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(54) **CABLE TRAY SEGMENTS WITH INTEGRATED SPLICE PLATES**

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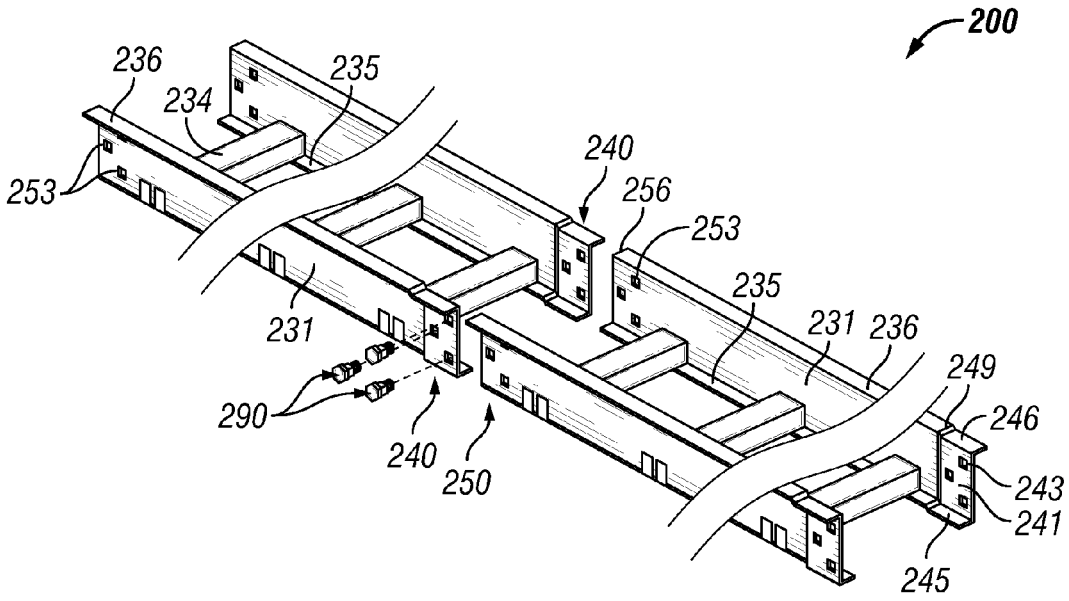
(57) **ABSTRACT**

A cable tray segment is described herein. The cable tray segment can include a first rail substantially parallel to a second rail. The first rail can have a length and include a first coupling portion disposed at a first distal end of the first rail, where the first coupling portion protrudes from the first rail by a distance, and where the first coupling portion includes at least one first coupling feature. The first rail can also include a second coupling portion disposed at a first proximal end of the first rail, where the second coupling portion includes at least one first complementary coupling feature. The second rail can be disposed substantially parallel to the first rail and have the first length. The second rail can be substantially similar to the first rail.



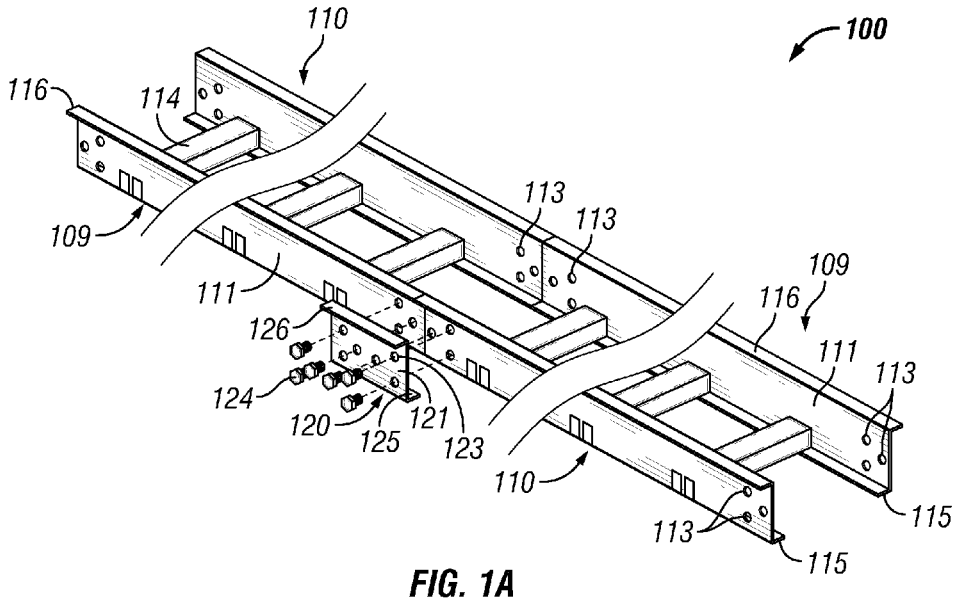


FIG. 1A
(Prior Art)

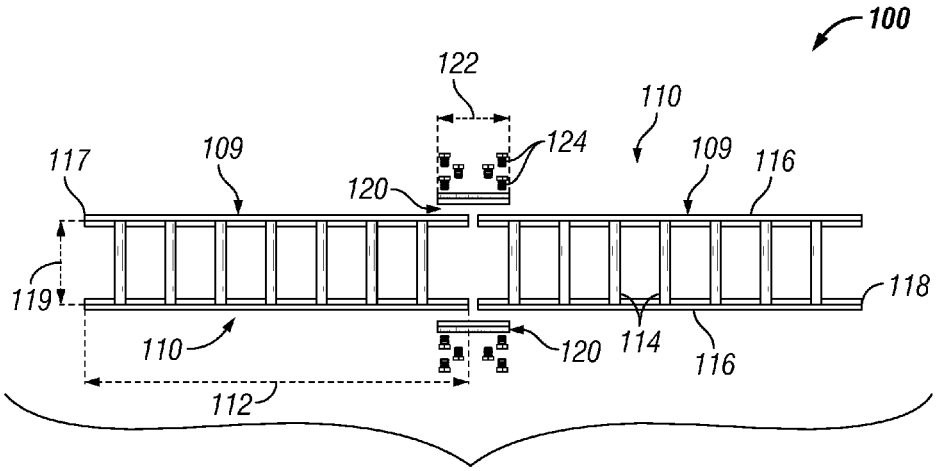
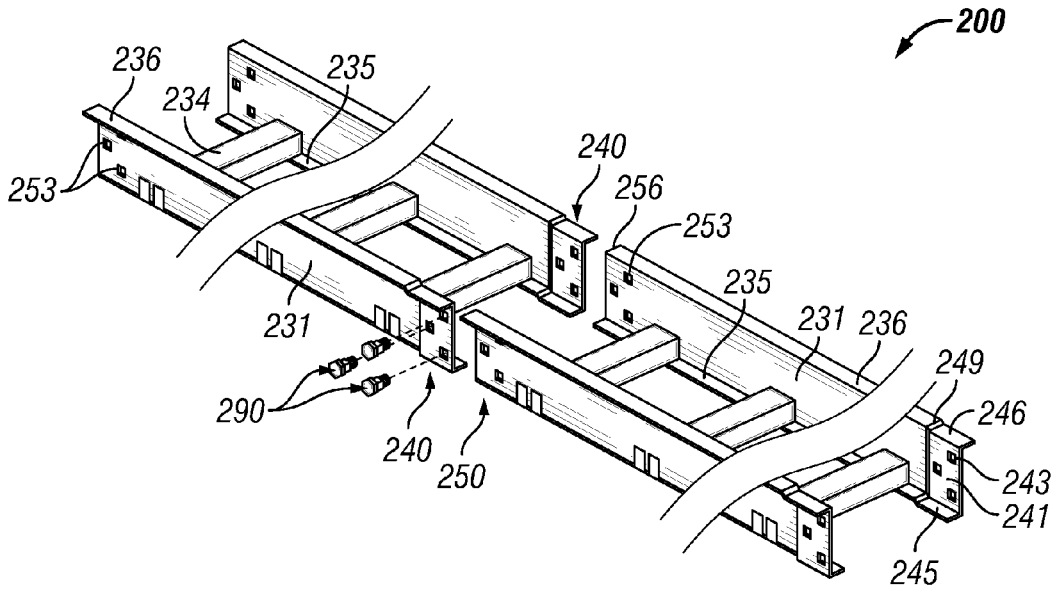


