

[72] Inventor **Walter T. Kennedy**
 1120 Prescott Road, Newton Square, Pa.
 19073
 [21] Appl. No. **797,490**
 [22] Filed **Feb. 7, 1969**
 [45] Patented **Mar. 16, 1971**

FOREIGN PATENTS

129,667	9/1932	Austria.....	174/15(C)
916,363	8/1946	France.....	174/15(C)
285,920	9/1968	Australia.....	174/15(C)
1,222,734	1/1960	France.....	174/47
902,988	2/1954	Germany.....	174/15(C)
206,441	1/1968	U.S.S.R.....	174/47

Primary Examiner—Laramie E. Askin
 Attorney—Roy B. Moffitt

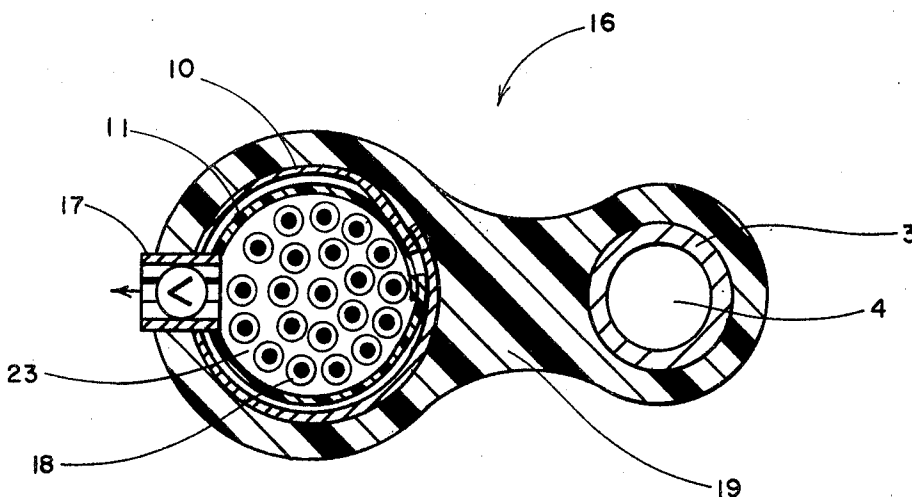
[54] **PRESSURIZED COMMUNICATION CABLE AND SYSTEM**
 12 Claims, 6 Drawing Figs.

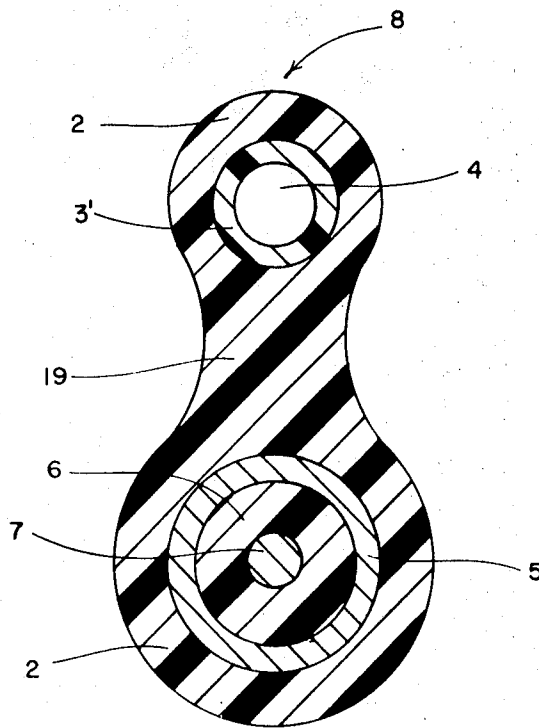
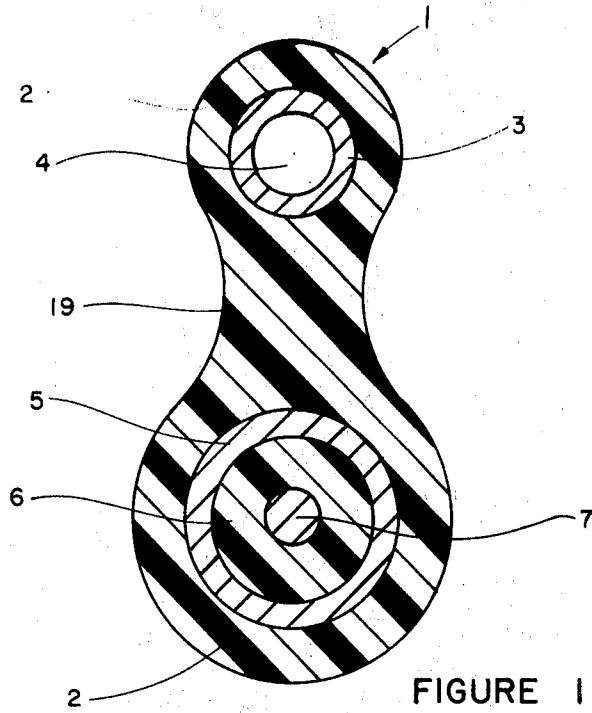
[52] U.S. Cl..... 174/11,
 174/47, 174/70
 [51] Int. Cl..... H01b 7/00
 [50] Field of Search..... 174/8, 11,
 14, 15 (C), 16, 18, 24, 41, 47, 68, 70, 70.1, 70.4,
 115, 113.2, 12, 13; 340/320; 339/15, 16; 179/170,
 179

