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(71) Demandeur/Applicant:
COMMSCOPE, INC. OF NORTH CAROLINA, US

(72) Inventeurs/Inventors:
VOGEL, MARK O., US;
GEMME, CHRISTOPHER P., US;
ALRUTZ, MARK E., US;
LEE, MARTIN B., US

(74) Agent: TEITELBAUM & MACLEAN

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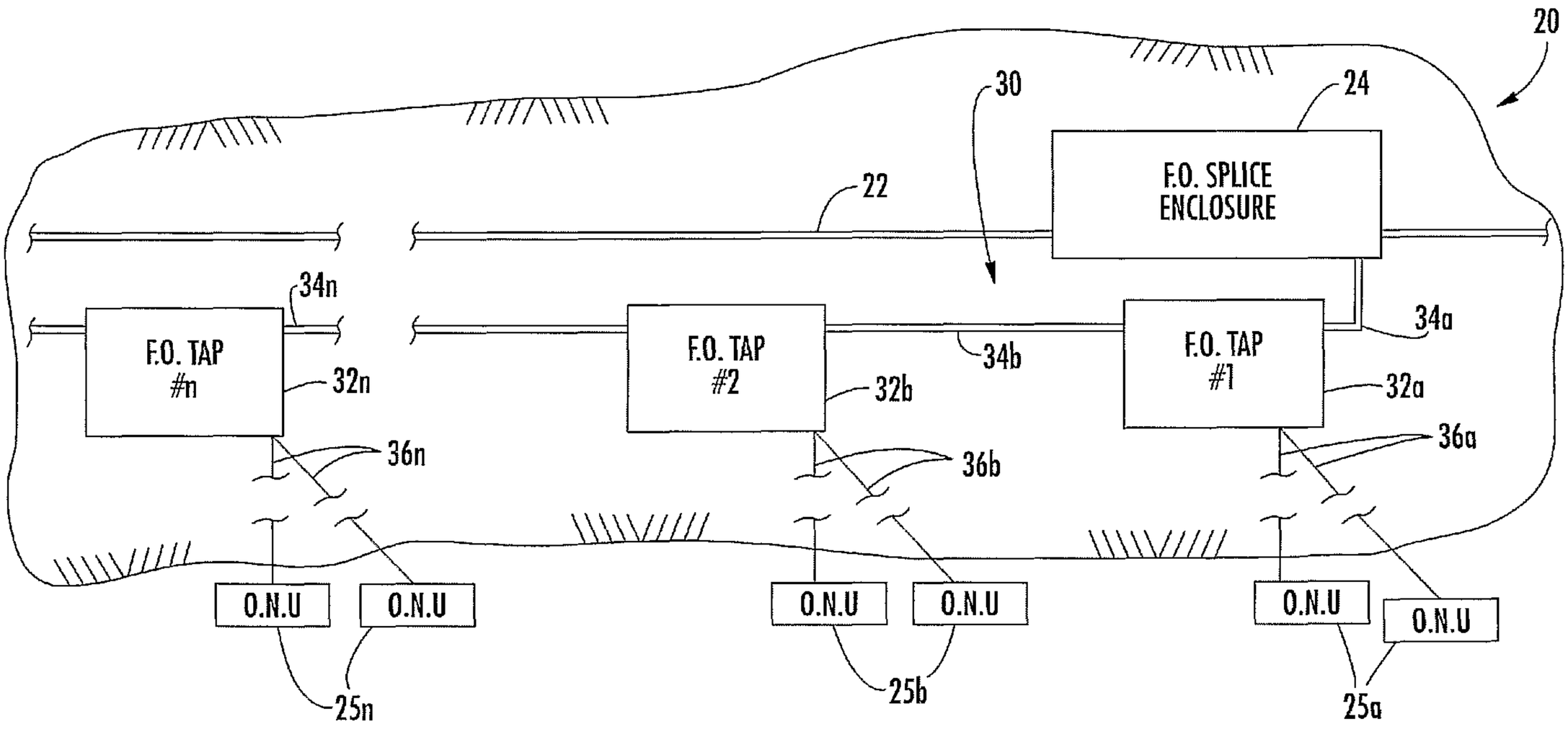

(57) Abrégé/Abstract:
A buried fiber optic cable system (20) includes a distribution cable (22) extending along a buried route, a splice enclosure (24) connected to the distribution cable (22) along the buried route, and a first sub-distribution fiber optic system (30) extending along the buried route in a first direction away from the fiber optic splice enclosure (24). The first sub-distribution system (30) may include spaced apart fiber optic taps along the buried route, a first sub-distribution fiber optic cable between the fiber optic splice enclosure (24) and a first fiber optic tap (32a), and at least one second sub-distribution fiber optic cable (34b-34n) between adjacent fiber optic taps so that the first sub-distribution fiber optic cable (34a) and the at least one second sub-distribution fiber optic cable (34b-34n) are arranged in end-to-end relation. The system may also or alternately include a similar lateral sub-distribution system.

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(71) Applicant *(for all designated States except US)*: **COMMSCOPE, INC. OF NORTH CAROLINA** [US/US]; 1100 Commscope Place, SE, Hickory, North Carolina 28603 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **VOGEL, Mark, O.** [US/US]; 1274 Fourth Creek Landing Dr., Statesville, North Carolina 28625 (US). **GEMME, Christopher, P.** [US/US]; 2736 25th Street NE, Hickory, North Carolina 28601 (US). **ALRUTZ, Mark, E.** [US/US]; 910 37th Ave NE, Hickory, North Carolina 28601 (US). **LEE, Martin, B.** [US/US]; 203 Fox Briar Lane, Cary, North Carolina 27511 (US).

(74) Agents: **REGAN, Christopher, F.** et al.; 255 S. Orange Ave, Suite 1401, Orlando, FL 32802-3791 (US).

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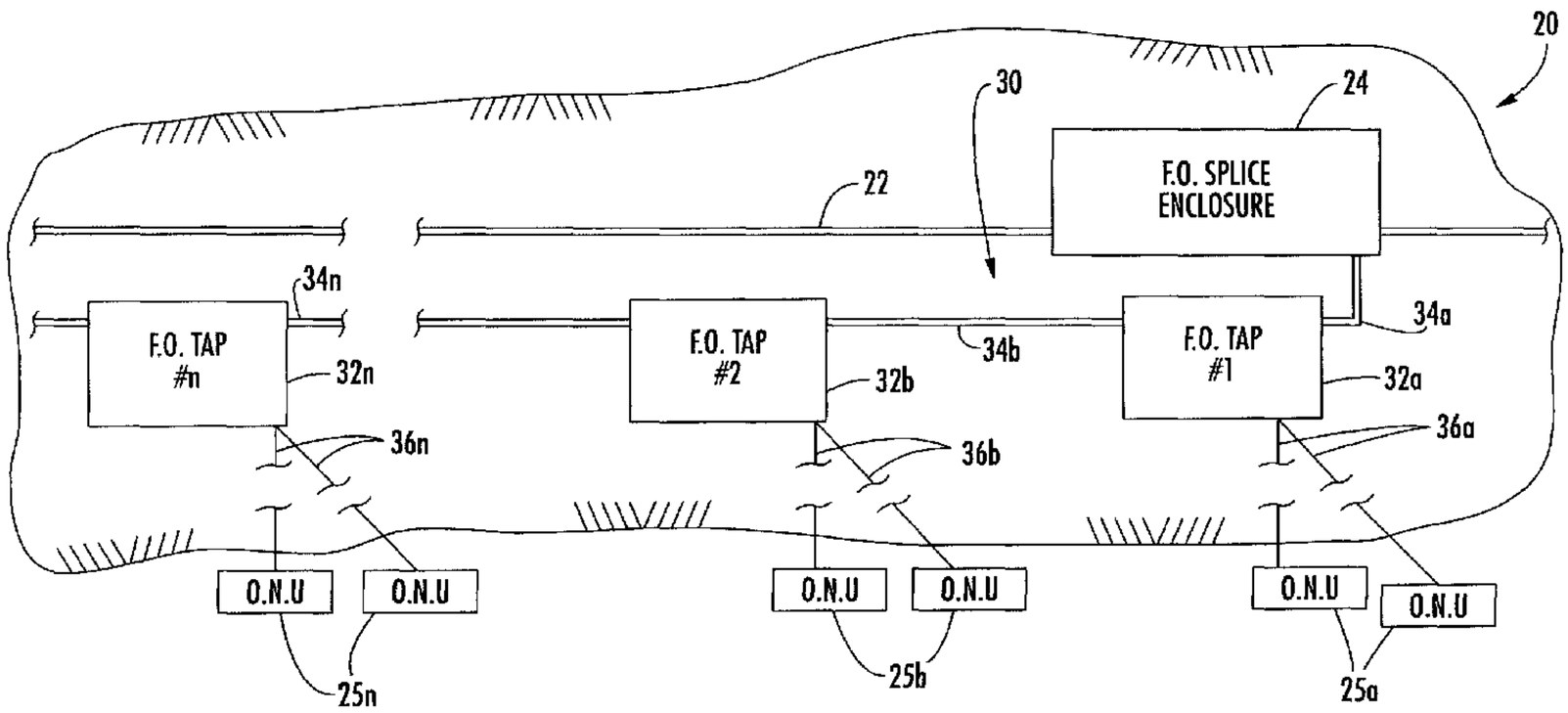
(54) Title: BURIED FIBER OPTIC SYSTEM INCLUDING A SUB-DISTRIBUTION SYSTEM AND RELATED METHODS