FIG. 1B
(Prior Art)


200
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234
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FIG. 2A

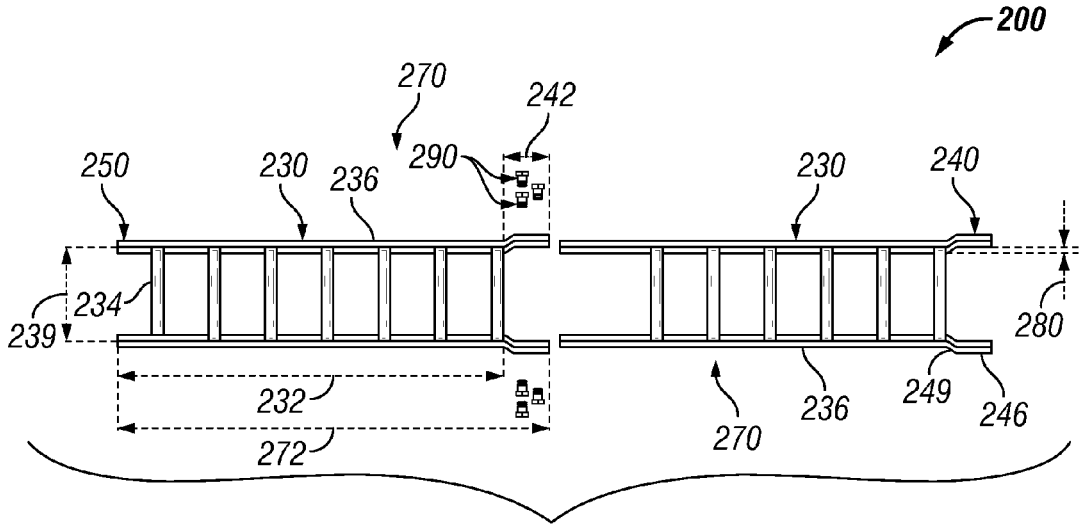
200
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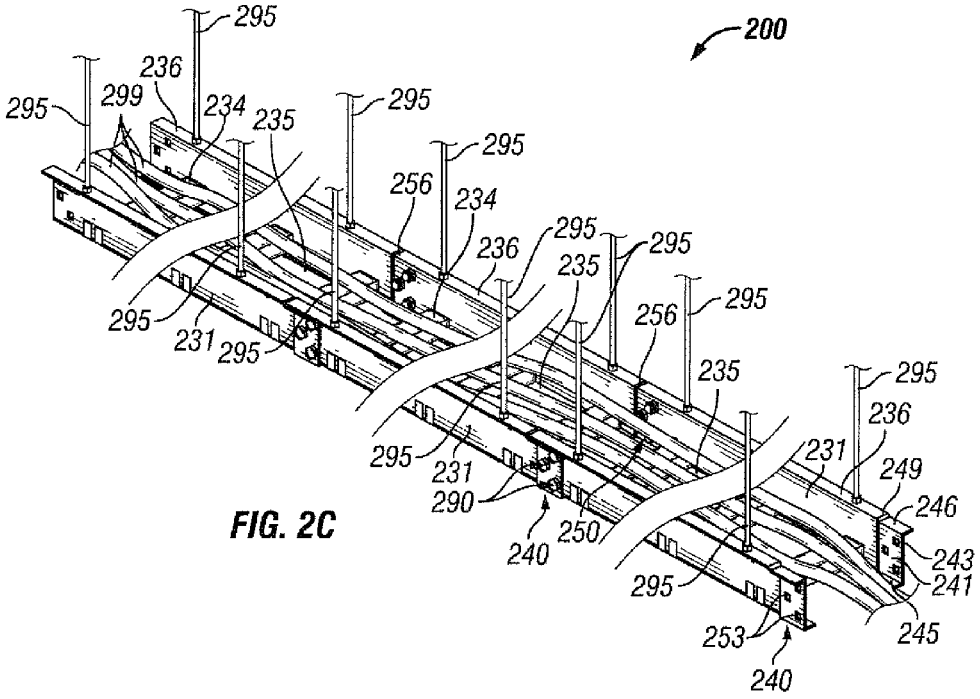
FIG. 2B


200
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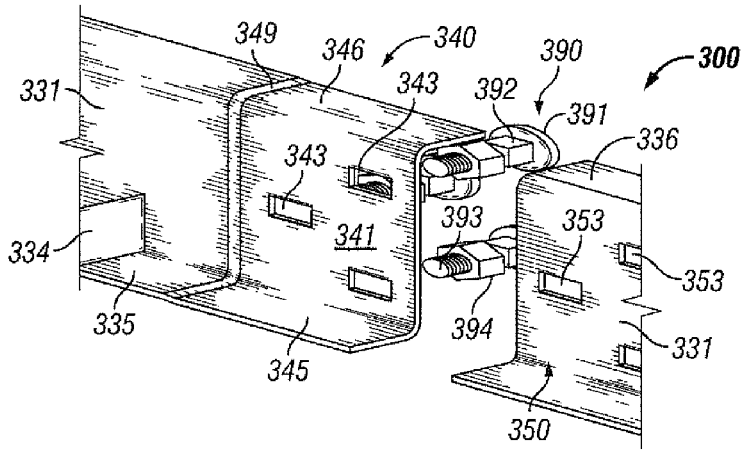
253

FIG. 2C


300
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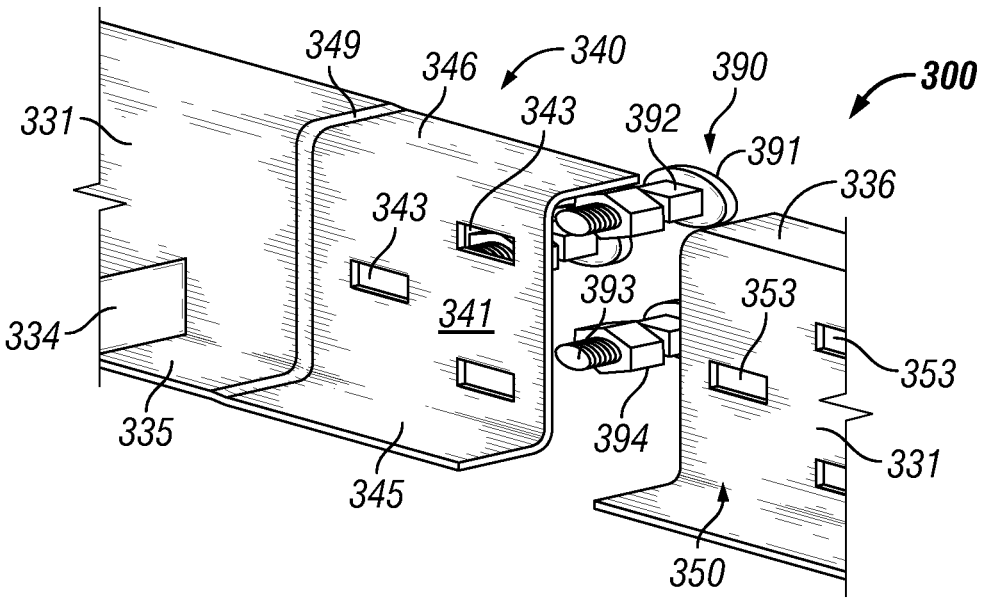
345
350

FIG. 3


349
346
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390
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353
334
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331
345
350