[56] **References Cited**
UNITED STATES PATENTS

2,063,703	12/1936	Siddall et al.	174/47X
2,550,021	4/1951	Rappl.....	174/47UX
2,722,237	11/1955	Rosel.....	174/47UX
2,776,385	1/1957	Modrey.....	174/47UX
3,143,641	8/1964	Wise.....	174/47X

ABSTRACT: Disclosed herein is a pressurized communication system and a novel-type cable forming a significant component of the pressurized system. Such a system is composed of a plurality of spaced-apart enclosures, which may contain means for transmitting, modifying, amplifying or repeating an electrical signal. Each of the enclosures is connected one to another by a novel-type cable, which comprises a plastic sheath surrounding and defining a first cable portion containing electrical conductors and a second cable portion containing a longitudinally disposed cavity adapted for the transport of a fluid (dry gas). The electrical conductors of the cable are in electrical connection with a transmitter, repeater, modifier, or amplifying means and the fluid carrying cavity portion of the cable may be in pneumatic communication with the inside of the enclosure and physically separable either in whole or in part from that portion of the cable containing the electrical conductors.





INVENTOR
WALTER T. KENNEDY

Roy B. Harris
ATTORNEY

3 Sheets-Sheet 2

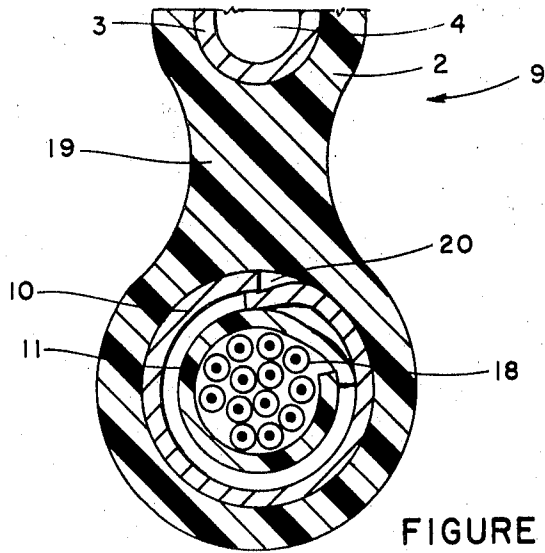


FIGURE 3

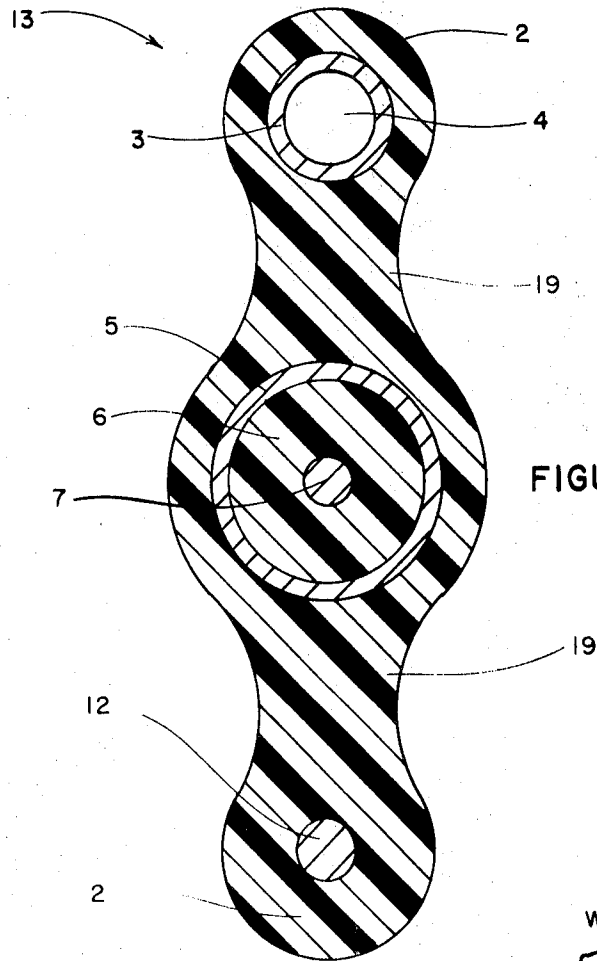


FIGURE 4

INVENTOR
WALTER T. KENNEDY

Ray B. Morris
ATTORNEY

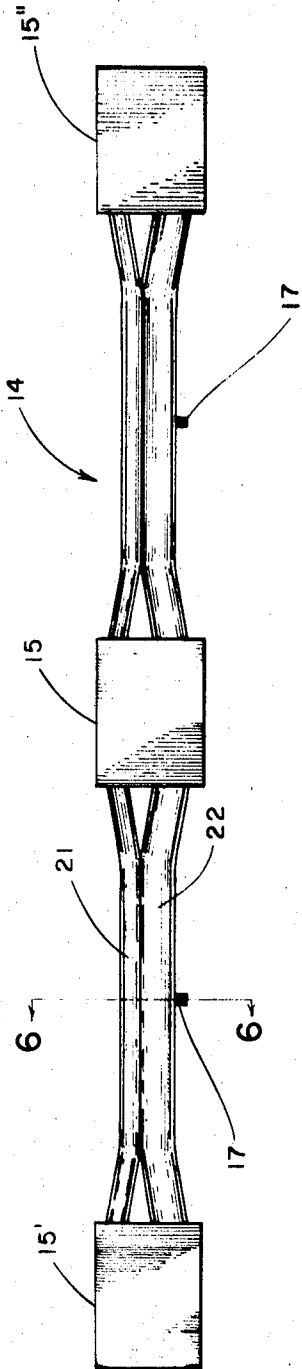


FIGURE 5

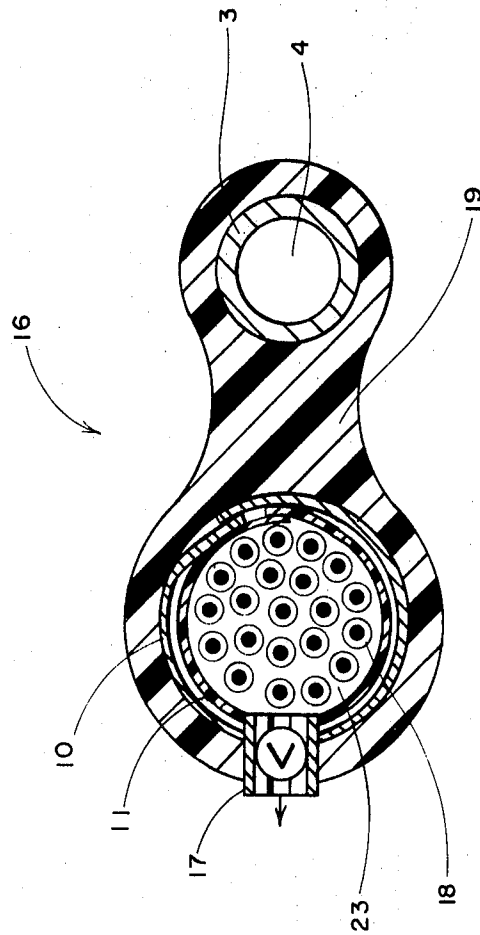


FIGURE 6

INVENTOR
WALTER T. KENNEDY

Roy B. Howard

ATTORNEY

PRESSURIZED COMMUNICATION CABLE AND SYSTEM

This invention relates to pressurized communication systems and more particularly to the structure of a novel-type cable and its use in a pressurized communication system. Such cable as disclosed herein is normally used in low voltage level applications as in connection with voice transmission lines (telecommunication lines) or television signal transmission.