(57) Abstract: A buried fiber optic cable system (20) includes a distribution cable (22) extending along a buried route, a splice enclosure (24) connected to the distribution cable (22) along the buried route, and a first sub-distribution fiber optic system (30) extending along the buried route in a first direction away from the fiber optic splice enclosure (24). The first sub-distribution system (30) may include spaced apart fiber optic taps along the buried route, a first sub-distribution fiber optic cable between the fiber optic splice enclosure (24) and a first fiber optic tap (32a), and at least one second sub-distribution fiber optic cable (34b-34n) between adjacent fiber optic taps so that the first sub-distribution fiber optic cable (34a) and the at least one second sub-distribution fiber optic cable (34b-34n) are arranged in end-to-end relation. The system may also or alternately include a similar lateral sub-distribution system.

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BURIED FIBER OPTIC SYSTEM INCLUDING A SUB-DISTRIBUTION SYSTEM AND RELATED METHODS

Field of the Invention

The present invention relates to the field of communications systems, and, more particularly, to the field of fiber optic communications systems, such as installed along buried routes, for example, and associated methods.

Background of the Invention

Some cable television systems in the past have used exclusively electrical coaxial cables to distribute TV signals from a headend to a plurality of individual subscribers. A main distribution coaxial cable extended along a route, and a series of taps were connected to the main distribution cable along the route. One or more coaxial drop cables extended outwardly from the taps to the individual subscribers.

Fiber optic cables are widely used for transmitting telecommunications signals over relatively long distances, and at higher data rates than electrical cables, such as coaxial cables. Fiber optic cables also offer immunity to lightning and other potential electrical faults along the route. A typical fiber optic cable includes a plurality of individual optical fibers contained within a protective sheath. Fiber optic cables are now commonly used in hybrid fiber/coax systems where the main, or trunk, cable is

provided by an optical fiber cable.

Newer cable television systems are employing fiber optic cables throughout and are sometimes referred to as "fiber-in-the-loop" (FITL) systems. In other words, even the drop cables that extend to the individual subscribers are provided by optical fiber cables in an FITL system. Unfortunately, one drawback of a conventional FITL system is that the main distribution cable must be entered, the fibers accessed, spliced/interconnected and stored within a splice enclosure, and the entire assembly protected at each drop location along the route. This results in relatively high labor costs and material costs for the drop locations.

In addition, the splice enclosure is opened each time an additional subscriber is added to the system. This exposes the components to the risk of accidental damage.

U.S. Patent No. 6,427,035 B1 to Mahony discloses a fiber optic network for connecting subscribers to a central office of the telephone service provider. The network includes a so-called "splitter-terminal apparatus" for connecting a plurality of drop cables to a secondary cable that, in turn, is connected to the primary cable. The splitter-terminal apparatus includes a housing, a splitter, and a plurality of connectorized terminations. Unfortunately, each tap is connected to the secondary cable at a conventional splice enclosure.

Summary of the Invention

In view of the foregoing background, it is therefore an object of the present invention to provide a fiber optic communication system having a relatively low installation cost, a relatively low cost to add additional subscribers, and that reduces exposure of the distribution cable to damage.

These and other objects, features, and

advantages of the present invention are provided by a buried fiber optic cable system comprising a sub-distribution fiber optic system associated with the distribution fiber optic cable. More specifically, the buried fiber optic cable system may comprise a distribution fiber optic cable extending along a buried route, at least one fiber optic splice enclosure connected to the distribution fiber optic cable along the buried route, and the sub-distribution fiber optic system extending along the buried route in a direction away from the fiber optic splice enclosure.

The sub-distribution fiber optic system may comprise a plurality of spaced apart fiber optic taps along the buried route, and a first sub-distribution fiber optic cable extending along the buried route between the fiber optic splice enclosure and a first one of the plurality of fiber optic taps. The first sub-distribution fiber optic system may also comprise at least one second sub-distribution fiber optic cable extending along the buried route between adjacent fiber optic taps so that the first sub-distribution fiber optic cable and the at least one second sub-distribution fiber optic cable are arranged in end-to-end relation. Drop fiber optic cables may extend away from the buried route at each fiber optic tap.

Each of the sub-distribution fiber optic cables may comprise a desired length of cable and a fiber optic cable connector on at least one end thereof. Each fiber optic cable connector may comprise a factory installed fiber optic cable connector. In other words, pre-connectorized fiber optic cables may be used for the first and at least one second sub-distribution cables. Accordingly, the installation may be simplified and the cost reduced.

Each of the fiber optic taps may comprise a tap housing, and an input fiber optic connector carried by the tap housing for coupling to a preceding sub-

distribution fiber optic cable. The fiber optic taps may also comprise an output fiber optic connector carried by the tap housing for coupling to a succeeding sub-distribution fiber optic cable, and a plurality of drop fiber optic connectors carried by the tap housing for coupling to respective drop fiber optic cables. The tap housing may also carry a fiber optic splitter, for example. The taps permit additional subscribers to be later added and without exposing the distribution cable to potential damage.

The buried fiber optic cable system may further comprise a second sub-distribution fiber optic system extending along the buried route in a second direction opposite the first direction. The first direction may be considered the forward direction, and the second direction a backward direction, for example. Accordingly, the fiber optic system may advantageously be extended over a greater range. A respective optical network unit may be connected to each drop fiber optic cable at the subscriber's location.

In accordance with another aspect of the invention, the buried fiber optic cable system in some embodiments may include a lateral sub-distribution fiber optic system extending outwardly from the buried route in a lateral direction away from the at least one splice enclosure. The lateral sub-distribution system may include a plurality of spaced apart fiber optic taps, with each tap comprising a tap housing and a plurality of tap fiber optic connectors carried thereby. The lateral sub-distribution system may also include a first lateral sub-distribution fiber optic cable extending between the at least one splice enclosure and a first one of the fiber optic taps, and at least one second lateral sub-distribution fiber optic cable extending between adjacent fiber optic taps. Accordingly, the first lateral sub-distribution fiber optic cable and the at least one second lateral

sub-distribution fiber optic cable are arranged in end-to-end relation. In addition, the first lateral sub-distribution fiber optic cable and the at least one second lateral sub-distribution fiber optic cable may each comprise a pre-connectorized fiber optic cable.

A method aspect of the present invention is for installing a buried fiber optic cable system. The method may comprise installing a fiber optic distribution cable along a buried route, connecting at least one fiber optic splice enclosure to the fiber optic distribution cable along the buried route, and installing a first fiber optic sub-distribution system extending along the buried route in a first direction away from the at least one fiber optic splice enclosure.

Another method aspect of the present invention is also for installing a buried fiber optic cable system, and may include installing a fiber optic distribution cable along a buried route, and connecting at least one fiber optic splice enclosure to the fiber optic distribution cable along the buried route. The method may also comprise installing a forward sub-distribution fiber optic system extending along the buried route in a forward direction away from the at least one fiber optic splice enclosure, and installing a backward sub-distribution fiber optic system extending along the buried route in a backward direction.

Yet another method aspect is also for installing a buried fiber optic cable system. The method may include connecting at least one fiber optic splice enclosure to a fiber optic distribution cable along a buried route, and installing a lateral fiber optic sub-distribution system extending outwardly from the buried route in a lateral direction away from the at least one fiber optic splice enclosure.

Brief Description of the Drawings

FIG. 1 is a schematic diagram of a buried fiber optic cable system according to the present invention.

FIG. 2a is a schematic diagram of a sub-distribution fiber optic cable shown in FIG. 1.

FIG. 2b is a schematic diagram of another sub-distribution fiber optic cable shown in FIG. 1.

