1199 can be attached to bottom 1124 of cap 1100 to seal inner cavity 1128 including disinfection sponge 1180.

[00108] According to yet further exemplary implementation of the embodiments of the present invention as illustrated in Figures 13, 14A and 14B, an extended-thread-design gap disinfection cap 1300 can fit onto a tip 12 of needless connector 9 and comprises housing 1302 comprising: a closed top 1322; an essentially cylindrical sidewall 1304 with an outer sidewall surface 1320; and an open bottom 1324 with an opening 1326 to an inner cavity 1328 within housing 1302 for receiving tip of a needleless connector 9. The inner cavity 1328 comprises an upper region 1312 and a lower region 1314, and accommodates an alcohol soaked disinfection sponge 1380. Lower region 1334 comprises engaging threads 1340 on inner sidewall surface 1330 of sidewall 1304 for engaging thread 13 of needleless connector 9. Threads 1340 include an extended portion 1348, which extends below bottom 1324 formed by sidewall 1304 of housing 1302 such that space 1370 exists between a surface 1310 of top portion 25 of needless connector 9 and bottom 1324 of cap 1300 when cap 1300 is installed onto connector 9 such that extended portion 1348 contacts top portion 25 of needleless connector 9.

[00109] In an exemplary implementation, upper region 1312 can comprise protrusions 1355 from inner sidewall surface 1330, and/or protrusions 1357 from inner surface of top 1322, engaging or contacting disinfection sponge 1380. The pitch of engaging threads 1340 corresponds to the pitch of thread 13 of needleless connector 9. However, the profile (major profile 1341 and/or minor profile 1342) of engaging threads 1340 of the cap 1300 does not correspond to the thread 13 of the needleless connector 9. Since engaging threads 1340 of cap 1300 do not correspond to the thread 13 of the needleless connector 9, venting 1311 of

1530Fas the bottom most section, or an aperture step, below section 1530F. All sections have essentially the same slope or angle with respect to the longitudinal axis A. However, unlike an exemplary implementation illustrated in Figure 19, sections 1530C, 1530D, 1530E, and/or 1530F are not collinear.

[00118] In yet further exemplary implementation of an embodiment of the invention as illustrated in Figure 19, inner sidewall surface 1530 in lower region 1514 of cap 1500 can include essentially collinear 1531 sections1530C, 1530D and 1530E essentially between threads 1540 all sections having essentially the same slope or angle with respect to the longitudinal axis A. However, unlike an exemplary implementation illustrated in Figure 18, section 1530F can be configured as an integral bottom most portion of section 1530E.

[00119] In yet another exemplary implementation, cap 1500 comprises ridges 1598 formed on outer sidewall surface 1520 of housing 1502, for example to facilitated better gripping of cap 1500 such as when handling cap 1500 to remove cover 1599, engage needleless connector 9, and/or disengage needleless connector 9.

[00120] According to yet further exemplary implementation of the embodiments of the present invention as illustrated in Figures 20A, 20B, and 20C, a disinfection cap 2000 can fit onto a tip 12 of needless connector 9 and comprises housing 2002 comprising: a closed top 2022; sidewall 2004 with an outer sidewall surface 2020; and an open bottom 2024 with an opening 2026 to an inner cavity 2028 within housing 2002 for receiving tip of a needleless connector 9. The inner cavity 2028 accommodates an alcohol soaked disinfection sponge 2080. The bottom 2024 formed by sidewall 2004 of housing 2002 includes a bottom portion 2090 having an inner sidewall surface 2032 such that the opening 2026 does not form an airtight seal with outer surface 25 of needleless connector 9 when tip of connector 9 is

thread 3040 can include a further protrusion (bump, lug, or rib) 3040A extending into cavity 3028 from thread 3040. Protrusion 3040A engageably interfaces with at least a portion of thread 133 of connector 93, for example a portion of connector thread **α** feature 133A and/or a portion of connector thread major feature 133B, to facilitate engagement of connector 93 within cavity 3028 of cap 3000.

[00134] In an exemplary implementation, threads 3042 on inner sidewall surface 3030 of sidewall 3004 have a smaller profile than threads 3040 and do not engage, for example in a friction fit manner, with thread 133 of connector 93. Threads 3040 and 3042 can be formed as a single continuous or partial thread with selectively formed features of thread 3040 and/or 3042 thereon, or as alternating continuous or partial threads for example at 180-degrees, or at 90 degrees (as illustrated for example in Figures 24A-24I).

[00135] In another or additional exemplary implementation, thread or threads, such as threads 3042, which do not have further protrusions, can facilitate axial alignment of cap 3000 with connector 93 when placing cap 3000 onto connector 93, or inserting connector 93 into cavity 3028 of cap 3000, as illustrated for example in Figures 23A and 23B. In an exemplary implementation, major profile of thread 3040 within cavity 3028 can correspond to, or match, essentially exactly or within a given tolerance thread major feature 133B of connector 93. In other words, threads 3042 interface with threads 133 essentially tangentially at the surface contact portions thereof. For example, in a cylindrical embodiment of cap 3000, threads 3042 would meet threads 133 essentially at a contact diameter.

