US 20240003162A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2024/0003162 A1**

LIN et al. (43) **Pub. Date: Jan. 4, 2024**

(54) **DOOR HANDLE ADAPTER FOR SPRUNG HUB**

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(21) Appl. No.: **18/344,217**

(22) Filed: **Jun. 29, 2023**

Related U.S. Application Data

(63) Continuation of application No. 15/856,694, filed on Dec. 28, 2017, now Pat. No. 11,725,416.

(60) Provisional application No. 62/439,974, filed on Dec. 29, 2016.

Publication Classification

(51) **Int. Cl.**

E05B 1/00	(2006.01)
E05B 3/04	(2006.01)
E05B 15/00	(2006.01)
E05B 3/06	(2006.01)

(52) **U.S. Cl.**

CPC ***E05B 1/0053*** (2013.01); ***E05B 3/04*** (2013.01); ***E05B 15/0013*** (2013.01); ***E05B 3/065*** (2013.01)

(57) **ABSTRACT**

An adapter for either a handle set or a lever set door lever is equipped with a pair of springs to provide a pre-load on the spindle. The pre-load prevents sagging of the lever due to the large mass of the lever. A sleeve in the adapter is formed out of a compressible material that accepts the spindle in a press-fit configuration. This allows for greater manufacturing tolerances while still providing a solid and secure engagement between the spindle and the adapter. As a result, any free play in the lever is eliminated and the lever is maintained in a horizontal, home position when the lever is not in use. Following use through rotation of the lever, the springs promptly return the lever back to the home position while the sleeve prevents any slop or free-play in the lever's motion.

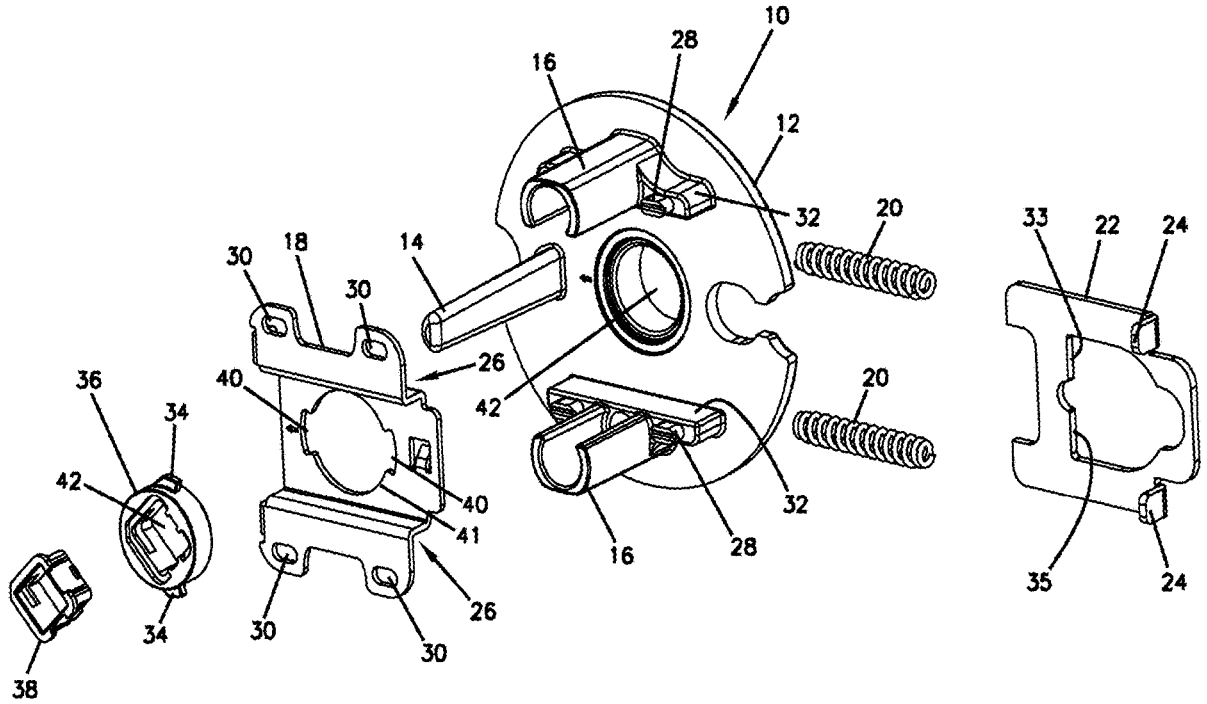
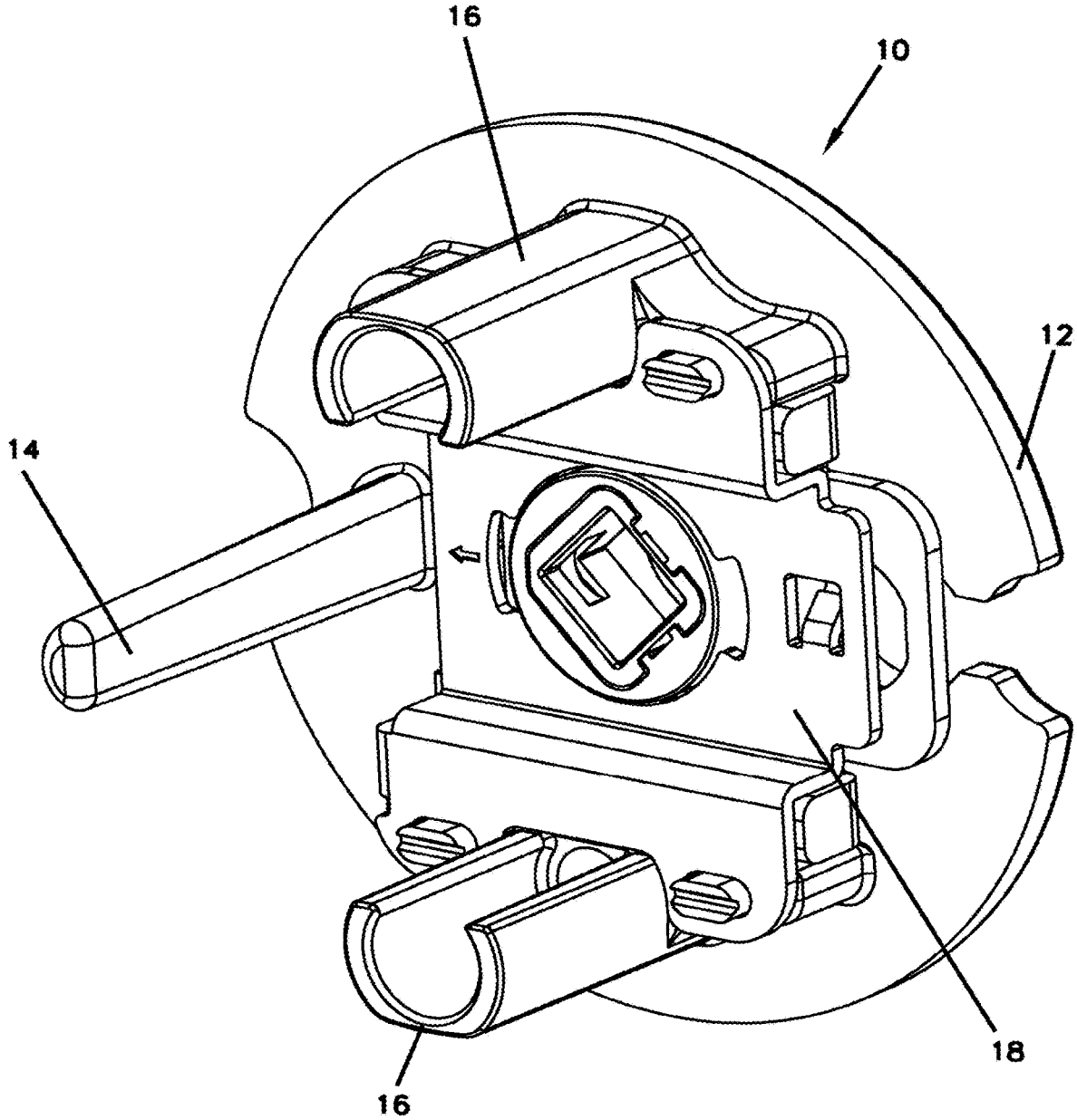


