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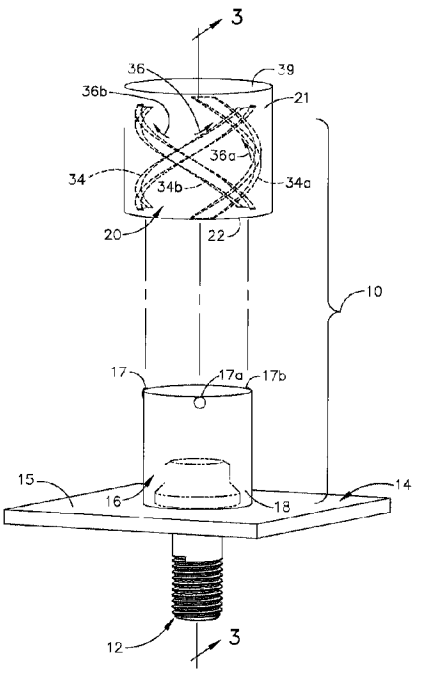
(54) **Titre : SYSTEME DE CAPUCHON DE PROTECTION DES EFFETS ELECTROMAGNETIQUES (EME) AVEC MECANISME D`ETANCHEITE A VIS**

(54) **Title: EME PROTECTION CAP SYSTEM WITH SCREW SEALANT MECHANISM**



(57) **Abrégé/Abstract:**
A containment cap assembly for enclosing a metallic fastener extending through a structure includes an inner cap with a projection extending from an outer surface of the inner cap and an outer cap includes a first end which defines an opening and includes an inner surface which defines a first space within the outer cap in communication with the opening. A dimension of the opening and of the first space defined by the inner surface of the outer cap are each greater than a dimension defined by the outer surface of the inner cap such that with positioning the inner cap within the outer cap, a second space is defined between the outer cap and the inner cap. A slot of the outer cap extends first curvilinear direction such that the projection positioned within the slot moves along first curvilinear direction with moving the inner cap into the outer cap.

ABSTRACT

A containment cap assembly for enclosing a metallic fastener extending through a structure includes an inner cap with a projection extending from an outer surface of the inner cap and an outer cap includes a first end which defines an opening and includes an inner surface which defines a first space within the outer cap in communication with the opening. A dimension of the opening and of the first space defined by the inner surface of the outer cap are each greater than a dimension defined by the outer surface of the inner cap such that with positioning the inner cap within the outer cap, a second space is defined between the outer cap and the inner cap. A slot of the outer cap extends first curvilinear direction such that the projection positioned within the slot moves along first curvilinear direction with moving the inner cap into the outer cap.

EME PROTECTION CAP SYSTEM WITH SCREW SEALANT MECHANISM

FIELD

[0001] This disclosure relates to an electrical insulation containment apparatus which electrically insulates a metallic fastener from transmitting electrical current or sparks into a vicinity of the metallic fastener upon an occurrence of an electromagnetic effect ("EME") or lightning strike event and more particularly to a cap assembly used in conjunction with a sealant.

BACKGROUND

[0002] In fabricating assemblies, such as for example an aircraft, cap assemblies are used to enclose a metallic fastener which extends through a structure of the assembly being fabricated. Enclosing the metallic fastener with the cap assembly protects the vicinity in which the metallic fastener is located by insulating the metallic fastener from transmitting any current or electrical spark from the metallic fastener into the vicinity within the fabricated assembly such as the aircraft upon an occurrence of an electromagnetic effect ("EME") or lightning strike event.

[0003] In the installation of cap assemblies to electrically isolate a metallic fastener, the cap assembly is filled with uncured sealant and the cap assembly is then placed over the metallic fastener. The uncured sealant tends to expand with the cap assembly installed over the metallic fastener. The expansion of the uncured sealant tends to lift off the cap assembly from a surface of a structure through which the metallic fastener extends and the cap assembly abuts in enclosing the metallic fastener. Cap assemblies which have experienced lift off are reinstalled enclosing the metallic fastener. Reinstallation increases the cost of providing electrical isolation of the metallic fasteners in the fabrication of an assembly such as an aircraft.

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[0004] In addition, sealant can be constructed from high density material and with the cap assembly internal volume being filled with this high density material additional weight is added to the fabricated assembly such as an aircraft. The additional weight to the aircraft can result in an increase in cost of operation of the aircraft.

[0005] There is a need for cap assemblies which will provide electrical isolation of a metallic fastener and will to avoid unnecessary additional weight being added to the aircraft as a result of filling the internal volume of the cap assemblies with uncured sealant. There is also a need to provide a cap assembly in which uncured sealant expansion has minimal or no lift off effect to a cap assembly installed on a structure.

SUMMARY

[0006] An example includes a containment cap assembly for enclosing a metallic fastener extending through a structure which includes an inner cap having a projection extending from an outer surface of the inner cap. The containment cap assembly further includes an outer cap which includes a sidewall having a first end which defines an opening and an inner surface which defines a first space configured to hold uncured sealant, wherein the opening is in communication with the first space. A dimension of the opening and a dimension of the first space defined by the inner surface of the outer cap are each greater than a dimension defined by the outer surface of the inner cap such that with positioning the inner cap within the outer cap, a second space is defined between the inner surface of the sidewall of the outer cap and the outer surface of the inner cap. A slot defined by the inner surface of the outer cap extends along the inner surface away from the first end of the outer cap in a first curvilinear direction relative to the first end wherein with the projection positioned within the slot and the inner cap moved into the outer cap, the projection moves in the first curvilinear direction within the first slot. Rotating the outer cap relative to the inner cap moves the projection along the slot in the first curvilinear direction to draw the inner cap into the first space

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and displace at least some of the uncured sealant in the outer cap into the second space.

[0007] An example includes a method for enclosing a metallic fastener extending through a structure with a containment cap assembly which includes a step of positioning uncured sealant into an outer cap, wherein the outer cap includes a sidewall having an inner surface which defines a first space and a first end which defines an opening wherein the opening is in communication with the first space. A dimension of the opening and a dimension of the first space defined by the inner surface of the outer cap are each greater than a dimension defined by an outer surface of an inner cap such that with positioning the inner cap within the outer cap a second space is defined between the inner surface of the outer cap and the outer surface of the inner cap. A slot defined by the inner surface of the outer cap extends along the inner surface away from the first end in a first curvilinear direction relative to the first end. The method further includes a step of positioning the inner cap over a metallic fastener extending from a structure wherein the inner cap includes a projection extending from the outer surface of the inner cap and a step of inserting the inner cap into the outer cap with the projection received by the slot and rotating the outer cap relative to the inner cap to move the projection along the slot in the first curvilinear direction to draw the inner cap into the first space and displace at least some of the uncured sealant in the outer cap into the second space.

[0008] The features, functions, and advantages that have been discussed can be achieved independently in various embodiments or may be combined in yet other embodiments further details of which can be seen with reference to the following description and drawings.