FIG. 3

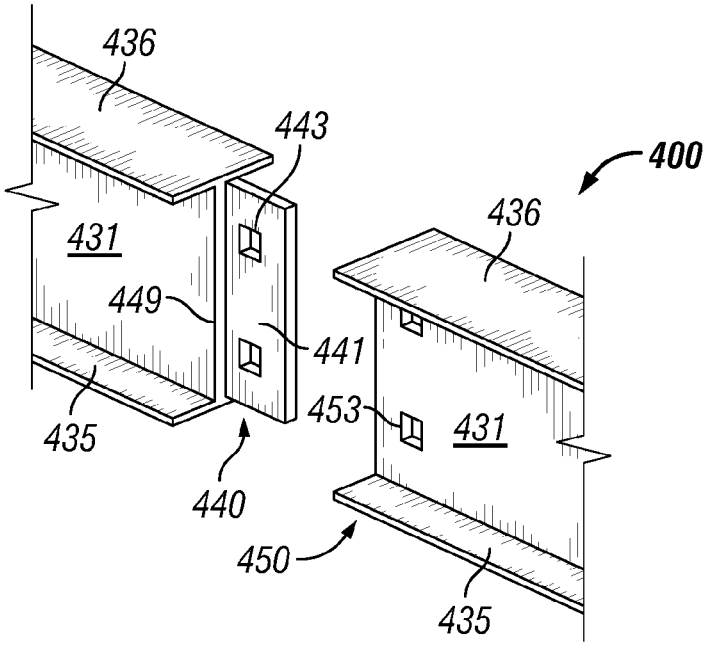
436
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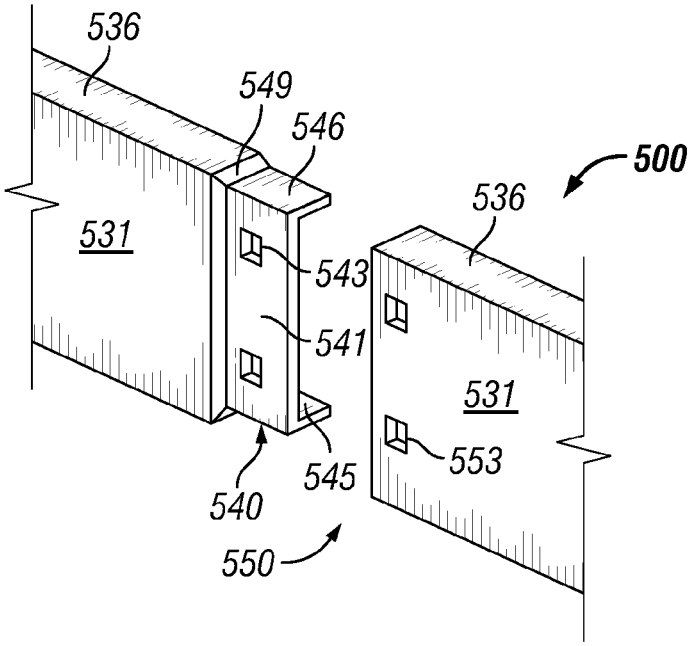
FIG. 4


536
549
546
500
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531
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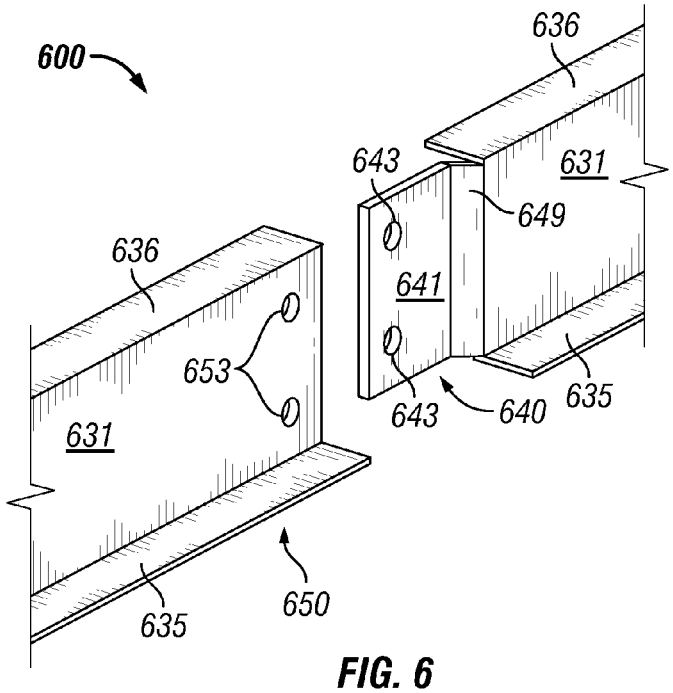
553
545
540
550

FIG. 5


600
636
643
631
649
636
641
653
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635
650

FIG. 6

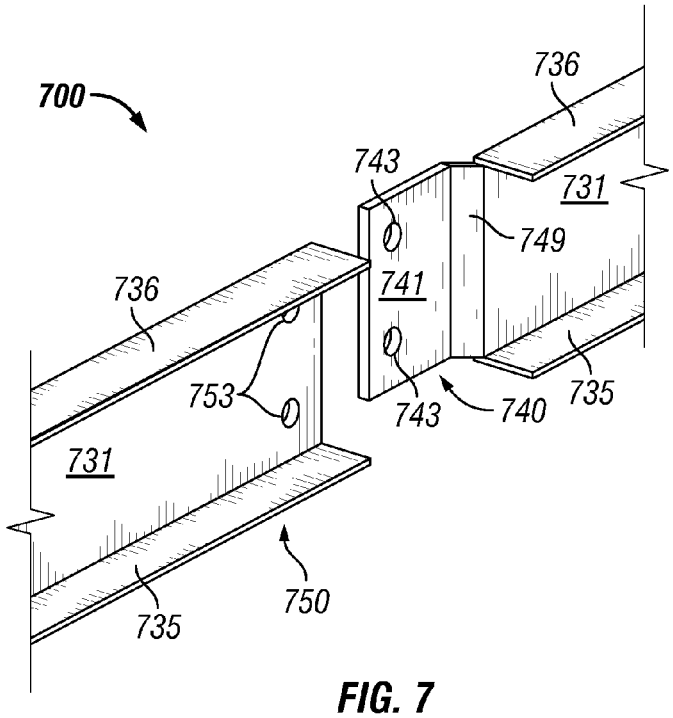
700
736
743
731
749
736
741
753
731
743
740
735
735
750

FIG. 7

CABLE TRAY SEGMENTS WITH INTEGRATED SPLICE PLATES

TECHNICAL FIELD

[0001] The present disclosure relates generally to cable trays and more particularly to systems, methods, and devices for cable tray segments with integral splice plates.

BACKGROUND

[0002] In a number of commercial and industrial applications, electrical cable is used to provide power from a power source to one or more electrical loads. The electrical cable can be run (laid out along a path) in one or more ways. In some cases, one or more electrical cables are disposed within conduit. In some cases, one or more electrical cables are put in a cable tray system. A cable tray system often includes multiple cable tray segments that are assembled end-to-end. Assembling cable tray segments to each other can be a time-consuming task.

SUMMARY

[0003] In general, in one aspect, the disclosure relates to a cable tray segment having a first side rail and a second side rail. The first side rail can have a length and can include a first coupling portion disposed at a first distal end of the first side rail, where the first coupling portion protrudes from the first side rail by a distance, and where the first coupling portion has at least one first coupling feature. The first side rail can also include a second coupling portion disposed at a first proximal end of the first side rail, where the second coupling portion has at least one first complementary coupling feature. The second side rail can have the length and can be disposed substantially parallel to the first side rail. The second side rail can include a third coupling portion disposed at a second distal end of the second side rail, where the first coupling portion protrudes from the first side rail by the distance, and where the third coupling portion has at least one second coupling feature. The second side rail can also include a fourth coupling portion disposed at a second proximal end of the second side rail, where the fourth coupling portion has at least one second complementary coupling feature. The at least one first coupling feature can be configured to mechanically couple to the first complementary coupling feature of a first other cable tray segment. The at least one first complementary coupling feature can be configured to mechanically couple to the first coupling feature of a second other cable tray segment. The at least one second coupling feature can be configured to mechanically couple to the second complementary coupling feature of the first other cable tray segment. The at least one second complementary coupling feature can be configured to mechanically couple to the second coupling feature of the second other cable tray segment.

