shrinkable tube type can only be used for the direct splice and the branching splice operations, while the water-proof treatment of the heat-shrinkable type or the mechanical type should be used for the branch splicing of an intermediately introduced connection.

[0008] Therefore, if there is a feasible solution to improve the cable splice enclosure of the prior art so that a cable can pass through an end surface of a cable splice enclosure and a hollow cylindrical tube disposed thereon in a dual-cable manner, an elastic shrinkable tube is possibly used for the waterproof treatment. If the method of cable splice operation using the cable splice enclosure and waterproof treatment is feasibly standardized, not only the quality and safety of the construction are improved, but also the manufacturing and maintenance cost of the constructor are greatly lowered.

[0009] In order to overcome the drawbacks in the prior art, a cable splice enclosure is provided. The particular design in the present invention not only solves the problems described above, but also is easy to be implemented. Thus, the present invention has the utility for the industry.

SUMMARY OF THE INVENTION

[0010] In accordance with an aspect of the present invention, a cable splice enclosure is provided. The cable splice enclosure includes at least one end surface passing therethrough a first cable, wherein the first cable has a fiber-optic core therein and is bent in a U-shape, or is oppositely bent, without breaking the fiber-optic core, and the bent first cable has an inner part in the cable splice enclosure and an outer part out of the cable splice enclosure, at least a first hollow cylindrical tube formed on the end surface and passing therethrough the bent first cable, at least an auxiliary device cooperating with the outer part of the bent first cable to form a first waterproof structure, and at

splice enclosure having a small space that causes a problem of a poor transmission quality.

[0016] Moreover, the end surface has a second location passing therethrough a third cable, and the second location is disposed at a second linear path on which the third cable enters the cable splice enclosure without being blocked and interfered by the collecting disk. The operation related to the fixing, storing, and allocating of the cable collecting support can still follow an originally designed technical operation procedure to reduce the adverse influence caused by changing the location for passing therethrough a cable. Accordingly, the application field of the end surface for the cable to pass therethrough is promoted, and the technical quality of the related operation is assured as well.

[0017] Moreover, the cable splice enclosure further includes a second cable fixture device fixing the collecting disk support, wherein the second cable fixture device fixes the collecting disk support at a specific position corresponding to the second location.

[0018] Moreover, the first shrinkable tube is one selected from the group consisting of an elastic shrinkable tube, a heat-shrinkable tube and a combination thereof.

[0019] In accordance with another aspect of the present invention, a cable splice enclosure is provided. The cable splice enclosure includes at least one end surface passing therethrough a cable bent into a first part having a U-shaped part in the cable splice enclosure and a second part having a linear part out of the cable splice enclosure, wherein the linear part of the cable has an interstice, at least a hollow tube formed on the end surface and passing therethrough the cable, at least an auxiliary device cooperating with the linear part of the cable and

filling the interstice to form a first waterproof structure, at least a first shrinkable device covering an outer surface of the hollow tube and an outer surface of the auxiliary device to form a second waterproof structure, and at least a cable fixture device fixing the U-shaped part of the cable.

[0020] In accordance with a further aspect of the present invention, a cable splice enclosure is provided. The cable splice enclosure includes an end surface separating the cable splice enclosure into an inner part and an outer part, at least a hollow tube configured on the end surface and passing therethrough a cable, , at least an auxiliary device filling an interstice to form a first waterproof structure, at least a shrinkable device covering an outer surface of the hollow tube and an outer surface of the auxiliary device to form a second waterproof structure, and at least a cable fixture device being used to fix the portion of the cable in the inner part of the cable splice enclosure. The cable passing through the hollow tube is arranged to extend from the outer part to the inner part through the hollow tube, leaves a portion in the inner part, and leave from the inner part through the hollow tube toward the outer part. Meanwhile, the cable has a first segment before extending into the inner part and a second segment leaving from the inner part. The first and the second segments have an interstice therebetween to which the interstice is necessary to be filled by the auxiliary device.