In the main, it is the primary purpose and one of the fundamental objects of the instant invention to provide a cable structure that can be used either aerially or underneath the soil, which can give rise to a unique pressurized system. For example, within the scope of coaxial cable transmission systems using either an expanded or unexpanded polyethylene dielectric, conventional cable construction precludes a pressurized system that uses any part of the cable for gas passage. In view of the fact that the instant invention visualizes a tube addition integrally fixed to a coaxial cable, dry air or gas can be forced under pressure into, through and out of equipment enclosures connected together by the cable itself. Such a system, using the novel type cable disclosed herein, enables the creation and maintenance of a stabile atmosphere and pressure within enclosures housing such devices as CATV amplifiers, telephone repeater units, and any pole mounted or underground equipment whose proper operating characteristics are stabilized or enhanced by dry gas pressurization.

In the area of multiconductor communication cables, as distinguished from coaxial cable, the structure of the novel-type cable allows the transmission of dry gas through that part of the cable carrying the electrical conductors as well as that cable part especially designed for such transport to and into desired enclosures. Thus, gas may be used to pressurize such enclosures, but the gas also may be used to purge water that may collect in a cavity where insulated electrical conductors are confined. Gas can be forced from each enclosure into that longitudinal cavity in which a plurality of insulated conductors are disposed; therefore, water collecting in said last-mentioned cavity is forced towards the middle of each cable section between enclosures. A valve adapted to open and close automatically by the degree of moisture or pressure within that cavity of the cable enclosing insulated electrical conductors may be inserted in the cable between any two enclosures. Such a valve is optimally placed at the point in the conductor carrying portion of cable section where pneumatic pressure is equal from both directions. Thus, each cable section can be automatically purged of moisture when such moisture reaches an undesirable level. Furthermore, enclosures that need to be bypassed and not pressurized can be in a simple and inexpensive manner.