[0004] In another aspect, the disclosure can generally relate to a cable tray system. The cable tray system can include a first cable tray segment having a first side rail having a length and a second side rail having the length, where the first side rail and the second side rail each has a first coupling portion disposed at a first distal end, where each first coupling portion protrudes from the first side rail and the second side rail by a distance, where each first coupling portion has at least one first coupling feature. The cable tray system can also include a second cable tray segment having a third side rail having the length and a fourth side rail having the length, where the third side rail and the fourth side rail each has a second coupling portion disposed at a second proximal end, where each second coupling portion has at least one first complementary coupling feature. The cable tray system can further include at least one crossbar disposed between and coupled to the first side rail and the second side rail. The at least one first coupling feature can couple to the at least one first complementary coupling feature.

[0005] In yet another aspect, the disclosure can generally relate to a cable system. The cable system can include a first cable tray segment having a first side rail having a length and a second side rail having the length, where the first side rail and the second side rail each has a first coupling portion disposed at a first distal end, where each of the first coupling portions protrudes from the first side rail and the second side rail by a distance, where each first coupling portion has at least one first coupling feature. The cable system can also include a second cable tray segment, comprising a third side rail having the length and a fourth side rail having the length, where the third side rail and the fourth side rail each has a second coupling portion disposed at a second proximal end, where each second coupling portion has at least one first complementary coupling feature. The cable system can further include at least one fastening device coupled to the at least one first coupling feature of the first cable tray segment and the at least one first complementary coupling feature of the second cable tray segment. The cable system can also include a number of crossbars disposed between and coupled to the first side rail and the second side rail. The cable system can further include at least one cable disposed on the crossbars.

[0006] These and other aspects, objects, features, and embodiments will be apparent from the following description and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The drawings illustrate only example embodiments and are therefore not to be considered limiting of its scope, as the example embodiments may admit to other equally effective embodiments. The elements and features shown in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the example embodiments. Additionally, certain dimensions or positionings may be exaggerated to help visually convey such principles. In the drawings, reference numerals designate like or corresponding, but not necessarily identical, elements.

[0008] FIGS. **1**A and **1**B shows various views of adjacent cable tray segments currently known in the art.

[0009] FIGS. **2**A-**2**C show various views of adjacent cable tray segments in accordance with certain example embodiments.

[0010] FIG. **3** shows a detailed view of coupling features of adjacent cable tray segments in accordance with certain example embodiments.

[0011] FIG. **4** shows a detailed view of coupling portions of adjacent cable tray segments in accordance with certain example embodiments.

[0012] FIG. **5** shows a detailed view of alternative coupling portions of adjacent cable tray segments in accordance with certain example embodiments.

[0013] FIG. **6** shows a detailed view of other alternative coupling portions of adjacent cable tray segments in accordance with certain example embodiments.

[0014] FIG. **7** shows a detailed view of still other alternative coupling portions of adjacent cable tray segments in accordance with certain example embodiments.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

[0015] The example embodiments discussed herein are directed to systems, apparatuses, and methods of cable tray segments with integrated splice plates. While the example cable tray segments with integrated splice plates shown in the Figures and described herein are supporting electrical cable, example cable tray segments with integrated splice plates can also be used to support other types of cable, including but not limited to pipe (including conduit inside of which a cable is disposed) and mechanical cable. Thus, the examples of cable tray segments with integrated splice plates described herein are not limited to conduit for electrical cables.

[0016] As defined herein, electrical cable can be used to conduct power (e.g., high voltage) and/or control (e.g., low voltage) signals. Power flowing through an electrical cable can be alternating current or direct current. Each electrical cable can carry voltage and/or current from one end of the electrical cable to the other end. Each electrical cable can have one or more electrical conductors disposed therein. In some cases, an electrical cable can include a ground or neutral conductor, through which no (or negligible) current or voltage flows. Each electrical conductor within an electrical cable may be of any suitable size (e.g., 12 American Wire Gauge (AWG)) and made of one or more of a number of materials (e.g., copper, aluminum). Each electrical cable may be coated with an insulator made of any suitable material (e.g., rubber, plastic) to keep the electrical conductors electrically isolated from any other conductor in the electrical cable.

[0017] The cable tray segments with integrated splice plates described herein can be physically placed in outdoor environments. In addition, or in the alternative, example cable tray segments with integrated splice plates can be subject to extreme heat, extreme cold, moisture, humidity, high winds, dust, chemical corrosion, and other conditions that can cause wear on the cable tray segments with integrated splice plates or portions thereof. In certain example embodiments, the cable tray segments with integrated splice plates, including any portions thereof, are made of materials that are designed to maintain a long-term useful life and to perform when required without mechanical failure. Such materials can include, but are not limited to, stainless steel and aluminum.

[0018] Cable tray systems are often suspended from a ceiling or other portion of a structure. In such a case, a number of supports are used to suspend the cable tray system (or a portion thereof) by coupling to a cable tray segment of the cable tray system (sometimes with the aid of a strut channel) at one end of the support and to the ceiling or other portion of the structure at the other end of the support. In one or more example embodiments, a user is any person that interacts with cable trays. For example, a user may be, but is not limited to, a maintenance worker, an electrician, a contractor, an engineer, a supervisor, a home owner, a business owner, and a company representative.

[0019] A cable tray system, whether using one or more example cable tray segments or not, may have to comply with one or more of a number of electrical and/or mechanical standards. For example, the National Electrical Manufacturers Association (NEMA) has created and maintains one or more standards related to cable tray systems. As a specific example, NEMA VE 1-2009 lists specific requirements for metal cable trays and associated fittings. As another specific example, NEMA classifies cable trays by load designation. For instance, a NEMA 8A cable tray is capable of supporting a working load (e.g., one or more electrical cables) of at least 50 pounds per foot with cable tray supports for the cable tray spaced every 8 feet, while a NEMA 20C cable tray is capable of supporting a working load (e.g., one or more electrical cables) of at least 100 pounds per foot with cable tray supports for the cable tray spaced every 20 feet. Cable tray systems using example cable tray segments can meet any NEMA cable tray classification.

[0020] Examples of other entities that have standards associated with cable tray systems is the National Electric Code (NEC), the Canadian Electric Code (CEC), the Canadian Standards Association (CSA), Underwriters Laboratories (UL), and the International Electrotechnical Commission (IEC). Example cable tray segments described herein can allow such cable tray systems to comply with such standards.

[0021] Components and/or features described herein can include elements that are described as coupling, fastening, securing, or other similar terms. Such terms are merely meant to distinguish various elements and/or features within a component or device and are not meant to limit the capability or function of that particular element and/or feature. For example, a feature described as a "coupling feature" can secure, fasten, align, and/or perform other functions aside from merely coupling.

[0022] A coupling feature (including a complementary coupling feature) as described herein can allow one or more components and/or portions of an example cable tray segment to become mechanically coupled, directly or indirectly, to a portion of another example cable tray segment. A coupling feature can include, but is not limited to, a portion of a hinge, an aperture, a recessed area, a protrusion, a slot, a spring clip, a tab, a detent, and mating threads. One portion of an example cable tray segment can be coupled to a portion of another cable tray segment by the direct use of one or more coupling features.

[0023] In addition, or in the alternative, a portion of an example cable tray segment can be coupled to a portion of another cable tray segment using one or more independent devices that interact with one or more coupling features disposed on a component of the example cable tray segment. Examples of such devices can include, but are not limited to, a pin, a hinge, a fastening device (e.g., a bolt, a screw, a rivet), and a spring. One coupling feature described herein can be the same as, or different than, one or more other coupling features described herein. A complementary coupling feature as described herein can be a coupling feature that mechanically couples, directly or indirectly, with another coupling feature.

[0024] Any component described in one or more figures herein can apply to any subsequent figures having the same label. In other words, the description for any component of a subsequent (or other) figure can be considered substantially the same as the corresponding component described with respect to a previous (or other) figure. Further, if a component associated with a figure is described but not expressly shown or labeled in the figure, a corresponding component shown and/or labeled in another figure can be inferred. The numbering scheme for the components in the figures herein parallel the numbering scheme for the components of previously or subsequently described figures in that each component is a three digit number having the identical last two digits.