[0021] The above objectives and advantages of the present invention will become more readily apparent to those ordinarily skilled in the art after reviewing the following detailed descriptions and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Figs. 1(A)~1(E) show a cable splice enclosure having an auxiliary device for filling an interstice and proofing against water according to a first embodiment of the present invention;

[0023] Fig. 2 shows an end surface on the cable splice enclosure for a fiber-optic cable to pass therethrough according to the first embodiment of the present invention;

[0024] Fig. 3 shows the interior of the cable splice enclosure in one view according to the first embodiment of the present invention; and

[0025] Fig. 4 shows the interior of the cable splice enclosure in another view according to the first embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0026] The present invention will now be described more specifically with reference to the following embodiments. It is to be noted that the following descriptions of preferred embodiments of this invention are presented herein for the purposes of illustration and description only; it is not intended to be exhaustive or to be limited to the precise form disclosed.

[0027] First Embodiment:

[0028] Please refer to Figs. 1(A)~1(E), which show a cable splice enclosure 1 having an auxiliary device for filling an interstice and proofing against water according to a first embodiment of the present invention. The cable splice enclosure 1 includes an end surface 2 for a cable to pass therethrough. The end surface 2 has a hollow cylindrical tube 3 formed thereon, as shown in Fig. 1(A). The cable splice enclosure further includes an auxiliary device for filling an interstice and proofing against water, and an shrinkable tube 4 which can be an elastic shrinkable or a heat-shrinkable one. As shown in Fig. 1(B), the auxiliary device includes two pieces of bundling bodies 401, fixing

screws 402, a waterproof double-faced adhesive tape 403, and an elastomer waterproof single-faced adhesive tap 404. The two pieces of bundling bodies 401 are in a semi-cylinder shape each having a concave space for containing each of the dual cables therein respectively for tightly bundling the cables. The waterproof double-faced adhesive tape 403 has characteristics of adhesion and plasticity. The elastomer waterproof single-faced adhesive tap 404 could be alternatively replaced by other applicable glues. When a cable, bent in a double-folded shape, a U shape, or other possible shapes without being cut off to have a form in a dual-cable manner is ready to pass through the hollow cylindrical tube 3 formed on the end surface 2 and to go into the cable splice enclosure 1, the operation of waterproof treatment is proceeded as described hereinafter. There are another interstice formed possibly by different cable combinations and are also applicable to the present invention. For example, a cable having a U-shaped part in the cable splice enclosure and a linear part out of the cable splice enclosure. An interstice is formed on the linear part of the cable in a dual-cable manner. In another case, a cable extends from the outer part to the inner part of the cable splice enclosure through the hollow tube, leaves a portion in the inner part thereof, and leaves from the inner part through the hollow tube toward the outer part. The cable has a first segment before extending into the inner part and a second segment leaving from the inner part. Another interstice is formed between the first and the second segments. Firstly, the waterproof double-faced adhesive tape 403 having characteristics of adhesion and plasticity is put and laid at one of the semi-cylindrical bundling bodies 401 having a concave space for containing each of the dual cables therein respectively. The waterproof adhesive tape 403 having characteristics of adhesion and plasticity is used to encompass a joint portion of the fiber-optic cable 5 for the intermediately

introduced branching splice and the bundling bodies 401 for tightly bundling the cable in a curled type. Fasten the joint portion by using the fixing screws 402 to tightly combine the two pieces of the semi-cylindrical bundling bodies 401 to form a waterproof structure of an integrated cylindrical body. After removing the excess of the waterproof double-faced adhesive tape 403 having characteristics of adhesion and plasticity squeezed out from the gap between the bundling bodies 401 after tightly fastening the fixing screws 402, an elastomer waterproof single-faced adhesive tape 404 is used to encompass the outer surface of the integrated cylindrical bundling body formed by combining the two pieces of the semi-cylindrical bundling bodies 401. Accordingly, a first waterproof structure is formed among each of the dual cables 5 and the bundling bodies 401, as shown in Fig. 1(C). Besides, the fiber-optic cable 5 and the first waterproof structure therewith, intended to be operated by an intermediately introduced branching splice, are inserted into and covered by an elastic shrinkable 4 to proceed a waterproof treatment, which can be an elastic shrinkable tube, an heat-shrinkable tube or a combination thereof. The fiber-optic cable 5 with the first waterproof structure is bended without breaking the cores contained therein, passes through the first hollow cylindrical tube 3, is inserted into the cable splice enclosure 1 in a dual-cable manner, and then is fixed thereto. A shrinkable tube 4 bundles and covers an outer portion of the first hollow cylindrical tube 3 and a part of the bent cable lying externally to the first hollow cylindrical tube 3 to form a second waterproof structure, as shown in Fig. 1(D). Therefore, a waterproof treatment to the joint portion of the cable 5 intended to be intermediately introduced branching splice operated and the end surface 2 for the cable 5 to pass therethrough is completed, as shown in Fig. 1(E). Accordingly, the cable splice enclosure 1 of the present invention for