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BRIEF SUMMARY OF THE DRAWINGS

[0009] FIG. **1** an exploded perspective view of the cap assembly with an inner cap of the cap assembly enclosing a metallic fastener;

[0010] FIG. **2** is an exploded view of the containment cap assembly of FIG. **1** with a bottom perspective view of an outer cap of the cap assembly;

[0011] FIG. **3** is a cross section view of the containment cap assembly along line **3-3** of FIG. **1** with outer cap in an installed orientation as seen in FIG. **5**;

[0012] FIG. **4** is a perspective view of the containment cap assembly of FIG. **1** assembled and installed with squeeze out uncured sealant positioned about the cap assembly;

[0013] FIG. **5** is the containment cap assembly of FIG. **3** assembled and installed;

[0014] FIG. **6** is a cross section view of the containment cap assembly along line **6-6** of FIG. **5**; and

[0015] FIG. **7** is a flow chart of a method for enclosing a metallic fastener extending through a structure utilizing a containment cap assembly.

DESCRIPTION

[0016] In referring to FIGS. **1-3**, containment cap assembly **10** encloses a metallic fastener **12**, which extends through structure **14**, for electrically isolating metallic fastener **12** from a vicinity in which metallic fastener **12** is located within structure **14**. Electrically isolating metallic fastener **12** protects the vicinity by insulating the metallic fastener from transmitting any current or electrical spark from metallic fastener **12** into the vicinity, such as within an aircraft, upon an occurrence of an electromagnetic effect ("EME") or lightning strike event. Containment cap assembly

10 includes inner cap **16**, which encloses a portion of metallic fastener **12** to be contained within an enclosure of inner cap **16** and structure **14**, as seen in FIG. **3**. Inner cap **16** also includes, as will be further discussed herein, projection **17**, which extends from outer surface **18** of inner cap **16**. Containment cap assembly **10** also includes outer cap **20**, which includes, as seen in FIG. **2**, sidewall **21** having a first end **22** which defines opening **24** and inner surface **25**, which defines first space **26**. Inner surface **25** extends from first end **22** and into outer cap **20** defining first space **26** within outer cap **20**. Opening **24** is in communication with first space **26**, which provides access and positioning of inner cap **16** into first space **26**, as seen in FIG. **5**. Inner cap **16** and outer cap **20** can be constructed from one of a wide variety of non-electrically conductive materials and in this example are constructed of a thermoplastic material.

[0017] In referring to FIG. **3**, dimension D of opening **24** of outer cap **20** and dimension D**1** of first space **26** defined by inner surface **25** of outer cap **20** are each greater than dimension D**2** defined by outer surface **18** of inner cap **16**. With dimensions D and D**1** being greater than dimension D**2**, inner cap **16** can be positioned within outer cap **20**, as seen in FIG. **5**, such that second space **28** is defined between inner surface **25** of sidewall **32** of outer cap **20** and outer surface **18** of sidewall **30** of inner cap **16**. In inserting inner cap **16** within outer cap **20**, projection **17** of inner cap **16** is inserted within slot **34** at opening **35** defined by first end **22** of outer cap **20**, as seen in FIG. **2**.

[0018] Slot **34** defined by inner surface **25** of outer cap **20** extends along inner surface **25** of outer cap **20** away from first end **22** in curvilinear direction **36** relative to first end **22**. In this example, curvilinear direction **36** is in a helical direction. In this example, with projection **17** positioned within slot **34** and inner cap **16** moved into outer cap **20**, a seen in FIG. **5**, projection **17** moves in curvilinear direction **36** within slot **34**, as seen in FIGS. **2**, **3** and **5** until projection **17**, in this example, reaches and abuts inner surface **37** of end wall **39** of outer cap **20**. End wall **39** of outer cap **20** can be one of a variety of shapes. In this example, end wall **39** has a

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flat configuration and other examples of end wall **39** can include a dome configuration or other desired shape. With projection **17** moving along curvilinear direction **36**, outer cap **20** turns relative to inner cap **16**. Projection **17** can be constructed in one of a variety of shapes such that projection **17** can engage slot **34** and follow curvilinear direction **36** of slot **34**.

[0019] Slot **34**, as seen in FIGS. **2**, **3** and **5**, have opposing sidewalls **41** and **43**, which confine projection **17** within slot **34**. In this example, sidewall **41**, as seen in FIG. **3**, extends in curvilinear direction **36** and blocks projection **17** from moving directly toward first end **22** of outer cap **20**. Sidewall **41**, upon an occurrence of expansion of uncured sealant **54** positioned within second space **28**, as seen in FIG. **5**, blocks and resists lift off of outer cap **20** in direction **45**, as seen in FIG. **3**. In addition, uncured sealant **54** positioned within slot **34**, which was displaced within second space **28** with the insertion of inner cap **16** into outer cap **20** containing uncured sealant **54** as seen in FIG. **3**, provides resistance of movement of projection **17** within slot **34**. The insertion of inner cap **16** into outer cap **20**, as seen in FIG. **5**, displaces uncured sealant **54** within second space **28** toward first end **22** of outer cap **20** and uncured sealant **54** is moved into and along slot **34** positioned along second space **28**. As a result, the angular position of sidewall **41** of slot **34** relative to first end **22** of outer cap **20** and uncured sealant **54** displaced into slot **34** resists projection **17** from moving directly toward first end **22** of outer cap **20** with a lift off force applied to outer cap **20** from expansion of uncured sealant **54** exerted in direction **45**.

[0020] As seen in FIG. **2**, first end **22** of sidewall **32** of outer cap **20** defines opening **35** which is aligned with and in communication with slot **34**. In this example, additional projections are positioned extending from outer surface **18** of inner cap **16** and additional corresponding slots are positioned and defined along inner surface **25** of outer cap **20**. Second projection **17a** and third projection **17b** extend from outer surface **18** of inner cap **16**, wherein second projection **17a** is positioned spaced apart about inner cap **16** from projection **17** and third projection **17b** is positioned

spaced apart about inner cap **16** from projection **17**a and projection **17**. This example, as seen in FIGS. **2**, **3**, **5** and **6**, further includes second slot **34**a defined by inner surface **25** of outer cap **20** which extends along inner surface **25** away from first end **22** in second curvilinear direction **36**a relative to first end **22** of outer cap **20** having opposing sidewalls **41**a and **43**a. Similarly this example also includes third slot **34**b defined by inner surface **25** of outer cap **20** which extends along inner surface **25** away from first end **22** in third curvilinear direction **36**b relative to first end **22** of outer cap **20** having opposing sidewalls **41**b and **43**b. Curvilinear directions **36**, **36**a and **36**b in this example extend generally parallel to one another along inner surface **25** of outer cap **20**.