The foregoing delineates the objects of the instant invention, other objects, advantages and features of the present invention will become apparent from the following detailed description, one embodiment of which is present in conjunction with the drawings, in which:

FIG. 1 shows a cross section of a figure "8" Cable, wherein the plastic sheath of the cable describes two cavities, one such cavity being longitudinally disposed and essentially unoccupied and the other such cavity containing an outside and inside conductors separated by a plastic dielectric;

FIG. 2 shows essentially the same subject matter as FIG. 1 except that FIG. 1 discloses a metal tube disposed in the essentially unoccupied cavity whereas FIG. 2 uses a plastic tube disposed in that cavity;

FIG. 3 is a fragmentary view of a cross section of a FIG. "8" Cable, wherein there is shown two cavities longitudinally disposed in the plastic sheath, one such cavity containing a metal tube and the other such cavity containing a plurality of electrical conductors;

FIG. 4 shows a plastic sheath containing three longitudinally disposed indefinite length cavities, the plastic portion of an integral sheath surrounding said cavities being connected one to another by a plastic web, one of said cavities being essentially unoccupied but containing a metal tube longitudinally disposed therein, another of said cavities being occupied by a centrally disposed electrical conductor nested inside of a tu-

bular outside electrical conductor, these conductors separated one from another by a plastic dielectric, and the third cavity being essentially occupied by a messenger cable which is adapted to support the entire cable;

FIG. 5 shows a pressurized communication system that includes spaced-apart enclosures containing amplifying or repeater means pneumatically and electrically connected together by a means of the novel-type cable disclosed herein; and,

FIG. 6 shows a cross section along lines 6-6 of FIG. 5.

