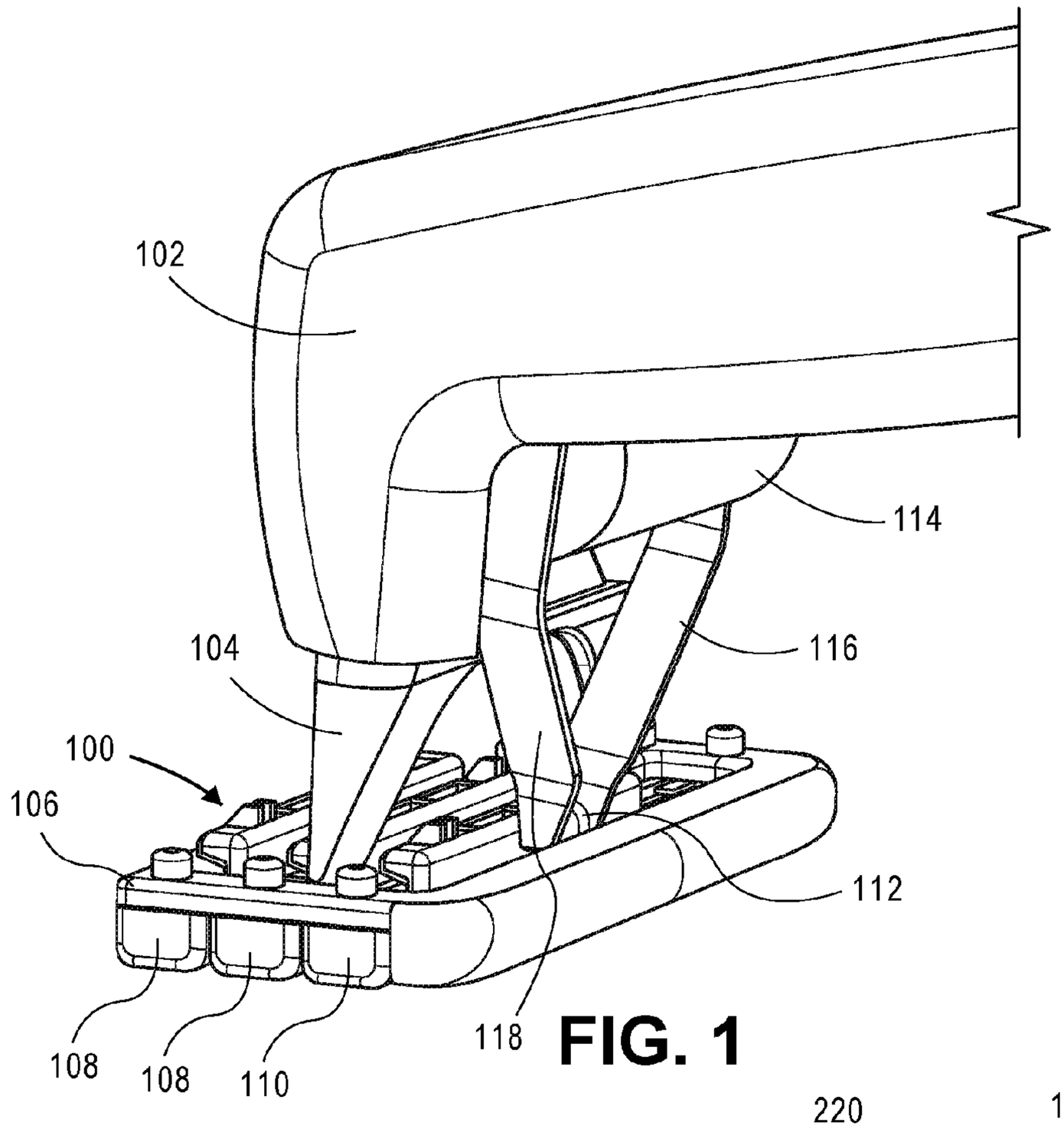
102
114
116
104
100
106
112
118
108
108
110