[0021] First end **22** of sidewall **32** of outer cap **20** defines second opening **35**a which is aligned with and in communication with second slot **34**a and first end **22** of sidewall **32** of outer cap **20** also defines third opening **35**b which is aligned with and in communication with third slot **34**b. All three projections **17**, **17**a and **17**b are inserted into opening **35**, second opening **35**a and third opening **35**b respectively and continued insertion of inner cap **16** into outer cap **20** results in projections **17**, **17**a and **17**b moving along slots **34**, **34**a and **34**b respectively. Second slot **34**a is spaced from slot **34** about inner surface **25** of outer cap **20** and third slot **34**b is spaced apart from second slot **34**a and slot **34** about inner surface **25**. In this example, second curvilinear direction of second slot **34**a extends in a helical direction such as does slot **34** and third slot **34**b. With projection **17**, second projection **17**a and third projection each positioned within slot **34**, second slot **34**a and third slot **34**b respectively and inner cap **16** is inserted into outer cap **20**, projection **17**, second projection **17**a and third projection **17**b move in the curvilinear direction **36**, second curvilinear direction **36**a and third curvilinear direction **36**b respectively within second slot **34**, second slot **34**a and third slot **34**b respectively. With projection **17**, second projection **17**a and third projection **17**b each moving in curvilinear direction **36**, second curvilinear direction **36**a and third curvilinear direction **36**b respectively, outer cap **20** turns relative to inner cap **16**. Outer cap **20**

is installed with end wall **39** of outer cap **20** in abutting relationship with end wall **48** of inner cap **16** as seen in FIG. **5**.

[0022] As seen in FIGS. **3** and **5**, inner cap **16** includes sidewall **30** having an inner surface **31** which defines third space **38** and first end portion **40** of sidewall **30** includes first end **42**. First end **42** defines opening **44** in communication with third space **38** for receiving at least a portion of the metallic fastener **12** within third space **38**. Opposing second end portion **46** of sidewall **30** includes end wall **48** secured to sidewall **30**. In this example of containment cap assembly **10**, cross section of the inner cap **16** includes sidewall **30** defining circular configuration **50**, as seen in FIG. **6**. Similarly, cross section of outer cap **20** includes sidewall **32** also defining circular configuration **52**. Circular configuration optimizes the occupation of space with respect to structure **14** in enclosing metallic fasteners **12** and provides outer cap **20** to rotate about and relative to inner cap **16**.

[0023] Containment cap assembly **10** includes uncured sealant **54**, as mentioned earlier, positioned within outer cap **20**, as seen in FIGS. **2-3**. With inner cap **16** positioned within outer cap **20**, uncured sealant **54** is displaced within second space **28** between outer surface **18** of inner cap **16** and inner surface **25** of outer cap **20**, as seen in FIG. **5**. Uncured sealant **54** is also displaced into slot **34** and in this example, into second slot **34a** and also into third slot **34b**. As seen in FIG. **5**, with end wall **39** secured to sidewall **32** of outer cap **20** positioned against end wall **48** of inner cap **16**, sidewall **32** of outer cap **20** positions first end **22**, which defines first plane P, spaced apart from second plane P' defined by first end **42** of inner cap **16** which abuts structure **14**. With first end **42** of inner cap **16** positioned on surface **15** of structure **14**, first end **22** of outer cap **20** defines gap **58** between outer cap **20** and surface **15** of structure **14**, which extends about inner cap **16**. With end wall **48** of inner cap **16** abutting end wall **39** of outer cap **20**, uncured sealant **54**, as originally positioned within outer cap **20** as seen in FIGS. **2** and **3** of containment cap assembly **10**, is displaced within and along second space **28** and into and along slot **34**, second slot **34a** and third slot **34b**, toward first end **22** of outer cap **20**. Uncured

sealant **54** from within second space **28** moves through gap **58** between first end **22** of sidewall **32** of outer cap **20** and structure **14** and extrudes from gap **58**.

[0024] With a measured amount of uncured sealant positioned in outer cap **20**, the amount of uncured sealant extruding through gap **58** can be controlled. The uncured sealant **54** that is extruded is smoothed out and further seals second space **28** closed without a need for having installer provide additional sealant for installation. In the present example, outer cap **20** can be provided to installer with a measured amount of uncured sealant **54** positioned within outer cap **20**. With containment cap assembly **10** installed, uncured sealant **54** for containment cap assembly **10** is positioned within a limited volume of second space **28** positioned between inner cap **16** and outer cap **20**. There is no need to fill a complete volume defined by inner cap **16** or outer cap **20**. As a result, sealing of metallic fastener **12** is accomplished with a reduced amount of uncured sealant **54**. Utilization of a relatively lesser amount of uncured sealant **54** reduces the weight of securement of containment cap assembly **10** and provides less operational cost with use of containment cap assembly **10** in association with, for example, an aircraft assembly. Additionally, further installation costs are saved with minimizing reworking a containment cap assembly **10** installation which would otherwise be incurred as a result of uncured sealant **54** expansion. The above described operation of projection **17** with respect to slot **34** restricts outer cap **20** lift off movement relative to inner cap **16** and reduces an occurrence of lift off of outer cap **20** from inner cap **16**.

[0025] Method **60** for enclosing metallic fastener **12** extending through structure **14** with containment cap assembly **10** includes step **62** of positioning uncured sealant **54** into outer cap **20**, wherein outer cap **20** includes sidewall **32** having inner surface **25**, which defines first space **26** and first end **22**, which defines opening **24**. Opening **24** is in communication with first space **26**. Outer cap **20** further includes dimension D of opening **24** and dimension D1 of first space **26** defined by inner surface **25** of outer cap **20**, which are each greater than dimension D2 defined by outer surface **18** of inner cap **16** such that with positioning inner cap **16** within outer

cap **20**, second space **28** is defined between inner surface **25** of outer cap **20** and outer surface **18** of inner cap **16**, as seen in FIG. **5**. Slot **34** defined by inner surface **25** of outer cap **20** extends along inner surface **25** away from first end **22** in curvilinear direction **36** relative to first end **22**. Method **60** further includes step **64** of positioning inner cap **16** over metallic fastener **12** extending from structure **14** wherein inner cap **16** includes projection **17** extending from outer surface **18** of inner cap **16**. Method **60** further includes step **66** of inserting inner cap **16** into outer cap **20** with projection **17** received by slot **34**, which includes moving projection **17** along slot **34** in curvilinear direction **36** and includes displacing uncured sealant **54** positioned within second space **28**.