[0025] Example embodiments of cable tray segments with integrated splice plates will be described more fully hereinafter with reference to the accompanying drawings, in which example embodiments of cable tray segments with integrated splice plates are shown. Cable tray segments with integrated splice plates may, however, be embodied in many different forms and should not be construed as limited to the example embodiments set forth herein. Rather, these example embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of cable tray segments with integrated splice plates to those of ordinary skill in the art. Like, but not necessarily the same, elements (also sometimes called components) in the various figures are denoted by like reference numerals for consistency. Terms such as "first," "second," "distal," "proximal," "top," and "bottom" are used merely to distinguish one component (or part of a component) from another. Such terms are not meant to denote a preference or a particular orientation.

[0026] FIGS. **1**A and **1**B shows various views of a cable tray system **100** of adjacent cable tray segments **110** currently known in the art. Specifically, FIG. **1**A shows a top-side perspective view of the system **100**, and FIG. **1**B shows a top view of the system **100**. Referring to FIGS. **1**A and **1**B, the cable tray system **100** includes two adjacent cable tray segments **110** that are substantially identical to each other. The system **100** also includes two splice plates **120**, and a number of bolts **124**. Each cable tray segment **110** has two rails **109** (also called side rails **109**), where each rail **109** has a length **112** and is substantially parallel to the other rail **109** of the cable tray segment **110**. A number of cable supports **114** (also called crossbars **114**), each having a length **119**, are disposed between and mechanically coupled to the two rails **109**, giving each cable tray segment **110** a width that is substantially the same as the length **119** of the crossbars **114**.

[0027] Each rail **109** can have one or more of a number of features. For example, as shown in FIGS. **1**A and **1**B, a rail **109** has a "Z" shape when viewed cross-sectionally along its length **112**. Specifically, the rail **109** can have a body **111** that forms a substantially straight (flat) vertical line when viewed cross-sectionally along its length **112**. The rails **109** of FIGS. **1**A and **1**B also have a top flange **116** and a bottom flange **115**, where the top flange **116** extends substantially perpendicularly outward from the top end of the body **111**, and where the bottom flange **115** extends substantially perpendicularly inward from the bottom end of the body **111**.

[0028] Each rail **109** also includes multiple apertures **113**. The apertures **113** traverse the body **111** at both ends (the proximal end **117** and the distal end **118**) of the rail **109**. Typically, as in this case, there are three apertures **113** at the proximal end **117** of the rail **109** and another three apertures **113** at the distal end **118** of the rail **109**. The apertures **113** have a sufficient shape and size to accommodate the bolts **124**. Also, the apertures **113** are oriented in a particular way.

[0029] Each splice plate **120** has a length **122** that is substantially shorter than the length **122** of a rail **109**. Otherwise, as shown in FIGS. **1**A and **1**B, the splice plate **120** can have substantially the same dimensions (e.g., height, thickness) and/or features (e.g., top flange **126**, bottom flange **125**) as the dimensions and features of a rail **109** of a cable tray segment **110**. Alternatively, the splice plate **120** can have one or more dimensions (other than the length **122**) and/or features that are different than the dimensions and features of a rail **109**.

[0030] The splice plate **120** also includes multiple apertures **123**. The apertures **123** traverse the body **121** of the splice plate **120** and are positioned at both ends (the proximal end and the distal end) of the splice plate **120**. Typically, as in this case, there are three apertures **123** at the proximal end of the splice plate **120** and another three apertures **123** at the distal end of the splice plate **120**. The apertures **123** have a shape and size that is substantially similar to the shape and size of the apertures **113** of the rails **109**. Also, the apertures **123** at each end of the splice plate **120** are oriented in such a way as to substantially align with the apertures **113** at the proximal end **117** of a rail **109** of a cable tray segment **110** and the apertures **113** at the distal end **118** of a rail **109** of an adjacent cable tray segment **110** when the proximal end **117** of the cable tray segment **110** and the distal end **118** of the adjacent cable tray segment **110** abut against each other.

[0031] When the apertures **123** of the splice plate **120** align with the apertures **113** at the proximal end **117** of a rail **109** of one cable tray segment **110** and the apertures **113** at the distal end **118** of a rail **109** of an adjacent cable tray segment **110**, the bolts **124** can be inserted through and disposed within the apertures **123** and the apertures **113** to mechanically couple the splice plate **120** to the cable tray segment **110** and the adjacent cable tray segment **110**. In this case, there are six bolts **124** for each splice plate **120**, and two splice plates **120** are used to couple to adjoining cable tray segments **110**, one for each rail **109** of each adjoining cable tray segment **110**.

[0032] FIGS. **2**A-**2**C show various views of cable tray system **200** that includes adjacent cable tray segments **270** in accordance with certain example embodiments. Specifically, FIG. **2**A shows a top-side perspective view of the system **200**, and FIG. **2**B shows a top view of the system **200**. FIG. **2**C shows a cable tray system **201** in which three cable tray segments **270** are coupled to each other and have a number of electrical cables **299** disposed therein. In one or more embodiments, one or more of the components shown in FIGS. **2**A-**2**C may be omitted, repeated, and/or substituted. Accordingly, embodiments of a cable tray system should not be considered limited to the specific arrangements of components shown in FIGS. **2**A-**2**C.

[0033] Referring to FIGS. **1**A-**2**C, the cable tray system **200** of FIGS. **2**A and **2**B can include two adjacent cable tray segments **270** that are substantially identical to each other. The system **200** can also include one or more fastening devices **290**. Each cable tray segment **270** can include two rails **230** (also called side rails **230**), where each rail **230** has a length **272** and is substantially parallel to the other rail **230** of the cable tray segment **270**. A number of cable supports **234** (also called crossbars **234**), each having a length **239**, are disposed between and mechanically coupled to the two rails **230**, giving each cable tray segment **270** a width that is substantially the same as the length **239** of the crossbars **234**.

[0034] As shown in FIG. **2**C, one or more electrical cables **299** (whether in conduit, in some other protective device, or on its own) can be laid upon the top of the crossbars **234**. The crossbars **234** can be oriented substantially parallel to each other. A crossbar **234** can be positioned some distance (e.g., 6 inches, 8 inches, 10 inches, 36 inches) from an adjacent crossbar **234**. The crossbars **234** can be used for load resistance, distributing the weight of the cables to some extent along the length and/or width of the cable tray segment **270**. The spacing between adjacent crossbars **234** can affect the load resistance of the cables. FIG. **2**C shows a number of cable tray supports **295** (e.g., chains, rods, straps) that are used to suspend the cable tray system **201** from a ceiling or other overhead structure.

[0035] As with the rails **109** of FIGS. **1**A and **1**B, the rails **230** of FIGS. **2**A and **2**B can include one or more of a number of optional features. For example, as shown in FIGS. **2**A and **2**B, a rail **230** can have a "Z" shape when viewed cross-sectionally along its length **272**. Specifically, the rail **230** can have a body **231** that forms a substantially straight (flat) vertical line when viewed cross-sectionally along its length **272**. Alternatively, some or all of the body **231** of the rail **230** can have one or more of a number of other shapes (e.g., curved, sawtoothed) when viewed cross-sectionally along its length **272**. Each rail **230** of FIGS. **2**A and **2**B can also have a top flange **236** and a bottom flange **235**, where the top flange **236** extends substantially perpendicularly outward from the top end of the body **231**, and where the bottom flange **235** extends substantially perpendicularly inward from the bottom end of the body **231**.

[0036] In certain example embodiments, each cable tray segment **270** can include a coupling portion **250** disposed at one end (e.g., the proximal end) of one or both rails **230**, and a coupling portion **240** disposed at an opposite end (e.g., the distal end) of one or both rails **230**. The coupling portion **250** can include one or more coupling features **253**. In this case, the coupling features **253** are apertures that traverse the body **231** at the proximal end of the rail **230**. Also, in this case, each coupling portion **250** has three coupling features **253** arranged in a particular orientation. The shape, size, and/or location of each coupling feature **253** can be substantially similar to a shape, size, and location of complementary coupling features disposed on an end (e.g., a distal end) of an adjacent cable tray segment to which the example cable tray segment **270** couples. The adjacent cable tray segment can also be an example cable tray segment **270**. Alternatively, the adjacent cable tray segment can also be an existing cable tray segment.