FIG. 1



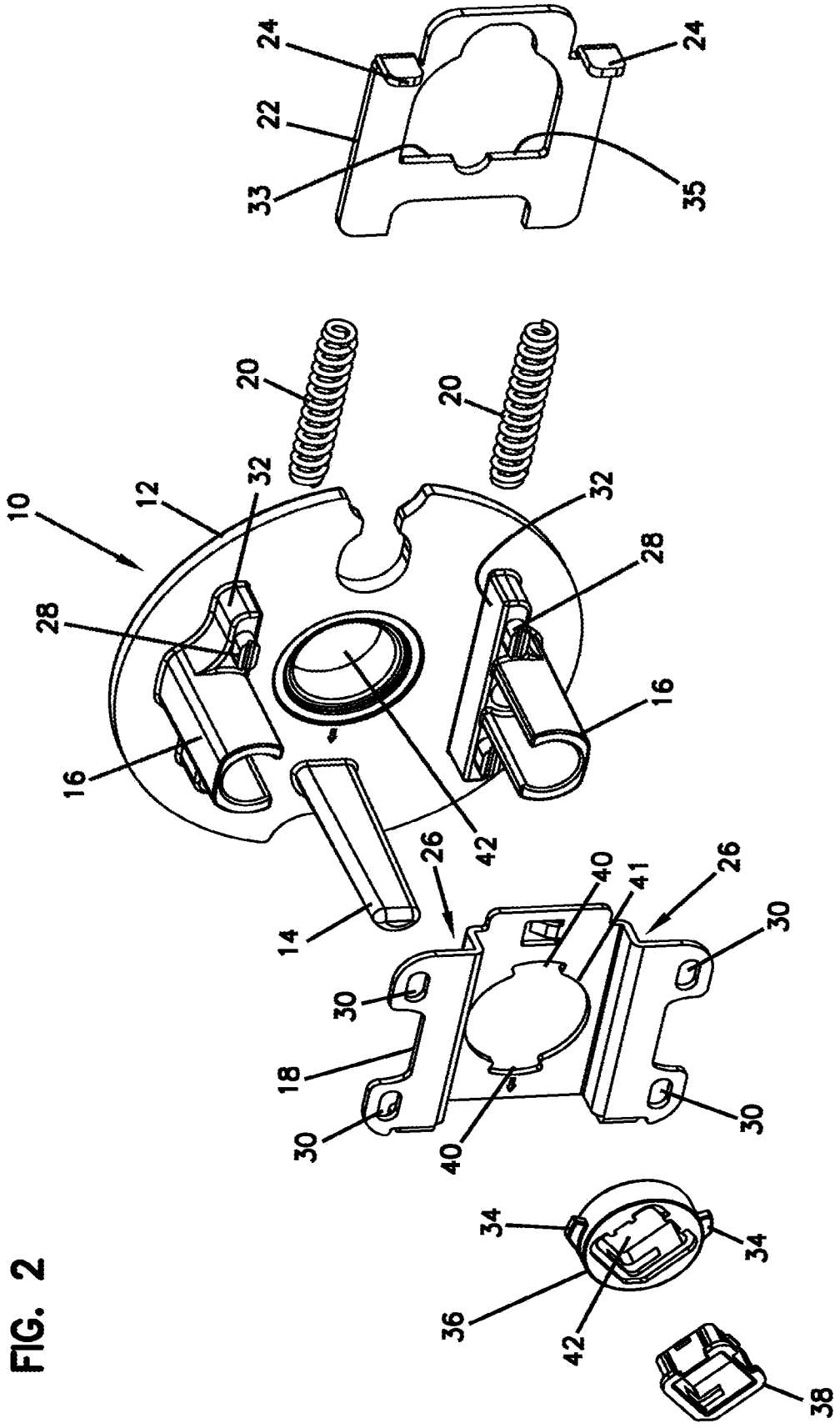

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FIG. 2

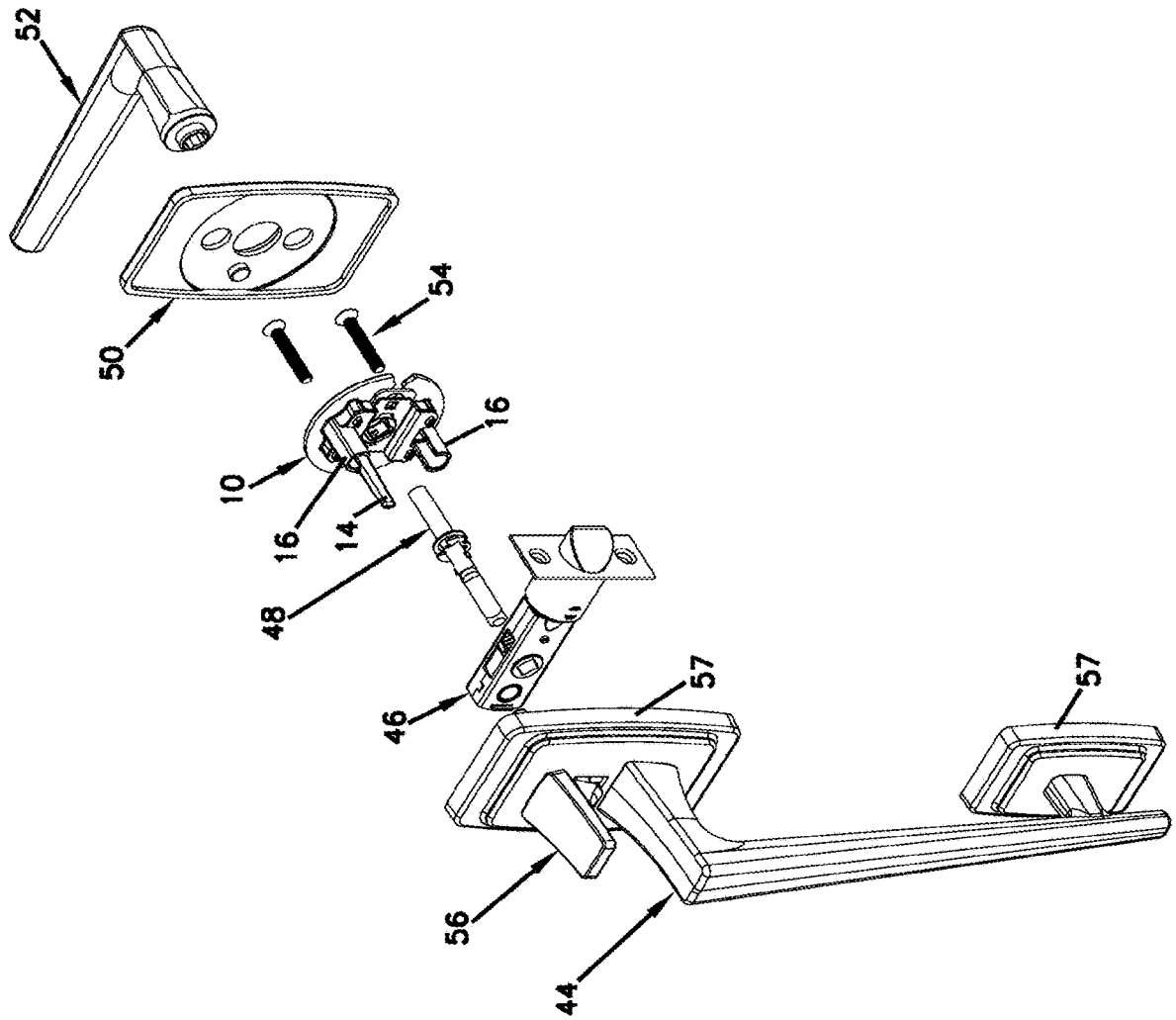

FIG. 3

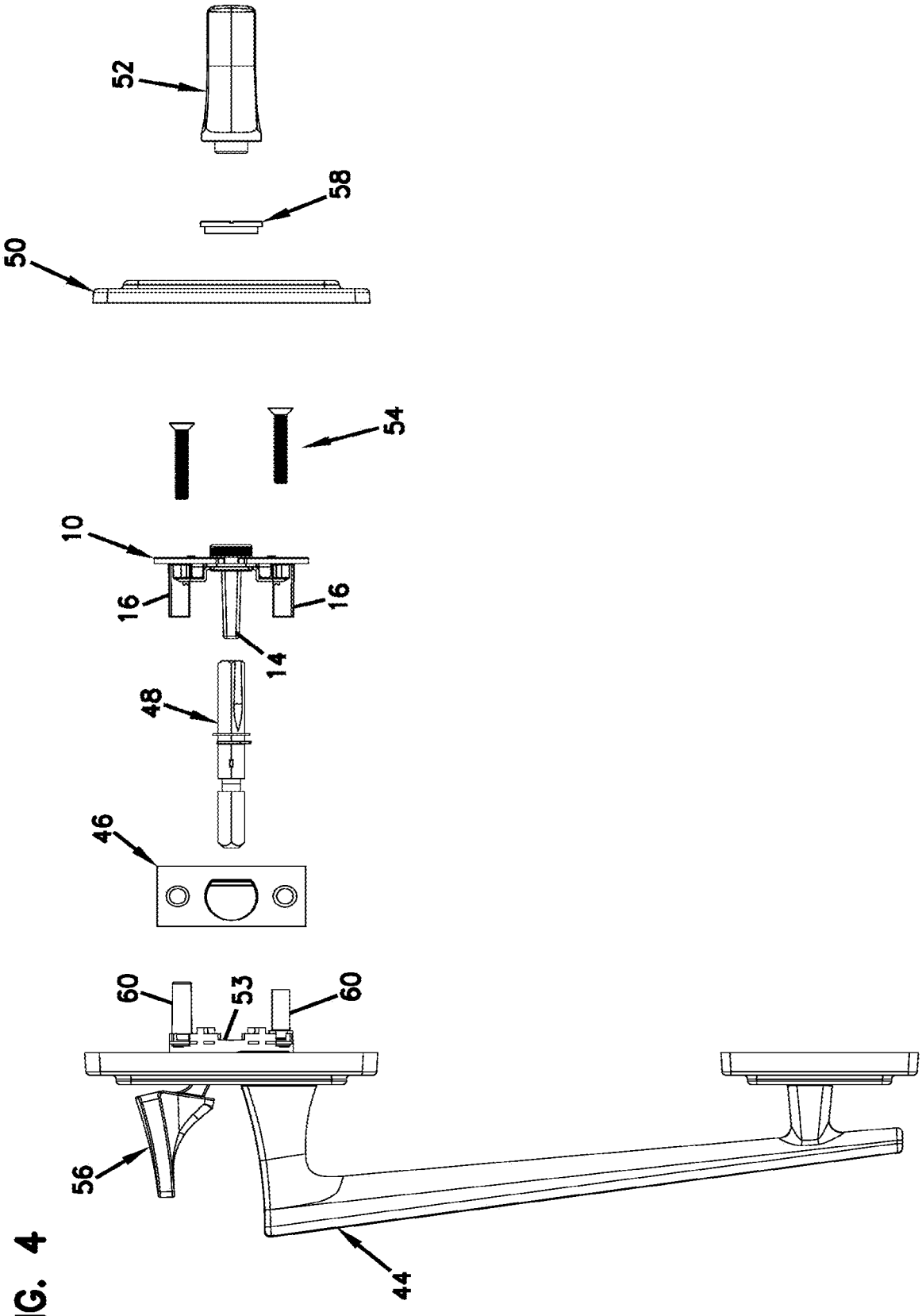

FIG. 4

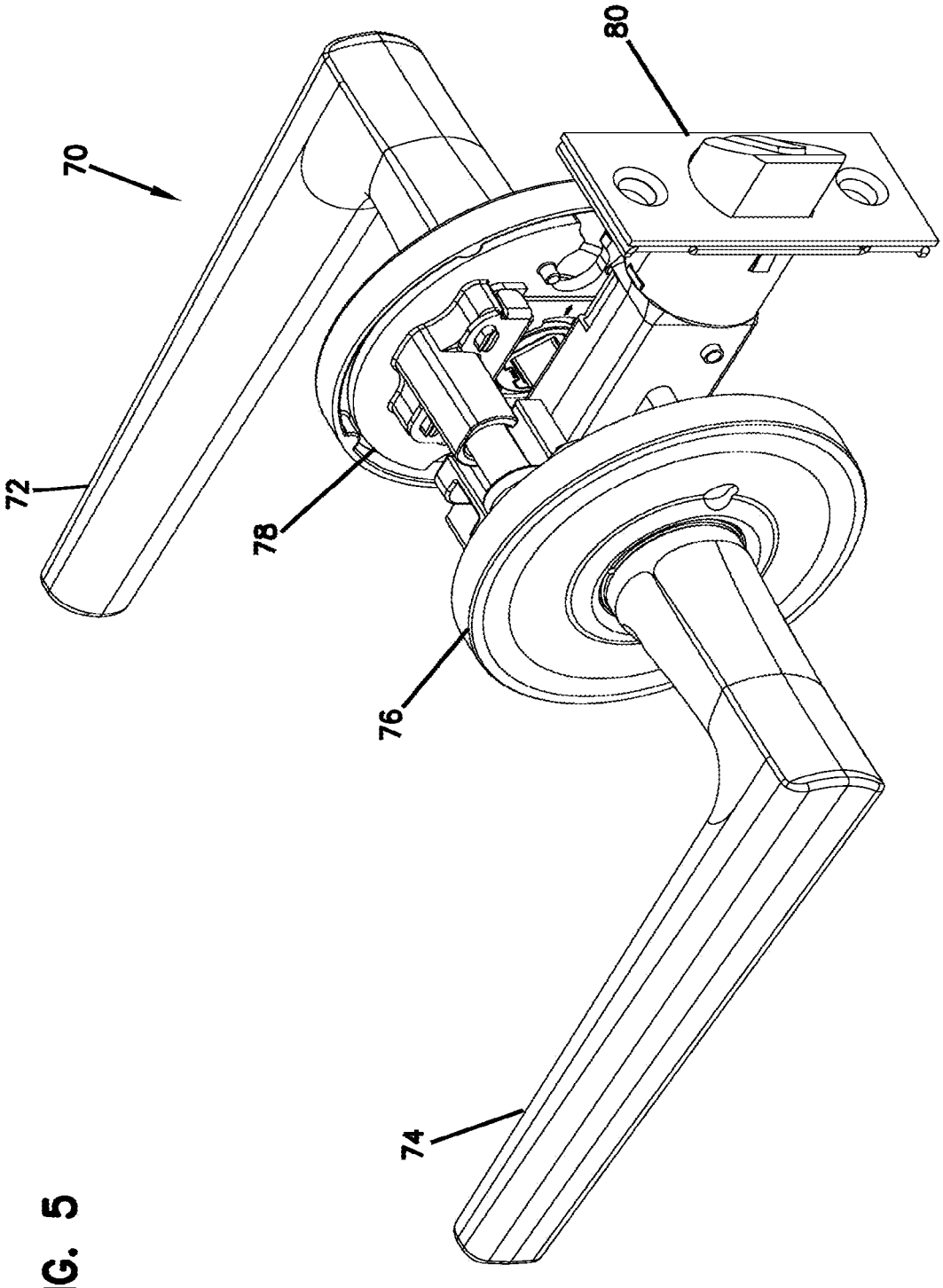

FIG. 5

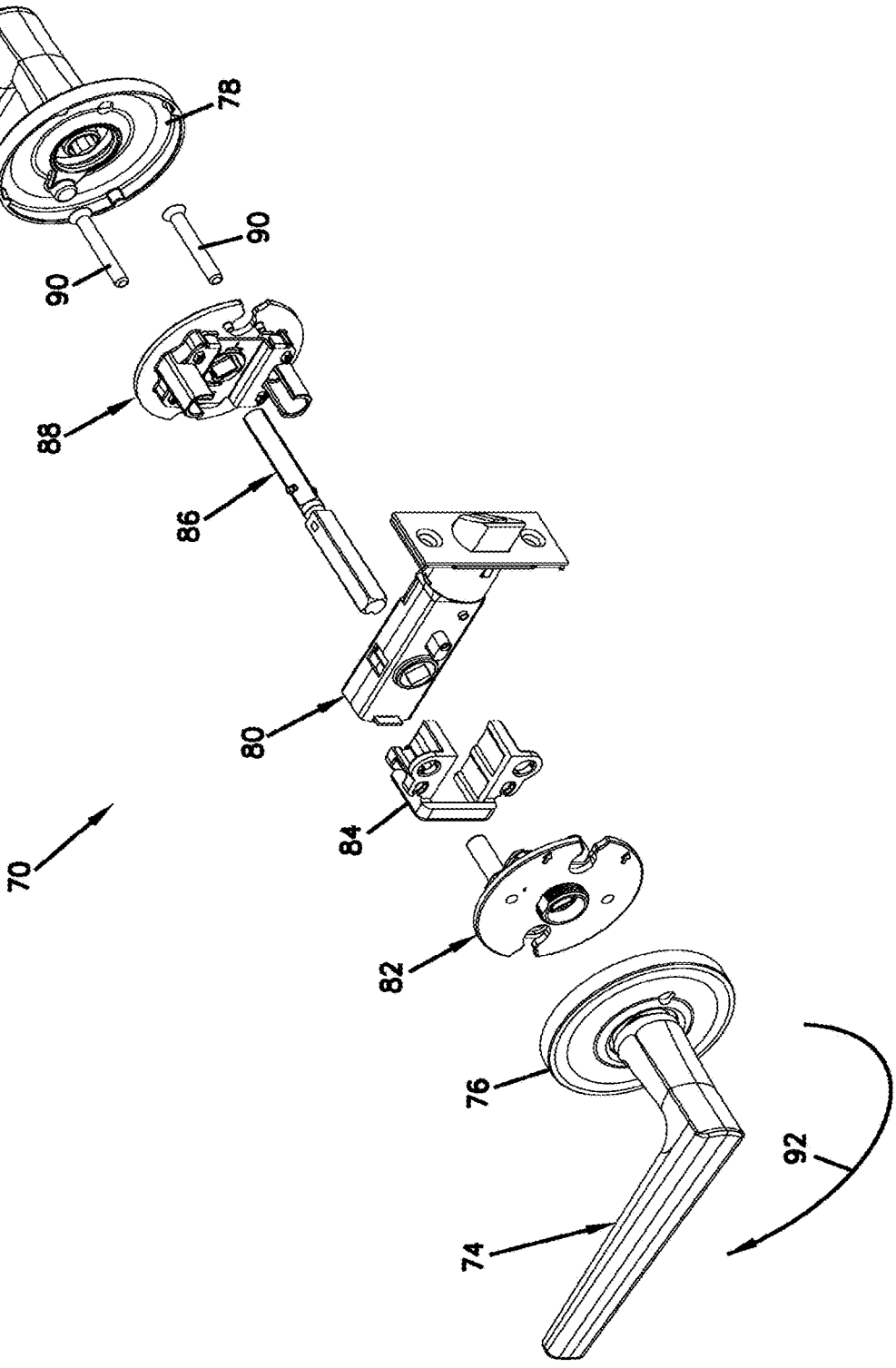

FIG. 6

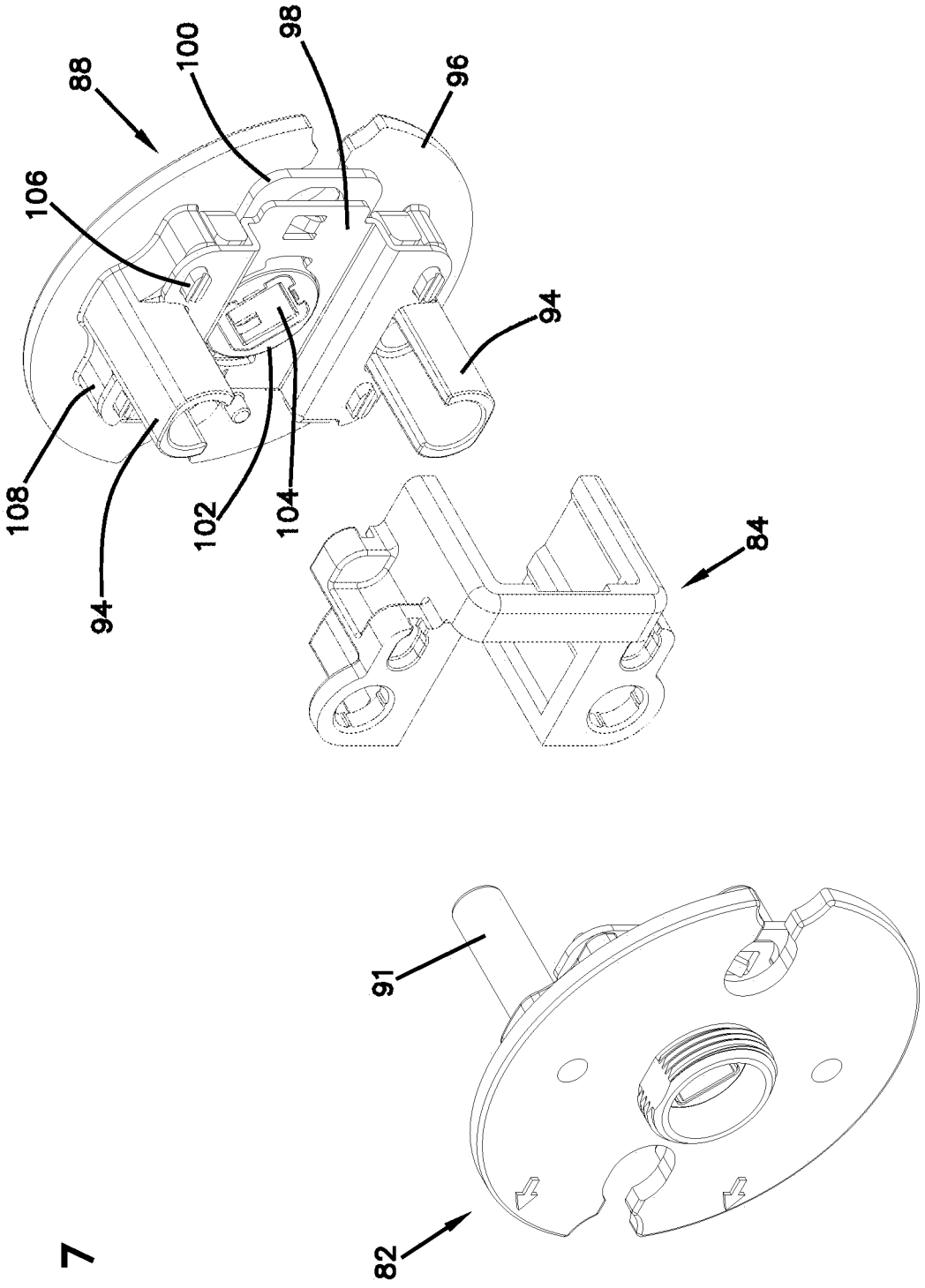

FIG. 7

DOOR HANDLE ADAPTER FOR SPRUNG HUB

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. patent application Ser. No. 15/856,694, filed Dec. 28, 2017, which claims priority to U.S. Provisional Patent Application No. 62/439,974, filed Dec. 29, 2016, the disclosures of which are hereby incorporated by reference in their entireties.

TECHNICAL FIELD

[0002] This invention relates to the field of door locks. More particularly, this invention relates to hub adapters for door handles with removable spindles.

BACKGROUND OF THE INVENTION