Turning now to FIG. 1, this drawing shows in cross section the structure of an indefinite length cable indicated by element 1. A tubular conduit 3 is surrounded by an impervious plastic sheath 2 forming an essentially unoccupied cavity 4 longitudinally disposed in the cable sheath and adapted to transport a fluid. A web 19 connects this fluid-carrying portion of the cable with that portion of the plastic sheath 2 that surrounds electrical conductors 5 and 7, which are, in this particular embodiment, a tubular outer conductor 5, usually made of metal such as aluminum or copper and the like, and center conductor 7, centrally disposed inside of tubular electrical conductor 5. Center conductor 7 is insulated from outer electrical conductor 5 by dielectric 6, which can be either expanded or unexpanded plastic, the composition of which can be the same as or different from that of plastic sheath 2. In effect, elements 5, 6, and 7 make up a coaxial cable surrounded by an outer plastic sheath 2, this outer plastic sheath being joined by web 19 to the same plastic sheath 2 which surrounds a metal conduit or tubular means 3, the latter being adapted to carry a fluid in the longitudinal direction. It is to be understood, however, that metal tube 3 of FIG. 1, as well as plastic tube 3' of FIG. 2, can be deleted. In this case, cavity 4 formed by plastic sheath 2 is used to transport a fluid in a longitudinal direction.

The figure "8" Cable shown by element 8 of FIG. 2 is essentially the same as that shown by element 1 in FIG. 1, except for the fact that the metal tube 3 of FIG. 1 has been replaced by a plastic tube 3'. Usually, but not absolutely necessary, this plastic tube 3' is of a different composition from that forming web 19 and plastic sheath 2. For example, tube 3', as well as plastic sheath 2, can be made from polyethylene, either of the high or low density type, polyvinyl chloride, polycarbonates, fluorinated hydrocarbons (Teflon) and nylon. In some instances, it may be desirable to have plastic tube 3' filled with a finely divided filler such as metal or a silica material (quartz, ground rock and the like) in order to make this particular plastic tube abrasive and resistant to attack from outside elements, such as gophers, tools of careless workmen, and intentional vandalism.

Elements 1 and 8 of FIGS. 1 and 2 are made from a coaxial cable portion composed of elements 5, 6, and 7 integral, via sheath 2 and web 19, with a cable containing a longitudinally disposed cavity 4, adapted for the transport of a fluid, created by elements 3 or 3'. Heretofore, there has been a need for such a cable like 1 and 8, but cable fabricators have always attempted to position the fluid-carrying, longitudinally disposed cavity 4 in the dielectric 6. Such a positioning of this cavity 4 in that particular area 6 disrupts the electrical characteristics of the coaxial cable. Thus, complicated electrical design problems were created in an effort to recoup those electrical properties normally incident to coaxial cable structure.

Shown in FIG. 3 is a figure "8" Cable having a structure much like that of the figure "8" Cables in FIGS. 1 and 2. In fact, from web 19 upwards, the structure of the cable 9, shown in FIG. 3, is the same as the cable 1, shown in FIG. 1. Thus, no further discussion of this particular structure is deemed necessary. The balance of cable 9 of FIG. 3, from web 19 downward, resembles the balance of the cable 1 and 8, shown in FIGS. 1 and 2 respectively, only in the sense that there is a cavity in which electrical conductors are disposed. This cavity 20 is filled with three elements, namely metal tape 10, plastic tape 11, and insulated electrical conductors 18. The metal tape, the extremities of which overlap one another to form a

circular configuration, can be either a metal tape per se made from steel, aluminum or copper or alloys thereof or it can be a plastic-coated tape much like that shown in the U.S. Pat. to Jachimowicz (No. 3,233,036). Plastic tape 11 can be either a noncorrugated polyethylene terephthalate tape or corrugated tape such as that shown and described in Roberts' U.S. Pat. No. 3,244,799. Of course, the polyethylene terephthalate composition of plastic tape 11 is exemplary only and other compositions could be used as equivalents such as polyethylene, PVC, polycarbonate, halogenated hydrocarbons, and nylon.