[0026] Step **66** of inserting inner cap **16** further includes moving projection **17** from first end **22** of outer cap **20** to inner surface **37** of end wall **39**, secured to sidewall **32**, of outer cap **20** wherein outer cap **20** turns relative to inner cap **16**. Step **66** of inserting inner cap **16** further includes displacing uncured sealant **54** toward first end **22** of outer cap **20** and includes moving uncured sealant **54** to within gap **58** defined by first end **22** of sidewall **32** of outer cap **20** and structure **14**. Step **66** of inserting further includes extruding uncured sealant **54** from gap **58** along structure **14** and beyond outside surface **59** of outer cap **20**. Uncured sealant **54** positioned outside of outer cap **20** can be smoothed out by the installer further sealing closed second space **28** and securing outer cap **20** to inner cap **16** and securing both inner cap **16** and outer cap **20** to structure **14**.

[0027] While various embodiments have been described above, this disclosure is not intended to be limited thereto. Variations can be made to the disclosed embodiments that are still within the scope of the teachings herein.

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EMBODIMENTS IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A containment cap assembly for enclosing a metallic fastener extending through a structure, comprising:

an inner cap including a projection extending from an outer surface of the inner cap; and

an outer cap comprising:

a sidewall having a first end which defines an opening and an inner surface which defines a first space configured to hold uncured sealant, wherein:

the opening is in communication with the first space;

a dimension of the opening and a dimension of the first space defined by the inner surface of the outer cap are each greater than a dimension defined by the outer surface of the inner cap such that with positioning the inner cap within the outer cap, a second space is defined between the inner surface of the sidewall of the outer cap and the outer surface of the inner cap; and

a slot defined by the inner surface of the outer cap which extends along the inner surface away from the first end of the outer cap in a first curvilinear direction relative to the first end wherein with the projection positioned within the slot and the inner cap moved into the outer cap, the projection moves in the first curvilinear direction within the slot;

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wherein rotating the outer cap relative to the inner cap moves the projection along the slot in the first curvilinear direction to draw the inner cap into the first space and displace at least some of the uncured sealant in the outer cap into the second space.

2. The containment cap assembly of claim **1**, wherein the inner cap and outer cap are constructed of a thermoplastic material.

3. The containment cap assembly of claim **1** or **2**, wherein:

the inner cap includes a sidewall having an inner surface which defines a third space;

a first end portion of the sidewall of the inner cap includes a first end which defines an opening in communication with the third space for receiving at least a portion of the metallic fastener within the third space; and

an opposing second end portion of the sidewall of the inner cap includes an end wall secured to the sidewall.

4. The containment cap assembly of any one of claims **1-3**, wherein a cross section of the inner cap includes the sidewall defining a circular configuration.

5. The containment cap assembly of any one of claims **1-4**, wherein a cross section of the outer cap defines a circular configuration.

6. The containment cap assembly of any one of claims **1-5**, further including an uncured sealant positioned within the outer cap such that with the inner cap positioned within the outer cap the uncured sealant is displaced into the second space between the outer surface of the inner cap and the inner surface of the outer cap.

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7. The containment cap assembly of any one of claims **1-6**, wherein with an end wall secured to the sidewall of the outer cap positioned against the end wall of the inner cap, the first end of the sidewall of the outer cap defines a first plane and is spaced apart from a second plane defined by the first end of the inner cap.

8. The containment cap assembly of any one of claims **3-7**, wherein with the first end of the inner cap positioned on the structure, the first end of the outer cap defines a gap between the outer cap and the structure which extends about the inner cap.

9. The containment cap assembly of claim **8**, wherein uncured sealant which is displaced within the second space moves to and through the gap between the first end of the sidewall of the outer cap and the structure and extrudes from the gap.

10. The containment cap assembly of any one of claims **1-9**, wherein the first curvilinear direction extends in a helical direction.

11. The containment cap assembly of any one of claims **1-10**, wherein the first end of the sidewall of the outer cap defines an opening which is in communication with the slot.

12. The containment cap assembly of any one of claims **1-11**, further including a second slot defined by the inner surface of the outer cap which extends along the inner surface away from the first end in a second curvilinear direction relative to the first end.

13. The containment cap assembly of claim **12**, wherein the second slot is spaced from the slot about the inner surface of the outer cap.

14. The containment cap assembly of claim **12**, wherein the second curvilinear direction of the second slot extends in a helical direction.

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15. The containment cap assembly of claim **12**, further including a second projection extending from the outer surface of the inner cap such that with the second projection positioned within the second slot and the inner cap moved into the outer cap, the second projection moves in the second curvilinear direction within the second slot.

16. A method for enclosing a metallic fastener extending through a structure with a containment cap assembly, comprising the steps of:

positioning uncured sealant into an outer cap, wherein the outer cap comprises:

a sidewall having an inner surface which defines a first space and a first end which defines an opening wherein the opening is in communication with the first space;

a dimension of the opening and a dimension of the first space defined by the inner surface of the outer cap are each greater than a dimension defined by an outer surface of an inner cap such that with positioning the inner cap within the outer cap a second space is defined between the inner surface of the outer cap and the outer surface of the inner cap; and

a slot defined by the inner surface of the outer cap which extends along the inner surface away from the first end in a first curvilinear direction relative to the first end,

positioning the inner cap over a metallic fastener extending from a structure wherein the inner cap includes a projection extending from the outer surface of the inner cap; and

inserting the inner cap into the outer cap with the projection received by the slot; and

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rotating the outer cap relative to the inner cap to move the projection along the slot in the first curvilinear direction to draw the inner cap into the first space and displace at least some of the uncured sealant in the outer cap into the second space.

17. The method of claim **16**, the step of inserting the inner cap further includes moving the projection from the first end of the outer cap to an inner surface of an end wall, secured to the sidewall of the outer cap, wherein the outer cap turns relative to the inner cap.

18. The method of claim **16** or **17**, wherein the step of inserting the inner cap further includes displacing the uncured sealant toward the first end of the outer cap.

19. The method of claim **18**, wherein the step of inserting further includes moving the uncured sealant to within a gap defined by the first end of the sidewall of the outer cap and the structure.

20. The method of claim **19**, wherein the step of inserting further includes extruding the uncured sealant from the gap along the structure, into the second space and beyond an outside surface of the outer cap.