FIG. 3 is a schematic diagram of the tap housing shown in FIG. 1.

FIG. 4 is a schematic diagram of another embodiment of a buried fiber optic cable system according to the present invention.

FIG. 5 is a flow chart illustrating a method of installing the fiber optic cable system shown in FIG. 1.

FIG. 6 is a flow chart illustrating a method of installing the fiber optic cable system shown in FIG. 4.

Detailed Description of the Preferred Embodiments

The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout, and prime notation is used to indicate similar elements in alternate embodiments.

Referring to FIGS. 1-3, a buried fiber optic cable system **20** is now described. The buried fiber optic cable system **20** illustratively comprises a distribution fiber optic cable **22** extending along a buried route. A fiber optic splice enclosure **24** is

illustratively connected to the distribution fiber optic cable **22** along the buried route.

The buried fiber optic cable system **20** also illustratively comprises a sub-distribution fiber optic system **30** extending along the buried route away from the fiber optic splice enclosure **24**. The sub-distribution fiber optic system **30** illustratively comprises a plurality of spaced apart fiber optic taps **32a-32n** along the buried route. The sub-distribution fiber optic system **30** also illustratively comprises a plurality of sub-distribution fiber optic cables **34a-34n**. A first one of the plurality of sub-distribution fiber optic cables **34a** illustratively extends along the buried route between the fiber optic splice enclosure **24** and a first one of plurality of fiber optic taps **32a**.

A plurality of second sub-distribution cables **34b-34n** illustratively extends between adjacent fiber optic taps **32a-32n**. Accordingly, the plurality of sub-distribution fiber optic cables **34a-34n** is arranged in end-to-end relation. A respective plurality of drop fiber optic cables **36a-36n** illustratively extends away from the buried route at each of the plurality of fiber optic taps **32a-32n**. Accordingly, the respective plurality of fiber optic drop cables **36a-36n** may advantageously be connected to the distribution cable **22** without exposing the distribution cable for another splice, or without opening the fiber optic splice enclosure **24**.

Referring now more specifically to FIGS. 2a and 2b, the first and second sub-distribution fiber optic cables **34a, 34b** are now described in greater detail. The first and second sub-distribution fiber optic cables comprise a desired length of cable. The first sub-distribution fiber optic cable **34a** illustratively includes a fiber optic connector **38a** on one end thereof. The second sub-distribution fiber

optic cable **34b** illustratively includes a fiber optic connector on each of the opposing ends thereof. The sub-distribution fiber optic cables **34a, 34b** may be pre-connectorized fiber optic cables. Each of the fiber optic cable connectors **38a, 38b** may comprise a factory installed fiber optic cable connector. Those skilled in the art will appreciate, however, that the fiber optic connectors **38a, 38b** may also be installed in the field, if so desired, but this may lead to higher installation costs.

Referring now more specifically to FIG. 3, one of the plurality of fiber optic taps **32a** is now described in greater detail. The fiber optic tap **32a** illustratively comprise a tap housing **40a**. An input fiber optic connector **42a** is illustratively carried by the tap housing **40a** for coupling to the sub-distribution fiber optic cable **34a** located before or preceding the tap housing. The tap housing **40a** may be made of a plastic or a composite material, for example, or any other type of high strength material. An output fiber optic connector **44a** is illustratively carried by the tap housing **40a** for coupling to the fiber optic cable **34b** located after or succeeding from the tap housing. A plurality of drop fiber optic connectors **46a** are illustratively carried by the tap housing **40a** for coupling to respective drop fiber optic cables **36a**.

As will be appreciated by those skilled in the art, rather than have the connectors **46a** carried by the housing, the connectors may be located within the housing **40a** in other embodiments. In other words, pigtails may extend into the housing **40a** and the optical connections made internal to the housing. This may reduce the need to provide a mechanical connection and environmental seal along with making the optical connection, as the mechanical connection and environmental seal may be made at the housing **40a** while the optical connection is internal to the housing.

The fiber optic tap **32a** illustratively comprises a fiber optic splitter **48a** carried by the tap housing **40a**. The fiber optic splitter **48a** illustratively comprises a splitter input fiber **51a** connected to the input fiber optic connector **42a**. The fiber optic splitter **48a** also comprises a plurality of splitter output fibers **52a**. One splitter output fiber **52a** is illustratively connected to the output fiber optic connector **44a**. The remaining splitter output fibers **52a** are illustratively connected to the respective plurality of fiber optic connectors **46a**.

Those of skill in the art will recognize that in other embodiments, a wavelength-division-multiplexer (WDM) device may be substituted for the splitter **48a**. In yet other embodiments, a WDM device may be used in combination with a splitter. Of course, other passive and/or active components may be provided within the housing **40a**.

The fiber optic tap **32a** illustrated in FIG. 3 is the first fiber optic tap. Those skilled in the art will appreciate, however, that all of the fiber optic taps **32b-32n** are similar to the first fiber optic tap **32a** and require no further discussion herein. Optical network units **25a-25n** are illustratively connected to the respective drop fiber optic cable **36a-36n**.

Referring now additionally to FIG. 4, a second embodiment of the buried fiber optic cable system **20'** according to the present invention is now described. The second embodiment of the buried fiber optic cable system **20'** illustratively includes a first sub-distribution fiber optic system **30'** extending in a first or forward direction along the buried route, and a second sub-distribution fiber optic system **130** extending in a second or backward direction along the buried route opposite the first direction. This advantageously allows for a broader range of connection to the distribution cable **22'**. The elements of the

system **20'** of the backward sub-distribution system **130** are indicated by reference numbers incremented by one hundred for simplicity of explanation.

Another aspect of the system **20'** illustrated in FIG. 4 relates to a lateral sub-distribution system **230** extending outwardly from the buried route in a lateral direction away from the splice enclosure **24'**. The lateral sub-distribution system **230** illustratively includes a plurality of spaced apart fiber optic taps **232a-232n**, wherein each tap includes a tap housing and a plurality of tap fiber optic connectors carried thereby as described above.

The lateral sub-distribution system **230** includes a first lateral sub-distribution fiber optic cable **234a** extending between the splice enclosure **24'** and a first fiber optic tap **232a**, and at least one second lateral sub-distribution fiber optic cable **234n** extending between adjacent fiber optic taps. Accordingly, the first lateral sub-distribution fiber optic cable **234a** and the at least one second lateral sub-distribution fiber optic cable **234n** are arranged in end-to-end relation.

The lateral sub-distribution fiber optic cables **234a, 234n** may each comprise a pre-connectorized fiber optic cable. Drop cables **236a** connect the first lateral tap **232a** to the optical network units **225**, and drop cables **236n** connect the last lateral tap **232n** to the optical network units **235n**. As will be appreciated by those skilled in the art, portions of the forward and backward sub-distribution systems **30', 130** may also extend laterally outwardly similar to the lateral sub-distribution system **230**. The other elements of the second embodiment of the buried fiber optic cable system **20'** are similar to those of the first embodiment **20**, are labeled with prime notation, and require no further discussion herein.

Referring now additionally to the flow chart

60 of FIG. 5, a method for installing a buried fiber optic cable system 20 is now described. From the start (Block 62), a fiber optic distribution cable 22 is installed along a buried route at Block 64. At Block 66, a fiber optic splice enclosure 24 is connected to the fiber optic distribution cable 22 along the buried route.

The blocks generally labeled as 67 represent installing a fiber optic sub-distribution system 30 extending along the buried route in a direction away from the fiber optic splice enclosure 24. More specifically, at Block 68, a plurality of spaced apart fiber optic taps 32a-32n is installed along the buried route. At Block 70, a first sub-distribution fiber optic cable 34a is installed between the fiber optic splice enclosure 24 and a first one of the plurality of fiber optic taps 32a. At Block 72, at least one second sub-distribution fiber optic cable 34b is installed between adjacent fiber optic taps 32a-32n so that the sub-distribution fiber optic cables are arranged in end-to-end relation. At Block 74, at least one respective drop fiber optic cable 36 is installed to extend outwardly from each of the fiber optic taps 32a-32n before completing installation at Block 76. Those of skill in the art will also appreciate that a similar method may be used to install the lateral sub-distribution system 230 described above with reference to FIG. 4.