[0003] Door knobs and levers are known to include springs that return the knob or lever back to a home position. This allows an operator to rotate the knob or lever, retract the latch, and open the door. Releasing the knob or lever allows the spring to use stored energy and return the knob or lever to its original position.

[0004] Different springs are also commonly used on door knobs and levers. As a lever extends away from the axis of rotation, a greater amount of resistive force is generated by the mass of the lever. Door knobs have a consistent mass around the entire rotational axis and do not extend as far from the rotational axis. For this reason, lighter springs are typically used on door knobs and heavier springs are used on levers.

[0005] One problem associated with sprung levers is that the lever can sag and not rest at a perfectly horizontal position. Efforts to resolve this issue have included simply using a stronger spring, but the increased resistance experienced by the operator is not optimal. Another problem associated with sprung levers is that the connection of the lever to the latch mechanism often includes some play, allowing the operator to loosely jiggle the handle. This issue has been addressed in the past by simply manufacturing pieces with tighter tolerances. Success has been limited as the tighter tolerances cause binding and require perfect alignment of the components, which rarely happens in installations.

[0006] What is therefore needed is an improved mechanism that prevents sagging of a lever handle. What is also needed is an improved mechanism that prevents a loose connection of the lever handle thereby minimizing any free-play.

SUMMARY AND OBJECT OF THE INVENTION

[0007] A door handle adapter comprising: a spindle configured to engage the door handle and transfer an input rotational force from the door handle; a hub with a central aperture configured to receive the spindle and further transfer the rotational force from the spindle; a first engager extending from an outer circumference of the hub; a second engager opposite the first engager extending from the outer circumference of the hub; a slider with a first receiver configured to engage the first engager and a second receiver configured to engage the second engager such that as the rotational force is transmitted to the hub, thereby axially rotating the hub, at least one of the first and second engager linearly displace the slider; a first spring configured to engage the first receiver when the rotational force is in a first direction and also when the rotational force is in an opposing direction; a second spring to engage the second receiver when the rotational force is in the first direction and also when the rotational force is in the opposing direction; and a spacer formed of a material softer and more compressible than the hub and spindle inserted between the spindle and hub configured to retain a positive engagement between the spindle and hub.

[0008] The door handle adapter according to claim **1**, wherein the hub is formed of one of zinc, brass, steel, and aluminum, and the spacer is a polymer.