FIG. 1

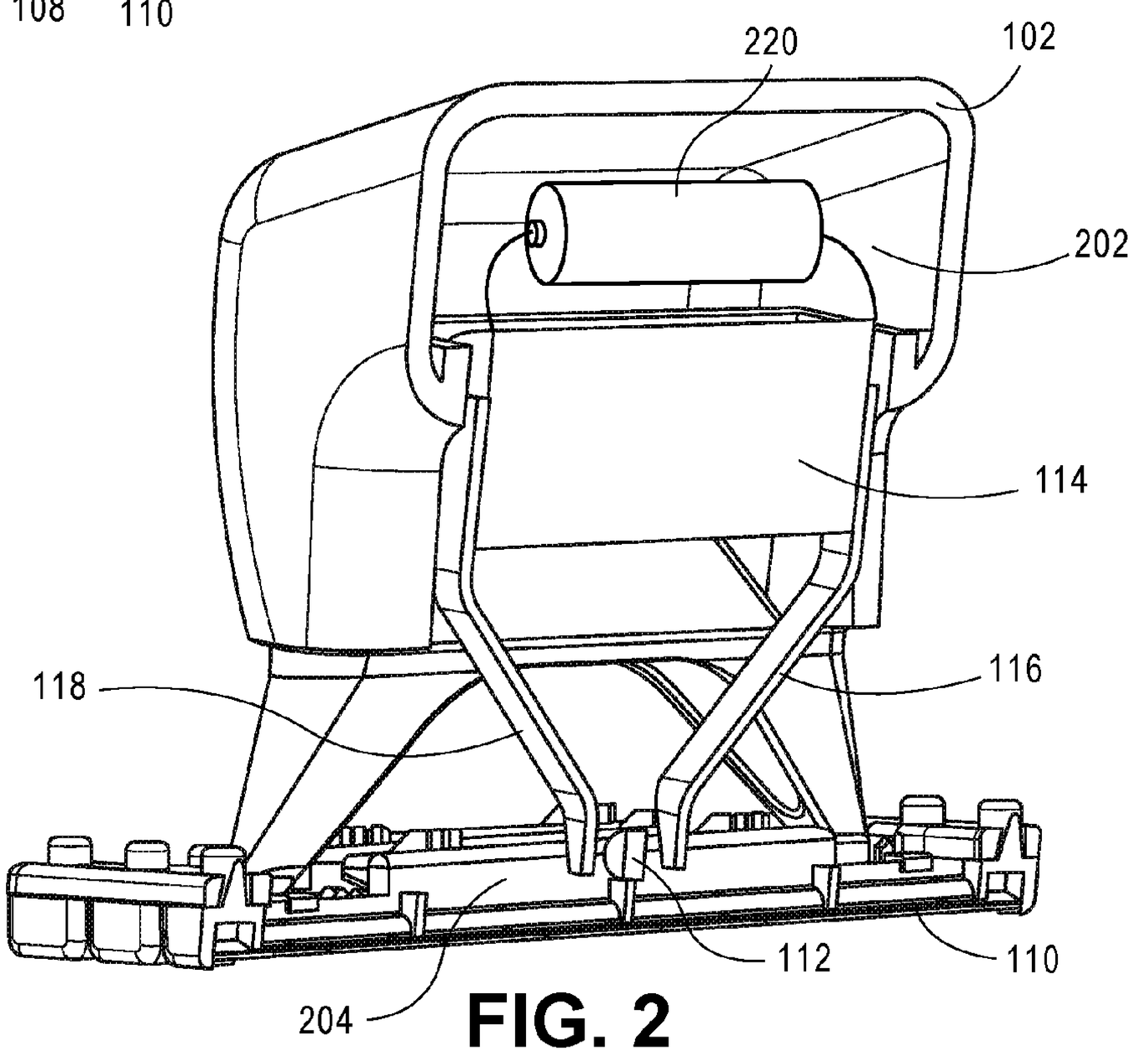
220
102
202
114
116
118
112
110
204

FIG. 2

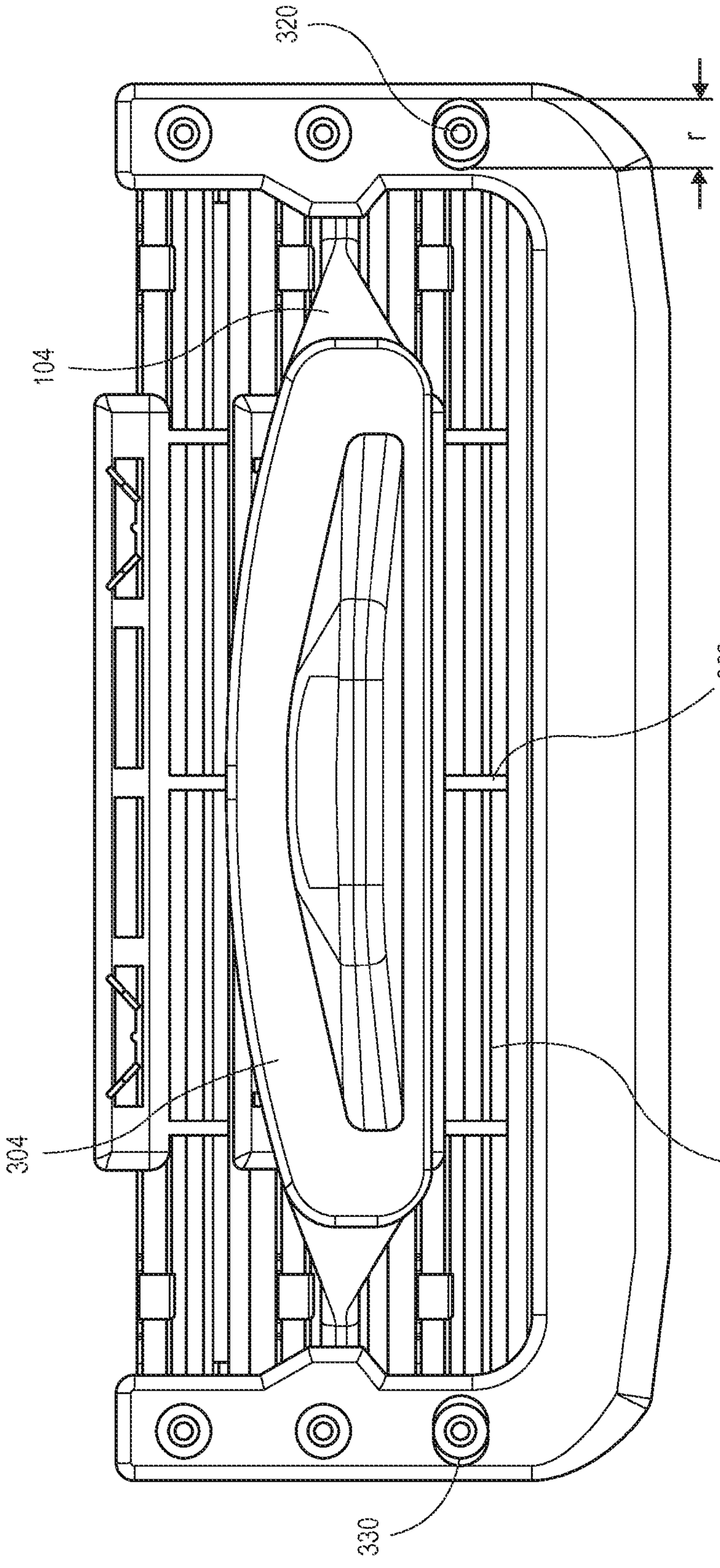

FIG. 3

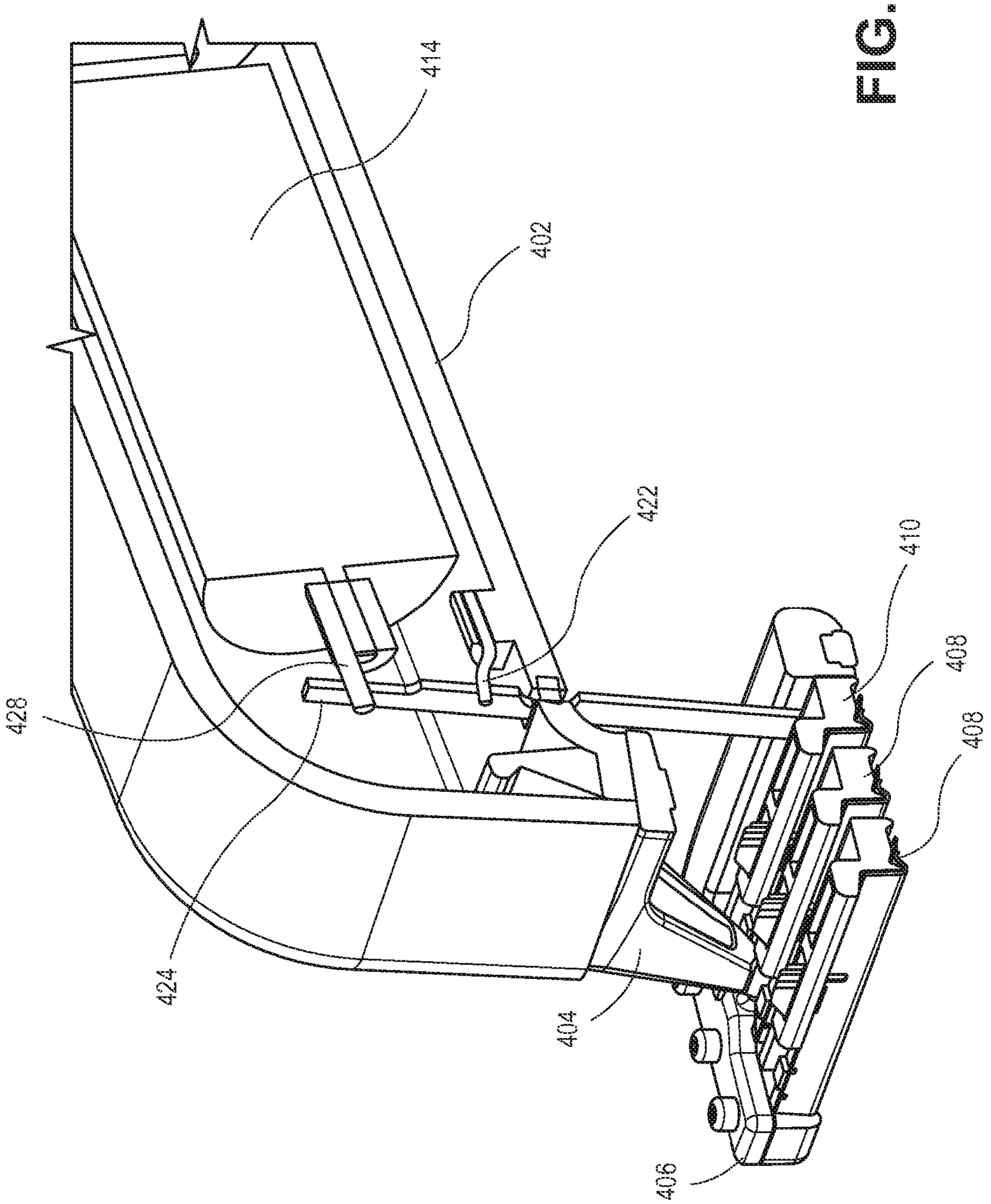

FIG. 4

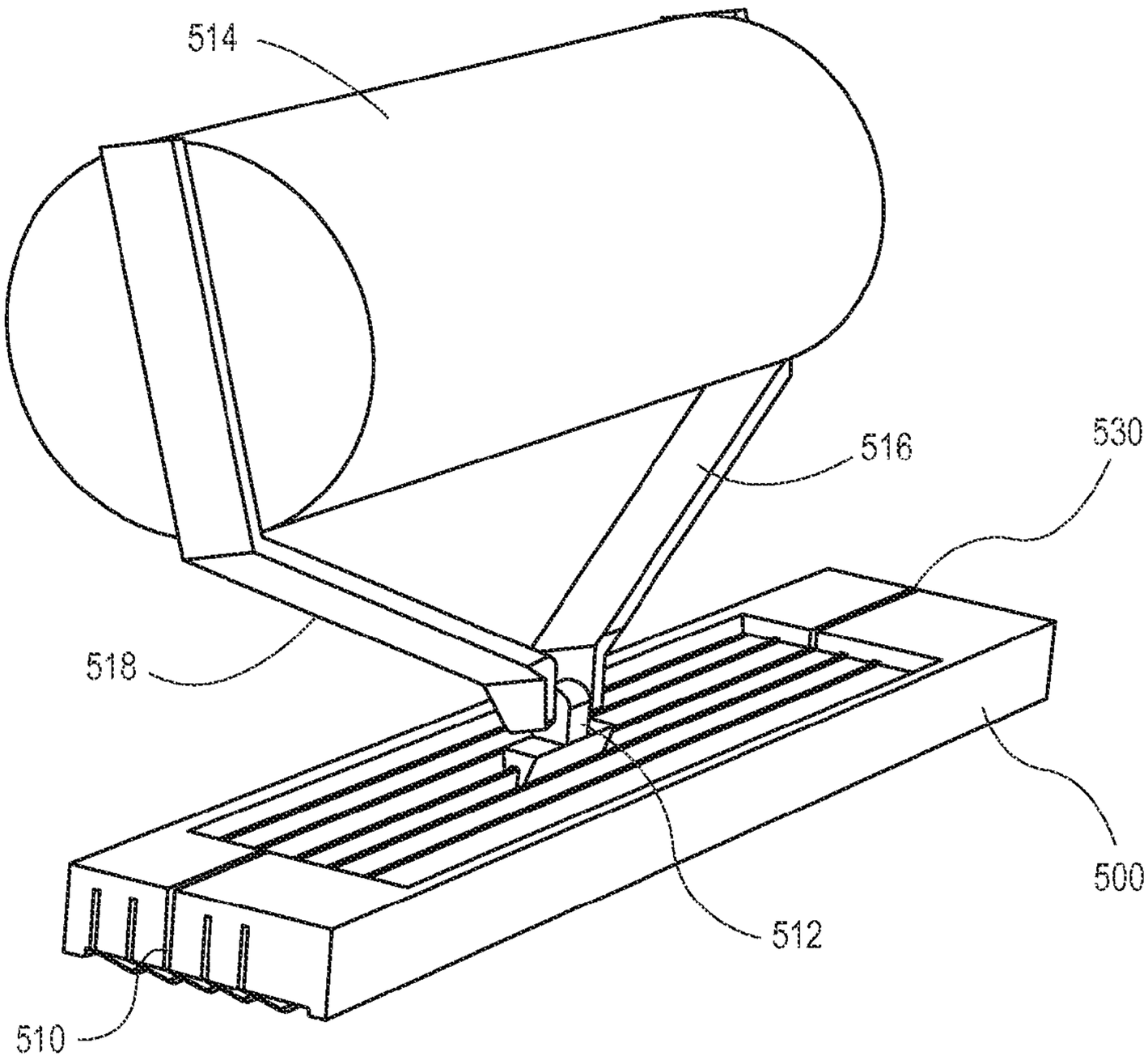

FIG. 5

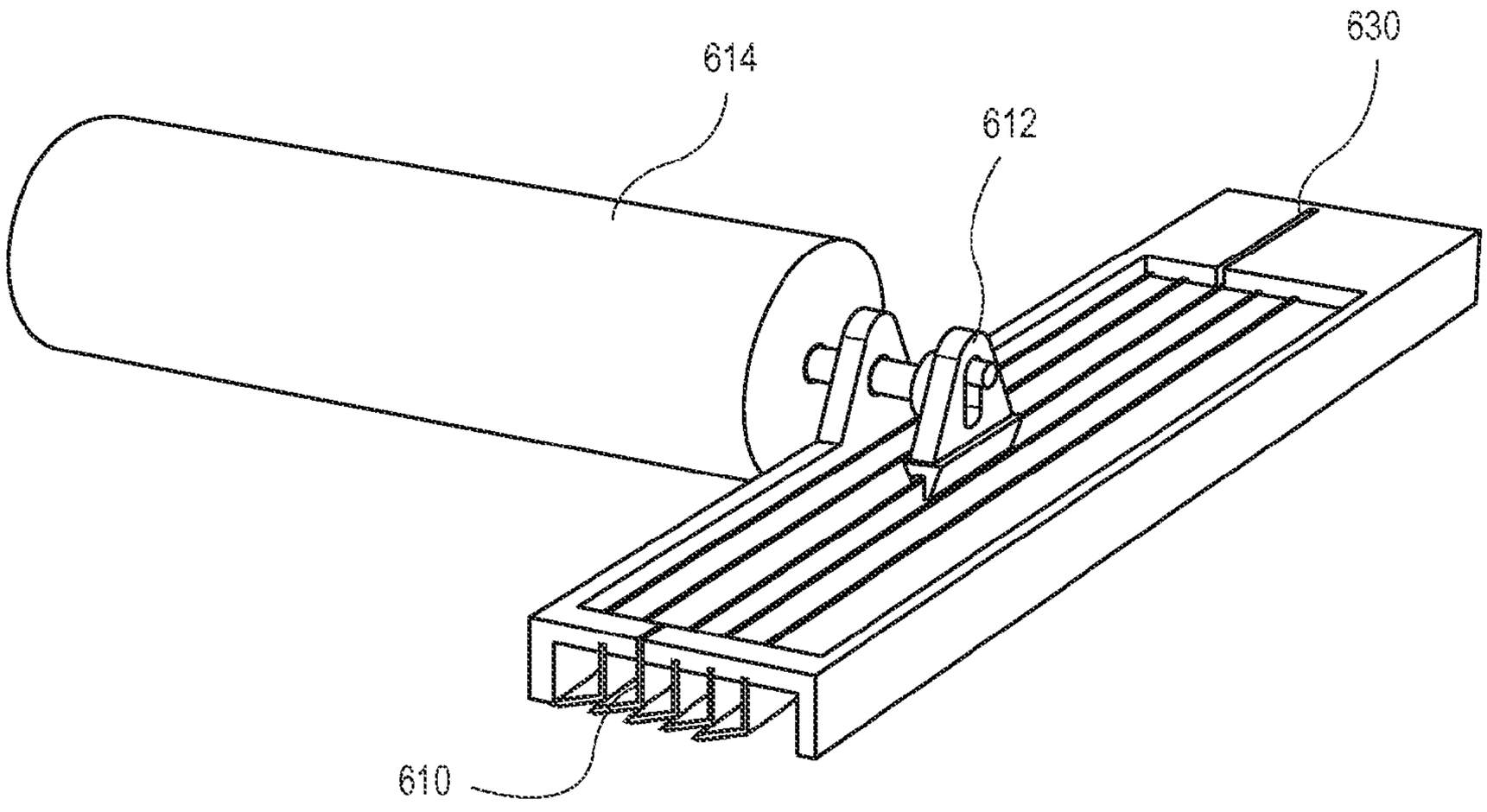

FIG. 6

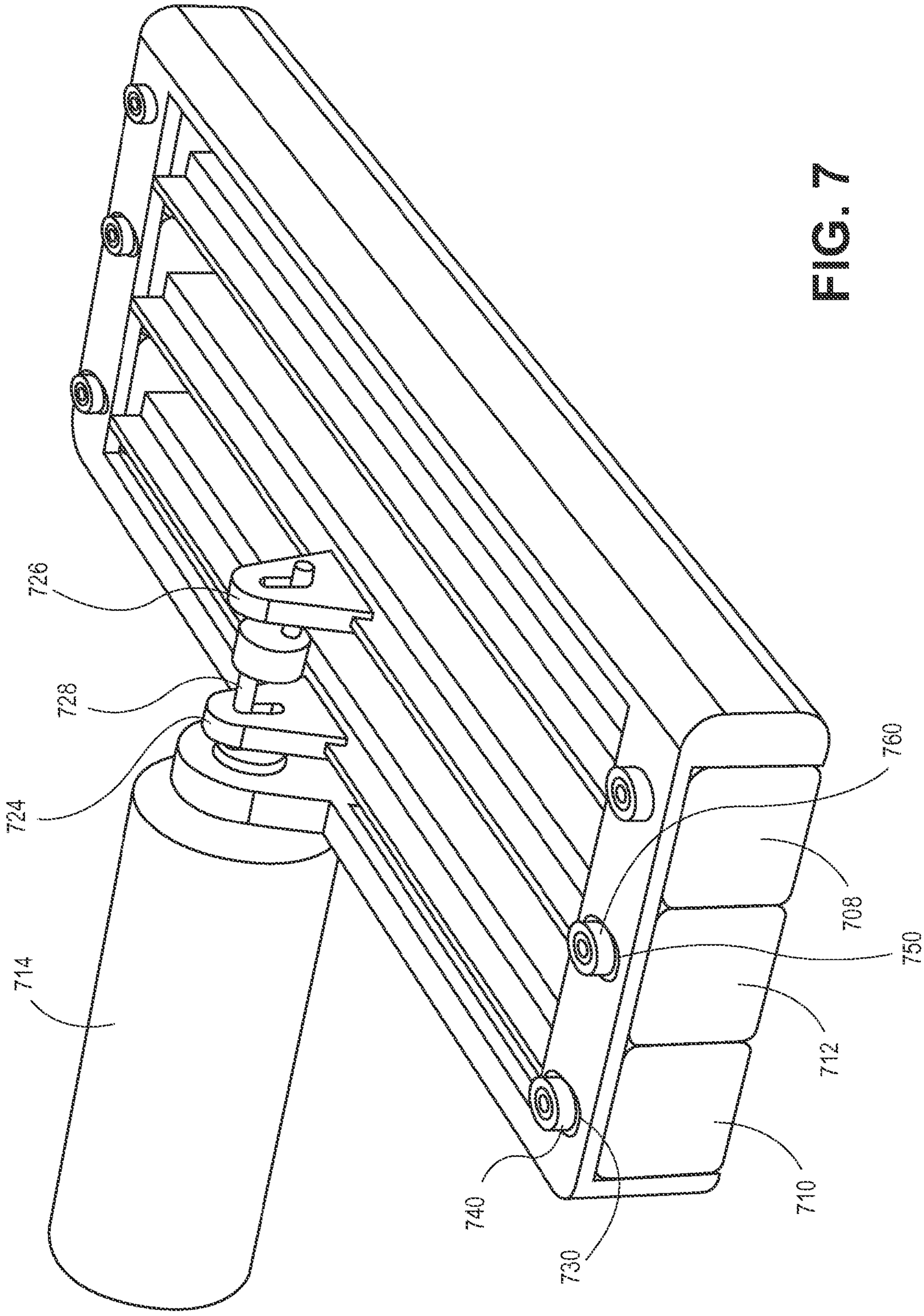

FIG. 7

SHAVING RAZOR WITH ONE OR MORE RECIPROCATING BLADES

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

BACKGROUND

Field

Embodiments of the invention relate to a shaving razor. More particularly, embodiments of the invention relate to a shaving razor having at least one exposed reciprocating blade.

Background

There are two main classes of shaving razors that dominate the market. There are electric razors, which have one or more cutting implements behind a screen or other protective barrier, where the cutting elements are powered to, for example, spin such that hair penetrating the screen or barrier is cut. The advantage of these types of razors is after the initial purchase, a large number of shaves are possible without replacing the device or parts thereof. Unfortunately, electric razors are typically somewhat bulky, making it difficult to get into tight spaces, for example, around a user's nose. Additionally, even in open spaces such as a user's