Referring now additionally to the flow chart 80 of FIG. 6, another method aspect for installing a buried fiber optic cable system 20' of FIG. 4 is now described. From the start (Block 82), a fiber optic distribution cable 22' is installed along a buried route at Block 84. At Block 86, a fiber optic splice enclosure 24' is connected to the fiber optic distribution cable 22' along the buried route. At Block 88, a forward sub-distribution fiber optic system

30' is installed along the buried route in a forward direction away from the at least one fiber optic splice enclosure 24'. At Block 90, a backward sub-distribution fiber optic system 130 is installed along the buried route in a backward direction before completing installation at Block 92. Installing the forward sub-distribution fiber optic system 30' and the backward sub-distribution fiber optic system 130 each comprises installing at least one fiber optic tap 32a', 132a along the buried route, and installing a first sub-distribution fiber optic cable 34a', 134a extending along the buried route between the at least one fiber optic splice enclosure 24' and a first fiber optic tap 32a', 132a.

In other embodiments, any of the sub-distribution systems may be installed onto an existing fiber optic distribution cable as will be appreciated by those skilled in the art. Other aspects of the cable system may be understood with reference to U.S. Patent No. 6,819,842, entitled "AERIAL FIBER OPTIC SYSTEM INCLUDING A SUB-DISTRIBUTION SYSTEM AND RELATED METHODS", filed the same date as the present application, and the entire disclosure of which is incorporated by reference herein.

Accordingly, many modifications and other embodiments of the invention will come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed, and that other modifications and embodiments are intended to be included within the scope of the appended claims.

it is to be understood that the invention is not to be limited to the specific embodiments disclosed, and that other modifications and embodiments are intended to be included within the scope of the appended claims.

THAT WHICH IS CLAIMED IS:

1. A buried fiber optic cable system (20) comprising:

a distribution fiber optic cable (22) extending along a buried route;

at least one fiber optic splice enclosure (24) connected to said distribution fiber optic cable(22) along the buried route; and

a first sub-distribution fiber optic system (30) extending along the buried route in a first direction away from said at least one fiber optic splice enclosure (24) and comprising

a plurality of spaced apart fiber optic taps (32a-32n) along the buried route,

a first sub-distribution fiber optic cable (34a) extending along the buried route between said at least one fiber optic splice enclosure (24) and a first one of said plurality of fiber optic taps (32a),

at least one second sub-distribution fiber optic cable (34b-34n) extending along the buried route between adjacent fiber optic taps (32a-32n) so that said first sub-distribution fiber optic cable (34a) and said at least one second sub-distribution fiber optic cable (34b-34n) are arranged in end-to-end relation, and

at least one drop fiber optic cable (36a-36n) extending away from the buried route at at least one of said fiber optic taps (32a-32n).

2. A buried fiber optic cable system (20) according to Claim 1 wherein each of said sub-distribution fiber optic cables (34a-34n) comprises a desired length of cable and a fiber optic cable connector (38) on at least one end thereof.

3. A buried fiber optic cable system (20) according to Claim 2 wherein each fiber optic cable connector (38) comprises a factory installed fiber optic cable connector.

4. A buried fiber optic cable system (20) according to Claim 1 wherein each of said fiber optic taps (32a-32n) comprises:

a tap housing (40a);

an input fiber optic connector (42a) carried by said tap housing (40a) for coupling to a preceding sub-distribution fiber optic cable (34a);

an output fiber optic connector (44a) carried by said tap housing (40a) for coupling to a succeeding sub-distribution fiber optic cable (34b); and

a plurality of drop fiber optic connectors (46a) carried by said tap housing (40a) for coupling to respective drop fiber optic cables (36a).

5. A buried fiber optic cable system (20) according to Claim 4 wherein each of said fiber optic taps (32a-32n) further comprises a fiber optic splitter (48a) carried by said tap housing (40a).

6. A buried fiber optic cable system (20) according to Claim 1 further comprising a second sub-distribution fiber optic system (130) extending along the buried route in a second direction opposite the first direction.

7. A buried fiber optic cable system (20) according to Claim 1 further comprising a respective optical network unit (25a-25n) connected to each drop fiber optic cable (36a-36n).

8. A buried fiber optic cable system (20') comprising:

a distribution fiber optic cable (22') extending along a buried route;

AMENDED SHEET

at least one fiber optic splice enclosure (24') connected to said distribution fiber optic cable (22') along the buried route;

a forward sub-distribution fiber optic system (30') extending along the buried route in a forward direction away from said at least one fiber optic splice enclosure (24'); and

a backward sub-distribution fiber optic system (130) extending along the buried route in a backward direction;

each of said forward and backward sub-distribution fiber optic systems comprising at least one fiber optic tap (32a'-32n') along the buried route, and a first sub-distribution fiber optic cable (34a') extending along the buried route between said at least one fiber optic splice enclosure (24') and a first fiber optic tap (32a').

9. A buried fiber optic cable system (20') according to Claim 8 wherein each of said forward and backward sub-distribution fiber optic systems (30', 130) further comprises at least one drop fiber optic cable (36a'-36n') extending away from the buried route at at least one of said fiber optic taps (32a'-32n').

10. A buried fiber optic cable system (20') according to Claim 9 wherein said at least one fiber optic tap comprises:

an input fiber optic connector (42a) for coupling to a preceding sub-distribution fiber optic cable (34a');

an output fiber optic connector (44a) for coupling to a succeeding sub-distribution fiber optic cable (34b'); and

a plurality of drop fiber optic connectors (46a) for coupling to respective drop fiber optic cables (36a').

11. A buried fiber optic cable system (20') according to Claim 10 wherein each of said fiber optic taps (32a'-32n') further comprises a splitter (48a) carried by said tap housing (40a).

12. A buried fiber optic cable system (20') comprising:

a distribution fiber optic cable (22') extending along a buried route;

at least one fiber optic splice enclosure (24') connected to said distribution fiber optic cable (22') along the buried route; and

a lateral sub-distribution fiber optic system (230) extending outwardly from the buried route in a lateral direction away from said at least one splice enclosure (24') and comprising

a plurality of spaced apart fiber optic taps (232a-232n), each tap comprising a tap housing and a plurality of tap fiber optic connectors carried thereby,

a first lateral sub-distribution fiber optic cable (234a) extending between said at least one splice enclosure (24')and a first one of said fiber optic taps (232a), and

at least one second lateral sub-distribution fiber optic cable (234n) extending between adjacent fiber optic taps so that said first lateral sub-distribution fiber optic cable (234a) and said at least one second lateral sub-distribution fiber optic cable (234n) are arranged in end-to-end relation,

said first lateral sub-distribution fiber optic cable (234a) and said at least one second lateral sub-distribution fiber optic cable (234n) each comprising a pre-connectorized fiber optic cable.

13. A buried fiber optic cable system (20') according to Claim 12 wherein said lateral sub-distribution fiber optic system (230) further comprises at least one drop fiber optic cable (236a) extending away from at least one of said fiber optic taps (232a).

14. A buried fiber optic cable system (20') according to Claim 13 wherein each of said plurality of fiber optic taps (232a) comprises:

an input fiber optic connector (42a) for coupling to a preceding lateral sub-distribution fiber optic cable (234a);

an output fiber optic connector (44a) for coupling to a succeeding lateral sub-distribution fiber optic cable (234n); and

a plurality of drop fiber optic connectors (46a) for coupling to respective drop fiber optic cables (236a-236n).

15. A buried fiber optic cable system (20') according to Claim 14 wherein each of said fiber optic taps (232a-232n) further comprises a splitter (48a) carried by said tap housing (40a).

16. A method for installing a buried fiber optic cable system (20) comprising:

installing a fiber optic distribution cable (22) along a buried route;

connecting at least one fiber optic splice enclosure (24) to the fiber optic distribution cable (22) along the buried route; and

installing a first fiber optic sub-distribution system (30) extending along the buried route in a first direction away from the at least one fiber optic splice enclosure (24) by

installing a plurality of spaced apart fiber optic taps (32a-32n) along the buried route,

installing a first sub-distribution fiber optic cable (34a) extending along the buried route between the at least one fiber optic splice enclosure (24) and a first one of the fiber optic taps (32a),

installing at least one second sub-distribution fiber optic cable (34b-34n) extending between adjacent fiber optic taps (32a-32n) so that the first sub-distribution fiber optic cable (34a) and the at least one second sub-distribution fiber optic cable (34b-34n) are arranged in end-to-end relation, and

installing at least one drop fiber optic cable (36a-36n) extending outwardly from the buried route at at least one of the fiber optic taps (32a-32n).

17. A method according to Claim 16 further comprising adding at least one drop fiber optic cable (36a-36n) to the first fiber optic sub-distribution system (30) after an initial installation.

18. A method according to Claim 16 wherein each of the first and at least one second sub-distribution fiber optic cables (34a-34n) comprises a pre-connectorized fiber optic cable.