[0009] The door handle adapter according to claim **1**, further comprising a liner providing a backstop for the first and second spring, wherein the first and second receiver provide opposing backstops for the respective first and second springs, thereby sandwiching at least a portion of each spring in-between, respectively.

[0010] The door handle adapter according to claim **3**, wherein the first and second receivers are inserted in-between a plurality of coils of the respective first and second springs, thereby engaging the springs when the slider is linearly displaced by the axial rotation of the spindle and hub.

[0011] The door handle adapter according to claim **1**, wherein the slider is linearly displaced in the same direction when the hub is axially rotated the first direction as when the hub is axially rotated the opposing direction.

[0012] The door handle adapter according to claim **1**, wherein the first and second springs maintain a torsional resistance against the input rotational force at all times.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The present disclosure will be described hereafter with reference to the attached drawings which are given as non-limiting examples only, in which:

[0014] FIG. **1** shows a perspective view of an adapter according to an embodiment of the invention;

[0015] FIG. **2** shows an exploded perspective view of the adapter of FIG. **1**;

[0016] FIG. **3** shows a partially exploded perspective view of a handle set installation using the adapter of FIG. **1**;

[0017] FIG. **4** shows a side view of the handle set installation of FIG. **3**;

[0018] FIG. **5** shows a perspective view of a lever set installation using an adapter according to an alternative embodiment of the invention;

[0019] FIG. **6** shows a partially exploded perspective view of the lever set installation according to FIG. **5**; and

[0020] FIG. **7** shows a partially exploded perspective view of the adapter of FIG. **5**.

[0021] Corresponding reference characters indicate corresponding parts throughout the several views. The exemplifications set out herein illustrate an embodiment of the invention, and such exemplifications are not to be construed as limiting the scope of the invention in any manner.

DETAILED DESCRIPTION

[0022] Beginning with FIG. **1**, an adapter **10** is shown. The adapter **10** is configured for installation on an interior side of an entry door. The adapter **10** is preferably formed of a single-piece with an arm **14** and pair of receivers **16** extend-

ing from a flange **12**. The flange **12** is intended to rest on the interior surface of a door while the receivers **16** and arm **14** protrude into the hole formed into the door for the door handle (not pictured). The adapter **10** is also shown in FIG. **2** in exploded form with the spring plate **18** components separated for view.

[0023] A slide **22** includes spring stops **24** that extend from the slide **22**. The spring stops **24** contain a spring **20** on each side of hole **42** formed in the adapter **10**. The spring plate **18** contains the springs within spring chambers **26** thereby allowing the slide **22** to slide and compress springs **20** in the spring chambers **26** and rebound due to the spring force.

[0024] The adapter **10** includes a plurality of studs **28** extending from the flange **12**. The studs **28** in particular extend from a base **32** that in turn extends from the flange **12**, and act as mounting bosses to locate and retain the spring plate **18** in place. Each stud **28** is inserted into an aperture **30** on the spring plate **18** thereby preventing movement of the spring plate **18**. The hole **42** formed in the center of the adapter **10** is lined up with the opening **41** in the spring plate **18**. The opening **41** in the spring plate **18** includes slots **40** that receive engagers **34** on the outer diameter of a hub **36**.

[0025] The hub **36** is configured to rotate within the hole **42** of the adapter and opening **41** of the spring plate **18**. As the hub **36** rotates, the engagers **34** contact one of a first contact **33** and a second contact **35** on the slide **22**. The engagers **34** interact with the first contact **33** or second contact **35** thereby causing the slide **22** to compress the springs **20** within the spring chamber **26**. As a result, the hub **36** is compelled to rotate back to a "home" position by the stored energy in the springs **20**, urging the inside lever **52** (see FIG. **3**) in a horizontal position, whenever the hub **36** is rotated. A sleeve **38** may also be inserted into the central aperture **42** of the hub **36**. Preferably, the sleeve **38** is made out of a compressible material such as plastic.

[0026] The sleeve **38** acts as a buffer to take up any play that a spindle **48** (shown in FIG. **3**) may have with the central aperture **42** in the hub **36**. The spindle **48** is therefore preferable pressed into the sleeve **38** such that a press-fit is required. Due to the nature of manufacturing processes used to form the spindle **48** and hub **36**, it is very difficult to eliminate any play between the two components. Incorporating a sleeve **38** with a press-fit ensures a consistent, secure mating between the parts without any slop or play.

[0027] Referring to FIGS. **3** and **4**, the adapter **10** described in FIGS. **1** and **2** is shown in an exploded installation of a handle set for an entry door application. The outside handle **44** is configured for mounting on an exterior side of an entry door (not pictured). A rose **57** conceals the mounting points of the outside handle **44** to the door. A switch **56** may be depressed in order to rotate the spindle **48**. The switch **56** is connected to a mechanical device **53** concealed by the rose **57** in FIG. **3**, but viewable in FIG. **4**, that converts the linear motion generated when the switch **56** is depressed into a rotary motion. This rotary motion is transferred to the latch **46**, adapter **19**, and inside lever **52** by the spindle **48**. The spindle **48** also mechanically links the inside lever **52** to the adapter **10**, latch **46**, and switch **56**. Preferably, a multi-piece spindle **48** is used and the portion of the spindle **48** in contact with the switch operates just the latch **46** to avoid movement of the switch **56** from rotating the inside lever **52**, and vice versa.

[0028] A rose **50** conceals the adapter **10** and fasteners **54** that are used to secure the adapter to the interior side of the door. The fasteners **53** pass through the receivers **16** in the adapter **10** and into the posts **60** of the outside handle **44**. As the fasteners **54** are tightened, the adapter **10** and outside handle **44** are drawn together thereby squeezing the door in between and securing them to the door. The latch **46** is held in place by both the spindle **48** passing through the latch **46** and the arm **14** passing through the latch **46**. The spindle **48** rotates to retract the latch **46** while the arm **14** prevents the latch **46** from rotating. A rose trim screw **58** fastens to the adapter **10** and maintains the rose **50** secured to the adapter **10**.

[0029] As previously discussed, the springs **20** and sleeve **38** maintain the inside lever **52** at a home position, as depicted in FIG. **4**. The sleeve **38** also prevents any rotational slop in the movement of the inside lever **52**. The result is that a more-positive and secure connection of the inside lever **52** to the spindle **48** and adapter **10**.

[0030] Another embodiment of the invention is shown in FIG. **5** as a lever set **70** incorporating the spring plate **18**, slide **22**, springs **20**, and sleeve **38** as shown in FIG. **2**. In this embodiment, an exterior lever **74** and exterior rose **76** are mounted to the exterior side of a door (not pictured). An interior lever **72** and interior rose **78** are mounted to an interior side of the door. The interior lever **72** and the exterior lever **74** may be rotated to retract latch **80** thereby allowing the door to open. As there are two levers used in this embodiment as opposed to a single lever and a handle, there are slight differences from the previously-mentioned embodiment. These differences do not affect the function of the springs **20**, slide **22**, spring plate **18**, hub **36**, and sleeve **38** as described with respect to FIGS. **1** and **2**.