cheek, the closeness of the shave generally does not match that which is possible with exposed-blade razors. This lack of closeness is due at least impart to the dimension of the barrier. Even relatively thin micro-screens have a thickness that dictates the maximum closeness of the shave. That is, the shave can be no closer than the thickness of the screen.

The second class of razors in common use today is exposed-blade razors, which have one or more blades arranged in a cartridge. A user pulls the cartridge across the area to be shaved, and the blades provide a shave that is generally closer than possible with an electric razor, owing to the fact that the blades are in direct contact with the user's skin and the dimension of the protective shield of the electric razors need not be accommodated. Commonly, three, four, or even five blades are aligned to cut in the same shaving direction. Even where multiple blades are present, the leading blade performs the most of the cutting. As used herein, "leading" when modifying blade refers to the first blade to come in contact with the hair in the direction of shaving. As a result, the leading blade dulls more quickly than the other blades. Often, the dullness of the leading blade requires replacement of the cartridge while the remaining blades are perfectly serviceable.

Some razor manufacturers have come up with "power" models of their exposed blade razors. These razors include a battery in the handle and a motor with an eccentric mass such that when powered, the entire razor vibrates. In these models, the blades do not actually move; rather, the entire device vibrates. This feature has been heavily advertised, but market research reflects that it fails to provide any real benefit to the user, and the majority of users do not replace the battery once it goes dead. Studies have not revealed that power models have longer cartridge life or improved cutting efficacy over the unpowered models. Rather, these "power" exposed blade razors appear to be little more than a marketing gimmick

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention are illustrated by way of example and not by way of limitation in the figures of the accompanying drawings in which like references indicate similar elements. It should be noted that different references to "an" or "one" embodiment in this disclosure are not necessarily to the same embodiment, and such references mean at least one.

FIG. **1** is a perspective view of a shaving razor of one embodiment of the invention.

FIG. **2** is a sectional view of the embodiment of FIG. **1**.