19. A method according to Claim 17 wherein each of the fiber optic taps (32a-32n) comprises:

a tap housing (40a);

an input fiber optic connector (42a) carried by the tap housing (40a) for coupling to a preceding sub-distribution fiber optic cable (34a);

an output fiber optic connector (44a) carried by the tap housing (40a) for coupling to a succeeding sub-distribution fiber optic cable (34b); and

a plurality of drop fiber optic connectors (46a) carried by tap housing (40a) for coupling to

respective drop fiber optic cables (36a).

20. A method according to Claim 19 wherein each of the fiber optic taps (32a) further comprises a fiber optic splitter (48a) carried by the tap housing (40a).

21. A method according to Claim 16 further comprising installing a second sub-distribution fiber optic system (130) extending along the buried route in a second direction opposite the first direction.

22. A method according to Claim 16 further comprising installing a respective optical network unit (25a-25n) to each drop fiber optic cable (36a-36n).

23. A method for installing a buried fiber optic cable system (20') comprising:

installing a fiber optic distribution cable (22') along a buried route;

connecting at least one fiber optic splice enclosure (24') to the fiber optic distribution cable (22') along the buried route;

installing a forward sub-distribution fiber optic system (30') extending along the buried route in a forward direction away from the at least one fiber optic splice enclosure (24'); and

installing a backward sub-distribution fiber optic system (130) extending along the buried route in a backward direction;

wherein installing the forward sub-distribution fiber optic system (30') and installing the backward sub-distribution fiber optic system (130) each comprises

installing at least one fiber optic tap (32a'-32n') along the buried route, and

installing a first sub-distribution fiber optic cable (34a') extending along the buried route between the at least one fiber optic

splice enclosure (24') and a first fiber optic tap (32a').

24. A method according to Claim 23 wherein each of the forward and backward sub-distribution fiber optic systems (30', 130) comprises at least one drop fiber optic cable (36a'-36n') extending away from the buried route at at least one of the fiber optic taps (32a'-32n').

25. A method according to Claim 23 wherein the first sub-distribution fiber optic cable (30') comprises a pre-connectorized fiber optic cable.

26. A method according to Claim 24 wherein the at least one fiber optic tap comprises:

an input fiber optic connector (42a) for coupling to a preceding sub-distribution fiber optic cable (34a');

an output fiber optic connector (44a) for coupling to a succeeding sub-distribution fiber optic cable (34b'); and

a plurality of drop fiber optic connectors (46a) for coupling to respective drop fiber optic cables (36a').

27. A method according to Claim 26 wherein each of said fiber optic taps (32a'-32n') further comprises a splitter (48a) carried by said tap housing (40a).

28. A method for installing a buried fiber optic cable system (20') comprising:

connecting at least one fiber optic splice enclosure (24') to a fiber optic distribution cable (22') along a buried route;

installing a forward sub-distribution fiber optic system (30') extending along the buried route in a forward direction away from the at least one fiber

optic splice enclosure (24'); and

installing a backward sub-distribution fiber optic system (130) extending along the buried route in a backward direction;

wherein installing the forward sub-distribution fiber optic system (30') and installing the backward sub-distribution fiber optic system (130) each comprises

installing at least one fiber optic tap (32a'-32n') along the buried route, and

installing a first sub-distribution fiber optic cable (34a') extending along the buried route between the at least one fiber optic splice enclosure (24') and a first fiber optic tap (32a').

29. A method according to Claim 28 wherein each of the forward and backward sub-distribution fiber optic systems (30', 130) comprises at least one drop fiber optic cable (36a'-36n') extending away from the buried route at at least one of the fiber optic taps (32a'-32n').

30. A method according to Claim 28 wherein the first sub-distribution fiber optic cable (34a') comprises a pre-connectorized fiber optic cable.

31. A method according to Claim 29 wherein the at least one fiber optic tap comprises:

an input fiber optic connector (42a) for coupling to a preceding sub-distribution fiber optic cable (34a');

an output fiber optic connector (44a) for coupling to a succeeding sub-distribution fiber optic cable (34b'); and

a plurality of drop fiber optic connectors (46a) for coupling to respective drop fiber optic cables (36a').

32. A method according to Claim 31 wherein each of said fiber optic taps (32a'-32n') further comprises a splitter (48a) carried by said tap housing (40a).

33. A method for installing a buried fiber optic cable system (20') comprising:

connecting at least one fiber optic splice enclosure (24') to a fiber optic distribution cable (22') along a buried route; and

installing a lateral fiber optic sub-distribution system (230) extending outwardly from the buried route in a lateral direction away from the at least one fiber optic splice enclosure (24') by

installing a plurality of spaced apart fiber optic taps (232a-232n),

installing a first lateral sub-distribution fiber optic cable (234a) extending between the at least one fiber optic splice enclosure (24') and a first one of the fiber optic taps (232a), and

installing at least one second lateral sub-distribution fiber optic cable (234n) extending between adjacent fiber optic taps so that the first lateral sub-distribution fiber optic cable (234a) and the at least one second lateral sub-distribution fiber optic cable (234n) are arranged in end-to-end relation,

the first lateral sub-distribution fiber optic cable (234a) and the at least one second lateral sub-distribution fiber optic cable (234n) each comprising a pre-connectorized fiber optic cable.

34. A method according to Claim 33 further comprising adding at least one drop fiber optic cable (236a) to the lateral fiber optic sub-distribution system (230) after an initial installation.

35. A method according to Claim 34 wherein each of the fiber optic taps comprises:

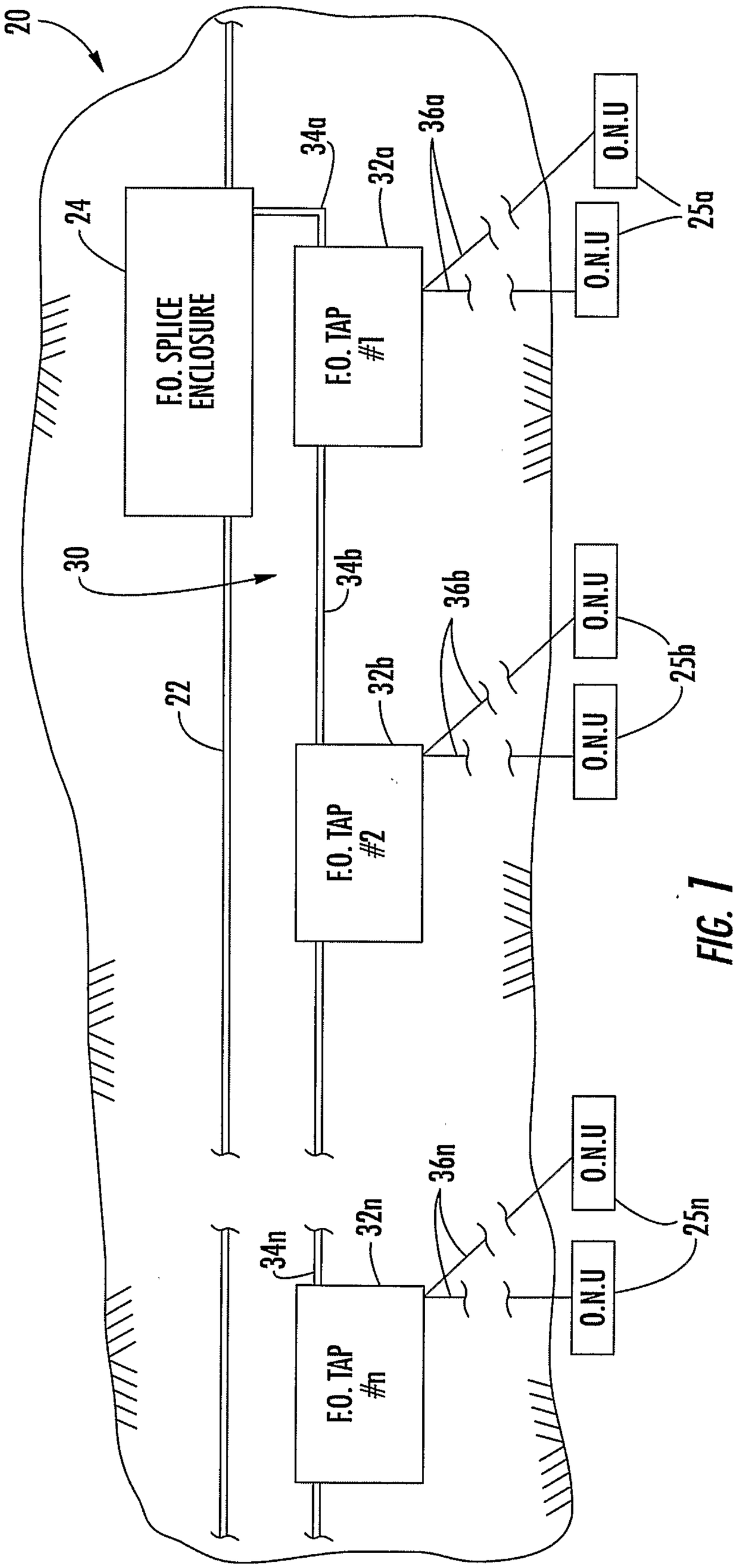
a tap housing (40a);

an input fiber optic connector (42a) carried by the tap housing (40a) for coupling to a preceding lateral sub-distribution fiber optic cable (234a);

an output fiber optic connector (44a) carried by the tap housing (40a) for coupling to a succeeding lateral sub-distribution fiber optic cable (234n); and

a plurality of drop fiber optic connectors (46a) carried by tap housing (40a) for coupling to respective drop fiber optic cables (236a-236n).