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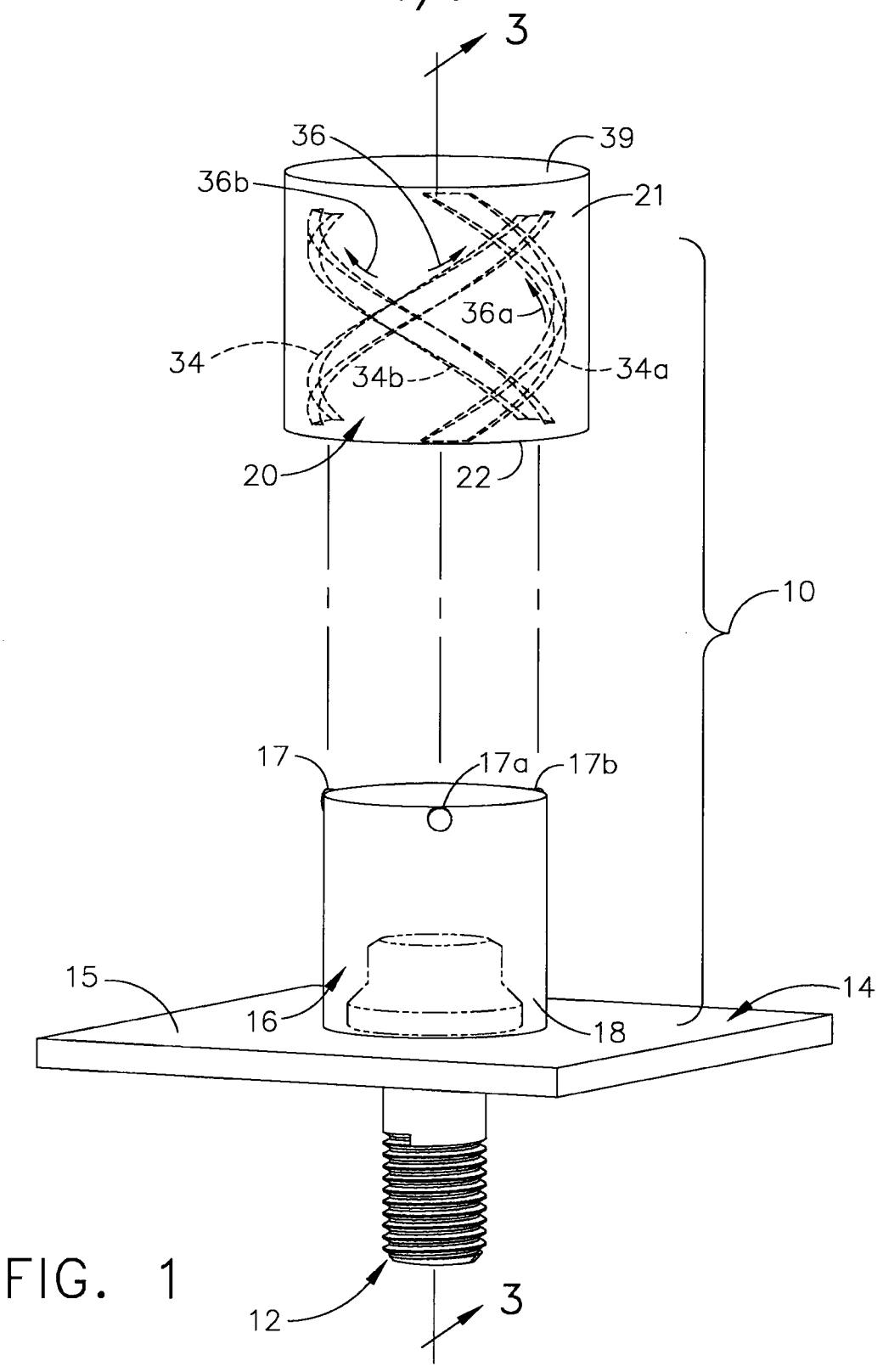