[0031] FIG. **6** shows an exploded view of the lever set **70**. A second adapter **82** is shown, one on the interior side and one on the exterior side. Each adapter **88**, **82** includes the same parts and functions similarly. One of the adapters is configured to receive fasteners (female fitting) while the opposing adapter has through holes (male fitting). The exterior lever **74** is joined to the spindle **86** thereby allowing rotational force **92** to transfer to the second adapter **82**, latch **80**, adapter **88** and interior lever **72**. As the rotational force **92** is applied to the exterior lever **74** the adapter **82** adds opposing tension to resist the rotational force **92**. This opposing tension assists in maintaining the exterior lever **74** in a home, horizontal position. An exterior rose **76** may also be used to conceal the adapter **82** which is secured to the surface of the door. As the adapter **88** used in a lever set **70** application does not have an arm **14** as shown in FIGS. **1** and **2**, an adapter bracket **84** is used to secure the latch **80** in place and prevent rotation as the spindle **86** is rotated by either the exterior lever **74** or the interior lever **72**. Fasteners **90** pass through the adapter **88**, through the adapter bracket **84** and into the adapter **82**. The fasteners **90** sandwich the door between the adapter **82** and the adapter **88** while the latch **80** and adapter bracket **84** remain within a bore in the door. An interior rose **78** conceals the adapter **88** and the exterior rose **76** conceals the adapter **82**.

[0032] Referring to FIG. **7**, a partially exploded view of the adapter **88**, adapter **82**, and bracket **84** is shown. The adapter **88** shown in FIGS. **6** and **7** is the same as the adapter **10** shown in FIGS. **1** and **2**, except that the adapter **88** does not include an arm **14**. This is due to the difference in application of using a handle set shown in FIG. **3** as opposed

to a lever set shown in FIG. **5**. The mechanical workings of the adapter **88** do not differ from the previously discussed mechanicals of adapter **10** shown and described with respect to FIG. **2**.

[0033] The adapter **88** shown in FIG. **7** includes a bracket **84** that holds the latch **80** in position as a rotational force **92** is applied to either lever (see FIG. **6**). As previously described, the adapter **88** includes a pair of receivers **94** that accept posts **90** from the adapter **82**. Studs **106** maintain the spring plate **98** and slide **100** in place and secured to the base **108** of the flange **96**. As rotational force **92** is applied (as shown in FIG. **6**), the sleeve **104** and hub **102** rotate thereby compressing the springs within the spring chambers of the spring plate **98** as previously described with respect to FIG. **2**.

[0034] With both embodiments of the invention as described with respect to FIGS. **2** and **7**, both adapters **10**, **88** perform the same functions with the same components. The only difference is a lack of an arm **14** with the embodiment shown in FIG. **7**. As a result, the adapters **10**, **88** minimize any play in the lever through the use of a sleeve **38** shown in FIG. **2** or sleeve **104** shown in FIG. **7**. The sleeve is preferably formed out of a compressible material such as plastic allowing for a greater range of manufacturing tolerances when constructing the associated spindle. The overall goal is to provide a tight, press-fit between the spindle and the sleeve. The use of springs **20**, shown in FIG. **2**, also minimizes any unintended sagging of the lever due to the weight of the lever itself. The springs **20** can therefore be pre-loaded to maintain the levers at the predetermined home position of horizontal when not in use, despite having a great mass due to solid forging manufacturing techniques. In accordance with the preceding disclosure various aspects of a door handle adapter are disclosed, In one aspect, the door handle adapter includes a spindle configured to engage the door handle and transfer an input rotational force from the door handle, as well as a hub with a central aperture configured to receive the spindle and further transfer the rotational force from the spindle. The door handle adapter includes a first engager extending from an outer circumference of the hub, and a second engager opposite the first engager extending from the outer circumference of the hub. The adapter includes a slider with a first receiver configured to engage the first engager and a second receiver configured to engage the second engager such that as the rotational force is transmitted to the hub, thereby axially rotating the hub, at least one of the first and second engager linearly displace the slider. The adapter further includes a first spring configured to engage the first receiver when the rotational force is in a first direction and also when the rotational force is in an opposing direction, as well as a second spring to engage the second receiver when the rotational force is in the first direction and also when the rotational force is in the opposing direction. The adapter includes a spacer formed of a material softer and more compressible than the hub and spindle inserted between the spindle and hub configured to retain a positive engagement between the spindle and hub.

[0035] In further examples, the adapter described above may be modified by the hub being formed of one of zinc, brass, steel, and aluminum, and the spacer is a polymer. Stull further, such an adapter can include a liner providing a backstop for the first and second spring, wherein the first and second receiver provide opposing backstops for the respective first and second springs, thereby sandwiching at least a portion of each spring in-between, respectively. The first and second receivers can be inserted in-between a plurality of coils of the respective first and second springs, thereby engaging the springs when the slider is linearly displaced by the axial rotation of the spindle and hub.

[0036] Still further, in some example aspects, the slider of any of the above examples is linearly displaced in the same direction when the hub is axially rotated the first direction as when the hub is axially rotated the opposing direction. Further the first and second springs maintain a torsional resistance against the input rotational force at all times.

[0037] In a further example, a door handle adapter includes a hub with an open inner circumference configured to receive a spindle and transfer a rotational force input into the spindle, as well as a first engager extending from an outer circumference of the hub. The door handle adapter further includes a second engager extending from the outer circumference of the hub, as well as a slider with a first receiver configured to engage the first engager and a second receiver configured to engage the second engager such that, as the rotational force is transferred to the hub, the hub axially rotates, thereby urging a linear displacement of the slider through contact between one of the first engager with the first receiver and the second engager with the second receiver. The door handle adapter includes a first spring configured to engage the first receiver when the rotational force is in a first direction, and a second spring configured to engage the second receiver when the rotational force is in a second direction opposing the first direction. The door handle adapter includes a spacer, formed of a material softer and more compressible than the hub and the spindle, press-fitted between the spindle and hub configured to retain a positive engagement between the spindle and hub.

[0038] In further aspects, the hub of the above door handle adapter is formed of one of zinc, brass, steel, and aluminum, and the spacer is a polymer. The door handle adapter above can further include a liner providing a backstop for the first and second spring, wherein the first and second receiver provide opposing backstops for the respective first and second springs, thereby sandwiching at least a portion of each spring in-between the respective backstop and receiver. In some aspects, the first and second receivers are inserted in-between a plurality of coils of the respective first and second springs, thereby engaging the springs when the slider is moved. In further aspects, the slider is linearly displaced in the same direction irrespective of a direction of the rotational force of the hub. In some aspects, the first and second springs maintain a torsional resistance against the input rotational force at all times.