36. A method according to Claim 35 wherein each of the fiber optic taps further (232a-232n) comprises a fiber optic splitter (48a) carried by the tap housing (40a).


20
24
F.O. SPLICE ENCLOSURE
30
22
34a
32a
36a
F.O. TAP #1
O.N.U
O.N.U
25a
34b
32b
36b
F.O. TAP #2
O.N.U
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25b
34n
32n
36n
F.O. TAP #n
O.N.U
O.N.U
25n

FIG. 1

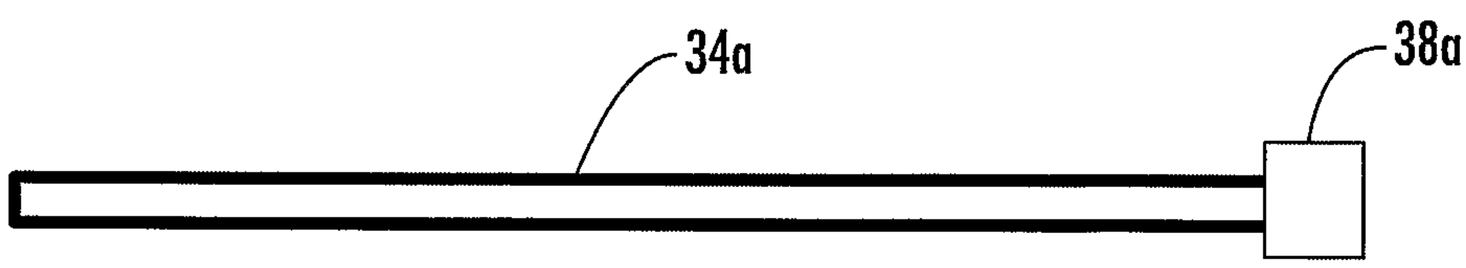


FIG. 2a

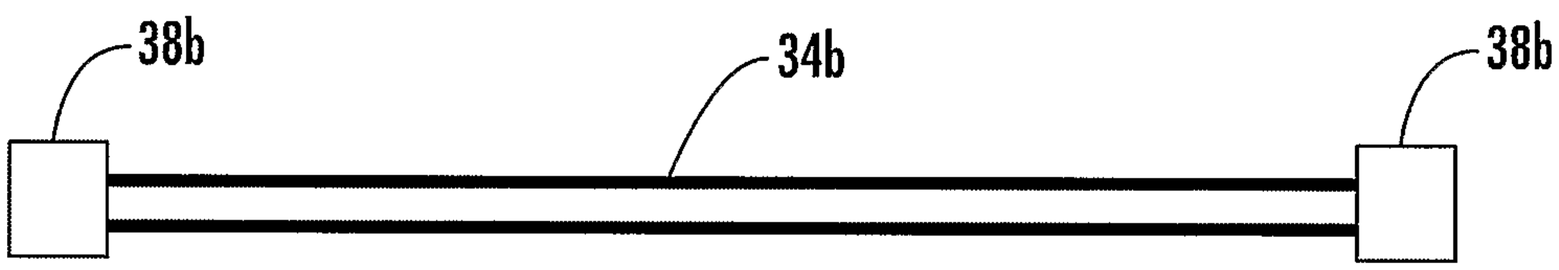


FIG. 2b

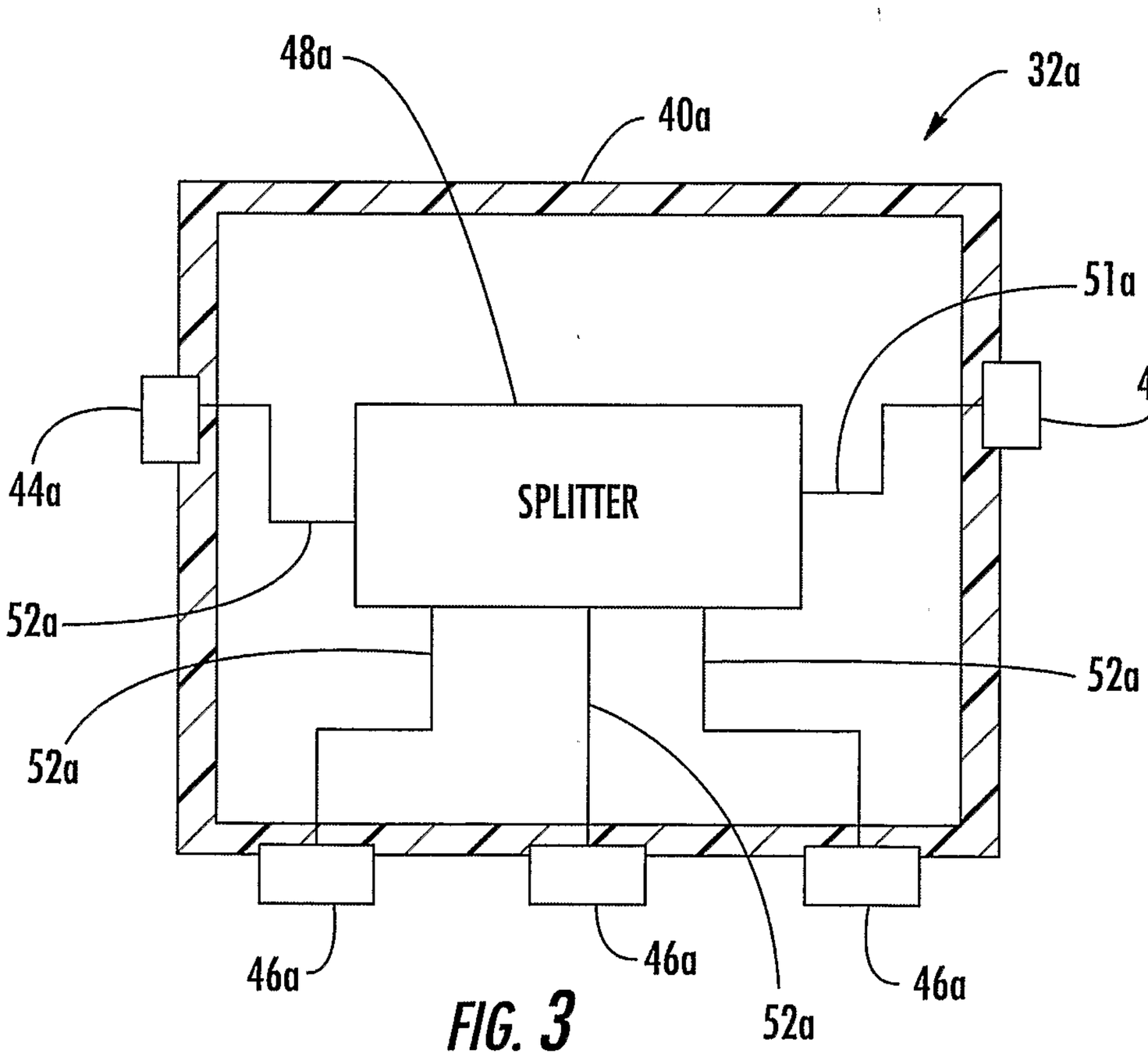


FIG. 3

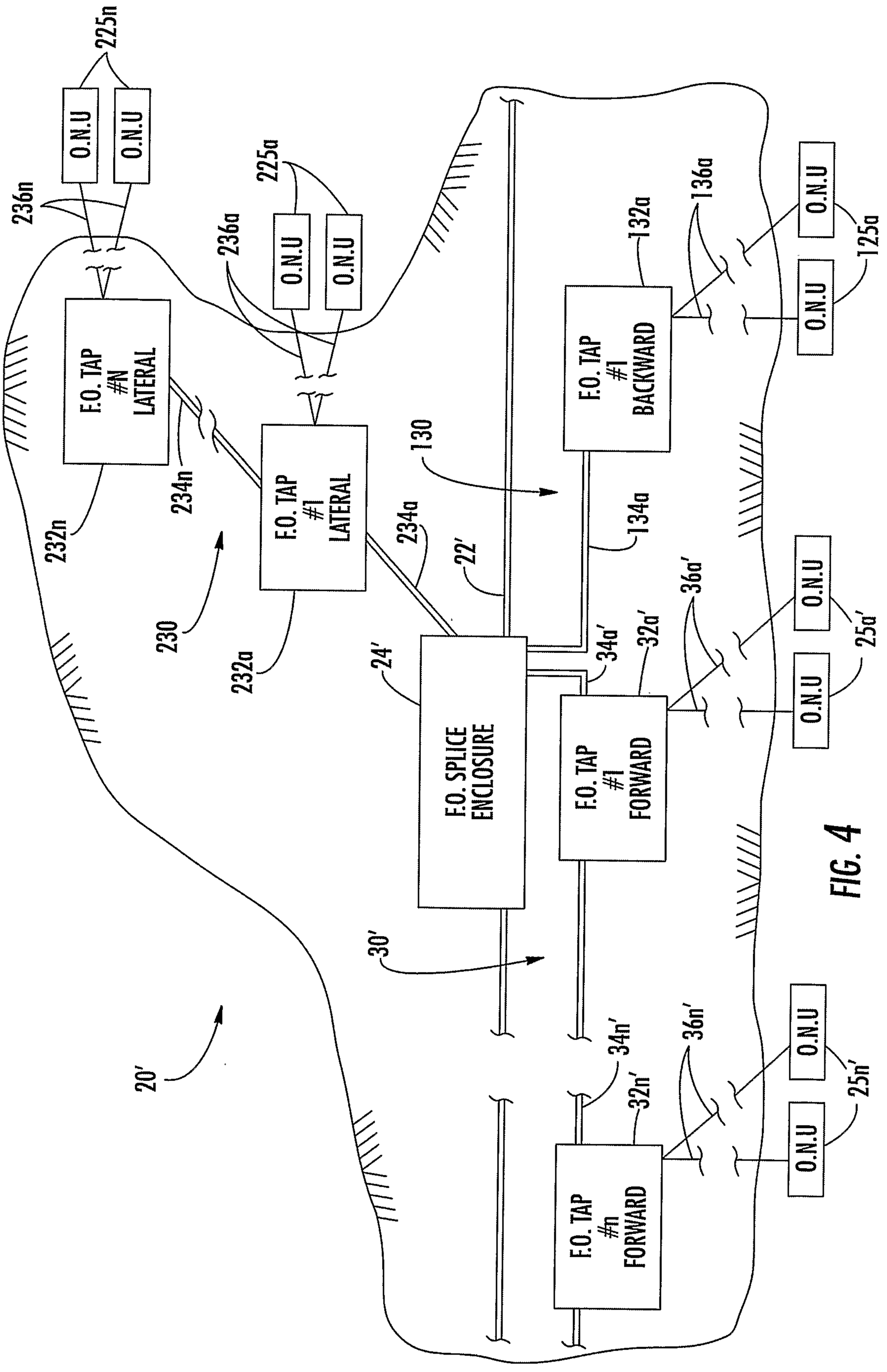

225n
O.N.U
O.N.U
236n
225a
O.N.U
O.N.U
236a
F.O. TAP #N LATERAL
232n
234n
F.O. TAP #1 LATERAL