FIG. 1

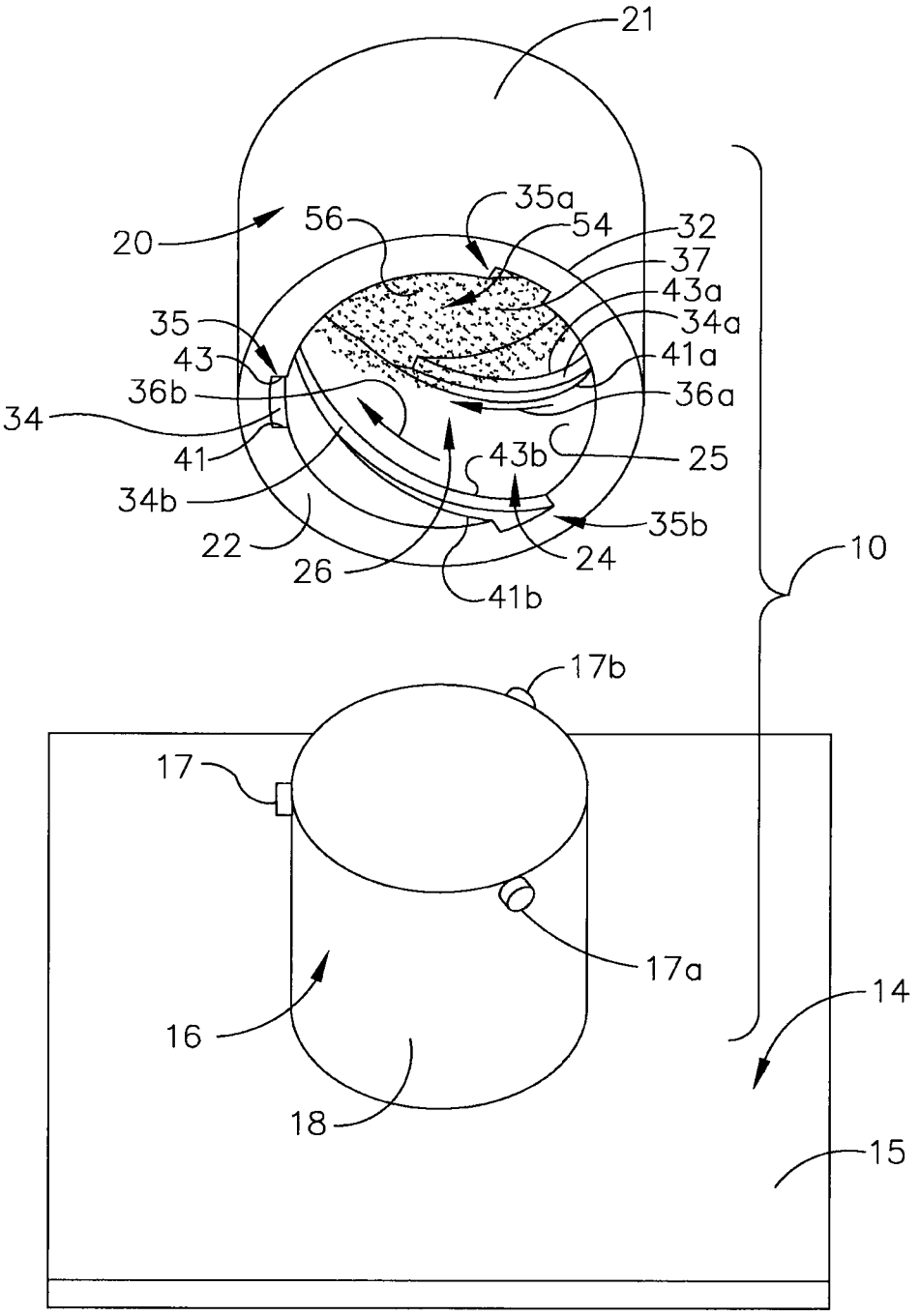
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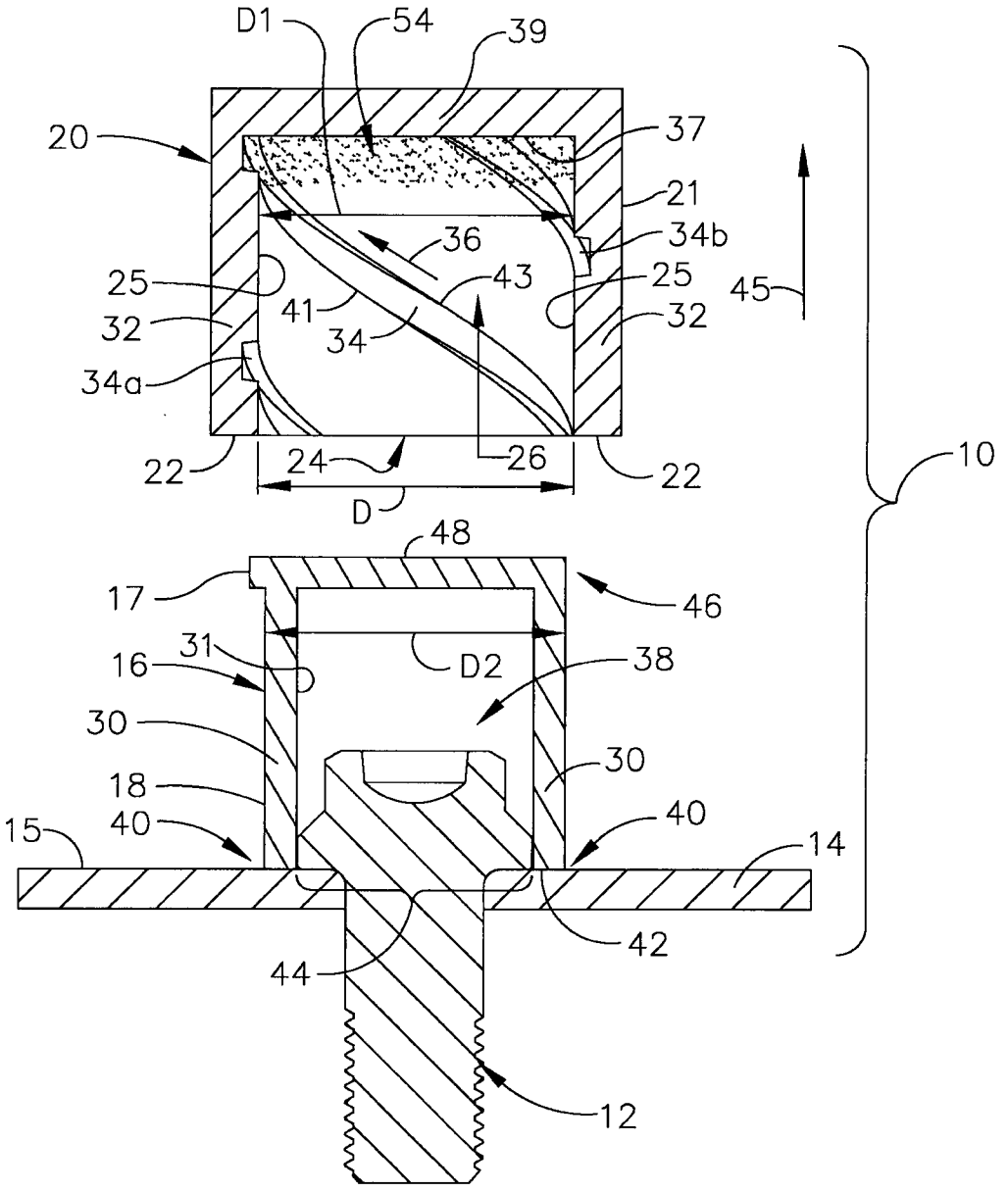
FIG. 2


D1
54
39
20
37
21
34b
36
43
25
41
34
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34a
22
24
26
D
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D2
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FIG. 3