[0037] In certain example embodiments, the coupling portion **240** protrudes from the rail **230**. In such a case, the coupling portion **240** can have the same features as, or different features than, the rail **230**. For example, as shown in FIGS. **2**A and **2**B, the coupling portion **240** can include a body **241** that forms a substantially straight (flat) vertical line when viewed cross-sectionally along its length **242**. Alternatively, some or all of the body **241** of the coupling portion **240** can have one or more of a number of other shapes (e.g., curved, sawtoothed) when viewed cross-sectionally along its length **242**. Each coupling portion **240** of FIGS. **2**A and **2**B can also include a top flange **246** and a bottom flange **245**, where the top flange **246** extends substantially perpendicularly outward from the top end of the body **241**, and where the bottom flange **245** extends substantially perpendicularly inward from the bottom end of the body **241**. In other words, in this example, the coupling portion **240** can have a "Z" shape when viewed cross-sectionally along its length **242**. The transition point **249** is the portion of the cable tray assembly **270** where the coupling portion **240** protrudes from the rail **230**. Similarly, the coupling portion **240** of an example cable tray segment **270** can have the same features as, or different features than, the rail **230** of an adjacent cable tray segment **270** (or the proximal end of a rail of an existing cable tray segment).

[0038] The coupling portion **240** and the rail **230** can be formed from a single piece, as from a mold or by a machine that deforms the distal end of the rail **230** to achieve the coupling portion **240**. Alternatively, the coupling portion **240** and the rail **230** can be separate pieces that are mechanically coupled to each other using one or more of a number of coupling methods, including but not limited to welding, fastening devices, compression fittings, slots, and tabs. In either case, the coupling portion **240** can be considered a part of, or a separate component from, the rail **230**. In some cases, the overall length **272** of the rail **230** can include the length **242** of the coupling portion **240** and the length **232** of the rest of the rail **230**.

[0039] When the coupling portion **240** protrudes from the rail **230**, the coupling portion **240** can act similarly to a splice plate (as described above with respect to FIGS. **1**A and **1**B), which can have the effect of integrating a splice plate into the coupling portion **240**. In other words, the length **242** of the coupling portion **240** can be substantially shorter than the length **232** of the rest of the rail **230**. Otherwise, as shown in FIGS. **2**A and **2**B, the coupling portion **240** can have substantially the same dimensions (e.g., height, thickness) and/or features (e.g., top flange **246**, bottom flange **245**) as the dimensions and features of the rail **230** of the cable tray segment **270**. Alternatively, the coupling portion **240** can have one or more dimensions (other than the length **242**) and/or features that are different than the dimensions and features of the rail **230**.

[0040] A coupling portion **240** can protrude from the rail **230** in one or more of a number of directions. As discussed above, each coupling portion **240** of each rail **230** protrudes outward in FIGS. **2**A and **2**B. In addition, or in the alternative, a coupling portion **240** can protrude in some other direction relative to the rail **230**, including but not limited to inward, downward, and upward. For a cable tray segment **270** having multiple coupling portions **240**, one coupling portion **240** can protrude from its rail **230** in the same or a different direction as the direction that another coupling portion **240** of the cable tray segment **270** protrudes from its respective rail **230**.

[0041] Also, when the coupling portion **240** protrudes from the rail **230**, the coupling portion **240** is located some distance **280** relative to the rail **230**. For example, as shown in FIGS. **2**A and **2**B, the coupling portion **240** is displaced by distance **280** from the rail **230**. In certain example embodiments, the distance **280** is substantially equal to the thickness of the body **231** of the rail **230** and/or the thickness of the body **241** of the coupling portion **240**. Thus, when the proximal end of an adjacent cable tray segment (which can be an example cable tray segment **270** or an existing cable tray segment), having the coupling portion **250** or some equivalent thereof, abuts against the transition point **249** between the rail **230** and the coupling portion **240**, the coupling portion **250** (or equivalent thereof) of the adjacent cable tray segment can also abut against the coupling portion **240**, as shown in FIG. **2**B.

[0042] The coupling portion **240** can include one or more coupling features **243**. In this case, the coupling features **253** are apertures that traverse the body **241** at the proximal end of the coupling portion **240**. Also, in this case, each coupling portion **240** has three coupling features **243** arranged in a particular orientation. The shape, size, and/or location of each coupling feature **243** can be substantially similar to a shape, size, and location of complementary coupling features disposed on an end (e.g., a distal end) of an adjacent cable tray segment to which the example cable tray segment **270** couples. The adjacent cable tray segment can also be an example cable tray segment **270**. Alternatively, the adjacent cable tray segment can also be an existing cable tray segment.

[0043] In certain example embodiments, the shape, size, and location of the coupling features **243** of the coupling portion **240** are substantially the same as the shape, size, and

location of the coupling features **253** of the coupling portion **250**. In other words, when the proximal end of a cable tray segment **270** having the coupling portions **250** (or some other cable tray segment having an equivalent of the coupling portion) abuts against the transition point **249** of an adjacent cable tray segment **270**, the coupling features **253** of the coupling portion **250** align with the coupling features **243** of the coupling portion **240**.

[0044] When the coupling features **243** of the coupling portion **240** disposed on one rail **230** of a cable tray segment **270** align with the coupling features **253** of the coupling portion **250** disposed on a rail **230** of an adjacent cable tray segment **230** (or some equivalent coupling features of an existing cable tray segment), and when the coupling features **243** of the coupling portion **240** disposed on the other rail **230** of the cable tray segment **270** align with the coupling features **253** of the coupling portion **250** disposed on the other rail **230** of the adjacent cable tray segment **230** (or the equivalent coupling features of the existing cable tray segment), the fastening devices **290** can be inserted through and disposed within the apertures **243** and the apertures **253** to mechanically couple the cable tray segment **230** to the adjacent cable tray segment **230**. In this case, there three fastening devices **290** for each pair of coupling portion **240** and coupling portion **250**. In certain example embodiments, the fastening devices **290** are not used because the coupling features **243** and the coupling features **253** can be directly coupled to each other.

[0045] As stated above, example cable tray segments **270** can be used with existing cable tray segments currently known in the art, such as cable tray segment **110** described above with respect to FIGS. **1**A and **1**B. In such a case, the splice plate **120** is replaced by the coupling portion **240** of the example cable tray segment **270**. Other sizing considerations are also made. For example, if the length **112** of an existing cable tray segment **110** is approximately 144 inches (12.0 feet), and if the length **122** of the splice plate **120** is approximately four inches, then the overall length **272** of the example cable tray segment **270** can be approximately 146 inches, where the length **242** of the coupling portion **250** is approximately two inches, and the length **232** of the rest of the cable tray segment **270** is approximately 144 inches.

[0046] The number of coupling features **243** of a coupling portion **240** can be the same as, or different than, the number of coupling features **253** of a coupling portion **250** to which the coupling portion **240** couples. In addition, or in the alternative, the number of coupling devices **290** can be the same as, or different than, the number of coupling features **243** and/or the number of coupling features **253** to which the coupling devices **290** couple.

[0047] FIG. **3** shows a detailed view of a portion of a cable tray system **300** that includes coupling features of adjacent cable tray segments in accordance with certain example embodiments. Specifically, FIG. **3** shows how the coupling features **343** of the coupling portion **340** of an example cable tray segment **370** and/or the coupling features **353** of the coupling portion **350** of an adjacent cable tray segment **370** can be shaped and sized to increase reliability in coupling the fastening devices **390** to the coupling features **343** and the coupling features **353**.