234a
130
22'
230
232a
24'
F.O. SPLICE ENCLOSURE
30'
20'
F.O. TAP #1 BACKWARD
132a
136a
134a
O.N.U
O.N.U
125a
36a'
34a'
32a'
F.O. TAP #1 FORWARD
O.N.U
O.N.U
25a'
34n'
36n'
32n'
O.N.U
O.N.U
25n'
F.O. TAP #n FORWARD

FIG. 4

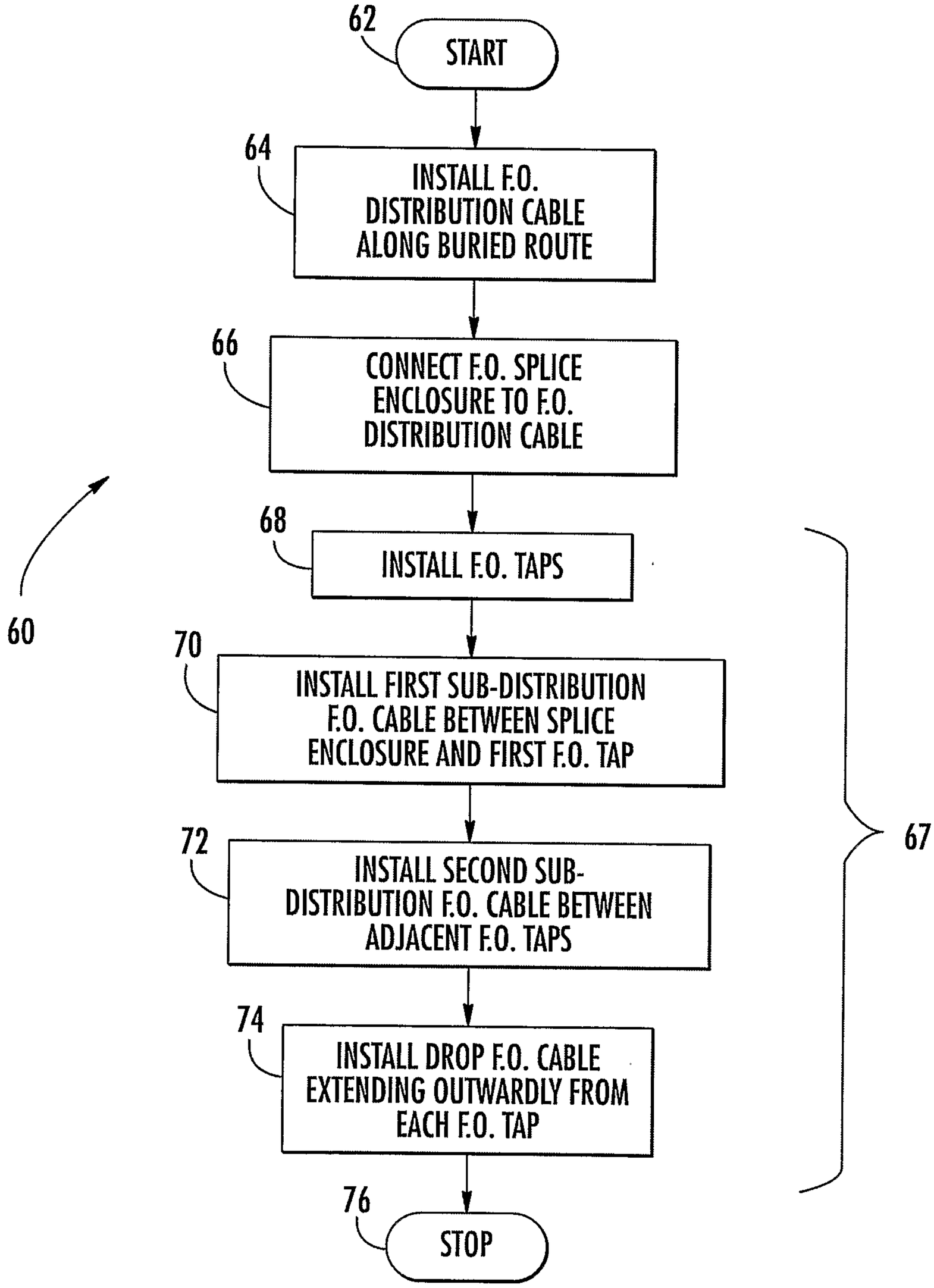

62
START
64
INSTALL F.O. DISTRIBUTION CABLE ALONG BURIED ROUTE
66
CONNECT F.O. SPLICE ENCLOSURE TO F.O. DISTRIBUTION CABLE
68
INSTALL F.O. TAPS
70
INSTALL FIRST SUB-DISTRIBUTION F.O. CABLE BETWEEN SPLICE ENCLOSURE AND FIRST F.O. TAP
72
INSTALL SECOND SUB-DISTRIBUTION F.O. CABLE BETWEEN ADJACENT F.O. TAPS
74
INSTALL DROP F.O. CABLE EXTENDING OUTWARDLY FROM EACH F.O. TAP
76
STOP
60
67