Cable 13, shown in FIG. 4, is a variation of that cable structure 1 shown in FIG. 1. An additional web 19 has been added to the cable structure 1 of FIG. 1 and this additional web is integral with plastic sheath 2, which completely surrounds a messenger cable 12. This last-mentioned messenger cable is usually made up of a plurality of metal strands so designed, woven, and structured so as to be adapted to carry the entire weight of the cable. Thus, cable 3 in service is strung using the messenger cable 12 in an aerial disposition, the messenger cable 12 being structurally adapted to carry not only its own weight, but the weight of the balance of the cable as well. This messenger portion of cable 13 shown in FIG. 4 is essentially the same as the messenger cable portion shown in U.S. Pat. to Pusey, No. 3,267,201 and can be formed in the same manner as disclosed in this particular prior art disclosure.

FIG. 5 shows a portion of a pressurized telecommunications system with elements 15, 15' and 15'' representing enclosures in which there are disposed amplifying, modifying, repeating, or splicing means, which either amplify repeat, or connect the signal transmitted along electrical conductors inside of the cable represented by component 22. The line 6-6 indicates a cross section through the cable and valve means 17, which is located approximately midway between two enclosures 15 and 15'. As previously indicated, the cable connecting enclosures 15, 15', and 15'' are interconnected one to another by means of a cable, that cable having two portions indicated by fluid-carrying portion 21 and electrical-carrying portion 22.

In FIG. 6, element 16 shows the cross section along line 6-6, which passes through valve 17. The cable structure shown in 16 is essentially the same as that of element 9 of FIG. 3, except for the addition of valve 17. This particular valve can be either pressure or moisture sensitive in the sense that it will respond, i.e., open, when a given pressure is achieved or when a predetermined moisture content has been detected. In the cable system 14, of FIG. 5, cable 16 of FIG. 6 is used. Both cavity 4, [cable portion 21] and that cavity created by metal tape 10 not otherwise occupied by insulated electrical conductors 18, [cable portion 22] are under pressure and are thus used to transmit longitudinally a fluid (dry gas for example). Thus, in this embodiment, both cavities 4 and 23 would carry a dry gas under pressure.

Gas pressure in cavity 4 is envisioned to be greater in most circumstances than that in cavity 23. Assuming for example that the air or gas under pressure flows from left to right (FIG. 5), the total pressure in enclosure 15 would be the sum of the pressures in cavity 23 plus 4 and thus would be greater than that in the individual cable portions 21 and 22 defining respectively cavities 4 and 23. Therefore, that in cavity 23 upstream therefrom. Hence, some of the dry gas in enclosure 15 will flow to the left, consequently forcing any condensed water in cavity 23 towards cable valve 17. When a predetermined pressure or moisture content is detected by valve 17, this valve opens and cavity 23 is thus purged of collected moisture. Gas pressure in enclosure 15' forces dry gas in the rightwardly direction in cable 22 [cavity 23] consequently forcing moisture condensation towards valve 17 and its subsequent expulsion in an automatic manner from the cable system 14.

In FIG. 5, it will be noted that cable portion 22 carrying the electrical elements of the cable is separated from cable portion 21 just before cable portions 21 and 22 enter enclosures 15 and 15'. Usually, separation takes place in web 19 and is for ease of attachment of the cable to the enclosures. Previous

discussion of FIG. 5 employed that cable structure 16 shown in FIG. 6 as the cable portion of the pressurized system; however, cable structures [13, FIG. 4]; [9, FIG. 3]; [8, FIG. 2]; and [1, FIG. 1] can all be used as that cable portion of the pressurized system as shown in FIG. 5, it being understood that pressurized gas would exist only in cavity 4 in these specific embodiments.