slicing a cable 5 therehrough is also suitable for any kind of the cable splice method and/or a preparation for a cable splice requirement.

[0029] Please refer to Fig. 2, which shows an end surface 2 on the cable splice enclosure 1 for a fiber-optic cable to pass therethrough according to the first embodiment of the present invention. A second hollow cylindrical tube 7 for a fiber-optic cable 8 intended to be proceeded by an direct splice or a branching splice operation to pass therethrough and further go into the cable splice enclosure 1 is further formed on the end surface 2. A shrinkable tube 4 is used for simultaneously bundling and covering both an outer surface of the second hollow cylindrical tube 7 and a part of the cable 8 passing out of the second hollow cylindrical tube 7 to form a third waterproof structure, as shown in Fig. 2. If the second hollow cylindrical tube 7 or the outside diameter of the cable 8 is a littler smaller or the surface of the cable 8 is slightly scratched, an elastomer waterproof single-faced adhesive tape 404 is additionally used to surround the cable 8 to enlarge its outside diameter to properly fit the dimension of the inside diameter of the shrinkable tube 4 after bundling and covering the cable 8, and to make up the scratch on the surface of the cable 8.

[0030] Please refer to Fig. 3, which shows the interior of the cable splice enclosure 1 in one view according to the first embodiment of the present invention. A first cable fixture device 9 is disposed at the interior of the cable splice enclosure 1. The first cable fixture device 9 can be a fastening ring, a fastening band, a clamping joint, or a combination thereof. The first cable fixture device 9 fixes the cable 8 which lies at the inner part of the cable splice enclosure 1 by using a stainless steel fastening ring 10.

[0031] Please refer to Fig. 4, which shows the interior of the cable splice enclosure 1 in another view according to the first embodiment of the present

invention. A collecting support 11 for collecting fiber-optic cables is further disposed at the interior of the cable splice enclosure 1. A first location on the end surface 2 of the first hollow cylindrical tube 3 for a main cable 5 to pass therethrough is disposed at a linear path on which the main cable 5 enters the cable splice enclosure 1 without being blocked and interfered by the collecting disk 12 disposed on the collecting support 11. A second cable fixture device 13 is further disposed at the interior of the cable splice enclosure 1. The second cable fixture device 13 also can be a fastening ring, a fastening band, a clamping joint, or a combination thereof. The second cable fixture device 13 fixes the collecting support 11 at a different specific position corresponding to a second location for passing therethrough another main cable 5 for an intermediately introduced branching splice operation or a main cable 501 for a direct splice operation, as shown in Fig. 4. Furthermore, the second location on the end surface 2 of the second hollow cylindrical tube 7 for a main cable 5 to pass therethrough is disposed at a linear path on which the main cable 8 enters the cable splice enclosure 1 without being blocked and interfered by the collecting disk 12 disposed on the collecting support 11, as shown in Fig. 3.

[0032] Based on the above-mentioned description for the first embodiment, the cable splice enclosure having an auxiliary device for filling an interstice and proofing against water of the present invention overcomes a variety of disadvantages of the prior art, such as the insufficiency of the function, high cost, a difficulty of controlling a consistent quality and keeping the construction under a safe environment. In addition, the standardization to the tools and operation method effectively improves the quality and safety of the construction and greatly lowers the manufacturing and maintenance costs of the constructor.

shrinkable tube type can only be used for the direct splice and the branching splice operations, while the water-proof treatment of the heat-shrinkable type or the mechanical type should be used for the branch splicing of an intermediately introduced connection.