FIG. **3** is a view of the shaving assembly disconnected from the handle.

FIG. **4** is a sectional view of an alternative embodiment of the invention having a mechanical drive.

FIG. **5** is a schematic view of an alternative embodiment of the invention.

FIG. **6** is a schematic diagram of an alternative embodiment of the invention with the mechanical actuator.

FIG. **7** is a schematic view of an embodiment of the invention in which plural blades are mobile.

DETAILED DESCRIPTION

FIG. **1** is a perspective view of a shaving razor of one embodiment of the invention. A disposable shaving head **100** includes a yoke **104** that provides a handle attachment mechanism (not shown in this figure) to connect to handle **102**. Yoke **104** bridges between flexible cross-members **106**, to which are coupled a plurality of discreet cartridges **108**, **110**, each containing a blade that is exposed in the shaving plane during use. The construction of yoke, cross members and cartridges may be consistent with the description in U.S. Pat. No. 8,479,398 or co-pending U.S. Pat. No. 9,144,914 invented by the inventor hereof

Cartridges **108** are coupled to cross-members **106** in a fixed manner. Cartridge **110** is coupled to allow it to reciprocate, as explained below in more detail with reference to FIG. **3**. Cartridge **110** has coupled thereto a magnetic mass **112**. As used herein, magnetic mass refers to a material that responds to a magnetic field. In one embodiment, magnetic mass **112** is a permanent magnet. In one embodiment, it is a rare earth magnet. Handle **102** includes a power source (not shown) such as a battery. In one embodiment, a single AAA battery is used. In other embodiments, a rechargeable battery, such as a lithium ion battery, may be employed. The power source powers a magnetic actuator **114**, which generates a magnetic field responsive to the electric current. Magnetic actuator **114** may be a solenoid, electromagnetic coil, piezoelectric element or the like. Extending from the magnetic actuator **114** are arms **116** and **118**. Arms **116** and **118** extend so as to be adjacent to magnetic mass **112**. By switching the direction of current through applied to the magnetic actuator, the polarity of the magnetic field between the two arms can be alternated. In this manner, the magnetic mass **112** coupled to cartridge **110** can be driven back and forth between the magnetic arms **116** and **118**, causing cartridge **110** to exhibit a reciprocating motion. As used herein "reciprocating motion" is motion lateral to a direction of shaving.