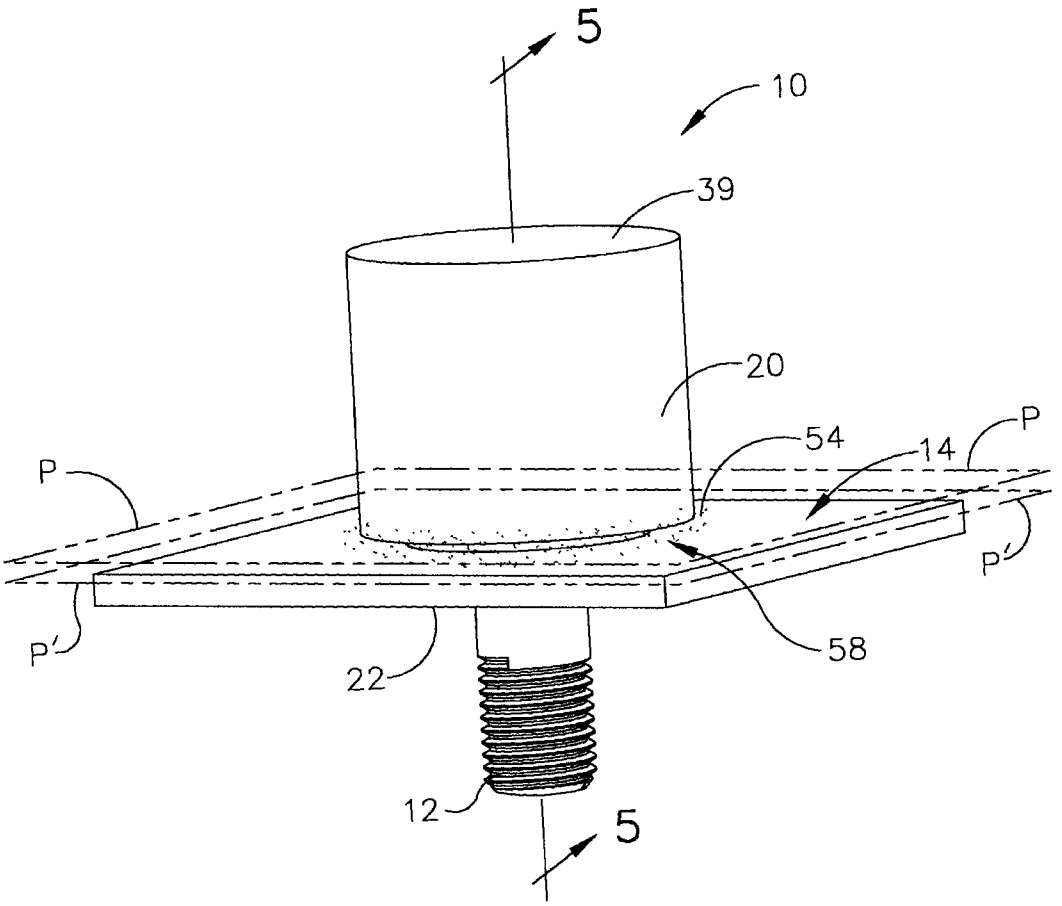
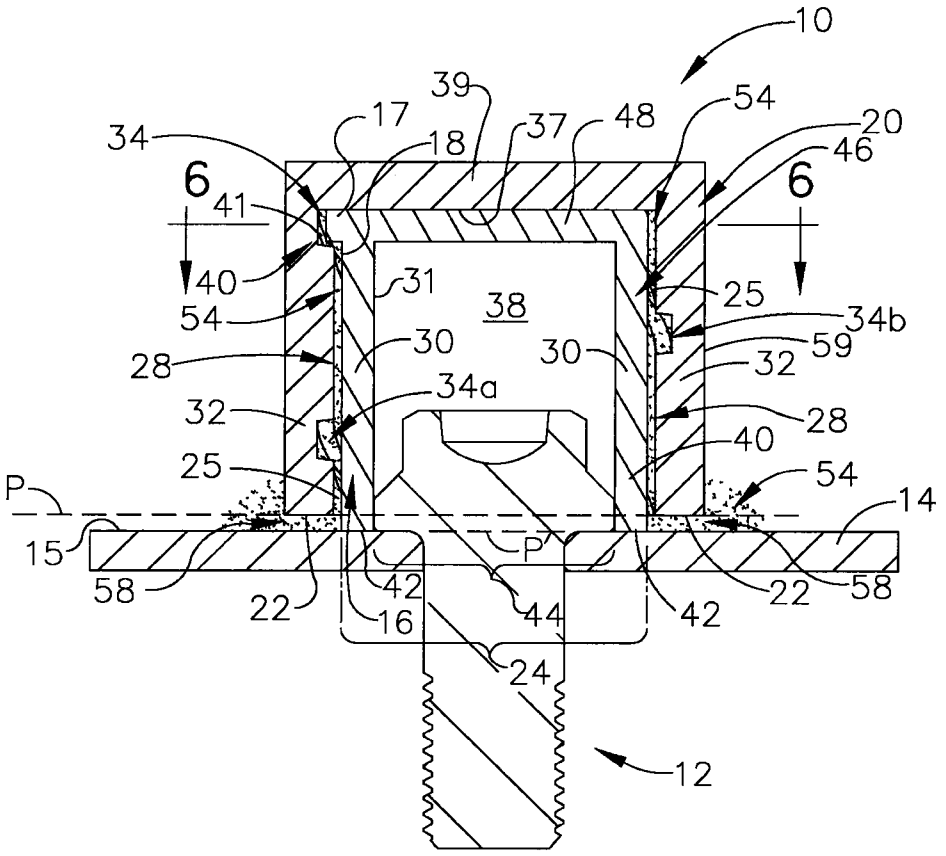


FIG. 4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34a
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P
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P'
58
22
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16
44
42
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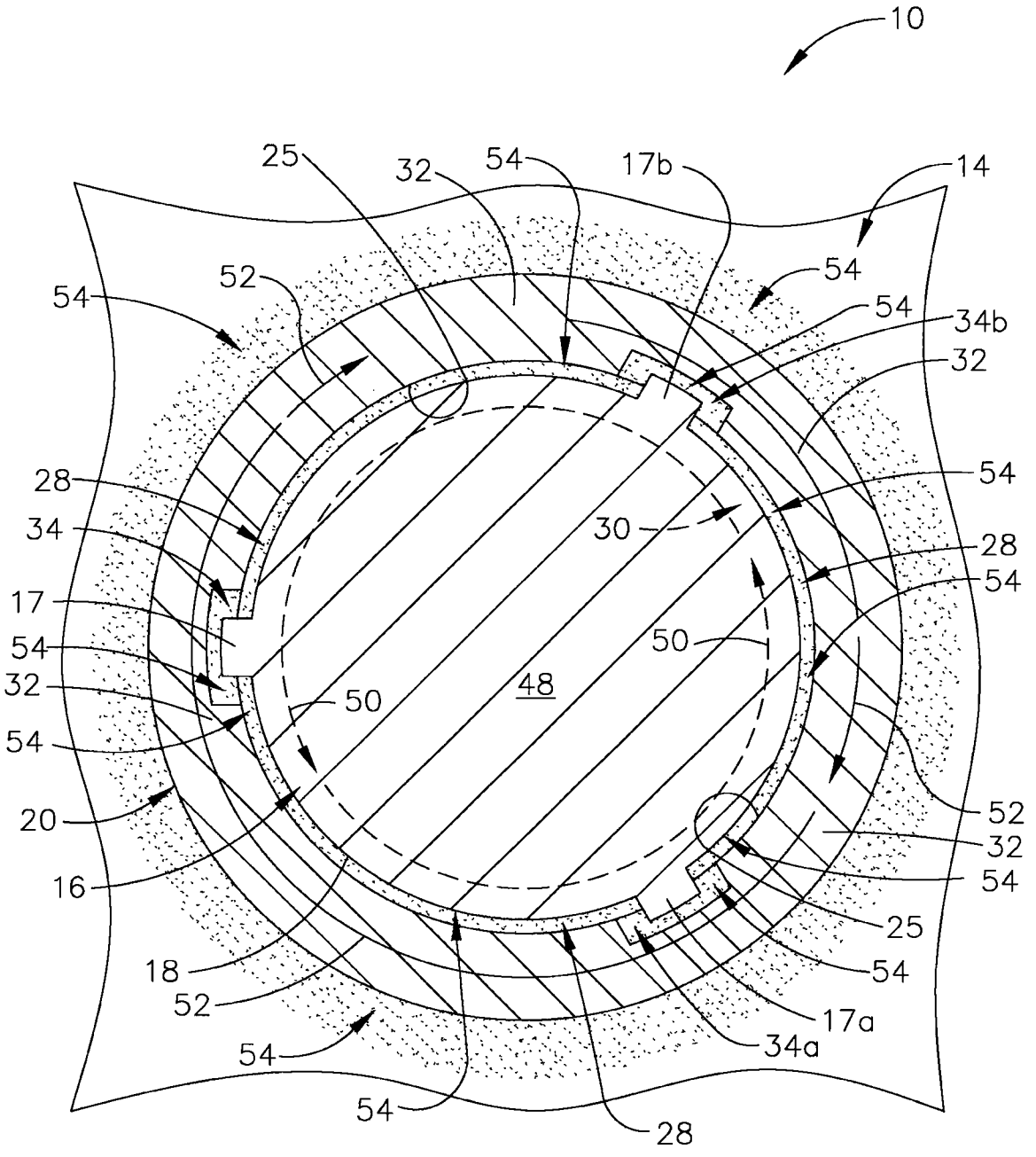
58
24
12