[0048] In this example, the coupling features **343** and the coupling features **353** are each rectangularly shaped (also called an aperture shape), having substantially the same height and width. The shape and size of the rectangle formed by the coupling features **343** and the coupling features **353** can be substantially the same as, or slightly larger than, the shape and size of a portion **392** of each fastening device **390**. Specifically, the portion **392** of each fastening device **390**, when viewed cross-sectionally along its length, forms the aperture shape (is rectangular). The portion **392** of the fastening device **390** is disposed within one of the coupling features **343** and an corresponding one of the coupling features **353**. In such a case, the head **391** of the fastening device **390** can be rounded and have a continuously smooth surface, one or more coupling features. Examples of coupling features that can be removed from the head **391** can include, but are not limited to, a slot (or similar feature) disposed in the head **391** for a screwdriver, and a hex-head (or other shaped) configuration of its outer perimeter for a wrench or socket head.

[0049] In addition, the distal end **393** of the fastening device **390** can be positioned within the space of the cable tray (formed by the cable tray segments **370**) in which one or more electrical cables (not shown) can be disposed. To prevent or reduce the chance of the distal end **393** of the fastening device **390** from puncturing, scratching, or otherwise damaging the electrical cable, a protective component **394** can cover some or all of the distal end **393** of the fastening device **390**. The protective component **394** can have smooth, rounded, or other non-sharp edges, so that the protective component **394** has little or no possibility of damaging one or more of the electrical cables disposed within the cable tray, even over time and when the cable tray is subject to vibrations and other factors that can cause movement of the cable tray.

[0050] The protective component **394** can be a sleeve, a nut, a washer, and/or any other type of device. The protective component **394** can couple to the distal end **393** using one or more of a number of coupling methods, including but not limited to mating threads, fusion, epoxy, and clamps. The protective component **394** can be made of one or more of a number of materials, including but not limited to plastic, ceramic, rubber, and metal. In certain example embodiments, the orientation of the fastening device **390** is reversed, so that the head **391** is disposed against the inner-facing surface of the coupling portion **340** and/or the coupling portion **350**. In such a case, because of the lack of coupling features disposed on the head **391** of the fastening device **390**, the head **391** of each fastening device **390** has little or no possibility of damaging one or more of the electrical cables disposed within the cable tray

[0051] FIG. **4** shows a detailed view of a portion of a cable tray system **400** that includes coupling portions of adjacent cable tray segments in accordance with certain example embodiments. FIG. **5** shows a detailed view of a portion of a cable tray system **500** that includes alternative coupling portions of adjacent cable tray segments in accordance with certain example embodiments. In one or more embodiments, one or more of the components shown in FIGS. **4** and **5** may be omitted, repeated, and/or substituted. Accordingly, embodiments of a cable tray system should not be considered limited to the specific arrangements of components shown in FIGS. **4** and **5**.

[0052] Referring to FIGS. **1-5**, the system **400** of FIG. **4** shows how the coupling portion **440** of an example cable tray segment **470** can have a shape and size that is different than the shape and size of the rail **430** of the cable tray segment **470**. Specifically, in this example, the rail **430** of the cable tray segment **470** forms an "I" shape when viewed cross-sectionally along its length **432**, while the coupling portion **440** of the

cable tray segment **470** forms a straight (flat) vertical line when viewed cross-sectionally along its length **442**. The body **441** of the coupling portion **440** protrudes away from the body **431** of the rail **430** by a distance **480** that is approximately equal to the thickness of the body **431** of the rail **430**.

[0053] The proximal end of the body **431** of the rail **430** of the adjacent cable tray segment **470** abuts against the transition point **449** disposed between the coupling portion **440** and the rail **430**. In such a case, the coupling features **443** of the coupling portion **440** align with the coupling features **453** of the coupling portion **450**. Here, there are two coupling features **443** and two coupling features **453**, all having substantially the same shape and size.

[0054] FIG. **4** also shows that the coupling portion **440** of an example cable tray segment **470** can have a shape and size that is different than the shape and size of a proximal end (including the coupling portion **450**) of a rail **430** of an adjacent cable tray segment **470**. While the shape and size of the rail **430** of the adjacent cable tray segment **470** in FIG. **4** is substantially the same as the shape and size of the rail **430** of the cable tray segment **470**, the shape and size of the rail **430** of the adjacent cable tray segment **470** in FIG. **4** can alternatively be different than the shape and size of the rail **430** of the cable tray segment **470**.

[0055] FIG. **5** shows different features of the rail **530** and the coupling portion **540**. Specifically, the rail **530** of the cable tray segment **570** forms a "C" shape when viewed cross-sectionally along its length **532**. Similarly, the coupling portion **540** of the cable tray segment **570** forms a "C" shape when viewed cross-sectionally along its length **542**. In such a case, the transition point **549** can extend beyond the body **531** of the rail **530** and the body **541** of the coupling portion **540**. Specifically, the transition point **549** can also be disposed between the top flange **536** of the rail **530** and the top flange **546** of the coupling portion **540**, as well as between the bottom flange **535** of the rail **530** and the bottom flange **545** of the coupling portion **540**. Again, as with the system **400** of FIG. **4**, there are two coupling features **543** and two coupling features **553**, all having substantially the same shape and size.

[0056] FIG. **6** shows different features of the rail **630** and the coupling portion **640**. Specifically, the rail **630** of the cable tray segment **670** forms a "Z" shape when viewed cross-sectionally along its length **632**. By contrast, the coupling portion **640** of the cable tray segment **670** forms a straight (flat) vertical line when viewed cross-sectionally along its length **642**. In such a case, the transition point **649** can be disposed between the body **631** of the rail **630** and the body **641** of the coupling portion **640**. In other words, the transition point **649** is not positioned adjacent to the top flange **636** of the rail **630** or the bottom flange **635** of the rail **630**. Here, the coupling portion **640** extends away from the outer surface of the body **631** of the rail **630**. In alternative embodiments, the coupling portion **640** can extend away from the inner surface of the body **631** of the rail **630**. Again, as with the system **400** of FIG. **4**, there are two coupling features **643** and two coupling features **653**, all having substantially the same shape and size.

[0057] FIG. **7** shows different features of the rail **730** and the coupling portion **740**. Specifically, the rail **730** of the cable tray segment **770** forms a "C" shape when viewed cross-sectionally along its length **732**. By contrast, the coupling portion **740** of the cable tray segment **770** forms a straight (flat) vertical line when viewed cross-sectionally along its length **742**. In such a case, the transition point **749** can be disposed between the body **731** of the rail **730** and the body **741** of the coupling portion **740**. In other words, the transition point **749** is not positioned adjacent to the top flange **736** of the rail **730** or the bottom flange **735** of the rail **730**. Here, the coupling portion **740** extends away from the outer surface of the body **731** of the rail **730**. Again, as with the system **400** of FIG. **4**, there are two coupling features **743** and two coupling features **753**, all having substantially the same shape and size.

[0058] The example embodiments discussed herein provide for simplified retrofitting of certain portions of existing cable tray systems. Example embodiments can also allow for easy installation for new cable tray systems and existing cable tray systems. Cable tray systems using example embodiments can allow those cable tray systems to meet one or more of a number of cable tray standards, such as a NEMA classification for cable trays. Example embodiments requires fewer material, fewer parts (e.g., no splice plates, at least half the number of fastening devices). The design and reduction in parts of example embodiments can significantly reduce the amount of time, labor, cost, and material needed to install and/or repair a cable tray system.

[0059] In addition, the design of example cable tray segments creates a higher (e.g., 20%) mechanical resistance under load. In other words, the NEMA classification rating can be increased by using example embodiments. At the very least, even if under the same NEMA classification, example embodiments can hold a higher amount of weight within the cable tray.

[0060] Although the invention is described with reference to example embodiments, it should be appreciated by those skilled in the art that various modifications are well within the scope and spirit of this disclosure. Those skilled in the art will appreciate that the present invention is not limited to any specifically discussed application and that the embodiments described herein are illustrative and not restrictive. From the description of the example embodiments, equivalents of the elements shown therein will suggest themselves to those skilled in the art, and ways of constructing other embodiments of the present invention will suggest themselves to practitioners of the art. Therefore, the scope of the present invention is not limited herein.