FIG. 5

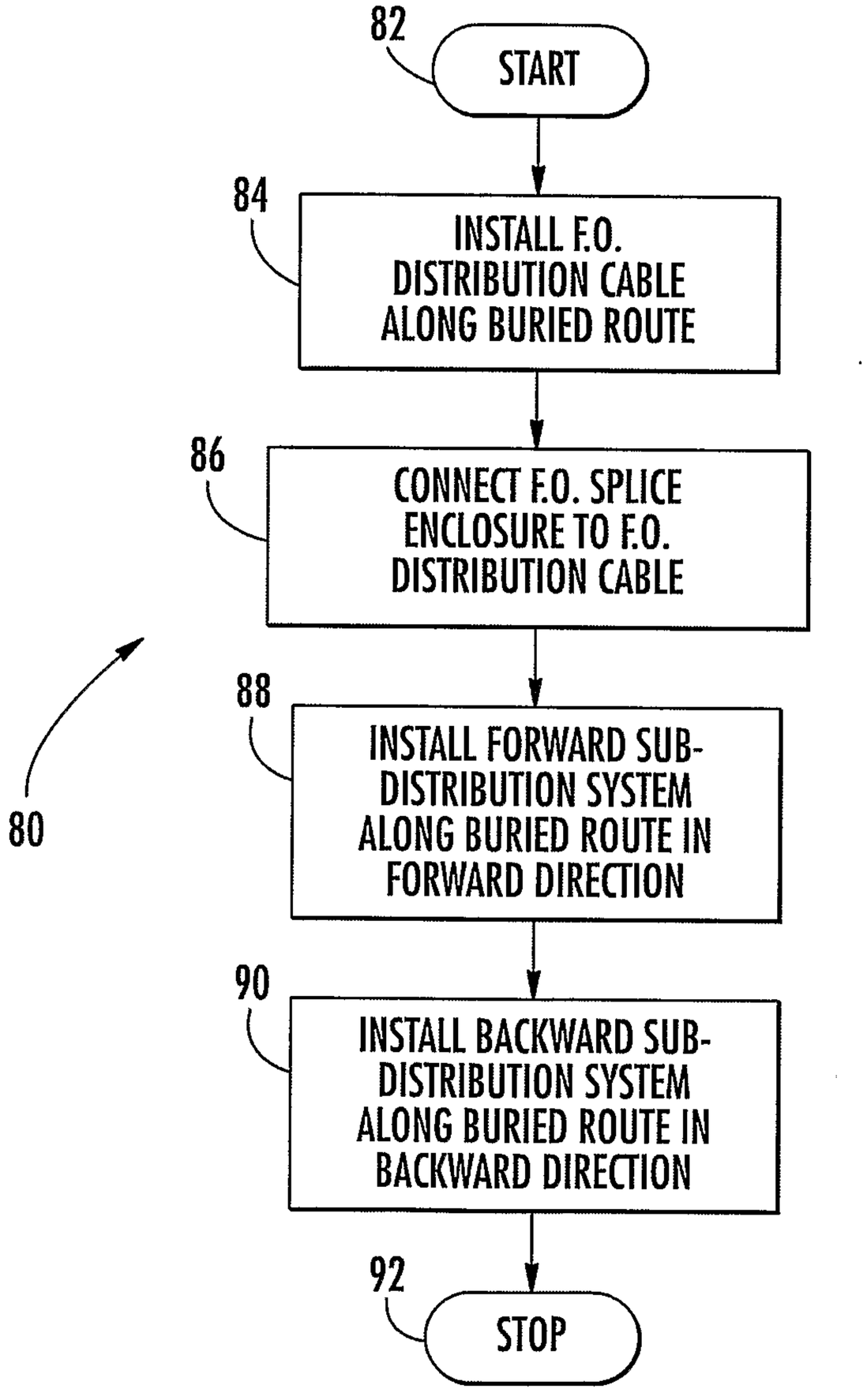
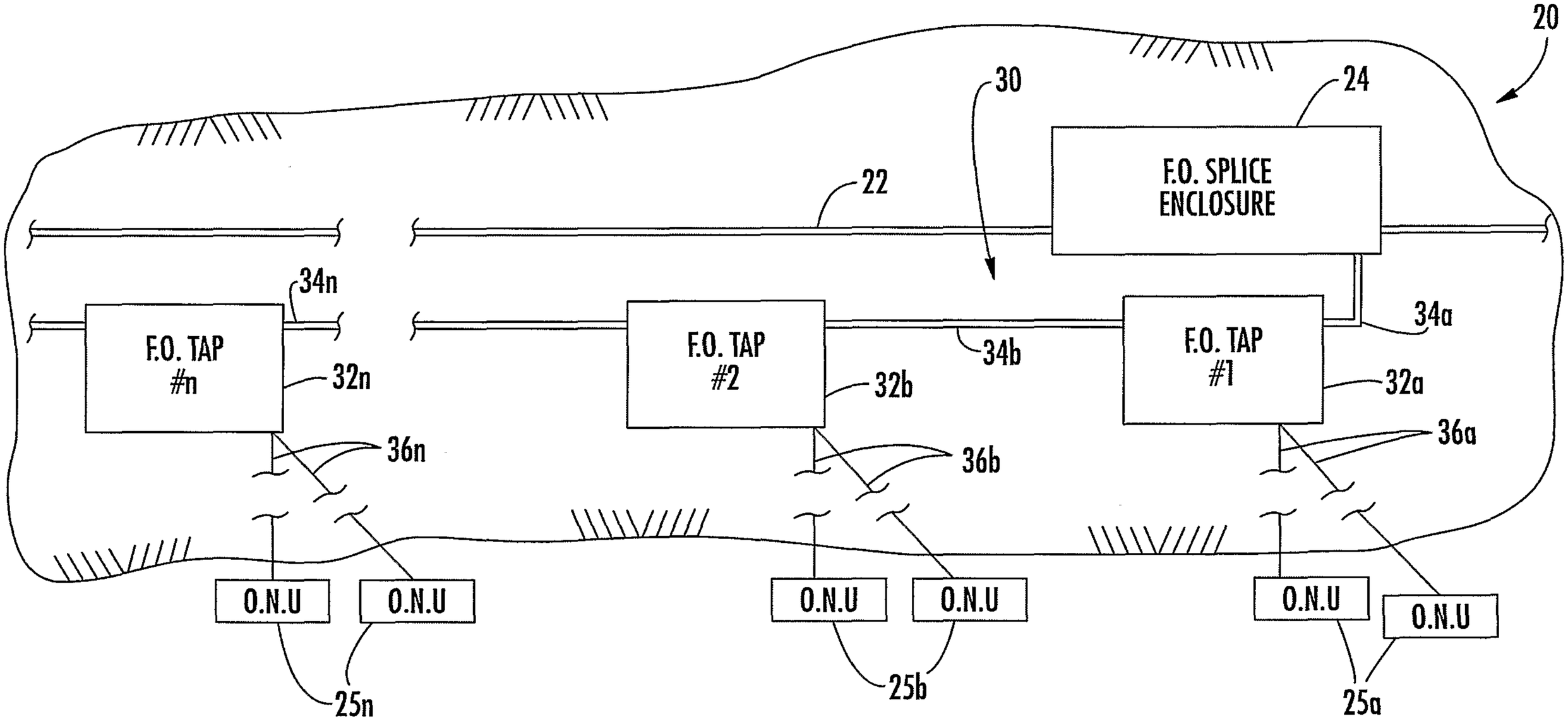

82
START
84
INSTALL F.O. DISTRIBUTION CABLE ALONG BURIED ROUTE
86
CONNECT F.O. SPLICE ENCLOSURE TO F.O. DISTRIBUTION CABLE
80
88
INSTALL FORWARD SUB-DISTRIBUTION SYSTEM ALONG BURIED ROUTE IN FORWARD DIRECTION
90
INSTALL BACKWARD SUB-DISTRIBUTION SYSTEM ALONG BURIED ROUTE IN BACKWARD DIRECTION
92
STOP

FIG. 6


20
30
24
F.O. SPLICE ENCLOSURE
22
34n
F.O. TAP #n
32n
34b
F.O. TAP #2
32b
F.O. TAP #1
34a
32a
36n
36b
36a
O.N.U
O.N.U
O.N.U
O.N.U
O.N.U
O.N.U
25n
25b
25a