[0008] Therefore, if there is a feasible solution to improve the cable splice enclosure of the prior art so that a cable can pass through an end surface of a cable splice enclosure and a hollow cylindrical tube disposed thereon in a dual-cable manner, an elastic shrinkable tube is possibly used for the waterproof treatment. If the method of cable splice operation using the cable splice enclosure and waterproof treatment is feasibly standardized, not only the quality and safety of the construction are improved, but also the manufacturing and maintenance cost of the constructor are greatly lowered.

[0009] Implementation of the techniques disclosed herein may help to solve or at least alleviate the problems described above, providing techniques which are also easy to be implemented. Thus, the present invention has the utility for the industry.

SUMMARY OF THE INVENTION

[0009a] The invention is defined in the independent claims. Some optional features of the invention are defined in the dependent claims.

[0010] In accordance with one disclosed example, a cable splice enclosure is provided. The cable splice enclosure includes at least one end surface passing therethrough a first cable, wherein the first cable has a fiber-optic core therein and is bent in a U-shape, or is oppositely bent, without breaking the fiber-optic core, and the bent first cable has an inner part in the cable splice enclosure and an outer part out of the cable splice enclosure, at least a first hollow cylindrical tube formed on the end surface and passing therethrough the bent first cable, at least an auxiliary device cooperating with the outer part of the bent first cable to form a first waterproof structure, and at

splice enclosure having a small space that causes a problem of a poor transmission quality.

[0016] Moreover, the end surface has a second location passing therethrough a third cable, and the second location is disposed at a second linear path on which the third cable enters the cable splice enclosure without being blocked and interfered by the collecting disk. The operation related to the fixing, storing, and allocating of the cable collecting support can still follow an originally designed technical operation procedure to reduce the adverse influence caused by changing the location for passing therethrough a cable. Accordingly, the application field of the end surface for the cable to pass therethrough is promoted, and the technical quality of the related operation is assured as well.

[0017] Moreover, the cable splice enclosure further includes a second cable fixture device fixing the collecting disk support, wherein the second cable fixture device fixes the collecting disk support at a specific position corresponding to the second location.

[0018] Moreover, the first shrinkable tube is one selected from the group consisting of an elastic shrinkable tube, a heat-shrinkable tube and a combination thereof.

[0019] In accordance with another disclosed example, a cable splice enclosure is provided. The cable splice enclosure includes at least one end surface passing therethrough a cable bent into a first part having a U-shaped part in the cable splice enclosure and a second part having a linear part out of the cable splice enclosure, wherein the linear part of the cable has an interstice, at least a hollow tube formed on the end surface and passing therethrough the cable, at least an auxiliary device cooperating with the linear part of the cable and

filling the interstice to form a first waterproof structure, at least a first shrinkable device covering an outer surface of the hollow tube and an outer surface of the auxiliary device to form a second waterproof structure, and at least a cable fixture device fixing the U-shaped part of the cable.

[0020] In accordance with a further example, a cable splice enclosure is provided. The cable splice enclosure includes an end surface separating the cable splice enclosure into an inner part and an outer part, at least a hollow tube configured on the end surface and passing therethrough a cable, , at least an auxiliary device filling an interstice to form a first waterproof structure, at least a shrinkable device covering an outer surface of the hollow tube and an outer surface of the auxiliary device to form a second waterproof structure, and at least a cable fixture device being used to fix the portion of the cable in the inner part of the cable splice enclosure. The cable passing through the hollow tube is arranged to extend from the outer part to the inner part through the hollow tube, leaves a portion in the inner part, and leave from the inner part through the hollow tube toward the outer part. Meanwhile, the cable has a first segment before extending into the inner part and a second segment leaving from the inner part. The first and the second segments have an interstice therebetween to which the interstice is necessary to be filled by the auxiliary device.