1. A cable tray segment, comprising:

a first molecularly continuous side rail having a first length and comprising:

a first coupling portion forming one piece with the first molecularly continuous side rail and disposed at a first distal end of the first molecularly continuous side rail, wherein the first coupling portion protrudes from the first molecularly continuous side rail by a distance, and wherein the first coupling portion comprises at least one first coupling feature; and

a second coupling portion forming one piece with the first molecularly continuous side rail and disposed at a first proximal end of the first molecularly continuous side rail, wherein the second coupling portion comprises at least one first complementary coupling feature;

a second molecularly continuous side rail disposed substantially parallel to the first molecularly continuous side rail and having the first length, wherein the second molecularly continuous side rail comprises:

a third coupling portion forming one piece with the second molecularly continuous side rail and disposed at a second distal end of the second molecularly con-

tinuous side rail, wherein the third coupling portion protrudes from the second molecularly continuous side rail by the distance, and wherein the third coupling portion comprises at least one second coupling feature; and

a fourth coupling portion forming one piece with the molecularly continuous second side rail and disposed at a second proximal end of the second molecularly continuous side rail, wherein the fourth coupling portion comprises at least one second complementary coupling feature,

wherein the at least one first coupling feature is configured to mechanically couple to the first complementary coupling feature of a first other cable tray segment,

wherein the at least one first complementary coupling feature is configured to mechanically couple to the first coupling feature of a second other cable tray segment,

wherein the at least one second coupling feature is configured to directly mechanically couple to the second complementary coupling feature of the first other cable tray segment, and

wherein the at least one second complementary coupling feature is configured to directly mechanically couple to the second coupling feature of the second other cable tray segment.

2. The cable tray segment of claim **1**, wherein the first coupling portion protrudes in an outward direction and is parallel to the length of the first molecularly continuous side rail, and wherein the distance is substantially equivalent to a thickness of the first molecularly continuous side rail.

3. The cable tray segment of claim **1**, wherein the first molecularly continuous side rail, when viewed cross-sectionally along its length, forms a straight line.

4. The cable tray segment of claim **1**, wherein the molecularly continuous first side rail, when viewed cross-sectionally along its length, forms a "C" shape.

5. The cable tray segment of claim **4**, wherein the first coupling portion, when viewed cross-sectionally along its length, also forms the "C" shape.

6. The cable tray segment of claim **1**, wherein the first molecularly continuous side rail, when viewed cross-sectionally along its length, forms an "I" shape.

7. The cable tray segment of claim **6**, wherein the first coupling portion, when viewed cross-sectionally along its length, forms a straight line.

8. The cable tray segment of claim **1**, wherein the first molecularly continuous side rail, when viewed cross-sectionally along its length, forms a "Z" shape.

9. The cable tray segment of claim **1**, further comprising:

a plurality of crossbars disposed between and coupled to the first molecularly continuous side rail and the second molecularly continuous side rail.

10. A cable tray system, comprising:

a first cable tray segment comprising a first molecularly continuous side rail having a length and a second molecularly continuous side rail having the length, wherein the first molecularly continuous side rail and the second molecularly continuous side rail each comprises a first coupling portion that forms one piece with the first molecularly continuous side rail and the second molecularly continuous side rail and that is fixedly disposed at a first distal end, wherein each first coupling portion is recessed relative to the first molecularly continuous side rail and the second molecularly continuous side rail by a distance, wherein each first coupling portion comprises at least one first coupling feature;

a second cable tray segment comprising a third molecularly continuous side rail having the length and a fourth molecularly continuous side rail having the length, wherein the third molecularly continuous side rail and the fourth molecularly continuous side rail each comprises a second coupling portion that forms one piece with the third molecularly continuous side rail and the fourth molecularly continuous side rail and that is fixedly disposed at a second proximal end, wherein each second coupling portion comprises at least one first complementary coupling feature; and

at least one crossbar disposed between and coupled to the first molecularly continuous side rail and the second molecularly continuous side rail,

wherein the at least one first coupling feature couples to the at least one first complementary coupling feature.

11. The cable tray system of claim **10**, further comprising:

a third cable tray segment, comprising a fifth molecularly continuous side rail having the length and a sixth molecularly continuous side rail having the length, wherein the fifth molecularly continuous side rail and the sixth molecularly continuous side rail each comprise a third coupling portion that forms one piece with the fifth molecularly continuous side rail and the sixth molecularly continuous side rail and that is fixedly disposed at a second distal end, wherein each of the third coupling portions is recessed relative to the fifth molecularly continuous side rail and the sixth molecularly continuous side rail by the distance, wherein each third coupling portion comprises the at least one first coupling feature,

wherein the first cable tray segment further comprises the at least one first complementary coupling feature disposed on a fourth coupling portion at a first proximal end of the first molecularly continuous side rail and the second molecularly continuous side rail, and

wherein the at least one first coupling feature of the third cable tray segment couples to the at least one first complementary coupling feature of the first cable tray segment.

12. The cable tray system of claim **10**, further comprising:

at least one fastening device coupled to the at least one first coupling feature of the first coupling portion of the first cable tray segment and the at least one first complementary coupling feature of the second coupling portion of the second cable tray segment.

13. The cable tray system of claim **12**, wherein the at least one first coupling feature of the first cable tray segment and the at least one first complementary coupling feature of the second cable tray segment each has an aperture shape, wherein the at least one fastening device comprises a portion that, when viewed cross-sectionally along its length, forms the aperture shape, wherein the portion of the at least one fastening device is disposed within the at least one first coupling feature of the first cable tray segment and the at least one first complementary coupling feature of the second cable tray segment.

14. The cable tray system of claim **12**, wherein the aperture shape is a rectangle.

15. The cable tray system of claim **10**, wherein the at least one first coupling feature of the first cable tray segment and the at least one first complementary coupling feature of the

second cable tray segment align with each other when the second coupling portion disposed at the second proximal end of the third molecularly continuous side rail and the fourth molecularly continuous side rail of the second cable tray abuts against a transition point of the first cable tray segment, wherein the transition point is where each of the first coupling portions is recessed relative to the first molecularly continuous side rail and the second molecularly continuous side rail of the first cable tray segment.

16. The cable tray system of claim **10**, wherein the first molecularly continuous side rail, when viewed cross-sectionally along its length, forms a first shape that is substantially the same as a second shape formed by the first coupling portion when the first coupling portion is viewed cross-sectionally along its length.

17. The cable tray system of claim **10**, wherein the first molecularly continuous side rail, when viewed cross-sectionally along its length, forms a first shape that is different than a second shape formed by the first coupling portion when the first coupling portion is viewed cross-sectionally along its length.

18. The cable tray system of claim **10**, wherein the first cable tray segment replaces an existing cable tray segment, and wherein the second cable tray segment and the existing cable tray segment are part of an existing cable tray system.

19. A cable system, comprising:

a first cable tray segment comprising a first molecularly continuous side rail having a length and a second molecularly continuous side rail having the length, wherein the first molecularly continuous side rail and the second molecularly continuous side rail each comprises a first coupling portion that forms one piece with the first molecularly continuous side rail and the second molecularly continuous side rail and that is fixedly disposed at a first distal end, wherein each of the first coupling portions protrudes from the first molecularly continuous side rail and the second molecularly continuous side rail by a distance, wherein each first coupling portion comprises at least one first coupling feature;

a second cable tray segment comprising a third molecularly continuous side rail having the length and a fourth molecularly continuous side rail having the length, wherein the third molecularly continuous side rail and the fourth molecularly continuous side rail each comprises a second coupling portion that forms one piece with the third molecularly continuous side rail and the fourth molecularly continuous side rail and that is fixedly disposed at a second proximal end, wherein each second coupling portion comprises at least one first complementary coupling feature;

at least one fastening device directly coupled to the at least one first coupling feature of the first cable tray segment and the at least one first complementary coupling feature of the second cable tray segment;

a plurality of crossbars disposed between and coupled to the first molecularly continuous side rail and the second molecularly continuous side rail; and

at least one cable disposed on the plurality of crossbars.

20. The cable system of claim **19**, further comprising:

a plurality of cable tray supports, wherein the at least one cable weighs at least 50 pounds per foot when the plurality of cable tray supports for the first cable tray segment are spaced 8 feet apart from each other.

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