[0039] In a still further example, a door handle adapter includes a hub with an open inner circumference configured to receive a spindle and transfer a rotational force input into the spindle, as well as a first engager extending from an outer circumference of the hub. The door handle adapter further includes a slider with a first receiver configured to engage the first engager such that as the rotational force is transferred to the hub, the hub axially rotates thereby urging a linear displacement of the slider through contact between the first engager with the first receiver. The door handle adapter further includes a first spring configured to engage the first receiver when the rotational force is in a first direction. The door handle adapter also includes a spacer, formed of a material softer and more compressible than the hub and the

spindle, press-fitted between the spindle and hub configured to retain a positive engagement between the spindle and hub.

[0040] In further examples, the hub is formed of one of zinc, brass, steel, and aluminum, and the spacer is a polymer. The door handle adapter can also include a liner providing a backstop for the first spring, as well as a backstop for the first spring formed from a portion of the liner, thereby sandwiching at a portion of the first spring in-between the backstop and receiver. In such examples, the first receiver is inserted in-between a plurality of coils of the first spring, thereby engaging the spring when the slider is moved.

[0041] In further example aspects, the slider is linearly displaced in the same direction irrespective of a direction of the rotational force of the hub. Additionally, the first spring maintains a torsional resistance against the input rotational force at all times. The door handle adapter can further include a second engager extending from the outer circumference of the hub, a second receiver connected to the first receiver configured to engage the second engager, and a second spring configured to engage the second receiver when the rotational force is in the first direction and also when the rotational force is in a second direction opposing the first direction. In such examples, the first receiver and second receiver are joined together proximate the hub.

[0042] Although the present disclosure has been described with reference to particular means, materials and embodiments, from the foregoing description, one skilled in the art can easily ascertain the essential characteristics of the present disclosure and various changes and modifications may be made to adapt the various uses and characteristics without departing from the spirit and scope of the present invention as set forth in the following claims.

1-19. (canceled)

20. A door handle adapter assembly comprising:

a spindle configured to engage a door handle and transfer an input rotational force from the door handle to the latch;

a door handle adapter comprising:

a flange including a flange aperture;

a hub including a hub aperture, the hub aperture aligning with the flange aperture along a spindle axis, the spindle extending through the hub aperture and flange aperture, the hub also including an outer surface positioned at least partially within the flange aperture, the hub also including first and second engagers extending outwardly from the outer surface;

a plate having a plate aperture aligning with the spindle axis and extending around the hub;

a slider positioned between the flange and the plate, the slider including a slider aperture and defining a first receiver and a second receiver positioned about the slider aperture, the first receiver configured to contact the first engager and the second receiver configured to contact the second engager such that the input rotational force rotates the hub about the spindle axis and thereby rotates the first and the second engagers to displace the slider in a direction transverse to the spindle axis, the slider also including first and second spring stops;

first and second springs positioned within first and second spring chambers, the first spring chamber including a first end defined by the plate and a second end defined by the first spring stop, the second spring chamber including a first end defined by the plate and a second end defined by the second spring stop, wherein the input rotational force causes engagement of a receiver of the first receiver and the second receiver by an engager of the first engager and the second engager to move the slider along a direction transverse to the spindle axis and compress the first and second springs when the input rotational force is in a first rotational direction and also when the input rotational force is in an opposing rotational direction.

21. The door handle adapter assembly of claim **20**, wherein the door handle adapter further includes a spacer inserted between the spindle and the hub configured to retain a positive engagement between the spindle and the hub.

22. The door handle adapter assembly of claim **21**, wherein the spacer is formed of a material softer and more compressible than the hub and the spindle.

23. The door handle adapter assembly of claim **20**, wherein when the first spring is in an extended position, first and second ends of the first spring are on opposite sides of the plate aperture about the spindle axis.

24. The door handle adapter assembly of claim **20**, wherein the first and second springs extend parallel to each other and on opposite sides of the plate aperture about the spindle axis.

25. The door handle adapter assembly of claim **20**, wherein the hub is formed of one of zinc, brass, steel, and aluminum, and the spacer is a polymer.

26. The door handle adapter assembly of claim **20**, wherein the slider is linearly displaced in the same direction when the hub is axially rotated the first direction as when the hub is axially rotated the opposing direction.

27. The door handle adapter assembly of claim **20**, wherein the first spring and the second spring maintain a torsional resistance against the input rotational force.

28. The door handle adapter assembly of claim **20**, wherein the plate includes a first tab defining the first end of the first spring chamber and a second tab defining the first end of the second spring chamber.

29. The door handle adapter assembly of claim **20**, wherein the spindle extends through the slider aperture.

30. The door handle adapter assembly of claim **20**, wherein the spindle extends through each of the flange aperture, the hub aperture, the plate aperture, and the slider aperture.

31. The door handle adapter assembly of claim **20**, wherein the flange further includes a base having a plurality of studs, the plurality of studs providing mounting locations to retain the plate relative to the flange.

32. A door handle adapter comprising:

a spindle;

a door handle adapter comprising:

a flange including a flange aperture;

a hub including a hub aperture, the hub aperture aligning with the flange aperture along a spindle axis, the spindle extending through the hub aperture and flange aperture, the hub also having an outer circumference positioned at least partially within the flange aperture, the hub including first and second engagers extending outwardly from the outer circumference;

a plate having a plate aperture aligning with the spindle axis and extending around the hub;

a slider positioned between the flange and the plate, the slider including a slider aperture and defining a first

receiver and a second receiver positioned about the slider aperture, the first receiver configured to contact the first engager and the second receiver configured to contact the second engager such that the input rotational force rotates the hub about the spindle axis and thereby rotates the first and the second engagers to displace the slider in a direction transverse to the spindle axis, the slider also including first and second spring stops;

first and second springs positioned within first and second spring chambers, the first spring chamber including a first end defined by the plate and a second end defined by the first spring stop, the second spring chamber including a first end defined by the plate and a second end defined by the second spring stop, wherein the input rotational force causes engagement of a receiver of the first receiver and the second receiver by an engager of the first engager and the second engager to move the slider along a direction transverse to the spindle axis and compress the first and second springs;

wherein the spindle extends through the slider aperture.

33. The door handle adapter of claim **32**:

wherein the input rotational force causes engagement of the first receiver by the first engager to move the slider along the direction transverse to the spindle axis and compresses the first and second springs when the input rotational force is in a first rotational direction, and

wherein the input rotational force causes engagement of the second receiver by the second engager to move the slider along the direction transverse to the spindle axis and compresses the first and second springs when the input rotational force is in a second rotational direction opposite the first rotational direction.

34. The door handle adapter of claim **32**, wherein the first and second springs extend parallel to each other and on opposite sides of the plate aperture about the spindle axis.

35. The door handle adapter of claim **32**, wherein the door handle adapter further includes a spacer positioned within the hub aperture and configured to retain a positive engagement between the spindle and the hub.

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