In this embodiment, since cartridge **110** contains the leading blade and is therefore responsible for a disproportionate amount of the cutting effort, by reciprocating this blade, the hair is cut more efficiently with reduced dulling of the blade. This has been found to significantly increase the useful life of shaving assembly **100**. More specifically, the

reciprocation results in a sawing effect when the blade encounters a hair. By analogy, a knife must be much sharper to cut with pressure alone than with a sawing motion. Similarly, here, the reciprocation allows the blade to cut more efficiently. It reduces the dulling effect on cutting and allows for more effective cutting with a duller blade than possible with conventional techniques. The more effective cutting reduces the pulling and tugging. Cartridges employing this reciprocating technique have been found to last up to a year without replacement.

FIG. **2** is a sectional view of the embodiment of FIG. **1**. In this view, the positioning of magnetic mass **112** between actuator arms **116** and **118** can be seen. Magnetic mass **112** may be coupled to leading blade **204** by adhesive, spot welding, or any other suitable manner for attachment. In one embodiment, the magnetic mass **112** is insert molded into cartridge **110**. Handle **102** defines an internal space **202** in which the power source **220** and the magnetic actuator **114** may reside.

FIG. **3** is a view of the shaving assembly disconnected from the handle. In this view, handle attachment mechanism **304** is visible. The handle attachment mechanism is formed as part of the yoke and provides a male receiver for the corresponding female element of the handle. Various handle attachment mechanisms are noted in the art, and any suitable handle attachment mechanism could be employed. One suitable handle attachment is described in co-pending U.S. patent application Ser. No. 14/221,086 invented by the inventor hereof. Cartridge **110** has a central support **322** that provides a suitable place for attachment of the magnetic mass or coupling of a mechanical linkage as may be used with other embodiments of the invention such as described with reference to FIG. **4** below. Also visible in this view are slots **330** defined in cross members **106**. Posts **320** of cartridge **110** couple cartridge **110** within the slots **330**. The slots **330** define the maximum range (r) over which the blade of cartridge **110** can reciprocate.

Testing has revealed that reciprocation of less than 0.1 mm is not effective in increasing blade life or increasing the efficacy in cutting the hair to be shaved. Reciprocation greater than 0.5 mm significantly increases the risk of nicks and cuts during use. As a result the range r is chosen to be in the range of 0.1-0.5.mm and approximately 0.2 mm has be found to be effective without increased cut risk. While in some embodiments the arm **116** and **118** may limit the reciprocation of the blade, the slots **330** provide hard stops and ensure the blade will not move beyond that limit. This provides a safety margin in the event that any other restriction on the blade movement is compromised.

FIG. **4** is a sectional view of an alternative embodiment of the invention having a mechanical drive. Handle **402** contains a mechanical actuator **414** which may be, for example, a servo, a piezoelectric motor, dc electric motor or the like. Mechanical linkage **424** is engaged by the eccentric extension of, e.g., the motor shaft **428**, and may be biased into engagement therewith. For example, a spring or other elastic bias member may press linkage **424** into engagement with shaft **428**. Mechanical actuator **414** rotates shaft **428**. The mechanical linkage **424** converts the rotation of the motor into reciprocating motion of the mobile cartridge **410**. As with the embodiment described with reference to FIG. **3**, cartridge **410** is coupled to cross-member **406** to permit a desired range of motion. Cartridges **408** are coupled in a fixed relation to **406**. Cross-member **406** is coupled to yoke **404**, which in turn is coupled in a mated relationship to handle **402**.

As noted above, it is desirable to limit the relative motion between cartridges **410** and **408** to less than 0.5 mm. It has been found that relative motion in excess of 0.5 mm increases the risk of nicks and cuts for the user. It has also been found that a range of motion less than 0.1 mm fails to provide the desired utility. Thus, the range of motion between 0.1 and 0.5 mm is desirable (the reduced upper bound provides an additional safety margin), and 0.2 mm has been found satisfactory. As shown in FIG. **3**, the cross-members **406** may provide hard stops for the range of motion. In other embodiments, the movement of the mechanical linkage **424** is constrained by hard stops **422** within the handle. Cross-member **406** is coupled to yoke **404**, which in turn is coupled in a mated relationship to handle **402**. In other embodiments the coupling of the linkage **424** between the blade and shaft **428** limits the range of motion to the desired range.

FIG. **5** is a schematic view of an alternative embodiment of the invention. In the embodiment the shaving head is a single multi-blade cartridge **500**. A magnetic actuator **514** applies alternating polarity magnetic fields between field arms **516** and **518**, which act on magnetic mass **512**. It is coupled to one blade of the multi-blade razor cartridge **500**. Moveable blade **510** resides in a slot **530** that allows it to reciprocate in a range of motion relative to the other blades of cartridge **500**. In this example, moveable blade **510** is the middle blade of a five-blade cartridge. It is within the scope and contemplation of the invention for any of the blades to be selected as the moveable blade. However, where the leading blade is at least one of the moveable blades, the greatest increase in the longevity of the cartridge and improved efficacy of shaving is achieved.