FIG. 5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34b
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54
25
18
54
52
17a
54
34a
54
28

FIG. 6

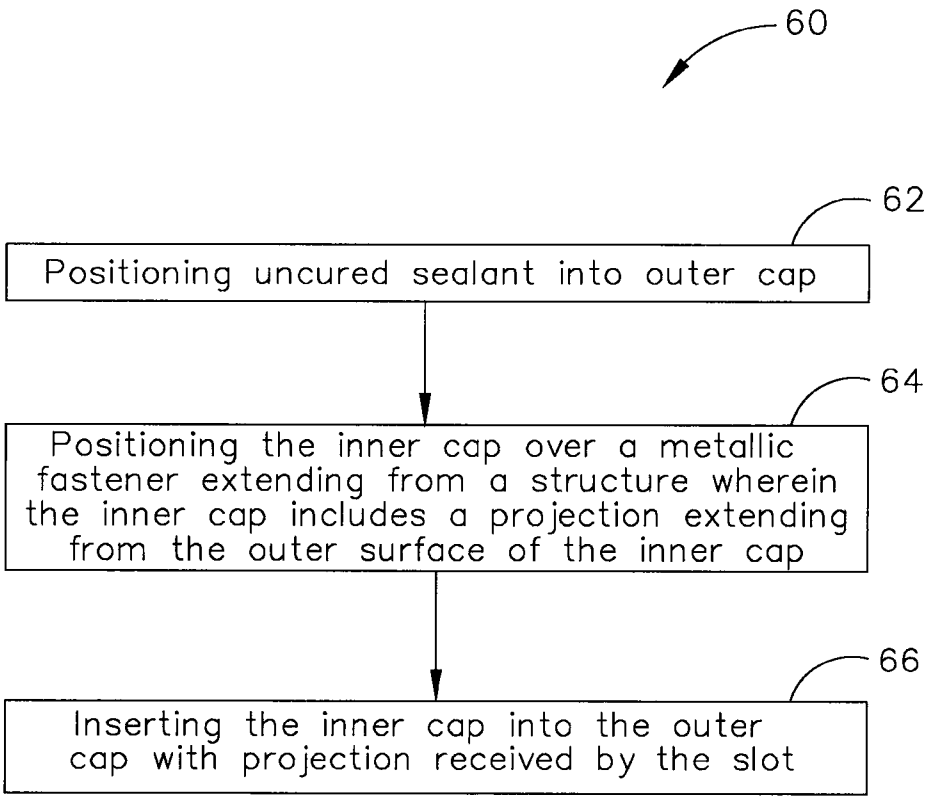
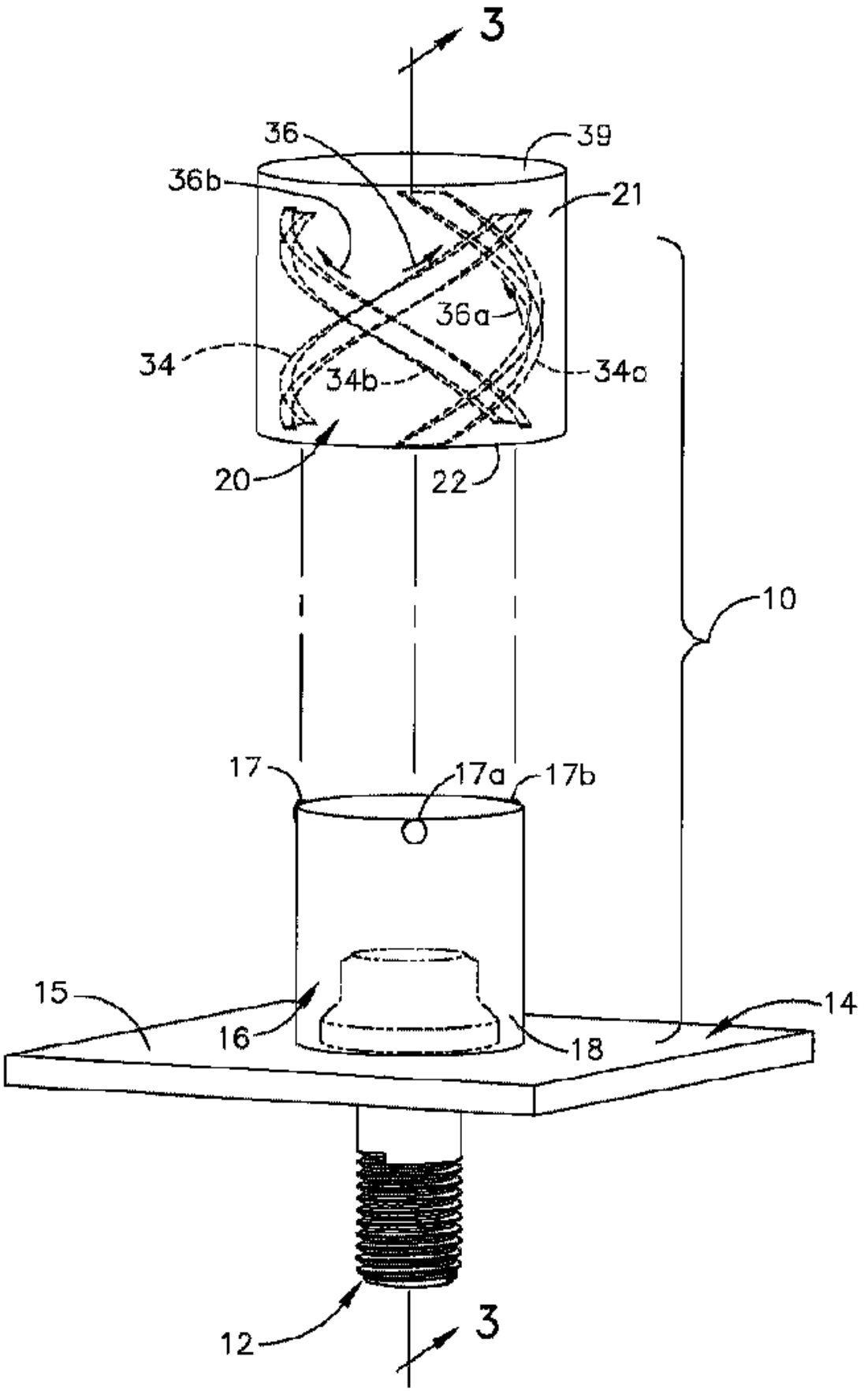

60
62
Positioning uncured sealant into outer cap
64
Positioning the inner cap over a metallic fastener extending from a structure wherein the inner cap includes a projection extending from the outer surface of the inner cap
66
Inserting the inner cap into the outer cap with projection received by the slot

FIG. 7


3
36
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36b
21
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17b
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3