One of the great advantages of the cable structure shown by elements 1 and 8 of FIGS. 1 and 2 respectively, is that fluid-carrying cavity 4 can be used to pressurize enclosures such as 15, 15' and 15'' in which amplifiers, repeaters, modifiers, splitters, or splices are located. In the technological area of telecommunications, enclosures 15, 15' and 15'' may be what is called a "splice case" and they contain load coils and other well-known apparatus incident to telecommunications systems. Therefore, a splice case which is an enclosure, can be pressurized using this cable with relative ease.

Previous discussion has emphasized the use of the cable structures for purposes of transmitting data from one point to another; however, the cables shown in the drawings, can be used in conjunction with electrical power transmission and the cavity integral with such power-conveying electrical conductors can be used to moderate temperature and/or moisture control of remote transformers, breakers and other power system facilities. Such an application of the instant cable structure to the field of power transmission is quite obvious from the instant disclosure and one of only ordinary skill in the art only need the disclosure previously set forth before him to construct a power-transmitting facility that can be and is pressurized for various and sundry purposes.

From the foregoing, it is believed that the invention may be readily understood by those skilled in the art so that further descriptions are unnecessary. It being born in mind that numerous changes may be made in the details disclosed without departing from the spirit of the invention as set forth in the following claims.

I claim:

1. A cable comprising an essentially impervious plastic sheath of indefinite length which surrounds at least two spaced-apart, longitudinally disposed cavities, one of said cavities being occupied by a center conductor circumscribed longitudinally by a dielectric material which is in turn circumscribed by a second conductor and the other cavity being essentially unoccupied and adapted for the longitudinal transport of a fluid therethrough, that portion of the plastic sheath lying between and connecting the plastic surrounding said first and second cavities being configured so as to permit division of said plastic sheath into at least two such sheaths each containing one of said cavities.

2. A cable as defined in claim 1 wherein said sheath defines a third cavity in which is disposed a means for structurally supporting the entire weight of said cable.

3. A cable as defined in claim 1 wherein that cavity adapted for the longitudinal transport of a fluid contains a tubular means longitudinally disposed therein.

4. A cable as defined in claim 3 wherein said tube is constructed of a plastic of a composition differing from the plastic sheath.

5. A cable as defined in claim 3 wherein said tube is constructed of a metal.

6. A pressurized communications system comprising a plurality of spaced-apart enclosures containing means for modifying an electrical signal connected one to another by a cable comprising a plastic sheath defining a first cable portion containing electrical conductors and a second cable portion containing a longitudinally disposed cavity adapted for the transport of a fluid, the electrical conductors being in electrical connection with said modifying means and said cable second portion being in pneumatic communication with the inside of said enclosure.

7. A communications system as defined in claim 6 wherein said second cable portion is physically separated from said first cable portion just before it reaches the outside surface of

the sidewalls of the enclosure and terminates just after passing into the interior of said container.

8. A cable comprising an essentially impervious plastic sheath defining a first cable portion having a first longitudinally disposed cavity, in which a plurality of insulated electrical conductors are contained, and a second cable portion having a second cavity adapted for the longitudinal transport of a fluid and a valve means disposed in said first cavity adapted to establish communications between the interior of said first cavity and that atmosphere in contact with the outside surface of said plastic sheath.

9. A pressurized communication system comprising a plurality of spaced-apart means for modifying an electrical signal, each of said means being enclosed in a container having sidewalls and connected one to another by a cable composed of a plastic sheath defining a first cable portion having a first longitudinally disposed cavity in which a plurality of insulated electrical conductors are contained and a second cable portion having a second longitudinally disposed cavity adapted

for the longitudinal transport of a fluid, the electrical conductors of said cable first portion being in electrical connection with said modifying means and said first and second cable portion being in pneumatic communication with the inside of said container so that pressurized fluid may be introduced into said container from said first and second cable portions.

10. A communication system as defined in claim 9 wherein a valve is disposed in said second cable portion between the container means adapted for the expulsion of water accumulated in that space of said first cavity not otherwise occupied by the insulated electrical conductors.

11. A communications system as defined in claim 10 wherein said valve is responsive to open at a predetermined pressure.

12. A communications system as defined in claim 10 wherein said valve is responsive to open at a predetermined moisture content.

20

25

30

35

40

45

50

55

60

65

70

75