[00136] In an exemplary implementation where cap 3000 and cavity 3028 are essentially frustoconical with a larger cross section being at top 3022, as shown in the example of Figure 23A, engaging threads 3040 can provide a more secure engagement of

connector 93 as it advances into cavity 3028. Non-engaging threads 3042 can provide interference fit, for example to facilitate further alignment or retention of connector 93 within cavity 3028.

[00137] In yet another or additional exemplary implementation, pitch and/or profile of threads 3040 and/or 3042 of the cap 3000 do not correspond to pitch and/or profile of thread 133 of connector 93. Accordingly, venting in cavity 3028 of cap 3000 occurs essentially around the outside of threads 133 when connector 93 is inside cavity 3028.

[00138] In still another or additional exemplary implementation, pitch of threads 3040 corresponds to the pitch of thread 133 of connector 93. However, the profile of threads 3040 does not correspond to thread 133. Since engaging threads 3040 do not correspond to thread 133 venting in inner cavity 3028 occurs essentially around the outside of threads 133 when connector 93 is inside the inner cavity 3028.

[00139] In yet another exemplary implementation as illustrated in Figure 24A and similar to an exemplary embodiment of Figure 17C and 21B, cap 3000 comprises ridges 3098 formed on outer sidewall surface 3020 of housing 3002, for example to facilitated better gripping of cap 3000 such as when handling cap 3000, engaging connector 93 (into cavity 3028), and/or disengaging connector 93 (out of cavity 3028).

[00140] Referring to Figures 24A-24I, an exemplary implementation of embodiments of the present invention is described in terms of certain dimensional characteristics of various component of a disinfection cap 3000. Both relative and specific numerical characteristics presented in Figures 24A-24I are intended to facilitate a more complete understanding of exemplary implementations of embodiments of the present invention without limiting the scope of the invention as set forth in the claims. As in the example of Figure 15, a removable

[00143] Figure 24G is an enlarged cross sectional view B (see Figure 24F) of specific relative dimensional characteristics of thread 3040 according to an exemplary implementation of the embodiments of the present invention. Figure 24I is an enlarged cross sectional view A (see Figure 24H) of specific relative dimensional characteristics of thread 3042 according to an exemplary implementation of the embodiments of the present invention. As shown in the examples of Figures 24G and 24I, thread 3040 and thread 3042 can have substantially similar respective root section profiles 3040R and 3042R, and substantially different crest section profiles 3040C and 3042C.

[00144] Referring to Figures 25A and 25B, a dispensing device 2260 according to an exemplary embodiment of the present invention, includes a plurality of caps 2230 disposed on a perforated strip 2220. In an exemplary implementation, perforations 2270 are formed between caps 2230 disposed on strip 2220 to define portions 2272 of strip 2220 having at least one cap 2230 disposed thereon. Caps 2230 can be configured structurally and functionally like any of the caps illustrated in the examples of Figures 1A, 1B, and 3A through 21C and described above with reference thereto. In an exemplary implementation, strip 2220 can be a peel strip configured as a cap cover attached to bottom of each cap 2230 to seal inner cavity of each cap 2230, for example as described above with reference to Figures 1A, 1B, 4B, 8B, 11B, 14B, 15, 20B, 21B, 25A.

[00145] As illustrated in the example of Figure 25A, each cap 2230 can be peeled off or separated from strip 2220 for immediate use, for example, to cap a needleless connector. On the other hand, as illustrated in the example of Figure 25B, portion 2272 including a cap 2230 disposed thereon can be selectively separated from strip such that inner cavity of cap

2230 remains sealed by the portion 2272 similar to individual caps illustrated in the examples of Figures 1A, 1B, 4B, 8B, 11B, 14B, 15, 20B, and 21B.

[00146] According to exemplary embodiments of the present invention, dispensing device 2260 can be configured to have a perforated strip 2220 having a single row of caps 2230, as shown in Figures 25A and 25B, or a perforated strip 2250 having multiple rows of caps 2230 separated by perforations 2273, as illustrated in the example of Figure 25C showing a top view of such an implementation. According to yet another exemplary implementation as illustrated in a side view of Figure 25D, dispensing device 2260 can be configured to have a double-sided perforated peel strip 2255 having two opposing sides 2265 and 2267, and caps 2230 attached at both sides thereof, such that two sealed caps 2230 can be selectively detached from strip 2255 at perforation 2275 for later use (see Figure 25D) and/or individually removed from either side of strip 2255 for immediate use (see Figure 25D).

[00147] As illustrated in Figures 25A, 25B, 25C, and 25D, strip 2220/2250/2255 is essentially flat and has perforations in-between each cap 2230. Hence each perforated cap strip section can be torn off, or detached from, the main strip such that the cap 2230 can be peeled opened for later use (see Figure 25B). Or, alternatively each cap can be peeled open from the cap strip for immediate use (see Figure 25A).

[00148] In exemplary implementations, strip 2220/2250/2255 includes an attachment portion, such as an opening 2240 at least at one end thereof, for example to accommodate a hanger of an IV pole such that device 2260 can be hung on the IV pole for convenience. Other variations of an attachment portion, or means for selectively placing or hanging strip 2220/2250/2255 on an IV pole, such as a hook or the like, can be integral with, or attached to, strip 2220/2250/2255 as would be readily appreciated by one of ordinary skill in the art.