[0021] The above objectives and advantages of the present invention will become more readily apparent to those ordinarily skilled in the art after reviewing the following detailed descriptions and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Figs. 1(A)~1(E) show a cable splice enclosure having an auxiliary device for filling an interstice and proofing against water according to a first arrangement;

[0023] Fig. 2 shows an end surface on the cable splice enclosure for a fiber-optic cable to pass therethrough according to the first arrangement;

[0024] Fig. 3 shows the interior of the cable splice enclosure in one view according to the first arrangement; and

[0025] Fig. 4 shows the interior of the cable splice enclosure in another view according to the first arrangement;

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0026] The present invention will now be described more specifically with reference to the following embodiments. It is to be noted that the following descriptions of preferred embodiments of this invention are presented herein for the purposes of illustration and description only; it is not intended to be exhaustive or to be limited to the precise form disclosed.

[0027] First Embodiment:

[0028] Please refer to Figs. 1(A)~1(E), which show a cable splice enclosure 1 having an auxiliary device for filling an interstice and proofing against water according to a first embodiment. The cable splice enclosure 1 includes an end surface 2 for a cable to pass therethrough. The end surface 2 has a hollow cylindrical tube 3 formed thereon, as shown in Fig. 1(A). The cable splice enclosure further includes an auxiliary device for filling an interstice and proofing against water, and an shrinkable tube 4 which can be an elastic shrinkable or a heat-shrinkable one. As shown in Fig. 1(B), the auxiliary device includes two pieces of bundling bodies 401, fixing

screws 402, a waterproof double-faced adhesive tape 403, and an elastomer waterproof single-faced adhesive tap 404. The two pieces of bundling bodies 401 are in a semi-cylinder shape each having a concave space for containing each of the dual cables therein respectively for tightly bundling the cables. The waterproof double-faced adhesive tape 403 has characteristics of adhesion and plasticity. The elastomer waterproof single-faced adhesive tap 404 could be alternatively replaced by other applicable glues. When a cable, bent in a double-folded shape, a U shape, or other possible shapes without being cut off to have a form in a dual-cable manner is ready to pass through the hollow cylindrical tube 3 formed on the end surface 2 and to go into the cable splice enclosure 1, the operation of waterproof treatment is proceeded as described hereinafter. There are another interstice formed possibly by different cable combinations and are also applicable to the present techniques. For example, a cable having a U-shaped part in the cable splice enclosure and a linear part out of the cable splice enclosure. An interstice is formed on the linear part of the cable in a dual-cable manner. In another case, a cable extends from the outer part to the inner part of the cable splice enclosure through the hollow tube, leaves a portion in the inner part thereof, and leaves from the inner part through the hollow tube toward the outer part. The cable has a first segment before extending into the inner part and a second segment leaving from the inner part. Another interstice is formed between the first and the second segments. Firstly, the waterproof double-faced adhesive tape 403 having characteristics of adhesion and plasticity is put and laid at one of the semi-cylindrical bundling bodies 401 having a concave space for containing each of the dual cables therein respectively. The waterproof adhesive tape 403 having characteristics of adhesion and plasticity is used to encompass a joint portion of the fiber-optic cable 5 for the intermediately

introduced branching splice and the bundling bodies 401 for tightly bundling the cable in a curled type. Fasten the joint portion by using the fixing screws 402 to tightly combine the two pieces of the semi-cylindrical bundling bodies 401 to form a waterproof structure of an integrated cylindrical body. After removing the excess of the waterproof double-faced adhesive tape 403 having characteristics of adhesion and plasticity squeezed out from the gap between the bundling bodies 401 after tightly fastening the fixing screws 402, an elastomer waterproof single-faced adhesive tape 404 is used to encompass the outer surface of the integrated cylindrical bundling body formed by combining the two pieces of the semi-cylindrical bundling bodies 401. Accordingly, a first waterproof structure is formed among each of the dual cables 5 and the bundling bodies 401, as shown in Fig. 1(C). Besides, the fiber-optic cable 5 and the first waterproof structure therewith, intended to be operated by an intermediately introduced branching splice, are inserted into and covered by an elastic shrinkable 4 to proceed a waterproof treatment, which can be an elastic shrinkable tube, an heat-shrinkable tube or a combination thereof. The fiber-optic cable 5 with the first waterproof structure is bended without breaking the cores contained therein, passes through the first hollow cylindrical tube 3, is inserted into the cable splice enclosure 1 in a dual-cable manner, and then is fixed thereto. A shrinkable tube 4 bundles and covers an outer portion of the first hollow cylindrical tube 3 and a part of the bent cable lying externally to the first hollow cylindrical tube 3 to form a second waterproof structure, as shown in Fig. 1(D). Therefore, a waterproof treatment to the joint portion of the cable 5 intended to be intermediately introduced branching splice operated and the end surface 2 for the cable 5 to pass therethrough is completed, as shown in Fig. 1(E). Accordingly, the cable splice enclosure 1 for

