Figures 4 and 5 show front views of a female connector comprising an alignment feature in accordance with certain example embodiments.

Figure 6 shows a perspective view of a male connector in accordance with certain example embodiments.

Figure 7 shows a front view of an insert for a male connector in accordance with certain example embodiments.

Figure 8 shows a front view of a male connector with an insert in accordance with certain example embodiments.

Figure 9 shows a perspective view of a male connector in accordance with certain example embodiments.

Figures 10 and 11 show a front view of a male connector in accordance with certain example embodiments.

Figure 13 shows a perspective view of a properly aligned male and female connector in accordance with certain example embodiments.

Figures 15, 16 and 17 show additional connectors with alignment features located in various positions in accordance with certain example embodiments.

Figures 18 and 19 show additional connectors with alignment features for a non-hazardous environment in accordance with certain example embodiments.

SUMMARY

The present disclosure is directed to high-amperage connectors with visual alignment features. In one embodiment, a connector can comprise a male connector with a male skirt where the male skirt has two keys on an outer surface. At least one of the keys on the outer surface of the male skirt can have an alignment feature. The connector also comprises a female connector with a female skirt where the female skirt has two keyways on an inner surface of the female skirt. At least one of the keyways can have a corresponding keyway alignment feature located on the outer surface of the female skirt. An insert key is disposed on an inner surface of one of the male skirt or the female skirt. The alignment features on the male skirt and the female skirt allow a user to easily align the two connectors before connecting them.

In another embodiment, a connector can comprise a male connector with a male skirt where the male skirt has at least one key on an outer surface. The connector also comprises a female connector with a female skirt where the female skirt has at least one keyway on an inner surface of the female skirt. The at least one keyway can have a single corresponding keyway alignment feature located on the outer

surface of the female skirt. The female connector further comprises an insert key disposed on an inner surface of one of the male skirt and the female skirt. The keyway alignment feature on the outer surface of the female skirt allows a user to easily align the key on the male skirt with the keyway on the female skirt.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

The example embodiments discussed herein are directed to systems, apparatuses, and methods of connecting high-amperage connectors using a keyway visual alignment feature. Embodiments of connectors using a keyway visual alignment feature can take a variety of configurations based on the amperage rating, the conductor size, the size of the plug and receptacle and the arrangement of the conductor pins. Embodiments of connectors using a keyway visual alignment feature may be compliant with one or more industry standards such as those set by Underwriters Laboratory (UL) or the National Electric Code (NEC).

Referring to Figures 1, 12 and 14, illustrations are shown of conventional male and female connectors. For example, Figure 1 shows a connector 100 comprising a male connector 105 and a female connector 110. As shown in these figures, there are no features on the outside of the male and female connectors that allow a person to easily align the connectors. Accordingly, a person must push and twist the male and female connectors together blindly until the correct alignment is achieved.

Referring now to Figure 2, an example male and female portions of a connector are shown in accordance with one embodiment. In the embodiment shown in Figure 2, the connector 200 comprises a male connector 202, which comprises a coupling nut 215 and a male skirt 205. The female connector 203 comprises threads 220 and female skirt 210. One difference between the male connectors shown in Figure 1 and Figure 2 is that the coupling nut 215 in Figure 2 has a greater range of motion allowing it to be pushed back further to show the key 225 (the 12 o'clock key) on the male skirt 205. When the connectors are properly aligned and connected, the key 225 located on the male skirt 205 must fit within a keyway (not shown in Figure 2) located on the inside surface of the female skirt 210.

Also shown in the example connector 200 of Figure 2, key 225 includes an alignment feature 230 in the form of a groove on the key 225. The female skirt 210 includes alignment feature 235 which is also in the form of a groove in this example. When a person attempts to connect the male connector 202 with the female connector 203, the person can align alignment feature 230 and keyway alignment feature 235 as

CLAIMS

What is claimed is:

1. An electrical connector comprising:

a male connector comprising a male skirt, the male skirt comprising at least two keys, the at least two keys disposed on an outer surface of the male skirt, wherein a first key of the at least two keys comprises a first key alignment feature; ~~and~~

a female connector comprising a female skirt, the female skirt comprising at least two keyways disposed on an inner surface of the female skirt, wherein a first keyway of the at least two keyways has a corresponding first keyway alignment feature disposed on an outer surface of the female skirt; and

an insert key disposed on an inner surface of one of the male skirt or the female skirt.

2. The electrical connector of claim 1, wherein the first key is inserted into the first keyway when the male connector and female connector are connected.

3. The electrical connector of claim 1, wherein the first key alignment feature is selected from ~~the~~ a group comprising a notch, a groove, an arrow, a dimple, a pilot hole, a painted designation, and a masking mark left after anodizing.

4. The electrical connector of claim 1, wherein the first keyway alignment feature is selected from ~~the~~ a group comprising a notch, a groove, an arrow, a dimple, a pilot hole, a painted designation, and a masking mark left after anodizing.

5. The electrical connector of claim 1, wherein the ~~male connector further comprises an~~ insert key is disposed on ~~an~~ the inner surface of the male skirt.

6. The electrical connector of claim 1, wherein the ~~female connector further comprises an~~ insert key is disposed on ~~an~~ the inner surface of the female skirt.

7. The electrical connector of claim 1, wherein the male connector further comprises a coupling nut.

8. The electrical connector of claim 7, wherein the coupling nut is retractable to expose the first key.

9. The electrical connector of claim 1, wherein the first keyway alignment feature is disposed adjacent to a leading edge of the female skirt.

10. The electrical connector of claim 1, wherein the first keyway alignment feature is disposed in a position set back from a leading edge of the female skirt.

11. The electrical connector of claim 1, wherein the first keyway alignment feature is disposed adjacent to a thread on the outer surface of the female skirt.

12. The electrical connector of claim 1, wherein the first keyway alignment feature is disposed on a far side of a thread opposite a side of the thread near the leading edge.

13. The electrical connector of claim 5, wherein the male connector further comprises a rigid insert, the rigid insert comprising an insert keyway.

14. The electrical connector of claim 13, wherein the insert keyway of the rigid insert aligns with the insert key on the inner surface of the male skirt when the male connector is properly assembled.

15. The electrical connector of claim 13, wherein the insert keyway aligns with the first key alignment feature when the male connector is properly assembled.

16. The electrical connector of claim 1, wherein the female connector has a second keyway alignment feature disposed on the outer surface of the female skirt.

17. The electrical connector of claim 1, wherein the first keyway alignment feature is a beginning of a thread on the female connector.

18. The electrical connector of claim 1, wherein the first keyway alignment feature is disposed on a collar on the female connector.

19. The electrical connector of claim 1, wherein the first keyway alignment feature is disposed on a nut on the female connector.

20. An electrical connector comprising:

a male connector comprising a male skirt, the male skirt comprising at least one key, the at least one key disposed on an outer surface of the male skirt; and

a female connector comprising a female skirt, the female skirt comprising at least one keyway disposed on an inner surface of the female skirt, wherein the at least one keyway has a single corresponding keyway alignment feature disposed on an outer surface of the female skirt,

wherein the female connector further comprises an insert key disposed on an inner surface of one of the male skirt and the female skirt.