FIG. **6** is a schematic diagram of an alternative embodiment of the invention with the mechanical actuator. In FIG. **6**, a mechanical actuator is coupled to a mechanical link **612** that in turn is coupled to mobile blade **610**. A slot **630** is defined to provide the desired range of motion. Analogous to the embodiment of FIG. **5**, the moveable blade could be selected to be any individual blade, but the leading blade achieves the greatest improvement in efficacy.

FIG. **7** is a schematic view of an embodiment of the invention in which plural blades are mobile. Mechanical actuator **714** is coupled by its shaft **728** to a pair of mechanical linkages **724** and **726**, which are respectively coupled to mobile blades **710** and **712** of blade assembly **700**. Cartridge **708** is coupled in fixed relation within the assembly. Cartridges **710** and **712** reciprocate in opposite directions; that is when cartridge **710** moves left, cartridge **712** moves right. As shown, posts **740** and **760** engage slots **730** and **750** respectively. The slots **730**, **750** define the range of motion of the blades. In this embodiment where multiple blades are moving, it is important that the relative motion between the blades remains less than 0.5 mm. Thus, where the blades move in opposite directions, each blade should move no more than 0.2 mm maintaining the relative motion within an acceptable range to avoid nicks and cuts for the user. Each blade moving 0.1 mm such that the aggregate relative movement is 0.2 mm has been found effective. In the shown embodiment, the mechanical linkages **724** and **726** limit the range of motion of the cartridges **710** and **712** respectively.

While this embodiment uses a mechanical actuator, embodiments with a magnetic actuator moving more than one blade are also within the scope and contemplation of the invention. For example, the embodiment of FIG. **1** could be provided with two moveable cartridges and with magnetic masses having oppositely oriented polarities (e.g., leading

blade magnet is oriented NS and the subsequent blade magnet is orient SN) so that when the magnetic field is applied by the arms, the blades reciprocate in opposite directions.

In the foregoing specification, the embodiments of the invention have been described with reference to specific embodiments thereof. It will, however, be evident that various modifications and changes can be made thereto without departing from the broader spirit and scope of the invention as set forth in the appended claims. The specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense.

What is claimed is:

1. A shaving razor comprising:

a handle;

a power source residing within the handle;

a shaving head containing at least two razor blade assemblies, each of the blade assemblies include **[**blades which**]** *at least one blade each having a cutting edge, wherein the cutting edges of the blade assemblies* reside in a single cutting plane, at least a first of the blade assemblies is moveably coupled within the shaving head so that the first blade assembly can be driven to translate laterally within a zone of motion; and

an actuator coupled to the power source, the actuator to apply a force that drives the first blade assembly to reciprocate within the zone of motion to translate relative to an adjacent one of the blade assemblies.

2. The shaving razor of claim **1** **[**where in**]** *wherein* the actuator comprises:

one of an electric motor, a piezo electric motor or a servo.

3. The shaving razor of claim **1** wherein the force applied by the actuator is a magnetic force to drive the first blade assembly.

4. The shaving razor of claim **1** wherein the force applied by the actuator is a mechanical force to drive the first blade assembly.

5. The shaving razor of claim **1** wherein the zone of motion is defined to be in the range of 0.1 mm to 0.5 mm relative to the adjacent blade assembly.

6. The shaving razor of claim **1** wherein the actuator comprises:

a magnetic actuator.

7. The shaving razor of claim **6** further comprising:

a magnetic mass coupled to the first blade assembly and driven by the magnetic actuator.

8. The shaving razor of claim **1** further comprising a second blade assembly that is moveably coupled to the **[**razor**]** *shaving* head so as to translate within a second zone of motion via a force applied by the actuator and wherein the first and second blade assemblies translate in opposite directions within their respective zones of motion, *wherein the second blade assembly is one of the at least two blade assemblies.*

9. The shaving razor of claim **8** wherein each of the zones of motion are defined to be in a range of 0.1 mm to 0.5 mm relative to at least the adjacent blade assembly.

10. The shaving razor of claim **8** wherein the actuator applies a magnetic force to drive the first and second blade assemblies.

11. The shaving razor of claim **8** wherein the first and second blade assemblies are adjacent to each other within the shaving head.

12. The shaving razor of claim 1 wherein a second of the blade assemblies is moveably coupled within the shaving head so that the second blade assembly can be driven to translate laterally within a second zone of motion.

13. A shaving razor comprising:

a handle;

a shaving head containing at least two razor blade assemblies, each of the blade assemblies include at least one blade, each of a first blade assembly and a second blade assembly of the at least two blade assemblies are moveably coupled within the shaving head so that the first blade assembly can be driven to translate laterally within a first zone of motion and the second blade assembly can be driven to translate in a second zone of motion; and

one or more actuators coupled to, in use, receive power from a power source, the actuators to apply a force that drives the first blade assembly to reciprocate within the first zone of motion and the second blade assembly to reciprocate within the second zone of motion, wherein the translation of the first blade assembly is in an opposite direction relative to the translation of the second blade assembly, and

wherein a first blade in the first blade assembly and a second blade in the second blade assembly are ones of the at least one blade and each have a single substantially straight cutting edge.

14. The shaving razor of claim 13 wherein each of the zones of motion are defined to be in a range of 0.1 mm to 0.5 mm relative to each other.

15. The shaving razor of claim 13 wherein the first and second blade assemblies are adjacent to each other within the shaving head.

* * * * *