slicing a cable 5 therehrough is also suitable for any kind of the cable splice method and/or a preparation for a cable splice requirement.

[0029] Please refer to Fig. 2, which shows an end surface 2 on the cable splice enclosure 1 for a fiber-optic cable to pass therethrough according to the first embodiment. A second hollow cylindrical tube 7 for a fiber-optic cable 8 intended to be proceeded by an direct splice or a branching splice operation to pass therethrough and further go into the cable splice enclosure 1 is further formed on the end surface 2. A shrinkable tube 4 is used for simultaneously bundling and covering both an outer surface of the second hollow cylindrical tube 7 and a part of the cable 8 passing out of the second hollow cylindrical tube 7 to form a third waterproof structure, as shown in Fig. 2. If the second hollow cylindrical tube 7 or the outside diameter of the cable 8 is a littler smaller or the surface of the cable 8 is slightly scratched, an elastomer waterproof single-faced adhesive tape 404 is additionally used to surround the cable 8 to enlarge its outside diameter to properly fit the dimension of the inside diameter of the shrinkable tube 4 after bundling and covering the cable 8, and to make up the scratch on the surface of the cable 8.

[0030] Please refer to Fig. 3, which shows the interior of the cable splice enclosure 1 in one view according to the first embodiment. A first cable fixture device 9 is disposed at the interior of the cable splice enclosure 1. The first cable fixture device 9 can be a fastening ring, a fastening band, a clamping joint, or a combination thereof. The first cable fixture device 9 fixes the cable 8 which lies at the inner part of the cable splice enclosure 1 by using a stainless steel fastening ring 10.

[0031] Please refer to Fig. 4, which shows the interior of the cable splice enclosure 1 in another view according to the first embodiment.

A collecting support 11 for collecting fiber-optic cables is further disposed at the interior of the cable splice enclosure 1. A first location on the end surface 2 of the first hollow cylindrical tube 3 for a main cable 5 to pass therethrough is disposed at a linear path on which the main cable 5 enters the cable splice enclosure 1 without being blocked and interfered by the collecting disk 12 disposed on the collecting support 11. A second cable fixture device 13 is further disposed at the interior of the cable splice enclosure 1. The second cable fixture device 13 also can be a fastening ring, a fastening band, a clamping joint, or a combination thereof. The second cable fixture device 13 fixes the collecting support 11 at a different specific position corresponding to a second location for passing therethrough another main cable 5 for an intermediately introduced branching splice operation or a main cable 501 for a direct splice operation, as shown in Fig. 4. Furthermore, the second location on the end surface 2 of the second hollow cylindrical tube 7 for a main cable 5 to pass therethrough is disposed at a linear path on which the main cable 8 enters the cable splice enclosure 1 without being blocked and interfered by the collecting disk 12 disposed on the collecting support 11, as shown in Fig. 3.

[0032] Based on the above-mentioned description for the first embodiment, the cable splice enclosure having an auxiliary device for filling an interstice and proofing against water overcomes a variety of disadvantages of the prior art, such as the insufficiency of the function, high cost, a difficulty of controlling a consistent quality and keeping the construction under a safe environment. In addition, the standardization to the tools and operation method effectively improves the quality and safety of the construction and greatly lowers the manufacturing and maintenance costs of the constructor.